
USACE / NAVFAC / AFCEA / NASA UFGS-32 16 15 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02780 (May 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 9 October 2006

Latest change indicated by CHG tags

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 16 15

CONCRETE BLOCK PAVEMENTS

04/06

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 BASIS FOR PAYMENT
 - 1.3.1 Pavements
 - 1.3.2 Edge Restraint
- 1.4 MAINTENANCE

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Bedding and Jointing Sand
 - 2.1.2 Concrete Paving Block
 - 2.1.3 Edge Restraints
 - 2.1.3.1 Treated Wood
 - 2.1.3.2 Precast Concrete
 - 2.1.3.3 Cast-in-Place Concrete
- 2.2 TESTS, INSPECTIONS AND VERIFICATIONS
 - 2.2.1 Paving Block
 - 2.2.1.1 Freezing and Thawing
 - 2.2.1.2 Dimensional Tolerance
 - 2.2.1.3 Retest
 - 2.2.2 Sand

PART 3 EXECUTION

- 3.1 PREPARATION
 - 3.1.1 Edge Restraint Location
 - 3.1.2 Sand Bedding Layer
- 3.2 BLOCK PLACEMENT
 - 3.2.1 Unfilled Gaps
 - 3.2.2 Seating Blocks
 - 3.2.3 Jointing Sand

- 3.2.4 Timing of Operations
- 3.2.5 Final Rolling
- 3.2.6 Construction Traffic
- 3.3 CLEANUP
- 3.4 SMOOTHNESS AND GRADE TOLERANCES
 - 3.4.1 Smoothness
 - 3.4.2 Block Height
 - 3.4.3 Grade
 - 3.4.4 Remedial Action

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-32 16 15 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02780 (May 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 9 October 2006

Latest change indicated by CHG tags

SECTION 32 16 15

CONCRETE BLOCK PAVEMENTS 04/06

NOTE: This guide specification covers the requirements for constructing a concrete block pavement.

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.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

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.

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 301 (2005) Specifications for Structural
Concrete for Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C 117 (2004) Materials Finer Than 75 micrometer
(No. 200) Sieve in Mineral Aggregates by
Washing

ASTM C 131 (2003) Resistance to Degradation of
Small-Size Coarse Aggregate by Abrasion
and Impact in the Los Angeles Machine

ASTM C 136 (2005) Sieve Analysis of Fine and Coarse
Aggregates

ASTM C 67 (2003a) Sampling and Testing Brick and
Structural Clay Tile

ASTM C 936 (2001) Solid Concrete Interlocking Paving
Units

ASTM C 979 (1999) Pigments for Integrally Colored
Concrete

ASTM D 1760 (2001) Pressure Treatment of Timber
Products

ASTM D 4318 (2000) Liquid Limit, Plastic Limit, and
Plasticity Index of Soils

ASTM D 75 (2003) Sampling Aggregates

ASTM E 11 (2004) Wire Cloth and Sieves for Testing
Purposes

1.2 SUBMITTALS

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.

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.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Concrete Paving Block[; G][; G, [_____]]

A sample of five paving blocks prior to the start of the work. Also, a representative sample of not less than 15 blocks as directed by the Contracting Officer, from each lot of 20,000 concrete paving blocks or fraction thereof.

SD-06 Test Reports

Tests, Inspections and Verifications

A written report within 7 calendar days after completion of the work, covering the testing required for each lot.

1.3 BASIS FOR PAYMENT

NOTE: Delete this paragraph in fixed price contracts.

1.3.1 Pavements

The blocks, cut blocks, bedding sand, and jointing sand will be paid per

square meter foot of satisfactorily installed block pavement surface.

1.3.2 Edge Restraint

The edge restraint will be paid per lineal meter foot of satisfactorily installed edge restraint.

1.4 MAINTENANCE

NOTE: This paragraph will be included only if the project has aesthetic considerations where future maintenance must exactly match the color of the block.

At the completion of work the Contractor shall provide [_____] paving blocks matching those used in the project. These paving blocks shall be delivered stacked on pallets.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Bedding and Jointing Sand

NOTE: If the pavement is to be subjected to Design Index traffic of 8 or higher, both the bedding and jointing sands will consist of 100 percent crushed sand, if it is available in the construction locale. For block pavements to be used for walkway, driveway, storage area, parking area, or subject to traffic Design Indexes of 1 or 2, the bedding sand gradation can be changed to the fine aggregate gradation in ASTM C 33 with the additional requirement of 0-10 percent passing the 0.075 mm (No. 200) sieve.

Two separate sand gradations shall be used for the bedding layer and in the block joints. Both sand gradations shall consist of crushed sand, natural sand, or a combination of crushed and natural sand. Both sand gradations shall have a minimum L.A. Abrasion of 40 percent when tested in accordance with ASTM C 131. Both sand gradations shall be nonplastic when tested in accordance with ASTM D 4318 and shall be free of lumps, clay, vegetation, soft particles, sulphates, and other contaminants. The bedding and jointing sands shall conform to the following gradations, determined in accordance with ASTM C 136 and ASTM C 117, using ASTM E 11 sieve.

Sieve (ASTM E 11)	Percent Passing	
	Bedding Sand	Jointing Sand
9.5 mm	100	100
4.75 mm	80-100	100
2.36 mm	60-90	95-100

Sieve (ASTM E 11)	Percent Passing	
	Bedding Sand	Jointing Sand
1.18 mm	25-70	70-100
0.600 mm	10-35	40-75
0.300 mm	5-20	10-40
0.150 mm	0-10	2-25
0.075 mm	0-5	0-10

Sieve (ASTM E 11)	Percent Passing	
	Bedding Sand	Jointing Sand
3/8 in.	100	100
No. 4	80-100	100
No. 8	60-90	95-100
No. 16	25-70	70-100
No. 30	10-35	40-75
No. 50	5-20	10-40
No. 100	0-10	2-25
No. 200	0-5	0-10

2.1.1.2 Concrete Paving Block

 NOTE: Color and shape of block may be specified.
 Check local availability of specific colors or
 shapes before specifying. Organic pigments should
 not be used, since they are unstable in the alkaline
 concrete environment and subject to weathering.
 Shape is generally rectangular or interlocking.

The concrete paving block shall conform to ASTM C 936, and shall be [_____] thick, [_____] in color, and [_____] in shape. Pigmentation shall conform to ASTM C 979.

2.1.1.3 Edge Restraints

2.1.1.3.1 Treated Wood

 NOTE: Treated wood edge restraint is only
 acceptable for walkways and residential driveways.
 Delete this paragraph when this option is not
 retained.

The edge restraint shall be wood treated in accordance with ASTM D 1760 and of dimensions shown on the plans.

2.1.1.3.2 Precast Concrete

NOTE: Minimum compressive strength of precast concrete should be 21 MPa (3,000 psi) unless analysis requires some other value. Entrained air content of the fresh concrete should be 6 percent plus or minus 1.5 percent in areas where freezing and thawing coverage is a design consideration. Delete this paragraph when this option is not retained.

The edge restraint shall be precast portland cement concrete elements with the dimensions shown on the plans. The precast concrete shall have a compressive strength of not less than [_____] at 28 days and an entrained air content of not less than [_____].

2.1.3.3 Cast-in-Place Concrete

NOTE: Minimum compressive strength of cast-in-place concrete should be 21 MPa (3,000 psi) unless analysis requires some other value. Entrained air content of the fresh concrete should be 6 percent plus or minus 1.5 percent in areas where freezing and thawing coverage is a design consideration. Delete this paragraph when this option is not retained.

The edge restraint shall be portland cement concrete placed with the dimensions shown in the plans. Concrete shall conform to the requirements of ACI 301, except that it shall have a compressive strength of not less than [_____] at 28 days and an entrained air content of not less than [_____].

2.2 TESTS, INSPECTIONS AND VERIFICATIONS

2.2.1 Paving Block

NOTE: Sampling of paving blocks prior to the start of the work for the purposes of verifying the color and shape of the blocks will only be required when these considerations are critical to the project aesthetics. For jobs of less than 1000 square meters (10,000 square feet) or for pavements not to be exposed to vehicular traffic, a manufacturer's certificate which certifies that the paving blocks meet the requirements of ASTM C 936 can be accepted in lieu of sampling and testing the blocks of each lot.

The Contractor shall conduct the tests prescribed by ASTM C 936 and the following tests on the remaining 13 blocks of each sample from each lot.

2.2.1.1 Freezing and Thawing

NOTE: The freezing and thawing test may be waived

for climates not subject to freezing and thawing. For jobs of less than 1000 square meters (10,000 square feet), a manufacturer's certificate which certifies that the paving blocks meet the requirements of this paragraph may be accepted in lieu of sampling and testing the blocks of each lot.

Resistance to freezing and thawing shall be determined in accordance with Section 8 of **ASTM C 67** for five blocks. The blocks shall have no breakage and no more than 1.0 percent loss of any individual unit in dry weight when subjected to 50 cycles of freezing and thawing.

2.2.1.2 Dimensional Tolerance

The length and width of each block in the sample shall not vary from any other block in this or any other lot sample by more than **3 mm 1/8 inch**. Thickness of any block in the sample shall not vary by more than **3 mm 1/8 inch** from the specified block thickness.

2.2.1.3 Retest

The Contractor shall notify the Contracting Officer if any blocks fail to meet the specified requirements. In case the shipment fails to conform to the specified requirements, the Contractor may sort it, and new specimens shall be selected by the Contractor from the retained lot for retesting, as directed by the Contracting Officer. All concrete paving block retests shall be performed at the expense of the Contractor. In case the second set of specimens fail to conform to the test requirements, the entire lot shall be rejected.

2.2.2 Sand

The Contractor shall obtain a representative sample in accordance with **ASTM D 75** from each **75 cubic meters 100 cubic yard** of sand to be used in the project. If the sand fails to meet the gradation requirements the Contractor may take another sample and retest it at his expense. If this retest fails or if no second test is taken, the sand is rejected by the Government and shall be removed from the job site.

PART 3 EXECUTION

NOTE: The base course for the block pavement must be a dense graded or bound material to avoid loss of the sands from the bedding layer. It must also be properly graded and leveled. A smoothness of no more than 10 mm (3/8 inch) deviation from a 3 m (10 foot) straight edge is needed. The project specification for the pavement base course should be checked to ensure these requirements are met.

3.1 PREPARATION

3.1.1 Edge Restraint Location

The edge restraint shall be placed as shown in the drawings and shall be installed prior to placement of the blocks.

3.1.2 Sand Bedding Layer

The bedding sand shall be spread evenly over the area to be paved and shall be screeded to an uncompacted average thickness of 30 mm 1-1/4 inch with a tolerance for grade and surface smoothness of plus or minus 6 mm 1/4 inches.

This bedding sand shall not be used to fill low areas that exceed the specified tolerance for the base. The sand shall be left uncompacted and shall not be disturbed by any pedestrian or vehicle construction traffic.

3.2 BLOCK PLACEMENT

NOTE: Paving block to be subject to vehicular
traffic should be placed in herringbone pattern, and
this pattern can be specified here.

The paving block shall be placed by hand or machine in the indicated pattern. Placement of paving block shall start from a corner or straight edge and proceed forward over the undisturbed sand bedding layer. The joints, excluding any chamfer between paving blocks, shall be not less than 2 mm 1/16 inch or more than 6 mm 1/4 inch in width. After seating, the block surface shall be flush or up to 6 mm 1/4 inch above the edge restraint.

3.2.1 Unfilled Gaps

Any gaps between paving blocks and any edge restraint, drainage structures, or other members that cannot be filled with a whole block shall be filled with a paving block cut to fit the gap, except that slivers will not be allowed and the minimum size of cut block shall be [____]. Cutting shall be done with a hydraulic splitter, a masonry saw, or other device that accurately leaves a clean, vertical face without spalling. Any remaining gap between the block and adjoining edge restraint or structure greater than 6 mm 1/4 inch will not be accepted; adjacent blocks shall be cut or rearranged to prevent this.

3.2.2 Seating Blocks

The blocks shall be seated in the bedding sand by compacting them with a minimum of three passes of a vibratory plate compactor, sized as follows: [____].

3.2.3 Jointing Sand

The jointing sand shall be swept into joints and vibrated with a vibratory plate or vibratory roller compactor. This process shall be continued until sweeping and vibrating have filled all joints with sand and further vibration cannot force additional sand into the joints. The coarser particles of the sand will not enter the joints and will remain on the surface. These particles and any excess sand shall be swept off the pavement.

3.2.4 Timing of Operations

Seating of blocks and placement of jointing sand can be done concurrently with block placement. However, seating of blocks and placement of jointing sand shall not be done within 1.5 m 5 feet of any unfinished edge of the

block pavement that is not supported by the edge restraint.

3.2.5 Final Rolling

NOTE: This paragraph can be deleted for light load
pavements such as driveways or pedestrian walkways.

The final finished paving block surface shall be rolled with four passes of a vibratory or pneumatic roller with a static weight of not less than 4.5 metric tons 10,000 pounds.

3.2.6 Construction Traffic

Construction traffic shall not be allowed on the paving block surface until the jointing sand has been placed and vibrated into the joints and all debris and excess sand has been swept off.

3.3 CLEANUP

The Contractor shall sweep the entire pavement surface and remove all excess sand, blocks and debris from the project area.

3.4 SMOOTHNESS AND GRADE TOLERANCES

3.4.1 Smoothness

No portion of the finished pavement surface shall deviate by more than 10 mm 3/8 inch from a 3 m 10 foot long metal straightedge placed on the pavement surface.

3.4.2 Block Height

The finished block surface shall be either flush or up to 6 mm 1/4 inch higher than all edge restraints or drainage structures.

3.4.3 Grade

The finished pavement shall be within 12 mm 0.04 feet of planned grade shown on the plans.

3.4.4 Remedial Action

Any area not meeting the smoothness, block height, or grade tolerance shall be taken up, adjustments made, and the blocks relaid.

-- End of Section --