

**DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL HOUSING ADMINISTRATION**

Series and Series No.

**USE OF MATERIALS
BULLETIN NO. 65**

**TO: AREA OFFICE DIRECTORS
INSURING OFFICE DIRECTORS**

Date October 11, 1973

SUBJECT: CONTROLLED DENSITY CELLULAR CONCRETE FLOOR FILL

Members of the HUD Staff processing cases and inspecting construction shall use this information in determining acceptability of the subject material for the uses indicated.

This bulletin should be filed with Bulletins on Special Methods of Construction and Materials as required by prescribed procedures. Additional copies may be requisitioned by the field offices.

The technical description, requirements and limitations expressed herein do not constitute an endorsement, approval or acceptance by the Federal Housing Administration of the subject matter, and any statement or representation, however made, indicating approval or endorsement by the Federal Housing Administration is unauthorized and false, and will be considered a violation of the United States Criminal Code 18, U.S.C. 709.

Any reproduction of this bulletin must be in its entirety and any use in sales promotion or advertising is not authorized.

Subject to good workmanship, compliance with local codes, and the methods of application listed herein, the materials described in the bulletin may be considered suitable for FHA mortgage Insurance or Low Rent Public Housing Programs.

The eligibility of a property under these Programs is determined on the property as an entity and involves the consideration of underwriting and other factors not indicated herein. Thus, compliance with this bulletin should not be construed as qualifying the property as a whole, or any part thereof, as to its eligibility.

The methods of application for the materials listed herein are to be considered as part of the FHA Minimum Property Standards and shall remain effective until this bulletin is cancelled or superseded.

SECTION 1. GENERAL

1.1

This bulletin sets forth the specifications and conditions for the use of controlled density cellular concrete floor fill. All the requirements of the Minimum Property Standards apply to this bulletin except where modified herein.

1.2

The cellular concrete system described herein is for a non-structural floor fill on a lumber or plywood subfloor, steel decking or a concrete structural floor. The floor system shall be designed to carry all dead loads and design live loads. The maximum allowable lived load deflection shall not exceed $L/360$. The floor system shall be investigated by a rational method to assure stability under the ponding load of the fluid cellular concrete.

1.3

The cellular concrete shall be made by blending a preformed aqueous foam into a slurry of water, cement and natural or lightweight aggregate to produce a controlled density concrete. Cellular concrete floor fill shall not be used as a wearing surface, but shall be covered with a wear resistant material such as wood, resilient flooring or carpet.

SECTION 2. SPECIFICATIONS AND STANDARDS

2.1 Applicable specifications and standards

Except where modified by this bulletin, the following specifications and standards, latest edition are part of this bulletin.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

- C33 Standard Specifications for Concrete Aggregates.
- C39 Compressive Strength of Cylindrical Concrete Specimens.
- C144 Specifications for Aggregate for Masonry Mortar.
- C150 Standard Specification for Portland Cement.
- C171 Specifications for Waterproof Sheet Materials for Curing Concrete.
- C172 Sampling Fresh Concrete

- C309 Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
- C330 Standard Specifications for Lightweight Aggregates for Structural Concrete.
- C494 Chemical Admixtures for Concrete
- C595 Standard Specification for Blended Hydraulic Cements.
- D226 Asphalt Saturated Roofing Felt for Use in Waterproofing and in Constructing Built-Up Roofs.
- D227 Coal-Tar Saturated Roofing Felt for Use in Waterproofing and in Constructing Built-Up Roofs.
- D250 Asphalt-Saturated Asbestos Felt for Use in Waterproofing and in Constructing Built-Up Roofs.

DEPARTMENT OF COMMERCE

PS 1-66 Softwood Plywood, Construction and Industrial.

FEDERAL SPECIFICATION

UU-B-790 Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

SECTION 2.2 MATERIALS

2.2.1

Portland Cement Shall conform to ASTM Specification C-150 Type I, II or III or C595 Type I, S.

2.2.2

Aggregate shall conform to ASTM C33 Standard Specifications for Concrete Aggregates, ASTM C330 Standard Specification for Lightweight Aggregates for Structural Concrete or ASTM C144 Specifications for Aggregate for Masonry Mortar.

2.2.3

Water Shall be potable and free from deleterious amounts of acid, alkali or organic material.

2.2.4

Chemical admixtures to accelerate or to retard the setting of the cellular concrete shall conform to ASTM C494 Type B - Retarding Admixtures or Type C - Accelerating Admixtures. Admixtures containing chlorides shall not be used in cellular concrete installed on steel decking.

2.2.5

Preformed foam shall be produced from an aqueous solution of a hydrolyzed protein base concentrate and compressed air, in predetermined proportions, using a calibrated foam generator from which a minute, closed cell, stable foam is discharged at a known rate. The stability of the foam shall be such that the concrete's gain in unit weight between its discharge from the mixer and its placement in the forms does not exceed 5%.

2.2.6

Plywood subfloors supporting cellular concrete floor fill shall comply with PS 1-66. Plywood with a minimum Identification Index of 32/16 shall be applied to joists spaced 16" on center and 42/20 for joists spaced 24" on center. Provide edge support or use tongue and groove plywood. Panels shall be applied with the face grain perpendicular to the joists. Space the panels 1/16" at the ends and 1/8" at the edges. Fasten 1/2" thick plywood with 6d common nails spaced 6" on center where the panel edges fall on the framing member and 10" on center at the intermediate supports. Use 8d common nails at the same nail spacing for plywood thicker than 1/2".

SECTION 3. PROPORTIONING, MIXING AND TESTING

3.1

The concrete shall be mixed in a continuous or a batch type mechanical mixer capable of thoroughly blending the ingredients. After mixing the concrete shall be pumped or otherwise conveyed to the point of deposit.

3.2

Field control weighings for control of the wet unit weight shall be made. The design wet unit weight for field control of the concrete shall be based upon previously established data for the relation between the wet unit weight and the air dry unit weight at 28 days for the mix being placed. Field control weighings for determining the wet unit weight shall be made at the mixer discharge and at the point of deposit. Make one pair of weighings per batch for batch type mixers and one pair of weighings per 10 cubic yards for continuous type mixers. The gain in unit weight between the mixer discharge and point of deposit shall not exceed 5%. The wet unit weight at the point of deposit of the concrete shall not exceed $\pm 5\%$ of the design wet unit weight. A variation exceeding $\pm 5\%$ of the design wet unit weight shall require a modification of the mix proportions, a change of materials or a change in the mixing procedure.

3.3

Two test cylinders, for compressive strength tests, shall be made for each 4,000 square feet of surface area placed. A minimum of two test cylinders shall be made each day. Each strength test result shall be the average of two cylinders from the same sample tested at 28 days or at a specified earlier age.

3.4

The minimum air dry density shall be 90 pounds per cubic foot. The minimum design compressive strength shall be 1,000 psi when the curing procedure specified herein is applied. The minimum design compressive strength shall be 1250 psi if the slab is placed in a completely enclosed area of a building and a specified curing medium is not applied. The specified design compressive strength shall be increased 20% when the specified strength is greater than 1,000 psi and the slab is placed in a completely enclosed area of a building and a specified curing medium is not applied.

3.5

The design mix shall be proportioned so that the average of any three consecutive strength tests shall be equal to or greater than the required strength, $f'c$, and not more than 10% of the strength tests shall have values less than the required strength. No individual test may fall below $.85f'c$.

3.6

The cellular concrete shall be sampled at the point of deposit in accordance with the applicable procedures of ASTM C-172, Sampling Fresh Concrete. Cylinder molds shall be either 3"x6" or 6"x 12". Lightly tap the sides of the mold with a rubber hammer while filling the mold instead of rodding the mix. Moist cure the specimens for 7 days at $73.4 \pm 3^{\circ}F$. At the age of 7 days, remove the specimens from the moist condition and store in a temperature of $73.4 \pm 3^{\circ}F$ and a relative humidity of $50 \pm 10\%$ until the time of test at 28 days. The compressive strength test shall be in accordance with ASTM C-39, Compressive Strength of Cylindrical Concrete Specimens. Determine the air dry unit weight at 28 days.

SECTION 4. PLACING, FINISHING AND CURING

4.1

The concrete shall be placed, finished and cured to produce a level, smooth, surface. The concrete shall be placed in a single layer to a minimum thickness of 1 1/2". The deviation from a plane shall not exceed 1/4" in any 10'. The final finish of the concrete shall be suitable for the application of the specified wear resistant covering. Cracks wider than 1/32" shall be repaired.

4.2

Install a water resistant membrane between wood or plywood sub-floors and the cellular concrete to prevent leakage of the concrete and wetting of the subfloor. The membrane shall consist of waterproof paper or plastic sheets conforming to ASTM C171 Sheet Materials for Curing Concrete or 15 lb. roofing felt conforming to ASTM D226, D250 or D227, or Federal Specification UU-B-790, Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellant and Fire Resistant) Type 1, Grade B. The sheets shall be lapped a minimum of 3" and securely fastened to the subfloor.

4.3

Control joint forming materials shall be metal or plastic. Control joints shall be provided in the cellular concrete slab in all individual areas larger than 400 square feet and in areas where the length exceeds the width by a factor of 1.5, and at all door thresholds. No control joint is required at thresholds where the threshold plate serves to form a control joint.

4.4

The concrete shall not be placed when the ambient temperature is below 40°F. In hot weather the temperature of the concrete should not be so high as to cause flash set, cold joint, or excessive change in the specified density. When the temperature of the concrete exceeds 90°F., precautionary measures should be taken. Curing shall be started as soon as possible. Apply the curing medium without damaging the surface. Curing shall continue for at least 5 days at concrete surface temperatures of 70°F or higher or at least 7 days at concrete surface temperatures of 50°-70°F. The temperature of the concrete shall be prevented from falling below 50°F during the curing period. Curing shall consist of light sprinkling or the application of sheet materials conforming to ASTM C171, Sheet Materials for Curing Concrete or a liquid membrane-forming material conforming to ASTM C309, Liquid Membrane-Forming Compounds for Curing Concrete. Curing compound shall not be used on concrete surfaces which are to receive a wear resistant covering which is adhered to the concrete by an adhesive unless it can be shown that the curing compound can be removed before the application of the adhesive or tests show that the membrane can serve as a satisfactory base for the application of the adhesive.

SECTION 5. REHABILITATION OF EXISTING FLOORS

5.1

Existing Floors, which are to be rehabilitated shall meet the strength and deflection criteria for new floors.

5.2

Defective flooring shall be repaired. All loose boards shall be renailed. Loose floor coverings shall be reattached. All protrusions higher than 1/4" above the general floor level shall be removed.

5.3

The water-resistant membrane and the slabs shall meet the requirements for new work, except that the thickness of the slab may be reduced to 1" over high spots of the floor provided the areas thinner than 1 1/2" are reinforced with steel hardware cloth or chicken-wire.

SECTION 6. APPLICATOR QUALIFICATION AND WARRANTY

6.1

The applicator shall present evidence to the Project Architect, or to the Builder if there is no Project Architect, that the equipment to be used is adequate for the work and that his supervisory personnel have at least 6 months of successful experience in the type of work covered by this bulletin. The Project Architect, or the Builder, shall evaluate and approve this evidence. A copy of the evidence and the approval shall be given to HUD.

6.2

The applicator shall furnish the building owner and HUD with a properly executed one year warranty against defects in materials and workmanship. Defective work shall be repaired or removed and new work provided at no cost to the building owner or to HUD.

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