



COCONINO COUNTY PUBLIC WORKS DEPARTMENT
CONCRETE and STEEL STANDARDS

CONTENTS

ABOUT THESE STANDARDS	page 2
CONCRETE AND CEMENTICEOUS MATERIALS	2
General	2
CONCRETE MIX DESIGN	2
SLURRY MIX DESIGN	3
CURING	3
SAW CUTTING	3
CONCRETE DRIVEWAYS	3
SIDEWALK AND CURB & GUTTER	3
ALL OTHER CONCRETE STRUCTURES	3
PLACEMENT AND DELIVERY	3
Concrete Requirements	3
Delivery Tickets	4
STEEL REINFORCEMENT	4
QUALITY CONTROL (QC)	4
SAMPLING AND TESTING OF CONCRETE	5
Minimum Required Sampling and Testing	5
ACCEPTED TEST METHODS	6
Field	6
Lab	6
REPORTS	6
Reports Shall Include	6
FINAL ACCEPTANCE AND PAYMENT	6
HEALTH AND SAFETY	7
DUST CONTROL	7
TRAFFIC CONTROL	8

About These Standards

All concrete and steel shall be placed and tested in accordance with this section, unless otherwise stated by the County engineer or his/her representative. For construction purposes, *the following precedence of standards will prevail*: Current Coconino County Public Works Department Standards (including: Earthwork, Concrete, and Paving Standards); current International Building Code (IBC), Project specific plans and specifications; geotechnical report; ADOT Standards; and MAG Standards.

Within 30 days of completion of the concrete project, the project engineering firm shall submit a *report* to the County Engineering Department. The report shall comply with the subheading in this section titled "Reports".

The following standards shall be considered the minimum standards to be used on Coconino County concrete projects. Additional recommendations and specifications may also be incorporated for construction if stated in a project engineering report, as shown on the project plans, or as directed by the County.

Concrete and Cementitious Materials

The contractor shall be responsible for producing, transporting, and placing concrete and all related materials in conformance with this section. All work performed, and material used shall be warranted from defect by the contractor for a period of 1 year from the date of final acceptance of the project. Any work necessary to repair damaged or failing areas shall be performed wholly at the contractor's expense, with the repairs made in a timely manner, as determined by the County Engineering Department.

General Unless otherwise stated within this section, or directed by the County Engineering Department, **cementitious materials and reinforcement shall be placed in conformance with the American Concrete Institute (ACI) and the International Building Code (IBC) standards. Suppliers shall conform to ASTM C94 standards, and shall have their scales calibrated annually by ADOT, or other testing agency accepted by the County Engineering Department. Proof of compliance with the *General* provisions in this section shall be submitted by the supplier or contractor if requested by the County Engineering Department.**

All concrete rampways, stairways, steel handrails, and other related structures shall comply with current **ADA** (Americans with Disabilities Act) and **ABA** (Architectural Barriers Act) standards.

Concrete Mix Design Concrete shall conform to **ASTM C94** standards. All concrete shall be air entrained with **6% air (± 1.5%)**. Concrete for **curb, gutter, and sidewalk shall be a 3,000 psi mix**; concrete for **all other structures shall be 4,000 psi**.

The contractor will either choose a mix design currently approved by the County, or hire an engineering laboratory to develop the necessary mix design. All new mix designs are subject to approval by the County Engineering Department, and shall be submitted for approval no less than 30 days prior to the use date. After acceptance by the County, subsequent changes to the mix design may only be made with the approval of the County Engineering Department.

Slurry Mix Design: Slurry shall be a 2 sack chip or sand slurry. Slurry shall be placed in conformance with ASTM C94, unless otherwise approved by the County Engineering Department.

Curing: Curing shall begin immediately after machine or hand finishing of the concrete is completed, and shall continue for a **minimum of 7 days**, unless otherwise approved by the County Engineering Department.

During curing, **all exposed concrete shall be covered by blanketing or plastic**, depending on weather conditions. For curb, gutter, and sidewalk; curing compound shall also be applied (at a minimum of 1 gallon per 100'). Forms may be required to be left in place until 80% of strength has been attained. Traffic and other loads shall be restricted until 80% of planned strength has been reached. Percent of strength shall be confirmed by ASTM C39, compressive strength of cast cylinders.

Saw cutting: All saw cutting of concrete must be performed with a saw cutting machine and cut to clean and straight edges. No hand held rotary blade saw cutting will be allowed unless approved by the County. Sidewalk and curb & gutter shall be cut at the nearest contraction or expansion joint.

Concrete Driveways shall be 5" thick **4,000 psi** concrete entrained with 6% air, with 6x6/W1.4xW1.4 (6x6/10x10) welded wire centered horizontally in the slab, supported by dobies, over 4" of aggregate base (compacted to 95%); placed over prepared and compacted subgrade (95%), per Coconino County Earthwork Standards.

Sidewalk and Curb & Gutter shall be **3,000 psi** concrete with 6% air, supported by 4" of aggregate base (compacted to 95%); placed over prepared and compacted subgrade (compacted to 95%), per Coconino County Earthwork Standards.

All Other Concrete Structures (including manholes, bridges, culverts, and all traffic bearing concrete) shall be **4,000 psi** concrete with 6% air, supported by 4" of aggregate base (compacted to 95%); placed over prepared and compacted subgrade (compacted to 95%), per Coconino County Earthwork Standards.

Placement and Delivery: Concrete shall comply with ASTM C94; "Standard Specifications for Ready-Mixed Concrete", unless otherwise stated herein. Cementitious material shall be rejected when not in compliance with any project specifications.

Concrete shall meet the following requirements:

- The County may reject upon delivery if the product code shown on the ticket does not match a current County approved mix.
- Placement of cementitious materials below air **temperature of 32^oF shall require hot water in mix**, unless otherwise approved by the County Engineer.
- **Hot water** shall only be added during batching, the temperature must then be allowed to stabilize in the aggregate *prior* to adding in cement.
- Cementitious **material Temperature** at time of placement shall be **50^oF to 80^oF**
- **Slump:**

<i>For Specified Slump</i>	<i>Tolerance</i>
2" or less	±1/2"
>2" through 4"	±1"
>4"	±1 1/2"

- **Air Entrainment:** 6% ($\pm 1.5\%$)
- **Mixing :** Discharge of concrete shall be completed within **90 minutes** of batching
- Maximum of **300 drum revolutions** prior to completion of discharge
- Concrete shall not be transported in loads larger than 10 cu. yds.
- **Water** may be added at the time of arrival to bring the mix to specified slump; then no subsequent water shall be added.
- **Delivery:** A **tremie** or other methods, as required by the project Engineering firm or County Engineering Department, shall be used to help minimize segregation during placement as necessary. Cementitious materials should not be allowed to free fall from a height greater than 5'.

Delivery Tickets must have the following information at the time of delivery; concrete trucks arriving without the following information on their tickets may be rejected by the County or their representative.

- Plant or manufacture name and location
- Project name, and location of delivery
- Material batched: Mix # (Product code), including all additives
- Date and Time batched
- Time of arrival at site
- Weight or yd³ of material batched into truck
- Truck number or license
- Driver name
- Total gallons of water added after leaving the batch plant, including on-site
- Signature by the Contractor's representative acknowledging receipt of the product
- Ready-mix trucks shall bear proof of certification by ADOT or other County approved agency.
- A copy of the delivery ticket shall be given to the County or their representative at the time of delivery.

Steel Reinforcement: All reinforcing steel shall be placed in accordance with the current **International Building Code (IBC)**, and shall conform to the following, unless otherwise approved by the County Engineering Department:

- **Delivery** of all steel (and other specified materials) **shall include a Certificate** of manufacture (including original tickets and/or data sheets or shop drawings) confirming that specifications and standards are met.
- All steel placed must be inspected and approved prior to pouring concrete. **Steel Inspections** shall be performed in accordance with **IBC section 1704.1**.
- **Steel Inspectors** shall be **ICC certified**, unless otherwise approved by the County.
- **Steel bar** shall conform to ASTM A615 and be **Grade 40; Welded wire mesh** shall conform to ASTM A185.
- All flatwork **steel** (welded wire mesh, etc.) **shall be supported by dobie blocks** (or other material approved by the County Engineering Dept.) and placed midway in concrete thickness. The **raising of steel during a concrete pour will not be accepted.**

Quality Control (QC): The *contractor* shall hire an engineering laboratory (QC) to sample, test, inspect, and document the batching, delivery, and placement of all cementitious materials, as well as footing excavations and all steel placed.

It is the QC's responsibility to understand current County standards, and communicate test results to the contractor and the County on a daily basis. Field reports and field test data shall be submitted by the QC to the County daily during the project. Construction that is dependant on field or lab results may be stopped by the County, until the necessary data has been submitted to the County.

The engineering laboratory shall hold current accreditation by AMRL, as described in this section under the subheading "Sampling and Testing of Concrete and Related Materials".

The contractor shall stop placing, and/or remove any unacceptable material upon notification by the QC engineering lab or the County that the material is out of specifications, and shall not resume placement until the material is shown to the County to be back within project specs. The QC engineering lab shall submit all testing, sampling, and field observation documentation to the County Engineering Department, as specified in the subheading of this section titled "*reports*".

The County Engineering Department reserves the right to hire an engineering laboratory of their choice to perform quality assurance (QA); including steel and footing inspection, mix design review, and the sampling or testing of cementitious materials; either at the plant and/or during placement.

Materials or work not meeting project requirements will be rejected. Unacceptable materials shall be removed immediately by the contractor, unless the County Engineering Department agrees to other arrangements.

Sampling and Testing of Concrete and Related Materials

All sampling procedures for concrete and related materials shall be performed in accordance with current ASTM standard test methods, unless otherwise approved by the County Engineer or noted below. **Laboratory testing, field sampling and testing, and inspection or observations, shall be performed by ACI, NICET, or ICC certified personnel only**, unless otherwise approved by the County Engineering Department. **All Engineering laboratories performing work on Coconino County projects shall hold current accreditation by AMRL as an approved AASHTO-R18 Lab.**

Minimum Required Sampling and Testing for concrete, grout, and slurry:

- **1 set of 4 cylinders per each 50 cu. yds.** of material placed (min. of 1 set per pour)
- **1 air test per each 50 cu. yds.** (Sample 1st truck load)
- **Slump and Temperature:** Each Truck load
- **Cylinders shall be broken at:** 1 @ 7 days; 2 @ 28 days (ave.); 1 hold.
- **Forms shall not be removed**, and concrete shall not be loaded with traffic (or otherwise) until **80% of required strength** has been met.
- Concrete, slurry, and grout will **not be accepted** by the County as meeting specifications **until 100% of the required strength** has been met.

Accepted Test Methods are:

Field

Sampling Freshly Mixed Concrete	C172 / 4.02
Slump	C143 / 4.02
Temperature of Freshly Mixed Concrete	C1064 / 4.02
Air Content (Type B Meter) by Pressure	C231 / 4.02
Air Content by Volumetric	C173 / 4.02
Making and Curing Test Cylinders	C31 / 4.02
Unit Weight	C138 / 4.02

Lab

Standards Specifications for Ready-Mixed Concrete	C94 / 4.02
Compressive Strength of Cast Cylinders	C39 / 4.02
Compressive Strength of Drilled Cylinders	C42 / 4.02
Shotcrete Panel Testing (3 Cores)	C1140 / 4.02
Flexural Strength, Beam (3 Point Loading)	C78 / 4.02
Flexural Strength, Beam (Center Point Loading)	C293 / 4.02
Length of Change of Hardened Concrete	C157 / 4.02
Time of Setting of Concrete Mixtures	C403 / 4.02
Air Entraining Admixtures for Concrete	C260 / 4.02
Specifications for Fly Ash	C618 / 4.02
Specifications for Air Entraining Additions	C226 / 4.01
Soil Cement Design	Ariz 220 / ADOT
Compressive Strength of Soil Cement	Ariz 241a / ADOT

Reports Upon completion of a concrete or related project, an engineering report shall be submitted to the County Engineering Department. This engineering report shall be signed by a registered civil or geotechnical engineer, or a NICET Level IV technician.

Reports shall include:

- **A description of the project**
- **All laboratory and field test results**
- **A plot plan, showing areas of work.**
- A statement that ***“all concrete and steel has been placed in general accordance with project plans and specifications”***. Any exceptions or non-compliances shall be stated in the report.

All reports shall be submitted to the County Engineering Department within 30 days after the completion of construction.

Final Acceptance and Payment

- Payment shall only be made for materials used that conform to the project specifications.
- Concrete shall be rejected if it does not reach 100% of designed strength at 28 days. Strength of concrete shall be confirmed by either test method C39 or C42 (ASTM vol 4.02).
- Original delivery tickets shall be used in calculation of payment for materials.
- All concrete must have an appearance of uniform finish and color and shall be aesthetically pleasing in appearance, and acceptable to the County Engineering Department.

- The **finished tolerances** for extruded and cast-in-place concrete shall conform to the following:
 - ❖ Not vary more than $\frac{1}{4}$ " **within any 10' length**.
 - ❖ Not vary more than **1" for entire length**.
 - ❖ Not vary more than $\frac{1}{8}$ " **where new concrete abuts existing concrete** (saw cut or poured).
- **Cracked, out of tolerance, honeycombed (observable air pockets), or otherwise visually unacceptable concrete shall be removed and replaced** by the contractor prior to County acceptance of the final product. No patching with mortar, epoxy, or other materials will be accepted unless specifically approved by the County Engineering Department.
- **Final acceptance and payment shall not be made by the County until all lab reports and inspection data has been submitted** to the County by the contractor's QC engineering firm, in accordance with the "Reports" section herein.

Health and Safety During the construction process, all applicable "OSHA Standards for the Construction Industry" shall be followed, including (but not limited to) 29 CFR Part 1926, Subpart P – Excavations. All construction equipment, materials, open trenches and excavations shall be safely fenced off from public access during the entirety of the project. The County may stop construction on a project until safety concerns have been corrected.

Knowing and following OSHA Safety Standards is the contractor's responsibility. If at any time a representative of the County determines that a safety or health concern is present, he/she may stop construction on a project until safety concerns have been corrected to the satisfaction of the County—the County shall pay no additional monies for such corrections.

During construction the contractor shall supply the work area (job site) with a minimum of one porta-toilet, and more as necessary or directed by the County for larger projects. The County may stop a project until safety violations have been corrected, and may choose to rescind the grading permit for continued safety violations.

Dust Control Dust and airborne particulate must be limited in all areas that a contractor is performing construction, or where equipment is driven to access the work area. Dust generated by a construction project shall not impact the health or safety of personnel on or nearby the project site. Dust shall not impede the visibility of traffic or pedestrians around the project site. All trucks transporting material while working on Coconino County projects shall have their loads covered during transit and until they unload at their destination.

Dust control shall be maintained throughout the duration of the project, including weekends, and other off-work hours as necessary. It is the contractor's responsibility to maintain dust control. The County may stop a project until dust and debris have been properly controlled.

Existing paved roadways, driveways, and any other paved/concrete areas must be washed or swept free of dirt and debris daily, or more often as necessary. The County may stop a

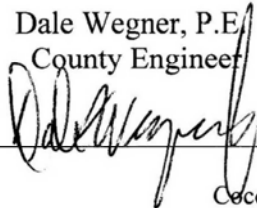
project until dust and debris have been properly controlled, or until truck loads are properly covered. For repeated offenses regarding dust or any other safety violations the County may choose to rescind the grading permit.


Traffic Control A traffic control plan shall be submitted to the County a **minimum of 7 days prior to the commencement of any roadwork** (or construction, where the contractor may be entering or crossing the roadway with equipment during construction). The traffic control plan must be approved by the County prior to commencement of construction.

The traffic control plan shall conform to Part 6 – Temporary Traffic Control, in the MUTCD. Traffic control shall be maintained in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), which is published by ATSSA/ITE/AASHTO, and approved by USDOT and the Federal Highway Administration (current edition). It is the contractor’s responsibility to implement the traffic control plan. The County may stop construction on a project until traffic safety concerns have been corrected.

Within all County residential areas and roadways, flaggers and construction warning signage shall be used during all construction. Flaggers shall use standard hand held “Stop” and “Slow” paddles (not hand held flags). Flaggers shall be equipped with radio communication when not in full view of each other. Pilot vehicles used during paving and other roadway projects shall be clearly marked, be equipped with warning lights, and be in radio communication with flaggers at each end of the traffic control area.

Flaggers shall be certified by the ATSSA or a County accepted equivalent program. It is the contractor’s responsibility to have properly trained flaggers—and they must perform their duties according to all County traffic safety standards. Flaggers that do not perform their work according to County and ATSSA standards will be removed from the project.

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Standards may be downloaded at: <http://www.coconino.az.gov/> (Public Works; Engineering)