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PAVERS FOR ROOF PLAZA DECKS

SECTION 32 14 13

*Note: This guide specification for the U.S. is for pavers used as ballast and/or paving on pedestrian plaza and vehicular roof deck applications with an open-graded aggregate setting bed and joints (to facilitate drainage) over an optional drainage mat. Drainage mats should not be used in vehicular areas. Vehicular roof decks should receive limited vehicular traffic, i.e. automobiles and occasional light trucks. This Section includes the term "Architect." Edit this term as necessary to identify the design professional in the General Conditions of the Contract. **The text must be edited by a qualified, licensed design professional to suit specific project requirements. ICPI makes no representations or warranties of any kind, expressed or implied, and disclaims any liability for damages resulting in the use of this guide construction specification.***

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes**
1. Concrete Paver Units.
 2. Bedding and Joint Materials.
 3. Geotextiles.
 4. [Drainage Mat.]
 5. [Edge restraints].
 6. [Cleaning and Sealing].
- B. Related Sections**
1. Section [] – Roofing Membrane.
 2. Section [] - Roof Drains.
 3. Section [] - Roof Accessories.
 4. Section [] - Roof and Deck Insulation.
 5. Section [] - Sheet Metal Flashing and Trim.

Note: Pavements should be designed in consultation with a qualified civil engineer in accordance with established pavement and roof design procedures, and in accordance with the ICPI Tech Spec technical bulletins.

1.02 REFERENCES

- A. American Society of Testing and Materials (ASTM):**

Revised April 2, 2020

1. C33 Specification for Concrete Aggregates.
 2. C136 Method for Sieve Analysis for Fine and Coarse Aggregate.
 3. C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 4. C144 Standard Specification for Aggregate for Masonry Mortar.
 5. C936 Specification for Solid Interlocking Concrete Paving Units.
 6. C979 Standard Specification for Pigments for Integrally Colored Concrete.
 7. C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
 8. D448 Standard Classification of Sizes of Aggregate for Road and Bridge Construction.
- B. Interlocking Concrete Pavement Institute (ICPI) Technical Bulletins**
1. ICPI Tech Spec 5 Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavement.
 2. ICPI Tech Spec 14 Segmental Concrete Paving Units for Roof Decks.

1.03 SUBMITTALS

- A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.**
- B. Manufacturer's drawings and details: Indicate perimeter conditions, relationship to adjoining materials and assemblies, [expansion and control joints,] concrete paver [layout,] [patterns,] [color arrangement,] installation [and setting] details.**
- C. [Drainage mat sample.]**
- D. Sieve analysis per ASTM C136 for grading of bedding and joint materials.**
- E. Concrete pavers:**
1. [Four] representative full-size samples of each paver type, thickness, color, finish that indicate the range of color variation and texture expected in the finished installation. Color(s) selected by [Architect] [Engineer] [Landscape Architect] [Owner] from manufacturer's available colors.
 2. Accepted samples become the standard of acceptance for the work.
 3. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C936.
 4. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.
- E. Paver Installation Subcontractor:**
1. Current certificates from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program for job foremen on the project.
 2. Job references from projects of a similar size and complexity. Provide Owner/ Client/General Contractor names, postal address, phone, fax, and email address.

1.04 QUALITY ASSURANCE

- A. Paving Subcontractor Qualifications:**
1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
 2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
- B. Regulatory Requirements and Approvals: [Specify applicable licensing, bonding or other requirements of regulatory agencies.]**
- C. Mock-Ups:**

1. Install a 7 ft x 7 ft (2 x 2 m) paver area.
2. Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s), and texture of the job.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and properly dispose of mock-up.

1.05 DELIVERY, STORAGE & HANDLING

- A. **General: Comply with Division 1 Product Requirement Section.**
- B. **Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.**
- C. **Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers packaging with identification labels intact.**
 1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
 2. Deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
 3. Unload pavers at job site in such a manner that no damage occurs to the product.
- D. **Storage and Protection: Store materials protected such that they are kept free from mud, dirt, and other foreign materials. [Store concrete paver cleaners and sealers per manufacturer's instructions.]**
 1. Cover bedding sand and joint sand with waterproof covering if needed to prevent exposure to rainfall or removal by wind. Secure the covering in place.

1.06 PROJECT/SITE CONDITIONS

- A. **Environmental Requirements:**
 1. Do not install aggregate bedding materials or pavers during heavy rain or snowfall.
 2. Do not install frozen sand or saturated aggregate bedding materials.
 3. Do not install concrete pavers on frozen or saturated aggregate bedding materials.

1.07 MAINTENANCE

- A. **Extra Materials: Provide [Specify area] [Specify percentage.] additional material for use by owner for maintenance and repair.**
- B. **Pavers shall be from the same production run as installed materials.**

PART 2 PRODUCTS

2.01 CONCRETE PAVERS

Note: Concrete pavers may have spacer bars on each unit. They are highly recommended for mechanically installed pavers. Manually installed pavers may be installed with or without spacer bars.

- A. **Manufacturer: [Specify ICPI member manufacturer name].**
 1. Contact: [Specify ICPI member manufacturer contact information].
- B. **Interlocking Concrete Paver Units, including the following:**
 1. Paver Type: [Specify name of product group, family, series, etc.].
 - a. Material Standard: Comply with ASTM C936.

- b. Color [and finish]: [Specify color] [Specify finish].
- c. Color Pigment Material Standard: Comply with ASTM C979.
- d. Size: [Specify] inches [mm] x [Specify] inches [mm] x [Specify] inches [mm] thick.
- e. Average Compressive Strength (ASTM C 140): 8000 psi (55 MPa) with no individual unit under 7200 psi (50 MPa).
- f. Average Water Absorption (ASTM C 140): 5% with no unit greater than 7%.
- g. Freeze-thaw Deicing Salt Resistance (ASTM C1645): 28 freeze-thaw cycles with no greater loss than 225 g/m² of paver surface area or no greater loss than 500 g/m² of paver surface area after 49 freeze-thaw cycles while immersed in a saline solution. Freeze-thaw testing requirements shall be waived for applications not exposed to freezing conditions.

2.02 PRODUCT SUBSTITUTIONS

- A. Substitutions: No substitutions permitted.**

2.03 BEDDING AND JOINT MATERIALS

- A. Provide as follows:**

- 1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
- 2. Do not use limestone screenings or stone dust.
- 3. Sieve according to ASTM C136.
- 4. Conform to the grading requirements as shown in Table 1.

Table 1

Grading Requirements for Bedding Materials
No. 89 (per ASTM D448)

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	95 to 100
No. 4 (4.75 mm)	20 to 55
No. 8 (2.36 mm)	4 to 30
No. 16 (1.18 mm)	0 to 10
No. 50 (0.300 mm)	0 to 5
No. 200 (0.075 mm)	0 to 2

2.04 ACCESSORIES

- A. Provide accessory materials as follows:**

- 1. Geotextile:
 - a. Material Type and Description: [Specify material type and description].
 - b. Material Standard: [Specify material standard].
 - c. Manufacturer: [Acceptable to interlocking concrete paver manufacturer] [Specify manufacturer].

Note: Edit articles below if drainage mat, cleaners and/or sealers are not specified.

- [2. Drainage Mat
 - a. [] or approved substitute.]
- [3. Edge Restraints]
- [4. [Cleaners] [Sealers]
 - a. Material Type and Description: [Specify material type and description].
 - b. Material Standard: [Specify material standard].
 - c. Manufacturer: [Specify manufacturer.]

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. [Specify acceptable paving subcontractors.]

Note: The elevations and surface tolerance of the roof deck determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in elevations of the base surface with additional bedding sand or by other means. Therefore, the surface elevations of the base should be checked and accepted by the General Contractor or designated party, with written certification to the paving subcontractor, prior to placing bedding materials.

3.02 EXAMINATION

A. Acceptance of Site Verification of Conditions:

1. General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that roof conditions meet specifications for the following items prior to installation of interlocking concrete pavers.
 - a. Verify that geotextiles, if applicable, have been placed according to drawings and specifications.
 - b. Verify that roof deck materials, thickness, surface tolerances and elevations conform to specified requirements.
 - c. Provide written test results for roof deck materials to the Owner, General Contractor and paver installation subcontractor.
 - d. Verify location, type, and elevations of edge restraints, drains, drain holes, and inlets.
2. Do not proceed with installation of bedding and interlocking concrete pavers until roof conditions are corrected by the General Contractor or designated subcontractor.

3.03 PREPARATION

- A. Verify that all surfaces, waterproof membrane(s) [protection board] [insulation] and drains, are free from dirt, oil, grease or any deleterious substances and debris that may prevent installation, drainage, and stability of the paver installation.**
- B. Verify that roof deck has a minimum of [2%] slope to drains. Verify roof deck is clean and dry, and certified by General Contractor as meeting material, installation, smoothness and slope specifications.**
- C. Verify that roof deck is ready to support bedding, [edge restraints,] pavers and imposed loads.**
- D. Edge Restraints:**
 1. Install edge restraints per the drawings [and manufacturer's recommendations] [at the indicated elevations].

Note: Use the following paragraphs include drainage mat. Edit as required.

3.04 INSTALLATION

- [A. Spread, join, and trim drainage mat according to manufacturer's recommendations.]**
- B. Spread geotextile and turn up at sides of installation against parapets and protrusions in the roof. Overlap downslope a minimum of 12 in. (30 cm) [as indicated on the drawings].**
- C. Apply geotextile over the surface of the [deck] [drainage mat] and turn up vertically at edges to prevent migration of bedding material. Allow an extra 12 in. (30 cm) length at perimeters to fold over and capture bedding material at edges. Place remaining length of geotextile under pavers at perimeter of installation.**

Note: The aggregate bedding layer should not exceed 2 in. (50 mm) for vehicular applications and 3 in. (75 mm) for pedestrian applications.

- D. Spread the bedding materials evenly over the geotextile and screed to a nominal [1 in. (25 mm)] thickness.**

1. Do not disturb screeded aggregate.
2. Screeded area shall not substantially exceed that covered by pavers in one day.

Note: Paver joint widths and lines (bond lines) are straightened and aligned to specifications with rubber hammers and pry bars as paving proceeds.

- E. Lay pavers in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.**

Note: Contact manufacturer of interlocking concrete paver units for recommended joint widths.

- F. Provide consistent joints widths between pavers of [3/8 in. (10 mm)]. No more than 5% of the joints shall exceed [3/8 in. (10 mm)] wide to achieve straight bond lines.**
- G. Joint (bond) lines shall not deviate more than $\pm 1/2$ in. (± 15 mm) over taut 50 ft. (15 m) long string lines.**
- H. Fill gaps at the edges of the paved area with cut pavers or edge units.**
- I. Cut pavers to be placed along the edge with a [double blade paver splitter or] masonry saw.**
- J. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.**
- K. [Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized.] [Cut pavers at edges as indicated on the drawings.]**
- L. Keep skid steer and forklift equipment off newly laid pavers that have not received joint materials and compaction.**
- M. Spread and sweep ASTM No. 89 aggregate into the paver joints until full.**
- N. Use a low-amplitude plate compactor capable of at least of 5,000 lbf (22 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the bedding materials. Make at least 4 passes with a plate compactor.**
- O. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.**
- P. Remove any cracked or damaged pavers and replace with new units.**
- Q. [Inspect roof drains to confirm no damage from compaction.]**
- R. All work more than 6 ft. (2 m) of the laying face shall be left fully compacted with filled joints at the end of each day.**
- S. Remove excess aggregate from surface when installation is complete.**
- T. Surface shall be broom clean after removal of excess aggregate.**

3.05 FIELD QUALITY CONTROL

Note: Surface tolerances on flat slopes should be measured with a rigid straightedge. Tolerances on complex contoured slopes should be measured with a flexible straightedge capable of conforming to the complex curves on the pavement surface.

- A. The final surface tolerance from grade elevations shall not deviate more than $\pm 3/8$ in. (± 10 mm) under a 10 ft (3 m) straightedge.**
- B. Check final surface elevations for conformance to drawings.**
- C. The surface elevation of pavers shall be 1/8 in. to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.**
- D. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.**

Note: Cleaning and sealing may be required for some applications. See ICPI Tech Spec 5, Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavement for guidance on when to clean and seal the paver surface. Delete article below if cleaners or sealers are not applied.

3.06 [CLEANING] [SEALING]

- A. [Clean] [Seal] concrete pavers in accordance with the manufacturer's written recommendations.

3.07 PROTECTION

- A. After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

END OF SECTION

ABOUT CMHA

The Concrete Masonry & Hardscapes Association (CMHA) represents a unification of the Interlocking Concrete Pavement Institute (ICPI) and National Concrete Masonry Association (NCMA). CMHA is a trade association representing US and Canadian producers and suppliers in the concrete masonry and hardscape industry, as well as contractors of interlocking concrete pavement and segmental retaining walls. CMHA is the authority for segmental concrete products and systems, which are the best value and preferred choice for resilient pavement, structures, and living spaces. CMHA is dedicated to the advancement of these building systems through research, promotion, education, and the development of manufacturing guides, design codes and resources, testing standards, and construction practices.

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