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Best Way Stone, Ltd.

Ontario
1-800-BESTWAY
bestwaystone.com

SLABS ON AN AGGREGATE BASE (RESIDENTIAL)

SECTION 32 14 13.16

NOTE: This guide specification for the U.S. is for paving slabs on a sand bed over a compacted aggregate base for residential and commercial pedestrian, and residential driveway applications. Excavation and preparation of soil subgrade, subgrade drainage and the aggregate base are by others. Paving slabs installed on compacted aggregate bases with sand bedding subject to very limited vehicular traffic should be at least 3 1/8 in. (80 mm) thick. Thicker units will resist cracking under vehicular loads. 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. Paving slabs
2. Bedding and joint sand.
3. Edge restraints.
4. [Geotextile].
5. [Cleaning, Sealing, and Joint sand stabilization].

B. Related work

1. Section [ ] - Earthwork.
2. Section [ ] - Grading.
3. Section [ ] - Aggregate base.
4. Section [ ] - Concrete [Walks] [Curbs] [and] [Gutters].

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C33 Specification for Concrete Aggregates.
2. C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates.

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3. C144 Standard Specification for Aggregate for Masonry Mortar.
4. C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
5. C1782 Standard Specification for Utility Segmental Concrete Paving Slabs
6. D698 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft^3 (600 kN-m/m^3)).
7. D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
8. D2940 Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

B. Interlocking Concrete Pavement Institute (ICPI) Technical Bulletins

1. Tech Spec 3 Edge Restraints for Interlocking Concrete Pavements.
2. Tech Spec 5 Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavements.

1.03 SUBMITTALS

A. Shop drawings: Indicate perimeter conditions, relationship to adjoining materials and assemblies, expansion and control joints, paving slab [layout,] [patterns,] [color, arrangement,] installation [and setting] details.

B. Sieve analysis per ASTM C136 for the bedding and joint sands.

C. Paving slabs:

1. [Four] representative full-size samples of each slab type, thickness, color, finish. Select samples to indicate the extremes of color and texture expected in the finished installation.
2. Test results from an independent testing laboratory for compliance of concrete slabs with C1782.
3. Accepted samples become the standard of acceptance for the work of this Section.
4. Manufacturer's catalog literature and material safety data sheets for the safe handling of the specified materials and products.
5. Current certificates from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program for job foremen on the project.

1.04 QUALITY ASSURANCE

A. Paving Subcontractor Qualifications:

1. Utilize an installer having successfully completed concrete paving slab 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 Certified Concrete Paver Installer 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) slab area.
2. Use this area to determine surcharge of the bedding 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 paving slabs to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
3. Unload slabs 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 paving slab 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 sand or slabs during heavy rain or snowfall.
2. Do not install frozen bedding sand.
3. Do not install concrete slabs on frozen aggregate base or bedding sand.

1.07 MAINTENANCE

A. Extra Materials: Provide [Specify area] [Specify percentage.] additional material for use by owner for maintenance and repair.

B. Slabs shall be from the same production run as installed materials.

PART 2 PRODUCTS

2.01 CONCRETE PAVING SLABS

A. Manufacturer: [Specify ICPI member manufacturer name.].

1. Contact: [Specify ICPI member manufacturer contact information.].

B. Concrete paving slabs:

1. Slab type: [Specify name of product group, family, series, etc.].
   a. Material Standard: Comply with C1782, 725 psi (5 MPa) min. average flexural strength. Freeze-thaw testing requirements per ASTM C1645 shall be waived for applications not exposed to freezing conditions.
   b. Color [and finish]: [Specify color.] [Specify finish].

Note: Tighter dimensional tolerances may be required for pedestal-set, bitumen-set and some sand-set applications.

   c. Size: [Specify] inches [mm] x [Specify] inches [mm] x [Specify] inches [Specify] [mm] thick.

2.02 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted.

2.03 BEDDING AND JOINT SAND

A. Provide bedding and joint sand as follows:

1. Clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
2. Do not use limestone screenings, stone dust, or sand for the bedding sand material that does not conform to conform to the grading requirements of ASTM C33.
3. Do not use mason sand or sand conforming to ASTM C144 for the bedding sand.
4. Sieve according to ASTM C136.
5. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C33 with modifications as shown in Table 1.

Table 1

Grading Requirements for Bedding Sand
ASTM C33

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075 mm)	0 to 1

Note: ASTM C144 allows up to 10% passing the No. 200 (0.075 mm) sieve for manufactured sand. ICPI recommends reducing this to no more than 5% as a means to maintain interlock since material passing the No. 200 sieve can lubricate larger sand particles and thereby reduce interlock among paving units.

Note: Coarser sand than that specified in Table 2 below may be used for joint sand including ASTM C33 material as shown in Table 1. Use material where the largest sieve size easily enters the smallest joints. For example, if the smallest slab joints are 2 mm wide, use sand 2 mm and smaller in particle size. If ASTM C33 sand is used for joint sand, extra effort may be required in sweeping material and compacting the slabs order to completely fill the joints.

6. Joint Sand Material Requirements: Conform to the grading requirements of ASTM C144 as shown with modifications in Table 2 below:

Table 2

Grading Requirements for Joint Sand

Sieve Size	ASTM C144 Natural Sand Percent Passing	ASTM C144 Manufactured Sand Percent Passing
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 16 (1.18 mm)	70 to 100	70 to 100
No. 30 (0.600 mm)	40 to 75	40 to 100
No. 50 (0.300 mm)	10 to 35	20 to 40
No. 100 (0.150 mm)	2 to 15	10 to 25
No. 200 (0.075 mm)	0 to 5	0 to 5

Note: Specify specific components of a system, manufactured unit or type of equipment. See ICPI Tech Spec 3, Edge Restraints for Interlocking Concrete Pavements for guidance on selection and design of edge restraints.

2.04 EDGE RESTRAINTS

A. Provide edge restraints installed around the perimeter of all interlocking concrete paving unit areas as follows:

1. Manufacturer: [Specify manufacturer.].
2. Material: [Plastic] [Concrete] [Aluminum] [Steel] [Pre-cast concrete] [Cut stone] [Concrete].

3. Material Standard: [Specify material standard.].

2.05 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 concrete slab manufacturer] [Specify manufacturer.].

Note: Delete article below if cleaners, sealers, and/or joint sand stabilizers are not specified.

2. [Cleaners] [Sealers] [Joint sand stabilizers]
   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.].

3.02 EXAMINATION

A. Acceptance of Site Verification of Conditions:

Note: Compaction of the soil subgrade is recommended to at least 98% standard Proctor density per ASTM D698 for pedestrian areas and residential driveways. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.

Note: Compaction of the soil subgrade is recommended to at least 98% standard Proctor density per ASTM D698 for pedestrian areas and residential driveways. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.

Note: Local aggregate base materials typical to those used for highway flexible pavements are recommended, or those conforming to ASTM D2940. Compaction of aggregate is recommended to a minimum of 98% Proctor density in accordance with ASTM D698 is recommended for pedestrian and areas and residential driveways, and a minimum of 98% modified Proctor density in accordance with ASTM D1557 for all other areas subject to vehicular traffic. Mechanical tampers are recommended for compaction of soil subgrade and aggregate base in areas not accessible to large compaction equipment. Such areas can include that around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions.

Note: Prior to screeding the bedding sand, the recommended base surface tolerance should be ±10 mm over a 3 m straight edge. See ICPI Tech Spec 2, Construction of Interlocking Concrete Pavements for further guidance on construction practices.

Note: The elevations and surface tolerance of the base determine the final surface elevations of concrete paving slabs. The slab installation contractor cannot correct deficiencies in 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 sand and concrete paving slabs.

1. General Contractor shall inspect, accept and certify in writing to the slab installation subcontractor that site conditions meet specifications for the following items prior to installation of concrete paving slabs.
   a. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
   b. Verify that geotextiles, if applicable, have been placed according to drawings and specifications.
   c. Verify that [Aggregate] [Cement-treated] [Asphalt-treated] [Concrete] [Asphalt] base materials, thickness, [compacted density], surface tolerances and elevations conform to specified requirements.

d. Provide written density test results for soil subgrade, [aggregate] [cement-treated] [asphalt-treated] [asphalt] base materials to the Owner, General Contractor and paving slab installation subcontractor.

e. Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage inlets.

2. Do not proceed with installation of bedding sand and concrete paving slabs until [subgrade soil and] base conditions are corrected by the General Contractor or designated subcontractor.

3.03 PREPARATION

A. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.

B. Verify that base [and geotextile] is ready to support sand, [edge restraints,] and, slabs and imposed loads.

C. Edge Restraint Preparation:

1. Install edge restraints per the drawings [and manufacturer's recommendations] [at the indicated elevations].

Note: Retain the following two subparagraphs if specifying edge restraints that are staked into the base with spikes.

2. Mount directly to finished base. Do not install on bedding sand.

3. The minimum distance from the outside edge of the base to the spikes shall be equal to the thickness of the base.

3.04 INSTALLATION

A. Spread bedding sand evenly over the base course. Screed and compact to a nominal 1 in. (25 mm) thickness, not exceeding 1½ (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.

1. Do not disturb screeded sand.

2. Screeded area shall not substantially exceed that which is covered by slabs in one day.

3. Do not use bedding sand to fill depressions in the base surface.

Note: When initially placed on the bedding sand, manually installed slabs often touch each other, or their spacer bars if present. Joint widths and lines (bond lines) are straightened and aligned to specifications with rubber hammers and pry bars as paving proceeds.

B. Lay slabs in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid slabs with rubber hammers as required.

Note: Contact manufacturer of concrete paving slabs for recommended joint widths.

C. Provide joints between slabs of [1/16 in. and 3/16 in. (2 and 5 mm)] wide. No more than 5% of the joints shall exceed [1/4 in. (6 mm)] wide to achieve straight bond lines.

D. Joint (bond) lines shall not deviate more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from taut string lines.

E. Fill gaps at the edges of the paved area with cut slabs or edge units.

F. Cut slabs to be placed along the edge with a [double blade slab splitter or] masonry saw. Cut units shall be no smaller than [1/3 of a whole slab].

Note. Specify requirements for edge treatment in paragraph below.

G. [Adjust bond pattern at pavement edges such that cutting of edge slabs is minimized. Do not exposed cut slabs to vehicular traffic.] [Cut slabs at edges as indicated on the drawings.]

H. Keep skid steer and forklift equipment off newly laid slabs that have not received initial compaction and joint sand.

I. After an area is completely paved, compact the units into the sand with a mechanical plate vibrator using rollers or a neoprene pad.

J. Use a low-amplitude plate compactor capable of at least minimum of 4,000 lbf (18 kN) at a frequency of 75 to 100 Hz. Remove any cracked or damaged slabs and replace with new units.

K. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.

L. All work more than 6 ft. (2 m) of the laying face must shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted slabs with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

M. Remove excess sand from surface when installation is complete.

Note: Excess joint sand can remain on surface of slabs to aid in protecting their surface especially when additional construction occurs after their installation. If this is the case, delete the article above and use the article below. Designate person responsible for directing timing of removal of excess joint sand.

N. Allow excess joint sand to remain on surface to protect slabs from damage from other trades. Remove excess sand when directed by [Architect].

O. Surface shall be broom clean after removal of excess joint sand.

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 ± 3/8 in. (±10 mm) under a 10 ft (3 m) straightedge.

B. Check final surface elevations for conformance to drawings.

Note: For installations on a compacted aggregate base and soil subgrade, the top surface of the slabs may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

C. The surface elevation of slabs 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 slabs.

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

3.06 [CLEANING] [SEALING] [JOINT SAND STABILIZATION]

A. [Clean] [Seal] [Apply joint sand stabilization materials between] concrete slabs 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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