DESIGN CRITERIA

1. Related Sections: Division 03 Sections; Insulated Freezer Floors, Polished Concrete Finishing, Precast Architectural Concrete, and Tilt-Up Concrete; and Division 09 Sections for floor finishes requiring special preparation of concrete floor slabs.

2. This Section specifies cast-in-place, normal-weight concrete for general building construction including related formwork, reinforcement, concrete materials and admixtures, vapor retarders, concrete mixture requirements, placement, as-cast and applied finishes, curing, repairs, and field quality control.

   A. This Section does not specify structural lightweight concrete, light weight insulating concrete, tilt-up concrete, post-tensioned concrete, precast concrete, grouts, metallic and nonmetallic floor toppings, cement concrete pavement, or decorative cement concrete pavements.

   B. DeCA Guide Specifications require that floor slabs not be placed until building spaces are enclosed and weathertight, as recommended by the Portland Cement Association (PCA) and the National Ready Mixed Concrete Association (NRMCA).

3. Codes and Standards:

   A. ACI 301 is incorporated by reference and applies to cast-in-place structural concrete construction for any Commissary building project.

   B. ACI 318 is adopted by IBC and establishes minimum requirements for acceptance of design and construction of structural concrete.

   C. ASTM standards are referenced throughout to establish appropriate requirements for specifications, test methods, practices, classifications, and terminology.

4. Design concrete in accordance with the Concrete Mixture Schedule at the end of Part 3 of the specifications and the following unless project conditions require alternatives:

   A. Floor Slab-on-Grade Reinforcing:

      1. ACI 302.1R indicates that concrete slab reinforcement can be furnished in the form of deformed steel bars, welded wire reinforcing, steel fibers, synthetic fibers, or post-tensioning tendons. ACI 302.1R discusses the attributes of various types of reinforcing. It is left to the A/E of record to specify the type of reinforcing most appropriate for each project. Regardless of the reinforcement selected special attention must be given to the spacing and kind of support provided for each type of reinforcement.

      2. While both wire mesh reinforcing and deformed steel bar reinforcing provide suitable crack control in floor slabs, quality control during construction has a significant impact on actual crack control. If reinforcing is not maintained within the upper third of slab thickness or 2" below the slab surface (whichever is closer to the slab surface), its crack control qualities are reduced. When wire mesh reinforcing is used, its larger flexibility dictates that the Contractor pay close attention to establishing and maintaining adequate support of the reinforcement during concrete placing operations. Wire mesh reinforcing shall not be placed on the ground and pulled up after placement of the concrete, nor shall the mats be walked in after placing the concrete.

      3. ACI Committee 302 "Strategic Development Council Task Group on Moisture" indicates that for the best crack control, reinforcing steel should be placed as close to the surface as

possible and adequately supported so the location doesn't change during floor construction. They further state that designers should consider using supported deformed bars no smaller than #4 instead of welded wire reinforcing. Smaller-diameter bars are too limber, requiring too many bar supports, and welded wire reinforcing is difficult to keep in the correct location. For a 5" thick floor slab, consider using #4 or #5 bars near the top with 1" of clear cover. Typically, #4 bars spaced at 12" to 18" on center both ways are used. This amount of steel holds crack faces together tightly enough for non-rigid floor coverings by maintaining aggregate interlock and significantly reducing slab curling. In some instances, closer spacing or larger diameter bars may be needed. Constructability becomes an issue when bar spacing is so close that workers can't step into openings between the bars. Larger-diameter bars may be the better choice in this case.

4. Considering the above, DeCA Design Standard shall be to reinforce concrete slab-on-grade floors using properly supported deformed steel bars.

B. Key Joints: Do not use.

C. Placement of slab-on-grade contraction joints (i.e., control joints) shall be continuous at intersecting joints. Avoid designing non-continuous or "T" joints, as they will typically crack. Provide additional slab reinforcing where non-continuous joints are unavoidable.

D. Floor Slopes in Food Storage and Processing Areas: Slope to drains approximately 1/8 in/ft. Locate drains so that maximum overall slope is approximately 1". Coordinate floor drain rim elevations with plumbing.

E. Floor Live Loads: Design for the most stringent of the IBC, local codes, or the following DeCA criteria:

1. Administrative areas and corridors: 100 psf.

2. Sales Area: 125 psf.

3. Equipment mezzanine: 125 psf, unless equipment loads dictate greater.

4. Staging/receiving and dock areas: 300 psf, unless loads at point of contact of shelving uprights or material handling equipment wheel loads dictate greater.

5. Other areas (frozen food, produce, dairy, etc.): 250 psf.

F. The mixes indicated in the Schedule are based on Type I Portland cement without supplements.

1. Concrete and cement products containing fly ash are included in the current list of EPA designated guideline items. Specify cementitious materials in accordance with Article 5.10 - Specification of Preferential Recyclable Items of the DeCA Commissary Design Guidance except where project conditions exclude their use.

G. Slump Limit: A 4" slump is indicated in the Schedule for all the Mix Uses listed. This in accordance with ACI 301, 4.2.2.2, and allows a tolerance of ± 1" in accordance with ACI 117. This slump also agrees with ACI 302.1R, Table 8.4.1a, for floors. Modify slumps as required by project conditions.

H. Air Content: The air content indicated in the Schedule for the Mix Uses listed are in accordance with ACI 301, Table 4.2.2.7.b, ACI 201.2R, Table 4.2.3.2.4, and ACI 318/318R, Table 19.3.3.1, based on relationship of air content of concrete and size of coarse aggregate. Modify air content

percentages in accordance with project conditions. Entrained air is not recommended for concrete to be given a smooth, dense, hard troweled finish (ACI 302.1R, 8.4.3).

1. Consider omitting air entrainment if project will not be exposed to freeze/thaw conditions.

I. Footings and Foundation Walls Not Subject to Freezing and Thawing: The Maximum water-cementitious materials ratio indicated in the Schedule for this Mix Use is in accordance with the w/c ratio of ACI 211.1, Table 6.3.4 (a), for concrete containing Type I Portland cement, non-air-entrained concrete, not subject to special exposure conditions or sulfate exposure, and for compressive strength indicated. If Type of cement, exposure or compressive strength is changed, change w/c ratio accordingly.

J. Foundation Walls Subject to Freezing and Thawing, i.e., Retaining Walls: The Maximum water-cementitious materials ratio indicated in the Schedule for this Mix Use is in accordance with the w/c ratio of ACI 201.2R, 4.2.3.2, ACI 318 Table 19.3.2.1, and ACI 211.1, Table 6.3.4 (a), for concrete containing Type I Portland cement, air-entrained concrete, subject to freezing and thawing, not subject to sulfate exposure, and for compressive strength indicated. If Type of cement, exposure or compressive strength is changed, change w/c ratio accordingly.

K. Concrete Floor Finishing: DeCA has determined ACI 302.1R, Table 4.1, Class 5, with hard steel-troweled final finish as the standard concrete floor finish for Commissaries. Because of the impracticality of preparing small isolated floor areas for different finish floor surface materials, a hard-troweled concrete floor finish is specified for all interior floor slabs. Where distinctive concrete floor surfaces are required, the preparation of the concrete floor slab to receive the floor covering is specified as the responsibility of the finish flooring installer.

L. Water-Cement Ratio: ACI 302.1R indicates that the total water content can have a major impact on the bleeding characteristics of the concrete, as well as the potential for shrinkage, so use of the lowest practical quantity of water in the concrete mixture is recommended. Typically, the higher the w/cm ratios, the lower the compressive strength of the concrete. ACI 302.1R further indicates that w/cm ratios in the range of 0.47 to 0.53 are applicable for most interior floors with Floor Classification 4 and higher. A typical Commissary Sales Area floor slab will have a Floor Classification 9. Other areas within a Commissary will have a Floor Classification 5. Interior floor slabs subject to freezing will have a w/cm ratio of 0.45 as recommended by ACI 302.1R. Refer to table at end of Section 03 30 00 Cast-in-place Concrete Guide Specification for recommended w/cm ratios.

M. Concrete Floor Flatness: Provide minimum overall and local area F Flatness and minimum overall area and local F Levelness for appropriate slab construction, building usage, and slab finishing technique per ASTM E 1155 Determining Floor Flatness and Levelness Using the F-Number System. Test for flatness per ASTM E 1155.

5. Vapor Retarders for Concrete Slabs on Grade: The following information was derived from ASTM E 1643, "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs" and ACI 302.1R "Guide for Concrete Floor and Slab Construction".

A. Although both ACI and ASTM identify applications where vapor retarders may not be necessary, all new commissary facilities shall have vapor retarders installed beneath slab-on-grade construction. ACI 302.1R indicates that a vapor retarder should be provided if the project is required to have a humidity-controlled environment, which all commissary facilities are required to have. Additionally, the O & M life of a commissary facility will typically include multiple renovations. While current DeCA Design Criteria establishes an exposed concrete floor throughout most of the facility; this may not be criteria in the future. Providing a vapor retarder will accommodate moisture sensitive floor finishes possibly required at a later date.

6. Floor Surface Treatments:

   A. Floor Sealing: Provide for the application of two coats of 20% solids acrylic solvent-based sealer on floors indicated to be left exposed. The first coat, applied after the concrete has cured, is intended to protect the concrete from stains during construction operations. The second coat, applied just before completion of project, dresses-up the floor for the Commissary opening. Do not indicate a sealer on floors receiving a polished concrete finish specified in Division 03 Section Polished Concrete Finishing.

   B. Floor Hardeners: Liquid surface treatments designed to reduce dusting and create a denser, harder surface, are not intended to provide additional wear resistance in new, well designed, well constructed and cured floors, nor to permit the use of lower quality concrete. Therefore, floor hardeners are not specified. Add/Alter projects exhibiting floors with low wear resistance or dusting may require remediation with a floor hardener.

7. Testing and Inspection: Although the IBC requires special inspections be performed by special inspectors who are engaged by the owner or the design professional, this Section specifies the Contractor shall engage the special inspectors.

8. Medium Temperature Cold Storage Room Floor Slabs: Provide perimeter wood thermal break (preservative treated or redwood) around medium temperature cold storage room floor slabs. Discontinue wood thermal break at door openings and provide isolation membrane across door opening. Isolation membrane should be an ASTM D226 Type II No. 30 Asphalt Felt.

END OF SECTION