

Section Number	Title
<b>03 00 00</b>	<b>CONCRETE</b>
<b>03 10 00</b>	<b>CONCRETE FORMING AND ACCESSORIES</b>
<b>03 11 00</b>	<b>Concrete Forming</b>
03 11 13	Structural Cast-in-Place Concrete Forming
03 11 16	Architectural Cast-in-Place Concrete Forming
<b>03 15 00</b>	<b>Concrete Accessories</b>
<b>03 20 00</b>	<b>CONCRETE REINFORCING</b>
<b>03 21 00</b>	<b>Reinforcing Steel</b>
<b>03 22 00</b>	<b>Welded Wire Fabric Reinforcing</b>
<b>03 24 00</b>	<b>Fibrous Reinforcing</b>
<b>03 30 00</b>	<b>CAST-IN-PLACE CONCRETE</b>
<b>03 31 00</b>	<b>Structural Concrete</b>
<b>03 34 00</b>	<b>Low Density Concrete</b>
<b>03 35 00</b>	<b>Concrete Finishing</b>
<b>03 39 00</b>	<b>Concrete Curing</b>
<b>03 40 00</b>	<b>PRECAST CONCRETE</b>
<b>03 41 00</b>	<b>Precast Structural Concrete</b>
<b>03 45 00</b>	<b>Precast Architectural Concrete</b>
<b>03 48 00</b>	<b>Precast Concrete Specialties</b>
<b>03 50 00</b>	<b>CAST DECKS AND UNDERLAYMENT</b>
03 52 16	Lightweight Insulating Concrete
<b>03 60 00</b>	<b>GROUTING</b>
<b>03 63 00</b>	<b>Epoxy Grouting</b>
<b>03 80 00</b>	<b>CONCRETE CUTTING AND BORING</b>
<b>03 81 00</b>	<b>Concrete Cutting</b>
<b>03 82 00</b>	<b>Concrete Boring</b>

Section Title  
Number

**03 00 00 CONCRETE**

All concrete work shall conform to the code requirement in Section 01 41 00 and ACI Standards 301(Specifications for Structural Concrete), 305 (Hot Weather Concreting), 306 (Cold Weather Concreting), 308 (Recommended Practices for Curing Concrete) & 318 (Building Code Requirements for Structural Concrete). Any non-conforming work shall be removed and replaced at the contractor's expense.

Inspections required per Section 01 41 00.

DP to specify both cold and hot weather requirements for mix, placement, and curing of concrete.

All concrete foundation walls require waterproofing. The DP shall specify the methods and products that may be used for this purpose. Foundation wall waterproofing must be backfilled within 3 days. Inspection required prior to backfill.

Concrete civil work design shall conform to the details set forth in the City of Flagstaff Engineering Design and Construction Standards and Specifications.

Concrete curb cuts, ramps etc. to allow for handicapped accessibility shall meet the requirements outlined in Section 01 41 00. A copy of this law with design details are on file at Capital Assets and Services.

Supplementary Cementitious materials

Fly ash may be added to concrete as a supplementary cementitious material with explicit approval of the Capital Assets and Services Project Manager. If fly ash is required as part of the mix design, maturity modeling of the mix during curing is required.

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 10 00 CONCRETE FORMING AND ACCESSORIES**

**03 11 00 Concrete Forming**

Part 1 – General

The concrete contractor shall supply all formwork complete with necessary shoring, bracing and anchorage.

Earth forms

Earth forms are permitted in the forming of appropriate subgrade elements. Sides of earth forms shall be hand trimmed and bottoms swept clean of all loose dirt prior to placement of concrete. No concrete shall be placed in earth forms prior to review and inspection by the DPs and the CAS project manager.

Part 2 – Products

Part 3 – Execution

The proper concrete hydration reaction is particularly sensitive to cold temperatures when using earth forms. The following standards shall be in place for cold weather concrete placement in addition to the ACI 306 guidelines for Cold Weather Concreting as referenced by MAG2010.

All temperatures referenced under cold weather concrete are to be taken in the shade and away from artificial heat sources. Temperatures shall be collected and recorded in Fahrenheit degrees.

In cases with ambient temperature concrete, concrete placement operations shall not be continued when a descending air temperature falls below 40 degrees F; nor shall concrete placement operations be resumed until an ascending air temperature reaches 35 degrees F. Mixing and placing concrete shall continue no later in any day than that time which will allow sufficient time to place, finish and protect the concrete already placed before the air temperature drops to 35 degrees F.

When using heated concrete mixes, concrete operations may be allowed with specific DP and CAS approval, although the air temperature in the shade and away from artificial heat is below the limit permitted above. Where concrete operations are thus allowed, the contractor shall use equipment to heat the aggregates or water or both, prior to mixing. Aggregates shall be uniformly heated to at least 60 degrees F. and shall have no chunks of ice. Equipment used to heat the aggregates shall be such that uniform temperatures are obtained throughout the aggregate within each batch and from one batch to another. Water shall not be heated in excess of 150 degrees F.

The contractor shall provide adequate insulation or heat or both, to protect the concrete after placement. This protection shall be to the extent required to maintain a temperature under the insulation of the concrete of from 60 to 90 degrees F. for a period of 72 hours after placement and from 40 to 90 degrees F. for an additional 96 hours.

Section Number	Title
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Regardless of the air temperature at the time of mixing and placing concrete, the protection specified above shall be provided at all times when the air temperature is below 35 degrees F.

Forms shall remain in place throughout any required curing period. All portions or pieces of any wood forms shall be removed completely after the cure period has been completed and prior to Owner possession.

03 11 13	Structural Cast-in-Place Concrete Forming
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Part 1 – General

All Structural Cast-in-Place Concrete Forming shall be in accordance with MAG2010 standard Section 505.3: Forms for Concrete Structures

Forms shall be of suitable material and of type, size, shape, quality, and strength to enable construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist any appreciable amount of springing out of shape during placing of the concrete. The responsibility for their adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited. The surfaces of forms shall be smooth and free from irregularities, dents, sags and holes that would appreciably deface the finished surface. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused, and the reuse of forms shall be subject to the approval of the Design Professional. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent that will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete. (MAG2010, p 505-4).

Waterproofing will be applied to foundation walls after removal of the forms but prior to backfilling the excavation. Foundation wall waterproofing must be backfilled within 3 days. Inspection is required prior to backfill. Refer to Section 01 41 00 in Division 1 for inspection guidelines.

Part 2 – Products

Part 3 – Execution

Section Number	Title
03 11 16	Architectural Cast-in-Place Concrete Forming

Part 1 – General

Part 2 – Products

At a minimum all form materials shall be in accordance with MAG2010 standard Section 505.3: Forms for Concrete Structures. Form materials, metal or wood shall be specified with requirements listed below:

Exposed concrete - use HDO plyform

Unexposed concrete – use A-C plywood

DP will specify the grade and thickness of plywood form material. Plans and specs will limit reuse to 3 times.

Part 3 – Execution

**03 15 00 Concrete Accessories**

Part 1 – General

All anchors and inserts in exterior work exposed to weather shall be inset and/or protected to prevent rusting. The concrete cover for anchors and inserts must meet the minimum concrete cover requirements per ACI 318.

Part 2 – Products

Part 3 – Execution

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 20 00 CONCRETE REINFORCING**

**03 21 00 Reinforcing Steel**

Part 1 – General

All reinforcement shall be in conformance with MAG 2010 Section 727: Steel Reinforcement. All placement of reinforcement shall be in accordance with Section 505.5 Placing reinforcement.

Reinforcing steel shall be a minimum of 60 ksi yield grade, deformed. Exceptions to this shall require DP approval.

All sidewalks shall have, placed to reinforce the slab at midpoint, steel welded wire mesh with 6 in x 6 in openings.

Exterior facilities that are exposed to weather that may be subjected to deicing during the winter including but not limited to: stairs, walks, ramps, curbs and loading docks, shall have all reinforcing steel and accessories epoxy coated per ASTM A775.

Concrete features that house interior corrosive environments such as chemical storage rooms and swimming pool buildings shall have all reinforcing steel and accessories epoxy coated per ASTM A775.

Other reinforcement may be uncoated per MAG2010 section 727.

Part 2 – Products

Part 3 – Execution

**03 22 00 Welded Wire Fabric Reinforcing**

Part 1 – General

Part 2 – Products

Part 3 – Execution

Welded wire fabric shall be held firmly in place and spliced not less than 2 meshes per MAG 505.5.3.

Section Title  
Number

**03 24 00 Fibrous Reinforcing**

Part 1 – General

Fibermesh reinforcement is an allowable substitute for wire mesh with DP written approval.

Part 2 – Products

N/A

Part 3 – Execution

N/A

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 30 00 CAST-IN-PLACE CONCRETE**

Part 1 – General

All cast-in-place concrete shall conform to the MAG Uniform Standard Specifications for Public Works Construction (MAG 2010) for portland cement concrete (PCC). PCC shall be composed of cementitious materials, fine and coarse aggregates, water, and, if specified or allowed, certain chemical admixtures and additives in conformance to MAG 2010 Section 725.

Only the following classes of concrete will be considered acceptable for construction at Northern Arizona University: Class AA and Class A in conformance to MAG 2010 Section 725.

All exterior concrete shall conform to the specifications for Class AA concrete with 5% to 7% air entrainment (containing at a minimum: 600 pounds per cubic yard of cementitious materials and having a minimum compressive strength of 4000 psi at 28 days).

Upon the recommendation and specification of a DP, all interior concrete shall conform to the specifications for Class A concrete (containing at a minimum: 520 pounds per cubic yard of cementitious materials and having a minimum compressive strength of 3000 psi at 28 days).

PCC Street pavement shall conform to MAG 2010 Section 324.

Part 2 – Products

Part 3 – Execution

**03 31 00 Structural concrete**

Part 1 – General

All structural concrete shall conform to the MAG Uniform Standard Specifications for Public Works Construction (MAG 2010) for portland cement concrete (PCC). PCC shall be composed of cementitious materials, fine and coarse aggregates, water, and, if specified or allowed, certain chemical admixtures and additives in conformance to MAG 2010 Section 725.

Only the following classes of concrete will be considered acceptable for construction at Northern Arizona University: All exterior concrete shall conform to the specifications for Class AA concrete containing 5% to 7% air entrainment (containing at a minimum: 600 pounds per cubic yard of cementitious materials and having a minimum compressive strength of 4000 psi at 28 days). Upon the recommendation and specification of a DP, all interior concrete shall conform to the specifications for



Section Title  
Number

Class A concrete (containing at a minimum: 520 pounds per cubic yard of cementitious materials and having a minimum compressive strength of 3000 psi at 28 days).

No structural concrete shall be placed without the approval of the CAS project manager or the special inspector representing the CAS project manager.

Part 2 – Products

Part 3 – Execution

**03 34 00 Low Density Concrete**

Part 1 – General

Lightweight concrete shall not exceed 110 pounds per cubic foot and shall be made from lightweight coarse aggregates and a blend of lightweight and normal weight fines.

Part 2 – Products

Part 3 – Execution

**03 35 00 Concrete Finishing**

Part 1 – General

In general exterior concrete traffic surfaces shall be designed with a heavy broom finish.

All stoops, porches, steps and any other exterior concrete shall be finished so as to slope to drain and shall be placed per the plans within the dimensional tolerances for concrete slabs (+1/4 to -3/4 inches). Ponding or puddling resulting from finish work that does not address this requirement shall be repaired at the Contractor's expense.

Concrete Finished Floors

Generally concrete finished floors are to receive a hardener with colorant. Positive protection shall be provided to prevent staining and chipping during construction work. DP to specify products finish required and positive protection required.

All slabs with floor drains shall be required to slope to floor drains with no ponding areas, and be dished 1/2 inch deep around all floor drains.

A suitable sealant or paint shall be specified for interior exposed concrete.

Section Title  
Number

Part 2 – Products

Part 3 – Execution

**03 39 00 Concrete Curing**

Part 1 – General

All concrete must be cured in accordance with MAG2010 Section 505.8. DP must specify the methods or materials necessary for proper curing of concrete structural elements. Examples include water fog, chemical membrane, wet burlap, or cold weather blanket protection. DP should include the weather conditions wind, hot or cold temperatures that may trigger special curing methods as applicable to structural features. The Contractor is solely responsible for protection of all concrete products throughout the curing period. Any damage to partially cured concrete shall require removal and replacement at no cost.

Non-structural concrete must be cured a minimum of three days prior to form removal. Normal concrete in structures and pavement shall be cured a minimum of seven days.

On all formed structural concrete, forms shall remain in place until work has reached 90% of its design strength or as specified by Structural Engineer of record.

High strength concrete and concrete that includes supplemental cementitious materials such as fly ash may require extended curing and weather protection. DP shall provide guidelines and requirements for curing protection and if appropriate, maturity modeling methods and procedures for concrete.

Part 2 – Products

Part 3 – Execution

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 40 00 PRECAST CONCRETE**

This work shall consist of furnishing and placing precast prestressed concrete members in accordance with the details shown on the plans, and as provided in the MAG 2010 specifications and special provisions.

All precast concrete that is part of an exterior feature or element that will be exposed to the weather, shall be formed with Class AA PCC with five to seven percent air entrainment.

**03 41 00 Precast Structural Concrete**

Part 1 – General

Projects designed with precast, tilt-up, or special finished concrete shall include in the Project Specifications a requirement for a sample panel, constructed as specified. The panel shall be a minimum of 36 square feet. It shall be erected at, and remain on the jobsite as the visual criterion which the final product must match.

Part 2 – Products

Part 3 – Execution

**03 45 00 Precast Architectural Concrete**

Part 1 – General

This section applies to areas of a building that the DP may be considering for the use of precast panels, or special design features or projection from and around the building that will be visible.

As noted above, projects incorporating architectural precast concrete shall have included in the specifications a requirement for a sample. Such sample shall be made at the site and remain on site as a visual criterion through project completion.

The manufacturer of precast pre-stressed concrete shall submit structural calculations, certified by an Arizona registered Engineer, to the DP for approval.

As part of design proposal and approval process, colors, finishes and scoring of materials shall be presented to the facility owner and each selection shall be clearly delineated either by a sample or a drawing of a scale that can be viewed across a conference room. Elevations that contain precast material or features shall be keyed to such a sample or drawing.

Precast in-fill panels, elements or exposed precast structural members shall be designed and detailed in a manner that clearly and concisely conveys the architectural meaning and significance of its use.

Section Number	Title
-------------------	-------

Rough or heavy textured precast should be avoided immediately adjacent to heavy pedestrian traffic flow, or in the interior of the building (particularly corridors).

Precast concrete panels shall be water sealed with products warranted for a minimum of five years against UV breakdown.

Exposed panel fastening devices should be avoided due to annual maintenance costs (paint and rust inhibitors) and eventual staining of the panel.

Special consideration should be given to panel joinery and caulking when panels are intended to act as weather tight assemblies. The design of such joinery must facilitate required amounts of expansion/contraction and facilitate a neat appearance and weather tightness of the caulk joint.

Part 2 – Products

Part 3 – Execution

**03 48 00 Precast Concrete Specialties**

Part 1 – General

Precast concrete specialties that will be exposed to weather or corrosive environments (sewer lines, manholes, etc...) shall be made from Class AA PCC that conforms to MAG 2010 Section 725 five to seven percent entrained air.

Part 2 – Products

Part 3 – Execution

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 50 00 CAST DECKS AND UNDERLAYMENT**

03 52 16 Lightweight Insulating Concrete

Part 1 – General

Lightweight concrete insulating fill roof decks shall not be used in conjunction with urethane roof systems. Lightweight structural concrete shall not be allowed.

Part 2 – Products

N/A

Part 3 – Execution

N/A

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 60 00 GROUTING**

Grouting of concrete structures shall be in accordance with MAG 2010 Section 505.

**03 63 00 Epoxy Grouting**

Part 1 – General

Use of epoxy grout is not encouraged. However it may be used as a retrofit or repair material upon approval by the design professional.

Part 2 – Products

Part 3 – Execution

**\*\*END OF SECTION\*\***

Section Title  
Number

**03 80 00 CONCRETE CUTTING AND BORING**

**03 81 00 Concrete Cutting**

Part 1 – General

Part 2 – Products

Part 3 – Execution

Control joints shall be tooled or cut into in slabs on grade so that the length to width ratio of each cut portion of the slab is no more than 1.25 to 1. Control joints shall be completed within 12 hours or optimal time of concrete placement per ACI specs. Control joint depth shall be ¼ the thickness of the slab whether tooled or cut.

**03 82 00 Concrete Boring**

Part 1 – General

Part 2 – Products

Part 3 – Execution