SECTION 32 14 43

FLEXIBLE POROUS PAVEMENTS

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\*\* NOTE TO SPECIFIER \*\* Invisible Structures, Inc.; Porous Pavement products including "Gravelpave2" and "Grasspave2"; plastic rings with decorative gravel fill or for reinforcing turf.  
  
This section is based on the products of Invisible Structures, Inc., which is located at:  
3510 Himalaya Rd., Suite 200  
Aurora, CO 80011  
Tel: 303-233-8383  
Email: [request info (sales@invisiblestructures.com)](https://arcat.com/rfi?action=email&company=Invisible%252BStructures%252C%252BInc.&message=RE%253A%2520Spec%2520Question%2520(02795inv)%253A%2520&coid=33364&spec=02795inv&rep=&fax=)  
Web: <https://www.invisiblestructures.com>   
   
[ [Click Here](http://www.arcat.com/company/33364) ] for additional product data and info.  
   
 Invisible Structures, Inc. (ISI) provides surfacing and storm water solutions that protect and enhance the environment. Since 1982, ISI has manufactured porous paving, erosion control, drainage, and storm water storage products for easy, cost-effect, on-site storm water management. Solutions that effectively filter out pollutants reduce runoff volumes and rates, and lower treatment costs. Grasspave2 and Gravelpave2 are the best porous paving products on the market - both creating beautiful and functional areas. Rainstore3 is an underground storm water storage pond, which eliminates the need for real estate-consuming retention ponds.  
   
 This specification includes Grasspave2 and Gravelpave2 porous paving products.

Gravelpave2 units are plastic rings that retain decorative gravel fill.

Grasspave2 units are plastic rings that reinforce lawns. They can be filled with sand and either seeded or used with 1/2 inch (13 mm) thick sod. Thick sod is used without sand fill.  
  
See our SpecWizard: [Click Here](http://www.arcat.com/specwizard/02795inv/index.htm)

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Base course of sandy gravel, over sub-base prepared by others.
    2. Porous paver units.
    3. Gravel fill for porous paver units.
    4. Turf cover for porous paver units.
  1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 31 20 00 - Earth Moving.
    2. Section 33 46 19 - Underslab Drainage Piping.
    3. Section 32 10 00 - Bases, Ballasts, and Paving.
    4. Section 32 84 23 - Underground Sprinklers.
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. ASTM C 33 - Standard Specification for Concrete Aggregates.
    2. AASHTO M6 - Fine Aggregate for Portland Cement Concrete.
    3. United States Golf Association (USGA) - Greens, Section - sand mix �The Root Zone Mixture.�
  1. SUBMITTALS
     1. Submit under provisions of Section 01 30 00.
     2. Product Data: Manufacturer's data sheets on each product to be used, including:
        1. Preparation instructions and recommendations.
        2. Storage and handling requirements and recommendations.
        3. Installation methods.
     3. Shop Drawings: Submit manufacturer's shop drawings including laying pattern and anchoring.

\*\* NOTE TO SPECIFIER \*\* Delete the following paragraphs if LEED is not applicable.

* + 1. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
       1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
       2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
       3. List product benefits and potential LEED credit for each product specified.
    2. Verification Samples: For each finish product specified, two samples, minimum size 10 inches (250 mm) square, representing actual product and material.
    3. Manufacturer's Certificates: Certify base course and sand fill materials products meet or exceed specified requirements.
  1. QUALITY ASSURANCE
     1. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience and capable of reviewing and approving proposed application methods and providing field service representation during installation.
     2. Installer Qualifications: Installer Qualifications: A firm approved by manufacturer and experienced in and able to provide skilled workman with satisfactory record of performance on landscaping or paving projects of comparable size and quality with minimum five years documented experience.
     3. Preinstallation Meetings: Conduct meetings to verify project requirements, sub-base conditions, and manufacturer's installation instructions. Require attendance of parties directly affecting work of this section, including the contractor, architect, engineer, installer, and manufacturer's representative. Comply with Division 1 requirements.
  2. DELIVERY, STORAGE, AND HANDLING
     1. Store products in manufacturer's unopened packaging until ready for installation.
     2. Protect porous paver units from damage; store pavers protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer; store turf paver units under tarp when time from delivery to installation exceeds one week.
     3. Keep grass conditioner in a dark and dry location.
     4. Handling: Protect materials during handling and installation to prevent damage.
  3. 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 porous pavements until all hard surface paving adjacent to porous pavement areas, including concrete walks and asphalt paving, is completed.
     3. Install turf when ambient air temperatures is at least 55 degrees F (13 degrees C).
     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. Protect turf paving from traffic until grass root system has matured (about 3 to 4 weeks). Use barricades to only permit accessible by emergency and fire equipment during and after installation.

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: Invisible Structures, Inc., which is located at: 3510 Himalaya Rd. Suite 200; Aurora, CO 80011; ASD Tel: 303-233-8383; Email: [request info](http://admin.arcat.com/users.pl?action=UserEmail&company=Invisible+Structures,+Inc.&coid=33364&rep=&fax=&message=RE:%2520Spec%2520Question%2520(02795inv):%2520%2520&mf=); Web: <http://www.invisiblestructures.com>

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.
  1. MATERIALS
     1. Base Course: Sandy gravel material from local sources commonly used for road base construction and conforming to the following sieve analysis and requirements:
        1. 100 percent passing sieve size 1 inch (25 mm).
        2. 90-100 percent passing sieve size 3/4 inch (19 mm).
        3. 70-80 percent passing sieve size 3/8 inch (9 mm).
        4. 55-70 percent passing sieve size #4.
        5. 45-55 percent passing sieve size #10.
        6. 25-35 percent passing sieve size #40.
        7. 3-8 percent passing sieve size #200.

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph for use with turf pavers. if Delete if grass is not specified.

* + - 1. For turf pavers, provide materials nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for turf.
      2. Material may be either "pit run" or "crusher 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 percent by volume) to ensure long-term porosity.
      3. Alternative materials such as crushed shell, limerock, or crushed lava may be used for base course use, provided they are mixed with sharp sand (20 to 30 percent) to ensure long term porosity, and are brought to proper compaction. Without added sand, crushed shell and limerock set up like concrete and become impervious.
    1. Porous Paving Units for Gravel Fill: Invisible Structures Gravelpave2; hollow rings rising from a strong open grid with a geotextile fabric bonded to the bottom of the grid; made of lightweight injection-molded 100 percent post-consumer recycled plastic, predominately HDPE; fabricated in pre-assembled rolls.
       1. Unit Size: 20 by 20 inches by 1 inch high (500 by 500 m by 25 mm high).
       2. Unit Area: 2.7 square feet (0.25 sq m) each.
       3. Rolls: From 108 sq ft (10 sq m) to 1345 sq ft (125 sq m) in area.
       4. Unit Weight: 19 oz (535 g).
       5. Volume Solid: 8 percent.
       6. Maximum Loading Capability: 5700 psi (402 kg/sq cm) when filled with sand, over appropriate depth of road base.

\*\* NOTE TO SPECIFIER \*\* Select one of the following colors and delete those not required. Custom colors are available.

* + - 1. Color: Black.
      2. Color: Gray.
      3. Color: Tan.
      4. Color: Terra Cotta.
    1. Porous Paving Units for Turf: Invisible Structures Grasspave2; hollow rings rising from a strong open grid allowing maximum grass root penetration and development; made of lightweight injection-molded 100 percent post-consumer recycled plastic, predominately HDPE; fabricated in pre-assembled rolls.
       1. Unit Size: 20 by 20 inches by 1 inch high (500 by 500 m by 25 mm high).
       2. Unit Area: 2.7 square feet (0.25 sq m) each.
       3. Rolls: From 40 inches (1 meter) to 8.2 feet (2.5 meters) wide.
       4. Unit Weight: 18 oz (510 g).
       5. Volume Solid: 8 percent.
       6. Maximum Loading Capability: 5700 psi (402 kg/sq cm) when filled with sand, over appropriate depth of road base.
       7. Color: Black.
    2. Paver Unit Anchors: 16d galvanized common nails with fender washers of galvanized metal or similar coating.

\*\* NOTE TO SPECIFIER \*\* Select the following gravel fill paragraph for gravel fill units. Delete if units are covered with turf.

* + 1. Gravel Fill for Rings and Spaces Between Rings: Clean washed stone 3/16 inch (5 mm) to 3/8 inch (9.55 mm) not graded.

\*\* NOTE TO SPECIFIER \*\* The following two paragraphs are required only if covering the paver unit with turf. Delete both paragraphs if not required. For turf, use a species resistant to wear by traffic - generally a Blue/Rye/Fescue mix like those used for athletic fields in northern climates; or Zoysia, Fescue, or Bermuda types in southern climates. Check with local sod and seed suppliers for preferred mixtures. Dedicated fire lanes can use same grass species used on surrounding turf. Parking applications require greatest wear resistant species possible, generally available only by seeding or sprigging. Select one of the following Turf paragraphs and delete the other. Insert the name of the species if not shown on the Drawings or left to the contractor's discretion.

* + 1. Turf: Rolled sod of from a reputable local grower; free from disease, and in excellent condition, grown in sand or sandy loam soils or supplied from a recognized "Washed Sod" process.
       1. Sod Thickness: "Thin" sod, 1/2 inch (13 mm) soil thickness, grown in sand or sandy loam soils or supplied from a recognized "Washed Sod" process.
       2. DO NOT use sod grown in soils of clay, silt, or high organic materials such as peat.
       3. Species: As indicated on Drawings.
       4. Species: Preferred type for local environment and expected traffic conditions.
       5. Species: \_\_\_\_\_\_\_\_\_\_.
    2. Turf: Grown from pure live seed from certified sources.
       1. Furnish in containers clearly labeled to show seed name, lot number, net weight, percent weed seed content, and guaranteed percent of purity and germination.
       2. Quantity: \_\_\_\_\_\_ pounds per 1000 square feet (\_\_\_\_ kg per 100 square meters).
       3. Species: As indicated on Drawings.
       4. Species: Preferred type for local environment and expected traffic conditions.
       5. Species: \_\_\_\_\_\_\_\_\_\_.

\*\* NOTE TO SPECIFIER \*\* Use the following fill only for seeding or "thin" sod. Delete if thick sod is required.

* + 1. Sand Fill for Rings and Spaces Between Rings: Clean sharp sand (washed concrete sand).

\*\* NOTE TO SPECIFIER \*\* Select one the following paragraphs and delete the one not required.

* + - 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.�
    1. Turf Conditioner: Hydrogrow a proprietary soil amendment manufactured by Invisible Structures, Inc. and provided with Grasspave2. NO SUBSTITUTIONS.
    2. Fertilizer: Commercial "starter" fertilizer, with guaranteed analysis of 17-23-6, or as recommended by local grass supplier, for rapid germination and root development.
    3. Firelane Signage and Markings: Identify entrance and physical location of firelanes using signs if gates, curbs, bollards, and other built elements do not adequately indicate firelanes; comply with requirements of local fire authorities.
    4. Grass Paver Sign: Provide a sign indicating the presence of turf paver paving, stating that special maintenance is required, with manufacturer's phone number; provide sign of durable materials suitable for outdoor exposure.

\*\* NOTE TO SPECIFIER \*\* Include the following mulch paragraph only for seeding. Delete if not required.

* + 1. Mulch: Wood or paper cellulose commercial mulch materials compatible with hydroseeding operations. DO NOT use mulch of straw, pine needles, etc., because of their low moisture holding capacity.

1. EXECUTION
   1. EXAMINATION
      1. Examine subgrade and base course installed conditions. Do not start porous paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.

\*\* NOTE TO SPECIFIER \*\* It is recommended that Fire department inspectors be scheduled to inspect installation of turf paving during preparation of the sub-base, installation of the base course and installation of the paver units. Most small projects can accommodate these inspections all on the same day. Verify with Fire Department if certificates of inspection are required. Delete the following paragraph if not required.

* + 1. Prior to installing base course for turf paving, obtain approval of local fire authorities of sub-base.
    2. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Architect for resolution.
  1. PREPARATION
     1. Clean surfaces thoroughly prior to installation.
     2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the project conditions.

\*\* NOTE TO SPECIFIER \*\* Verify that the design and sub-base construction meets these criteria.

* + 1. Ensure that sub-base Specified in Section 32 10 00 - Bases, Ballasts, and Paving.
  1. INSTALLATION
     1. Install in porous pavement in accordance with manufacturer's instructions.
     2. Place base course material over prepared sub-base to grades indicated on the Drawings. Place in lifts not to exceed 6 inches (150 mm), compacting each lift separately to 95 percent Modified Proctor. Leave 1 inch (25 mm) of depth below final grade for porous paver unit and gravel fill.

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph for turf paving only. Delete if not required.

* + 1. Immediately before installing turf paver units, spread turf conditioner evenly over the surface of the base course, at rate of 10 pounds per 1000 square feet (4.5 kg per 100 sq m) using a hand held or wheeled, rotary spreader. Placement of conditioner too long before installation may cause the polymer to expand when installing the units.
    2. Install porous paver units and fill in accordance with paver unit manufacturer's instructions.

\*\* NOTE TO SPECIFIER \*\* Include all of the following applications as required and delete those not applicable. If any gravel or turf surfaces WITHOUT porous paver units are also included in the project, clearly indicate a demarcation line between paver units and no paver units on the Drawings.

* + - 1. Where gravel surface is indicated, install porous paving units with gravel fill.
      2. Where gravel surface is indicated, install porous paving units with gravel fill with Portland cement binder.
      3. Where turf (grass) surface is indicated, install porous paving units with sand fill and seed.
      4. Where turf (grass) surface is indicated, install porous paving units with sand fill and thin sod.
      5. Where turf (grass) surface is indicated, install porous paving units with thick sod without any fill.
    1. Install porous paver units by placing with rings facing up, using the snap fit system provided along each edge to maintain proper spacing and interlock the units.
       1. Cut units to shape with pruning shears and knife.
       2. Place with tops of rings flush or slightly below the surface of adjacent hard-surfaced pavements.
       3. Anchor units to the base course, using anchors specified, wherever anchorage is necessary to prevent movement by traffic.

\*\* NOTE TO SPECIFIER \*\* Delete the following paragraphs covering fill if ONLY "thick" sod covering has been specified.

* + 1. Fill (Gravel or Sand): Install fill into rings, after the units are anchored, by "backdumping" directly from a dump truck, or from buckets mounted on tractors, which then exit the site by driving forward over rings already filled.
       1. Spread fill laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings.
       2. Use a stiff bristled broom for final "finishing."
       3. Compact gravel, if necessary, by using a vibrating plate compactor or small roller.
       4. Compact sand by using water from hose, irrigation heads, or rainfall.
       5. Fill and compact so that finish grade is no less than at the top of rings and no more than 1/4 inch (6 mm) above top of rings.

\*\* NOTE TO SPECIFIER \*\* A binder is recommended for areas of high traffic speed or concentrated water flow. Consult with manufacturer for additional information. Delete the following if not required for gravel fill.

* + - 1. Portland Cement Binder for Gravel: Before placing gravel, mix dry with 10 percent Portland cement by weight of gravel; thoroughly wet base before placing; after compaction lightly mist surface and cover with water resistant tarp or plastic sheeting for minimum of 3 days or until mixture has bonded.
    1. Inspection and Repair: Remove and replace segments of porous paver units where three or more adjacent rings are broken or damaged. Reinstall as specified, with no evidence of replacement.

\*\* NOTE TO SPECIFIER \*\* Select one of the following three methods of installing turf and delete those methods not required. Delete entirely if no turf is required.

* + 1. Hydro-Seeding: Install grass seed and mulch over sand-filled rings using commercial hydroseeding equipment. Apply at rates specified and in accordance with manufacturer's recommendations.
       1. Provide uniform and complete coverage.
       2. Following germination, immediately re-seed areas larger than 8 by 8 inches (200 by 200 mm) without germinated seeds.
       3. Keep seeded areas mulched, fertilized and moist during plant development for 6 to 8 weeks.
    2. Thin Sod: Install sod directly over paver units with very tight joints.
       1. Keep sodded areas fertilized and moist during root establishment (minimum of 3 weeks).
       2. Protect sodded areas from all traffic other than emergency vehicles for a period of 3 to 4 weeks, or until the root system has penetrated and established grass well below the paver units.
    3. Seeding: Install sand fill over paver units with a light dusting of commercial topsoil mix, not to exceed 1/2 inch (25 mm) thickness placed above the rings and seed mix to aid germination.
       1. Keep seeded areas mulched, fertilized and moist during plant development for 6 to 8 weeks.
  1. CLEANING
     1. Keep the work area and adjacent areas clean during the work. Remove all excess materials, debris, and equipment from site.
     2. Repair any damage to adjacent materials and surfaces resulting from installation of this work.
  2. PROTECTION
     1. Protect installed products until completion of project.
     2. Repair or replace damaged products before Substantial Completion.

END OF SECTION