

NDS, Inc.
851 North Harvard Avenue
Lindsay, California 93247
Toll Free 800-726-1994
Phone 559-562-9888
Toll Free Fax 800-726-1998
Fax 559-562-4488
Website www.ndspro.com
Email nds@ndspro.com

August 2017

Product Guide Specification

Specifier Notes: This product guide specification is written in Construction Specifications Institute (CSI) 3-Part Format in accordance with *The CSI Construction Specifications Practice Guide*, including *MasterFormat*, *SectionFormat*, and *PageFormat*.

This section must be carefully reviewed and edited by the Architect to meet the requirements of the project and local building code. Coordinate this section with Division 1, other specification sections, and the Drawings. Delete all Specifier Notes after editing this section.

Section numbers and titles are based on *MasterFormat 2016 Update*.

SECTION 32 12 43

POROUS / PERMEABLE PAVING

Specifier Notes: This section covers NDS, Inc. “**EZ Roll Gravel Pavers**”. Consult NDS, Inc. for assistance in editing this section for the specific application.

The performance of NDS EZ Roll Gravel Pavers is directly correlated to the load bearing capacity, plasticity, and permeability of native soil; frost-heave potential; volume and load-rating of project traffic; shear & torsional forces imparted by dynamic, heavy loads; as well as the type, gradation, and thickness of the base course on which the paver is installed. The separation between the seasonal high water table and the bottom of the base course shall be a minimum of 3 ft to prevent potential saturation of groundwater into the base course.

Use of “EZ Roll Gravel Pavers” may contribute to LEED credits. Consult NDS, Inc. for more information.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Porous / permeable paving using gravel pavers.

1.2 RELATED REQUIREMENTS

Specifier Notes: Edit the following list of related sections as necessary. Limit the list to sections with specific information that the reader might expect to find in this section, but is specified elsewhere.

- A. Section 31 20 00 – Earth Moving: Subgrade preparation.
- B. Section 32 15 00 – Aggregate Surfacing: Gravel to fill gravel pavers
- C. Section 33 46 00 – Subdrainage: Subsurface drainage.

1.3 REFERENCE STANDARDS

Specifier Notes: List reference standards used elsewhere in this section, complete with designations and titles.

- A. ASTM F1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

1.4 PREINSTALLATION MEETINGS

Specifier Notes: Edit preinstallation meetings as necessary. Delete if not required.

- A. Convene preinstallation meeting [1 week] [2 weeks] before start of Work of this Section.
- B. Require attendance of parties directly affecting Work of this Section, including Contractor, Architect, installer, and manufacturer's representative.
- C. Review the Following:
 - 1. Materials.
 - 2. Protection of in-place conditions.
 - 3. Preparation.
 - 4. Installation.
 - 5. Adjusting.
 - 6. Protection.
 - 7. Coordination with other Work.

1.5 SUBMITTALS

Specifier Notes: Edit submittal requirements as necessary. Delete submittals not required.

- A. Comply with Division 1.

- B. Product Data: Submit manufacturer's product data, including preparation and installation instructions.
- C. Samples: Submit manufacturer's sample of EZ Roll gravel paver.
- D. Submit Material Certification / Gradation Analysis for base course and gravel fill.
- E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- F. Manufacturer's Project References: Submit manufacturer's list of successfully completed gravel paver projects, including project name and location, name of architect, and type and quantity of gravel pavers furnished.
- G. Installer's Project References: Submit installer's list of successfully completed gravel paver projects, including project name and location, name of architect, and type and quantity of gravel pavers installed.
- H. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 10 years, in the manufacturing of gravel pavers of similar type to that specified.
- B. Installer's Qualifications:
 - 1. Installer regularly engaged, for a minimum of 5 years, in installation of gravel pavers of similar type to that specified.
 - 2. Employ persons trained for installation of gravel pavers.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver gravel pavers to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 - 1. Store and handle gravel pavers in accordance with manufacturer's instructions.
 - 2. Keep gravel pavers in manufacturer's original, unopened containers and packaging until installation.
 - 3. Store gravel pavers in clean areas, protected from exposure to harmful weather conditions.
 - 4. Store gravel pavers out of direct sunlight.
 - 5. Protect gravel pavers during storage, handling, and installation to prevent damage.

1.8 AMBIENT CONDITIONS

- A. During Cold Weather:
 - 1. Do not use frozen materials.
 - 2. Do not use materials mixed or coated with ice or frost.
 - 3. Do not build on frozen Work.

- B. During Wet Weather: Do not build on wet, saturated, or muddy subgrade.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: NDS, Inc., 851 North Harvard Avenue, Lindsay, California 93247. Toll Free 800-726-1994. Phone 559-562-9888. Toll Free Fax 800-726-1998. Fax 559-562-4488. Website www.ndspro.com. Email nds@ndspro.com.

Specifier Notes: Specify if substitutions will be permitted.

- B. Substitutions: [Not permitted] [Comply with Division 1].

2.2 MATERIALS

- A. **Gravel Pavers:** NDS “EZ Roll Gravel Pavers”. Model GP4X150

Composition and Dimensions:

1. Injection-molded, nested-honeycomb, rolled-plastic-panel gravel pavers for permeable, gravel paved environments.
2. Load-transfer paving system.
3. Use full rigid base coarse to prevent pavers from being pressed into subbase.
4. Material: Polyolefin plastic with carbon black for UV stabilization.
 - a. Black Gravel Pavers: 100 percent recycled material.
 - b. Colored Gravel Pavers: Virgin material.
5. Recyclable Content: 100 percent.
6. Paver Size: Preassembled rolls comprised of 3.870ft x 150ft rolls by 1 inch high with integrated connecting cross links.
7. Wall Thickness: 0.12 inch.
8. Cells:
 - a. Number per Paver: 72.
 - b. Shape: Hexagon.
 - c. Size: 2-1/4-inches.
 - d. Form: Nested honeycomb.
9. Top Surface of Pavers: Smooth, without notches or grooves.
10. Connections:
 - a. Connecting Clips per Paver: 24.
 - b. Between Panels to Form Rolls: End-to-end clips snap-lock together.
 - c. Between Rolls: Side-to-side clips snap-lock together.
11. Bottom Open Area:
 - a. 100 percent geotextile filter fabric.
 - b. Total Area per Paver: 478 square inches.

Specifier Notes: Specify color of gravel pavers.

12. Paver Color: [Black] [Gray] [Tan] [Brick Red].

13. Paver Compressive Strength, Empty Cells: 57,888 psf.
14. Nominal Coverage Area per Paver: 4 square feet.
15. Weight per Paver: 2.32 pounds.
16. Chemical Resistance: Superior chemical resistance; totally inert.
17. Geotextile Filter Fabric:
 - a. Nonwoven, spunbonded, continuous-filament, polypropylene filter fabric.
 - b. Thermally bonded to gravel paver bottom surface.
 - c. Grab Tensile Strength: 110 lbs.
 - d. Puncture Resistance: 30 lbs.
 - e. Apparent Opening Size (AOS), US Sieve Number: 50.
 - f. Permeability: 0.05 cm/sec.
 - g. Water Flow Rate: 95 gal/min/sf.
 - h. UV Stability: 70 percent.

- B. Stakes: NDS model "GPSTAKE".
1. Compliance: ASTM F 1667.
 2. Material: Steel, C1004-C1008.
 3. Coating: Bright-dipped galvanized.
 4. Size: 12 inches by 3/8-inch diameter.
 5. Head: 3/4 inch.
 6. Point: Diamond.
 7. Shank: Smooth/ring.

Performance:

8. Paver Compressive Strength, Empty Cells: 53,683 lbs (372 psi)
9. Paver Compressive Strength, Cells Filled with 3/8 inch Gravel: 500,000 lbs.

Specifier Notes: Edit the following for the local available base course material and anticipated traffic loads. Consult NDS, Inc. for more information.

- C. **Gravel Fill Inside Pavers:** Clean, crushed, angular, uniformly-graded 3/8-inch gravel OR AASHTO #6 in the following gradation:

<u>Percent Passing</u>	<u>Sieve Size</u>
100	1 inch
90-100	3/4 inch
20-55	1/2 inch
0-15	3/8 inch
0-5	No. 4

NDS recommends rock of igneous origin. The use of limestone is prevalent in the South and Southeastern Regions of the US. The Engineer-of-Record shall refer to his/her State's Department of Transportation (DOT) Standard Specification guidelines regarding the use of limestone in the friction / wearing course. If limestone rock is used by the Engineer, NDS recommends that a Los Angeles Abrasion Test be performed. The abrasion values recommended by the DOTs varies by state, and ranges from 30 to 45. NDS recommends that the abrasion value shall not exceed 30.

Base Course below Pavers: AASHTO #57 or equivalent from local sources, passing the following sieve analysis:

<u>Percent Passing</u>	<u>Sieve Size</u>
100	1 1/2 inch
95-100	1 inch
25-60	½ inch
0-10	#8

NDS recommends rock of igneous origin. The use of limestone is prevalent in the South and Southeastern Regions of the US. The Engineer-of-Record shall refer to his/her State's Department of Transportation (DOT) Standard Specification guidelines regarding the use of limestone in the base course. If limestone rock is used, NDS recommends that a Los Angeles Abrasion Test be performed. The abrasion values recommended by the DOTs varies by state, and ranges from 30 to 45. NDS recommends that the abrasion value shall not exceed 30.

Note:

1. Contact NDS if locally available materials do not meet the above gradation.
 2. Sources of the material may include locally-available pit run or crusher run.
 3. Perform sieve analysis to confirm gradation.
 4. Perform LA Abrasion Test per AASHTO T96 or ASTM C35 if limestone is used.
- D. **Filter Fabric (Optional):** Use non-woven, needle-punched geotextile filter fabric. Use filter fabric with Apparent Opening Size (AOS) <0.60 mm for native soils with 50% or less particles by weight passing No. 200 sieve and AOS <0.30 mm for native soils with 50% or greater particles by weight passing the No. 200 sieve. Woven geotextiles should not be used.
- E. **Under Drain (Use if native soil is clayey):** Use minimum 4-inch diameter perforated PVC or polyethylene pipe. Recommended 2 square inches of opening per linear foot of pipe.
- F. **Anchors:** Use NDS 3/8 in x 12 in long galvanized steel stakes (Part No. GPSTAKES) with Fastenal or equivalent 3/8 inch I.D. x 2" O.D. X 1/16th inch thick Fender Washer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Examine areas to receive pavers. Paver installation shall not occur when excavated and exposed subgrade native soil area that is to receive the base course has ponding water or ice. Do not begin preparation or installation until these unacceptable conditions are corrected.
- B. Excavate to the required depth and compact Native Soil as follows:
1. Compact subgrade native soils 90 to 95% standard proctor density per ASTM D696 for soils with California Bearing Ratio >20%, R value >30, AASHTO A-1, A-2, and A-3 soils. Lower compaction levels promote infiltration through soil.
 2. NDS recommends that Engineer-of-Record consider higher level of compaction for native soils with CBR 5 to 20%, R-value 10 to 30, AASHTO A-4 soils for heavy loads (e.g., fire trucks) where infiltration into native soils is not a requirement.
 3. NDS recommends that Engineer-of-Record consult with Project Geotechnical Engineer for potential soil modification (e.g., lime treatment) and compaction level for CBR <5% and R-value <10, AASHTO A-5, A-6, and A-7 soils.

- C. Install filter fabric per manufacturer's recommendations.
- D. Place Base Course material over prepared subbase to grades indicated on the Drawings, in lifts not to exceed 6 inches. Since it is difficult to measure density of coarse aggregate, approach of requiring a fixed density is not applicable. Compact Base Course with one to three passes of 5-ton steel wheel roller or equivalent. Base Course thickness is based on native soil conditions and anticipated wheel loads.
- E. Install perforated underdrain in the base course layer.

3.2 INSTALLATION

- A. Install gravel pavers by placing units with cells facing up and connecting lateral snap locks together to maintain proper spacing and to interlock units.
- B. Clearance: Leave 1-inch-minimum clearance between gravel pavers and fixed objects or surface structures.
- C. Install the galvanized steel stakes supplied with the EZ Roll to secure the pavers in place prior to filling gravel.
- D. Anchoring recommended for all emergency vehicle access road projects using EZ Roll with gravel fill. NDS provides stakes with EZ Roll gravel pavers. Additional stakes recommended for emergency vehicle access roads that have cross slopes greater than or equal to 5% and at sharp 90-degree turns where paver is subjected to shear and torsion.
- E. Top of Cells: Leave top of cells 1/4 inch to 1/2 inch below surface of adjacent hard-surface pavements.
- F. Fill the gravel in cells as pavers are laid in sections. Fill pavers from outer periphery moving inward and avoid driving on empty pavers. Dump trucks and front end loaders that drive on empty pavers while filling gravel should minimize or avoid turn maneuvers to avoid displacement of panels.
- G. Extend gravel fill inside pavers ¼ inch to ½ inch above paver surface and match surrounding grade. When gravel fill is properly installed, paver cells will have minimum visibility. In locations where the area of the pavers is subjected to snow plowing, NDS recommends extending the gravel fill at least 1-inch above the paver surface to minimize contact of the plow blade with the plastic paver surface.
- H. NDS recommends filling pavers with gravel within 30 days of being installed. Re-inspect inter-paver locking as well as anchoring with stakes prior to filling with gravel if not filled on same day of installation. Make necessary corrections if displacement has occurred since installation.

3.3 PROTECTION

- A. Work area consisting of pavers shall be opened to traffic only upon completion of all fill activities.

3.4 NOTES:

1. EZ Roll with Gravel Fill is recommended for the following vehicle classes*
 - Class 1 (Motorcycles)
 - Class 2 (Passenger cars with trailers)
 - Class 3 (Pickup Trucks with trailers)
 - Class 4 (Buses....non-articulated)
 - Class 5 (Two axle, six tire, single unit vehicles)
 - Class 6 (Three axle, six tire, single unit vehicles)

*All vehicle classes per Federal Highway Administration Vehicle Classification

2. Do not install EZ Roll with Gravel Fill for the following vehicle classifications:
 - Class 7 and above vehicles (four and more axles, including single unit and single and multi-trailer)
 - In areas subjected to movement of trash-hauling trucks
 - As playground surfaces.
3. Project's Engineer-of-Record to consult with NDS Design Worx / Product Support at 1-888-825-4716 to determine suitability of EZ Roll with gravel fill where the paver may be subjected to shear & torsional forces imparted by dynamic, heavy loads before specifying this product in project plans. Heavy loads include trucks transporting / delivering cars in to a car parking lot, trucks with trailers, and semi-trucks.
4. Engineer-of-record shall ensure that run-on from surrounding areas in to the paver area is minimized by capturing this flow using swales or other measures before it enters the paver area. In the absence of swales or other flow-capturing measures, NDS recommends that the area contributing to run-on not exceed 2 times the area of the paver.
5. Side slopes adjacent to the paver shall not exceed 4H:1V so as to minimize transport of erosive sediment carried by runoff from steep side slopes into the pavers. NDS recommends stabilization of slopes using EZ Roll Grass Pavers and establishing grass cover using seeding or sodding, or other slope stabilization measures deemed suitable for project conditions by the engineer-of-record.
6. NDS recommendations for EZ Roll with Gravel fill for longitudinal slopes are as follows:

Slope	Recommendation
Up to 5%	Up to Class 6 vehicles
5% to 7%	Only light loads (golf carts)
Greater than 7%	Not recommended

END OF SECTION