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## CONCRETE TESTING PROCEDURES

*(Aligned with ASTM C31, C39, C143, C138, C231, C173, C94, ACI 301, ACI 318, and FDOT Section 346)*

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### 1. PURPOSE AND SCOPE

This procedure establishes standardized methods for sampling, testing, and verifying the quality of concrete used in all Magnum Construction Services projects. It ensures compliance with contract specifications, design requirements, and governing codes (ASTM, ACI, FDOT, USACE).

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### 2. RESPONSIBILITIES

Role	Responsibilities
<b>Project QC Manager</b>	Oversees testing program, ensures certified technicians and calibrated equipment.
<b>Field QC Technician</b>	Performs sampling, slump, temperature, and air content tests. Casts cylinders per procedure.
<b>Third-Party Lab</b>	Performs compressive strength testing, moisture correction, and reports certified results.
<b>Site Superintendent</b>	Coordinates access for QC activities and ensures corrective action for any non-conformance.

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### 3. APPLICABLE STANDARDS

- ASTM C31 – Making and Curing Concrete Test Specimens in the Field
- ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens
- ASTM C138 – Density (Unit Weight), Yield, and Air Content (Gravimetric)
- ASTM C143 – Slump of Hydraulic Cement Concrete
- ASTM C173 / C231 – Air Content (Volumetric / Pressure Method)
- ASTM C1064 – Temperature of Freshly Mixed Concrete
- ASTM C94 – Ready-Mixed Concrete
- ACI 301 – Specifications for Structural Concrete
- ACI 318 – Building Code Requirements for Structural Concrete
- FDOT Section 346 – Portland Cement Concrete

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### 4. SAMPLING PROCEDURE (ASTM C172)

- Obtain sample from the **middle third of the batch discharge**.
- Minimum sample size:
  - 1 ft<sup>3</sup> (28 L) for slump, air, and temperature
  - Additional 1 ft<sup>3</sup> (28 L) per set of test cylinders
- Time from batching to sampling: **≤ 15 minutes**.
- Avoid contamination, segregation, or re-mixing.
- Label each sample with project ID, truck #, batch time, location, and sample time.

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### 5. FIELD TESTING (PER LOAD)

Test	Standard	Frequency	Acceptance Criteria
Slump	ASTM C143	Each truck	±1.5 in from design slump
Temperature	ASTM C1064	Each truck	50 °F – 90 °F





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Test	Standard	Frequency	Acceptance Criteria
Air Content	ASTM C231 / C173	1 per 50 yd <sup>3</sup> (min 1 / day)	±1.5 % of design value
Density / Yield	ASTM C138	1 per 50 yd <sup>3</sup>	±2 % of theoretical
Cylinders (Compressive)	ASTM C31/C39	1 set per 50 yd <sup>3</sup> (min 1 set/day)	Meets f'c @ 28 days

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## 6. CYLINDER CASTING & CURING (ASTM C31)

- **Molds:** 6 × 12 in or 4 × 8 in plastic molds.
- **Preparation:** Lightly oil molds; fill in two layers (rodding 25 times each).
- **Initial Curing (Field):** 60 – 80 °F for 24 ± 8 hours.
- **Transport:** Secure upright; prevent shock or vibration.
- **Final Curing (Lab):** 73 ± 3 °F and moist conditions until testing.
- **Testing Ages:** 7 days and 28 days (optional 56 days if specified).

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## 7. COMPRESSIVE STRENGTH TESTING (ASTM C39)

- **Machine calibration:** Verified every 12 months (per ASTM E4).
- **Loading rate:** 35 ± 7 psi/sec.
- **Reporting:** Strength to nearest 10 psi.
- **Acceptance:**
  - Average of 3 cylinders ≥ f'c.
  - No single cylinder < f'c – 500 psi.

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## 8. NON-CONFORMANCE PROTOCOL

If test results do not meet specification:

1. QC Manager notifies Project Manager and Structural Engineer.
2. Immediate field investigation (placement, batching, curing).
3. Optional **core sampling** (ASTM C42) or **rebound hammer** (ASTM C805).
4. Engineer-of-Record (EOR) decision: accept, reject, or remedial action.
5. NCR form logged in **Non-Conformance Register**.

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## 9. RECORDS AND REPORTING

- Each test documented on **Concrete Test Report Form (MCS-QC-CON-01)**.
- Reports include: date, time, truck, location, batch ticket, test results, technician signature.
- All test data uploaded to **Project QC Database** and retained  $\geq$  5 years.
- Lab certifications (AASHTO R18 / ASTM C1077) attached to report package.

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## 10. EQUIPMENT CALIBRATION LOG

Equipment	Calibration Frequency	Reference Standard
Slump Cone	Annual	ASTM C143
Air Meter	Semi-annual	ASTM C231
Thermometer	Quarterly	ASTM C1064
Compression Machine	Annual	ASTM E4
Scale	Annual	ASTM C702

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## 11. SAFETY AND ENVIRONMENTAL CONTROLS

- PPE required: safety glasses, gloves, concrete-resistant boots.
- Rinse and dispose of wash water in compliance with **EPA 40 CFR Part 122**.
- Maintain clean test area and spill containment at all times.

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## 12. QUALITY ASSURANCE VERIFICATION

- Random internal audits by QA Manager per ISO 9001 Clause 9.2.
- Third-party verification quarterly by accredited lab.
- Continuous improvement log tracks recurring non-conformances and resolutions.