MAR 3 1992

ORNL
MASTER COPY

ORNL/NRC/LTR-91/26

SUMMARY OF TEST RESULTS FOR PORTLAND CEMENT ASSOCIATION STUDY ON LONG-TERM PROPERTIES OF CONCRETE

M. G. Van Geem
Construction Technology Laboratories, Inc.
5420 Old Orchard Road
Skokie, IL 60077–1030

D. J. Naus
Oak Ridge National Laboratory
Oak Ridge, TN 37831–8056

January 1992

Prepared for
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-84OR21400

Prepared for the
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Under Interagency Agreement No. 1886-8084-5B

NRC FIN No. B0845

This document has been reviewed and is determined to be
APPROVED FOR PUBLIC RELEASE.

Name/Title: Tammy Claiborne/ORNL TIO
Date: 02/19/2021

Contents

Page

LIST OF TABLES v
ABSTRACT 1
1. INTRODUCTION 1
2. BACKGROUND 3
3. PORTLAND CEMENT ASSOCIATION STUDY 5
3.1 Program Description 5
3.2 Material Characteristics and Mixture Proportions 5
3.3 Specimen Description 6
3.4 Curing Conditions 6
3.5 Test Methods 6
3.5.1 Cylindrical Test Specimens 6
3.5.2 Prismatic Test Specimens 6
3.5.3 Modified Cube Test Specimens 7
3.6 Available Data 7
4. REFERENCES 9
APPENDIX A: PORTLAND CEMENT ASSOCIATION SERIES 356
APPENDIX B: PORTLAND CEMENT ASSOCIATION SERIES 374
APPENDIX C: PORTLAND CEMENT ASSOCIATION SERIES 436

LIST OF TABLES

Table Page

1. Summary of Properties of Cementitious Materials 12
2. Summary of Characteristics of Aggregate Materials 13
3. Summary of Mixture Proportions and Selected Concrete Properties 14
4. Utilization of Test Specimens 15
5. Summary of Data Availability: Modified Cube Test Specimens 16
6. Summary of Data Availability: Prismatic Test Specimens 17
7. Summary of Data Availability: Cylindrical Test Specimens 18

SUMMARY OF TEST RESULTS FOR PORTLAND CEMENT ASSOCIATION STUDY ON LONG-TERM PROPERTIES OF CONCRETE

M. G. Van Geem
D. J. Naus*

ABSTRACT

The long-term data presented in this report were compiled from the results of three studies conducted by the Portland Cement Association using specimens cast between 1948 and 1957. The study was part of a comprehensive investigation of portland cement in concrete in which the behavior of concrete was studied, primarily compressive strength and other physical properties, at ages ranging from 1 day to 34 years. Results are summarized for Portland Cement Association Series 356, Portland Cement Association Series 374, and Portland Cement Association Series 436. Detailed results for each of these series are provided as appendices to the main report in the form of handbook pages for entry into the Structural Materials Information Center, being developed at Oak Ridge National Laboratory.

---

1. INTRODUCTION

Under the materials property data base task of the Structural Aging Program,[1] a Structural Materials Information Center, (SMIC)[2] is being developed at the Oak Ridge National Laboratory. The SMIC will contain information on the time variation of structural materials' properties under the influence of pertinent environmental stressors and aging factors. The center, which is being developed in both hard copy (handbook) and electronic data base formats, will aid in the prediction of potential long-term deterioration of critical structural components in nuclear power plants and in establishing limits on hostile environmental exposure for these structures. The results also will have application in helping to establish maintenance or remedial measures programs that will assist in either prolonging component service life or improving the probability of the component surviving an extreme event such as a loss-of-coolant accident. Successful utilization of SMIC, however, requires that it contain good quality, representative data.

---

* Text was prepared by D. J. Naus, ORNL Program Manager. Data analysis and entry onto ORNL handbook pages was prepared by Martha G. Van Geem, Senior Engineer, Construction Technology Laboratories, Inc., 5420 Old Orchard Road, Skokie, Ill. 60077.

2. BACKGROUND

One of the findings in Ref. 3 was that materials property data for concrete over an extended period of time are limited. This is especially true for concretes which have been subjected to aging factors or environmental stressors characteristic of those that could occur in a nuclear power plant. Another limitation on availability of materials property data is that in order for the data to be considered as being of "high quality," detailed information such as constituent composition, mixture proportions, curing conditions, environmental exposure, etc., are required. For most structures that have been in service for the period of interest, 20 to 100 years, this information and the time variation of the properties of the constituent materials are not available. Fortunately, the Portland Cement Association study on long-term properties of concrete is an exception to the above limitations.

3. PORTLAND CEMENT ASSOCIATION STUDY

3.1 PROGRAM DESCRIPTION

A comprehensive field and laboratory investigation of the long-term performance of cement in concrete was developed conceptually in 1938.[4] However, it was not until 1940 that the program plan was finalized. The overall objective of the study was to investigate the behavior of cements with respect to durability through laboratory and field studies designed to provide first, a comparison of the performance of cement in structures, and second, the relation between differences in performance and differences in the definable properties of the cements or concretes.[5]

The investigation was primarily designed to be a study of cement. A total of 27 cements, representing the full range of physical and chemical properties of commercial cements produced in widely separated sections of the United States, were utilized. The cements were used in the fabrication of several types of concrete structures at different locations throughout the U.S. selected to provide the widest ranges in conditions of exposure. The study described in this report is a laboratory portion of the investigation which included field studies of full-size concrete structures. This laboratory portion was undertaken to provide data on the strength-producing properties of the various cements that were used to produce the concretes. More details on the field and other laboratory studies are provided in Ref. 6–12.

Four studies were initiated at the Portland Cement Association between 1940 and 1957 to investigate the strength-producing properties of the various cements. Series 308 was conducted to define the strength characteristics of concretes made from the five types of portland cement and tested specimens ranging in age from 1 day to 5 years.[13] Series 356 was conducted to evaluate the influence of curing conditions on the performance of concrete pavements cast using Types I and III portland cement with specimens tested at ages up to either 5 or 20 years, depending on curing conditions. Series 374 was conducted to investigate the long-term properties of continuously moist cured concretes made from the five types of portland cement. Concrete strength results were obtained at ages up to 34 years. Series 436 was conducted to compare concretes made using portland blast-furnace slag cement (Type IS) with those obtained from concretes fabricated using conventional Type I portland cements. Results were compared at ages from 1 day to 27 years. Since Series 308 only tested specimens to an age of 5 years, results for these tests are not presented as a part of this report. However, Ref. 14 provides information on Series 308 as well as a compilation of results for all four test series.

3.2 MATERIAL CHARACTERISTICS AND MIXTURE PROPORTIONS

A summary of the properties of the cementitious materials used in the three test series is presented in Table 1. Actual cement composition results for each mix of each test series are presented in the appendices. Each appendix is for a Portland Cement Association test series: Appendix A for Series 356, Appendix B for Series 374, and Appendix C for Series 436. Each appendix is divided into two volumes in accordance with the ORNL format: Volume 2 – Supporting Documentation and Volume 3 – Material Data Sheets. Cement composition for each mix is presented in the respective Volume 3 for each series.

Characteristics of the fine and coarse aggregate materials used in the study are summarized in Table 2. More detailed information on the aggregate materials used in each particular mix can be obtained from Volume 3 of the appropriate appendix for a test series.

Table 3 summarizes mixture proportions (water-cement ratios, cement contents, and fine and coarse aggregate contents) and plastic concrete properties (slump and air content) for the three test series. Actual mixture proportions and plastic concrete properties for each particular mix in a test series can be obtained from Volume 3 of the appropriate appendix. Also presented in Table 3 is the range in the 28-day baseline compressive strength values that was obtained for each cement type of each test series.

3.3 SPECIMEN DESCRIPTION

Three types of test specimens were utilized in the investigation: cylinders, modified cubes, and prisms. A small number of 152.4-mm diameter by 304.8-mm cylinders were cast in Series 374 and Series 436 primarily to establish the 28-day strength of the mixes. The cylinders were prepared using procedures similar to those described in ASTM C 192 (Ref. 15). Modified cube specimens (152.4 by 152.4 by 152.4-mm), prepared from sections of beams broken in flexure, were used throughout the investigation to provide compressive strength results. Flexure and dynamic properties of the concretes were obtained from 152.4 by 152.4 by 762-mm concrete prisms cast using procedures such as described in ASTM C 192. Table 4 presents types of tests performed using the various test specimens.

3.4 CURING CONDITIONS

Five curing conditions were utilized for Series 356: (1) moist curing–continuous storage in moist room at 100% relative humidity and 23° C; (2) air curing–moist curing for 7 days followed by storage at ≈50% relative humidity and 21 to 23°C; (3) air curing followed by soaking–moist curing for 7 days, air curing till 48 hours before testing, soaking in water at 23° C for 48 hours; (4) outdoor exposure (Skokie, Illinois)–moist curing for 7 days, store outdoors on a clay loam; and (5) outdoor exposure (Dallas, Texas) - moist curing for 7 days, store outdoors on a sandy soil. During the outdoor exposure curing, the specimens were stored side by side in the ground with only the upper surface exposed. Series 374 specimens were all continuously moist cured until time of testing. Series 436 specimens were either continuously moist cured or air cured. Curing conditions for a particular concrete mix can be obtained from Volume 3 of the appropriate appendix.

3.5 TEST METHODS

3.5.1 CYLINDRICAL TEST SPECIMENS

Cylindrical concrete test specimens were utilized to determine compressive strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity values. Tests for compressive strength, static modulus of elasticity, and dynamic modulus of elasticity were conducted using procedures such as those presented in Refs. 16, 17, and 18, respectively.

3.5.2 PRISMATIC TEST SPECIMENS

Prismatic test specimens were utilized to determine flexural strength, static modulus of elasticity, and dynamic modulus of elasticity. Tests for flexural strength were conducted

using procedures such as described in Refs. 19 and 20. The static modulus of elasticity of the prismatic test specimens from Series 374 was determined from the empirical relation:

$$E_s = \frac{P}{f}\left[0.96 + \frac{1}{4}\left(\frac{4}{5} + \frac{\upsilon}{2}\right)\right] \text{(psi)}.$$

where P is load applied to specimen loaded at third-points of a 457-mm span (Ref. 20), f is midspan deflection, and u is Poisson's ratio determined from sonic tests. The dynamic modulus of elasticity was obtained using a procedure such as described in Ref. 18. In addition, pulse velocities were determined for several of the specimens using a soniscope.

3.5.3 MODIFIED CUBE TEST SPECIMENS

Modified cube test specimens were utilized throughout the study as the primary test article to determine concrete compressive strengths. The specimens were tested using procedures such as described in Ref. 21.

3.6 AVAILABLE DATA

Tables 5, 6, and 7 present a summary of data availability for each cement type of each test series for the modified cube, prismatic and cylindrical test specimens, respectively. The results are presented in terms of ages at which tests were conducted. Detailed information and results for each test series are provided in the appendices of this report: Appendix A corresponds to Series 356, Appendix B to Series 374, and Appendix C to Series 436. The results are presented in a format compatible with the Structural Material Information Center being developed at the Oak Ridge National Laboratory, that is, for each cement type of each test series, Volume 2 - Supporting Documentation and Volume 3 - Material Data Sheet entries have been prepared.

4. REFERENCES

1. D. J. Naus and C. B. Oland, "Structural Aging Program Technical Progress Report for Period October 1, 1989, to December 31, 1990," ORNL/NRC/LTR-91/2, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, March 1991.

2. C. B. Oland and D. J. Naus, "Structural Materials Information Center for Presentation of the Time Variation of Material Properties, "ORNL/NRC/LTR-90/22, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, November 1990.

3. D. J. Naus, "Concrete Component Aging and Its Significance Relative to Life Extension of Nuclear Power Plants," NUREG/CR-4652(ORNL/TM-10059), Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, September 1986.

4. F. R. McMillan and I. L. Tyler, "Long-Time Study of Cement Performance in Concrete. Chapter 1 — History and Scope," *Journal of the American Concrete Institute*, February 1948, pp. 441–453. Reprinted as *Research Department Bulletin RX026-1*, Portland Cement Association, Skokie, Ill., August 1948.

5. P. Klieger, "Long-Time Study of Cement Performance in Concrete. Chapter 10 — Progress Report on Strength and Elastic Properties of Concrete," *Journal of the American Concrete Institute, Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. Reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, Ill., February 1958.

6. F. R. McMillan, W. C. Hansen, W. Lerch, C. L. Ford, and L. S. Brown, ""Long-Time Study of Cement Performance in Concrete. Chapter 2 — Manufacture of the Test Cements; Chapter 3 — Chemical and Physical Tests of the Cements; Chapter 4 — Microscopical Study of Clinkers," *Journal of the American Concrete Institute*, March 1948, pp. 553–602; April 1948, pp. 743–795; May 1948, pp. 877–923. Reprinted as *Research Department Bulletin RX026-2, 3, & 4*, Portland Cement Association, Skokie, Ill., August 1948.

7. F. R. McMillan, T. E. Stanton, I. L. Tyler, and W. C. Hansen, "Long-Time Study of Cement Performance in Concrete. Chapter 5 — Concrete Exposed to Sulfate Soils," *Special Publication of the American Concrete Institute*, 1949, 64 pages. Reprinted as *Research Department Bulletin RX030*, Portland Cement Association, Skokie, Ill., December 1949.

8. G. J. Verbeck and C. W. Foster, "Long-Time Study of Cement Performance in Concrete. Chapter 6 — The Heats of Hydrations of the Cements," *Proceedings, American Society for Testing and Materials*, Vol. 50, 1950, pp. 1235–1262. Reprinted as *Research Department Bulletin RX032*, Portland Cement Association, Skokie, Ill., 1950.

9. F. H. Jackson and I. L. Tyler, "Long-Time Study of Cement Perofrmance in Concrete. Chapter 7 — New York Test Road," *Journal of the American Concrete Institute, Proceedings*, Vol. 47, June 1951, pp. 773–796. Reprinted as *Research Department Bulletin RX038*, Portland Cement Association, Skokie, Ill., 1951.

9. F. H. Jackson and I. L. Tyler, "Long-Time Study of Cement Perofrmance in Concrete. Chapter 7 — New York Test Road," *Journal of the American Concrete Institute, Proceedings*, Vol. 47, June 1951, pp. 773–796. Reprinted as *Research Department Bulletin RX038*, Portland Cement Association, Skokie, Ill., 1951.

10. R. F. Blanks, Advisory Committee Chairman, "Ten Year Report on the Long-Time Study of Cement Performance in Concrete," *Journal of the American Concrete Institute, Proceedings,* Vol. 49, March 1953, pp. 601–614. Reprinted as *Research Department Bulletin RX038,* Portland Cement Association, Skokie, Ill., 1953.

11. F. H. Jackson, "Long-Time Study of Cement Performance in Concrete. Chapter 9 — Correlation of the Results of Laboratory Tests with Field Performance Under Natural Freezing and Thawing Conditions," *Journal of the American Concrete Institute, Proceedings*, Vol. 52, October 1955, pp. 159–193. Reprinted as *Research Department Bulletin RX060*, Portland Cement Association, Skokie, Ill., 1955.

12. P. Klieger and A. W. Isberner, "Laboratory Studies of Blended Cements - Portland Blast-Furnace Slag Cements," Journal of Portland Cement Association Research and Development Laboratories, Vol. 9, No. 3, Portland Cement Association, pp. 2–22, September 1967. Reprinted as Research Department Bulletin RX218, Portland Cement Association, Skokie, Ill.

13. H. F. Gonnerman and W. Lerch, "Changes in Characterisitics of Portland Cement as Exhibited by Laboratory Tests over the Period 1904 to 1950," Special Technical Publication No. 127, American Society for Testing and Materials, Philadelphia, Pennsylvania, 1952. Reprinted as Research Department Bulletin RX039, Portland Cement Association, Skokie, Ill.

14. S. L. Wood, "Evaluation of the Long-Term Properties of Concrete," Vol. 88, No. 6, *ACI Materials Journal*, American Concrete Institute, Detroit, Michigan, November - December 1991, pp. 630–643.

15. "Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory," ASTM C 192, Vol. 4.02, American Society for Testing and Materials, Philadelphia, Penn., 1991.

16. "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens," ASTM C 39, Ibid.

17. "Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression," ASTM C 469, Ibid.

18. "Standard Test Method for Fundamental Transverse, Longitudinal, and Torsonial Frequencies of Concrete," ASTM C 215, Ibid.

19. "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)," ASTM C 293, Ibid.

20. "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading), ASTM C 78, Ibid.

21. "Standard Test Method for Compressive Strength of Concrete Using Portions of Beams Broken in Flexure," ASTM C 116, Ibid.

Table 1. Summary of Properties of Cementitious Materials*

Series No.	Type Cement**	Potential Compound Composition, %				Specific Surface, cm^2/gm	
		C_3S	C_2S	C_3A	C_4AF	Blaine	Wagner
356	I	43.2-58.1	16.2-30.8	11.2-12.3	6.9-7.8	2910-3550	1680-1910
	III	43.9-58.3	15.9-29.7	10.3-12.4	6.3-7.5	4080-5360	2270-2650
374	I	36.8-64.5	10.0-35.5	7.5-13.2	6.5-10.7	2470-3985	1320-1880
	I***	45.0	28.0	12.6	7.3	3276	1815
	II	34.0-51.0	24.0-41.0	3.7-6.6	9.7-16.6	2891-3697	1630-1925
	II***	51.0	24.0	3.7	16.6	3109	1875
	III	56.0-60.0	13.0-17.0	10.4-10.8	6.4-7.7	5272-5795	2530-2795
	IV	20.0-29.0	48.0-55.0	3.5-6.2	8.2-15.2	3501-3846	1915-1965
	IV***	29.1	52.0	5.3	9.3	3633	1915
	V	41.0	39.0	3.7	10.0	3483	2025
	IA	44.0-52.5	21.0-28.5	7.9-13.2	6.7-10.4	3114-3756	1680-2010
	IIA	38.0	40.0	6.6	9.7	2983	1750
	IIIA	57.0	16.0	10.4	7.3	5169	2510
436	I	41.7	28.9	10.7	8.4	3425	—
	IS	37.8-52.1	23.5-31.5	9.1-12.8	7.7-11.1	3625-4525	—

*Where more than one cement of a specific type is used in a series, a range in composition is provided.
**ASTM C 150 designation.
***Air-entraining agent added to mix.

Table 2. Summary of Characteristics of Aggregate Materials

Series No.	Type Aggregate	Source	Geologic Characteristics	ASTM Classification*	Specific Gravity	Sand Fineness Modulus
356	Fine	Victoria, Texas	Siliceous Sand	—	2.63	2.53
	Fine	Elgin, Illinois	Dolomitic Sand	—	2.65	2.77
	Coarse	Elgin, Illinois	Dolomitic Gravel	357	2.66	—
	Coarse	Elmhurst, Illinois	Crushed Limestone	357	2.68	—
	Coarse	Victoria, Texas	Siliceous Gravel	357	2.57	—
374	Fine	Elgin, Illinois	Dolomitic Sand	—	2.65	2.90
	Coarse	Elgin, Illinois	Dolomitic Gravel	467	2.65	—
436	Fine	Elgin, Illinois	Dolomitic Sand	—	2.65	3.05
	Coarse	Elgin, Illinois	Dolomitic Gravel	467	2.65	—

*ASTM C 33 designation for coarse aggregate.

Table 3. Summary of Mixture Proportions and Selected Concrete Properties*

Series No.	Type Cement**	Total Mixes	Cement Content, lb/yd^3	w/c, by weight	Fine Aggregate Content, lb/yd^3	Coarse Aggregate Content, lb/yd^3	Slump, in.	Air Content, %	28-day Compressive Strength, psi***
356	I	18	339-704	0.40-0.71	851-1248	1929-2166	1.1-3.2	0.7-1.7	4060-9020
	III	18	328-717	0.40-0.71	833-1268	1929-2166	1.6-3.4	0.0-1.5	4920-9400
374	I	22	423-566	0.41-0.61	1198-1368	2017-2090	1.9-3.4	1.1-2.0	2750-7490
	I****	1	282	0.81	1397	2012	2.9	4.8	2360
	II	10	424-566	0.41-0.56	1217-1372	2034-2098	2.2-2.8	1.1-1.8	3580-6560
	II****	1	284	0.79	1410	2031	2.4	4.3	2010
	III	4	423-565	0.44-0.60	1185-1365	2019-2063	2.0-3.0	1.2-1.6	5310-6560
	IV	8	424-567	0.40-0.55	1214-1371	2036-2088	2.1-2.7	1.2-2.2	2810-5900
	IV****	1	284	0.78	1414	2037	2.1	4.3	1280
	V	2	423-565	0.41-0.54	1232-1377	2068-2101	2.1-2.4	1.3-1.5	3890-6200
	IA	8	420-567	0.38-0.53	1027-1301	2064-2138	1.9-2.5	2.8-7.5	3840-6700
	IIA	2	423-563	0.39-0.49	1137-1261	2086-2105	2.0-2.1	3.9-4.9	4020-4880
	IIIA	2	427-562	0.40-0.48	1102-1202	2076-2094	2.1-2.4	4.6-5.8	4790-5650
436	I	4	373-740	0.35-0.62	1023-1408	2069-2188	2.2-2.7	1.0-1.4	3620-7120
	IS	20	360-839	0.35-0.62	953-1412	1937-2134	2.4-3.0	1.2-1.7	3590-7630

*Where more than one concrete mix or cement of a specific type is used in a series, a range in composition is provided.
**ASTM C 150 designation.
***All specimens moist cured until time of test. Except for Series 356, all tests were performed using 6-in. diameter by 12-in. long cylindrical test specimens. Series 356 used 6-in. modified cube test specimens.
****Air-entraining agent added to mix.

Conversion Factors: 1 in. = 25.4 mm, 1 lb/yd^3 = 0.5933 kg/m^3, and 1 psi = 6.894757 × 10^{3}Pa.

Table 4. Utilization of Test Specimens

Specimen Type	Type Test				
	Compressive Strength	Modulus of Rupture	Modulus of Elasticity		Pulse Velocity
			Static	Dynamic	
Modified Cube*	X				
Prism		X	X	X	X
Cylinder	X		X	X	X

*Modified cube specimens were provided by broken portions of prismatic specimens tested in flexure.

Table 5. Summary of Data Availability: Modified Cube Test Specimens

Series	Type Cement***	Compressive Strength*				
		Curing Condition**				
		M	A	A+S	OD-S	OD-D
356	I	3d-20y	3d-5y	3d-5y	3d-20y	3d-5y
	III	3d-20y	3d-5y	3d-5y	3d-20y	3d-5y
374	I	1d-34y	—	—	—	—
	I****	1d-34y	—	—	—	—
	II	1d-34y	—	—	—	—
	II****	1d-10y	—	—	—	—
	III	1d-34y	—	—	—	—
	IV	1d-34y	—	—	—	—
	IV****	1d-34y	—	—	—	—
	V	1d-34y	—	—	—	—
	IA	1d-34y	—	—	—	—
	IIA	1d-34y	—	—	—	—
	IIIA	1d-10y	—	—	—	—
436	I	1d-27y	1d-27y	—	—	—
	IS	1d-27y	1d-27y	—	—	—

*Values given are ages at which tests were conducted, e.g., 3d-20y indicates tests were conducted on concrete specimens at ages from 3 days to 20 years.

**M=moist, A=air curing, A+S=air curing followed by soaking, OD-S=outdoors at Skokie (IL), and OD-D=outdoors at Dallas (TX). See Section 3.4.

***ASTM C 150 designation.

****Air-entraining agent added to mix.

Table 6. Summary of Data Availability: Prismatic Test Specimens*

		Modulus of Rupture (Flexural Strength)							Modulus of Elasticity					
		Loading Conditions												
		Midspan					Third-Point		Dynamic				Static	Pulse Velocity
		Curing Condition**												
Series	Type Cement***	M	A	A+S	OD-S	OD-D	M	A	M	A	A+S	OD-S	M	M
356	I	3d-20y	3d-5y	3d-5y	3d-20y	3d-5y	7d-28d	—	1d-5y	1d-5y	1d-5y	1d-5y	—	—
	III	3d-20y	3d-5y	3d-5y	3d-20y	3d-5y	7d-28y	—	1d-5y	1d-5y	1d-5y	1d-5y	—	—
374	I	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	I****	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	7d-10y
	II	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	II****	—	—	—	—	—	1d-10y	—	1d-10y	—	—	—	28d-3y	7d-10y
	III	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	IV	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	IV****	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	7d-10y
	V	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	IA	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	IIA	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	28d-3y	1d-10y
	IIIA	—	—	—	—	—	1d-34y	—	1d-10y	—	—	—	—	—
436	I	—	—	—	—	—	1d-27y	1d-27y	—	—	—	—	—	—
	IS	—	—	—	—	—	1d-27y	1d-27y	—	—	—	—	—	—

*Values given are ages at which tests were conducted, e.g., 3d-20y indicates tests were conducted on concrete specimens at ages from 3 days to 20 years.
**M = moist, A = air curing, A+S = air curing followed by soaking, OD-S = outdoors ar Skokie (IL), and OD-D = outdoors at Dallas (TX). See Section 3.4.
***ASTM C 150 designation.
****Air-entraining agent added to mix.

Table 7. Summary of Data Availability: Cylindrical Test Specimens*

Series	Type Cement**	Compressive Strength	Modulus of Elasticity		Pulse Velocity
			Static	Dynamic	
356	I	—	—	—	—
	III	—	—	—	—
374	I	28d	28d-3y	28d-3y	—
	I***	28d	28d-3y	28d-3y	—
	II	28d	28d-3y	28d-3y	—
	II***	28d	28d-3y	28d-3y	—
	III	28d	28d-3y	28d-3y	—
	IV	28d	28d-3y	28d-3y	—
	IV***	28d	28d-3y	28d-3y	—
	V	28d	28d-3y	28d-3y	—
	IA	28d	28d-3y	28d-3y	—
	IIA	28d	28d-3y	28d-3y	—
	IIIA	28d	—	—	—
436	I	7d-28d	—	7d-28d	7d-28d
	IS	7d-28d	—	7d-28d	7d-28d

*All specimens moist cured until testing. Values given are ages at which tests were conducted,
e.g., 3d-20y indicates tests were conducted on concrete specimens at ages from 3 days to 20 years.
**ASTM C 150 designation.
***Air-entraining agent added to mix.

APPENDIX A:

PORTLAND CEMENT ASSOCIATION SERIES 356

PORTLAND CEMENT ASSOCIATION SERIES 356

TABLE OF CONTENTS

Page No.

General Information for All Cement Types 1

Type I Cement
ORNL.Volume 2 — Supporting Documentation..... 7
ORNL.Volume 3 — Material Data Sheets..... 71

Type III Cement
ORNL.Volume 2 — Supporting Documentation..... 143
ORNL.Volume 3 — Material Data Sheets..... 207

SERIES 356

GENERAL INFORMATION FOR ALL CEMENT TYPES

PORTLAND CEMENT ASSOCIATION SERIES 356

Laboratory tests reported in Portland Cement Association (PCA) Series 356 were used to evaluate the influence of curing conditions on the performance of concrete pavements. Portland cement Types I and III and aggregates from three sources were used to prepare concrete specimens subjected to five curing conditions:

(1) Moist cured
(2) Air cured
(3) Air cured and then soaked for 48 hours before test
(4) Stored outdoors on a clay loam in Skokie, Illinois
(5) Stored outdoors on a sandy soil in Dallas, Texas

Compressive strength, flexural strength, and dynamic modulus of elasticity are reported at selected intervals through either 5 or 20 years depending on the curing condition.

In the following pages, data for concrete with the same cement type, same aggregate source, and a water-cement ratio within 0.04 are considered similar and are grouped together. Cements from different manufacturers are considered to cause less variations in long term properties than differences in water-cement ratios. Fig. 4 of the reference by Sharon Wood shows the effect of water-cement ratio on concrete compressive strength.

Material Code 01 C Property Code ____ Page 1.1

Portland Cement Concrete Normal-Weight Aggregate Series 356		Update Package Number 0 Revision Control Code 0.0 Quality Level _

Preparer: _____

Organization: _____

Sources: References __, __, __, __ and __

Information Sources
Reference 50 (Also called Reference 1 on some of the following pages): Report from Sharon Wood to PCA. This information source presents constituent material, concrete mix, and material property data for concrete specimens made from portland cement Types I and III. Compressive strength, flexural strength, and dynamic modulus of elasticity are reported for five curing conditions at selected intervals through 34 years.
Reference __:
Reference __:
Reference __:

PORTLAND CEMENT ASSOCIATION SERIES 356

TYPE I CEMENT

SERIES 356

TYPE I CEMENT

ORNL Volume 2 — Supporting Documentation

7

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AVI	(5650)	(7140)	(9020)	(9460)	(8870)	(10,760)	(10,070)	(11,020)	(12,700)
DVI	(5000)	(6710)	(7980)	(8530)	(8660)	(10,240)	(10,340)	(10,540)	(12,300)
EVI	(4670)	(6650)	(8530)	(9790)	(10,090)	(9940)	(11,330)	(10,900)	(12,460)
XVI	(5220)	(6950)	(8520)	(—)	(9720)	(—)	(10,550)	(10,850)	(13,100)
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C=0.53

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV2	(3390)	(4760)	(6510)	(7480)	(6890)	(7780)	(7720)	(8900)	(9680)
DV2	(3070)	(4810)	(6270)	(7400)	(7840)	(8780)	(8720)	(9330)	(9980)
EV2	(2700)	(4580)	(6730)	(7690)	(7860)	(8240)	(8960)	(8680)	(10,290)
XV2	(3350)	(4870)	(6700)	(—)	(7950)	(—)	(8710)	(8760)	(9800)
Average	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV3	(1770)	(2540)	(4160)	(4540)	(4540)	(4960)	(5030)	(5840)	(6130)
DV3	(1580)	(2610)	(4380)	(5060)	(5360)	(5680)	(5700)	(6470)	(6710)
EV3	(1470)	(2500)	(4290)	(5010)	(5070)	(5110)	(5770)	(6200)	(6420)
XV3	(1680)	(2610)	(4120)	(—)	(5060)	(—)	(5610)	(6280)	(6590)
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Elgin Dolomitic

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.40

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cube:, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XW1	(4680)	(6200)	(7780)	(—)	(9840)	(—)	(10,100)	(10,310)	(11,480)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356, Elgin Dolomitic

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XW2	(3100)	(4520)	(6270)	(–)	(7420)	(–)	(8180)	(8150)	(8760)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB

Property Code 3621

Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XW3	(1770)	(2680)	(4140)	(—)	(5290)	(—)	(5560)	(5630)	(5460)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 35% Elmhurst Limestone
Mixes with W/C = 0.40

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XL1	(4780)	(6300)	(8090)	(—)	(9470)	(—)	(10,780)	(10,740)	(11,730)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 3621

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 356 Elmhurst Limestone

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XL2	(3170)	(4470)	(6040)	(—)	(7740)	(—)	(8070)	(8370)	(8060)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 35% Elmhurst Limestone

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XL3	(1800)	(2650)	(4060)	(—)	(4990)	(—)	(5220)	(5280)	(5260)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Compressive Strength Test Results for Air-Cured, 6 in. Cubes, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(5650)	(7140)	(8390)	(9400)	(8740)	(9100)	(8940)
DV1	(5000)	(6710)	(8170)	(8730)	(8900)	(8610)	(8920)
EV1	(4670)	(6650)	(8690)	(9710)	(9600)	(8550)	(9340)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for Air-Cured, 6 in. Cubes, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(3390)	(4760)	(6550)	(7310)	(6880)	(6780)	(6840)
DV2	(3070)	(4810)	(6280)	(6790)	(7100)	(6690)	(6930)
EV2	(2700)	(4580)	(6750)	(7450)	(7140)	(6600)	(6030)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Comoressive Strength Test Results for Air-Cured, 6 in. Cubes, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(1770)	(2540)	(4010)	(4260)	(3860)	(3900)	(3830)
DV3	(1580)	(2610)	(4330)	(4780)	(4780)	(4570)	(4610)
EV3	(1470)	(2500)	(4250)	(4380)	(3940)	(4040)	(4070)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Compressive Strength Test Results for Air-Cured, Saturated before Test, 6-in. Cubes, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(5650)	(7140)	(8210)	(—)	(8130)	(—)	(7800)
DV1	(5000)	(6710)	(7880)	(—)	(7940)	(—)	(7470)
EV1	(4670)	(6650)	(8530)	(—)	(7710)	(—)	(7510)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for Air-Cured, Saturated before Test, 6-in. Cubes, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(3390)	(4760)	(6270)	(—)	(5460)	(—)	(4960)
DV2	(3070)	(4810)	(5940)	(—)	(5620)	(—)	(5480)
EV2	(2700)	(4580)	(6790)	(—)	(5790)	(—)	(5310)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Air-Cured, Saturated before Test, 6-in. Cubes, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(1770)	(2540)	(3560)	(—)	(2840)	(—)	(3020)
DV3	(1580)	(2610)	(3820)	(—)	(3550)	(—)	(3590)
EV3	(1470)	(2500)	(3810)	(—)	(3200)	(—)	(3190)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Victoria Siliceous
Mixes with W/C = 0.40

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Skokie, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AVI	(5650)	(7140)	(8520)	(9200)	(9410)	(9870)	(10,580)	(10,200)	(11,240)
DVI	(5000)	(6710)	(7430)	(8330)	(8770)	(9380)	(9410)	(9460)	(10,550)
EVI	(4670)	(6650)	(8550)	(9340)	(9480)	(9500)	(10,530)	(10,290)	(10,030)
XVI	(5220)	(6950)	(7580)	(—)	(8660)	(—)	(10,730)	(9470)	(10,540)
Average	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356, Victoria Siliceous
Mixes with W/C = 0.53

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Skokie, MPa (psi) at:

Mix No.	3days	7days	28days	3 months	1 year	3 years	5 years	10 years	20 years
AV2	(3390)	(4760)	(6120)	(7030)	(7410)	(7550)	(8010)	(8820)	(8480)
DV2	(3070)	(4810)	(5570)	(6250)	(7010)	(7760)	(8230)	(8560)	(8960)
EV2	(2700)	(4580)	(7040)	(6800)	(7880)	(7420)	(8380)	(8380)	(9160)
XV2	(3350)	(4870)	(5430)	(—)	(6890)	(—)	(8280)	(7960)	(7920)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous
Mixes with w/c = 0.71

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Skokie, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV3	(1770)	(2540)	(3470)	(4120)	(4220)	(4540)	(4790)	(5300)	(5080)
DV3	(1580)	(2610)	(3740)	(4290)	(4860)	(4520)	(5210)	(5700)	(5450)
EV3	(1470)	(2500)	(3660)	(4360)	(4440)	(4780)	(5290)	(5410)	(5390)
XV3	(1680)	(2610)	(3360)	(—)	(4440)	(—)	(4950)	(5350)	(5480)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Dallas, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(5650)	(7140)	(8140)	(7940)	(—)	(9930)	(10,690)
DV1	(5000)	(6710)	(7610)	(7770)	(—)	(9670)	(10,280)
EV1	(4670)	(6650)	(7890)	(8050)	(—)	(10,560)	(9750)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Dallas, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(3390)	(4760)	(6310)	(6580)	(6720)	(7390)	(8000)
DV2	(3070)	(4810)	(5790)	(6400)	(7310)	(7940)	(9040)
EV2	(2700)	(4580)	(6200)	(6580)	(7280)	(7090)	(8910)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Dallas, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(1770)	(2540)	(3870)	(4340)	(4200)	(4410)	(5260)
DV3	(1580)	(2610)	(3750)	(4270)	(4670)	(4740)	(5620)
EV3	(1470)	(2500)	(3820)	(4150)	(4490)	(4310)	(5550)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XVI	(—)	(625)	(725)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XV2	(—)	(555)	(655)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XV3	(—)	(385)	(490)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XW1	(—)	(620)	(750)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XW2	(—)	(515)	(665)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XW3	(—)	(395)	(515)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CA Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XL1	(—)	(705)	(880)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CA Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XL2	(—)	(555)	(720)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CA Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XL3	(—)	(420)	(555)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356, Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AVI	(720)	(805)	(930)	(985)	(1020)	(1045)	(1045)	(1060)	(1220)
DVI	(680)	(785)	(870)	(995)	(1000)	(1010)	(1050)	(1130)	(1190)
EVI	(575)	(785)	(990)	(925)	(940)	(980)	(995)	(1000)	(1140)
XVI	(675)	(740)	(860)	(—)	(1035)	(—)	(1070)	(1100)	(1150)
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Flexural Strength Test Results
for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV2	(500)	(630)	(790)	(820)	(780)	(785)	(755)	(800)	(870)
DV2	(475)	(620)	(785)	(835)	(815)	(880)	(915)	(970)	(970)
EV2	(455)	(625)	(815)	(765)	(770)	(835)	(830)	(850)	(910)
XV2	(520)	(645)	(780)	(—)	(815)	(—)	(795)	(840)	(920)
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous
Mixes with W/C = 0.71

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV3	(320)	(405)	(585)	(590)	(545)	(550)	(540)	(590)	(640)
DV3	(320)	(500)	(695)	(695)	(660)	(625)	(660)	(700)	(770)
EV3	(270)	(400)	(640)	(625)	(590)	(595)	(615)	(620)	(690)
XV3	(310)	(440)	(610)	(—)	(630)	(—)	(615)	(670)	(690)
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal- Weight
Gravel Aggregate
Series 356, Elgin Dolomitic
Mixes with W/C = 0.40

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Flexural Strength Test Results
for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XW1	(630)	(720)	(855)	(—)	(1030)	(—)	(1140)	(1100)	(1110)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356, Elgin Dolomitic
Mixes with W/C = 0.53

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XW2	(470)	(605)	(740)	(—)	(920)	(—)	(955)	(1000)	(1000)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Flexural Strength Test Results
for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XW3	(295)	(465)	(615)	(—)	(720)	(—)	(710)	(700)	(770)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete
Normal- Weight
Stone Aggregate
Series 356 Elmhurst Limestone

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XL1	(645)	(785)	(1030)	(—)	(1080)	(—)	(1080)	(1170)	(1170)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CA Property Code ____ Page 1.3

Portland Cement Concrete Normal- Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Flexural Strength Test Results
For Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XL2	(520)	(630)	(860)	(—)	(955)	(—)	(935)	(1020)	(1030)
Average									

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CA Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 356 Elmhurst Limestone

Flexural Strength
versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XL3	(330)	(485)	(680)	(—)	(775)	(—)	(720)	(710)	(780)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(720)	(805)	(590)	(660)	(695)	(770)	(795)
DV1	(680)	(785)	(470)	(555)	(635)	(710)	(730)
EV1	(575)	(785)	(515)	(620)	(640)	(710)	(705)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(500)	(630)	(500)	(660)	(675)	(710)	(675)
DV2	(475)	(620)	(445)	(550)	(635)	(740)	(720)
EV2	(455)	(625)	(490)	(625)	(615)	(625)	(625)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(320)	(405)	(405)	(545)	(500)	(480)	(500)
DV3	(320)	(500)	(445)	(515)	(630)	(605)	(620)
EV3	(270)	(400)	(425)	(550)	(500)	(465)	(515)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 350, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Soaked Before Test, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(720)	(805)	(815)	(—)	(650)	(—)	(675)
DV1	(680)	(785)	(735)	(—)	(635)	(—)	(550)
EV1	(575)	(785)	(775)	(—)	(475)	(—)	(580)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Soaked Before Test, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(500)	(630)	(740)	(—)	(560)	(—)	(580)
DV2	(475)	(620)	(655)	(—)	(510)	(—)	(510)
EV2	(455)	(625)	(740)	(—)	(480)	(—)	(540)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 350 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Soaked Before Test, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(320)	(405)	(515)	(—)	(370)	(—)	(405)
DV3	(320)	(500)	(525)	(—)	(445)	(—)	(510)
EV3	(270)	(400)	(485)	(—)	(355)	(—)	(430)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Flexural Strength Test Results
for Specimens Stored Outdoors in Skokie, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AVI	(720)	(805)	(905)	(880)	(970)	(1075)	(1100)	(1230)	(1240)
DVI	(680)	(785)	(825)	(905)	(980)	(1095)	(1010)	(1190)	(1190)
EVI	(575)	(785)	(860)	(965)	(980)	(990)	(1030)	(1290)	(1170)
XVI	(675)	(740)	(900)	(—)	(1060)	(—)	(980)	(1110)	(1280)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Flexural Strength Test Results
for Specimens Stored Outdoors in Skokie, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV2	(500)	(630)	(805)	(825)	(780)	(815)	(855)	(920)	(880)
DV2	(475)	(620)	(790)	(865)	(840)	(905)	(880)	(990)	(960)
EV2	(455)	(625)	(770)	(810)	(830)	(775)	(865)	(960)	(910)
XV2	(520)	(645)	(760)	(—)	(845)	(—)	(920)	(920)	(920)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Skokie, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AV3	(320)	(405)	(530)	(550)	(620)	(610)	(645)	(670)	(640)
DV3	(320)	(500)	(605)	(655)	(690)	(690)	(745)	(770)	(730)
EV3	(270)	(400)	(525)	(575)	(620)	(595)	(670)	(700)	(690)
XV3	(310)	(440)	(555)	(—)	(605)	(—)	(690)	(670)	(700)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Dallas, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AVI	(720)	(805)	(855)	(860)	(965)	(1110)	(840)
DVI	(680)	(785)	(865)	(895)	(1025)	(1185)	(875)
EVI	(575)	(785)	(855)	(870)	(955)	(985)	(795)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests. Dallas experienced a prolonged dry period immediately before the 5-year tests. As a result the beam specimens began to dry and the flexural strengths dropped an average of 30 % (Ref.: Report by Sharon Wood.)

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _
Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous		

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Dallas, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(500)	(630)	(735)	(770)	(820)	(915)	(560)
DV2	(475)	(620)	(715)	(745)	(890)	(990)	(650)
EV2	(455)	(625)	(705)	(785)	(790)	(860)	(600)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests. Dallas experienced a prolonged dry period immediately before the 5-year tests. As a result the beam specimens began to dry and the flexural strengths dropped an average of 30 % (Ref.: Report by Sharon Wood.)

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Dallas, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(320)	(405)	(555)	(655)	(565)	(650)	(435)
DV3	(320)	(500)	(610)	(625)	(675)	(710)	(485)
EV3	(270)	(400)	(565)	(620)	(625)	(700)	(435)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests. Dallas experienced a prolonged dry period immediately before the 5-year tests. As a result the beam specimens began to dry and the flexural strengths dropped an average of 30 % (Ref.: Report by Sharon Wood.)

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AVI	(5,300)	(6,540)	(7,030)	(7,700)	(7,930)	(7,980)	(8,130)	(8,270)
DVI	(5,260)	(6,320)	(7,050)	(7,660)	(7,890)	(7,870)	(7,860)	(8,180)
EVI	(4,380)	(6,190)	(6,960)	(7,470)	(7,820)	(8,000)	(7,960)	(8,290)
XVI	(5,040)	(6,360)	(7,020)	(7,470)	(—)	(8,010)	(—)	(8,260)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6 x 6 x 30-in. prisms were moist cured until test. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(4,200)	(5,900)	(6,500)	(7,120)	(7,280)	(7,450)	(7,440)	(7,450)
DV2	(4,190)	(5,750)	(6,570)	(7,200)	(7,430)	(7,550)	(7,500)	(7,680)
EV2	(3,210)	(6,570)	(7,200)	(7,100)	(7,410)	(7,540)	(7,510)	(7,590)
XV2	(3,990)	(5,780)	(6,460)	(7,000)	(—)	(7,480)	(—)	(7,750)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6 x 6 x 30-in. prisms were moist cured until test. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(2,690)	(4,800)	(5,760)	(6,420)	(6,590)	(6,560)	(6,650)	(6,660)
DV3	(2,770)	(4,830)	(5,920)	(6,530)	(6,870)	(6,990)	(7,100)	(6,950)
EV3	(2,180)	(4,330)	(5,330)	(6,450)	(6,880)	(6,770)	(6,720)	(6,830)
XV3	(2,600)	(4,610)	(5,680)	(6,450)	(—)	(6,810)	(—)	(6,970)
Average	( )	( )	( )	( )	( )	( )	( )	

6 x 6 x 30-in. prisms were moist cured until test. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C= 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(5,300)	(6,540)	(7,030)	(6,650)	(6,530)	(6,050)	(6,270)	(6,330)
DV1	(5,260)	(6,320)	(7,050)	(6,160)	(6,100)	(5,870)	(5,880)	(6,050)
EV1	(4,380)	(6,190)	(6,960)	(6,170)	(5,860)	(5,630)	(5,580)	(5,710)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(4,200)	(5,900)	(6,500)	(6,140)	(5,980)	(5,820)	(5,970)	(5,900)
DV2	(4,190)	(5,750)	(6,570)	(5,790)	(5,630)	(5,380)	(5,620)	(5,610)
EV2	(3,210)	(6,570)	(7,200)	(5,950)	(5,450)	(5,210)	(5,480)	(5,320)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(2,690)	(4,800)	(5,760)	(5,480)	(5,010)	(4,840)	(5,070)	(5,130)
DV3	(2,770)	(4,830)	(5,920)	(5,590)	(5,120)	(5,070)	(5,200)	(5,430)
EV3	(2,180)	(4,330)	(5,330)	(5,070)	(4,790)	(4,500)	(4,730)	(4,820)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Soaked Before Test, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV1	(5,300)	(6,540)	(7,030)	(7,170)	(—)	(6,760)	(—)	(6,770)
DV1	(5,260)	(6,320)	(7,050)	(7,070)	(—)	(6,340)	(—)	(6,270)
EV1	(4,380)	(6,190)	(6,960)	(7,170)	(—)	(6,250)	(—)	(6,630)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Soaked Before Test, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(4,200)	(5,900)	(6,500)	(6,540)	(—)	(6,110)	(—)	(6,160)
DV2	(4,190)	(5,750)	(6,570)	(6,460)	(—)	(5,800)	(—)	(5,820)
EV2	(3,210)	(6,570)	(7,200)	(6,520)	(—)	(5,850)	(—)	(6,080)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C=0.71

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Soaked Before Test, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(2,690)	(4,800)	(5,760)	(5,810)	(—)	(5,030)	(—)	(5,310)
DV3	(2,770)	(4,830)	(5,920)	(5,840)	(—)	(5,300)	(—)	(5,520)
EV3	(2,180)	(4,330)	(5,330)	(5,580)	(—)	(5,020)	(—)	(5,320)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Prisms Stored Outdoors in Skokie, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AVI	(5,300)	(6,540)	(7,030)	(7,350)	(7,780)	(8,500)	(7,970)	(8,050)
DVI	(5,260)	(6,320)	(7,050)	(7,350)	(7,630)	(8,470)	(7,600)	(7,940)
EVI	(4,380)	(6,190)	(6,960)	(7,430)	(7,770)	(8,540)	(7,820)	(8,130)
XVI	(5,040)	(6,360)	(7,020)	(7,470)	(—)	(8,440)	(—)	(8,230)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C= 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Prisms Stored Outdoors in Skokie, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV2	(4,200)	(5,900)	(6,500)	(7,020)	(7,270)	(7,850)	(7,440)	(7,500)
DV2	(4,190)	(5,750)	(6,570)	(6,820)	(7,250)	(7,850)	(7,460)	(7,620)
EV2	(3,210)	(6,570)	(7,200)	(7,140)	(7,430)	(7,980)	(7,470)	(7,580)
XV2	(3,990)	(5,780)	(6,460)	(7,070)	(—)	(7,850)	(—)	(7,750)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Prisms Stored Outdoors in Skokie, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AV3	(2,690)	(4,800)	(5,760)	(6,070)	(6,370)	(6,810)	(6,400)	(6,700)
DV3	(2,770)	(4,830)	(5,920)	(6,370)	(6,720)	(7,180)	(6,440)	(6,740)
EV3	(2,180)	(4,330)	(5,330)	(6,140)	(6,400)	(7,010)	(6,640)	(6,760)
XV3	(2,600)	(4,610)	(5,680)	(6,390)	(—)	(7,110)	(—)	(6,840)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

SERIES 356

TYPE I CEMENT

ORNL Volume 3 — Material Data Sheets

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. AV1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement A in this series. The concrete mix contained 618 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. AV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement A in this series. The concrete mix contained 453 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. AV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement A in this series. The concrete mix contained 354 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. DV1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement D in this series. The concrete mix contained 626 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. DV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement D in this series. The concrete mix contained 461 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. DV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement D in this series. The concrete mix contained 354 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. EV1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement E in this series. The concrete mix contained 614 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. EV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement E in this series. The concrete mix contained 461 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. EV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement E in this series. The concrete mix contained 354 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XVI

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement X and is a blend of Cements A,D, and E in this series. The concrete mix contained 615 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement X and is a blend of Cements A,D, and E in this series. The concrete mix contained 456 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement X and is a blend of Cements A,D, and E in this series. The concrete mix contained 354 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XW1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement X and is a blend of Cements A, D, and E in this series. The concrete mix contained 639 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XW2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement X and is a blend of Cements A, D, and E in this series. The concrete mix contained 450 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XW3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement X and is a blend of Cements A, D, and E in this series. The concrete mix contained 339 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Material Code 01 CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XL1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement, dolomitic sand from Elgin, Illinois, and crushed limestone from Elmhurst, Illinois. The cement was designated Cement X and is a blend of Cements A, D, and E in this series. The concrete mix contained 704 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XL2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement, dolomitic sand from Elgin, Illinois, and crushed limestone from Elmhurst, Illinois. The cement was designated Cement X and is a blend of Cements A, D, and E in this series. The concrete mix contained 501 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XL3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement, dolomitic sand from Elgin, Illinois, and crushed limestone from Elmhurst, Illinois. The cement was designated Cement X and is a blend of Cements A, D, and E in this series. The concrete mix contained 376 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AV1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	618	2001
Fine Aggregate	—	1042	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	247	2421
Total	—	4061	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Property Code 1220

Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured, air cured, air cured and then soaked, stored outdoors in Skokie, Illinois, or stored outdoors in Dallas, Texas.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature between 70 and 75°F and at a relative humidity of approximately 50%.

"Air cured -- saturated before test" means specimens were cured 7 days in a moist room and then stored indoors as described above. Specimens were soaked in water at 75°F for 48 hours prior to testing.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Specimens stored outdoors in Dallas, Texas were cured 7 days in a moist room and then stored outdoors on a sandy soil. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Dallas normally varies from 64 to 75 percent and averages about 69 percent. The annual precipitation including snowfall is about 29 in. Annual air temperatures usually range between 18 and 102°F. Dallas experienced a prolonged dry period immediately before the 5-year tests.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	453	2001
Fine Aggregate	—	1193	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	240	2421
Total	—	4040	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

See sheet following Vol: 3 page 2 (this page)
for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 35%, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	354	2001
Fine Aggregate	—	1248	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	251	2421
Total	—	4007	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	626	2001
Fine Aggregate	—	1029	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	250	2421
Total	—	4059	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AVI and AhVI

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	461	2001
Fine Aggregate	—	1179	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	244	2421
Total	—	4038	

Weight of water was derived from water/cement ratio of 053.

Property Code 1220	Processing Information
See sheet following Vol: 3 page 2 (this page) for Mix Nos. AV1 and AhV1	

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	354	2001
Fine Aggregate	—	1248	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	251	2421
Total	—	4007	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

See sheet following Vol: 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	614	2001
Fine Aggregate	—	1056	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	246	2421
Total	—	4070	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information
See sheet following Vol. 3 page 2 (this page) for Mix Nos. AVI and AhVI	

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	461	2001
Fine Aggregate	—	1179	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	244	2421
Total	—	4038	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	354	2001
Fine Aggregate	—	1248	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	251	2421
Total	—	4007	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information
See sheet following Vol: 3 page 2 (this page) for Mix Nos. AV1 and AhV1	

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	615	2001
Fine Aggregate	—	1049	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	246	2421
Total	—	4064	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or stored outdoors in Skokie, Illinois.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	456	2001
Fine Aggregate	—	1186	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	242	2421
Total	—	4038	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or stored outdoors in Skokie, Illinois.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	354	2001
Fine Aggregate	—	1248	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	251	2421
Total	—	4007	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or stored outdoors in Skokie, Illinois.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XW1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	639	2001
Fine Aggregate	—	957	2211
Coarse Aggregate	—	2166	2222
—	—	—	—
Water	—	256	2421
Total	—	4018	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XW2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	450	2001
Fine Aggregate	—	1135	2211
Coarse Aggregate	—	2166	2222
—	—	—	—
Water	—	239	2421
Total	—	3990	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XW3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	339	2001
Fine Aggregate	—	1210	2211
Coarse Aggregate	—	2166	2222
—	—	—	—
Water	—	241	2421
Total	—	3956	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CA Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356 Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XL1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	704	2001
Fine Aggregate	—	851	2211
Coarse Aggregate	—	1929	2222
—	—	—	—
Water	—	282	2421
Total	—	3766	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XL2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	501	2001
Fine Aggregate	—	999	2211
Coarse Aggregate	—	1929	2222
—	—	—	—
Water	—	266	2421
Total	—	3695	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CA Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XL3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	376	2001
Fine Aggregate	—	1070	2211
Coarse Aggregate	—	1929	2222
—	—	—	—
Water	—	267	2421
Total	—	3642	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
AVI	_._	9020	
DVI	_._	7980	
EVI	_._	8530	
XVI	_._	8520	
Average Compressive Strength	_._	_	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
AV2	_._	6510	
DV2	_._	6720	
EV2	_._	6730	
XV2	_._	6700	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.71

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
AV3	_._	4160	
DV3	_._	4380	
EV3	_._	4290	
XV3	_._	4120	
Average Compressive Strength	_._	_	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XW1	—.—	7780	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Oolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c= 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XW2	—.—	6270	
	—.—	—	
	—.—	—	
	—.—	—	
		—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Oolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.71

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XW3	—	4140	
	—	—	
	—	—	
	—	—	
Average Compressive Strength	—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XL1	—.—	8090	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XL2	—.—	6040	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XL3	—.—	4060	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes AV1, AV2, & AV3
Cement A

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	58.1	
	C_2S, %	16.2	
	C_3A, %	12.3	
	C_4AF, %	7.8	
	Fineness, Blaine	291	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	168	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	88.0	2128

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes DV1, DV2, & DV3
Cement D

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	43.2	
	C_2S, %	30.8	
	C_3A, %	11.2	
	C_4AF, %	6.9	
	Fineness, Blaine	355	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	191	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	95.3	2128

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes EV1, EV2, & EV3
Cement E

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	47.8	
	C_2S, %	26.2	
	C_3A, %	11.7	
	C_4AF, %	7.5	
	Fineness, Blaine Air-Permeability Test, m^2/kg	331	2103
	Fineness, Wagner Turbidimeter, m^2/kg^2	180	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	86.8	2128

Material Code 01C Property Code 2000

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes XL1, XL2, XL3 XV1, XV2, XV3, XW1, XW2, & XW3
Cement X*

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	49.7	
	C_2S, %	24.4	
	C_3A, %	11.7	
	C_4AF, %	7.4	
	Fineness, Blaine	326	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	180	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	90.0	2128

*This cement is a blend of cements A, D, & E.

Material Code 01 CB Property Code 2000 Page 5

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes AV1, AV2, AV3, DV1, DV2, DV3, EV1, EV2, EV3, XV1, XV2, XV3, AhV1, AhV2, AhV3, DhV1, DhV2, DhV3, EhV1, EhV2, EhV3, XhV1, XhV2, and XhV3

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Siliceous Sand		2211
	from Victoria, Texas		
	Fineness Modulus	2.53	2302
	Specific Gravity	2.63	2313
Coarse Aggregate	Siliceous Gravel		
	from Victoria, Texas		
	Maximum Size	2 in.	2351
	ASTM C33-90	357	
	Specific Gravity	2.57	2363
Water			2421

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties.	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes XW1, XW2, XW3, XhW1, XhW2, & XhW3

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Dolomitic Sand		2211
	from Elgin, Illinois		
	Fineness Modulus	2.77	2302
	Specific Gravity	2.65	2313
Coarse Aggregate	Dolomitic Gravel		
	from Elgin, Illinois		
	Maximum Size	2 in.	2351
	ASTM C33-90	357	
	Specific Gravity	2.66	2363
Water			2421

Material Code 01 CA Property Code 2000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes XL1, XL2, XL3, XhL1, XhL2, & XhL3

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Dolomitic Sand		2211
	from Elgin, Illinois		
	Fineness Modulus	2.77	2302
	Specific Gravity	2.65	2313
Coarse Aggregate	Crushed Limestone		
	from Elmhurst, Illinois		
	Maximum Size	2 in.	2351
	ASTM C33-90	357	
	Specific Gravity	2.68	2363
Water			2421

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AVI

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	618 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		0.7	2613

Reference Documentation
1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	453 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		1.1	2613

Reference Documentation
__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete" Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
__.
__.
__.
__.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	354 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation
__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
__.
__.
__.
__.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DV1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	626 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	1.1 in.	2631
Air Content, %		1.0	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	461 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		1.0	2613

Reference Documentation
__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
__.
__.
__.
__.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DY3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	354 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.3	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EVI

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	614 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	1.5 in.	2631
Air Content, %		0.7	2613

Reference Documentation
__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
__.
__.
__.
__.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	461 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		1.0	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	354 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.0 in.	2631
Air Content, %		1.3	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XVI

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	615 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		0.9	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

__.

__.

__.

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	456 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	354 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	3.2 in.	2631
Air Content, %		1.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XW1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	639 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		0.9	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XW2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	450 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XW3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	339 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.7	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XL1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	704 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.0 in.	2631
Air Content, %		1.0	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XL2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	501 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XL3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	376 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	1.8 in.	2631
Air Content, %		1.5	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

PORTLAND CEMENT ASSOCIATION SERIES 356

TYPE III CEMENT

SERIES 356

TYPE III CEMENT

ORNL Volume 2 — Supporting Documentation

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Victoria Siliceous

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.40

Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV1	(7050)	(8020)	(9400)	(9680)	(8960)	(10,520)	(10,080)	(10,710)	(12,340)
DhV1	(7480)	(8280)	(8860)	(9350)	(9420)	(10,460)	(10,240)	(10,830)	(12,700)
EhV1	(5790)	(7780)	(8720)	(9270)	(9930)	(10,440)	(10,890)	(10,660)	(13,470)
XhV1	(6650)	(7780)	(8910)	(—)	(9730)	(—)	(9960)	(10,980)	(12,390)
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 350, Victoria Siliceous

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV2	(4850)	(6230)	(7700)	(8300)	(8470)	(8380)	(8320)	(9160)	(9760)
DhV2	(5160)	(6180)	(7040)	(7710)	(7530)	(8340)	(8920)	(9240)	(9910)
EhV2	(3940)	(5600)	(7390)	(8500)	(8710)	(8900)	(9610)	(9450)	(10,730)
XhV2	(4760)	(6060)	(7380)	(—)	(8460)	(—)	(8430)	(9510)	(10,330)
Average	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

145

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 350, Victoria Siliceous

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV3	(2730)	(3700)	(5170)	(5520)	(5380)	(5800)	(5810)	(6270)	(6640)
DhV3	(2880)	(3890)	(4960)	(5000)	(5200)	(5920)	(5920)	(6260)	(6590)
EhV3	(2010)	(3010)	(5190)	(5870)	(6020)	(6210)	(6570)	(6810)	(7000)
XhV3	(2630)	(3520)	(4960)	(—)	(5580)	(—)	(6280)	(6810)	(7020)
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

146

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.40

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhW1	(6520)	(7670)	(8500)	(—)	(10,220)	(—)	(10,860)	(11,580)	(11,780)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhW2	(4680)	(5650)	(7070)	(—)	(7900)	(—)	(8390)	(8870)	(9350)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhW3	(2570)	(3620)	(4920)	(—)	(5470)	(—)	(5490)	(5590)	(5920)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 35% Elmhurst Limestone

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.40

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhL1	(6400)	(7350)	(8960)	(—)	(10,100)	(—)	(11,300)	(11,340)	(12,220)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 35a Elmhurst Limestone
Mixes with W/C = 0.53

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhL2	(4790)	(5910)	(7030)	(—)	(8280)	(—)	(8400)	(8400)	(8590)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Stone Aggregate
Series 356, Elmhurst Limestone

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XHL3	(2860)	(3840)	(5030)	(—)	(5510)	(—)	(5580)	(5790)	(5590)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Comoressive Strength Test Results for Air-Cured, 6 in. Cubes, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhVI	(7050)	(8020)	(9380)	(9420)	(9260)	(8740)	(9320)
DhVI	(7480)	(8280)	(8760)	(9560)	(9100)	(9140)	(9420)
EhVI	(5790)	(7780)	(8830)	(9670)	(9380)	(9230)	(9340)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Comoressive Strenath Test Results for Air-Cured, 6 in. Cubes, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4850)	(6230)	(7420)	(8210)	(7490)	(6520)	(7360)
DhV2	(5160)	(6180)	(6860)	(7550)	(7500)	(6900)	(7330)
EhV2	(3940)	(5600)	(7350)	(8620)	(8260)	(7760)	(7720)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Air-Cured, 6 in. Cubes, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(2730)	(3700)	(5270)	(5330)	(4720)	(4290)	(4550)
DhV3	(2880)	(3890)	(4910)	(5100)	(5500)	(5390)	(5100)
EhV3	(2010)	(3010)	(5230)	(5730)	(5430)	(5040)	(5010)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Compressive Strength Test Results for Air-Cured, Saturated before Test, 6-in. Cubes, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV1	(7050)	(8020)	(8960)	(—)	(8250)	(—)	(8220)
OhV1	(7480)	(8280)	(8470)	(—)	(8160)	(—)	(7710)
EhV1	(5790)	(7780)	(8450)	(—)	(8230)	(—)	(7740)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for Air-Cured, Saturated before Test, 6-in. Cubes, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4850)	(6230)	(6870)	(—)	(6250)	(—)	(5780)
DhV2	(5160)	(6180)	(6390)	(—)	(6050)	(—)	(5840)
EhV2	(3940)	(5600)	(6960)	(—)	(6870)	(—)	(6770)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for Air-Cured, Saturated before Test, 6-in. Cubes, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(2730)	(3700)	(4740)	(—)	(3650)	(—)	(3580)
DhV3	(2880)	(3890)	(4320)	(—)	(4080)	(—)	(4020)
EhV3	(2010)	(3010)	(4850)	(—)	(4270)	(—)	(4050)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous
Mixes with W/C = 0.40

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Skokie, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhVI	(7050)	(8020)	(8830)	(9260)	(9620)	(9940)	(9860)	(10,160)	(11,580)
DhVI	(7480)	(8280)	(8060)	(8360)	(8950)	(9380)	(9900)	(9700)	(10,920)
EhVI	(5790)	(7780)	(8530)	(9220)	(9180)	(9680)	(10,940)	(10,770)	(11,910)
XhVI	(6650)	(7780)	(8690)	(—)	(8920)	(—)	(10,380)	(10,300)	(11,730)
Average	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)	(_____)		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Victoria Siliceous
Mixes with W/C = 0.53

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Skokie, MPa (psi) at:

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV2	(4850)	(6230)	(6540)	(7650)	(7560)	(7900)	(8720)	(8440)	(8690)
DhV2	(5160)	(6180)	(5970)	(6500)	(7100)	(7530)	(8390)	(7970)	(9000)
EhV2	(3940)	(5600)	(6910)	(8030)	(7920)	(8010)	(8660)	(8880)	(9140)
XhV2	(4760)	(6060)	(6850)	(—)	(7520)	(—)	(8300)	(8380)	(8920)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 35% Victoria Siliceous

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Skokie, MPa (psi) at: 3days	7days	28days	3 months	1 year	3 years	5 years	10 years	20 years
AhV3	(2730)	(3700)	(4760)	(5330)	(5460)	(5160)	(5350)	(5670)	(5870)
DhV3	(2880)	(3890)	(4340)	(5040)	(4970)	(5070)	(5550)	(5790)	(5440)
EhV3	(2010)	(3010)	(4950)	(5520)	(5570)	(5760)	(5900)	(6400)	(6590)
XhV3	(2630)	(3520)	(4630)	(—)	(5290)	(—)	(5800)	(5860)	(5710)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Dallas, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhVI	(7050)	(8020)	(8110)	(8100)	(—)	(10,470)	(11,190)
DhVI	(7480)	(8280)	(7980)	(7980)	(—)	(10,010)	(10,770)
EhVI	(5790)	(7780)	(8060)	(7950)	(—)	(9280)	(11,450)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Dallas, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4850)	(6230)	(7270)	(7240)	(7790)	(6370)	(9360)
DhV2	(5160)	(6180)	(6270)	(6670)	(7650)	(7200)	(7760)
EhV2	(3940)	(5600)	(7040)	(7350)	(7970)	(7180)	(8440)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Compressive Strength Test Results for 6-in. Cubes stored Outdoors in Dallas, MPa (psi) at:						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(2730)	(3700)	(4840)	(4890)	(5170)	(4750)	(5790)
DhV3	(2880)	(3890)	(4410)	(4520)	(5650)	(4790)	(6000)
EhV3	(2010)	(3010)	(4730)	(4940)	(5560)	(4990)	(6340)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. Modified cubes were tested according to ASTM C116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhV1	(—)	(675)	(810)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhV2	(—)	(605)	(670)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhV3	(—)	(470)	(545)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhW1	(—)	(700)	(815)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhW2	(—)	(585)	(695)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhW3	(—)	(445)	(580)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CA Property Code ____

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C=0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhL1	(—)	(770)	(905)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CA Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhL2	(—)	(650)	(780)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CA Property Code ____

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
XhL3	(—)	(530)	(565)	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
	(—)	( )	( )	(—)	(—)	(—)	(—)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ____ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhVI	(820)	(825)	(1050)	(1140)	(1115)	(1085)	(1010)	(1160)	(1170)
DhVI	(760)	(885)	(960)	(1090)	(1030)	(1085)	(1075)	(1170)	(1120)
EhVI	(675)	(815)	(955)	(955)	(1065)	(1110)	(1095)	(1180)	(1240)
XhVI	(750)	(800)	(940)	(—)	(1130)	(—)	(1085)	(1170)	(1210)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CR Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV2	(635)	(765)	(845)	(870)	(835)	(785)	(800)	(810)	(870)
DhV2	(625)	(695)	(800)	(895)	(835)	(835)	(845)	(930)	(980)
EhV2	(545)	(725)	(805)	(845)	(825)	(850)	(875)	(990)	(990)
XhV2	(610)	(750)	(825)	(—)	(830)	(—)	(835)	(890)	(930)
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV3	(470)	(570)	(620)	(670)	(580)	(545)	(555)	(590)	(630)
DhV3	(460)	(565)	(675)	(630)	(580)	(585)	(630)	(640)	(710)
EhV3	(355)	(505)	(670)	(665)	(635)	(620)	(635)	(700)	(720)
XhV3	(450)	(560)	(655)	(—)	(625)	(—)	(615)	(650)	(700)
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Elain Dolomitic

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhW1	(750)	(800)	(925)	(—)	(1065)	(—)	(1075)	(1120)	(1180)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356, Elgin Dolomitic

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhW2	(580)	(725)	(800)	(—)	(970)	(—)	(1030)	(1020)	(1020)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ____ Page 1.3

Portland Cement Concrete
Normal- Weight
Gravel Aggregate
Series 356 Elgin Dolomitic
Mixes with W/C=0.71

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhW3	(430)	(525)	(650)	(—)	(735)	(—)	(710)	(730)	(790)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CA Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Flexural Strength Test Results
For Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhL1	(830)	(895)	(1030)	(—)	(1195)	(—)	(1110)	(1170)	(1190)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CA Property Code ____ Page 1.3

Portland Cement Concrete Normal- Weight Stone Aggregate Series 356, Elmhurst Limestone	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Flexural Strength Test Results
for Moist-Cured Specimens, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XHL2	(670)	(760)	(895)	(—)	(905)	(—)	(995)	(980)	(1030)
Average									

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)." Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CA Property Code ___ Page 1.3

Portland Cement Concrete
Normal- Weight
Stone Aggregate
Series 35% Elmhurst Limestone

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Moist-Cured Specimens, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
XhL3	(455)	(600)	(790)	(—)	(755)	(—)	(695)	(710)	(770)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6 x 6 x 30-in. prisms were moist-cured until test. Prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhVI	(820)	(825)	(585)	(660)	(665)	(740)	(725)
DhVI	(760)	(885)	(515)	(565)	(625)	(635)	(620)
EhVI	(675)	(815)	(520)	(575)	(645)	(635)	(640)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 350 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(635)	(765)	(590)	(755)	(750)	(750)	(720)
OhV2	(625)	(695)	(440)	(580)	(590)	(635)	(615)
EhV2	(545)	(725)	(545)	(625)	(675)	(715)	(695)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(470)	(570)	(530)	(655)	(615)	(575)	(605)
DhV3	(460)	(565)	(430)	(490)	(570)	(595)	(560)
EhV3	(355)	(505)	(485)	(575)	(615)	(585)	(540)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Soaked Before Test, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhVI	(820)	(825)	(850)	(—)	(690)	(—)	(665)
DhVI	(760)	(885)	(780)	(—)	(555)	(—)	(495)
EhVI	(675)	(815)	(830)	(—)	(550)	(—)	(550)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Soaked Before Test, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(635)	(765)	(755)	(—)	(615)	(—)	(685)
DhV2	(625)	(695)	(725)	(—)	(545)	(—)	(530)
EhV2	(545)	(725)	(715)	(—)	(550)	(—)	(625)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Air-Cured Specimens, Soaked Before Test, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(470)	(570)	(655)	(—)	(445)	(—)	(570)
DhV3	(460)	(565)	(575)	(—)	(440)	(—)	(465)
EhV3	(355)	(505)	(620)	(—)	(480)	(—)	(475)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.40

Flexural Strength Test Results
for Specimens Stored Outdoors in Skokie, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV1	(820)	(825)	(860)	(1140)	(1015)	(1105)	(1060)	(1210)	(1260)
DhV1	(760)	(805)	(865)	(1095)	(1115)	(1105)	(1080)	(1060)	(1200)
EhV1	(675)	(815)	(920)	(960)	(970)	(1100)	(1045)	(1150)	(1260)
XhV1	(750)	(800)	(885)	(—)	(1085)	(—)	(1005)	(1120)	(1270)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 356, Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Skokie, Midspan Loading, MPa (psi)								
	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV2	(635)	(765)	(750)	(920)	(850)	(845)	(825)	(920)	(850)
DhV2	(625)	(695)	(740)	(865)	(895)	(880)	(855)	(930)	(960)
EhV2	(545)	(725)	(825)	(785)	(860)	(835)	(865)	(850)	(910)
XhV2	(610)	(750)	(795)	(—)	(910)	(—)	(855)	(910)	(930)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal- Weight
Gravel Aggregate
Series 356 Victoria Siliceous

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.71

Flexural Strength Test Results
for Specimens Stored Outdoors In Skokie, Midspan Loading, MPa (psi)

Mix No.	3 days	7 days	28 days	3 months	1 year	3 years	5 years	10 years	20 years
AhV3	(470)	(570)	(610)	(710)	(650)	(670)	(610)	(650)	(640)
DhV3	(460)	(565)	(605)	(665)	(690)	(685)	(665)	(700)	(680)
EhV3	(355)	(505)	(680)	(625)	(640)	(670)	(665)	(680)	(680)
XhV3	(450)	(560)	(640)	(—)	(710)	(—)	(700)	(680)	(700)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Dallas, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhVI	(820)	(825)	(945)	(900)	(1060)	(1090)	(825)
DhVI	(760)	(885)	(925)	(930)	(1110)	(1190)	(915)
EhVI	(675)	(815)	(915)	(815)	(1005)	(1070)	(845)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests. Dallas experienced a prolonged dry period immediately before the 5-year tests. As a result the beam specimens began to dry and the flexural strengths dropped an average of 30 % (Ref.: Report by Sharon Wood.)

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 350 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Dallas, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(635)	(765)	(820)	(855)	(860)	(900)	(575)
DhV2	(625)	(695)	(765)	(805)	(950)	(940)	(650)
EhV2	(545)	(725)	(755)	(850)	(815)	(940)	(605)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests. Dallas experienced a prolonged dry period immediately before the 5-year tests. As a result the beam specimens began to dry and the flexural strengths dropped an average of 30 % (Ref.: Report by Sharon Wood.)

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Victoria Siliceous	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Flexural Strength Test Results for Specimens Stored Outdoors in Dallas, Midspan Loading, MPa (psi)						
	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(470)	(570)	(680)	(730)	(615)	(640)	(410)
DhV3	(460)	(565)	(660)	(685)	(720)	(730)	(465)
EhV3	(355)	(505)	(660)	(645)	(680)	(715)	(440)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

Test specimens were moist cured for 7 days and then placed outside in Dallas, Texas. 6 x 6 x 30-in. prisms were tested with the load applied at the midpoint of an 18-in. span according to ASTM C 293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests. Dallas experienced a prolonged dry period immediately before the 5-year tests. As a result the beam specimens began to dry and the flexural strengths dropped an average of 30 % (Ref.: Report by Sharon Wood.)

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhVI	(5,550)	(6,680)	(7,140)	(7,450)	(7,850)	(7,830)	(7,820)	(8,100)
DhVI	(6,220)	(6,990)	(7,260)	(7,470)	(7,860)	(7,860)	(7,1060)	(8,030)
EhVI	(5,700)	(6,410)	(7,090)	(7,480)	(7,870)	(8,030)	(7,890)	(8,270)
XhVI	(5,900)	(6,750)	(7,140)	(7,520)	(—)	(7,940)	(—)	(8,030)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6 x 6 x 30-in. prisms were moist cured until test. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4,540)	(6,150)	(6,820)	(7,250)	(7,320)	(7,390)	(7,410)	(7,500)
DhV2	(5,630)	(6,450)	(6,990)	(7,250)	(7,430)	(7,480)	(7,470)	(7,880)
EhV2	(4,890)	(5,990)	(6,620)	(7,200)	(7,310)	(7,420)	(7,500)	(7,800)
XhV2	(4,970)	(6,130)	(6,760)	(7,250)	(—)	(7,400)	(—)	(7,620)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6 x 6 x 30-in. prisms were moist cured until test. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(3,270)	(5,360)	(5,860)	(6,430)	(6,560)	(6,760)	(6,860)	(6,660)
DhV3	(4,350)	(5,840)	(6,310)	(6,660)	(6,870)	(6,750)	(6,920)	(7,020)
EhV3	(3,330)	(4,910)	(5,720)	(6,420)	(6,910)	(6,780)	(7,060)	(6,980)
XhV3	(3,850)	(5,400)	(5,970)	(6,560)	(—)	(6,810)	(—)	(6,860)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6 x 6 x 30-in. prisms were moist cured until test. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV1	(5,550)	(6,680)	(7,140)	(6,790)	(6,540)	(6,040)	(6,070)	(6,240)
DhV1	(6,220)	(6,990)	(7,260)	(6,210)	(6,150)	(5,570)	(5,680)	(5,490)
EhV1	(5,700)	(6,410)	(7,090)	(6,310)	(6,080)	(5,890)	(5,680)	(5,840)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4,540)	(6,150)	(6,820)	(6,270)	(6,120)	(5,740)	(5,880)	(5,910)
DhV2	(5,630)	(6,450)	(6,990)	(6,050)	(6,080)	(5,460)	(5,500)	(5,610)
EhV2	(4,890)	(5,990)	(6,620)	(6,070)	(5,980)	(5,600)	(5,780)	(5,730)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(3,270)	(5,360)	(5,860)	(5,600)	(5,290)	(4,990)	(5,220)	(5,300)
DhV3	(4,350)	(5,840)	(6,310)	(5,900)	(5,530)	(5,160)	(5,340)	(5,310)
EhV3	(3,330)	(4,910)	(5,720)	(5,490)	(5,280)	(4,960)	(5,250)	(5,290)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Soaked Before Test, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV1	(5,550)	(6,680)	(7,140)	(7,170)	(—)	(6,770)	(—)	(6,810)
OhV1	(6,220)	(6,990)	(7,260)	(7,100)	(—)	(6,440)	(—)	(6,360)
EhV1	(5,700)	(6,410)	(7,090)	(7,160)	(—)	(6,460)	(—)	(6,220)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Soaked Before Test, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4,540)	(6,150)	(6,820)	(6,620)	(—)	(6,160)	(—)	(6,320)
DhV2	(5,630)	(6,450)	(6,990)	(6,750)	(—)	(6,180)	(—)	(6,000)
EhV2	(4,890)	(5,990)	(6,620)	(6,740)	(—)	(6,160)	(—)	(6,260)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Air-Cured Prisms, Soaked Before Test, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(3,270)	(5,360)	(5,860)	(5,790)	(—)	(5,420)	(—)	(5,730)
DhV3	(4,350)	(5,840)	(6,310)	(6,010)	(—)	(5,370)	(—)	(5,630)
EhV3	(3,330)	(4,910)	(5,720)	(5,880)	(—)	(5,550)	(—)	(5,660)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature between 70 and 75°F and a relative humidity of approximately 50%. Specimens were soaked in water for 48 hours prior to testing. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Prisms Stored Outdoors in Skokie, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV1	(5,550)	(6,680)	(7,140)	(7,440)	(7,830)	(8,490)	(7,600)	(7,750)
OhV1	(6,220)	(6,990)	(7,260)	(7,350)	(7,750)	(8,330)	(7,680)	(7,940)
EhV1	(5,700)	(6,410)	(7,090)	(7,450)	(7,510)	(8,340)	(7,690)	(8,090)
XhV1	(5,980)	(6,750)	(7,140)	(7,570)	(—)	(8,640)	(—)	(8,200)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Prisms Stored Outdoors in Skokie, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV2	(4,540)	(6,150)	(6,820)	(7,070)	(7,170)	(7,970)	(7,290)	(7,590)
DhV2	(5,630)	(6,450)	(6,990)	(6,960)	(7,430)	(7,990)	(7,340)	(7,720)
EhV2	(4,890)	(5,990)	(6,620)	(7,000)	(7,190)	(8,040)	(7,210)	(7,460)
XhV2	(4,970)	(6,130)	(6,760)	(7,230)	(—)	(8,050)	(—)	(7,520)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.71

Mix No.	Dynamic Elastic Modulus Test Results for Prisms Stored Outdoors in Skokie, Pa (ksi)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	5 years
AhV3	(3,270)	(5,360)	(5,860)	(6,370)	(6,560)	(7,160)	(6,400)	(6,690)
DhV3	(4,350)	(5,840)	(6,310)	(6,560)	(6,730)	(7,120)	(6,600)	(6,770)
EhV3	(3,330)	(4,910)	(5,720)	(6,410)	(6,570)	(7,090)	(6,610)	(6,720)
XhV3	(3,850)	(5,400)	(5,970)	(6,590)	(—)	(7,300)	(—)	(7,030)
Average	( )	( )	( )	( )	( )	( )	( )	

Test specimens were moist cured for 7 days and then placed outside in Skokie, Illinois. Prisms were tested according to ASTM C 215, "Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens." Listed values are the average for 3 specimens.

SERIES 356

TYPE III CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. AhVI

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Ah in this series. The concrete mix contained 643 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. AhV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Ah in this series. The concrete mix contained 455 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. AhV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Ah in this series. The concrete mix contained 347 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. DhV1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Dh in this series. The concrete mix contained 653 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. DhV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Dh in this series. The concrete mix contained 465 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. DhV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Dh in this series. The concrete mix contained 348 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. EhV1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Eh in this series. The concrete mix contained 661 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 256, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. EhV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Eh in this series. The concrete mix contained 468 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. EhV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Eh in this series. The concrete mix contained 353 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhV1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 635 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhV2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 447 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhV3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then subjected to one of the following five curing conditions: moist cured, air cured, air cured and then soaked for 48 hours before test, stored outdoors on a clay loam in Skokie, Illinois, or stored outdoors on a sandy soil in Dallas, Texas. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and siliceous sand and gravel from Victoria, Texas. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 349 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 256, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhW1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 663 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhW2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 449 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 256, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhW3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 328 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Material Code 01 CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhL1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement, dolomitic sand from Elgin, Illinois, and crushed limestone from Elmhurst, Illinois. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 717 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhL2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement, dolomitic sand from Elgin, Illinois, and crushed limestone from Elmhurst, Illinois. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 492 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.53. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. XhL3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1948 as part of a study to evaluate the influence of curing conditions on the performance of concrete pavements. Prismatic-shaped specimens were cast from this material and then continuously moist cured. Specimens were removed and tested at specified intervals over a twenty-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type III cement, dolomitic sand from Elgin, Illinois, and crushed limestone from Elmhurst, Illinois. The cement was designated Cement Xh and is a blend of Cements Ah, Dh, and Eh in this series. The concrete mix contained 370 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.71. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AhVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	643	2001
Fine Aggregate	—	1001	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	257	2421
Total	—	4055	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

See sheet following Vol: 3 page 2 (this page) for Mix Nos. AVI and AhVI

Property Code 1220

Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured, air cured, air cured and then soaked, stored outdoors in Skokie, Illinois, or stored outdoors in Dallas, Texas.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature between 70 and 75°F and at a relative humidity of approximately 50%.

"Air cured -- saturated before test" means specimens were cured 7 days in a moist room and then stored indoors as described above. Specimens were soaked in water at 75°F for 48 hours prior to testing.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Specimens stored outdoors in Dallas, Texas were cured 7 days in a moist room and then stored outdoors on a sandy soil. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Dallas normally varies from 64 to 75 percent and averages about 69 percent. The annual precipitation including snowfall is about 29 in. Annual air temperatures usually range between 18 and 102°F. Dallas experienced a prolonged dry period immediately before the 5-year tests.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AhV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	455	2001
Fine Aggregate	—	1193	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	241	2421
Total	—	4043	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

See sheet following Vol: 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AhV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	347	2001
Fine Aggregate	—	1268	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	246	2421
Total	—	4015	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information
See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1	

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 35%, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DhVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	653	2001
Fine Aggregate	—	974	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	261	2421
Total	—	4042	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AVI and AhVI

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DhV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	465	2001
Fine Aggregate	—	1166	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	246	2421
Total	—	4031	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DhV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	348	2001
Fine Aggregate	—	1262	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	247	2421
Total	—	4011	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EhVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	661	2001
Fine Aggregate	—	974	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	264	2421
Total	—	4053	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

See sheet following Vol. 3 page 2 (this page) for Mix Nos. AVI and AhVI

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EhV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	468	2001
Fine Aggregate	—	1166	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	248	2421
Total	—	4036	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information
See sheet following Vol. 3 page 2 (this page) for Mix Nos. AV1 and AhV1	

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EhV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	353	2001
Fine Aggregate	—	1255	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	251	2421
Total	—	4013	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information
See sheet following Vol: 3 page 2 (this page) for Mix Nos. AV1 and AhV1	

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhVI

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	635	2001
Fine Aggregate	—	1015	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	254	2421
Total	—	4058	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or stored outdoors in Skokie, Illinois.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhV2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	447	2001
Fine Aggregate	—	1207	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	237	2421
Total	—	4045	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or stored outdoors in Skokie, Illinois.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 66 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhV3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	349	2001
Fine Aggregate	—	1262	2211
Coarse Aggregate	—	2154	2222
—	—	—	—
Water	—	248	2421
Total	—	4013	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or stored outdoors in Skokie, Illinois.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Specimens stored outdoors in Skokie, Illinois were cured 7 days in a moist room and then stored outdoors on a clay loam. Specimens were stored side by side on the ground with soil packed around the sides. Only the top surface of the specimens was exposed to the atmosphere. The average daily relative humidity in Skokie normally varies from 68 to 75 percent and averages about 70 percent. The annual precipitation including snowfall is about 33 in. Annual air temperatures usually range between -8 and 91°F.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhW1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	663	2001
Fine Aggregate	—	921	2211
Coarse Aggregate	—	2166	2222
—	—	—	—
Water	—	265	2421
Total	—	4015	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356 Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhW2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	449	2001
Fine Aggregate	—	1135	2211
Coarse Aggregate	—	2166	2222
—	—	—	—
Water	—	238	2421
Total	—	3988	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhW3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type III	—	328	2001
Fine Aggregate	—	1236	2211
Coarse Aggregate	—	2166	2222
—	—	—	—
Water	—	233	2421
Total	—	3963	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhL1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type III	—	717	2001
Fine Aggregate	—	833	2211
Coarse Aggregate	—	1929	2222
—	—	—	—
Water	—	287	2421
Total	—	3766	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CA Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356 Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XnL2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	492	2001
Fine Aggregate	—	1011	2211
Coarse Aggregate	—	1929	2222
—	—	—	—
Water	—	261	2421
Total	—	3693	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01 CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 35%, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhL3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	370	2001
Fine Aggregate	—	1082	2211
Coarse Aggregate	—	1929	2222
—	—	—	—
Water	—	263	2421
Total	—	3644	

Weight of water was derived from water/cement ratio of 0.71.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
AhVI	_._	9400	
DhVI	_._	8860	
EhVI	_._	8720	
XhVI	_._	8910	
Average Compressive Strength	_._	_	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
AhV2	_._	7700	
DhV2	_._	7040	
EhV2	_._	7390	
XhV2	_._	7380	
Average Compressive Strength	_._	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete	General Information	Update Package Number 0
Normal-Weight		Revision Control Code 0.0
Gravel Aggregate		Quality Level _
Series 356, Victoria Siliceous		

Mixes with W/C = 0.71

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
AhV3	—.—	5170	
DhV3	—.—	4960	
EhV3	—.—	5190	
XhV3	—.—	4960	
	—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c= 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XhW1	—.—	8500	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c= 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XhW2	—	7070	
	—	—	
	—	—	
	—	—	
Average Compressive Strength	—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c= 0.71

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XhW3	—.—	4920	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 1000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XhL1	—.—	8960	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XhL2	—·—	7030	
	—·—	—	
	—·—	—	
	—·—	—	
Average Compressive Strength	—·—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CA Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356 Elmhurst Limestone	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.71

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
XhL3	—.—	5030	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01C Property Code 2000

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes AhV1, AhV2, & AhV3
Cement Ah

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III		2001
	C_3S, %	58.3	
	C_2S, %	15.9	
	C_3A, %	12.4	
	C_4AF, %	7.5	
	Fineness, Blaine	408	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner	227	2101
	Turbidimeter, m^2/kg^2		
	Fineness, % Passing No. 325 Sieve (ASTM C430)	95.1	2128

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes DhV1, DhV2, & DhV3
Cement Dh

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III		2001
	C_3S, %	55.7	
	C_2S, %	17.2	
	C_3A, %	11.4	
	C_4AF, %	6.3	
	Fineness, Blaine	536	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner	265	2101
	Turbidimeter, m^2/kg^2		
	Fineness, % Passing No. 325 Sieve (ASTM C 430)	99.0	2128

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes EnV1, EhV2, & EhV3
Cement Eh

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III		2001
	C_3S, %	43.9	
	C_2S, %	29.7	
	C_3A, %	10.3	
	C_4AF, %	7.2	
	Fineness, Blaine	504	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner	255	2101
	Turbidimeter, m^2/kg^2		
	Fineness, % Passing No. 325 Sieve (ASTM C430)	93.3	2128

Material Code 01C Property Code 2000

Portland Cement Concrete Normal-Weight Aggregate Series 356	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes XhL1, XhL2, XhL3, XhV1, XhV2, XhV3, XhW1, XhW2, & XhW3
Cement Xh

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III		2001
	C_3S, %	52.6	
	C_2S, %	20.9	
	C_3A, %	11.4	
	C_4AF, %	7.0	
	Fineness, Blaine	483	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	249	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	94.8	2128

*This cement is a blend of cements Ah, Dh, and Eh.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes AV1, AV2, AV3, DV1, DV2, DV3, EV1, EV2, EV3, XV1, XV2, XV3, AhV1, AhV2, AhV3, DhV1, DhV2, DhV3, EhV1, EhV2, EhV3, XhV1, XhV2, and XhV3

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Siliceous Sand		2211
	from Victoria, Texas		
	Fineness Modulus	2.53	2302
	Specific Gravity	2.63	2313
Coarse Aggregate	Siliceous Gravel		
	from Victoria, Texas		
	Maximum Size	2 in.	2351
	ASTM C33-90	357	
	Specific Gravity	2.57	2363
Water			2421

Material Code 01 CB Property Code 2000 Page 5

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes XW1, XW2, XW3, XhW1, XhW2, & XhW3

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Dolomitic Sand		2211
	from Elgin, Illinois		
	Fineness Modulus	2.77	2302
	Specific Gravity	2.65	2313
Coarse Aggregate	Dolomitic Gravel		
	from Elgin, Illinois		
	Maximum Size	2 in.	2351
	ASTM C33-90	357	
	Specific Gravity	2.66	2363
Water			2421

Material Code 01 CA Property Code 2000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes XL1, XL2, XL3, XhL1, XhL2, & XhL3

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Dolomitic Sand		2211
	from Elgin, Illinois		
	Fineness Modulus	2.77	2302
	Specific Gravity	2.65	2313
Coarse Aggregate	Crushed Limestone		
	from Elmhurst, Illinois		
	Maximum Size	2 in.	2351
	ASTM C33-90	357	
	Specific Gravity	2.68	2363
Water			2421

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AhVI

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	643 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		0.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AhV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	455 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.9 in.	2631
Air Content, %		0.7	2613

Reference Documentation
__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
__.
__.
__.
__.

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix AhV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	347 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.1	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DhVI

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	653 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		0.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DhV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	465 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	3.4 in.	2631
Air Content, %		0.7	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix DhV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	348 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	3.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EhV1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	661 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	3.2 in.	2631
Air Content, %		0.0	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EhV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	468 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	3.1 in.	2631
Air Content, %		0.5	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete" Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix EhV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	353 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		0.9	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level -

Mix XhVI

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	635 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		0.4	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhV2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	447 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	3.1 in.	2631
Air Content, %		0.9	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Victoria Siliceous	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhV3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	349 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	3.0 in.	2631
Air Content, %		1.2	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhW1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	663 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	3.3 in.	2631
Air Content, %		0.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhW2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	449 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.1	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 356, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhW3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	328 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.0 in.	2631
Air Content, %		1.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhL1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	717 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	1.6 in.	2631
Air Content, %		0.8	2613

Reference Documentation

1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete" Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Material Code 01 CA Property Code 2000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356, Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhL2.

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	492 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.0 in.	2631
Air Content, %		1.0	2613

Reference Documentation
1. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
2.
3.
4.
5.

Material Code 01 CA Property Code 2000

Portland Cement Concrete Normal-Weight Stone Aggregate Series 356 Elmhurst Limestone	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix XhL3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	370 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.71	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		1.3	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

APPENDIX B:

PORTLAND CEMENT ASSOCIATION SERIES 374

PORTLAND CEMENT ASSOCIATION SERIES 374

TABLE OF CONTENTS

Page No.

General Information for All Cement Types 1

Type I Cement
- ORNL Volume 2 — Supporting Documentation 5
- ORNL Volume 3 — Material Data Sheets 63

Type II Cement
- ORNL Volume 2 — Supporting Documentation 149
- ORNL Volume 3 — Material Data Sheets 165

Type III Cement
- ORNL Volume 2 — Supporting Documentation 203
- ORNL Volume 3 — Material Data Sheets 225

Type IV Cement
- ORNL Volume 2 — Supporting Documentation 245
- ORNL Volume 3 — Material Data Sheets 261

Type V Cement
- ORNL Volume 2 — Supporting Documentation 293
- ORNL Volume 3 — Material Data Sheets 309

Type I Air-Entraining Cement
- ORNL Volume 2 — Supporting Documentation 319
- ORNL Volume 3 — Material Data Sheets 341

Type II Air-Entraining Cement
- ORNL Volume 2 — Supporting Documentation 375
- ORNL Volume 3 — Material Data Sheets 391

Type III Air-Entraining Cement
- ORNL Volume 2 — Supporting Documentation 401
- ORNL Volume 3 — Material Data Sheets 409

Type I Cement and Air-Entraining Admixture
- ORNL Volume 2 — Supporting Documentation 419
- ORNL Volume 3 — Material Data Sheets 427

Type II Cement and Air-Entraining Admixture
- ORNL Volume 2 — Supporting Documentation 433
- ORNL Volume 3 — Material Data Sheets 441

Type IV Cement and Air-Entraining Admixture
- ORNL Volume 2 — Supporting Documentation 447
- ORNL Volume 3 — Material Data Sheets 456

SERIES 374

GENERAL INFORMATION FOR ALL CEMENT TYPES

PORTLAND CEMENT ASSOCIATION SERIES 374

Laboratory tests reported in Portland Cement Association (PCA) Series 374 were one phase of an extensive study of cement performance in concrete. Series 374 focused on long-term properties of continuously moist-cured concrete specimens. Compressive strength, flexural strength, dynamic modulus of elasticity, static modulus of elasticity, and pulse velocity for concrete specimens made from the five types of portland cement and three air-entraining cements are reported at selected intervals through 34 years. Additional specimens are currently in storage and are scheduled to be tested 50 years after casting.

In the following pages, data for concrete with the same cement type, same aggregate source, and a water-cement ratio within 0.04 are considered similar and are grouped together. Cements from different manufacturers are considered to cause less variations in long term properties than differences in water-cement ratios. Fig. 4 of the reference by Sharon Wood shows the effect of water-cement ratio on concrete compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374	_____ _____ _____	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Preparer: _____

Organization: _____

Sources: References __, __, __, __ and __

Information Sources

Reference 50 (Also called Reference 1 on some of the following pages): Report from Sharon Wood to PCA. This information source presents constituent material, concrete mix, and material property data for concrete specimens made from the five types of portland cement and three air-entraining cements. Compressive strength, flexural strength, dynamic modulus of elasticity, static modulus of elasticity, and pulse velocity are reported at selected intervals through 34 years.

Reference 51: American Concrete Institute Journal. This information source identifies the mix proportions, constituent materials, constituent material properties, plastic concrete properties, curing procedures and test results for the first three years of a long-time study of cement performance in concrete that was conducted at the Portland Cement Association.

Reference 52: American Concrete Institute Journal. This information source contains data and properties for the different cements used in the long-time study of cement performance in concrete that was conducted at the Portland Cement Association.

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

All Mixes

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Dolomitic sand		2211
	from Elgin, Illinois		
	Fineness Modulus	2.90	2302
	Specific Gravity	2.65	2313
Coarse Aggregate	Dolomitic gravel		
	from Elgin, Illinois		
	Maximum Size	1-1/2 in.	2351
	ASTM C33-90	467	
	Specific Gravity	2.65	2363
	Fineness Modulus	7.3	2353
Water			2421

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE I CEMENT

SERIES 374

TYPE I CEMENT

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41 to 0.43

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
11A	(1550)	(5680)	(7390)	(7610)	(9160)	(9810)	(10070)	(10460)
12A	(1120)	(5920)	(7490)	(8770)	(9170)	(9710)	(9710)	(10900)
13A	(1520)	(4320)	(6280)	(7560)	(8280)	(8620)	(9100)	(9940)
14A	(1490)	(5020)	(6460)	(7160)	(8730)	(9280)	(9400)	(10140)
16A	(1820)	(6040)	(7230)	(8080)	(9540)	(10160)	(10400)	—
Average	(1500)	(5400)	(6970)	(7840)	(8980)	(9520)	(9740)	(10360)

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45-0.49

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
15A	(2230)	(6080)	(7180)	(7820)	(8530)	(9290)	(9520)	(10770)
17A	(1340)	(5220)	(7040)	(7560)	(8700)	(9310)	(9280)	—
18A	(1220)	(5290)	(7000)	(7600)	(8360)	(9110)	(10290)	(10630)
19C1	(1540)	(5370)	(6860)	(7390)	(7960)	(9000)	(9520)	—
Average	(1580)	(5490)	(7020)	(7590)	(8390)	(9180)	(9650)	(10,700)

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.55-0.57

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
11B	(780)	(4210)	(5870)	(6390)	(7020)	(6910)	(6740)	(7410)
12B	(580)	(3800)	(5710)	(6650)	(7010)	(7380)	(7010)	(7300)
13B	(890)	(2740)	(4730)	(5760)	(6400)	(6750)	(6340)	(7360)
14B	(800)	(3480)	(5190)	(5700)	(6540)	(7030)	(6560)	(7410)
16B	(1020)	(4000)	(5820)	(6520)	(7060)	(7640)	(7230)	(6840)
Average	(810)	(3650)	(5460)	(6200)	(6810)	(7140)	(6780)	(7260)

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58-0.61

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
15B	(1260)	(4730)	(5830)	(6280)	(6440)	(6360)	(5980)	—
17B	(740)	(3480)	(5770)	(6410)	(6560)	(6890)	(6700)	(7190)
18B	(670)	(3600)	(5600)	(6230)	(6540)	(6810)	(6660)	—
19C2	(890)	(3910)	(5520)	(6200)	(6580)	(6970)	(6640)	(7220)
Average	(890)	(3930)	(5680)	(6280)	(6530)	(6760)	(6500)	(7210)

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19A1	(770)	(3090)	(4810)	(6600)	(7350)	(7930)	(8610)	(9240)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19A2	(410)	(1710)	(3100)	(4280)	(5060)	(5940)	(5950)	(6480)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19B1	(1110)	(4350)	(6560)	(7450)	(7740)	(8850)	(9550)	(10550)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B2

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19B2	(560)	(2640)	(4260)	(5140)	(5420)	(6000)	(6360)	(6730)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41-0.43

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
11A	(240)	(640)	(765)	(840)	(905)	(855)	(945)	(1070)
12A	(180)	(640)	(790)	(910)	(925)	(965)	(970)	(1030)
13A	(260)	(525)	(690)	(845)	(885)	(915)	(995)	(1140)
14A	(250)	(620)	(725)	(800)	(915)	(890)	(965)	—
16A	(265)	(675)	(755)	(890)	(920)	(935)	(1035)	(1110)
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45-0.49

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at: 1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
15A	(320)	(660)	(755)	(865)	(865)	(870)	(945)	(970)
17A	(210)	(600)	(685)	(855)	(870)	(935)	(905)	—
18A	(220)	(585)	(720)	(830)	(915)	(895)	(965)	(1090)
19C1	(275)	(605)	(750)	(890)	(920)	(890)	(950)	(1050)
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.55-0.57

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
11B	(135)	(520)	(625)	(710)	(690)	(730)	(730)	(830)
12B	(100)	(530)	(705)	(785)	(755)	(770)	(795)	(850)
13B	(165)	(420)	(595)	(705)	(765)	(765)	(800)	(880)
14B	(150)	(490)	(630)	(740)	(765)	(745)	(780)	(890)
16B	(165)	(535)	(655)	(760)	(770)	(775)	(820)	(930)
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58-0.61

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
15B	(215)	(580)	(650)	(710)	(710)	(665)	(735)	(830)
17B	(120)	(490)	(650)	(735)	(760)	(720)	(695)	—
18B	(130)	(510)	(650)	(750)	(740)	(730)	(725)	—
19C2	(170)	(510)	(665)	(775)	(810)	(765)	(790)	(890)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19A1	(145)	(450)	(605)	(745)	(840)	(870)	(950)	(1000)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							34 years
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	
19A2	(75)	(300)	(470)	(610)	(655)	(700)	(735)	(850)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19B1	(195)	(555)	(670)	(810)	(835)	(875)	(955)	(1060)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B2

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
19B2	(105)	(415)	(580)	(680)	(725)	(715)	(785)	(840)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41-0.43

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
11A	(3.23)	(5.29)	(5.86)	(6.38)	(7.18)	(7.09)	(7.24)
12A	(2.67)	(5.40)	(5.98)	(6.44)	(7.06)	(7.60)	(7.46)
13A	(3.39)	(4.97)	(5.73)	(6.30)	(7.57)	(7.41)	(7.28)
14A	(3.37)	(5.07)	(5.67)	(6.20)	(6.86)	(7.00)	(7.03)
16A	(3.26)	(5.25)	(5.89)	(6.35)	(6.93)	(7.36)	(7.28)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45-0.49

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
15A	(3.65)	(5.08)	(5.65)	(6.23)	(6.91)	(7.07)	(6.95)
17A	(2.77)	(4.56)	(5.51)	(6.21)	(6.52)	(7.12)	(6.78)
18A	(2.89)	(4.88)	(5.47)	(6.24)	(7.01)	(7.33)	(7.21)
19C1	(3.37)	(5.02)	(5.82)	(6.17)	(6.74)	(7.12)	(7.01)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C= 0.55-0.57

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
11B	(2.41)	(4.85)	(5.53)	(6.03)	(6.47)	(6.66)	(6.70)
12B	(2.02)	(4.73)	(5.64)	(6.19)	(6.48)	(6.94)	(6.61)
13B	(2.71)	(4.44)	(5.38)	(6.01)	(6.53)	(6.83)	(6.77)
14B	(2.57)	(4.70)	(5.38)	(5.81)	(6.26)	(6.53)	(6.52)
16B	(2.60)	(4.69)	(5.46)	(5.98)	(6.37)	(6.66)	(6.57)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58-0.61

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
15B	(2.98)	(4.87)	(5.34)	(5.98)	(6.33)	(6.46)	(6.43)
17B	(2.17)	(4.31)	(5.19)	(5.89)	(6.22)	(6.52)	(6.25)
18B	(2.33)	(4.52)	(5.37)	(5.99)	(6.50)	(6.68)	(6.58)
19C2	(2.68)	(4.64)	(5.44)	(5.92)	(6.43)	(6.66)	(6.52)
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
19A1	(2.50)	(4.39)	(5.22)	(6.13)	(6.55)	(6.94)	(6.96)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
19A2	(1.84)	(3.86)	(4.88)	(5.64)	(6.13)	(6.61)	(6.40)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
19B1	(2.89)	(4.88)	(5.77)	(6.19)	(6.88)	(7.04)	(7.06)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
19B2	(2.12)	(4.27)	(5.16)	(5.85)	(6.26)	(6.57)	(6.40)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41-0.43

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11A	(5.41)	(6.43)	(6.74)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C= 0.45-0.49

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28days	1 year	3 years				
15A	(5.30)	(6.28)	(6.74)	( )	( )	( )	( )
19C1	(5.20)	(6.18)	(6.68)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C= 0.55-0.57

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11B	(5.09)	(5.90)	(6.18)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.58-0.61

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
15B	(5.00)	(5.90)	(6.14)	( )	( )	( )	( )
19C2	(4.93)	(5.92)	(6.14)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19A1	(4.99)	(5)	(6.51)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19A2	(4.62)	(5.70)	(6.16)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19B1	(5.20)	(5.97)	(6.60)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19B2	(4.77)	(5.69)	(6.07)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41-0.43

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11A	(5.46)	(6.96)	(7.27)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45-0.49

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
15A	(5.52)	(6.99)	(7.10)	( )	( )	( )	( )
19C1	(5.47)	(6.92)	(6.98)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.55-0.57

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11B	(4.96)	(6.23)	(6.30)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58-0.61

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
15B	(4.96)	(6.03)	(6.07)	( )	( )	( )	( )
19C2	(4.75)	(6.24)	(6.31)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19A1	(4.37)	(6.79)	(6.44)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19A2	(4.31)	(6.00)	(6.26)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19B1	(5.39)	(7.07)	(7.11)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{3} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _
Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic		

Mix 19B2

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19B2	(4.55)	(5.70)	(6.20)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41-0.43

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11A	(3.57)	(5.48)	(5.84)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45-0.49

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
15A	(4.02)	(5.57)	(5.86)	( )	( )	( )	( )
19C1	(3.68)	(5.72)	(5.82)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 274, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.55-0.57

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11B	(3.26)	(5.29)	(5.47)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58-0.61

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
15B	(3.68)	(5.33)	(5.20)	( )	( )	( )	( )
19C2	(3.39)	(5.53)	(5.24)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19A1	(3.52)	(5.49)	(5.71)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19A2	(3.13)	(5.47)	(5.59)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
1981	(3.47)	(5.56)	(5.64)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 274, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
19B2	(3.16)	(5.41)	(5.44)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elain Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41-0.43

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
11A	(—)	(14290)	(15180)	(15720)	(16270)	(16480)	(17010)	(17240)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Colomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45-0.49

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
15A	( )	(14200)	(14880)	(15530)	(16160)	(16410)	(16630)	(17120)
19C1	(12950)	(14040)	(14650)	(15430)	(15960)	(16410)	(16970)	(17010)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.55-0.57

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
11B	( )	(13690)	(14590)	(15340)	(15850)	(16130)	(16380)	(16780
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A Soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Colomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58-0.61

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
15B	( )	(13690)	(14450)	(15150)	(15690)	(15950)	(16020)	(16340)
19C2	(12100)	(13660)	(14310)	(15120)	(15720)	(16100)	(16490)	(16670)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A Soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
19A1	( )	(13350)	(14320)	(15180)	(15920)	(16310)	(16740)	(16890)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
19A2	( )	(12400)	(13640)	(14650)	(16430)	(15950)	(16340)	(16450)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A Soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Calcitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
19B1	(12440)	(13990)	(14650)	(15500)	(16060)	(16480)	(16930)	(17120
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A Soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B2

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
19B2	(11210)	(13120)	(14120)	(15000)	(15600)	(16030)	(16490)	(16450)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE I CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 11 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 11 in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.56. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 12 in this series. The concrete mix contained 6.00 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 12 in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.55. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 13A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 13 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.43. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 13B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 13 in this series. The concrete mix contained 4.53 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.57. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 14A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 14 in this series. The concrete mix contained 6.00 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 14B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 14 in this series. The concrete mix contained 4.53 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.55. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 15A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 15 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.45. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 15B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 15 in this series. The concrete mix contained 4.52 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.58. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 16 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 16 in this series. The concrete mix contained 4.51 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.56. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 17A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 17 in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.46. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 17B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 17 in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.61. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 18 in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.44. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 18 in this series. The concrete mix contained 4.54 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.58. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1949 and was designated Cement No. 19A in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.45. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1949 and was designated Cement No. 19A in this series. The concrete mix contained 4.52 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.59. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1949 and was designated Cement No. 19B in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.45. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1949 and was designated Cement No. 19B in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.60. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19C1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1949 and was designated Cement No. 19C in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.45. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19C2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1949 and was designated Cement No. 19C in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.58. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic Mix 11A	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	565	2001
Fine Aggregate	—	1224	2211
Coarse Aggregate	—	2090	2222
—	—	—	—
Water	—	232	2421
Total	—	4113	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity.)

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic Mix 11B	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	423	2001
Fine Aggregate	—	1368	2211
Coarse Aggregate	—	2054	2222
—	—	—	—
Water	—	237	2421
Total	—	4082	

Weight of water was derived from water/cement ratio of 0.56.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	564	2001
Fine Aggregate	—	1226	2211
Coarse Aggregate	—	2089	2222
—	—	—	—
Water	—	231	2421
Total	—	4110	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic Mix 12B	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	423	2001
Fine Aggregate	—	1368	2211
Coarse Aggregate	—	2054	2222
—	—	—	—
Water	—	232	2421
Total	—	4077	

Weight of water was derived from water/cement ratio of 0.55.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 13A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	565	2001
Fine Aggregate	—	1219	2211
Coarse Aggregate	—	2077	2222
—	—	—	—
Water	—	243	2421
Total	—	4104	

Weight of water was derived from water/cement ratio of 0.43.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 13B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	426	2001
Fine Aggregate	—	1362	2211
Coarse Aggregate	—	2045	2222
—	—	—	—
Water	—	243	2421
Total	—	4076	

Weight of water was derived from water/cement ratio of 0.57.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 14A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	564	2001
Fine Aggregate	—	1223	2211
Coarse Aggregate	—	2085	2222
—	—	—	—
Water	—	231	2421
Total	—	4103	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 14-B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	426	2001
Fine Aggregate	—	1364	2211
Coarse Aggregate	—	2048	2222
—	—	—	—
Water	—	234	2421
Total	—	4072	

Weight of water was derived from water/cement ratio of 0.55.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 15A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	565	2001
Fine Aggregate	—	1204	2211
Coarse Aggregate	—	2052	2222
—	—	—	—
Water	—	254	2421
Total	—	4075	

Weight of water was derived from water/cement ratio of 0.45.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 15B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	425	2001
Fine Aggregate	—	1354	2211
Coarse Aggregate	—	2034	2222
—	—	—	—
Water	—	247	2421
Total	—	4060	

Weight of water was derived from water/cement ratio of 0.58.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic Mix 16A	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	565	2001
Fine Aggregate	—	1226	2211
Coarse Aggregate	—	2090	2222
—	—	—	—
Water	—	232	2421
Total	—	4113	

Weight of water was derived from water/cement ratio of. 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	424	2001
Fine Aggregate	—	1366	2211
Coarse Aggregate	—	2051	2222
—	—	—	—
Water	—	237	2421
Total	—	4078	

Weight of water was derived from water/cement ratio of 0.56.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 17A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	566	2001
Fine Aggregate	—	1198	2211
Coarse Aggregate	—	2043	2222
—	—	—	—
Water	—	260	2421
Total	—	4067	

Weight of water was derived from water/cement ratio of 0.46.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 17B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	423	2001
Fine Aggregate	—	1348	2211
Coarse Aggregate	—	2024	2222
—	—	—	—
Water	—	258	2421
Total	—	4053	

Weight of water was derived from water/cement ratio of 0.61.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	566	2001
Fine Aggregate	—	1210	2211
Coarse Aggregate	—	2063	2222
—	—	—	—
Water	—	249	2421
Total	—	4088	

Weight of water was derived from water/cement ratio of 0.44.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	427	2001
Fine Aggregate	—	1358	2211
Coarse Aggregate	—	2040	2222
—	—	—	—
Water	—	248	2421
Total	—	4073	

Weight of water was derived from water/cement ratio of 0.58.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	566	2001
Fine Aggregate	—	1202	2211
Coarse Aggregate	—	2049	2222
—	—	—	—
Water	—	255	2421
Total	—	4072	

Weight of water was derived from water/cement ratio of 0.45.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 A 2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	425	2001
Fine Aggregate	—	1343	2211
Coarse Aggregate	—	2017	2222
—	—	—	—
Water	—	251	2421
Total	—	4036	

Weight of water was derived from water/cement ratio of 0.59.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 B1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	566	2001
Fine Aggregate	—	1204	2211
Coarse Aggregate	—	2053	2222
—	—	—	—
Water	—	255	2421
Total	—	4078	

Weight of water was derived from water/cement ratio of 0.45.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 B2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	423	2001
Fine Aggregate	—	1347	2211
Coarse Aggregate	—	2023	2222
—	—	—	—
Water	—	254	2421
Total	—	4047	

Weight of water was derived from water/cement ratio of 0.60.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19C1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	565	2001
Fine Aggregate	—	1204	2211
Coarse Aggregate	—	2053	2222
—	—	—	—
Water	—	254	2421
Total	—	4076	

Weight of water was derived from water/cement ratio of 0.45.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 C2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	423	2001
Fine Aggregate	—	1355	2211
Coarse Aggregate	—	2035	2222
—	—	—	—
Water	—	245	2421
Total	—	4058	

Weight of water was derived from water/cement ratio of 0.58.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41 to 0.43

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
11A		7020	
12A	—.—	7370	
13A	—.—	5850	
14A	—.—	5920	
16A	—.—	6780	
	—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.45 to 0.49

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
15A	_._	7490	
17A	_._	6740	
18A	_._	6560	
19C1	_._	6530	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c= 0.55 to 0.57

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
11B		5250	
12B	_._	5510	
13B	_._	3990	
14B	_._	4500	
16B	_._	5000	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.58 to 0.61

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
15B	_._	5580	
17B	_._	4920	
18B	_._	5240	
19C2	_._	4720	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A1

Property Code 1310	Baseline Information		
Material Property	28-Day Compressive Strength Values		Property Code
	MPa	psi	
19A1	—.—	—	
—	—.—	—	
—	—.—	—	
—	—.—	—	
Average Compressive Strength	—.—	4320	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Property Code 1310	Baseline Information		
Material Property	28-Day Compressive Strength Values		Property Code
	MPa	psi	
19A2	_._	_____	
_____	_._	_____	
_____	_._	_____	
_____	_._	_____	
Average Compressive Strength	_._	2750	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Property Code 1310	Baseline Information		
Material Property	28-Day Compressive Strength Values		Property Code
	MPa	psi	
19B1	—.—	—	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	5720	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19BZ

Property Code 1310	Baseline Information		
Material Property	28-Day Compressive Strength Values		Property Code
	MPa	psi	
19BZ	—.—	—	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	3810	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 11A & 11B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	50.0	
	C_2S, %	22.0	
	C_3A, %	12.1	
	C_4AF, %	7.2	
	Fineness, % Passing	88.4	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine Air-Permeability, m^2/kg	3436	2103
	Fineness, Wagner Turbidimeter, m^2/kg	1820	2101

Material Code 01CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 12A & 12B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	45.0	
	C_2S, %	28.0	
	C_3A, %	12.6	
	C_4AF, %	7.3	
	Fineness, % Passing	89.5	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3276	2103
	Fineness, Wagner	1865	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 13A & 13B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	50.0	
	C_2S, %	26.0	
	C_3A, %	10.1	
	C_4AF, %	6.5	
	Fineness, % Passing	82.6	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness Blaine	3428	2103
	Fineness, Wagner	1665	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 14A & 14B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	42.5	
	C_2S, %	32.0	
	C_3A, %	8.2	
	C_4AF, %	9.2	
	Fineness, % Passing	92.3	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3424	2103
	Fineness, Wagner	1880	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 15A & 15B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	64.5	
	C_2S, %	10.0	
	C_3A, %	12.1	
	C_4AF, %	7.5	
	Fineness, % Passing	92.4	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3229	2103
	Fineness, Wagner	1845	2101

Material Code 01CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 16A & 16B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	53.5	
	C_2S, %	21.0	
	C_3A, %	7.5	
	C_4AF, %	10.7	
	Fineness, % Passing	91.9	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	326.1	2103
	Fineness, Wagner	178.5	2101

Material Code 01 CB Property Code 2000

Portland Cement Concrete	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _
Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic		

Mixes 17A & 17B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	52.0	
	C_2S, %	23.0	
	C_3A, %	10.4	
	C_4AF, %	9.3	
	Fineness, % Passing	85.1	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3985	2103
	Fineness, Wagner	177.0	2101

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 1BA & 1BB

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	44.5	
	C_2S, %	28.0	
	C_3A, %	13.2	
	C_4AF, %	6.8	
	Fineness, % Passing	91.0	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	326.8	2103
	Fineness, Wagner	1750	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 19A1 & 19A2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	36.8	
	C_2S, %	35.5	
	C_3A, %	9.8	
	C_4AF, %	9.5	
	Fineness, % Passing	71.1	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	2500	2103
	Fineness, Wagner	1320	2101

Cement for Mixes 19A1 & 19A2 was produced in 1949; however, the fineness is representative of cements produced in 1929. The chemical composition of cement used for Mixes 19A1 & 19A2 was also representative of cements produced in 1929.

Material Code 01CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 19B1 & 19B2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	48.6	
	C_2S, %	25.2	
	C_3A, %	9.9	
	C_4AF, %	8.4	
	Fineness, % Passing	72.8	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	247.0	2103
	Fineness, Wagner	133.0	2101

Cement for Mixes 19B1 & 19B2 was produced in 1949; however, the fineness is representative of cements produced in 1929.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 19C1 & 19C2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	52.0	
	C_2S, %	19.1	
	C_3A, %	10.3	
	C_4AF, %	9.0	
	Fineness, % Passing	86.1	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3200	2103
	Fineness, Wagner	1630	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	1.9 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	423 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.56	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	564 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		1.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	423 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.55	2603
Slump	___ mm	2.9 in.	2631
Air Content, %		1.7	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 13 A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.43	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.1	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 13B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	426 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.57	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 14A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	564 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 14B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	426 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.55	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.8	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 15A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.45	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 15B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	425 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.58	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	565 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	1.9 in.	2631
Air Content, %		1.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	424 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.56	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		1.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 17A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	566 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.46	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481-504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441-453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 17B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	423 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.61	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	566 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.44	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	427 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.58	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.2	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.
Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).
McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic Mix 19A1	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	566 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.45	2603
Slump	___ mm	3.4 in.	2631
Air Content, %		1.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19A2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	425 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.59	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		2.0	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19B1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	566 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.45	2603
Slump	___ mm	2.9 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 B 2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	423 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.60	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 C 1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	565 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.45	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 19 C2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	423 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.50	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		1.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE II CEMENT

SERIES 374

TYPE II CEMENT

ORNL Volume 2 — Supporting Documentation

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41 to 0.43

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
21A	(860)	(4110)	(6510)	(8160)	(9640)	(9580)	(10060)	(11360
22A	(1060)	(5030)	(7540)	(8340)	(9240)	(9940)	(9790)	(10490
23A	(1420)	(4530)	(6760)	(7550)	(9210)	(9540)	(9810)	—
24A	(1270)	(4400)	(5530)	(6920)	(8170)	(8160)	(8460)	—
25A	(1300)	(3740)	(5960)	(7710)	(8560)	(9300)	(9710)	(10500
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.54 to 0.57

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
21B	(540)	(2600)	(4630)	(6080)	(7410)	(7630)	(7830)	(7720)
22B	(560)	(2800)	(5150)	(6000)	(6620)	(7170)	(7260)	(7380)
23B	(830)	(3220)	(5040)	(6200)	(6790)	(7100)	(7200)	(7210)
24B	(680)	(2800)	(4300)	(5360)	(5940)	(6060)	(6040)	(6380)
25B	(620)	(1980)	(4000)	(5630)	(6580)	(6820)	(6950)	(7480)
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41 to 0.43

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
21A	(140)	(525)	(710)	(845)	(940)	(925)	(1010)	(1050)
22A	(170)	(580)	(735)	(910)	(935)	(945)	(955)	(1080)
23A	(215)	(565)	(750)	(870)	(950)	(945)	(915)	—
24A	(240)	(565)	(715)	(780)	(865)	(870)	(915)	—
25A	(220)	(510)	(715)	(850)	(905)	(925)	(975)	(1030)
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.54 to 0.57

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at: 1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
21B	(75)	(380)	(590)	(745)	(825)	(825)	(805)	(890)
22B	(95)	(425)	(640)	(760)	(755)	(815)	(840)	(860)
23B	(130)	(445)	(615)	(765)	(800)	(765)	(790)	(880)
24B	(130)	(440)	(585)	(690)	(735)	(745)	(750)	(870)
25B	(105)	(325)	(545)	(730)	(790)	(760)	(825)	(980)
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41 to 0.43

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
21A	(2.33)	(4.56)	(5.65)	(6.22)	(6.96)	(7.33)	(7.12)
22A	(2.75)	(5.24)	(6.01)	(6.49)	(7.31)	(7.50)	(7.46)
23A	(2.99)	(4.94)	(5.72)	(6.43)	(6.93)	(7.15)	(7.16)
24A	(3.25)	(4.94)	(5.43)	(6.10)	(6.48)	(6.77)	(6.70)
25A	(2.93)	(4.50)	(5.44)	(6.11)	(6.79)	(6.97)	(6.99)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.54 to 0.57

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
21B	(1.72)	(4.12)	(5.12)	(5.96)	(6.55)	(6.77)	(6.72)
22B	(1.95)	(4.39)	(5.51)	(6.05)	(6.48)	(6.87)	(6.85)
23B	(2.32)	(4.49)	(5.38)	(5.96)	(6.48)	(6.77)	(6.66)
24B	(2.32)	(4.24)	(5.10)	(5.67)	(6.16)	(6.37)	(6.20)
25B	(2.11)	(3.82)	(4.96)	(5.69)	(6.35)	(6.60)	(6.51)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41 to 0.43

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21A	(5.14)	(6.30)	(6.61)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.54 to 0.57

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21B	(4.65)	(6.08)	(6.45)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41 to 0.43

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21A	(5.12)	(7.05)	(6.93)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.54 to 0.57

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21B	(4.61)	(6.42)	(6.46)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41 to 0.43

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21A	(3.79)	(6.03)	(5.95)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.54 to 0.57

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21B	(3.45)	(5.79)	(5.80)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41 to 0.43

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 year
21A	(11580)	(13520)	(14450)	(15340)	(16100)	(16700)	(16890)	(17,120
25A	(12400)	(13790)	(14590)	(15400)	(16060)	(16520)	(16630)	(17010
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.54 to 0.57

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
21B	(10,380)	(13,070)	(14,050)	(15,000)	(15,720)	(16,370)	(16,600)	(16,670)
25B	(11,130)	(12,800)	(13,710)	(14,880)	(15,690)	(16,100)	(16,230)	(16,560)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE II CEMENT

ORNL Volume 3 — Material Data Sheets

165

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1940 and was designated Cement No. 21 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.43. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1940 and was designated Cement No. 21 in this series. The concrete mix contained 4.54 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.56. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 22A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 22 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 22B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 22 in this series. The concrete mix contained 4.51 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.54. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23 A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 23A in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.42. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 23 in this series. The concrete mix contained 4.53 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.55. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 24A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 24 in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.42. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 24B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 24 in this series. The concrete mix contained 4.53 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.56. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 25A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 25 in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.42. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 25B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 25 in this series. The concrete mix contained 4.55 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.56. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	565	2001
Fine Aggregate	—	1219	2211
Coarse Aggregate	—	2078	2222
—	—	—	—
Water	—	243	2421
Total	—	4105	

Weight of water was derived from water/cement ratio of 0.43.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	427	2001
Fine Aggregate	—	1368	2211
Coarse Aggregate	—	2054	2222
—	—	—	—
Water	—	239	2421
Total	—	4088	

Weight of water was derived from water/cement ratio of 0.56.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 22 A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	565	2001
Fine Aggregate	—	1231	2211
Coarse Aggregate	—	2098	2222
—	—	—	—
Water	—	232	2421
Total	—	4126	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 22B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type II	—	424	2001
Fine Aggregate	—	1371	2211
Coarse Aggregate	—	2059	2222
—	—	—	—
Water	—	229	2421
Total	—	4083	

Weight of water was derived from water/cement ratio of 0.54.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	565	2001
Fine Aggregate	—	1224	2211
Coarse Aggregate	—	2086	2222
—	—	—	—
Water	—	237	2421
Total	—	4112	

Weight of water was derived from water/cement ratio of 0.42.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23 B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	426	2001
Fine Aggregate	—	1372	2211
Coarse Aggregate	—	2060	2222
—	—	—	—
Water	—	234	2421
Total	—	4092	

Weight of water was derived from water/cement ratio of 0.55.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 24 A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	566	2001
Fine Aggregate	—	1217	2211
Coarse Aggregate	—	2074	2222
—	—	—	—
Water	—	238	2421
Total	—	4095	

Weight of water was derived from water/cement ratio of 0.42.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 24-B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	426	2001
Fine Aggregate	—	1358	2211
Coarse Aggregate	—	2039	2222
—	—	—	—
Water	—	239	2421
Total	—	4062	

Weight of water was derived from water/cement ratio of 0.56.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 25A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	566	2001
Fine Aggregate	—	1220	2211
Coarse Aggregate	—	2079	2222
—	—	—	—
Water	—	238	2421
Total	—	4103	

Weight of water was derived from water/cement ratio of 0.42.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 25B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II	—	428	2001
Fine Aggregate	—	1359	2211
Coarse Aggregate	—	2040	2222
—	—	—	—
Water	—	240	2421
Total	—	4067	

Weight of water was derived from water/cement ratio of 0.56.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41 to 0.43

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
21A		6000	
22A	_._	6560	
23A	_._	5970	
24A	_._	5310	
25A	_._	5720	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.54 to 0.57

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
21B		4320	
22B	_._	4600	
23B	_._	4690	
24B	_._	3860	
25B	_._	3580	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 21A & 21B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type II		2001
	C_3S, %	40.0	
	C_2S, %	41.0	
	C_3A, %	6.4	
	C_4AF, %	9.7	
	Fineness, % Passing	92.0	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine Air-Permeability, m^2/kg	289.1	2103
	Fineness, Wagner Turbidimeter, m^2/kg	163.0	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 22 A & 22 B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type II		2001
	C_3S, %	41.5	
	C_2S, %	33.5	
	C_3A, %	6.6	
	C_4AF, %	11.7	
	Fineness, % Passing	89.3	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3065	2103
	Fineness, Wagner	1775	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 23A & 23B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type II		2001
	C_3S, %	51.0	
	C_2S, %	24.0	
	C_3A, %	3.7	
	C_4AF, %	16.6	
	Fineness, % Passing	96.9	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	310.9	2103
	Fineness, Wagner	1875	2101

Material Code 01CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 24A & 24B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type II		2001
	C_3S, %	41.0	
	C_2S, %	29.0	
	C_3A, %	5.4	
	C_4AF, %	14.8	
	Fineness, % Passing	90.7	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	369.7	2103
	Fineness, Wagner	1925	2101

Material Code 01CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 25A & 25B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type II		2001
	C_3S, %	34.0	
	C_2S, %	39.0	
	C_3A, %	4.7	
	C_4AF, %	14.9	
	Fineness, % Passing	89.8	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	328.7	2103
	Fineness, Wagner	1825	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.43	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.1	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__. _____

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	427 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.56	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 22A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.4	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 22B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	424 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.54	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.7	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.42	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.3	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	426 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.55	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		1.5	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__. _____

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 24A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	566 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.42	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 24B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	426 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.56	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.8	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 25A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	566 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.42	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		1.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 25 B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	428 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.56	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.7	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE III CEMENT

SERIES 374

TYPE III CEMENT

ORNL Volume 2 — Supporting Documentation

203

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
31A	(2110)	(5730)	(6540)	(7350)	(7800)	(7970)	(8550)	(7750)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31B

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
31B	(1480)	(4820)	(5820)	(6490)	(6260)	(6370)	(6520)	(6470)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33A

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
33A	(3690)	(6580)	(7360)	(8140)	(8840)	(9340)	(9100)	(9260)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33B

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
33B	(2290)	(4900)	(5560)	(6340)	(6600)	(6790)	(6410)	(6550)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							34 year
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	
31A	(315)	(590)	(655)	(765)	(760)	(790)	(860)	(880)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31B

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							34 years
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	
31B	(230)	(540)	(640)	(710)	(645)	(640)	(700)	(790)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33A

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
33A	(435)	(650)	(665)	(825)	(850)	(815)	(1015)	(1010)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33B

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
33B	(370)	(585)	(635)	(755)	(695)	(720)	(835)	(840)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
31A	(3.27)	(4.77)	(5.43)	(6.00)	(6.31)	(6.66)	(6.53)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31B

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
31B	(2.88)	(4.78)	(5.22)	(5.79)	(6.18)	(6.40)	(6.27)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33A

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
33A	(4.07)	(5.32)	(5.77)	(6.19)	(6.57)	(6.95)	(7.13)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33B

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
33B	(3.69)	(4.93)	(5.43)	(5.96)	(6.26)	(6.57)	(6.46)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
31A	(4.91)	(6.01)	(6.11)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31B

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
31B	(4.84)	(5.61)	(5.83)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
31A	(4.91)	(6.05)	(6.33)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31B

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
31B	(4.60)	(6.26)	(5.75)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
31A	(3.78)	(5.28)	(5.29)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31B

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
31B	(3.69)	(5.28)	(5.00)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
31A	(12,560)	(13,760)	(14,530)	(15,120)	(15,790)	(16,130)	(16,300)	(16,340)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31 B

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
31B	(12,290)	(13,610)	(14,340)	(14,970)	(15,560)	(15,920)	(16,060)	(16,020)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A Soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE III CEMENT

ORNL Volume 3 — Material Data Sheets

225

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31 A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 31 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31 B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 31 in this series. The concrete mix contained 4.54 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.60. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 33 in this series. The concrete mix contained 5.99 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.44. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33 B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 33 in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.55. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type III	—	565	2001
Fine Aggregate	—	1185	2211
Coarse Aggregate	—	2019	2222
—	—	—	—
Water	—	277	2421
Total	—	4046	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31 B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	427	2001
Fine Aggregate	—	1349	2211
Coarse Aggregate	—	2026	2222
—	—	—	—
Water	—	256	2421
Total	—	4058	

Weight of water was derived from water/cement ratio of 0.60.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33 A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	563	2001
Fine Aggregate	—	1210	2211
Coarse Aggregate	—	2063	2222
—	—	—	—
Water	—	248	2421
Total	—	4084	

Weight of water was derived from water/cement ratio of 0.44.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type III	—	423	2001
Fine Aggregate	—	1365	2211
Coarse Aggregate	—	2049	2222
—	—	—	—
Water	—	233	2421
Total	—	4070	

Weight of water was derived from water/cement ratio of 0.55.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
31A	_._	6560	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
31B	_._	5440	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
33A	—	6100	
	—	—	
	—	—	
	—	—	
Average Compressive Strength	—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
33B	_._	5310	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 31A & 31B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III		2001
	C_3S, %	56.0	
	C_2S, %	17.0	
	C_3A, %	10.8	
	C_4AF, %	6.4	
	Fineness, % Passing	99.7	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	579.5	2103
	air-permeability		
	test, m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	279.5	2101

Material Code 01CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 33A & 33B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III		2001
	C_3S, %	60.0	
	C_2S, %	13.0	
	C_3A, %	10.4	
	C_4AF, %	7.7	
	Fineness, % Passing	98.7	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	527.2	2103
	air-permeability		
	test, m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	253.0	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	565 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.9 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 31 B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	427 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.60	2603
Slump	___ mm	3.0 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	563 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.44	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	423 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.55	2603
Slump	___ mm	2.0 in.	2631
Air Content, %		1.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE IV CEMENT

SERIES 374

TYPE IV CEMENT

ORNL Volume 2 — Supporting Documentation

245

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40 + 0.42

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
41A	(970)	(3290)	(5950)	(7730)	(9140)	(9630)	(10,010)	(10,500)
42A	(800)	(2460)	(4880)	(7720)	(9470)	(9640)	(10,370)	(10,330)
43C A?	(660)	(3340)	(5470)	(7280)	(8480)	(9500)	(9980)	(10,590)
43A1	(880)	(2580)	(5470)	(7610)	(9220)	(9890)	(10,100)	(11,500)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53-0.55

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
41B	(510)	(1760)	(3860)	(5920)	(6940)	(6830)	(6970)	(7570)
42B	(460)	(1490)	(3200)	(5930)	(7140)	(7850)	(7840)	(7780)
43B	(340)	(1780)	(3810)	(5560)	(6750)	(7070)	(7030)	—
43A2	(460)	(1490)	(3450)	(5700)	(6820)	(7380)	(7780)	(7680)
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40 to 0.42

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
41A	(180)	(495)	(725)	(875)	(980)	(940)	(965)	(910)
42A	(160)	(405)	(665)	(890)	(925)	(965)	(1020)	—
43C AT.	(115)	(495)	(750)	(890)	(930)	(905)	(1085)	(1010)
43A1	(160)	(430)	(650)	(870)	(935)	(965)	(990)	—
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53 to 0.55

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
41B	(95)	(305)	(575)	(745)	(875)	(835)	(865)	(860)
42B	(95)	(270)	(500)	(825)	(880)	(860)	(875)	(920)
43B	(60)	(325)	(615)	(770)	(770)	(775)	(1010)	(900)
43A2	(80)	(265)	(525)	(745)	(845)	(815)	(820)	(990)
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40 to 0.42

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
41A	(2.74)	(4.51)	(5.46)	(6.24)	(6.72)	(6.99)	(7.03)
42A	(2.51)	(4.05)	(5.48)	(6.23)	(7.01)	(7.35)	(7.32)
43C	(2.18)	(4.62)	(5.67)	(6.16)	(6.74)	(7.11)	(7.05)
43A1	(2.56)	(4.27)	(5.41)	(6.20)	(6.81)	(7.42)	(7.27)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53 to 0.55

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
41B	(1.92)	(3.74)	(4.95)	(5.86)	(6.35)	(6.69)	(6.59)
42B	(1.90)	(3.52)	(4.89)	(5.81)	(6.61)	(7.14)	(6.96)
43B	(1.63)	(3.87)	(5.20)	(5.86)	(6.30)	(6.79)	(6.68)
43A2	(1.80)	(3.58)	(4.85)	(5.78)	(6.44)	(6.97)	(6.79)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40-0.42

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
41A	(4.98)	(6.16)	(6.65)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
41B	(4.47)	(5.73)	(6.23)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40 to 0.42

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
41A	(4.97)	(6.96)	(6.68)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete	Static Elastic Modulus versus Time	Update Package Number 0
Normal-Weight		Revision Control Code 0.0
Gravel Aggregate		Quality Level _
Series 374, Elgin Dolomitic		

Mixes with w/c = 0.53 to 0.55

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
41B	(4.36)	(6.28)	(6.34)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40 to 0.42

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
41A	(3.88)	(5.67)	(5.83)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.53 to 0.55

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
41B	(3.20)	(5.39)	(5.37)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.40 to 0.42

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							10 year:
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	
41A	(12,040)	(13,590)	(14,310)	(15,530)	(16,130)	(16,590)	(16,820)	(17,120)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53 to 0.55

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
41B	(10,700)	(12,320)	(13,250)	(14,880)	(15,600)	(16,230)	(16,490)	(16,450)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE IV CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 41A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 41 in this series. The concrete mix contained 6.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.40. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 41B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 41 in this series. The concrete mix contained 4.53 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.54. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 42A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 42 in this series. The concrete mix contained 6.03 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.43. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 42B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 42 in this series. The concrete mix contained 4.54 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.55. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43 A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 43 in this series. The concrete mix contained 6.00 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.42. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 43 in this series. The concrete mix contained 4.52 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.54. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 43A in this series. The concrete mix contained 6.00 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 43A in this series. The concrete mix contained 4.51 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.55. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 41A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	566	2001
Fine Aggregate	—	1225	2211
Coarse Aggregate	—	2088	2222
—	—	—	—
Water	—	226	2421
Total	—	4105	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 41B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	426	2001
Fine Aggregate	—	1368	2211
Coarse Aggregate	—	2054	2222
—	—	—	—
Water	—	230	2421
Total	—	4078	

Weight of water was derived from water/cement ratio of 0.54.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days dynamic modulus of elasticity, and static modulus of elasticity.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 42A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	567	2001
Fine Aggregate	—	1222	2211
Coarse Aggregate	—	2083	2222
—	—	—	—
Water	—	244	2421
Total	—	4116	

Weight of water was derived from water/cement ratio of 0.43.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 42B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IV	—	427	2001
Fine Aggregate	—	1371	2211
Coarse Aggregate	—	2059	2222
—	—	—	—
Water	—	235	2421
Total	—	4092	

Weight of water was derived from water/cement ratio of 0.55.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43C

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	564	2001
Fine Aggregate	—	1214	2211
Coarse Aggregate	—	2069	2222
—	—	—	—
Water	—	237	2421
Total	—	4084	

Weight of water was derived from water/cement ratio of 0.42.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	425	2001
Fine Aggregate	—	1356	2211
Coarse Aggregate	—	2036	2222
—	—	—	—
Water	—	230	2421
Total	—	4047	

Weight of water was derived from water/cement ratio of 0.54.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43 A1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	564	2001
Fine Aggregate	—	1220	2211
Coarse Aggregate	—	2079	2222
—	—	—	—
Water	—	231	2421
Total	—	4094	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43 A2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	424	2001
Fine Aggregate	—	1361	2211
Coarse Aggregate	—	2044	2222
—	—	—	—
Water	—	233	2421
Total	—	4062	

Weight of water was derived from water/cement ratio of 0.55.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.40 to 0.42

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
41A	—.—	5900	
42A	—.—	4660	
43C	—.—	5700	
43A1	—.—	5180	
	—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.53 to 0.55

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
41B	—.—	3410	
42B	—.—	2810	
43B	—.—	3950	
43A2	—.—	3010	
	—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 41A & 41B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IV		2001
	C_3S, %	20.0	
	C_2S, %	51.0	
	C_3A, %	4.5	
	C_4AF, %	15.2	
	Fineness, % Passing	89.5	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	367.9	2103
	air-permeability		
	test, m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	191.5	2101

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 42A & 42B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IV		2001
	C_3S, %	27.0	
	C_2S, %	55.0	
	C_3A, %	3.5	
	C_4AF, %	8.2	
	Fineness, % Passing	94.6	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	350.1	2103
	air-permeability		
	test, m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	192.0	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 43C & 43B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IV		2001
	C_3S, %	25.0	
	C_2S, %	48.0	
	C_3A, %	6.2	
	C_4AF, %	13.8	
	Fineness, % Passing	94.4	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	3846	2103
	air-permeability		
	test, m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	196.5	2101

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 43A1 & 43A2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IV		2001
	C_3S, %	29.0	
	C_2S, %	52.0	
	C_3A, %	5.3	
	C_4AF, %	9.3	
	Fineness, % Passing	94.6	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	363.3	2103
	air-permeability		
	test m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	191.5	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 41A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	566 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		1.9	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 41B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	426 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.54	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		2.0	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 42A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	567 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.43	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.2	2613

Reference Documentation
Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.
Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).
McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 42B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	427 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.55	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		1.4	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43C

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	564 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.42	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		2.1	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	425 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.54	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		2.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	564 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.9	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	424 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.55	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		2.2	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE V CEMENT

SERIES 374

TYPE V CEMENT

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
51A	(1420)	(4400)	(6560)	(8300)	(8620)	(9990)	(10150)	(10120)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51B

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
51B	(780)	(2590)	(4220)	(6440)	(6850)	(7570)	(7060)	(7340)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
51A	(215)	(520)	(705)	(860)	(945)	(965)	(1085)	(1120)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51B

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
51B	(125)	(380)	(595)	(745)	(780)	(795)	(990)	(920)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
51A	(3.12)	(5.07)	(5.72)	(6.51)	(7.27)	(7.56)	(7.53)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51 B

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
51B	(2.41)	(4.36)	(5.37)	(6.10)	(6.61)	(7.12)	(7.11)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
51A	(5.43)	(6.50)	(7.11)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51B

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
51B	(4.93)	(6.20)	(6.72)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
51A	(4.96)	(7.29)	(7.22)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51 B

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
51B	(4.57)	(7.33)	(7.06)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
51A	(3.65)	(6.41)	(6.50)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51 B

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
51B	(3.23)	(6.23)	(6.28)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 year.
51A	(12,540)	(13,890)	(14,530)	(15,530)	(16,270)	(16,780)	(17,360)	(17,480)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51B

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
51B	(11,960)	(13,350)	(14,040)	(15,150)	(15,890)	(16,560)	(16,970)	(17,120)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE V CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type V cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 51 in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51B

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 51 in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.54. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type V	—	565	2001
Fine Aggregate	—	1232	2211
Coarse Aggregate	—	2101	2222
—	—	—	—
Water	—	232	2421
Total	—	4130	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days dynamic modulus of elasticity, and static modulus of elasticity.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51B

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type V	—	423	2001
Fine Aggregate	—	1377	2211
Coarse Aggregate	—	2068	2222
—	—	—	—
Water	—	228	2421
Total	—	4096	

Weight of water was derived from water/cement ratio of 0.54.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
51A	—.—	6200	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
51B	—.—	3890	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 51A & 51B

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type V		2001
	C_3S, %	41.0	
	C_2S, %	39.0	
	C_3A, %	3.7	
	C_4AF, %	10.0	
	Fineness, % Passing	98.0	2128
	No. 325 Sieve		
	(ASTM C 430)		
	Fineness, Blaine	348.3	2103
	air-permeability		
	test, m^2/kg		
	Fineness, Wagner turbidimeter, m^2/kg	202.5	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 51A

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		1.3	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__. _____

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 52B

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	423 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.54	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.5	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE IA CEMENT

SERIES 374

TYPE I AIR-ENTRAINING CEMENT

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.38 to 0.40

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
11T1	(890)	(3690)	(5030)	(5380)	(5740)	(6390)	(6370)	(6570)
12T1	(860)	(4930)	(6920)	(7740)	(8720)	(9330)	(9960)	(10,000)
16T1	(1250)	(3850)	(5050)	(5710)	(6380)	(7390)	(7070)	(6620)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.43

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
1877	(720)	(4750)	(6310)	(6500)	(7450)	(8080)	(8110)	(8100)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.46 to 0.47

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
11T2	(600)	(3010)	(4190)	(4460)	(4780)	(5080)	(4690)	(5000)
16T2	(800)	(2940)	(4150)	(4480)	(4770)	(5490)	(5390)	(5350)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.51 to 0.53

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
12T2	(420)	(3680)	(6030)	(6580)	(7240)	(7560)	(6890)	(7870)
18T2	(500)	(3980)	(5460)	(5770)	(6260)	(6570)	(6310)	(6010)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.38 to 0.40

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
11T1	(180)	(500)	(600)	(660)	(660)	(710)	(770)	(860)
12T1	(160)	(595)	(730)	(850)	(885)	(865)	(1000)	—
16T1	(230)	(510)	(625)	(720)	(780)	(800)	(820)	(920)
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.43

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
18T1	(140)	(530)	(655)	(760)	(785)	(830)	(880)	(910)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.46 to 0.47

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
11T2	(140)	(445)	(515)	(595)	(585)	(595)	(610)	(650)
16T2	(155)	(415)	(550)	(635)	(605)	(665)	(685)	(690)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/C = 0.51 to 0.53

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							34 years
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	
12T2	(80)	(495)	(645)	(765)	(790)	(760)	(820)	(930)
18T2	(100)	(485)	(585)	(710)	(720)	(720)	(735)	(840)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.38 to 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
11T1	(2.52)	(4.21)	(5.04)	(5.40)	(5.85)	(6.06)	(6.18)
12T1	(2.43)	(5.14)	(5.85)	(6.28)	(6.87)	(7.39)	(7.16)
16T1	(3.02)	(4.49)	(5.16)	(5.67)	(6.26)	(6.58)	(6.37)
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/C = 0.43

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
18T1	(2.26)	(4.87)	(5.42)	(6.00)	(6.49)	(6.88)	(6.83)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.46 to 0.47

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
11T2	(2.22)	(4.02)	(4.75)	(5.13)	(5.66)	(5.82)	(5.62)
16T2	(2.47)	(4.13)	(4.87)	(5.17)	(5.74)	(6.13)	(5.87)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.51 to 0.53

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
12T2	(1.68)	(4.61)	(5.39)	(5.85)	(6.53)	(6.82)	(6.68)
18T2	(1.97)	(4.49)	(5.32)	(5.83)	(6.39)	(6.65)	(6.56)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.38 to 0.40

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11T1	(4.64)	(5.38)	(5.61)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.46 to 0.47

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11T2	(4.31)	(5.00)	(5.20)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.38 to 0.40

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11T1	(4.60)	(5.41)	(5.48)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.46 to 0.47

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11T2	(4.28)	(5.15)	(5.24)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.38 to 0.40

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11T1	(3.14)	(4.86)	(5.00)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 274, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.46 to 0.47

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
11T2							
	(2.93)	(4.40)	(4.41)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elain Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.38 to 0.40

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
11T1	(11,770)	(13,350)	(13,970)	(14,850)	(15,340)	(15,720)	(15,890)	(16,130)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.46 to 0.47

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
11T2	(11,140)	(13,210)	(13,940)	(14,850)	(15,270)	(15,690)	(15,750)	(16,020)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE I AIR-ENTRAINING CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11T1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 11T in this series. The concrete mix contained 5.95 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.40.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11T2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 11T in this series. The concrete mix contained 4.49 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.47.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12T1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 12T in this series. The concrete mix contained 6.00 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.40.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12T2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 12T in this series. The concrete mix contained 4.48 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.53.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16T1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I*cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 16T in this series. The concrete mix contained 6.03 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.38.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16T2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 16T2 in this series. The concrete mix contained 4.47 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.46.

*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18T1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 18T in this series. The concrete mix contained 6.01 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.43.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18T2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 18T in this series. The concrete mix contained 4.51 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.51.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11T1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I*	—	559	2001
Fine Aggregate	—	1022	2211
Coarse Aggregate	—	2088	2222
—	—	—	—
Water	—	224	2421
Total	—	3893	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

-6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11T2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I*	—	422	2001
Fine Aggregate	—	1181	2211
Coarse Aggregate	—	2066	2222
—	—	—	—
Water	—	198	2421
Total	—	3867	

Weight of water was derived from water/cement ratio of 0.47.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12T1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I*	—	564	2001
Fine Aggregate	—	1169	2211
Coarse Aggregate	—	2098	2222
—	—	—	—
Water	—	226	2421
Total	—	4057	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6×6×30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6×12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12T2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I*	—	421	2001
Fine Aggregate	—	1301	2211
Coarse Aggregate	—	2064	2222
—	—	—	—
Water	—	223	2421
Total	—	4009	

Weight of water was derived from water/cement ratio of 0.53.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16T1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I*	—	567	2001
Fine Aggregate	—	1038	2211
Coarse Aggregate	—	2138	2222
—	—	—	—
Water	—	215	2421
Total	—	3958	

Weight of water was derived from water/cement ratio of 0.38.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6×6×30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6×12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01 CB Property Code 1000

Portland Cement Concrete	General Information	Update Package Number 0
Normal-Weight		Revision Control Code 0.0
Gravel Aggregate		Quality Level _
Series 374, Elgin Dolomitic		

Mix 16T2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I*	—	420	2001
Fine Aggregate	—	1153	2211
Coarse Aggregate	—	2115	2222
—	—	—	—
Water	—	193	2421
Total	—	3881	

Weight of water was derived from water/cement ratio of 0.46.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6×6×30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6×12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18T1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I*	—	565	2001
Fine Aggregate	—	1131	2211
Coarse Aggregate	—	2084	2222
—	—	—	—
Water	—	243	2421
Total	—	4023	

Weight of water was derived from water/cement ratio of 0.43.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6×6×30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6×12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18T2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I*	—	424	2001
Fine Aggregate	—	1252	2211
Coarse Aggregate	—	2106	2222
—	—	—	—
Water	—	216	2421
Total	—	3998	

Weight of water was derived from water/cement ratio of 0.51.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6×6×30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6×12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Oolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.38 to 0.40

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
11T1	—.—	4760	
12T1	—.—	6700	
16T1	—.—	4670	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.43

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
18T1	—.—	5800	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.46 to 0.47

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
11T2	—.—	3840	
16T2	—.—	3970	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.51 to 0.53

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
12T2	_._	5480	
18T2	_._	5050	
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 11T1 & 11T2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	51.0	
	C_2S, %	21.0	
	C_3A, %	12.2	
	C_4AF, %	7.1	
	Fineness, Blaine	364.0	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	92.8	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner Turbidimeter, kg/m^2	201	2101

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 12T1 & 12T2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	46.0	
	C_2S, %	27.0	
	C_3A, %	12.5	
	C_4AF, %	7.1	
	Fineness, Blaine	315.2	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	89.8	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner	179	2101

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 16T1 & 16T2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	52.5	
	C_2S, %	22.0	
	C_3A, %	7.9	
	C_4AF, %	10.4	
	Fineness, Blaine	311.4	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	91.5	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner	168	2101

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 18T1 & 18T2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	44.0	
	C_2S, %	28.5	
	C_3A, %	13.2	
	C_4AF, %	6.7	
	Fineness, Blaine	375.6	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	93.3	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner	196	2101

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11T1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	559 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		6.7	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 11T2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	422 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.47	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		7.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12T1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	564 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		2.8	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12T2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	421 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.53	2603
Slump	___ mm	2.3 in.	2631
Air Content, %		3.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16T1.

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	567 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.38	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		5.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 16T2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	420 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.46	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		7.5	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18T1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	565 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.43	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		3.1	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 18T2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	424 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.51	2603
Slump	___ mm	1.9 in.	2631
Air Content, %		3.9	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX069*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE IIA CEMENT

SERIES 374

TYPE II AIR-ENTRAINING CEMENT

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
21T1	(770)	(3590)	(5780)	(6950)	(8350)	(9460)	(9970)	(9760)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
21T2	(450)	(2650)	(4590)	(5900)	(6920)	(7080)	(6880)	(7270)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
21T1	(140)	(490)	(640)	(740)	(870)	(920)	(970)	(1020)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
21T2	(90)	(420)	(575)	(700)	(810)	(800)	(825)	(880)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
21T1	(2.32)	(4.64)	(5.49)	(6.05)	(6.80)	(7.21)	(7.25)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
21T2	(1.78)	(4.23)	(5.14)	(5.73)	(6.29)	(6.68)	(6.79)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21T1	(5.08)	(6.18)	(6.40)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21T2	(4.56)	(5.82)	(6.09)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21T1	(5.36)	(7.08)	(7.14)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _
Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic		

Mix 21T2

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21T2	(4.47)	(6.66)	(6.10)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21T1	(3.49)	(5.58)	(5.84)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
21T2	(3.09)	(5.31)	(5.37)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
21T1	(11,090)	(13,790)	(14,480)	(15,500)	(16,130)	(16,670)	(16,860)	(17,120)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
21T2	(10,420)	(13,210)	(14,040)	(15,150)	(15,750)	(16,340)	(16,490)	(16,780)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE II AIR-ENTRAINING CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1940 and was designated Cement No. 21T in this series. The concrete mix contained 5.99 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.39.

*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1940 and was designated Cement No. 21T in this series. The concrete mix contained 4.50 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.49.
*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II*	—	563	2001
Fine Aggregate	—	1137	2211
Coarse Aggregate	—	2105	2222
—	—	—	—
Water	—	220	2421
Total	—	4025	

Weight of water was derived from water/cement ratio of 0.39.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type II*	—	423	2001
Fine Aggregate	—	1261	2211
Coarse Aggregate	—	2086	2222
—	—	—	—
Water	—	207	2421
Total	—	3977	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

- 6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
21T1	—.—	4880	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
21T2	_._	4020	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 21T1 & 21T2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type II*		2001
	C_3S, %	38.0	
	C_2S, %	40.0	
	C_3A, %	6.6	
	C_4AF, %	9.7	
	Fineness, Blaine	2983	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	93.4	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner	175	2101

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	563 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.39	2603
Slump	___ mm	2.0 in.	2631
Air Content, %		3.9	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX069*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 21T2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	423 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		4.9	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE IIIA CEMENT

SERIES 374

TYPE III AIR-ENTRAINING CEMENT

ORNL Volume 2 — Supporting Documentation

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
33T1	(2580)	(5330)	(6090)	(6390)	(7320)	(7870)	(7490)	—
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
33T2	(1860)	(4320)	(4950)	(5370)	(5560)	(5880)	(5610)	—
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 year
33T1	(405)	(635)	(675)	(745)	(815)	(770)	(815)	(860)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							34 years
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	
33T2	(340)	(545)	(615)	(655)	(660)	(615)	(650)	—
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
33T1	(3.56)	(4.85)	(5.35)	(5.79)	(6.19)	(6.31)	(6.28)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
33T2	(3.33)	(4.47)	(4.97)	(5.43)	(5.83)	(5.93)	(5.77)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

SERIES 374

TYPE III AIR-ENTRAINING CEMENT

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type III* cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 33T in this series. The concrete mix contained 5.98 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.40. Flake Vinsol resin was ground with cement clinker to produce

*this air-entraining cement. No additional chemical admixtures were used.

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type III cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 33T in this series. The concrete mix contained 4.54 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.48. *Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. No additional chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type III*	—	562	2001
Fine Aggregate	—	1102	2211
Coarse Aggregate	—	2076	2222
—	—	—	—
Water	—	225	2421
Total	—	3965	

Weight of water was derived from water/cement ratio of 0.40.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6 x 6 x 30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

*Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type III*	—	427	2001
Fine Aggregate	—	1202	2211
Coarse Aggregate	—	2094	2222
—	—	—	—
Water	—	205	2421
Total	—	3928	

Weight of water was derived from water/cement ratio of 0.48.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength and dynamic modulus of elasticity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine 28-day compressive strength.

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
33T1	—.—	5650	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
33T2	—.—	4790	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes 33T1 & 33T2

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type III*		2001
	C_3S, %	57.0	
	C_2S, %	16.0	
	C_3A, %	10.4	
	C_4AF, %	7.3	
	Fineness, Blaine	516.9	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	99.4	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner	251	2101

* Flake Vinsol resin was ground with cement clinker to produce this air-entraining cement. The quantity of resin was not reported and there were no ASTM specifications for air-entraining cements at the time the cements were produced. Therefore it cannot be determined if the air-entraining cements used are representative of modern cements.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	562 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.40	2603
Slump	___ mm	2.1 in.	2631
Air Content, %		4.6	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 33T2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	427 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.48	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		5.8	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE I CEMENT PLUS AIR-ENTRAINING ADMIXTURE

SERIES 374

TYPE I CEMENT AND AIR-ENTRAINING ADMIXTURE

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
12C	(170)	(1240)	(2550)	(2820)	(2780)	(2990)	(3310)	(3680)
	( )	( )	( )	( )	( )	( )	( )	
	( )	(-)	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
12C								
	(35)	(250)	(420)	(490)	(500)	(485)	(520)	(630)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^6)						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
12C	(0.91)	(3.25)	(4.31)	(5.09)	(5.37)	(5.40)	(5.30)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
12C	(4.00)	(4.99)	(5.04)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
12C	(3.51)	(4.83)	(4.77)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
12C	(2.94)	(4.52)	(4.75)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
12C	(—)	(—)	(12,780)	(14,000)	(14,680)	(14,910)	(15,060)	(15,06[illegible]
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE I CEMENT AND AIR-ENTRAINING ADMIXTURE

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 12 in this series. The concrete mix contained 3.00 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.81. Neutralized Vinsol resin was added at the mixer to entrain 4 1/2 ± 1/2 percent air. No additional chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	282	2001
Fine Aggregate	—	1397	2211
Coarse Aggregate	—	2012	2222
Vinsol resin*	—	—	—
Water	—	228	2421
Total	—	3919	

Weight of water was derived from water/cement ratio of 0.81.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).
6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Neutralized Vinsol resin was added at the mixer to entrain 4 1/2 ± 1/2 percent air. The amount and concentration is not available.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No. 12C	28-Day Compressive Strength Values		Property Code
	MPa	psi	
	—.—	—	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	2360	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	45.0	
	C_2S, %	28.0	
	C_3A, %	12.6	
	C_4AF, %	7.3	
	Fineness, Blaine	327.6	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	89.5	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner Turbidimeter, m^2/kg	181.5	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 12C

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	282 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.81	2603
Slump	___ mm	2.9 in.	2631
Air Content, %	-	4.8	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481-504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441-453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE II CEMENT PLUS AIR-ENTRAINING ADMIXTURE

SERIES 374

TYPE II CEMENT AND AIR-ENTRAINING ADMIXTURE

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
23C	(270)	(1280)	(2240)	(2680)	(2860)	(2940)	(3020)	—
	( )	( )	( )	( )	( )	( )	( )	
	( )	(-)	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							34 years
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	
23C	(50)	(225)	(370)	(440)	(440)	(450)	(470)	—
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^6)						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
23C	(1.26)	(3.38)	(4.29)	(5.00)	(5.52)	(5.52)	(5.27)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23 C

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
23 C	(3.93)	(4.94)	(5.21)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
23C	(3.60)	(4.76)	(4.96)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
23C	(2.85)	(4.47)	(4.82)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
23C	(—)	(—)	(12,650)	(14,060)	(14,790)	(15,120)	(15,000)	(15,240
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE II CEMENT AND AIR-ENTRAINING ADMIXTURE

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type II cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 23 in this series. The concrete mix contained 3.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.79. Neutralized Vinsol resin was added at the mixer to entrain 4 1/2 ± 1/2 percent air. No additional chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type II	—	284	2001
Fine Aggregate	—	1410	2211
Coarse Aggregate	—	2031	2222
Vinsol resin*	—	—	—
Water	—	224	2421
Total	—	3949	

Weight of water was derived from water/cement ratio of 0.79.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Neutralized Vinsol resin was added at the mixer to entrain 4 1/2 ± 1/2 percent air. The amount and concentration is not available.

Material Code 01CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No. 23C	28-Day Compressive Strength Values		Property Code
	MPa	psi	
	—.—	—	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	2010	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	51.0	
	C_2S, %	24.0	
	C_3A, %	3.7	
	C_4AF, %	16.6	
	Fineness, Blaine	310.9	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	96.9	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner Turbidimeter, m^2/kg	187.5	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 23C

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	284 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.79	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		4.3	2613

Reference Documentation

__. Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

__.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481–504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441–453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

PORTLAND CEMENT ASSOCIATION SERIES 374

TYPE IV CEMENT PLUS AIR-ENTRAINING ADMIXTURE

SERIES 374

TYPE IV CEMENT AND AIR-ENTRAINING ADMIXTURE

ORNL Volume 2 — Supporting Documentation

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Ultimate Compressive Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	34 years
43A3	(160)	(600)	(1400)	(2620)	(3150)	(3660)	(3760)	(4410)
	( )	( )	( )	( )	( )	( )	( )	
	( )	(-)	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

Six-in. modified cubes were moist-cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref. 1).

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Flexural Strength versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Flexural Strength Test Results for Moist-Cured Prisms, Third Point Loading, MPa (psi) at:							
	1 day	7 days	28 days	3 months	1 year	3 years	10 years	24 years
43A3	(30)	(115)	(270)	(460)	(535)	(560)	(600)	(690)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C78 with loads applied at the third-points of an 18-in. span. Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from 6 tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^6)						
	1 day	7 days	28 days	3 months	1 year	3 years	10 years
43A3	(0.92)	(2.38)	(3.80)	(5.18)	(5.73)	(5.95)	(5.79)
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
43A3	(3.68)	(5.14)	(5.41)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Prisms were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Prisms, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
43A3	(3.17)	(5.46)	(5.98)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. prisms were moist-cured until test. The static modulus was determined from flexural tests of prisms using the following equation:

$$E_s = \frac{P}{f}\left[0.96 + 1/4\left(\frac{4}{5} + \frac{\nu}{2}\right)\right]$$

where

P = total load on beam loaded at third-points of an 18-in. span (ASTM C 78)

f = midspan deflection

ν = Poisson's ratio determined from sonic tests

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	Static Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Static Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (psi x 10^{+6})						
	28 days	1 year	3 years				
43A3	(2.69)	(5.17)	(5.20)	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12 in. cylinders were moist-cured until test. Cylinders were tested according to ASTM C469.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374 Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Mix No.	Pulse Velocity Test Results for Moist-Cured Prisms, m/sec (ft/sec)							
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years
43A3	( )	( )	(11,160)	(13,490)	(14,760)	(15,270)	(15,590)	(15,720)
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
	( )	( )	( )	( )	( )	( )	( )	
Average	( )	( )	( )	( )	( )	( )	( )	

6x6x30-in. prisms were moist-cured until test. A soniscope was used to measure the velocity of a compressional wave through a 30-in. path length.

SERIES 374

TYPE IV CEMENT AND AIR-ENTRAINING ADMIXTURE

ORNL Volume 3 — Material Data Sheets

Material Code 01CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Property Code 1010	Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1950 as part of an extensive study of cement performance in concrete. Cylindrical- and prismatic-shaped specimens were cast from this material and then continuously moist cured. At specified intervals over a 34-year period, specimens were removed and tested. Fifty-year tests are scheduled in 2000.

Property Code 1110	Material Characteristics

This material was prepared from ASTM C150 Type IV cement and dolomitic sand and gravel from Elgin, Illinois. The cement was manufactured in 1941 and was designated Cement No. 43A in this series. The concrete mix contained 3.02 bags of cement per cubic yard of concrete and had a water-cement ratio of 0.78. Neutralized Vinsol resin was added at the mixer to entrain 4 1/2 ± 1/2 percent air. No additional chemical admixtures were used.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IV	—	284	2001
Fine Aggregate	—	1414	2211
Coarse Aggregate	—	2037	2222
Vinsol resin*	—	—	—
Water	—	222	2421
Total	—	3957	

Weight of water was derived from water/cement ratio of 0.78.

Property Code 1220	Processing Information

Concrete specimens were moist-cured (continuous storage in a moist room with a nominal temperature of 73°F and 100% relative humidity).

6x6x30-in. prisms were cast from this material to determine flexural strength, static modulus of elasticity, dynamic modulus of elasticity, and pulse velocity. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. 6x12-in. cylinders were cast to determine compressive strength at 28 days, dynamic modulus of elasticity, and static modulus of elasticity.

* Neutralized vinsol resin was added at the mixer to entrain 4 1/2 ± 1/2 percent air. The amount and concentration is not available.

Material Code 01CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elain Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Property Code 1310	Baseline Information		
Mix No. 43A3	28-Day Compressive Strength Values		Property Code
	MPa	psi	
	—.—	—	
	—.—	—	
	—.—	—	
	—.—	—	
Average Compressive Strength	—.—	1280	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

aterial Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I*		2001
	C_3S, %	29.1	
	C_2S, %	52.0	
	C_3A, %	5.3	
	C_4AF, %	9.3	
	Fineness, Blaine	94.6	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, % Passing	363.3	2128
	No. 325 Sieve		
	(ASTM C430)		
	Fineness, Wagner Turbidimeter, m^2/kg	191.5	2101

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 374, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix 43A3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	284 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.78	2603
Slump	___ mm	2.1 in.	2631
Air Content, %	-	4.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, "Long-Time Study of Cement Performance in Concrete. Chapter 10—Progress Report on Strength and Elastic Properties of Concrete," ACI JOURNAL, *Proceedings*, Vol. 54, No. 6, December 1957, pp. 481-504. (reprinted as *Research Department Bulletin RX089*, Portland Cement Association, Skokie, February 1958).

McMillan, F.R., and Tyler, I.L., "Long-Time Study of Cement Performance in Concrete. Chapter 1—History and Scope," ACI JOURNAL, *Proceedings*, Vol. 44, No. 6, February 1948, pp. 441-453. (reprinted as *Research Department Bulletin RX026*, Portland Cement Association, Skokie, August 1948).

APPENDIX C:

PORTLAND CEMENT ASSOCIATION SERIES 436

PORTLAND CEMENT ASSOCIATION SERIES 436

TABLE OF CONTENTS

Page No.

General Information for All Cement Types 1

Type I Cement
- ORNL Volume 2 — Supporting Documentation 5
- ORNL Volume 3 — Material Data Sheets 35

Type IS Cement
- ORNL Volume 2 — Supporting Documentation 53
- ORNL Volume 3 — Material Data Sheets 83

SERIES 436

GENERAL INFORMATION FOR ALL CEMENT TYPES

PORTLAND CEMENT ASSOCIATION SERIES 436

Laboratory tests reported in Portland Cement Association (PCA) Series 436 were used to compare properties of concrete made using portland blast-furnace slag cement (Type IS) to concrete made from Type I portland cement. Portland cement Types I and IS and dolomitic aggregates from Elgin were used to prepare concrete specimens that were moist or air cured until test. Compressive strength, flexural strength, dynamic modulus of elasticity, and pulse velocity are reported at selected intervals up to 27 years depending on the test.

In the following pages, data for concrete with the same cement type, same aggregate source, and a water-cement ratio within 0.04 are considered similar and are grouped together. Cements from different manufacturers are considered to cause less variations in long term properties than differences in water-cement ratios. Fig. 4 of the reference by Sharon Wood shows the effect of water-cement ratio on concrete compressive strength.

Material Code 01CB Property Code ____ Page 1.1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic		Update Package Number 0 Revision Control Code 0.0 Quality Level _

All Mixes

Preparer: _____

Organization: _____

Sources: References __, __, __, __ and __

Information Sources
Reference 50 (Also called Reference 1 on some of the following pages): Report from Sharon Wood to PCA. This information source presents constituent material, concrete mix, and material property data for concrete specimens made from portland cement Types I and IS (portland blast-furnace slag cement). Compressive strength, flexural strength, dynamic modulus of elasticity, and pulse velocity are reported for moist and air-cured specimens at selected intervals through 27 years. Reference 53: Journal of the PCA Research and Development Laboratories. This information source describes the long-term test plan to compare concretes made using portland blast-furnace slag cements to Type I portland cement concretes. Cement properties and selected concrete properties through three years are presented. Reference __:
Reference __:

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

All Mixes

Property Code 2000	Constituent Material Information (Continued)		
Constituent Material	Material Description or Property	Property Value	Property Code
Fine Aggregate	Dolomitic sand		2211
	from Elgin, Illinois		
	Fineness Modulus	3.05	2302
	Specific Gravity	2.65	2313
Coarse Aggregate	Dolomitic gravel		
	from Elgin, Illinois		
	Maximum Size	1-1/2 in.	2351
	ASTM C33-90	467	
	Specific Gravity	2.65	2363
Water			2421

PORTLAND CEMENT ASSOCIATION SERIES 436

TYPE I CEMENT

SERIES 436

TYPE I CEMENT

ORNL Volume 2 — Supporting Documentation

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.36

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
1	(2640)	(4780)	(6460)	(8070)	(8890)	(9670)	(9840)	(11030)	(10710)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB

Property Code 3621

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.49

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at:								
	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
2	(1320)	(2780)	(4200)	(6110)	(7210)	(7920)	(7990)	(8990)	(8940)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with W/C = 0.62

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
3	(700)	(1620)	(2550)	(4170)	(5210)	(5840)	(5850)	(6010)	(6390)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436, Elgin Dolomitic
Mixes with W/C = 0.42

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
4	(1760)	(3500)	(5080)	(7200)	(8100)	(8720)	(9640)	(10540)	(10,820)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3021 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with W/C = 0.36

Ultimate
Compressive Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for Air-Cured, 6-in. cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
1	(2640)	(4780)	(6460)	(8310)	(9110)	(9400)	(8910)	(9430)	(10,600)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes With W/C = 0.49

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Compressive Strength Test Results for Air-Cured, 6-in. Cubes, MPA (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
2	(1320)	(2780)	(4200)	(6490)	(7360)	(7080)	(6460)	(7260)	(8800)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with W/C = 0.62

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Compressive Strength Test Results for Air-Cured, 6-in. Cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
3	(700)	(1620)	(2550)	(4430)	(4910)	(4740)	(4450)	(5100)	(6610)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

12

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.42

Compressive Strength Test Results for Air-Cured, 6-in. cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
4	(1760)	(3500)	(5080)	(7750)	(8500)	(8450)	(8120)	(7980)	(9430)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.36

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days						
1	(5690)	(7120)						
Average								

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.49

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days						
2	(3600)	(5750)						
Average								

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.62

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days						
3	(2040)	(3620)						
Average								

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.42

Compressive Strength Test Results
For Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days						
4	(4610)	(6670)						
Average								

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436, Elgin Dolomitic
Mixes with w/c = 0.36

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
1	(370)	(555)	(655)	(770)	(925)	(980)	(955)	(960)	(1030)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span.according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with w/c = 0.49

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
2	(225)	(435)	(565)	(745)	(825)	(860)	(905)	(900)	(960)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436, Elgin Dolomitic
Mixes with w/c = 0.62

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
3	(135)	(300)	(420)	(620)	(690)	(720)	(730)	(730)	(800)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01 CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight Aggregate
Gravel
Series 436 Elain Dolomitic
Mixes with w/c = 0.42

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
4	(320)	(505)	(655)	(755)	(875)	(890)	(1005)	(1010)	(1060)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01 CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight Aggregate
Gravel
Series 436 Elgin Dolomitic

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.36

Mix No.	Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
1	(370)	(555)	(655)	(580)	(790)	(805)	(800)	(700)	(680)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01 CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with w/c = 0.49

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
2	(225)	(435)	(565)	(600)	(790)	(765)	(745)	(620)	(830)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01 CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with w/c = 0.62

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
3	(135)	(300)	(420)	(525)	(600)	(623)	(565)	(610)	(860)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with w/c = 0.42

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
4	(320)	(505)	(655)	(605)	(790)	(865)	(800)	(720)	(730)
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
	( )	( )	( )	( )	( )	( )	( )		
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.36

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)						
	7 days	28 days					
1	(5260)	(5920)	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.49

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)						
	7 days	28 days					
2	(4950)	(5830)	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.62

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)						
	7 days	28 days					
3	(4350)	(5170)	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Dynamic Elastic Modulus versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.42

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)						
	7 days	28 days					
4	(5220)	(5860)	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )	( )	( )
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete Normal-Weight CB Aggregate Serie: 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.36

Mix No.	Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)						
	7 days	28 days					
1	(15,850)	(17,030)					
Average							

6x6x30-in. Cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight CB Aggregate Serie: 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.49

Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)

Mix No.	7 days	28 days						
2	(15,380)	(15,880)						
Average								

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight CB Aggregate Series 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.62

Mix No.	Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)							
	7 days	28 days						
3	(14,360)	(15,080)						
Average								

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight CB Aggregate Serie: 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.42

Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)

Mix No.	7 days	28 days						
4	(15,470)	(15,960)						
Average								

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

SERIES 436

TYPE I CEMENT

ORNL Volume 3 — Material Data Sheets

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 1

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concrete made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement No. 19479 in this series. The concrete mix contained 740 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.35 No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 2

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concrete made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement No. 19479 in this series. The concrete mix contained 454 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 3

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concrete made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement No. 19479 in this series. The concrete mix contained 373 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.62. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 4

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concrete made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from ASTM C150 Type I cement and dolomitic sand and gravel from Elgin, Illinois. The cement was designated Cement No. 19479 in this series. The concrete mix contained 534 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.42. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 1

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	740	2001
Fine Aggregate	—	1023	2211
Coarse Aggregate	—	2077	2222
—	—	—	—
Water	—	259	2421
Total	—	4099	

Weight of water was derived from water/cement ratio of 0.35.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 2

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	454	2001
Fine Aggregate	—	1288	2211
Coarse Aggregate	—	2147	2222
—	—	—	—
Water	—	222	2421
Total	—	4111	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 3

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type I	—	373	2001
Fine Aggregate	—	1408	2211
Coarse Aggregate	—	2069	2222
—	—	—	—
Water	—	231	2421
Total	—	4081	

Weight of water was derived from water/cement ratio of 0.62.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 4

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type I	—	534	2001
Fine Aggregate	—	1177	2211
Coarse Aggregate	—	2188	2222
—	—	—	—
Water	—	224	2421
Total	—	4123	

Weight of water was derived from water/cement ratio of 0.42.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436 Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.36

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
1	—	7120	
	—	—	
	—	—	
	—	—	
Average Compressive Strength	—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.49

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
2	_._	5750	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.62

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
3	_._	3620	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix Nos. 1, 2, 3 & 4
Cement No. 19479

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type I		2001
	C_3S, %	41.7	
	C_2S, %	28.9	
	C_3A, %	10.7	
	C_4AF, %	8.4	
	Fineness, Blaine	342.5	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	—	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	—	2128

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.42

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
4	_._	6670	
	_._		
	_._		
	_._		
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 1

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	740 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.35	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.0	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 2

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	454 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.2 in.	2631
Air Content, %		1.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 3

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	373 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.62	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 4

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	534 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.42	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.1	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

PORTLAND CEMENT ASSOCIATION SERIES 436

TYPE IS CEMENT

SERIES 436

TYPE IS CEMENT

ORNL Volume 2 — Supporting Documentation

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436, Elgin Dolomitic

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.36

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
5	(2460)	(4080)	(6170)	(8640)	(9180)	(9600)	(9980)	(10,820)	(9730)
9	(1850)	(3790)	(5060)	(7210)	(8841)	(9230)	(9610)	(10,810)	(10,400)
13	(2730)	(4320)	(5820)	(7200)	(8480)	(9260)	(9720)	(11,210)	(11,350)
17	(2310)	(3910)	(5700)	(7470)	(8510)	(8550)	(9700)	(11,060)	(11,120)
21	(2460)	(4230)	(5760)	(7830)	(8910)	(9500)	(9700)	(11,170)	(10,480)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.49

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
6	(1260)	(2310)	(3780)	(6780)	(8050)	(8120)	(8120)	(9370)	(9440)
10	(930)	(2260)	(3420)	(5860)	(7190)	(8130)	(7950)	(9220)	(8790)
14	(1280)	(2440)	(3670)	(6230)	(7280)	(8040)	(8110)	(9490)	(9450)
18	(1270)	(2320)	(3600)	(5850)	(7180)	(7900)	(7880)	(8690)	(9300)
22	(1160)	(2480)	(3870)	(6520)	(7820)	(8600)	(8410)	(8850)	(9490)
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.62 to 0.63

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
7	(690)	(1300)	(2110)	(4840)	(6240)	(6550)	(6700)	(7040)	(7300)
11	(510)	(1250)	(2060)	(3890)	(5480)	(6020)	(6310)	(6710)	(6950)
15	(770)	(1450)	(2200)	(4470)	(5710)	(6340)	(6540)	(6890)	(7510)
19	(780)	(1490)	(2230)	(4120)	(5320)	(5840)	(5960)	(6190)	—
23	(680)	(1420)	(2280)	(4850)	(6060)	(6660)	(6720)	(6890)	(7160)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic
Mixes with W/C = 0.41

Ultimate Compressive Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mix No.	Compressive Strength Test Results for Moist-Cured, 6-in. Cubes, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
8	(1820)	(3020)	(4560)	(7900)	(8610)	(9290)	(9950)	(10,680)	(10,360)
12	(1290)	(2970)	(4210)	(6500)	(8070)	(8660)	(9510)	(10,200)	(9250)
16	(2010)	(3340)	(4660)	(6920)	(8110)	(8900)	(9510)	(10,500)	(10,670)
20	(1800)	(3130)	(4690)	(7040)	(8120)	(9080)	(9920)	(10,510)	(9230)
24	(1800)	(3430)	(5120)	(7500)	(8170)	(9510)	(9670)	(10,100)	(10,550)
Average	( )	( )	( )	( )	( )	( )	( )		

6-in. modified cubes were moist cured until test. Modified cubes were tested according to ASTM C116 procedures. Listed strengths correspond to the average from 6 tests. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For moist curing, the compressive strength of 6-in. modified cubes is approximately 4% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3021 Page 1.3

Portland Cement Concrete
Normal-Weight
Group: Aggregate
Series: 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.36

Compressive Strength Test Results for Air-Cured, 6-in. cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
5	(2460)	(4080)	(6170)	(9210)	(10,030)	(9840)	(9190)	(9580)	(9980)
9	(1850)	(3790)	(5060)	(8090)	(8940)	(9200)	(9070)	(9330)	(10,100)
13	(2730)	(4320)	(5820)	(7800)	(9020)	(9280)	(8680)	(9550)	(10,770)
17	(2310)	(3910)	(5700)	(8040)	(8960)	(8510)	(8500)	(8990)	(10,070)
21	(2460)	(4230)	(5760)	[illegible]40)	(8980)	(9530)	(8950)	(9630)	(10,720)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Grade
Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.49

Compressive Strength Test Results for Air-Cured, 6-in. cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
6	(1260)	(2310)	(3780)	(6690)	(7530)	(7570)	(6990)	(7380)	(8930)
10	(930)	(2260)	(3420)	(5990)	(6970)	(7240)	(6790)	(7000)	(8780)
14	(1280)	(2440)	(3670)	(6510)	(7270)	(7090)	(6680)	(7040)	(8620)
18	(1270)	(2320)	(3600)	(6200)	(6960)	(6900)	(6230)	(6650)	(8480)
22	(1160)	(2480)	(3870)	(6980)	(7720)	(7770)	(7300)	(7460)	(9340)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Portland Cement Concrete
Normal-Weight
Grade: Aggregate
Series: 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.62 to 0.63

Compressive Strength Test Results for Air-Cured, 6-in. cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
7	(690)	(1300)	(2110)	(4890)	(5500)	(5260)	(4910)	(5070)	(6990)
11	(510)	(1250)	(2060)	(4180)	(4840)	(5100)	(4410)	(4940)	(6250)
15	(770)	(1450)	(2200)	(4420)	(4960)	(4960)	(4640)	(4990)	(6950)
19	(780)	(1490)	(2230)	(4200)	(4810)	(4900)	(4570)	(4910)	(6730)
23	(680)	(1420)	(2280)	(4810)	(5620)	(5480)	(5390)	(5550)	(7220)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01CB Property Code 3021 Page 1.3

Portland Cement Concrete
Normal-Weight
Grade Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.41

Compressive Strength Test Results for Air-Cured, 6-in. cubes, MPA (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
8	(1820)	(3020)	(4560)	(8140)	(8980)	(9100)	(8860)	(8670)	(9200)
12	(1290)	(2970)	(4210)	(7490)	(8560)	(8290)	(8480)	(8130)	(9580)
16	(2010)	(3340)	(4660)	(7540)	(8240)	(8730)	(8320)	(8370)	(9920)
20	(1800)	(3130)	(4690)	(7350)	(8230)	(8260)	(7920)	(7760)	(9720)
24	(1800)	(3430)	(5120)	(8020)	(8570)	(9150)	(8420)	(8530)	(10,180)
Average	( )	( )	( )	( )	( )	( )	( )		

Test specimens were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Modified cubes were tested according to ASTM C 116 procedures. Each value listed above represents the average compressive strength from six 6-in. modified cubes. The compressive strength of cylinders and modified cubes cannot be compared directly because of differences in the aspect ratio of the specimens. For air curing, the compressive strength of 6-in. modified cubes is approximately 11% greater than that of 6x12-in. cylinders (Ref.: Report by Sharon Wood).

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.36

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days						
5	(5180)	(7450)	( )	( )	( )	( )	( )	( )
9	(4860)	(7150)	( )	( )	( )	( )	( )	( )
13	(5240)	(6910)	( )	( )	( )	( )	( )	( )
17	(5040)	(6800)	( )	( )	( )	( )	( )	( )
21	(5590)	(7470)						
Average	( )	( )						

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.49

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days						
6	(2960)	(6430)	( )	( )	( )	( )	( )	( )
10	(3060)	(5310)	( )	( )	( )	( )	( )	( )
14	(3350)	(5680)	( )	( )	( )	( )	( )	( )
18	(3170)	(5070)	( )	( )	( )	( )	( )	( )
22	(3290)	(6170)						
Average	( )	( )						

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Ultimate Compressive Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.62 to 0.63

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA (psi) at:

Mix No.	7 days	28 days					
7	(1970)	(4280)	( )	( )	( )	( )	( )
11	(1790)	(3590)	( )	( )	( )	( )	( )
15	(1720)	(3940)	( )	( )	( )	( )	( )
19	(1940)	(3680)	( )	( )	( )	( )	( )
23	(1940)	(4400)					
Average	( )	( )	( )	( )	( )	( )	( )

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01 CB Property Code 3621 Page 1.3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Ultimate Compressive Strength Versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41

Compressive Strength Test Results for Moist-Cured, 6x12-in. cylinders, MPA(psi) at:

Mix No.	7 days	28 days						
8	(4170)	(7630)	( )	( )	( )	( )	( )	( )
12	(3910)	(6190)	( )	( )	( )	( )	( )	( )
16	(4320)	(6640)	( )	( )	( )	( )	( )	( )
20	(4250)	(6420)	( )	( )	( )	( )	( )	( )
24	(4620)	(7300)						
Average	( )	( )						

Specimens were moist cured until test at a nominal temperature of 73°F and 100% relative humidity. Cylinders were tested according to ASTM C39. Each value listed above represents the average compressive strength from three cylinders.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight Aggregate
Gravel
Series 436 Elgin Dolomitic

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.36

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
5	(355)	(540)	(675)	(805)	(900)	(895)	(930)	(930)	(880)
9	(260)	(425)	(550)	(745)	(855)	(840)	(920)	(950)	(970)
13	(380)	(545)	(650)	(795)	(885)	(970)	(930)	(980)	(1000)
17	(365)	(465)	(650)	(795)	(880)	(945)	(930)	(930)	(960)
21	(345)	(535)	(670)	(840)	(885)	(885)	(920)	(930)	(960)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span.according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Flexural Strength Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.49

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
6	(235)	(375)	(550)	(765)	(880)	(875)	(910)	(930)	(1010)
10	(160)	(345)	(495)	(700)	(845)	(840)	(870)	(980)	(970)
14	(230)	(400)	(505)	(710)	(800)	(870)	(860)	(880)	(1000)
18	(225)	(375)	(485)	(675)	(795)	(855)	(895)	(890)	(810)
22	(200)	(390)	(545)	(715)	(825)	(885)	(935)	(910)	(960)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01 CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.62 to 0.63

Mix No.	Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
7	(140)	(250)	(380)	(645)	(725)	(800)	(865)	(890)	(910)
11	(95)	(225)	(325)	(590)	(725)	(825)	(825)	(810)	(860)
15	(150)	(255)	(370)	(645)	(740)	(830)	(860)	(780)	(900)
19	(145)	(265)	(380)	(645)	(740)	(785)	(805)	(800)	(860)
23	(125)	(260)	(390)	(650)	(735)	(855)	(860)	(840)	(890)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436, Elgin Dolomitic
Mixes with w/c = 0.41

Flexural Strength
versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Flexural Strength Test Results, for Moist-Cured Prisms, Third-Point Loading, MPa (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
8	(325)	(440)	(595)	(780)	(850)	(935)	(995)	(980)	(970)
12	(225)	(400)	(530)	(700)	(825)	(825)	(950)	(960)	(1000)
16	(330)	(485)	(605)	(745)	(865)	(950)	(945)	(1020)	(920)
20	(285)	(455)	(605)	(765)	(875)	(935)	(935)	(920)	(990)
24	(290)	(470)	(595)	(770)	(935)	(885)	(935)	(930)	(970)
Average	(____)	(____)	(____)	(____)	(____)	(____)	(____)		

6x6x30-in. prisms were moist cured until test. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Flexural Strength
Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.36

Mix No.	Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at: 1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
5	(355)	(540)	(675)	(575)	(725)	(655)	(610)	(640)	(670)
9	(260)	(425)	(550)	(530)	(635)	(575)	(595)	(600)	(550)
13	(380)	(545)	(650)	(555)	(720)	(725)	(720)	(610)	(650)
17	(365)	(465)	(650)	(535)	(705)	(735)	(660)	(600)	(630)
21	(345)	(535)	(670)	(580)	(700)	(660)	(660)	(600)	(700)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Portland Cement Concrete
Normal-Weight Aggregate
Gravel
Series 436 Elain Dolomitic
Mixes with w/c = 0.49

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
6	(235)	(375)	(550)	(675)	(750)	(715)	(605)	(620)	(800)
10	(160)	(345)	(495)	(540)	(675)	(705)	(675)	(660)	(710)
14	(230)	(400)	(505)	(650)	(740)	(730)	(715)	(650)	(960)
18	(225)	(375)	(485)	(600)	(715)	(720)	(710)	(590)	(770)
22	(200)	(390)	(545)	(670)	(720)	(740)	(775)	(730)	(850)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Material Code 01CB Property Code ___ Page 1.3

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.62 to 0.63

Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
7	(140)	(250)	(380)	(560)	(575)	(585)	(505)	(530)	(800)
11	(95)	(225)	(325)	(455)	(535)	(590)	(515)	(545)	(740)
15	(150)	(255)	(370)	(515)	(610)	(640)	(565)	(600)	(900)
19	(145)	(265)	(380)	(525)	(585)	(610)	(555)	(540)	(900)
23	(125)	(260)	(390)	(580)	(600)	(650)	(630)	(680)	(890)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

72

Material Code 01 CB

Property Code ___

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elain Dolomitic

Flexural Strength versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.41

Flexural Strength Test Results, for Air-Cured Prisms, Third-Point Loading, MPa (psi) at:

Mix No.	1 day	3 days	7 days	28 days	3 months	1 year	3 years	10 years	27 years
8	(325)	(440)	(595)	(675)	(780)	(765)	(685)	(660)	(800)
12	(225)	(400)	(530)	(600)	(745)	(740)	(715)	(630)	(700)
16	(330)	(485)	(605)	(620)	(735)	(815)	(760)	(720)	(810)
20	(285)	(455)	(605)	(575)	(705)	(745)	(710)	(640)	(760)
24	(290)	(470)	(595)	(595)	(835)	(770)	(695)	(750)	(830)
Average	( )	( )	( )	( )	( )	( )	( )		

6x6x30-in. prisms were moist cured for 7 days and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%. Prisms were tested with loads applied at the third-points of an 18-in. span according to ASTM C78, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.)" Two flexural breaks were obtained from each specimen. Listed strengths correspond to the average from six tests.

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Dynamic Elastic Modulus Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C = 0.36

Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)

Mix No.	7 days	28 days					
5	(4930)	(5780)	( )	( )	( )	( )	( )
9	(4570)	(5440)	( )	( )	( )	( )	( )
13	(5130)	(5820)	( )	( )	( )	( )	( )
17	(5030)	(5830)	( )	( )	( )	( )	( )
21	(5040)	(5760)					
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Mixes with w/c = 0.49

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)						
	7 days	28 days					
6	(4530)	(5840)	( )	( )	( )	( )	( )
10	(4660)	(5450)	( )	( )	( )	( )	( )
14	(4720)	(5640)	( )	( )	( )	( )	( )
18	(4750)	(5680)	( )	( )	( )	( )	( )
22	(4640)	(5610)					
Average	( )	( )	( )	( )	( )	( )	( )

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete	Dynamic Elastic Modulus versus Time	Update Package Number 0
Normal-Weight Aggregate		Revision Control Code 0.0
Gravel Series 436 Elgin Dolomitic		Quality Level _

Mixes with W/C= 0.62 to 0.63

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)								
	7 days	28 days							
7	(4190)	(5400)	( )	( )	( )	( )	( )		
11	(4090)	(5450)	( )	( )	( )	( )	( )		
15	(4160)	(5140)	( )	( )	( )	( )	( )		
19	(4310)	(5230)	( )	( )	( )	( )	( )		
23	(4160)	(5270)							
Average	( )	( )	( )	( )	( )	( )	( )		

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete
Normal-Weight
Gravel Aggregate
Series 436 Elgin Dolomitic

Dynamic Elastic Modulus Versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with W/C= 0.41

Mix No.	Dynamic Elastic Modulus Test Results for Moist-Cured Cylinders, Pa (ksi)								
	7 days	28 days							
8	(4810)	(5850)	( )	( )	( )	( )	( )		
12	(4640)	(5540)	( )	( )	( )	( )	( )		
16	(4930)	(5620)	( )	( )	( )	( )	( )		
20	(5100)	(5940)	( )	( )	( )	( )	( )		
24	(5060)	(5940)							
Average	( )	( )	( )	( )	( )	( )	( )		

6x12-in. cylinders were moist cured until test. Specimens were tested according to ASTM C215. Listed values are the average for 3 specimens.

Portland Cement Concrete
Normal-Weight
CB Aggregate
Series 436 Elgin Dolomitic

Pulse Velocity versus Time

Update Package Number 0
Revision Control Code 0.0
Quality Level _

Mixes with w/c = 0.36

Mix No.	Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)						
	7 days	28 days					
5	(14,720)	(16,580)	( )	( )	( )	( )	( )
9	(15,850)	(15,870)	( )	( )	( )	( )	( )
13	(15,390)	(16,400)	( )	( )	( )	( )	( )
17	(15,790)	(15,880)	( )	( )	( )	( )	( )
21	(15,460)	(15,870)					
Average	( )	( )	( )	( )	( )	( )	( )

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight CB Aggregate Serie: 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.49

Mix No.	Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)							
	7 days	28 days						
6	(15,080)	(16,400)	( )	( )	( )	( )	( )	( )
10	(14,220)	(15,000)	( )	( )	( )	( )	( )	( )
14	(14,710)	(15,960)	( )	( )	( )	( )	( )	( )
18	(14,780)	(15,230)	( )	( )	( )	( )	( )	( )
22	(14,640)	(15,950)						
Average	( )	( )						

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight CB Aggregate Serie: 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.62 to 0.63

Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)

Mix No.	7 days	28 days						
7	(14,290)	(15,070)						
11	(14,170)	(15,380)						
15	(14,080)	(15,540)						
19	(14,220)	(15,380)						
23	(14,360)	(15,970)						
Average	( )	( )						

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

Material Code 01 CB Property Code ____ Page 1.3

Portland Cement Concrete Normal-Weight CB Aggregate Serie: 436, Elgin Dolomitic	Pulse Velocity versus Time	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with w/c = 0.41

Pulse Velocity Test Results for Moist-Cured Cylinders, m/sec (ft/sec)

Mix No.	7 days	28 days						
8	(15,000)	(15,960)						
12	(14,640)	(15,700)						
16	(15,410)	(15,620)						
20	(15,310)	(16,130)						
24	(15,230)	(16,400)						
Average								

6x6x30-in. cylinders were moist-cured until test. Listed values are the average for 3 cylinders.

SERIES 436

TYPE IS CEMENT

ORNL Volume 3 — Material Data Sheets

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 5

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19458 in this series. The concrete mix contained 839 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.35. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 6

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19458 in this series. The concrete mix contained 478 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 7

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19458 in this series. The concrete mix contained 384 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.62. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 8

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19458 in this series. The concrete mix contained 619 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 9

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19461 in this series. The concrete mix contained 781 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.36. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 10

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19461 in this series. The concrete mix contained 477 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 11

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19461 in this series. The concrete mix contained 360 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.62. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 12

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19461 in this series. The concrete mix contained 594 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 13

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19464 in this series. The concrete mix contained 745 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.36. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 14

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19464 in this series. The concrete mix contained 477 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 15

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19464 in this series. The concrete mix contained 374 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.62. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 16

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19464 in this series. The concrete mix contained 582 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 17

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19467 in this series. The concrete mix contained 769 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.36. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 18

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19467 in this series. The concrete mix contained 461 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 19

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19467 in this series. The concrete mix contained 365 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.62. No chemical admixtures were used.

Material Code 01 CB Property Code 1000 Page 1

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 20

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19467 in this series. The concrete mix contained 578 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 21

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19470 in this series. The concrete mix contained 772 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.36. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 22

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19470 in this series. The concrete mix contained 471 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.49. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 23

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19470 in this series. The concrete mix contained 367 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.62. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 24

Property Code 1010 Descriptive Information

This material is a normal-weight concrete that was prepared at the Portland Cement Association, Skokie, Illinois, in 1957 as part of a study to compare concretes made using Type I cement to concrete made from portland blast-furnace slag cement. Cylindrical- and prismatic-shaped specimens were cast from this material and then either continuously moist cured or air cured. Specimens were removed and tested at specified intervals over a twenty-seven-year period.

Property Code 1110 Material Characteristics

This material was prepared from portland blast-furnace slag cement and dolomitic sand and gravel from Elgin, Illinois. The cement satisfies the current requirements in ASTM C595-89, Standard Specification for Blended Hydraulic Cements and was designated Cement No. 19470 in this series. The concrete mix contained 579 lbs of cement per cubic yard of concrete and had a water-cement ratio of 0.41. No chemical admixtures were used.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 5

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	839	2001
Fine Aggregate	—	953	2211
Coarse Aggregate	—	1937	2222
—	—	—	—
Water	—	294	2421
Total	—	4023	

Weight of water was derived from water/cement ratio of 0.35.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 6

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	478	2001
Fine Aggregate	—	1264	2211
Coarse Aggregate	—	2110	2222
—	—	—	—
Water	—	234	2421
Total	—	4086	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 7

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	384	2001
Fine Aggregate	—	1392	2211
Coarse Aggregate	—	2050	2222
—	—	—	—
Water	—	238	2421
Total	—	4064	

Weight of water was derived from water/cement ratio of 0.62.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 8

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	619	2001
Fine Aggregate	—	1120	2211
Coarse Aggregate	—	2081	2222
—	—	—	—
Water	—	254	2421
Total	—	4074	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 9

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	781	2001
Fine Aggregate	—	987	2211
Coarse Aggregate	—	2005	2222
—	—	—	—
Water	—	281	2421
Total	—	4054	

Weight of water was derived from water/cement ratio of 0.36.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 10

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	477	2001
Fine Aggregate	—	1267	2211
Coarse Aggregate	—	2113	2222
—	—	—	—
Water	—	234	2421
Total	—	4091	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 11

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	360	2001
Fine Aggregate	—	1415	2211
Coarse Aggregate	—	2081	2222
—	—	—	—
Water	—	223	2421
Total	—	4079	

Weight of water was derived from water/cement ratio of 0.62.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 12

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	594	2001
Fine Aggregate	—	1136	2211
Coarse Aggregate	—	2110	2222
—	—	—	—
Water	—	244	2421
Total	—	4084	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 13

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	745	2001
Fine Aggregate	—	1010	2211
Coarse Aggregate	—	2052	2222
—	—	—	—
Water	—	268	2421
Total	—	4075	

Weight of water was derived from water/cement ratio of 0.36.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 14

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	477	2001
Fine Aggregate	—	1265	2211
Coarse Aggregate	—	2109	2222
—	—	—	—
Water	—	234	2421
Total	—	4085	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 15

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	374	2001
Fine Aggregate	—	1401	2211
Coarse Aggregate	—	2061	2222
—	—	—	—
Water	—	232	2421
Total	—	4068	

Weight of water was derived from water/cement ratio of 0.62.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 16

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	582	2001
Fine Aggregate	—	1147	2211
Coarse Aggregate	—	2131	2222
—	—	—	—
Water	—	239	2421
Total	—	4099	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 75°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 17

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	769	2001
Fine Aggregate	—	995	2211
Coarse Aggregate	—	2019	2222
—	—	—	—
Water	—	277	2421
Total	—	4060	

Weight of water was derived from water/cement ratio of 0.36.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 18

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	461	2001
Fine Aggregate	—	1274	2211
Coarse Aggregate	—	2126	2222
—	—	—	—
Water	—	226	2421
Total	—	4087	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 19

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	365	2001
Fine Aggregate	—	1404	2211
Coarse Aggregate	—	2065	2222
—	—	—	—
Water	—	226	2421
Total	—	4060	

Weight of water was derived from water/cement ratio of 0.62.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 20

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	578	2001
Fine Aggregate	—	1145	2211
Coarse Aggregate	—	2127	2222
—	—	—	—
Water	—	237	2421
Total	—	4087	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 21

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	772	2001
Fine Aggregate	—	994	2211
Coarse Aggregate	—	2015	2222
—	—	—	—
Water	—	278	2421
Total	—	4059	

Weight of water was derived from water/cement ratio of 0.36.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 22

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m³	lb/yd³	Property Code
Portland Cement ASTM C 150, Type IS	—	471	2001
Fine Aggregate	—	1271	2211
Coarse Aggregate	—	2121	2222
—	—	—	—
Water	—	231	2421
Total	—	4094	

Weight of water was derived from water/cement ratio of 0.49.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 2

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 23

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	367	2001
Fine Aggregate	—	1412	2211
Coarse Aggregate	—	2076	2222
—	—	—	—
Water	—	228	2421
Total	—	4083	

Weight of water was derived from water/cement ratio of 0.62.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 24

Property Code 1210	Material Composition		
	Mix Proportions per Unit Volume		
Constituent Material	kg/m^3	lb/yd^3	Property Code
Portland Cement ASTM C 150, Type IS	—	579	2001
Fine Aggregate	—	1149	2211
Coarse Aggregate	—	2134	2222
—	—	—	—
Water	—	237	2421
Total	—	4099	

Weight of water was derived from water/cement ratio of 0.41.

Property Code 1220	Processing Information

6x6x30-in. prisms were cast from this material to determine flexural strength. Following flexural tests, beam ends were tested in compression as 6-in. modified cubes. Before testing, specimens were either moist cured or air cured. 6x12-in. cylinders were cast to determine dynamic modulus of elasticity, pulse velocity, and compressive strength at 7 and 28 days. Cylinders were moist cured before testing.

Moist-cured specimens were continuously stored in a moist room with a nominal temperature of 73°F and 100% relative humidity.

Air-cured specimens were cured 7 days in a moist room with the above conditions, and then stored indoors at a nominal temperature of 73°F and a relative humidity of approximately 50%.

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.36

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
5		7450	
9	_._	7150	
13	_._	6910	
17	_._	6800	
21	_._	7470	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders

Material Code 01 CB Property Code 1000 Page 3

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.49

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
6		6430	
10	_._	5310	
14	_._	5680	
18	_._	5070	
22	_._	6170	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Material Code 01 CB Property Code 1000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.62 to 0.63

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
7		4280	
11	—.—	3590	
15	—.—	3940	
19	—.—	3680	
23	—.—	4400	
	—	—	
Average Compressive Strength	—.—	—	3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	General Information	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mixes with W/C = 0.41

Property Code 1310	Baseline Information		
Mix No.	28-Day Compressive Strength Values		Property Code
	MPa	psi	
8		7630	
12	_._	6190	
16	_._	6640	
20	_._	6420	
24	_._	7300	
Average Compressive Strength	_._		3022

All specimens were moist cured for 28 days. Each value listed above represents the average compressive strength from three 6x12-in. cylinders.

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix Nos. 5, 6, 7, & 8
Cement No. 19458

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IS		2001
	C_3S, %	48.7	
	C_2S, %	23.5	
	C_3A, %	11.8	
	C_4AF, %	11.1	
	Fineness, Blaine	402	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	—	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	98.4	2128

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix Nos. 9, 10, 11, & 12
Cement No. 19461

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IS		2001
	C_3S, %	41.0	
	C_2S, %	28.5	
	C_3A, %	11.6	
	C_4AF, %	9.2	
	Fineness, Blaine	452.5	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	—	2101
	Fineness, % Passing No. 325 Sieve (ASTM C430)	98.2	2128

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix Nos. 13, 14, 15, & 16
Cement No. 19464

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IS		2001
	C_3S, %	37.8	
	C_2S, %	31.5	
	C_3A, %	12.8	
	C_4AF, %	8.6	
	Fineness, Blaine	362.5	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner	—	2101
	Turbidimeter, m^2/kg^2		
	Fineness, % Passing No. 325 Sieve (ASTM C 430)	92.8	2128

Material Code 01 CB Property Code 2000 Page 4

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix Nos. 17, 18, 19, & 20
Cement No. 19467

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IS		2001
	C_3S, %	39.7	
	C_2S, %	31.5	
	C_3A, %	9.1	
	C_4AF, %	8.9	
	Fineness, Blaine	383.5	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner Turbidimeter, m^2/kg^2	—	2101
	Fineness, % Passing No. 325 Sieve (ASTM C 430)	97.1	2128

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix Nos. 21, 22, 23, & 24
Cement No. 19470

Property Code 2000	Constituent Material Information		
Constituent Material	Material Description or Property	Property Value	Property Code
Portland Cement	ASTM C 150, Type IS		2001
	C_3S, %	52.1	
	C_2S, %	25.6	
	C_3A, %	10.0	
	C_4AF, %	7.7	
	Fineness, Blaine	447	2103
	Air-Permeability		
	Test, m^2/kg		
	Fineness, Wagner	—	2101
	Turbidimeter, m^2/kg^2		
	Fineness, % Passing No. 325 Sieve (ASTM C 430)	96.5	2128

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 43/0, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 5

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	839 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.35	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 6

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	478 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 7

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	384 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.62	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 8

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	619 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 9

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	781 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.36	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436 Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 10

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	477 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 11

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	360 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.62	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 12

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	594 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 13

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	745 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.36	2603
Slump	___ mm	3.0 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 14

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	477 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 15

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	374 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.62	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements--Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 16

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	582 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 17

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	769 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.36	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 18

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	461 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.8 in.	2631
Air Content, %		1.5	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000 Page 6

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 19

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	365 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.62	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.7	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 20

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	578 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.5 in.	2631
Air Content, %		1.4	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2-22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Material Code 01 CB Property Code 2000

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 21

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	772 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.36	2603
Slump	___ mm	2.6 in.	2631
Air Content, %		1.3	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 22

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m³	471 lb/yd³	2601
Water-Cement Ratio (by weight)	0.__	0.49	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 436, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 23

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	367 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.62	2603
Slump	___ mm	2.4 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Portland Cement Concrete Normal-Weight Gravel Aggregate Series 43/6, Elgin Dolomitic	Constituent Material and Plastic Concrete Properties	Update Package Number 0 Revision Control Code 0.0 Quality Level _

Mix No. 24

Property Code 2600	Plastic Concrete Properties		
Plastic Concrete Property	Property Value		Property Code
Cement Content	___ kg/m^3	579 lb/yd^3	2601
Water-Cement Ratio (by weight)	0.__	0.41	2603
Slump	___ mm	2.7 in.	2631
Air Content, %		1.2	2613

Reference Documentation

Sharon L. Wood, "Evaluation of the Long-Term Properties of Concrete," Research and Development Bulletin RD 102, Portland Cement Association, Skokie, 1991.

Klieger, Paul, and Isberner, Albert W., "Laboratory Studies of Blended Cements—Portland Blast-Furnace Slag Cements," *Journal of the PCA Research and Development Laboratories*, Vol. 9, No. 3, Portland Cement Association, September 1967, pp. 2–22. (reprinted as *Research Department Bulletin RX218*, Portland Cement Association, 1967).

Internal Distribution

1. D. J. Naus
2. C. B. Oland
3. C. E. Pugh
4. Laboratory Records, RC

External Distribution

5. E. G. Arndt, Division of Engineering, Office of Nuclear Regulatory Research, Nuclear Regulatory Commission, Washington, DC 20555.
6. R. G. Burg, Construction Technology Laboratories, Inc., 5420 Old Orchard Road, Skokie, IL 60077-1030.
7. M. G. Van Geem, Construction Technology Laboratories, Inc., 5420 Old Orchard Road, Skokie, IL 60077-1030.