

DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS

DIVISION 3 • CONCRETE

03 30 00 • CONCRETE

SECTION INCLUDES

Cast-In-Place Concrete
Vapor Barrier under Slabs
Architectural Precast Concrete
Concrete Repair

RELATED SECTIONS

05 10 00 Structural Steel
05 50 00 Miscellaneous and Ornamental Iron
06 10 00 Rough Carpentry
07 10 00 Waterproofing and Dampproofing
07 20 00 Building Insulation & Moisture Protection
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CAST-IN-PLACE CONCRETE

MATERIALS

Provide structural concrete as per code and engineering requirements.
The following classes of concrete are recommended:

Foundations, basements walls, slabs not exposed to weather	3,000 psi
Foundations, basements walls, slabs exposed to weather	3,500 psi
Driveways, slabs, sidewalks, porches, patios, and steps exposed to weather	5,000 psi

Mixing Types:

- Type I, IA Residential work
- Type II, IIA Soils or ground water contains sulfates
- Type IIIA Cold weather use when freezing is a risk

Air entrainment for all exterior concrete exposed to weather such as flatwork, steps, walkways, and patios should be 5% to 7%. Air entrained concrete resists harmful effects from rock salt and performs better in freeze thaw cycles. Admixtures shall be employed only when necessary for use in a particular concrete, and they shall be in accordance with manufacturer's instructions.

Admixture Types:

Admixtures shall comply with ASTM C 494 and are classified as follows:

Type A Water-reducing
Type B Retarding
Type C Accelerating
Type D Water-reducing and retarding
Type E Water-reducing and accelerating
Type F High range water-reducing
Type G High range water-reducing and retarding

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The use of chloride-containing admixtures is prohibited because it can cause detrimental effects on embedded metals and degradation of concrete structures.

Where removable formwork is used, specify a biodegradable form release agent.

Specify standard ready-mix concrete for which historical performance data is available.

The Designer and DHCD Construction Advisor will determine the extent of testing. If testing is necessary it will be per the requirements of the Designer, and paid for by the LHA. Check building code testing requirements of the International Building Code.



Sustainable Products:



Concrete as a building material is very durable, provides some thermal benefits and pest deterrence. Concrete also has the highest embedded energy (and therefore greenhouse gas emissions) of building materials in its manufacture and the lowest value when it comes to recycling at the end of its life. However, most concrete is produced locally or regionally with plentiful natural resources like sand and gravel, or industrial by-products like fly ash; using concrete with some recycled content helps reduce its CO₂ emissions.

In addition to recycled content, other sustainability issues to consider in using concrete include:

Use reusable concrete formwork with vegetable based form release.

Use termite shields in lieu of chemical treatment.

Low VOC concrete hardening compounds may be considered.

Use plastic rebar supports in lieu of steel and consider glass fiber reinforced polymer rebar near the shore.

DESIGN

Standards:

All cast-in-place concrete shall comply with the following standards:

- ACI 302, "Recommended Practice for Concrete Floor and Slab Construction"
- ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete"
- ACI 305, "Recommended Practice for Hot Weather Concreting"
- ACI 306, "Recommended Practice for Cold Weather Concreting"
- ACI 309, "Consolidation of Concrete"
- ACI 315, "Recommended Practice for Detailing Reinforced Concrete Systems"
- ACI 614, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete"
- CRSI, "Reinforced Concrete - A Manual of Standard Practice"

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Mix designs shall be submitted to the Designer for approval prior to placing concrete.

Concrete Finishes:

- Floated finish: shall be provided where concrete flatwork is to receive waterproofing membranes or setting beds for finished materials.
- Floated finish: shall be provided for top surfaces of walls, slabs and beams
- Smooth troweled finish: shall be provided where interior concrete flatwork is to be exposed work or is to receive resilient flooring materials.
- Broom Finish, transverse direction (with smooth edging): shall be provided at exterior concrete walks, pavements and steps.
- HC Ramps: broom finish, parallel to pitch to facilitate water run-off.

The minimum interior slab thicknesses is 4" is industry standard, with 6" for garages. Allowed tolerances for slab levelness of a 1/4 inch over 10 feet typical and an 1/8 inch over 10 feet for new wood flooring. Provide a concrete sealer to the exposed edges of slabs on grade.

Coordinate the design and the documentation of the foundation drainage systems.

For New Slabs at Existing Basement Floors:

- New fully bonded slab over existing concrete: use overlay toppings 1"-2" thick (Self-Leveling Concrete), such as:
 - Sikaset by Sika
 - ARdex K-15 by Ardex
 - Bonsal Self Leveling Wear Topping by W.R. Bonsal
 - or conventional concrete (low slump, high sand, small aggregate)

Do not use gypsum-based products.

- New unbonded concrete floor slab over the existing floor slab: provide a polyethelene bondbreaker

For Crawl Space Floors:

- Provide a "rat slab" (3" average depth over polyethelene vapor barrier)

EXECUTION

The contractor is to turn over a copy of all concrete delivery slips to the project representative.

If concrete piles are required, the work must be done under the observation of the Owner's approved testing lab.

Power troweling is a recommended finishing technique where ever possible.

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Consider requiring a washout disposal system to capture concrete materials from equipment washing operations.

INTERIOR VAPOR BARRIER & INSULATION

MATERIALS

Acceptable materials include 6 mil thick cross laminated polyethylene (such as Sto-Cote Products Model Tu-Tuf 4).

All slabs should be completely insulated with a 2" of rigid extruded polystyrene with 25-30 psi compressive strength.

In wet locations water barriers for below slab horizontal waterproofing systems are recommended such as W.R. Grace & Co. pre-applied integrally bonded sheet waterproofing membrane: Preprufe 330R or approved equal.

On all below grade surfaces of concrete foundation walls, a fluid-applied, membrane, water proofing system is recommended in combination with the liquid applied waterproofing.

EXECUTION

All seams should be overlapped 6 to 8 inches.

Rigid insulation should be tongue and groove with end joints butted tightly.

ARCHITECTURAL PRECAST CONCRETE

DESIGN

Precast concrete is a good choice for sills, copings, and other architectural elements that are part of new masonry wall construction. In existing, older buildings which use stone for these elements, consider the use of cast-stone products where precast units cannot match the existing construction.

Precast elements should be thoroughly designed, sized, and scheduled to facilitate construction coordination and improve overall quality.

Precast stair assemblies are generally not preferred.

Provide positive slopes away from the building envelope on all horizontal surfaces exposed to weather.

Standards:

- ACI 318, Building Code Requirements for Reinforced Concrete
- CRSI Manual of Standard Practice
- PCI MNL 117, Manual of Quality Control for Plants and Production of Architectural Precast Concrete Products Manual
- Design Mix: 5000 psi, 28 day compressive strength, 4 to 6 percent air content.

EXECUTION

Require samples, and include precast elements as part of masonry sample panels.

The concrete batch plant and the installer fabricator should be PCI certified.

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PATCHING CONCRETE, CONCRETE REPAIR

DESIGN

For cracks in walls and slabs:

Repair should not be undertaken until cause of cracking has been determined. Structural repair or new drainage systems may be required.

Wall crack options:

- Conventional grouting systems:
 - Portland cement with or without acrylic admixtures for bond.
 - proprietary “dry-pack” mixtures.
 - hydraulic cements : will prevent water penetration.
 - fiber reinforced cements : “surface bonding” cements.
- Epoxy injections are an advanced technique to restore structural soundness. This is a preferred option.
- Urethane grout injections are good when there is substantial seepage through the wall. These are costly, state of the art products used in critical situations where there is structural movement and water penetration. Use products such as 3M Co., Green Mountain International, Prime Resins and De Neef Company.

General concrete repair options:

- Spall repair is done by low pressure spraying for large scale repairs.
- Surface repair is most often done using form and pour techniques.

Stair repair options:

- Resurface the concrete of the stair to repair damage from flaking scaling, etc. Apply a thin cement overlay system which includes a preliminary application of patching compound for holes followed by a thin coat as a resurfacer. Use products such as A-300 Pourable Outdoor Concrete Topping and Ardex Engineered Cements
- Repair or Replace Steps:
 - For serious stair repairs the designer should perform a cost analysis of repair verses replacement.
 - Preparation is a key component of the repair process. Enlarge and clean damaged area and apply a bonding agent.
 - For cracks, a concrete patching compound or expansive mortar may be used.
 - Use hydraulic concrete if there are signs of water seepage.
 - For damaged nosings use form boards and new concrete.
 - For stair corners and difficult areas use latex based ready-mix or a sand-cement-epoxy-mix.

Standards:

- ICRI guidelines NO 03732 Selecting and Specifying Materials for the Repair of Concrete Surfaces.

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- ❑ ICRI guidelines NO 03732 Selecting and Specifying concrete Surface preparation for Sealers Coatings and Overlays.

EXECUTION

Require sample areas of repair.

Preconstruction meetings are essential to review repair techniques.

Third party inspectors or clerks or the works are advisable for final inspections.