VUSP – 2019 Pennsylvania Stormwater Symposium

Session 2C – Reducing Our Flows

A Stormwater Case Study

Porous Asphalt Construction, Operation, & Maintenance

Presented by

Rob Creech

Van Note-Harvey Associates, Inc

103 College Road East, Princeton, NJ 08540

(609) 987-2323 | www.vannoteharvey.com

ENGINEERS | PLANNERS | ENVIRONMENTAL CONSULTANTS | SURVEYORS

Abstract

Porous asphalt pavement is a technology that has now been around for over 40 years. Porous pavement offers property owners and developers one of many tools for managing stormwater runoff from their project sites. The technology is really quite simple, but it does require those who are knowledgeable of its proper design and installation as well as those who are provided with the knowledge to properly maintain it to keep it functioning as intended.

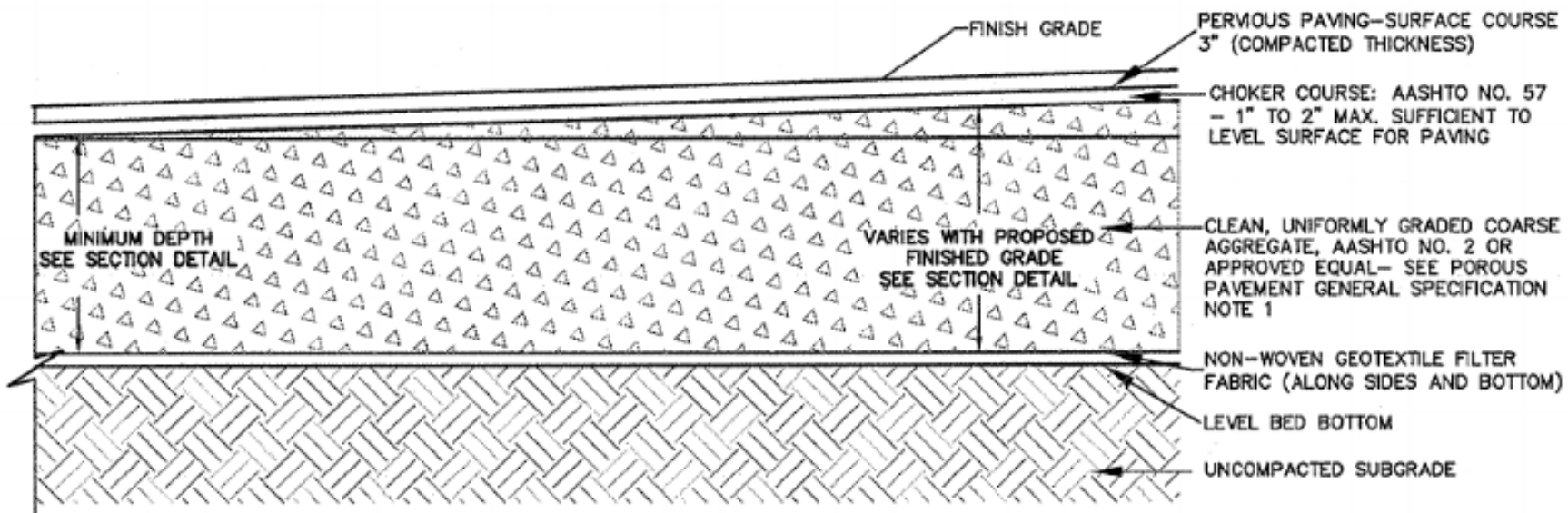
With the proper design and installation, porous asphalt can provide cost-effective, attractive pavements with a life-span of more than twenty years, while at the same time provide stormwater management systems that promote infiltration, improve water quality, and potentially eliminate the need for a separate detention basin. While design of the porous asphalt mix is important, the technology has advanced far enough along that it is generally the same across most projects. The key word here is “installation” such that, when installed or constructed properly, porous asphalt can last for years. Several factors, including permeability of in-situ soil beneath the underlying stone storage bed, subgrade preparation, management of construction equipment, suitable stone material, and paving guidelines, all will affect the success of the porous asphalt installation.

This presentation will focus on several porous asphalt installations that Van Note-Harvey Associates has been involved with and our perspective of same during contractor installation and post-construction operation and maintenance. Several “lessons learned” have been gathered and will be shared from our construction related experience with porous asphalt projects. Next steps for us include development of better property owner and developer operation and maintenance plans and client outreach to educate them on the need for proper maintenance and upkeep of their porous asphalt pavement systems.

Pavement Design

- Design generally similar between projects
  - Asphalt paved directly over stone storage bed
    - Non-woven geotextile placed over in-situ soil on bottom and sides of basin
    - Stone bed choked at surface with smaller stone (no. 2 stone choked with no. 57 stone typical)
    - May contain perforated underdrains connected to storm sewer

Typical Porous Pavement Section Detail



NOTES:

1. SEE PLANS FOR LOCATION/LIMITS OF UNDERGROUND STORAGE AREA.
2. FINISHED GRADES AS INDICATED ON GRADING PLANS.
3. POROUS PAVEMENT CONSISTS OF A PERMEABLE SURFACE COURSE UNDERLAIN BY AN OPEN–GRADED STONE SUBBASE WHICH PROVIDES STORMWATER MANAGEMENT. THE SURFACE COURSE SHALL CONSIST OF POROUS ASPHALT, SEE CONSTRUCTION SEQUENCE & GENERAL SPECIFICATIONS.
4. CLEAN UNIFORMERLY GRADED COURSE AGGREGATE SHALL NOT EXTEND UNDER PARKING LOT ISLANDS.
5. PRIOR TO THE RELEASE OF THE PERFORMANCE BOND, THE PAVEMENT AND UNCOMPACTED SUBGRADE AREA INFILTRATION RATE SHALL BE TESTED IN AT LEAST THREE LOCATIONS TO ENSURE THAT IT IS TWICE THE DESIGN RATE REQUIRED FOR THAT AREA.

POROUS PAVEMENT TYPICAL SECTION

NOT TO SCALE

vnh
van note - harvey associates

Basin Construction - Best Practices

- Ensure Permeability of In-situ Soil
  - Scarify bottom following excavation
  - Avoid compaction of basin bottom
    - Begin inside basin, work way out
    - Eliminate or minimize equipment traffic in basin
    - Keep basin free of debris and construction materials
- Perform Permeability Tests Within Basin
- Overlap Installed Fabric for Movement During Construction

Best Practices: thoroughly scarify soil in basin for proper infiltration

vnh
van note - harvey associates

Best Practices: neatly place, overlap, and pin filter fabric in basin

van note - harvey associates

Avoid: staging materials and equipment in basin causing compaction of soil

vnh
van note - harvey associates

Avoid: construction of basin during winter months over soil with poor infiltration

vanmote - harvey associates

Avoid: installing fabric in suboptimal conditions over non-scarified soil

vnh
van note - harvey associates

Stone Storage – Best Practices

van note - harvey associates

- All Stone to be Clean And Free of Fines
- Work From Outside-In to Avoid Compaction of Basin Soil
- Install Just Enough Small Stone to Choke Large Stone
  - Fine grade before choking stone to avoid mixing stone
  - Choker course should not exceed 2”
    - Too much stone moves and ruts beneath paver tracks and truck tires
    - Creates uneven base for asphalt
    - Choked stone should feel firm under foot

Stone Storage – Best Practices

van note - harvey associates

- Paving Should Immediately Follow Installation of Stone
  - If unable to immediately pave stone base must be protected
    - Cover stone bed with non-woven filter fabric
    - Place a lift of ¾" clean stone (No. 57) over fabric
  - If stone becomes contaminated prior to paving it must be removed and replaced

Best Practices: Install stone from outside in to avoid compaction in basin

van note - harvey associates

Best Practices: keep installed stone clean, stage materials and equipment off stone where possible

vnh
van note - harvey associates

Best Practices: push stone into unfilled areas from atop previously placed stone

vnh
van note - harvey associates

Best Practices: fine grade before installing choker course, only place enough small stone to successfully choke larger stone

vnh
van note - harvey associates

Avoid: contaminating clean stone by mixing with unclean stone

vnh
van note - harvey associates

Avoid: clogging stone storage with stone containing fines

vnh
van note - harvey associates

Avoid: fine grading after choker course has been installed

vnh
van note - harvey associates

Avoid: leaving stone storage exposed for prolonged period before paving

vnh
van note - harvey associates

Paving – Best Practices

van note - harvey associates

- Asphalt Able to be Placed With Standard Paving Machines
  - Temperature of asphalt out of truck should not exceed 280 degrees
  - Any rutting in stone base should be raked out and rolled ahead of paver passes
- Asphalt May be Compacted With Standard Rollers
  - Asphalt must be static rolled and cannot be vibrated
  - Asphalt should be allowed to cool and rolled below 240 degrees (with 13tn roller)
  - A vibratory plate tamper is generally permitted to be used along curb line

Best Practices: eliminate any ruts that occur in stone base and roll

van note - harvey associates

Best Practices: Static roll only, do not vibrate or over compact

van note - harvey associates

Best Practices: finish roll to a smooth surface

vnh
van note - harvey associates

Best Practices: compact along curb with plate tamper

van note - harvey associates

Avoid: paving over rutted or yielding stone causing uneven pavement

vnh
van note - harvey associates

Avoid: over compaction of asphalt preventing proper infiltration

vnh
van note - harvey associates

Testing

van note - harvey associates

- Tests Performed During Paving Vary from Standard Asphalt Tests
  - As the goal is to ensure drainage, testing for 95%+ compaction is not required as with standard paved surfaces
  - Tests should instead look for % of voids in pavement
- Post Construction Infiltration Tests
  - infiltration rate of pavement should be tested using methods outlined in ASTM C1701
    - Tests not to be performed within 24 hours of rain event
    - Compare test results to specified infiltration rate in design documents

Maintenance – Best Practices

- General Maintenance
  - Ensure landscape areas are stabilized to prevent soil runoff onto pavement
  - Protect from materials and equipment staged on pavement
  - Quarterly vacuuming recommended, vacuum biannually at a minimum
- Winter Maintenance
  - Sand, cinders, and other abrasives should not be used on porous pavement
  - Salt may be used but non-toxic alternatives or brining are recommended
  - Plows should be equipped with poly blade, if steel blades are used they should be raised at least 1”

Avoid: paving prior to stabilization of landscape areas or after soil erosion protection has been removed

vnh
van note - harvey associates

Lessons Learned

van note - harvey associates

- **Basin Excavation**
  - Scarify bottom working way out of basin
  - Test infiltration rate of in-situ soil and avoid any compaction
- **Stone Storage**
  - Ensure use of open-graded clean aggregate while construction of stone storage bed
  - Fill stone working way in so all equipment used to spread stone only operates over stone to avoid soil compaction
- **Paving**
  - Do not vibrate while compacting asphalt
  - Do not test for standard density and compact accordingly, instead test for voids in pavement
- **Maintenance**
  - Communicate maintenance needs with owner, ensure a maintenance plan is developed and followed
  - Avoid fines settling into asphalt and clogging system, sweep and vacuum regularly to keep voids open

Above: a lot one week after completion of paving using ideal construction methods

Below: a lot one week after completion of paving using suboptimal construction methods

van note - harvey associates

Questions?

Rob Creech

Van Note-Harvey Associates, Inc

103 College Road East, Princeton, NJ 08540

(609) 987-2323 | www.vannoteharvey.com

ENGINEERS | PLANNERS | ENVIRONMENTAL CONSULTANTS | SURVEYORS