Exhibit 11

[illegible] [illegible] Assigned by [illegible]
Operator

B E C [illegible]

WASH[illegible]

TWX Message [illegible]

1,2220

TWX Number:

[illegible]

To: Mr. G. D. Carhart

Address: Paslan [illegible] Service, Inc.
2210 Nicollet Avenue

City: Minneapolis, Minnesota 55404

QC/[illegible] DOCUM[illegible]

January 20, 1971

[illegible]

[illegible] No. 7749

Acknowledgement Required [illegible] Yes [illegible] No

Message: Subject: The Toledo Edison Company, Davis-Besse [illegible]

Bechtel Job 7749, Shield Building, Concrete [illegible]

Concrete [illegible], [illegible]

Dear Mr. Carhart:

We have reviewed your [illegible] concrete mix design and find it [illegible]

satisfactory. [illegible] Company [illegible]

design mix are also approved.

Pittsburgh Testing Laboratories, at Bechtel's direction, [illegible]

thaw tests of the proposed mix. Our evaluation of these test [illegible]

that no deficiencies develop when the concrete is exposed to [illegible]

action.

In your phone conversation with Mr. McCandy, you informed us that [illegible]

signed [illegible] drawings were transmitted to us on January 18. If these

drawings are received in time, we will approve them for construction and have

Mr. Caldas carry them to the jobsite. He will arrive the evening of January [illegible]

In the event that additional changes develop, Mr. Caldas is authorized to

[illegible] sign for Engineering.

Exhibit 11

0 0 5 [illegible]

Logue No. ____________
Assigned by TWX Operator

S E C R E T

WASHINGTON [illegible]

TWX Message [illegible]

TWX Number: ____________ [illegible]: ____________

To: ____________ [illegible]: ____________

Address: ____________ Time: ____________

City: ____________ Job & Dept. No. ____________

Acknowledgement Required: / / Yes / / No

Message: (Page 2)

We trust that all Engineering approvals can now be completed before you start construction of the wall on January 25.

Very truly yours,

H. W. Wahl
Project Engineer

HWW/JPM/kw,tef

cc: L. E. Roe

[illegible] COPIES TO: G. C. Dauker
J. P. McCeady
W. R. Stephens
A. E. [illegible]

Exhibit 11

Exhibit 11

0053210006668 250

EGLES—POWER SERVICE, INC.
ENGINEERS - CONSTRUCTORS
2110 NICOLLET AVENUE
MINNEAPOLIS, MINN. 55404
(612) 339-8801

October 23, 1970

Bechtel Company
P. O. Box 607
190 Shady Grove Road
Gaithersburg, Maryland 20760

Attention: Mr. H. W. Wahl,
Project Engineer

Gentlemen:

Re: Shield Building Wall
Toledo Edison Company
Oak Harbor, Ohio
Letter No. 21

Reference is made to your verbal request of October 22, 1970 for additional information concerning the concrete design mix contained in our letters of October 6, 1970 and October 13, 1970.

We are enclosing a list of test reports that were prepared by Twin City Testing & Engineering Laboratory, Inc. in connection with the design mix for this project. We have attached a summary of the average test cylinder results for your easy reference.

We call your attention to Laboratory Report #6-7789 dated August 27, 1970, which indicates an approximate ratio of 90% compressive strength at 14 days for the freeze-thaw test.

The concrete mix design using Type 1 cement, contained in our letter of October 6, 1970, corresponds to design mix C-2-SF-4 in the laboratory reports. The concrete mix design using Type 2 cement, contained in our letter of October 13, 1970, was arrived at by interpolation from design mix C-2-SF-2.

Yours very truly,

EGLES POWER SERVICE, INC.

J. C. Ellison,
Vice President & Gen. Supt.

JCE:gl
#250
Encl.
cc: Bechtel - Oak Harbor w/encl.
Toledo Edison - Ohio w/encl.
Field w/encl.
JCE w/encl.

OCT 26 1970

Shield Building Wall
Toledo Edison Company
Oak Harbor, Ohio

SUMMARY -- TEST CYLINDERS

TYPE 1 CEMENT

Design Mix:	C-2-SF	C-2-SF-4	C-2-SF-3
Slump:	4"	5"	6"
1 day	1815	2000	1540
2 day	2560	2740	2620
7 day	-	3510	3390
28 day	4900	4850	4590

TYPE 2 CEMENT

Design Mix:	C-2-SF-2	C-2-SF-2
Slump:	4"	5-3/4"
1 day	1500	1300
2 day	1740	1545
7 day	3630	3365
28 day	5590	5040

10/23/70

OCT 26 1970

Shield Building Wall
Toledo Edison Company
Oak Harbor, Ohio

SUMMARY OF LABORATORY TESTS
CONCRETE MIX DESIGN

Laboratory Report Number	Date	Type of Test
Letter (2 pages)	July 6, 1970	---
8-2207	July 6, 1970	Fine Aggregate Test (Woodville Lime & Chemical Co.)
8-2207	July 6, 1970	Fine Aggregate Test (White Rock Quarry)
8-2207	July 6, 1970	Coarse Aggregate Test (Woodville Lime & Chemical Co.)
8-2207 (2 pages)	July 6, 1970	Concrete Mix Design C-2-SF
8-2207 (2 pages)	July 13, 1970	Soundness of Fine Aggregate (Woodville Lime & Chemical Co.)
8-2207 (2 pages)	July 28, 1970	Concrete Mix Design C-2-SF
6-7789 (2 pages)	August 27, 1970	Concrete Mix Design C-2-SF-2
6-7789	August 27, 1970	Freezing Test of Concrete
6-7789 (2 pages)	Sept. 10, 1970	Concrete Mix Design C-2-SF-2
6-7891 (2 pages)	Oct. 2, 1970	Concrete Mix Design C-2-SF-3 and C-2-SF-4
6-7891 (2 pages)	Oct. 22, 1970	Concrete Mix Design C-2-SF-3 and C-2-SF-4

10/23/70

OCT 26 1970

0 0 5 3 2 1 0 0 6 7 1

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, Inc.

CHEMICAL & PHYSICAL TESTS • INSPECTIONS • RESEARCH

HOME OFFICE:
662 CROMWELL AVENUE
ST. PAUL, MINN. 55114
BRANCH OFFICES:
BISMARCK, N.D.
MINOT, N.D.
FARGO, N.D.
GRAND FORKS, N.D.
SIOUX FALLS, S.D.
WATERLOO, IOWA
ROCHESTER, MINN.

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Vice-President Engineering
ALBERT C. HOLLER, F.A.I.C.
Vice-President Chemistry and Metallurgy
CLINTON R. EUE
Secretary-Treasurer

CCA HWB
WEB JCE
GDC MDF
GGB JFK
RECEIVED
JUL - 7 1970
LDC RLM
SEM RCS
JLH HMS
LWI LJW
LDP EFN

cc: [handwritten initials] JCE

July 6, 1970

Mr. John Ellison
Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota 55404

Re: Toledo-Edison Power & Light
Toledo, Ohio

Dear John:

The results of the tests completed to date on the aggregates for the concrete mix for the slip form at the above project are enclosed. The manufactured sand from the White Rock Quarry was too fine to meet specifications and, therefore, was not used in the concrete mix design. The gradation of the manufactured sand from the Woodville Lime & Chemical Company was satisfactory, and this sand was used in the preparation of the concrete mix design. To date, the tests on the coarse aggregate indicate that this material is of acceptable quality.

The concrete mix design and the 1 and 2 day compressive strengths are also included. The concrete mix utilizing 6 sacks of Type I Portland cement and Master Builders Type 200-N Pozzolith had very satisfactory compressive strength results. This mix had a compressive strength of 1815 psi at 1 day and 2560 psi after 2 days curing. The cylinders were cured in air at the laboratory for the first 48 hours. The ambient temperature at the laboratory was approximately 73 F and the relative humidity was about 50 per cent.

Since the compressive strength of the Type I concrete mix was exceedingly satisfactory, it is not felt necessary to investigate the use of the Type III High Early strength Portland cement in the concrete mixture. From past experience, we would estimate that if Type III Portland cement is used in the mixture, the resultant concrete would have a compressive strength of about 2600 psi after 1 day curing and 3400 psi after 2 days curing.

OCT 28 1970

Exhibit 11

Mr. John Ellison
Fegles Construction Company
July 6, 1970
Page 2

The remaining tests on the aggregate will be reported when completed.

Very truly yours,

TWIN CITY TESTING AND
ENGINEERING LABORATORY, INC.

R C McNamara

R. C. McNamara

RCM/ds
Encls.
Laboratory No. 8-2207

OCT 26 1970

0 0 5 3 2 1 0 6 7 3 645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS
662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: FINE AGGREGATE TEST

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 6, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
(8) Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

FURNISHED BY: Woodville Lime & Chemical Co.
Woodville, Ohio

COPIES TO:

LABORATORY No. 8-2207

TYPE OF AGGREGATE: Crushed Limestone - Manufactured Sand

		PROJECT SPECIFICATIONS
MECHANICAL ANALYSIS:		
Passing 3/8"		100%
# 4	100%	95-100
# 8	84	70-95
# 16	51	45-80
# 30	30	25-60
# 50	18	10-30
#100	9.8	1-10
Fineness Modulus	3.07	2.5-3.1 (Max. Var. ±0.2
DELETERIOUS MATERIALS:		
Friable Particles	None	Maximum 1.0%
Material Finer than #200	3.5%	Max. 5.0% (3.0% for concret subject to abrasion)
Lightweight Particles (Specific Gravity under 2.00)		
Coal and Lignite	None	Max. 1.0% (0.5% appearance of concrete is important)
Shale	None	
Total	None	
Organic Matter	Plate #1	Plate 3 or Lighter
SOUNDNESS (5 cycle $MgSO_4$)	To be reported later	Maximum 15%
SPECIFIC GRAVITY (B.O.D.)	2.63	
ABSORPTION (%)	2.9	
UNIT WEIGHT: (Dry Rodded)	103.5 pcf	

REMARKS: The above sample meets project specifications for fine aggregate for portland cement concrete as shown. Sample was submitted to the laboratory and received here on June 18, 1970.

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

645-1601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: FINE AGGREGATE TEST

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 6, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
(8) Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

FURNISHED BY: White Rock Quarry

COPIES TO:

LABORATORY No. 8-2207

TYPE OF AGGREGATE: Crushed Limestone - Manufactured Sand

		ASTM C33-67 SPECIFICATIONS
MECHANICAL ANALYSIS:		
Passing 3/8"		100%
# 4	100%	95-100
# 8	97	70-95
# 16	75	45-80
# 30	54	25-60
# 50	36	10-30
#100	20	1-10
Fineness Modulus	2.18	2.5-3.1 (Max. Var. ±0.20)
DELETERIOUS MATERIALS:		
Friable Particles		
Material Finer than #200	6.0%	Max. 5.0% (3.0% for concrete subject to abrasion)
Lightweight Particles (Specific Gravity under 2.00)		
Coal and Lignite		
Shale		
Total		
Organic Matter		
SOUNDNESS (5 cycle $MgSO_4$)		
SPECIFIC GRAVITY (B.O.D.)		
ABSORPTION (%)		

REMARKS: The above sample is too fine to meet specifications for fine aggregate for portland cement concrete. Therefore, the use of this sand is not recommended. Sample was submitted to the laboratory and received here on June 18, 1970.

OCT 28 1970

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

Exhibit 11

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645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS
662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: COARSE AGGREGATE TEST

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 6, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
(8) Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

FURNISHED BY: Woodville Lime & Chemical Co.
Woodville, Ohio

COPIES TO:

LABORATORY No. 8-2207

TYPE OF AGGREGATE: Crushed Limestone

MECHANICAL ANALYSIS:			Composite	PROJECT SPECIFICATIONS	
Sample Number	1	2	40%-60%		
Sample Size	1 1/2"-3/4"	3/4"-#4	1 1/2"-#4	1 1/2"-#4	3/4"-#4
Passing 2"				100%	
1½"	100%		100%	95-100	
1"	78	100%	91	-	100%
¾"	32	90	67	35-70	90-100
½"	2.1	40	25	-	-
3/8"	1.3	20	13	10-30	20-55
#4	1.3	2.0	1.2	0-5	0-10
#8	0.8	1.0	0.9		0-5
Fineness Modulus	7.65	6.87	7.18		
DELETERIOUS MATERIALS:					
Friable Particles	None	None	None	Maximum 0.25%	
Soft Particles	0.2%	0.2%	0.2%	Maximum 5.0%	
Chert (Unsound or Specific Gravity under 2.35)					
Chert	None	None	None	Maximum 5.0%*	
Material Finer than #200	0.4%	0.3%	0.3%	Maximum 1.0%	
Lightweight Particles (Specific Gravity under 2.0)					
Coal and Lignite	None	None	None	Maximum 1.0%**	
Shale	None	None	None		
Total	None	NOne	None		
Iron Oxide	None	None	None		
UNIT WEIGHT: (Dry Rodded)	89.9 pcf	93.4 pcf	-		
SOUNDNESS (5 cycle $MgSO_4$)	To be reported later			Maximum 18%	
ABRASION LOSS (L.A.R. "A" Grading)			29.4%	Maximum 50%	
SPECIFIC GRAVITY (B.O.D.)	2.69	2.68	2.68	*(1.0% severe exposure)	
ABSORPTION (%)	1.2	1.4	1.3	**(0.5% appearance importa	

REMARKS: A 40%, 60% combination of samples 1 and 2, respectively meets the 1 1/2"-#4 size designation coarse aggregate. Sample 2 meets the 3/4"-#4 size designation. These samples meet quality requirements as shown. The above samples were submitted to the laboratory and received here on June 18, 1970.

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

OCT 1 6 1970

Exhibit 11

Exhibit 11

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TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 6, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
(8) Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

FURNISHED BY: Nicholson Concrete & Supply Co.

COPIES TO:

LABORATORY No. 8-2207

SPECIFICATIONS:

Mix Number	C-2-SF
Compressive Strength @28 Days	4000 psi
Portion of Structure	Foundation Walls over 12" Thick
Size of Coarse Aggregate	1 1/2"-#4
Slump, Working Limit	4"
Air Content	3%-6%

MATERIALS:

Cement	Type I Portland Cement (ASTM C150)
Fine Aggregate	Manufactured Sand furnished by Woodville Lime & Chemical Co.
Coarse Aggregate	Crushed Limestone furnished by Woodville Lime & Chemical Compa
Admixture	1. Master Builders Pozzolith Type 200-N 2. MBVR AEA furnished by Master Builders Company

DESIGNED MIX:

Cement	564#
Admixture 1. Type 200-N Pozzolith	16.9 ounces
2. MBVR AEA	4.2 ounces*
Fine Aggregate	1460#
Coarse Aggregate (1 1/2"-3/4")	630#
Coarse Aggregate (3/4"-#4)	945#
Coarse Aggregate - Total	1575#
Water, Net	35.5 gals
W/C Ratio	5.9 gal/sk
Slump	4"
Cement Factor, Nominal	6.0 sx/yd
Air Content	5.5%
Unit Weight of Plastic Concrete	145.5 pcf

COMPRESSIVE STRENGTH: (6" Diameter X 12" high cylinders)

1 Day Strength (psi)	
Cylinder #1	1830
Cylinder #2	1800
Average	1815

OCT 20 1970

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TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

DATE: July 6, 1970

LABORATORY No. 8-2207

PAGE: 2

COMPRESSIVE STRENGTH: (6" Diameter X 12" high cylinders) - Continued

2 Day Strength (psi)

Cylinder #3	2520
Cylinder #4	2600
Average	2560

28 Day Strength (psi) To be reported later

Cylinder #5	
Cylinder #6	
Average	

REMARKS:

The batch weights shown above are on an oven dry basis and should be adjusted for the amount of moisture in the aggregates at the time of batching.

The compressive strength specimens were cured in laboratory air in the molds for the first 48 hours. The ambient temperature was approximately 73°F and the relative humidity approximatel 50%. The 28 day specimens were placed in the laboratory fog room at 2 days of age.

*The amount of MBVR AEA will have to be varied to maintain the specified air content.

OCT 26 1970

Twin City Testing and Engineering Laboratory, Inc.

By: [signature]

Exhibit 11

00532106678 645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue • St. Paul, Minn. 55114

REPORT OF: SOUNDNESS TEST OF FINE AGGREGATE

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 13,1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
(8) Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

FURNISHED BY: Woodville Lime & Chemical Co.
Woodville, Ohio

COPIES TO:

LABORATORY No. 8-2207

SAMPLE IDENTIFICATION: Manufactured Sand Crushed Limestone

METHOD OF TEST: ASTM Designation C88-63 (5 cycle)

SOLUTION USED: Sodium Sulfate

TEST RESULTS:

Sieve Size	Gradation of Original Sample (%)	Test Fraction Before Test (grams)	Test Fraction After Test (grams)	Material Passing Finer Sieve After Test (Actual Loss)		Weighted Average Loss (%)
				(grams)	(%)	
3/8"-#4	-	-	-	-	-	-
#4-#8	16	100	94	6	6	0.96
#8-#16	33	100	98	2	2	0.66
#16-#30	21	100	97	3	3	0.63
#30-#50	12	100	98	2	2	0.24
#50-#100	8	-	-	-	-	-
#100 down	10	-	-	-	-	-
Totals	100.0	400	387	13	-	2.49

REMARKS: In the calculation of the weighted average loss, the sizes smaller than a #50 sieve shall be assumed to have no loss. The soundness loss of this material meets specifications. This report is an addendum to ours of July 6, 1970. Sample was submitted to the laboratory and received here on June 18, 1970.

20 1970

Twin City Testing and Engineering Laboratory, Inc.

By Theodore C. Johnson

Exhibit 11

00532106679

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

INSPECTION TESTS

REPORT OF: **SOUNDNESS TEST OF COARSE AGGREGATE**

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 13, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
(8) Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

FURNISHED BY: Woodville Lime & Chemical Co.
Woodville, Ohio

COPIES TO:

LABORATORY No. 8-2207

SAMPLE IDENTIFICATION: 40% 1 1/2"-3/4" and 60% 3/4"-#4 Crushed Limestone

METHOD OF TEST: ASTM Designation C88-63 (5 cycle)

SOLUTION USED: Sodium Sulfate

TEST RESULTS:

Sieve Size	Gradation of Original Sample (%)	Test Fraction Before Test (grams)	Test Fraction After Test (grams)	Material Passing Finer Sieve After Test (Actual Loss) (grams)	Material Passing Finer Sieve After Test (Actual Loss) (%)	Weighted Average Loss (%)
1 1/2"-3/4"	33.0	1518	1518	0	0.0	0.00
3/4"-3/8"	56.6	1000	998	2	0.2	0.11
3/8"-#4	10.4	300	298	2	0.7	0.07
Totals	100.0	2818	2814	4	-	0.18

EXAMINATION OF PARTICLES LARGER THAN ¾" BEFORE TEST:

Sieve Fraction	Number of Particles Before Test	Number of Particles After Test: Split	Crumbled	Cracked	Flaked	Sound	Total
1 1/2"-3/4"	50	0	0	3	0	55	58

REMARKS: The weighted average loss is based on the gradation of the plus #4 fraction of the submitted samples. The soundness loss meets specifications. This report is an addendum to ours of July 6, 1970. Samples were submitted to the laboratory and received here on June 18, 1970.

OCT 2 6 1970

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

Exhibit 11

615-3801

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: July 28, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

(8)

FURNISHED BY: Nicholson Concrete & Supply Co.

COPIES TO:

LABORATORY No. 8-2207

SPECIFICATIONS:

Mix Number	C-2-SF
Compressive Strength @28 Days	4000 psi
Portion of Structure	Foundation Walls over 12" Thick
Size of Coarse Aggregate	1 1/2"-#4
Slump, Working Limit	4"
Air Content	3%-6%

MATERIALS:

Cement	Type I Portland Cement (ASTM C150)
Fine Aggregate	Manufactured Sand furnished by Woodville Lime & Chemical Co.
Course Aggregate	Crushed Limestone furnished by Woodville Lime & Chemical Compa
Admixture	1. Master Builders Pozzolith Type 200-N 2. MBVR AEA furnished by Master Builders Company

DESIGNED MIX:

Cement	564#
Admixture 1. Type 200-N Pozzolith	16.9 ounces
2. MBVR AEA	4.2 ounces*
Fine Aggregate	1460#
Coarse Aggregate (1 1/2"-3/4")	630#
Coarse Aggregate (3/4"-#4)	945#
Coarse Aggregate - Total	1575#
Water, Net	35.5 gals
W/C Ratio	5.9 gal/sk
Slump	4"
Cement Factor, Nominal	6.0 sx/yd
Air Content	5.5%
Unit Weight of Plastic Concrete	145.5 pcf

COMPRESSIVE STRENGTH: (6" Diameter X 12" high cylinders)

1 Day Strength (psi)	
Cylinder #1	1830
Cylinder #2	1800
Average	1815

OCT 26 1970

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

DATE: July 28, 1970

LABORATORY No. 8-2207

PAGE: 2

COMPRESSIVE STRENGTH: (6" Diameter X 12" high cylinders) - Continued

2 Day Strength (psi)

Cylinder #3	2520
Cylinder #4	2600
Average	2560

28 Day Strength (psi)

Cylinder #5	4850
Cylinder #6	4950
Average	4900

REMARKS:

The batch weights shown above are on an oven dry basis and should be adjusted for the amount of moisture in the aggregates at the time of batching.

The compressive strength specimens were cured in laboratory air in the molds for the first 48 hours. The ambient temperature was approximately 73°F and the relative humidity approximat 50%. The 28 day specimens were placed in the laboratory fog room at 2 days of age.

*The amount of MBVR AEA will have to be varied to maintain the specified air content.

OCT 26 1970

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue · St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

PROJECT: TOLEDO - EDISON POWER AND LIGHT
TOLEDO, OHIO

DATE: August 27, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota
Attn: Mr. John Ellison

FURNISHED BY: Nicholson Concrete Supply Co.

COPIES TO:

LABORATORY No. 6-7789

SPECIFICATIONS:

Mix Number	C-2-SF-2
Compressive Strength @ 28 Days	4000 psi
Portion of Structure	Foundation Walls over 12" Thick
Size of Coarse Aggregate	1½"-#4
Slump, Maximum	4"
Air Content	3% -6%

MATERIALS:

Cement	Medusa Type II Portland Cement (ASTM C150)
Fine Aggregate	Manufactured Sand furn. by Woodville Lime & Chemical Co.
Coarse Aggregate	Crushed Limestone furn. by Woodville Lime & Chemical Co.
Admixture	1. Master Builders Pozzolith Type 200-N
	2. MBVR AEA furn. by Master Builders Company

DESIGNED MIX:

Cement	564#
Admixture 1. Type 200-N Pozzolith	16.9 ounces
2. MBVR AEA	3.0 ounces*
Fine Aggregate	1475#
Coarse Aggregate (1½"-3/4")	620#
Coarse Aggregate (3/4"-#4)	930#
Coarse Aggregate - Total	1550#
Water, Net	36.0 gals
W/C Ratio	6.0 gal/sk
Slump	4"
Cement Factor, Nominal	6.0 sx/yd
Air Content, Calculated	5.5%
Unit Weight of Plastic Concrete	145.0 pcf

COMPRESSIVE STRENGTH: (6" diameter x 12" high cylinders)

Slump (inches)	4"	5 3/4"
Air Content (%)	5.5	5.1
Unit Weight (pcf)	145.0	145.8
1 Day Strength (psi)		
Cylinder 1	1450	1340
2	1550	1260
Average	1500	1300

Exhibit 11

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

DATE: August 27, 1970

LABORATORY No. 6-7789

PAGE: 2

2 Day Strength (psi)		
Cylinder 3	1760	1520
4	1720	1570
Average	1740	1545
7 Day Strength (psi)		
Cylinder 5	3580	3320
6	3680	3410
Average	3630	3365
28 Day Strength (psi)	To be reported later	
Cylinder 7		
8		

REMARKS:

The batch weights shown above are on an oven dry basis and should be adjusted for the amount of moisture in the aggregates at the time of batching.

The compressive strength specimens were cured in the laboratory air in the molds for the first 48 hours. The ambient temperature has approximately 73 F and the relative humidity about 50%. The specimens for 7 day and 28 day tests were moist cured after 2 days until tested.

* The amount of MBVR AEA will have to be varied to maintain the specified air content.

OCT 28 1970

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

Exhibit 11

Exhibit 11

00532106684 645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: FREEZING TEST OF CONCRETE

PROJECT: TOLEDO - EDISON POWER AND LIGHT
TOLEDO, OHIO

DATE: August 27, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota
Attn: Mr. John Ellison

FURNISHED BY:

COPIES TO:

LABORATORY No. 6-7789

GENERAL:

Two cylinders were subjected to freezing when the concrete had reach approximately 1900 psi. The cylinders were cured in the molds the laboratory air at approximately 73 F and 50% relative humidity for 3 days. After 3 days the cylinders were removed from the molds and sealed in a plastic bag and place in a freezer at 0 F for 2 days . After 2 days, the cylinders were removed from the freezer and placed in the laboratory fogroom until 14 days of age. Compressive strength was determined on these cylinders as well as on two companion cylinders which had not been subjected to freezing but had been moist cured after the initial 3 days of air storage.

CONCRETE DATA:

Nominal Cement Factor	6 sx/yd
Consistency Slump	5 3/4"
Air Content	5.1%

COMPRESSIVE STRENGTH OF 14 DAYS:

Control Cylinders	
Cylinder 1	4600
2	4470
Average	4535
Cylinders Subjected to Freezing	
Cylinder 1	4100
2	4170
Average	4135
Ratio, Frozen to Control	91.3%

OCT 20 1970

Twin City Testing and Engineering Laboratory, Inc.

By

Exhibit 11

0 0 5 3 2 1 0 6 8 5

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

PROJECT: TOLEDO - EDISON POWER AND LIGHT
TOLEDO, OHIO

DATE: September 10, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota
Attn: Mr. John Ellison

FURNISHED BY: Nicholson Concrete Supply Co

COPIES TO:

LABORATORY No. 6-7789

SPECIFICATIONS:

Mix Number	C-2-SF-2
Compressive Strength @ 28 Days	4000 psi
Portion of Structure	Foundation Walls over 12" thick
Size of Coarse Aggregate	1½"-#4
Slump, Maximum	4"
Air Content	3% - 6%

MATERIALS:

Cement	Medusa Type II Portland Cement (ASTM C150)
Fine Aggregate	Manufactured Sand furn. by Woodville Lime & Chemical Co.
Coarse Aggregate	Crushed Limestone furn. by Woodville Lime & Chemical Co.
Admixture	1. Master Builders Pozzolith Type 200-N 2. MBVR AEA furn. by Master Builders Company

DESIGNED MIX:

Cement	564#
Admixture 1. Type 200-N Pozzolith	16.9 ounces
2. MBVR AEA	3.0 ounces*
Fine Aggregate	1475#
Coarse Aggregate (1½"-3/4")	620#
Coarse Aggregate (3/4"-#4)	930#
Coarse Aggregate - Total	1550#
Water, Net	36.0 gals
W/C Ratio	6.0 gal/sk
Slump	4"
Cement Factor, Nominal	6.0 sx/yd
Air Content, Calculated	5.5%
Unit Weight of Plastic Concrete	145.0 pcf

COMPRESSIVE STRENGTH: (6" diameter x 12" high cylinders)

Slump	(inches)	4"	5 3/4"
Air Content	(%)	5.5	5.1
Unit Weight	(pcf)	145.0	145.8
1 Day Strength (psi)			
Cylinder 1		1450	1340
2		1550	1260
Average		1500	1300

Exhibit 11

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

DATE: September 10, 1970

LABORATORY No. 6-7789

PAGE: 2

2 Day Strength (psi)		
Cylinder 3	1760	1520
4	1720	1570
Average	1740	1545
7 Day Strength (psi)		
Cylinder 5	3580	3320
6	3680	3410
Average	3630	3365
28 Day Strength (psi)		
Cylinder 7	5540	4950
8	5640	5130
Average	5590	5040

REMARKS:

The batch weights shown above are on an oven dry basis and should be adjusted for the amount of moisture in the aggregates at the time of batching.

The compressive strength specimens were cured in the laboratory air in the molds for the first 48 hours. The ambient temperature has approximately 73 F and the relative humidity about 50%. The specimens for 7 day and 28 day tests were moist cured after 2 days until tested.

* The amount of MBVR AEA will have to be varied to maintain the specified air content.

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

Exhibit 11

0 0 5 3 2 1 0 6 6 8 7 645-3501

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: October 2, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

(8)

FURNISHED BY: Nicholson Concrete & Supply Co.

COPIES TO:

LABORATORY No. 6-7891

SPECIFICATIONS:

Mix Number	C-2-SF-3	C-2-SF-4
Compressive Strength @ 28 Days	4000 psi	4000 psi
Portion of Structure	Foundation Walls over 12" Thick	Foundation Walls over 12" Thick
Size of Coarse Aggregate	1½"-#4	1½"-#4
Slump	6"	5"
Air Content	3% - 6%	3% - 6%

MATERIALS:

Cement	Type I Portland Cement (ASTM C150)
Fine Aggregate	Manufactured Sand furn. by Woodville Lime & Chemical Co.
Coarse Aggregate	Crushed Limestone furn. by Woodville Lime & Chemical Co.
Admixture	1. Master Builders Pozzolith Type 200-N 2. MBVR AEA furn. by Master Builders Company

DESIGNED MIX:

Cement	588#	588#
Admixture 1. Type 200-N Pozzolith	17.6 ounces	17.6 ounces
2. MBVR AEA	3.8 ounces*	4.0 ounces*
Fine Aggregate	1435#	1440#
Coarse Aggregate (1½"-3/4")	620#	620#
Coarse Aggregate (3/4"-#4)	940#	940#
Coarse Aggregate - Total	1560#	1560#
Water, Net	36.5 gals	36.0 gals
W/C Ratio	5.8 gal/sk	5.8 gal/sk
Slump	6"	5"
Cement Factor, Nominal	6.25 sx/yd	6.25 sx/yd
Air Content	5.5%	5.7%
Unit Weight of Plastic Concrete	145.2 pcf	144.8 pcf

COMPRESSIVE STRENGTH: (6" Diameter x 12" high Cylinders)

1 Day Strength (psi)		
Cylinder 1	1920	1960
2	1960	2040
Average	1940	2000

OCT 26 1970

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645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

DATE: October 2, 1970

LABORATORY No. 6-7891

PAGE: 2

COMPRESSIVE STRENGTH: (6" Diameter x 12" high Cylinders) (cont.)

2 Day Strength (psi)		
Cylinder 3	2600	2770
4	2640	2710
Average	2620	2740
7 Day Strength (psi)		
Cylinder 5	3450	3470
6	3330	3550
Average	3390	3510
28 Day Strength (psi)	To be reported later	
Cylinder 7		
8		
Average		

REMARKS:

The batch weights shown above are on an oven dry basis and should be adjusted for the amount of moisture in the aggregates at the time of batching.

The compressive strength specimens were cured in laboratory air on the molds for the first 48 hours. The ambient temperature was approximately 73 F and the relative humidity approximately 50%. The 28 day specimens were placed in the laboratory fog room at 2 days of age.

* The amount of MBVR AEA will have to be varied to maintain the specified air content.

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

Exhibit 11

00532106 91 645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

PROJECT: TOLEDO-EDISON POWER & LIGHT
TOLEDO, OHIO

DATE: October 22, 1970

REPORTED TO: Fegles Construction Company
2110 Nicollet Avenue
Minneapolis, Minnesota 55404
Attn: Mr. John Ellison

(8)

FURNISHED BY: Nicholson Concrete & Supply Co.

COPIES TO:

LABORATORY No. 6-7891

SPECIFICATIONS:

Mix Number	C-2-SF-3	C-2-SF-4
Compressive Strength @ 28 Days	4000 psi	4000 psi
Portion of Structure	Foundation Walls over 12" Thick	Foundation Walls over 12" Thick
Size of Coarse Aggregate	1 1/2" -#4	1 1/2" -#4
Slump	6"	5"
Air Content	3%-6%	3%-6%

MATERIALS:

Cement	Type I Portland Cement (ASTM C150)
Fine Aggregate	Manufactured Sand furnished by Woodville Lime & Chemical Co.
Coarse Aggregate	Crushed Limestone furnished by Woodville Lime & Chemical Co.
Admixture	1. Master Builders Pozzolith Type 200-N 2. MBVR AEA furnished by Master Builders Company

DESIGNED MIX:

Cement	588#	588#
Admixture 1. Type 200-N Pozzolith	17.6 ounces	17.6 ounces
2. MBVR AEA	3.8 ounces *	4.0 ounces*
Fine Aggregate	1435#	1440#
Coarse Aggregate (1 1/2"-3/4")	620#	620#
Coarse Aggregate (3/4"-#4)	940#	940#
Coarse Aggregate - Total	1560#	1560#
Water, Net	36.5 gals	36.0 gals -- SSD
W/C Ratio	5.8 gal/sk	5.8 gal/sk
Slump	6"	5"
Cement Factor, Nominal	6.25 sx/yd	6.25 sx/yd
Air Content	5.5%	5.7%
Unit Weight of Plastic Concrete	145.2 pcf	144.8 pcf

COMPRESSIVE STRENGTH: (6" Diameter x 12" High Cylinders)

1 Day Strength (psi)		
Cylinder #1	1920	1960
Cylinder #2	1960	2040
Average	1940	2000

1970

0053210 692

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: CONCRETE MIX DESIGN

DATE: October 22, 1970

LABORATORY No. 6-7891

COMPRESSIVE STRENGTH: (6" Diameter x 12" High Cylinders) (Continued)

2 Day Strength (psi)		
Cylinder #3	2600	2770
Cylinder #4	2640	2710
Average	2620	2740
7 Day Strength (psi)		
Cylinder #5	3450	3470
Cylinder #6	3330	3550
Average	3390	3510
28 Day Strength (psi)		
Cylinder #7	4530	4890
Cylinder #8	4650	4810
Average	4590	4850

REMARKS:

The batch weights shown above are on the oven dry basis and should be adjusted for the amount of moisture in the aggregate at the time of batching.

The compressive strength specimens were cured in laboratory air in the molds for the first 48 hours. The ambient temperature was approximately 73° F and the relative humidity approximately 50%. The 28 day specimens were placed in the laboratory fog room at 2 days of age.

* The amount of MBVR AEA will have to be varied to maintain the specified air content.

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

Exhibit 12: NCR – Interim Field Report, W2C and Temp.

BECHTEL
JOB NO. 7749

INTERIM FIELD REPORT

SHEET 1 OF 1

OWNER TECO & CEI PLANT Davis-Besse Nuclear Station UNIT 1

STARTUP SYSTEM: NO. N.A. NAME N.A.

QC NO. 1.2220 NON CONFORM. HOLD TAG NO. N.A.

SUBJECT: Shield Building Slipform Concrete
Mix Design C2-SF-4
Contract 7749-18

PROBLEM: Water cement ratio of mix design C2-SF-4 was exceeded for 48 cu.yds of concrete placed at el. 583'-6" in the containment shield building walls. Minimum temperature was below the specified requirement of 70 degress F. as per attached reports.

Attachments: Concrete cylinder test reports for cylinder Nos. 170, 171, 172 and 175.

APPARENT CAUSE: ENGR'G CONSTR. S.U. TEST PROC. OPER. ERROR

REFERRED TO: ENGR'G CONSTR. STARTUP

SOLUTION OR SUGGESTED ACTION:

The attached cylinder strength reports and mix plant inspection report indicate acceptable strengths were attained. Request Engineering approve this deviation from specification requirements on the basis of acceptable 28 day cylinder strengths. Code requirements in way of low temperatures for the placement area were not violated.

QA 2 WCJ 6/9/73

REPLY REQUESTED OF H. W. Wahl BY DATE 6/18/71
(USE FIELD REPORT REPLY FORM) REPLY RECEIVED DATE 7/29/71
AUTHORIZATION TO PROCEED WITHOUT A WRITTEN REPLY

DISTRIBUTION:
1 - AC/PFE - FILE
2 - QAE
3 - ENGR'G

PREPARED BY BECHTEL
Signed/Date

BECHTEL P&I DIVISION Revised 6/70 STARTUP FORM 47

QC/QO DOCUMENT

1.2220

REPORT NO. 1 Exhibit 12
FILE NO. 0513, CC-18
7-30-71

BECHTEL
JOB NO. 7749 INTERIM FIELD REPORT REPLY SHEET 1 OF 1

OWNER TECo - CEI PLANT Davis-Besse Nuclear/Power Station UNIT 1

STARTUP SYSTEM: NO. N.A. NAME N.A.

QC NO. 1.2220 NONCONFORM. HOLD TAG NO. N.A.

SUBJECT: Shield Building Slipform Concrete
Mix Design C-2-SF-4
Contract 7749-18

COMMENT: (SOLUTION OR CORRECTION ACTION TAKEN)

Engineering has reviewed the Interim Field report and its attachments, relating to an excess of water in concrete mix C-2-SF-4.

All concrete breaks are considerable higher than the 4000 psi specified. No other harmful effects have been noted in the subject concrete.

Consequently, Engineering approves the structure as it is constructed.

IMPORTANT: THE FOLLOWING ITEMS MUST BE FILLED OUT:

FIELD CHANGE NOTICE REQUIRED	YES ___ NO X
FIELD CHANGE NOTICE ISSUED	NUMBER ___
AS BUILD DRAWING CHANGE REQUIRED	YES ___ NO X

DISTRIBUTION:
1 - QC/PFE
2 - QAE
3 - FILE

JUL 20 1971 BECHTEL CORP.

PREPARED BY BECHTEL
Signed/Date
Joseph P. McGeady
July 14, 1971

BECHTEL P&I DIVISION Revised 6/70 STARTUP FORM 48

6/9/75

PITTSBURGH TESTING LABORATORY

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PITTSBURGH, PA.

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Exhibit 12

Order No. CL-3300

Report No. 118

Date 4-26-71

REPORT

QC/QA

Date of Inspection 4-26-71 Temp. °F 47 Weather Cloudy Relative Humidity [illegible]

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power STATION

Construction Manager: Bechtel Corporation

Batch Plant: Nicholson CONCRETE & SUPPLY CO.

MIX PLANT INSPECTION

Concrete Class C-2-5F4 No. Cu. Yds. 48 No. Loads 6 Plant Mix 6 X 8

Quantities per Cu. Yd.		DESIGN	Brand or Source
Cement, lbs.	588	588	Medusa Type I
Sand, Lbs. (S.S.D.)	1476	1475	Woodville Lime & Chem.
Agg., Lbs. (S.S.D.) #4	615	633	" " "
#67	984	964	" " "
Water, Gals. (Total)	38.8	36	Lake Erie
WRA, Oz.	17.6	17.6	200 N Pz. Master Builders
AEA, Oz.	2.4	2.0	Daravair Grace Co.

AGGREGATE GRADATION – % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	F M	MOISTURE %
Specs.	2-10	10-30	25-60	45-80	70-95	95-100	100							
Sand -Manuf.	5.8	17.2	32.9	56.6	91.2	100	100						2.967	3.5 To 4.0
Sand -Manuf.														To
Agg. No. 4							2.0		10.4	42.4	96.4	100		— To —
Agg. No. 67					2.8	7.3	39.3		77.6	100				To —
Agg. Specs. No. 4							0-5		0-15	20-55	90-100	100		
Agg. Spec No 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS MAX %
Mat'l Finer than 200 Wash	2.6		Mat'l Finer than 200	0.2	0.2	1.0
Clay Lumps	0.0	1.0	Clay Lumps	0.0	0.0	0.25
Coal & Lignite	0.0	0.5	Coal & Lignite	0.0	0.0	0.25
Organic Impurities	Less than Plate 1	No. 3	Flat & Elong. 3-1	0.0	0.0	5.0
Specific Gravity	2.72		Specific Gravity	2.68	2.70	
Absorption	2.29		Absorption	1.79	2.12	
			Soft Fragments	0.0	0.0	5.0

LOCATION OF CONCRETE PLACEMENT: Fegles Pour #2

TEST CYLINDERS CAST

CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. Lb./C.F.	YIELD C.F./C.Y.		
172	6.0	6.0	62°	146.8	27.3	TOTAL BATCHED	48
						REJECTED	0
						NOT NEEDED	0
						TOTAL PLACED	48
						UNIT WEIGHT	146.8
						STARTED	0942
						FINISHED	1051

CY Cards W/cement Ratio Allowed
Under Mix Authorized by Mr. D. Pedrick
Bech Corp.

[signature]

QA 2

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Order No. CEx680012

Report No. 115

Date 1-26-71

REPORT

QC/QA

...te of Inspection 1-26-71 Temp. °F 44° Relative Humidity

...ported To: Bechtel Corporation

...oject Identification: Toledo Edison Company
Davis-Besse Nuclear Power STATION

...nstruction Manager: Bechtel Corporation

...tch Plant: Nicholson CONCRETE & SUPPLY CO.

MIX PLANT INSPECTION

...ncrete Class C-2-55-4 No. Cu. Yds. 42 No. Loads 7 Plant ~~Transit~~ Mix 7 X 6

Quantities per Cu. Yd.		DESIGN	Brand or Source
...ment, lbs.	559	580	Medusa Type I
...nd, Lbs. (S.S.D.)	1474	1475	Woodville Lime & Chem.
... Agg., Lbs. (S.S.D.) #4	615	633	Woodville Lime & Chem.
...y ~~Ash, Lbs.~~ C.Agg. #67	1000	964	Woodville Lime & Chemical
...ter, Gals. (Total)	36.0	26	Lake Erie
...RA, Oz.	17.6	17.6	300 N Pozz. Master Builders
...EA, Oz.	3.0	3.0	Darex AEA Grace Co.

AGGREGATE GRADATION — % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	F.M.	MOISTURE %
... Specs.	2-10	10-30	25-60	45-80	70-95	95-100	100							
...-Manuf.	5.8	17.2	32.9	56.2	91.2	100	100						2.91.7	3½ To 4
...nd -Manuf.														To
... Agg. No. 4							2.0		10.4	42.11	94.9	100		To
... Agg. No. 67					2.8	7.3	38.3		97.6	100				To
... Agg. Specs. No. 4							0-5		0-15	20-55	90-100	100		
... Agg. Spec No 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS MAX %
...t'l Finer than 200 Wash	2.6		Mat'l Finer than 200	0.2	0.2	1.0
...ay Lumps	0.0	1.0	Clay Lumps	0.0	0.0	0.25
...al & Lignite	0.0	0.5	Coal & Lignite	0.0	0.0	0.25
...ganic Impurities Less than	Plate 1	No. 3	Flat & Elong. 3-1	0.0	0.0	5.0
...ecific Gravity	2.72		Specific Gravity	2.69	2.70	
...sorption	2.29		Absorption	1.79	2.12	
			Soft Fragments	0.0	0.0	5.0

...CATION OF CONCRETE PLACEMENT: Test Pour #2

TEST CYLINDERS CAST

CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. LB./C.F.	YIELD C.F./C.Y.		
# 170	3.5	6.0	59°	146.0	27.2	TOTAL BATCHED	42
						REJECTED	0
						NOT NEEDED	0
						TOTAL PLACED	42
						UNIT WEIGHT	146.0
						[illegible]	.0747
						[illegible]	.0.9.2

PITTSBURGH TESTING LABORATORY

Exhibit 12

ESTABLISHED 1881

PITTSBURGH, PA.

Order No. CL-8800

Report No. 148

Date 4-26-71

REPORT

QC/QA

REPORT OF TEST ON CONCRETE CYLINDERS 6" DIAMETER BY 12" LENGTH

To: Bechtel Corporation

Identification: Toledo Edison Company

Davis-Besse Nuclear Power Plant

in: FECIOS Power Service

...nt: Nicholson

of Concrete Placement: Pour #2

4-26-71 Concrete Class C-2-SF4 P.S.I. 4000 Area 28.27 Sq. In.

...ler ...	Slump Inches	Air %	Concrete Temp. °F.	Date Tested	Age Days	Total Load Lbs.	Comp. St. P.S.I.
	5.5	6.0	59°	5-3	7	105,000	3714
				5-3	7	105,500	3731
				5-24	28	164,000	5800
				5-24	28	156,500	5535
				7-25	90		
				7-25	90		
			Compressive @ 28 days				
	6.0	6.0	62°	5-3	7	100,000	3537
				5-3	7	98,000	3466
				5-24	28	159,500	5641
				5-24	28	146,000	5164
				7-25	90		
				7-25	90		
			Compressive @ 28 days				

QA 2

Cyl. wts. A.28.75 D.28.55 A.28.15 D.28.25

#170 B.28.70 E.28.50 #172 B.28.20 E.27.95

C.28.45 F.28.50 C.28.30 F.28.30

PITTSBURGH TESTING LABORATORY

J. Baird[illegible]

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Order No. CL-8800

Report No. 118

Date 4-26-71

REPORT

Date of Inspection 4-26-71 Temp. °F 50° Weather Cloudy Relative Humidity [illegible]

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company

Davis-Besse Nuclear Power STATION

Construction Manager: Bechtel Corporation

Batch Plant: Nicholson CONCRETE & SUPPLY CO.

MIX PLANT INSPECTION

Concrete Class C-2-SF-4 No. Cu. Yds. 102 No. Loads 17 ~~Transit~~ Plant Mix 6 X 17

Quantities per Cu. Yd.		DESIGN	Brand or Source
Cement, lbs.	589	588	Medusa Type I
Sand, Lbs. (S.S.D.)	1474	1475	Woodville Lime & Chem
C. Agg., Lbs. (S.S.D.) #4	633	633	" " "
Fly Ash, Lbs. #67	972	964	" " "
Water, Gals. (Total)	37.5	37.5	Lake Erie
WRA, Oz.	17.6	17.6	200 N Pz. Master Builders
AEA, Oz.	2.0	3.0	Darex AEA Grace Co.

AGGREGATE GRADATION – % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	F.M.	MOISTURE %
Sand – Specs.	2-10	10-30	25-60	45-80	70-95	95-100	100							
Sand – Manuf.	5.4	17.2	32.9	56.2	91.2	100	100						2.96	3½ To 4
Sand – Manuf.														To
C. Agg. No. 4							2.0		10.4	44.4	94.9	100		To
C. Agg. No. 67					2.8	7.3	39.3		97.6	100				To
C. Agg. Specs. No. 4							0-5		0-15	20-55	90-100	100		
C. Agg. Spec No 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS MAX %
Mat'l Finer than 200 Wash	2.6		Mat'l Finer than 200	0.2	0.2	1.0
Clay Lumps	0.0	1.0	Clay Lumps	0.0	0.0	0.25
Coal & Lignite	0.0	0.5	Coal & Lignite	0.0	0.0	0.25
Organic Impurities	Less than Plate #1	No. 3	Flat & Elong. 3-1	0.0	0.0	5.0
Specific Gravity	2.72		Specific Gravity	2.68	2.70	
Absorption	2.29		Absorption	1.74	2.12	
			Soft Fragments	0.0	0.0	5.0

LOCATION OF CONCRETE PLACEMENT: Foyles Pour #2

TEST CYLINDERS CAST

CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. LB./C.F.	YIELD C.F./C.Y.		
						TOTAL BATCHED	102
						REJECTED	0
175	5.5	5.7%	68°	147.8	27.0	NOT NEEDED	0
						TOTAL PLACED	102
H2O Additional Raised by MR [illegible]						UNIT WEIGHT	147.8
Bechtel Corp.							
						STARTED:	1805
						FINISHED:	1153

[signature]

FORM UE-3

Exhibit 12

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

Order No. CL-8800

Report No. 148

Date 4-26-71

QC/QA DOCUMENT

REPORT

REPORT OF TEST ON CONCRETE CYLINDERS
6" DIAMETER BY 12" LENGTH

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power Plant

Contractor: in: Feyler

Batch Plant: Nicholson

Location of Concrete Placement: Pour # 2

Date Cast 4-26-71 Concrete Class C-2-5K4 P.S.I. Area 28.27 Sq. In.

Cylinder Ident.	Slump Inches	Air %	Concrete Temp. °F.	Date Tested	Age Days	Total Load Lbs.	Comp. St. P.S.I.
175	4"	5.7	65°	5-3-71	7	126,000	4456
				5-3-71	7	126,000	4456
	Shew C 28 days			5-24-71	28	168,000	5942
				5-24-71	28	163,000	5765
				7-25-71	90		
				7-25-71	90		
177	4.5	5.7	72	5-3-71	7	134,000	4739
				5-3-71	7	134,000	4739
				5-24-71	28	182,000	6437
				5-24-71	28	173,500	6136
				7-25-71	90		
				7-25-71	90		

Cone Shew C 28 days.

QA 2

REMARKS: Cyl. wgts A 29.2 D 29.3 A 29.25 D-29.25
#175 B 29.2 E 29.2 #177 B-29.30 E-29.20
C 29.3 F 29.3 C-29.10 F-29.30

PITTSBURGH TESTING LABORATORY

J Barnes

PITTSBURGH TESTING LABORATORY

(ESTABLISHED 1881) 10021

PITTSBURGH, PA.

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Exhibit 12

Order No. CL-8800

Report No. 148

Date 4-26-71

REPORT

Date of Inspection 4-26-71 Temp. °F 50° Weather Cloudy Relative Humidity ____

QC/QA

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power STATION

Construction Manager: Bechtel Corporation

Batch Plant: Nicholson CONCRETE & SUPPLY CO.

MIX PLANT INSPECTION

Concrete Class C- Grout No. Cu. Yds. 8 E6 No. Loads 2 Plant ~~Transit~~ Mix 2 X of 3

Quantities per Cu. Yd.		DESIGN	Brand or Source
Cement, lbs.	780	799	Medusa Type II
Sand, Lbs. (S.S.D.)	2381	2380	Woodville Lime & Chem.
C. Agg., Lbs. (S.S.D.)		—	
Fly Ash, Lbs.	141	141	Detroit Edison
Water, Gals. (Total)	52	52	LAKE ERIE
WRA, Oz.	30 oz.	30 oz.	300R Pozz Master Builders
AEA, Oz.	—	—	

AGGREGATE GRADATION – % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	FM	MOISTURE %
Sand – Specs.	2-10	10-30	25-60	45-80	70-95	95-100	100							
Sand –Manuf.	5.8	17.2	32.9	56.6	94.2	100	100						2.92	3 To 4
Sand –Manuf.														To
C. Agg. No. 4														To
C. Agg.No. 67														To
C. Agg. Specs. No. 4							0-5		0-15	20-55	90-100	100		
C. Agg. Spec No 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS MAX %
Mat'l Finer than 200 Wash	2.6		Mat'l Finer than 200			1.0
Clay Lumps	0.0	1.0	Clay Lumps			0.25
Coal & Lignite	0.0	0.5	Coal & Lignite			0.25
Organic Impurities	Less than Plate 1	No. 3	Flat & Elong. 3-1	N/A		5.0
Specific Gravity	2.72		Specific Gravity			
Absorption	2.29		Absorption			
			Soft Fragments			5.0

LOCATION OF CONCRETE PLACEMENT: Bentley Park M/1 #42

TEST CYLINDERS CAST							
CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. Lb./C.F.	YIELD C.F./C.Y.	TOTAL BATCHED	8 E6
# 171	5"	4.2	64°	140.2	26.7	REJECTED	0
						NOT NEEDED	0
						TOTAL PLACED	8 E6
						UNIT WEIGHT	140.2
						STARTED:	1014
						FINISHED:	1315

QA

J. Brown

FORM UK-

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

Exhibit 12

Order No. CL-8800

Report No. 148

Date 4-26-71

REPORT

REPORT OF TEST ON CONCRETE CYLINDERS
6" DIAMETER BY 12" LENGTH

QC/QA DOCUMENT

Reported To: Bechtel Corporation
Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power Plant
Contractor: in: Bentley
Batch Plant: Nicholson
Location of Concrete Placement: Rock #41 & #42

Date Cast 4-26-71 Concrete Class C-Grout P.S.I. 4000 Area 28.27 Sq. In.

Cylinder Ident.	Slump Inches	Air %	Concrete Temp. °F.	Date Tested	Age Days	Total Load Lbs.	Comp. St. P.S.I.
172	5"	4.2	68	5-3	7	155000	5482
				5-3	7	156000	5517
				5-24	28	223,500	7905
				5-24	28	224000	7922
				7-25	90		
				7-25	90		

Steve O'Kelly

REMARKS: Cyl. Wts. A 28.85 D 28.80
B 28.95 E 28.95
C 28.90 F 29.0

PITTSBURGH TESTING LABORATORY

[signature]

Exhibit 13: NCR – Interim Field Report (Wrong Mix)

BECHTEL JOB NO. 7749 INTERIM FIELD REPORT SHEET 1 OF 1 Exhibit 13

OWNER TECo - CEI PLANT Davis-Besse Power Station UNIT 1

STARTUP SYSTEM: NO. N.A. NAME N.A.

QC NO. 1.2421 NON CONFORM. HOLD TAG NO. N.A.

SUBJECT: Concrete placement Contract 7749-18

PROBLEM: Fegles Power Services, Inc., placed 6 yds. of C 1-3 concrete in pour #2 at elevation 215'-6". Fly ash was not used in the batch. The batch plant operator apparently did not change the batch plant mix design punch card before producing the aforementioned concrete.

APPARENT CAUSE: ENGR'G CONSTR. S.U. TEST PROC. OPER. ERROR

REFERRED TO: ENGR'G CONSTR. STARTUP

SOLUTION OR SUGGESTED ACTION:

The Field recommends that Engineering approve this concrete as placed. The mix design is approved for use in Q-listed structures, the batch did not contain fly ash and is designed for the 4000 PSI strength requirements.

The concrete batch ticket was checked and reveals acceptable quantities of all materials were used to produce the concrete in question.

QA 2 6/9/73

REPLY REQUESTED OF H. W. Wahl BY DATE 6/18/71

(USE FIELD REPORT REPLY FORM) REPLY RECEIVED DATE

AUTHORIZATION TO PROCEED WITHOUT A WRITTEN REPLY

DISTRIBUTION:
1 - AC/PFE - FILE
2 - QAE
3 - ENGR'G

PREPARED BY BECHTEL
Signed/Date

BECHTEL P&I DIVISION Revised 6/70 STARTUP FORM 47

QC/ DOCUMENT

REPORT NO. 3 Exhibit 13
FILE NO. 0513, CC-50

BECHTEL
JOB NO. 7749 INTERIM FIELD REPORT REPLY 3 SHEET 1 OF 1

OWNER TECo-CEI PLANT Davis-Besse Nuclear Power Station UNIT

STARTUP SYSTEM: NO. N. A. NAME N. A.

QC NO. 1-2220 NONCONFORM. HOLD TAG NO. N.A.

SUBJECT: Concrete Placement Contract 7749-18- 6 yds OF C-1-3 concrete mix was placed in the shield building pour No. 2 @ elev. 215'-6". Fly ash was not used in the mix.

COMMENT: (SOLUTION OR CORRECTION ACTION TAKEN)

Pittsburg Testing Reports Nos. 275, 276, 277 & 278 on Concrete Cylinder Compressive Strength indicate that the concrete inadvertently placed in the shield building meets the specified minimum strength of 4000 psi with considerable margin. No other concrete defects are discernible.

Consequently, Engineering approves the concrete as it has been placed in the structure. No remedial action is required.

IMPORTANT: THE FOLLOWING ITEMS MUST BE FILLED OUT:

FIELD CHANGE NOTICE REQUIRED	YES ___ NO X
FIELD CHANGE NOTICE ISSUED	NUMBER ___
AS BUILD DRAWING CHANGE REQUIRED	YES ___ NO X

DISTRIBUTION:
1 - QC/PFE
2 - QAE
3 - FILE

6/9/73

PREPARED BY BECHTEL
Signed/Date
Joseph F. McGeady
July 14, 1971

BECHTEL P&I DIVISION Revised 6/70 STARTUP FORM 48

DB 02764

Nicholson
CONCRETE and SUPPLY CO.

MAILING ADDRESS
P.O. BOX 2707 STATION B
TOLEDO, OHIO 43606

BUSINESS OFFICE
2201 ALBION ST
PHONE 249-2602

DAVIS-BESSE PLANT

DB 02764

SOLD TO Fisher

DELIVERED TO D.B.

P O NO	CLASS	AGG	SLUMP
	C-2-SA4		

Pour #2

Heated

1747
513
103
2000
600

Decreasing
700 W Proj. 105½

LEAVE PLANT	ARRIVE JOB	LEAVE JOB	ARRIVE PLANT
	355		

TOTAL JOB TIME

RECEIVED BY

DRIVER'S COPY

Exhibit 14: NCR 57 – Wrong Cement Type

BECHTEL

NONCONFORMANCE REPORT

Spec. C26

1. PAGE 1 OF 8 | 2. No. 57

SKETCH ATTACHED Yes [X] No [ ]

3. DATE MO 4 DAY 11 YR 72

ITEM HELD	AREA/BLDG	5. DWG/PART No.	REV.	6. ITEM NAME
N/A	9/Cont.	C-104	2	Containment Concrete Placement, Pour #2

INSPECTION CRITERIA: DWG [ ] SPEC [X] MRI [ ] OTHER [ ] (EXPLAIN)

DOCUMENT NUMBER & TITLE: 7749-C-26 Form, Finish., Place. & Curing of Concrete

SOURCE: SUPPLIER [ ] ENGRG [ ] CONSTR [X] STARTUP [ ] — Fegles Power Service

ADDRESS: Minn., Minn.

9. P.O. No. 1.2220

11. NONCONFORMANCE (DISCREPANCY) DESCRIPTION:
(LIST SERIAL NUMBERS WHERE APPLICABLE)

No.	
1	PTL reports attached show that for 156 cu. yds., Type II cement was used in place of Type I. Exhibits 1, 2 & 3 attached.
2	A copy of Fegles Form No. 1, "Slip Form Daily Record," documents the occasion and the reason. Exhibit 4 attached.
3	PTL "Reports of Test on Concrete Cylinders" document the results of the test breaks on the cylinders involved. Exhibits 5 and 6 attached.
4	See Exhibit 7 for location of pour.

12. FIELD PRELIMINARY DISPOSITION: REWORK [ ] REJECT [ ] ROUTE TO PROJECT ENGRG [X]

Both the 28-day test results and the 90-day test results far exceed specification requirements indicating that the change in cement type did not adversely affect the required strength characteristics. Therefore, it is recommended that the concrete be accepted for use "as is".

13. NCR PREPARED BY: Edwin V. Kopp

14. APPROVAL OF FIELD PRELIMINARY DISPOSITION: PFE: [signature] 4-12-72

15. FINAL DISPOSITION: REPAIR [ ] REJECT [ ] USE AS IS [X] SEE BELOW [ ]

NEW DCN REQD: YES [ ] NO [X] DCN No.

BECHTEL ENGINEERING APPROVES THE CONCRETE AS PLACED AND DESCRIBED IN ITEM NO. 11 OF THIS NCR TO BE "USED AS IS" BASED ON THE ACCEPTABLE 28 DAY CONCRETE COMPRESSION TESTS AS REPORTED. [initials]

16. APPROVAL OF FINAL DISPOSITION: FE [signature] PFE [signature] DATE; P.E. M H [signature] 4/27/72

17. REINSPECTION: ACCEPT [X] REJECT [ ] SIGNATURE [signature] 5/1/72; SIGNATURE [signature] 5/18/72

WHITE-ORIGINATOR PINK-FIELD ENGR. GREEN-QC ENGR. GOLDEN ROD-QA ENGR. QC-ENGR REV. 2-1-71

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

QC/QA DOCUMENT

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REC'D MAY 5 1972 BECHTEL CORP. JOB NO. 7749

REPORT

Order No. [illegible]8800

Report No. 167

Date 5-16-71

…of Inspection 5-18-71 Temp. °F 65 Weather Clear Relative Humidity

…ued To: Bechtel Corporation

…ct Identification: Toledo Edison Company

Davis-Besse Nuclear Power Station

…ruction Manager: Bechtel Corporation

…Plant: Nicholson Concrete & Supply Co.

MIX PLANT INSPECTION

…crete Class C-2-SF-1 No. Cu. Yds. 96 No. Loads 16 Plant Mix 6 X 16

Actual Quantities per Cu. Yd.		Design	Brand or Source
…ent, lbs.	567	558	[illegible] Type II
…Lbs. (S.S.D.)	1424	1478	Woodville Lime & [illegible]
…Lbs. (S.S.D.) #4	696	[illegible]	" " "
…Lbs. (S.S.D.) #67	972	929	" " "
…sh, lbs.	—	—	—
…Gals. (Total) %	32.2	36	Lake water
…Oz.	19.6	19.6	[illegible]
…Oz.	1.67	[illegible]	[illegible]

AGGREGATE GRADATION – % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	F.M.	MOISTURE %
…– Specs.	0-10	10-30	25-60	45-80	70-95	95-100	100							
…– Manuf.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100						[illegible]	To
…gg.														To
…gg. No. 4							[illegible]		[illegible]	[illegible]	[illegible]	100		To
…gg. No. 67					[illegible]	[illegible]	[illegible]		[illegible]	100				To
…gg. Specs. No. 4							0-5		0-15	20-55	90-100	100		
…gg. Spec. No. 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS MAX %
…Finer than 200 Wash	[illegible]		Mat'l Finer than 200	[illegible]	[illegible]	
…Lumps	0.0	1.0	Clay Lumps	0.0	0.0	0.25
…& Lignite	0.0	0.5	Coal & Lignite	0.0	0.0	0.25
…ic Impurities	Less Than Plate #1	No. 3	Flat & Elong. 3-1	[illegible]	[illegible]	5.0
…ific Gravity	[illegible]		Specific Gravity	[illegible]	[illegible]	
…rption	[illegible]		Absorption	[illegible]	[illegible]	
			Soft Fragments	0.0	0.0	5.0

…ATION OF CONCRETE PLACEMENT: [illegible]

TEST CYLINDERS CAST

CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. LB./C.F.	YIELD C.F./C.Y.	
[illegible]	3.5	5.2	[illegible]	[illegible]	[illegible]	TOTAL BATCHED 96
						REJECTED 0
						NOT NEEDED 0
						TOTAL PLACED 96
						UNIT WEIGHT [illegible]
						START [illegible]
						FINISH [illegible]

[illegible handwritten remarks]

[signature]

Exhibit 14

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

QC/QA DOCUMENT

Report No. [illegible]

Date 5-19-71

REPORT

Date of Inspection 5-19-71 Temp. °F 67 Weather clear Relative Humidity

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power Station

Construction Manager: Bechtel Corporation

Plant: Nicholson Concrete & Supply Co.

MIX PLANT INSPECTION

Concrete Class C-3-5F-2 No. Cu. Yds. 48 No. Loads 8 Plant Mix 6 X 48

Actual Quantities per Cu. Yd.		Design	Brand or Source
Cement, lbs.	564	564	Medusa Type II
Sand, Lbs. (S.S.D.)	1490	1510	[illegible] Stone
Agg., Lbs. (S.S.D.)	620	631	" " "
Agg., Lbs. (S.S.D.)	947	950	" " "
Ash, Lbs.	—	—	—
Water, Gals. (Total)	35.0	36.0	[illegible]
Oz.	16.9	16.9	[illegible]
Oz.	16.9	9.8	[illegible]

AGGREGATE GRADATION – % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	FM	MOISTURE %
Sand – Specs.	0-10	10-30	25-60	45-80	70-95	95-100	100							
Sand – Manuf.	6.9	19.0	31.0	56.6	91.6	100	100						2.91	5 To 7
Agg.														To
Agg. No. 4							2.6		12.1	45.7	93.7	100		To
Agg. No. 67					2.9	7.7	52.4		91.0	100				To
Agg. Specs. No. 4							0-5		0-15	20-55	90-100	100		
Agg. Specs. No. 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS % MAX %
Mat'l Finer than 200 Wash	3.9		Mat'l Finer than 200	[illegible]	[illegible]	
Clay Lumps	0.0	1.0	Clay Lumps	0.0	0.0	0.25
Coal & Lignite	0.0	0.5	Coal & Lignite	[illegible]	[illegible]	0.25
Organic Impurities [illegible]	[illegible]	No. 3	Flat & Elong. 3-1	0.0	0.0	5.0
Specific Gravity	2.62		Specific Gravity	[illegible]	[illegible]	
Absorption	[illegible]		Absorption	[illegible]	[illegible]	
			Soft Fragments	0.0	0.0	5.0

LOCATION OF CONCRETE PLACEMENT: [illegible]

TEST CYLINDERS CAST					
CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. LB/C.F.	YIELD C.F./C.Y.
[illegible]	4.5	4.8	71	147.2	[illegible]

TOTAL BATCHED 48
REJECTED —
NOT NEEDED —
TOTAL PLACED 48
UNIT WEIGHT 147.2

STARTED [illegible]
FINISHED [illegible]

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

REPORT

Order No. CL-8800

Report No. 168

Date 5-19-71

Inspection 5-19-71 Temp. °F. 66 Weather Cloudy Relative Humidity ______

To: Bechtel Corporation

Identification: Toledo Edison Company

Davis-Besse Nuclear Power Station

Construction Manager: Bechtel Corporation

Plant: Nicholson Concrete & Supply Co.

MIX PLANT INSPECTION

Class [illegible] No. Cu. Yds. [illegible] No. Loads [illegible] Mix 6 X 3

Actual Quantities per Cu. Yd.		Design	Brand or Source
Lbs.	565	561	[illegible] Type II
Lbs. (S.S.D.)	1197	1210	[illegible]
Lbs. (S.S.D.)	627	631	" " "
Lbs. (S.S.D.)	933	950	" " "
Lbs.	—	—	—
Gals. (Total)	37.5	36.0	[illegible]
Oz.	16.7	16.9	[illegible]
Oz.	1.5	3.0	[illegible]

AGGREGATE GRADATION – % PASSING

SIEVE SIZE	100	50	30	16	8	4	3/8"	1/2"	3/4"	1"	1½"	2"	F.M.	MOISTURE %
Specs.	0-10	10-30	25-60	45-80	70-95	95-100	100							
Manuf.	6.9	19.0	31.0	56.6	91.6	[illegible]	100						2.90	[illegible]
[illegible]														To
No. 4							2.4		13.3	45.7	93.9	100		To
No. 67					2.9	7.6	36.9		97.2	100				To
Specs. No. 4							0-5		0-15	20-55	90-100	100		
Spec. No. 67					0-5	0-10	20-55		90-100	100				

FINE AGGREGATE	RESULTS	SPECS % MAX	COARSE AGGREGATE	#4	#67	SPECS % MAX
Finer than 200 Wash	2.4		Mat'l Finer than 200	[illegible]	[illegible]	
Lumps	0.0	1.0	Clay Lumps	0.0	[illegible]	0.25
Lignite	0.0	0.5	Coal & Lignite	0.0	[illegible]	0.25
Impurities	[illegible]	No. 3	Flat & Elong. 3:1	[illegible]	[illegible]	5.0
Gravity	2.72		Specific Gravity	[illegible]	[illegible]	
Absorption	[illegible]		Absorption	[illegible]	[illegible]	
			Soft Fragments	[illegible]	[illegible]	5.0

LOCATION OF CONCRETE PLACEMENT: [illegible]

TEST CYLINDERS CAST					
CYL. IDENT.	SLUMP	AIR %	TEMP. °F	UNIT WT. LB./C.F.	YIELD C.F./C.Y.
[illegible]	5.0	5.4	68	[illegible]	[illegible]

TOTAL BATCHED [illegible]

REJECTED 0

NOT NEEDED 0

TOTAL PLACED [illegible]

UNIT WEIGHT

[illegible handwritten remarks]

START [illegible]

FINISH [illegible]

[signature]

SLIP FORM DAILY RECORD

DATE	SHIFT	DECK ELEVATION	FOOTAGE JACKED	SHIFT CONCRETE	TOTAL CONCRETE	YDS. PER FT.
5/18/71	1ST	250'-4"	3'-7"	168	10,7?4.5	
	2ND	253'-0"	2'-8"	108	10,854.5	
	3RD	256'-4½"	3'-6½	108	10,9?2.5	39.1
			9'-9½"			

I HEREBY CERTIFY THAT THE ABOVE ELEVATIONS AND QUANTITIES HAVE BEEN ATTAINED

DATE: 5-19-71

SIGNED: [illegible]

REMARKS:

ON 5-18-71 ABOUT 9:30 PM THE CONCRETE MIX WAS NOTED AS BEING STICKY AND NOT AS CONSISTANT A MIX AS IT SHOULD BE, THE SLUMP WAS 3", THE PROBLEM APPEARED TO BE THE CEMENT — TO TRY TO CORRECT THE PROBLEM THE MIX WAS CHANGED TO TYPE II CEMENT AT ABOUT 11:30 PM. 5-18-71

CONCRETE CURED WITH GRACE'S CLEARSEAL #12 BELOW MOVING FORM

Exhibit 14

0045400 154

TP 6/20/71

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL.

Order No. CL-8800

Report No. 167

Date 5-18-71

RECEIVED MAY 6 1972 BECHTEL CORP. JOB NO. 7749

REPORT

REPORT OF TEST ON CONCRETE CYLINDERS
6" DIAMETER BY 12" LENGTH

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power Plant

Contractor: In: [illegible]

Batch Plant: Nicholson

Location of Concrete Placement: [illegible] #2

Date Cast 5-18-71 Concrete Class C-2-SF-4 P.S.I. 4000 Area 28.27 Sq. In.

Cylinder Ident.	Slump Inches	Air %	Concrete Temp. °F.	Date Tested	Age Days	Total Load Lbs.	Comp. Str. P.S.I.
[illegible]	3.5	5.2	71	5-25-71	7	114,000	4033
				5-25-71	7	110,500	[illegible]
				6-15-71	28	158,000	[illegible]
				6-15-71	28	156,000	5517
				8-16-71	90	159,500	[illegible]
				8-16-71	90	164,000	[illegible]
[illegible]	4.5	4.8	70	5-25-71	7	112,500	[illegible]
				5-25-71	7	109,000	[illegible]
				6-15-71	28	162,500	[illegible]
				6-15-71	28	165,000	[illegible]
				8-16-71	90	182,500	[illegible]
				8-16-71	90	187,000	[illegible]

REMARKS: Cyl. wgt. A 29.30 D 28.90 [illegible] A 28.95 D 29.15
295 B 29.10 E 28.95 296 B 28.95 E 28.90
C 29.10 F 29.05 C 29.05 F 29.15

#295 + #296 [illegible]

PITTSBURGH TESTING LABORATORY

[signature]

Exhibit 14

0 0 4 5 2 0 [illegible] 4 5 — TF 5/7/71

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL.

Order No. CL-8800

Report No. 168

Date 5-19-71

REC'D MAY 5 1972 BECHTEL CORP. JOB NO. 7749

REPORT

REPORT OF TEST ON CONCRETE CYLINDERS
6" DIAMETER BY 12" LENGTH

Reported To: Bechtel Corporation

Project Identification: Toledo Edison Company
Davis-Besse Nuclear Power Plant

Contractor: In: Pecka

Batch Plant: Nicholson

Location of Concrete Placement: Pour #2

Date Cast: 5-19-71 Concrete Class C-3-SF-2 P.S.I. 4000 Area 28.27 Sq. In.

Cylinder Ident.	Slump Inches	Air %	Concrete Temp. °F.	Date Tested	Age Days	Total Load Lbs.	Comp. Str. P.S.I.
301	4.5	4.6	71	5-26-71	7	97,000	3431
				5-26-71	7	97,500	3448
				6-16-71	28	141,000	4987
				6-16-71	28	154,000	5447
				8-17-71	90	182,000	6437
				8-17-71	90	179,000	6331
302	5.0	5.4	66	5-26-71	7	79,500	2812
				5-26-71	7	80,500	2847
				6-16-71	28	144,500	5111
				6-16-71	28	137,000	[illegible]
				8-17-71	90	180,500	[illegible]
				8-17-71	90	185,500	6561

REMARKS: Cyl. wts. A 28.90 D 29.10 — A 28.60 D 28.70
301 B 29.10 E 29.05 — 302 B 28.85 E 28.75
C 29.15 F 29.40 — C 28.80 F 28.80

PITTSBURGH TESTING LABORATORY

Exhibit 15: Slip Form Time Quantities Analysis

DATE	SHIFT	DECK ELEVATION	FOOTAGE JACKED	CYDS SHIFT CONCRETE	TOTAL CONCRETE	
1-25-71	1	4'-0	0	108	108	
1-25-71	2	5'-8"	1'-8"	132	240	
1-26-71	3	8'-8"	3'-0	108	348	
	1					POUR STOPPED DUE TO HIGH WINDS
	1					" "
4/ /	1					
/ /						
/ /						
/ /		19'-8"				
/		21'-9"				
/2/		24'-9"				
/						
/ /				90		
2/4/71 ~~4/26/71~~		37'-6"	3'-4"	132		
4/		38'-6"	1'-0	66		
		Pour Stopped + Waterstop installed at Top & B				
/24/		43'-4"				
/		47'-5"		4		
4/ /71		51'-0"				X

Exhibit 15

Date	S.H.	Deck Elevation	Footage Jacked	Cyds Slipped Concrete	Total Concrete	Yds Concrete per Foot
/27/71		55'-0	4'-0	132	2222	
4/27/71		59'-2"	4'-3"	132	2354	
4/27/71		63'-6"	4'-3"	150	2504	
4/28/71		68'-7"				
4/28/71		73'-6"				
4/28/71		77'-0"				
/ /		81'-7"				
/ /		85'-5"				
/ /		90'-0"				
4/30/71			4'-9"			
4/30/71			4'-11"			
4/30/71		/ 3	3'-5"			
//	/					
/2/		ATM				
5/ /		108'-6"			4280	
/ /		113'-2"			4472	
/ /		117'-6"	4		4464? 4664	
/ /7					4862	
/4/					5066	
/4/ /		/			5246	

DATE		DECK ELEVATION	FOOTAGE JACKED	SHIFT CONCRETE	TOTAL CONCRETE	YDS CONC PER F…
5/5/71		135'-0"	4'-9"	228	5474	
5/5/71		139'-10"	4'-10"	222	5696	
5/5/71		143'-6"	3'-8"	180	5876	
/		148'-5"			6092	
5/ /		153'-3"			6314	
9/		158'-4"			6542	
/		163'-4"				
/ /		167'-10"				
/ /		171'-10"				
/ /	/	176'-9"				
/ /		181'-3"				
/10/		185'-10"				
5/ /		189'-5"				
/		193'-6"		/		
		197'-10"				
5/12/71		202'-2"	4'-4"			
5/12/71		205'-11"	3'-9"			
5/12/71		210'-4"	4'-5"			
/ /		214'-5"		8		
/3/		218'-3"				
/ /		223'-6"				

Exhibit 15 (4)

DATE		DECK ELEVATION	FOOTAGE JACKED	SHIFT CONCRETE	TOTAL CONCRETE	YDS CONC PER FOOT
7/14/71		226'-10"	4'-4"	195	9677	
5/14/71		230'-9"	3'-11"	180	9857	
5/14/71		234'-2"	3'-5"	181.5	10,038.5	
/ /		238'-8"			10,230.5	
/		242'-6"			10,386.5	
/ /		246'-9"			10,578.5	
/ /	1	250'-4"			10,746.5	
/8/71	2	253'-0"			10,854.5	
5/ /		258'-6½"			10,962.5	39.1
7/ /	1					

Exhibit 16: Rebar Cover Spacing (FENOC Document – Not Included as an Attachment to this Report)

Exhibit 17: Spec C-29 Reinforcing Steel

BECHTEL Power and Industrial Division

Specification No. 7749-C-29
Job No. 7749
Q-List No. 1.2230 | 2

THE TOLEDO EDISON COMPANY

AND

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

RECEIVED AUG 1 9 1971 MECH. ENG. DIV.

DAVIS-BESSE NUCLEAR POWER STATION

UNIT NO. 1 CONSTRUCTION

SECTION XIc

TECHNICAL SPECIFICATIONS

FOR THE

FURNISHING, DETAILING, FABRICATING, AND DELIVERING

REINFORCING STEEL

RECEIVED JUN 24 1974 DAVIS-BESSE

DAVIS-BESSE MASTER FILE COPY
MECHANICAL ENGINEERING
TRANSMITTED ____ DATE ____ SOURCE
RECEIVED ____ DATE
FILED ____ DATE BY ____
PREVIOUS ISSUE HAS BEEN VOIDED

MASTER FILE COPY

BECHTEL COMPANY
GAITHERSBURG, MARYLAND

No.	Date	Revisions	By	G.L.	C.E.	P.E.	TECo
A	3-23-70	Issued for Client Approval and Bid	[signature]	[signature]	[signature]	[signature]	
0	8-17-70	Issued for Detailing and Material Purchase	[signature]	[signature]	[signature]	[signature]	[signature]
1	10-30-70	Issued for Construction & Addendum 3	[signature]	[signature]	[signature]	[signature]	[signature]
2	5-11-71	Revised for Addendum 4	[signature]	[signature]	[signature]	[signature]	[signature]

SPECIFICATION REV. 2

INDIVIDUAL PAGE REVISION INDEX SHEET

Page No.	Latest Individual Page Addendum No.
Cover Sheet	4
Table of Contents	3
1	0
2	4
3	4
4	3
Documentation Distribution Requirements	4

Power and Industrial Division

Specificatio o. 7749-C-29

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

BECHTEL Power and Industrial Division

Specification No. 7749-C-29

TECHNICAL SPECIFICATIONS

FOR

FURNISHING, DETAILING, FABRICATING AND DELIVERING

REINFORCING STEEL

1.0 GENERAL

The WORK includes the furnishing of all plant, labor, materials, tools and equipment and the performance of all operations and incidentals necessary to detail, furnish, fabricate, deliver, unload and store reinforcing steel and wire mesh fabric, as specified herein or as shown on the design drawings and in this Contract.

2.0 ABBREVIATIONS

The abbreviations listed below, when used in these Specifications, shall have the following meanings and shall refer to the latest edition in effect on the date of the Contract.

ACI - American Concrete Institute
ASTM - American Society for Testing and Materials
AISI - American Iron and Steel Institute

3.0 CODES AND STANDARDS

Except as otherwise specified or shown in the final design drawings, the detailing, fabrication, and tagging of all reinforcing steel shall be in accordance with the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI Standard 315).

4.0 MATERIAL

4.1 All material shall be new and unused free from loose rust, scale, or coatings which would reduce or destroy bond. Reinforcing appreciably reduced in cross section by bending shall not be used.

4.2 Reinforcing bars shall conform to the "Standard Specifications for Deformed Billet Steel Bars for Concrete Reinforcement" (ASTM A 615). Reinforcing bars shall be Grade 60 unless noted otherwise on the drawings.

4.3 Welded wire fabric for concrete reinforcement shall conform to "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement" (ASTM A 185).

5.0 TESTS

5.1 The CONTRACTOR shall furnish the required number of certified copies of all Mill Test Reports to the respective parties listed on Form ED 6058 covering the chemical and physical properties of the reinforcing steel, as described in the referenced specifications and standards. Each delivery shall be identified by its applicable Mill Test Report. 2

5.2 The CONSTRUCTION MANAGER may, for the purpose of making chemical analysis checks and physical property tests, at his option, select random samples of the steel delivered to perform user's tests as follows: 2

a. No. 11 bar size and smaller -- one random diameter size sample from each 50 tons of bar delivered for tension and bend tests.

b. No. 14 and No. 18 bar sizes -- one sample for each bar size from each 100 tons of bar delivered for tension test only. 3

5.3 The OWNERS' Independent Testing Laboratory will perform the user's tests and if the test sample bar does not meet the minimum strength requirements as defined in ASTM A 615, a second full-size sample from the same heat will be taken and tensile tested. If the latter test result meets the minimum strength requirements, results from these two tests will be combined with the mill tensile test result and averaged. If the averaged result is found to meet the minimum strength requirement, the heat will be accepted.

In the event that the averaged result of all three tests does not meet the minimum strength requirements, the heat will be rejected.

5.4 The method of testing will conform to the ASTM A 615 requirements.

5.5 The CONTRACTOR shall furnish sufficient bars with each shipment to satisfy the testing needs of Paragraph 5.2.

6.0 INSPECTION

The WORK shall include receiving inspection at the jobsite by the CONTRACTOR. The receiving inspection shall determine that the requirements of ASTM-A615 have been met, that adequate documentation as required by paragraph 10.3.1 accompany the delivery, and that tagging conforms to paragraph 7.3 and the shop detail drawings. 4

7.0 DETAIL DRAWINGS

7.1 The OWNERS will furnish prints of the design drawings which will give all information required for the shop detailing of the reinforcing steel. 2

7.2 For approval and distribution of reinforcing steel detail drawings, see Section V, paragraph 37.0, addendum number 2.

7.3 All reinforcing steel should be tagged. Tags should be made of durable material and marked in a legible manner, not less than one tag per bundle, attached by wire. Identification tags should show the grade, the mark or size, the length of the bars, and heat numbers or reference thereto. 2 3

8.0 SHOP ERRORS

Material improperly detailed or wrongly fabricated, so that its placing in the field necessitates extra work, shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall pay the entire cost of replacement or of field corrections, including all shipping costs.

9.0 HANDLING, SHIPPING AND STORAGE OF MATERIALS

All materials shall be stored at the jobsite in a manner that will protect them from being contaminated by any deleterious materials such as grease, oil and mud. Also see Section XII of the Contract Document.

10.0 QUALITY CONTROL REQUIREMENTS

10.1 See Section XII of the Contract Document. 2

10.2 Shop Inspection

See paragraph 6.0 of this specification. 2 4

10.3 Quality Control Documentation Required

10.3.1 The CONTRACTOR shall furnish certified copies to the CONSTRUCTION MANAGER of the Mill Test Report, containing the following properties, for each heat delivered to the jobsite. 4 3

a. Chemical Analysis

b. Ladle Analysis

c. Tension Test

d. Bending Test (except No. 14 and No. 18 bars) 3

e. Elongation Test

11.0 MEASUREMENT AND PAYMENT

11.1 The Lump Sum Price for the complete WORK for the Shield Building shall include the reinforcing steel specified herein. The unit prices bid in Paragraph 2.2 and 2.3 of the Proposal shall be used for additions to or deletions from the Lump Sum bid in Items 2.1.1 and 2.1.2, respectively, of the Proposal. Only net changes in quantities as directed by the CONSTRUCTION MANAGER or the ENGINEER shall constitute additions to or deletions from the Lump Sum bids. 1

11.2 Net changes in quantities shall be calculated on the theoretical lengths of the bars as detailed, and at the theoretical weights as given in the "Standard Specifications for Deformed Billet Steel Bars for Concrete Reinforcement" (ASTM A 615).

FOR QUALITY ASSURANCE USE

(A) MR. H. W. WAHL
PROJECT ENGINEER
BECHTEL COMPANY
190 SHADY GROVE ROAD
GAITHERSBURG, MD. 20760

(B) M. R. STEPHENS
CONSTRUCTION MANAGER
P.O. BOX 449
PORT CLINTON, OHIO 43452

* The required certified copies shall be furnished upon or prior to the arrival of the material at the jobsite.

No.	TYPE OF DRAWINGS AND OTHER REQUIREMENTS	REFER TO SPECIFICATION PARA	COPIES WITH BID TO (A)	KIND OF COPIES	COPIES FOR APPRV. TO (A)	CERTIFIED COPIES TO (A)	CERTIFIED COPIES TO (B)
1	QUALITY CONTROL INSPECTION AND TEST PROCEDURES (OUTLINE)	10.1 *		REPRODUCIBLE			
			3	PRINTS			
2	QUALITY CONTROL INSPECTION AND TEST PROCEDURES (DETAILED)	10.1 *		REPRODUCIBLE			
				PRINTS	3	2	
3	PRODUCTION SCHEDULE	10.1*		REPRODUCIBLE			
				PRINTS	3	2	2
4	Mill Test Reports	10.3.1*		REPRODUCIBLE			
				PRINTS			2
5				REPRODUCIBLE			
				PRINTS			
6				REPRODUCIBLE			
				PRINTS			
7				REPRODUCIBLE			
				PRINTS			
8				REPRODUCIBLE			
				PRINTS			
9				REPRODUCIBLE			
				PRINTS			
10				REPRODUCIBLE			
				PRINTS			
11				REPRODUCIBLE			
				PRINTS			
12				REPRODUCIBLE			
				PRINTS			
13				REPRODUCIBLE			
				PRINTS			
14				REPRODUCIBLE			
				PRINTS			
15							
16							
17							
18							
19							
20							

4

3

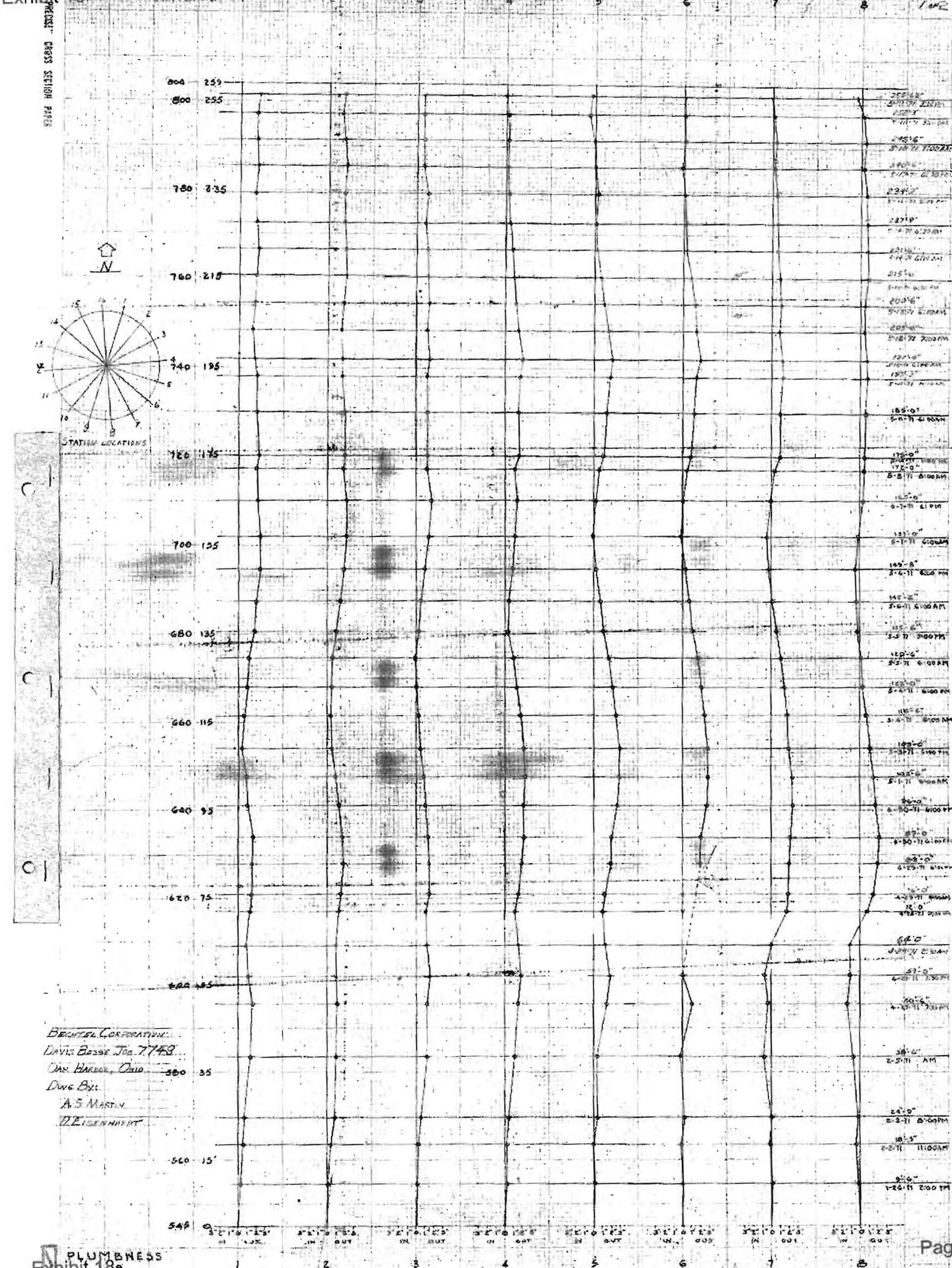
REV.	DESCRIPTION	ENG.	DR.	CHK.	SUPV.	MAIL	APPRV.	DATE	TECH APP	DATE
2	Revised for Addendum 4							[illegible]		
1	Issued for Construction & Addendum 3							[illegible]		
0	Issued for Detailing and Material Purchase							8-20-76		
A	Issued for Client Approval and Bid							3-18-76		

THE TOLEDO EDISON COMPANY
AND
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY
DAVIS-BESSE UNIT NO. 1 CONSTRUCTION
QUALITY ASSURANCE
DOCUMENTATION DISTRIBUTION REQUIREMENTS
CONSTRUCTION DOCUMENT NO. 7749-18

JOB NO. 7749
SPEC. NO. 7749-C-39
EQPT. ITEM NO. N/A
P. O. NO.

ED 6058

Exhibit 18: Wall Plumb Measurements


STATION No.
1
2
3
4
5
6
7
8
1 of 2
"PRECISE" CROSS SECTION PAPER
N
STATION LOCATIONS
804 259
800 255
780 235
760 215
740 195
720 175
700 155
680 135
660 115
640 95
620 75
600 55
580 35
560 15'
546 0
BECHTEL CORPORATION
DAVIS BESSE JOB 7749
OAK HARBOR, OHIO
DWG BY:
A.S. MARTIN
D. EISENHARDT
PLUMBNESS

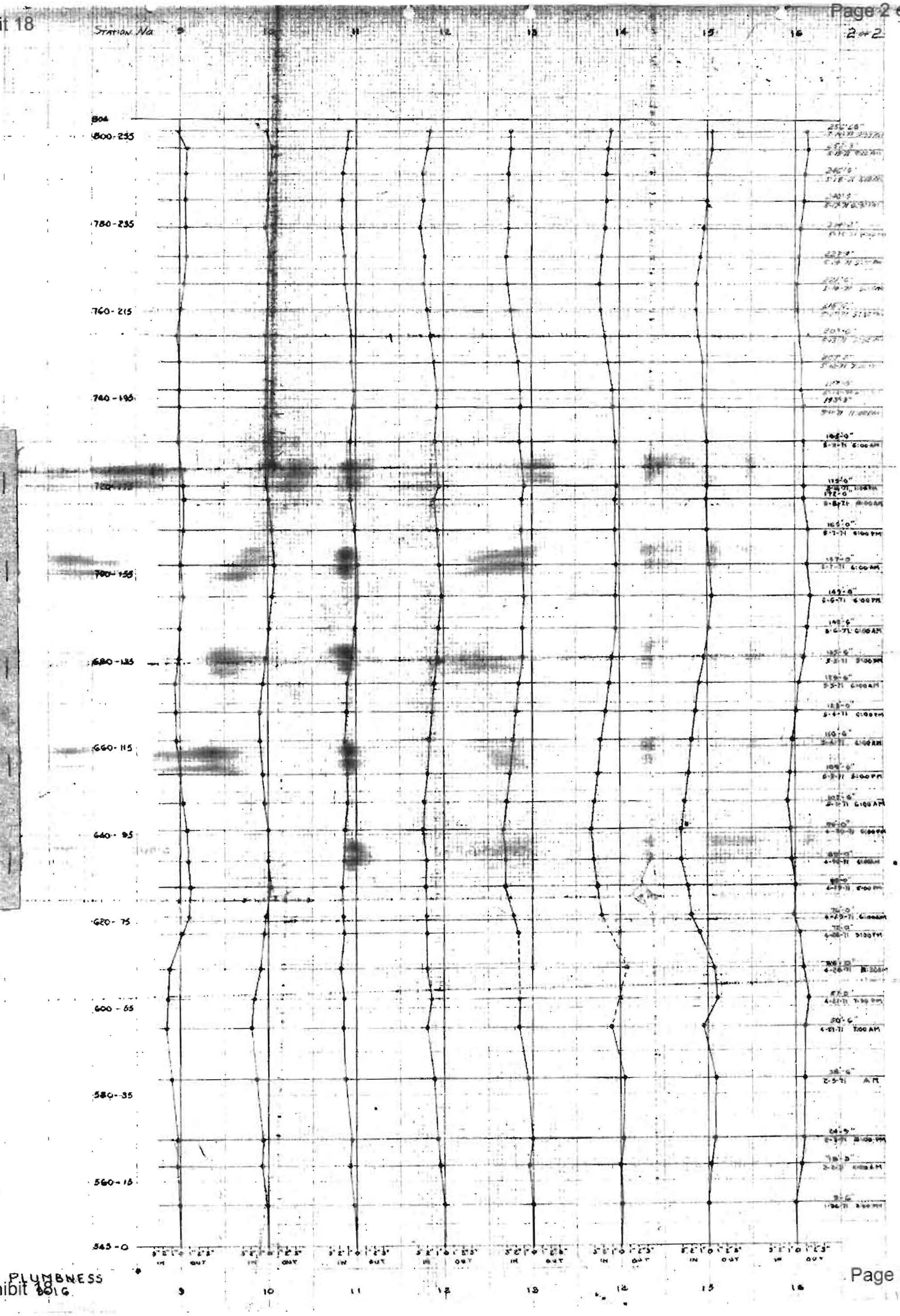

STATION No.
9
10
11
12
13
14
15
16
2 of 2
804
800-235
780-235
760-215
740-195
720-175
700-155
680-135
660-115
640-95
620-75
600-65
580-35
560-15
545-0
IN OUT
PLUMBNESS

Exhibit 19: Out-of-Plumb Interim Field Reports

Exhibit 19

BECHTEL #5

JOB NO. 7749 INTERIM FIELD REPORT SHEET 1 OF 1

OWNER TECo-CEI PLANT Davis-Besse Nuclear Power Station UNIT 1

STARTUP SYSTEM: NO. NA NAME Containment Sheild Building

QC NO. 1,2220 NON CONFORM. HOLD TAG NO. NA

SUBJECT: Containment shield building out of plumbness. Contract 7749-18

PROBLEM: The Containment Shield building concrete wall outside face is not within the plumbness tolerance of 1 inch in any 25 feet.

See attached charts plotting plumbness readings.

APPARENT CAUSE: ENGR'G CONSTR. S.U. TEST PROC. OPER. ERROR

REFERRED TO: ENGR'G CONSTR. STARTUP

SOLUTION OR SUGGESTED ACTION:

Evaluate existing structure and approve as placed or provide recommended action.

REPLY REQUESTED OF H.W. Wahl BY DATE 6/28/71

(USE FIELD REPORT REPLY FORM) REPLY RECEIVED DATE

AUTHORIZATION TO PROCEED WITHOUT A WRITTEN REPLY

DISTRIBUTION:
1 - AC/PFE - FILE
2 - QAE
3 - ENGR'G

PREPARED BY BECHTEL

Signed/Date

BECHTEL P&I DIVISION Revised 6/70 STARTUP FORM 17

JUL 30 1971
BECHTEL CORP.
JOB NO. 7749

REPORT NO. 5
FILE NO. 0513

BECHTEL
JOB NO. 7749

INTERIM FIELD REPORT REPLY
REPORT NO. 5

SHEET 1 OF 1

OWNER TECo - CEI PLANT Davis-Besse Nuclear Power Station UNIT 1

STARTUP SYSTEM: NO. N.A. NAME Containment Shield Building

QC NO. 1.2220 NONCONFORM. HOLD TAG NO. N.A.

SUBJECT: Containment Shield Building out of plumbness
Contract 7749-18

COMMENT: (SOLUTION OR CORRECTION ACTION TAKEN)

Engineering has reviewed the Interim Field Report and its attached plumbness plots. Out of tolerance exceeds the 1" in 25' specified by 2-3/4". The effects this has on the shield building structural integrity were found to be insignificant.

Engineering recommends that all interface work be adjusted to meet the as-built alignment of the structure.

The structure is accepted as is.

IMPORTANT: THE FOLLOWING ITEMS MUST BE FILLED OUT:

FIELD CHANGE NOTICE REQUIRED	YES ___	NO x
FIELD CHANGE NOTICE ISSUED	NUMBER	N.A.
AS BUILD DRAWING CHANGE REQUIRED	YES x	NO ___

DISTRIBUTION:
1 - QC/PFE
2 - QAE
3 - FILE

PREPARED BY BECHTEL
Signed/Date Joseph F. McGeady
July 26, 1971

BECHTEL P&I DIVISION Revised 6/70 STARTUP FORM 48

Exhibit 20: Slip-Form Records Summary

Davis-Besse Containment Shield Building Records

Davis-Besse Containment Shield Building Construction **Data taken from slip form record**

Date	Shift	Outside Temp	Deck Elevation	Footage jacked	Shift Concrete	Total Concrete	Comments
01/25/71	1	31	4'0"	0	108	108	1 6 cy batch rejected 81/4 slump
01/25/71	2	37	5'8"	1'8"	132	240	
01/26/71	3	38	8'8'	3'0"	108	348	1 6 cy batch rejected 7 slump
01/26/71	1	29	10'8"	2'0"	42	390	Pour stopped at 10 am due to high winds
02/01/71	1	5	?				
02/01/71	2	9	14'10'	3'0'			Weather cold
02/01/71	3	0	17'8'	2'10'	108		
02/02/71	1	-2	19'8"	2'8"	108	86?	
02/02/71	2	12		2'10"	102	968	6 cu yd dumped on 2nd shift because to tower crane down time
02/02/71	3	16	24'9"	3'0"	114	1092	
02/03/71	1	19	28'8"	3'11"	162		
02/03/71	2	22	31'11"	3'8"	132		
02/03/71	3	21	34'2"	2'8"	90		
02/04/71	1		37'6"	3'4"	192		
02/04/71	2	32	38'6"	1'0"	66		Pour stopped at 583'6" at el. Waterstop inserted and key way poured
							Pour apparently stopped. Maybe due to cold weather!
04/26/71	1		43'4"	3'9"	150	1314	*Date?*
04/26/71	2		47'5"	4'1"	144	1458	
04/26/71	3		51'0"	3'7"	126	2084	The concrete below the moving forms after being finished was sprayed with clean seal #12 by Drace Co.
04/27/71	1		55'0"	4'0"	138	2222	Engineering on 12 hour shifts The concrete below moving form cured with Brace's clear seal #12
04/27/71	2			4'3'	170	2504	
04/29/71	1		68'7"	5'1"	168	2672	
04/29/71	2		73'6'"	4'11"	156	2822	
04/29/71	3		77'0"	5'6"	144	2972	Concrete below moving form cured with Graces's clear seal #12
04/30/71	1		94'4"	4'9"	210	3710	
04/30/71	2		99'8"	4'11"	198	3906	

Davis-Besse Containment Shield Building Records

05/01/71	3		103'11"	5'5"	156	4064	Construction joint water cured and water cut before starting next pour. Concrete below moving form cured with Graces's Clear Seal #12
05/03/71	1		108'6"	5'5"	216	4280	
05/03/71	2		113'2"	4'8"	192	4472	
05/04/71	3		117'6"	4'4"	192	4464	4 story poles checked on 5-1-71 by taping up from B.M. el 549'0" on inside wall pole near yoke #1 1/16" short -pole near yoike #21: 1/16" short; -pole near yoke #41: 3/16" short - pole near yoke #61: 1/16" short
05/04/71	1		122'6"	4'6"	198	4862	
05/04/71	2		126'6"	4'6"	204	5066	
05/05/71	3		130'3"	3'9"	180	5246	Concrete below moving form cured with Grace's clear seal #12
05/06/71	1		140	4'11"	216	6092	
05/06/71	2		153'3"	4'10"	234	6314	
05/07/71	3		158'4"	5'1"	207	65??	Concrete below moving from cured with Grace's clear seal #12
05/07/71	1		163'4"	5'0"	234	6776	
05/07/71	2		167'10"	4'6"	204	6980	
05/08/71	3		171'10"	4'0"	204	7184	Concrete below moving form cured with Grace's clear seal #12 Construction joint water cured and water cut before starting the next pour
05/10/71	1		176'9"	4'11"	215	74??	
05/10/71	2		183'3"	4'6"	198	7598	
05/11/71	3		185'10'	4'7"	204	7802	4 story poles checked on 5-8-71 by taping up from B.M. el. 549'0" on inside wall: Story pole near yoke #1 0'01/8"short Story pole near yoke #21 0'01/8" short Story pole near yoke #41 0' 01/4" short Story pole near yoke #61 0" ¼" short
05/11/71	1		189'5"	3'7"	180	7982	
05/11/71	2		193'4"	4'4"	184	8162	
05/12/71	3		197'10"	4'4"	210	8372	6 cy of concrete was sent back to the batch plant due to time factor (governed by the spec) due to a break down in the tower crane. Concrete below moving form cured with Grace's clearseal #12
05/12/71	1			4'4"	192	8564	
05/12/71	2		205'11"	3'9'	174	8738	

Davis-Besse Containment Shield Building Records

05/13/71	3		210'4"	4'5"	198	8932	Concrete below moving form cured with Graces Clear seal #12
05/13/71	1		214'5"	4'1"	180	9116	
05/13/71	2		218'3"	3'10"	174	9290	
05/14/71	3		222'6"	4'3"	192	9482	Concrete below moving form cured with clear seal #12
05/14/71	1		226'10"	4'4"	195	9677	
05/14/77	2		230'9"	3'11"	180	9857	
05/15/71	3		234'2"	3'5"	181.5	10038.5	4 Story poles checked on 5-15-71 by taping up B.M. el. 549'0" on inside wall; Story pole near yoke #1 – 0' 0 1/8" short Story pole near yoke #21 – 0' 03/16" short Story pole near yoke #41 – 0' 0 3/16" short Story pole near yoke #61 – 0' 05/16" short On 5/14/71 2nd shift truck #82 ticket DB02764 delivered 02764 delivered 6 cuyds of concrete with Type II cement instead of Type I cement. Concrete below moving form cured with Braces Clear Seal #12.
05/17/71	1		238'8"	4'6"	192	10230.5	
05/17/71	2		242'6"	3'10"	156	10, 386.5	
05/18/71	3		246'9"	4'3"	192	10578.5	Concrete below moving form cured with Graces Clear Seal #12
05/18/71	1		250'4"	3'7"	168	10726.6	
05/18/71	2		253'0"	2'8"	108	10854.5	
05/18/71	3		256' 61/2"	3'6 ½"	108	10962.5	On 5-18-71. about 9:30 pm the concrete mix was noted as being sticky and not as consistent a mix as it should be. The slump was 3". The problem appeared to be the cement – to try to correct the problem the mix was changed to type II cement at about 11:30 pm 5-18-71. Concrete cured with Graces Clearseal #12 before moving form.
05/19/71	1		256' 61/2"	0'0"	66	11028.5	Concrete struck off @ 256'0 ½" & 256'6 ½" water stop and keyway in place and water is being piped to the top of the shield wall for curing the concrete for required time. Concrete below moving form cured with Graces Clearseal #12

Exhibit 21: Guide for Preparation

TECHNICAL GUIDELINES

Prepared by the International Concrete Repair Institute September 2004

Guide for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods

Guideline No. 03737

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About ICRI Guidelines

The International Concrete Repair Institute (ICRI) was founded to improve the durability of concrete repair and enhance its value for structure owners. The identification, development, and promotion of the most promising methods and materials is a primary vehicle for accelerating advances in repair technology. Working through a variety of forums, ICRI members have the opportunity to address these issues and to directly contribute to improving the practice of concrete repair.

A principal component of this effort is to make carefully selected information on important repair subjects readily accessible to decision makers. During the past several decades, much has been reported in literature on concrete repair methods and materials as they have been developed and refined. Nevertheless, it has been difficult to find critically reviewed information on the state of the art condensed into easy-to-use formats.

To that end, ICRI guidelines are prepared by sanctioned task groups and approved by the ICRI Technical Activities Committee. Each guideline is designed to address a specific area of practice recognized as essential to the achievement of durable repairs. All ICRI guideline documents are subject to continual review by the membership and may be revised as approved by the Technical Activities Committee.

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Synopsis

This guideline is intended to provide an introduction to hydrodemolition for concrete removal and surface preparation, the benefits and limitations of using hydrodemolition, and an understanding of other aspects to be addressed when incorporating hydrodemolition into a repair project. This guideline provides a description of the equipment, applications, safety procedures, and methods of water control and cleanup.

Keywords

Bond, bonding surface, bruising, chipping hammer, coating, concrete, delamination, deterioration, full depth repair, hand lance, high-pressure water, hydrodemolition, impact removal, mechanical removal, micro-fracture, post-tensioning, rebar, reinforced concrete, reinforcing steel, robot, rotomill, safety, sound concrete, surface preparation, surface profile, surface repair, tendon, vibration, wastewater, and water jet.

Purpose

This guideline is intended to provide owners, design professionals, contractors, and other interested parties with a detailed description of the hydrodemolition process; a list of the benefits and limitations of using hydrodemolition for concrete removal and surface preparation; and an understanding of other aspects to be addressed when incorporating hydrodemolition into a repair project. The guideline provides a description of the equipment, applications, safety procedures, and methods of water control and cleanup. This guideline is not intended as an operating manual for hydrodemolition equipment as that information is specific to each equipment manufacturer.

The scope of this guideline includes the use of hydrodemolition for the removal of deteriorated and sound concrete in preparation for a concrete surface repair. In addition, the use of hydrodemolition for the removal of coatings is discussed.

While the procedures outlined herein have been found to work on many projects, the requirements for each project will vary due to many different factors. Each project should be evaluated individually to ascertain the applicability and cost-effectiveness of the procedures described herein. Other methods of surface preparation are discussed in ICRI Technical Guideline No. 03732, "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays."

Introduction

Hydrodemolition is a concrete removal technique which utilizes high-pressure water to remove deteriorated and sound concrete. This process provides an excellent bonding surface for repair material. First developed in Europe in the 1970s, this technology has become widely accepted for concrete removal and surface preparation throughout Europe and North America.

Hydrodemolition can be used for horizontal, vertical, and overhead concrete removals and surface preparation on reinforced and non-reinforced structures. It is effective in removing concrete from around embedded metal elements such as reinforcing steel, expansion joints, anchorages, conduits, shear connectors, and shear studs. Hydrodemolition can be used for localized removals where deterioration is confined to small areas and for large area removals in preparation for a bonded overlay. This technology can also be used to remove existing coatings from concrete.

Hydrodemolition has been used on the following types of structures:

- Bridge decks and substructures
- Parking structures
- Dams and spillways
- Water treatment facilities
- Tunnels and aqueducts
- Nuclear power plants
- Piers and docks
- Stadiums
- Warehouses
- Retaining walls

The Effects of Mechanical Impact Techniques

Mechanical methods such as chipping hammers, rotomills, scabblers, and scarifiers remove concrete by impacting the surface. These procedures crush (bruise) the surface, fracture and split the coarse aggregate, and create micro-fractures in the substrate (Fig. 1 and 2). As a result, the ability of the fractured substrate to provide a durable

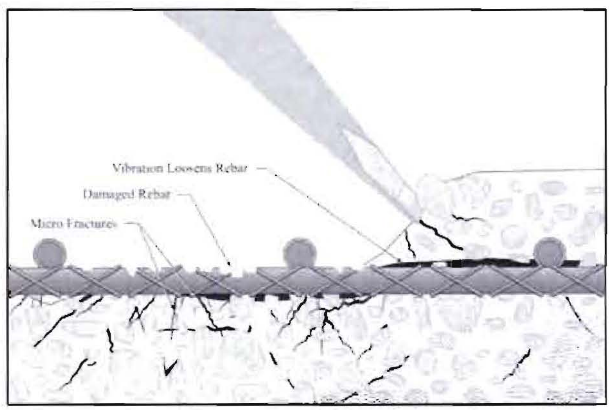

Fig. 1: Damage created by chipping hammer

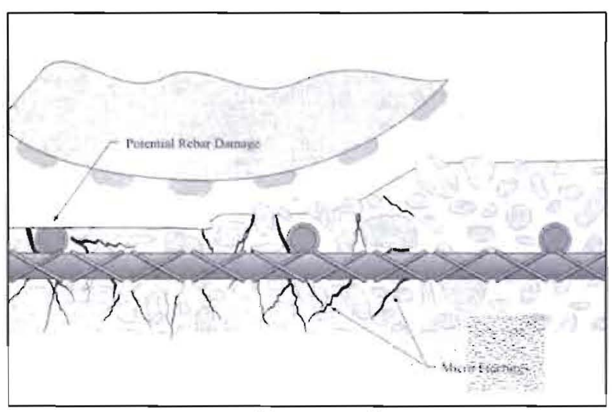

Fig. 2: Damage created by rotomilling

bond with the repair material is compromised, requiring a second step of surface preparation to remove the damaged region.

Furthermore, impact methods may damage the reinforcing steel and embedded items such as conduit, shear studs and connectors, and expansion joint hardware. Impact methods transmit vibrations through the reinforcing steel, which may cause further cracking, delamination, and loss of bond between the reinforcing steel and the existing concrete. Vibration and noise created by the mechanical impact will travel through the structure, disturbing the occupants. During repair of thin slabs and precast tees, chipping hammers may shatter the substrate resulting in unanticipated full depth repairs.

For a discussion on surface bruising and the mechanics of concrete removal by impact methods, refer to ICRI Technical Guideline No. 03732, "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays."

Hydrodemolition Benefits and Limitations

The benefits of hydrodemolition can be placed into two groups: structural benefits that improve the quality of the repair, and environmental benefits that improve the quality of the work place. Hydrodemolition also has limitations, which need to be considered.

Structural Benefits

- A rough, irregular surface profile is created to provide an excellent mechanical bond for repair materials;
- Surface micro-fracturing (bruising) is eliminated;
- Exposed aggregates are not fractured or split;
- Lower strength and deteriorated concrete is selectively removed;
- Vibration is minimal;
- Reinforcement is cleaned, eliminating the need for a second step of surface preparation; and
- Reinforcing and other embedded metal elements are undamaged.

During concrete removal, the water jet is directed at the surface, causing high-speed erosion of the cement, sand, and aggregate. The water jet does not cut normal weight aggregate which remains intact and embedded as part of the rough, irregular surface profile (Fig. 3). The aggregate interlocks with the repair material to assist in developing a

Fig. 3: Surface prepared by hydrodemolition has a rough irregular profile with protruding aggregate and is excellent for creating a mechanical bond

mechanical bond and composite action between the substrate and the repair material.

The rough, irregular surface profile provided by hydrodemolition can result in bond strengths that equal or exceed the tensile strength of the existing concrete. The concrete surface profile can exceed CSP-9 (very rough) as defined in ICRI Technical Guideline No. 03732.

Rotomills and scarifiers remove concrete to a uniform depth and may leave deteriorated concrete below the specified depth. Alternatively, the water jet moves in a consistent pattern over the surface and will remove unsound concrete even if it is below the specified depth.

Since the water jet does not create mechanical impact, vibration is not transmitted into the structure from the hydrodemolition operation. Delamination beyond the repair area caused by vibration of the reinforcing steel is greatly reduced.

During hydrodemolition, sand and cement particles mix with the water jet. The abrasive action of theses particles is usually sufficient to clean uncoated reinforcing bar and embedded metal items without damaging them. Corrosion material is removed from the reinforcing bar and metal items, allowing for easy inspection and identification of cross-sectional area loss. The reinforcing bar is cleaned without any loss of deformations. Cleaning of the entire reinforcing bar, however, will not occur if the reinforcing bar has not been completely exposed during hydrodemolition.

Environmental Benefits

- Minimizes disruptions to users of occupied space by significantly reducing transmitted sound through the structure;
- Increased speed of concrete removal can reduce construction time;
- Minimizes dust; and

- Robotic units reduce labor and minimize injuries as compared to chipping hammers.

Concrete removal by hydrodemolition can take place inside an occupied structure, such as a hotel, apartment building, office building or hospital with minimal noise disruption to the occupants.

Hydrodemolition can quickly remove concrete. As such, project duration can be reduced, minimizing the impact on the users of the structure.

During demolition, cleanup, and final wash down, the concrete debris and repair surface remain wet, minimizing dust in the work area. Since hydrodemolition cleans the reinforcing steel, the need to sandblast is eliminated unless additional concrete removal is required using chipping hammers. As such, silica dust in the work area is reduced, thereby providing a safer work environment.

The use of chipping hammers and other impact methods are labor intensive and physically demanding, which can cause injury to the employee. Robotic hydrodemolition equipment reduces the use of these tools and the possibility of injury.

Limitations

- The hydrodemolition process consumes a significant amount of water (6 to 100 gpm [25 to 380 lpm]). A potable water source must be available. The cost of the water should be considered;
- Wastewater containing sand and cement fines (slurry) must be collected, treated, and returned to the environment. Wastewater disposal may require a permit;
- Projects requiring total demolition can be done faster and more economically with crushers and similar equipment;
- Water can leak through cracks in the concrete and damage occupied space below the repair area. Hydrodemolition should not be used over occupied areas due to the risk of blow-through (unanticipated full-depth removal);
- Repair areas of varying strength will result in non-uniform removal. Areas of high strength may need to be removed using hand lances or chipping hammers;
- The water jet is blocked by reinforcing steel resulting in concrete shadows under the reinforcing bar that may need to be removed using hand lances or chipping hammers;
- Since the water jet of a robotic unit is contained in a metal shroud, some robots are unable to completely remove concrete up to a vertical surface such as a curb, wall or column. The remaining concrete may have to be removed using hand lances or chipping hammers;
- The water jet will remove the sheathing from post-tensioning tendons and may drive water into the tendon;
- The hydrodemolition robot may be too large to access small or confined areas of the structure;
- The water jet can damage coatings on reinforcing steel and other embedded items;
- The water jet can introduce water into electrical system components, especially if embedded in the concrete and already deteriorated or not properly sealed; and
- If cleanup is not properly performed in a timely manner, further surface preparation may be required.

The Hydrodemolition System

The hydrodemolition system consists of a support trailer or vehicle, high-pressure pump(s), a robotic unit to perform the demolition, and high-pressure hoses to connect the pump(s) to the robot. Hand lances are also available to remove concrete in areas inaccessible to the robot.

Support Trailer

Hydrodemolition units are typically transported on 40 to 50 ft trailers (Fig. 4). The robot may

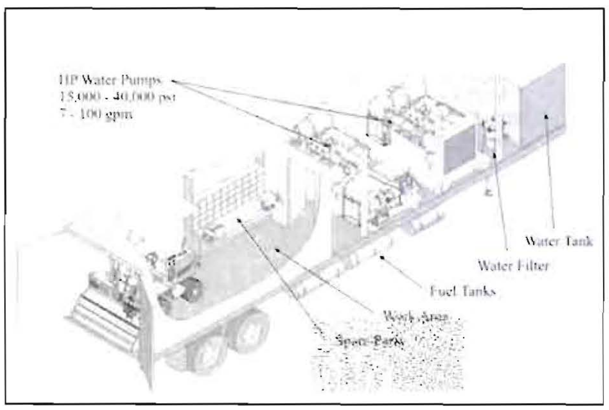

Fig. 4: Hydrodemolition support trailer. A self-contained unit transports pumps, robot, hoses, and spare parts

be transported on the same trailer or separately on a smaller trailer. The support trailer usually contains a supply of spare parts, tools, maintenance area, fuel and water storage, supply water hoses, and filters. These units are designed to be self-sufficient on the job site with adequate spare parts to perform routine maintenance and repairs.

High Pressure Pumps

The high-pressure pumps used for hydrodemolition are capable of generating pressures from 10,000 psi to 40,000 psi (70 to 275 MPa) with flow rates from 6 to 100 gpm (25 to 380 lpm). The pumps are driven by a diesel or electric motor, typically operating between 100 and 700 horsepower. The engine size will vary based on the flow and pressure rating of the pump. The pumps operate most efficiently at their design pressure and flow. High-pressure hoses connect the pumps to the robot. The pumps may be located a significant distance (500 ft [150 m]) from the actual removal area. However, due to a drop in pressure and flow through the high-pressure hoses, the pumps should be located as close as possible to the removal area, typically within 300 ft (100 m).

Robotic Removal Unit–Horizontal Surfaces

The force created by the high-pressure pump(s) is controlled using a robotic removal unit (Fig. 5). The robot is a diesel or electric powered, self-propelled, wheeled or tracked vehicle. It is used to uniformly move and advance the water jet over the surface during concrete removal.

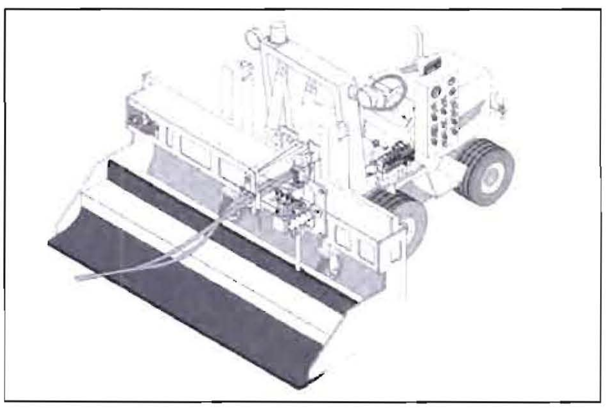

Fig. 5: Typical hydrodemolition robot

The water jet is mounted on a trolley that traverses over the removal area along a cross feed or traverse beam (Fig. 6) perpendicular to the advance of the robot. The water-jet nozzle may either oscillate or rotate (Fig. 7). The oscillating nozzle is angled forward in the direction of the traverse. Rotating nozzles are angled from the center, creating a cone effect while rotating (Fig. 8 and 9).

The nozzle assembly is enclosed within a steel shroud with rubber seals around the perimeter to contain the debris during demolition (Fig. 10).

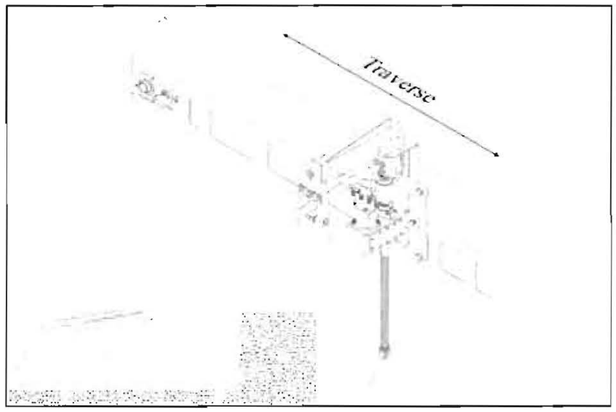

Fig. 6: Nozzle is mounted on a traverse beam

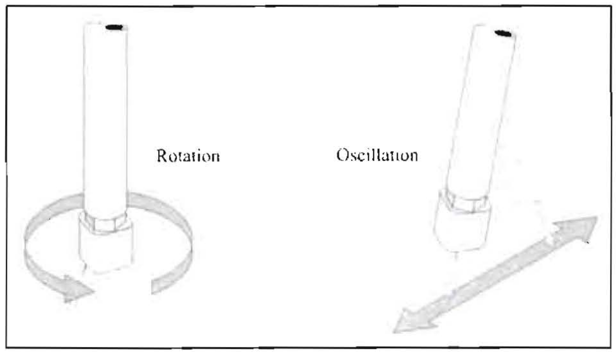

Fig. 7: Rotating or oscillating nozzles

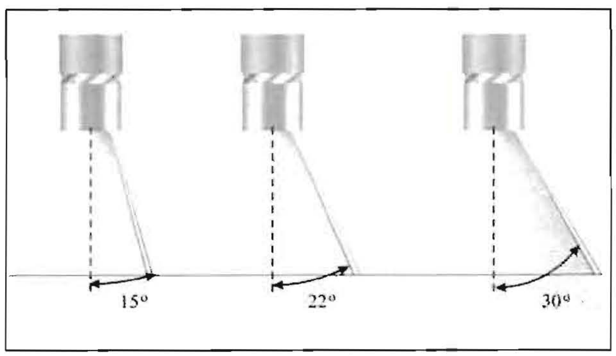

Fig. 8: Rotating nozzles are angled from center

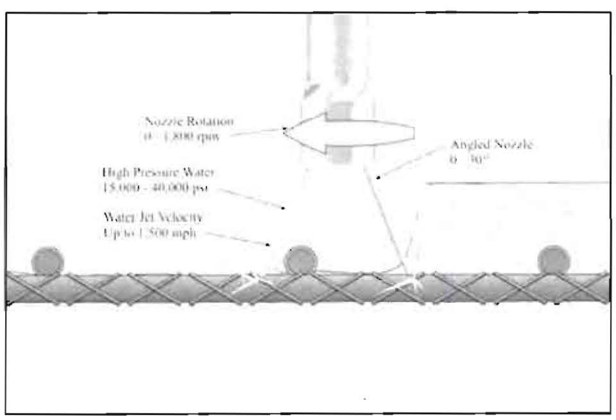

Fig. 9: Rotation of the angled nozzle creates a water cone

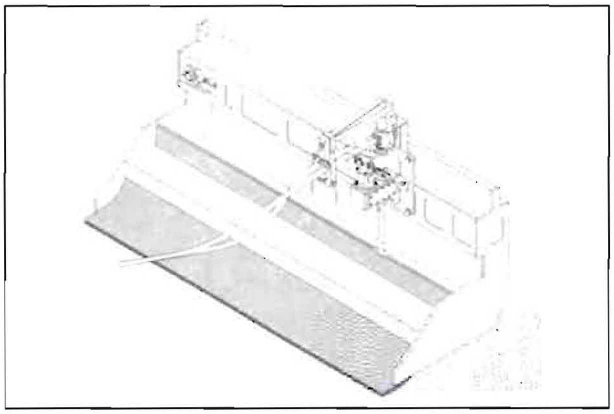

Fig. 10: Nozzle is enclosed within a steel shroud

The rotation/oscillation of the nozzle combined with the traverse and advance of the robot provide a uniform and continuous motion of the water jet over the removal area (Fig. 11). Each of these functions is fully adjustable. The depth of concrete removal is determined by the length of time the water jet is directed at the removal area.

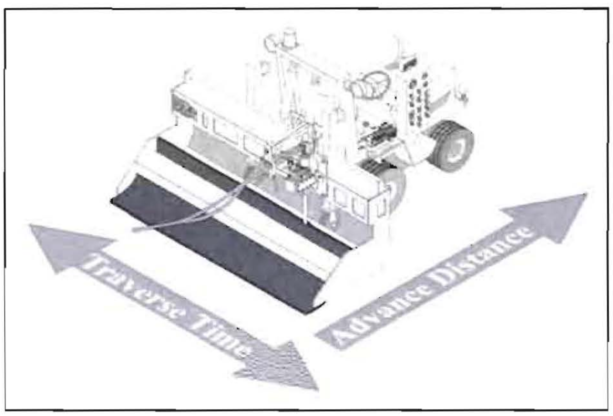

Fig. 11: The water jet traverses back and forth perpendicular to the forward advance of the robot

Adjusting the following parameters will increase or decrease the depth of removal:

a. Total traverse time (time of each traverse × number of traverses); and
b. Distance of the advance.

Once these parameters are set, the robot will reproduce the settings in a programmed sequence to provide consistent removal of the concrete. For example, during deep removal to expose the reinforcing bar 3 to 4 in. (75 to 100 mm), the traverse speed may be 8 seconds (the time required for the water jet to move from one side of the traverse beam to the other) and the water jet may traverse 3 times before the robot advances forward 1 to 2 in. (25 to 50 mm). On the other hand, for light scarification 1/4 to 1/2 in. (6 to 13 mm) or coating removal, the traverse speed may be 3 seconds and the water jet may traverse only one time before the robot advances 2 to 4 in. (50 to 100 mm).

The depth of concrete removal is controlled at the robot. Since the pumps are designed to operate at a specific pressure and flow rate, it is unusual to reduce the pressure (and subsequently the flow rate) to adjust the depth of removal.

Narrow areas may be removed by adjusting sensors that limit the movement of the water jet along the traverse beam. The traverse and advance functions limit the removal to a rectangular area along the advance path of the robot. Because the water jet is contained within a steel shroud, most robots are unable to remove concrete within 3 to 6 in. (75 to 150 mm) of vertical surfaces.

Specialized Robotic Equipment—Vertical and Overhead Surfaces

Various types of robotic equipment are available to perform removals on walls, soffits, substructures, beams, columns, and tunnels. These robots are often built on wheeled or tracked vehicles and have the ability to lift the traverse beam into the vertical or overhead position. The primary functions of traverse and advance are utilized in order to provide uniform concrete removal during vertical and overhead repairs.

As an alternative to the robot, the water jet may also be attached to a frame that allows the jet to move in a two dimensional "X-Y" plane. The X-Y movement of traverse and advance are present in these units to provide uniform concrete removal. The X-Y frames can be lifted and positioned over the removal area using a crane, backhoe, all-terrain forklift or other similar equipment.

Hand Lance

Hand lances operate at pressures of 10,000 to 40,000 psi (70 to 275 MPa) while delivering approximately 2 to 12 gpm (8 to 45 lpm) of water. Hand lances are not as fast or as precise for concrete removal as a programmed robot and are slower than chipping hammers. Hand lances are effective in performing light scarification and coating removals. It should be noted that the water jets on hand lances may not be shrouded, increasing the risk of debris becoming airborne. Hand lances can be used for removal of:

- Concrete shadows below reinforcing bar;
- Concrete adjacent to walls, columns, curbs, and in tight and confined areas not accessible to the robotic equipment; and
- Coatings.

Safety

Hydrodemolition involves the use of potentially dangerous specialized equipment. At all times, the manufacturer's instructions for the safe operation of the equipment and personal protective equipment should be followed, as well as all local, state, and federal regulations. Hydrodemolition units should be supervised and operated by qualified personnel certified by the equipment manufacturer.

Hydrodemolition employs high-velocity water jets to demolish concrete and perform surface preparation. Even though the water jet is shrouded on robotic units, debris can be propelled from beneath the shroud with sufficient velocity to cause serious injury. Serious injury or death can also occur if struck by the water jet. Hand lances are typically not shrouded and care must be exercised to avoid injury when using these tools.

Workers, equipment operators, and any individuals entering the work area are required to wear hard hats, safety glasses, hearing protection, safety shoes, gloves, long pants and long-sleeve shirts, and must be trained in the proper use of personal protective equipment. When using a hand lance, the operator should wear a full-face shield, rain suit, and metatarsal and shin guards. Additional protective clothing may also be required for use with hand lances. Everyone involved with the hydrodemolition operation should receive specific training outlining the dangers associated with the use of high-pressure water.

Prior to starting demolition, an inspection of the area should be performed including the area under the work area. All barricades, partitions, shielding, and shoring must be installed and warning signs posted to prevent unauthorized entry into the work area. The area below the work area must be closed off and clearly marked "Danger— Do Not Enter." Electrical conduits or other electrical equipment in the work area should be deenergized to avoid electrical shock.

Special precautions are required for post-tensioned structures as referred to in the section "Considerations for Hydrodemolition Use."

Hydrodemolition Applications

Scarification

Scarification is performed to remove the surface concrete and provide a rough profile (Fig. 12 and 13). Scarification is often used in preparation for

Fig. 12: Scarified surface with 1 in. aggregate

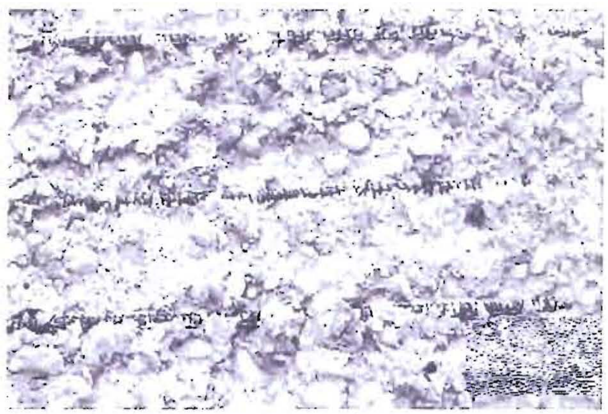

Fig. 13: Scarified surface with 3/4 in. aggregate

a concrete overlay. If the surface was previously rotomilled, the minimum removal depth using hydrodemolition should equal the size of the coarse aggregate to remove all concrete micro fractures and damaged or crushed aggregate.

Scarification may not remove all unsound concrete due to the rapid rate at which the water jet moves over the surface. It may be necessary to resurvey the scarified surface and identify delaminated or deteriorated areas for further removal.

Partial Depth Removal

Partial depth removal is commonly required if chloride contamination has reached the top mat of reinforcing steel or deterioration, delamination or spalling occurs within the top mat of reinforcing steel. Partial depth concrete removal can expose the top mat of reinforcing steel and provide clearance, typically a minimum of 3/4 in. (19 mm), below the bottom reinforcing bar of the top mat (Fig. 14 and 15). Determining the reinforcing bar size and concrete cover are critical to determine the required removal depth.

Concrete removal using hand lances or chipping hammers may be required to remove shadows under the reinforcing bar, previously repaired areas

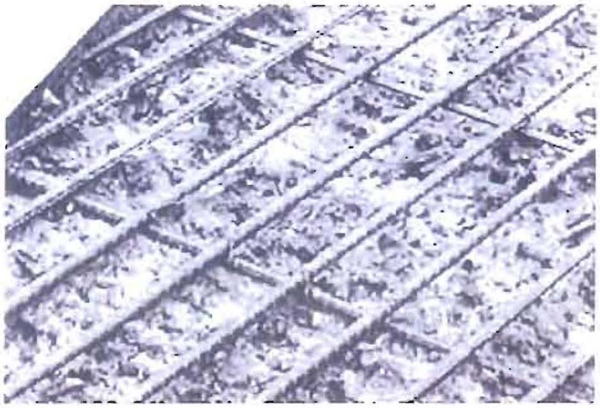

Fig. 14: Partial depth removal

Fig. 15: Partial depth removal on a retaining wall

or high areas resulting from variations in the strength of the concrete. In addition, concrete removal may be necessary adjacent to vertical surfaces such as curbs, walls and columns. Saw cutting of the perimeter of the repair area, if required, should be performed after hydrodemolition to prevent damage to the saw cut. This will require additional concrete removal along the repair perimeter with hand lances or chipping hammers. If the saw cut is made first, the area outside the saw cut should be protected using a steel plate. The steel plate will allow the water jet to slightly over run the saw cut without damaging the surface outside the saw cut while completely removing the concrete within the repair area.

Full Depth Removal

Hydrodemolition can be used for full depth removal where delamination has occurred in the lower mat of reinforcing or chloride contamination exists throughout the entire thickness of the slab. Full depth removal can be performed along expansion joints and other areas where there is a high concentration of reinforcing steel that may be damaged if conventional removal methods are used. Other structural elements such as shear connectors, shear studs, and steel beam flanges can be exposed without damage.

During full depth removal, the removal rate slows as the depth increases because the water jet stream dissipates as it moves away from the nozzle and the water jet must push more water and debris from its path prior to contacting the surface to be removed.

Full depth removal is often necessary on waffle or pan joist slab systems (Fig. 16).

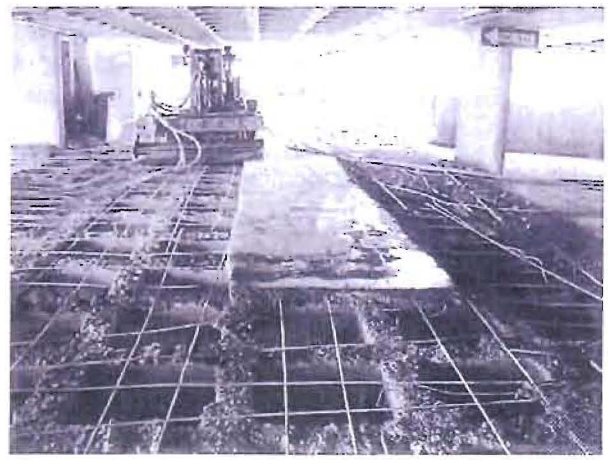

Fig. 16: Full depth removal—waffle slab

Coating Removal

Hydrodemolition can be used for the removal of epoxy, urethane, hot applied membrane, and other coatings from concrete surfaces (Fig. 17). When performing coating removal, a multiple jet nozzle is used. The multiple jets allow the water to penetrate the coating without damaging the concrete. However, if the concrete below the coating is deteriorated, it may be removed along with the coating.

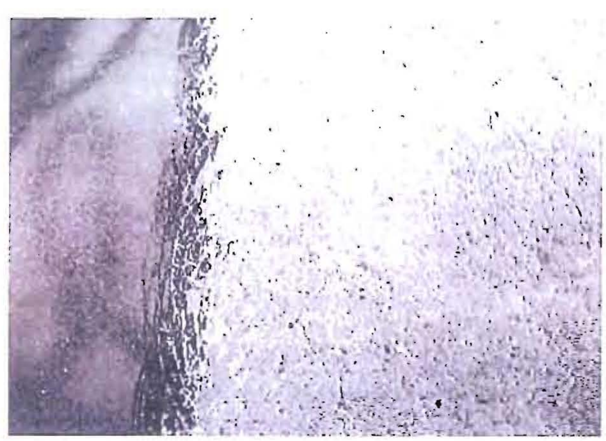

Fig. 17: Coating removal using a spinning, multi-nozzle spray head

Exhibit 21

The Hydrodemolition Process

Concrete removal by hydrodemolition is impacted by the following factors:

- Size and density of the aggregate;
- Concrete strength;
- Uniformity of concrete strength;
- Extent of cracking;
- Deterioration and delamination;
- Surface hardeners;
- Previous repairs with dissimilar strength material; and
- Size and spacing of reinforcing steel or other embedded items.

In sound concrete, the variation in the depth of removal will generally equal the size of the coarse aggregate (Fig. 18). For example, if the coarse aggregate is 1 in. (25 mm), $D = 1$ in. (25 mm) and the specified depth of removal is 2 in. (50 mm), the range of removal will be 2 in. (50mm) $\pm D/2$ (1/2 in. or 13 mm), or 1-1/2 in. (38 mm) to 2-1/2 in. (63 mm).

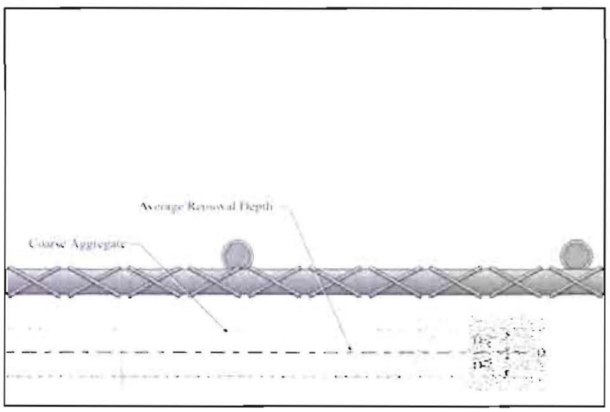

Fig. 18: The depth of removal depends on the size of the course aggregate

During hydrodemolition, a high-pressure water jet is uniformly moved over the surface and, provided the concrete is sound and the strength does not change significantly, the removal depth will remain consistent. Depth variations occur when the concrete strength changes, cracking or delamination is present, the concrete is deteriorated or the surface has been previously repaired using a different type and strength of material. In comparison, rotomilling or dry-milling equipment can be set to a specific depth and the milling drum will mill the surface to that depth regardless of any variations in the concrete strength, quality or level of deterioration.

If the strength of the concrete increases or a high-strength repair area is encountered during hydrodemolition, the removal depth will decrease (Fig. 19). The decrease in depth may not be immediately detected by the operator, resulting in an area of shallow removal (Fig. 20). To obtain the required depth in higher strength concrete, the total traverse time is increased and the advance of the robot is decreased. If the high-strength repair area is large enough, it may be possible to set up the hydrodemolition robot over the area and remove to the specified depth. This

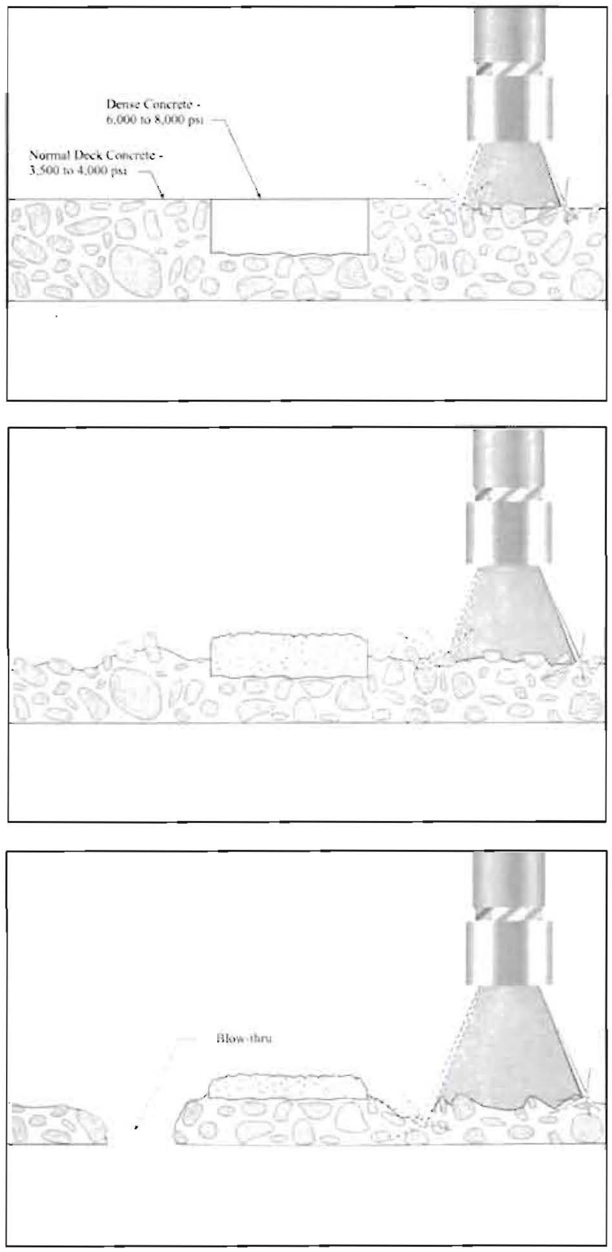

Fig. 19: High-strength concrete is removed at a slower rate than normal concrete, which can result in a non-uniform removal

Fig. 20: High-strength repair area within the hydro-demolition area

procedure can be problematic for two reasons. First, if the water jet overruns the high-strength repair area, it may result in a blow-through or full depth removal at the perimeter of the high-strength repair area. Second, since the water jet must be slowed significantly, it may cause excessive removal below the high-strength area once it is removed and the softer base concrete is exposed. For these reasons, it is often preferable to use chipping hammers in high-strength repair areas.

The opposite effect is encountered if the concrete strength decreases or there is cracking, deterioration or delaminations (Fig. 21). Concrete that is deteriorated, low strength or delaminated is removed faster than the surrounding sound concrete by the water jet. For example, if the average removal depth is 2 in. (50 mm) and there is a delamination that is 2 in. (50 mm) deep, the actual removal within the delaminated area could be 3 to 4 in. (75 to 100 mm) deep. For this reason, removal in an area that is seriously deteriorated and delaminated may not be consistent.

This effect is often described as "selective removal of deteriorated concrete." While the water jet is traversing and advancing uniformly over the surface, it is removing unsound, delaminated, deteriorated, cracked, and low strength concrete selectively below the specified removal depth.

Selective removal is not without limitations. For example, if the robot is traversing and advancing rapidly as during scarification, it may not remove deeper delaminations.

Size and spacing of the reinforcing steel will also influence the removal depth. The reinforcing steel blocks the water jet and shields the concrete below, creating concrete "shadows" (Fig. 22 and 23). Removal of concrete shadows becomes more difficult as the reinforcing bar size increases and is most difficult at reinforcing bar intersections. Increasing the specified depth of removal will minimize the amount of shadowing.

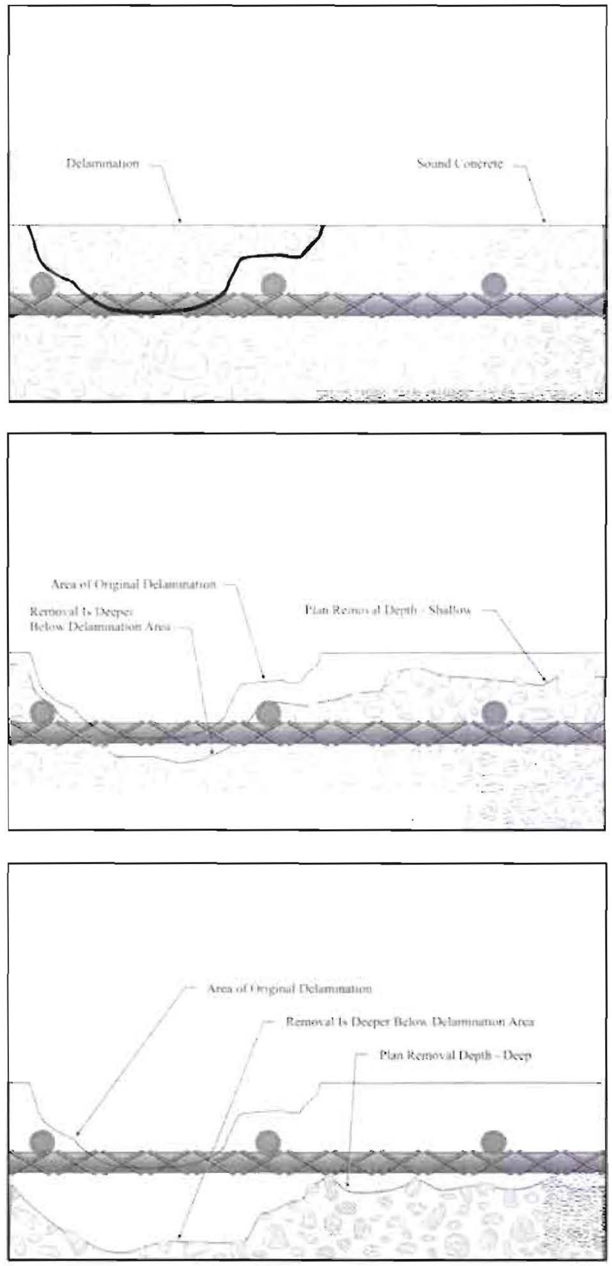

Fig. 21: Delaminated or deteriorated concrete is removed at a faster rate leading to non-uniform removal

Pointing the water jet under the reinforcing bar can reduce concrete shadows. This can be accomplished by using a rotating or oscillating nozzle (refer to Fig. 7-9). Rotating nozzles are typically angled 10° and 30° from center. The nozzle rotates between 100 and 1800 rpm, creating a demolition cone that will undercut both the transverse and parallel reinforcing bar provided the specified removal depth is greater than the

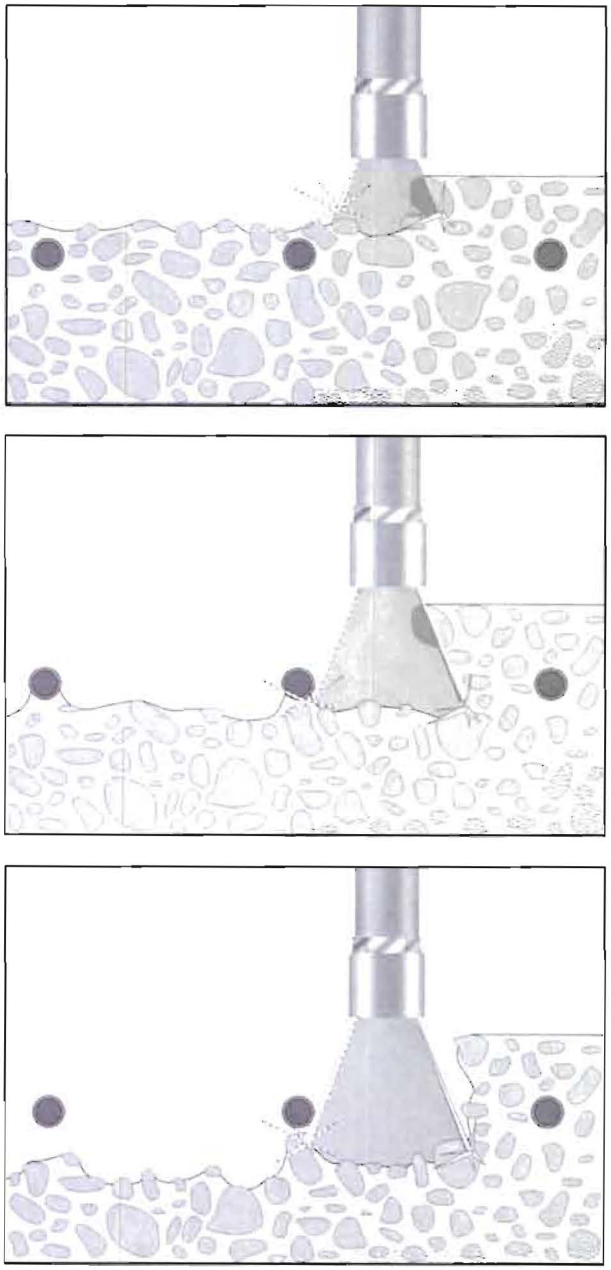

Fig. 22: Reinforcing steel blocks the water jet leaving a concrete "shadow" under the reinforcing. Increasing the removal depth will decrease the amount of shadowing

depth of the reinforcing bar. Similarly, the oscillating nozzle moves from side to side as it traverses, directing the water jet at an angle to the surface, cutting under the reinforcing bar. The nozzle is angled forward as it traverses left, and at the end of the traverse, flips to face forward as it traverses right. To minimize concrete shadows, the required depth of removal should be at least 3/4 in. (19 mm) below a #5 reinforcing bar. Larger reinforcing bars will require a greater removal depth to minimize shadowing. While this additional

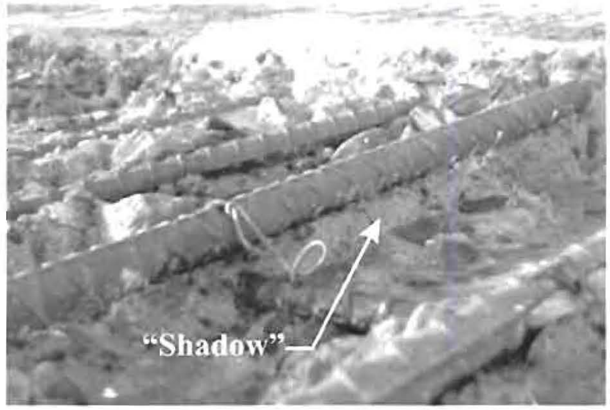

Fig. 23: "Shadow" under the rebar (note tie wire undamaged and in excellent condition)

removal may result in the removal of sound concrete, it will minimize the need for concrete removal under the reinforcing bar with chipping hammers or hand lances.

Considerations for Hydrodemolition Use

Issues that should be considered when evaluating the use of hydrodemolition for a repair project include:

Limited quantity of repair: Mobilization and set up of the hydrodemolition equipment can be expensive. If there are only minor repairs or a limited quantity of repairs, the mobilization cost may make the process uneconomical.

Increase in repair quantity: The traverse and advance function of the hydrodemolition robot results in removal areas that are rectangular. The removal areas may have to be "squared up" in order for the hydrodemolition equipment to efficiently remove the concrete. "Squaring up" the repair areas may lead to an increase in the removal quantity and the cost of the project.

Reinforcing bar size and concrete cover: Partial-depth removal normally requires clearance below the bottom reinforcing bar of the top mat of reinforcing. The size and quantity of the reinforcing bar and the concrete cover over the reinforcing bar should be determined in order to specify the correct removal depth to achieve the required clearance.

Potential for full-depth blow-throughs: Hydrodemolition of severely deteriorated structures may result in full-depth blow-throughs. Blow-throughs may take place where full depth slab cracks occur, especially if deterioration is evident on the slab underside. Shielding may be required to protect the area below from damage. Shoring below the blow-through may be damaged or destroyed. When the water jet is in the open air, as will happen when the water jet blows through the deck, it is extremely noisy (may exceed 130 db) and dangerous. Sound resistant partitions should be installed to contain the noise within the structure if blow-throughs are expected.

Extent of previous repairs: Repair materials may have a different compressive strength than the original concrete. Since the hydrodemolition jet is set to move at a uniform rate, the presence of dissimilar strengths of material will result in a variation in the depth of removal. Higher strength areas may require further concrete removals using chipping hammers or hand lances to achieve the specified depth of removal. Lower strength areas may result in deeper removals and possibly full-depth blow-throughs.

Occupied areas adjacent to or under the repair area: Occupied spaces such as stores or offices may occur in the structure. It may not be practical to perform hydrodemolition adjacent to or over these areas. Water from the hydrodemolition may leak to the occupied level below. As such, the repair area should be protected to prevent water from entering the occupied area.

Shoring requirements: During structural repairs, concrete may be removed from around the top reinforcing. An analysis of the structural capacity of the remaining slab section should be made by a qualified engineer to determine if shoring will be required. The weight of the hydrodemolition robot should be considered when determining shoring requirements.

Equipment location: The hydrodemolition equipment is transported on a trailer. If possible, the pumps should be located within 300 ft of the repair area. A suitable location next to the structure must be selected. Pump units that are powered by diesels engines should not be located next to the air intake of adjacent buildings. In congested metropolitan areas, the pumps may be removed from the trailer and placed within the structure. Diesel powered pumps will need to be located close to an exhaust shaft and the exhaust from the pumps piped to this location. A fuel tank will also have to be placed in the pump area and provisions made to fill the tank as required. Although electric pumps may be used inside the structure eliminating the fueling and exhaust concerns, they have a substantial power requirement and will need an electrical service installed. Due to the weight of the pumps, they may need to be placed on the slab on ground or in a shored area of the structure. Temporary shoring may be needed to move the pumps into the structure.

Available water sources: Pumps used for hydrodemolition require a steady supply of clean water at a sufficient volume to perform the work. Generally, local municipal water is used for hydrodemolition. Sources close to the work area, such as a nearby fire hydrant or water line feeding the structure, should be adequate. Specific water requirements will vary, depending on the hydrodemolition unit used for the project and the method of cleanup. Cleanup performed using a fire hose operating at 100 to 200 gpm (380 lpm to 760 lpm) will use substantially more water than an 8000 to 10,000-psi (55 to 70 MPa) water blaster operating at 8 to 12 gpm (30 to 45 lpm). In remote areas, water can be drawn from wells, fresh water lakes, rivers, or streams. This water must be pre-filtered to remove any suspended solids to avoid damage to the high-pressure pumps. Recycled water has been used for hydrodemolition, however, it can add substantially to the cost of the project due to collection and filtration of the water and the added wear to the equipment caused by dissolved minerals in the recycled water. When available, potable water is used. Water may have to be trucked into remote locations.

Post-tensioned structures: The use of hydrodemolition on post-tensioned structures has potentially severe risks and must be carefully evaluated to maintain a safe working environment, maintain structural integrity, and to preserve the long-term durability of the structure. Sudden release of anchorages can result in dangerous explosive energy and flying debris capable of causing damage to equipment and serious injury or death to workers. Tendons should be de-tensioned prior to removing concrete from around anchorages to prevent the sudden release of the anchorages and loss of pre-stress forces. The loss of pre-stress forces may result in the loss of structural integrity and result in the need for shoring. Careful evaluation must also be exercised when removing concrete around post-tensioning tendons. Removal of concrete around tendons can result in a change of tendon profile, which may also result in the loss of prestressing force and structural integrity.

The wires or strands of post-tensioning tendons are usually undamaged during hydrodemolition, however the sheathing and protective grease will be removed from unbonded tendons. In bonded post-tensioning tendons, the water jet may penetrate the duct and remove the grout inside. In either case, the hydrodemolition water may enter the tendon at the edge of the repair area and can be driven into the tendon outside the work area. Water remaining in the tendon can cause future corrosion affecting the long-term durability of the post-tensioning system. Each tendon must be carefully examined and any water that has entered the tendon removed. Both the grease and the protective sheathing must be restored.

It may not be possible to remove moisture that has entered the post-tensioning system during the hydrodemolition process. In addition, verification of the presence of moisture is difficult and may not be possible. Refer to ICRI Technical Guideline No. 03736, "Guide for the Evaluation of Unbonded Post-Tensioned Concrete Structures," for suggested procedures to detect water in post-tensioning tendons. Long term monitoring for future corrosion may also be prudent.

Conduit and embedded metal items: Embedded aluminum and steel conduit will not be damaged by hydrodemolition if they are in good condition. However, deteriorated portions of aluminum and steel conduit will be damaged and water will enter the conduit system. PVC conduit will be damaged during hydrodemolition. As a safety precaution, all conduits should be deenergized during demolition. Other metal items within the removal area such as shear connectors, shear studs, and anchorages will not be damaged by hydrodemolition.

Noise limitations: Hydrodemolition does not produce sound that is transmitted through a structure, however, the noise from the hydrodemolition unit in the work area is sufficiently loud to be objectionable to the public. Furthermore, noise can be excessive during full-depth repairs or blow-throughs. Sound reducing partition walls that separate the public from the work area may be required. Acoustical studies indicate that the sound waves created by hydrodemolition are low frequency and are best controlled using dense material such as sheet rock or concrete board. There are a variety of sound deadening materials supplied by various vendors that have proven effective in controlling noise. Partition walls should be protected from moisture. If properly sealed at the base, a water resistant sound reducing partition wall will also assist in containing the water within the work area.

Protection of lighting, sprinklers, and other services: Light fixtures, fire protection systems, and other services may be damaged by airborne debris from the hydrodemolition or clean up operation. If full depth removal or blow-throughs are anticipated, light fixtures may need to be removed and stored and temporary lighting installed. Sprinkler heads may need to be protected. Mist and high humidity in the work area could damage electrical panels and other services. Items remaining in the work area should be protected.

Temperature: When the temperature falls below freezing, the structure must be heated or the hydrodemolition stopped to prevent water from freezing in the work area.

Test Area

A test area should be designated to establish the operating parameters and to demonstrate that the equipment, personnel, and methods of operation are capable of producing satisfactory concrete removal results. The test should include sound and deteriorated concrete areas, each a minimum of 50 ft^2 (5 m^2). First the robot is set to remove sound concrete to the specified depth. Once the operating parameters have been determined, the equipment is moved to the deteriorated area and a second test is performed using the same operating parameters. If satisfactory results are achieved, the quality and depth of removal will become the standard for the project. If hand lances are to be used to perform concrete removals, they should also be demonstrated to show satisfactory results.

It is noted that the hydrodemolition robot will move the water jet over the surface in a constant motion and if the concrete is of uniform strength, the removal depth will be consistent. However, since concrete is seldom uniform, there will be variations in the removal depth on the project. Other factors affecting the removal depth include the extent and depth of deterioration, the size and quantity of reinforcing bar, the concrete cover over the reinforcing bar, and the presence of surface hardeners. As the equipment is used, nozzles will wear, changing the force created by the water jet. As such, the hydrodemolition equipment operator must monitor the depth and quality of removal and adjust the parameters of the robot to provide consistent removal throughout the project.

Wastewater Control

Controlling the wastewater has often been viewed as one of the more difficult tasks associated with the use of hydrodemolition. However, with preplanning and proper installation of a wastewater control system, the water can be properly managed (Fig. 24). Hydrodemolition wastewater should be

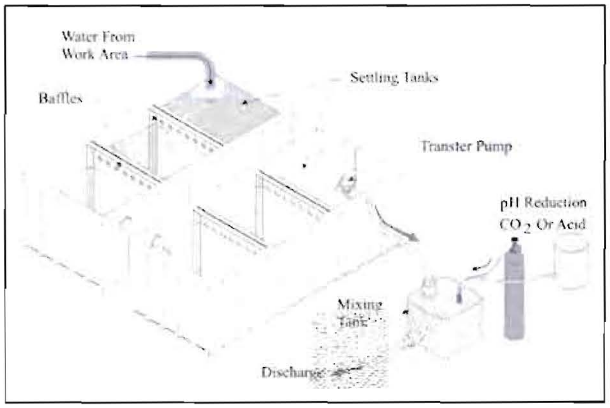

Fig. 24: Typical wastewater handling system

discharged to the storm or sanitary sewer or to the ground for absorption and/or evaporation under permit from the controlling authority. Discharge into an existing storm or sanitary line may occur in the structure or to a nearby storm or sanitary line accessed through a manhole. A 4-in. (100 mm) connection should be adequate. Wastewater may not be discharged directly to a wetland, stream, river or lake.

Hydrodemolition wastewater contains suspended particles and typically has a pH of 11 to 12.5. The wastewater is initially placed in settling tanks or ponds to reduce the suspended solids. The particles are heavy and settle out quickly as the water is allowed to stand. This can also be accomplished by allowing the water to pass through a series of berms that are lined with filter fabric or hay bales.

The controlling authorities for discharge have varying requirements for the level of suspended solids and the range of pH for discharge into their system. Typically the water should be clear and the pH range between 5 and 10. Ponding the water will clarify it, however, the pH of the wastewater may have to be reduced prior to discharge. This can be accomplished by the introduction of acid, CO_2 or other pH reducing materials into the wastewater. Adding flocculants can assist in reducing suspended solids. A location for settling ponds or tanks and pH reducing equipment should be determined.

The cost to discharge wastewater ranges from the cost of a discharge permit to charges for the actual water consumed and discharged. The cost of water consumed is generally that of commercial water usage within the community. The controlling authority may require monitoring and testing of the wastewater. Local ordinance requirements must be reviewed and met prior to discharge, including the obtaining of proper permits.

Water containment and collection systems will vary depending on the structure. Where possible, it is best to take advantage of gravity to move the water to the treatment area. In many structures, the slab on ground can be used to collect and treat the water. The water may be allowed to flow through the structure to the lowest level or through the existing drains, which have been disconnected just below the underside of the first supported level. All slab-on-ground drains should be plugged and water should not be allowed to enter the drainage system prior to treatment. Once the water is clear and the pH adjusted, it can be pumped directly to the discharge point. Additional treatment capacity may be necessary if rainwater cannot be separated from the wastewater.

Floor slabs and decks are commonly crowned or sloped to provide drainage. Since water will run to the low area, a simple method of water control involves the use of hay bales or aggregate dams, which can be set up along curb lines or the perimeter of the work area. As the water ponds in front of the hay bales or aggregate dams, the suspended solids will settle out. In areas where the drains are plugged, the water is forced to pass through the hay bales or aggregate dams. Retention ponds can be built at the end of the structure and the water directed or pumped to these ponds. Settling tanks can also be used and the water pumped from the structure to the tanks.

Debris Cleanup and Disposal

Hydrodemolition debris consists of wet sand, aggregate, chips or chunks of concrete, and slurry water. Slurry contains cement particles and ranges from muddy water to a thick paste. Removal of the debris should occur as soon as possible to prevent the debris from solidifying and adhering to the surface, making cleanup more difficult.

Tools used for cleanup include: fire hoses, pressure washers, compressed air, sweepers, skid steer loaders, vacuum trucks, and manual labor.

The types of cleanup will vary based on the type of removal performed as follows:

1. *Above the reinforcing bar*—any removal depth above the top reinforcing bar of the top mat of reinforcing and the reinforcing bar remains supported by the concrete;
2. *Below the reinforcing bar*—any removal depth below the top mat of reinforcing bar in which the top reinforcing bar mat becomes unsupported by the original concrete; and

3. *Full-depth* removal.

During *above the reinforcing bar* clean up, equipment such as skid steer loaders, sweepers, and vacuum trucks may be driven over the surface to assist with the cleanup (providing they meet the weight requirements of the structure). The debris can be swept, pressure washed or air blown into piles where it is picked up by a loader. A vacuum truck may be used to vacuum the debris from the surface. In all cases, the surface must be pressure washed to remove any remaining cement slurry.

If the removal is *below the reinforcing bar* and the reinforcing bar is unsupported, it is difficult and possibly unsafe to drive equipment into the removal area. The debris can be removed by washing with a fire hose (large water consumption), pressure washing or blowing it onto the adjacent original surface where it can be picked up with a loader. A pressure washer operating at 8000 to 10,000 psi (55 to 70 MPa) and 8 to 12 gpm (30 to 45 lpm) is effective. Vacuuming has proven very effective in removing debris from around the reinforcing steel, however, the surface will require pressure washing to remove the cement slurry and paste.

During *full-depth removal*, the debris simply falls to the floor below where it can be picked up with a loader.

The debris, which consists of wet sand, aggregate, chips or chunks of concrete, and slurry is placed in dumpsters or hauled away in trucks and may be recycled or placed in a landfill in accordance with the requirements of the controlling authority.

Removal Depth Measurements

Following hydrodemolition, the surface profile is very rough and three depth measurements are possible (Fig. 25):

1. Minimum removal—original surface to the shallowest removal point.
2. Maximum removal—original surface to the deepest removal point.
3. Average depth of removal—The difference between the minimum and maximum removal at the same location.

Measuring the depth of removal can be accomplished using:

1. A straight-edge placed on the original surface;
2. A string-line pulled over the removal area; and
3. A surveyor's level.

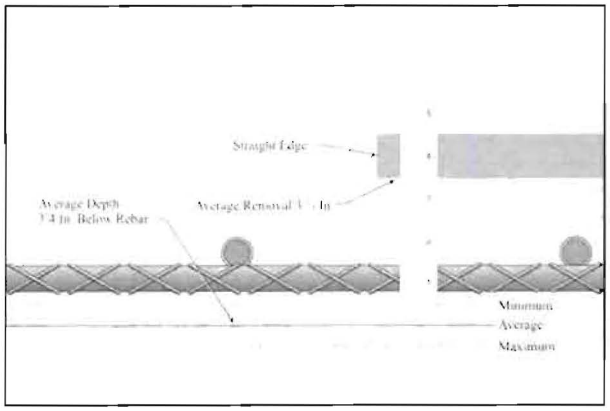

Fig: 25: Measuring depth of removal using a straight edge

The most common practice of measuring the depth of removal is to place a straightedge on top of the original surface and extend it over the removal area. Measurements are taken from the bottom of the straightedge to determine the depth of removal. This quick and simple technique can only be used during the removal process and is not applicable for final measurements in large removal areas.

A string line may be pulled over the removal area and measurements taken below the string. However, this method could provide incorrect results if slopes or crowns occur in the original surface. Surveying equipment may be used and is very accurate; however, to account for slopes, pitches and crowns in the original surface, a detailed survey must be made of the original surface prior to removal and measurements taken at the same locations after removal for comparison and determination of the actual removal depth.

Summary

Effective concrete removal and proper surface preparation are key elements to a successful repair project. A surface prepared using hydrodemolition is rough, irregular, and is excellent in creating a mechanical bond with the repair material. Hydrodemolition eliminates micro-fractures and damage to reinforcing steel, minimizes transmitted noise and dust, and cleans the reinforcing steel.

The use of hydrodemolition may not be appropriate for every structure and a careful review of the benefits and limitations of the process relative to each structure should be undertaken. Proper safety procedures must be observed at all times when using hydrodemolition.

Exhibit 22: ACI 546R-04