	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Yale Design Standard Division: 32 14 40 Bluestone Paving	Section: 32 14 40 Requirements for Bluestone Paving
		Date: 11/22/2019
		Author: Landscaping and Grounds Management

PART 1 - GENERAL

1.1 PURPOSE

- A. This section contains general design criteria for bluestone paving. This document is intended to act as a guideline for specification details. Individual site conditions and requirements must be incorporated into a project's final specification.

1.2 SUMMARY

- A. This section includes the following:
1. Bluestone paving on no-fines concrete base
 - a. See APPENDIX A for example section view
 2. Bluestone paving on mortar setting bed on concrete
 - a. See APPENDIX A for example section view
 3. Bluestone paving on existing stonedust/aggerate base
 - a. See APENDIX A for example section view


1.3 PERFORMANCE REQUIREMENTS

- A. Structural performance: provide stone units and connections capable of withstanding the expected loads under conditions as indicated on drawings. Stone paver loads will fall into one of the following categories:
1. Typical stone paver – able to support pedestrian loads (including sub slab or compacted sub grade).
 - a. See APPENDIX B for example section view
 2. Vehicular stone paver – able to support vehicular loads (including sub slab or compacted sub grade)
 - a. See APPENDIX B for example section view


PART 2 - PRODUCTS

2.1 MATERIALS

- A. All stone pavers shall be from a sole source, same quarry strata – matching in color unless otherwise indicated.
- B. Dimension cut bluestone pavers for no-fines and mortar setting bed installation
1. Stone type: Bluestone
 2. Thickness: as specified by drawing
 3. Size: as specified by drawing
 4. Color: as specified by drawing
 5. Finish: sawn thermal or natural cleft depending on project

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- C. Bluestone pavers for existing stonedust base
 - 1. Stone type: Bluestone
 - 2. Thickness: minimum 2 ½”
 - 3. Size: as specified by drawing or site requirements
 - 4. Color: as specified by drawing or site requirements
 - 5. Finish: shall match existing site finish
- D. Polymeric Sand to be used between joints
 - 1. Example approved product: ‘Gator MAXX G2’ supplied by Alliance Designer Products Inc.
- E. Soil separator fabric to be used between setting bed and no fines slab or compacted aggregate base
 - 1. Example approved product: Mirafi, ‘140N’ supplied by Ten Cate Nicolon USA.
- F. “No-Fines” concrete mixture
 - 1. Provide only transit mixed concrete conforming to STM C-94
 - a. Strength: 2000 psi minimum at 28 days
 - b. Slump: not more than 3” in accordance to ASTM c-143
 - c. Mix design
 - 1) Cement 564 lbs.
 - 2) ½” aggregate 2950 lbs.
 - 3) Water 25 gal.
 - 2. Provide a water reducing admixture in concrete
 - 3. Provide an air-entraining admixture in concrete for an air content of 5% to 7% as determined in accordance with ASTM C-173
- G. Mortar Setting Bed, Bond Coat, and Grout
 - 1. Mortar Setting Bed shall be polymer-fortified Setting
 - a. Example approved product: ‘3701 Fortified Mortar Bed’ as provided by Laticrete International Inc.
 - 2. Bond Coat shall be a polymer-fortified thin-set mortar
 - a. Example approved product: ‘254 Platinum’ as provided by Laticrete International Inc.
 - 3. Joint Mortar shall be a polymer-fortified joint mortar
 - a. Example approved product: ‘Laticrete PermaColor Grout’ as provided by Laticrete International Inc.
- H. Stonedust for setting bed and existing base (also referred to as “Sand setting bed”)
 - 1. Stone dust must comply with CT DOT, form 817, ‘Stone Dust Screenings’, 100% passing #4 sieve, 60-100% passing #8 sieve, dark grey
- I. Restraint (edging) staked
 - 1. Edging height: 4”
 - 2. Edging thickness: 1/4”
 - 3. Stake insert spacing: 48” on center
 - 4. Stake height: 12” minimum

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- a. See APPENDIX B 321440 of this section for sectional views of example restraints (edging).

J. Restraint (edging) angle iron bolted to concrete slab

1. Angle iron height: 3"
2. Angle iron width: 5"
3. Angle iron thickness: 1/4"
4. Bolt spacing: 48" on center

- a. See APPENDIX B 321440 of this section for sectional views of example restraints (edging).

PART 3 - EXECUTION

3.1 INSTALLATION GUIDELINES

A. Bluestone pavers pattern

1. Bluestone walkways should be laid in a Random/Uncoursed Ashlar pattern consisting of varying sizes and discontinuous courses.
 - a. See APPENDIX B 321440 of this section for example.
2. Bluestone walkways receiving an extra run to increase the walkway width shall be incorporated into the existing Random/Uncoursed Ashlar patter. Integration is to specifically avoid linear courses that run the length of preexisting walkway.

B. Bluestone pavers installed on a grade, such as handicapped access ramps, must be mortar set to ensure stone movement does not occur. Joints must be grouted.

C. All surface water must shed from walkway surfaces. All mortar and grouted installs must shed to a curtain drain or area drain.

D. Tolerances shall not exceed 1/32" lip paver to paver.

E. Jointing shall be 1/4" to a maximum 3/8" to comply with "Yale Supplementary Standards for Making Buildings Accessible to Persons Having Disabilities" guideline per the University of Accessibility Committee.

F. All restraints, such as but not limited to adjacent edging, curbs, walls, steps, etc., shall be installed prior to placing pavers.


G. Edging shall be set 1" below finish grade.

H. Pavers shall be mixed between pallets as they are placed to ensure a uniform blend of colors through the installation.

3.2 BLUESTONE PAVING ON NO FINES CONCRETE BASE

- A. Prior to setting bed installation soil separator fabric must be installed per manufactures recommendations to ensure migration of setting bed into no-fines base does not occur. Specific care must be taken to wrap separator fabric up edging or restraint at the premier of installation to ensure migration of setting bed beyond the edging or restraint does not occur.

- B. The setting bed shall be placed and screeded to provide a uniform bedding plane parallel to the finish


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surface. The bed material shall be screeded to a surface tolerance of 3/16" giving a compacted thickness of 1". The setting bed will be compacted with a light vibratory roller. After compacted bed material shall be screeded again to a tolerance of 1/4".

- C. The setting bed shall be protected from disturbance in anyway. If the setting bed is disturbed it must be raked and re-screeded as above.
- D. Paver installation shall be plumb, level and true to line and grade and shall coincide and align with adjacent work and elevations.
 - 1. Paving of each area will proceed from one side or end; installation will not commence from opposite ends or sides.
 - 2. Starting at paver layout baselines, commence laying the pavers on the undisturbed setting bed in the pattern and color as show on the drawings. Hand tamp with a rubber mallet to ensure that each paver is in place, completely supported and at finished grade.
 - 3. Full units shall be laid first and cuts done subsequently. Pavers are to be no smaller than 3" in an dimension. Where field cutting would result in pavers below 3" use larger pavers adjacent to fill space. All units are to fit together accurately with joint widths as indicated on drawings.

3.3 BLUESTONE PAVING ON MORTAR SETTING BED WITH GROUTED JOINTS

- A. Mixing Mortar
 - 1. Machine mixing: Pour Laticrete liquid in mixer, start machine and add dry materials. Mix only long enough to wet out the batch. DO NOT OVER MIX. Stop mixer and dump mortar from mixer promptly. Clean out mixer promptly with water.
 - 2. Hand mixing: Pour Laticrete liquid in container or mixing box. Add dry material and mix. Adjustment of liquid or dry material to obtain proper consistency.
- B. Installation by Thick Bed Method
 - 1. Clean dust and foreign material from back of masonry units.
 - 2. Just prior to slurry coat application, dampen concrete subslab and back of pavers if they are dry and removed excess water if they are wet.
 - 3. Place slurry bond coat on concrete sub-slab prepared to receive mortar bed. Introduce a nominal 1" setting bed mortar while slurry is tacky.
 - 4. Install setting bed using damp packed mortar mix with only enough water to produce moist surface ready for stone unit installation. Spread and screed to uniform thickness, level in plane, or uniformly sloped for drainage to as indicated. Rod and compact with steel trowel. Mix and place only amount which can be covered with unit pavers prior to initial set of bed. Cut back and discard setting bed mortar which has reached its initial set prior to placing unit pavers.
 - 5. Before placing stone unit on green or wet screed bed, apply slurry bond coat to mortar bed to a thickness of approximately 1/16" using a flat towel. Apply skim coat of the mortar to back of each paver just prior to placing on bed.
 - 6. Place stone unit in wet slurry bond coat before surface dries.
 - 7. Adjust stone unit to make joints consistent width, parallel, and perpendicular to base lines.
 - 8. After each stone unit is laid, beat it with a wooden block or rubber mallet to make a flush and level surface and embed the stone unit. Beat before mortar takes initial set.
 - 9. On hardened screed or mortar bed, install stone unit by Thin Bed Method, as specified by Laticrete International.

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C. Expansion and Control Joints


1. Carry joints in concrete through to surface of units as indicated on drawings.
2. Install expansion joints where abuts restraining edges such as edging, curbs, walls, steps, etc., and directly over cold joints and control joints in structural surface.
3. Install expansion joints as indicated on the drawing or 20' on center maximum. Rake or cut expansion joints through the setting bed to the supporting slab.
4. Install ½" wide expansion joints with joint filler full width and to bottom of joint. Recess top edge 5/8" below adjacent finished surface by attaching approved plastic spaced made specifically for purpose.
5. Provide joint filler in single lengths for full paving widths, whenever possible. Fasten joint filler sections together when multiple lengths are required. Hold fillers in place by means of steel points or approved installing devices to prevent warping during unit paving installation.

D. Pointing Joints

1. Grout joints as soon as possible after initial set of mortar bed.
2. Moisten dry joint surfaces prior to grouting.
3. Pack joints full and free of voids and pits. Strike flush with edge of paver and tool slightly concave.
4. Clean excess mortar from faces of pavers with water as the work progresses. Remove spillage while grout is fresh.
5. Damp cure grout for 7 days.
6. After curing, remove grout film with Laticrete 'TC-500 Tile & Grout Masonry Cleaner'. Saturate joints with water, then dampen surface with cleaner. For cleaning hard stone also sprinkle fine sand (40-80 mesh) over surface allowing to soak 15-30 minutes; then use a power scrubbing machine with a coarse texture nylon pad to remove grout film.

3.4 BLUESTONE PAVERS ON EXISTING STONEDUST/AGGREGATE BASE

- A. Prior to setting bed installation soil separator fabric must be installed per manufactures recommendations to ensure migration of setting bed into no-fines base does not occur. Specific care must be taken to wrap separator fabric up edging or restraint at the premier of installation to ensure migration of setting bed beyond the edging or restraint does not occur.
- B. The setting bed shall be placed and screeded to provide a uniform bedding plane parallel to the finish surface. The bed material shall be screeded to a surface tolerance of 3/16" giving a compacted thickness of 1". The setting bed will be compacted with a light vibratory roller. After compacted bed material shall be screeded again to a tolerance of 1/4".
- C. The setting bed shall be protected from disturbance in anyway. If the setting bed is disturbed it must be raked and re-screeded as above.
- D. Paver installation shall be plumb, level and true to line and grade and shall coincide and align with adjacent work and elevations.
 1. Paving of each area will proceed from one side or end; installation will not commence from opposite ends or sides.
 2. Starting at paver layout baselines, commence laying the pavers on the undisturbed setting bed in the pattern and color as show on the drawings. Hand tamp with a rubber mallet to ensure that

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- each paver is in place, completely supported and at finished grade.
- Full units shall be laid first and cuts done subsequently. Pavers are to be no smaller than 3” in an dimension. Where field cutting would result in pavers below 3” use larger pavers adjacent to fill space. All units are to fit together accurately with joint widths as indicated on drawings.

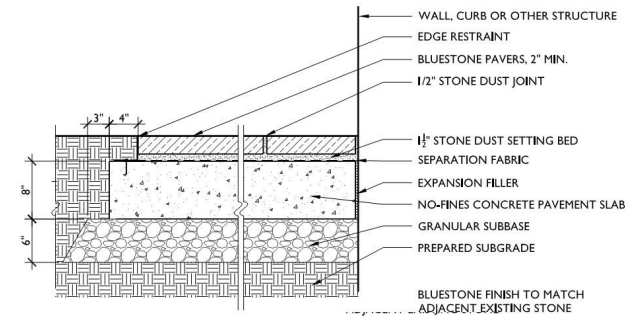
Date	Description of Change	Pages / Sections Modified	ID
11/05/19	Entire Document	-	MAW229

	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Yale Design Standard Division: 32 14 40 Bluestone Paving	Section: APPENDIX A 32 14 40 Requirements for Bluestone Paving
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APPENDIX A – SAMPLE BLUESTONE INSTALLATION REQUIREMENTS

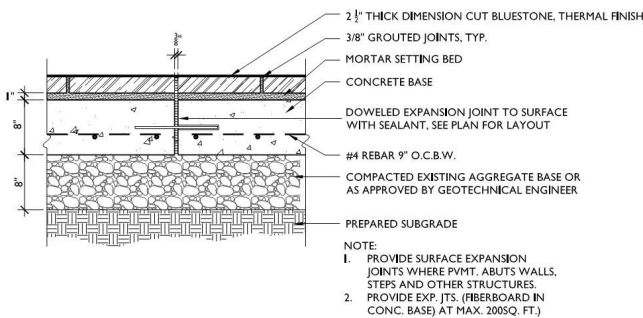
1.1 SAMPLE BLUESTONE INSTALLATIONS

A. Bluestone paving on no-fines concrete base



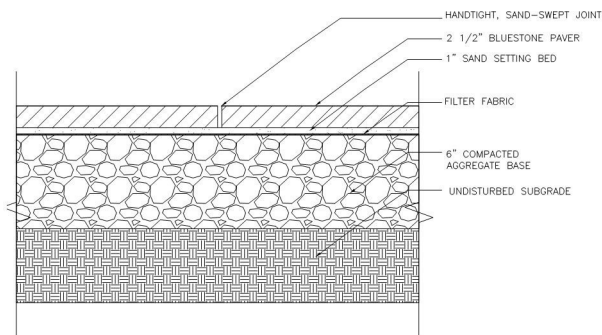
BLUESTONE PAVING ON NO-FINES CONCRETE
SCALE: 1" = 1'-0" SECTION

B. Bluestone paving on mortar setting bed on concrete



BLUESTONE PAVING
1"=1'-0"

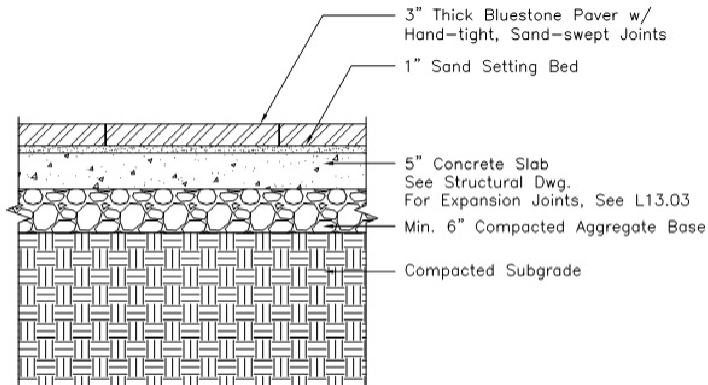
C. Bluestone paving on existing stonedust/aggregate base



1 BLUESTONE PAVING
1 1/2" = 1'-0"

1.2 SAMPLE BLUESTONE PERFORMANCE REQUIREMENTS

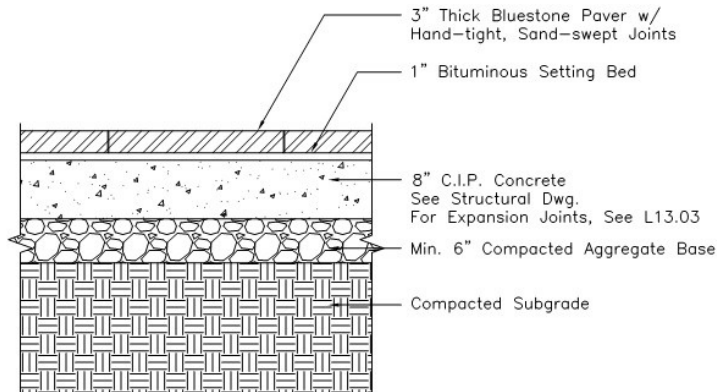
A. Section view: typical stone paver – pedestrian rated



6 | BLUESTONE PAVERS - PEDESTRIAN

3/4"=1'-0"

B. Section view: vehicular stone paver – vehicular rated

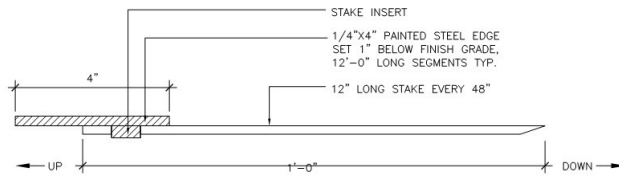


4 | BLUESTONE PAVERS - VEHICULAR

3/4"=1'-0"

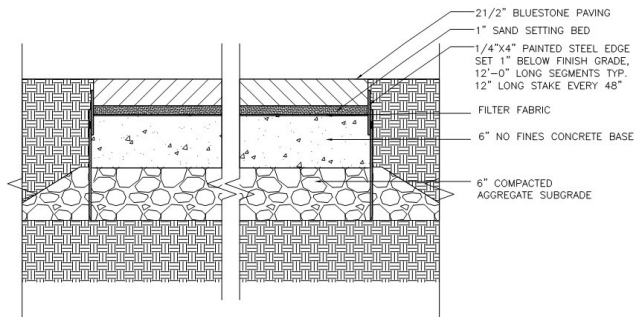
1.3 SAMPLE RESTRAINTS (EDGING)

A. Section view: Restraint – stake



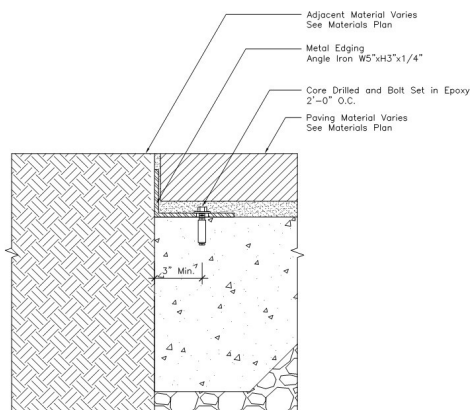
15 | PAINTED STEEL EDGE RESTRAINT
1/8.00 | 6" x 1'-0"

B. Section view: Restraint – stake installed (does not depict required filter fabric wrapping up restraint)



4 | BLUESTONE PATH STAKED EDGE RESTRAINT
1/8.00 | 1 1/2" x 1'-0"

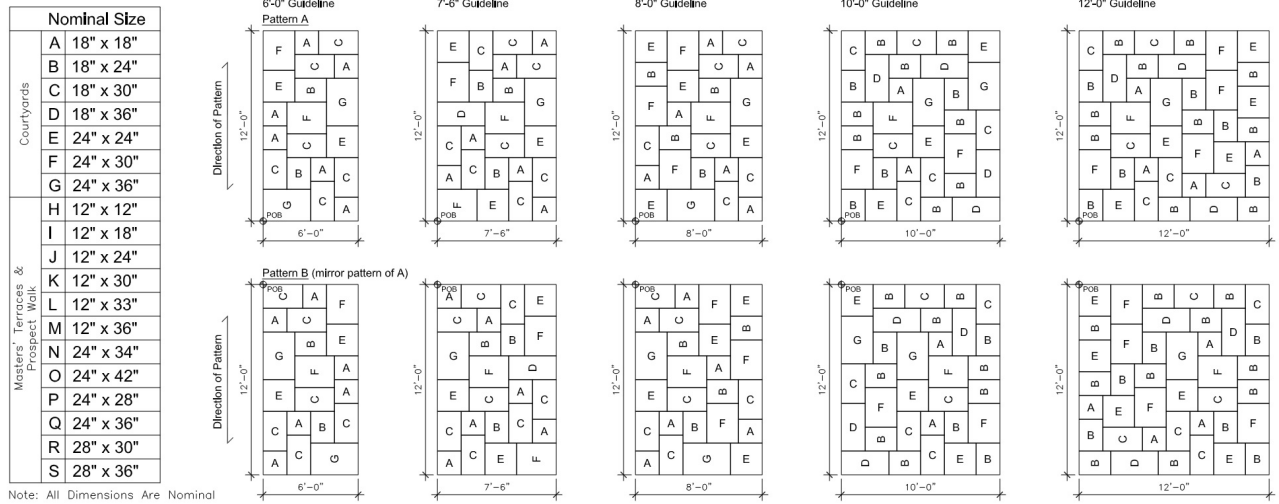
C. Section view: Restraint – angle iron (does not depict required filter fabric wrapping up restraint)



3 | METAL EDGING 'A' - ANGLE IRON
3" x 1'-0"

1.4 SAMPLE RANDOM/UNCOURSED ASHLAR PATTERN

A. Section view: paving patterns



1 TYPICAL BLUESTONE PAVING PATTERN GUIDELINE

Date	Description of Change	Pages / Sections Modified	ID
11/05/19	Entire Document	-	MAW229