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USACE / NAVFAC / AFCEA / NASA UFGS-03 20 01.00 10 (October 2007)  
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Preparing Activity: USACE Superseding  
UFGS-03 20 01.00 10 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2009

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CONCRETE REINFORCEMENT

10/07

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Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

- ACI 318 (2008; Errata 2008; Errata 2009; Errata 2009; Errata 2009; Errata 2009; Errata 2009) Building Code Requirements for Structural Concrete and Commentary
- ACI 318M (2008; Errata 2008; Errata 2009) Metric Building Code Requirements for Structural Concrete and Commentary

AMERICAN WELDING SOCIETY (AWS)

- AWS D1.4/D1.4M (2005; Errata 2005) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

- ASTM A 184/A 184M (2006) Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
- ASTM A 185/A 185M (2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
- ASTM A 496/A 496M (2007) Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- ASTM A 497/A 497M (2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
- ASTM A 53/A 53M (2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASTM A 615/A 615M (2009) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- ASTM A 675/A 675M (2003; R 2009) Standard Specification for

	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(2009) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(2009) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A 775/A 775M	(2007b) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A 82/A 82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 884/A 884M	(2006) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A 934/A 934M	(2007) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM C 1116/C 1116M	(2008a) Standard Specification for Fiber-Reinforced Concrete

#### CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2001; 27Ed) Manual of Standard Practice
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### 1.2 SUBMITTALS

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**NOTE:** Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for

Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Reinforcement[; G][; G, [\_\_\_\_]]

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

#### SD-03 Product Data

##### Welding

A list of qualified welders names.

#### SD-07 Certificates

##### Reinforcing Steel

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

### 1.3 QUALITY ASSURANCE

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**NOTE: Delete this paragraph and submittal requirement under SD-03 when welding is not permitted. Welding will not be specified in blast-resistant structures.**

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Welders shall be qualified in accordance with AWS D1.4/D1.4M. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4/D1.4M.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

## PART 2 PRODUCTS

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NOTE: Designer should require materials, products,  
and innovative construction methods and techniques  
which are environmentally sensitive, take advantage  
of recycling and conserve natural resources.  
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### 2.1 DOWELS

Dowels shall conform to [ASTM A 675/A 675M](#), Grade 80. Steel pipe conforming to [ASTM A 53/A 53M](#), Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

### 2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to [ASTM A 184/A 184M](#).

### 2.3 REINFORCING STEEL

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NOTE: Grades and sizes of reinforcing steel will be shown on the drawings. Low-alloy steel conforming to [ASTM A 706/A 706M](#) is specified for its special qualities such as bending ability and ease of welding.

Specially coated bars (epoxy and zinc) may be specified for use in a highly corrosive atmosphere where concrete cover is not considered sufficient.

Certified mill reports should be obtained when welding is specified or permitted. On minor projects with no welding, submittal SD-07 may be deleted.

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Reinforcing steel shall be deformed bars conforming to [ASTM A 615/A 615M](#) or [ASTM A 706/A 706M](#), grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to [ASTM A 82/A 82M](#). In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to [ASTM A 767/A 767M](#), [ASTM A 775/A 775M](#) or [ASTM A 934/A 934M](#) as appropriate.

### 2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to [[ASTM A 185/A 185M](#)][[ASTM A 496/A 496M](#)][[ASTM A 497/A 497M](#)]. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to [ASTM A 884/A 884M](#).

### 2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

### 2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with [CRSI 10MSP](#) and shall be steel or precast concrete blocks.

Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 13 mm 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

## 2.7 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 50 mm 2 inches.

## PART 3 EXECUTION

### 3.1 REINFORCEMENT

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**NOTE:** There may be special cases where reinforcing bars, at determined intervals, will be added across expansion, isolation or construction joints to provide continuity of reinforcement in meeting lightning protection criteria. The structural designer should coordinate this requirement with the electrical designer to minimize reinforcement across the joints.

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Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

#### 3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318M ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

#### 3.1.2 Splicing

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**NOTE:** Edit this paragraph to remove welding requirements when welding is not permitted. The

only type of connection allowed in blast resistant  
structures is Cadweld or lapping of rebars.

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Splices of reinforcement shall conform to **ACI 318M ACI 318** and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to **AWS D1.4/D1.4M**. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or **150 mm 6 inches**. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

### 3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus **50 mm 2 inches**. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed **1.2 m 4 feet**. Fabric shall be positioned by the use of supports.

### 3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

### 3.4 SYNTHETIC FIBER REINFORCED CONCRETE

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**NOTE: Synthetic fiber reinforcement may be used in concrete slabs as an aid in preventing plastic or shrinkage cracking in placements susceptible to this condition. Fiber reinforcement will not be used as a substitute for wire mesh and where service temperature may exceed 150 degrees C (300 degrees F). Concentrations above 0.1 percent by volume are not cost-effective.**

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Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of **ASTM C 1116/C 1116M** and the recommendations of the manufacturer, and in an amount of [0.1] [\_\_\_\_\_] percent by volume.



### 3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

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NOTE: Include this paragraph only when special inspection and testing for seismic-resisting systems is required by Chapter 2 of FEMA 450, NEHRP RECOMMENDED PROVISIONS FOR SEISMIC REGULATIONS FOR NEW BUILDINGS AND OTHER STRUCTURES.

This paragraph will be applicable to both new buildings designed according to UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS and to existing building seismic rehabilitation designs.

The designer must indicate on the drawings all locations and all features for which special inspection and testing is required in accordance with UFC 3-310-04 and Chapter 2 of FEMA 450. This includes indicating the locations of all structural components and connections requiring inspection.

Add any additional requirements as necessary.

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Special inspections and testing for seismic-resisting systems and components shall be done in accordance with UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS and Section 01 45 35 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

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