**SP- 157031**
**(New)**

**SPECIAL PROVISIONS**
**FOR**
**PERMEABLE PAVEMENT, GRASS PAVE**

**Johnson County**
**RT-C052(105)--9H-52**

**Effective Date**
**October 17, 2017**

**THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

## PART 1 DESCRIPTION

### A. Description of Work.

1. Permeable pavement, grass pave system.
2. Section includes:
   - **a.** Subgrade preparation.
   - **b.** Sand and “hard” gravel base course
   - **c.** Grow mixture as provided by manufacturer.
   - **d.** Grass pavement system
   - **e.** Clean sharp concrete sand
   - **f.** Hydro-seed
   - **g.** Maintenance
   - **h.** PCC Barrier Curb

### B. Related Sections of the Standard Specifications

1. Section 2102 Roadway Borrow and Excavation
2. Section 2111 Granular Subbase
3. Section 2512 PCC Curb and Gutter (Straight)
4. Section 2601 Hydro-Seeding

### C. References

1. ASTM D 638-10 Standard Test Method for Tensile Properties of Plastics
2. ASTM C 33 Standard Test Methods for Concrete Aggregates
3. AASHTO M6 Standard Specification for Fine Aggregate for Hydraulic Cement Concrete

### D. System Description

1. The permeable pavement, grass pave provides vehicular and pedestrian load support for grass areas, while protecting grass roots from harmful effects of traffic.
2. Major Components of the Complete System:
   - **a.** Permeable pavement, grass pave units, assembled in rolls.
   - **b.** Engineered sand and gravel base course

   **c.** Grow medium soil amendment and fertilizer, supplied with Grass pavement system.
   **d.** Sand fill or USGA greens mix.
   **e.** Selected grass from seed, hydro-seeding/hydro-mulching, or sod.
   **f.** Selected topsoil (only for seeded installation).
   **g.** Mulch (needed only for seeded or hydro-deeded installation).
3. The grass pave units, sand, and base course work together to support imposed loading.
4. The grass pave grow medium, and sand fill contribute to vegetation support.

**E. Submittals.**

1. Shop Drawings: Submit design detail showing proper cross-section.
2. Samples: Submit manufacturer's sample of grass pave system 10 inch by 10 inch section of grass pave system material.
3. Installation Instructions: Manufacturer's printed installation instructions. Include methods for maintaining installed products.
4. Certificates:
   **a.** Manufacturer signed certificate stating the product is made in the USA.
   **b.** Submit Material Certificates for base course and sand (or USGA mix) fill materials
   **c.** Product certificates signed by the manufacturer certifying material compliance of polyethylene used to make Grass pavement system units.
   **d.** ISO Certificate certifying manufacturer's quality management system is currently registered to ISO 9001:2008 quality standards.
5. Substitutions: No material will be considered as an equivalent to the grass pavement system unit specified herein unless it meets all areas of this specification without exception. Manufacturers seeking to supply what they represent as equivalent material must submit records, data, independent test results, samples, certifications, and documentation deemed necessary by the Engineer to prove equivalency.
6. Manufacturer's Material Certification: Product manufacturers shall provide certification of compliance with all applicable testing procedures and related specifications upon written request. Request for certification shall be submitted by the purchasing agency no later than the date of order placement.
7. Product manufacturers shall also have a minimum of 30 years' experience producing products for permeable pavement systems.
8. Manufacturer Quality Certification: ISO Certification certifying manufacturer's quality management system for its Grass pavement system is currently registered to ISO 9001:2008 quality standards. Any alternate materials submitted shall provide a certification that their permeable pavement system manufacturing process is part of an ISO program and a certification will be required specifically stating that their testing facility is certified and in accordance with ISO.

**F. Delivery, storage and handling**

1. Store products in manufacturer's unopened packaging until ready for installation.
2. Protect grass pave units/rolls from damage during delivery and store rolls upright, under tarp, to protect from sunlight, when time for delivery to installation exceeds one week.
3. Store Grow medium in a dark and dry location
4. Handling: Protect materials during handling and installation to prevent damage

**G. Maintenance Service**

1. Installer responsible for maintenance of grass plants – water/irrigation, fertilizing, mowing – for one growing season. Do not aerate. See Grass pavement system Maintenance Guide from Invisible Structures
2. System to be maintained by City of Solon after one growing season.

**H. Project Conditions**

1. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

2. Do not begin installation of permeable pavements until all hard surface paving adjacent to permeable pavement areas, including concrete walks and asphalt paving, is completed.
3. Install turf when ambient air temperature is at least 55°F.
4. In cold weather, do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen base or wet, saturated or muddy subgrade.
5. Protect partially completed paving against damage from other construction traffic when work is in progress.
6. Adequately water sod or grass seed to assure germination of seed and growth of root system.
7. Grass coverage on the sand-filled Grass pavement system must be completed within one week: See Part 3 Execution.
8. Do not drive, park on, or use Grass pavement system for two or three mowing cycles until grass root system has matured (about 3 to 4 weeks for sod or 6 to 8 weeks for seeded areas). Any barricades constructed must still be accessible by emergency and fire equipment during and after installation.

**I. Limited Warranty**

1. Grass pave manufacturer selected shall warrant its purchasers that all products furnished by selected company will be free from defects in material and/or workmanship.
2. This warranty shall be extended for a period of 5 years following the date of shipment by selected company.
3. Our liability under this warranty is limited to the refurnishing of materials and does not include any responsibility for incidental, consequential, or other damages of any nature.

## PART 2 PRODUCTS

**A. Manufacturers**

1. Acceptable Manufacturers:
   - **a.** Invisible Structures, Inc – “Grass Pave 2”:1600 Jackson St. Suite 310 ; Golden, CO 80401; Toll Free Tel: 800-233-1510; Tel: 303-233-8383; Email: request info (sales@invisiblestructures.com); Web: www.invisiblestructures.com.
   - **b.** Contech Construction Products, Inc. – “UrbanGreen Paving System”: 200 Enterprise Drive; Scarboroug h, ME 04074; Toll Free Tel: 877-907-8676; Distributer Tel: 312/835-9046; Email: info@conteches.com
   - **c.** Presto Geosystems – “GEOBLOCK 5150 SYSTEM”: P.O. Box 2399; 670 North Perkins; Appleton, WI 54912-2399; Toll Free Tel: 800-548-3424; Tel: 920-738-1328; Distributer, Quick Supply, Des Moines, Iowa Tel:515-250-6079.
2. Substitutions: as approved by Engineer.

**B. Grass pavement system**

1. Composition:
   - **a.** Manufactured in the USA.
   - **b.** High density polyethylene (HDPE): 100% recycled materials.
   - **c.** Color: black
   - **d.** Color Uniformity: Uniform color throughout all units rolls.
   - **e.** Carbon Black for ultraviolet light stabilization.
   - **f.** Grow medium soil amendment and fertilizer, provided by manufacturer with Grass pavement system.
2. Performance Properties:
   - **a.** Maximum Loading Capability: 5721 pounds per square inch when filled with sand.
   - **b.** Wheelchair Access testing for ADA Compliance: Passing ASTM F 1951-08.
   - **c.** Wheelchair Access testing for ADA Compliance: Passing Rotational Penetrometer testing.
   - **d.** Tensile strength, pull-apart testing: 458 pounds per inch from ASTM D638 Modified.
   - **e.** System Permeability (Grass pavement system, sand, base course): 2.63 to 38.55 inches of water per hour.

**f.** Effective Imperviousness (E.I.): 10%.

**3.** Dimensions (individual units are assembled and distributed into rolls):
- **a.** Roll area: From 108 square feet to 538 square feet, in 108 square feet increments
- **b.** Roll Widths: From 3.3 feet to 8.2 feet, in 1.6 foot increments.
- **c.** Roll Lengths: From 32.8 feet to 65.6 feet, in 3.3 foot increments.
- **d.** Roll Weights: From 41 pounds to 205 pound, in 41 pound increments.
- **e.** Unit Nominal Width by Length: 20 inches by 20 inches or 40 inches by 40 inches
- **f.** Nominal Depth: 1 inch – for rolls and individual units.
- **g.** Unit Weight: 18 ounce or 5 pounds.
- **h.** Volume Solid: 8%.

## PART 3 MATERIALS

**A.** Base Course: Sandy gravel material from local sources commonly used for road base construction (recycled materials such as crushed concrete or crushed asphalt are NOT acceptable).

**1.** Conforming to the following sieve analysis and requirements:
- **a.** 100% passing sieve size 1 inch.
- **b.** 90 to 100% passing sieve size 3/4 inch.
- **c.** 70 to 80% passing sieve size 3/8 inch.
- **d.** 55 to 70% passing sieve size #4.
- **e.** 45 to 55% passing sieve size #10.
- **f.** 25 to 35% passing sieve size #40.
- **g.** 3 to 8% passing sieve size #200.

**2.** Provide a base course material nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for turf.

**3.** Material may be either "pit run" or "crusher run." Avoid using clay based crusher run/pit run. Crusher run material will generally require coarse, well-draining sand conforming to AASHTO M6 or ASTM C 33 to be added to mixture (20% to 30% by volume) to ensure long-term porosity.

**4.** Alternative materials such as crushed shell, lime rock, or crushed lava may be used for base course use, provided they are mixed with sharp sand (20% to 30%) to ensure long-term porosity, and are brought to proper compaction. Without added sand, crushed shell and lime rock set up like concrete and become impervious.

**5.** Alternative size and/or composition of base course materials should be submitted to Invisible Structures, Inc. (Manufacturer) for approval.

**6.** Comply with Section 2512 of the Standard Specifications for PCC Barrier Curb. Meet requirements of Division 41 of the Standard Specifications for respective materials.

**B.** Sand Fill for permeable paving and Spaces Between: Clean sharp sand (washed concrete sand). Choose one of the following:

**1.** Coarse, well-draining sand, such as washed concrete sand conforming to AASHTO M6 or ASTM C-33.

**2.** United States Golf Association (USGA) greens, section - sand mix “The Root Zone Mixture.”

**C.** Turf Conditioner:

**1.** Grow medium a proprietary soil amendment manufactured by Invisible Structures, Inc. and provided with Grass pavement system.

**2.** No substitutions.

**D.** Grass – seed:

Iowa DOT Urban Mix. Use seed materials, of the preferred species for local environmental and projected traffic conditions, from certified sources. Seed shall be provided in containers clearly labeled to show seed name, lot number, net weight, % weed seed content, and guaranteed percent of purity and germination. Pure Live Seed types and amount shall be as shown on plans.

1. Mulch – needed only for hydro-seeding: Wood or paper cellulose commercial mulch materials compatible with hydro-seeding operations. Mulch depth according to mulch manufacturers' recommendation. Do not use mulch of straw, pine needles, etc., because of their low moisture holding capacity.
2. Topsoil – needed only for seeding, recommended for hydro-seeding: Obtain specified topsoil for a light "dusting" above (no more than 1/2 inch) filled with sand for seeding germination.

## PART 4 EXECUTION

### A. Inspection

1. Examine subgrade and base course installed conditions. Do not start permeable paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.
2. For fire lane installations: prior to installing base course for turf paving, obtain approval of local fire authorities of sub-base.
3. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Engineer for resolution.

### B. Preparation

1. Subgrade Preparation:
   - **a.** Prepare subgrade as specified in Sections 2109 and 2102 of the Standard Specifications. Verify subgrade in accordance with permeable paving system manufacturer's instructions.
   - **b.** Proper subgrade preparation will enable the Grass pavement system rolls/units to connect properly and remain level and stationary after installation.
   - **c.** Excavate area allowing for unit thickness, the engineered base depth (where required), and 0.5 inch for depth of sod root zone or topsoil germination area (when applicable).
   - **d.** Provide adequate drainage from excavated area if area has potential to collect water, when working with in-place soils that have poor permeability.
   - **e.** Ensure in-place soil is relatively dry and free from standing water.
   - **f.** Uniformly grade base.
   - **g.** Level and clear base of large objects, such as rocks and pieces of wood.
2. Base Preparation:
   - **a.** Install Base as specified in Section 2111 of the Standard Specifications. Verify engineered base (if required) is installed in accordance with permeable paving system manufacturer's instructions.
   - **b.** Place base in lifts not to exceed 6 inches, compacting each lift separately to 95% Modified Proctor.
   - **c.** Leave 1 inch of depth below final grade for permeable paver unit and sand fill and 0.5 inch for depth of sod root zone or topsoil germination area (when applicable).

### C. Grow Medium Installation

1. Spread all Grow medium mix provided (spreader rate = 10 pounds per 1076 square feet) evenly over the surface of the base course with a hand-held, or wheeled, rotary spreader.
2. The Grow medium mix should be placed immediately before installing the Grass pavement system.

### D. Grass Pave Installation

1. Install the grass pave system units by placing units with facing up, and using snap-fit connectors, pegs and holes, provided to maintain proper spacing and interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves, slopes, and high traffic areas shall be anchored to the base course, using 40d common nails with fender washer, as required to secure units in place. Tops of units shall be between 0.25 inch to 0.5 inch below the surface of adjacent hard-surface pavements.
2. Install sand in rings or cells as they are laid in sections by "back-dumping" directly from a

dump truck, or from buckets mounted on tractors, which then exit the site by driving over already filled with sand. The sand is then spread laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings or cells. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water from hose, irrigation heads, or rainfall, with the finish grade no less than the top of and no more than 0.25 inch above top of.

**E. Installation of Grass**

1. Grass coverage on the sand-filled units must be completed within one week. Sand must be re-installed and leveled and grass pave system checked for integrity if it becomes exposed due to wind, rain, traffic, or other factors.
2. Preferred method: Hydro-seeding/hydro-mulching - A combination of water, seed and fertilizer are homogeneously mixed in a purpose-built, truck-mounted tank. The seed mixture is sprayed onto the site at rates shown on plans and per hydro-seeding manufacturer's recommendations. Coverage must be uniform and complete. Following germination of the seed, areas lacking germination larger than 8 inches by 8 inches must be reseeded immediately. Seeded areas must be fertilized and kept moist during development of the turf plants). Do not drive on system: Hydro-seeded/hydro-mulch areas must be protected from any traffic, other than emergency vehicles, for a period of 6 to 8 weeks, or until the root system has penetrated and established well below the Grass pavement system units.
3. Adequately water sod or grass seed to assure germination of seed and growth of root system.

**F. Protection**

Seeded areas must be protected from any traffic, other than emergency vehicles, for a period of 4 to 8 weeks, or until the grass is mature to handle traffic.

**G. Field Quality Control**

1. Remove and replace segments of Grass pavement system units where three or more adjacent are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.
2. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

**H. Maintenance**

1. Maintain grass in accordance with manufacturer’s instructions.
2. Lawn Care: Normal turf care procedures should be followed, including de-thatching.
3. Do not aerate. Aerator will damage the Grass pavement system units. Aeration in not necessary in a sand root zone.
4. When snow removal is required, keep a metal edged plow blade a minimum of 3/4 inch above the surface during plowing operations to avoid causing damage to the Grass pavement system units, or
   a. Use a plow blade with a flexible rubber edge, or
   b. Use a plow blade with skids on the lower outside corners set so the plow blade does not come in contact with the units.

**I. PCC Barrier Curb**

Comply with Article 2512.03 of the Standard Specifications.

## PART 4 MEASUREMENT AND PAYMENT

**A.** Method of Measurement: The unit price for this item will be paid based upon the number of square yards of grass pave furnished and installed according to the plans, details and specifications. The PCC Barrier Curb is incidental to the grass pavement system.

**B.** Basis of Payment: Payment is based upon the square yardage of a fully functioning grass pave provided and installed. This work item includes: subgrade preparation; gravel base course; grow mixture as provided by manufacturer; grass pavement system; clean sharp sand; hydro-seeding; PCC Barrier Curb and maintenance. The PCC Barrier Curb is incidental to the grass pavement system.