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 MCGAUGHY, R.W. Iowa Electric Light & Power Co.
 RECIP. NAME RECIPIENT AFFILIATION
 DENTON, H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards response to 840222 request for addl info re IE
 Bulletin 80-11, "Masonry Wall Design."

SEE REPTS

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Iowa Electric Light and Power Company

April 23, 1984
NG-84-1681

Mr. Harold Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Masonry Wall Design

Dear Mr. Denton:

This letter is submitted in response to Mr. D. B. Vassallo's letter dated February 22, 1984 regarding masonry block walls at the DAEC. The information contained in Attachments 1 and 2 provides our response to the information requested.

Please contact this office if there are additional questions regarding this subject.

Very truly yours,

R. W. McGaughey

Richard W. McGaughey
Manager, Nuclear Division

RWM/BWR/dmb*

cc: B. Reid
L. Liu
S. Tuthill
M. Thadani
NRC Resident Office
Commitment Control No. 84-0041

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50-331

MASONRY WALL DESIGN

Docket # 50-331
Control # 8404260150
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Response to
Request for Additional Information
Masonry Wall Design, IE Bulletin 80-11
(dated February 22, 1984)
Duane Arnold Energy Center
Docket No. 50-331

1.a Question: With reference to the reinforcement in masonry walls, the ACI 531-79 Code (1) specifies that the minimum area of reinforcement in a wall in each direction, vertical or horizontal, shall be 0.0007 (0.07%) times the gross cross-sectional area of the wall and that the minimum total area of steel, combined vertical and horizontal, shall not be less than 0.002 (0.2%) times the gross cross-sectional area. Clarify whether the reinforced walls at this plant meet the above requirements. It should be noted that the horizontal reinforcement is installed to satisfy the minimum reinforcement requirement for a reinforced wall.

Response: The masonry walls reviewed at DAEC for Bulletin 80-11 meet the reinforcing requirements of ACI 531-79 for reinforced masonry walls. This is based on a review of design drawings for masonry walls at DAEC (See Reference 3, Attachment 5, Design Drawings A-21, Revision 5 and A-22, Revision 2). We have summarized the percentages of horizontal and vertical reinforcement for various wall thicknesses in the table below.

Wall Thicknesses	% of Reinforcement		
	Vertical	Horizontal	Total
8"	0.24	0.32	0.56
12"	0.16	0.21	0.37
2'-3"	0.14	0.15	0.29
4'-0"	0.116	0.081	0.203

Note: 1. For wall thicknesses between 12" and 2'-3" the percentage of reinforcement would be greater than the percentages specified for a 2'-3" wall thickness.

2. For wall thicknesses between 2'-3" and 4'-0" the percentage of reinforcement would be greater than the percentages specified for a 4'-0" wall thickness.

1.b Question: If the joint reinforcement is used to resist tension in the walls meeting the above minimum requirements, it should follow the working stress design method which limits its allowable to 30 ksi. Please clarify whether this requirement has been satisfied. If this requirement is not satisfied, identify all affected walls along with the calculated stress value for each wall and indicate specific actions planned to correct this situation.

Response: The masonry walls reviewed at DAEC for Bulletin 80-11 are reinforced masonry walls which meet the reinforcing requirements of ACI 531-79. The working stress design method was the method of design utilized (unless noted otherwise for load combinations involving extreme environmental or abnormal loads).

Joint reinforcement was used in resisting the tension in masonry walls. The calculations used an allowable stress for joint reinforcement equal to 24 ksi which is less than the allowable specified by ACI 531-79 ($F_s = 30$ ksi). This allowable stress was increased for loading combinations as defined in Reference 3, Attachment 3, Section 5.2.

Therefore the walls reviewed at DAEC for Bulletin 80-11 meet the requirements as stated in the question above.

1.c Question: Indicate if there are any walls that may have been qualified using the tensile resistance of the joint reinforcement but not satisfying the above stated minimum requirements. It should be noted that the NRC, at present, does not approve the use of joint reinforcement to qualify this type of wall (See attached staff position). In view of this, indicate all walls belonging to this category and your intended actions to bring those walls in compliance with the staff criteria.

Response: As previously stated the masonry walls reviewed at DAEC for Bulletin 80-11 meet the reinforcing requirements of ACI 531-79 for reinforced masonry walls. Therefore no walls have been qualified using the tensile resistance of the joint reinforcement which do not satisfy the requirements stated in Question 1.a.

2. Question: With respect to the compressive strength of masonry and mortar strength, the Licensee indicated that a test program was conducted (2) to confirm the assumed values used in the analysis ($f_m' = 2000$ psi and $m_o = 2000$ psi). Indicate whether the tests were conducted in accordance with ASTM C140 for the masonry units and ASTM E447 for the masonry prisms. Also provide the test results for review.

Response: Attachment 2 are the test reports for the masonry block and mortar used in the construction of masonry walls at DAEC. The test reports for masonry block do not make specific reference to the procedure used for testing, but do specify that the block conforms to ASTM C90, Grade NI (with exception to moisture content). In reviewing the ASTM specification (ASTM C90) for Hollow Load-Bearing Concrete Masonry Units the specified sampling and testing procedure is ASTM C140. This indicates that the tests were conducted in accordance with ASTM C140.

The masonry prism test (ASTM E447) was not conducted for testing masonry compressive strength.

3. Question: Please note that the NRC is currently preparing a position statement regarding the energy balance technique, which will be forwarded to the Licensee in the near future. In the meantime, please clarify whether the following walls have also been qualified by the energy balance technique: 412-13, 412-14, 412-17, and 412-18 (from Attachment 4 of Reference 2). If yes, explain why they were not included in the first response of Reference 2.

Response: Wall 412-13 (subject to pipe rupture load) was originally analyzed using yield line theory as stated in Reference 3, Attachment 4, Page 7 of 11. This wall was re-examined after the NRC expressed a concern with the use of yield line theory. Our re-evaluation of this wall determined that the wall would behave elastically using an energy balance technique as a method of analysis. This is stated in the revised report Reference 2, Attachment 4, Page 7 of 11.

Walls 412-14 and 412-17 were analyzed using the working stress design method. The energy balance technique or yield line theory was not used in the qualification of these walls. (Note: Reference 3, Attachment 4, Page 7 of 11 stated that wall 412-17 used "Yield Line Theory for pipe break". This wall was reanalyzed (for jet impingement load) using working stress design method and Reference 2 deleted the comment with regard to "Yield Line Theory for Pipe Break").

Wall 412-18, (subjected to seismic and room pressurization loads) was originally analyzed using an inelastic energy balance technique as stated in Reference 3, Attachment 4, Page 7 of 11. This wall was re-examined after the NRC expressed a concern with the use of inelastic energy balance technique. Our re-evaluation of this wall determined that the wall would behave elastically using the working stress design method. Therefore the comment stating "Energy balance with pipe break loading" was deleted in the revised report Reference 2, Attachment 4, Page 7 of 11.

- References:
1. ACI 531-79 and ACI 531-R-79
Building Code Requirements for Concrete Masonry Structures
American Concrete Institute, 1979.
 2. L.D. Root (Iowa Electric Light and Power Company) Letter
with Enclosures to H.D. Denton (NRC)
Subject: IE Bulletin 80-11, Masonry Wall Design
October 6, 1982 (LDR-82-264)
 3. L.D. Root (Iowa Electric Light and Power Company) Letter
with Enclosures to J.G. Keppler (NRC)
Subject: IE Bulletin 80-11, Masonry Wall Design
November 10, 1980 (LDR-80-335)

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF: **CONCRETE BLOCK TEST**
DUANE ARNOLD NUCLEAR PLANT
PROJECT: PALO, IOWA - PROJECT NO. 7884

DATE: November 24, 1971

REPORTED TO: Bechtel Corporation

FURNISHED BY: Cedar Rapids Block Company

P.O. Box 209

COPIES TO:

Palo, Iowa 52324

Attn: M.E. Daubenheyer

LABORATORY No. 6-9695

 ASTM:C90-70
 SPECIFICATIONS
 GRADE "N-I"
DIMENSIONS:

Sample Number	6	7	8	9	10	Individual Unit	Average of 5 Units
Size and Type of Block	12"x8"x16"	Heavy	density				
Length (in.)	15 5/8	15 5/8	15 5/8	15 5/8	15 5/8		
Width (in.)	11 5/8	11 5/8	11 5/8	11 5/8	11 5/8		
Height (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Shell Thickness (in.)	1 33/64	1 17/32	1 17/32	1 17/32	1 17/32		Minimum 1 1/2"
Web Thickness (in.)	1 9/32	1 17/64	1 59/64	1 9/32	1 19/64		Minimum 1 1/8"
Weight as Received (lb.)	54.69	57.30	54.52	54.40	54.20		
Number of Cells	2	2	2	2	2		
Voids (%)	51	51	51	51	51		
Equivalent Web (in./lin. ft.)	3.04	3.04	3.01	3.04	3.02		Minimum 2 1/2"
Date Cast							

ABSORPTION:

Per Cent	5.8	3.5	5.9	5.7	5.9		
Lb./Cu. Ft.	7.9	4.9	8.0	7.7	8.0		Maximum 13pcf
DRY DENSITY (pcf)	136	141	136	137	136		

MOISTURE CONTENT AS RECEIVED:

Per Cent of Total Absorption	42	73	42	44	42		Maximum 35%
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COMPRESSION:

Load (lb.)	315,000	400000+	311,000	267,000	353,000		
Gross Area (sq. in.)	182	182	182	182	182		
Gross Unit Load (psi)	1730	2200+	1710	1470	1940	Min.800psi	Min.1000psi
Net Area (sq. in.)							
Net Unit Load (psi)							
Date of Test	November 23, 1971						

POTENTIAL SHRINKAGE (%)

REMARKS: The above blocks meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content.

Samples were submitted to the laboratory and received here on November 5, 1971.

This work was authorized by your Purchase Order Number 7884-F-6959.

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

Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



CONCRETE BLOCK TEST

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Corporation
Box 209
(3) Palo, Iowa 52324

DATE: 12-7-71
FURNISHED BY:
Copies to: (3) TCT & EL, Inc.-Waterloo
(3) TCT & EL, Inc.-Palo

LABORATORY No. 70-1966

DIMENSIONS: 8" x 8" x 16" Heavy Density

ASTM C90-70
SPECIFICATIONS
GRADE "N-I"

Sample No.	W-1	W-2	W-3	W-4	W-5	Individual Average of	
Type of Block	Corner	Std.	Std.	Std.	Std.	Unit	5 Units
Length (Inches)	15 10/16	15 11/16	15 10/16	15 10/16	15 10/16		
Width (Inches)	7 11/16	7 11/16	7 11/16	7 11/16	7 11/16		
Height (Inches)	7 10/16	7 10/16	7 10/16	7 11/16	7 10/16		
Shell Thickness (Inches)	1 4/16	1 5/16	1 6/16	1 4/16	1 6/16		Min. 1 1/4"
Web Thickness (Inches)	1 1/16	1 1/16	1 1/16	1 1/16	1		Min. 1"
Weight (Lbs.)	41.37	39.10	40.47	39.40	40.80		
No. of Cells	2	2	2	2	2		
Voids (%)	46	48	47	48	46		
Equivalent Web (in./1-f.)	2.45	2.44	2.45	2.45	2.30		Min. 2 1/4"

COMPRESSION:

Load (Lbs.)	179,000	204,500	265,000	217,800	287,000		
Gross Area (Sq. In.)	120	121	120	120	120		
Gross Unit Load (Lbs./Sq. In.)	1490	1690	2210	1810	2390	Min. 800psi	Min. 100 psi
Date of Test	December 6, 1971						

ABSORPTION:

Per Cent	4.5	4.9	4.5	4.8	4.2		
Lbs. Cu. Ft.	6.3	6.7	6.3	6.6	6.0		Max. 13 psi

DENSITY (Lbs./Cu. Ft.) 139 138 140 138 140

MOISTURE CONTENT (%) 62 53 51 59 51 Max. 35%

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content as received.

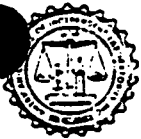
Samples W-1 through W-5 were submitted to the laboratory and received here on 11-30-71.

Twin City Testing and Engineering Laboratory, Inc.

By Paul E. Petch

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF: **CONCRETE BLOCK TEST**
PROJECT: **DUANE ARNOLD NUCLEAR PLANT**
PALO, IOWA
PROJECT NUMBER 7884
REPORTED TO: **Bechtel Corporation**
P.O. Box 209
Palo, Iowa 52324
Attn: M.F. Daubenheyer

DATE: December 22, 1971
FURNISHED BY: **Bechtel Corporation**
COPIES TO: **Bechtel Corporation**

RECEIVED

LABORATORY No. 6-9824-

JAN 1972

ASTM: C90-70
SPECIFICATIONS
GRADE "N-I"

DIMENSIONS:

BECHTEL CORP
15 JOB 7884

Sample Number	11	12	13	14	15	Individual Unit	Average Of 5 Units
Size and Type of Block	12"x8"x16"	12"x8"x16"	12"x8"x16"	12"x8"x16"	12"x8"x16"		
Length (in.)	15 5/8	15 5/8	15 5/8	15 5/8	15 5/8		
Width (in.)	11 5/8	11 5/8	11 5/8	11 5/8	11 5/8		
Height (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Shell Thickness (in.)	1 39/64	1 37/64	1 35/64	1 35/64	1 39/64		Minimum 1 1/2"
Web Thickness (in.)	1 5/16	1 17/64	1 17/64	1 17/64	1 17/64		Min. 1 1/8"
Weight as Received (lb.)	57.42	56.27	56.61	56.18	57.82		
Number of Cells	2	2	2	2	2		
Voids (%)	50	51	51	51	50		
Equivalent Web (in./lin. ft.)	3.06	3.05	3.04	3.04	3.04		Minimum 2 1/2"
Date Cast							

Absorption:

Per Cent	3.8	4.0	3.6	3.9	3.7		
Lb./Cu. Ft.	5.4	5.7	5.2	5.6	5.2		Max. 13 pcf

DRY DENSITY (pcf) 141 140 141 141 142 *Min. 147pcf -

MOISTURE CONTENT AS RECEIVED:

Per Cent of Total Absorption	50	48	57	54	57		Maximum 35%
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COMPRESSION:

Load (lb.)	400,000	400,000	400,000	400,000	400,000		
Gross Area (sq. in.)	182	182	182	182	182		
Gross Unit Load (psi)	2200+	2200+	2200+	2200+	2200+	Min. 800psi	Min. 1000psi
Net Area (sq. in.)							
Net Unit Load (psi)							
Date of Test	December 21, 1971						*Project Requirement

POTENTIAL SHRINKAGE (%)

REMARKS: The above blocks meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content.
The dry density is below the project requirement.
Samples were submitted to the laboratory and received here on December 15, 1971.

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Twin City Testing and Engineering Laboratory, Inc.
By *Theodore Johnson*

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****CONCRETE BLOCK TEST****PROJECT:**DUANE ARNOLD NUCLEAR PLANT
PALO, IOWA**DATE:** December 22, 1971**REPORTED TO:**

PROJECT NUMBER 7884

FURNISHED BY: Cedar Rapids Block Company

Bechtel Corporation

COPIES TO:

P.O. Box 209

Palo, Iowa 52324

Attn: M.F. Daubenheyer

LABORATORY No. 6-9824ASTM:C90-70
SPECIFICATIONS
GRADE "N-I"**DIMENSIONS:**

Sample Number	11	12	13	14	15	Individual Unit	Average Of 5 Units
Size and Type of Block	12"x8"x16"	High	Density				
Length (in.)	15 5/8	15 5/8	15 5/8	15 5/8	15 5/8		
Width (in.)	11 5/8	11 5/8	11 5/8	11 5/8	11 5/8		
Height (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Shell Thickness (in.)	1 39/64	1 37/64	1 35/64	1 35/64	1 39/64		Minimum 1 1/2"
Web Thickness (in.)	1 5/16	1 17/64	1 17/64	1 17/64	1 17/64		Min. 1 1/8"
Weight as Received (lb.)	57.42	56.27	56.61	56.18	57.82		
Number of Cells	2	2	2	2	2		
Voids (%)	50	51	51	51	50		
Equivalent Web (in./lin. ft.)	3.06	3.05	3.04	3.04	3.04		Minimum 2 1/2"
Date Cast							

ABSORPTION:

Per Cent	3.8	4.0	3.6	3.9	3.7		
Lb./Cu. Ft.	5.4	5.7	5.2	5.6	5.2		Max. 13 pcf

DRY DENSITY (pcf)	141	140	141	141	142		*Min. 147pcf
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MOISTURE CONTENT AS RECEIVED:

Per Cent of Total Absorption	50	48	57	54	57		Maximum 35%
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COMPRESSION:

Load (lb.)	400,000+	400,000+	400,000+	400,000+	400,000+		
Gross Area (sq. in.)	182	182	182	182	182		
Gross Unit Load (psi)	2200+	2200+	2200+	2200+	2200+	Min. 800psi	Min. 1000psi
Net Area (sq. in.)							
Net Unit Load (psi)							
Date of Test	December 21, 1971					*Project Requirement	

POTENTIAL SHRINKAGE (%)

REMARKS: The above blocks meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content.
The dry density is below the project requirement.
Samples were submitted to the laboratory and received here on December 15, 1971.

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.

Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

CONCRETE BLOCK TEST

PROJECT:

DUANE ARNOLD NUCLEAR PLANT
PALO, IOWA

DATE: May 10, 1972

REPORTED TO:

PROJECT NO. 7884

FURNISHED BY:

Bechtel Corporation

COPIES TO:

P.O. Box 209

Palo, Iowa 52324

Attn: M.E. Daubenbayer

LABORATORY No. 6-10161

ASTM:C90-70
SPECIFICATIONS
GRADE "N-I"

DIMENSIONS:

Sample Number	26	27	28	29	30	Individual Unit	Average of 3 Units
Size and Type of Block	12"x8"x16"	12"x8"x16"	12"x8"x16"	12"x8"x16"	12"x8"x16"		
Length (in.)	15 5/8	15 5/8	15 5/8	15 5/8	15 5/8		
Width (in.)	11 5/8	11 5/8	11 5/8	11 5/8	11 5/8		
Height (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Shell Thickness (in.)	1 33/64	1 35/64	1 17/32	1 9/16	1 35/64		Minimum 1 1/2"
Web Thickness (in.)	1 17/64	1 19/64	1 9/32	1 9/32	1 19/64		Min. 1 1/8"
Weight as Received (lb.)	57.21	58.10	57.28	58.11	57.52		
Number of Cells	2	2	2	2	2		
Voids (%)	50	50	50	50	50		
Equivalent Web (in./lin. ft.)	2.98	3.00	2.96	3.00	3.01		Minimum 2 1/2"
Date Cast							

ABSORPTION:

Per Cent	4.4	4.3	4.3	4.3	4.3		
Lb./Cu. Ft.	6.2	6.1	6.2	6.1	6.2		Max 13 pcf

DRY DENSITY (pcf) 140.3 141.6 140.1 141.4 140.8

MOISTURE CONTENT AS RECEIVED:

Per Cent of Total Absorption	56	59	56	58	54		Maximum 35%
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COMPRESSION:

Load (lb.)	400000+	400000+	400000+	400000+	400000+		
Gross Area (sq. in.)	182	182	182	182	182		
Gross Unit Load (psi)	2200+	2200+	2200+	2200+	2000+	Min. 800psi	Min. 1000psi
Net Area (sq. in.)							
Net Unit Load (psi)							
Date of Test	May 8, 1972						

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units, except the moisture content is too high.

Samples were submitted to the laboratory and received here on April 28, 1972.

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

Twin City Testing and Engineering Laboratory, Inc.

By

Theodore Johnson

TWIN-CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF: CONCRETE BLOCK TEST**

PROJECT: DUANE ARNOLD NUCLEAR PLANT
PALO, IOWA
REPORTED TO: PROJECT NO. 7884
Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.F. Baubenheyer

DATE: May 10, 1972**FURNISHED BY:****COPIES TO:****LABORATORY No.** 6-10161**DIMENSIONS:**

Sample Number	31	32	33	34	35	Individual Unit	Average of 3 Units
Size and Type of Block	8"x8"x16" High Density						
Length (in.)	15 5/8	15 5/8	15 5/8	15 5/8	15 5/8		
Width (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Height (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Shell Thickness (in.)	1 19/64	1 19/64	1 15/64	1 19/64	1 15/64		Minimum 1 1/4"
Web Thickness (in.)	1 3/64	1 3/64	1 3/64	1 1/32	1 3/64		Minimum 1"
Weight as Received (lb.)	40.93	41.09	41.57	41.03	41.21		
Number of Cells	2	2	2	2	2		
Voids (%)	46	46	46	46	46		
Equivalent Web (in./lin. ft.)	2.48	2.48	2.48	2.48	2.48		Minimum 2 1/4"
Date Cast							

ABSORPTION:

Per Cent	4.2	4.4	4.3	4.5	4.4	
Lb./Cu. Ft.	6.1	6.3	6.2	6.4	6.4	Max. 13 pcf

DRY DENSITY (pcf) 142.1 142.0 143.2 141.2 142.4

MOISTURE CONTENT AS RECEIVED:

Per Cent of Total Absorption	49	50	52	50	51	Maximum 35%
------------------------------	----	----	----	----	----	-------------

COMPRESSION:

Load (lb.)	324,000	320,000	342,000	326,000	316,000	
Gross Area (sq. in.)	119	119	119	119	119	
Gross Unit Load (psi)	2720	2690	2870	2740	2650	Min. 800psi Min. 1000psi
Net Area (sq. in.)						
Net Unit Load (psi)						
Date of Test	May 8, 1972					

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units, except the moisture content is too high.

Samples were submitted to the laboratory and received here on April 28, 1972.

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

Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cramwell Avenue - St. Paul, Minn. 55114

**REPORT OF: CONCRETE BLOCK TEST**

PROJECT: DUANE ARNOLD NUCLEAR PLANT
PALO, IOWA
REPORTED TO: PROJECT NO. 7884
Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.F. Baubenhayr

DATE: May 10, 1972**FURNISHED BY:****COPIES TO:****LABORATORY No.** 6-10161**DIMENSIONS:**

Sample Number	31	32	33	34	35		
Size and Type of Block	8"x8"x16" High Density					Individual Unit	Average of 3 Units
Length (in.)	15 5/8	15 5/8	15 5/8	15 5/8	15 5/8		
Width (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Height (in.)	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8		
Shell Thickness (in.)	1 19/64	1 19/64	1 15/64	1 19/64	1 15/64		Minimum 1 1/2"
Web Thickness (in.)	1 3/64	1 3/64	1 3/64	1 1/32	1 3/64		Minimum 1"
Weight as Received (lb.)	40.93	41.09	41.57	41.03	41.21		
Number of Cells	2	2	2	2	2		
Voids (%)	46	46	46	46	46		
Equivalent Web (in./lin. ft.)	2.48	2.48	2.48	2.48	2.48		Minimum 2 1/4"
Date Cast							

ABSORPTION:

Per Cent	4.2	4.4	4.3	4.5	4.4		
Lb./Cu. Ft.	6.1	6.3	6.2	6.4	6.4		Max. 13 pcf

DRY DENSITY (pcf) 142.1 142.0 143.2 141.2 142.4

MOISTURE CONTENT AS RECEIVED:

Per Cent of Total Absorption	49	50	52	50	51		Maximum 35%
------------------------------	----	----	----	----	----	--	-------------

COMPRESSION:

Load (lb.)	324,000	320,000	342,000	326,000	316,000		
Gross Area (sq. in.)	119	119	119	119	119		
Gross Unit Load (psi)	2720	2690	2870	2740	2650	Min. 800psi	Min. 1000psi
Net Area (sq. in.)							
Net Unit Load (psi)							
Date of Test	May 8, 1972						

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units, except the moisture content is too high.

Samples were submitted to the laboratory and received here on April 28, 1972.

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Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: 9-1-71

REPORTED TO:

Bechtel Corporation
Box 209
(3) Palo, Iowa 52324

FURNISHED BY: Bechtel Corporation

COPIES TO: (3) TCT & EL, Inc. - Waterloo
(3) TCT & EL, Inc. - Palo

FIELD DATA:

* Job Identification

1A

1B

1C

* Date Cast

8-25-71

8-25-71

8-25-71

* Age to be Tested, days

7

28

90

* Type of Sample

2" x 2" cubes

* Location Placed

Turbine building block placement mortar

Specified Strength @ 28 Days

Mix Proportions:

Cement

94#

Fine Agg.

254#

Admixture

Hydra lime 10

COMPRESSIVE STRENGTH:

Laboratory Number

71416-1

71416-2

71416-3

Date Received

8-26-71

8-26-71

8-26-71

Method of Curing:

Days on Job & Enroute

1

1

1

Days Lab. Cured

6

27

89

Area, square inches

4.0

Load at Failure, pounds

10,500

Strength, psi

2620

REMARKS:

* Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By

Paul E. Pickett

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cramwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: 9-21-71, 10-11-71

REPORTED TO: Bechtel Corporation
Box 209

FURNISHED BY:

(3) Palo, Iowa 52324

COPIES TO: (3) TCT & EL, Inc.-Waterloo
(3) TCT & EL, Inc.-Palo**FIELD DATA:**

* Job Identification

A

B

C

* Date Cast

9-14-71

9-14-71

9-14-71

* Age to be Tested, days

7

7

7

* Type of Sample

2" x 2" cubes

* Location Placed

Block mortar room #1 - Turbine Building

Specified Strength @ 28 Days

* Mix Proportions:

Mortar

* Cement

94#

* Fine Agg.

254#

* Admixture

Hydrated lime - 10#

* Admixture

AEA - 0.7 fl. oz.

COMPRESSIVE STRENGTH:

Laboratory Number

71479-1

71479-2

71479-3

Date Received

9-20-71

9-20-71

9-20-71

Method of Curing:

Days on Job & Enroute

6

6

6

Days Lab. Cured

1

1

1

Area, square inches

4.0

4.0

4.0

Load at Failure, pounds

13,800

15,300

15,000

Strength, psi

3450

3820

3750

REMARKS:

* Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

DATE: 9-23-71

REPORTED TO:

PALO, IOWA
Bechtel Corporation
Box 209

FURNISHED BY: Bechtel Self Mixed

(3) Palo, Iowa 52324

COPIES TO: (3) TCT & EL, Inc.-Waterloo
(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification	2A	2B	2C
* Date Cast	8-26-71	8-26-71	8-26-71
* Age to be Tested, days	28	28	28
* Type of Sample	2" x 2" cubes		
* Location Placed	Turbine building block placement mortar		
Specified Strength @ 28 Days			
* Mix Proportions:	Mortar		
* Cement:	94#		
* Fine Agg.:	25#		
* Admixture:	Hydrated lime-10#		
* Admixture:	AEA - 0.5 fl. oz.		

COMPRESSIVE STRENGTH:

Laboratory Number	71477-1	71477-2	71477-3
Date Received	9-20-71	9-20-71	9-20-71
Method of Curing:			
Days on Job & Enroute	25	25	25
Days Lab. Cured	3	3	3
Area, square inches	4.0	4.0	4.0
Load at Failure, pounds	23,600	23,000	23,800
Strength, psi	5900	5750	5950

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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

Twin City Testing and Engineering Laboratory, Inc.

By Paul E. Fietzsch

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

DATE: 9-24-71

PALO, IOWA

REPORTED TO: Bechtel Corporation

FURNISHED BY: Bechtel Self Mixed

Box 209

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) Palo, Iowa 52324

(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification	3A	3B	3C
* Date Cast	8-27-71	8-27-71	8-27-71
* Age to be Tested, days	28	28	28
* Type of Sample	2" x 2" cubes		
* Location Placed	Turbine building block placement mortar		
Specified Strength @ 28 Days			
* Mix Proportions:	Mortar		
* Cement:	94#		
* Fine Agg.:	254#		
* Admixture:	Hydrated lime 12.5#		
* Admixture:	AEA - 22 oz.		

COMPRESSIVE STRENGTH:

Laboratory Number	71478-1	71478-2	71478-3
Date Received	9-20-71	9-20-71	9-20-71
Method of Curing:			
Days on Job & Enroute	24	24	24
Days Lab. Cured	4	4	4
Area, square inches	4.0	4.0	4.0
Load at Failure, pounds	22,200	20,000	19,500
Strength, psi	5550	5000	4870

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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

Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cramwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****PROJECT:**

DUANE ARNOLD ENERGY CENTER

DATE: 10-6-71**REPORTED TO:**PALO, IOWA
Bechtel Corporation**FURNISHED BY:** Bechtel Self Mixed

Box 209

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) Palo, Iowa 52324

(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification

A

B

C

* Date Cast

9-29-71

9-29-71

9-29-71

* Age to be Tested, days

7

7

7

* Type of Sample

2" x 2" cubes

* Location Placed

Control building block walls

Specified Strength @ 28 Days

* Mix Proportions:

Block mortar

* Cement:

94#

Fine Agg.:

254#

Admixture:

Hydrated lime - 10#

* Admixture:

AEA - 0.7 oz.

COMPRESSIVE STRENGTH:

Laboratory Number

71522-1

71522-2

71522-3

Date Received

10-1-71

10-1-71

10-1-71

Method of Curing:

Days on Job & Enroute

2

2

2

Days Lab. Cured

5

5

5

Area, square inches

4.0

4.0

4.0

Load at Failure, pounds

16,400

16,500

13,500

Strength, psi

4100

4130

3380

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By Paul E. Pritsch

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF: **MORTAR COMPRESSION TESTS**

PROJECT: DUANE ARNOLD ENERGY CENTER
 PALO, IOWA
 REPORTED TO: Bechtel Corporation
 Box 209
 (3) Palo, Iowa 52324

DATE: 10-27-71
 FURNISHED BY: Bechtel Self Mixed
 COPIES TO: (3) TCT & EL, Inc.-Waterloo
 (3) TCT & EL, Inc.-Palo

FIELD DATA:

	D	E	F
* Job Identification			
* Date Cast	9-29-71	9-29-71	9-29-71
* Age to be Tested, days	28	28	28
* Type of Sample	2" x 2" cubes		
* Location Placed	Control Building block walls		
Specified Strength @ 28 Days			
* Mix Proportions:	Block mortar		
* Cement:	94#		
* Fine Agg.:	254#		
* Coarse Agg.:	Hydrated lime - 10#		
* Admixture:	AEA - 0.7 oz.		

COMPRESSIVE STRENGTH:

	71524-1	71524-2	71524-3
Laboratory Number			
Date Received	10-1-71	10-1-71	10-1-71
Method of Curing:			
Days on Job & Enroute	2	2	2
Days Lab. Cured	26	26	26
Area, square inches	4.0	4.0	4.0
Load at Failure, pounds	23,000	23,800	22,200
Strength, psi	5750	5950	5550

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By *Paul E. Pustich*

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

DATE: 10-27-71

REPORTED TO:

Bechtel Corporation

FURNISHED BY: Bechtel Self Mixed

Box 209

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) Palo, Iowa 52324

(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification

D

E

F

* Date Cast

9-29-71

9-29-71

9-29-71

* Age to be Tested, days

28

28

28

* Type of Sample

2" x 2" cubes

* Location Placed

Control Building block walls

Specified Strength @ 28 Days

* Mix Proportions:

Block mortar

* Cement:

94#

* Fine Agg.:

254#

* Coarse Agg.:

Hydrated lime - 10#

* Admixture:

AEA - 0.7 oz.

COMPRESSIVE STRENGTH:

Laboratory Number

71524-1

71524-2

71524-3

Date Received

10-1-71

10-1-71

10-1-71

Method of Curing:

Days on Job & Enroute

2

2

2

Days Lab. Cured

26

26

26

Area, square inches

4.0

4.0

4.0

Load at Failure, pounds

23,000

23,800

22,200

Strength, psi

5750

5950

5550

REMARKS:

* Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By Paul E. Preteck

McCracker

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

REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Corporation
Box 209
(3) Palo, Iowa 52324

DATE: 11-2-71

FURNISHED BY:

COPIES TO: (3) TCT & EL, Inc.-Waterloo
(3) TCT & EL, Inc.-Palo

FIELD DATA:

	D	E	F
* Job Identification			
* Date Cast	10-5-71	10-5-71	10-5-71
* Age to be Tested, days	28	28	28
* Type of Sample	2" x 2" cubes		
* Location Placed	Turbine building basement - block mortar		
Specified Strength @ 28 Days			
* Mix Proportions:	Block mortar		
* Cement:	94#		
* Fine Agg.:	254#		
* Admixture:	Hydrated lime - 10#		
* Admixture:	AEA - 25 nl.		

COMPRESSIVE STRENGTH:

	71544-1	71544-2	71544-3
Laboratory Number			
Date Received	10-7-71	10-7-71	10-7-71
Method of Curing:			
Days on Job & Enroute	2	2	2
Days Lab. Cured	26	26	26
Area, square inches	4.0	4.0	4.0
Load at Failure, pounds	19,000	18,000	19,500
Strength, psi	4750	4500	4875

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

McCracken
645-3601**TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.****ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

DATE: 11-5-71

REPORTED TO:

PALO, IOWA

FURNISHED BY: Bechtel Self Mixed

Bechtel Corporation

Box 209

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) Palo, Iowa 52324

(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification

A

B

C

* Date Cast

10-28-71

10-28-71

10-28-71

* Age to be Tested, days

7

7

7

* Type of Sample

2" x 2" cubes

* Location Placed

Turbine Building wall BWT #39 & 40 @ 75'-6"

Specified Strength @ 28 Days

* Mix Proportions:

Block mortar

* Cement:

94#

* Fine Agg.:

254#

* Coarse Agg.:

NA

* Admixture:

Hydrated lime: 12.5#

* Admixture:

AEA 25 nl.

COMPRESSIVE STRENGTH:

Laboratory Number

71593-1

71593-2

71593-3

Date Received

11-1-71

11-1-71

11-1-71

Method of Curing:

Days on Job & Enroute

4

4

4

Days Lab. Cured

3

3

3

Area, square inches

4.0

4.0

4.0

Load at Failure, pounds

11,700

10,200

14,300

Strength, psi

2925

2550

3575

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By

Paul E. Piestach

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: MORTAR MIX DESIGN-TYPE "PL" FOR REINFORCED MASONRY

PROJECT: DUANE ARNOLD NUCLEAR PLANT
PALO, IOWA
REPORTED TO: PROJECT NO. 7884
Bechtel Corporation
Box 209
Palo, Iowa 52324
Attn: M. F. Daubenheyer

DATE: November 12, 1971**FURNISHED BY:****COPIES TO:****LABORATORY No. 6-9681****MATERIAL USED:**

- 1) Dewey Portland Cement, Type II (ASTM Specification C150-68) produced by Dewey Portland Cement Company, Davenport Iowa.
- 2 Western Miracle Lime, Type "S", (ASTM Specification C207-49) produced by The Western Lime and Cement Company, Milwaukee, Wisconsin.
- 3) Masonry sand (ASTM Specification C 144-66T) furnished from the project.

MIX PROPORTIONS:

1.0 part Dewey Type II Portland Cement (by volume)
0.31 parts Western Miracle Lime (by volume)
0 parts Masonry sand (by volume)
Water - 13.2% (by batch weight)
Flow - 126%

PROPERTIES OF MIX:**A. Water Retention:**

Initial Flow - 126%
Flow after Section - 108%
Water Retention - 85.7%

**ASTM: C476-63
SPECIFICATIONS**130 \pm 5%

Minimum 70%

B. Compressive Strength: (Average of three 2" cubes)

7-Day Strength 4930 psi
28-Day Strength 6380 psi

Minimum 1600 psi
Minimum 2500 psi

C. Wet Unit Weight: 132 pcf**D. Air Content: 8.7%**

Maximum 18%

REMARKS:

Based on the above test results, this mix will have satisfactory strength and water retention for a type "PL" mortar.

Twin City Testing and Engineering Laboratory, Inc.

By Theodore Johnson

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF: MORTAR MIX DESIGN-TYPE "PL" FOR REINFORCED MASONRY****PROJECT:**

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA

DATE: November 12, 1971**REPORTED TO:**

PROJECT NO. 7884

FURNISHED BY:

Bechtel Corporation

Box 209

COPIES TO:

Palo, Iowa 52324

Attn: M. F. Daubenhaver

LABORATORY No. 6-9681**MATERIAL USED:**

- 1) Dewey Portland Cement, Type II (ASTM Specification C150-68) produced by Dewey Portland Cement Company, Davenport Iowa.
- 2 Western Miracle Lime, Type "S", (ASTM Specification C207-49) produced by The Western Lime and Cement Company, Milwaukee, Wisconsin.
- 3) Masonry sand (ASTM Specification C 144-66T) furnished from the project.

MIX PROPORTIONS:

1.0 part Dewey Type II Portland Cement (by volume)
 0.31 parts Western Miracle Lime (by volume)
 3.0 parts Masonry sand (by volume)
 Water - 13.2% (by batch weight)
 Flow - 126%

PROPERTIES OF MIX:**A. Water Retention:-**

Initial Flow - 126%
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 Water Retention - 85.7%

ASTM: C476-63
SPECIFICATIONS

130 \pm 5%

Minimum 70%

B. Compressive Strength: (Average of three 2" cubes)

7-Day Strength 4930 psi
 28-Day Strength 6380 psi

Minimum 1600 psi

Minimum 2500 psi

C. Wet Unit Weight: 132 pcf**D. Air Content:**

8.7%

Maximum 18%

REMARKS:

Based on the above test results, this mix will have satisfactory strength and water retention for a type "PL" mortar.

Twin City Testing and Engineering Laboratory, Inc.

By

045-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF: **MORTAR COMPRESSION TESTS**

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Corporation
Box 209
(3) Palo, Iowa 52324

DATE: 11-26-71
FURNISHED BY: Bechtel Self Mixed
COPIES TO: (3) TCT & EL, Inc.-Waterloo
(3) TCT & EL, Inc.-Palo

<u>FIELD DATA:</u>				
* Job Identification	D	E	F	
* Date Cast	10-28-71	10-26-71	10-28-71	
* Age to be Tested, days	28	28	28	
* Type of Sample	2" x 2" cubes			
* Location Placed	Turbine Building wall BWT #39 & 40 757'-6"			
Specified Strength @ 28 Days				
* Mix Proportions:	Block mortar			
* Cement:	94#			
* Fine Agg.:	254#			
* Admixtures:	Hydrated lime: 12.5#		128.6# pcf unit weight	
* Admixture:	AEA 25 nl.		58° temperature	
<u>COMPRESSIVE STRENGTH:</u>				
Laboratory Number	71594-1	71594-2	71594-3	
Date Received	11-1-71	11-1-71	11-1-71	
Method of Curing:				
Days on Job & Enroute	4	4	4	
Days Lab. Cured	24	24	24	
Area, square inches	4.0	4.0	4.0	
Load at Failure, pounds	24,000	21,500	21,500	
Strength, psi	6000	5375	5375	

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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.

Twin City Testing and Engineering Laboratory, Inc.

By Paul E. Petersen

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

DATE:

2-29-72

REPORTED TO:

PALO, IOWA

FURNISHED BY: Bechtel Self Mixed

Bechtel Corporation

Box 209

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) Palo, Iowa 52324

(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification

D

E

F

* Date Cast

2-1-72

2-1-72

2-1-72

* Age to be Tested, days

28

28

28

* Type of Sample

2" x 2" cubes

* Location Placed

Test batch

* Specified Strength @ 28 Days

~~1600~~ per 2000 PSI

* Mix Proportions:

Block mortar

Temperature 79°

* Cement

94#

* Fine Agg.

254#

* Admixture

12.5# hydrated lime

* Admixture

5 1/2 Gal. water

* Admixture

25 ML. ABA

COMPRESSIVE STRENGTH:

Laboratory Number

71746-1

71746-2

71746-3

Date Received

2-3-72

2-3-72

2-3-72

Method of Curing:

Days on Job & Enroute

2

2

2

Days Lab. Cured

26

26

26

Area, square inches

4

4

4

Load at Failure, pounds

11,500

10,400

16,000

Strength, psi

2875

2600

4000

REMARKS: *Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By Paul E. Bechtel

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.F. Dauberheyer

DATE: June 7, 1972

FURNISHED BY: Job Mixed

COPIES TO: (1) Twin City Testing and Engineering Laboratory, Inc. - Palo, Iowa
(1) Twin City Testing and Engineering Laboratory, Inc. - Waterloo, Iowa

FIELD DATA:

* Job Identification	A	B	C	D	E	F
* Date Cast	May 31, 1972					
* Age to be Tested, days	7	7	7	28	28	28
* Type of Sample	Six 2" Mortar Cubes					
* Location Placed	Reactor Building BWR 13 @757 and Turbine Building BWT 11 @734					
Specified Strength @ 28 Days						
* Mix Proportions:						
Cement	94 lbs. Portland cement					
Lime	12.5 lbs. Hydrated lime					
Sand	254 lbs. Masonry Sand					
Admixture	AEA					

COMPRESSIVE STRENGTH:

Laboratory Number	210	210	210	210	210	210
Date Received	June 5, 1972					
Method of Curing:						
Days on Job & Enroute	5	5	5	5	5	5
Days Lab. Cured	2	2	2	23	23	23
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,070	12,890	13,460			
Strength, psi	3260	3220	3360			

REMARKS:

* Information taken from data sheet prepared by M. Olson.

JUN 12 1972

IN 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.

Twin City Testing and Engineering Laboratory, Inc.

By Theodore J. Olson

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF: MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

DATE: June 12, 1972
FURNISHED BY: Job Mixed
COPIES TO: Twin City Testing and Engineering Laboratory, Inc., Palo, Iowa
Twin City Testing and Engineering Laboratory, Inc., Waterloo, Iowa

FIELD DATA:

	A	B	C	D	E	F
* Job Identification						
* Date Cast	June 5, 1972					
* Age to be Tested, days	7	7	7	28	28	28
* Type of Sample	Six 2" Mortar Cubes					
* Location Placed	Turbine Building BWT 11 D+E, Reactor Building BWR 13					
Specified Strength @ 28 Days						
* Mix Proportions:						
Cement	94 lbs. Portland cement					
Lime	12.5 lbs. Hydrated lime					
Sand	250 lbs Masonry Sand					
Admixture	25 ml. AEA					

COMPRESSIVE STRENGTH:

	213	213	213	213	213	213
Laboratory Number						
Date Received	June 9, 1972					
Method of Curing:						
Days on Job & Enroute	4	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	15,220	15,320	15,380			
Strength, psi	3810	3830	3850			

REMARKS:

* Information taken from data sheet prepared by Mr. Olson.

JUN 12 1972
BECHTEL CORP
128 7000

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

Twin City Testing and Engineering Laboratory, Inc.

By *Michael Olson*

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER

DATE: June 12, 1972

REPORTED TO: PALO, IOWA
Bechtel Corporation

FURNISHED BY: Job Mixed
Twin City Testing and Engineering
Laboratory, Inc., Palo, Iowa

P.O. Box 209
Palo, Iowa 52324

COPIES TO: Twin City Testing and Engineering
Laboratory, Inc., Waterloo, Iowa

Attn: Mr. Daubenheyer

FIELD DATA:

* Job Identification	A	B	C	D	E	F
* Date Cast	June 5, 1972					
* Age to be Tested, days	7	7	7	28	28	28
* Type of Sample	Six 2" Mortar Cubes					
* Location Placed	Turbine Building BWT 11 D+E, Reactor Building BWR 13					
Specified Strength @ 28 Days						
* Mix Proportions:						
Cement	94 lbs. Portland cement					
Lime	12.5 lbs. Hydrated lime					
Sand	250 lbs Masonry Sand					
Admixture	25 ml. AEA					

RECEIVED
JUN 16 1972

COMPRESSIVE STRENGTH:

Laboratory Number	213	213	213	213	213	213
Date Received	June 9, 1972					
Method of Curing:						
Days on Job & Enroute	4	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	15,220	15,320	15,380			
Strength, psi	3810	3830	3850			

BECHTEL CORP
JUN 7 1972

REMARKS:

* Information taken from data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By Theodore C. Johnson

File - C-13 + OC

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.**ENGINEERS AND CHEMISTS**

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****DUANE ARNOLD ENERGY CENTER****PROJECT:****PALO, IOWA****DATE: June 19, 1972****REPORTED TO:****Bechtel Corporation****FURNISHED BY: Job Mixed****(3)****P.O. Box 209****COPIES TO: (3) TCT & EL, Inc. - Waterloo****Palo, Iowa 52324****(3) TCT & EL, Inc. - Palo****Attn: M.F. Daubenheyer****FIELD DATA:**

	A	B	C	D	E	F
* Job Identification						
* Date Cast	May 19, 1972					
* Age to be Tested, days	14	14	14	28	28	28
* Type of Sample	Six 2" Mortar Cubes					
* Location Placed	Reactor Building, BWR - 30 and Turbine Building BWT 24, 26, 11A, 12, 13 & 14					
Specified Strength @ 28 Days						
* Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

COMPRESSIVE STRENGTH:

Laboratory Number	202	202	202	202	202	202
Date Received	May 30, 1972					
Method of Curing:						
Days on Job & Enroute	11	11	11	11	11	11
Days Lab. Cured	3	3	3	17	17	17
Area, square inches	4.0	4.0	4.0	4.0	4.0	4.0
Load at Failure, pounds	16,160	14,950	15,490	19,480	19,240	18,110
Strength, psi	4040	3740	3870	4860	4810	4530

REMARKS: *Information taken from field data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC. *McCracken*

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF: **MORTAR COMPRESSION TESTS**

PROJECT: **DUANE ARNOLD ENERGY CENTER**
 REPORTED TO: **PALO, IOWA**
Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.F. Daubenhayer

DATE: **June 28, 1972**
 FURNISHED BY: **Job Mixed**
 COPIES TO: (1) **Twin City Testing and Engineering Laboratory, Inc. - Palo, Iowa**
 (1) **Twin City Testing and Engineering Laboratory, Inc. - Waterloo, Iowa**

FIELD DATA:

	A	B	C	D	E	F
* Job Identification						
* Date Cast	May 31, 1972					
* Age to be Tested, days	7	7	7	28	28	28
* Type of Sample	Six 2" Mortar Cubes					
* Location Placed	Reactor Building BWR 13 @757 and Turbine Building BWT 11 @734					
Specified Strength @ 28 Days						
* Mix Proportions:						
Cement	94 lbs. Portland cement					
Lime	12.5 lbs. Hydrated lime					
Sand	254 lbs. Masonry Sand					
Admixture	AEA					

RECEIVED

JUN 30 1972

BECHTEL CORP.
JOB 7824

COMPRESSIVE STRENGTH:

	210	210	210	210	210	210
Laboratory Number						
Date Received	June 5, 1972					
Method of Curing:						
Days on Job & Enroute	5	5	5	5	5	5
Days Lab. Cured	2	2	2	23	23	23
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,070	12,890	13,460	18,570	18,980	19,920
Strength, psi	3260	3220	3360	4640	4750	4980

REMARKS:

* Information taken from data sheet prepared by M. Olson.

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

NOTE
McCracken
OC

Twin City Testing and Engineering Laboratory, Inc.

By *Heather Olson*

File - B H - 31154C

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER

DATE: July 3, 1972

REPORTED TO: PALO, IOWA

FURNISHED BY: Job Mixed

Bechtel Corporation

Twin City Testing and Engineering Laboratory, Inc., Palo, Iowa

P.O. Box 209

Twin City Testing and Engineering Laboratory, Inc., Waterloo, Iowa

Palo, Iowa 52324

Attn: Mr. Daubenheyer

FIELD DATA:

	A	B	C	D	E	F
* Job Identification						
* Date Cast	June 5, 1972					
* Age to be Tested, days	7	7	7	28	28	28
* Type of Sample	Six 2" Mortar Cubes					
* Location Placed	Turbine Building BWT 11 D+E, Reactor Building BWR 13					
Specified Strength @ 28 Days						
* Mix Proportions:						
Cement	94 lbs. Portland cement					
Lime	12.5 lbs. Hydrated lime					
Sand	250 lbs Masonry Sand					
Admixture	25 ml. AEA					

COMPRESSIVE STRENGTH:

	213	213	213	213	213	213
Laboratory Number	213	213	213	213	213	213
Date Received	June 9, 1972					
Method of Curing:						
Days on Job & Enroute	4	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	15,220	15,320	15,380	21,870	22,800	22,780
Strength, psi	3810	3830	3850	5480	5700	5700

REMARKS:

Information taken from data sheet prepared by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

PROJECT:

Bechtel Corporation

REPORTED TO: P.O. Box 209

Palo, Iowa 52324

Attn: M.F. Daubenheyer

DATE: July 6, 1972

FURNISHED BY: Job Mixed

TCT & EL - Palo, Iowa

COPIES TO: TCT & EL - Waterloo, Iowa

BECHTEL CORP.
JOB 7334FIELD DATA:

Job Identification

A

B

C

D

E

F

Date Cast

June 29, 1972

Age to be Tested, days

7

7

7

28

28

28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Reactor Building BWR-49, 13, 30, 51, and Radwaste Building BWRW 2C, 3A

Specified Strength @ 28 Days

Mix Proportions:

Cement

94 lbs. Portland Cement

Lime

12.5 lbs. Hydrated Lime

Sand

254 lbs. Masonry Sand

Admixture

25 ml AEA

COMPRESSIVE STRENGTH:

Laboratory Number

221

221

221

221

221

221

Date Received

July 5, 1972

Method of Curing:

Days on Job & Enroute

6

6

6

6

6

6

Days Lab. Cured

1

1

1

22

22

22

Area, square inches

4.00

4.00

4.00

4.00

4.00

4.00

Load at Failure, pounds

16,960

17,610

17,000

Strength, psi

4240

4400

4250

REMARKS:

The above samples were taken on the job by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By

Theodore J. Hanson

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS**

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

PROJECT:

Bechtel Corporation

DATE: July 27, 1972**REPORTED TO:**

P.O. Box 209

Palo, Iowa 52324

Attn: M.F. Daubenheyer

FURNISHED BY: Job Mixed

TCT & EL - Palo, Iowa

COPIES TO: TCT & EL - Waterloo, Iowa**FIELD DATA:**

Job Identification

A

B

C

D

E

F

Date Cast

June 29, 1972

Age to be Tested, days

7

7

7

28

28

28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Reactor Building BWR-49, 13, 30, 51, and Radwaste Building BWRW 2C, 3A

Specified Strength @ 28 Days

Mix Proportions:

Cement

Lime

Sand

Admixture

94 lbs. Portland Cement

12.5 lbs. Hydrated Lime

254 lbs. Masonry Sand

25 ml AEA

COMPRESSIVE STRENGTH:

Laboratory Number

221

221

221

221

221

221

Date Received

July 5, 1972

Method of Curing:

Days on Job & Enroute

Days Lab. Cured

6

6

6

6

6

6

1

1

1

22

22

22

Area, square inches

4.00

4.00

4.00

4.00

4.00

4.00

Load at Failure, pounds

16,960

17,610

17,000

23,000

23,290

22,420

Strength, psi

4240

4400

4290

5780

5820

5800

REMARKS:

The above samples were taken on the job by Mr. Olson.

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA

PROJECT:

PROJECT NUMBER 7884

DATE: August 8, 1972

REPORTED TO:

Bechtel Corporation

FURNISHED BY: Job Mixed

P.O. Box 209

Palo, Iowa 52324

COPIES TO: TCT & EL, Inc. - Palo, Iowa
TCT & EL, Inc. - Waterloo, Iowa.

Attn: M.F. Daubenheyer

FIELD DATA:

Job Identification

A

B

C

D

E

F

Date Cast

July 10, 1972

Age to be Tested, days

7

7

7

28

28

28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Reactor Building BWR 30 & Radwaster Building BWRW 1B, 2-A & 2-B

Specified Strength @ 28 Days

Mix Proportions:

Cement

94 lbs. Portland Cement

Lime

12.5 lbs. Hydrated lime

Sand

254 lbs. Masonry Sand

Admixture

25 ml

COMPRESSIVE STRENGTH:

Laboratory Number

227

227

227

227

227

227

Date Received

July 15, 1972

Method of Curing:

Days on Job & Enroute

5

5

5

5

5

5

Days Lab. Cured

2

2

2

23

23

23

Area, square inches

4.00

4.00

4.00

4.00

4.00

4.00

Load at Failure, pounds

14,480

14,830

14,800

20,670

19,650

19,450

Strength, psi

3610

3710

3700

5170

4910

4860

REMARKS:

The above samples were taken on the job by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc.

By: *Richard C. Olson*

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.



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



REPORT OF: MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.F. Daubenheyer

DATE: August 2, 1972
FURNISHED BY: Job Mixed
COPIES TO: TCT & EL, Inc. - Palo, Iowa
TCT & EL, Inc. - Waterloo, Iowa

FIELD DATA:

Job Identification	A	B	C	D	E	F
Date Cast	July 26, 1972					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Cubes					
Location Placed	Reactor Building, BWR-31					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

RECEIVED
AUG 4 1972
BECHTEL CORP
JOB 7004

COMPRESSIVE STRENGTH:

Laboratory Number	233	233	233	233	233	233
Date Received	July 28, 1972					
Method of Curing:						
Days on Job & Enroute	2	2	2	2	2	2
Days Lab. Cured	5	5	5	26	26	26
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	16,300	15,890	16,910			
Strength, psi	4070	3970	4230			

REMARKS:

The above samples were taken by Mr. Olson.

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

Twin City Testing and Engineering Laboratory, Inc.

By: Theodore C. Johnson

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: March 21, 1973

REPORTED TO:

Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.R. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (1) TCT & EL - Palo, Iowa
(1) TCT & EL - Waterloo, Iowa

FIELD DATA:

Job Identification

A	B	C	D	E	F
February 21, 1973					
7	7	7	28	28	28
Six 2" Mortar Cubes					
Off Gas Building BWG-1, Reactor Building BWR-19, 29, 43, 50B, 42 & 46, Redwaste Building BWRW-19					
Specified Strength @ 28 Days					
Mix Proportions:					
Cement 94 lbs. Portland Cement					
Lime 12.5 lbs. Hydrated Lime					
Sand 254 lbs. Masonry Sand					
Admixture 25 ml AEA					

Date Cast

Age to be Tested, days

Type of Sample

Location Placed

Specified Strength @ 28 Days

Mix Proportions:

Cement
Lime
Sand
Admixture

COMPRESSIVE STRENGTH:

Laboratory Number

Date Received

Method of Curing:

Days on Job & Enroute
Days Lab. Cured

Area, square inches

Load at Failure, pounds

Strength, psi

REMARKS: The above samples were taken on the job by Mr. Olson.

CONFIDENTIALITY 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.

Twin City Testing and Engineering Laboratory, Inc.

By

Richard C. Johnson

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****PROJECT:**DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: March 21, 1973

REPORTED TO:Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: M.R. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (1) TCT & EL - Palo Iowa
(1) TCT & EL - Waterloo, Iowa**FIELD DATA:**

	A	B	C	D	E	F
Job Identification						
Date Cast	March 14, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Reactor Building BWR-19, 12, 64 & 34					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

COMPRESSIVE STRENGTH:

	504	504	504	504	504	504
Laboratory Number						
Date Received	March 19, 1973					
Method of Curing:						
Days on Job & Enroute	5	5	5	5	5	5
Days Lab. Cured	2	2	2	23	23	23
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	10,670	10,03	10,170			
Strength, psi	2670	2510	2540			

REMARKS: The above samples were taken on the job by Mr. Olson.

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.

Twin City Testing and Engineering Laboratory, Inc.

By

Wesely
648-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.



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



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: June 28, 1973

REPORTED TO:

Bechtel Corporation
P. O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubonheyer

FURNISHED BY: Job mixed

COPIES TO: TCT & EL - Palo
TCT & EL - Waterloo

FIELD DATA:

	A	B	C	D	E	F
Job Identification						
Date Cast	May 29, 1973	May 29, 1973	May 29, 1973	May 29, 1973	May 29, 1973	May 29, 1973
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Reactor Building BWR-16, 35 & 19, off gas building BWOG-6					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland cement					
Lime	12.5 lbs Hydrated lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml. AEA					

COMPRESSIVE STRENGTH:

	567	567	567	567
Laboratory Number				
Date Received	June 1, 1973	June 1, 1973	June 1, 1973	June 1, 1973
Method of Curing:				
Days on Job & Enroute	3	3	3	3
Days Lab. Cured	4	4	25	25
Area, square inches	4.00	4.00	4.00	4.00
Load at Failure, pounds	13270	12,870	19,770	19,820
Strength, psi	3310	3220	4940	4960

REMARKS:

The above cubes were cast by Marv Olson.

RECEIVED

Wesely
OC

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BECHTEL CORP

108

File A-3 & OC

Twin City Testing and Engineering Laboratory, Inc.

By

Theodore Johnson

Route
645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: July 2, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (1) TCT & EL, Inc. - Palo
(1) TCT & EL, Inc. - Waterloo

FIELD DATA:

Job Identification

A B C D E F

Date Cast

June 25, 1973

Age to be Tested, days

7 7 7 28 28 28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Turbine Building BWT-10, Reactor Building BWR-61

Specified Strength @ 28 Days

Mix Proportions:

Cement
Lime
Sand
Admixture

94 lbs. Portland Cement
12.5 lbs. Hydrated Lime
254 lbs. Masonry Sand
25 ml AEA

COMPRESSIVE STRENGTH:

Laboratory Number

602 602 602 602 602 602

Date Received

June 27, 1973

Method of Curing:

Days on Job & Enroute
Days Lab. Cured

2 2 2 2 2 2
5 5 5 26 26 26

Area, square inches

4.00 4.00 4.00 4.00 4.00 4.00

Load at Failure, pounds

8,900 8,960 8,940

Strength, psi

2220 2240 2230

REMARKS: The above cubes were cast by Mr. Marvin Olson.

RECEIVED

JUL 6 1973

Wesley
OC

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.

JOB 7834

Twin City Testing and Engineering Laboratory, Inc.

By: Dwight F. Bejau

7.13 11-3 50C

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

DATE: July 2, 1973

REPORTED BY:

PALO, IOWA

FURNISHED BY:

Job mixed

Bechtel Power Corporation

COPIES TO:

TCT & EL, Inc. - Palo

P.O. Box 209

TCT & EL, Inc. - Waterloo

Palo, Iowa 52324

Attn: Mr. Daubenhaver

FIELD DATA:

Job Identification

A

B

C

D

E

F

Date Cast

June 4, 1973

Age to be Tested, days

7

7

7

28

28

28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Turbine Building BWT-10A, B, C, & D & 32 & 33 off-gas buildi:
BWOG-6

Specified Strength @ 28 Days

Mix Proportions:

Cement

94# Portland cement

Lime

12.5 # Hydrated lime

Sand

254# Masonry Sand

Admixture

25 ml. AEA

COMPRESSIVE STRENGTH:

Laboratory Number

579

579

579

579

579

579

Date Received

June 7, 1973

Method of Curing:

Days on Job & Enroute

3

3

3

3

3

3

Days Lab. Cured

4

4

4

25

25

25

Area, square inches

4.00

4.00

4.00

4.00

4.00

4.00

Load at Failure, pounds

11,195

10,839

11,078

19,070

17,730

19,430

Strength, psi

2790

2740

2770

4760

4440

4860

REMARKS:

The above cubes were cast by Mr. Marvin Olson.

RECEIVED
Wesely

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BECHTEL CORP

123 7224

Twin City Testing and Engineering Laboratory, Inc.

By

Signature of Theodore Olson

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
 PALO, IOWA

DATE: July 10, 1973

REPORTED TO:

Bechtel Corporation
 P.O. Box 209
 Palo, Iowa 52324
 Attn: Mr. Dauben Heyer

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo
 (2) TCT & EL, Inc. - Waterloo

FIELD DATA:

Job Identification

A	B	C	D	E	F
---	---	---	---	---	---

Date Cast

June 7, 1973

Age to be Tested, days

7	7	7	28	28	28
---	---	---	----	----	----

Type of Sample

Six 2" Grout Cubes

Location Placed

Reactor Building R.P.V. Skirt, Interior Wall Grouting
 around Supports

Specified Strength @ 28 Days

Mix Proportions:

Cement

94 lbs. Portland Cement

Fly Ash

10 lbs. Fly Ash

Sand

209 lbs. Sand

Admixture

4 ounces WRA

COMPRESSIVE STRENGTH:

Laboratory Number

581	581	581	581	581	581
-----	-----	-----	-----	-----	-----

Date Received

June 11, 1973

Method of Curing:

Days on Job & Enroute

4	4	4	4	4	4
---	---	---	---	---	---

Days Lab. Cured

3	3	3	24	24	24
---	---	---	----	----	----

Area, square inches

4.00	4.00	4.00	4.00	4.00	4.00
------	------	------	------	------	------

Load at Failure, pounds

24,730	26,100	25,870	32,240	32,500	32,650
--------	--------	--------	--------	--------	--------

Strength, psi

6180	6520	6470	8060	8130	8170
------	------	------	------	------	------

REMARKS:

RECEIVED

JUL 12 1973

Wesely
DC

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Twin City Testing and Engineering Laboratory, Inc.

By *Dwight F. Beglan*

H E-10 A-3 EOL

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****PROJECT:**DUANE ARNOLD ENERGY CENTER
PALO, IOWA**DATE:** July 13, 1973**REPORTED TO:**Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer**FURNISHED BY:** Job Mixed**COPIES TO:** (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo**FIELD DATA:**

Job Identification

A

B

C

D

E

F

Date Cast

June 14, 1973

Age to be Tested, days

7

7

7

28

28

28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Turbine Building BWT-13, 25 and 10A, B, C & D

Specified Strength @ 28 Days

Mix Proportions:

Cement

Sand

Admixture

94 lbs. Portland Cement
254 lbs. Masonry Sand
25 ml AEA**COMPRESSIVE STRENGTH:**

Laboratory Number

586

586

586

586

586

586

Date Received

June 18, 1973

Method of Curing:

Days on Job & Enroute

Days Lab. Cured

4

4

4

4

4

4

3

3

3

24

24

24

Area, square inches

4.00

4.00

4.00

4.00

4.00

4.00

Load at Failure, pounds

9,500

9,520

10,600

16,210

16,000

15,700

Strength, psi

2370

2380

2650

4060

4000

3930

REMARKS:

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.

Twin City Testing and Engineering Laboratory, Inc.

By Dwight K. Beglan

TWIN CITY TESTING AND ENGINEERING LABORATORY
 ENGINEERS AND CHEMISTS
 662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF: **MORTAR COMPRESSION TESTS**

PROJECT: DUANE ARNOLD ENERGY CENTER
 PALO, IOWA
 REPORTED TO: Bechtel Corporation
 P.O. Box 209
 Palo, Iowa 52324
 Attn: Mr. Daubenheyer

DATE: July 13, 1973
 FURNISHED BY: Job No.
 COPIES TO: (2) TCT & E
 (2) TCT & E

Inc. - Palo
 Inc. - Waterloo

FIELD DATA:

	A	B	C	D	F
Job Identification					
Date Cast	June 14, 1973				
Age to be Tested, days	7	7	7	28	28
Type of Sample	Six 2" Mortar Cubes				
Location Placed	Turbine Building BWT-13, 25 and 10A, D & D				
Specified Strength @ 28 Days					
Mix Proportions:					
Cement	94 lbs. Portland Cement				
Sand	254 lbs. Masonry Sand				
Admixture	25 ml AEA				

COMPRESSIVE STRENGTH:

	586	586	586	586	586
Laboratory Number					
Date Received	June 18, 1973				
Method of Curing:					
Days on Job & Enroute	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	9,500	9,520	10,600	16,210	15,700
Strength, psi	2370	2380	2650	4060	3930

REMARKS:

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JUL 17 1973

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.
 BY: Dwight
Baglan

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W. A. Daubenheyer
W. A. Daubenheyer
W. A. Daubenheyer

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: July 13, 1973

REPORTED TO:

Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

Job Identification

A	B	C	D	E	F
June 14, 1973					
7	7	7	28	28	28
Six 2" Mortar Cubes					
Turbine Building BWT-13, 25 and 10A, B, C & D					
Specified Strength @ 28 Days					
Mix Proportions:					
Cement					
Sand					
Admixture					
94 lbs. Portland Cement					
254 lbs. Masonry Sand					
25 ml AEA					

Date Cast

June 14, 1973

Age to be Tested, days

7 7 7 28 28 28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Turbine Building BWT-13, 25 and 10A, B, C & D

Specified Strength @ 28 Days

Mix Proportions:

Cement

Sand

Admixture

94 lbs. Portland Cement
254 lbs. Masonry Sand
25 ml AEA

COMPRESSIVE STRENGTH:

Laboratory Number

586	586	586	586	586	586
June 18, 1973					
Method of Curing:					
Days on Job & Enroute					
Days Lab. Cured					
4	4	4	4	4	4
3	3	3	24	24	24
4.00	4.00	4.00	4.00	4.00	4.00
9,500	9,520	10,600	16,210	16,000	15,700
2370	2380	2650	4060	4000	3930

Date Received

June 18, 1973

Method of Curing:

Days on Job & Enroute

Days Lab. Cured

Area, square inches

Load at Failure, pounds

Strength, psi

REMARKS:

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Twin City Testing and Engineering Laboratory, Inc.

By Dwight K. Baglan

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: July 13, 1973

REPORTED TO:

Bechtel Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job No.

COPIES TO: (2) TCT & E
(2) TCT & E

Inc. - Palo
Inc. - Waterloo

FIELD DATA:

Job Identification

A B C D F

Date Cast

June 14, 1973

Age to be Tested, days

7 7 7 28 28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Turbine Building BWT-13, 25 and 10A, D & D

Specified Strength @ 28 Days

Mix Proportions:

Cement

Sand

Admixture

94 lbs. Portland Cement
254 lbs. Masonry Sand
25 ml AEA

COMPRESSIVE STRENGTH:

Laboratory Number

586 586 586 586 586

Date Received

June 18, 1973

Method of Curing:

Days on Job & Enroute

Days Lab. Cured

4 4 4 4 4
3 3 3 24 24

Area, square inches

4.00 4.00 4.00 4.00 4.00

Load at Failure, pounds

9,500 9,520 10,600 16,210 15,700

Strength, psi

2370 2380 2650 4060 3930

REMARKS:

CEIVED

JUL 17 1973

HTEL CORP

REPLY OF CLIENTS AND AUTHORITY
SOME BUT CRITERIA APPROVAL

Engineering Laboratory, Inc.

Twin City Testing and

By Dwight

Bechtel

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Route

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: July 20, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

Job Identification

A	B	C	D	E	F
July 6, 1973					
7	7	7	28	28	28
Six 2" Mortar Cubes					
Reactor Building BWR-64, Turbine Building BWT-25, and Control Building BWC-5					
Specified Strength @ 28 Days					
x Proportions: Cement 94 lbs. Portland Cement Lime 12.5 lbs. Hydrated Lime Sand 254 lbs. Masonry Sand Admixture 25 ml AEA					

Date Cast

Age to be Tested, days

Type of Sample

Location Placed

Specified Strength @ 28 Days

x Proportions:

Cement

Lime

Sand

Admixture

COMPRESSIVE STRENGTH:

Laboratory Number

Date Received

Method of Curing:

Days on Job & Enroute

Days Lab. Cured

Area, square inches

Load at Failure, pounds

Strength, psi

627	627	627	627	627	627
July 12, 1973					
6	6	6	6	6	6
1	1	1	22	22	22
4.00	4.00	4.00	4.00	4.00	4.00
13,400	12,160	12,170			
3350	3040	3040			

REMARKS: The above cubes were taken on the job by Mr. Marvin Olson.

JUL 25 1973

Daubenheyer *SWB*
OK

BECHTEL CORP
JOB 7034

Twin City Testing and Engineering Laboratory, Inc.

By *Dwight F. Beglau*

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9-1-A-3 501

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: July 20, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

	A	B	C	D	E	F
Job Identification						
Date Cast	July 6, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Reactor Building BWR-64, Turbine Building BWT-25, and Control Building BWC-5					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

COMPRESSIVE STRENGTH:

	627	627	627	627	627	627
Laboratory Number						
Date Received	July 12, 1973					
Method of Curing:						
Days on Job & Enroute	6	6	6	6	6	6
Days Lab. Cured	22	22	22	22	22	22
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,400	12,160	12,170			
Strength, psi	3350	3040	3040			

REMARKS: The above cubes were taken on the job by Mr. Marvin Olson.

JUL 23 1973

Benelwitz *SWB*
OC

BECHTEL CORP
JOB 7034

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

Twin City Testing and Engineering Laboratory, Inc.

By *Dwight F. Beglau*

9-14-3 501

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****PROJECT:**DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: August 16, 1973

REPORTED TO:Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo**FIELD DATA:**

	A	B	C	D	E	F
Job Identification						
Date Cast	August 8, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Turbine Building BWT-50 & 58					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

COMPRESSIVE STRENGTH:

	691	691	691	691	691	691
Laboratory Number						
Date Received	August 10, 1973					
Method of Curing:						
Days on Job & Enroute	2	2	2	2	2	2
Days Lab. Cured	5	5	5	26	26	26
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	17,840	18,000	16,530			
Strength, psi	4460	4500	4140			

REMARKS: The above samples were cast on the job by Mr. Marvin Olson.

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

Twin City Testing and Engineering Laboratory, Inc.

By: Dwight K. Beglar

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF: MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER
PALO, IOWA
REPORTED TO: Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

DATE: August 16, 1973
FURNISHED BY: Job Mixed
COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

<u>FIELD DATA:</u>						
Job Identification	A	B	C	D	E	F
Date Cast	July 18, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Three 3" x 6" Mortar Cylinders					
Location Placed	Reactor Building BWR-61, 33 & 62, Mechanic Shop BWM-1, Radwaste Building BWRW-2					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					
<u>COMPRESSIVE STRENGTH:</u>						
Laboratory Number	644	644	644	644	644	644
Date Received	July 20, 1973					
Method of Curing:						
Days on Job & Enroute	2	2	2	2	2	2
Days Lab. Cured	5	5	5	26	26	26
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	12,250	12,170	11,930	19,100	17,100	18,140
Strength, psi	3060	3040	2990	4780	4280	4530

REMARKS: The above cubes were cast on the job by Mr. Marvin Olson.

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

Twin City Testing and Engineering Laboratory, Inc.

By: Dwight T. Beglau

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: August 24, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Bechtel Power Corp.

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

	A	B	C	D	E	F
Job Identification						
Date Cast	August 15, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Block Mortar for Turbine Building BWT-50+58 and Reactor Building BWR-61					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

COMPRESSIVE STRENGTH:

	706	706	706	706	706	706
Laboratory Number						
Date Received	August 20, 1973					
Method of Curing:						
Days on Job & Enroute	5	5	5	5	5	5
Days Lab. Cured	2	2	2	23	23	23
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,980	13,290	12,970			
Strength, psi	3490	3320	3240			

REMARKS:

Bennewitz
DC

RECEIVED

AUG 27 1973

BECHTEL CORP

103-75

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Twin City Testing and Engineering Laboratory, Inc.

By *Dwight F. Beglau*

F. L. B. - 2 DC

Mc Cracken 645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****PROJECT:**DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: September 6, 1973

REPORT TO:Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo**FIELD DATA:**

Job Identification

A B C D E F

Date Cast

August 8, 1973

Age to be Tested, days

7 7 7 28 28 28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Turbine Building BWT-50 & 58

Specified Strength @ 28 Days

Mix Proportions:

Cement

94 lbs. Portland Cement

Lime

12.5 lbs. Hydrated Lime

Sand

254 lbs. Masonry Sand

Admixture

25 ml AEA

RECEIVED

SEP 10 1973

BECHTEL CORP.
JOB 7834**COMPRESSIVE STRENGTH:**

Laboratory Number

691 691 691 691 691 691

Date Received

August 10, 1973

Method of Curing:

Days on Job & Enroute

2 2 2 2 2 2

Days Lab. Cured

5 5 5 26 26 26

Area, square inches

4.00 4.00 4.00 4.00 4.00 4.00

Load at Failure, pounds

17,840 18,000 16,530 27,050 28,000 28,000

Strength, psi

4460 4500 4140 6770 7000 7000

REMARKS: The above samples were cast on the job by Mr. Marvin Olson.Mc Cracken
QC

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Twin City Testing and Engineering Laboratory, Inc.

By:

Dwight K. Beglar

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

Mc Cracken 102507

page 47 of 51



REPORT OF: MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: September 12, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Bechtel Power Corp.

COPIES TO: (2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

Job Identification

A B C D E F

Date Cast

August 15, 1973

Age to be Tested, days

7 7 7 28 28 28

Type of Sample

Six 2" Mortar Cubes

Location Placed

Block Mortar for Turbine Building BWT-50-53 and
Reactor Building BWR-61

Specified Strength @ 28 Days

Mix Proportions:

Cement

94 lbs. Portland Cement

Lime

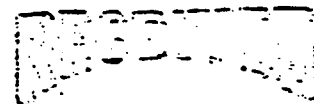
12.5 lbs. Hydrated Lime

Sand

254 lbs. Masonry Sand

Admixture

25 ml AEA



SEP 14 1973

BECHTEL CORP

COMPRESSIVE STRENGTH:

Laboratory Number:

706 706 705 706 705 705

Date Received

August 20, 1973

Method of Curing:

Days on Job & Enroute

5 5 5 5 5 5

Days Lab. Cured

2 2 2 23 23 23

Area, square inches

4.00 4.00 4.00 4.00 4.00 4.00

Load at Failure, pounds

13,980 13,290 12,970 17,080 17,510 17,770

Strength, psi

3490 3320 3240 4270 4110 4140

REMARKS:

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Twin City Testing and Engineering Laboratory, Inc.

By Wright F. Bechtel

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

645-3601



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: September 24, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO:

(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

Job Identification

A B C D E F

Date Cast

September 13, 1973

Age to be Tested, days

7 7 7 28 28 28

Type of Sample

Two 3" x 6" Mortar Cylinders

Location Placed

Turbine Building BWT-23, 20A + 12E

Specified Strength @ 28 Days

Mix Proportions:

Cement
Lime
Sand94 lbs. Portland Cement
12.5 lbs. Hydrated Lime
254 lbs. Masonry Sand

RECEIVED

SEP 26 1973

BECHTEL CORP
JOB 7884

COMPRESSIVE STRENGTH:

Laboratory Number

754 754 754 754 754 754

Date Received

September 17, 1973

Method of Curing:

Days on Job & Enroute
Days Lab. Cured4 4 4 4 4 4
3 3 3 24 24 24

Area, square inches

4.00 4.00 4.00 4.00 4.00 4.00

Load at Failure, pounds

14,250 14,000 14,050

Strength, psi

3560 3500 3510

REMARKS:

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Twin City Testing and Engineering Laboratory, Inc.

By

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

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



REPORT OF: MORTAR COMPRESSION TESTS

PROJECT: DUANE ARNOLD ENERGY CENTER
 PALO, IOWA
 REPORTED TO: Bechtel Power Corporation
 P.O. Box 209
 Palo, Iowa 52324
 Attn: Mr. Daubenheyer

DATE: September 27, 1973
 FURNISHED BY: Job Mixed
 COPIES TO: (2) TCT & EL, Inc. - Palo
 (2) TCT & EL, Inc. - Waterloo

FIELD DATA:

	A	B	C	D	E	F
Job Identification						
Date Cast	August 29, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Off-Gas Building BWG-7 and Reactor Building BWR-5					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					
Admixture	25 ml AEA					

RECEIVED

OCT 1 1973

BECHTEL CORP.
 JOB 7834

COMPRESSIVE STRENGTH:

	719	719	719	719	719	719
Laboratory Number						
Date Received	September 4, 1973					
Method of Curing:						
Days on Job & Enroute	6	6	6	6	6	6
Days Lab. Cured	1	1	1	22	22	22
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	17,050	17,000	16,800	23,250	24,300	23,450
Strength, psi	4260	4250	4200	5820	6070	6120

REMARKS:

cc/K McCracken
 C-12

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Twin City Testing and Engineering Laboratory, Inc.

By Dwight F. Beglau

HC

McCracken

5-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: October 11, 1973

REPORTED TO:

Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO:

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FIELD DATA:

	A	B	C	D	E	F
Job Identification						
Date Cast	September 13, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Two 3" x 6" Mortar Cylinders					
Location Placed	Turbine Building BWT-23, 20A + 12E					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					

RECEIVED

OCT 15 1973

BECHTEL CORP
JOB 7884COMPRESSIVE STRENGTH:

	754	754	754	754	754	754
Laboratory Number						
Date Received	September 17, 1973					
Method of Curing:						
Days on Job & Enroute	4	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	14,250	14,000	14,050	19,700	19,950	20,850
Strength, psi	3560	3500	3510	4920	4990	5210

REMARKS:McCracken
Hessley
OK

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Twin City Testing and Engineering Laboratory, Inc.

By: Wright F. Bejau

Lib A-3 50C

645-3601

CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

**REPORT OF:****MORTAR COMPRESSION TESTS****OBJECT:**DUANE ARNOLD ENERGY CENTER
PALO, IOWA

DATE: October 11, 1973

REPORTED TO:Bechtel Power Corporation
P.O. Box 209
Palo, Iowa 52324
Attn: Mr. Daubenheyer

FURNISHED BY: Job Mixed

COPIES TO:

(2) TCT & EL, Inc. - Waterloo

FIELD DATA:

	A	B	C	D	E	F
Job Identification						
Date Cast	September 13, 1973					
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Two 3" x 6" Mortar Cylinders					
Location Placed	Turbine Building BWT-23, 20A + 12E					
Specified Strength @ 28 Days						
Mix Proportions:						
Cement	94 lbs. Portland Cement					
Lime	12.5 lbs. Hydrated Lime					
Sand	254 lbs. Masonry Sand					

COMPRESSIVE STRENGTH:

	754	754	754	754	754	754
Laboratory Number						
Date Received	September 17, 1973					
Method of Curing:						
Days on Job & Enroute	4	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	14,250	14,000	14,050	19,700	19,950	20,850
Strength, psi	3560	3500	3510	4920	4990	5210

REMARKS:

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Twin City Testing and Engineering Laboratory, Inc.

By: Alvin F. Beal