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USACE / NAVFAC / AFCESA / NASA | **UFGS-03 45 00.00 40 (June 2006)**

Preparing Activity: NASA | **Superseding**
UFGS-03 45 00.00 40 (April 2006)
NASA-03475S (December 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 18 July 2006

Latest Change indicated by CHG tags
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DIVISION 03 - CONCRETE

SECTION 03 45 00.00 40

PRECAST ARCHITECTURAL CONCRETE

06/06

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCESA / NASA | UFGS-03 45 00.00 40 (June 2006)

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SECTION 03 45 00.00 40

PRECAST ARCHITECTURAL CONCRETE
06/06

****
NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers normal weight, aggregate portland cement concrete, conventionally reinforced, solid-section wall panels having exposed aggregate facing, designed for attachment to the building framing system at each floor elevation and at roof elevation and provided with built-in anchorage devices for the attachment of thermal insulation blankets to the interior face of the wall panels, and for the attachment of metal flashing, after the wall panels have been installed.

Drawings must include a complete design indicating the character of the work to be performed and the following:

Location and details of wall panels, showing all dimensions, and size and type of reinforcement.

Details of joints between wall panel units, showing gasket shape, dimensions, and location.

Details showing the anchorage of the panels to the building framing system, and the relation of panels to other building structures or assemblies.

Cast-in-place concrete, including foundation walls, grade beams, and concrete structural members, is specified in Section 03 30 53.00 40 CAST-IN-PLACE CONCRETE (SHORT SECTION).

Precast concrete structural sections, including columns, beams, hollow core flat slabs, and single- and double-tee slabs, are specified in Section

03 41 33.00 40 PRECAST STRUCTURAL PRETENSIONED CONCRETE.

Structural steel framing system is specified in Section 05 12 00.00 40 STRUCTURAL STEEL FRAMING.

Metal flashing is specified in Section 07 60 00.00 40 FLASHING AND SHEET METAL.

Sealing joints between adjacent wall panels and between wall panels and other building construction is specified in Section 07 92 00.00 40 JOINT SEALANTS.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991; R 2002) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 318/318R	(2005) Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05)
ACI/MCP 205	(2005) Manual of Concrete Practice Part 2 - ACI 224R-01 to ACI 313R-97
ACI/MCP 305	(2005) Manual of Concrete Practice Part 3:315-99 to 343R-95

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(2004) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 185	(2002) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 27/A 27M	(2005) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A 283/A 283M	(2003) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 47/A 47M	(2004) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 615/A 615M	(2005a) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A 653/A 653M	(2004a) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 675/A 675M	(2003) Standard Specification for Steel

	Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM B 370	(2003) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C 109/C 109M	(2005) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
ASTM C 114	(2005) Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C 115	(1996a; R 2003) Standard Test Method for Fineness of Portland Cement by the Turbidimeter
ASTM C 117	(2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(2004) Standard Test Method for Lightweight Particles in Aggregate
ASTM C 125	(2003) Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C 127	(2004) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 128	(2004a) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C 131	(2003) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2005) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138/C 138M	(2001a) Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 142	(1997; R 2004) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C 143/C 143M	(2005) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	(2005) Standard Specification for Portland Cement
ASTM C 151	(2005) Standard Test Method for Autoclave

	Expansion of Hydraulic Cement
ASTM C 172	(2004) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 183	(2002) Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C 185	(2002) Standard Test Method for Air Content of Hydraulic Cement Mortar
ASTM C 186	(2005) Standard Test Method for Heat of Hydration of Hydraulic Cement
ASTM C 191	(2004) Standard Test Method for Time of Setting Hydraulic Cement by Vicat Needle
ASTM C 192/C 192M	(2005) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 204	(2000) Standard Test Method for Fineness of Hydraulic Cement by Air Permeability Apparatus
ASTM C 231	(2004) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 232	(2004) Standard Test Methods for Bleeding of Concrete
ASTM C 233	(2004) Standard Test Method for Air-Entraining Admixtures for Concrete
ASTM C 260	(2001) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 266	(2004) Standard Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles
ASTM C 289	(2003) Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C 29/C 29M	(1997; R 2003) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C 31/C 31M	(2003a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 39/C 39M	(2004) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C 40	(2004) Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 403/C 403M	(2005) Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C 42/C 42M	(2004) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 451	(2005) Standard Test Method for Early Stiffening of Hydraulic Cement (Paste Method)
ASTM C 535	(2003e1) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 566	(1997; R 2004) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C 595	(2003) Standard Specification for Blended Hydraulic Cements
ASTM C 618	(2005) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 67	(2003a) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 70	(1994; R 2001) Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C 78	(2002) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C 88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 94/C 94M	(2004a) Standard Specification for Ready-Mixed Concrete
ASTM C 989	(2005) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1056	(2000) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1149	(1999) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in

	a Chamber
ASTM D 3744	(2003) Standard Test Method for Aggregate Durability Index
ASTM D 635	(2003) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D 746	(2004) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 75	(2003) Standard Practice for Sampling Aggregates

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 1 MSP	(2001e27) Manual of Standard Practice

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116	(1985e1) Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force

and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Records of qualification showing the qualifications of personnel, handling and erection equipment, lists of projects similar to specified work, and other information as may be required shall be submitted for the following installers:

Precast Concrete Manufacturer
Wall-Panel Installer

SD-02 Shop Drawings

Fabrication Drawings and Installation Drawings for the following shall be in accordance with paragraph entitled, "Panel Fabrication," of this section.

Reinforcement Materials
Precast Concrete Wall Panels

SD-04 Samples

Contractor shall provide three samples of each type of the following items:

Anchorage Materials
Gasket (300 millimeter 12 inches long)

Contractor shall provide samples of the following in accordance with paragraph entitled, "Finishing for Formed Surfaces," of this section.

Exposed-to-View Finished Surfaces
Finish Aggregate
Wall Panel

SD-05 Design Data

Mix design data shall be submitted in accordance with the paragraph entitled, "Concrete Design Mixes," of this section for the following:

Exposed-to-View Concrete
Backing Concrete

SD-06 Test Reports

Test reports for the following tests shall be in accordance with paragraph entitled, "Concrete Sampling and Testing." Reports

shall include the project name and number, date, name of Contractor, name of precast wall panel manufacturer, name of concrete testing service, source of concrete aggregates, generic name of aggregate, and value specified.

Slump
Compressive Strength
Air Content

SD-07 Certificates

Certificates shall be provided for the following items showing conformance with referenced standards contained in this section.

Concrete
Portland Cement
Reinforcement Materials
Air-Entrained Admixtures
Aggregates

1.3 QUALIFICATIONS FOR PRECAST CONCRETE MANUFACTURER

Panels shall be manufactured by an organization experienced in the manufacture of precast concrete panels.

A letter of reference for the manufacturer shall be submitted giving the qualifications of personnel, location of plant, concrete batching facilities, manufacturing equipment and facilities, list of projects similar to specified work, and other information as may be required by the Contracting Officer.

1.4 QUALIFICATIONS FOR WALL-PANEL INSTALLER

Panels shall be installed by an organization experienced in the installation of precast wall panels.

A letter of reference for the installer shall be submitted giving the qualifications of personnel, handling and erection equipment, lists of projects similar to specified work, and other information as may be required by the Contracting Officer.

1.5 CONCRETE SAMPLING AND TESTING

1.5.1 Test for Concrete Materials

****
NOTE: Delete the following where required by the project.
****

Concrete materials proposed for use in the work shall be sampled and tested as follows:

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Aggregate	Sampling sieve analysis, calculating fineness modulus	ASTM D 75 ASTM C 136 ASTM C 125	One for each material source and grading size

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
	Amount of material passing 75 micrometer sieve	ASTM C 117	
	Amount of friable particles	ASTM C 142	
	Amount of organic impurities	ASTM C 40	
	Amount of coal and lignite	ASTM C 123	
	Magnesium sulfate soundness test	ASTM C 88	
	Aggregate durability	ASTM D 3744	
	Specific gravity of fine aggregate	ASTM C 128	
	Specific gravity of coarse aggregates	ASTM C 127	
	Resistance to abrasion of small size coarse aggregate	ASTM C 131 or ASTM C 535	
	Potential reactivity to alkalis	ASTM C 289	
Portland cement	Sampling	ASTM C 183	One for each material source, type, and color
	Chemical analysis	ASTM C 114	
	Fineness	ASTM C 115 or ASTM C 204	
	Autoclave expansion time of setting	ASTM C 151 ASTM C 191 or ASTM C 266	
	Air Content of mortar	ASTM C 185	

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
	Compressive strength	ASTM C 109/C 109M	
	Heat of hydration	ASTM C 186	
	False set	ASTM C 451	
Air-entraining admixture using air-entrained concrete made of the proposed concrete materials	Materials for test	ASTM C 233	One set of tests for each type and color of portland cement proposed for use
	Number of specimens	ASTM C 233, Table 1	
	Bleeding	ASTM C 232	
	Time of setting	ASTM C 403/C 403M and ASTM C 233	
	Compressive strength test specimen	ASTM C 192/C 192M and ASTM C 233	
	Compressive strength test at 3, 7, and 28 calendar days	ASTM C 39/C 39M and ASTM C 233	

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Aggregate	Sampling sieve analysis, calculating fineness modulus	ASTM D 75 ASTM C 136 ASTM C 125	One for each material source and grading size
	Amount of material passing No. 200 sieve	ASTM C 117	
	Amount of friable particles	ASTM C 142	
	Amount of organic impurities	ASTM C 40	
	Amount of coal and lignite	ASTM C 123	
	Magnesium sulfate soundness	ASTM C 88	

MATERIALS	REQUIREMENT test	TEST METHOD	NUMBER OF TESTS
	Aggregate durability	ASTM D 3744	
	Specific gravity of fine aggregate	ASTM C 128	
	Specific gravity of coarse aggregates	ASTM C 127	
	Resistance to abrasion of small size coarse aggregate	ASTM C 131 or ASTM C 535	
	Potential reactivity to alkalis	ASTM C 289	
Portland cement	Sampling	ASTM C 183	One for each material source, type, and color
	Chemical analysis	ASTM C 114	
	Fineness	ASTM C 115 or ASTM C 204	
	Autoclave expansion time of setting	ASTM C 151 ASTM C 191 or ASTM C 266	
	Air Content of mortar	ASTM C 185	
	Compressive strength	ASTM C 109/C 109M	
	Heat of hydration	ASTM C 186	
	False set	ASTM C 451	
Air-entraining admixture using air-entrained concrete made of the proposed concrete materials	Materials for test	ASTM C 233	One set of tests for each type and color of portland cement proposed for use
	Number of specimens	ASTM C 233, Table 1	
	Bleeding	ASTM C 232	

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
	Time of setting	ASTM C 403/C 403M and ASTM C 233	
	Compressive strength test specimen	ASTM C 192/C 192M and ASTM C 233	
	Compressive strength test at 3, 7, and 28 calendar days	ASTM C 39/C 39M and ASTM C 233	

****

NOTE: Water absorption test is a relative measure of the ability of different concretes to resist dirt adhesion, staining from soft aggregates, or other phenomena that may lead to nonuniformity and unsightliness.

****

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Concrete made of the proposed concrete materials	Water absorption	As specified	Three 100 by 200 millimeter cylinders or 100 millimeter cube concrete specimens for each type of mixture required

MATERIALS	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Concrete made of the proposed concrete materials	Water absorption	As specified	Three 4- by 8-inch cylinders or 4-inch cube concrete specimens for each type of mixture required

Reports for each material sampled and tested shall be submitted prior to the start of work. Reports shall contain the project name and number, date, name of Contractor, name of precast wall panel manufacturer, name of concrete testing service, source of concrete aggregates, generic name of aggregate, and values specified.

1.5.2 Concrete Design Mixes

Concrete design mix for concrete, including Exposed-to-View Concrete facing mixture and Backing Concrete mixture, shall be determined and tested as follows:

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Specific gravity and absorption of fine	ASTM C 128	As required for the concrete aggregates

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
aggregate		
Specific gravity and absorption of coarse aggregate	ASTM C 127	
Moisture content of both fine and coarse aggregate	ASTM C 70 and ASTM C 566	
Dry-rodded unit weight of coarse aggregate	ASTM C 29/C 29M	
Trial mixes using at least three different water/cement ratios, minimum allowable cement content, and maximum allowable slump; all with air-entrainment	ACI 211.1	As required to determine the concrete mix having the properties specified
Making and curing concrete specimens in the laboratory	ASTM C 192/C 192M	Two sets of three specimens for each design mix
Sampling fresh concrete in the laboratory	ASTM C 192/C 192M	One for each set of design mix specimens
Slump	ASTM C 143/C 143M ACI 211.1	
Air Content	ASTM C 231	
Yield	ASTM C 138/C 138M	
Compressive Strength	ASTM C 39/C 39M	Three specimens tested at 7 calendar days and three specimens tested at 28 calendar days

From the results of the tests, a curve shall be plotted for each concrete mixture, showing the relationships between water/cement ratios and compressive strengths. Maximum permissible water/cement ratio shall be that value not exceeding the maximum water/cement ratio specified, indicated by the curve to produce a design minimum laboratory compressive strength at 28 calendar days not less than that specified.

Report of the design mix for both exposed-to-view facing mixture and backing mixture shall be submitted for approval at least 15 calendar days prior to start of fabricating panels. Report shall contain the project name and number, date, name of Contractor, name of precast concrete wall panel manufacturer, name of concrete testing service, use of concrete

mixture (facing or backing), source of concrete aggregates for each mixture, manufacturer and brand name of manufactured materials, the exact proportions of each concrete mix, the concrete properties specified, and the test results for each requirement specified for the concrete design mixes.

1.5.3 Quality Control Testing During Panel Fabrication

Concrete shall be sampled and tested for quality control during fabrication as follows:

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Sampling fresh concrete	ASTM C 172 except modified for slump per ASTM C 94/C 94M	As required for each test
Slump test	ASTM C 143/C 143M	One for each concrete load at point of discharge and one for each set of compressive strength tests
Air Content by pressure method	ASTM C 231	One for each set of compressive strength tests
Compressive test specimens	ASTM C 31/C 31M	One set of six specimens for each Compressive Strength test

Compression test specimens may be either standard 150 by 300 millimeter 6-by 12-inch cylinders or 100 millimeter 4-inch cubes. Cubes may be molded individually or cut from slabs. Preparation and testing of cube specimens shall be as nearly consistent with the test methods specified as possible, with the exception that the concrete shall be placed in a single layer.

Curing of compression test specimens shall be the same as the curing method used for the precast concrete wall panels until panels are stripped of forms and then standard moist cure shall continue.

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Concrete temperature		Each time a set of compression test specimens is made
Compressive strength tests	ASTM C 39/C 39M	One set of facing mix and one set of backing mix for every ten panels or fraction thereof cast in any one day; two specimens in each set tested at 7 calendar

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
		days; three specimens in each set tested at 28 calendar days, and one specimen in each set retained in reserve for testing if required

Test reports shall be submitted on the same day that tests are made.

Test results that fail to meet the value for any concrete property specified in "Quality of Concrete" shall be noted in the report.

Reports for Compressive Strength tests shall contain the project name and number, date of concrete placement, name of Contractor, name of precast concrete wall panel manufacturer, name of concrete testing service, panel identification letter and number, use of concrete mixture (facing or backing), design compressive strength at 28 calendar days, concrete-mix proportions and materials, and compressive breaking strength and type of break.

If 100 millimeter 4-inch cubes are used for compressive strength specimens, average strength of the cubes at any test age shall be multiplied by the factor of 0.8 to arrive at an estimate of the corresponding 150 by 300 millimeter 6- by 12-inch cylinder strength. Both of these values shall be reported.

PART 2 PRODUCTS

2.1 PROPERTIES OF CONCRETE

PROPERTY	VALUE
Design compressive strength at 28 calendar days, 150 by 300 millimeter cylinders	Not less than 34,500 kilopascal
Maximum aggregate size	As specified
Maximum water/cement ratio	16 liter per 43 kilogram sack of cement
Minimum cement content	7.5 43 kilogram sacks of cement per 0.76 cubic meter
Slump at point of concrete discharge	Not to exceed 50 millimeter
Total air content by volume at point of concrete dis-charge	Not less than 4 percent nor more than 6 percent

PROPERTY	VALUE
Design compressive strength at 28 calendar days, 6- by 12-inch cylinders	Not less than 5,000 psi
Maximum aggregate size	As specified
Maximum water/cement ratio	4.25 gallons per 94-pound sack of cement
Minimum cement content	7.5 94-pound sacks of cement per cubic yard
Slump at point of concrete discharge	Not to exceed 2 inches
Total air content by volume at point of concrete discharge	Not less than 4 percent nor more than 6 percent

2.2 CONCRETE MATERIALS

2.2.1 Aggregates

****
NOTE: Ground granulated blast furnace slag is one of the materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (http://nodis3.gsfc.nasa.gov).
****

Fine and coarse aggregates shall conform to ASTM C 33 for fine aggregate subject to abrasion and for coarse aggregate subject to severe exposure, for aggregate to be used where surface appearance of concrete is important, and with the following modification:

Specific gravity not less than 2.60

Nonreactive to alkalis when tested in accordance with ASTM C 289

Average water absorption of concrete made of the concrete aggregates

less than 6 percent by weight after immersion in water at 21 degrees C 70 degrees F for 48 hours and less than 10 percent by weight after immersion in cold water and subsequent boiling for 5 hours when tested in accordance with ASTM C 67

Each type of aggregate shall be obtained from a single source.

Grading requirements for coarse aggregate shall conform to ASTM C 33, Size No. 67, (19.0 TO 4.75 millimeter) (3/4 inch to No. 4).

****
NOTE: Delete the following paragraph when exposed-to-view facing is not required for the project.
****

2.2.2 Aggregates for Exposed-to-View Facing

****
NOTE: Aggregates for exposed-to-view facing mixture may be natural mineral particles, natural building stone particles, or combinations thereof, or synthetic materials such as glass or plastic; natural aggregates may be crushed or gravel.

Delete the following paragraph when crushed natural aggregate is not required by the project. Specify the mineral or rock generic name, color, particle shape, size range of particles, and other information relative to the appearance of the exposed-to-view finish surface as applicable to the project.
****

Coarse aggregate shall be crushed by a means that will produce material of cubical shape with a minimum of elongated, thin, or partially fractured particles. Material or crushing methods that produce particles classified by petrographic examination as being weak, highly fractured or somewhat friable, or both, in excess of 16 percent of the particles in any whole sample shall be rejected. Material for coarse aggregate shall be free of substances that change color on oxidation. Material used for the work shall be obtained from the same basic source and stratum. Material shall be quarried to produce a uniformly colored aggregate that does not change color upon weathering. During quarrying operations, the uniformity of rock face color shall be verified by periodically comparing the rock face color to the approved coarse aggregate sample.

****
NOTE: Revise the following paragraph when fine white-quartz aggregate is not required by the project.
****

Fine aggregate shall be white quartz natural sand or stone screenings, or manufactured sand produced from white quartz. Aggregate shall be free of substances that change color on oxidation. Color shall conform to the approved sample.

2.2.3 Portland Cement

****
NOTE: Ground granulated blast furnace slag is one of the materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (http://nodis3.gsfc.nasa.gov).
****

[Portland cement shall conform to ASTM C 150, Type [_____].]

[Blended hydraulic cement shall conform to ASTM C 595, Type [_____].]

One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

2.2.4 Fly Ash

Fly ash [is required] [used] as an admixture [and] shall conform to ASTM C 618, Class [C or F] with 4 percent maximum loss on ignition and between 15 to 35 percent maximum cement replacement by weight.

2.2.5 Ground Granulated Blast Furnace (GGBF) Slag

****
NOTE: Ground granulated blast furnace slag is one of the materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (http://nodis3.gsfc.nasa.gov).
****

GGBF slag [is required] [used] as an admixture [and] shall conform to ASTM C 989, Grade [120] with between 25 to 50 percent maximum cement replacement by weight.

2.2.6 Air-Entrained Admixtures

Admixture shall contain no sodium chloride or nitrates and shall conform to ASTM C 260.

2.2.7 Water

Water shall be potable.

2.3 REINFORCEMENT MATERIALS

2.3.1 Reinforcing Bars

****
NOTE: When prestressed precast concrete wall panels are required, refer to Section 03 41 33.00 40 PRECAST STRUCTURAL PRETENSIONED CONCRETE.
****

Bars, except No. 2, shall be deformed in conformance with ASTM A 615/A 615M, Grade 60.

No. 2 bars shall be round, conforming to ASTM A 675/A 675M, Grade 80.

****
NOTE: Delete the following paragraph when galvanized reinforcing bars are not required. Galvanizing is required when the concrete cover over reinforcing bars is less than 40 millimeter 1-1/2 inches.
****

Reinforcing bars shall be galvanized in accordance with ASTM A 153/A 153M.

2.3.2 Welded Wire Fabric

****
NOTE: Delete one of the following paragraphs as applicable to the project.
****

Fabric shall be uncoated wire conforming to ASTM A 185.

Fabric shall be galvanized wire conforming to ASTM A 185.

2.3.3 Supports for Concrete Reinforcement

Supports shall include bolsters, chairs, spacers, and other devices necessary for spacing, supporting, and fastening in place. Supports shall conform to CRSI 1 MSP.

2.4 BUILT-IN ANCHORAGE MATERIALS

****
NOTE: Delete the following built-in anchorage

materials that are not applicable to the project. Built-in anchorage materials include both those required for the precast concrete panels (such as threaded-type concrete inserts, wood nailer inserts, and flashing reglets) and for cast-in-place concrete structural members (such as wedge-type and slotted-type concrete insert).

****

2.4.1 Threaded-Type Concrete Inserts

Inserts shall be ferrous castings having enlarged bases with not less than two nailing lugs, length as indicated, internally threaded to receive machine bolts. Castings shall conform to ASTM A 47/A 47M, Grade 32510 or Grade 35018, [Grade 22010 or Grade 24118,] or ASTM A 27/A 27M, Grade U-60-30, and shall be galvanized in accordance with ASTM A 153/A 153M.

Inserts shall not loosen or pull free when embedded in 25 Megapascal 3,000 pounds per square inch (psi) concrete and subjected to a tension load test in an axial direction.

2.4.2 Wood Nailer Inserts

****

NOTE: Location and size of wood nailer inserts must be indicated.

****

Inserts shall be kiln-dried "standard" grade Douglas fir or "No. 2" grade southern pine, surfaced 4 sides, and sized as indicated. Wood shall be pressure treated with an approved wood preservative.

2.4.3 Flashing Reglets

****

NOTE: Location of flashing reglets embedded in precast-concrete panels must be indicated.

****

Reglets shall be sheet metal open-type with continuous groove not less than 29 millimeter 1-1/8 inches deep by 5 millimeter 3/16-inchwide at opening and sloped upward, designed to anchor snap-lock counter flashing.

****

NOTE: Delete the following paragraphs if not applicable to the project.

When visible staining from the flashing reglets can occur, corrosion-resisting chromium-nickel steel only must be specified.

When the wall panels will be subjected to a sea coast atmosphere, galvanized carbon steel flashing reglets must not be specified.

****

Metal shall be minimum 0.28 millimeter 0.011-inch thick conforming to ASTM A 167, Type 302 or 304, No. 1 finish, soft temper.

Metal shall be copper strip weighing a minimum of 4.8 kilogram per square meter 16 ounces per square foot, and conforming to ASTM B 370, cold-rolled temper.

Metal shall be 0.55 millimeter 26-gage galvanized steel sheet conforming to ASTM A 653/A 653M, Z275 G90.

2.4.4 Wedge-Type Concrete Inserts

****
NOTE: Location of wedge-type concrete inserts must be indicated on the drawings. Such inserts are suitable for embedment in cast-in-place concrete structural elements where reinforcing bars can be inserted through the loop at the back of the insert.
****

Inserts shall be box-type ferrous castings with integral anchor loop at the back of the box, designed to accept bolts having special wedge-shaped heads. Castings shall be iron conforming to ASTM A 47/A 47M, Grade 22010 or Grade 24118 ASTM A 47/A 47M, Grade 32510 or Grade 35018, or ASTM A 27/A 27M, Grade U-60-30, galvanized in accordance with ASTM A 153/A 153M.

Inserts shall not loosen or pull free when embedded in 25 Megapascal 3,000 psi concrete and subjected to a tension load test in an axial direction.

Carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims shall be provided and shall be galvanized in accordance with ASTM A 153/A 153M.

2.4.5 Slotted-Type Concrete Inserts

****
NOTE: Location of slotted-type concrete inserts must be indicated. Such inserts are suitable for embedment in cast-in-place concrete slabs or beams where a clip angle will be attached to the top or bottom surface of the slab or beam.
****

Inserts shall be galvanized pressed steel plate, welded construction, box types with slots designed to receive square-head bolts and to provide lateral adjustment of the bolt. Length of the insert body less anchorage lugs shall be not less than 115 millimeter 4-1/2 inches. Insert shall be provided with a knockout cover. Steel plate shall be not less than 3 millimeter 1/8 inch in thickness, shall conform to ASTM A 283/A 283M, Grade C, and shall be galvanized in accordance with ASTM A 123/A 123M.

Inserts shall not loosen or pull free when embedded in 25 Megapascal 3,000-psi concrete and subjected to a tension load test in an axial direction.

2.5 CONNECTION DEVICES

****
NOTE: Delete the following connection devices that are not applicable to the project. Method of anchoring the precast concrete wall panels to the

building framing system must be indicated. Connection devices must provide 3-way adjustment (up down, in out, and sideways). A typical anchorage of panels to concrete construction consists of built-in anchorage items (such as threaded-type and slotted-type concrete inserts), clip angles, ferrous casting clamps, and threaded fasteners.

****

Clip angles shall be steel conforming to ASTM A 675/A 675M or ASTM A 36/A 36M and galvanized in accordance with ASTM A 123/A 123M.

Casting clamps shall be malleable iron or cast steel, shall conform to ASTM A 47/A 47M, Grade 22010 or Grade 24118 ASTM A 47/A 47M, Grade 32510 or Grade 35018, or to ASTM A 27/A 27M, Grade U-60-30, galvanized in accordance with ASTM A 153/A 153M.

Threaded fasteners shall be machine bolts, washers, and, when required, nuts.

Machine bolts shall be hexagon head galvanized type.

Washers shall be the lock-spring galvanized type.

Nuts shall be hexagon or square and, unless otherwise specified, galvanized.

2.6 JOINT MATERIALS

****

NOTE: Cross sections of gaskets with dimensions must be indicated.

****

Gasket shall be elastomeric material, premolded to cross section indicated.

Material shall be a vulcanized closed-cell expanded chloroprene conforming to ASTM D 1056, Grade No. SCE 42, with the following additional properties:

Brittleness temperature shall be minus 5 degrees C 40 degrees F when tested in accordance with ASTM D 746.

Flammability resistance shall be self-extinguishing when tested in accordance with ASTM D 635.

Resistance to ozone shall be "no cracks" after exposure of a sample, at 20 percent elongation, to an ozone concentration of 100 parts per million of air by volume in air for 100 hours at 40 degrees C 104 degrees F when tested in accordance with ASTM D 1149.

2.7 PANEL FABRICATION

****

NOTE: When prestressed precast concrete wall panels are required, refer to Section 03 41 33.00 40 PRECAST STRUCTURAL PRETENSIONED CONCRETE.

****

Fabrication Drawings and Installation Drawings shall show location, dimensions, and arrangement for Reinforcement Materials and Precast

Concrete Wall Panels. Drawings shall show all accessories including anchorage materials, lifting devices, connection devices, and joint materials.

2.7.1 Fabrication Tolerances

Panels shall be fabricated within the following tolerances:

Overall panel dimensions:	Plus 3, minus 0 millimeter
Cross section dimensions:	Plus or minus 1.5 millimeter
Deviation from plane:	Not exceeding 3 millimeter in 3000 millimeter
Concrete cover over reinforcement:	Plus 6, minus 0 millimeter
Position of anchorage devices:	Plus or minus 6 millimeter
Position of pick up devices:	Plus or minus 150 millimeter
Overall panel dimensions:	Plus 1/8, minus 0 inch
Cross section dimensions:	Plus or minus 1/16 inch
Deviation from plane:	Not exceeding 1/8 inch in 10 feet
Concrete cover over reinforcement:	Plus 1/4, minus 0 inch
Position of anchorage devices:	Plus or minus 1/4 inch
Position of pick up devices:	Plus or minus 6 inches

2.7.2 Forms

****
NOTE: Precast concrete wall panel dimensions, cross sections, and details of edges, sills, soffits, and reveals, as required by the project, must be indicated.
****

Forms and facing materials shall be wood, metal, plastic, or other approved material that is nonreactive with concrete. Completed panels shall conform to the shapes, lines, and dimensions indicated, within the limits of the specified fabrication tolerances.

2.7.3 Reinforcement

****
NOTE: Reinforcement types, sizes, and arrangement required for structural strength after the panels have been installed must be indicated. Approved

shop drawings must indicate both the above reinforcement and any additional reinforcement provided by the panel manufacturer to strengthen the panels against handling and erection stresses.
****

Reinforcing bars shall be the sizes and arrangement indicated on the approved shop drawings. Details of reinforcement shall be in accordance with ACI/MCP 305 and ACI 318/318R unless otherwise specified.

Reinforcing bars and welded wire fabric shall be secured by supports and spacers.

****
NOTE: Revise the following paragraph when not applicable to the project. 40 Millimeter 1-1/2-Inch concrete protection is the minimum recommended for uncoated steel.
****

Concrete protection for reinforcement shall be not less than 40 millimeter 1-1/2 inches.

2.7.4 Built-In Anchorage Devices

****
NOTE: Anchorage devices to be embedded in the panels must be indicated. Anchorage devices include threaded concrete inserts for bolted connections; wood nailers to receive thermal insulation that will be applied to the panel; and flashing reglets to receive sheetmetal counter flashing.
****

Anchorage devices shall be accurately positioned and securely anchored. Openings in anchorage devices shall be filled temporarily to prevent entry of concrete.

2.7.5 Lifting Devices

Lifting devices shall be provided, and shall be designed for a safety factor of 4, which includes 100 percent impact. Brittle material shall not be used.

2.7.6 Concrete Mixing and Conveying

Measuring concrete materials, concrete batching plant, concrete mixers, and concrete mixing shall be in accordance with ASTM C 94/C 94M.

Concrete shall be handled in a manner that will prevent segregation and loss of concrete mix materials.

2.7.7 Preparations for Placing Concrete

Form interiors and reinforcement shall be free of accumulations of hardened concrete, form-parting compound, standing water, ice, snow, or other deleterious substances. Reinforcement and other embedded items shall be secured in position, inspected, and approved.

2.7.8 Weather Limitations

Concrete shall not be placed when the temperature of the atmosphere is below 5 degrees C 40 degrees F nor during rain, sleet, or snow unless adequate protection is provided. Protection during inclement weather shall prevent entry of rain, sleet, or snow into the forms or into the fresh concrete.

2.7.9 Concrete Placing

Concrete shall be deposited so that no concrete will be placed on concrete that has hardened sufficiently to cause formation of seams or planes of weakness. Concrete shall be consolidated in a manner that will prevent segregation, will produce concrete free of honeycomb or rock pockets, and will achieve the required surface finish (see paragraph entitled, "Finishing Unformed Surfaces").

****
NOTE: Delete the following paragraph when the panel will be fabricated of one concrete mixture.
****

Exposed-to-View Concrete facing mixture shall be a minimum of 25 millimeter 1 inch in thickness or a minimum of 1-1/2 times the maximum size of aggregate. Backing Concrete mixture shall be placed before the facing mixture has started initial set.

2.7.10 Identification Markings

Each panel shall be clearly marked in a permanent manner to indicate the pickup points and the panel's location and orientation in the building.

Each panel shall have the date of casting indented on the unexposed face of the concrete.

2.7.11 Finishing Unformed Surfaces

****
NOTE: Delete the following paragraph, and specify the required finish when a trowel finish is not required for all concealed-from-view panel surfaces. Other finishes include wood-float finish.
****

Surfaces that are to be concealed shall have a trowel finish. Surface shall be smooth, free of any trowel marks, uniform in texture and appearance, and planed to a tolerance not exceeding 3 in 3000 millimeter 1/8 in 10 feet when tested with a 3000 millimeter 10-foot straightedge.

2.7.12 Curing

Concrete shall be cured by keeping the concrete damp for not less than 7 calendar days. For each decrease of 3 degrees 5 degrees below 21 degrees C 70 degrees F in the average curing temperature, the curing period shall be increased by 4 calendar days.

Curing by low-pressure steam, steam vapor, radiant heat, and moisture or other process may be employed provided that the compressive strength of the concrete is equal to that obtained by moist curing and the 28-day

compressive strength meets the requirements specified, as determined by test cylinders of the same concrete cured by the same curing process.

Panels shall not be removed from the casting bed until the curing period is completed and concrete has attained at least 75 percent of the design compressive strength.

2.7.13 Protection of Concrete After Placing

Protection shall meet the requirements of ACI/MCP 205 for hot or cold weather as applicable.

2.7.14 Finishing for Formed Surfaces

Prior to panel fabrication, three samples of Exposed-to-View Surface Finish (300 by 300 millimeter) (12 by 12 inches), and Finish Aggregate for exposed-to-view facing material shall be provided by the Contractor.

After approval of the surface, Contractor shall provide one full size sample Wall Panel. Approved sample may be used in construction when properly identified.

Upon removal of forms, defective areas shall be repaired and patched. Where the finished surface will be exposed to view, the combined area of defective areas shall not exceed 0.2 percent of the surface and shall be limited to honeycomb or rock pockets not deep enough to expose the reinforcement. Where the finished surface will be concealed by other construction, defective areas shall be limited to holes left by the rods and other temporary inserts and honeycomb or rock pockets not deep enough to expose the reinforcement. Defective areas shall be cut out to solid concrete, cleaned, and patched with grout. Where concrete surface will be exposed to view, the patches, when dry, shall be indistinguishable from the surrounding surfaces.

****

NOTE: Delete the following paragraph, and specify the required finish or finishes when an exposed-aggregate finish is not required for exposed-to-view panel surfaces. Other finishes include textured form finishes, sculptured inserts, rubbed finishes, and combinations thereof; such finishes may require the specified exposed-to-view facing mixture.

It is recommended that a sample of the required exposed-to-view finish be on display where it may be seen by bidders during the bidding period.

****

Exposed-aggregate finish shall match the finish of the approved sample. Aggregates in exposed-to-view surfaces shall be exposed as soon after concrete placing as practical by power sanders, wire brushes, or other acceptable methods. Surfaces shall be given one or more washings with a dilute solution of muriatic acid, then washed with fresh, clean water to remove all traces of the acid.

PART 3 EXECUTION

3.1 GENERAL

Panels and accessories shall be installed in accordance with the approved shop drawings and as specified.

3.2 CONCRETE INSERTS EMBEDDED IN CAST-IN-PLACE CONCRETE

****
NOTE: Delete paragraph heading and the following paragraph when the precast concrete wall panels will not be attached to cast-in-place concrete structural members. Installation of concrete inserts embedded in cast-in-place concrete is specified in Section 03 30 53.00 40 CAST-IN-PLACE CONCRETE (SHORT SECTION).
****

Inserts shall be delivered to the site in time to be installed before the start of concrete placing. Contractor shall provide setting drawings, instructions, and directions for the installation of inserts.

3.3 CONCRETE STRENGTH AT TIME OF PANEL INSTALLATION

****
NOTE: Delete one of the following paragraphs as applicable to the project. First paragraph shall be selected except when the project schedule indicates installation of 28-day panels.
****

Panels shall not be installed until concrete has attained the minimum laboratory compressive strength at 28 calendar days specified.

Panels shall not be installed before 28 calendar days from the date of casting unless approval has been obtained to make one compressive strength test, ASTM C 39/C 39M, and one flexural strength test using simple beam with third-point loading, ASTM C 78, on field cured concrete test specimens, ASTM C 31/C 31M, for each individual panel to determine the strength of the concrete.

3.4 INSTALLATION TOLERANCES

Panels shall be installed within the tolerances specified in PCI MNL-116.

3.5 PLACING PANELS

Supporting members, including anchorage items attached to or embedded in building structural elements, shall be in place before placing panels is started.

Panels shall be installed plumb, level, in alignment, and within limits of the installation tolerances.

3.6 CONNECTIONS TO THE BUILDING FRAMING SYSTEM

Panels shall be connected to the building framing system as indicated on the approved shop drawings. Adjustable connections shall be fixed by

locknuts or other approved means after panels have been positioned.

3.7 JOINTS AND GASKETS

Joints between panels shall be the width indicated and within limits of installation tolerances.

Gaskets shall be installed in joints as indicated, shall be continuous throughout the joint length, and shall be compressed at least 25 percent by volume.

3.8 PROTECTION

Panels shall be protected against staining of exposed-to-view facing and other damage until completion of the work.

3.9 CLEANING

Before final acceptance, exposed-to-view surfaces of the panels shall be cleaned as recommended by the panel manufacturer. Stains shall be removed with a dilute solution of muriatic acid and immediately washed with water to remove the acid. Metal in adjacent construction shall be protected from the acid solution.

3.10 INSPECTION AND ACCEPTANCE PROVISIONS

****

NOTE: When prestressed precast concrete wall panels are required, refer to Section 03 41 33.00 40 PRECAST STRUCTURAL PRETENSIONED CONCRETE.

****

3.10.1 Evaluation of Compressive Strength Tests

Concrete quality control tests specified will be evaluated as specified.

Concrete delivered to the point of placement having a slump or total air content outside the values specified shall not be used in the work.

Compressive strength tests will be considered satisfactory if the average of any group of five consecutive compressive strength tests which may be selected is in each instance equal to or greater than the 28-day design compressive strength, or if not more than one compressive strength test in 10 has a value less than 90 percent of the 28-day design compressive strength.

If the compressive strength tests fail to meet the minimum requirements specified, panels fabricated of concrete represented by such tests will be considered deficient in strength and subject to the provisions specified.

3.10.2 Dimensional Tolerances

Panels having dimensions outside the limits for fabrication tolerances will be rejected.

3.10.3 Surface Finish Requirements

Panels will be rejected for the following surface finish deficiencies:

Exposed-to-view surfaces that do not match the color, aggregate size and distribution, and texture of the approved sample

Exposed-to-view surfaces that contain defects that affect the appearance of the finish, such as cracks, spalls, honeycomb, rock pockets, or stains and discoloration of aggregate or matrix that cannot be removed by cleaning

Concealed surfaces that contain cracks in excess of 0.2 millimeter 0.01 inch wide, cracks that penetrate to the reinforcement regardless of width, honeycomb, rock pockets, and spalls except minor breakage at corners and edges

3.10.4 Strength of Panels

Strength of precast concrete panels will be considered potentially deficient if the panels fail to comply with the requirements that control the strength of the panels, including the following conditions:

Failure to meet compressive strength tests

Reinforcement not conforming to the requirements specified

Concrete curing and protection of panels against extremes of temperature during curing not conforming to the requirements specified

Panels damaged during handling and erection

3.10.5 Testing Panels for Strength

When there is evidence that the strength of precast concrete panels does not meet specification requirements, cores drilled from hardened concrete for compressive strength determination shall be made in accordance with ASTM C 42/C 42M and as follows:

At least three representative cores shall be taken from the precast-concrete panels that are considered potentially deficient.

Cores shall be tested with the saturated surface dry.

Strength of cores will be considered satisfactory if their average is equal to or greater than 90 percent of the 28-day design compressive strength of 150 by 300 millimeter 6- by 12-inch cylinders.

Test reports shall be submitted on the same day that tests are made. Reports shall contain the project name and number, date, name of contractor, name of precast concrete wall panel manufacturer, name of concrete-testing service, identification letter and number of panel or panels represented by core tests, nominal maximum size of aggregate, design compressive strength of concrete at 28 calendar days, compressive breaking strength and type of break, length of core test specimen before capping, compressive strength after correcting for length diameter ratio, direction of application of the load on the core test specimen with respect to the horizontal plane of the concrete as placed, and the moisture condition of the core test specimen at time of testing.

If the results of the core tests are unsatisfactory or if core tests are impractical to obtain, static load tests shall be made of a panel and will be evaluated in accordance with ACI/MCP 305 and ACI 318/318R.

Panels used for core tests or static load tests shall be replaced with panels that meet the requirements of this section.

3.10.6 Panels-in-Place

Panels will be rejected for any one of the following deficiencies:

Panels not conforming to the requirements for installation tolerances

Panels that are damaged during construction operations

Panels that develop surface-finish deficiencies as specified

-- End of Section --