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USACE / NAVFAC / AFCESA | **UFGS-01452 (August 2004)**

Preparing Activity: USACE | **Superceding UFGS-01452A (November 1999)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

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SECTION 01452

SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS
08/04

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NOTE: This guide specification covers the requirements for special inspection and testing for seismic-resisting systems when required by paragraph 3.2 of FEMA 302 NEHRP RECOMMENDED PROVISIONS FOR SEISMIC REGULATIONS FOR NEW BUILDINGS AND OTHER STRUCTURES. This specification will apply only to buildings.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
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PART 1 GENERAL

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NOTE: This guide specification will be applicable to both new buildings designed according to TI 809-04 SEISMIC DESIGN FOR BUILDINGS, and existing building seismic rehabilitation designs done according to TI 809-05 SEISMIC EVALUATION AND REHABILITATION FOR BUILDINGS.

In addition to the special inspection and testing specified requirements, the structural designer of the seismic-resisting structural systems must

perform "structural observations" during construction when required by paragraph 3.5 of FEMA 302. All observed deficiencies will be immediately reported to the Contracting Officer. The structural designer performing these observations will be a representative of the Engineer of Record (EOR) for the building being constructed. The EOR will be the Chief of Engineering of the USACE office performing the design for in-house designs and will be the principal of the firm in charge of the design for Architect-Engineer (A-E) designs.

The requirements for special inspection, the special inspector, and related testing will be used only where required by Chapter 3 of FEMA 302. When special inspection is required, FEMA 302 also requires that for certain buildings a quality assurance plan be developed.

The extent of the qualifications of the Contractor and subcontractors can vary considerably, hence the extent of the quality control can vary considerably. The quality assurance plan, therefore, is an opportunity to identify those areas of special concern that must be addressed during the construction process. Those areas include, but are not limited to, types of testing, frequency of testing, types of inspections and frequency of inspections.

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1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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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 318/318R	(2002) Building Code Requirements for Structural Concrete and Commentary
ACI 318M/318RM	(2002) Metric Building Code Requirements for Structural Concrete and Commentary
ACI 530/530.1	(2002) Building Code Requirements for Masonry Structures and Specifications for Masonry Structures and Commentaries

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341	(2002) Seismic Provisions for Structural Steel Buildings
AISC 350	(1999) Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A 435/A 435M	(1990; R 2001) Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A 615/A 615M	(2003a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 898/A 898M	(1991; R 2001) Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes

U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA 302	(Feb 1998) NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures

1.2 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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 projects.

Submittal items not designated with a "G" are

considered as being for information only for Army projects and for Contractor Quality Control approval for Navy 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.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Special Inspector[; G][; G, [_____]]

Certification attesting that the Special Inspector is qualified by knowledge and experience to perform the specified Special Inspections. Information, which provides evidence of the knowledge and experience necessary to qualify a person as a Special Inspector for the category of work being certified, will accompany the qualification.

Quality Assurance Plan[; G][; G, [_____]]

A copy of the Quality Assurance Plan covered by a certificate indicating that the plan meets the content specified in this section.

1.3 SPECIAL INSPECTOR

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NOTE: The requirements listed in this section have been included in the national model codes for many years, and it is a premise of FEMA 302 that there will be available an adequate supply of knowledge and experienced inspectors to provide the necessary special inspections for the various structural categories of work. Special training may have to be implemented for the nonstructural categories.

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A Special Inspector shall be used to perform Special Inspections required by this section. The Special Inspector is a person employed by the Contractor and approved by the Government as being qualified by knowledge and experience to perform the Special Inspection for the category of work being constructed. Special Inspectors shall perform their duties independent from the construction quality control staff employed by the Contractor. More than one Special Inspector may be required to provide the varied knowledge and experience necessary to adequately inspect all of the categories of work requiring Special Inspection.

1.4 QUALITY ASSURANCE PLAN

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NOTE: The designer should retain this paragraph only when paragraph 3.2 of FEMA 302 requires that a Quality Assurance Plan be developed.

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A quality assurance plan shall be developed containing the following:

a. A list of all iems that require quality assurance Special Inspection and testing, including the type, frequency, extent, and duration of the special inspection for each item on this list.

b. A list of all items that require quality assurance testing, including the type and frequency of testing for each item on this list.

c. The content, distribution, and frequency of special inspection reports.

d. The content, distribution, and frequency of testing reports.

e. The procedures, controls, and people used within the Contractor's organization to develop, sign, and distribute Special Inspection and Testing reports along with the position title and pertinent qualifications of all Contractor personnel involved.

1.5 SPECIAL INSPECTION

The Special Inspection for seismic-resisting system components shall be done as specified. Special Inspector personnel shall be in addition to the quality control inspections and inspectors required elsewhere in this section.

1.5.1 Continuous Special Inspection

Continuous special inspection is the full time observation of the work by the Special Inspector present in the work area whenever work is being performed. Continuous special inspection shall be performed where specified for items as shown on the drawings.

1.5.2 Perodic Special Inspection

Perodic special inspection is the intermittent observation of the work by a Special Inspector present in the work area while work is being performed. The intermittent observation periods shall be at times of significant work, shall be recurrent over the complete work period, and shall total at least 25 percent of the total work time. Perodic special inspection shall be performed where specified for items as shown on the drawings.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PERFORMANCE OF INSPECTIONS

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NOTE: Include only those requirements applicable to the project and the applicable Seismic Design Category. Add any additional necessary requirements.

The desinger must indicate on the drawings all locations and all features for which special

inspection is required in Chapter 3 of FEMA 302, including the locations of all structural elements requiring inspection, such as intermediate moment frames, special moment frames, shear walls, etc. The designer must also clearly indicate the components of these elements that require special inspection, such as boundary elements of shear walls.

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Special Inspections shall be performed for the following where designated on the drawings:

3.1.1 [Piers] [Piles] [Caissons]

a. Continuous special inspection during [driving of piles] [and] [placement of concrete in [piers] [piles] [caissons]].

b. Periodic special inspection during construction of [drilled piles] [piers] [caissons] including the placement of reinforcing steel.

3.1.2 Reinforcing Steel

a. Periodic special inspection during and upon completion of the placement of reinforcing steel in [intermediate moment frames] [special moment frames] [shear walls].

b. Continuous special inspection during the welding of reinforcing steel resisting flexural and axial forces [in intermediate moment frames] [in special moment frames] [in boundary members of concrete shear walls] [and during welding of shear reinforcement].

3.1.3 Structural Concrete

Periodic special inspection during and on completion of the placement of concrete in [intermediate moment frames] [special moment frames] [boundary members of shear walls].

3.1.4 Prestressed Concrete

Periodic special inspection during the placement and after completion of placement of prestressing steel. Continuous special inspection during all stressing and grouting operations and during the placement of concrete.

3.1.5 Structural Masonry

a. Periodic special inspection during the preparation of mortar, the laying of masonry units, and placement of reinforcement and prior to placement of grout.

b. Continuous special inspection during the welding of reinforcement, grouting, consolidation and reconsolidation [and] [placement of bent-bar anchors].

3.1.6 Structural Steel

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NOTE: The designer must indicate on the drawings all locations where welds are loaded to less than 50% of their design strength, thus requiring only

periodic special inspection.
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a. Continuous special inspection for all structural welding, except that periodic special inspection is permitted for single-pass or resistance welds [and] [welds loaded to less than 50 percent of their design strength] provided the qualifications of the welder and the welding electrodes are inspected at the beginning of the work and all welds are inspected for compliance with the approved construction documents at the completion of welding.

b. Periodic special inspection in accordance with AISC 350 for the installation of bolts in [intermediate moment frames] [special moment frames] [special truss moment frames] [special concentrically braced frames] [eccentritically braced frames] except that bolts not required to be fully tensioned need not be inspected for bolt tension, other than to ensure that the plies of the connected elements have been brought into snug contact

3.1.7 Structural Wood

a. Continuous special inspection during all field gluing operations of elements of the seismic-force-resisting system.

b. Periodic special inspections for nailing, bolting, anchoring, and other fastening of components within the seismic-force-resisting system including drag struts braces, and tie-downs.

3.1.8 Cold-Formed Steel Framing

a. Periodic special inspections during all welding operations of elements of the seismic-force-resisting system.

b. Periodic special inspections for screw attachment, bolting, anchoring, and other fastening of components within the seismic-force-resisting system, including struts, braces, and hold-downs.

3.1.9 Architectural Components

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NOTE: If multiple conditions relative to structure height or cladding or veneer weight exist on a project, the designer should indicate on the drawings where special inspection done according to this specification paragrph is both required and not required, i.e., the structure height is 9 m (30 feet) or less or the cladding or veneer weight is 240 kg/m^2 (5 lb/ft^2) or less.
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Special inspection of the architectural components shall assure that the methods of anchoring and fastening indicated on the drawings are being complied with at the onset of construction of the components, and that the specified or shown number, spacing, and types of fasteners were actually installed. Special inspection for architectural components shall be as follows:

a. Periodic special inspection during the erection and fastening of [exterior cladding] [interior nonloadbearing partition walls] [exterior

nonloadbearing walls] [masonry veneer].

b. Periodic special inspection during the anchorage of [access floors] [suspended ceilings] [storage racks 2.4 m 8 feet or greater in height].

3.1.10 Mechanical and Electrical Components

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NOTE: The registered design professional should consider requirements to demonstrate the seismic performance of mechanical and electrical components critical to the post-earthquake life safety of the occupants. Any requirements should be clearly indicated on the construction documents. Any currently accepted technology should be acceptable to demonstrate compliance with the requirements.
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Special inspection of the mechanical and electrical components shall assure that the methods of anchoring and fastening indicated on the drawings are being complied with at the onset of construction of the component, and that the specified or shown number, spacing, and types of fasteners were actually installed. Special inspection for mechanical and electrical components shall be as follows:

a. Periodic special inspection during the anchorage of electrical equipment for emergency or standby power systems.

b. Periodic special inspection during the installation of anchorage of all other electrical equipment.

c. Periodic special inspection during installation for flammable, combustible, or highly toxic piping systems and their associated mechanical units.

d. Periodic special inspection during the installation of HVAC ductwork that will contain hazardous materials.

3.1.11 Seismic Isolation System

Periodic special inspection during the fabrication and installation of isolator units.

3.1.12 Energy Dissipation System

Periodic special inspection during the fabrication and installation of energy dissipation devices.

3.2 TESTING

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NOTE: The specified testing of the structural materials follows procedures and tests long established by industry standards. The acceptance criteria for each material to be tested should be included in the construction documents prepared for the project.

The designer must indicate on the drawings all locations and all features for which testing, to be reviewed by the special inspector, is required in Chapter 3 of FEMA 302. This includes indicating the locations of all structural elements requiring testing, such as intermediate moment frames, special moment frames, shear walls, etc. The designer must also clearly indicate the material, etc. in these elements that require testing, such as the flexural reinforcement used in the boundary elements of shear walls.

Designers should note that, before ASTM A 615 reinforcing steel is specified as an optional material used to resist earthquake-induced flexural and axial forces in special moment frames or in boundary elements of shear walls of structures in Seismic Design Categories D, E, and F, they must verify that the requirements of Sec. 21.2.5.1 of ACI 318 have been satisfied. Also, before ASTM A 615 reinforcing steel is used where it must be welded, chemical tests must be performed to verify the weldability in accordance with Sec. 3.5.2 of ACI 318.

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The special inspector shall be responsible for verifying that the testing requirements are performed by an approved testing agency for compliance with the following, where shown on the drawings:

a. Reinforcing and Prestressing Steel: Special testing of reinforcing and prestressing steel shall be as follows:

(1) Examine certified mill test reports for each shipment of reinforcing steel used in reinforced concrete [intermediate frames] [special moment frames] [boundary members of reinforced concrete shear walls] [reinforced masonry shear walls]. The special inspector shall determine conformance with the construction documents.

(2) Examine the reports for chemical tests, done in accordance with Sec. 3.5.2 of ACI 318M/318RM ACI 318/318R, which were performed to determine the weldability of ASTM A 615/A 615M reinforcing steel.

b. Structural Concrete: Verify that samples of structural concrete obtained at the project site, along with all material components obtained at the batch plant, have been tested in accordance with the requirements of ACI 318M/318RMACI 318/318R and comply with all acceptance provisions contained therein.

c. Structural Masonry: Verify that all quality assurance testing of structural masonry along with all material components is in accordance with the requirements of ACI 530/530.1 and complies with all acceptance provisions contained therein.

d. Structural Steel:

(1) Verify that all quality assurance testing needed to confirm required material properties [contained in Section 05120 STRUCTURAL STEEL] [and] [given in the quality assurance plan] has been done in accordance with applicable provisions in AISC 341 and AISC 350 and that the test

results comply with all acceptance provisions contained therein.

(2) When a flange or a plate of steel member with a base metal thickness greater than 38 mm 1.5 inches, is joined by welding so that the flange or plate is subjected to through-thickness weld shrinkage strains, verify that the required ultrasonic testing for discontinuities behind and adjacent to such welds has been done after joint completion. Further verify that any material discontinuities rejected on the basis of the requirements contained in [Section 05120 STRUCTURAL STEEL] [and] [ASTM A 435/A 435M or ASTM A 898/A 898M, (Level 1 Criteria)] were repaired and were retested after the repairs and found acceptable.

e. Seismically Isolated Structures: Verify that the required system and component tests for seismically isolated structures have been done in accordance with FEMA 302 and comply with all acceptance provisions contained therin.

f. Energy Dissipation Systems: Verify that the required system and component tests for seismic energy dissipation systems have been done in accordance with FEMA 302 and comply with all acceptance provisions contained therein.

3.3 REPORTING AND COMPLIANCE PROCEDURES

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NOTE: The success of a quality assurance plan depends upon the experience, training, and knowledge of the special inspector and the accuracy and thoroughness of the reports prepared by the special inspector. It should be emphasized that both the special inspector and the Contractor are required to submit to the Government a final certification attesting that the completed work is in conformance with the approved construction documents.

The Contractor, having day-to-day knowledge of the construction of the project, is in the best position to state whether or not all the construction has been completed in accordance with the approved construction documents. To be fully aware however, the Contractor must institute a system of reporting within its organization that enables the Contractor to effectively practice quality control. The special inspector can only attest to the work personally inspected and, therefore, the special inspector acts more as an auditor or monitor of the quality control program exercised by the Contractor and the testing conducted by the testing agency.

Continuous inspection does not imply that the special inspector has observed all of the work as it is being installed, rather it implies that the special inspector has observed all of the critical conditions of the work to be sufficiently confident that the work was completed in conformance with the construction documents.

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a. On the first day of each month, the Contractor shall furnish to

the Government five copies of the combined progress reports of the special inspector's observations. These progress reports shall list all special inspections of construction or reviews of testing performed during that month, note all uncorrected deficiencies, and describe the corrections made both to these deficiencies and to previously reported deficiencies. Each monthly report shall be signed by all special inspectors who performed special inspections of construction or reviewed testing during that month, regardless of whether they reported any deficiencies . Each monthly report shall be signed by the Contractor.

b. At completion of construction, each special inspector shall prepare and sign a final report attesting that all work they inspected and all testing and test reports they reviewed were completed in accordance with the approved construction documents and that deficiencies identified were satisfactorily corrected. The Contractor shall submit a combined final report containing the signed final reports of all the special inspectors. The Contractor shall sign the combined final report attesting that all final reports of special inspectors that performed work to comply with these construction documents are contained therein, and that the Contractor has reviewed and approved all of the individual inspector's final reports.

-- End of Section --