City of Lawrence

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

Final Construction Report

for

Federal Energy Regulatory Commission (FERC)

May 7, 2010

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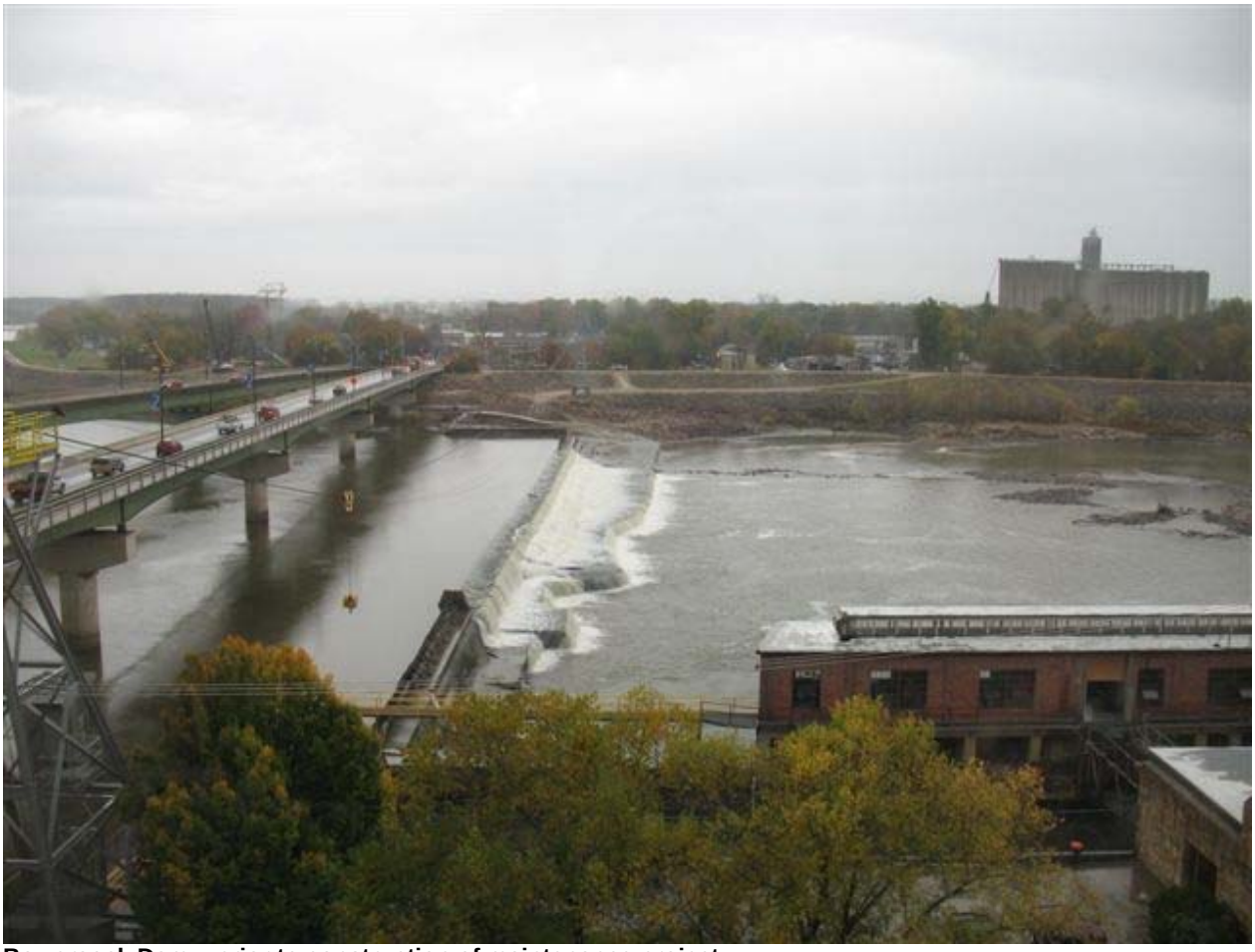
1. GENERAL INFORMATION

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

1. GENERAL INFORMATION

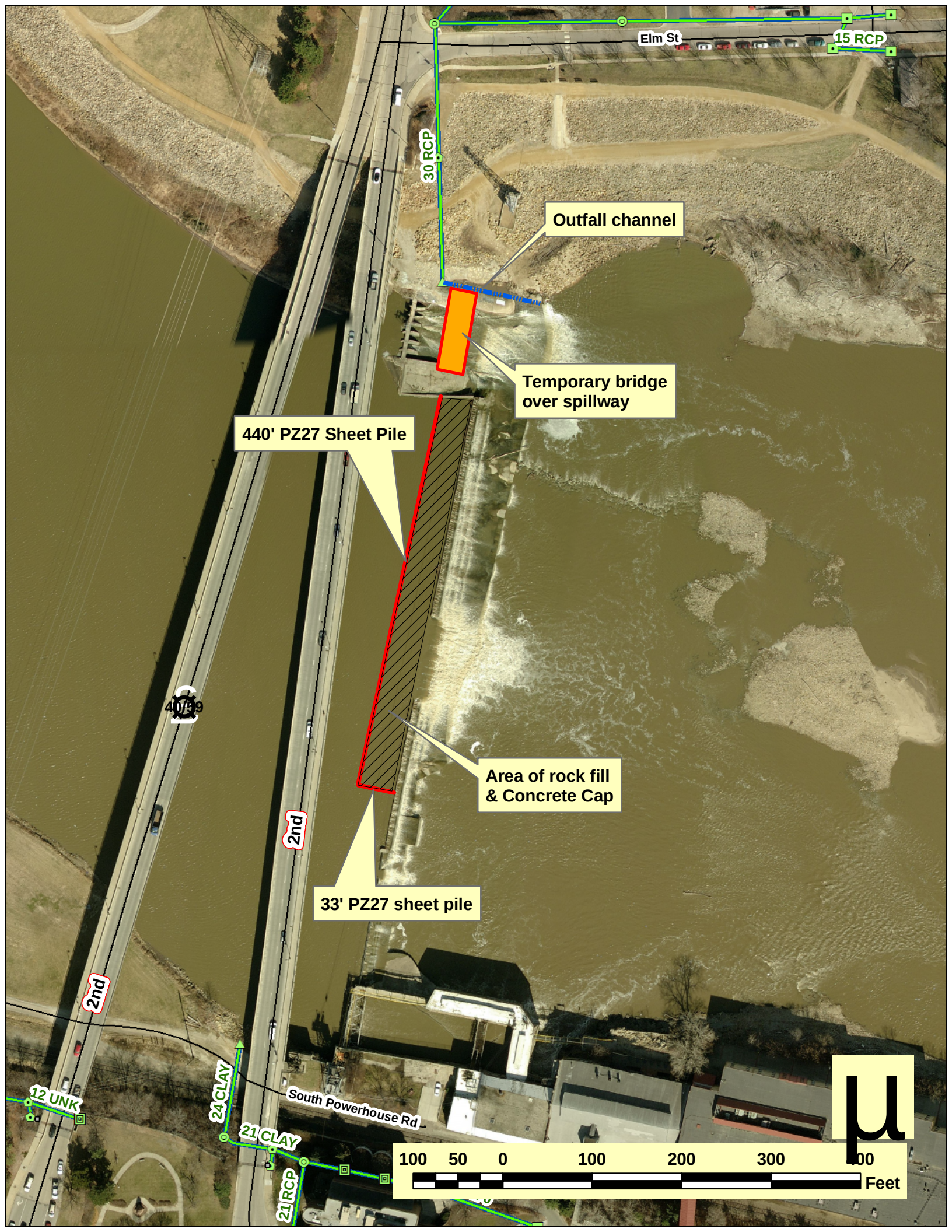
The Bowersock Dam located on the Kansas River in Lawrence, KS was inspected on January 23, 2009 to assess the condition of the dam. The findings and assessments of that inspection resulted in the maintenance project listed in this Final Construction Report. The elimination of water flowing through the dam was the primary goal of the maintenance project.



Bowersock Dam – prior to construction of maintenance project

To achieve this goal, sheet piling was driven parallel to and upstream of the existing dam face. Rock fill was then placed between the existing dam face and the newly driven sheet piling. A two foot thick reinforced concrete cap was then poured between the sheet piling and tied to the existing dam face. Refer to the aerial photograph on the next page for clarification of project activities and the corresponding locations. The existing top of dam elevation of 808.00 ft. was maintained for the project. It is important to note that the new construction DID NOT change the original elevation of the existing dam. The concrete cap mirrored the elevation of the top of the existing dam for the length of the project.

Sealed bids for the Bowersock Dam Maintenance Project (Project No. 6CP907, Public Works Project No. PW0931) were received by the City Commission at the office of the


Elm St
15 RCP
30 RCP
Outfall channel
Temporary bridge
over spillway
440' PZ27 Sheet Pile
Area of rock fill
& Concrete Cap
33' PZ27 sheet pile
2nd
2nd
12 UNK
24 CLAY
South Powerhouse Rd
21 CLAY
21 RCP
100 50 0 100 200 300 400
Feet

City Clerk in the City of Lawrence, Kansas, until 2:00 p.m. on the 11th day of August, 2009. There were two bidding contractors on the project: L.G. Barcus & Sons and United Construction Inc. On August 25, 2009 the Lawrence City Commission approved awarding the contract to L.G. Barcus & Sons in the amount of $2,279,130.26.

The City of Lawrence received a letter from the Corps of Engineers dated September 11, 2009 which stated "*the project is authorized by nationwide permit (NPW) 3, Maintenance.*" A letter dated September 14, 2009 was received from the Federal Regulatory Commission (FERC) which stated that the project may proceed upon the consideration of few comments within the received letter. These comments were addressed prior to the start of construction.

After the City of Lawrence received the required approvals from the US Army Corps of Engineers and the Federal Regulatory Energy Commission a NOTICE to PROCEED was issued to the contractor on September 21, 2009. Selection of a geotechnical firm, mobilization of the geotechnical investigation equipment, mobilization of the contractor, design of the temporary bridge across the spillway and the acquisition of building materials preceded physical work completed on site.

Geotechnical investigative work began with borings to aid in the design of the substructure for the temporary bridge within the spillway. This work was performed on October 15th & 16th, 2009. After the mobilization of a barge for the drill rig, the mainline channel borings were taken from November 5th to November 11th, 2009. Coinciding with the geotechnical investigation across the width of the river, L.G. Barcus began construction of the temporary bridge spanning the spillway. Refer to the plan and profile sheet in the "Drawings" section for boring locations and the corresponding geology. Appendix A contains the individual geotechnical boring log sheets for the width of the river. Appendix K contains the locations and boring logs used in the substructure design for the temporary bridge.

The month of January involved the mobilization of the contractor's equipment, the placement of fill between the upstream face of the dam and the line of sheet pile and the construction of a rock causeway upstream of the sheet pile line. The fill area and the causeway enabled the contractor to work from two locations to break up concrete and rubble within the sheet pile line. This dual work platform construction technique would prove crucial to the completion of the project before the river came up forcing construction activities to stop.

Tuesday February 2nd, 2010 marked the first delivery of sheet pile to the site. The first one hundred linear feet of the concrete cap was formed and placed on Thursday, February 18th. Three additional concrete placement dates (February 26th, March 2nd and March 8th, 2010) completed the concrete cap.

The end of the project construction was marked by the restoration of the outfall channel immediately north of the spillway on April 19, 2010 to its original condition. The channel had been covered with steel plates and riprap to enable access during construction.

2. FOUNDATIONS

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

2. FOUNDATIONS

The primary method used for eliminating the water flowing through the dam face was the installation of PZ27, A572 Grade 50, sheet piling approximately 33' upstream and parallel to the existing Bowersock Dam. Appendix B contains the specifications for the sheet pile. Each pile was coated with a polyamide epoxy-coal tar and was driven to refusal with a Hydraulic Power System, Inc. vibratory hammer. Models 250 & 500 hydraulic hammers were used for the installation. The model 250 hammer was the primary hammer used with the model 500 used for piles encountering greater resistance. Appendices C & D contain the specifications for the polyamide epoxy-coal tar coating and the vibratory hammer respectively. Pile tips were placed on all sheets before coating.

A line of sheet pile 440 feet in length measured from the south side of the spillway was installed parallel to the existing upstream dam face. From that point the sheet pile was driven perpendicular to the dam face to enclose the fill area for a distance of 33’.

Model 250 Hydraulic Power System, Inc. vibrator hammer shown

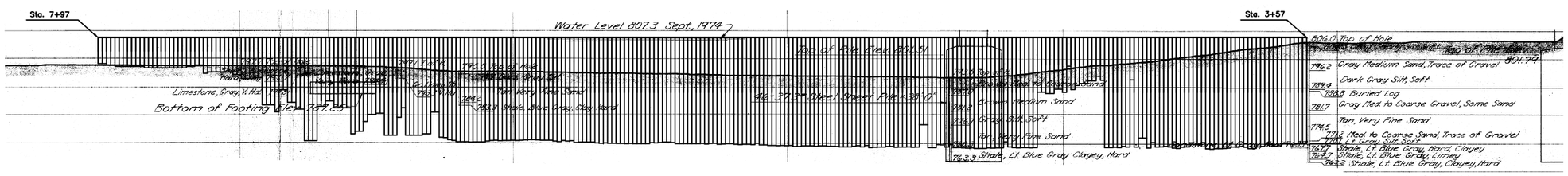
The drawing on the following page shows pile tip elevations and lengths.

Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation	Pile Number	Length Ft	Bottom Elevation
1	38.40	769.60	31	40.30	767.70	61	20.37	787.63	91	31.70	776.30	121	39.60	768.40	151	38.10	769.90	181	37.30	770.70	211	35.50	772.50	241	23.50	784.50	271	11.00	797.00
2	38.40	769.60	32	40.20	767.80	62	20.37	787.63	92	31.70	776.30	122	39.60	768.40	152	38.00	770.00	182	37.30	770.70	212	35.50	772.50	242	23.50	784.50	272	11.00	797.00
3	38.60	769.40	33	39.70	768.30	63	19.87	788.13	93	39.80	768.20	123	39.20	768.80	153	38.00	770.00	183	37.20	770.80	213	35.50	772.50	243	19.00	789.00	273	11.00	797.00
4	38.80	769.20	34	39.60	768.40	64	19.87	788.13	94	39.90	768.10	124	39.30	768.70	154	38.10	769.90	184	37.10	770.90	214	35.50	772.50	244	19.00	789.00	274	11.00	797.00
5	38.60	769.40	35	39.70	768.30	65	40.00	768.00	95	39.70	768.30	125	39.20	768.80	155	38.30	769.70	185	37.10	770.90	215	25.50	782.50	245	27.00	781.00	275	11.00	797.00
6	38.50	769.50	36	39.80	768.20	66	40.10	767.90	96	39.80	768.20	126	39.30	768.70	156	38.20	769.80	186	37.20	770.80	216	29.00	779.00	246	24.50	783.50	276	11.00	797.00
7	39.20	768.80	37	38.20	769.80	67	40.00	768.00	97	39.80	768.20	127	39.20	768.80	157	38.60	769.40	187	37.30	770.70	217	35.50	772.50	247	24.50	783.50	277	10.50	797.50
8	39.50	768.50	38	40.20	767.80	68	40.00	768.00	98	39.90	768.10	128	39.20	768.80	158	38.60	769.40	188	37.40	770.60	218	35.50	772.50	248	24.50	783.50	278	10.50	797.50
9	38.90	769.10	39	36.50	771.50	69	40.10	767.90	99	39.60	768.40	129	39.00	769.00	159	38.60	769.40	189	37.30	770.70	219	35.50	772.50	249	14.50	793.50	279	10.50	797.50
10	38.80	769.20	40	36.50	771.50	70	40.00	768.00	100	39.60	768.40	130	39.00	769.00	160	38.60	769.40	190	37.40	770.60	220	27.50	780.50	250	14.50	793.50	280	10.50	797.50
11	39.60	768.40	41	39.80	768.20	71	39.70	768.30	101	39.80	768.20	131	38.40	769.60	161	38.50	769.50	191	37.40	770.60	221	27.50	780.50	251	15.00	793.00	281	10.50	797.50
12	39.70	768.30	42	15.40	792.60	72	39.90	768.10	102	39.80	768.20	132	38.90	769.10	162	38.60	769.40	192	37.50	770.50	222	28.00	780.00	252	15.00	793.00	282	10.50	797.50
13	40.30	767.70	43	39.80	768.20	73	40.10	767.90	103	39.90	768.10	133	38.80	769.20	163	38.50	769.50	193	37.30	770.70	223	28.00	780.00	253	15.00	793.00	283	10.50	797.50
14	40.40	767.60	44	39.60	768.40	74	40.10	767.90	104	40.00	768.00	134	38.80	769.20	164	38.50	769.50	194	37.40	770.60	224	30.50	777.50	254	13.50	794.50	284	10.00	798.00
15	39.90	768.10	45	40.00	768.00	75	40.20	767.80	105	39.20	768.80	135	38.90	769.10	165	38.40	769.60	195	37.60	770.40	225	34.00	774.00	255	13.50	794.50	285	10.00	798.00
16	39.60	768.40	46	39.90	768.10	76	40.10	767.90	106	39.70	768.30	136	38.80	769.20	166	38.40	769.60	196	37.60	770.40	226	34.00	774.00	256	12.50	795.50	286	9.50	798.50
17	39.90	768.10	47	40.00	768.00	77	40.30	767.70	107	39.30	768.70	137	38.60	769.40	167	38.30	769.70	197	37.90	770.10	227	35.00	773.00	257	12.50	795.50	287	9.50	798.50
18	39.80	768.20	48	40.00	768.00	78	40.30	767.70	108	39.50	768.50	138	38.60	769.40	168	38.40	769.60	198	37.90	770.10	228	25.50	782.50	258	12.50	795.50			
19	40.20	767.80	49	15.58	792.42	79	40.30	767.70	109	39.70	768.30	139	38.70	769.30	169	38.30	769.70	199	38.00	770.00	229	25.50	782.50	259	12.50	795.50			
20	40.30	767.70	50	14.08	793.92	80	40.10	767.90	110	39.70	768.30	140	38.80	769.20	170	38.00	770.00	200	37.80	770.20	230	25.50	782.50	260	12.50	795.50			
21	40.40	767.60	51	15.75	792.25	81	40.20	767.80	111	39.70	768.30	141	38.40	769.60	171	38.00	770.00	201	37.80	770.20	231	25.50	782.50	261	12.50	795.50			
22	40.40	767.60	52	15.75	792.25	82	40.10	767.90	112	39.60	768.40	142	38.50	769.50	172	38.00	770.00	202	37.80	770.20	232	23.00	785.00	262	13.00	795.00			
23	40.60	767.40	53	16.75	791.25	83	39.90	768.10	113	39.50	768.50	143	38.70	769.30	173	38.00	770.00	203	37.40	770.60	233	23.00	785.00	263	10.00	798.00			
24	40.50	767.50	54	16.75	791.25	84	40.00	768.00	114	39.50	768.50	144	38.50	769.50	174	38.10	769.90	204	37.10	770.90	234	25.00	783.00	264	10.00	798.00			
25	38.20	769.80	55	17.42	790.58	85	38.90	769.10	115	39.40	768.60	145	38.60	769.40	175	37.50	770.50	205	36.40	771.60	235	25.00	783.00	265	10.50	797.50			
26	39.00	769.00	56	18.92	789.08	86	39.80	768.20	116	39.40	768.60	146	38.60	769.40	176	37.60	770.40	206	36.20	771.80	236	37.50	770.50	266	10.50	797.50			
27	38.80	769.20	57	10.45	797.55	87	39.00	769.00	117	39.50	768.50	147	38.60	769.40	177	37.40	770.60	207	27.10	780.90	237	37.50	770.50	267	11.00	797.00			
28	38.30	769.70	58	19.95	788.05	88	38.90	769.10	118	39.40	768.60	148	38.60	769.40	178	37.80	770.20	208	27.10	780.90	238	37.50	770.50	268	11.00	797.00			
29	39.70	768.30	59	18.78	789.22	89	40.00	768.00	119	39.40	768.60	149	38.60	769.40	179	37.60	770.40	209	35.00	773.00	239	26.00	782.00	269	11.00	797.00			
30	39.90	768.10	60	18.78	789.22	90	40.00	768.00	120	39.40	768.60	150	38.60	769.40	180	37.30	770.70	210	35.00	773.00	240	26.00	782.00	270	11.00	797.00			

North South Piles

Pile Number	Length Ft	Bottom Elevation
1	1.25	806.75
2	2.50	805.50
3	3.25	804.75
4	3.25	804.75
5	8.00	800.00
6	8.25	799.75
7	11.00	797.00
8	11.00	797.00
9	11.00	797.00
10	11.25	796.75
11	10.50	797.50
12	10.50	797.50
13	6.25	801.75
14	12.50	795.50
15	7.50	800.50
16	7.50	800.50
17	10.75	797.25
18	10.75	797.25
19	12.00	796.00
20	12.00	796.00

East West Piles



PROFILE

Notes:
Pile numbering begins on the north and west sides
Top pile elevation is 808.00

Scale 1"=20'

SHEET ? OF ?

DATE	BY	REVISION

CITY OF LAWRENCE, KANSAS
ENGINEERING DIVISION OF PUBLIC WORKS

BOWERSOCK DAM

PROJECT NO. PW?????

SHOEB M. UDDIN
CITY ENGINEER

DAVID L. CORLISS
CITY MANAGER

3. CONCRETE WORK

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

3. CONCRETE WORK

The top of the existing dam is approximately Elevation 808.00. The concrete cap that was placed with this project mirrored the existing top of dam elevation. The concrete cap was placed in four separate pours. Concrete testing results are in Appendix J.

Date	Concrete (yd^3)
2/18/2010	173
2/26/2010	242
3/2/2010	290
3/8/2010	240

All concrete materials conformed to the specifications of the Kansas City Metropolitan Materials Board (KCMMB) or alternative mixes as approved by the Engineer. Information is available on the website ***www.kcmmb.org***.

The "Thawzall" heating system shown in Appendix L was used in conjunction with thermal blankets to thaw the sub grade prior to concrete placement. Both were also used after placement to aid in cold weather cure.

Steel reinforcing mat on 12" centers both directions.

4. ANCHORS

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

4. ANCHORS

An anchor rod assembly was used to tie the upstream sheet piling to the concrete cap. Refer to Appendix E for the detail sheets. In order to form a contiguous section reinforcing bars were doweled into the existing upstream face of the dam. The anchor rod assemble consists of two Grade 75 threaded bars with three steel plates and nuts connected to a continuous waler plate. The waler plate was welded to the sheet pile. Prior to all welded connections the coal tar epoxy was removed at the weld connection points.

Sheet piling anchor – detail showing relation to waler

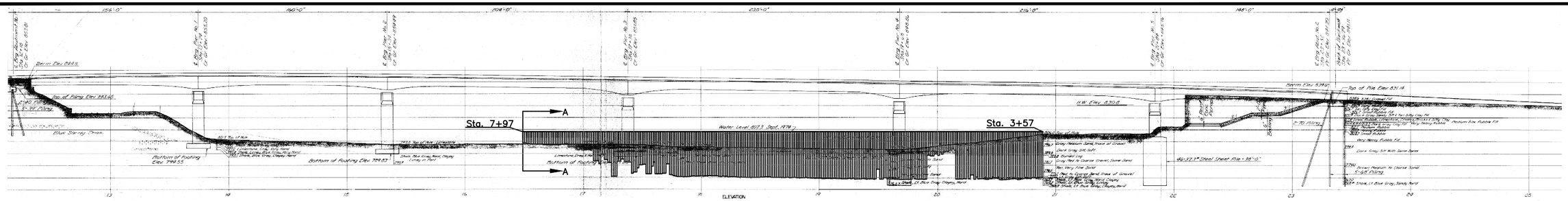
Sheet Pile Anchor – free end

The sheet pile anchor system is visible below the layer of epoxy coated reinforcing steel.

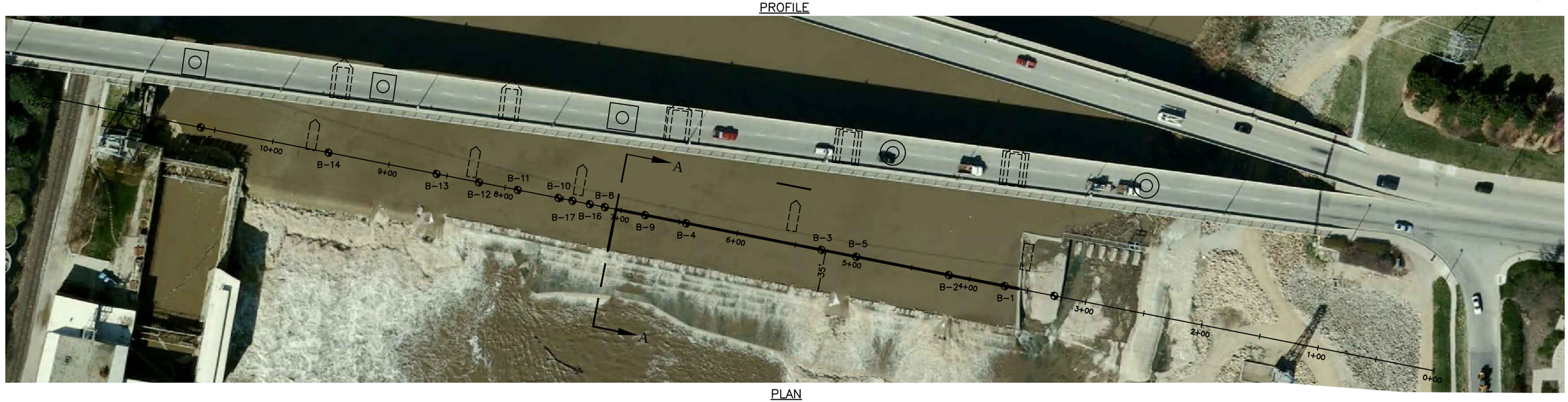
5. DRAWINGS

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

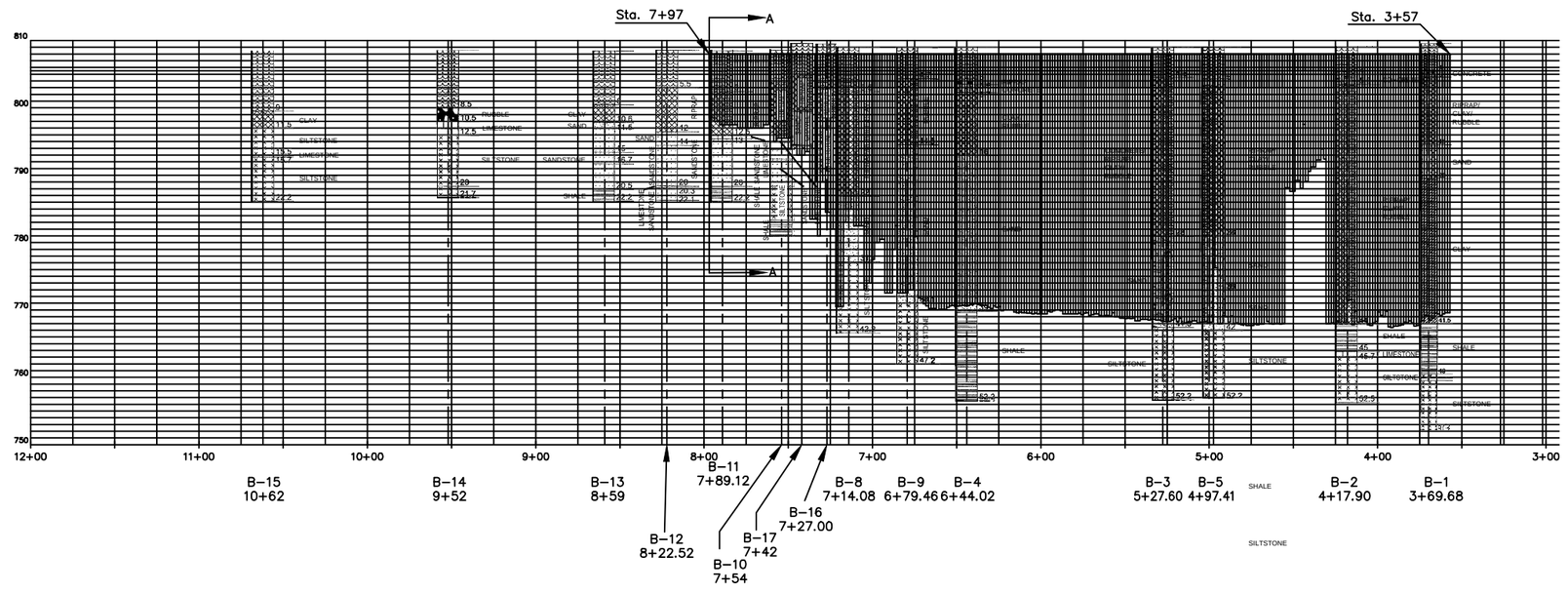
City of Lawrence



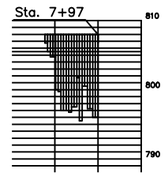
PROFILE



PLAN



North South Piles



SECTION A
East West Piles

Scale 1"=40'

SHEET ? OF ?

DATE	BY	REVISION

CITY OF LAWRENCE, KANSAS
ENGINEERING DIVISION OF PUBLIC WORKS

BOWERSOCK DAM

PROJECT NO. PW0931

SHOEB M. UDDIN
CITY ENGINEER

DAVID L. CORLISS
CITY MANAGER

6. CONSTRUCTION PHOTOGRAPHS

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

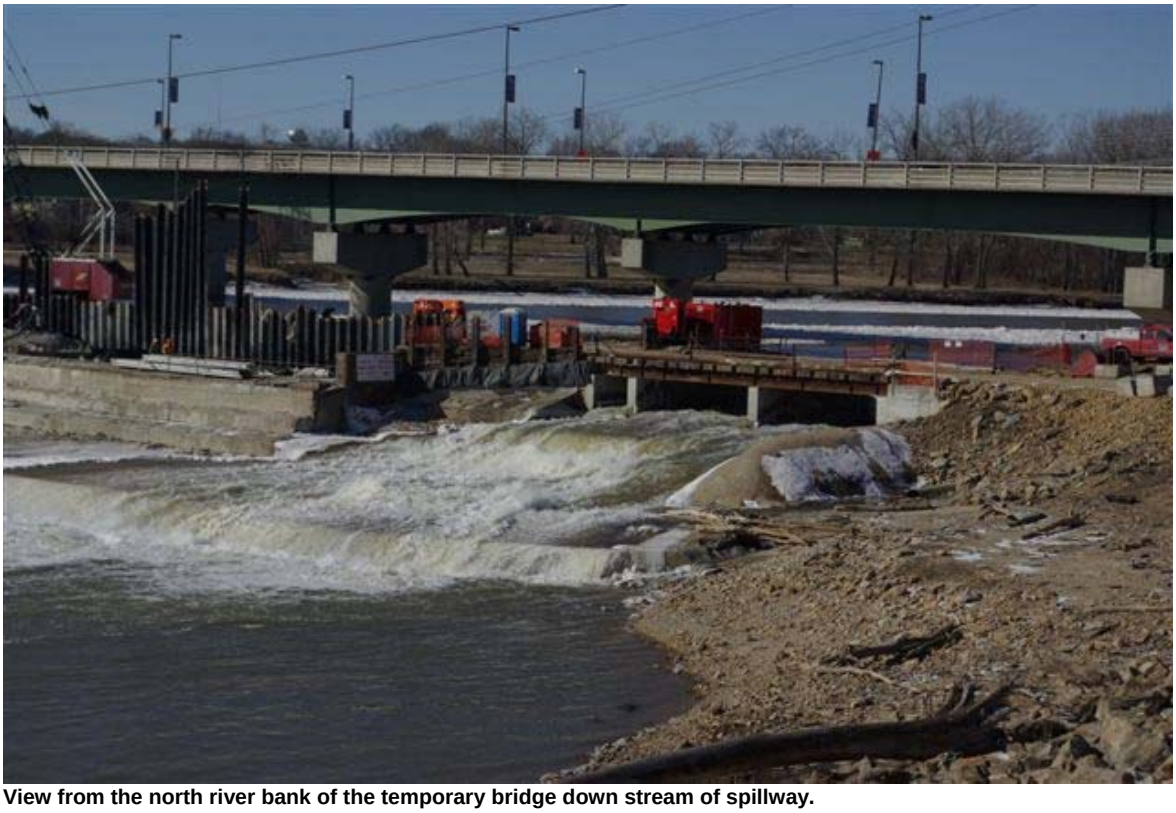
City of Lawrence

Middle bents of the temporary bridge spanning the spillway under construction.

Middle bents of the temporary bridge spanning the spillway.

Completed temporary bridge across spillway

Template used to align sheet pile



View from the north river bank of the temporary bridge down stream of spillway.

View from the north river bank downstream of the dam.

View from US-59 Bridge looking down on the construction site.

Final concrete cap pour

APPENDICIES

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

Appendix A

Geotechnical Boring Logs

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

LOG OF BORING NO. B-1

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 3+69.68

Approx. Surface Elev.: 809.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	4 805.5									
	5 CONCRETE 804.5									
	FILL, with rubble, rip-rap and fine to coarse grained sand -well graded sand between 5' and 5.5' -rubble between 5.5' and 12.5'	5								
	-sand with rubble	10								
	15 794.5	15								
	SAND, well graded				WB					
	20 789.5	20								
	CLAY, sandy, silty	25								
		30								
		35								
	41.5 768	40								
	***SHALE, gray with occasional 1" to 2" limestone stringers			1	SS WB	3	50/3"	20		9000+*
		45								
	49 760.5			2	SS WB	3	50/3"	20		9000+*
		50								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-3-09		
BORING COMPLETED	11-3-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-1

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	***SILTSTONE, gray, shaley									
		55		3	SS WB	2	50/2.5"	20		9000+*
	57.2 752.5									
	BOTTOM OF BORING			4	SS	2	50/2.5"	20		9000+*

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	11-3-09		
BORING COMPLETED	11-3-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-2

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 4+17.90

Approx. Surface Elev.: 809.0 ft

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
WATER	4 (805)			HS					
5.5 CONCRETE (803.5)	5.5								
FILL, concrete, rubble, riprap, wood - clay between 5.5' and 7' -rubble between 7' and 11' -possible concrete between 11' and 11.4' -rubble between 11.4' and 15' -sand with gravel and wood pieces between 15' and 41'	5, 10, 15, 20, 25, 30, 35, 40			WB					
41 (768) SHALE, gray, weathered	40		1	SS WB	2	50/2.5'	20		9000+*
45 (764) 45.7 LIMESTONE, weathered (763.5)	45		2	SS WB	2	50/2"	19		9000+*
SILTSTONE, gray, shaley	50		3	SS	1	50/2"	18		9000+*
52.5 (756.5) BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-4-09		
BORING COMPLETED	11-4-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-3

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 5+27.60

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	4.5 804.5									
	FILL, concrete, clay, rubble -concrete between 4.5' and 6.5' -clay between 6.5' and 9.5' - rubble between 9.5' and 28'	5 10 15 20 25								
	28 781									
	SAND, coarse sand and gravel	30 35			WB					
	41.5 767.5	40								
	***SILTSTONE, gray, shaley	45		1	SS WB	2	50/2.5"	20		9000+*
		50		2	SS WB	2	50/2"	23		9000+*
	52.2 757			3	SS	2.5	50/3"	19		9000+*
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-4-09		
BORING COMPLETED	11-4-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-4

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 6+44.02

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	5 804									
	5.5 RIP RAP 803.5									
	6.7 8" CONCRETE 802.5									
	FILL, concrete, rubble, rip rap, and sand									
	-clay between 6.7' and 9'									
	16 -rubble between 9' and 9.4' 793									
	-possible concrete between 9.4' and 10'									
	-riprap, cobbles with sand between 10' and 16'									
	SAND, with gravel and wood fragments				WB					
	39 770									
	***SHALE, weathered,			1	SS WB	2	50/2"	22		+9000*
				2	SS WB	2	50/2"	19		+9000*
	52.2 757			3	SS	2	50/2"	20		+9000*
	BOTTOM OF BORING									
	***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.									
	All descriptions taken from driller's field logs.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▼		▼

Terracon

BORING STARTED	11-4-09		
BORING COMPLETED	11-4-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-5

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 4+97.41

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER	5			HS					
	804									
	FILL, rip rap with sand and clay - riprap between 5.5' and 6.2' -clay between 6.2' and 12' -sandy clay between 12' and 16' -sand with occassional gravel, cobbles and wood between 18' and 28'				DB					
					HS					
	28 781									
	SAND, medium coarse, cobbles									
	36 773									
	SAND, medium coarse, with gravel									
	42 767									
	***SILTSTONE, shaley, weathered, gray			1	SS WB	1	50/2"	19		+9000*
				2	SS WB	2	50/2"	17		+9000*
	52.2 757			3	SS	3	50/2"	18		+9000*
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▼		▼

Terracon

BORING STARTED	11-5-09		
BORING COMPLETED	11-5-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-6

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Not provided

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER	4			HS					
		805								
	FILL, concrete, rip rap, and sand	6			DB					
		803	5							
	-concrete between 4' and 4.9'									
	-limestone cobbles between 4.9' and 5.2'									
	-sand between 5.2' and 6'									
	BOTTOM OF BORING									
	All descriptions taken from driller's field logs.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▽		▼

Terracon

BORING STARTED	11-5-09		
BORING COMPLETED	11-5-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-7

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Not provided

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	3.6 805.5									
	5.3 FILL, concrete, rip rap, and sandy clay 803.5	5			DB					
	-concrete between 3.6' and 4.9'									
	-limestone cobbles between 4.9' and 5.2'									
	-sandy clay between 5.2' and 5.3'									
	BOTTOM OF BORING									
	All descriptions taken from driller's field logs.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	11-5-09		
BORING COMPLETED	11-5-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-8

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 7+14.08

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	6.5 802.5 FILL,clay, sand, rip rap and rubble - riprap between 6.5' and 8' -sandy clay between 8' and 9' -riprap between 9' and 11.5' -sand between 11.5' and 15.5'	5								
	22 787 -rubble and riprap between 15.5' and 18' -concrete between 18' and 19' - riprap, rubble and sand beteen 19' and 22'	10 15 20 25								
	31.7 777.5 - fine to coarse sand layer from 11.5 to 15.5 SAND, medium coarse sand, with occaisonal cobbles -wood from 28' to 28.5' -wood from 29.5 to 30.2'	30		1	SS WB	10	50/6"	14		+9000*
	***SILTSTONE,shaley, weathered, gray	35		2	SS WB	2	50/2"	18		+9000*
	42.2 767 BOTTOM OF BORING	40		3	SS	2	50/2"	17		+9000*

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	11-5-09		
BORING COMPLETED	11-5-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-9

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 6+79.46

Approx. Surface Elev.: 809.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	4.7 804.5									
	FILL, rip rap, clay, rubble and wood -riprap between 4.7' and 7' -clay between 7' and 9.5'	5								
	14.5 794.5 -riprap between 9.5' and 10'	10								
	-wood between 10' and 11'	15								
	-riprap between 11' and 14.5'									
	SAND, medium coarse, with gravel	20								
	-occasional cobbles below 27'	25								
	38.1 771	30								
	***SILTSTONE, shaley, weathered, gray	35		1	SS WB	3	50/4"	13		+9000*
		40		2	SS WB	2	50/2"	18		+9000*
	47.2 - 2" limestone stringer at 45.5' 762	45		3	SS	NR	50/2"			
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	11-5-09		
BORING COMPLETED	11-5-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-10

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 7+54.00

Approx. Surface Elev.: 808.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	4.5 804 FILL, rip rap, clay, sand, trace cobbles -riprap between 4.5' and 7' -clay between 7' and 9.5'	5								
	12.5 796 -riprap between 9.5' and 10.5'	10		R1	DB					
	14.6 794 - sandy clay with trace cobbles between 12' and 12.5'	15		1	SS HS	1	50/5"			
	16 792.5 ***LIMESTONE, severely weathered			2	SS WB	NR	50/1"			
	20 788.5 ***SANDSTONE, highly weathered ***SANDSTONE, weathered, gray	20		3	SS WB	2	50/2"			+9000*
	25 783.5 ***SILTSTONE, shaley, weathered, gray	25								
	27.5 781 ***SHALE, weathered, gray			4	SS	1	50/2"			+9000*
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-6-09		
BORING COMPLETED	11-6-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-11

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 7+89.12

Approx. Surface Elev.: 808.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	6 — 802.5	5								
	FILL, rip rap, clay, sand, trace cobbles									
	-riprap between 6' and 9.5'	10								
	12.5 — 796									
	13 — 795.5 - sandy clay with trace cobbles between 9.5' and 12.5'				WB					
	***LIMESTONE, severely weathered	15		1	SS	NR	50/1"			
	***SANDSTONE, highly weathered				WB					
	20 — 788.5			2	SS	1	50/1"			
	***SHALE, weathered, gray	20			WB					
	22.2 — 786.5									
	BOTTOM OF BORING			3	SS	2	50/2"			

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-6-09		
BORING COMPLETED	11-6-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-12

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 8+22.52

Approx. Surface Elev.: 808.5 ft

DESCRIPTION		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
WATER					HS					
5.5	803	5								
FILL, riprap with sand										
12	796.5	10								
***SANDSTONE, gray				1	SS WB	NR	50/1"			
14 -interbedded with limestone	794.5	15								
***SANDSTONE,silty, gray										
20	788.5			2	SS WB	2	50/2"			
20.3 ***LIMESTONE, weathered, gray	788	20								
22.1 ***SANDSTONE,weathered, gray	786.5			3	SS		50/1.5"			
BOTTOM OF BORING										

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-6-09		
BORING COMPLETED	11-6-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-13

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 8+59.00

Approx. Surface Elev.: 808.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	8 800.5	5								
	FILL, lean clay, with sand and rubble									
	10.6 798	10								
	11.5 797 -sandy clay trace rubble between 8' and 10'			1	SS WB	1	50/1"			
	15 793.5 -wood pieces between 10' and 10.6'	15								
	16.7 792 -			2	SS WB	1	50/1"			
	20.5 SAND 788	20								
	22.2 786.5 ***SANDSTONE, weathered,with limestone seams, gray			3	SS	NR	50/2"			
	***SANDSTONE, highly weathered, gray									
	***SANDSTONE, weathered, gray									
	***SHALE, weathered,silty, gray									
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	11-6-09		
BORING COMPLETED	11-6-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-14

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 9+52.00

Approx. Surface Elev.: 808.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	8.5 800	5								
	RUBBLE	10								
	10.5 (possible Rip Rap) 798									
	12.5 ***LIMESTONE, weathered, sandy, gray 796			1	SS WB	1	1			
	***SILTSTONE, sandy, gray -with occasional limestone stringers	15								
	20 788.5			2	SS WB	2	50/2"			
	21.7 ***SILTSTONE, shaley 787	20								
	BOTTOM OF BORING			3	SS	NR	50/2"			

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-6-09		
BORING COMPLETED	11-6-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-15

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 10+62.00

Approx. Surface Elev.: 808.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER				HS					
	9 — 799.5									
	FILL, clay, sand and riprap									
	11.5 — 797									
	- riprap between 9' and 10.5'									
	15.5 — 793			1	SS WB	2	50/3"			
	15.7 — 793									
	***SILTSTONE, with sand, gray									
	-sandy clay between 10.5' and 11.5'									
	***LIMESTONE			2	SS WB	3	50/5"			
	22.2 — 786.5									
	***SILTSTONE, shaley, gray			3	SS	2	50/2"			
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	11-6-09		
BORING COMPLETED	11-6-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-16

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 7+27.00

Approx. Surface Elev.: 809.5 ft

GRAPHIC LOG	DESCRIPTION		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER					HS					
		802	5								
	FILL, clay, sand with occassional boulders and riprap										
	7.5										
	-riprap between 7.5' and 11'		10								
	11	798.5									
	-sandy clay with occassional cobbles between 11' and 19'		15								
	19.5 ***SILTSTONE, sandy, gray	790									
	BOTTOM OF BORING										

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	11-10-09		
BORING COMPLETED	11-10-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. B-17

CLIENT **LG Barcus & Sons Inc**

ARCHITECT

SITE **Bowersock Dam**
Lawrence, Kansas

PROJECT **Bowersock Dam Repairs**

Boring Location: Station 7+42.00

Approx. Surface Elev.: 809.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	WATER									
	4.5 805 FILL, clay, sand and riprap	5								
	- riprap between 4.5' and 7'									
	10 799.5 -sandy clay between 7' and 10'	10								
	SAND, with gravel and cobbles									
	15 794.5	15								
	15.5 794 ***SILTSTONE, sandy, gray									
	BOTTOM OF BORING									

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▽ NONE	AB
WL	▽		▽	

Terracon

BORING STARTED	11-10-09		
BORING COMPLETED	11-10-09		
RIG	208	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. S-1

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 3+27

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.7 8" CONCRETE			1	PA SS	14	24			
	3.5 FILL, sand and gravel									
	5 LEAN CLAY, sandy, with gravel, tan	5		2	PA SS HS	12	28			
	LEAN CLAY, sandy, with gravel, brown 8.5									
	LEAN CLAY, sandy, with gravel	10		3	SS HS	10	16			
	13.5									
	SILTY SAND, and gravel	15		4	SS WB	6	8			
	18.5									
	LEAN TO FAT CLAY, shaley, gray	20		5	SS WB	18	5			
		25		6	SS WB	18	6			
	28.5									
	LEAN TO FAT CLAY, silty, shaley, gray	30		7	SS WB	18	5			
	33.5									
	LEAN TO FAT CLAY, silty, trace gravel, gray	35		8	SS WB	18	9			
	38.5									
	40 LEAN TO FAT CLAY, silty, with gravel, gray	40		9	SS WB	12	24			
	***SHALE, weathered, gray	45		10	SS WB	2	50/2"			
	48.8									
	BOTTOM OF BORING			11	SS	4	50/4"			

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

Note: Void from 8.5' to 10.0'.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▼		▼

Terracon

BORING STARTED	10-16-09
BORING COMPLETED	10-16-09
RIG CME 45 ATV	FOREMAN SF
APPROVED CWV	JOB # 02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. S-2

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam
Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 3+02

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.7 8" CONCRETE			1	PA	11	10			
	3.5 FILL, clay, sand, gravel				SS					
	LEAN TO FAT CLAY, silty, sand, with gravel	5		2	PA	8	4			
					SS					
					PA					
	10			3	SS	10	4			
	RUBBLE	10			HS					
	13.5 (possible Rip Rap)									
	LEAN TO FAT CLAY, shaley, gray	15		4	SS	10	5			
					WB					
		20		5	SS	18	4			
					WB					
		25		6	SS	18	4			
					WB					
	28.5									
	SILTY SAND	30		7	SS	12	11			
					WB					
	33.5									
	34.5 SAND, coarse grained	35		8	SS	16	61/12"			
	***SHALE, weathered, gray				WB					
	38.8									
	BOTTOM OF BORING			9	SS	2	50/3"			
	***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.									
	All descriptions taken from driller's field logs.									
	Note: Void from 3.0' to 4.5'.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▽		▼

Terracon

BORING STARTED	10-16-09		
BORING COMPLETED	10-16-09		
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. S-3

CLIENT: LG Barcus & Sons Inc

ARCHITECT:

SITE: Bowersock Dam, Lawrence, Kansas

PROJECT: Bowersock Dam Repairs

Boring Location: Station 2+74

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.3 3" CONCRETE			1	PA SS	3	10			
	3.5 FILL, sand, gravel									
	5 GRAVEL, sandy	5		2	PA SS HS	8	11			
	RUBBLE (possible Rip Rap) 8.5									
	10 SILTY SAND, and gravel	10		3	SS HS	6	21			
	RUBBLE (possible Rip Rap) 13.5									
	15 SILTY SAND	15		4	SS HS	0	5			
	SAND, coarse grained	20		5	SS WB	18	8			
	23.5 ***SHALE, weathered, gray	25		6	SS WB	4	4			
	28.5 SAND, coarse grained, trace gravel	30		7	SS WB	12	9			
	33.5 34.5 SAND, coarse grained	35		8	SS WB	16	66/10"			
	***SHALE, weathered, gray 38.8									
	BOTTOM OF BORING			9	SS	3	50/3"			

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

Note: Void from 3.0' to 4.5'.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▽		▼

Terracon

BORING STARTED	10-15-09
BORING COMPLETED	10-15-09
RIG CME 45 ATV	FOREMAN SF
APPROVED CWV	JOB # 02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

LOG OF BORING NO. S-4

CLIENT: **LG Barcus & Sons Inc**

ARCHITECT:

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

Boring Location: Station 2+48

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	1.7 20" CONCRETE				DB					
	3.5 FILL, lean clay, sandy, trace gravel, tan			1	SS	16	9			
	FILL, clay, sandy, with gravel	5		2	HS	8	6			
	8.5				SS HS					
	FILL, clay, sand, with gravel, tan	10		3	SS HS	9	8			
	13.5									
	FILL, clay, gravel	15		4	SS HS	6	7			
	18.5									
	SILT, with gravel	20		5	SS WB	6	10			
	23.5									
	SAND, medium fine grained, trace gravel	25		6	SS WB	18	18			
	28.5									
	31 SAND, fine grained	30		7	SS WB	8	5			
	33 BOULDER									
	SAND, medium grained, with gravel	35		8	SS WB	10	14			
	38.5									
	SAND, medium grained, with gravel	40		9	SS WB	10	22			
	43.5									
	45 ***SHALE, weathered, trace gravel, gray	45		10	SS WB	4	50/4"			
	***SHALE, weathered, gray									
	48.8									
	BOTTOM OF BORING			11	SS	3	50/3"			

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

Note: Void from 8.5' to 10.0'.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	10-15-09
BORING COMPLETED	10-15-09
RIG CME 45 ATV	FOREMAN SF
APPROVED CWV	JOB # 02095255

BOREHOLE 02095255.GPJ TERRACON.GDT 12/14/09

Appendix B

Skyline Steel Sheet Pile Specifications

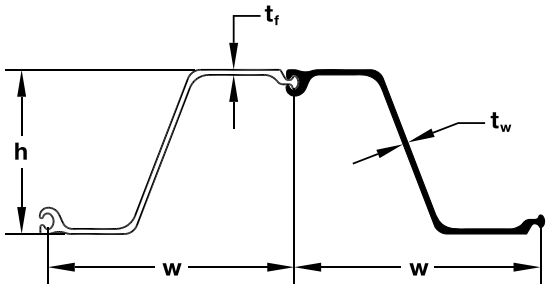
Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

PZ/PS

PZ/PS Hot Rolled Steel Sheet Piling

ArcelorMittal | skylinesteel



PZ

SECTION	Width (w) in (mm)	Height (h) in (mm)	THICKNESS Flange (t_f) in (mm)	THICKNESS Wall (t_w) in (mm)	Cross Sectional Area in²/ft (cm²/m)	WEIGHT Pile lb/ft (kg/m)	WEIGHT Wall lb/ft² (kg/m²)	SECTION MODULUS Elastic in³/ft (cm³/m)	SECTION MODULUS Plastic in³/ft (cm³/m)	Moment of Inertia in⁴/ft (cm⁴/m)	COATING AREA Both Sides ft²/ft of single (m²/m)	COATING AREA Wall Surface ft²/ft² of wall (m²/m²)
PZ 22	22.0 559	9.0 229	0.375 9.50	0.375 9.50	6.47 136.9	40.3 60.0	22.0 107.4	18.1 973	21.79 1171.4	84.38 11500	4.48 1.37	1.22 1.22
PZ 27	18.0 457	12.0 305	0.375 9.50	0.375 9.50	7.94 168.1	40.5 60.3	27.0 131.8	30.2 1620	36.49 1961.9	184.20 25200	4.48 1.37	1.49 1.49
PZ 35	22.6 575	14.9 378	0.600 15.21	0.500 12.67	10.29 217.8	66.0 98.2	35.0 170.9	48.5 2608	57.17 3073.5	361.22 49300	5.37 1.64	1.42 1.42
PZ 40	19.7 500	16.1 409	0.600 15.21	0.500 12.67	11.77 249.1	65.6 97.6	40.0 195.3	60.7 3263	71.92 3866.7	490.85 67000	5.37 1.64	1.64 1.64

PS

SECTION	Width (w) in (mm)	Web (t_w) in (mm)	Maximum Interlock Strength k/in (kN/m)	Minimum Cell Diameter* ft (m)	Cross Sectional Area in²/ft (cm²/m)	WEIGHT Pile lb/ft (kg/m)	WEIGHT Wall lb/ft² (kg/m²)	Elastic Section Modulus in³/sheet (cm³/sheet)	Moment of Inertia in⁴/sheet (cm⁴/sheet)	COATING AREA Both Sides ft²/ft of single (m²/m)	COATING AREA Wall Surface ft²/ft² of wall (m²/m²)
PS 27.5	19.69 500	0.4 10.2	24 4800	30 9.14	8.09 171.2	45.1 67.1	27.5 134.3	3.3 54	5.3 221	3.65 1.11	1.11 1.11
PS 31	19.69 500	0.5 12.7	24 4800	30 9.14	9.12 193.0	50.9 75.7	31.0 151.4	3.3 54	5.3 221	3.65 1.11	1.11 1.11

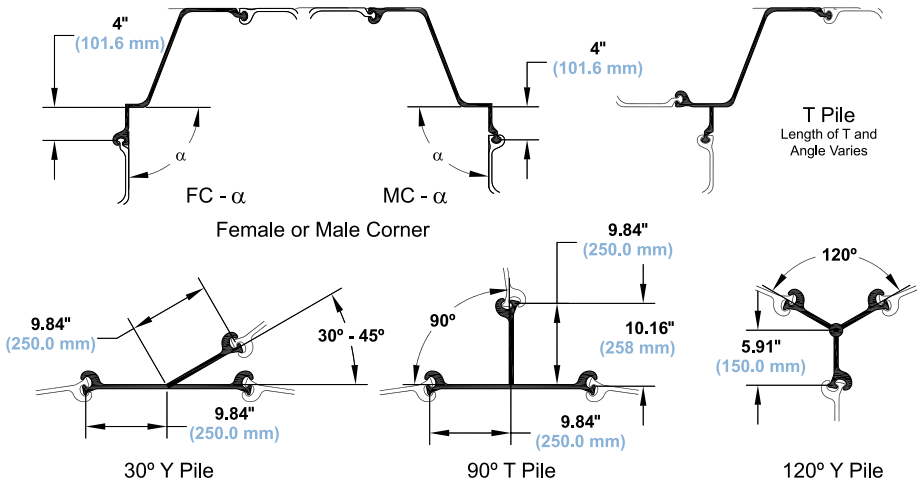
* Minimum cell diameter cannot be guaranteed for piles over 65 feet (19.81 m) in length.
* Minimum cell diameter cannot be guaranteed if piles are spliced.
* 58 Piles are needed to make a 30 foot diameter cell.

PZ/PS

PZ/PS Hot Rolled Steel Sheet Piling

Available Steel Grades							
PZ's			PS's				
ASTM	YIELD STRENGTH		ASTM	YIELD STRENGTH		INTERLOCK STRENGTH	
	(ksi)	(MPa)		(ksi)	(MPa)	(k/in)	(kN/m)
A 328	39	270	A 328	39	270	16	2800
A 572 Grade 50	50	345	A 572 Grade 50	50	345	20	3500
A 572 Grade 60	60	415	A 572 Grade 60	60	415	24	4200
A 572 Grade 65	65	450	A 572 Grade 65	65	450	24	4200
A 588	50	345	A 588	50	345	20	3500
A 690	50	345	A 690	50	345	20	3500

Corner and Junction Piles



Delivery Conditions & Tolerances

	ASTM A 6	
Mass	± 2.5%	
Length	+ 5 inches	– 0 inches

Maximum Rolled Lengths*

PZ	85 feet for singles, 70 feet for pairs	(25.9 m, 21.3 m)
PS	65 feet	(19.8 m)

* Longer lengths may be possible upon request.

Appendix C

Tnemec
Polyamide Epoxy-Coal Tar
Specification Sheets

Bowersock Dam
Maintenance Project
(Dec. 2009 – Mar. 2010)

City of Lawrence

TNEMEC

PRODUCT DATA SHEET

HI-BUILD TNEME-TAR® SERIES 46H-413

PRODUCT PROFILE

GENERIC DESCRIPTION Polyamide Epoxy-Coal Tar

COMMON USAGE High-build corrosion resistant coating providing one coat protection for concrete and steel in a variety of chemical, immersion and undergound conditions. Also, when a two-coat application is desired, a low film build option is possible.

COLORS Black

FINISH Semi-gloss

SPECIAL QUALIFICATIONS Conforms to the performance requirements of AWWA C 210 (not for potable water contact).

PERFORMANCE CRITERIA Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEM

PRIMERS

Steel: Self-priming or Series 1, 66, N69, N69F, 90-97, H90-97, 161
Galvanized Steel: Series 66, N69, N69F, 161
Concrete: Self-priming, 63-1500, 218

SURFACE PREPARATION

STEEL

Immersion Service: SSPC-SP10 Near-White Blast Cleaning
Non-Immersion Service: SSPC-SP6 Commercial Blast Cleaning

GALVANIZED STEEL Surface preparation recommendations will vary depending on substrate and exposure conditions. Contact your Tnemec representative or Tnemec Technical Services.

CAST/DUCTILE IRON Contact your Tnemec representative or Tnemec Technical Services.

CONCRETE Allow new concrete to cure for 28 days. Abrasive blast all surfaces referencing SSPC-SP13/NACE 6, ICRI CSP 2-4 Surface Preparation of Concrete and Tnemec's Surface Preparation and Application Guide.

PRIMED SURFACES **Immersion Service:** Scarify the surface with fine abrasive before topcoating if the Series 66, N69 or 161 prime coat has been exposed to sunlight for 60 days or longer.

ALL SURFACES Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS 75.0 ± 2.0% (mixed)

RECOMMENDED DFT 16.0 to 20.0 mils (405 to 510 microns)
8.0 to 10.0 mils (200 to 250 microns) for the two-coat option

CURING TIME

Temperature	To Touch	To Recoat (Min./Max)	Immersion
95°F (35°C)	2 hours	3-14 hours	5 days
85°F (29°C)	3 hours	4-18 hours	6 days
75°F (24°C)	4 hours	6-28 hours	7 days
65°F (18°C)	6 hours	10-50 hours	10 days
55°F (13°C)	9 hours	16 hrs-3 days	14-16 days
45°F (7°C)	18 hours	32 hrs-4 days	22-24 days
35°F (2°C)	26 hours	44 hrs-6 days	28-32 days

Curing time varies with surface temperature, air movement, humidity and film thickness.
Use the above times as guidelines only. Scarify the surface with fine abrasive before recoating if the maximum recoat time has been exceeded.

VOLATILE ORGANIC COMPOUNDS

Unthinned: 1.91 lbs/gallon (229 grams/litre)
Thinned 20% (No. 2 Thinner): 2.80 lbs/gallon (335 grams/litre)
Thinned 20% (No. 65 Thinner): 1.91 lbs/gallon (229 grams/litre)

THEORETICAL COVERAGE 1,203 mil sq ft/gal (29.5 m²/L at 25 microns). See APPLICATION for coverage rates.

NUMBER OF COMPONENTS Two: Part A and Part B

MIXING RATIO By volume: One (Part A) to one (Part B)

PACKAGING 5 gallon (18.9L) pails and 1 gallon (3.79L) cans — Order in multiples of 2.

NET WEIGHT PER GALLON 11.74 ± 0.25 lbs (5.32 ± .11 kg) (mixed)

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)

TEMPERATURE RESISTANCE (Dry) Continuous 200°F (93°C) Intermittent 250°F (121°C)

SHELF LIFE 12 months at recommended storage temperature.

FLASH POINT - SETA Parts A & B: 81°F (27°C)

HEALTH & SAFETY Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product.
Keep out of the reach of children.

HI-BUILD TNEME-TAR® | SERIES 46H-413

APPLICATION

COVERAGE RATES

Conventional Build

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	18.0 (455)	24.0 (610)	69 (6.4)
Minimum	16 (405)	21.5 (545)	75 (7.0)
Maximum	20.0 (510)	27.0 (685)	59 (5.5)

Two-Coat System (DFT each coat)

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	9.0 (225)	12.0 (300)	134 (12.5)
Minimum	8.0 (200)	11.0 (275)	150 (14.0)
Maximum	10.0 (250)	13.0 (325)	120 (11.2)

Allow for overspray and surface irregularities. Film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance.

MIXING

Power mix contents of each container, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. Do not use mixed material beyond pot life limits. **Note:** Both components should be above 50°F (10°C) prior to mixing. For application to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand thirty (30) minutes and restir before using. For optimum application properties, the material temperature should be above 60°F (16°C).

THINNING

Use No. 2 Thinner. For air spray, thin up to 20% or 1 1/2 pints (760 mL) per gallon; for airless spray, thin up to 5% or 1/4 pint (190 mL) per gallon. A maximum of 20% of No. 65 Thinner may be used to comply with VOC regulations.

POT LIFE

16 hours at 35°F (2°C) 6 hours at 55°F (13°C) 2 hours at 75°F (24°C) 3/4 hour at 95°F (35°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E .070"	704 or 765	5/16" or 3/8" (7.9 or 9.5 mm)	1/2" (12.7 mm)	75-100 psi (5.2-6.9 bar)	20-40 psi (1.4-2.8 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.017"-0.021" (430-530 microns)	3400-4000 psi (234-276 bar)	3/8" or 1/2" (9.5 or 12.7 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.
Note: Application over inorganic zinc-rich primers: Apply a wet mist coat and allow tiny bubbles to form. When bubbles disappear in 1 to 2 minutes, apply a full wet coat at specified mil thickness.
Brush: Brushing is recommended on small areas only. Ladle material on and then use flat side of brush to spread. Do not brush out to thin film as with conventional coatings.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 120°F (49°C)
The surface should be dry and at least 5°F (3°C) above the dew point. Coating won't cure below minimum surface temperature.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or xylol.

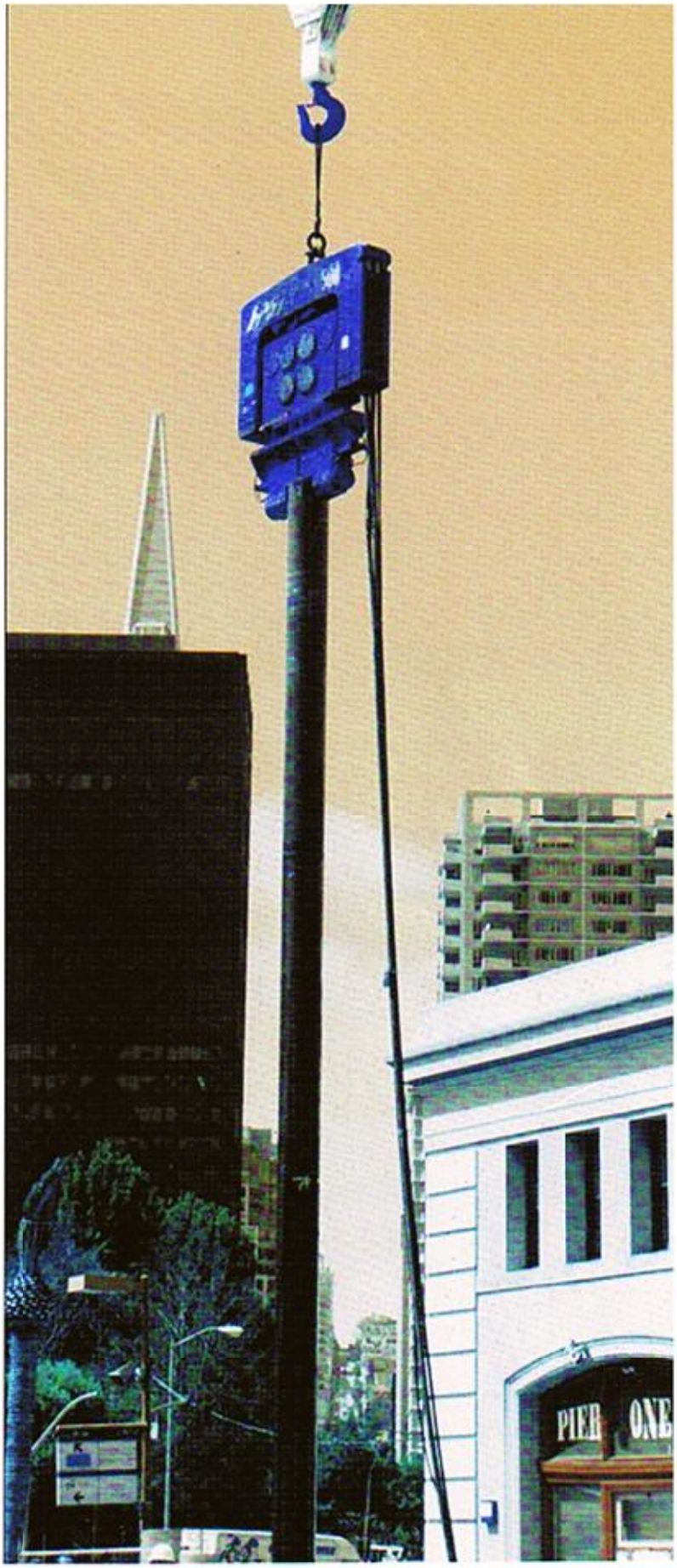
Appendix D

Vibratory Pile Driving Equipment

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

Vibratory Pile Driving Equipment



HPSI

HYDRAULIC POWER SYSTEMS, INC.

Introduction

HPSI Vibratory Driver/Extractors have been designed to be as dependable and free of downtime as any product available in today's construction market. Some of the features to make these products the most reliable machines today are as follows:

Gear Box Fabrication

Supplied with quality steel free of laminated plate. All welds are full penetration welds and every gear box is stress relieved after fabrication.

Vibration Supressors

Furnished by one of the worlds leaders of rubber mounting and shear block products for years of dependable service.

Eccentric Gears

Produced from high quality alloy steel requiring no additional heat treating or hardening of the gear teeth.

Eccentric Bearings

Manufactured only by quality state-of-the-art bearing companies to our highest standards.

Hydraulic Motors

HPSI takes pride in using only the best hydraulic motors and pumps available in the industry.

Model 1600 driving 150' pipe on San Francisco wharf project

Clamp Housings
All steel castings from foundries with expertise in casting products of perfection.

Seals and Gaskets
From the die cut eccentric cover and gear case cover gaskets, to the quality 5,000 psi clamp seals, HPSI units are fully capable of underwater use and free from oil leaks.

Hose Bundles
Scuff-resistant hydraulic hose covers add longer hose bundle life to the hammers.

Power Pack Units
Powered by reliable diesel engines as indicated, or per our customers' preference.

Remote Controls
Air remote pendants of 35 feet are standard on most units with optional radio remotes available.

Sound Enclosures
Sheet metal enclosures are standard on most vibratory packages. Reduced sound enclosures are available as an option on any HPSI power unit.

Model 250 driving sheets in St. Louis.

Model 150 w/50 ton caisson clamp assembly.

Special Applications

- Underwater
- 90° Turning Plate
- Stingers
- Lead Adapters
- Low Headroom Clamp
- Excavator Mounted
- Biodegradable Hydraulic Oils

Vibratory Hammer Specifications

Exciter

	Model 100		Model 150L		Model 150		Model 200		Model 250		Model 260	
	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)
Eccentric Moment (in lbs, kgm)	1,000	11.5	1,500	17.3	1,500	17.3	2,000	23.0	2,500	28.7	2,600	30.0
Dynamic Force (tons, tonnes)	36	32	55	50	55	50	73	66	91	82	95	86
Frequency (VPM)	1,600	1600	1,600	1600	1,600	1600	1,600	1600	1,600	1600	1,600	1600
Amplitude (in, mm)	1.0	25.4	1.0	25.4	.875	22.22	.875	22.22	1.0	25.4	.80	20.32
Pile Clamp Force (tons, KN)	50	445	50	445	50	445	150	1335	150	1335	150	1335
Maximum Crane Pull (tons, KN)	25	222	30	267	30	267	45	400	45	400	60	534
Suspended Weight (lbs, kg)	4,210	1913	4,250	1931	7,050	3204	8,600	3910	8,600	3910	10,750	4886
Length (in, mm)	60	1524	83	2108	87	2210	95	2413	95	2413	95	2413
Width @ Throat (in, mm)	12	304	14	356	14	356	14	356	14	356	14	356
Height (in, mm)	64	1626	63	1600	78	1981	85	2159	85	2159	96	2438

Power Unit

	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)
Engine	Cummins		3116 Cat		3116 Cat		3306 Cat		3406 Cat		3406 Cat	
Power (HP, KW)	110	82	210	157	210	157	300	224	335	250	335	250
Speed (RPM)	2,500	2500	2,400	2400	2,400	2400	2,100	2100	2,100	2100	2,100	2100
Operating Pressure (PSI, BAR)	2,500	170	2,500	170	2,500	170	5,000	345	5,000	345	5,000	345
Flow (GPM, LPM)	60	227	120	454	120	454	70	265	96	363	96	363
Weight (lbs, kg)	5,250	2386	7,800	3538	7,800	3538	11,000	4990	11,500	5216	11,500	5216
Length (in, mm)	98	2489	108	2743	108	2743	144	3658	144	3658	144	3658
Width (in, mm))	42	1066	48	1219	48	1219	60	1524	60	1524	60	1524
Height (in, mm)	75	1905	78	1981	78	1981	95	2413	95	2413	95	2413

Model 300		Model 400		Model 450		Model 500		Model 1200		Model 1600		Model 2000	
(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)
3,000	35.0	4,000	46.0	4500	52.0	5,000	58.0	12,000	138	16,000	184	20,000	230
109	99	145	132	164	149	182	165	334	304	445	405	480	436
1,600	1600	1,600	1600	1600	1600	1,600	1600	1,400	1400	1,400	1400	1,300	1300
.875	22.22	1.12	28.5	1.0	25.4	1.12	28.5	.75	19.0	1.0	25.4	1.0	25.4
200	1780	200	1780	200	1780	200	1780	600	5340	600	5340	600	5340
60	534	75	667	75	667	75	667	150	1335	150	1335	150	1335
10,750	4886	13,600	6182	17000	7730	17,000	7730	44,340	20155	52,500	23860	54,000	24545
95	2413	102	2590	102	2590	102	2590	132	3353	132	3353	144	3658
14	356	14	356	14	356	14	356	36	914	40	1016	40	1016
96	2438	102	2590	102	2590	102	2590	103	2616	103	2616	128	3251

(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)	(US)	(METRIC)
3406 Cat		3408 Cat		3412 Cat		3412 Cat		Cummins		Cummins		Cummins	
400	300	505	378	600	448	700	522	1200	897	1,600	1196	1,600	1196
2,100	2100	2,100	2100	2,100	2100	2,100	2100	2,100	2100	2,100	2100	2,100	2100
5,000	345	5,000	345	5,000	345	5,000	345	5,000	345	5,000	345	5,000	345
115	435	140	530	192	727	202	764	280	1060	400	1514	400	1514
11,500	5216	15,000	6804	16,500	7484	16,500	7484	37,120	16838	48,000	21818	48,000	21818
144	3658	164	4166	184	4674	184	4674	276	7010	276	7010	276	7010
60	1524	66	1676	66	1676	66	1676	96	2438	96	2438	96	2438
95	2413	102	2590	103	2616	103	2616	120	3048	120	3048	120	3048

Accessories

Universal Sheeting Clamp

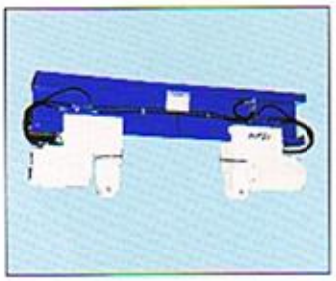
Sheeting clamps with 200 tons of clamping force are standard on HPSI 200 and larger hammers. They allow driving of most commonly driven sections of sheeting.

Concrete Pile Puller

150 tons of clamping force available for a maximum of 24" concrete pile.

Caisson Clamp

HPSI caisson clamps available with 35, 50, 125 and 150 tons of clamping force for driving 12" to 15' diameter pipe. Hydraulic locking devices eliminate moving of clamps during driving.



Shipping Stand

For ease of shipping and convenience of storing on barges and limited access job sites.

Four Point Clamp

Standard on Models 1200, 1600 and 2000. Available as an accessory assembly for use with the Model 500 and smaller vibratory hammers.

Wood Pile Clamp

Models 8" to 18" and 10" to 20" are available for all vibratory hammers and are operated by 2500 P.S.I. hydraulic cylinders.

Radio Remote Control

Available for all vibratory models. Controls vibro, clamp, engine rpm and emergency stop.

Other Custom Designed Accessories are Available to Solve Your Pile Driving Equipment Needs

Let Our Experience Work For You Today!

Engineering Data

Technical data on vibratory pile hammers can often be useful when selecting a machine for a particular application.

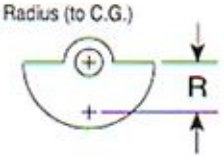
It is very useful to select a machine with the right combination of eccentric moment, amplitude, dynamic force, hydraulic horsepower, engine horsepower and total weight for a particular application.

The following information may be valuable in your selection of equipment for your job.

Eccentric Moment

A value in inch pounds equal to the weight of the eccentric multiplied by the distance from the center of rotation to the center of gravity of the eccentric.

Eccentric Moment = Weight x Radius (to C.G.)



Centrifugal Force

A weight rotating about a center of rotation at a fixed radius equal to outward force.

$$\text{Centrifugal Force, lbs.} = \frac{\text{Weight x Radius x RPM x RPM}}{35204}$$

Clamp Force

The area of the piston rod head of the clamp multiplied by the available clamp pressure of the Power Pack. Clamp force is very important to the life of the jaws of the clamp.

$$\text{Clamp Force Tons} = \frac{\text{Dia}^2 \text{ x .7854 x Pressure}}{2000}$$

Hydraulic Horsepower

Output horsepower of the hydraulic motors is equal to the actual gallons per minute of hydraulic oil being delivered multiplied by the maximum relief setting of the hydraulic system. It is important when reviewing hammer specifications that the diesel engine horsepower is capable of providing more power than is required to achieve the required hydraulic horsepower. Without this horsepower available, it is not possible to maintain frequency to obtain maximum driving forces.

$$\text{Hydraulic Horsepower} = \frac{\text{GPM x Pressure}}{1714} \div \text{Motor Efficiency}$$

Dynamic Forces

Also sometimes known as driving force, is the force generated by the rotation of the eccentrics. The driving force is the product of the eccentric moment multiplied by a constant multiplied by the steady state frequency squared.

$$\text{Force Tons} = \frac{\text{Eccentric Moment x .0142 x Frequency}^2}{1{,}000{,}000}$$

Driving Amplitude

The total vertical travel of the vibrating mass including the vibrating portion of the Exciter and the weight of the pile being driven.

$$\text{Amplitude in inches} = \frac{\text{Eccentric Moment}}{\text{Vibrating Mass}} \text{ x } 2$$

Vibrating Mass

In determining the drivability of very heavy pile such as caissons, it is helpful to know the vibrating mass of the particular machine you are using. With known factors of eccentric moment and amplitude, the vibrating mass may be expressed as follows.

$$\text{Vibrating Mass} = \frac{\text{Eccentric Moment x 2}}{\text{Amplitude}}$$

Caisson Weight

To calculate the total vibrating mass for determining available amplitude, it is necessary to know the weight of the caisson. The simplified formula for pipe is shown as

Weight per Foot = O.D. of Pipe – Wall Thickness x Wall Thickness x 10.68

Model 130 installing wick drains

Model 260 Exciter

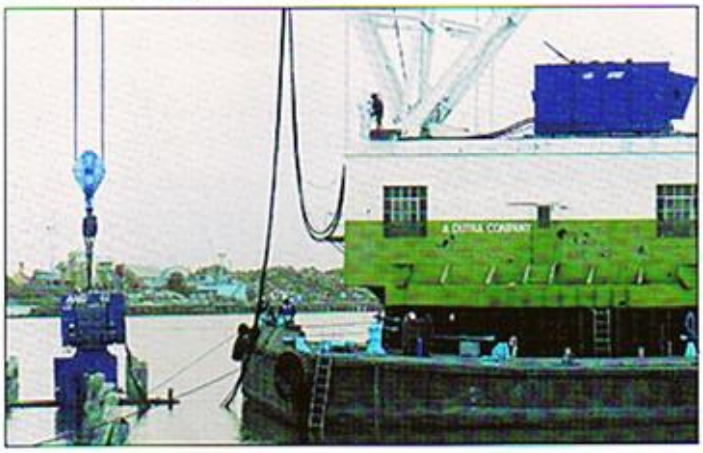
Model 150 Exciter

Model 500 Exciter

Model 20 Exciter

80E Excavator Mounted Exciter

Model 450 Extracting 24" Concrete Pile



- Diesel, gasoline and electrically-driven hydraulic power units
- Hydraulic drilling equipment
- Barge and rail movers
- Hydraulic impact hammers
- Hydraulic vibratory pile hammers
- Add-on crane drums
- Winch systems
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- Hydraulic winches
- Jet pumps
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VIB2000

Appendix E

Sheet Piling Anchor Details

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

BOWERSOCK DAM – LAWRENCE, KS
SHEET PILING ANCHOR DETAILS

BY

CHRISTOPHER E ORLANDO, MS PE

OF

CEO STRUCTURAL ENGINEERS

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PHONE 913.677.9000 • FAX 913.677.9097
ceosc@ceostructures.com

"Part of the solution..."

CITY OF LAWRENCE
PUBLIC WORKS DEPARTMENT

REVIEWED FOR GENERAL COMPLIANCE, WITH PLANS AND SPECIFICATIONS ONLY. DETAIL DIMENSIONS NOT CHECKED. NO RESPONSIBILITY IS ASSUMED FOR DETAIL ACCURACY OR DIMENSIONING.

☑ APPROVED

☐ APPROVED AS NOTED IN RED

☐ REVISE & RESUBMIT

Date: 1/14/2010

Reviewer: SMB

FOR

L G BARCUS & SONS

HOME OFFICE - KANSAS CITY
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JANUARY 11, 2010
CEO FILE NO: LGB08.09

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DATE 01/04/10
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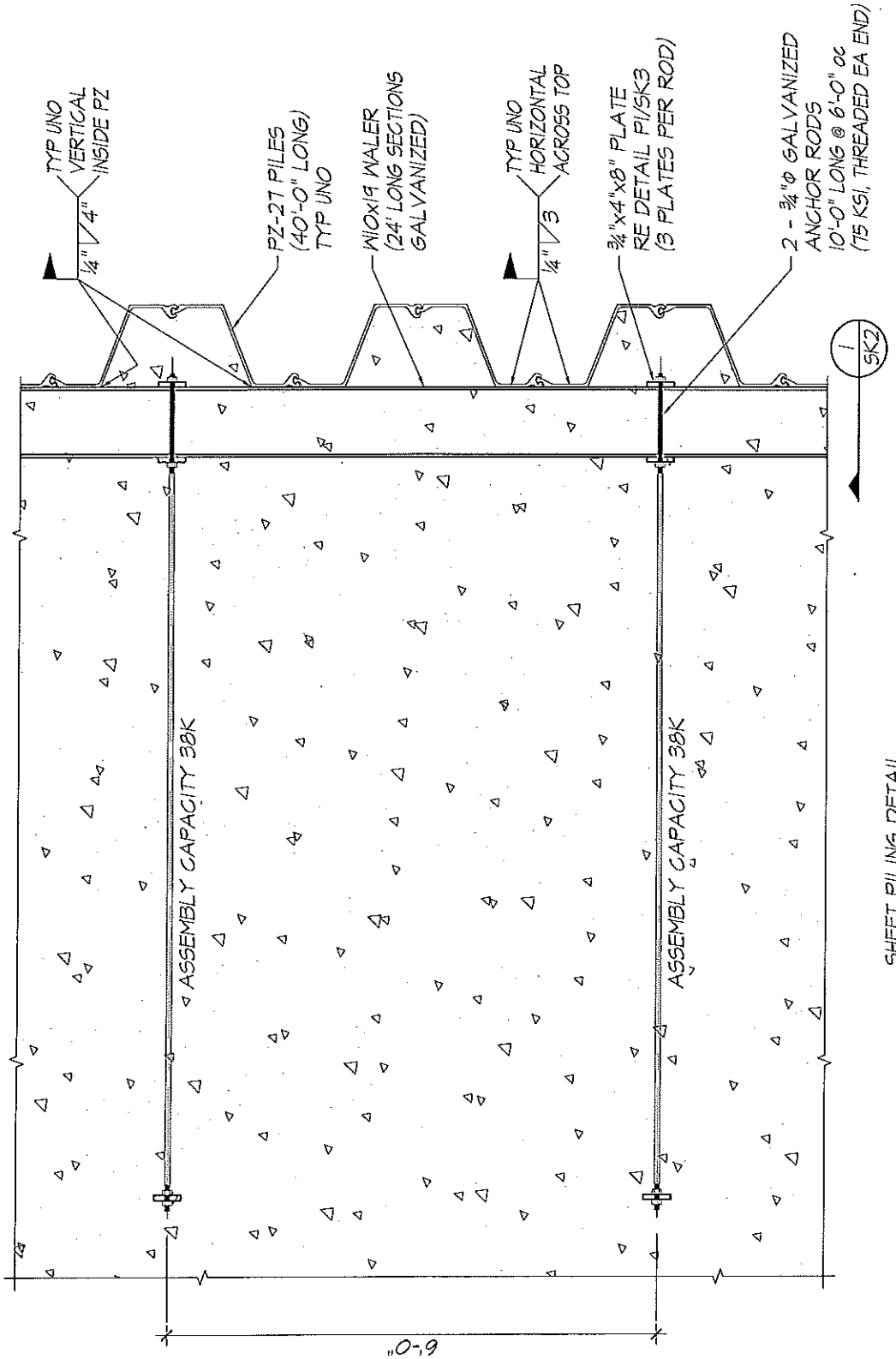
CHECKED BY CEO

SK1



SHIM W/ SINGLE OR MULTIPLE PLs AS REQ'D TO FILL GAPS BETWEEN SHEET PILING & WALER BM AT ALL ATTACHMENT LOCATIONS

SHEET PILING DETAIL
PLAN VIEW
A / SK1
1/2" = 1'-0"

GR 60 REINF NOT SHOWN

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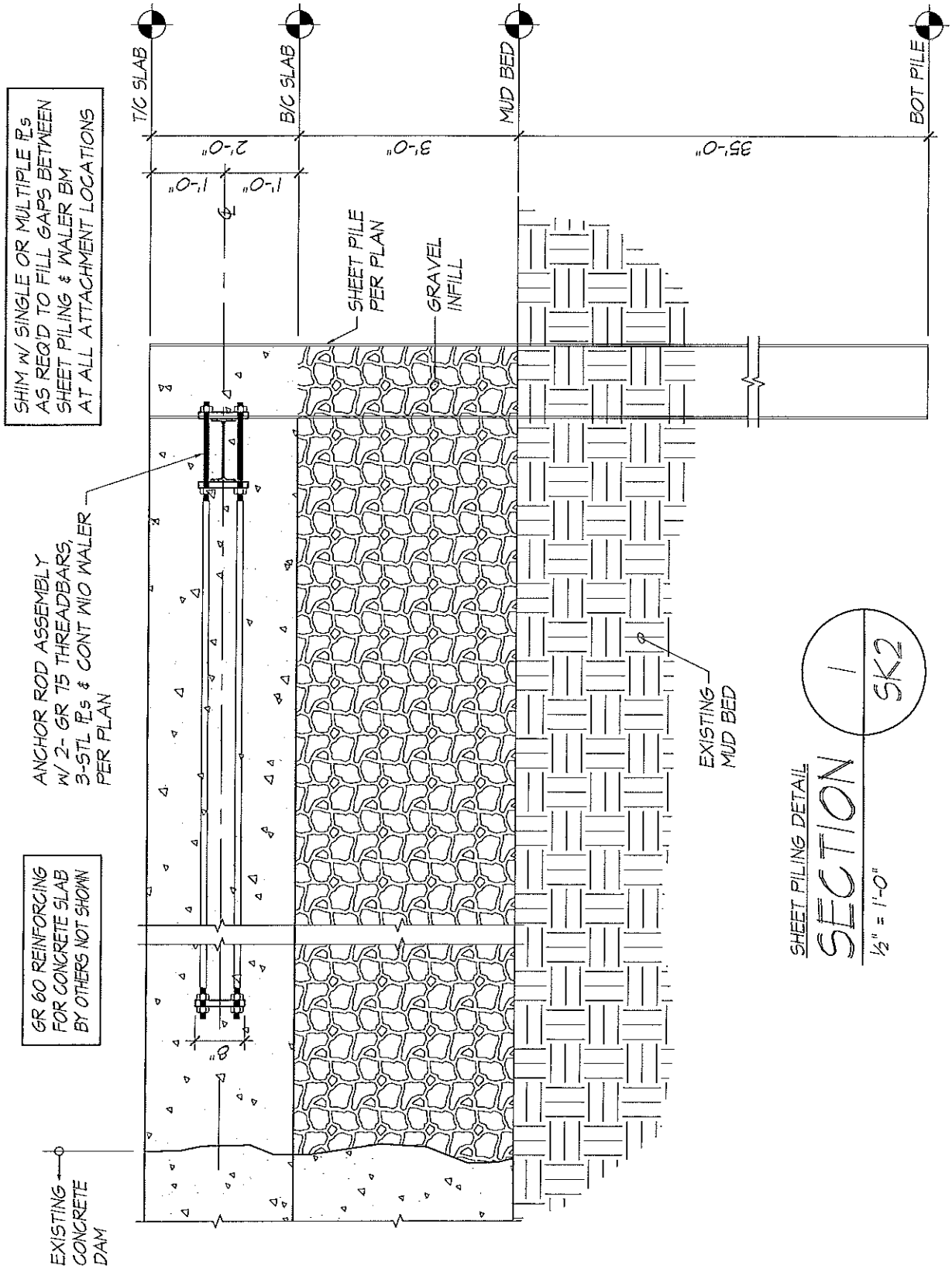
SK2



SHEET PILING DETAIL
SECTION 1/SK2
½" = 1'-0"

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SK3

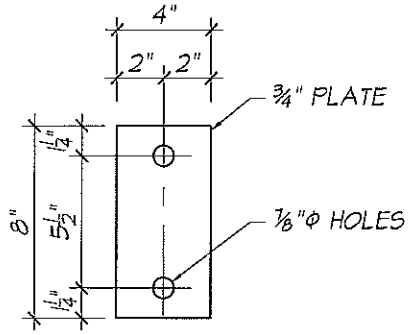


PLATE DETAIL
DETAIL P1 / SK3
1½" = 1'-0"

Appendix F

Expandable Waterstops Specification Sheets

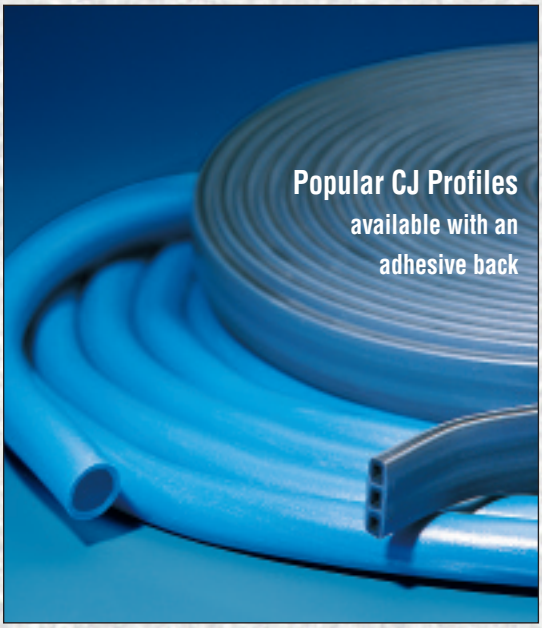
Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

Hydrotite

hydrophilic water sealing materials

The Benchmark for Expandable Waterstops



Hydrotite is a state-of-the-art hydrophilic waterstop with unmatched durability and watersealing capacity. Comprised of NON-BENTONITE, modified chloroprene rubber, **Hydrotite** expands up to EIGHT TIMES its original volume when exposed to water. This expansion creates an effective compression seal within joints of limited movement. Recognized worldwide, **Hydrotite** has a proven track record as a high quality and cost effective solution to your water containment needs.

Since 1950, GREENSTREAK has maintained its position of industry leadership by responding to the unique needs of our customers. **Hydrotite** is one more example of our continued dedication to the construction market and to the advancement of joint sealing technologies.

TYPICAL STRUCTURES UTILIZING *HYDROTITE*:

- Water and waste water treatment facilities
- Primary and secondary containment structures
- Tunnels and culverts
- Dams, locks, canals, water reservoirs and aqueducts
- Pipe penetrations
- Swimming pools
- Storage tanks
- Retaining walls
- Foundations
- Slabs on grade

Hydroelectric and Flood Control Projects

Water and Waste Water Treatment Plants

Tunnels

GREENSTREAK®

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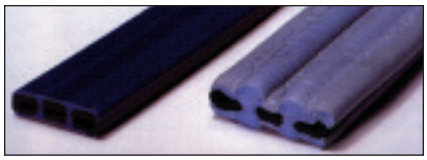
www.greenstreak.com

Flexible solutions. Concrete performance.

HYDROTITE: The Benchmark for Expandable Waterstops

Hydrotite® is a state-of-the-art hydrophilic waterstop now available from GREENSTREAK®. Comprised of a modified chloroprene rubber, **Hydrotite** has unmatched durability and water sealing capacity. **Hydrotite** expands up to EIGHT TIMES its volume when exposed to water. This remarkable hydrophilic property enables **Hydrotite** to reliably seal joints.



BEFORE EXPANSION AFTER EXPANSION

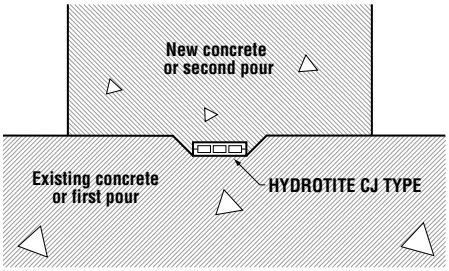
Note: *Hydrotite CJ-Type is not a sealing material for expansion joints and should not be used as such.*

Exceptional Qualities to Ensure Unparalleled Performance

- Swells up to EIGHT times its volume when exposed to water
- Comprised of NON-BENTONITE, modified chloroprene rubber
- Outstanding physical properties
- Available as a co-extruded profile to provide directional expansion (also available as a single extrusion)
- Special expansion delay coating to allow concrete cure prior to expansion
- Reliable and durable (lifespan up to 100 years)
- ISO 9002 certified
- CJ-0725-3K-ADH and CJ-1020-2K-ADH offered with an adhesive back
- Simple, low cost installation
- Available in a multitude of sizes and shapes for numerous applications
- Appropriate for retro-fit as well as new construction
- Can withstand high hydrostatic pressures (150' head minimum for most profiles)
- International acceptance
- 15 years of service

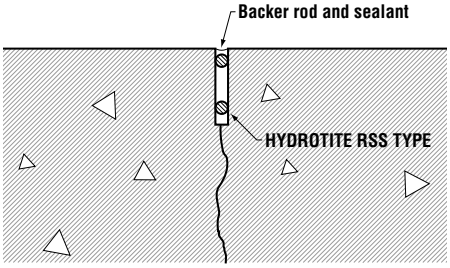
HYDROTITE CJ: A Superior Waterstop for Concrete Joint Gaps

As this innovative product absorbs water and expands, it conforms to gap variations along the joint. This action ensures complete sealing even under extraordinary hydrostatic pressures. Due to its slim profile, it won't project like conventional waterstops and trap air or become displaced by the second pour. The result is optimum concrete placement. **Hydrotite CJ**, is treated with a special expansion-delay coating to prevent it from reacting to the fresh, moist concrete and expanding before curing takes place.



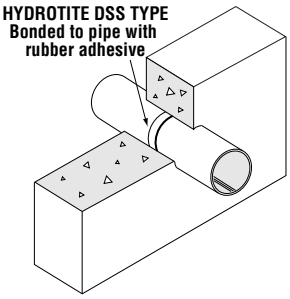
HYDROTITE RSS: Seal for Sawed Control Joints/Joint Repairs

Hydrotite RSS profiles create effective seals in sawed control joints and in the repair of failed joints. **Hydrotite** eliminates hydrostatic pressure below the sealant, thus extending the sealant's life. Select solid profiles with slightly larger diameters than the joint width for joints of consistent widths. Hollow profiles should be selected based on the maximum width of joints with varying widths. Compress both profiles slightly on initial insertion.



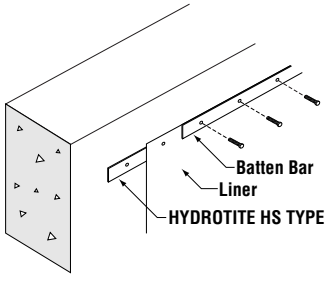
HYDROTITE DSS: Pipe Penetrations/Pipe Thimbles

The DSS profiles can be bonded to various piping materials, including concrete, steel and plastic. Bond **Hydrotite DSS** to the pipe prior to concrete placement. Installation in existing walls requires an oversize cutout be made and **Hydrotite** installed both on the pipe and the outside diameter of the cutout. Fill the annulus with a non-shrink grout. Embedded pipe thimbles can also be sealed with **Hydrotite DSS**.



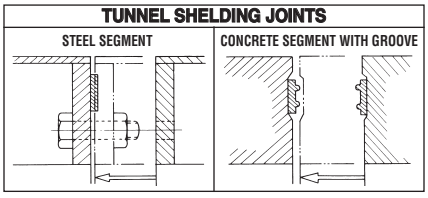
HYDROTITE HS: Termination for Liner Systems

Hydrotite HS-0540-30 is used to complete liner systems. Placed under a batten bar, between the liner and concrete wall, **Hydrotite HS** effectively terminates the liner. Dual composition prevents the profile from expanding out from under the batten bar. The HS profile can be supplied solid or with 3/8 inch diameter prepunched holes on 6 inch centers for ease of installing anchors.



HYDROTITE DS: Ideal In Shield Segment Tunnel Lining Systems

The outstanding hydrophilic performance of **Hydrotite DS** enables it to follow the expansion and contraction of joint gaps, creating an effective seal even under high water pressure. In contrast, conventional compressive seals tend to lose their elasticity and restoring force over time and, therefore, their water-sealing effectiveness. Furthermore, conventional seals must be thicker compared to **Hydrotite DS** to have the same gap-sealing ability.

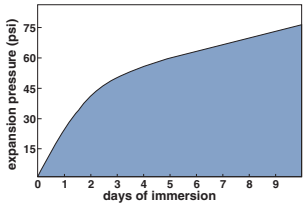


PROPERTIES OF *HYDROTITE*

Property	Test Method	Unit	Hydrophilic Rubber		Chloroprene Rubber	
			Minimum	Typical	Minimum	Typical
Tensile Strength	ASTM D412	lb/in2	350	366	1300	1570
Elongation	ASTM D412	%	600	670	400	450
Hardness	ASTM D2240	Shore A	52+/-5	54	50+/-5	50
Tear Resistance	ASTM D624	lb/in	50	60.3	100	123
Specific Gravity	ASTM D792		1.32+/-0.1	1.32	1.38+/-0.1	1.38

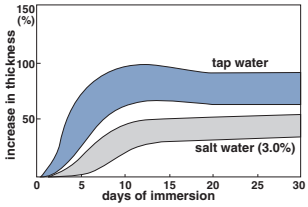
EXPANSION CHARACTERISTICS

Typical expansion pressures of **Hydrotite** are shown below.



SWELLING CHARACTERISTICS

Swelling characteristics of **Hydrotite** depend on the water quality as typical examples shown below.



INSTALLATION GUIDELINES

1. For best results, apply **Hydrotite** to smooth, even surfaces to ensure good bonding.
2. Provide 2" minimum concrete cover.
3. **Hydrotite** can be installed to the plain surface of concrete or in a formed keyway.

4. **Hydrotite** should be spliced by cutting ends square (or mitered) with a sharp knife or shears. Bond the prepared ends together with a cyanacrylate (super glue) adhesive. **Leakmaster** can be used to further protect the splice area.

5. Remove all dust, oil, etc. From concrete surface prior to adhering **Hydrotite**.
6. CJ-0725-3K-ADH and CJ-1020-2K-ADH are available with an adhesive back for adhering to the concrete surface. Bonding of other **Hydrotite** profiles can be accomplished using a contact adhesive compatible with chloroprene rubber. On rough concrete surfaces, **GREENSTREAK 7300 Epoxy** or **Leakmaster** should be used to smooth the surface and to adhere **Hydrotite**.
7. Concrete nails, in conjunction with adhesives, are recommended for vertical or overhead applications.

SHAPE AND APPLICATION

ITEM	NOMINAL SIZE mm (inches)			PACKAGING UNIT METERS/REEL x REELS (FT/BOX)
FOR CONSTRUCTION JOINTS				
CJ-0725-3K	H 7 (.28)	W 25 (.98)		10m x 4 (131)
CJ-0725-3K-ADH	Same as above with pressure sensitive adhesive backing			
CJ-1020-2K	10 (.39)	20 (.79)		10m x 5 (164)
CJ-1020-2K-ADH	Same as above with pressure sensitive adhesive backing			
CJ-1030-4M	10 (.39)	30 (1.18)		10m x 4 (131)
CJ-3030-M	30 (1.18)	30 (1.18)		10m x 1 (33)
FOR PIPE PENETRATIONS, CONCRETE CURBS, TUNNEL LINING SEGMENTS				
	H	W		h
SS-0215	2 (.08)	15 (.59)	–	25m x 4 (328)
SS-0220	2 (.08)	20 (.79)	–	25m x 4 (328)
SS-0320	3 (.12)	20 (.79)	–	25m x 4 (328)
SS-0520	5 (.20)	20 (.79)	–	20m x 4 (262)
RS-0520-3.5I	5 (.20)	20 (.79)	3.5 (.14)	20m x 5 (328)
RS-0723-3.5I	7 (.28)	23 (.91)	3.5 (.14)	15m x 4 (196)
DS-0415-2.5I	4 (.16)	15 (.59)	2.5 (.10)	20m x 5 (328)
DS-0420-2.5I	4 (.16)	20 (.79)	2.5 (.10)	20m x 5 (328)
DS-0520-3.5I	5 (.20)	20 (.79)	3.5 (.14)	20m x 5 (328)
DS-0615-4.5I	6 (.24)	15 (.59)	4.5 (.18)	15m x 5 (245)
DSS-0320	3 (.12)	20 (.79)	–	25m x 4 (328)
DSS-0420	4 (.16)	20 (.79)	–	25m x 5 (328)
HS-0540-30	5 (.20)	40 (1.57)	–	20m x 3 (196)
FOR JOINT REPAIR, CONTROL JOINTS, SPECIAL APPLICATIONS				
	D	B		
RSS-1006 D	10 (.39)	6 (.24)		20m x 3 (196)
RSS-1208 D	12 (.47)	8 (.31)		20m x 2 (131)
RSS-1409 D	14 (.55)	9 (.35)		10m x 2 (65)
RSS-1610 D	16 (.63)	10 (.39)		10m x 2 (65)
RSS-2014 D	20 (.79)	14 (.55)		10m x 2 (65)
RSS-2519 D	25 (.98)	19 (.75)		5m x 2 (32)
RSS-0806 C	8 (.31)	6 (.24)		20m x 5 (320)
RSS-1007 C	10 (.39)	7 (.28)		20m x 3 (196)
RSS-1209 C	12 (.47)	9 (.35)		20m x 2 (131)
RSS-1410 C	14 (.55)	10 (.39)		15m x 2 (98)
RSS-040 P	4 (.16)	–		20m x 10 (656)
RSS-050 P	5 (.20)	–		20m x 10 (656)
RSS-060 P	6 (.24)	–		20m x 10 (656)
RSS-080 P	8 (.31)	–		20m x 5 (320)
RSS-100 P	10 (.39)	–		20m x 3 (196)
RSS-120 P	12 (.47)	–		20m x 2 (131)
RSS-140 P	14 (.55)	–		15m x 2 (98)
RSS-160 P	16 (.63)	–		10m x 2 (65)

Appendix G

Leakmaster

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

LEAKMASTER

SINGLE COMPONENT WATER-SWELLING SEALANT

LEAKMASTER

LEAKMASTER LV-1 is a single component water-swelling sealant with excellent and unique properties.

Its development was based on C.I. Kasei's technology and long experience in water-swelling sealants.

LEAKMASTER may be applied in locations where conventional solid sealants cannot be easily applied. This includes irregular shaped joints, rough surfaces, odd penetrations, etc.

After curing, LEAKMASTER has excellent physical properties. The rubber-like elasticity of the material and expansion characteristics create an effective watertight seal.

ADVANTAGES

EASY APPLICATION – As a moisture-cure single component water-swelling sealant, standard caulking guns can be used.

PHYSICAL PROPERTIES – After curing, LEAKMASTER has better physical properties than those of conventional sealants.

EXPANSION – LEAKMASTER expands approximately two times its original volume when exposed to water. It provides excellent water sealing properties while retaining its rubberlike elasticity.

ADHESION – Before swelling, LEAKMASTER adheres to various materials such as concrete, metal, glass, etc.

MAIN APPLICATION

- Water sealing at joints of in-situ cast concrete
- Water sealing around H-section steel joints and bars
- Caulking for water distribution systems
- Pipe penetrations
- Irregular joint surfaces
- Waterproofing work

CHARACTERISTICS

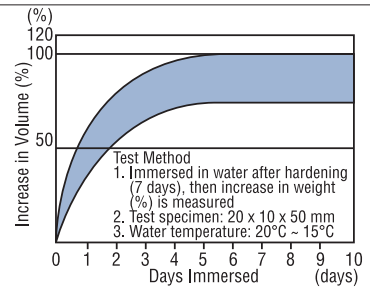
1. GENERAL PROPERTIES

Appearance	Putty-Like
Color	Grey
Specific Gravity	1.30
Extrudability	Within 20 seconds (at 23°C)
Slump	3mm max. (at 23°C)
Tack-Free Time	Within 8 hours (at 23°C, 60% R.H.)
	JIS-A-5758

2. PROPERTIES AFTER HARDENING

Hardness	35 Shore A
Tensile Strength	30 kgf/cm^2 (425 psi)
Elongation	1250%
Tear Strength	10 kgf/cm (56 lb/in)
	JIS-K-6301

3. SWELLING PROPERTIES

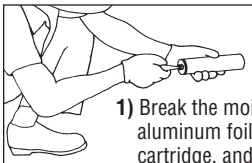


4. ADHESION PROPERTIES

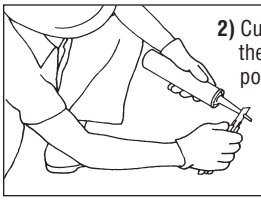
	Steel	Aluminum	Mortar
50% Modulus (kgf/cm^2)	4.5 64 psi	6.5 92 psi	6.5 92 psi
Max. Tensile Strength (kgf/cm^2)	7.0 99 psi	12.2 173 psi	11.1 157 psi
Elongation at Break (%)	330	580	570

JIS-A-5758

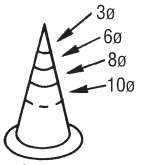
APPLICATION



1) Break the moisture-proofing aluminum foil at the top of the cartridge, and remove the metal back seamer from the bottom.

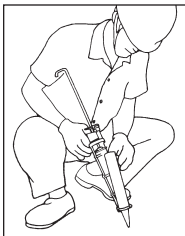


2) Cut the nozzle at the appropriate position diagonally.



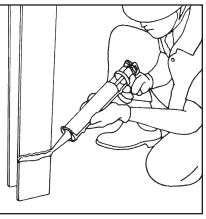
NOZZLE DIAMETER	LENGTH
3mm∅ (1/8 in)	35-40m (125 ft)
6mm∅ (1/4 in)	8-10m (30 ft)
8mm∅ (3/8 in)	4-5m (15 ft)
10mm∅ (1/2 in)	Approx. 3m (8 ft)

3) Average extrudable length vs. nozzle diameter.



4) Put the cartridge into caulking gun.

5) Apply Leakmaster continuously without a break to the place to be sealed.



PACKAGING

Item No.	LEAKMASTER LV-1
Cartridge	320 cc
Carton	24 cartridges

GREENSTREAK GROUP, INC
A Family of Construction Companies

3400 Tree Court Industrial Blvd., St. Louis, Missouri 63122
Phone: 800. **325-9504** or 636. **225-9400**
Fax: 800. **551-5145** or 636. **225-9854**
www.greenstreak.com

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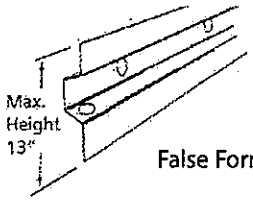
Appendix H

Dayton Superior Keyway

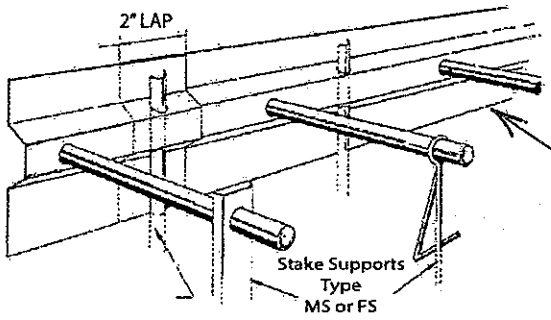
Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

DAYTON SUPERIOR METAL & PLASTIC KEYWAYS



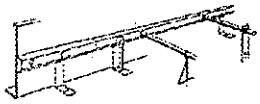
False Form

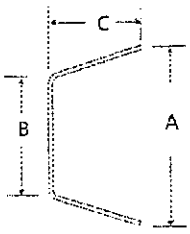


Proposed Keyway with Standard Keyway Deformation

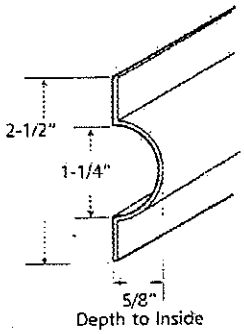
General Center Strip

A = 2 1/2"
B = 2"
C = 1"





Standard Keyway Deformation



Half-Round Keyway Deformation

Appendix I

Project Document & Specifications

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

DOCUMENTS
AND
SPECIFICATIONS

LAWRENCE, KANSAS
BOWERSOCK DAM
MAINTENANCE PROJECT
(City Project No. 6CP907)

August 31, 2009

City *of* Lawrence

CITY OF LAWRENCE, KANSAS
BOWERSOCK DAM MAINTENANCE PROJECT

I. BACKGROUND

The Bowersock Dam provides several benefits in addition to its main purpose of providing a mill pond for the generation of hydroelectric power. The dam is a key component in the City of Lawrence's water supply system. It provides the intake crib at the Kaw Water Treatment Plant (WTP) with the necessary submergence to convey raw water from the river to the WTP for processing. Scour prevention and river bed stability are additional benefits of the dam. These are essential due to the proximity of the twin US-40/59 Bridges immediately upstream of dam. The University of Kansas rowing team benefits from the mill pond created by the dam as well. The Kansas Department of Wildlife & Parks has also expressed the benefit of the dam providing a barrier against invasive species from migrating upstream.

The Bowersock Dam was completed in 1874. The southern third of the dam is masonry block construction with the remaining northern two thirds comprised of timber crib construction. In 1977 the City of Lawrence and the Bowersock Mill entered into a public/private partnership. Since the origin of this agreement the dam has seen the completion of two major rehabilitation projects. An initial inspection of the structure performed by Black & Veatch in 1975 concluded that critical repairs were needed to prevent structural failure. Following these recommendations a major rehabilitation of the dam was completed in 1978 to restore the dam to a stable condition.

In 2000 the City of Lawrence contracted with Black & Veatch again to assess the dams overall condition and received a situational report dated September 18, 2000. The majority of the identified deficiencies found in 2000 were repaired in the fall/winter of 2001/2002. The repairs mainly focused on driving sheet piling, constructing an extended apron cap to protect the piling, filling eroded/failed sections of the dam with concrete and placing riprap downstream of the piling to fill the riverbed and provide downstream support/protection of the piling. In addition, shotcrete was applied to the severely eroded face of the dam in the north and southern extreme portions of the dam.

The recent repairs funded by the City in 2001/2002 addressed major structural integrity concerns of the dam, but erosion of the concrete surfaces has exposed steel reinforcing and timber cribbing. The corresponding inspection report done by Black & Veatch stated the following: "*The steel reinforcing is provided to carry the tensile loads within the concrete, while the timber cribbing forms the interior foundation of the dam. Maintenance of the timbers in either a continuously wet or dry condition is important. Exposing the timbers to sunlight allows them to dry out and splinter and/or crack, thereby weakening them and increasing the likelihood of failing when loaded. A major loss of either of these elements would compromise the integrity of the structure. Recent*

installations of bags of grout in front of the dam have helped to reduce the amount flow through the dam. However, the amount of the flow observed in October 2006, compared to the amount of flow through the dam in the same location in 2004 has increased significantly, and several timbers that were observable in 2004 have eroded completely. The installation of grout bags in front of the dam to halt the flow is only temporary. As water continues to leak through the dam, erosion of the sediment in front of the dam cause the flow path to work it way around or through the grout bag patch area, degrading the effectiveness of the attempted repair. The first priority is to stop the flow through the dam."

II. PROPOSED REPAIRS

The February 14, 2007 inspection report recommended that the first goal of any long term repairs should be that the upstream face of the dam be sealed. "*Long term repairs should consist of methods to completely restore the upstream face of the dam to prevent leakage. The water flow through the dam needs to be stopped to prevent degradation to the dam interior not visible during inspections. Because the dam is a gravity dam, it relies on the interior cribbing and rockfill for its stability. Degradation of cribbing and movement of the rockfill can go undetected for a long time and is a cause for concern for long term stability of the dam."*

The purpose of the proposed work will be to stop the leakage through the dam face. Prior to any construction, borings will be taken along the proposed sheet pile alignment. These boring will be spaced approximately every 25 feet and adjusted accordingly as needed. The proposed alignment of the sheet pile will be approximately 30 feet upstream of the existing dam face.

The total sheet pile (PZ-27) lengths will be adjusted based upon the results of the borings. The existing top of dam is approximately elevation 808. The sheet pile will be driven and cutoff at elevation 810. This temporary elevation allows additional protection from higher than normal seasonal river flows so that work can be done on the downstream dam face. It also allows the crane to straddle the pile during subsequent sheet installation with riprap being placed on both sides of the newly driven sheet pile. The interface between the sheet pile and stream bed will be grouted to provide a seal against the infiltration of water.

The area between the sheet pile and existing dam face will be filled with riprap. A two foot thick concrete cap will be place on top of the riprap filled area. This cap will be attached by a shear connection to the sheet pile as well as doweled into the existing dam face. After the new concrete cap has had proper cure time the sheet pile will be cutoff flush with the top of the cap. The proposed cap will slope (1 to 2%) toward the stream bed so that they upstream face will be lower than the existing top of dam elevation of 808.

III. TENTATIVE SCHEDULE

The tentative schedule for the project follows:

1. Bid Received August 11, 2009 at City Clerks Office.
2. Selection of Contractor August 12, 2009.
3. Award Bid at City Commission Meeting August 25, 2009.
4. Plans submitted to Federal Energy Regulatory Commission (FERC) August 31, 2009.
5. September 16, 2009 Approval by FERC
6. October 1, 2009 Construction Begins
7. February 2010, Project Completion

IV. LIST OF ATTACHMENTS

1. Technical Specifications

    a. Quality Control
    b. Sheet Piling
    c. Shotcrete
    d. Concrete
    e. Riprap
    f. Anchor Bolts

2. Detail Drawings

    - Figure No. 1: Existing Dam Section
    - Figure No. 2: Existing Strata Upstream of Dam
    - Figure No. 3: Shotcrete Installation Detail
    - Figure No. 4: Sheet Piling Detail (Plan View)
    - Figure No. 5: Sheet Piling Detail (Section A-A)
    - Figure No. 6: Aerial Photograph of Repair Area

TECHNICAL SPECIFICATIONS

SECTION A

QUALITY CONTROL

1. TESTING SERVICES. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.

Testing services provided by Owner are for the sole benefit of Owner; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

1.01. Testing Services Furnished by Contractor. Unless otherwise specified, Contractor shall provide all testing services in connection with the following:

All tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.

Contractor shall obtain Engineer's acceptance of the testing firm before having services performed, and shall pay all costs for these testing services.

1.02. Testing Services Furnished by Owner. Unless otherwise specified, Owner shall provide for tests made on the following materials and equipment:

Concrete.

Other materials at the discretion of Owner.

Testing, including sampling, will be performed by Engineer or the testing firm's laboratory personnel, in the general manner indicated in the Specifications. Engineer shall determine the exact time, location, and number of tests, including samples.

Arrangements for delivery of samples and test specimens to the testing firm's laboratory will be made by Owner. The testing firm's laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.

End of Section

SECTION B

STEEL SHEET PILING

1. GENERAL. This section covers materials and installation of permanent steel sheet piling for a cutoff wall at the location indicated on the drawings, or as directed by Engineer.

2. DRAWINGS. Shop fabrication and field installation drawings for the steel sheet piling and fabricated piling accessories shall be prepared, checked, and submitted for review and acceptance as specified in the submittals section. Certification that the furnished materials meet the specified material and strength requirements shall be submitted.

3. MATERIALS. Materials for steel sheet piling shall meet the following requirements:

Sheet Piling	New interlocking piling meeting ASTM A328, coated.
Shapes and Plates	ASTM A36, galvanized or coated as specified.
Wales and Bearing Plates	ASTM A36, galvanized or coated as specified.
Primer	Kop-Coat "340 Gold Primer".
Coal Tar Epoxy Coating	Kop-Coat "Bitumastic No. 300-M".

The sheet pile indicated on the drawings is required for the permanent construction to prevent scour and to minimize underseepage. The permanent sheet pile system is designed to have earth or riprap on one or both sides, and to be attached at the top with anchor bolts as indicated on the drawings or directed by Engineer. The permanent sheet pile section indicated on the drawings shall be not less than 9 inches deep, PZ27 or equal: minimum S_x = 30.2 inches^3/foot; minimum I_x = 184.2 inches^4/foot. Steel sheet piling shall be furnished in sufficient lengths to allow trimming of tops after installation to match the grades indicated on the drawings.

4. FABRICATION. Metal components furnished under this section shall be fabricated in accordance with the Engineer's drawings and applicable requirements of AISC Manual of Steel Construction. Steel sheet piles and interlocks shall be free of kinks, cambers, or twists that would prevent free sliding of the piles in the interlocks.

5. COATING. The surfaces of the steel sheet piling shall be coated with a protective layer of bituminous material. Any wales and steel attachments shall be coated. The coating shall be self-curing and consist of two components. Materials used shall meet the requirements of Steel Structures Painting Council Specification SSPC-Paint No. 16, Coal Tar Epoxy-Polyamide Black Paint.

Materials shall be shop coated.

Shop coated surfaces shall be thoroughly prepared and primed for coating application in accordance with SSPC-SP1 0 and the coating manufacturer's recommendations. A field coating may be placed over galvanizing, provided the surface is free of dirt, rust, and oil. The coating shall be applied by brush or spray using commercially available equipment. Excessive sagging of the coating shall be prevented during application.

The coating shall be applied to a minimum thickness of 20 mils. Coated surfaces shall be cured for at least 7 days at 77°F or shall be post-cured at a higher temperature for a shorter period in accordance with the coating manufacturer's recommendations.

Coated surfaces shall not be damaged during handling. Damaged coatings shall be repaired to the satisfaction of the Engineer.

6. INSTALLATION. Prior to installation of new sheet piling, any existing failed or damaged sheet piling shall be removed to the extent determined by the Engineer. The damaged sheet piling shall be cut off at the level set, or shall be extracted completely, as directed by the Engineer. A complete description of pile driving equipment, including hammers, extractors, protective caps, and other pile driving aids, as well as a complete description of the proposed method of sealing the sheet piling at its interface with the bedrock shall be submitted to the Engineer for review and acceptance as specified before beginning the work. Steel sheet piling shall be driven to refusal in bedrock at the locations indicated on the drawings. The piling shall be driven plumb and shall not exceed a vertical tolerance of 1/8 inch per foot of length along the interlock. Piles shall be placed as true to line as possible. Suitable temporary wales, master piles, templates, or other guide structures shall be provided to drive the piles in the correct location and alignment. Sections that are damaged during handling or driving shall be replaced or repaired to the satisfaction of the Engineer.

6.01. Installation of Sheet Piling. Sections of the pile shall be interlocked for the full length. Interlocks on sheets, wyes, and corners shall be installed in their normal position.

All rocks, riprap, boulders, and broken concrete shall be removed from the riverbed to the level of soil subgrade prior to driving piles.

Piles shall be driven by acceptable methods that prevent damage to the piles. Pile hammers shall be of the size and type necessary to install the piling as specified. Alignment shall be maintained during driving operations by using suitable leads or guides attached to the hammer. A protective cap consisting of a steel casting slotted to fit the top of the sheet pile shall be used during driving.

A Vibratory hammer may be used to drive piles when the vibratory loading does not exceed 1 minute, continuous loading, with a penetration rate of 1.0 foot or less. An impact hammer shall be used to drive sheet pile when vibratory hammer requirements are exceeded. When a Vibratory hammer is used, piles shall be driven without heating the interlocks to the point of melting. Where piles encounter obstructions above the bedrock surface, the obstructions shall be removed by jetting, spudding, or other means acceptable to the Engineer. Water jets and other commonly used pile driving aids shall not be used during installation unless acceptable to the Engineer. Jetting, if permitted, shall be performed simultaneously on both sides of the sheet pile. The pile shall be seated without the use of jetting. All spaces around the piles created by jetting shall be filled with sand. Adjacent piles may be pinned together to prevent movement during

installation of an adjoining pile. Damaged piles and piles that are not interlocked shall be removed and replaced.

No piles shall be driven within 100 feet of concrete less than 7 days old.

Welding sheet pile to plates designated to be embedded in concrete shall be performed after the piles are driven. Welding to plates that are embedded in the concrete will not be allowed.

6.02. Sequencing of Work. Sheet piling extraction and replacement, placement of concrete and related work shall be performed in a manner and sequence that does not cause instability or erosion and undermining of the dam. To achieve this goal, only one area or segment shall be subject to removal and replacement of sheeting and concrete placement at a given time.

End of Section

SECTION C

SHOTCRETE

PART 1 - GENERAL

1-1. SCOPE. This section covers application of shotcrete to the downstream face of the Bowersock Dam and appurtenant work, including the removal of unsound and deteriorated concrete, and cleaning and preparation of the surface. Materials will be provided by the Owner.

1-2. GENERAL.

1-2.01. General Requirements. Shotcrete shall be applied by the wet-mix method using an automated system acceptable to the Engineer. All shotcrete shall be accurately formed, properly placed, and finished as indicated on the drawings and as specified herein. The Contractor shall inform the Engineer at least 24 hours in advance of the times and places at which he intends to place shotcrete.

1-2.02. Governing Standards. Shotcrete shall comply with the recommendations of ACI 506, "Guide to Shotcrete", and the requirements of ACI 506.2, "Specification for Materials, Proportioning, and Application of Shotcrete", except as otherwise specified.

1-2.03. Qualifications. Workers, including the foreman, nozzleman, and delivery equipment operator, shall be fully qualified to perform the work. The nozzleman shall have had a minimum of 2 years continuous experience on similar structural shotcrete work and shall demonstrate his ability to satisfactorily place the material in accordance with the recommendations of ACI 506.3R, "Guide to Certification of Shotcrete Nozzlemen".

The shotcrete application system shall be of a design and size that has given satisfactory results on similar work in the last 5 years. At the time of the bid, the Contractor shall have at least one operable shotcrete application system that has produced satisfactory results. The system shall discharge mixed materials into the hose under close control and shall to deliver a continuous, smooth stream of uniformly mixed material free from slugs, at the proper velocity.

When automated shotcrete equipment is used, it shall discharge the concrete, water, and air to the automated shotcrete tower through a swivel pin located at the center of the tank. The nozzle shall be of designed and sized to allow a smooth and uninterrupted flow of materials and shall be mounted on power machinery so that it travels parallel to the surface to be sprayed at a uniform linear or bidirectional speed. The operator of the automated system shall serve as the nozzle man and shall comply with the nozzle man qualifications specified herein.

1-3. SUBMITIALS. All submittals of data and drawings shall be in accordance with the submittals section except as specified herein. Specifications and data for the proposed equipment, including the compressed air equipment, the proposed arrangements, and capacities, shall be submitted for review.

1-4. STORAGE OF MATERIALS. Reinforcement shall be carefully handled and shall be stored on supports which will keep the steel from contact with the ground.

PART 2 - PRODUCTS

2-1. MATERIALS. The shotcrete materials shall conform to the following requirements:

Reinforcing Steel Bars ASTM A615, Grade 40 or 60, deformed.

Welded Wire Fabric ASTM A 185 or A497.

Fibers Collated, fibrillated, polypropylene fibers; Fibermesh, Forta Fibre, or Grace.

Membrane Curing Compound ASTM C1315, Type I, Class A, minimum 25 percent solids, nonyellowing, unit moisture loss 0.40 kb/rn" in 72 hours. L&M Chemical "Dress & Seal 30", Sonneborn "Kure-N-Seal 30", or Symons "Cure & Seal 31 %".

2-2. EMBEDMENTS. Anchor bolts, castings, steel shapes, sleeves, and other materials that are to be embedded in the shotcrete shall be accurately positioned and securely anchored. All exposed surfaces not to be in contact with shotcrete shall be protected during shotcreting.

Embedments shall be clean when installed. After shotcrete placement, adjacent surfaces shall be cleaned of shotcrete spatter and other foreign substances.

2-3. DELIVERY TICKETS. A delivery ticket shall be prepared for each load of ready-mixed (wet-mix) shotcrete. A copy of each ticket shall be handed to Contractor and Engineer by the truck operator at the time of delivery. Tickets shall show name and location of shotcrete supplier, the project name, the mix identification, the quantity of shotcrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time when the cement was added, and the numerical sequence of the delivery.

PART 3 - EXECUTION

3-1. CONCRETE SURFACE PREPARATION. Contractor shall prepare the existing concrete surfaces that will be in contact with the new shotcrete as specified herein and in a manner acceptable to Engineer. Contractor shall remove all spalled, loose, and deteriorated concrete to sound material, and shall clean exposed concrete surfaces of contamination that would prevent bonding of shotcrete to existing sound concrete.

Contractor shall remove any ice from the area where shotcrete will be placed immediately prior to the placement of shotcrete using procedures acceptable to Engineer.

3-2. PLACEMENT. The limits of placement of each batch shall be predetermined by Contractor and shall be acceptable to Engineer. All shotcrete within such limits shall be placed in one continuous operation. Unless otherwise specified, preparation and placement shall be as specified in ACI 506.2.

Before shotcrete is placed, reinforcement and embedments shall be rigidly secured in proper position. All dirt, mud, water, ice, snow, and debris shall be removed from the space to be occupied by shotcrete. All surfaces encrusted with dried shotcrete and concrete from previous placement shall be cleaned. The entire installation shall be acceptable to Engineer.

3-2.01. Bonding to Hardened Shotcrete. The surfaces of hardened concrete and shotcrete upon which fresh shotcrete is placed shall be rough, clean, sound, and damp. Preceding placement of fresh concrete, the hardened surface shall be cleaned of ailiaitance and foreign substances, washed with clean water, and wetted thoroughly.

3-2.02. Placing Shotcrete. The shotcrete shall be applied to cleaned surfaces which have been prepared as specified, and shall be compact, with no sand pockets. Particular care shall be taken during placement of shotcrete to maintain a uniform spray distance from the surface and to keep the nozzle as nearly perpendicular to the surface as possible.

Shotcrete shall be gunned behind, around, and over the slabs and structural members to build up a monolithic coating, filling all areas as directed by the Engineer.

At the edge of any section where the operations are temporarily suspended, the shotcrete shall be brought to a tapered edge, with the taper extending back for not less than 12 inches.

Prior to placing the adjacent section, the surface of the tapered edge shall be cleaned by scraping and blowing away all rebound, and washing down with air and water blast. No square joints will be permitted.

As the operation progresses, all rebound shall be kept out of the work. If the rebound does not fall clear of the work, it shall be removed by appropriate methods. No shotcrete shall be placed over rebound and in case such condition arises, the Contractor shall remove, at his own expense, any shotcrete so placed. All rebound removed shall be discarded.

If excessive aggregate rebound and cement loss occur, shotcreting shall be ceased immediately. Shotcrete shall not be placed during adverse weather conditions which may cause excessive loss of moisture.

3-2.03. Thickness Control. Shotcrete thickness shall be controlled by the use of vertical shooting wires installed under tension and spaced not more than 3 feet apart to establish uniform and correct shotcrete thickness. Wires shall be of 18 to 20 gage high tensile strength steel. Shooting wires shall be removed after shotcrete is placed and shall not be embedded in the shotcrete surface. Shooting wires shall scribe the contour of the wall from top to bottom.

Prior to placement of shotcrete, Contractor shall submit details of thickness control procedures and aids to Engineer for review. During application of shotcrete coats, Contractor shall demonstrate the effectiveness of his control procedures.

3-5. CURING. Shotcrete shall be continuously membrane cured for a minimum of 7 days which shall commence as soon as possible after placement of shotcrete is

completed, without damaging the shotcrete. Curing compounds may be used, except on surfaces where additional shotcrete will be placed or any bonding to the shotcrete will be required.

Membrane curing compound shall be spray applied at a coverage of not more than 300 square feet per gallon within 30 minutes after completion of the final layer.

3-6. FIELD QUALITY CONTROL. Field control tests shall be performed by qualified personnel in the presence of Engineer. As stipulated in the quality control section, Contractor shall provide equipment, supplies, and the services of one or more employees as necessary to assist in the field control testing.

Tests required during the progress of the work will be made at the expense of Owner.

The frequency specified for each field control test is approximate. If additional field control tests are necessary, in the opinion of Engineer, all such tests shall be made.

A clearly defined pattern of continuous horizontal or vertical ridges or depressions at the reinforcing elements, after they are covered, will be an indication of insufficient cover or poor application and the probable presence of voids. In such case, the application of shotcrete shall be immediately suspended and the work carefully inspected by Engineer. Corrective measures, if considered necessary, shall be implemented and completed prior to resuming the shotcreting operations.

The shotcreting procedure may be corrected by adjusting the nozzle distance and orientation perpendicular to the surface or water content of the shotcrete mix. All overspray shall be removed from the surface. The shotcreted surface shall be broomed and roughened, if needed, to ensure proper bond.

3-6.01. Compression Tests. Two shotcrete test panels shall be made each day when up to 50 cubic yards of shotcrete is placed. Two additional panels shall be made for each additional 50 cubic yards or major fraction thereof, placed in any one day. The panels shall be cured and tested as specified herein for preconstruction testing. Compression tests as specified shall be made on each design mixture when used.

Panels shall be 30 inches square and shall be shot against a solid backboard in a position equal to the angle required for the work. Several lengths of reinforcement, with a clear space equal to not less than 2-1/2 inches between reinforcement, shall be included in a portion of each test panel.

Panels shall be shot in a manner similar to the proposed placement procedure. Specimens shall be cured under conditions that simulate site curing of the applied shotcrete. A minimum of three cubes or cores, not less than 3 inches in diameter and having a LID ratio of at least one, shall be made from each test panel in accordance with ASTM C42 and shall be tested at 28 days.

3-6.02. Test Reports. Test reports shall be prepared in four copies and shall be distributed by the testing laboratory directly to the Resident Project Representative, the Engineer, and the Contractor, in accordance with the quality control section.

End of Section

SECTION D

CAST-IN-PLACE CONCRETE – CONSTRUCTION

PART 1 - GENERAL

1-1. SCOPE. This section covers all construction requirements of cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work. Procurement of the concrete mixture and delivery to the site through discharge at the end of the delivery truck chute is covered in Section 03300P Cast-in-Place Concrete Procurement.

Both inch-pound (English) and SI (metric) units of measurement are specified herein; the governing units of measurement shall be as indicated at the top of the Data Sheet.

1-1.01. **Terminology. When the phrase "when required" or "as required" is stated in this section, it shall mean, " when ' ' is required in the attached Data Sheets".**

1-2. GENERAL. All cast-in-place concrete shall be accurately formed and properly placed, finished, and cured as indicated on the drawings and as specified herein.

1-2.01. Concrete Classifications. Concrete classifications shall be defined and used as indicated for the following classes:

Concrete Classification

A. Structural Concrete

Class	Class Description
A1.	Concrete for Liquid Containing Structures: liquid-containing environmental structures, liquid-containing tanks, interior suspended slabs in high humidity areas, headwalls, and all other concrete exposed to view and not otherwise indicated on the drawings.
A2.	Pea Gravel Concrete; Congested areas.
A3.	Concrete for Non-Liquid Containing Structures; footings, foundations, manholes, catch basins, pan-formed joists, and all other structural concrete other than for liquid containing structures.
A4.	Mortar Puddle.
A5.	Drilled Pier Concrete.

B. Exterior Flatwork Concrete

C. Architectural Concrete

All concrete that will be visible to the public or indicated in the Contract Documents.

D. Miscellaneous Concrete

D1. Ductbanks, Pipe Blocking, Concrete Fill, and Pipe Encasement.

D2. Underwater Concrete.

D3. Mass Concrete.

D4. Pan Stairs Concrete.

D5. Wash Water Troughs Concrete.

D6. Composite Topping Concrete.

D7. Lean Concrete.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. All submittals of drawings and data; manufacturers' certificates of compliance, certification of reinforcement, reinforcement bar lists and placement drawings; test data; reports; catalog data sheets; and other data shall be in accordance with the submittals section, and as required.

When epoxy coated reinforcement is specified, CONTRACTOR shall provide certifications from the epoxy-coated reinforcement manufacturer verifying that coatings comply with ASTM A775, Annex A1, and that all coated reinforcement complies with ASTM A775 or A884 and with this specification at the time of shipment.

When required, bar lists and drawings for the fabrication and placing of reinforcement shall be submitted for review and shall have sufficient plans, elevations, and sections to adequately detail and label all reinforcement. The bar lists and drawings shall also include a reference to the structure in which the reinforcement will be installed and to the project drawing showing the reinforcement.

When required, concrete lift drawings shall be submitted in accordance with the submittals section.

1-3.02. Manufacturer's Certificate of Compliance. When required, a manufacturer's certificate of compliance, which includes the name of the project and, when requested, copies of independent test results confirming compliance with specified requirements, shall be submitted to ENGINEER for the following materials:

Membrane curing compound and floor sealer

VOC Compliant Form Coating

1-4. STORAGE AND HANDLING.

Reinforcing steel shall be carefully handled and shall be stored on supports which prevent the steel from touching the ground.

When epoxy-coated reinforcing bars are specified, epoxy-coated reinforcement shall be handled using equipment with protected contact areas. Bundles or stacks of epoxy-coated reinforcement shall be lifted at multiple points to prevent abrasion from sags.

Epoxy-coated reinforcement shall not be dropped or dragged and shall be stored on protective cribbing. Faded or chalking coating will not be cause for rejecting epoxy-coated reinforcement.

Expansion joint filler and rubber and plastic (PVC) water stops for expansion or contraction joints shall be stored in a cool place protected from direct sunlight.

PART 2 - PRODUCTS

2-1. LIMITING REQUIREMENTS. Each concrete mixture will be designed and controlled, within the limits specified in Section P, to provide a dense, durable concrete suitable for the expected service conditions.

Concrete shall be handled, placed, and cured in a manner that will minimize shrinkage and cracking as specified herein, and in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled both before and after placement to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled with blankets or other acceptable means of insulation.

2-1.06. Slump. Concrete slump shall be kept as low as possible, consistent with proper handling and thorough consolidation. Unless otherwise authorized by ENGINEER, slump shall be at least 2 inches [50 mm] and shall not exceed 3 inches [75 mm]. When superplasticizer is dispensed at the site, slump shall not exceed 3 inches [75 mm] before superplasticizer is added. Slump shall not exceed 8 inches [200 mm] after superplasticizer has been added, except for Classes D2 and D7.

2-1.06.01. Pumped Concrete. Coarse aggregate size for pumped concrete mixtures shall be limited to a maximum of 1-1/2 inch [37.5 mm].

The slump of concrete, with or without a superplasticizer, that is discharged into the pump may exceed the specified maximum slump value by the amount of slump loss in the pumping system, up to a maximum of 1 inch [25 mm]. The slump loss shall be determined by tests made at each end of the pumping system.

2-1.09. Admixtures. Superplasticizer may be dispensed into the concrete on the jobsite and shall be mixed in accordance with the admixture manufacturer's recommendations.

Each superplasticizer dose, when dispensed at the site, shall be easily verifiable. The superplasticizer for each load shall be accurately proportioned into a separate container prior to dispensing the admixture into the concrete. When truck-mounted dispensers are

used, the system shall not be flushed or cleaned with water until after the entire load of concrete has been discharged. When permitted by ENGINEER, redosing of concrete with superplasticizer shall be done only once. Redosing procedures shall be as recommended by the admixture manufacturer.

2-2. MATERIALS.

Reinforcing Steel

Bars, Except Weldable	ASTM A615, Grade 60, deformed.
Bars, Weldable	ASTM A706 or A615, Grade 60, deformed, with maximum carbon equivalent of 0.55%.
Ductile Reinforcing Bars	ASTM A706 or A615, Grade 60, if the actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 psi [124 MPa] (retests shall not exceed this value by more than an additional 3,000 psi [21 MPa]) and the ratio of the actual ultimate tensile strength to the actual tensile strength to the actual tensile yield strength is not less than $1.32.
Column Spirals	ASTM A82, cold drawn wire
Welded Wire Fabric	ASTM A185 or A497
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Bars, Epoxy-Coated	ASTM A775 using ASTM A615 and A705 bars only, minimum dry film thickness of 7 mils [178 Fm].
Welded Wire Fabric and Steel Wire, Epoxy Coated	ASTM A884, minimum dry film thickness of 7 mils [178 Fm].
Patching Material for the Epoxy Coated	As specified in ASTM A775, Annex A1.
Bars Supports for Epoxy-Coated Reinforcement	Coated wire bar supports, bar supports made of dielectric material, or other acceptable. Wire bar supports shall be coated with dielectric material for a minimum distance of 2 inches [50 mm] from

		the point of contact with the epoxy-coated reinforcing bars. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars shall be epoxy-coated. Proprietary combination bar clips and spreader used in walls shall be made of corrosion-resistant material or coated with dielectric material.
	Mechanical Connections	Erico Products “Cadweld T-Series” or “Lenton”, or Richmond “Dowel Bar Splice System.”
	Protective Tape Wrap	Tapecoat “Tapecoat 20”.
Forms		
	Prefabricated	Simplex "Industrial Steel Frame Forms", Symons "Steel Ply", or Universal "Uni-form".
	Plywood	Product Standard PS1, waterproof, resin-bonded, exterior type Douglas fir, face adjacent to concrete Grade B or better.
	Fiberboard	ANSI/AHA A 135.4, Class 1, tempered, water-resistant, concrete form hardboard.
	Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
	Chamfer Strips	Clear white pine, surface against concrete planed.
Form Coating - VOC		Nonstaining and nontoxic after 30 days, VOC-compliant; Burke "Form Release (WB)", L&M Chemical"E Z Strip", Nox-Crete "Form Coating", or Symons "Thrift Kote E".
Wedge Inserts		Malleable iron, with galvanized askewhead bolts, nuts, and washers; Hohmann and Barnard

	"HW", Richmond "Peerless", or Weston "WC50".
Water Stops	
Metal	Uncoated carbon steel, with size and thickness as indicated on the drawings.
Rubber	“Dumbbell" type, 3/8 inch [9.5 mm] thick, with a 3/4 inch [19 mm] bead along each edge; Grace, U.S. Rubber, or Williams.
Plastic	Polyvinyl chloride (PVC), ribbed or serrated type, 3/8 inch [9.5 mm] thick, with an "a" bulb closed center section.
For Concrete Sections 8 Inches [200 mm] or Less in Thickness	Six inches [150 mm] wide; Greenstreak "70S" or Vinylex "RB6-38".
For Concrete Sections Thicker Than 8 Inches [200 mm] Thick	Nine inches [230 mm] wide; Greenstreak "709" or Vinylex "RB9- 38".
Expansion Joint Materials	
Filler	Preformed sponge rubber, ASTM D1752, Type I.
Filler Adhesive	As recommended by manufacturer.
Sealant	As specified in the caulking section.
Vapor Barrier	Polyethylene coated reinforced paper; Fortifiber "Moistop".
Bearing Pads	Preformed fiber-reinforced synthetic rubber elastomer, at least 1 /4 inch [6 mm] thick; JVI"Capralon" or Voss Engineering "Sorbtex".
Concrete Surface	Dry-shake colored hardener for Coloring/Hardener concrete flatwork; Davis Colors "ColorShake", L.M. Scofield "Lithchrome", Master

	Builders "Colorcron", or Tamms "Dust-On Color Hardener".
Polyethylene Film	Product Standard PS17, 6 mils [0.152 mm] or thicker.
Pre-Cure Finishing Aid	Burke "Finishing Aid Concentrate", Euclid "Eucbar", L7M Chemical "ECon", Master Builders "Confilm", or Sika "Sikafilm".
Nonslip Aggregate	Aluminum oxide aggregate; L&M Chemical "Grip It" or Sonneborn "Frictex H".
Epoxy Bonding Agent	ASTM C881, Types I and V, moisture insensitive, 100 percent solids; Master Builders "Concresive Liquid LPL" or Sika "Sikadur Hi-Mod Adhesive".
Membrane Curing Compound and Floor Sealer	
VOC - Type 1 (Federal)	ASTM C1315, Type I, Class A, maximum VOC 5.8 lb/gal [700 g/L], minimum 25 percent solids, acrylic, nonyellowing, unit moisture loss 0.40 kg/m^2 maximum in 72 hours; L&M Chemical "Dress & Seal 30", Sonneborn "Kure-N-Seal 30 ", or Symons "Cure & Seal 30%".
VOC -Type 2	ASTM C1315, Type I, Class A, water based, VOC-compliant acrylic, maximum VOC 2.9 lb/gal [350 g/L], minimum 30 percent solids, nonyellowing, unit moisture loss 0.40 kg/m^2 in 72 hours maximum; Euclid "Super Aqua Cure VOX", L&M Chemical "Dress & Seal WB30", or Symons "Cure & Seal 31%E".

2-4. FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall conform to ACI 347 and the following additional requirements.

Forms for surfaces which will be exposed to view after construction is completed shall be constructed of prefabricated plywood panels, job-built of plywood, or lined with plywood or fiberboard. Forms for exposed surfaces shall be laid out in a regular and uniform pattern with the long dimension of panels vertical and all joints aligned. The forms shall

produce finished surfaces that are free from offsets, ridges, waves, and concave or convex areas, within the tolerances specified herein.

Plywood or lined forms will not be required for surfaces which are normally submerged or not ordinarily exposed to view, such as the interior of manholes, basins, and reservoirs. Other types of forming materials, such as steel or unlined wood, may be used where plywood or lined forms are not required and may be used as backing for form linings. Concrete forms are required above all extended footings.

Flat segmented forms not more than 24 inches [600 mm] wide may be used for forming curved surfaces 25 feet [7600 mm] in diameter or larger.

Where concrete is placed against gravel or crushed rock which does not contain at least

25 percent material passing a NO.4 [4.75 mm] sieve, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be lapped at least 4 inches [100 mm] and taped.

Where concrete is placed against rock, all loose pieces of rock shall be removed and the exposed surface cleaned with a high-pressure water spray.

2-4.01. Design. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that permissible working stresses are not exceeded.

Beams and slabs supported by concrete columns shall be formed so that the column forms may be removed without disturbing the supports for the beams or slabs.

Wherever the top of a wall will be exposed to weathering, the forms on at least one side shall not extend above the top of the wall and shall be brought to true line and grade. At other locations, forms shall be brought to a true line and grade, or a wooden guide strip shall be placed at the proper location on the forms so that the concrete surface can be finished with a screed or template to the specified elevation, slope, or contour. At horizontal construction joints in walls, the forms on one side shall not extend more than 2 feet [600 mm] above the joint.

Temporary openings shall be provided at the bottom of column and wall forms and at other points where necessary to facilitate cleaning and inspection.

2-4.02. Form Ties. Form ties shall have removable end and permanently embedded body, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Cones shall be provided on the outer ends of each tie, and the permanently embedded portion shall be at least 1 inch [25 mm] back from the concrete face. Form ties for liquid-containing walls shall be provided with water stop washers located on the permanently embedded portions of the ties at the approximate center of the wall. Permanently embedded portions of form ties without threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. Through-wall tapered

removable ties will not be acceptable. The type of form ties used shall be acceptable to ENGINEER.

Form ties in exposed surfaces shall be uniformly spaced and aligned in horizontal and vertical rows.

2-4.03. Edges and Corners. Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Equipment bases shall have formed beveled salient edges for all vertical and horizontal corners, unless specifically indicated otherwise on the drawings. Unless otherwise noted, bevels shall be 3/4 inch [19 mm] wide.

2-4.04. Form Removal. Forms shall not be removed from structures until the concrete in the structures has sufficient strength to support the weight of the structure and any superimposed load, including loads from construction operations. CONTRACTOR shall be responsible for limiting any applied loadings. There shall be no evidence of damage to concrete and no excessive deflection or distortion of members due either to the removal of forms or to loss of support.

Supporting formwork shall not be removed from horizontal members until the concrete has attained at least 75 percent of the specified 28 day compressive strength as determined by cylinders made and cured in the field. Shores shall not be removed before concrete has attained 28 day compressive strength as specified herein. Shoring shall be left in place and reinforced as necessary to carry any construction equipment or materials placed thereon.

When forms are removed before the specified curing is completed, measures shall be taken to immediately continue curing and to provide adequate thermal protection for the concrete.

2-5. REINFORCEMENT. Reinforcement shall be accurately formed and shall be free from loose rust, scale, concrete splatter, and contaminants which reduce bond. Unless otherwise indicated on the drawings or specified herein, the details of fabrication shall conform to ACI 315 and 318.

2-5.01. Placement. Reinforcement shall be accurately positioned on supports, spacers, hangers, or other reinforcement, and shall be secured in place with wire ties or suitable clips.

When required, epoxy-coated reinforcement shall be fastened with nylon, epoxy, or plastic-coated tie wire.

With the exception of contact splices, the clear distance between parallel bars shall be not less than 2-1/2 inches [65 mm]. Where reinforcement in beams is placed in two or more layers, the bars in the upper layer shall be placed directly above the bars in the lower layer.

Reinforcement for beams or slabs which are supported by concrete columns shall not be installed until after the concrete for the column has been placed.

2-5.02. Splices. Splices shall conform to the details indicated on the drawings. Splices at locations other than those indicated on the drawings shall be acceptable to ENGINEER.

Except where indicated on the drawings, welding or tack welding of reinforcement is not permitted. Where welding is indicated on the drawings, weldable reinforcement having a carbon equivalent of not more than 0.55 percent shall be used. Preheating and welding shall conform to AWS 01.4. Reinforcement which has been welded improperly or without ENGINEER's concurrence shall be removed and replaced.

Whenever bars in tie beams subject to tensile loading must be spliced, a full mechanical connection in compliance with ACI 318 shall be provided. A full mechanical connection shall be able to develop in tension and compression at least 125 percent of specified yield strength of the spliced bars. Splices in adjacent bars shall be spaced at least 30 inches [760 mm] apart.

Mechanical connections at other locations shall be used only as indicated on the drawings.

2-5.03. Repair of Epoxy Coating. When epoxy-coated reinforcing bars is specified, before placing epoxy-coated reinforcement in the work, CONTRACTOR shall repair all damaged epoxy coatings and shall check the coating for holidays in accordance with the procedures set forth in ASTM A775. All reinforcement shall be free of holidays prior to placement in the work.

Damaged epoxy coating shall be repaired as recommended by the manufacturer using patching material provided by the manufacturer and conforming to ASTM A775, Annex A1.

Coatings damaged by handling and placing after onsite testing shall be repaired as specified. The maximum amount of damaged coating shall not exceed 0.5 percent of the surface area of each bar.

After completion of welding on epoxy-coated reinforcement, when acceptable to ENGINEER, damage to the coating shall be repaired as specified. All welds and steel splice members, including mechanical connections when used to splice bars, shall be coated with the same material as used to repair coating damage.

2-6. EMBEDMENTS. Anchor bolts, castings, steel shapes, conduits, sleeves, masonry anchors, and other objects that are to be embedded in the concrete shall be accurately positioned in the forms and securely anchored. Conduits shall be installed between the reinforcement in walls or slabs with reinforcement in both faces. In slabs with only a single layer of reinforcement, conduits shall be placed under the reinforcement.

Unless installed in pipe sleeves, anchor bolts shall have sufficient threads to permit a nut to be placed on the concrete side of the form or template. A second nut shall be placed on the other side of the form or template, and the two nuts shall be so adjusted that the bolt will be held rigidly in proper position.

2-7. CONSTRUCTION JOINTS. Construction joints shall be made at locations indicated on the drawings or where specified. Construction joints shall not be made at other locations without the concurrence of ENGINEER.

2-7.01. Location. Construction joints shall be located as follows:

a. In Columns and Walls. At the underside of beams, girders, haunches, drop panels, and column capitals, and at floor levels. All haunches, drop panels, and column capitals shall be considered part of the supported floor or roof and shall be placed monolithically therewith. Column bases will not be required to be monolithic with the floor beneath. Walls shall be divided into sections not to exceed 60 feet [18 m], except at corners which shall be as indicated on the drawings.

b. In Beams and Girders. Within the middle third of the span, unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset by twice the width of the beam. Provisions for the transfer of shear and other forces through the construction joint shall be acceptable to ENGINEER.

c. In Suspended Slabs. At or near the center of the span in flat slab or Tbeam construction. No joint will be permitted between a slab and a concrete beam or girder unless specifically required by the drawings. Suspended floor systems shall be divided by construction joints into approximately square sections not to exceed 60 feet [18 m] in their longest dimension.

d. In Pan-Formed Joists. Within the middle third of the span when perpendicular to the joists. Centered in the slab, midway between joists, when parallel to the joists.

e. In Bottom Slab. Each bottom slab shall be divided into approximately square sections not to exceed 60 feet [18 m] in their longest dimension.

Construction joints in beams, girders, pan-formed joists, and slabs shall be perpendicular to the planes of their surfaces.

2-7.02. Watertight Joints. Construction joints in the following locations shall be watertight and shall be provided with continuous metal water stops except as otherwise required:

a. Walls and bottom slabs of dry pits or rooms where below finished grade and in contact with backfill or subgrade material on the opposite side.

b. Walls in contact with liquid where the opposite face is above finished grade or exposed in a dry pit or room.

c. Slabs in contact with liquid where the opposite face is exposed in a dry pit or room.

d. Walls and floors of filters and clear water reservoirs.

e. Other locations where specifically indicated on the drawings.

Metal water stops shall be clean and free from coatings that would weaken the bond with concrete. Each water stop shall be continuous throughout the length of the construction joint in which it is installed. Junctions between adjacent sections shall be lapped 5 inches [130 mm] and securely bolted or welded together. All metal water stops shall be maintained in proper position until the surrounding concrete has been deposited and compacted.

2-8. EXPANSION AND CONTRACTION JOINTS. Expansion joint filler shall be firmly bonded to the previously poured joint face with a suitable adhesive, and the new concrete shall be poured directly against the joint filler. Accessible edges of each expansion and contraction joint shall be sealed as specified in the caulking section.

Elastic water stops in expansion or contraction joints shall be continuous and shall be of rubber or plastic (PVC). Elastic water stops shall be 9 inches [225 mm] wide for concrete sections thicker than 8 inches [200 mm] and 6 inches [150 mm] wide for concrete sections up to and including 8 inches [200 mm] thick. Water stop embedment shall be equal on both sides of the joint. Water stops shall be spliced in strict conformity with the recommendations of the water stop manufacturer.

Where the drawings indicate an expansion joint against existing construction, or as required the water stop shall be grouted into a recess cut into existing concrete prior to placing new concrete.

2-9. ARCHITECTURAL CONCRETE. When required, architectural concrete shall conform to the applicable requirements of Section 6 of ACI 301 and to the additional requirements specified herein. Particular care shall be taken in forming, placing, and finishing architectural concrete.

2-9.01. General Requirements. Architectural concrete shall be free from holes, sand streaks, mortar leakage, offsets, irregularities, and other defects. Tolerances shall be as specified herein.

2-9.02. Forms. Forms for architectural concrete shall conform to the requirements specified for all concrete forms and shall be fabricated from plastic overlay plywood or fiberglass reinforced plastic. All joints shall be watertight. Forms shall be reinforced, braced, and supported as necessary to obtain the required straightness tolerance.

2-9.03. Finishing. Architectural concrete shall be finished as specified for finishing formed surfaces, with particular attention to the procedures and quality of workmanship.

PART 3 - EXECUTION

3-1. RECEIVING. CONTRACTOR shall check each delivery ticket to verify the concrete class delivered to the jobsite is in compliance with the concrete requested and is suitable for CONTRACTOR's handling, placing, finishing, and curing procedures. ENGINEER shall collect the delivery tickets from the truck operator.

3-2. PLACEMENT. The limits of each concrete pour shall be determined by CONTRACTOR and shall be acceptable to ENGINEER. All concrete within the predetermined limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcement, water stops, anchor bolts, and embedment's shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placements shall be cleaned; and the entire installation shall be acceptable to ENGINEER. Remove all frost, ice, and snow from in the formwork before concrete is placed.

CONTRACTOR shall inform ENGINEER at least 24 hours in advance of the times and places at which he intends to place concrete.

3-2.01 Bonding to Hardened Concrete. The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, sound, and damp. Before placement of plastic concrete, the hardened surface shall be cleaned of all laitance and foreign substances (including curing compound), washed with clean water, wetted thoroughly, and the surface made free of standing water. Surface profile of the hardened concrete after surface preparation shall be as required.

Coarse aggregate shall be omitted from the first batch or batches of concrete placed on hardened concrete in wall or column forms. The mortar puddle, Class A4 concrete, shall cover the hardened concrete with at least 2 inches [50 mm] at every point.

Epoxy bonding agent may be used as an alternative to Class A4 concrete in all areas except walls and columns where existing concrete will be in contact with freshly placed concrete.

3-2.02. Conveying Concrete. Methods of conveying concrete to the point of final deposit shall prevent segregation or loss of ingredients. After placement in the forms, concrete shall not be moved laterally more than 5 feet [1500 mm]. Concrete's free fall should not exceed 4 feet [1200 mm].

3-2.03. Pumping Concrete. The slump of concrete, with or without a superplasticizer that is discharged into the pump may exceed the specified value by the amount of slump loss in the pumping system, up to a maximum of 1 inch [25 mm]. The slump loss shall be determined by tests made at each end of the pumping system. If tests indicate a loss greater than 1 inch [25 mm], CONTRACTOR shall modify the pumping system as required to reduce the slump loss to 1 inch [25 mm] or less.

3-2.04. Placing Concrete. For proper compaction, concrete shall be placed in approximately horizontal layers not to exceed 24 inches [600 mm]. Each layer of concrete shall be plastic when covered with the following layer, and the rate of vertical rise of the concrete in the forms shall be not less than 24 inches [600 mm] per hour. Vertical construction joints shall be provided as necessary to comply with these requirements.

Concrete shall be placed and compacted in wall or column forms before any reinforcement is placed in the system to be supported by such walls or columns. The height of any portion of a wall or column placed monolithically with a floor or roof slab shall not exceed 6 feet [1800 mm]. Concrete in walls or columns shall settle at least 2

hours before concrete is placed in the structural systems to be supported by such walls or columns.

Concrete shall be thoroughly settled before top finishing. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.

When required, concrete for piers or caissons shall be carefully deposited to avoid contact with forms, reinforcement, and earth sides until completion of the drop. Necessary precautions shall be taken during concrete placement to prevent earth or other material from falling into excavations and to avoid dislocation of reinforcement. Concrete shall be placed continuously to the top of each pier or caisson at a rate of not less than 2 feet [600 mm] of vertical rise per hour. Forms above grade shall be of cylindrical steel or fiber acceptable to ENGINEER.

3-2.05. Compaction. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Mechanical vibrators shall maintain at least 14,000 cycles per minute when immersed in the concrete. The number and type of vibrators shall be acceptable to ENGINEER. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

3-2.06. Cold Weather Concreting. Except as modified herein, cold weather concreting shall comply with ACI 306R. The temperature of concrete at the time of delivery shall not be less than that indicated in the following table for corresponding outdoor temperature (in shade) at the time of placement:

Outdoor Temperature	Minimum Concrete Temperature
Below 30°F [-1°C]	70°F [21°C]
Between 30 and 45°F [-1 and 7°C]	60°F [16°C]
Above 45°F [7°C]	45°F [7°C)]

When placed, heated concrete shall not be warmer than 80°F [26°C]. When freezing temperatures may be expected during the curing period, the concrete shall be maintained at a temperature of at least 50°F [10°C] for 5 days or 70°F [21°C] for 3 days, after placement. Concrete and adjacent form surfaces shall be kept continuously moist. Sudden cooling of concrete shall not be permitted.

If CONTRACTOR requires the temperature at the point of delivery to be higher than the values specified herein in order to achieve the temperature required at the time of placement, CONTRACTOR's Bid shall cover the additional cost to achieve the higher temperature required for construction. The procurement CONTRACTOR will provide an adjustment unit price in their bid that shall be used by CONTRACTOR to Bid the construction contract. The adjustment unit price for each additional 5°F per cubic yard

[3.6 °C/m^3] will be based on the additional costs associated with providing concrete at a temperature above the temperature bid under the procurement contract.

3-2.07. Hot Weather Concreting. Except as modified herein, hot weather concreting shall comply with ACI 305R. At air temperatures of 90°F [32°C] or above, concrete shall be kept as cool as possible during placement and curing. The temperature of the concrete when placed in the work shall not exceed the values indicated in Tables 1 A and 1 B in Section P.

Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented. Concrete shall not be placed when the evaporation rate (actual or anticipated) equals or exceeds 0.2 pound per square foot per hour [0.98 kg/m^2/h], as determined by Figure 2.1.5 in ACI 305R.

If CONTRACTOR requires the temperature at the point of delivery to be lower than the values specified herein in order to achieve the temperature required at the time of placement, CONTRACTOR's Bid shall cover the additional cost to achieve the lower temperature required for construction. The procurement CONTRACTOR will provide an adjustment unit price in their bid that shall be used by CONTRACTOR to bid the construction contract. The adjustment unit price for each reduction by 5°F per cubic yard [3.6 °C/m^3] will be based on the additional costs associated with providing concrete at a temperature below the temperature bid under the procurement contract.

3-2.08. Placement Sequence. When required, to minimize the effect of shrinkage in producing cracks, the concrete for the indicated structures shall be placed as follows:

a. Bottom Slab. Each bottom slab shall be divided into sections by the construction joints as indicated on the drawings and, when not indicated on the drawings, into approximately square sections not greater than 60 feet [18 m] in their longest dimension. When required, bottom slabs with radial and circumferential reinforcement patterns may be divided into pie-shaped segments with the longest dimension not greater than 60 feet [18 m]. A section near the center of each structure shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of previously placed sections. Placement shall be scheduled so that two adjacent sides of each section are free, except at closures.

b. Walls. Walls shall be divided into sections by the construction joints as indicated on the drawings and, when not indicated on the drawings, into sections not greater than 60 feet [18 m] in length. A section near the center of each wall shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of the previously placed section. Placement shall be scheduled so that one end of each section is free, except at corner closures.

c. Top Slab. Each top slab shall be placed in the manner described for the bottom slab.

No two abutting sections shall be placed within a period of 72 hours, unless otherwise authorized by ENGINEER.

3-2.09. Duct Banks. When required, all construction joints in the indicated duct banks shall conform to the requirements specified herein for watertight joints. Hardened

surfaces that are to receive additional concrete shall be prepared by removing all loose particles, scum, and laitance so that the aggregate is exposed. The hardened surface shall then be thoroughly wetted and a thin coating of neat cement mortar shall be spread over the entire surface just before the fresh concrete is placed. The fresh concrete shall be puddled and spaded to eliminate any honeycomb or lack of mortar near the joint.

All reinforcement and other magnetic materials installed in duct banks shall be installed parallel to the individual ducts, unless they enclose all the ducts of the duct bank.

Duct bank concrete shall be compacted by rodding or spading only. Mechanical vibrators shall not be used. Concrete shall be worked around reinforcement and embedments and into the corners of the forms.

3-2.10. Underwater Concrete. When required, underwater (tremie) concrete, if used, shall be deposited underwater within the construction limits indicated on the drawings.

Underwater concrete shall be placed in accordance with ACI 304R through tremies having hoppers at the upper end.

The water shall be quiescent when concrete is deposited. Velocity of flow within the space where the concrete is placed shall not exceed 2 feet per minute [600 mm/min] in any direction. After concrete is placed, the water level in the space shall be kept static until the concrete has hardened.

3-3. FINISHING UNFORMED SURFACES. Buried and permanently submerged concrete blocking and encasement will require no finishing except as necessary to obtain the required surface elevations or contours. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating, and troweling where required.

3-3.01. Screeding. Screeding shall produce a concrete surface conforming to the proper elevation and contour, with all aggregates completely embedded in mortar.

3-3.02. Application of Pre-Cure Finishing Aid. When required, concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with a pre-cure finishing aid. The finishing aid shall form a monomolecular film on the surface of fresh, plastic concrete to retard evaporation.

Immediately following screeding, pre-cure finishing aid shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon [4 m^2/L], in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray finishing aid at approximately 40 psi [275 kPa] with a suitable nozzle as recommended by the manufacturer.

The sprayable solution shall be prepared as recommended by the manufacturer.

Under severe drying conditions, additional applications of finishing aid may be required following each floating or troweling, except the last finishing operation.

3-3.03. Floating. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.

Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color, and unless additional finishing is specifically required, shall produce the completed finish for unformed surfaces.

Floating shall be done with hand floats or suitable mechanical compactor-floats.

3-3.04. Broom Finish. When required, concrete surfaces shall be given a light broom finish to produce a nonslip surface. Brooming shall be done after the second floating and at right angles to the normal direction of traffic.

3-3.05. Nonslip Aggregate Finish. When required, tread surfaces of all interior and exterior concrete and concrete filled pan type stairs shall be surfaced with nonslip aluminum oxide aggregate. Aggregate shall be uniformly graded from 100 percent retained on a No. 50 [300 µm] sieve to 100 percent passing a NO.8 [2.36 mm] sieve. Aggregate shall be uniformly distributed during steel troweling at the rate of 1/4 pound per square foot [1.22 kg/m^2], in accordance with the manufacturer's recommendations and as acceptable to ENGINEER.

3-3.06. Troweling. Interior floor surfaces which will be exposed after construction is completed; surfaces to be covered with resilient floor coverings, thinset terrazzo, or seamless floor covering; exposed top surfaces of equipment bases and interior curbs; and other surfaces designated on the drawings shall be steel trowel finished. Surfaces to be covered with elastomeric deck covering shall be lightly troweled but not burnished. Trowel finishing will not be required for floors which are normally submerged. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

3-3.07. Finishing Surfaces for Bonding. All surfaces to be covered with concrete or topping shall be float finished. All laitance, surface mortar, and unsound material shall be removed by brushing or air blasting at the time of initial set. Surfaces shall be rough, clean, and sound. Floors and other flat surfaces to receive toppings shall be given a broom finish or raked finish with at least a ¼ inch [6 mm] profile for Class D6 concrete topping.

3-3.08 Edging. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having at least a 1/8 inch [3 mm] corner radius.

3-3.09. Pavement Finishing. The surface of pavements shall not vary more than 1/8 inch [3 mm] under a 10 foot [3 m] straightedge placed parallel to the center line.

a. When required, following placement and consolidation, and the disappearance of bleed water, the concrete surface shall be drag finished, using a seamless strip of damp burlap over the full width of the surface. The burlap drag shall consist of sufficient layers of burlap and shall have sufficient length in contact

with the concrete to slightly groove the surface. The drag shall be moved forward with a minimum bow of the lead edge. The drag shall be kept damp, clean, and free of particles of hardened concrete. When acceptable to the ENGINEER, carpet, artificial turf, or cotton fabric may also be used.

b. When required, following placement and consolidation, and the disappearance of bleed water, the concrete surface shall be broom finished with a broom acceptable to ENGINEER. The broom shall be not less than 18 inches [460] wide and made from good quality bass or bassine fibers not more than 5 inches [125 mm] long. The broom finishing shall produce regular corrugations not over 1/8 inch [3 mm] deep. The broom shall be pulled square across the surface, from edge to edge, with adjacent strokes slightly overlapped, and shall not tear the concrete surface.

c. When required, following placement and consolidation, and the disappearance of bleed water, the concrete surface shall be grooved in the transverse direction, using a wire broom or comb with a single row of tines. Unless otherwise permitted by ENGINEER, the grooving shall be at least 1/8 inch [3 mm] wide at ¾ inch [19 mm] centers, and groove depth shall be approximately 1/8 inch [3 mm]. When required, the transverse grooving shall terminate approximately 1 foot [300 mm] from the gutter line at the base of the curb. The area adjacent to the curb shall be given a light broom finish longitudinally.

3-3.10. Curb and Gutter Finishing. When required, curb and gutter shall be finished to the shape indicated on the drawings. After the forms have removed, all exposed edges shall be rounded, using and edging tool with at least a 1/8 inch [3 mm] corner radius. Exposed surfaces shall be float finished and given a light broom finish applied at right angles to the curb at the time of initial set, using a horsehair type broom.

3-3.11. Sidewalk Finishing. When required, concrete surfaces shall be screeded to the proper elevation and contour. All aggregates shall be completely embedded in mortar. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface. Initial floating shall be followed by a second floating at the time of initial set.

Floated surfaces shall be given a light broom finish, using a horsehair broom, to provide a nonslip surface. Brooming shall be done at right angles to the length of the walk.

Sidewalks shall be edged using a 3 or 4 inch [75 or 100 mm] wide edging tool with a 1/8 inch [3 mm] corner radius. Edger lap marks at corners of each slab shall be carefully removed. False joints shall be provided at right angles to the length of the walk, using a grooving tool with 1/8 inch [3 mm] radius. The finished edge on each side of the joint shall be the same width as the edging tool used. False joints shall divide each sidewalk into square sections.

The finished surface of all sidewalks shall be neat in appearance, shall be sloped to drain, and shall not pond water.

3-3.12. Duct Bank Finishing. After screeding and before final floating, a red concrete surface coloring shall be dusted on the fresh concrete surface at the rate recommended by the manufacturer.

3-4. CURING. Concrete shall be protected from loss of moisture for at least 7 days after placement; however, when concrete is also being protected from low temperatures, the period of curing by saturation shall be 1 day less than the duration of the low temperature protection.

Curing of concrete shall be done by methods which will keep the concrete surfaces adequately wet for the specified curing period. All concrete in liquid-containing structures, and when required, all concrete structures shall be water cured; membrane curing will not be acceptable.

3-4.01. Water Curing. Water saturation of concrete surfaces shall begin as soon as possible' after initial set. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff. Acceptable methods of water curing are described in ACI 308. The application of water to walls may be interrupted for grout cleaning only over the areas being cleaned at the time, and the concrete surface shall not be permitted to become dry during such interruption.

3-4.02. Membrane Curing. Unless otherwise specified, membrane curing compound may be used instead of water curing on concrete in non-liquid-containing structures which will not be covered later with topping, mortar, coating, or additional concrete.

Membrane curing compound shall be sprayed at a coverage rate of not more than 300 square feet per gallon [7.3 m^2/L]. The spray equipment shall have sufficient capacity to continuously spray curing compound at approximately 40 psi [275 kPa] with a suitable nozzle as recommended by the manufacturer. Unformed surfaces shall be covered with the first coat of curing compound within 30 minutes after final finishing. A second coat of curing compound shall be applied when the first coat has become tacky to the touch and shall be applied at right angles to the first coat. If forms are removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surfaces.

When VOC-compliant curing compounds are used, concrete surfaces shall be covered with white polyethylene sheeting immediately after the curing compound has become dry to the touch. White polyethylene sheeting shall completely cover the surfaces and shall overlap the edges for proper sealing and anchorage. Joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges, and shall be anchored as necessary to prevent billowing on the surface.

Curing compound shall be suitably protected against abrasion during the curing period.

3-4.03. Film Curing. Unless otherwise specified, film curing with white polyethylene sheeting may be used instead of water curing on concrete in non liquid-containing structures which will be covered later with mortar or additional concrete, or which will otherwise not be exposed to view.

Film curing shall begin as soon as possible after initial set of the concrete. The concrete surfaces shall be completely covered with polyethylene sheeting. Sheeting shall overlap the edges of the concrete for proper sealing and anchorage, and joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges and as necessary to prevent billowing on the surface.

3-5. REPAIRING DEFECTIVE CONCRETE. Defects in formed concrete surfaces shall be repaired within 24 hours to the satisfaction of ENGINEER. Defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges cut square to avoid feathering.

Concrete repair work shall conform to Article 5.3.7. of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of the surrounding concrete. Repair work shall be adequately cured.

3-6. FINISHING FORMED SURFACES. Fins and other concrete surface projections shall be removed from all formed surfaces, except exterior surfaces that will be in contact with earth backfill and are not specified to be dampproofed. A power grinder shall be used, if necessary. Surfaces to be dampproofed shall have fins removed and tie holes filled, but no additional finishing will be required.

3-6.01. Tie Holes. Tie holes in formed surfaces shall be cleaned, wetted, and filled with patching mortar. The patches shall be finished flush and cured and shall match the texture and color of the adjacent concrete.

3-6.02. Special Surface Treatment. When required, the surfaces listed on the drawings shall be finished by grout cleaning.

Grout-cleaned finish shall conform to Paragraph 5.3.3.4.b. of ACI 301. Grout cleaning shall not result in an overall plastering of the concrete surfaces, but shall produce a smooth, uniform surface free of marks, voids, surface glaze, and cement dust.

3-7. TOLERANCES. Tolerances for cast-in-place concrete work shall be as stipulated in ACI 117, except as required. Formed surfaces stipulated in Article 3.4 of ACI 347 shall be considered Class A for architectural concrete as specified herein, and Class C for all other concrete work.

When required, settling basin floors shall be accurately finished to a uniform slope, and shall be within 1 inch [25 mm] of the shape indicated on the drawings.

3-8. RINGWALL TOLERANCES. When required, the top of the foundation ring wall for each steel reservoir shall be accurately constructed within the following tolerances:

a. In any 30 foot [9000 mm] length, the top of the wall shall not vary from level by more than 1/8 inch [3 mm], or 1/4 inch [6 mm] peak to valley.

b. No two points on the top of the wall shall differ in elevation by more than 2 inch [12.5 mm] "1/4 inch [6 mm].

Levels will be checked on the top of the foundation wall, and any variations exceeding the specified tolerances shall be corrected prior to erection of the reservoir.

3-9. WASH WATER TROUGHS. When required concrete filter wash water troughs shall conform to the details indicated on the drawings.

After installation, the top edges of troughs shall be dressed to conform to the actual water surface. Edges shall be brought to a level line with a rasp and finished with a fine-grained carborundum brick.

3-10. PAN-FORMED JOISTS. When required, pan-formed joists shall be provided. When pan-formed joists will be exposed as finished ceilings, new or undamaged metal pans shall be used to produce concrete that is smooth and free from waves and irregularities. Adjustable pans without flanges shall be used to provide joist lines which are straight and true. Pans and joist bottom boards shall be carefully removed to avoid damaging the concrete. Exposed surfaces shall be finished by removing fins and repairing honeycomb. Grout cleaning will not be required.

Nail-down flange type forms may be used for pan-formed joists which are located above suspended ceilings or required in connection with roof slabs for covered basins or reservoirs. Pans and joist bottom boards in such locations shall be removed in a careful manner and all honey comb shall be repaired.

3-11. PAN STAIRS. When required, pan type stair treads and landings shall be filled with a Class D4 concrete. The mix shall be adjusted as necessary to produce satisfactory surface finishing characteristics. Stair treads and landings shall be given a nonslip finish suitable for required finish surface.

All pans shall be carefully cleaned before they are filled with concrete. Grease, oil, wax, or other objectionable substance shall be completely removed by methods acceptable to ENGINEER. After the concrete has hardened, all droppings and dust shall be removed from the adjacent areas, and the work shall be left clean and suitable for painting.

When required, pan type stairs and landings shall be filled with concrete before aluminum handrails are installed.

3-12. VAPOR BARRIERS. When required, a vapor barrier shall be provided beneath concrete floor slabs poured directly on grade, except floors of basements, basins, digesters, and wet pits, and outdoor slabs. Joints in the film shall be sealed with waterproof sealing tape. Care shall be exercised to avoid tearing or puncturing the film. Any damage shall be promptly repaired, and the film shall be inspected for damage immediately before the concrete is placed.

3-13. COMPOSITE TOPPING CONCRETE. When required, composite topping concrete shall be placed in the locations indicated on the drawings.

3-13.01. Surface Preparation. Before topping is applied, the underlying hardened concrete surface shall be scrubbed clean. Grease or oil shall be completely removed by cleaning the surface in accordance with ASTM D4258 and abrading the surface in accordance with ASTM D4259 by chipping or grinding. The cleaned surface shall be rinsed with clean water and kept saturated for the 24 hour period immediately preceding

the application of topping. Immediately before topping is applied, the hardened concrete shall be coated with neat Portland cement slurry having the consistency of paint or epoxy bonding agent.

3-13.02. Composite Topping. A composite topping concrete (Class D6) shall be applied over the precast or cast-in-place concrete roof areas indicated on the drawings. Topping shall be spread, compacted, screeded, and floated with suitable concrete tools. Topping shall be accurately placed to the elevations and slopes indicated and shall be given a float finish.

3-14. MINERAL COLORED CONCRETE. When floors and walls that have colored concrete are required they shall be protected from damage until accepted by ENGINEER. Areas which are subject to traffic or over which equipment or materials are to be moved shall be covered with hardboard or plywood. Just before final inspection, the floors shall be thoroughly cleaned and then sealed with liquid floor sealer.

When required, walls that have colored concrete shall receive a brush-blasted finish.

3-15. CONCRETE SURFACE COLORING/HARDENER. When required and where concrete surface coloring/hardener is required on the drawings, a dry-shake coloring material shall be worked into the freshly screeded concrete surface. The coloring material shall be applied at the rate of 50 pounds per 100 square feet [244 kg/100 m^2] in strict accordance with the manufacturer's recommendations. The color of the concrete surface shall be as required.

Concrete floors with surface coloring shall be protected from damage until acceptance by ENGINEER. Areas which are subject to traffic or over which equipment or materials are to be moved shall be covered with hardboard or plywood. Just before final inspection, the colored floors shall be thoroughly cleaned and then waxed with colored wax furnished by the manufacturer of the coloring material.

3-16. FLOOR SEALER. When required, all concrete floors which are subject to foot traffic and are not required to be covered with resilient floor coverings, thinset terrazzo, seamless flooring, ceramic tile, or quarry tile shall be given two coats of clear floor sealer in addition to any which may have been applied as membrane curing compound. Prior to application of each coat of sealer, the floor shall be thoroughly cleaned of dirt, grease, and other foreign matter. The first coat shall be applied at the end of the curing period and before any traffic is permitted on the floor. The second coat shall be applied in preparation for substantial completion of the work. Floor sealer shall be applied in accordance with the manufacturer's recommendations.

3-17. OWNER'S FIELD CONTROL TESTING. Field control tests, including aggregate gradation, slump, air content, shrinkage tests, and making compression test cylinders, shall be performed by ENGINEER or testing laboratory personnel. CONTRACTOR shall provide all facilities and the services of one or more employees as necessary to assist with the field control testing.

As stipulated in the quality control section, tests required during the progress of the work shall be made at the expense of OWNER.

The frequency specified herein for each field control test is approximate and subject to change as required by OWNER.

ENGINEER may require field testing prior to the addition of superplasticizer at the site to determine compliance with the specifications. Field testing after the addition of superplasticizer shall be conducted as specified and as required to determine that the concrete is in compliance with the specifications. Air tests shall be conducted whenever field tests are conducted.

3-17.01. Slump. A slump test shall be made for each 50 cubic yards [40 m^3] of concrete. Slump shall be determined in accordance with ASTM C143.

3-17.02. Air Content. An air content test shall be made on concrete from one of the first three batches mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138.

3-17.03. Unit Weight. A unit weight test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C138.

3-17.04. Concrete Temperature. A concrete temperature test shall be made on concrete from the first batch of concrete mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Concrete temperature shall be determined in accordance with ASTM C1 064.

3-17.05. Water-Soluble Chloride Ion. Water-soluble chloride ion testing shall be performed in accordance with ASTM C1218.

3-17.06. Compression Tests. One set of four concrete compression test cylinders shall be made each day when 25 to 50 cubic yards [15 to 38 m^3] of concrete is placed. One additional set of test cylinders shall be made from each additional 50 cubic yards [38 m^3], or major fraction thereof, placed in anyone day. Two cylinders of each set shall be tested at an age of 7 days and the remaining cylinders shall be tested at an age of 28 days.

Test cylinders shall be 6 inches in diameter by 12 inches high [150 mm in diameter by 300 mm high] and shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.

Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, the unit weight, and the concrete temperature.

3-17.07. Shrinkage Tests. When required, concrete shrinkage tests shall be performed once for each 1,000 cubic yards [764 m^3] of concrete with controlled shrinkage that is placed and shall be made on concrete from a batch of concrete from which concrete compression test cylinders are made.

Three test specimens shall be prepared for each test. Drying shrinkage specimens shall be 4 by 4 by 11 inch [100 by 100 by 275 mm] prisms with an effective gauge length of 10 inches [250 mm], fabricated, cured, dried, and measured in accordance with ASTM C157 except with the following modifications:

Specimens shall not be disturbed during the first 23 hours of cure. At the 24 hour point, +/-1 hour, the specimens shall be transported to the testing laboratory in the molds where the testing shall commence. Specimens shall be removed from the molds upon arrival at the testing laboratory and shall be placed immediately in water at 73°F +/-3°F [23°C +/-2°C] for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in lime-saturated water as specified in ASTM C157. Measurement to determine expansion expressed as a percentage of original length shall be taken at age 7 days. The length at 7 days shall be the base length for drying shrinkage calculations ("a" days drying age). Specimens then shall be stored immediately in a humidity controlled room maintained at 73°F +/-3°F [23°C +/-2°C] and 50% +/-4% relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as a percentage of the base length shall be reported separately for 7, 14, and 21 days +/-4 hours of drying from "0" day after 7 days of moist curing for a total of 28 days from date of casting.

Drying shrinkage deformation for each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. Results of the shrinkage test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimen deviates from the average for that test age by more than 0.004 percent, the results for that specimen shall be disregarded.

Drying shrinkage tests will not be required for any additional concrete mixes used for piles, pile caps, isolated footings, pipe blocking, pipe encasement, and duct banks.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the point of final placement shall not exceed the values as indicated in the limiting requirements tables in Section 03300P.

3-17.08. Test Reports. Four copies of each test report shall be prepared and distributed by the testing laboratory to the Resident Project Representative (two copies), ENGINEER, and CONTRACTOR, in accordance with the quality control section.

3-18. EVALUATION AND ACCEPTANCE OF CONCRETE. Concrete will be evaluated for compliance with all requirements of the specifications. Concrete strength will be only one of the criteria used for evaluation and acceptance of the concrete. The results of all tests performed on the concrete and other data and information concerning the procedures for handling, placing, and curing concrete will be used to evaluate the concrete for compliance with the specified requirements.

3-18.01. Compression Test Evaluation. Compressive strength test results will be evaluated for compliance with the specified strength requirements and the specified requirements that relate to durability.

3-18.01.01. Strength. When required for compliance with the strength requirement, the strength level of the concrete will be considered satisfactory when the averages of all sets of three consecutive strength tests equal or exceed the specified compressive strength, f'_c, and no individual strength test result falls below the specified compressive strength by more than 500 psi [3.5 MPa).

3-18.01.02. Durability. When required for compliance with the limiting requirements that relate to durability, the results of compressive strength tests made in the field and tests made on the trial mix in the laboratory will be compared to confirm that the concrete received at the project site is essentially the same mix as that tested in the laboratory. The 28 day strength tests for any three consecutive sets of field made cylinders shall average not less than 700 psi [4.9 MPa) below the average 28 day compressive strength, f'_{cr} of the trial mixture strength tests, and no individual strength test from cylinders made in the field shall fall below the trial mixture average 28 day strength test by more than 1200 psi [11 .7 MPa).

A strength test shall be the average of the compressive strengths of at least two cylinders made from the same concrete sample tested at 28 days.

3-19. STEEL PROTECTION. When required, steel reinforcement which is to be left exposed for future bonding shall be cleaned and protected from corrosion by painting with two coats of rust-inhibitive primer. Bars shall be painted before adjacent concrete is placed. The coating shall extend 6 inches [150 mm] into the concrete. In addition, bar extensions exposed to weather shall be given a half-lapped layer of protective tape wrap after completion of concrete work.

3-20. CLEANING EMBEDMENTS. Embedments shall be clean when installed. After placement of concrete, surfaces of embedments not in contact with concrete shall be cleaned of concrete spatter and other foreign substances.

End of Section

CAST-IN-PLACE CONCRETE - CONSTRUCTION - EXCEPTIONS

PART 1 - GENERAL

1-1. SCOPE. This document covers Exceptions, Clarifications, and Comments for this specification section. This document includes additional project specific requirements where the space available on the Data Sheet is insufficient.

1-2. PREPLACEMENT CONCRETE SURFACE PREPARATION. Add the following new paragraphs:

> 3-1.01 Preplacement Concrete Surface Preparation. Contractor shall prepare the existing concrete surfaces that will be in contact with the new concrete as specified herein and in a manner acceptable to Engineer. Contractor shall remove spalled, loose, and deteriorated concrete to sound concrete. Contractor shall clean exposed concrete surfaces, to the maximum extent possible, free of contamination that would prevent bonding of new concrete to existing sound concrete.
>
> Contractor shall remove any ice that may exist, in the space where concrete will be placed, immediately prior to the placement of concrete. The removal procedures and the removal of ice shall be acceptable to the Engineer. Contractor shall dewater, at least a portion of the space where concrete will be placed, before placing tremie concrete.

1-3. COLD WEATHER PROTECTION. Add the following paragraph at the end of paragraph 3-2.06:

> Contractor shall provide an environmentally controlled enclosure system for the working area during concrete surface preparation, placing, and curing operations. Contractor shall provide, at their expense, a heating system that will provide the required temperatures. The enclosure and the heating system shall keep the working area inside the enclosure free of freezing temperatures and provide the temperatures required for concrete placement and curing as specified herein.

End of Section

SECTION E

RIPRAP

1. SCOPE. This section covers riprap at locations where indicated on the drawings.

2. GENERAL. Materials, equipment, and construction methods shall comply with the applicable provisions of the Kansas Department of Transportation "Standard Specifications for Road and Bridge Construction". In case of conflict between this section and the Department of Transportation specifications, the requirements of this section shall govern.

3. MATERIALS. Stone for riprap shall be obtained from sources selected by the Contractor and shall be acceptable to the Engineer.

Riprap shall consist of hard, durable rock, angular in shape, resistant to weathering and to water action, free from overburden, spoil, shale and organic material, and shall meet the specified gradation requirements. The breadth or thickness of a single stone shall not be less than one-third of its length. Rounded stone or boulders will not be accepted. Shale or stones with shale seams are not acceptable.

3.01. Riprap. Riprap shall be graded as follows:

	Stone Size (lb)	Percent of Total Weight Smaller Than Given Size
Class I	300	100
	165	85
	90	50
	12	15
Class II	3000	100
	2000	80
	1000	50
	50	10

Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Spalls and stones smaller than the specified 15 percent size shall not exceed 10 percent by weight in each load. Sand and rock dust shall not exceed 5 percent by weight in each load.

In addition to the gradation requirements, the specific gravity (bulk saturated surface dry) shall be greater than 2.6 as determined by AASHTO T85. The material shall not lose more than 40 percent of its weight during an abrasion test (Abrasion Grading A) after 500 cycles, as determined by AASHTO T96. The material shall also not lose more than 15 percent of its weight during a sodium sulfate test after 5 cycles, as determined by AASHTO T104 (2-1/2 to 1-1/2 sample).

4. PLACEMENT. Care shall be taken in placing riprap stone around concrete structures to prevent damage to the concrete. Except when otherwise indicated on the drawings or when repairing existing riprap, riprap shall not be less than 2 feet deep.

Riprap shall be placed in a manner which will produce a well graded mass of stone with the minimum practicable percentage of voids. The entire mass of stone shall be placed in conformance with the lines, grades, and thicknesses indicated on the drawings. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing the riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted. The larger stones shall be well distributed and the entire mass of stone shall conform to the gradation specified. Material shall be distributed in such a manner that there will not be a large accumulation of smaller or larger stones in any given area.

Placement of riprap in water by direct dumping will not be permitted. Underwater placement shall be by methods that prevent segregation.

5. DRAWINGS AND DATA. Complete details and compliance test data covering the materials to be furnished under this section shall be submitted in accordance with the submittals section.

End of Section

SECTION F

ANCHORAGE IN CONCRETE AND MASONRY

PART 1 - GENERAL

1-1. SCOPE. This section covers the procurement and installation of anchorage in concrete and masonry for structural applications. It includes cast-in-place anchor bolts, adhesive and chemically grouted anchors, expansion anchors, and epoxy grouted anchor bolts and reinforcing steel to be installed in concrete and masonry.

When this section is referenced by any equipment section, anchorage for that equipment, including anchors and anchor bolts, shall be as specified herein.

Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1-1.01. **Terminology. When the phase "when required" or "as required is stated in this section it shall mean "when .... is required in the attached Data Sheet" or "as required in the attached Data Sheet".**

1-2. GENERAL. Unless otherwise specified or indicated on the drawings all anchors and anchor bolts shall be cast-in-place anchor bolts with forged heads or embedded nuts and washers. Unless otherwise indicated bolts in concrete shall have a diameter of at least 3/4 inch [19 mm], and bolts in grouted masonry shall have a diameter of at least 1/2 inch [12.7 mm].

Unless otherwise required, anchors and anchor bolts used in the following locations and applications shall be of the indicated materials. Other anchors and anchor bolts shall be as indicated on the drawings.

Submerged Locations	Stainless Steel
Locations Subject to Splashing	Stainless Steel
Buried Locations	Stainless Steel
Other Exterior Locations	Galvanized or Stainless Steel
Anchorage of Structural Steel Columns	Galvanized Steel

Adhesive anchors and expansion anchors may be used instead of cast-in-place anchors where specifically indicated or permitted on the drawings or with the specific acceptance by ENGINEER.

1-3. SUBMITTALS. Letters of certification indicating the manufacturer and types of adhesive and chemically grouted anchors, expansion anchors, and epoxy grouts to be supplied shall be submitted in accordance with the submittals section. When required, all anchorage products and systems used shall have a current product report on file with ICBO.

1-4. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 - PRODUCTS

2-1. MATERIALS. Materials shall be as indicated below and as required.

Expansion Anchors	Hilti "Kwik-Bolt II"; ITW Ramset/Red Head "Trubolt Wedge Anchor"; Powers Rawl "Rawl-Stud Anchor".
Reinforcing Bars	ASTM A615, Grade 60, deformed.
Reinforcing Bars, weldable	ASTM A706, Grade 60, deformed.
Anchor Bolts and Nuts	
Carbon Steel	ASTM A307 or ASTM A36, with compatible nuts.
Stainless Steel	Bolts, ASTM F593, Alloy Group 1 or 2; nuts, ASTM F594, Alloy Group 1 or 2.
Galvanized Steel	Carbon steel bolts and nuts; hot-dip Galvanized, ASTM A153 and A385.
Flat Washers	ANSI B18.22.1; of the same material As anchor bolts and nuts.
Threaded Rod Anchors and Nuts	
Carbon Steel	ASTM A36, with compatible nuts.
Stainless Steel	Rods, ASTM F593, Alloy Group 1 or 2; nuts, ASTM F594, Alloy Group 1 or 2.
Galvanized Steel	Carbon steel bolts and nuts; hot-dip galvanized, ASTM A153 and A385.
Adhesive and Chemically Grouted Anchors for Concrete and Grout Filled Masonry	
Threaded Rod and Nuts	As specified for Threaded Rod Anchors and nuts.
Adhesive	Hilti "HIT HY 150" System; ITW Ramset/Redhead "Epcon Ceramic 6" System; or Power Rawl "Power Fast

	Epoxy "Injection Gel" System.
Epoxy Grout for Reinforcing Bars, Threaded Rod Anchors, and Anchor Bolts	
Adhesive For Floors and Horizontal Surfaces	Master Builders "Brutem AB" (Parts A&B); Sika "Sikadur 35, Hi-Mod LV"; Master Builders "Concresive Liquid LPL"; Sika "Sikadur 32 Hi-Mod".
For Vertical Surfaces and Overhead Applications	Master Builders "Concresive 1441"; Sika "Sikadur 31 Hi-Mod Gel".
Aggregate	As recommended by the epoxy grout manufacturer.
Water	Clean and free from deleterious substances.
Adhesive and Chemically Grouted Anchors for Hollow Masonry System	
Threaded Rod Anchors and Nuts	As specified for Threaded Rod Anchors and Nuts.
Adhesive	As specified for adhesive and chemically grouted anchors.
Screen Tubes	As recommended by the manufacturer.

2-2. ANCHORS.

2-2.01. Cast-in-Place Anchor Bolts. Cast-in-place anchor bolts shall be delivered in time to permit setting before the structural concrete is placed. Anchor bolts shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-place anchor bolts indicated on the drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts without locknuts. Installation of anchor bolts is covered in the cast-in-place concrete section.

2-2.02. Adhesive, Chemically Grouted, and Expansion Anchors. When adhesive, chemically grouted, or expansion anchors are indicated on the drawings, only acceptable systems shall be used. Acceptable systems shall include only those systems and products specified or as specifically indicated by product name on the drawings. Alternative anchoring systems may be used only when specifically accepted by ENGINEER. An acceptable adhesive or chemically grouted anchor system may be used

as an alternative in locations where epoxy grouted anchor bolts and epoxy grouted threaded rod anchors are specified or indicated.

Threaded rods used with adhesive and chemically grouted anchoring systems shall be stainless steel unless carbon steel is specifically permitted or otherwise indicated on the drawings. Expansion anchors shall be stainless steel unless otherwise indicated on the drawings.

Threaded rod anchors in adhesive anchor systems shall be furnished with a sufficient length to provide an embedment depth of at least 15 rod diameters and free of coatings that would weaken the bond with the adhesive. Unless otherwise required, single nut and washer shall be furnished for threaded rod anchors, adhesive anchors and expansion anchors. Anchor bolts and threaded rod anchors that are to be epoxy grouted shall be clean and free of coatings that would weaken the bond with the epoxy.

Adhesive anchors in hollow masonry shall utilize screen tubes as recommended by the manufacturer.

2-2.03. Epoxy Grouted Anchor Bolts and Reinforcing. Epoxy grout for installing reinforcing steel dowels and anchor bolts not indicated to be adhesive or chemically grouted anchors shall consist of a two-component liquid epoxy adhesive of viscosity appropriate to the location and application, and an inert aggregate filler component, if recommended by the adhesive manufacturer. Components shall be packaged separately at the factory and mixed immediately before use.

Anchor bolts and reinforcing steel shall be as indicated on the drawings.

PART 3 - EXECUTION

3-1. GENERAL. Anchor bolts shall be installed at the locations indicated on the drawings. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before final installation and tightening of the nuts.

3-2. CAST-IN-PLACE ANCHORS AND ANCHOR BOLTS. Cast-in-place anchors and anchor bolts shall be carefully positioned with templates and secured in the forms prior to placing concrete. CONTRACTOR shall verify that anchorage devices are positioned in accordance with the design drawings and with applicable equipment submittal drawings. Anchors and bolts shall be positioned sufficiently in advance of the concrete placement so that an on-site representative of ENGINEER or OWNER will have sufficient time to inspect the bolts prior to placing concrete. If Special Inspection of the anchor bolts is required by the local building code, anchorage shall be placed in sufficient time and with sufficient notification so that such inspection can take place without delaying progress of the work.

Threads, bolts, and nuts spattered with concrete during placement shall be cleaned prior to final installation of the bolts and nuts.

3-3. EPOXY GROUT. Epoxy grout components shall be packaged separately at the factory and shall be mixed immediately before use. Proportioning and mixing of the components shall be done in accordance with the manufacturer's recommendations.

An acceptable adhesive or chemically grouted anchoring system may be used where epoxy grouted threaded rod anchors are indicated on the drawings.

3-3.01. Preparation. Where indicated on the drawings, anchor bolts, threaded rod anchors, and reinforcing bars shall be epoxy grouted in holes drilled into hardened concrete. Diameters of holes shall be as follows:

Item	Diameter of Hole
Reinforcing Bars and Threaded Rod Anchors	1/8 inch [3 mm] larger than the outside diameter of the bar or the rod
Headed Anchor Bolts	Bolt diameter plus 2 inches [50 mm] and sufficient to clear the bolt head

The embedment depth for epoxy grouted anchor bolts, threaded rod anchors, and reinforcing bars shall be at least 15 bolt, rod, or bar diameters, unless otherwise indicated on the drawings.

Holes shall be prepared for grouting as recommended by the epoxy grout manufacturer.

3-3.02. Installation. Anchor bolts, threaded rod anchors, and reinforcing bars shall be clean, dry, and free of grease and other foreign matter when installed. The bolts, rods, and bars shall be set and positioned and the epoxy grout shall be placed and finished in accordance with the recommendations of the grout manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with epoxy grout, without voids.

3-4. ADHESIVE AND CHEMICALLY GROUTED ANCHORS. When adhesive and chemically grouted anchors are indicated on the drawings, only an acceptable system shall be used. Alternative anchoring systems may be used only when acceptable to ENGINEER. An acceptable adhesive or chemically grouted anchor system may be used as an alternative in locations where epoxy grouted anchor bolts and threaded rod anchors are specified or indicated. The embedment depth for adhesive or chemically grouted anchors shall be at least 15 rod diameters unless a greater depth is indicated on the drawings.

Adhesive for adhesive or chemically grouted anchors shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer's recommendations.

Anchors shall be installed in holes drilled into hardened concrete or grout filled masonry. Diameter of holes shall be 1/16 inch [1.5 mm] larger than the outside diameter of the rod unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared for insertion of the anchors by removing all dust and debris using procedures recommended by the adhesive manufacturer.

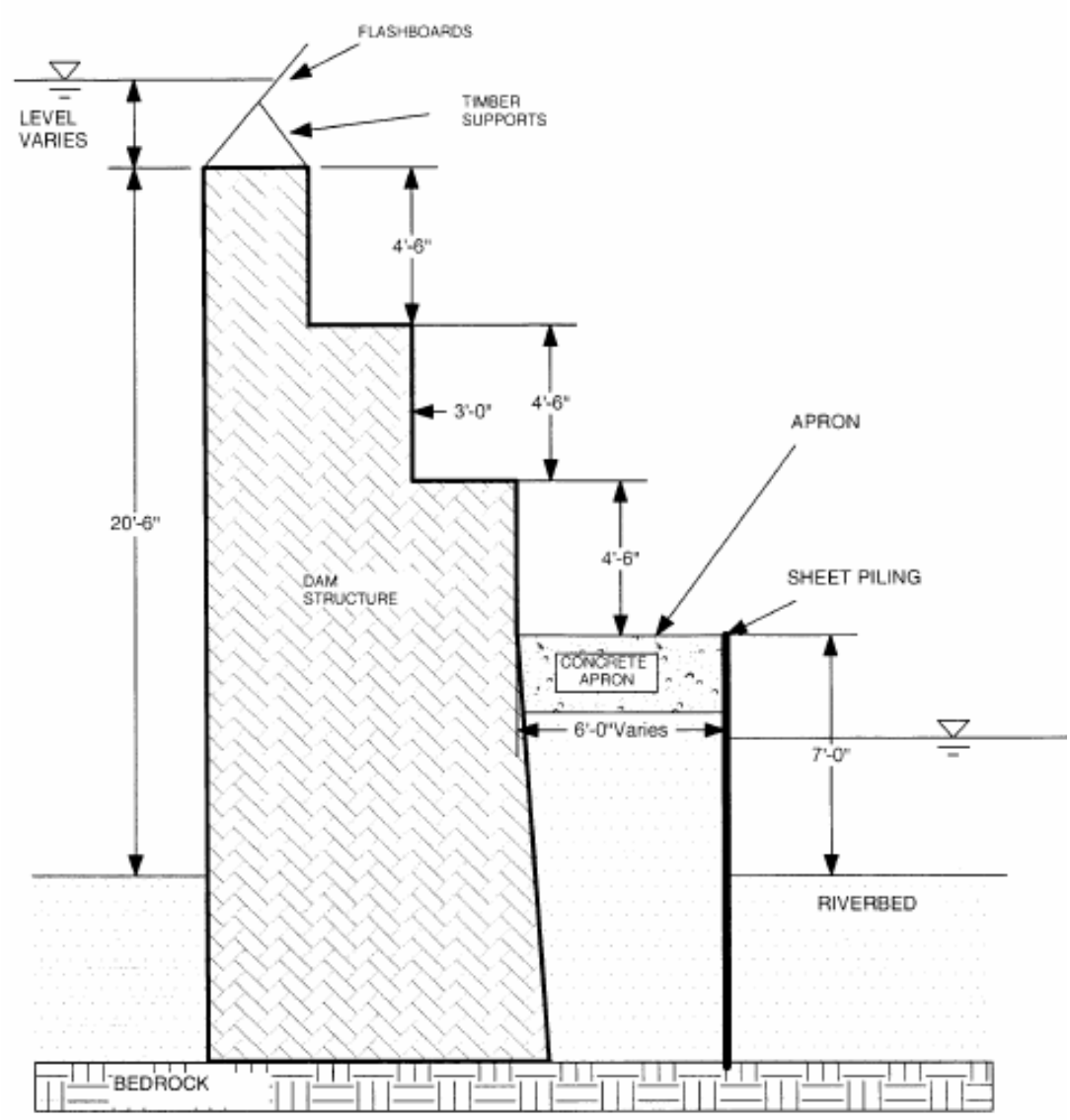
Adhesive and chemically grouted anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed, the rods shall be set and positioned, and the adhesive shall be finished, all in accordance with the recommendations of the material manufacturer. Care shall be taken

to ensure that all spaces and cavities are filled with adhesive, without voids, and remain filled with adhesive until completion of the curing period. Adhesive shall be cured in accordance with the recommendations of the adhesive manufacturer.

3-5. EXPANSION ANCHORS. When expansion anchors are indicated on the drawings, only an acceptable expansion anchor shall be used. Alternative anchoring systems may be used only when acceptable to ENGINEER. Expansion anchors shall be installed in accordance with the drawings, but in no case shall the depth of the hole be less than six bolt diameters. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least six times the diameter of the bolt. Unless otherwise indicated on the drawings, the minimum distance between the centers of expansion anchors shall be at least 12 times the diameter of the bolt.

End of Section

DETAILS DRAWINGS



NOTE: THIS DRAWING IS NOT TO SCALE. THE DIMENSIONS ON THIS DRAWING ARE INTENDED FOR INFORMATIONAL PURPOSES ONLY. THEY ARE NOT ACCURATE AND SHOULD BE VERIFIED ONSITE. THE ENTIRE DAM DOES NOT BEAR ON BEDROCK AND THE THICKNESS OF THE APRON IS UNKNOWN.

FIGURE NO. 1 – EXISTING DAM SECTION

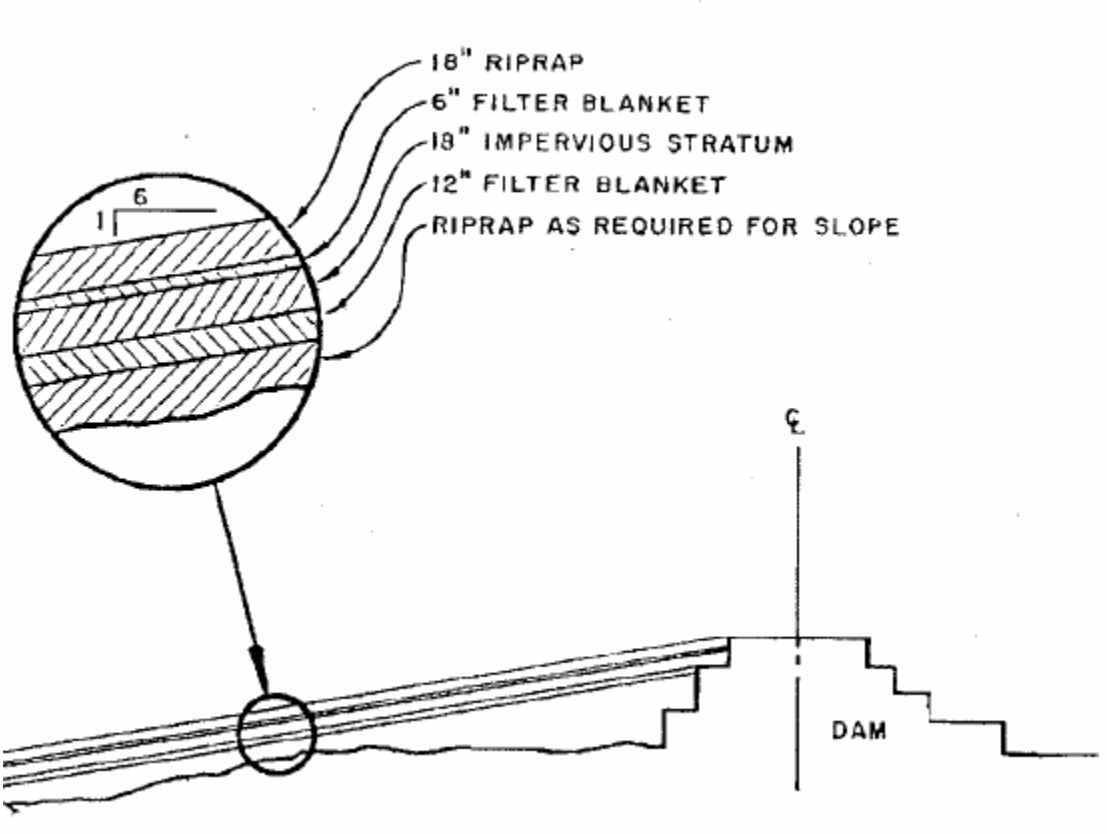


FIGURE NO. 2 – EXISTING STRATA UPSTREAM OF DAM

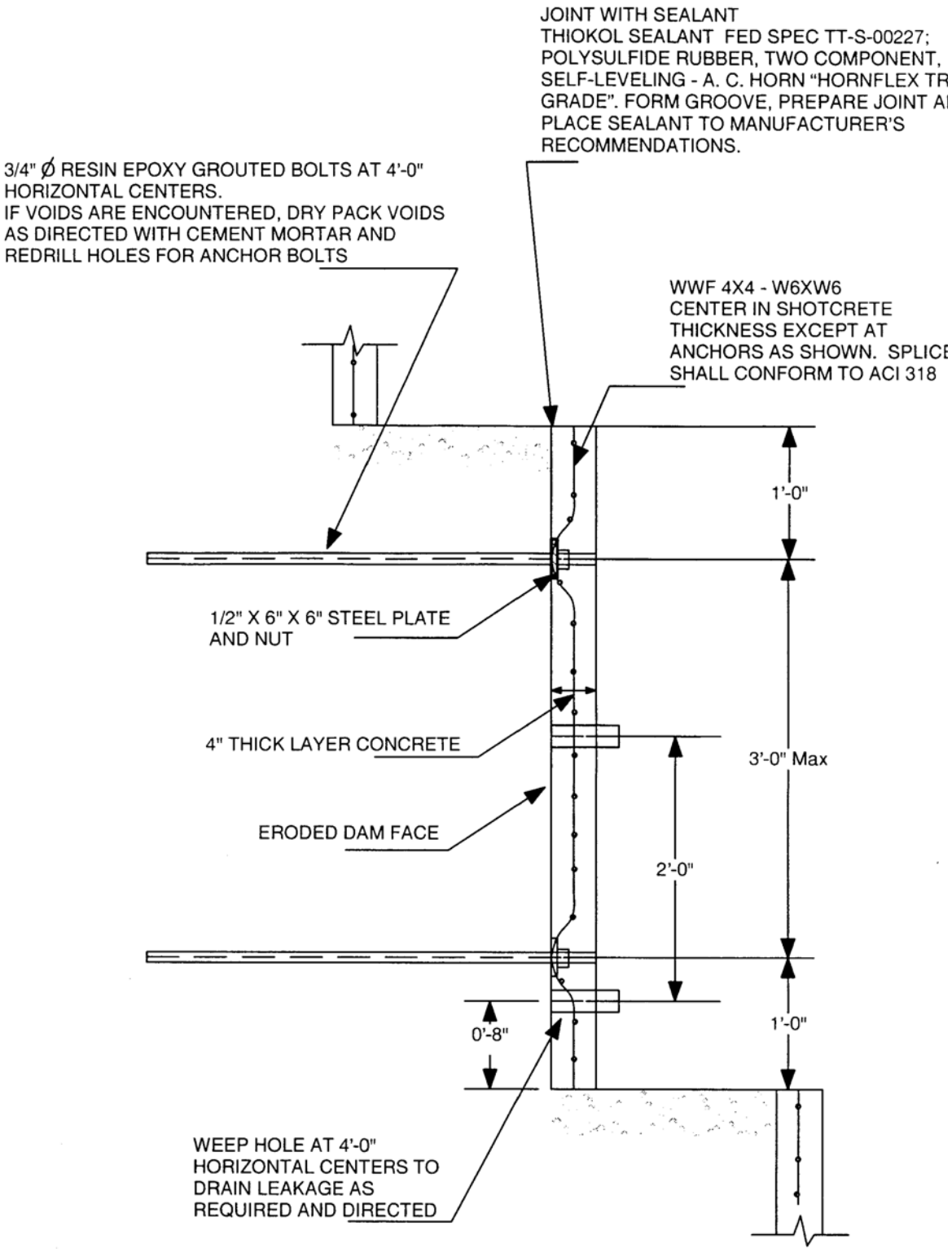


FIGURE NO. 3 – SHOTCRETE INSTALLATION DETAIL

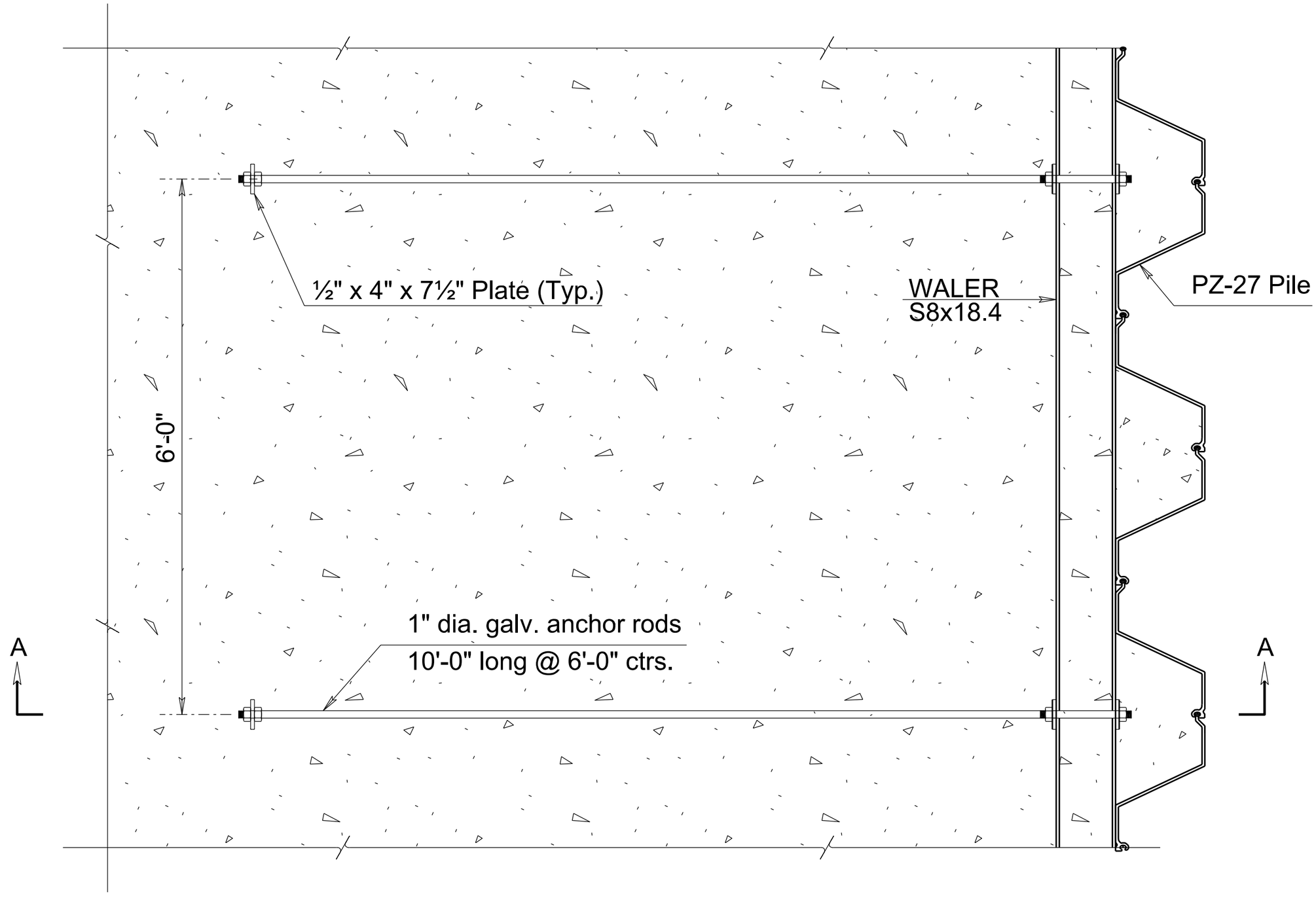
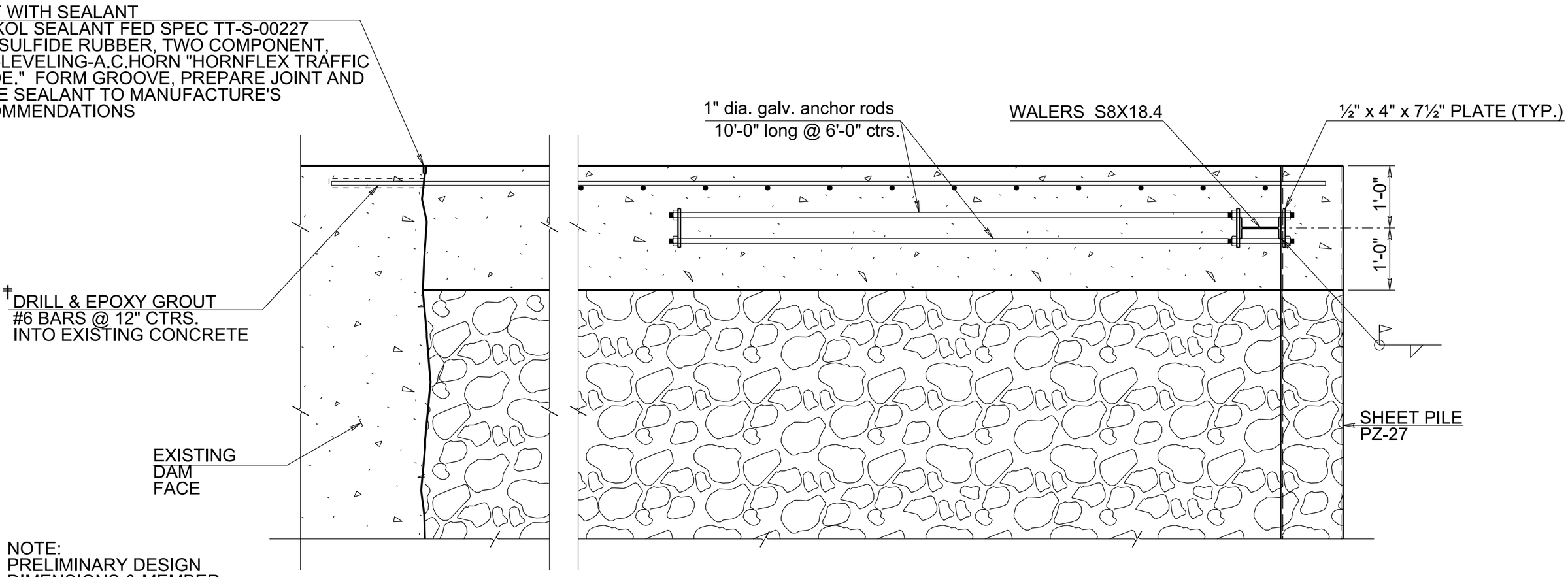


FIGURE NO. 4 - SHEET PILING DETAIL (PLAN VIEW)



NOTE:
PRELIMINARY DESIGN DIMENSIONS & MEMBER SIZES & SPACES SUBJECT TO REVISION

†IF VOIDS ARE ENCOUNTERED, FILL VOIDS AS DIRECTED WITH CEMENT MOTAR AND REDRILL HOLES

FIGURE NO. 5 - SHEET PILING DETAIL (SECTION A-A)

Appendix J

Concrete Testing Reports

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C4
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 2/22/2010

Mix Data

		Material	Source	Amount	Moisture
Mix Data Submitted By	Penny's Concrete	Cement 1 (lb)			N/A
Supplier	Penny's Concrete	Cement 2 (lb)			N/A
Mix Identification	A56425G4	Fly Ash (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Coarse Agg 1 (lb)			
Design Unit Weight (pcf)		Coarse Agg 2 (lb)			
Cement Factor (Sacks/yd³)		Fine Agg (lb)			
Water-Cement Ratio (lb/lb)		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	**Date Received**	2/20/2010	**Slump (in)**	ASTM C 143	5.50	– 4
General Location	First 100' of repair pad			**Slump w/ plasticizer (in)**		N/A	
Sample Location	NW corner			**Air Temp (°F)**		48	
Curing Method	Two day Field/Laboratory Cure			**Concrete Temp (°F)**	ASTM C 1064	70	
Field Sample No		**Field Cure Temp (°F) High**		**Air Content (%)**	ASTM C 231	6.80	5 – 8
			Low	**Unit Weight (pcf)**	ASTM C 138		
Contractor				**Batch Size (yd³)**		10	
Truck No.	113	**Ticket No.**	1056537	**Water Added (gal)**	**Before**		
Sampled By	Shawn Jones				**After**		
Submitted By				**Time Batched**		14:36	
Weather	Overcast			**Time Sampled**		14:51	
Est. Wind (mph)		**Yd³ Placed**	173.0	**Time Placed**		14:53	
Est. Rh (%)				**Time In Truck (mins)**		17	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C4\1	02/20/10	2	4.03	8.05	12.72	SITE-U	9760	3	770	
0353515-2-C4\2	02/25/10	7								
0353515-2-C4\3	03/18/10	28								4000
0353515-2-C4\4	03/18/10	28								4000
0353515-2-C4\5		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 3 = Vert cracking/no cones
Site = Air cured specimens cured on site

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Summary Daily Field Report

Report No: SDFR:0353515-3
Issue: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE

KANSAS CITY, KS 66102

CC: CHRIS CLAY, LARRY ROSS, MATT BOND, MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE KS

Approved Signatory: Jeffrey Brown (Staff Engineer)
Date of Issue: 2/24/2010

Date: 2/19/2010

WEATHER:

TEMPERATURE RANGE: **TO**

PSI REPRESENTATIVE: Mike Williams

TYPE OF INSPECTION BEING PERFORMED

- ☐ **SOILS**
  - ☐ **FOUNDATIONS**
  - ☐ **CONTROLLED FILL (COMPACTION)**
  - ☐
- ☐ **ASPHALT**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☐
- ☒ **CONCRETE**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☒ **SAMPLE PICK-UP**
- ☐ **OTHER**
  - ☐
  - ☐
  - ☐

BRIEF RESUME OF WORK ACCOMPLISHED THIS DATE:

A representative of Professional Service Industries, Inc. (PSI) picked-up 4 sets of 4 concrete cylinders at the referenced project and transported them to PSI's laboratory for compressive strength testing.

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Summary Daily Field Report

Report No: SDFR:0353515-4
Issue: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE

KANSAS CITY, KS 66102

CC: CHRIS CLAY, LARRY ROSS, MATT BOND, MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE KS

Approved Signatory: Jeffrey Brown (Staff Engineer)
Date of Issue: 2/24/2010

Date: 2/20/2010

WEATHER:

TEMPERATURE RANGE: **TO**

PSI REPRESENTATIVE: John Heide

TYPE OF INSPECTION BEING PERFORMED

- ☐ **SOILS**
  - ☐ **FOUNDATIONS**
  - ☐ **CONTROLLED FILL (COMPACTION)**
  - ☐
- ☐ **ASPHALT**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☐
- ☒ **CONCRETE**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☒ **SAMPLE PICK-UP**
- ☐ **OTHER**
  - ☐
  - ☐
  - ☐

BRIEF RESUME OF WORK ACCOMPLISHED THIS DATE:

A representative of Professional Service Industries, Inc. (PSI) picked-up concrete cylinders at the referenced project and transported them to PSI's laboratory for compressive strength testing.

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C1
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 2/26/2010

Mix Data

		Material	Source	Amount	Moisture
Mix Data Submitted By	Penny's Concrete	Cement 1 (lb)			N/A
Supplier	Penny's Concrete	Cement 2 (lb)			N/A
Mix Identification	A56425G4	Fly Ash (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Coarse Agg 1 (lb)			
Design Unit Weight (pcf)		Coarse Agg 2 (lb)			
Cement Factor (Sacks/yd³)		Fine Agg (lb)			
Water-Cement Ratio (lb/lb)		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/19/2010	Slump (in)	ASTM C 143	6.00	– 4
General Location	Repair Pad (1st 100')			Slump w/ plasticizer (in)		N/A	
Sample Location	SW Corner			Air Temp (°F)		40	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	65	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.50	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	163	Ticket No.	1056506	Water Added (gal)	Before	20	
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		11:29	
Weather	Overcast			Time Sampled		12:19	
Est. Wind (mph)		Yd³ Placed	10.0	Time Placed		12:15	
Est. Rh (%)				Time In Truck (mins)		46	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C1\1	02/25/10	7	4.02	7.73	12.66	U	61640	2	4870	
0353515-2-C1\2	03/18/10	28								4000
0353515-2-C1\3	03/18/10	28								4000
0353515-2-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C2
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 2/26/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	A56425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/19/2010	Slump (in)	ASTM C 143	5.50	– 4
General Location	Repair Pad (1st 100')			Slump w/ plasticizer (in)		N/A	
Sample Location	50' N & 12' E of W Side of Pour			Air Temp (°F)		45	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	7.00	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	105	Ticket No.	1056513	Water Added (gal)	Before		
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		12:31	
Weather	Overcast			Time Sampled		13:00	
Est. Wind (mph)		Yd³ Placed	70.0	Time Placed		12:58	
Est. Rh (%)				Time In Truck (mins)		27	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C2\1	02/25/10	7	4.01	7.75	12.60	U	48970	2	3890	
0353515-2-C2\2	03/18/10	28								4000
0353515-2-C2\3	03/18/10	28								4000
0353515-2-C2\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C3
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 2/26/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	A56425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/19/2010	Slump (in)	ASTM C 143	5.00	– 4
General Location	Repair Pad (1st 100')			Slump w/ plasticizer (in)		N/A	
Sample Location	25' S & 20' E of the W End of Pour			Air Temp (°F)		50	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	71	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.50	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	163	Ticket No.	1056519	Water Added (gal)	Before		
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		12:46	
Weather	Overcast			Time Sampled		13:45	
Est. Wind (mph)		Yd³ Placed	130.0	Time Placed		13:43	
Est. Rh (%)				Time In Truck (mins)		57	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C3\1	02/25/10	7	4.01	7.75	12.63	U	56270	5	4460	
0353515-2-C3\2	03/18/10	28								4000
0353515-2-C3\3	03/18/10	28								4000
0353515-2-C3\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C4
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 2/26/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	A56425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/20/2010	Slump (in)	ASTM C 143	5.50	– 4
General Location	First 100' of repair pad			Slump w/ plasticizer (in)		N/A	
Sample Location	NW corner			Air Temp (°F)		48	
Curing Method	Two day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.80	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	113	Ticket No.	1056537	Water Added (gal)	Before		
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		14:36	
Weather	Overcast			Time Sampled		14:51	
Est. Wind (mph)		Yd³ Placed	173.0	Time Placed		14:53	
Est. Rh (%)				Time In Truck (mins)		17	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C4\1	02/20/10	2	4.03	8.05	12.72	SITE-U	9760	3	770	
0353515-2-C4\2	02/25/10	7	4.02	7.60	12.69	U	49270	2	3880	
0353515-2-C4\3	03/18/10	28								4000
0353515-2-C4\4	03/18/10	28								4000
0353515-2-C4\5		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 3 = Vert cracking/no cones
Site = Air cured specimens cured on site

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Field Report

Report No: FC:0353515-5
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Jeffrey Brown (Staff Engineer)

Date of Issue: 3/4/2010

General Field Data

Technician: David Clark

Test Date: 2/26/2010

Weather: Clear

Test Results

Set No.	Specimens Made	Ticket	Time Batched	Time Unloaded	Cubic Yards Placed	Slump (in)	Air Content (%)	Air Temp. (°F)	Concrete Temp. (°F)
0353515-5-C1	4	1056648	11:25	11:50	30.0	4.00	5.70	38	67
0353515-5-C2	4	1056653	11:47	12:35	70.0	4.50	4.90	38	69
0353515-5-C3	4	1056657	12:18	12:55	110.0	4.75	5.40	40	70
0353515-5-C4	4	1056666	13:06	13:50	170.0	5.25	6.10	41	69

Location & Remarks

Set No.	Location
General Location:	2nd Slab from North End
0353515-5-C1	S End of Slab
0353515-5-C2	40' N of S End of Slab
0353515-5-C3	80' N of S End of Slab
0353515-5-C4	N End of Slab

Mix Data

Set No.	Supplier	Mix	Design Strength (psi)
0353515-5-C1	Penny's Concrete	AS6425G4	4000
0353515-5-C2	Penny's Concrete	AS6425G4	4000
0353515-5-C3	Penny's Concrete	AS6425G4	4000
0353515-5-C4	Penny's Concrete	AS6425G4	4000

Notes

Remarks

Total cubic yards placed = 230

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Field Report

Report No: FC:0353515-6
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Jeffrey Brown (Staff Engineer)

Date of Issue: 3/4/2010

General Field Data

Technician: Craig Dodd
Test Date: 3/2/2010
Weather: Clear

Test Results

Set No.	Specimens Made	Ticket	Time Batched	Time Unloaded	Cubic Yards Placed	Slump (in)	Air Content (%)	Air Temp. (°F)	Concrete Temp. (°F)
0353515-6-C1	4	1056762	11:32	11:45	10.0	2.75	7.00	35	68
0353515-6-C2	4	1056769		12:15	50.0	3.00	6.50	36	67
0353515-6-C3	4	1056776		13:00	100.0	2.50	6.80	39	69
0353515-6-C4	4	1056791		14:15	150.0	3.50	5.60	41	70
0353515-6-C5	4	1056808		15:10	200.0	3.75	5.80	42	70
0353515-6-C6	4	1056819		16:00	250.0	3.50	5.80	39	68

Location & Remarks

General Location: 3rd Pour on Dam Face

Set No.	Location
0353515-6-C1	South 4'
0353515-6-C2	20' from South End
0353515-6-C3	40' from South End
0353515-6-C4	60' from South End
0353515-6-C5	80' from South End
0353515-6-C6	100' from South End

Mix Data

Set No.	Supplier	Mix	Design Strength (psi)
0353515-6-C1	Penny's Concrete	KCMMB 4K	4000
0353515-6-C2	Penny's Concrete	KCMMB 4K	4000
0353515-6-C3	Penny's Concrete	KCMMB 4K	4000
0353515-6-C4	Penny's Concrete	KCMMB 4K	4000
0353515-6-C5	Penny's Concrete	KCMMB 4K	4000
0353515-6-C6	Penny's Concrete	KCMMB 4K	4000

Notes

Remarks

Technician picked-up 16 concrete cylinders and deliered them to PSI's laboratory for testing.

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C1
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/8/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/26/2010	Date Received	3/2/2010	Slump (in)	ASTM C 143	4.00	
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	S End of Slab			Air Temp (°F)		38	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	67	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.70	
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	130	Ticket No.	1056648	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		11:25	
Weather	Clear			Time Sampled		12:05	
Est. Wind (mph)	0 - 5	Yd³ Placed	30.0	Time Placed		11:50	
Est. Rh (%)	70			Time In Truck (mins)		25	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C1\1	03/05/10	7	4.01	7.85	12.63	U	54870	5	4340	
0353515-5-C1\2	03/26/10	28								4000
0353515-5-C1\3	03/26/10	28								4000
0353515-5-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C2
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)
Date of Issue: 3/8/2010

Mix Data

		Material	Source	Amount	Moisture
Mix Data Submitted By	Penny's Concrete	Cement 1 (lb)			N/A
Supplier	Penny's Concrete	Cement 2 (lb)			N/A
Mix Identification	AS6425G4	Fly Ash (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Coarse Agg 1 (lb)			
Design Unit Weight (pcf)		Coarse Agg 2 (lb)			
Cement Factor (Sacks/yd³)		Fine Agg (lb)			
Water-Cement Ratio (lb/lb)		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/26/2010	Date Received	3/2/2010	Slump (in)	ASTM C 143	4.50	
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	40' N of S End of Slab			Air Temp (°F)		38	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	69	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	4.90	
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	91	Ticket No.	1056653	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		11:47	
Weather	Clear			Time Sampled		12:45	
Est. Wind (mph)	0 - 5	Yd³ Placed	70.0	Time Placed		12:35	
Est. Rh (%)	70			Time In Truck (mins)		48	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C2\1	03/05/10	7	4.01	7.85	12.63	U	56470	5	4470	
0353515-5-C2\2	03/26/10	28								4000
0353515-5-C2\3	03/26/10	28								4000
0353515-5-C2\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C3
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/8/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/26/2010	Date Received	3/2/2010	Slump (in)	ASTM C 143	4.75	3 – 5
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	80' N of S End of Slab			Air Temp (°F)		40	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.40	4.5 – 7.5
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	124	Ticket No.	1056657	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		12:18	
Weather	Clear			Time Sampled		13:00	
Est. Wind (mph)	0 - 5	Yd³ Placed	110.0	Time Placed		12:55	
Est. Rh (%)	70			Time In Truck (mins)		37	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C3\1	03/05/10	7	4.01	7.75	12.63	U	60500	5	4790	
0353515-5-C3\2	03/26/10	28								4000
0353515-5-C3\3	03/26/10	28								4000
0353515-5-C3\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C4
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/8/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/26/2010	Date Received	3/2/2010	Slump (in)	ASTM C 143	5.25	3 – 5
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	N End of Slab			Air Temp (°F)		41	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	69	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.10	4.5 – 7.5
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	162	Ticket No.	1056666	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		13:06	
Weather	Clear			Time Sampled		13:55	
Est. Wind (mph)	0 - 5	Yd³ Placed	170.0	Time Placed		13:50	
Est. Rh (%)	70			Time In Truck (mins)		44	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C4\1	03/05/10	7	4.02	7.82	12.66	U	52500	2	4150	
0353515-5-C4\2	03/26/10	28								4000
0353515-5-C4\3	03/26/10	28								4000
0353515-5-C4\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Summary Daily Field Report

Report No: SDFR:0353515-7
Issue: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE

KANSAS CITY, KS 66102

CC: CHRIS CLAY, LARRY ROSS, MATT BOND, MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE KS

Approved Signatory: Jeffrey Brown (Staff Engineer)
Date of Issue: 3/9/2010

Date: 3/3/2010

WEATHER:

TEMPERATURE RANGE: **TO**

PSI REPRESENTATIVE: Craig Dodd

TYPE OF INSPECTION BEING PERFORMED

- ☐ **SOILS**
  - ☐ **FOUNDATIONS**
  - ☐ **CONTROLLED FILL (COMPACTION)**
  - ☐
- ☐ **ASPHALT**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☐
- ☒ **CONCRETE**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☒ **SAMPLE PICK-UP**
- ☐ **OTHER**
  - ☐
  - ☐
  - ☐

BRIEF RESUME OF WORK ACCOMPLISHED THIS DATE:

A representative of Professional Service Industries, Inc. (PSI) picked-up 6 sets of 4 concrete cylinders at the referenced project and transported them to PSI's laboratory for compressive strength testing.

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Field Report

Report No: FC:0353515-8
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Jeffrey Brown (Staff Engineer)

Date of Issue: 3/9/2010

General Field Data

Technician: Craig Dodd
Test Date: 3/8/2010
Weather: Overcast

Test Results

Set No.	Specimens Made	Ticket	Time Batched	Time Unloaded	Cubic Yards Placed	Slump (in)	Air Content (%)	Air Temp. (°F)	Concrete Temp. (°F)
0353515-8-C1	4	1057080	09:49	10:15	170.0	4.00	6.60	49	71
0353515-8-C2	4	1057087	11:29	11:45	190.0	3.75	6.40	49	70

Location & Remarks

Set No.	Location
General Location:	Final Pour
0353515-8-C1	30' from N End of Final Pour
0353515-8-C2	15' from N End of Final Pour

Mix Data

Set No.	Supplier	Mix	Design Strength (psi)
0353515-8-C1	Penny's Concrete	AS6425G4	4000
0353515-8-C2	Penny's Concrete	AS6425G4	4000

Notes

Remarks

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Summary Daily Field Report

Report No: SDFR:0353515-9
Issue: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE

KANSAS CITY, KS 66102

CC: CHRIS CLAY, LARRY ROSS, MATT BOND, MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE KS

Approved Signatory: Jeffrey Brown (Staff Engineer)
Date of Issue: 3/10/2010

Date: 3/9/2010

WEATHER:

TEMPERATURE RANGE: **TO**

PSI REPRESENTATIVE: Craig Dodd

TYPE OF INSPECTION BEING PERFORMED

- ☐ **SOILS**
  - ☐ **FOUNDATIONS**
  - ☐ **CONTROLLED FILL (COMPACTION)**
  - ☐
- ☐ **ASPHALT**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☐
- ☒ **CONCRETE**
  - ☐ **BATCH PLANT**
  - ☐ **PLACEMENT (JOB SITE)**
  - ☒ **SAMPLE PICK-UP**
- ☐ **OTHER**
  - ☐
  - ☐
  - ☐

BRIEF RESUME OF WORK ACCOMPLISHED THIS DATE:

A representative of Professional Service Industries, Inc. (PSI) picked-up 2 sets of 4 concrete cylinders at the referenced project and transported them to PSI's laboratory for compressive strength testing.

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C1
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/12/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	2.75	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	South 4'			Air Temp (°F)		35	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	68	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	7.00	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	163	Ticket No.	1056762	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched		11:32	
Weather	Clear			Time Sampled		12:00	
Est. Wind (mph)		Yd³ Placed	10.0	Time Placed		11:45	
Est. Rh (%)				Time In Truck (mins)		13	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C1\1	03/09/10	7	4.01	7.73	12.63	U	64980	2	5150	
0353515-6-C1\2	03/30/10	28								4000
0353515-6-C1\3	03/30/10	28								4000
0353515-6-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C2
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/12/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	KCMMB4K	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	3/2/2010	Date Received	3/3/2010	Slump (in)	ASTM C 143	3.00	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	20' from South End			Air Temp (°F)		36	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	67	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.50	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	165	Ticket No.	1056769	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		12:30	
Est. Wind (mph)		Yd³ Placed	50.0	Time Placed		12:15	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C2\1	03/09/10	7	4.01	7.75	12.60	U	65660	2	5210	
0353515-6-C2\2	03/30/10	28								4000
0353515-6-C2\3	03/30/10	28								4000
0353515-6-C2\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C3
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/12/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	2.50	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	40' from South End			Air Temp (°F)		39	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	69	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.80	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	108	Ticket No.	1056776	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		13:15	
Est. Wind (mph)		Yd³ Placed	100.0	Time Placed		13:00	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C3\1	03/09/10	7	4.01	7.71	12.63	U	71060	2	5630	
0353515-6-C3\2	03/30/10	28								4000
0353515-6-C3\3	03/30/10	28								4000
0353515-6-C3\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C4
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/12/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	3.50	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	60' from South End			Air Temp (°F)		41	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.60	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	170	Ticket No.	1056791	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		14:30	
Est. Wind (mph)		Yd³ Placed	150.0	Time Placed		14:15	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C4\1	03/09/10	7	4.01	7.70	12.63	U	71060	2	5630	
0353515-6-C4\2	03/30/10	28								4000
0353515-6-C4\3	03/30/10	28								4000
0353515-6-C4\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C5
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/12/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	3.75	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	80' from South End			Air Temp (°F)		42	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.80	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	91	Ticket No.	1056808	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		15:25	
Est. Wind (mph)		Yd³ Placed	200.0	Time Placed		15:10	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C5\1	03/09/10	7	4.01	7.73	12.63	U	76820	2	6080	
0353515-6-C5\2	03/30/10	28								4000
0353515-6-C5\3	03/30/10	28								4000
0353515-6-C5\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C6
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/12/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	KCMMB4K	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	3/2/2010	Date Received	3/3/2010	Slump (in)	ASTM C 143	3.50	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	100' from South End			Air Temp (°F)		39	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	68	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.80	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	103	Ticket No.	1056819	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		16:15	
Est. Wind (mph)		Yd³ Placed	250.0	Time Placed		16:00	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C6\1	03/09/10	7	4.00	7.80	12.57	U	70070	2	5580	
0353515-6-C6\2	03/30/10	28								4000
0353515-6-C6\3	03/30/10	28								4000
0353515-6-C6\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-8-C1
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/16/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	3/8/2010	Date Received	3/9/2010	Slump (in)	ASTM C 143	4.00	0 – 4
General Location	Final Pour			Slump w/ plasticizer (in)		N/A	
Sample Location	30' from N End of Final Pour			Air Temp (°F)		49	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	71	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.60	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	159	Ticket No.	1057080	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched		09:49	
Weather	Overcast			Time Sampled		10:30	
Est. Wind (mph)		Yd³ Placed	170.0	Time Placed		10:15	
Est. Rh (%)				Time In Truck (mins)		26	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-8-C1\1	03/15/10	7	4.02	7.80	12.69	U	65730	2	5180	
0353515-8-C1\2	04/05/10	28								4000
0353515-8-C1\3	04/05/10	28								4000
0353515-8-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-8-C2
Issue No: 1

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/16/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	3/8/2010	Date Received	3/9/2010	Slump (in)	ASTM C 143	3.75	0 – 4
General Location	Final Pour			Slump w/ plasticizer (in)		N/A	
Sample Location	15' from N End of Final Pour			Air Temp (°F)		49	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.40	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	162	Ticket No.	1057087	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched		11:29	
Weather	Overcast			Time Sampled		12:00	
Est. Wind (mph)		Yd³ Placed	190.0	Time Placed		11:45	
Est. Rh (%)				Time In Truck (mins)		16	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-8-C2\1	03/15/10	7	4.02	7.68	12.66	U	55860	5	4410	
0353515-8-C2\2	04/05/10	28								4000
0353515-8-C2\3	04/05/10	28								4000
0353515-8-C2\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Interim Report

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C1
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/19/2010

Mix Data

		Material	Source	Amount	Moisture
Mix Data Submitted By	Penny's Concrete	Cement 1 (lb)			N/A
Supplier	Penny's Concrete	Cement 2 (lb)			N/A
Mix Identification	A56425G4	Fly Ash (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Coarse Agg 1 (lb)			
Design Unit Weight (pcf)		Coarse Agg 2 (lb)			
Cement Factor (Sacks/yd³)		Fine Agg (lb)			
Water-Cement Ratio (lb/lb)		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/19/2010	Slump (in)	ASTM C 143	6.00	– 4
General Location	Repair Pad (1st 100')			Slump w/ plasticizer (in)		N/A	
Sample Location	SW Corner			Air Temp (°F)		40	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	65	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.50	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	163	Ticket No.	1056506	Water Added (gal)	Before	20	
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		11:29	
Weather	Overcast			Time Sampled		12:19	
Est. Wind (mph)		Yd³ Placed	10.0	Time Placed		12:15	
Est. Rh (%)				Time In Truck (mins)		46	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C1\1	02/25/10	7	4.02	7.73	12.66	U	61640	2	4870	
0353515-2-C1\2	03/18/10	28	4.01	7.80	12.60	U	93900	5	7450	4000
0353515-2-C1\3	03/18/10	28	4.01	7.61	12.63	U	90400	2	7160	4000
0353515-2-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C2
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/19/2010

Mix Data

		Material	Source	Amount	Moisture
Mix Data Submitted By	Penny's Concrete	Cement 1 (lb)			N/A
Supplier	Penny's Concrete	Cement 2 (lb)			N/A
Mix Identification	A56425G4	Fly Ash (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Coarse Agg 1 (lb)			
Design Unit Weight (pcf)		Coarse Agg 2 (lb)			
Cement Factor (Sacks/yd³)		Fine Agg (lb)			
Water-Cement Ratio (lb/lb)		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/19/2010	Slump (in)	ASTM C 143	5.50	– 4
General Location	Repair Pad (1st 100')			Slump w/ plasticizer (in)		N/A	
Sample Location	50' N & 12' E of W Side of Pour			Air Temp (°F)		45	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	7.00	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	105	Ticket No.	1056513	Water Added (gal)	Before		
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		12:31	
Weather	Overcast			Time Sampled		13:00	
Est. Wind (mph)		Yd³ Placed	70.0	Time Placed		12:58	
Est. Rh (%)				Time In Truck (mins)		27	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C2\1	02/25/10	7	4.01	7.75	12.60	U	48970	2	3890	
0353515-2-C2\2	03/18/10	28	4.02	7.75	12.66	U	75610	2	5970	4000
0353515-2-C2\3	03/18/10	28	4.01	7.74	12.63	U	76670	3	6070	4000
0353515-2-C2\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 3 = Vert cracking/no cones

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C3
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/19/2010

Mix Data

		Material	Source	Amount	Moisture
Mix Data Submitted By	Penny's Concrete	Cement 1 (lb)			N/A
Supplier	Penny's Concrete	Cement 2 (lb)			N/A
Mix Identification	A56425G4	Fly Ash (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Coarse Agg 1 (lb)			
Design Unit Weight (pcf)		Coarse Agg 2 (lb)			
Cement Factor (Sacks/yd³)		Fine Agg (lb)			
Water-Cement Ratio (lb/lb)		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/19/2010	Slump (in)	ASTM C 143	5.00	– 4
General Location	Repair Pad (1st 100')			Slump w/ plasticizer (in)		N/A	
Sample Location	25' S & 20' E of the W End of Pour			Air Temp (°F)		50	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	71	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.50	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	163	Ticket No.	1056519	Water Added (gal)	Before		
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		12:46	
Weather	Overcast			Time Sampled		13:45	
Est. Wind (mph)		Yd³ Placed	130.0	Time Placed		13:43	
Est. Rh (%)				Time In Truck (mins)		57	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C3\1	02/25/10	7	4.01	7.75	12.63	U	56270	5	4460	
0353515-2-C3\2	03/18/10	28	4.02	7.70	12.66	U	81960	2	6470	4000
0353515-2-C3\3	03/18/10	28	4.01	7.70	12.63	U	83020	2	6570	4000
0353515-2-C3\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-2-C4
Issue No: 3

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/19/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	A56425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/18/2010	Date Received	2/20/2010	Slump (in)	ASTM C 143	5.50	– 4
General Location	First 100' of repair pad			Slump w/ plasticizer (in)		N/A	
Sample Location	NW corner			Air Temp (°F)		48	
Curing Method	Two day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.80	5 – 8
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	113	Ticket No.	1056537	Water Added (gal)	Before		
Sampled By	Shawn Jones				After		
Submitted By				Time Batched		14:36	
Weather	Overcast			Time Sampled		14:51	
Est. Wind (mph)		Yd³ Placed	173.0	Time Placed		14:53	
Est. Rh (%)				Time In Truck (mins)		17	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-2-C4\1	02/20/10	2	4.03	8.05	12.72	U	9760	3	770	
0353515-2-C4\2	02/25/10	7	4.02	7.60	12.69	U	49270	2	3880	
0353515-2-C4\3	03/18/10	28	4.02	7.80	12.66	U	71800	2	5670	4000
0353515-2-C4\4	03/18/10	28	4.02	7.80	12.66	U	72290	2	5710	4000
0353515-2-C4\5		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 3 = Vert cracking/no cones
Site = Air cured specimens cured on site

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C1
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/30/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/26/2010	Date Received	3/2/2010	Slump (in)	ASTM C 143	4.00	3 – 5
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	S End of Slab			Air Temp (°F)		38	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	67	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.70	4.5 – 7.5
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	130	Ticket No.	1056648	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		11:25	
Weather	Clear			Time Sampled		12:05	
Est. Wind (mph)	0 - 5	Yd³ Placed	30.0	Time Placed		11:50	
Est. Rh (%)	70			Time In Truck (mins)		25	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C1\1	03/05/10	7	4.01	7.85	12.63	U	54870	5	4340	
0353515-5-C1\2	03/26/10	28	4.01	7.75	12.63	U	88900	2	7040	4000
0353515-5-C1\3	03/26/10	28	4.02	7.72	12.66	U	85180	2	6730	4000
0353515-5-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C2
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/30/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	2/26/2010	Date Received	3/2/2010	Slump (in)	ASTM C 143	4.50	3 – 5
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	40' N of S End of Slab			Air Temp (°F)		38	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	69	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	4.90	4.5 – 7.5
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	91	Ticket No.	1056653	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		11:47	
Weather	Clear			Time Sampled		12:45	
Est. Wind (mph)	0 - 5	Yd³ Placed	70.0	Time Placed		12:35	
Est. Rh (%)	70			Time In Truck (mins)		48	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C2\1	03/05/10	7	4.01	7.85	12.63	U	56470	5	4470	
0353515-5-C2\2	03/26/10	28	4.02	7.77	12.66	U	80840	2	6390	4000
0353515-5-C2\3	03/26/10	28	4.01	7.80	12.63	U	84950	2	6730	4000
0353515-5-C2\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C3
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/30/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	AS6425G4		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	2/26/2010	Date Received	3/2/2010			Measured	Specified
				Slump (in)	ASTM C 143	4.75	3 – 5
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	80' N of S End of Slab			Air Temp (°F)		40	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.40	4.5 – 7.5
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	124	Ticket No.	1056657	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		12:18	
Weather	Clear			Time Sampled		13:00	
Est. Wind (mph)	0 - 5	Yd³ Placed	110.0	Time Placed		12:55	
Est. Rh (%)	70			Time In Truck (mins)		37	

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C3\1	03/05/10	7	4.01	7.75	12.63	U	60500	5	4790	
0353515-5-C3\2	03/26/10	28	4.02	7.83	12.66	U	84380	5	6660	4000
0353515-5-C3\3	03/26/10	28	4.02	7.72	12.69	U	88170	5	6950	4000
0353515-5-C3\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-5-C4
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 3/30/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	AS6425G4	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

Date Sampled	2/26/2010	Date Received	3/2/2010			Measured	Specified
				Slump (in)	ASTM C 143	5.25	3 – 5
General Location	2nd Slab from North End			Slump w/ plasticizer (in)		N/A	
Sample Location	N End of Slab			Air Temp (°F)		41	
Curing Method	Four day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	69	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.10	4.5 – 7.5
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor	L. G Barcus			Batch Size (yd³)		10	
Truck No.	162	Ticket No.	1056666	Water Added (gal)	Before		
Sampled By	David Clark				After		
Submitted By				Time Batched		13:06	
Weather	Clear			Time Sampled		13:55	
Est. Wind (mph)	0 - 5	Yd³ Placed	170.0	Time Placed		13:50	
Est. Rh (%)	70			Time In Truck (mins)		44	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-5-C4\1	03/05/10	7	4.02	7.82	12.66	U	52500	2	4150	
0353515-5-C4\2	03/26/10	28	4.02	7.75	12.69	U	70870	2	5580	4000
0353515-5-C4\3	03/26/10	28	4.02	7.75	12.66	U	78010	2	6160	4000
0353515-5-C4\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C1
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 4/1/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	2.75	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	South 4'			Air Temp (°F)		35	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	68	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	7.00	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	163	Ticket No.	1056762	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched		11:32	
Weather	Clear			Time Sampled		12:00	
Est. Wind (mph)		Yd³ Placed	10.0	Time Placed		11:45	
Est. Rh (%)				Time In Truck (mins)		13	

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C1\1	03/09/10	7	4.01	7.73	12.63	U	64980	2	5150	
0353515-6-C1\2	03/30/10	28	4.01	7.70	12.60	U	86310	2	6850	4000
0353515-6-C1\3	03/30/10	28	4.01	7.71	12.60	U	78640	5	6240	4000
0353515-6-C1\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end, 5 = Side fracture-opposite ends

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C2
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 4/1/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	KCMMB4K	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	3/2/2010	Date Received	3/3/2010	Slump (in)	ASTM C 143	3.00	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	20' from South End			Air Temp (°F)		36	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	67	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.50	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	165	Ticket No.	1056769	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		12:30	
Est. Wind (mph)		Yd³ Placed	50.0	Time Placed		12:15	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C2\1	03/09/10	7	4.01	7.75	12.60	U	65660	2	5210	
0353515-6-C2\2	03/30/10	28	4.01	7.72	12.60	U	84120	2	6680	4000
0353515-6-C2\3	03/30/10	28	4.01	7.70	12.63	U	89220	2	7060	4000
0353515-6-C2\4		Hold				P				4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

Marks: P = Physically Damaged
FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C3
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 4/1/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	2.50	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	40' from South End			Air Temp (°F)		39	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	69	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	6.80	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	108	Ticket No.	1056776	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		13:15	
Est. Wind (mph)		Yd³ Placed	100.0	Time Placed		13:00	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C3\1	03/09/10	7	4.01	7.71	12.63	U	71060	2	5630	
0353515-6-C3\2	03/30/10	28	4.01	7.73	12.63	U	86690	2	6860	4000
0353515-6-C3\3	03/30/10	28	4.01	7.68	12.63	U	90100	2	7130	4000
0353515-6-C3\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C4
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 4/1/2010

Mix Data

Mix Data Submitted By	Penny's Concrete	Material	Source	Amount	Moisture
Supplier	Penny's Concrete	Cement 1 (lb)			N/A
Mix Identification	KCMMB4K	Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days	Fly Ash (lb)			N/A
Design Unit Weight (pcf)		Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)		Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)		Fine Agg (lb)			
		Admix 1 (oz)			
		Admix 2 (oz)			
		Admix 3 (oz)			
		Water (gal)			

Details of Sample

						Measured	Specified
Date Sampled	3/2/2010	Date Received	3/3/2010	Slump (in)	ASTM C 143	3.50	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	60' from South End			Air Temp (°F)		41	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.60	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	170	Ticket No.	1056791	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		14:30	
Est. Wind (mph)		Yd³ Placed	150.0	Time Placed		14:15	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C4\1	03/09/10	7	4.01	7.70	12.63	U	71060	2	5630	
0353515-6-C4\2	03/30/10	28	4.01	7.60	12.63	U	87420	2	6920	4000
0353515-6-C4\3	03/30/10	28	4.01	7.70	12.60	U	91310	2	7250	4000
0353515-6-C4\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C5
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)

Date of Issue: 4/1/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	3.75	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	80' from South End			Air Temp (°F)		42	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	70	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.80	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	91	Ticket No.	1056808	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		15:25	
Est. Wind (mph)		Yd³ Placed	200.0	Time Placed		15:10	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders

ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C5\1	03/09/10	7	4.01	7.73	12.63	U	76820	2	6080	
0353515-6-C5\2	03/30/10	28	4.01	7.67	12.63	U	86500	2	6850	4000
0353515-6-C5\3	03/30/10	28	4.01	7.65	12.60	U	91610	2	7270	4000
0353515-6-C5\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103

Phone: (913) 310-1600
Fax: (913) 310-1601

Concrete Test Report

Report No: CON:0353515-6-C6
Issue No: 2

Client: L.G. BARCUS & SONS INC.
1430 STATE AVENUE
KANSAS CITY, KS 66102

CC: CHRIS CLAY
LARRY ROSS
MATT BOND
MELISSA BOSLEY

Project: BOWERSOCK DAM REPAIR
LAWRENCE, KS

Approved Signatory: Diana Long (Lab Technician IV)
Date of Issue: 4/1/2010

Mix Data

Mix Data Submitted By	Penny's Concrete		Material	Source	Amount	Moisture
Supplier	Penny's Concrete		Cement 1 (lb)			N/A
Mix Identification	KCMMB4K		Cement 2 (lb)			N/A
Specified Design Strength (psi)	4000 at age 28 days		Fly Ash (lb)			N/A
Design Unit Weight (pcf)			Coarse Agg 1 (lb)			
Cement Factor (Sacks/yd³)			Coarse Agg 2 (lb)			
Water-Cement Ratio (lb/lb)			Fine Agg (lb)			
			Admix 1 (oz)			
			Admix 2 (oz)			
			Admix 3 (oz)			
			Water (gal)			

Details of Sample

Date Sampled	3/2/2010	Date Received	3/3/2010			Measured	Specified
				Slump (in)	ASTM C 143	3.50	– 4
General Location	3rd Pour on Dam Face			Slump w/ plasticizer (in)		N/A	
Sample Location	100' from South End			Air Temp (°F)		39	
Curing Method	One day Field/Laboratory Cure			Concrete Temp (°F)	ASTM C 1064	68	
Field Sample No		Field Cure Temp (°F)	High	Air Content (%)	ASTM C 231	5.80	5 – 7
			Low	Unit Weight (pcf)	ASTM C 138		
Contractor				Batch Size (yd³)		10	
Truck No.	103	Ticket No.	1056819	Water Added (gal)	Before		
Sampled By	Craig Dodd				After		
Submitted By				Time Batched			
Weather	Clear			Time Sampled		16:15	
Est. Wind (mph)		Yd³ Placed	250.0	Time Placed		16:00	
Est. Rh (%)				Time In Truck (mins)			

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (days)	Dimensions (in) Diameter	Height	Area (in²)	Type of Cap	Ultimate Load (lbf)	Type of Fracture	Compressive Strength (psi)	Required Strength (psi)
0353515-6-C6\1	03/09/10	7	4.00	7.80	12.57	U	70070	2	5580	
0353515-6-C6\2	03/30/10	28	4.01	7.75	12.60	U	91490	2	7260	4000
0353515-6-C6\3	03/30/10	28	4.02	7.75	12.66	U	86840	2	6860	4000
0353515-6-C6\4		Hold								4000

Notes

1.Sampling to ASTM C 172
2.Specimen(s) Prepared to ASTM C 31
3.Capping B=Bonded ASTM C 617, U=Unbonded ASTM C 1231, C = Combined

Remarks

FailureMode: 2 = Vert crack/ cone opposite end

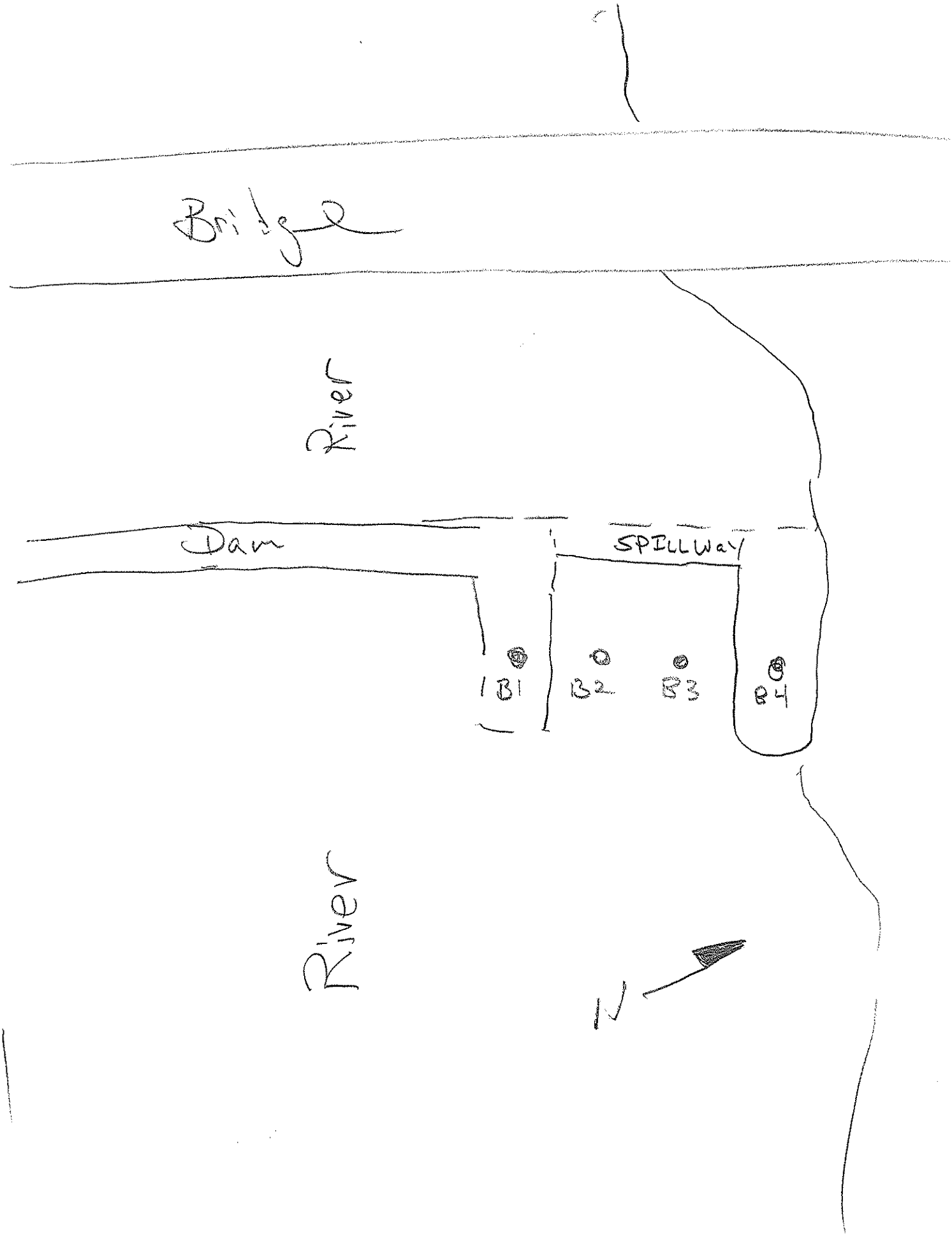
Except ASTM C231 sec 6 & ASTM C31 sec 10.1.2

Appendix K

Temporary Bridge Boring Locations & Logs

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence


Bridge
River
Dam
SPILLWAY
B1
B2
B3
B4
River
N

LOG OF BORING NO. B-1

CLIENT: **LG Barcus & Sons Inc**

SITE: **Bowersock Dam**
Lawrence, Kansas

PROJECT: **Bowersock Dam Repairs**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.7 8" CONCRETE				PA					
	3.5 FILL, sand and gravel			1	SS	14	24			
	5 LEAN CLAY, sandy, with gravel, tan				PA					
	LEAN CLAY, sandy, with gravel, brown	5		2	SS HS	12	28			
	8.5 LEAN CLAY, sandy, with gravel			3	SS HS	10	16			
	13.5 SILTY SAND, and gravel	10		4	SS WB	6	8			
	18.5 LEAN TO FAT CLAY, shaley, gray	15		5	SS WB	18	5			
		20		6	SS WB	18	6			
	28.5 LEAN TO FAT CLAY, silty, shaley, gray	25		7	SS WB	18	5			
	33.5 LEAN TO FAT CLAY, silty, trace gravel, gray	30		8	SS WB	18	9			
	38.5	35								
	40 LEAN TO FAT CLAY, silty, with gravel, gray			9	SS WB	12	24			
	***SHALE, weathered, gray	40		10	SS WB	2	50/2"			
	48.8	45		11	SS	4	50/4"			

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▼ NONE AB
WL	▽		▼

Terracon

BORING STARTED	10-16-09		
BORING COMPLETED	10-16-09		
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

LOG OF BORING NO. B-1

CLIENT **LG Barcus & Sons Inc**

SITE **Bowersock Dam**
Lawrence, Kansas

PROJECT **Bowersock Dam Repairs**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	BOTTOM OF BORING ***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types. All descriptions taken from driller's field logs. Note: Void from 8.5' to 10.0'.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	10-16-09		
BORING COMPLETED	10-16-09		
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE2 02095255.GPJ TERRACON.GDT 10/19/09

LOG OF BORING NO. B-2

CLIENT
LG Barcus & Sons Inc

SITE
Bowersock Dam
Lawrence, Kansas

PROJECT
Bowersock Dam Repairs

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.7 8" CONCRETE				PA					
	3.5 FILL, clay, sand, gravel			1	SS	11	10			
	LEAN TO FAT CLAY, silty, sand, with gravel				PA					
		5		2	SS	8	4			
					PA					
	10			3	SS	10	4			
	RUBBLE (possible Rip Rap)	10			HS					
	13.5 LEAN TO FAT CLAY, shaley, gray			4	SS	10	5			
		15			WB					
				5	SS	18	4			
		20			WB					
				6	SS	18	4			
		25			WB					
	28.5									
	SILTY SAND			7	SS	12	11			
		30			WB					
	33.5									
	34.5 SAND, coarse grained			8	SS	16	61/12"			
	***SHALE, weathered, gray	35			WB					
	38.8									
	BOTTOM OF BORING			9	SS	2	50/3"			

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

All descriptions taken from driller's field logs.

Note: Void from 3.0' to 4.5'.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	10-16-09		
BORING COMPLETED	10-16-09		
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE2 02095255.GPJ TERRACON.GDT 10/19/09

LOG OF BORING NO. B-3

CLIENT
LG Barcus & Sons Inc

SITE
Bowersock Dam
Lawrence, Kansas

PROJECT
Bowersock Dam Repairs

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	0.3 3" CONCRETE				PA					
	3.5 FILL, sand, gravel			1	SS	3	10			
	5 GRAVEL, sandy				PA					
	RUBBLE (possible Rip Rap)	5		2	SS	8	11			
	8.5				HS					
	10 SILTY SAND, and gravel			3	SS	6	21			
	RUBBLE (possible Rip Rap)	10			HS					
	13.5									
	15 SILTY SAND			4	SS	0	5			
	SAND, coarse grained	15			HS					
				5	SS	18	8			
		20			WB					
	23.5									
	***SHALE, weathered, gray			6	SS	4	4			
		25			WB					
	28.5									
	SAND, coarse grained, trace gravel			7	SS	12	9			
		30			WB					
	33.5									
	34.5 SAND, coarse grained			8	SS	16	66/10"			
	***SHALE, weathered, gray	35			WB					
	38.8									
	BOTTOM OF BORING			9	SS	3	50/3"			
	***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.									
	All descriptions taken from driller's field logs.									
	Note: Void from 3.0' to 4.5'.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED	10-15-09		
BORING COMPLETED	10-15-09		
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE2 02095255.GPJ TERRACON.GDT 10/19/09

LOG OF BORING NO. B-4

CLIENT **LG Barcus & Sons Inc**

SITE **Bowersock Dam**
Lawrence, Kansas

PROJECT **Bowersock Dam Repairs**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	1.7 20" CONCRETE				DB					
	3.5 FILL, lean clay, sandy, trace gravel, tan			1	SS	16	9			
	FILL, clay, sandy, with gravel	5		2	HS	8	6			
	8.5				SS HS					
	FILL, clay, sand, with gravel, tan	10		3	SS	9	8			
	13.5				HS					
	FILL, clay, gravel	15		4	SS	6	7			
	18.5				HS					
	SILT, with gravel	20		5	SS	6	10			
	23.5				WB					
	SAND, medium fine grained, trace gravel	25		6	SS	18	18			
	28.5				WB					
	SAND, fine grained	30		7	SS	8	5			
	31				WB					
	33 BOULDER									
	SAND, medium grained, with gravel	35		8	SS	10	14			
	38.5				WB					
	SAND, medium grained, with gravel	40		9	SS	10	22			
	43.5				WB					
	45 ***SHALE, weathered, trace gravel, gray	45		10	SS	4	50/4"			
	***SHALE, weathered, gray				WB					
	48.8			11	SS	3	50/3"			

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▽		▼	

Terracon

BORING STARTED			10-15-09
BORING COMPLETED			10-5-09
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE2 02095255.GPJ TERRACON.GDT 10/19/09

LOG OF BORING NO. B-4

CLIENT **LG Barcus & Sons Inc**

SITE **Bowersock Dam**
Lawrence, Kansas

PROJECT **Bowersock Dam Repairs**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	BOTTOM OF BORING ***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types. All descriptions taken from driller's field logs. Note: Void from 8.5' to 10.0'.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ NONE	WD	▼ NONE	AB
WL	▼		▼	

Terracon

BORING STARTED	10-15-09		
BORING COMPLETED	10-5-09		
RIG	CME 45 ATV	FOREMAN	SF
APPROVED	CWV	JOB #	02095255

BOREHOLE2 02095255.GPJ TERRACON.GDT 10/19/09

Appendix L

Thawzall (Thaw, Cure & Heat System)

Bowersock Dam Maintenance Project (Dec. 2009 – Mar. 2010)

City of Lawrence

HEATZONE™

H250 (replaces Model 6A)

Thawzall Hydronic Portable Heating System

Rental Rates:

Day _____

Week _____

Month _____

Season _____

Purchase _____

Standard HeatZone™ features:
Fire Extinguisher, hour meter, roof-top message beacon, Heatzone™ digital display return temperatures,fork lift picks, Hitch breakaway system, LED lights. Complies with all known electrical, industrial, institutional, and safety codes to include: NHTSA, CSA, Transport Canada, UL, and IBR.

New HEATZONE™ Model H250

Replaces the proven Model 6A. Improved capability with patented HeatZone™ fluid distribution technology. Superior THAW, CURE, HEAT for any job. Delivers a blistering 250 MBH of HEAT with unparalleled uniformity through 3000' (915m) - 5 zones of 600' (182m) of 5/8" (16mm) hydronic heat hose. Thawzall's patented HeatZone™ technology delivers HEAT more uniformly, THAWS more quickly and save a minimum of 24 gallons (91 liters) of fuel per day over its closest competitor. Expandable with accessories.

* MBH = Thousand BTU's per hour

PERFORMANCE

THAW frozen ground	sq ft	3,000
	sq m	278
CURE concrete	sq ft	6,000
	sq m	550
with accessories	sq ft	18,000 max
	sq m	1,670 max
FROST prevention	sq ft	9,000
	sq m	840
with accessories	sq ft	27,000 max
	sq m	2,500 max

HEAT buildings	cu ft	400,000
	cu m	11,300
Input/Output	MBH*	280/234
Operating Temperature	°F	180
	°C	82
Operating Pressure	psi	1-5
Fuel Consumption (max)	gph	1.75
	lph	6.62
Run Time	days	3+
Pump Capacity	gpm/gph	30/1800
	lpm/lph	110/6,800

DIMENSIONS & CAPACITIES

L x W x H	in	170 x 84 x 96
	cm	431 x 213 x 243
Weight w/fuel & fluid	lbs	5,600
	kg	2,540
Optional Generator	lbs	310
	kg	140
Fuel Capacity	gal	160
	liters	600
HTF (Heat Transfer Fluid)	gal	122
	liters	460

SPECIFICATIONS

HTF Pump, Twin	closed loop centrifugal	
Hose Length		
(5 zones x 600')	ft	3,000
(5 zones x 182m)	m	915
Electrical, GFI	2) 20 amp x 120 vac	
HTF Pumpability	°F	-80
	°C	-62
Fuel	Winter blend diesel or #1 fuel oil	
Hitch Choices	Forged, Stamped, or Pintle	
Diesel Generator	6.0 or 6.5 KWH Liquid Cooled	