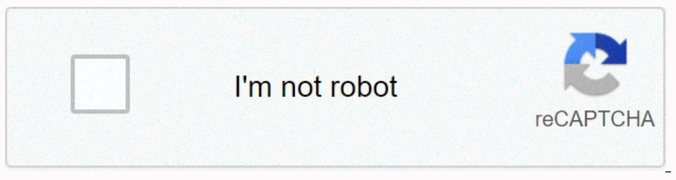

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These sections include concrete materials and proportions; reinforcing and compression steel; production, placing, finishing and curing of concrete; formwork performance criteria and design; treatment of joints; embedded elements; repair of surface defects; and finishing of moulded and unformed surfaces. The regulations governing testing, evaluation and acceptance of concrete, as well as the acceptance of the structure, have been taken into account. The remaining sections are designed for architectural concrete, light concrete, bulk concrete, post-tensioned concrete, shrinkage compensatory concrete, industrial floor slabs, tilting structures, prefabricated structural concrete and precast concrete. ACI was founded in January 1905 at the Indianapolis Convention. The Institute's headquarters are currently located in Farmington Hills, Michigan, USAGet eBook Info Here ACI 301-99 Specifications for Structural Concrete Reported by ACI Committee 301 James A. Lee Chairman W. Calvin McCall Secretary Jon B. Ardahl Mario R. Diaz Gilbert J. Haddad Joseph A. McElroy Domingo J. Carreira Robert M. Eshbach Jerry A. Holland Timothy L. Moore Oleh B. Ciuk W. Bryant Frye Roy H. Keck Jerry Parnes Steven R. Close Richard D. Gaynor Oswin Keifer, Jr. D. Gene Daniel Clifford Gordon Ross S. Martin Marwan A. Daye David P. Gustafson David K. Maxwell * Aimee Pergalsky James M. Shilstone, Sr. * Deceased 1.3.2—Cited publications 1.3.3—Field references 1.4—Reference standards and cited publications 1.5—Submittals 1.5.1—General 1.5.2—Testing agency reports 1.6—Quality assurance 1.6.1—General 1.6.2—Testing agencies 1.6.3—Testing responsibilites of Contractor 1.6.4—Testing responsibililites of Owner's testing agency 1.6.5—Tests on hardened concrete in-place 1.6.6—Evaluation of concrete strength tests 1.6.7—Acceptance of concrete strength 1.6.8—Field concrete collection 1.7 - Acceptance 1.7.1 — General 1.7.2 — Dimensional dimensional tolerances 1.7.4 — Structural strength 1.7.5 — Durability 1.8 — Protection of concrete in place 1.8.1 — Loading and supporting concrete 1.8.2 — Protection against mechanical damage This specification is a reference specification that the Engineer or architect may apply to any construction project, referring to it in the Design Specification. The architect/engineer shall supplement the provisions of this reference specification where necessary by setting or defining individual design requirements. The document includes concrete materials and proportions; reinforcing and compression steels; production, placing, finishing and curing of concrete; formwork and construction. Methods of treatment of joints and embedded elements, repair of surface defects and finishing of moulded and unformed surfaces have been specified. Separate sections are dedicated to architectural concrete, light concrete, bulk concrete, compressed concrete and compensating concrete. The regulations governing testing, evaluation and acceptance of concrete, as well as the acceptance of the structure, have been taken into account. Keywords: admixtures; aggregates; air entrainment; architectural concrete; buildings; cements; low temperature design; compressive strength; concrete construction; durability of concrete; concrete slab; concrete; consolidation; transport; curing; density; assessment; finish exposed aggregate; finishes; floors; formwork (construction); grouting; construction for hot heat; inspection; joints (spasm, construction, and insulation); light concrete; materials; proportions of the mixture; mixing; placement; compressed concrete; compression steel; reinforced concrete; reinforcing steel; repairs; reshoring; support; concrete to compensate for shrinkage; technical specifications; subclass; temperature; research; tolerances; ratio of water cement materials, (in /cm); welded wire fabric. CONTENT Section 2 — Formwork and formwork accessories, p. 301-10 2.1 — General 2.1.1 — Description 2.1.2 — Fore foreman, p. 301-3 SECTION 1 SPECIFICATION — General requirements, p. 301-3 1.1 — Scope 1.1.1 — Work specified 1.1.2 — Work not specified 1.2 — Definitions 1.3 — Standards producing organisations 1.3.1 — Reference standards ACI 301-99 replaces ACI 301-96 and enters into force on 3 November 1999. Copyright © 1999, American Concrete Institute. 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This fore forech is attached for explanatory purposes only. It is not part of the ACI 301 specification. F2. The ACI 301 specification is a reference specification that an architect/engineer can cite in the design specification for each construction project, along with additional design-specific requirements. F3. Each technical section of the ACI 301 specification is written in a three-part section format of the Institute of Building Specifications, adapted by the ACI and modified to the requirements of the ACI. Language is generally an imperative and narrows. The specification is saved to the Contractor. If a provision of this specification requires action on the part of the Executor, the verb will be used. If the Executor can use the option, the verb may or, in the case of limited alternatives, a concive expression or... Or... is used. The statements contained in the specification as information for the executor use verbs may or will. Informational statements typically identify actions or options that will be taken or can be taken by the owner or architect/engineer. F4. Checklists are not part of the ACI 301 reference specification. Checklists are designed to help the architect/engineer correctly select and determine any necessary requirements for the design specification. 301-3 SECTION 1 -GENERAL REQUIREMENTS 1.1 — Scope 1.1.1 Specific design — this reference specification includes in-place casting concrete. The provisions of this specification shall apply, except where other provisions are specified in the Order Documents. 1.1.2 Work is not specified — the following topics are not covered by this specification: • Prefabricated concrete products; • Heavyweight shielding concrete; • Slip-formed paving concrete; • Terrazzo; • Insulating concrete; and • Refractory concrete. 1.2 — Definitions acceptable or accepted — acceptable or accepted by the architect/engineer. Class 1 ACI field testing techniques - a person who has demonstrated the knowledge and ability to perform and record the results of asthma tests on freshly mixed concrete and to produce and harden test samples. Such knowledge and skills are demonstrated by passing the required written and examination exams and having credentials that are current at the American Concrete Institute. Architect/Engineer or Engineer/Architect — architect, engineer, architectural firm, engineering company, or architectural engineering company, issuing drawings and project specifications, or administering contract documents. Architectural concrete — concrete, which is exposed as an interior or exterior surface in a completed structure and is marked as architectural concrete in the order documents; contributes to the visual character of the completed and therefore requires special care when choosing concrete materials, forming, forming, and finishing to achieve the desired architectural appearance. Edge edges — edges placed tightly under a concrete slab or structural member after removing the original formwork and edges from a small area, not allowing you to deflect or support your own weight or existing structural loads from above. Cement, expansive - Cement, which, when mixed with water, produces a paste that, when set, tends to increase in volume much more than Portland paste; to compensate for a decrease in volume caused by contraction or to induce tensile stresses in reinforcement. Cement, an expansive mixture of Portland cement, anhydrous three-dimensional sulphate (C4A3S•), calcium sulphate (CaSO4) and lime (CaO); C4A3S• is a component of a separately burned clinker that is inter-tile with Portland cement or can alternately be formed simultaneously with cement-cement clinker compounds during the combustion process. 301-4 Standard ACI documents - Documents, including design drawings and design specifications, covering the required work. Contractor — A person, company or corporation with which the Owner concludes a contract for the construction of Works. Exposed to public view - Positioned so that it can be seen from a public location after construction is complete. High-strength concrete at an early stage — concrete that, thanks to the use of cement or ASTM C 150 type III admixtures, is able to achieve a certain strength at an earlier age than ordinary concrete. Lightweight concrete — concrete with a much lower density than concrete of normal weight. Bulk concrete — any volume of concrete large enough to require measures to cope with heat generation from cement hydration and the accompanying volume change to minimize cracking. Concrete, bulk, plain – mass concrete not containing reinforcement or less reinforcement than is necessary to be considered reinforced concrete. Solid concrete, reinforced concrete containing appropriate reinforcement, compressed or non-constant, designed to act together with concrete in resistant forces, including those caused by temperature and contraction. Concrete of normal weight — concrete with a density of about 150 lb/ft3 made of gravel aggregates or crushed stone. Owner — a corporation, association, partnership, natural person, public authority or body with which the Contractor concludes a contract and for which the Work is provided. Permitted – Accepted or accepted by the Architect/Engineer, usually related to the Contractor's request or after specified in the Agreement Documents. After stress - a method of compressing reinforced concrete, in which the tendons are strained after curing the concrete. Compressed concrete — concrete in which internal stresses of such size and distribution are introduced that the tensile stresses resulting from service loads are counteracted to the desired extent; in the reinforced concrete, is commonly introduced by tensioning tendons. Project drawings – Drawings that, together with project specifications, supplement descriptive information about constructing the work required or listed in contract documents. Project specifications – Written documents that specify the requirements for a project according to service parameters and other specific criteria established by the owner. Reference specification – A specification which, according to the architect/engineer, is intended to be the reference standard for the Contractor to be used in the construction of the project, referring to the reference specification in the procurement documents, together with the requirements of the project. Reference standards - Standards of a technical society, organization, or association, including the codes of local or state authorities referenced in contract documents. Required – required in this reference specification or contract documents. Reshores-Shores placed tightly under a stripped-down concrete slab or other structural part after removing the original molds and edges from a large area, which requires deformation of the new slab or structural member and maintenance of its own weight and existing structural loads applied before the installation of reshores. Shrink-compensating concrete — concrete made using expansive cement, in which the volume increases when set, if sufficiently elastic, induces compressive stresses, which are intended to roughly balance the tendency to dry contraction to induce tensile stresses. Strength test - Average compressive strength of two cylinders made of the same concrete sample and tested within 28 days or at the age of the test designated to determination of a specific compressive strength fc'. Lightweight concrete construction — structural concrete made of light aggregate; density is usually between 90 and 115 lb/ft3. Submitted – submitted to the architect/engineer for review and acceptance. Work – All construction or separate parts thereof that must be delivered on the basis of order documents; the work is the result of the provision of services, the provision of labor and equipment and the inclusion of materials and equipment for construction in accordance with the Procurement Documents. 1.3 — Reference standards and quoted publications 1.3.1 Reference standards — the ACI, ASTM, CRD, PTI and AWS standards referred to in this reference specification are listed with a serial designation, including the year of adoption or revision, and are part of this reference specification. 1.3.1.1 ACI Standards ACI 117-90 Tolerance requirements for concrete structures and materials 1.3.1.2 ASTM Standards A 82-97a Standard specification for steel wire, Smooth, concrete reinforcement A 184/ Standard specification for made steel mats DeA 184M-96 for concrete reinforcement A 185-97 Standard specification for welded steel fabric, smooth, for concrete reinforcement A Standard specification of steel strands, 416M-98ε1 Disturbed seven-wire, for compressed concrete A 421/ Standard specification for troubled StressA 421M-98a Released steel wire for compressed concrete A 496-97a Standard specification for steel wire, deformed, for concrete reinforcement A 497-97 Standard specification for steel welded wire fabric, deformed, for concrete reinforcement A 615/ Standard specification for deformed and ordinary bars 6 15M-96a for concrete reinforcement 617 M-96a A 706/ A 706M-98ε1 Standard specification for deformed steel axis and smooth bars for concrete reinforcement Standard specification for low alloy steel bars deformed and smooth for concrete reinforcement A 722/ Standard specification for troubled highs 722M-98 strength Steel bars for concrete compression A 767/ Standard specification for galvanized steel bars A 767M-97 (galvanized) for concrete reinforcement A 775/ Standard specification of steel bars type epoxy-coated A 775M-97ε1 Reinforcing Steel Strand , SevenA 779M-98 Wire, Uncoated, Compacted, Stress-Relieved for Prestressed Concrete A 780-93a Standard Practice for Repair of Damaged Hot-Dip Galvanized Coatings Standard Specification for Epoxy-Coated Steel A 884/ A 884M-96aε1 Wire and Welded Wire Fabric for Reinforcement A 934/ Standard Specification for Epoxy-Coated A 934M-97ε1 Prefabricated Steel Reinforcing Bars A 955M-96 Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement A 970/ Standard Specification for Welded or Forged A 970M-98 Headed Bars for Concrete Reinforcement A 996/ Standard Specification for Rail-Steel and A 996M-98 Axle-Steel Deformed Bars for Concrete Reinforcement C 31/ Standard Practice for Making and Curing C 31M-98 Concrete Test Specimens in the Field C 33-99 Standard Specification for Concrete Aggregates C 39/ Standard Test Method for Compressive C 39M-99 Strength of Cylindrical Concrete Specimens C 42/ Standard Test Method for Obtaining and C 42M-99 Testing Drilled Cores and Sawed Beams of Concrete C 94/C 94M-99 Standard Specification for Ready-Mixed Concrete C 138-92 Standard Metoda unit weight, performance, and air content (gravimetric) of concrete C 143/ Standard test method for hydraulic collapse 143M-98 Cement Concrete C 150-99 Standard specification for Portland cement C 171-97a Standard specification for sheet materials for curing concrete C 172-97 Standard sampling practice of freshly mixed concrete C 173-94aε1 Standard method for testing the air content of concrete freshly mixed by volume method C 192/ Standard practice for production and curing C 192M-98 Concrete test samples in laboratory C 231-97ε1 Standard method for testing the air content of concrete freshly mixed by pressure method C 260-98 Standard specification for Domieszki do betonu C 309-98a 301-5 Standardowa specyfikacja dla membran płynnych Związki formujące do utwardzania betonu C 330-99 Standardowa specyfikacja dla kruszyw lekkich do betonu konstrukcyjnego C 387-99 Standardowa specyfikacja dla pakowanych, suchych, Połączone materiały do zaprawy i betonu C 404-97 Standardowa specyfikacja dla kruszyw do zaprawy murarskiej Standardowa specyfikacja dla domieszek chemicznych C 494-99 dla betonu C 567-99a Standardowa metoda badania gęstości betonu lekkiego konstrukcji C 595-98 Standardowa specyfikacja dla Mieszane cementy hydrauliczne C 597-97 Standardowa metoda badania prędkości impulsowej przez beton C 618-99 Standardowa specyfikacja dla popiołu lotnego węgla i surowego lub kalcynowanego naturalnego pozzolana do stosowania jako domieszka mineralna w betonie cementowym Portland C 684-96 Standardowa metoda badania do produkcji, Przyspieszone utwardzanie i testowanie próbek testowych kompresji betonu C 685-98a Standardowa specyfikacja dla betonu wykonanego przez dozowanie objętościowe i ciągłe mieszanie Standardowa metoda testowa dla odporności na penetrację C 803 / C 803M-97 z hartowanego betonu C 805-97 Standardowa metoda testowa dla odbicia liczba odbić hartowanego Beton Standardowa specification for expansive hydraulic C 845-96 Cement C 873-99 Standard test method for compressive strength of concrete cylinders cast in place in cylindrical forms Standard test method for holding extension C 878-95a shrinkage-Concrete compensation C 881-99 Standard specification for epoxy-concrete resin bonding systems C 900-99 Standard test method for resistance to ejection of hardened concrete C 928-99 Standard specification for packaged, dry, Rapid Hardening Cementitious Materials for Concrete Repairs Standard Specification for Ground Granulated C 989-99 Blast-Furnace Slag for Use in Concrete and Mortars Standard Specification for Chemical Admixtures C 1017/ C 1017M-98 for Useing Flowing Concrete C 1059-99 Standard Specification for Latex Agents for Gluing Fresh to Hardened Concrete C 1064/ Standard temperature test methods C 1064M-99 Freshly mixed Portland cement concrete C 1074-98 Standard practice for estimating concrete strength by maturity method C 1077-99 Standard practice for laboratories testing concrete and concrete aggregates for use in construction and criteria Laboratory evaluation C 1107-99 Standard specification for dry packaging , Hydraulic cement mortar (nonshrink) 301-6 ACI STANDARD C 1150-96 Standard test method for concrete break count C 1218/ Standard dissolve test method water-based chloride C 1218M-99 Chloride in fashion and concrete C 1240-99 Standard specification of silica vapor for use in hydraulic-concrete cement, Mortar and mortar C 1315-95 Standard specification for liquid membrane mixturesForming compounds having special curing properties and concrete D

98-95 Standard specification for calcium chloride D 994-98 Standard specification for pre-formed concrete dilatation filler (bituminous type) D 1621-94 Standard test methods Properties of rigid cellular plastics D 1751-99 Standard specification for pre-formed dilatation fillers for laying concrete and structural construction (non-extreme and elastic bitumen types) D 1752-84 Standard specification for pre-formed sponges (1996)e1 Rubber and cork dilatation fillers for laying into concrete cubes and Design Method D 3575-93 Standard test methods for flexible cellular materials made of olefin polymers E 329-98a Standard specification for testing and/or control agencies for materials used in construction E 1155-96 Standard test method for determining flatness and floor equality Using F-Number 1.3.1.3 Other reference standards — Other standards, referred to in this reference specification: ANSI / structural welding code - reinforcement AWS D-1.4-98 Steel CRD-C 1513-74 Specification of rubber actuometers CRD-C 572 -74 Specification for polyvinyl chloride Waterstops PTI 1993 Specification for unsoiled single-pot tendons 1.3.2 Cited publications - Publications cited in this reference specification : ACI 318-99 Building Code Requirements for Reinforced Concrete ACI CP1-98 ACI Certification Terrain Testing Techniques - Class I ACI SP-15 Field Reference Manual CRSI MSP-1-97 Standard Practice Manual, 26. Edition 1.3.3 Field References — Store a copy of the following reference in the Contractor's field office: FIELD REFERENCE MANUAL SP-15: Concrete Specification (ACI 301-99) with selected ACI and ASTM references. 1.4 — Standard organisations Abbreviations for and full names and addresses of the issuing organisations referred to in this reference specification, listed are: American Concrete Institute (ACI) P.O. Box 9094 Farmington Hills, MI 48333-9094 American Society for Testing and Materials (ASTM) 100 Barr Harbor Drive West Conshohocken, PA 19428 American Welding Society (AWS) 550 N.W. Le Jeune Road P.O. Box 351040 Miami, FL 33135 Concrete Plant Manufacturers Bureau (CPMB) 900 Spring Street Silver Spring, MD 20910 Institute of Reinforcing Steel (CRSI) 933 N. Plum Grove Road Schaumburg, IL 60173 U.S. Army Corps of Engineers [COE(CRD Waterways Experiment Station 3909 Halls Ferry Road Vicksburg, MS 39180 National Ready Mixed Concrete Association (NRMCA) 900 Spring Street Silver Spring, MD 20910 Post Tensioning Institute (PTI) 1717 W. Northern Avenue #218 Phoenix , AZ 85021 1.5 — General notifications 1.5.1 — Unless otherwise specified, the conclusions required in this reference specification shall be submitted for review and acceptance. 1.5.2 Reports of research agencies — research agencies transmit the results of tests and inspections of concrete and concrete materials carried out during the Works to the owner, architect/engineer, contractor and concrete supplier. The endurance test reports shall include the location in Labour where the party represented by the deposited, and the ticket number of the lot. The endurance test reports contain detailed information on the and curing of samples before testing. Final reports shall be provided within 7 days of the end of the study. 1.6 — Quality Assurance 1.6.1 General — Concrete materials and operations may be tested and controlled by the Owner as the work progresses. Failure to cover up a malfunction or material at an early stage will not prevent rejection if the fault is detected later, nor will it oblige the architect/Engineer to be finally accepted. 1.6.2 Research agencies — Agencies providing research services in the field of concrete materials must comply with ASTM C 1077. Research agencies that provide testing services SPECIFICATIONS FOR STRUCTURAL CONCRETE ON REINFORCING STEEL MUST COMPLY WITH ASTM E 329 REQUIREMENTS. Research agencies are accepted by the Architect/Engineer before any work is carried out. The field concrete tests required in items 1.6.3 and 1.6.4 shall be carried out by an ACI Class 1 field test technician in accordance with ACI CP1 or equivalent. Equivalent certification programmes shall include requirements for written and examination examinations as defined in the publication of ACI CP1. 1.6.3 Test obligations of the Contractor 1.6.3.1 Transmission of data on the qualification of the proposed research agency for acceptance. The use of test services does not relieve the Contractor of the responsibility for providing materials and structures in full compliance with the Contract Documents. 1.6.3.2 Obligations and obligations — Unless otherwise specified in the Order Documents, the Contractor assumes the following obligations and obligations: 1.6.3.2.a Qualify the proposed materials and determine the proportions of the mixture. 1.6.3.2.b provide all necessary work to assist the Owner's research agency in obtaining and handling samples at the project site or in the source of materials. 1.6.3.2.c the Owner's research agency at least 24 hours before operations to enable quality tests to be completed and staff assigned. 1.6.3.2.d Ensure and maintain only for the exclusive use of the research agency suitable facilities for the safe storage and proper curing of concrete test samples on the site of the pre-curing project, in accordance with astm requirements C 31/C 31M. 1.6.3.2.e Submit data and test documentation of materials and proportions of mixtures. 1.6.3.2.f Present a supplier-specific quality control program and provide copies of work-related test reports. 1.6.3.2.g After determining or allowing concrete reception to burn on an accelerated strength test, correlation data shall be provided for the standard 28-day compressive strength based on at least 15 test datasets in accordance with 1.6.4.2.d. with concrete made of the same materials providing a range of at least the required average strength fcr' , plus or minus 1000 psi. 1.6.3.3 Tests required of the Contractor's research agency – Unless otherwise specified in the Order Documents, the Contractor free of charge necessary research services to the owner in the field of: 1.6.3.3.a Qualification of the proposed materials and concrete mixtures. 1.6.3.3.b Other test services needed or required by the Contractor. 1.6.4 Testing obligations of the Owner's research agency 1.6.4.1 Unless otherwise specified in the Contract Documents, the Owner's test agency will provide the necessary services in the scope of: 1.6.4.1.a Representatives of the Owner's research agency will inspect, take samples and test materials and concrete production required by the Architect/Engineer. When it is found that the material supplied or made by the Contractor does not comply with the Order Documents, the test agency 301-7 shall immediately report such defects to the architect/engineer, contractor and concrete supplier. 1.6.4.1.b The Research Agency and its representatives shall not be entitled to revoke, amend, relax, extend or release any requirements of the Agreement Documents or to accept any part of the Work. 1.6.4.1.c The Research Agency shall provide the architect/engineer, contractor and concrete supplier with the results of the tests and inspections relating to the Works within 7 days of the tests and inspections. 1.6.4.2 Test Services — Where required by the Owner or Architect/Engineer, the Owner's test agency will perform the following test services for the Contractor free of charge: 1.6.4.2.a Review and control test of the proposed materials to ensure compliance with the Order Documents. 1.6.4.2.b and inspection of the proposed concrete mixture in accordance with the requirements of the architect/engineer. 1.6.4.2.c Obtain production samples of materials in plants or warehouses during the Work and test for compliance with order documents. 1.6.4.2.d Take samples in accordance with ASTM C 172. Select the trucks or concrete lots to be tested randomly, using random numbers selected before placing the concrete. Obtain at least one composite sample for each 100 yd3 or fraction there of each concrete mixture placed within one day. If the total amount of concrete mixture is less than 50 yards3, the architect/engineer may opt out of the stress tests. 1.6.4.2.e Perform concrete strength tests during construction in accordance with the following procedures: • Form and harden three cylinders from each sample according to ASTM C 31/C 31M. Record any deviations from ASTM requirements in the test report. • Test cylinders according to ASTM C 39. Test one sample for information within 7 days and two samples within 28 days of acceptance, unless otherwise specified. The results of the compressive strength tests to be adopted are the average compressive strength of the two test samples within 28 days. If one sample in the test shows evidence of improper sampling, forming or testing, discard the sample and consider the strength of the remaining cylinder as the result of the test. If both samples in the test show any defects, the whole test must be discarded. • Where accelerated concrete testing is defined or permitted as a testing, forming and curing two samples from each sample assembled in accordance with ASTM C 684, in accordance with the procedure laid down by the Architect/Engineer. Perform at least one accelerated strength test from each sample submitted in 1.6.4.2.d and one standard 28-day compressive strength test for at least one second accelerated strength test in accordance with ASTM C 31/C 31M. These test results are used to maintain and update the correlation between accelerated and standardized 28-day compressive strength tests. 301-8 ACI standard 1.6.4.2.f Determine the decrease of each composite sample taken in accordance with point 1.6.4.2.d and where the consistency of the concrete appears to be different, using ASTM C 143/C 143M. 1.6.4.2.g Determine the temperature of each composite sample taken in accordance with 1.6.4.2.d with ASTM C 1064. 1.6.4.2.h Determine the air content of the normal mass concrete using ASTM C 231, C 173 or C 138 for each composite sample taken in accordance with 1.6.4.2.d or as recommended by the architect/engineer. Additional tests will be carried out if necessary. 1.6.4.2.i Where concrete is exposed to oduniaous salts, as indicated in the Contract Documents, air content tests shall be carried out on samples from the first three batches in the placement and until three consecutive batches have an air content within the range specified in section 4.2.2.4 - Air content at which time every fifth batch will be tested. This test frequency shall be maintained until the batch is within the range specified in item 4.2.2.4, during which time the test of each lot shall be resumed until three successive batches have an air content within the range specified in item 4.2.2.4. Additional tests may be carried out as necessary for inspection. These air content tests may be taken on samples submitted in 1.6.4.2.d. or on samples from batches at any time after discharge of 2 ft3 of concrete. 1.6.4.3 Additional research services if necessary — the Owner's test agency will perform the following test services when required by the Architect/Engineer, at no cost to the Contractor: • check the dosing, mixing and delivery operations of concrete; • Check molds, foundation preparation, reinforcing steel, embedded elements, reinforcement steel placement and concrete placement, finishing and curing operations; • Concrete sample at the place of placement and other places in accordance with the recommendations of the architect/engineer and carrying out the required tests; • review the manufacturer's report for each shipment of cement, reinforcing steel and compression tendons and carry out laboratory or on-the-spot checks of the materials received for compliance with the specifications; and • Other testing or inspection services required by the Architect/Engineer. 1.6.4.4 Other research services, if necessary, the contractor will pay for the following research services if necessary, by the Owner's research agency: • Additional tests and inspections required due to changes in the materials or proportions of the mixture required by the Contractor; and • Additional studies or specific due to non-compliance with the specifications. 1.6.5 Tests on hardened concrete at site 1.6.5.1 General — Tempered concrete testing will be carried out by the Owner's research agency when such tests are needed. The test shall be carried out at the contractor's expense when tests are carried out to verify the strength of the structure when required by this specification. The owner will cover the costs if the tests are at the request of the Owner and are not required by this Specification. 1.6.5.2 Non-destructive testing — The use of a reflecting hammer in accordance with ASTM C 805, the pulse speed method according to ASTM C 597 or other non-destructive testing may be permitted by the architect/engineer to assess the uniformity and relative strength of the concrete at the site or to select the areas to be cored. 1.6.5.3 Core testing 1.6.5.3.a Where required by an architect/engineer, cores shall be obtained and tested in accordance with ASTM C 42. If the concrete in the structure is dry under operating conditions, the cores are air-dried (temperature 60 to 80 F, relative humidity less than 60%] for 7 days before the test and are tested dry. If the concrete in the structure is more than superficially wet under exploding conditions, the core shall be tested after conditioning of moisture in accordance with ASTM C 42. 1.6.5.3.b At least three representative cores shall be taken from each member or concrete area which is considered potentially insufficient. The position of the cores specified by the Architect/Engineer affects the strength of the structure as little as possible. If, prior to the test, the cores show that they have been damaged after removal or during removal from the structure, replacement cores should be taken. 1.6.5.3.c Fill the core holes with low drop concrete or mortar with a strength equal to or greater than the original concrete. 1.6.6 Assessment of concrete strength tests 1.6.6.1 Standard moulded and hardened formulae -Test results from standard moulded and hardened test cylinders shall be assessed separately for each specific concrete mixture. The evaluation will only be valid if the studies have been carried out in accordance with certain procedures. For evaluation purposes, each specified mixture shall be represented by at least five tests. 1.6.6.2 Non-destructive tests — the test results will be evaluated by the Architect/Engineer and will only be valid if the tests have been carried out using properly calibrated equipment in accordance with recognised standard procedures and an acceptable correlation between test results and compressive concrete strength has been established and presented. 1.6.6.3 Basic Tests - The basic test results will be evaluated by the Architect/Engineer and will only be valid if the tests have been carried out in accordance with certain procedures. 1.6.7 Acceptance of concrete strength 1.6.7.1 Standard strength patterns moulded and hardened — concrete strength level will be satisfactory when the averages of all sets of the next three the results of endurance tests equal to or exceeding the specified compressive strength fc′, and no individual endurance test result shall fall below the specified compressive strength fc′ by more than 500 psi. These criteria shall also apply where accelerated endurance testing is specified, unless otherwise specified in the Contract Documents. 1.6.7.2 Non-destructive testing — Non-destructive testing must not be used as the only basis for accepting or rejecting concrete, but may be used to assess specific specifications of structural concrete where standard moulded and hardened cylinders have produced results which do not meet the criteria in point 1.6.7.1. 1.6.7.3 Core tests — the strength level of concrete in the area represented by the basic tests shall be considered appropriate when the mean compressive strength of the cores is equal to at least 85 % of the specified compressive strength fc′, and if no single core is less than 75% of the specified compressive strength fc′. 1.6.8 Concrete field reception 1.6.8.1 Air content — Concrete does not fit within the air-gust limits indicated in section 4.2.2.4 and tested in accordance with 1.6.4.2.h. cannot be used in the Working Room. 1.6.8.2 Fall — Concrete does not fall within the precipitation limits specified in section 4.2.2.2 at the point of placement must not be used in the Working. 1.6.8.3 Temperature — Concrete not within the temperature limits of 4.2.2.7 cannot be used in the working room. 1.7 — Acceptance of structure 1.7.1 General — Concrete work carried out must comply with the applicable requirements of this reference specification and procurement documents. 1.7.1.1 You can accept specific works that do not meet one or more of the requirements of the Order Documents, but are then repaired to ensure the conformity of the concrete. 1.7.1.2 Specific works that do not meet one or more of the requirements of the Order Documents and cannot comply with the regulations may be rejected. 1.7.1.3 Repair rejected concrete work by removing and replacing or reinforcing an additional structure required by the Architect/Engineer. To ensure that rejected works comply, use repair methods that maintain a certain strength and meet the appropriate requirements for function, durability, dimensional tolerances, and appearance as specified by the architect/engineer. 1.7.1.4 Submit for acceptance the proposed repair methods, materials and modifications necessary to ensure that the specific work meets the requirements of the Contract Documents. 1.7.1.5 The Contractor shall bear all costs in order to adapt the concrete works to the requirements of the project specifications. 1.7.1.6 Concrete of members cast in the wrong place may be rejected. 1.7.2 Dimensional tolerances 1.7.2.1 Formed surfaces resulting in concrete strokes being less than those permitted by ACI 117 tolerances may be considered insufficient and subject to 1.7.4 – Strength of the structure. 1.7.2.2 Formed surfaces as a result of which concrete strokes greater than those permitted by ACI 117 may be rejected. Remove excess materials when required by the Architect/Engineer. 1.7.2.3 Inaccurately formed concrete surfaces which exceed tolerances of ACI 117 may be rejected. 1.7.2.4 Finishing plates exceeding the tolerances in section 5.3.4.3 — Plate finishing tolerances may be adjusted provided that the strength or appearance is not affected. 1.7.2.5 Concrete with tolerances and defects exceeding restrictions 2.2.2.4 may be rejected. 301-9 1.7.3 Appearance 1.7.3.1 Concrete not complying with requirements 5.3.3 — Finishing of formed surfaces or 5.3.4 — Finishing of unformed surfaces must comply with point 1.7.1 — General. 1.7.4 Structural strength 1.7.4.1 Criteria for determining potential strength deficiency — Strength will be considered insufficient and specific when the work does not meet the requirements that control the strength of the structure, including but not limited to the following conditions: 1.7.4.1.a Concrete strength not complying with requirements 1.6.7 — Acceptance of concrete strength. 1.7.4.1.b Size, quantity, strength, position or arrangement of reinforced steel, depending on the requirements of Section 3 — reinforcement and reinforcement supports or other contract documents. 1.7.4.1.c Concrete elements which differ from the required dimensions or locations. 1.7.4.1.d Curing not in accordance with the Order Documents. 1.7.4.1.e Inadequate protection of concrete against extreme temperatures and other environmental conditions in the early stages of curing and strength development. 1.7.4.1.f Mechanical damage, construction fires, accidents or premature removal of the formwork causing a shortage of force. 1.7.4.2 Action is required when the force is potentially insufficient — where the strength of the structure is considered to be potentially insufficient, the architect/engineer may require the following actions: 1.7.4.2.a Structural analysis or additional studies, or both. 1.7.4.2.b Basic tests. 1.7.4.2.c If the test is ambiguous or impractical, or if structural analysis does not confirm structural safety, load tests may be required and their results evaluated in accordance with ACI 318. 1.7.4.2.d Concrete work rejected by structural analysis or load test results shall be reinforced with an additional structure if required by an architect/engineer, or replaced. 1.7.4.2.e Document all repair work proposed to ensure compliance with the Order Documents of non-completed specific works of insufficient strength, and then submit the documentation to the architect/engineer for collection. 1.7.5 Durability 1.7.5.1 Criteria for determining potential durability deficiency — the durability of concrete works will be considered insufficient and specific work will be rejected if they do not meet the requirements for the maintenance of the structure, including but not limited to the following conditions: 1.7.5.1.a — Force not met 1.6.7 — Acceptance of concrete strength. 1.7.5.1.b — Substandard concrete materials 4.2.1.2 — Aggregates, 301-10 ACI STANDARD 4.2.1.3 — Water and 4.2.1.4 – Admixtures, including air capture. 1.7.5.1.c —Concrete not complying with the air-gusting requirements of the order documents or air content limits in Table 4.2.2.4. 1.7.5.1.d —Curing not in accordance with the contract documents. 1.7.5.1.e — Inadequate protection of concrete against temperature and other environmental conditions in the early stages of hardening and strength development. 1.7.5.1.f —Concrete not meeting the maximum permissible requirements for the chloride ion content of Table 4.2.2.6. 1.7.5.2 Action is required when durability is potentially insufficient — Where the durability of the structure is considered insufficient, the architect/engineer may require the following actions: 1.7.5.2.a — Obtain and test samples of the constituent materials used in the concrete. 1.7.5.2.b — take concrete samples from the structure by corruring, sawing or other acceptable means. 1.7.5.2.c — Laboratory evaluation of concrete and concrete materials to assess concrete's ability to resist, chemical attack, abrasion, reinforcement corrosion or other deterioration. 1.7.5.2.d — Repair or replacement of concrete rejected due to lack of durability, as recommended by the architect/engineer. 1.7.5.2.e — Work related to the repair of documents in order to adapt the concrete works to the contract documents and to submit the documentation to the architect/engineer for acceptance. 1.8 — Protection of concrete in place 1.8.1 Loading and supporting concrete — must not allow the structural load to be exceeded which the structural element, with the necessary complementary support, is able to carry safely and without damage. 1.8.2 Protection against mechanical damage — During the curing period, the concrete must be protected against harmful mechanical interference, including load stresses, shocks and harmful vibrations. Protect concrete surfaces from damage from construction traffic, equipment, materials, rain or running water and other adverse weather conditions. SECTION 2 — FORMWORK AND FORMWORK ACCESSORIES 2.1 — General 2.1.1 Description — This section covers the design, construction and treatment of formwork to reduce and shape concrete to the required dimensions. 2.1.2 Submitted 2.1.2.1 Submit the following data, unless otherwise specified: a. Deformable materials — data on materials intended for shape proposed for a smooth finish if they differ from those specified in 2.2.1.1 — Materials directed to the shape. B. Construction and systolic connections — Location of construction and systolic ponds proposed if different from those indicated in the procurement documents. c. Shutter removal test — Data on the method for determining the strength of the concrete for the removal of formwork in accordance with 2.3.4.2 when a method other than those secured in the field is proposed. d. Plans are proposed for the removal of formwork , detailed plans for the operation to remove formwork when removing moulds with concrete capacity lower than those specified in 2.3.2.5. E. Reshoring and backshoring plans — when or backshoring is required or permitted, submit procedures and operation plans, before use, sealed by a professional licensed Engineer in the state where the work will be performed. F. Data on the release agent or form inserts proposed for use with each surface formed. 2.1.2.2 Submit the following information if required by the Agreement Documents: a. Shop formwork drawings sealed by a professional engineer licensed in the state where the work will be done. B. Calculations for formwork, reshoring and backshoring, sealed by a professional engineer licensed in the state where the work will be performed. c. Manufacturer's data and samples of the binding forms. d. Manufacturer's data and samples of expansion materials. E. Manufacturer data and waterstops samples. 2.2 —Products 2.2.1 Materials 2.2.1.1 Materials for shape — Materials for shape surfaces in contact with concrete must comply with section 5.3.3.5 — Unspecified finishes and the following requirements, unless otherwise specified in the Order Documents. • For rough finishes, no shape-directed material specified. • For a smooth mold finish, use plywood, hardened concrete slab, metal, plastic, paper, or other acceptable materials capable of obtaining the desired finish for shape-facing materials. Materials from side to shape must provide a smooth, uniform texture on the concrete. Do not use materials for forms with raised grain, torn surfaces, worn edges, stains, dents or other defects that weaken the structure of concrete surfaces. 2.2.1.2 Formwork accessories - Use commercially produced formwork accessories that are partially or completely embedded in concrete, including ties and hangers. Do not use unfabricated wire bare needles. Where indicated in the contract documents, links to the built-in barrier plates shall be used in the walls. 2.2.1.3 Formwork release agents — use commercially produced formwork release agents that prevent formwork from absorbing moisture, prevent bonding with concrete and do not scow concrete surfaces. 2.2.1.4 Dilatadar filler — pre-formed diffusion filler must comply with ASTM D 994, D 1751 or D 1752. 2.2.1.5 Other embedded elements — use water stops, sleeves, plates, anchors and other embedded material and design elements indicated in the Agreement Documents. Water limiter materials must meet crd c 513 requirements for rubber water stop or CRD C 572 for polyvinyl chloride specification for structural concrete water stop. Make welds in waterstops and use molded pieces according to the manufacturer's recommendations. 2.2.2 Performance and design requirements 2.2.2.1 The Contractor is responsible for the design and design of the Where required by the contract documents, the design calculations for formwork drawings and formwork shall be sealed by a professional engineer licensed in the state in which the work will be performed. 2.2.2.2 Design formwork, shores, shores and coasts to carry all loads transferred to them and meet the requirements the current Building Code. Structural formwork to withstand pressure resulting from the placement and vibration of concrete and to maintain specific tolerances. 2.2.2.3 Do not use ground cuts as vertical or sloping surfaces unless required or permitted in contract documents. 2.2.2.4 The maximum deflement of cladding surfaces reflected on concrete surfaces exposed to the public shall be 1/240 of the span between the structural members of the formwork. For architectural concrete, see 6.2.2.1.a. 2.2.2.5 Formed structural and systolic joints 2.2.2.5.a Locate and form structural joints that least weaken the strength of the structure and meet the requirements of 5.3.2.6 - Construction connections and other bonded joints. 2.2.2.5.b Unless otherwise specified or permitted, locate and detail the structural joints to the following requirements: • Locate structural joints in the middle third of the spans of plates, beams and girders. When the beam crosses the girder at this point, open the connection in the girder at a distance equal to or more than twice the width of the beam. • Locate joints in walls and columns on the bottom of floors, slabs, beams or girders and on tops of foundations or floor boards. • Make connections perpendicular to the main reinforcement. 2.2.2.5.c provide the cans as indicated in the order documents. Where longitudinal drains are indicated in the contract documents, at least 1-1/2 inch deep in the joints in the walls and between the walls and slabs or foundations. 2.2.2.5.d Providing structural and systolic connections, if indicated in the Order Documents. Submit for adoption the location of the construction and contraction of joints differs from those indicated in the Agreement Documents. 2.2.2.6 For a smooth finish, place the cladding materials in an orderly and symmetrical arrangement and keep the number of stitches to a minimum. Support materials with pins or other support which prevent excessive repeal within the tolerances set out in section 2.2.2.4. 2.2.3 Manufacture and manufacture 2.2.3.1 Formwork must be sealed to prevent loss of concrete mortar. 2.2.3.2 Place 3/4 inch minimum chamfered strips in the corners of the formwork to obtain oblique edges on permanently exposed surfaces, unless otherwise specified. Do not ming corners or edges of concrete unless specified in order documents. 2.2.3.3 Provide temporary openings at the base of column and wall formwork and at other points, where necessary to facilitate cleaning and inspection. Clean and in check immediately before placing the concrete. 2.2.3.4 Fassate the mold bond so that the ends or end elements can be removed with minimal chipping on concrete surfaces. After removing the ends or end fittings of the form mates, terminate the embedded part of the bond not less than two diameters, or twice the minimum dimension transverse tie, made of formed concrete surface. Under no circumstances may this distance be less than 3/4 inch. Repair holes mounted in accordance with 5.3.7.2 — Repair of power holes. 2.2.3.5 Locate the aquause in the ponds, if indicated in the order documents. Use pieces of pre-formed aquaform of the maximum possible length to keep the number of end connections to a minimum. Perform ponds in waterstops according to the manufacturer's recommendations. Make sure that the joints develop an effective water resistance equal to the continuous waterstop material, constantly develop not less than 50% of the mechanical strength of the parent section and constantly retain elasticity. 2.3 —Workmanship 2.3.1 Construction and installation of formwork 2.3.1.1 With structural joints, the contact surface on the knees in the form of surfaces for plaster exposed to the view of the paved concrete in the previous placement by not more than 1 inch. Make sure that the formwork is firmly held in front of the hardened concrete to prevent the mortar from moving or losing in the construction joints and maintain the real surface area. 2.3.1.2 Unless otherwise specified in the Order Documents, formwork must be built so that concrete surfaces meet the tolerance limits of ACI 117. The surface class to be offset between adjacent parts of the material is Class A for surfaces permanently exposed to public view and class C for surfaces that will be permanently hidden, unless otherwise specified. 2.3.1.3 Providing positive means of adjustment (wedge or lifts) of edges and struts. Do not make adjustments to the formwork when the concrete reaches the initial setting point. Formwork buckles safely against lateral deflece and lateral instability. 2.3.1.4 In order to maintain certain tolerances, tilt formwork compensates for the expected deflections in the formwork before hardening the concrete. Before removing formwork, carefully set formwork formwork and intermediate strips of screed for plates to get the designated elevations and contours of the finished surface. Make sure that the edges and screed forms are strong enough to support vibrating screeds or roller pipe screeds when a specific finish requires the use of such equipment. 2.3.1.5 When the formwork is bent, set the screeds to like a bend to maintain the required concrete thickness. 301-12 Standard ACI 2.3.1.6 Attach the mold wedges in place after final adjustment of the forms and before placing the concrete. 2.3.1.7 Anchor formwork to the edges, support surfaces or members to prevent upward or lateral movement of formwork when placing concrete. 2.3.1.8 Construct formwork for wall openings to facilitate removal and counteract wood formwork swelling. 2.3.1.9 Provide runways for mobile devices and support runways directly on the formwork or construction man without resting on reinforcing steel. 2.3.1.10 Place the bushings, plates, anchors and seated elements required for adhering operation or support before placing the concrete. 2.3.1.11 Positioning and support of expansion materials, water stops and other embedded elements prevent displacement. Fill Fills in the liners, inserts and anchor slots temporarily with easily removable material to prevent concrete from entering empty spaces. 2.3.1.12 Clean the surfaces of formwork and materials embedded in mortar, mortar and foreign materials before placing the concrete. 2.3.1.13 Cover the surfaces of the formwork with an acceptable material that prevents it from joining the concrete. You can use a formwork release agent used in the field or a factory-used insert. When using a formwork release agent, the formwork shall be applied to the formwork surface in accordance with the manufacturer's recommendations before placing the reinforcing steel. Do not allow formwork release in forms into a puddle. Do not allow the formwork release agent to come into contact with reinforcing steel or hardened concrete on which fresh concrete should be placed. 2.3.2 Removal of formwork 2.3.2.1 When finishing is required, the forms must be removed as soon as the removal operations do not damage the concrete. 2.3.2.2 Remove the upper forms on sloping concrete surfaces as soon as removal does not allow the concrete to deflece. Perform the necessary repairs or treatment required at once and immediately follow the specified curing. 2.3.2.3 Loosen wooden formwork for wall openings when this can be achieved without damaging the concrete. 2.3.2.4 Do not allow the removal of formwork for columns, walls, sides of beams and other parts not comcomparing the weight of concrete to damage concrete. Perform the required repair and treatment required on vertical surfaces at once and immediately follow the specified curing. 2.3.2.5 Unless otherwise specified, leave formwork and support to support the concrete weight in beams, slabs and in place until the concrete reaches the specified compressive strength fc′ in accordance with 2.3.4 - Concrete strength required to remove formwork. If a lower compressive strength is proposed for the removal of formwork and overheads, submit detailed inspection and acceptance plans. If the edges and other vertical supports are arranged in such a way as to allow the material to be removed from the vertical side without loosening or interfering with the edges and supports, the cladding material may be removed at an earlier age, unless otherwise specified. 2.3.2.6 Build formwork for easy removal. 2.3.3 Reshoring and backshoring 2.3.3.1 Applications for reshoring and backshoring operations must comply with 2.1.2.1 and 2.1.2.2. 2.3.3.2 While reshoring or backshoring is in progress, do not allow any structural load on the new design. 2.3.3.3 During reshoring and backrest, it is not permitted to load concrete into a beam, slab, column or any structural element with combined dead and structural loads exceeding the loads permitted by the Architect/Engineer for the compressive strength of the concrete during reshoring and backshoring. 2.3.3.4 Place reshores backshores in order with demolition operations. 2.3.3.5 Tighten the reshores and backshores to carry the required loads without overburdening the concrete elements. Leave them in place the tests required by item 2.3.4 — The strength of the concrete required to dismantle the formwork indicates that the compressive strength of the concrete has reached the minimum value specified in item 2.3.2.5. 2.3.3.6 In the case of floors supporting the edges under the newly placed concrete, the original support edges must be left in place or reshore or backshores installed. The support system and the support plates must have sufficient capacity to wither the expected loads. Find reshores and backshores directly below the shore position. 2.3.3.7 In multi-storey buildings, reshoring or backshoring should be extended to a sufficient number of storeys to spread the weight of newly placed concrete, molds and live loads so that the structural loads of the floors supporting the edges, reshores or backshores are not exceeded. 2.3.4 The strength of concrete required to remove formwork 2.3.4.1 When the removal of formwork or reshoring is based on concrete achieving a certain compressive strength, it is assumed that the concrete has reached that strength when the test cylinders, hardened in the same way as the concrete they represent, have reached the compressive strength specified for the removal of formwork or reshoring. Mold actuators according to ASTM C 31/C 31M and harden them under the same conditions for moisture and temperature as for the concrete they represent. Test cylinders in accordance with ASTM C 39. 2.3.4.2 Alternatively, if specified or permitted, one of the following methods for assessing the strength of concrete for the removal of formwork shall be used. Before applying the methods in section 2.3.4.2.b to 2.3.4.2.e., submit sufficient data using design materials to demonstrate a correlation of measurements on the structure with the compressive strength of laboratory-formed cylinders or drilled cores. Submit correlation data about the proposed alternative force determination method to the architect/engineer. 2.3.4.2.a On-site testing of cylinders in accordance with ASTM C 873. This is limited to concrete depth slabs from 5 to 12 w. 2.3.4.2.b Penetration resistance according to ASTM C 803/C 803M. 2.3.4.2.c eject strength according to ASTM C 900. 2.3.4.2.d Acceptable maturity factor procedure according to ASTM C 1074. SPECIFICATIONS FOR STRUCTURAL CONCRETE 2.3.4.2.e Number of concrete shards in accordance with ASTM C 1150. 2.3.5 Field quality control 2.3.5.1 Establishment and maintenance of controls and indicators in undisturbed condition until the final completion and adoption of the project. 2.3.5.2 Changes from the vertical and designated construction lines shall not exceed the tolerances set out in ACI 117. SECTION 3 — REINFORCEMENT SUPPORTS 3.1 — This general section covers materials, manufacture, distribution and tolerances of reinforcing and reinforcing accessories. 3.1.1 Submission, data and drawings , unless otherwise specified in the contract documents, submit the following data and drawings for review and acceptance before drawing and execution: unless otherwise specified: (a). Place drawings - Place drawings that show production dimensions and locations to place reinforcement and reinforcement supports. B. Splices – Submit a list and request the use of splices not specified in the contract documents. c. Mechanical splice — sending requests for the use of mechanical strands not illustrated in the drawings of the project. d. Column pins - Submit requests to place column pins without using templates. E. Field Bending - Submit requests and procedures to bend a field or straighten reinforcement partially embedded in concrete. 3.1.1.2 If necessary, send the following data: a. Welding – Describes the location of reinforcing welds, welding procedures, and welding welder qualifications when welding is permitted in accordance with section 3.2.2.2 - Welding. B. Supports - If coated reinforcement is required, a description of the reinforcement supports not described in section 3.3.2.4 — Reinforcement supports and materials for fastening coated reinforcement shall be provided. 3.1.1.3 If alternative solutions are proposed, the following particulars shall be provided: a. Gain Relocation – Request the transfer of any reinforcement that exceeds the deployment tolerances. 3.1.2 The supply, storage and handling of materials 3.1.2.1 Prevents bending, coating with earth, oil or other material or otherwise damages reinforcement. 3.1.2.2 For the transfer of coated reinforcement, use devices with padded contact surfaces to avoid damage to the coating. Coated reinforcement beams at multiple pick-up points prevent bar-to-bar abrasion in bundles. Do not drop or drag coated reinforcement. Keep the coated reinforcement on cribbing, which does not damage the coating. 3.2 —Products 3.2.1 Materials 3.2.1.1 Reinforcing bars — use deformed bars as reinforcing bars, with the exception of spirals and welded wire fabrics, which may be smooth. Reinforcement must be classes, types and sizes 301-13 required in the order documents and comply with one of the following characteristics: • ASTM A 615/A 615M; • ASTM A 616/A 616M, including additional requirement S1; • ASTM A 617/A 617M; • ASTM A 706/A 706M; • ASTM A 970/A 970M; or • ASTM A 996/A 996M type R. 3.2.1.2 Rebar coated rebar — use zinc-epoxy reinforcing coatings if required, as specified in the procurement documents. 3.2.1.2.a Zinc coated rebar (galvanized) must comply with ASTM A 767/A 767M. Repair of coating damage caused by shipping, handling and placement in accordance with ASTM A 780. The maximum number of damaged areas repaired must not exceed 2 % of the surface area of each linear foot of each bar. 3.2.1.2.b Epoxy coated reinforcing bars comply with ASTM A 775/A 775M or ASTM A 934/A 934M as specified in the Order Documents. Repair damaged areas with ASTM A 775/A patching material astm A 934/A 934M, as appropriate and in accordance with the written recommendations of the material manufacturer. Shell repair caused by shipping, handling and The maximum number of damaged areas repaired must not exceed 2 % of the surface area of each linear foot of each bar. Fading the color of the coating will not be a reason to reject epoxy-coated reinforcing bars. 3.2.1.3 Stainless steel rods - Stainless steel rods must comply with ASTM A 955M 3.2.1.4 mats - Use ASTM A 184/A 184M cropped type rod mats and assembled in one of the following combinations: • ASTM A 615/A 615M compliant rods, ASTM A 616/A 616M with additional requirement S1, ASTM A 617/A 617M or ASTM A 706/A 706M; • Galvanized (galvanized) rods complying with ASTM A 767/A 767M and galvanized (galvanized) or non-metallic, with damage to coatings repaired in accordance with 3.2.1.2.a. or • EPOXY rods compatible with ASTM A 775/A 775M or ASTM A 934/A 934M and epoxy or non-metallic clips with coating damage repaired in accordance with paragraph 3.2.1.2.b. 3.2.1.5 Wire — use a plain or deformed wire as indicated in the contract documents. Ordinary wire can be used for spiral. 3.2.1.5.a The normal cable must comply with ASTM A 82. 3.2.1.5.b Deformed wire size D4 and above must comply with ASTM A 496. 3.2.1.5.c Epoxy wire is compatible with ASTM A 884/A 884M. 3.2.1.5.d For wire with a specified plastic strength exceeding 60,000 psi, fy corresponds to a strain of 0.35%. 3.2.1.6 Welded wire fabrics — Use welded wire fabrics as defined in the contract documents and conforming to one of the following specifications: 301-14 ACI STANDARD 3.2.1.6.a Wire fabric — ASTM A 185, with welded intersections arranged no further than 12 in the direction of the main reinforcement. 3.2.1.6.b Deformed wire fabric - ASTM A 497, with welded intersections distributed not more than 16 inches in the direction of main reinforcement. 3.2.1.6.c Welded epoxy welded material must comply with ASTM A 884/A 884M. 3.2.1.6.d For welded wire fabrics with a specified plastic strength exceeding 60 000 psi, fy corresponds to a strain of 0,35 %. 3.2.1.7 Wire reinforcement supports shall, unless otherwise specified or permitted, use wire reinforcement supports in accordance with Class 1, maximum protection or class 2 protection, as indicated in Chapter 3 — Bar supports of the CRSI Standard Practice Manual. 3.2.1.8 Coated wire reinforcement supports 3.2.1.8.a For epoxy reinforcement — use wire-coated supports coated with dielectric material, including epoxy or other polymer, for a minimum distance of 2 inch from the point of contact with epoxy-coated reinforcement. 3.2.1.8.b Galvanized reinforcement — use galvanized wire reinforcement supports or wire reinforcement supports covered with dielectric material. 3.2.1.9 Prefabricated concrete reinforcement supports — concrete supports with an area of not less than 4 inch shall be used to support reinforcement. 3.2.2 Production Reinforcement — bend the cold reinforcement, unless heating is allowed. Reinforcement made in accordance with the manufacturing tolerances of ACI 117. 3.2.2.2 Welding 3.2.2.2.a During welding reinforcement is specified or permitted, the requirements of ANSI/AWS D1.4 must be met. Do not weld intersecting bars (tack welding) for mounting reinforcement, supports or embedded elements. 3.2.2.2.b After finishing the welds for galvanized (galvanized) or epoxy reinforcement, repair the damage to the coating in accordance with the requirements of paragraph 3.2.1.2.a or 3.2.1.2.b, respectively. Coating welds and steel weld elements used to combine reinforcement with the same material that is used to repair coating damage. 3.3 —Workmanship 3.3.1 Preparation 3.3.1.1 After placing concrete reinforcement must not be devoid of materials harmful to the joint. Reinforcement of rust, mill scale or combination of both will be considered satisfactory provided that the minimum nominal dimensions, nominal mass and minimum mean height of deformation of the test sample from brushed hand wire are not lower than the applicable ASTM specification requirements. 3.3.2 Arrangement 3.3.2.1 Tolerances — place, support and reinforcement clasp, as shown in the design drawings. Do not exceed the tolerances of the places specified in ACI 117 before placing the concrete. Placement tolerances must not reduce the requirements for the cover, except as specified in ACI 117. 3.3.2.2 Reinforcement transfer — If necessary, the transfer of reinforcement beyond the specified placement tolerances in order to avoid interference with other reinforcement elements, wires or integrated elements shall be submitted the resulting reinforcement arrangement for collection. 3.3.2.3 Concrete cover — The minimum concrete sheath for reinforcement, with the exception of extremely corrosive atmospheres, other serious exposures or fire protection, must be as indicated in Table 3.3.2.3. In the case of knotted bars, the minimum concrete cover shall be equal to the equivalent beam diameter, but need not be greater than 2 inches; except for the minimum cover, it must not be less than that specified in Table 3.3.2.3. The equivalent beam diameter shall be based on a single strip of diameter obtained from an equivalent total surface area. Tolerances on the minimum concrete cover must meet the requirements of ACI 117. 3.3.2.4 Reinforcing supports — unless permitted, use the following reinforcement supports: 3.3.2.4.a Reinforcement of bearings supported by ground support or mud on prefabricated concrete reinforcement supports. 3.3.2.4.b Unpenetrated reinforcement site with formwork on reinforcing supports made of concrete, metal or plastic. 3.3.2.4.c Galvanised (galvanised) reinforcement site supported by formwork on wire reinforcing supports which are galvanised, dielectric or dielectric material. Reinforcement and steel elements embedded with galvanized (galvanized) are galvanized (galvanized) or coated with non-metallic materials. 3.3.2.4.e Place epoxy-coated reinforcement from formwork on coated wire reinforcement supports or on reinforcing supports made of dielectric material. Use coatings or materials compatible with concrete. 3.3.2.4.f When prefabricated reinforcing supports with built-in fixing wires or pins are used with epoxy-coated reinforcement, use wires or pins coated with dielectric material. 3.3.2.4.g Reinforcement used as epoxy reinforcement supports is epoxy coated. 3.3.2.4.h Epoxy reinforced walls shall use epoxy-coated spreader rods. Patented combination clips and spreaders used in epoxy-coated reinforcement walls must be made of corrosion-resistant material or coated with dielectric material. 3.3.2.4.i Attach epoxy reinforcement with epoxy-bound wires coated with epoxy or other polymer. 3.3.2.5 Welded wire fabrics — in the case of slabs of the grade, welded wire fabrics up to 2 inches from the edge of the concrete should be scattered. The edges of the laps and the ends of the sheets of fabric are at least one mesh spacing. Unless otherwise permitted, do not stretch the welded wire fabric through systolic joints. Welded support of wire fabric when placing concrete to ensure the required position - SPECIFICATIONS FOR STRUCTURAL CONCRETE Table 3.3.2.3 — Minimum concrete cover for reinforcement Minimum concrete cover for reinforcement, except for extremely corrosive atmospheres, other serious exposures or fire protection, must be as follows: Minimum cover, w. Plates and joists 301-15 Table 3.3.2.8 — Minimum bend diameter Bar size Minimum diameter inside bends 3 to 8 6 bar diameters No. 9, 10 and 11 8 bar diameter No. 14 and 18 10 bar Upper and lower bars for dry conditions No. 11 bars and smaller 3/4 inch. No. 14 and 18 bars 1-1/2 inches. Formed concrete surfaces exposed to earth, water or weather, and over or in contact with wastewater and bearing bottom on the working mat, or support plates grounding cover No. 5 bar and smaller, W31 or D31 wire and 1-1/2 inch smaller no. 6 to 18 bar, W45 or D45 wire 2 in. Beams and columns, formed For dry conditions Stirrups, spirals and ties 1-1/2 inches. Main reinforcement 2 in. Exposed to ground, water, sewage, or stirrup weather and main reinforcement ties 2 in. 2-1/2 inches. Walls For dry conditions No. 11 bars and smaller No. 14 and 18 bars Forming concrete surfaces exposed to the ground, water, sewwater, weather or in contact with the ground Foundations and baseplates On the formed surfaces and bottoms of the bearing on the concrete working mat On unformed surfaces and bottoms in contact with the ground The upper part of the foundations Above the top burns 3/4 inch 1-1/2 in. 2 in. 2 in. 3 in. Do not place welded wire fabric on the species, and then lift to a position in the concrete. 3.3.2.6 Pegs — grazing and using templates to place column pins, unless otherwise permitted. 3.3.2.7 Splices — perform the spaces indicated in the project drawings, unless otherwise permitted. No mechanical reinforcement floats not illustrated in project drawings shall be used by the Architect/Engineer. Remove the reinforcing coating in the mechanical weave area if required by the weld manufacturer. After installation of mechanical sings for galvanized (galvanized) or epoxy reinforcement, repairs the damage to the coating and the areas of the removed coating in accordance with paragraphs 3.2.1.2.a. or 3.2.1.b. Layers of exposed mechanical splice parts used on coated rods of the same material, which is used to repair damage to the coating. 3.3.2.8 Bending or straightening in the field , where permitted, bend or straighten reinforcement partially embedded in concrete in accordance with the following procedures. Rebar sizes No. 3 to No. 5 can be cold-bent for the first time provided that the temperature of the reinforcing bar exceeds 32 F. For other bar sizes, heat the reinforcing bars before bending. 3.3.2.8.a Preheating — apply heat in any way that does not harm the rebar material or damage the concrete. Preheat the rebar length of at least five bar diameters in each direction from the center of the bend, but do not extend the preheating under the concrete surface. Do not allow the temperature of the reinforcing bar at the concrete contact to exceed 500 F. Preheating temperature of the reinforcing bar is between 1100 and 1200 F. Maintain the preheating temperature until bending or straightening is complete. Measure the preheating temperature using temperature measuring crayps, contact pyrometer or other acceptable methods. Heated reinforcing bars shall not be artificially cooled until the bar temperature is less than 600 F. 3.3.2.8.b Bend diameters — The minimum internal bend diameter must comply with the requirements of Table 3.3.2.8, unless otherwise permitted. In addition, the beginning of the bend must not be closer to the concrete surface than the minimum bend diameter. 3.3.2.8.c Repair of bar coatings — after field bending or straightening of galvanized galvanized (galvanized) or epoxy reinforcing bars, damage to the repair coating in accordance with paragraph 3.2.1.2.a or 3.2.1.2.b. 3.3.2.9 Reinforcement field cutting — Reinforcement must not be cut in the field unless expressly permitted. Do not flame cutting epoxy reinforcement. 3.3.2.9.a In the case of cutting zinc coated (galvanised) rebar in a field, cover the ends of the rods with a zinc-rich preparation used in accordance with the manufacturer's recommendations and repair any damage to the coating in accordance with point 3.2.1.2.a. 3.3.2.9.b When the epoxy-coated reinforcing bars are cut in the field, cover the ends of the bars with the same material, which is used to repair coating damage and repair any damage to the coating in accordance with 3.2.1.2.b. 3.3.2.10 Reinforcement via expansion joint — do not continue reinforcement or other embedded metal elements connected to concrete through connections Dowels connected only on one side of the pond and water stops extend through the connector. SECTION 4 — CONCRETE MIXTURES 4.1 — General 4.1.1 Description — This section covers the requirements for concrete production and supply. 4.1.2 Submission 4.1.2.1 Proportions of the mixture — indicate the proportions and characteristics of the concrete mixture. 301-16 4.1.2.2 Mixture proportion data — send field test records used to determine the required average strength according to 4.2.3.3 — Average compressive strength required. Submit for acceptance data from the tests used to determine the mean compressive strength of the mixture in accordance with 4.2.3.4 — Documentation of the required mean compressive strength. 4.1.2.3 Concrete materials — Submit the following information on concrete materials, together with evidence demonstrating compliance with 4.2.1 — Materials: • For aggregates: types, mine sites or quarrying sites, manufacturer names, slopes, specific weighing and no more than 90-day evidence showing compliance with 4.2.1 – Materials; • For admixtures: types, brand names, manufacturers, manufacturer's technical data sheets and certification data; and • For water and ice: a source of supply. 4.1.2.4 Basis for field tests — Where field test documentation is used as a basis for selecting the proportions for the concrete mixture, submit data on the materials and proportions of the mixtures together with the results of the tests confirming compliance with the specified requirements. 4.1.2.5 Corrections to the proportions of the mixture — any adjustment of the proportions of mixtures or changes in materials, including supporting documentation, made during the Work. 4.1.2.6 Floor concrete — present assessments and test results verifying the adequacy of the concrete, to be placed on floors where the content of cement materials is less than the minimum specified in Table 4.2.2.1. 4.1.2.7 Calcium chloride — If calcium chloride is desired, an application containing data demonstrating compliance with 4.2.2.5 — Admixtures shall be submitted. 4.1.2.8 Volumetric dosing — If it is desirable to produce concrete by volumetric addition, an application must be submitted together with a description of the proposed method. 4.1.2.9 Discharge time — If it is desirable to exceed the time required to discharge the concrete required by ASTM C 94, a request must be submitted together with a description of the precautions to be taken. 4.1.3 Quality control 4.1.3.1 Keeping records verifying the materials used are specified and accepted types and sizes and comply with requirements 4.2.1 — Materials. 4.1.3.2 Ensure that the production and delivery of concrete complies with requirements 4.3.1 — Measurement, dosing and mixing and 4.3.2 — Delivery. 4.1.3.3 Ensure that the concrete produced has certain characteristics in the freshly mixed state and that it is maintained during transport and delivery. 4.1.4 Storage and handling of materials 4.1.4.1 Cement materials — storage of cement materials in dry, airtight buildings, containers or silos that exclude contamination. 4.1.4.2 Aggregates – storing and handling aggregates in a way that avoids segregation and prevents contamination materials or other aggregate sizes. Store ACI STANDARD STANDARD units Freely. Do not use chillers containing frozen lumps. 4.1.4.3 Water and ice — protection of water and ice mixing from contamination during storage and delivery. 4.1.4.4 Admixtures — protect stored admixtures from contamination, brewing or damage. Provide mixing equipment for admixtures used in the form of suspensions or non-bored solutions to ensure accurate distribution of ingredients. Protect liquid admixtures from freezing and temperature changes that could negatively affect their properties. 4.2 —Products 4.2.1 Materials 4.2.1.1 Cement materials — Cement materials comply with ASTM C 150 Type I or Type II. Alternatively, use one or a combination of the following cement materials, if specified or permitted: 4.2.1.1.a Portland cement compliant with ASTM C 150. 4.2.1.1.b Mixed hydraulic cement compliant with ASTM C 595. 4.2.1.1.c Pozzolanic mineral admixture compatible with ASTM C 618. Where fly ash is used, the minimum quantity shall be 15 % by weight of the total cement materials, unless otherwise specified. 4.2.1.1.d Ground granulated large-scale slag compatible with ASTM C 989. 4.2.1.1.e Silica smoke compatible with ASTM C 1240. Cement materials of the same brand and type and from the same production plant as cement materials used in concrete represented by field test records submitted or used in test mixtures shall be used. 4.2.1.2 Aggregates — aggregates comply with ASTM C 33, unless otherwise specified. Where a single size or combination of two or more coarse aggregate sizes is used, the final classification must comply with the ASTM C 33 classification requirements, unless otherwise specified or permitted. Aggregates used in concrete are sourced from the same sources and have the same size ranges as aggregates used in the concrete represented by the historical data submitted or used in the sample mixtures. 4.2.1.3 Water and ice — Mixing of water into concrete and water used for ice production must comply with ASTM C 94. 4.2.1.4 Admixtures — If necessary or authorised, admixtures must meet the following requirements: • intake admixtures for air-snatching – ASTM C 260; • Chemical admixtures – ASTM C 494; • Chemical admixtures for the production of passing concrete – ASTM C 1017; and • Calcium chloride – ASTM D 98. The admixtures used in concrete are the same as in concrete represented by the field test records submitted or used in test mixtures. 4.2.1.5 Change of materials — where a brand, it is proposed to change the type, size or source of cement materials, aggregates, water, ice or admixtures, new field data or data from new test mixtures or evidence indicating that the change will not adversely affect the essential characteristics of the specification for conical table 4.2.2.1 — Minimum requirements for the content of cement materials for Nominal maximum aggregate size, w. Minimum content of cement materials, lb/yd3 1-1/2 470 Table 4.2.2.4 — Air content* of air* concrete for different sizes of coarse aggregate 1 520 Nominal maximum aggregate size, in. Less than 3/8 3/4 540 3/8 3/8 610 Note: When using fly ash, the quantity must not be less than 15 % or more than 25 % by weight of the total cement materials. concrete – submission for collection before use in concrete. 4.2.2 Performance and construction requirements 4.2.2.1 Cement content — The content of cement materials must be suitable for concrete to meet certain requirements regarding strength, material-to-water ratio and finishing capacity. In the case of concrete used in floors, the content of cement materials must not be less than that indicated in Table 4.2.2.1, unless otherwise specified. Acceptance of a lower content of cement materials will depend on verifying that concrete mixtures with a lower content of cement materials meet certain strength requirements and produce concrete of equal finish, appearance,

durability and surface hardness. If the finish quality history is not available, evaluate the proposed mixture by placing the concrete in the plate at the design site using design materials, equipment and personnel. The plate must be at least 8 x 8 feet long and of acceptable thickness. The decrease must not exceed a specified decrease. Submit the evaluation results for approval. 4.2.2.2 Breakdown — unless otherwise specified or permitted, the concrete at the point of delivery is 4 in. Determine the decrease by ASTM C 143/C 143M. Inheritance tolerances must meet the requirements of ACI 117. If a type I or II plasticising admixture complying with ASTM C 1017 is used, or if a type F or G water-reducing admixture with a long range complying with ASTM C 494 can increase the concrete drop, the concrete has a drop of 2 to 4 inches before admixture and a maximum collapse of 8 at the delivery point after admixture, unless otherwise specified. 4.2.2.3 Size of coarse aggregate — Unless otherwise specified or possible, the nominal maximum size of coarse aggregate shall not exceed three-quarters of the minimum clear spacing between reinforcing bars, one fifth of the narrowest dimension between the sides of the forms, or one-third of the thickness of plates or accessories. 4.2.2.4 Air content — unless otherwise specified, concrete must be scratched with air. Unless otherwise specified, the air content of the point of delivery must comply with the requirements of Table 4.2.2.4 for severe exposure. For concrete with compressive strengths above 5000 psi, the air content indicated in Table 4.2.2.4 may be reduced by 1%. Measure the air content according to ASTM C 231, C 173 or C 138. 301-17 Air content,† percent Severe moderate exposure Mild exposure 9 7 7 7 7.5 6 4.5 1/2 7.5 5 4 3/4 1 6 6 5 4.5 3 5 5 3 1-1/2 5.5 4.5 2.5 2 5 4 2 3 4.5 3.5 1.5 5 6 4 3 1 * Measured according to ASTM C 231, C 173, or C 138. † Tolerance air quality ±1-1/2%. 4.2.2.5 Admixtures — when are specified in the contract documents for each part of the work, use specific types. The use of calcium chloride or other admixtures containing chloride ions is subject to restrictions in 4.2.2.6 — concentration of chloride ions. 4.2.2.6 Concentration of chloride ions — Unless otherwise specified, the maximum water-soluble concentrations of chloride ions in the cured state between the ages of 28 and 42 days, which come from ingredients including water, aggregates, cement materials and admixtures, shall not exceed the limits of Table 4.2.2.6. During the test to determine the ion content of water-soluble chloride, the test procedures must comply with ASTM C 1218/C 1218M. The member type described in Table 4.2.2.6 applies to the Work as indicated in the Order Documents. 4.2.2.7 Concrete temperature — when the average of the highest and lowest temperatures between midnight and midnight is to fall below 40 °F for more than three consecutive days, deliver the concrete to the following minimum temperatures indicated for: • 55 F for sections less than 12 in. in the smallest dimension; • 50 F for sections 12-36 inches in the smallest dimension; • 45 F for sections 36-72 inches in the smallest dimension; and • 40 F for sections larger than 72 inches in the smallest dimension. The concrete temperature as it is located must not exceed these values by more than 20 F. These minimum requirements may be terminated when temperatures above 50 °F occur during more than half the duration of 24 hours. Unless otherwise specified or permitted, the temperature of the delivered concrete shall not exceed 90 F. 4.2.2.8 The ratio of strength and cement materials of water — compressive strength and, if necessary, the ratio of water-cement to water materials for each part of the work as specified in the Procurement Documents. 301-18 Standard ACI Table 4.2.2.6 — Maximum permissible ion content of partial chloride Type Partial compressed concrete Treated concrete exposed to chloride at service Table 4.2.2.8 — Requirements for concrete exposed to deicing substances Maximum water-soluble chloride ion content (Cl-) in concrete, percentage by weight of cement Maximum percentage of total cement materials by weight* Cement materials 0.06 Volatile ash or other pozzolans compatible with ASTM C 618 0.15 ASTM C 989 50 ASTM C 1240 10 Total quantity of fly ash or other pozzolans, silica slag and smoke 50† Total quantity of fly ash or other silica ash and vapours 35† Reinforcing concrete which will be dry or protected from moisture in operation 1.00 Other reinforced concrete structure 0.30 4.2.2.8.a When required for concrete exposed to narick chemicals, maximum mass of fly ash, natural pozzolans, silica vapours or ground granular which is contained in the concrete does not exceed the percentages of the total cement materials given in Table 4.2.2.8. 4.2.2.8.b Unless otherwise specified, the basic strength requirements for 28 days compressive strength established on cylindrical 6 x 12 inch samples made and tested in accordance with ASTM C 31/C 31M and C 39. 4.2.3 Proportion of concrete to proportion up to 4.2.2 — Performance and design requirements to ensure feasibility and consistency so that concrete can be easily worked in and around reinforcement without segregation or bleeding, and to ensure an average compressive strength suitable for meeting the requirements of acceptance 1.6.7.1 — Standard moulded and cured designs. If the production plant has records of field tests carried out during the last 12 months and covering a period of not less than 60 calendar days for a concrete class within 1000 psi of that specified for the work, calculate the standard deviation and determine the required average strength fcr' in accordance with items 4.2.3.2 and 4.2.3.3.a. If field test records are not available, select the required mean strength from Table 4.2.3.3.b. 4.2.3.2 Standard deviation 4.2.3.2.a Field test data — field test records used to calculate the standard deviation represent the materials, quality control procedures and climatic conditions similar to those expected at work. Changes in materials and proportions in concrete represented in the test documentation shall not be more limited than changes in the proposed work. Test records must comply with one of the following values: • Data from one group of at least 15 consecutive compressive strength tests of the same proportions of the mixture. • Data from two groups of subsequent compressive strength tests for a total of at least 30. Neither group consists of less than 10 studies. 4.2.3.2.b Standard deviation — calculate the standard deviation of the strength test records as follows: • For one group of subsequent test results: 25 * Total cement material also includes ASTM cement C 150, C 595 and C 845. The maximum percentages above include: (a) fly ash or other pozzolans present in mixed cement type IP or I(PM), ASTM C 595; (b) slag used in the manufacture of MIXED CEMENT IS or I(SM), ASTM C 595; and (c) Silica smoke, ASTM C 1240, present in mixed cement. † or other insulated ash and silica smoke shall represent not more than 25 and 10 % of the total weight of the cement materials. $s = \left[\sum (X_i - \bar{X})^2 / (n - 1)\right]^{1/2}$ (4-1), where: s = standard deviation; n = number of test results taken into account; X = mean n of the test results taken into account; and Xi = individual test result. • For two consecutive test groups: $s = \left[\frac{(n_1 - 1)(s_1)^2 + (n_2 - 1)(s_2)^2}{n_1 + n_2 - 2}\right]^{1/2}$ (4-2), where: s = standard deviation for both combined; s1, s2 = standard deviations for groups 1 and 2, respectively, calculated in accordance with (4-1); and n1, n2 = number of number results in groups 1 and 2. 4.2.3.3 Required mean compressive strength — calculate the required mean compressive strength fcr' for a specific concrete class according to one of the following: 4.2.3.3.a Use the standard deviation calculated in accordance with 4.2.3.2 determination of the required mean compressive strength as follows: f cr' = f c' + 1.34 ks (4-3) f cr' = f c' + 2.33ks – 500 (4-4), where: fcr' = mean compressive strength required; fc' = specified compressive strength; k = coefficient in Table 4.2.3.3.a to increase the standard deviation if the total number of tests is less than 30; and s = standard deviation calculated according to 4.2.3.2. Use the larger of the two fcr' values calculated according to 4.2.3.3.a. SPECIFICATIONS FOR STRUCTURAL CONCRETE Table 4.2.3.3.a-factor k for increasing the standard deviation for the number of tests considered to be the total test no. k for increasing the standard deviation 15 1,16 20 1,08 25 30 or more 1.00 Note: Linear interpolation for an intermediate number of tests is permitted. 301-19 Table 4.2.3.3.b — Required mean compressive strength fcr' Specified strength value fc', psi Required mean compressive strength fcr', psi Less than 3000 fc' + 1000 3000 up to 5000 fc' + 1200 More than 5000 up to 10,000 fc' + 1400 More than 10,000 to 15,000 fc' + 1900 *When data are not available to determine the standard deviation. 4.2.3.3.b If field test records are not available, select the required mean compressive strength fcr' from Table 4.2.3.3.b. 4.2.3.4 Documentation of the required mean compressive strength — Documentation indicating the proposed concrete proportions will produce an average compressive strength equal to or greater than the required mean compressive strength, consisting records or a test mixture. 4.2.3.4.a Field test data — if field test data are available and represent one group of at least 10 consecutive strength test mixture, using the same materials, under the same conditions and covering a period of not less than 60 days, check that the average field test results are equal to or exceed fcr'. Submit the proportions of the mixture, together with the field test data, for acceptance. If the field test data represent two groups of strength tests for two mixtures, plot the average strength X1 and X2 of each group compared to the ratio of the water-cement materials of the relevant proportions of the mixture and interpolate between them to determine the required proportions of the mixture for fcr'. 4.2.3.4.b Test mixtures — determination of the proportion of mixtures on the basis of test mixtures according to the following requirements: • Use materials and combinations of materials proposed for work. • Determine the required mean compressive strength in accordance with if relevant field test data are available, or use Table 4.2.3.3.b. • Make at least three test mixtures in accordance with each design. Each test mixture has a different content of cement material. Choose a ratio of water cement materials that will produce a range of compressive strengths covering the required average compressive strength fcr'. • The proportion of test mixtures to cause a drop within 3/4 of an inch from the maximum air-generated concrete and, in the case of air-irritated concrete, an air content within 0.5 % of the required air content indicated in Table 4.2.2.4. • The temperature of the freshly mixed concrete shall be recorded and shall be within 10 °F of the intended maximum temperature of the mixed and delivered concrete. • For each test mixture, three compressive strength cylinders must be made and hardened for each test age in accordance with ASTM C 192/C 192M. Compression strength test according to ASTM C 39 in 28 days or at the test age specified in the Contract Documents. • Based on the results of these studies, plot a curve showing the relationship between the ratio of water cement materials and compressive strength. • From the water-to-cement ratio curve to compressive strength, select the ratio of water cement materials that can be used to determine the proportion of the mixture, unless lower water to cement materials ratio is specified in 4.2.2.8 — Strength ratio and water cement materials. Determine the proportions of the mixture so that the maximum ratio of water-cement materials is not exceeded when the drop is at the maximum specified. 4.2.3.5 Field verification of the adequacy of the selected proportions of the mixture — Using the materials and proportions of the mixture authorised for use in the Work, check that the concrete can be properly positioned using the intended method of placement. Place the concrete mixture using design equipment and personnel. Check that the precipitation and air content obtained in the form is acceptable. If necessary, make appropriate adjustments to the methods of placement or proportion of the mixture. Any change in the proportion of the mixture should be sent to the architect/engineer for inspection and acceptance. 4.2.3.6 Changes to concrete mixtures — When 15 consecutive compressive strength test results are available in the field, calculate the actual mean compressive strength and standard deviation. Calculate the corrected value for the required mean compressive strength fcr' according to 4.2.3.3.a. Check that both requirements 1.6.7.1 — Standard moulded and hardened formulas are met. 4.2.3.6.a When the actual mean compressive strength X exceeds the changed value fcr' and requirements 1.6.7.1 -Standard moulded and hardened designs are met, the required mean compressive strength fcr' may be reduced if performance and requirements are met 4.2.3.6.b If the actual mean compressive strength X is less than the changed fcr' value or if the in 1.6.7.1 — Standard moulded and hardened designs are not met, take immediate steps to increase the average compressive strength of concrete. 301-20 STANDARD ACI 4.2.3.6.c Before placing in the work, the corrected proportions of the mixture shall be submitted for acceptance in accordance with the requirements of this reference specification. 4.3 — Execution 4.3.1 Measurement, dosing and mixing — Production plants produce concrete of a certain quality and meets the requirements of this reference specification. 4.3.1.1 Finished concrete mixed and produced on site, unless otherwise specified, measure, batches and mix concrete and concrete materials in accordance with ASTM C 94. 4.3.1.2 Concrete produced by well and continuous mixing — If concrete made in volumetric sub-body and continuous mixing is specified, it shall comply with ASTM C 685 requirements and comply with the requirements of this reference specification. 4.3.1.3 Prepackaged dry materials used in concrete — When packed dry combo materials are used, they must comply with ASTM C 387 requirements and meet the requirements of this reference specification. 4.3.2 Delivery — Concrete has certain characteristics in a freshly mixed state at the point of placement. Transport and delivery of concrete in quantity production complying with ASTM C 94. 4.3.2.1 Fall adjustment — When the concrete reaches the point of delivery with a drop below what will result in a specific drop at the point of placement and is not suitable for placing in this drop, the drop may be adjusted to the required value by adding water to the quantity permitted in the accepted proportions of the mixture, unless the architect/engineer decides otherwise. The addition of water is compatible with ASTM C 94. Do not exceed a certain ratio or decrease in water cement materials. Do not add water to concrete supplied in equipment that is unacceptable for mixing. After plasticizing or high water reduction, admixtures are added to the concrete in place to achieve liquid concrete, do not add water to the concrete. Measure the air content of the air-irritated concrete after precipitation correction to check compliance with the specified requirements. 4.3.2.2 Discharge Time - The discharge completion time is compatible with ASTM C 94, unless otherwise permitted. When discharge is permitted more than 90 minutes after the batch or after turning the drum at 300 revolutions, check that the air content of the temperature of the concrete is determined. SECTION 5 — HANDLING, PLACING AND CONSTRUCTING 5.1 — General Description 5.1.1 — This section covers the production of in-place cast structural concrete. Methods and procedures for obtaining concrete quality by properly handling, introducing, finishing, curing and repairing surface defects are included. 5.1.2 Submitted 5.1.2.1 When submitting the following data, unless otherwise specified: a. Field Control Test Reports - Maintain and submit accurate records Reports. B. Transport equipment - Submit a description of the transport equipment. c. Temperature measurement – Submit the proposed method for measuring changes in concrete surface temperature. d. Methods of repair – Where stains, rust, eruption and surface deposits must be removed as described in 5.3.7.7, the proposed method of disposal shall be submitted. E. Finisher Qualifications – Submit the qualifications of the final contractor and the contractors who will complete the Work. 5.1.2.2 If necessary, send the following data: a. Drawings and data - Submit drawings and store data to review as required by contract documents. B. Placement notification – When contract documents require prior notification of a specific placement, send a notification at least 24 hours in advance. c. Pre-placement requirements - request, if necessary, the adoption of long-distance deposition. d. Wet deployment - An application for protection must be submitted in case of planning to be placed in rainy weather. E. Placing in hot conditions – if concrete exceeding 90 F is placed, as described in 5.3.2.1.c, submit, if necessary, an application for placement together with the proposed precautions. F. Matching sample finish - If required by contract documents, send a sample finish as described in section 5.3.3.2. G. Surface exposed from aggregation — when the surface of exposed aggregate is determined and for the use of a chemical retarder, the manufacturer's specifications and data for the retarder and the proposed method of use of the retarder shall be provided. h. 5.1.2.3 If alternative solutions are proposed, the following particulars shall be provided: a. Construction connections – Send information to accept the proposed location and treatment of construction connections proposed but not indicated in the project drawings. B. Double-door plates — where a binder other than cement mortar is proposed, the technical data and the manufacturer of the binder shall be provided. c. Placing under water - Where it is planned to be placed underwater, an application for acceptance of the proposed method shall be submitted. d. Systolic joints — Where systolic joints other than those indicated in the procurement documents are proposed, an application for a location must be submitted. E. Moisture preservation method — where a moisture preservation method other than specified in 5.3.6.4.a. is proposed by e, an application for acceptance of the proposed method must be submitted. f. Coated ties — in the case of coating of bundles described in 5.3.7.2, it is proposed to exclude the requirement to fasten the fastened holes, to submit a proposed description of the coated ties. G. Repair materials — Where the repair material described in section 5.2.1.3 is proposed, the specifications of the repair material, the data proposed patching material and the proposed preparation and application procedure. 5.1.3 Specifications for the delivery, storage and operation of concrete construction 5.1.3.1 Delivery — Concrete site within the time limits required in paragraph 4.3.2.2. 5.1.3.2 Storage and handling — storage and handling of products in order to maintain the original quality. Do not use products stored outside of the recommended shelf life. 5.2 — Products 5.2.1 Materials 5.2.1.1 Curing compounds — use hardening compounds compliant with ASTM C 309 or ASTM C 1315. 5.2.1.2 Waterproof sheet materials — use waterproof sheet materials compliant with ASTM C 171. 5.2.1.3 Proprietary patching materials — Use acceptable proprietary patching materials in accordance with 5.3.7.6 — Repair materials other than portland cement mortar used on site. 5.2.1.4 Binding grout — apply binding mortar in accordance with 5.3.7.4 — Preparation of binding leaven. 5.2.1.5 Portland-cement repair mortar with mixed terrain — use repair mortar according to 5.3.7.5 — Preparation of mixed Portland cement mortar. 5.2.2 Performance and construction requirements 5.2.2.1 Structural joints — Construction connections which are designated but not illustrated in the project drawings in accordance with point 2.2.2.5. Do not impair the strength of the structure. 5.3 — Workmanship 5.3.1 Preparation 5.3.1.1 Do not place concrete until the data, materials and proportions of the mixture have been accepted. 5.3.1.2 Remove the hardened concrete and foreign materials from the inner surfaces of the transport equipment. 5.3.1.3 Before placing concrete in the moulds, the following steps must be carried out: • Meet the requirements of Section 2 — Formwork and formwork accessories; • Remove snow, ice, frost, water and other foreign materials from the surfaces, including reinforcing and embedded elements on which concrete will be placed; • Meet the reinforcement steel deployment requirements set out in Section 3 - Reinforcement and Reinforcement Supports; • Position and secure in-place expansion materials, anchors and other embedded components; and • Get approval of the finished preparation. 5.3.1.4 Before placing the concrete slab on the grade, clean the foreign materials in the subclass and complete the following: • The subclass must be well drained and of a uniform capacity; • The density of subclassified soils in place is uniform throughout the area and at least the minimum required in the procurement documents; • Subdivisions must be free of frost or ice; and • Podgrade must be moist without free water and without muddy or soft stains. 301-21 5.3.1.5 When high ambient temperature conditions protect concrete immediately after placement or finishing, provisions for the placement of concrete for winds, shading, ringing, sprinkling, pond or wet covering must be submitted. 5.3.1.6 Under the ambient temperature conditions described in 4.2.2.7 — The concrete temperature shall be before the concrete is laid in order to maintain the concrete temperature specified in 5.3.2.b. Using heating, coating or other means suitable for maintaining the required temperature without overheating or drying the concrete due to heat concentration. Do not use radiators unless precautions are taken to prevent concrete from being exposed to gases containing carbon dioxide. 5.3.2 Concrete distribution 5.3.2.1 Weather conditions 5.3.2.1.a Rainy weather — To start placing concrete while rain, sleet or snow falls, unless adequate protection is provided and, where required, obtaining protection approval. Do not allow the amount of water from rainwater to increase or damage the concrete surface. 5.3.2.1.b Cold weather — Concrete and ambient temperatures must meet minimum temperature requirements 4.2.2.7 — Concrete temperature; 5.3.2.1.c Heat — the temperature of the concrete in the position placed must not exceed 90 °F, unless otherwise permitted. Loss of precipitation, flash or cold connections due to the temperature of the concrete in the position placed will not be allowed. When the concrete temperature exceeds 90 F, obtain approval, if necessary, of the proposed precautions. When the temperature of steel reinforcement, set or mold is greater than 120 F, reinforcement of fog steel, sediment and mold with water immediately before placing the concrete. Before placing the concrete, remove standing water. 5.3.2.2 Transporting concrete from the mixer as quickly as possible by means of methods to prevent segregation or loss of components and ensure the required quality of concrete. Do not use aluminum pipes or chutes. 5.3.2.3 Transport equipment — use an acceptable transport equipment of a size and design that prevents cold connections. Clean transport equipment before each placement. 5.3.2.3.a Use conveyor belts which are horizontal or on a slope which do not cause excessive segregation or loss of components. Protect the concrete to minimize drying and the effects of rising temperatures. To prevent segregation, use an acceptable outlet partition or hopper at the end of the discharge. Do not allow clogging to cling to the length of the strap. 5.3.2.3.b Use chute with metal or metal lining with rounded bottom and inclined between one vertical to two horizontal and one vertical to three horizontal. Chutes of more than 20 ft in length and chutes not complying with the inclination requirements may be used provided that the discharge is in the tank before being distributed in the forms. 5.3.2.3.c Use the pumping equipment that allows placement that prevents the formation of cold joints and prevents segregation in discharge from pumped concrete. 301-22 Standard table ACI 5.3.2.5 — Range of characteristics, performance and applications of internal vibrators Column 1 Column group 2 Column 3 Head diameter, in. Frequency, vibration per min. Column 4 Column 5 Eccentric Medium Moment, Amplitude in.-lb, in. Column 6 Centrifugal Force, lb Column 7 Column 8 Radius of Action, in. Speed of concrete placement, yd3/h per vibrator column 9 Application 1 3/4 to 1-1/2 9000 to 15,000 0.03 to 0.10 0.015 to 0.03 100 up to 400 3 to 6 1 to 5 Plastic and concrete flow in very thin elements and closed places 2 1-1/4 to 2-1/2 8000 to 12 500 0.08 to 0.25 up to 0.04 300 to 900 5 to 10 3 to 10 Plastic concrete in thin walls, columns, beams, prefabricated piles, thin plates and along construction connections 6 to 20 Rigid plastic concrete (< 3 inch) in general construction, such as walls, columns, beams, prestressed piles, and heavy slabs 3 2 to 3-1/2 8000 to 12,000 0.20 to 0.70 0.025 to 0.05 700 to 2000 7 to 14 3 to 6 7000 to 10 500 0.70 to 2.5 0.03 to 0.05 1500 to 4000 12 to 20 15 to 40 5 5 to 7 5500 to 8500 2.25 to 3.50 0.04 to 0.08 2500 to 6000 16 to 24 25 to 50 Mass and structural concrete of 0 to 2 in. slump deposited in quantity up to 4 yd3 in relatively open forms of heavy construction Mass concrete in gravity dams, large piers, massive walls, etc. Column 3 - While the vibrator works in concrete. Column 4 — calculated eccentric moment ef, in.-lb, where e = distance from eccentric centre of gravity to center of rotation, in., and f = eccentric gravity force, lb. Column 5 — measured or calculated peak amplitude when operating in the air (deviating from the resting point), a = (W + w), among others, where W = mass of the shell and other non-exploding parts, lb and w = eccentric mass, lb. Column 6 - Calculated centrifugal force of the vibrator, F = 4π2n2 ew/g, lb, where n = vibrator frequency when working in concrete, cycles/s and g = acceleration due to gravity, 386.1 inch/s2. Column 7 – The radius over which the concrete is fully consolidated. Column 8 — assumes that the insertion intervals are 1-1/2 times the radius of action and that the vibrator works 2/3 of the time in which the concrete is placed. Columns 7 and 8 — These ranges reflect vibrator capacity, the feasibility of the mixture, the required deflected consolidation, and other structural conditions. 5.3.2.4 Deposition — place the concrete continuously in a single layer or in layers so that fresh concrete settles on the concrete in a place that is still plastic. Do not place fresh concrete on concrete which has been hardened sufficiently to cause seams or planes of weakness within the section, unless the design requirements of section 5.3.2.6 are met. Do not use concrete that has surface dried, partially hardened or foreign material. When temporary spreaders are used in forms, remove spreaders because their service becomes unnecessary. Spreaders made of metal or concrete may remain in place if prior approval has been obtained. Do not place concrete on poles and walls until the concrete in the columns and walls is no longer plastic and is in place for at least 1 hour. Deposit concrete as close as possible to the final position to avoid segregation. Place concrete for beams, girders, brackets, column letters, haunches and drop panels at the same time as concrete for slabs. When underwater is required or permitted, place the concrete in an acceptable manner. Deposit fresh concrete so that the concrete enter the mass of the previously placed concrete from the inside, displacing the water with minimal disturbance of the concrete surface. 5.3.2.5 Consolidation – consolidation of concrete by vibration. Carefully work the concrete around the and embedded objects and in the corners of forms, eliminating air and stone pockets that can cause honeycombs, pitting, pitting, the plane of weakness. Use internal vibrators of the largest size and power that can be used correctly in operation, as described in Table 5.3.2.5. Employees have experience in using vibrators. Do not use vibrators to move concrete in forms. 5.3.2.6 Construction and other combined connections — Locate the structural joints indicated in the design drawings or adopted in accordance with 5.1.2.3.a. The structural joints created must meet the requirements of 2.2.2.5. Remove the laitance and thoroughly clean and moisten the structural joints before placing fresh concrete. When binding is required or permitted, it must be achieved with one of the following objectives: • Use an acceptable adhesive applied in accordance with the manufacturer's recommendations; • Use an acceptable surface retarder in accordance with the manufacturer's instructions; • Bead surfaces in an acceptable way that uniformly exposes aggregate and leaves no laitance, loose aggregate particles or damaged concrete on the surface; or • Use portlandzno-cement mortar of the same proportions as the mortar in concrete in an acceptable manner. 5.3.3 Finishing of formed surfaces 5.3.3.1 General — After removal of the moulds, each surface formed must be reported, one or more finishes described in 5.3.3.2 — Matching sample finish, 5.3.3.3 — Finishes after casting or 5.3.3.4 — Rubbed finishes. When contract documents do not specify finishes, finish surfaces as required by 5.3.3.5 - Unspecified finishes. 5.3.3.2 Matching sample finish — when finishing is required in the order documents to fit the technical data of the STRUCTURAL CONCRETE provided to the Contractor to the sample panel, play the sample finish on an area of at least 100 ft2 in a place designated by the architect/engineer. Get approval before proceeding with this finish in specific locations. 5.3.3.3 Finishes after casting — apply materials to shape to meet requirements 2.2.1.1 — Cast materials. Unless otherwise specified, finish the shape after throwing according to the following requirements: 5.3.3.3.a Coarse finish - holes and defects patch. Chip or wipe off fins exceeding 1/2 inch in height. Leave surfaces with a texture that is submitted by forms. 5.3.3.3.b Smooth finish — unseal holes and defects. Remove fins more than 1/8 inch high. 5.3.3.3.c Architectural finishes — creation of architectural finishes, including special texture finishes, finishes of expert aggregation and aggregation transfer finishes according to section 6 — architectural concrete. 5.3.3.4 Wiped finishes - Delete forms already in accordance with 2.3.2 - Delete forms. Finish off one of the following finishes on concrete that has a smooth shape finish: 5.3.3.4.a Smooth wiping finish - removing forms according to point 2 — Accessories for formwork and making the necessary corrections. Finish the newly hardened concrete no later than the day after removing the formwork. Moisten the surface and rub it with carborundum brick or other until a uniform color and texture are created. Do not use cement mortar other than cement paste taken from the concrete itself in the friction process. 5.3.3.4.b Cleaned of mortar – start cleaning after finishing and making adjacent cleaning surfaces available. Do not clean the surface as work progresses. Moisten the surface and apply a mortar consisting of one part Portland cement and one and a half pieces of fine sand with enough water to obtain the consistency of thick paint. Add white cement if necessary to match the color of the surrounding concrete. Scrub the mortar into empty spaces and remove excess mortar. When the mortars whiten, rub the surface and keep the surface moist for 36 hours later. 5.3.3.4.c the cork finish – perform the necessary repairs. Remove ties, burrs and fins. Moisten the surface and apply a stiff mortar from one part of Portland cement and one part of fine sand, filling the voids. Add white cement if necessary to match the color of the surrounding concrete. Use enough water to get a rigid consistency. Press the mortar into empty spaces by grinding the surface with a slow-speed grinder. Produce the final cork finish with rotating motion. 5.3.3.5 Unspecified finishes — If the procurement documents do not specify a specific finish for the concrete surface, the following finishes shall be used: • Finish in a more high form on concrete surfaces not exposed to public view; and • Smooth finish on concrete surfaces exposed to the public. 5.3.4 Finishing of ceasing surfaces 301-23 5.3.4.1 Placing concrete at a rate which makes it possible to spread, straighten and weigh or delete before the water is displayed. Strike the smooth top of faces, buttboards, horizontal offsets, and other similar unformed surfaces and arrange them to a texture that matches the finish of the adjacent formed surface. Finishing plate surfaces according to one of the finishes in section 5.3.4.2 — finishes and tolerances, according to the contract documents. Use qualified flat finishers accepted by the architect/engineer. 5.3.4.2 Finishes and tolerances 5.3.4.2.a Scratched finish – place, consolidate, remove and level concrete, eliminating high stains and low places. Thicken the surface with stiff brushes or rakes before the last set. Produce a finish that meets the aci 117. 5.3.4.2.b floated finish - place, consolidate, reassuble and level concrete, eliminating high and low places. Do not continue to work with concrete until it is ready to be lifting. Start floating with a hand float, float equipped with float shoes or powered disc float when the shine of the venting water has disappeared and the surface has stiffened on to allow the operation. Produce a finish that meets conventional ACI 117 straight tolerance requirements, then immediately fill the plate with a uniform texture. 5.3.4.2.c Cup finish — concrete float surface and then power pacy surface. Hand-trowel surface smooth and free of trowel marks. Continue Continue until the ringing tone is generated as you sleep. Tolerance for concrete floors is a conventional straight tolerance according to ACI 117, unless otherwise specified. 5.3.4.2.d Broom or belt finish — immediately after receiving the concrete finish, give the concrete surface a thick transverse texture by drawing a broom or burlap strip on the surface. 5.3.4.2.e Dry finish - A mixture of metallic or mineral aggregate specified in the Portland Cement Agreement Documents in proportions recommended by the aggregate manufacturer or the use of premixture material in bags specified in the contract documents in accordance with the manufacturer's recommendations. Float-finish concrete surface. Apply about two hundred mixed material required to cover the surface with a method that provides uniform coverage without segregation. Float-finish the surface after applying the first dry shake. Apply the remaining dry shock material at right angles for the first application and in the places necessary to ensure a specified minimum thickness. Start trailing flying and ending immediately after applying dry shake. After the selected material is embedded by two variables, perform the operation with a broom, liquefaction or trowel finish, as specified in the contract documents. 5.3.4.2.f High-strength posyłka for two-piece panels – For mixtures with high-strength tops, use the materials and methods specified in the order documents. Place and consolidate the concrete for the base plate and concrete screed to a specified depth below the top of the finished surface. 301-24 Standard ACI Topping placed on the same day as the base plate is placed immediately after the disappearance of venting water in the base plate, and the surface will support the person without significant indentation. When the placement of the topping is deferred, brush the surface with a thicknew wire to remove the laitance and scratch the surface when the concrete is plastic. Harden the base plate for at least 3 days. Before placing the topping, thoroughly clean the surface of the base plate from impurities and loose mortar or aggregate. Moisten the surface, leaving it free of standing water. Immediately before placing the topping, scrub on the surface of the plate a layer of bonding mortar consisting of equal parts of cement and fine sand with enough water to make a creamy mixture. Do not allow mortar before placing the topping. Binders other than cement mortar may be used with prior acceptance. Spread, compact and float the topping mixture. Check the flatness of the surface and full operation with float, pacific or broom finishes as specified in the contract documents. 5.3.4.2.g Topping for a two-small plate not intended for heavy service — Preparation of the base plate, selection of complementary material, mixing, placing, (i) the finishing must be as specified in 5.3.4.2.f — Heavy duty for diminutive plates, but aggregates need not be selected for special special Resistance. 5.3.4.2.h Non-slip finish — where a non-slip finish is required, the surface of the broom or belt finish or dry shake of shredded alumina or other abrasive particles as specified in the contract documents. The rate of application must not be less than 25 lbs/100 ft2. 5.3.4.2.i Finish with exposed aggregate — As soon as the concrete surface is leveled to meet the conventional requirements for ACI 117 straight tolerance and the disappearance of the gloss of the venting water, distribute the aggregate of color and size specified in the contract documents evenly over the surface to ensure full coverage of the depth of one stone. Lightly whisk the aggregate to embed the aggregate on the surface. Lift the surface until the embedded stone is fully covered with mortar and the surface is finished to meet the conventional requirements for straight tolerance ACI 117. After curing the die enough to prevent the aggregate from being sucked out, carefully apply water and brush the surface with a fine-top brush to expose the aggregate without spilling it. An acceptable chemical reference sprayed on a freshly elaped concrete surface can be used to extend the working time of aggregates. 5.3.4.2.j Unspecified finish — if the finish type is not specified in the contract documents, use one of the following appropriate finishes and associated tolerances. • Scratched finish. For surfaces intended for the production of combined cement mixtures; • Floated finish. For walks, drives, steps, ramps and surfaces designed for water resistance, roofing, insulation or sandstone terrazzo; or • Cup finish. For floors intended as walking surfaces, floors in production, storage and storage areas or for the reception of floor coverings. 5.3.4.3 Measurement tolerances for plates 5.3.4.3.a Measurement of suspended and horizontal floor boards to check compliance with the tolerance requirements of ACI 117 set out in item 5.3.4.2. Measure floor finish tolerances within 72 hours after finishing the plate and before removing support formwork or feed. 5.3.4.3.b Unless otherwise specified in the contract documents for residential floors and non-residential flooring installations of 10 000 ft2 or less in the total area of the project, measure floor finish tolerances according to the 10-ft straightedge method in ACI 117. 5.3.4.3.c Unless otherwise specified in the Order Documents of impassable floor installations with a total design area, the measurement of floor finish tolerances in accordance with ASTM E 1155 and the F-number system in ACI 117. 5.3.5 Systolic joints - there, where saw cuts are required or allowed, start cutting as soon as the concrete hardens enough to prevent aggregates from being sucked out. He saw a continuous gap depth of one quarter of the thickness of the plate, but not less than 1 inch. Complete the cut within 12 hours after placement. If an alternative method is proposed, the time or depth of the depth of the detailed plans for the review and acceptance procedure. 5.3.6 Hardening and protection 5.3.6.1 Hardening of concrete in accordance with 5.3.6.2 or 5.3.6.3 for at least 7 days after placement. Harden high-gain concrete for at least 3 days after placement. Alternatively, moisture retention agents may be terminated when: • Tests carried out on at least two additional cylinders held in the vicinity of the structure and hardened by the same methods as the structure indicate that 70% of the specified compressive strength fc′ , determined in accordance with ASTM C 39, has been achieved; • The compressive strength of laboratory-hardened cylinders, representative of the concrete at the site, exceeds 85 % of the specified strength fc′ provided that the temperature of the concrete at the site has been maintained at 50 F or higher during curing; or • Concrete strength is achieved fc′ according to accepted non-destructive test methods meeting requirements 2.3.4.2. If one of the curing procedures in section 5.3.6.4 — Moisture protection is applied initially, the curing procedure may be replaced by one of the other procedures when the concrete is 1 day old, provided that the concrete cannot dry surface at any time. Use the curing procedure 5.3.6.4, which provides additional water throughout the curing period of silica smoke-containing concrete and after determination in the Order Documents. 5.3.6.2 Unformed concrete surfaces — Use one of the procedures in section 5.3.6.4 — Moisture retention, after com- SPECIFICATIONS FOR the structural concrete layer of the arrangement and finishing of concrete surfaces not in contact with moulds. 5.3.6.3 Formed concrete surfaces — keep absorbent wet wood until removed. After removing the formwork, harden the concrete one of the methods in 5.3.6.4 – Moisture protection. 5.3.6.4 Moisture protection — after placement and finishing, use one or more of the following methods of moisture retention in concrete: a. Joints, constant evaporation or constant sprinkling; B. Use of mats or continuously wet fabrics; c. continuous use of steam (less than 150 F); d. use of sheet materials compatible with ASTM C 171; E. Use of a curing mixture compatible with ASTM C 309 or C 1315. Apply the compound according to the manufacturer's recommendations, as soon as the gloss of water disappears from the concrete surface and after the operation is completed. The rate of application must not be less than 1 gal. The material used in each layer must not be less than 1 gal per 200 ft2 surface. Do not use the curing mixture on any surface on which the concrete or other material will be bonded, unless the curing compound does not prevent bonding or if measures are not taken to completely remove the curing mixture from the areas to receive glued requests; or f. Use of another accepted method of moisture retention. Moisture. Protection – Protect concrete from premature drying, too hot or cold temperatures and mechanical damage immediately after placement. Protect the concrete during the curing period in such a way that the concrete temperature does not fall below requirements 4.2.2.7 — Concrete temperature. Maintain concrete protection to prevent concrete freezing and ensure the necessary strength development for the safety of the structure. Remove the protection in such a way that the maximum temperature drop measured on the concrete surface over a period of 24 hours does not exceed: • 50 F for sections of less than 12 inches in the smallest dimension; • 40 F for sections from 12 to 36 inches in the smallest dimension; • 30 F for 36-72 inch sections in the smallest dimension; or • 20 F for sections larger than 72 inches in the smallest dimension. Measure the concrete temperature using the method allowed by the architect/engineer. When the surface temperature of the concrete is within 20 °F of the ambient or ambient temperature, protective measures may be removed. 5.3.7 Repair of surface defects 5.3.7.1 General — Repair of mounting holes and surface faults immediately after removal of formwork. Where the concrete surface will be textured by sandblasting or hammering, fix surface defects before texting. 5.3.7.2 Repair of fixing holes — plug-in holes, except where stainless steel bands, non-coding bindings or aeration bonding are used. When portland-cement patching mortar comply with 5.3.7.5 - Preparation of portland-cement patch mortar, it is 301-25 used to clog, clean and dampen fixing holes before applying the mortar. When using other materials, they should be used in accordance with the manufacturer's recommendations. 5.3.7.3 Repair of surface defects other than fixed holes — Honeycomb outline or otherwise defective concrete from 1/2 to 3/4 inch. deep saw cutting and removal of such concrete down to sound concrete. When chipping is necessary, leave the shredded edges perpendicular to the surface or slightly undercut. Do not blend the edges. Moisten the area to be patched, plus another 6 inch around the perimeter of the patch area. Prepare the binding mortar in accordance with section 5.3.7.4 — Preparation of the binding leaven. Carefully put the mortar into the surface. When the beam coat begins to lose the gloss of the water, apply a patch prepared in accordance with 5.3.7.5 — Preparation of the portland-cement patch mortar and carefully consolidate the mortar into place. Move the mortar away, leaving the patch slightly higher than the surrounding surface to allow initial contractions. Before finishing, leave the patch unhindered for 1 hour. The patch should be stored in a damp state for 7 days. 5.3.7.4 Preparation of binding leaven — For the binding leaven, mix about one part of cement and one part of fine sand with water to the consistency of thick cream. 5.3.7.5 Mortar portland-cement with off-road blend — Mix repair mortar using the same materials as the concrete to be patched without coarse aggregate. Do not use more than one part of cement for two and a half parts of sand sand damp loose volume. For repair in exposed concrete, make a test batch and check the color compatibility of the repair material with the surrounding concrete. When the repair is too dark, replace the white Portland cement with a portion of gray cement to produce a color closely matching the surrounding concrete. Use a repair mortar with a rigid consistency without more mixing water than is necessary for handling and placing. Mix the repair mortar and often manipulate the mortar with the trowel without adding water. Use a mortar with a rigid consistency. 5.3.7.6 Repair materials other than Portland mortar with mixed areas may be used for repair— acceptable repair materials other than cement-cement mortar based on site. Use repair materials as recommended by the manufacturer. Materials include, but are not limited to: 5.3.7.6.a Shotcrete; 5.3.7.6.b Commercial patching products, of which: • Portland cement-cement mortar modified with ASTM C 1059 type II latex binder; • Epoxy mortars and epoxy compounds that are insensitive to moisture during application and after curing that embody epoxy binders according to ASTM C 881, type III. The type, grade and class are suitable for your application as defined in ASTM C 881; • Portland cement mortar aligned with ASTM C 1107; and • Packaged dry concrete repair materials complying with ASTM C 928. 5.3.7.7 Removal of stains, rust, eruptions and surface deposits — removal of stains, rust, eruptions and facial deposits ACI STANDARD considered unacceptable by the architect/engineer. SECTION 6 — ARCHITECTURAL CONCRETE 6.1 — General 6.1.1 Description 6.1.1.1 Scope — This section covers the construction of architectural concrete according to the procurement documents. 6.1.1.2 Coordination — ensuring coordination between the work and work of other industries and other specific construction work. Integrate this work into the structure. Prevent damage or defects that reduce surface quality. 6.1.1.3 General Requirements — Architectural concrete must meet the requirements of Sections 1 to 5, unless otherwise specified in the Order Documents and in this section. 6.1.2 Submitted 6.1.2.1 We send the following data, unless otherwise specified: a. Drawings and data - Submit form store drawings to architectural concrete. Show standing panel connection; locations and details of ties of forms and nooks and crannies; and details of connections, attachment points and other accessories. 6.1.2.2 If necessary, the following data must be sent: a. Mock-ups – When contract documents require a full-scale mock-up of structural elements, apply for approval of the proposed location at the design site. B. Special finishes – send mock-ups or sample panels with bulk transfer and other special finishes if necessary. c. Exported aggregate terminations – if necessary, submit the proposed manufacturing method completed with aggregates. Overview of proposals - - forms until the application forms are accepted. Do not place concrete until the presented batch, mixing, placement and curing plans have been adopted. 6.1.3 Quality assurance 6.1.3.1 Technical specialists in concrete construction — For specific architectural operations listed in the design specifications, a technical specialist trained or approved by the manufacturer of the specialty product must be provided. The specialist is located on the project site during the first 3 days of construction work using a specialized position, and at other times required by the Project Specifications to provide technical assistance. 6.1.3.2 Pre-construction conference – At this stage of the Work, a pre-construction conference takes place. The organisation and procedures shall be established and agreed by all persons involved in this stage of work. 6.1.3.3 Samples and mock-ups - Make full-size mock-ups of structural elements, if specified in the contract documents. Use the same hardware, materials, and procedures that will be used in the final work. Make mockups in acceptable places on the project page. Use mock-ups as samples of the required quality of the finished structure. 6.1.4 Delivery, storage and handling of the product 6.1.4.1 Aggregates — deliver to the mixer any aggregate size with uniform humidity during each day of concrete production. 6.1.5 Design conditions 6.1.5.1 Environmental conditions — protection of architectural concrete from damage, distortion and discoloration from structure to acceptance. 6.2 —Products 6.2.1 Materials 6.2.1.1 Curing water and coating — use curing water and shields that do not stain concrete. 6.2.1.2 Reinforcing supports and spacers — use brackets and reinforcing washers covered with stainless steel, plastic or plastic near exposed surfaces, except that plastic-coated products cannot be used near surfaces to be sandblasted. 6.2.1.3 Formwork - Use a formwork that is waterproof. 6.2.2 Performance and construction requirements 6.2.2.1 Formwork 6.2.2.1.a Design forms for the required finish. Limit the deflection of the surface between the pins, as well as the deflection of pins and walruses to 0.0025 times the clear span (L/400). 6.2.2.1.b Where the finish of the natural plywood form, seasoned finish, smooth wiping finish or other finish is required, the walls of the form must be smooth and the forms must conform to line and class. The surfaces produced require only a small dressing to reach the real surfaces. Where a post-plan finish is required, forms must be constructed and installed so that no dressing is required during the finishing operation to match the sample taken. 6.2.2.1.c Where the surfaces of the including the finishing of the natural plywood mold, are laid out, ensure that the panels are ordered in the layout, with joints planned in an acceptable ratio to the openings, corners of the building and other architectural features. 6.2.2.1.d Where the panels to the surface after casting are separated by recessed or underlined joints, underlined, mates in the joints so that patches of holes are fixed in recessed or underlined joints, unless otherwise specified. 6.2.2.1.e Do not reuse moulds with surface wear, tear or defects that reduce surface quality. Before re-use, it is necessary to thoroughly clean and properly cover the molds. 6.3 — Execution 6.3.1 Preparation — thoroughly clean and in check formwork and batches, mixing, transporting and placing equipment before use. Do not use equipment for other concrete structures during architectural concrete works. 6.3.2 Proportions of concrete mixtures — preservation of the designated colours and uniformity of colour, except where the contract documents do not require it. For concrete of a certain color, use the same materials and proportions. Avoid changes in the amount of Portland cement per unit of concrete volume. Use only one type and one brand of cement from one mill, only one source and one nominal maximum size of thick aggregate, only one source of fine aggregate and only one consistency. In the case of architectural concrete with external exposure, concrete with water-cement materials should be used SPECIFICATIONS for structural concrete not exceeding 0,45 by weight. The air content must comply with Table 4.2.2.4. 6.3.3 Consolidation — do not allow vibrators to come into contact with formwork on exposed concrete surfaces. Where a smooth grate or similar finish is specified, convert the coarse aggregate back from the forms, exhaling or creating vibrations, leaving the full surface of the mortar but avoiding empty surface spaces. 6.3.4 Monitoring of formwork – continuously observe formwork when placing concrete. If deviations from the desired height, alignment, hydraulics or inclination are observed, or if weakness develops, and falsehood shows excessive unfolding or distortion, stop work, remove the damaged structure if it is unacceptably damaged, and amplify the falsehood. 6.3.5 Removal of formwork – prevents damage to concrete when removing formwork. Do not undermine the face of concrete. Use only wooden wedge to separate molds from concrete. 6.3.6 Repair of fixing holes and surface faults 6.3.6.1 Repair area — Where finishes after casting are specified, the total surface to be repaired must not exceed 2 ft2 in every 1000 ft2 cast surface. This is in addition to tie-hole patches if contractual documents allow ties to fall within ascast areas. 6.3.6.2 Color matching — repairs of architectural concrete after casting correspond to the color and texture of surrounding surfaces. Determine the repair mortar mixture by trying to obtain a color match to the concrete when both the repair and the concrete are hardened and dry. After the initial set, the repair clothing surfaces manually to obtain suitable for surrounding surfaces. 6.3.6.3 Exposed aggregate — Any finishing process aimed at revealing aggregates on the surface should show aggregated surfaces in patched areas. The outer patch of 1 inch contains the same aggregates as the surrounding concrete. In the case of an aggregate end of the transfer, the patching mixture contains the same selected colour aggregates. After allowing the patches to harden thoroughly, expose the aggregates together with the aggregates of adjacent surfaces in the same mortar removal process. 6.3.6.4 Curing patches — curing patches in architectural concrete surfaces for 7 days. Protect the patches from premature drying just like the concrete body. 6.3.7 Finish - Finishes must match one of the following finishes or other finishes indicated in the Contract Documents: 6.3.7.1 Textured finishes - use textured molds or textured plastic, wood or sheet metal inserts. Secure the insert panels in moulds by cementing or sepling. Do not let the impressions of nail heads, screw heads or washers be broadcast to the concrete surface. Seal the edges of textured panels to each other or to the strips of the splitter to prevent bleeding cement paste. Use sealants, which will not sinee the concrete surface. 6.3.7.2 Aggregate transfer completions — creation of bulk transfer and special finishes that duplicate mock-ups or sample panels that have been prepared in advance and accepted. 6.3.7.3 Finishes used aggregates — expose aggregates by an acceptable method, including blowing, hammer 301-27 or surface retarder. Provide a concrete surface that duplicates mock-ups or sample panels that have been prepared in advance and accepted. 6.3.7.3.a Finished with a well-polished finish – ensure a clean finish on partially hardened concrete. Thoroughly moisten the concrete surface and scrub with fibrous or wire brushes, using water freely until the surface mortar is removed and the aggregate is evenly exposed. Then rinse with clean water. If parts of the surface have become too difficult to allow uniform exposure to aggregate, use dilute hydrochloric acid (1 part commercial muric acid diluted with 4-10 parts of water) to remove excess surface mortar after placing the concrete for at least 14 days. Remove the acid from the finished surface with clean water within 15 minutes after application. To facilitate exposure to aggregates, cast concretes on mold surfaces coated with a chemical remover in accordance with the manufacturer's recommendations. 6.3.7.3.b Blast finish — blowing sand or blowing concrete surfaces sufficiently to reveal aggregates. Surfaces with the same specified shot finish are blown out at the same time after the concrete is placed. Use stainless steel or plastic reinforcement supports and spacers near concrete surfaces to blow out. Protect adjacent materials and tiles during abrasive abrasive operations. Unless otherwise specified in the design specifications, the blasting rate is light and must expose fine aggregate with occasional exposure thick aggregate to achieve a uniform color and not exceed 1/16 inch in. 6.3.7.3.c tool finish — dress the thoroughly hardened concrete surface with electric, air or manual tools on a uniform texture. Give the surface a hand-tooled, rough or finely sharp, twisted or knocked-out surface specified in the contract documents. 6.3.7.3.d Once the blown or instrumented finishes have been determined, the surface mortar must be removed to the level specified in the contract documents. 6.3.7.4 Finished finishes — After finishing stucco, cement coatings or similar coated materials, the concrete surface must be prepared to ensure a durable adhesion of the finish. When the concrete is less than 24 hours old, rough it with a heavy wire brush or scoring tool. When the concrete is older than 24 hours, coarsely surface mechanically or by etching with acid. After coarsely wash the surface free of dust, acid, chemical retarder and other foreign matter before applying the final finish. SECTION 7 – LIGHT CONCRETE 7.1 — General description 7.1.1 — This section covers the requirements for light concrete. Parts of the structure to be light concrete in accordance with the provisions of this Section shall be indicated in the procurement documents. Light concrete must comply with the requirements of sections 1 to 5, unless otherwise specified in this section. 7.1.2 Applications 301-28 ACI STANDARD 7.1.2.1 Review of submitted applications — obtaining the approval of the architect/engineer of the required messages before placing the concrete. 7.1.3 Supply, storage and operation of the product 7.1.3.1 Storage of aggregates — unless otherwise specified or permitted, pre-dry light aggregate and leave the aggregates in storage after initial wetting for at least 12 hours before use. Where appropriate, follow the light aggregate supplier's recommendations for storage, handling, pre-soaking and emptying. 7.1.3.2 Bulk treatment - Do not allow machines to pass light aggregates. 7.2 — Products 7.2.1 Aggregates — Fine and thick aggregates for light concrete must comply with ASTM C 330. Aggregate of normal weight used in light concrete must comply with 4.2.1.2 — Aggregates. 7.2.2 Operational and structural requirements 7.2.2.1 Concrete exposed to atmospheric agents — after identification in the procurement documents, light concrete air exposed to potentially destructive exposure (other than wear or load), including exposure to freezing and thawing, severe weather conditions or narating chemicals. Use 6 ± 2% of the air content when the nominal maximum aggregate size is greater than 3/8 inch. Use 7 ± 2% of the air content when the nominal maximum size is 3/8 inch or less. Determine the air content by ASTM C 173 volumetric methods. Select the proportions of the concrete mixture for air-filled concrete to ensure the specified compression strength fc′ specified in the contract documents. 7.2.2.2 Floors — In the case of pacited floors, a drop of 100% of the fine aggregate of normal weight placed by the pump must not exceed 5 inches at the point of placement. In other floors, the fall of light

concrete must not exceed 4 inches at the point of placement. 7.2.3 Mixtures 7.2.3.1 Density — Proportion of light concrete mixtures up to the specified limit of the maximum dry air density specified by ASTM C 567. 567. dry air density with fresh concrete loose density. Use fresh bulk density as a basis for adoption during construction. Submit test results and correlation for review. 7.2.3.2 Proportions — Determine the amount of cement materials needed to achieve a certain strength for light concrete in accordance with section 4.2.3 — Proportion. Refer to the cement content of concrete materials. Do not use the ratio of cement materials. 7.2.4 Application and mixing procedure 7.2.4.1 — If the procedure recommended by the manufacturer of the concrete aggregate is contrary to this reference specification, submit the manufacturers' recommendations to the architect/engineer for approval. 7.2.4.2 Low absorption aggregate — batch and mixing aggregate which absorbs less than 2 % of water by weight during the first hour after flooding, as required by point 4.3.1 — measurement, dosing, mixing and delivery. Test the aggregate for water absorption with the minimum moisture content that may occur in the project. Prelamination can be used to achieve this condition. 7.2.4.3 High absorption aggregate — batch aggregate and mixing concrete made of light absorbers of 2% or more of water weight as follows: 7.2.4.4.2 3.a First add the aggregate to about 80 % of the mixing water and stir for at least 1 to 1/2 min in a stationary mixer or 15 revolutions at the mixing speed in the transit mixer. 7.2.4.3.b Then add the admixtures, cement and the suspended part of the mixing water and complete the mixing in accordance with 4.3.1 — Measurement, dosing, mixing and delivery. 7.2.4.4 Precipitation regulation — If necessary, an additional admixture of water or air may be added to the mixture if permitted to bring the mixture to a specific drop after transport. In the case of pumped concrete, the drop of concrete entering the pump must be increased to maintain the specified drop at the point of placement, provided that the requirements 4.3.2.1 – Fall adjustment are met. Prevent light aggregation according to 7.1.3.1 - Bulk storage, unless otherwise specified. In the case of pumped concrete, pre-wetting must be sufficient to ensure that the losses of the drop through the pump line do not exceed 4 inch 7.3 — Implementation 7.3.1 Consolidation — Do not vibrate light concrete to the point that large aggregate particles float on the surface. 7.3.2 Finishing — do not work with light concrete to such an extent that the mortar is pushed and a light aggregate appears on the surface. 7.3.3 Field quality control 7.3.3.1 Additional tests 7.3.3.1.a Density — Acceptance of light concrete in the field will be based on fresh mass density measured in accordance with ASTM C 567. The nominal fresh bulk density is the density corresponding to the specified maximum dry air density calculated on the basis of the formula for the approximate dry air density in ASTM C 567. If the nominal fresh density varies by more than plus or minus 2 lbs/ft3 required fresh density, the mixture should be adjusted as soon as the conditions allow. to the desired level. Do not use any batch for which the fresh bulk density differs by more than plus or minus 3 lbs/ft3 from the specified level. 7.3.3.1.b Air content — determine the air content of a lightweight concrete sample for each strength test in accordance with ASTM C 173. SECTION 8 –BULK CONCRETE 8.1 General 8.1.1 Description 8.1.1.1 Scope — This section covers the concrete bulk requirements set out in the procurement documents. 8.1.1.2 General requirements — Bulk concrete, plain or reinforced, must comply with sections 1 to 5, unless otherwise specified in this section. 8.1.1.2 Submission — admixtures: Where admixtures are desired in bulk concrete, data on the proposed admixtures shall be provided. TECHNICAL DATA FOR STRUCTURAL CONCRETE 8.2 — Products 8.2.1 Materials 8.2.1.1 Cement materials — compliant with standard 4.2.1.1 and the following: 8.2.1.1.a Do not use ASTM C 150 Type III cement. 8.2.1.1.b Unless otherwise specified or permitted, moderate heat of Portland cement, mixed hydraulic cement with moderate or low hydration properties or Portland cement with fly ash, pozzolan or granular bulk slag shall be used. 8.2.1.2 Admixtures 8.2.1.2.a Do not use calcium chloride or other accelerating admixtures unless expressly permitted. 8.2.1.2.b Use an acceptable delay admixture, pre-tested with design materials under design conditions, when necessary to prevent cold joints due to the amount of concrete placed in order to offset the effects of high concrete temperatures, when concrete is allowed to be reheated or reduce the maximum temperature and rate of temperature rise. 8.2.2 Performance and design requirements 8.2.2.1 Cement content — use the minimum cement content required to achieve the specified compressive strength, desired durability and specific characteristics required in section 4.2.2 — Performance and construction requirements. 8.2.2.2 Precipitation — unless otherwise permitted or otherwise specified, the fall of concrete must comply with these requirements: • In the case of plain-weight concrete, 3 inch high; • For reinforcing concrete, requirements 4.2.2.2–Slump. 8.3 — Execution 8.3.1 Placement temperature — Unless permitted or otherwise specified, the temperature of concrete deposited at the point of placement must not exceed 70 F or be less than 35 F. Low-temperature concrete must meet the requirements of 4.2.7 — Concrete temperature. 8.3.1.2 The fall of concrete after placement must meet tolerances ACI 117. 8.3.1.3 Consolidation — place the concrete in layers not more than 18 inches thick. Extend the vibrator heads into a pre-placed layer of plastic concrete. 8.3.2 Curing and protection 8.3.2.1 Moisture retention 8.3.2.1.a The concrete for the minimum curing period specified in section 5.3.6 — Curing and protection, unless otherwise specified. Contract documents require longer curing. 8.3.2.1.b If the specified curing method is not specified in the Documents, retain moisture by keeping the moulds in place or, for surfaces not in contact with the moulds, using one of the procedures referred to in 5.3.6.4 — Moisture protection. 8.3.2.2 Low temperature position of concrete — protect concrete from freezing and moisture loss for the required curing period in accordance with 5.3.6.1 — General curing 301-29 and protection. Do not use steam or other curing methods that add heat to the concrete. 8.3.2.3 Arrangement of concrete on heater days — preserve moulds and exposed concrete continuously use during curing, when the ambient air temperature exceeds 90 F. 8.3.2.4 Concrete surface temperature control , unless otherwise specified, gradually cool the concrete so that the drop in concrete surface temperature during and at the end of the specified curing period does not exceed 20 F in any 24-hour period. SECTION 9 — COMPRESSED CONCRETE 9.1 — General description 9.1.1 Scope — This section covers the requirements for in-place casting, post-tensioned, compressed structural elements. Compressed concrete must meet the requirements of sections 1 to 5, unless otherwise specified. 9.1.2 Drawings 9.1.2.1 Drawings — Submit shop drawings of compressed concrete structures and provide the following information in addition to the information required in Section 2 – Formwork and accessories and section 3 — Reinforcement and reinforcement supports: • Tenion support heights and chair sizes; • The position of the tendons and the sheathing along their entire length; • Size, details, location, materials and stresses (where applicable) for tendons and accessories, including details of the fastening device; • Jack clearances, lift procedures, stress sequence, initial tensioning force, gage pressures and tenin elongation; and • Reinforcing steel details prevent cracking and crushing. 9.1.2.2 Preliminary data — submit the following information: • Typical stress and deformation curve of compression steel; • Results of tests on strength, plastic strength, elongation and composition of non-production materials in accordance with ASA specifications; and • Values of coefficients of friction of wobble and curvature, anchor set data and, where required in contract documents, test data confirming the expected coefficients and anchorage set. 9.1.2.3 Field data — Before installation, the following information on the actual materials to be used must be submitted: • Stress and strain curve for the sample representing the production batch from which the compression tendons will be taken; • Certified test reports of the mill for tendons; and • Test results required in section 9.1.3.1 — Testing, including demonstration of compliance with 9.2.1.5 to 9.2.1.7. 9.1.3 Quality control 9.1.3.1 Testing — test materials according to the following requirements. The report shall give a detailed description of the test procedures and apparatus as well as the results of the tests: 9.1.3.1.a Research team — Test, in accordance with point 9.1.3.1.b, two samples of each tendon size 10 feet long and with standard production quality fastening points. For tendons 301-30 ACI STANDARD without bonds in aggressive environments, test a third sample in accordance with 9.1.3.1.c. Test tendon assembly by a method that will accurately determine the plastic strength, final strength and lengthening of the sample to ensure compliance with 9.2.1.5 — Clamping for bonded tendons or 9.2.1.6 — Fasteners for bonds and 9.2.1.7 — Couplings. 9.1.3.1.c Cyclic tenth test without bonds — when required by contract documents, perform a cyclic test on a representative tenule assembly that can withstand 500,000 cycles from 60 to 66% without failure and backup to 60% of the guaranteed minimum final strength. A prototype tendon synonyme may be used provided that the band has not less than 10% full-size tendon strength. Test the tendons of a single element with one thread, rod or wire as a complete tendon assembly. Systems using multiple strands, wires or rods can be tested using a prototype tendon with enough elements to replicate the behavior of a full-size tendon. 9.1.3.1.d Test mortar - test mortar for strength and shrinkage according to ASTM C 1107. 9.1.3.2 Tolerances — Compliance with the following tolerances: 9.1.3.2.a The bearing surface between the anchorages and the concrete must be concentric with the tendons and perpendicular to plus or minus 1 to the direction of the tendon in the anchorage. 9.1.3.2.b Tendons — Install tendons in accordance with ACI 117 tolerances for reinforcement placement, distance between reinforcement and concrete cover. These tolerances shall be applied separately to both vertical and horizontal dimensions and may vary for each direction, except that in plates the horizontal tolerance must not exceed 1 inch by 15 feet of tendon length. 9.1.4 Supply, operation and storage of products – delivery, handling and storage of materials in such a way as to prevent mechanical damage and corrosion. Store cement and mortar with bonuses to prevent a set of bags. Use cement stored at the design site only for grouting. 9.2 — Products 9.2.1 Materials 9.2.1.1 Tendons — Materials meeting the following requirements: 9.2.1.1.1 Compression tendons — Compression steel must be of the type and strength required in the order documents and comply with one of the following specifications: ASTM • ASTM A 416/A 416M; • ASTM A 421/A 421M; • ASTM A 722/A 722M; or • ASTM A 779. Tanges, wires and rods not listed in ASTM A 416/A 416M, ASTM A 421/A 421M, ASTM A 722/A 722M, or ASTM A 779 may be used provided that they comply with the minimum requirements of this reference specification, do not have properties which make them less satisfactory than those listed in ASTM A 416/A 416M, ASTM A 421/A 421M, ASTM A 722/A 722M and ASTM A 779 and are acceptable for Tendons must be clean and free of excessive rust, rust. A coating with light oxide is acceptable. 9.2.1.2 Bond-free tensed coatings — tenth coating without bonds is a completely suitable material to protect against corrosion. The tenure cover must be continuous along the entire length to be covered with tendons and prevent the insidation of the cement paste or the loss of coating materials during the placement of concrete. Protect single-line tendons without bonds from corrosion according to PTI specifications for single-line tendons without bonds. 9.2.1.3 Sheathing for bonded tendons 9.2.1.3.a The sheathing and duct forming materials do not react with alkali in cement, they must be strong enough to retain their shape and resist damage during construction and prevent water from penetrating from cement paste. The sheathing must be capable of transferring forces from the leaven to the surrounding concrete. 9.2.1.3.b The inner diameter of the cable shall be at least 1/4 inch greater than the cutting of the wire, rod or thread and must have an internal cross-sectional area at least twice the net area of compressed steel. 9.2.1.3.c The duct must have vents or vents at each end and at each intended high point. Provide drain holes at any intended low point if the tendon is frozen after placement and before grouting. 9.2.1.4 Sheathing for tendons without bonds 9.2.1.4.a The sheathing for tendons without bonds must be made of a material with sufficient strength and water resistance to prevent damage or deterioration during transport, storage at the site of the design, installation and placement of concrete. The sheathing is continuous on the length of the tendons without bonds. The sheath prevents water from penetrating from the cement paste and the coating material from getting out. 9.2.1.4.b Where specified in the procurement documents for use in corrosive environments, the sheathing shall be combined with a tensioning, intermediate and fixed fastening to ensure the encapsulation of compressed steel. 9.2.1.5 Anchorages for bonded tendons — Anchorages for bond-free bonded tendons shall develop 90 % of the minimum specified final strength of the compression steel, without exceeding the intended kit at anchorage time and without slipping. Anchorages which develop at less than 100 % of the minimum specified final strength shall be used only if the supplied binding length is equal to or greater than the binding length required to develop 90 % of the minimum specified final strength. Indicate the required binding length between the attachment point and the zone where full compression force is required during operation and final charges. Determine the length of the binding by testing a full-size tendon. 9.2.1.6 If, in a state without bonds, the anchorage 100% of the minimum specified final strength need not be tested in the bonding state. TECHNICAL DATA FOR STRUCTURAL CONCRETE 9.2.1.6 Anchorages for tendons - tenth attachments without bonds, when permitted in contract documents, develop a minimum specified final strength of the pre-steel with the amount of permanent deformation, which will not reduce the expected final strength of the assembly. The total tendon load under the final tendon load must not be less than 2% when measured at a minimum tendon length of 10 ft. 9.2.1.7 Clutches — use couplings only when indicated in the order documents or as permitted. All couplings shall develop a strength exceeding the minimum specified final strength of compression steel without exceeding the intended coupling or compression steel set and shall not reduce the tendon plasticity below the minimum deformation of 2 % specified in 9.2.1.6 - Tendon fixings without bonds. Close the clutches in housings that allow the necessary movements during stress. In the case of knotted tendons, provide the fastenings to allow complete grouting of all components of the coupling. 9.2.1.8 Sleeves and gaskets — sprinkle in ponds with leaky sleeves or seals. 9.2.2 Proportions of concrete mixtures and mortar — Compliance with the following provisions for concrete mixtures and mortar: 9.2.2.1 Concrete mixtures according to section 4 – Concrete mixtures. 9.2.2 Mortar 9.2.2.2.a The mortar consists of a mixture of cement and water, unless the gross inside the cross-section of the incline exceeds four times the area of the tenth section, in which case fine aggregate may be added to the mixture. 9.2.2.2.b Admixtures of fly ash and after-solitary minerals may be added in relation to a non-transfer of 0.30 times the mass of cement. Mineral admixtures must comply with ASTM C 618. 9.2.2.2.c Add an acceptable admixture compensating for shrinkage or expansion to obtain an irrepressible extension of the mixture of less than 10 % by volume of mortar. 9.2.2.2.d Do not use admixtures containing more than traces of chlorides, fluorides, aluminum, zinc or nitrates. Other admixtures may be used provided that acceptable tests or performance records clearly indicate that the admixtures will not have a harmful effect on tendons, accessories or mortar. 9.2.2.2.e Use fine aggregate compatible with ASTM C 404, size 2, except that all material passes sieve No. 16. 9.2.2.2.f Proportional mortar to achieve a minimum compressive strength of 2500 psi after 7 days and 5000 psi after 28 days during the test in accordance with ASTM C 1107 and consistency that will facilitate the placement and fulfillment of requirements 9.3.3.2 - Mortar. The water content is the minimum value necessary for proper placement and the ratio of cement materials does not exceed 0,45 by weight. 9.2.2.2.g Mix the mortar in a high-speed mechanical mixer and pass the leaven through a strainer to pumping devices which are recirculatable. Begin mortar as soon as possible after mixing. Continue pumping according to 301-31 lengths, as the mortar retains the required consistency. Reject Reject which has been partially set. 9.3 — Implementation inspection 9.3.1 — Inspection to ensure that the requirements of this reference specification are met. Inspection includes, but is not limited to, the following: • Purity of material and formwork; • Arrange materials and formwork; and • Correct tensioning of pre-compression tendons. 9.3.2 Preparation 9.3.2.1 Grouting – reliable high-pressure water supply of sufficient volume is provided before grouting. Free plating of dirt and other foreign substances by thorough rinsing with water immediately before grouting. 9.3.2.2 Tendons and concrete 9.3.2.2.a Keep tendons dry and store water from the hose until the tendons are rinsed before grouting. Keep the concrete around the seasoned tendons at 40 F or higher for at least 3 days after grouting. 9.3.2.2.b Keep the sheathing for use with knotted tendons without grease, oil, paint or other foreign matter. A light layer of rust on the tendons is acceptable, provided that the loose rust has been removed and the surface of the steel is not pitted. 9.3.2.2.c Tendons must be placed in a bond-free structure in a clean and inflatable structure and protected by the fixed, continuous coating referred to in 9.2.1.2 — Coating of tendons without bonds. 9.3.2.2.d Where the tendon links extend beyond the ends of the limb or where the tendons are used outside the concrete of the tensioned element or where the structure is in or exposed to an atmosphere of salt air or high humidity, cover the exposed parts of the tendon with an additional coating applied to the fields of acceptable material. 9.3.2.2.e Keep end anchorages that will be permanently protected by concrete free of loose rust, grease, oil and other foreign matter. 9.3.2.2.f Protect the leaven and sheath from collapse and other damage. Before placing the concrete, it is necessary to examine the fasteners of the sheath and leaven into the holes and fix any holes located. If the tendon remains un-taped for more than 28 days after the tendon is placed, temporary corrosion protection should be provided. 9.3.3 Placement 9.3.3.1 Tendons and accessories — Placement of tendons and attachment points within tolerances 9.1.3.2 — Tolerances. They firmly support tendons, sheathing and attachment points to prevent displacement when placing concrete. 9.3.3.2 Mortar 9.3.3.2.a In the case of a knotted tendon structure, inject the mortar into all empty spaces between the compression tendons, the sheath and the fixings. Continue injecting until the mortar of the same consistency as the mortar injector flows without the presence of air bubbles from the vents. Close the vents gradually in the flow direction. After closing the ventilation holes, raise the grouting pressure to at least 50 psi and connect the injection hole. 301-32 ACI 9.3.3.2.b W blockage or interruption of grouting, remove the leaven from the hose by flushing with water. 9.3.4 Tensioning and other operations involving tendons 9.3.4.1 Sequence — Stress Stress in order, at the specific strength and at the construction stage indicated in the Order Documents. 9.3.4.2 Multiple tensioning - elemental tendons — Tension simultaneously of tendons consisting of multiple strands, wires or rods in the common sheath, unless the effects of interference between elements are considered to be potentially harmful. 9.3.4.3 Compression force - Determine the compression force by measuring tendon elongation and checking the lift pressure with a calibrated gage or dynamometer. Calibrate the gage or dynamometer within 6 months before use. Correct discrepancies that exceed 5%. Basic elongation requirements for load elongation curves for the steel used, unless statistics indicate that average values can be used. For each tendon, a record of the measured extensions and pressure readings of the dye or dynamometer shall be maintained and sent. 9.3.4.4 Preliminary loss — the total loss of initial strength in any tendon caused by undecognized damaged tendon elements must not exceed 2% of the total initial force. 9.3.4.5 Formwork 9.3.4.5.a Ensure that formwork does not restrict the elastic shortening, deflection or inclination resulting from the application of the compression force and is rigid enough to prevent the tendon profile from moving beyond the tolerances of 9.1.3.2. The anchoring beheading supports the formwork to maintain the tendon profile during concrete placement. 9.3.4.5.b Do not remove formwork supports until sufficient compression force has been applied to support the dead load, formwork and expected structural loads. When the structure is pre-compressed in two directions, formwork must support the load, which is separated by a partially completed underlining action. 9.3.4.6 Preventing tenth damage – do not expose tendons to mechanical damage, welding sparks or electric substrate currents. Combustion and welding operations in the vicinity of tendons shall not be carried out without prior approval, except as permitted in paragraph 9.3.4.7 — Tenth trimming. 9.3.4.7 Tendon trimming — Surplus tendon lengths outside the attachment points may be removed by rapid combustion of oxyacetyllene, abrasive wheel or shears, unless these procedures are contrary to the recommendations of the manufacturer of the pre-steel. SECTION 10 — SHRINKAGE COMPENSATING CONCRETE 10.1 — General 10.1.1 Scope — This section covers compensating concrete with shrinkage using expansion cement compatible with ASTM C 845, type E-1. 10.1.2 General requirements — Parts of structures to be constructed using compensating concrete under the provisions of this section are specified in the Order Documents. Concrete compensating for shrinkage must comply with the requirements of Sections 1 to 5, unless otherwise specified in this section. 10.1.3 Applications 10.1.3.1 Submission Overview — Obtaining the architect/engineer's approval of the required submissions before placing the concrete. Submit the results of the compensation tests measured in accordance with ASTM C 878 for the proportion of the concrete mixture. 10.1.3.3 10.1.3.3 placement sequence. 10.2 —Products 10.2.1 Materials 10.2.1.1 Cement materials 10.2.1.1.a Unless otherwise specified, cement must comply with ASTM C 845, Type E-1 (K). 10.2.1.1.b Silica fumes must comply with ASTM C 1240. 10.2.1.1.c Unless otherwise specified, fly ash or ground granular slag shall not be used. 10.2.1.2 Admixtures 10.2.2.1.a Do not use acceleration admixtures or admixtures containing calcium chloride unless otherwise specified or permitted. 10.2.1.2.b Do not change the type, brand or dosage of admixtures without evaluating the modified concrete mixture for expansion measured in accordance with ASTM C 878, unless permitted. 10.2.2 Performance and construction requirements — compliance with operating and construction requirements 4.2.2 and the following requirements: 10.2.2.1 Minimum cement content — Cement content must not be less than 564 lb/yd3. 10.2.2.2 Extension — Unless otherwise specified, the concrete dilata must be at least 0.03% and a maximum of 0.10% measured in accordance with ASTM C 878. 10.2.2.3 Refraction — unless otherwise specified or permitted, the drop must not exceed 6 inches at the point of placement. 10.2.3 Proportions — Conformity with 4.2.3 — Proportions i: 10.2.3.1 When laboratory test mixtures are used, the mixer must be discontinued after the initial mixing cycle and the laboratory concrete mixer covered for 20 minutes, unless otherwise specified. After this period, add water, if necessary, to get the maximum specified drop within 3/4 of an inch. The concrete is then mixed for an additional 2 min. 10.2.3.2 For the proposed concrete mixture, provide laboratory test results for three expandable cast and tested bars in accordance with ASTM C 878. Save the extension test results and submit them for approval. 10.2.3.3 Changes to concrete mixtures — Where the proportions of concrete mixtures are corrected in accordance with point 4.2.3.6 — Changes in concrete mixtures, they assess the effect on expansion by conducting laboratory tests on three expansion bars cast with the changed concrete mixture in accordance with ASTM C 878. Submit the test results together with the changed proportions of the mixture. 10.2.4 — Use deformed rods or deformed welds that meet requirements 3.2 — Products, in the quantities specified in the Contract Documents. 10.2.5 Filling materials with insulation joint , unless otherwise specified, use a compressible insulating filler material which, according to the specifications for structural concrete, does not cause compression stress greater than 25 psi at 50% deformation during the test in accordance with ASTM D 1621 or D 3575. 10.3 — Implementation 10.3.1 Reinforcement 10.3.1.1 Place reinforcement on supports that are rigid and positioned appropriately to ensure correct reinforcement positioning during deployment. 10.3.1.2 Unless the otherwise, reinforcement position 2 inches from the upper surface for reinforced plates on the species. 10.3.2 Placement 301-33 10.3.2.1 Placement order – Concrete placement order destinations to have at least one free edge to extend in each direction. 10.3.2.2 Unless otherwise specified or permitted, the minimum time between casting adjacent sections is 72 hours 10.3.3 Insulation connections — Provide insulation connections at intersections with columns, walls, sewers or other rigid obstacles to construction in accordance with the Contract Documents. 10.3.4 Curing — Unless otherwise specified, concrete compensating for wet shrinkage for at least 7 days in accordance with section 5.3.6.4 A or B. 301-34 ACI STANDARD Specification specifications for structural concrete notes to the specifications before checklist specification P1. The ACI 301 specification is intended to be used by reference or incorporated entirely into the design specifications. Individual sections, articles, or paragraphs cannot be copied to the Design Specification because deleting them from context can change their meaning. P2. If sections or parts of the ACI 301 reference specification are edited in design specifications or other documents, they are not referred to as ACI standards because the reference specification has been changed. P3. Building codes lay down the minimum requirements necessary to protect the public. This reference specification may lay down requirements that are more restrictive than the minimum requirements. The architect/engineer should make adjustments to meet the needs of the project. The architect/engineer should review each element of the specification checklist and take into account the architect/engineer's decision on each checklist item as a mandatory requirement in the Design Specification. P4. These mandatory requirements specify specific characteristics, procedures, materials and performance criteria for which alternatives are permitted or for which provisions have not been introduced in the reference specification. If necessary, the design specification shall make exceptions to the reference specification. P5. A manual, such as the following, will be used to make the ACI 301 reference specification part of the design specification. The work on (Project Title) complies with all requirements of ACI 301-99, Structural Concrete Specification, published by the American Concrete Institute, Farmington Hills, Michigan, except as amended by the requirements of these Agreement Documents. P6. Specification checklists identify the architect/engineer's choice and alternative. Checklists identify sections, parts and articles of the reference specification and the actions required by the architect/engineer. P7. The block diagram of the selection and documentation of the proportions of the concrete mixture on p. 36 is to be a pictorial guide showing the requirements of section 4 – Concrete mixtures. The flowchart is not part of the ACI 301 reference specification. Its purpose is to help the architect/engineer meet the requirements of Section 4. P8. Recommended references – documents of different and standards-setting publications checklists to the ACI 301 specification are listed below with their serial designation. These references are intended to provide guidance to the architect/engineer and are not considered part of the ACI 301 reference specification. The standards set out in this specification and considered to be part of the reference specification ACI 301 can be found in section 1.3 Reference standards and cited publications. American Concrete Institute (ACI) ACI 117R Commentary on standard specifications for 301-35 Tolerances for concrete structures and materials ACI 201.2R Guide to durable concrete ACI 207.2R Restraint effect, volume changes and reinforcement for cracking of bulk concrete ACI 211.1 Standard practice of choosing proportions for normal, Heavy weight and concrete weight ACI 222R Metal corrosion in concrete ACI 223 Standard practice for the use of compensating concrete ACI 225R Guide to the selection and use of hydraulic cements ACI 228.1R Methods on site for concrete strength estimates ACI 302.1R Guide to concrete construction and slab SSCA 303R Guide to cast-in-place Architectural Concrete Practice ACI 303.1 Standard specification for cast concrete in place ACI 305R Hot Weather Context ACI 306.1 Standard Specification for Cold Weather Continually ACI 308 Standard Practice for Concrete Curing ACI 311.1R ACI Concrete Inspection Manual (SP-2) ACI 311.4R Concrete Inspection Guide ACI 311.5R Guide to Determining Batch Plant Inspection and Field Testing ReadyMixed Concrete ACI 318R Commentary on Building Code Requirements for structural concrete ACI 347R Concrete formwork guide ACI CP 10 Concrete Flatwork Finisher Certification American Society for Testing and Materials (ASTM) ASTM C 441 Method of testing the effectiveness of mineral admixtures or ground bulk slag in preventing excessive expansion of concrete due to astm D 698 alkaline silica reaction Standard test method for laboratory characteristics Using Soil Standard Effort [12,400 ft-lbf/ft3 (600 kN-m/m3)] ASTM D 1557 Standard Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lbf/ft3 (2,700 kN-m/m3)] Portland Cement Association (PCA) PCA Design and Control of Concrete Mixtures, 13th edition of Wire Reinforcement Institute (WRI) WRI Manual of Standard Practice The above publications can be obtained from the following organizations (additional references can be found in section 1.3 of the Specification) : 301-36 ACI STANDARD American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 Portland Cement Association Old Orchard Road Skokie, IL 60076 American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428 Wire Reinforcement Institute, Inc. 301 East Sandusky Street Findlay, OH 43840 STRUCTURAL CONCRETE SPECIFICATIONS 301-37 301-38 ACI STANDARD MANDATORY REQUIREMENTS SECTION/Part/ Article Architect/Engineer Notes and reinforcement supports 3.2.1.1 Determine the required grades, types and sizes of reinforcing steel. 3.3.2.7 Show splice in project drawings. Concrete mixtures 4.2.2.6 Means which parts of a structure are classified according to Table 4.2.2.6 of the member types. Additional information on the effects of chlorides on reinforcing steel corrosion is given in ACI 201.2R and ACI 222R. The test procedures must comply with the procedures given in ASTM C 1218/C 1218M. A preliminary assessment can be obtained by testing individual concrete components for the total chloride content. If the total chloride ion content, calculated on the basis of the proportion of concrete, exceeds the content permitted in Table 4.2.2.6, it may be necessary to test the hardened concrete samples for water-soluble chloride ions as described in ASTM C 1218/C 1218M. Some chloride ions present in the components will be insoluble or react with cement during hydration and become insoluble according to the described test procedure. In the case of testing of concrete for water-soluble chloride ions, the tests shall be carried out between the ages of 28 and 42 days. The limits set out in Table 4.2.2.6 are to be applied to chlorides derived from concrete constituents and not from the surrounding environment. The water-soluble limits for chloride and ion ions in Table 4.2.2.6 differ from those of water-soluble chlorides recommended in ACI 201.2R and ACI 222R. Table 4.2.2.6 contains limits of 0.15 and 0.30% for reinforced concrete that will be exposed to chlorides or be moist in operation, respectively. These water-soluble limits for chloride and ions are compared with the recommended, acid-soluble ionic limit values of 0,10 and 0,15 in ACI 201.2R, while 222R recommends acid-soluble chloride-ionity values of 0,08 and 0,20 % respectively for compressed concrete and reinforced concrete. 4.2.2.8 Indicate the specified compressive strength of the concrete fc′ for different parts of the work. For most structural elements, design requirements will dictate the required durability. Greater compressive strength may be required for durability. In the case of floors, the specified compressive strength fc′ will generally depend on the intended use and expected wear, unless durability considerations dictate higher strengths. If the floor will be exposed to abrasive wear from early construction traffic, consider requiring a minimum compressive strength in 3 days of 1800 psi or higher. See ACI 302.1 for guidance on compressive strength for different floor classes. Treatment, placement and construction 5.3.1.4 Determine the required soil density at the site for slope plates as maximum laboratory density. Specify the test methods to be used, such as ASTM D 698 or ASTM D 1557. Architectural concrete 6.3.7 Determine which finishes from 6.3.7.1 to 6.3.7.3 (a (d) are required. Specify all special finishes that are required but not covered by the above. Compressed concrete 9.2.1.1 Determine the type and minimum tensile strength of the final compressive steel. OPTIONAL REQUIREMENTS SECTION/Part/Article General requirements 1.6.3.2, 1.6.3.3, 1.6.4.1.6.3.2.g, 1.6.4.2.e Notes to the architect/engineer Specify whether other test arrangements are required, such as the agency carried out by the owner by determining the proportions of mixtures or any test duties of the Owner's research agency to be performed by the Contractor's research agency. If accelerated concrete testing is specified or permitted as an alternative to standard tests, the procedure with ASTM C 684 to be used should be specified. Determine when the compressive test samples are to be tested if they are different than 7 and 28 days. SPECIFICATIONS FOR STRUCTURAL CONCRETE 301-39 OPTIONAL REQUIREMENTS CHECKLIST, continued Section/Part/Article 1.6.4.3 Notes to the architect/engineer Specify the additional testing services required to perform the work, if applicable. Please note that these additional testing services are to be performed by the owner's testing laboratory; therefore, the term will is used instead of must in section 1.6.4.3. For information on the individual checkpoints that may be relevant, refer to the ACI 311.1R (SP-2), ACI 311.4R and 311.5R control points. If it is necessary or desirable to know the characteristics of the concrete at the point of placement or in places other than the point of delivery, it should be specified that concrete samples should be taken at those other places for testing. See the discussion in optional requirements section of section 4.2.2.2. 1.6.5.2 Determine whether non-destructive testing will be allowed to assess the uniformity or relative strength of concrete in place. Guidance on non-destructive test methods can be found in ACI 228.1R. 1.6.7.1 If a different basis is required for the accelerated strength test to adopt the concrete strength level, the acceptance base shall be specified. Formwork and formwork accessories 2.1.2.1 Review the list of submitted items and specify the items that are not to be submitted in the contract documents. 2.1.2.2 Review the list of items submitted and specify in the Contract Documents the items to be submitted. 2.2.1.2 Indicate where the walls require bonding with barrier plates. 2.2.2.1 Determine whether formwork calculations and drawings must be sealed by a licensed Engineer. 2.2.2.3 Determine whether ground cuts will be permitted or required. 2.2.2.4 Specify more or less stringent deflection restrictions on cladding materials if necessary. More guidance can be found in aci 347R. 2.2.2.5.b Identify or allow alternative sites for moulded construction joints when necessary to facilitate the removal of formwork or acceleration provided that the alternative connection sites do not adversely affect the strength of the structure. 2.2.3.2 Determine whether chamfer strips are not required on the outer corners of permanently exposed surfaces. Specify whether bevels are required on concrete corners or edges Joints. 2.3.1.2 Specify tolerance limits that must be different from ACI 117. Specify when a more or more restrictive tolerance for sudden offset is required. More guidance can be found in ACI 347R and commentary on ACI 117. 2.3.2.5 Determine the minimum compressive strength for removing concrete weight support forms if different from the specified compressive strength of the concrete. Determine whether the impassable material for moving the shape cannot be removed in old age than the supporting part of the formwork. 2.3.4.2 Determine whether alternative methods for assessing the strength of concrete for the removal of formwork are permitted. Reinforcement and reinforcement supports 3.1.1 Determine whether the submitted reinforcements listed in 3.1.1.1- 3.1.3 are required. Otherwise, they will have to be folded. 3.2.1.1 For forged heads, specify the type of steel for reinforcing bars: • Low alloy steel (ASTM A 706/A 706M) • Bite steel (ASTM A 615/A 615M). For bite steel (ASTM A 615/A 615M) the grade • Rail steel rods or deformed axle steel (ASTM A 996/A 996M) must also be specified. 3.2.1.2 Determine whether coated reinforcing bars are required and, if so, whether the coating is to be zinc or epoxy. 3.2.1.2.a In the case of zinc-coated reinforcing bars complying with ASTM A 767/A 767M, specify the coating class whether galvanisation is to be carried out before or after manufacture and which bars require special finished bend diameters (usually smaller sizes used for stirrups and ties). The mixing of galvanized and non-galvanized reinforcing steel or other embedded steel, which may create galvanised cells, should be avoided. 3.2.1.2.b specify the ASTM specification to which epoxy-coated reinforcing bars are to be compatible. 3.2.1.4 Determine which of the three combinations will apply. 3.2.1.5 Determine the smooth or deformed wire and, if necessary, the epoxy wire. 3.2.1.6 Determine the smooth or deformed wire fabrics and, if necessary, epoxy-coated wire fabric. Additional guidance can be found in the WRI Standard Practice Manual. 3.2.1.7 Determine whether wire reinforcement supports other than those in 3.2.1.6 are required or permitted. 301-40 ACI STANDARD OPTIONAL REQUIREMENTS CHECKLIST, continued Section/Part/Art..2.8 3.3.2.9 Concrete mixtures 4.2.1.1 4.2.2 4.2.1.4 Architect/Engineer Notes Specify whether bar welds are required or permitted. If necessary or permitted, any desired requirements for welding preparation (e.g. removal of zinc or epoxy coating) more stringent than those in AWS D1.4 shall be specified. Specify the desired requirements for the chemical composition of reinforcing bars more stringent than those specified in the specified ASTM specifications. If necessary, a special heat treatment of welded assemblies should be specified. Specify additional requirements wire welding for wire and welding of wire or welded fabrics for reinforcing bars or structural steels. Specify special shielding requirements for corrosive atmospheres, other serious exposures or fire fire table 3.3.2.3. Some concrete covers in Table 3.3.2.3 may exceed the minimum concrete covers required for ACI 318. The concrete covers used for the design must comply with the covers specified in Table 3.3.2.3. Specify whether the support methods are to be different from those indicated in (a) to (i). Determine where reinforcement can extend through systolic joints. Specify whether bending or straightening reinforcement partially embedded in concrete is allowed. Specify whether reinforcement field cutting is allowed. Specify whether cement other than ASTM C 150 type I or Type II is required. Determine whether ASTM C 150 cement with POZZOLANIC ASTM C 989 or A S T M C 1240 silica fum e is required. Specify the pozzolan class or slag species that is required. Specify whether ASTM C 595 mixed hydraulic cement is required. Use ACI 318 and ACI 225R to determine the cement materials that will be acceptable for design conditions. If concrete is suspected of being exposed to sulphates, water-soluble sulphates in soil and groundwater should be assessed. The criteria ACI 318, 4.3.1 and Table 4.3.1 shall be used to determine the type of cement used. Use any of the cements in ACI 318, Table 4.3.1 for concrete exposed to seawater. Check the availability of a specific cement. Do not use ASTM C 595, Type S and SA. Specify whether less than 15% of fly ash is allowed. In some cases, the use of less than 15% fly ash may increase the susceptibility of concrete to excessive expansion due to alkali silica reactivity (ASR). If a smaller percentage of fly ash is proposed for use, the proposed mixture of fly ash and Portland cement from the same source should be tested and compared with a control mixture using Portland cement only in accordance with ASTM C 441. A design mixture should be considered acceptable provided that the average increase in the length of the design mixture does not exceed the average length of the control mixture. For projects where asr-caused extensions can be critical, consider requiring that tests be compared with a certain frequency during operation, for example every three months. Where reactive aggregates are available, the use of natural pozzolan, fly ash, slag or silica vapours should be determined in an amount which has proven effective in mitigating harmful extensions caused by alkali-silica reactivity. Alternatively, low-amalcalyal cement should be specified as described in the checklist optional requirements for section 4.2.1.2. If aggregates are to comply with a specification other than ASTM C 33 for classification, harmful substances or robustness, other requirements should be laid down. The test for compliance with the purity requirements shall be specified and the classification of samples obtained from aggregates at the batch point shall be specified. Specify additional aggregate requirements such as hardness, colour, mineralogical composition, texture or shape (crushed or gravel). If the they will be exposed to wetting, prolonged exposure to a moist atmosphere or in contact with a damp substrate, ridicule the use of aggregates that do not contain maliciously reactive materials with alkali in cement, although such aggregates may be used with cement containing less than 0,60 % alkalies as (Na20 + 0,658K20) or with a material such as natural pozzolan, fly ash, slag or silica smoke in an amount which has proven effective in preventing harmful expansion due to alkali reaction as aggregation in accordance with ASTM C 441. Specify the admixtures listed in 4.2.1.4 that are required or permitted. Indicate the parts of the Work in which each type of admixture should or may be used. Require ASTM certification. SPECIFICATIONS FOR STRUCTURAL CONCRETE 301-41 REQUIREMENTS CHECKLIST, continued Section/Part/Article 4.2.2.1 4.2.2.2 4.2.2.3 4.2.2.4 4.2.5 4.2.2.6 Notes to the architect/engineer Specify whether less than 15% or more than 25% of fly ash is permitted on floors. If more than 25 % is permitted, a history demonstrating the finishing capacity of the proposed concrete mixture shall be made available. If you want the drop to be different than 4 inches, specify a requirement. Sometimes it may be necessary to specify that the drop of concrete is determined at the point of placement, not at the point of delivery. For example, pumped concrete is often determined to have a drop measured at the end of the pump line to rule out problems encountered with various losses during pumping. This would allow a drop higher than 4 inches at the point of delivery to get a 4 in. drop at the end of the pump line. After the pumping loss is slammed, you can specify the acceptance or rejection of concrete based on the drop, which can then be determined at the point of delivery. For example, if a 1-1/2 inch drop in losses during pumping has been determined and confirmed by comparative testing, then the drop can be measured at the point of delivery to meet the 5-1/2 inch drop to meet the 4 inch drop requirement at the point of placement at the end of the pump line. Determine whether a high-range plasticifying or reducing admixture is required or permitted for the production of high-rainfall concrete. If so, the required decrease shall be determined if it differs from that indicated in point 4.2.2.2. For floors, refer to ACI 302.1R for drop guidance to specify for different floor classes. If a high-range plasticifying or reducing admixture is required or permitted to produce high-shock concrete with low proportions of low-water cement materials, such as 0.25-0.30, the drop requirements must be modified accordingly before adding the admixture. Work with concrete suppliers and admixture suppliers in the area where the project is located to determine their experience and contribution to such efficient concretes. If the aggregate size requirement differs from that specified in 4.2.2.3 for example, a smaller size in floor accessories), specify the nominal maximum size of the aggregate. Specify Specify concrete is not required for air. Intentionally trapped air should not be involved in normal-weight concrete slabs that require a dense, polished, machine-stitched surface. For more information, see ACI 302.1R. In the case of concrete air enormity other than severe exposure, the type of exposure as indicated in Table 4.2.2.4 shall be determined. Exposure is defined as follows: Mild exposure — service in a climate where concrete will not be exposed to freezing agents, dehydrating agents or other aggressive agents, but where air capture is desirable for other beneficial effects, such as improved feasibility or consistency in low cement concrete. To improve strength, you can use an air content lower than required for durability. This exposure includes indoor or outdoor handling. Moderate exposure — a service in a climate where freezing is expected, but where concrete will not be constantly exposed to moisture or free water for a long time before freezing and will not be exposed to casting agents, other aggressive agents or other aggressive chemicals. Examples include exterior beams, columns, walls, girders and slabs that do not come into contact with wet soil and are located so that they do not receive direct use of deacharizing salts. Severe exposure — concrete that is exposed to degreasing chemicals or other aggressive agents or which can become highly saturated by continuous contact with moisture or free water before freezing. Examples include parking structures, sidewalks, bridge decks, curbs, gutters, sidewalks, canal cladding, and external water tanks or bowls. Determine whether a specific ASTM test method (ASTM C 231, C 138 or C 173) is required to measure air content. For the same reasons as described in the optional requirements of section 4.2.2.2, it may be necessary to specify that the air content is measured at the point of placement to take account of the loss of air content during pumping. Once the loss of air content during pumping has been determined, acceptance limits can be set at the point of placement. Specify the required types of admixtures and indicate the parts of the Work in which each type should or can be used. Calcium chloride as admixture must not be used in concrete subjected to severe or very severe exposure to sulphate as defined in Table 4.3.1 of ACI 318. Where epoxy bars or galvanised rods are used, the limit values set out in Table 4.2.2.6 may be more restrictive than necessary. Specify whether higher limits are allowed. See references given in the mandatory checklist for 4.2.2.6. 301-42 ACI OPTIONAL STANDARD REQUIREMENTS CHECKLIST, continued Section/Part/Article 4.2.2.7 Notes for These requirements are taken from ACI 306.1. In the case of projects in cold climates, such as in northern winters, or in situations where it is reasonable to require the Contractor to follow certain procedures in order to reach limits of 4.2.2.7, the temperature limits for winter and SCI 306.1 may be directed to in its entirety. Then use the option under ACI 306.1. See also the optional requirements checklist for 5.3.6.1. If, in the case of concrete supplied in hot weather with a temperature higher than 90 F, it has been successfully used in a given climate or situation, a higher temperature may be determined instead of the 90 F limit. 4.2.2.8 Concrete exposed to alternating cycles of freezing and thawing in the saturated state; deicer salts; fresh, brackish or sea water, including an area in the splash or shower zone; sulphates and concrete, which must have low water permeability, should be determined in order to obtain a ratio of cement materials not exceeding the values in Tables 4.2.2 and 4.3.1 of the ACI, whicheo which of these values applies. If the age in the test is to be different than 28 days, specify the age during the test. If the test sample is to be different from a cylindrical sample measuring 6 x 12 inches, the size of the sample must be determined. If another test method is required, specify the test method. 4.2.2.8.a Identify the areas to be exposed to the chemicals causing the deviation and must comply with the restrictions set out in Table 4.2.2.8. 4.2.3.4.b Determine the age of the test, if different than 28 days, for the proportion of the test mixture. 4.3.1.1 If concrete materials are to be identified, measured, batched or otherwise mixed in accordance with ASTM C 94, the manner in which these procedures are to be carried out shall be specified. (For example, if volumetric drinking and continuous mixing in accordance with ASTM C 685. 4.3.2.1 determine when correction of the drop by adding water at the design site is not permitted. Operation, placement and construction 5.1.2.2.a Specify whether store drawings should be submitted. 5.1.2.2.b determine whether prior notification of a specific placement is required. 5.1.2.2.c whether a request for pre-sale action should be submitted. 5.1.2.2.d Determine whether to apply for rain protection. 5.1.2.2.e Specify whether to apply for heat protection. 5.1.2.2.f Determine whether completed samples must be submitted in accordance with 5.3.3.2. 5.1.2.2.g Determine whether an exposed surface is required. 5.3.2.1.c If concrete temperatures higher than 90 F are acceptable, based on location, relative humidity and previous experience, a higher permissible concrete temperature during hot heat shall be determined. Refer to the ACI 305R report for guidance on determining a higher temperature. 5.3.2.6 Determine whether binding is required in construction connections. 5.3.3.2 Determine whether a finish is required to match the finish of the sample panel to be supplied for comparison purposes. Specify the end location of the sample and the in-situ end location. 5.3.3.3 Specify restrictive tolerances for character finishes after throwing depending on the importance of the appearance of the surface. Additional guidance can be found in the optional requirements checklist in 2.3.1.2. 5.3.3.5 Determine whether or not other than those in 5.3.3.5. 5.3.4.1 Determine which of the finishes or combinations of finishes in 5.3.4.2 are required. If not done, finishes will be required in 5.3.4.2.j. Rigorous qualifications for finishers and finishers may be appropriate when the ease of floor servicing is important for the owner and for large bunk projects with special requirements for flatness, heavy loading, frequent truck movement or automated warehouse movement. For such projects, it should be specified that finishing contractors use qualified flat finishers who are qualified for a particular type of work required and are ACI certified for flat concrete finishers in accordance with ACI CP 10 or equivalent. Equivalent certificates should include written examinations and experience requirements similar to those provided for in the ACI programme. Additional experience requirements for a specific type of work may also be needed. 5.3.4.2.c Specify stricter tolerances, if applicable. Conventional straight tolerance from ACI 117 applies to most general floor structures. For floors requiring stricter tolerances, such as sensitive areas of test or monitoring equipment, flat or very flat floor tolerances from ACI 117 should be specified. More tips can be found in the comment for ACI 117 and ACI 302.1R. Specify tolerances that can be more or less restrictive, if applicable. TECHNICAL DATA FOR STRUCTURAL CONCRETE 301-43 OPTIONAL REQUIREMENTS CHECKLIST, continued Section/Part/Art.b. 5.3.4.3.c 5.3.5 5.3.6.1 5.3.6.5 5.3.7.7 Architectural concrete 6.1.1.1 6.1.1.3 6.1 3.1 6.1.3.3 6.2.2.1.d 6.3.2, 6.3.7.4 6.3.3 6.3.6.1 Notes to the architect/engineer on dry shock finishes, determine metallic or mineral aggregate, final finishing method and location. In the case of high-strength toppings for two-disc panels, the materials, the final finishing method and the location must be specified. For non-slip endings, specify a location. When abrasive particles other than crushed alumina are used, the remaining abrasive particles must be determined. For exposed aggregations, specify the location, color, and size of the aggregations. (Usually from 3/8 to 5/8 inches. Alternative methods of tolerance testing, floor types and floor surfaces may be identified where appropriate. The 10-metre tolerance measurement method of the ACI 117 applies to many small general flooring applications. The ACI 117 F measuring system is used for a wide range of large specialist and general applications. For floors requiring stricter tolerances, such as areas with frequent movement of lift trucks, automatic storage forklifts or housing-sensitive testing and monitoring equipment, flat floor tolerances should be defined very flat from the ACI 117 using the f-number measuring system. When specifying an F measurement system for non-coastal floors, only FF is to be specified, not FL. Note Note a comment for ACI 117 contains warnings (on ASTM E 1155) not to use an F-number measuring system within 2 feet of a connection or structural connection. Care should also be taken when determining the F-number measurement system in the floor areas that slope, unless a specific constant slope is specified so that the FF value is appropriate. More tips can be found in the comment for ACI 117 and ACI 302.1R. Determine whether systolic connections of the saw are required. For concrete surfaces that require increased durability, such as high wear resistance, low permeability or minimal cracking, a longer curing time may be needed than is required to meet the compression strength criteria themselves. When such reinforced properties are required, minimum curing periods of 7 days are recommended for high-strength concrete, 14 days for concrete containing type I or Type II cements and 14 to 21 days for concrete containing pozzolan as one of the cement materials. Additional guidance can be found in aci 308. Determine whether a curing procedure 5.3.6.4 is required to provide additional water. The temperature change rate requirements are taken from ACI 306.1. For optional low-temperature concreting requirements, see the optional requirements checklist for 4.2.2.7 and, where applicable, specify ACI 306.1 in its entirety. If stains, rust, eruption and surface deposits are to be prohibited, describe the extent to which they are unacceptable. Designate the areas to be treated as architectural concrete. Describe special color requirements. If necessary, specify a symmetric array of formwork panels of a specific size. Review sections 1 through 5 and specify the requirements to skip or add for architectural concrete. Designate any special cement materials, aggregates or admixtures required for architectural concrete. If the importance of work requires it, a list of operations for which a technical specialist, trained or approved by the manufacturer of a specialized product, is to be located on the site of the project to provide technical assistance during the first three days of construction work using a specialized position. Specify other times when a technical specialist is to be on site to provide technical support. Specify for which structural elements the Contractor should perform full-scale mock-ups as samples of the finished structure. Specify whether it is acceptable for constraints to be in exposed areas of architectural concrete. Specify areas where the designated colors and color uniformity do not need to be preserved. Specify the areas where stucco or cement coating is required. In this case, specify the applicable requirements or consult the relevant part of the contract documents in relation to the Requirements. Where applicable, specify the required colour. Specify areas where a smooth, wiped or similar finish is required. Specify the areas where post-throw finishes are allowed or required. 301-44 ACI STANDARD OPTIONAL REQUIREMENTS CHECKLIST, continued Section/Part/Article Section/Part/Article 6.3.7.3.b 6.3.7.3.c 6.3.7.3.d Light concrete 7.1.1 7.1.3.1 7.2.2.1 7.2.3.1 7.2.4.44 Concrete bulk 8.1.1.1 8.1.1.2 8.2.1.1 8.2.2.a 8.2.2.1 Architect/engineer notes When acid washing or surface removers are to be used to achieve a cleaned finish, ACI 303R review, A guide to the cast in the place of architectural specific practices, recommendations and appropriate precautions to be followed. For the end of the explosion, if the blasting step is to be different from light, specify what degree of blasting is to be used based on the following: Brush sufficient for matte surface gloss, but there are no revealing Light Maximum1/16 in. Total exposure Medium Maximum 1/4 w. Total exposure Heavy Maximum 1/3 inch with large aggregate diameter See ACI 303.1 for additional guidance. Where a tool finish is specified, indicate whether the surface is to be instrumented, rough or finely sharp, twisted or stamped from the sleeve of the surface texture. If a blow-out or instrumented finish is specified, specify the degree of removal of the surface mortar (removal of surface mortar only, removal of sufficient mortar to reveal the surface of some thickened aggregates in relief to a certain depth, or removal with tools of sufficient material to cut thick-resistance aggregate). Determine the parts of the structure to be made of light concrete. Review sections 1 through 5 and specify the requirements to skip or add for light concrete. Specify whether a pre-soaking lightweight aggregation is not required. Where light concrete is exposed to potentially destructive exposure other than

wear or load, it shall be specified that the air is entrained. Destructive exposure includes freezing and thawing, severe weather conditions or deicer chemicals. Determine the required compressive strength on the basis of requirements ACI 318 4.2.2 and Table 4.2.2. In the case of light concrete, the maximum density of dry air must be determined. Determine whether pre-aggregation of light aggregate by means other than vacuuming, joints or sprinkling is required. Designate the parts of the structure to be treated as ordinary bulk concrete or reinforced concrete. Whether concrete should be marked as bulk concrete depends on many factors such as weather conditions, volume-to-surface ratio, hydration rate, degree of volume limitation, temperature and mass of surrounding materials, and functional and aesthetic cracking effect. In general, heat generation should be taken into account when the minimum cross-sectional dimension approaches or exceeds 2-1/2 ft or when a cement content of more than 600 lb/yd3 is used. However, the requirements for each project should be assessed on the basis of their own achievements. sections 1 to 5 and specify additional requirements or any requirements to be omitted for bulk concrete. For bulk concrete section, cements such as ASTM C 150, type II moderate heat; ASTM C 150, type IV; ASTM C 595 (MH or LH) cements; or a combination of cement and air, air ash, or ground granulated large-scale slag should be used for low heat hydration benefits. Since the low heat of rehydration cement materials tends to have lower early capacity, the conformity of concrete using such materials should be taken into account with other design work. If the lower early strength of the concrete obtained by such cement materials is not acceptable, the appropriate procedures to be followed should be specified. The availability of cement materials should also be taken into account when determining a specific combination of cement or cement material. As a rule, accelerating admixtures should not be used in mass concrete, as they contribute to the early unwanted development of heat. In rare cases, such as early removal of formwork is crucial, accelerating admixtures may be needed to accelerate the development of strength in reinforced concrete in winter conditions. Calcium chloride, if used, should not be allowed in more than 1% by weight of cement. The use of any acceleration admixture must be accepted by the Architect/Engineer. If 28-day strength is not required under operating conditions, a reduction in cement content can be achieved by requiring concrete mixtures to be proportional to strengths other than 28 days, for example after 56 or 90 days. The use of fly ash or other acceptable pozzolana may also reduce the required cement content. Contract documents should specify the use of pozzolans and strong structures at a later age when permitted. SPECIFICATIONS FOR STRUCTURAL CONCRETE 301-45 REQUIREMENTS CHECKLIST, continued Section/Part/Article 8.2.2.2 8.3.1.1 8.3.2.1.a 8.3.2.1.b 8.3.2.4 Compressed concrete 9.1.1 Notes to architect/engineer Specify the maximum allowable drop if it is to be other than 3 inch. for concrete slides of mass or required by 4.2.2.2 for reinforcing concrete. If the concrete temperature limits during deposition are to be different from those given in 8.3.1.1, the maximum and minimum placement temperatures shall be specified. A curing period of 7 days is sufficient for mass concrete in proportion to the specified strength of 28 days. When the strength of the concrete is based on 56 or 90 days compressive strength, the curing period should be extended to a minimum of 14 days. Specify the duration of curing if more than 7 days are required. Bulk concrete is best cured with water to get an additional cooling benefit in warm weather. When water curing is impractical, for example when the ambient air temperature is less than 32 F, other methods, such as the use of liquid membrane-forming compounds, can be used. Specify whether a specific curing method is required. Additional or optional temperature regulators should be specified to minimize cracking For example, limiting temperature differences between the measure and the concrete surface may be desirable for large structurally reinforced areas, such as large mat foundations, if the entire concrete part can be cast in one continuous continuous and an external restraint from adjacent concrete elements can be avoided. Compliance with temperature differences usually requires maintaining warm concrete with insulation. Additional reinforcing steel may also be needed to minimize the width of cracks from the base fixation and higher peak concrete temperatures. Additional guidance can be found in pca publication Design and control of concrete mixtures, 13. Review sections 1 to 5 and specify additional requirements or requirements to be omitted for compressed concrete. 9.1.2.2 If necessary, it should be specified that the Contractor will submit test data confirming the expected coefficients and a set of fixing points. 9.1.3.1.c determine whether a cyclical examination of tendons without bonds is required. 9.2.1.4.b Identify areas which are considered to be corrosive environments where the encapsulation of compression steel at fixing, intermediate and fixed points is required. 9.2.1.6 Determine whether tenth fastenings without bonds are permitted. 9.2.1.7 Indicate the areas in which clutches may be used. 9.3.2.2.d Indicate the areas that will be exposed to salt air or high humidity. 9.3.4.1 Determine the order, strength of the concrete and the steps at which the tendons should be emphasized. Shrink compensation concrete 10.2.1.1.a If expansion cement other than ASTM C 845, type E-1 (K) is acceptable or required, the type of cement must be specified. 10.2.1.1.c Fly ash or ground granular scallop slag will affect expansion and should not be used without appropriate testing. 10.2.1.2.a Acceleration admixtures, in particular those containing calcium chloride, may reduce the expansion of concrete and should not be permitted for use in compensating concrete. 10.2.1.2.b Admixtures may affect the expansion of a specific concrete mixture. Do not allow changes in dosing of the admixture or type without additional testing. Additional information can be found in ACI 223. 10.2.2.2 If different minimum and maximum extensibility limits are desired, specify requirements. The minimum required expansion is based on the expected contraction for the concrete mixture and the amount of reinforcement used. For guidance, consult ACI 223. 10.2.2.3 If the drop is to be different from the 6-inch maximum at the point of placement, specify a requirement. Refer to the optional requirements checklist 4.2.2.2 for information on loss of drop between delivery points and destinations. 10.2.3.1 Due to the initial loss of shrinkage compensation concrete, it is necessary to take into account the initial loss of the drop. If the concrete mixture used in the work has a delivery time of more than 20 min, determine a longer storage time for use in the procedure of proportion of the test mixture. For guidance, consult ACI 223. 10.2.4 Determine the degree of the bar and the required amounts of reinforcement. Concrete compensating for shrinkage must always be strengthened. Reinforcement should be determined in accordance with ACI 318. 318. ACI 223 for additional guidance. 301-46 ACI OPTIONAL STANDARD REQUIREMENTS CHECKLIST, continued Section/Part/Article 10.2.5 10.3.1.2 10.2 10.3.4 Notes to the architect/engineer If necessary, an alternative insulating insulation filler material should be specified. Determine the position of the bars in the reinforced plates on the slope, if they differ from 2 inch from the upper surface. If you need a longer time between casting adjacent sections, specify the time required. For guidance, see aci 223. If the shrinkage-compensating concrete is hardened by a method other than wet curing, the expansion will be significantly reduced. The design or plate should be designed to compensate for this reduced expansion. For guidance, see aci 223. If curing is to continue for more than 7 days, or if a method other than water curing is possible, the requirements must be specified in the Order Documents. CHECKLIST NOTE: These items will be submitted by the Contractor and checked by the Architect/Engineer. Notify the Contractor of acceptance or rejection after reviewing the applications. All submissions and responses should be stored in files for future use during the Work. Some of the submission requirements presented will apply only if optional requirements are selected and saved in the project specifications. After selecting the optional requirements, review the section/part/article indicated for the item you are uploading to see if it applies. Section/Part/Article Submission of elements and notes to the general requirements of the architect/engineer 1.6.3.1 Proposed research agency. 1.6.3.2.e Test data and documentation on concrete materials and mixtures. 1.6.3.2.f Quality control program of the concrete supplier. 1.6.3.2.g Request accelerated test data and correlation. 1.6.4.1.c results of tests and inspections. 1.7.1.4 Proposed repair methods, materials and modifications to the Work. 1.7.4.2.e Description of repairs Performed work to adapt concrete with insufficient strength to comply with the Order Documents. 1.7.5.2.e Description of the repair carried out to bring potentially volatile concrete into the order documents. Formwork fittings and formwork 2.1.2.1.a Data on cladding materials, if different from those specified in section 2.2.1.1. 2.1.2.1.b Data on the proposed departure from the location or details of structural connections shown in the project drawings. 2.1.2.1.c correlation data for alternative methods of determining the strength of concrete for the removal of formwork. 2.2.2.1.d, 2.3.2.5 Detailed plan for removing formwork with less compressive strength than specified. 2.1.2.1.e Plan and procedures for installing and removing reshoring and backshoring. For guidance on the products to consider, see Articles ACI 347R. 2.1.2.1.f Data on the measure or formwork inserts. 2.1.2.2.a Shop drawings for formwork. 2.1.2.2.b For formwork, reshoring and backshoring. 2.1.2.2.c Data and samples of mold bindings. 2.1.2.2.d Data and samples of expansion materials. 2.1.2.2.e Data and and water stops. 2.2.2.5 Alternative locations and details for formed structural and systolic joints. 2.3.2.5 Detailed plan for removing formwork with less compressive strength than specified. 2.3.4.2 Data correlating alternative methods of measuring the strength of concrete for the removal of formwork. Reinforcement and reinforcement of support 3.1.1.a Placing drawings showing reinforcement dimensions and locations for reinforcement and supports placement. 3.1.1.1.b for the use of splices not in the project drawings. 3.1.1.1.c, 3.3.2.7 Application for the use of mechanical sings not in the project drawings. 3.1.1.1.d Request to place column pins without templates. 3.1.1.1.e, 3.3.2.8 Application and procedure for bending the field or straightening of partially mounted reinforcement. TECHNICAL DATA CONCRETE CONSTRUCTION.B EGO 301-47 SUBMITTALS CONTROL SECTION/Part/Art. 3.3.2.2 3.2.2.1 3.3.2.5 3.3.2.9 Concrete mixtures 4.1.2.1 4.1 1.2.2 4.1.2.3 4.1.2.4 4.2.5 4.1.2.6 4.1.2.7 4.1.2.8 Submission of observations to the architect/engineer Description of weld reinforcement locations, Locations welding procedure, and the qualifications of welders. Proposed supports for coated reinforcement and uncovered reinforcement not covered by 3.3.2.4. In the event that the Contractor deems it necessary to move the reinforcement beyond the specified placement tolerances in order to avoid interference with other reinforcements, relays or embedded elements, review the report showing the resulting reinforcement system. Request to warm and bend reinforcement. Request to expand welded wire fabric through systolic joints. Request for reinforcement cut in the field. Proportions and properties of the mixture. Check that the proportions of the mixture comply with requirements 4.2.2 for cement material content, yield, ratio of water cement materials, drop, nominal maximum coarse aggregate size, air content, admixtures and chloride ion concentrations, as well as compressive strength. Test methods and data used to determine the proportion of the mixture. Several different methods can be used to choose the proportion of the mixture to produce the necessary ease, density, strength and durability of concrete. Field experience of concrete mixtures previously used under similar conditions provides the best assurance that the proposed concrete mixture can be used satisfactorily and has certain characteristics. If there is no field experience, ACI 211.1 provides guidance on how to select the initial quantities of materials based on material properties and specific concrete properties. If a field test record is not available, ACI 211.1 recommends checking the properties of the mixture using test batches in the laboratory or in the field. Mixing aggregates to meet the criteria of a combined slope is another proportional method that can be used. The following are some of the different procedures that have been used to determine the proportion of mixed • Combined finesse module; • 8 to 18% 18% on each of the standard sieves; • Thickness factor graph; • Power chart 0.45. If one of the above or other similar methods is used, a special aggregate classification to which the aggregate is to be mixed shall be submitted, together with the control tolerances. This method also requires that specific properties be checked by trial batches. Information on the types, classes, manufacturer names and locations of cement plants; the types, sites of excavation or quarry, names of producers, classifications and characteristics required by ASTM C 33 for aggregates; types, brand names and manufacturer names for admixtures; sources of water and ice supply. With the exception of admixtures and water, test results confirming compliance with the relevant specifications may not be more than 90 days. The results of the aggregate robustness, abrasion and reactivity studies may be older than 90 days but not older than 1 year, provided that the test results for the other properties specified in ASTM C 33 indicate that the aggregate quality has not changed. Materials, proportions of mixtures and field strength test data used for proportions. Requests for adjustment of the proportion of mixtures. Requests for adjustment of the proportion of the mixture necessary for feasibility or consistency. If the Contractor wishes to reduce the content of cement materials in the concrete mixture after compliance with requirements 4.2.3.6, review the application for approval of the proposed modified mixture with a lower content of cement materials on a trial basis. If the Contractor considers it necessary to increase the content of cement materials, it is necessary to apply for acceptance of the proposed modified mixture with a higher content of cement materials on a trial basis. Confirmation that the adequacy of the modified proportions has been verified on the basis of a set of new field test data. The results of the assessment and testing required in section 4.2.2.1 verifying the adequacy of the concrete to be placed on the floors if the cement content is less than the minimum specified in Table 4.2.2.1. Application for calcium chloride. Request the use of a batch to volumetric method. 301-48 ACI STANDARD SUBMITTALS SECTION/Part/Article Submission of elements and observations to architect/engineer 4.1.2.9 Requests to exceed the required astm c 94 termination time. 4.2.1.1 Applications for the use of cement materials other than ASTM C 150 type I or Type II. 4.2.6.3.c Improved proportions of mixtures based on the changed value fcr′ . Operation, placement and construction of 5.1.2.1.a Test and inspection records. 5.1.2.1.b description of transport equipment. 5.1.2.1.c method for measuring changes in concrete surface temperature. 5.1.2.1.d Proposed method of repairing the removal of stains, rust, eruptions and surface sediments. 5.1.2.1.e Qualifications of the contractor of finishing and finishing flat finishers. 5.1.2.2a Shop drawings for entering, operating and constructing methods. 5.1.2.2.b Advance notification of the Placing. If necessary, appropriate investigations and inspections should be organised 5.1.2.2.c Request for the adoption of long-distance operations to ensure that the out-of-place operations are adequately controlled if necessary. 5.1.2.2.d Proposed rain protection measures. 5.1.2.2.e Proposed precautions for the placement of concrete hotter than 90 F. 5.1.2.2.f Sample finish. 5.1.2.2.g Manufacturer's specifications and data for the chemical retarder used in the manufacture of the finish with exposed aggregates together with the method of application. 5.1.2.3.a The proposed location and treatment of construction connections is not shown in the project drawings. Review of proposed methods of surface roughness and use of Portland cement mortar. 5.1.2.3.b non-cement mortar for double-door panels. 5.1.2.3.c Proposed method of underwater installation. 5.1.2.3.d The proposed location of the systolic connections is not indicated in the project drawings. 5.1.2.3.e, 5.3.6.4 Proposed curing methods other than those from 5.3.6.4.a to e. 5.1.2.3.f Description of the proposed coated bonds. 5.1.2.3.g, 5.2.1.3, 5.3.7.6 Specification and data and methods of use of any proposed repair materials other than portland cement mortar mixed in place as described in section 5.3.7.5 (see 5.3.7.6). In the case of slices in exposed concrete, care should be taken when using the materials described in 5.3.7.6, in particular with regard to possible colour changes due to airing and dissection caused by different coefficients of thermal expansion. Make sure that the material, including astm type or class, is suitable for moisture exposure conditions and thermal conditions. 5.3.2.1.c request to exceed the concrete temperature of 90 F together with the proposed precautions. 5.3.2.6 Proposed materials and methods of preparing the concrete surface to achieve bonding. 5.3.4.2.f Application for binding measures other than cement mortar. 5.3.5 Detailed plan for an alternative saw cutting method, such as shallow cutting and dry cutting. For more guidance, see aci 302.1R. 5.3.6.5 Method of measuring the temperature of the concrete surface. Architectural concrete 6.1.2.1.a Shop drawings and design drawings for architectural concrete formwork. These drawings shall show a combination of standing panels; locations and details of ties of forms and nooks and crannies; details of connections, attachment points and other accessories; and any necessary stiffening of the alignment. Review the drawings for the condition of the finished surface, joining, location of mold fixing holes and their treatment, types of mold bindings, location and details of rustic strips, tightness, assembly and removal. 6.1.2.2.a Request for a proposed full-scale mock-up location at the site of the project. 6.1.2.2.b Mock-ups or sample panels with aggregate translations and other special finishes. When an aggregation finish is required, refer to the method description (such as blast6.1.2.2.c, hammering or using a surface retarder) The contractor wants to use to reveal aggregates. Lightweight concrete 7.1.2.1 Test results on field deployment. 7.1.3.1 Request for alternative pre-soaking methods or light chiller times. Aggregate. The data correlate the density of dry air with fresh bulk density. TECHNICAL DATA OF STRUCTURAL CONCRETE 301-49 SUBMITTALS INSPECTION SECTION/Part/Art. 8.2.1.2 Pre-concrete 9.1.2.1 Submission of articles and observations to the architect/engineer The proposed dosing and mixing procedure, which differs from the specific requirements in Section 4 — Concrete mixtures and Art. If the Contractor needs additional water or air, review the application to do so. If the Contractor needs additional water or air to bring the concrete to a certain drop, review the application and the quantities to be added. If the Contractor deems it necessary to use a delaying, accelerating or other admixture in the bulk concrete, the manufacturer's data on the admixture and the results of the Contractor's tests for admixture with other project materials should be reviewed. Shop drawings and data on: • Location of tends and sheathing; • Size, details, location, materials and stresses (where applicable) for tendons and accessories; • Jack clearances, lift procedure, stress sequence, initial tendon forces, gage pressure and tendon elongation. 9.1.2.2 Data on: • Typical stress and deformation curve of compression steel; • Results of tests of the highest strength, elongation and composition of non-manufactured material according to ASTM specification; • Values of the wobble coefficient and curvature coefficient and anchor set data; • Test data confirming the expected factor and set of attachment points, if required. 9.1.2.3, 9.1.3 Data on the actual material to be used in the work: • Stress and strain curve for the sample taken from the production batch of compression tendons to be used in the Process; • Certified test reports of the mill for tendons, if necessary; • Results of the tests required in point 9.1.3.1 (test team, static test, cyclic test, mortar test). 9.2.1.1 Data showing that weaves, wires and rods not listed in ASTM A 416/A 416M, A 421/A 421M, A 722/A 722M and A 779 do not have properties that make them less satisfactory than those mentioned in these ASTM documents. Tendons should be produced in the Post Tensioning Institute (PTI) certified plant. 9.2.1.7 Proposed clutch locations in locations other than those indicated in the Order Documents. 9.3.2.2 Data on the coating used in the field for tendons extending beyond concrete or in concrete under conditions of severe exposure or non-rape tendons for more than 28 days after tendon placement. 9.3.4.3 Records of the measured elongation pressure and gage pressure or dynamometer for the compression force. Shrinkage-compensating concrete 10.1.3.2, 10.2.3.2 Results of conductive tests for proposed concrete mixtures. 10.1.3.3 Placing the sequence before placing the concrete. It is very important that concrete is in such a way as to allow for the placement of the For guidance, consult ACI 223. 10.2.3.3 Proportions and expansion test results for changed proportions of mixtures. Aspect ratio.