FILTERPAVE®
Porous Pavement

4th July 2013 - Kai Tietjen

SOILTEC
GEOSYSTEMS

Made in Germany

History

2007 - Presto / 3M
2008 - Presto / 3M / SOILTEC
2009 - Presto / BASF,Detroit / SOILTEC
Installation of German Glass in Manitowoc
2010 - 1st Contractor Training in Las Vegas
2012 - FilterPave America / BASF, Detroit / SOILTEC
2013 - New component production in Europe
2013 - Taking over of Patent- and Trade Name rights

The Market Need for Porous Pavements

- **The Clean Water Act** continues to create the need for stormwater management for smaller sites
- **Poor Soil Conditions** are more common as better suited sites are becoming more scarce
- **High Stormwater Management Value:** Desire to make best use of valuable high-cost land; reduce the need for stormwater ponds by increasing porosity of hard pavements.
- **Sustainable Solutions:** High percentage of recycled materials, reduce landfilling of abundant recycled materials, green building credit
- **Meet local building laws**

Porous Pavement Options

- Vegetated Porous Pavements
  - Occasional or infrequent traffic, aesthetics of green space.
  - Structural strength depends on paver unit strength and base materials.

- Non-Bound Aggregate Surfaced Porous Pavements
  - Higher frequency traffic, low-cost confined aggregate can perform as an on-site stormwater detention “basin”.
  - Structural strength depends on infill and base materials.

Porous Pavement Options

- "Traditional" Hard-Surfaced Porous Pavements
  - Normal frequency traffic, increases infiltration, reduces need for stormwater retention/detention.
    - Porous Concrete
    - Porous Asphalt
    - Porous Pavers

- Bound Glass/Aggregate Surfaced Porous Pavement-FilterPave
  - Normal frequency traffic, increases infiltration, reduces need for stormwater retention/detention.
  - Contains high percentage recycled materials
  - Higher void space than traditional hard-surfaced porous pavements.

Characteristics of Traditional Hard-Surfaced Porous Pavements

- Traditional Hard-Surfaced Porous Pavements
  - Porous Concrete
    - Void Ratio of 15 to 20%
    - Few Fines
    - Reduction in Life Term from 30 years to 15 years
    - 2 – 2.5 times the Cost of Traditional Concrete
  - Porous Asphalt
    - Void Ratio of 12 to 15%
    - Few Fines
    - Reduction in Life Term from 15 years to 10 years
    - Twice the Cost of Traditional Asphalt/No ordinary Asphalt Maintenance Allowed
    - Volatile fumes on application
  - Porous Pavers
    - Low Comparable Porosity: Void Ratio Depends upon Joint Infill Material
    - Expensive / Labor intensive
    - Difficult to Remove Accumulated Fines; Joints Clog over Time
    - Limited Applications; Uneven Surface

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Porous Pavement, What's the Difference?

Property	FilterPave®	Porous Concrete	Porous Asphalt
Design Life	15 Years	15 Years	10 Years
Binding Agent	Elastomeric	Cement	Asphaltic
Recycled Content	96%	None	None
Void Ratio	38%	15-20%	12-15%
Maintenance	Vacuum	Vacuum, Patch, Repair Cracks	Vacuum, Patch, Repair Cracks

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FilterPave Porous Pavement System

- FilterPave Benefits
  1) Highly Aesthetic = Design Flexibility
  2) High Void Ratio/Porosity = Stormwater Benefits
  3) Eco-Friendly = Low Impact Development
  4) High Percent Recycled Materials
  5) Contributes to LEED Green Building Credits

FilterPave®

- Highly-Aesthetic
  - Architectural Aesthetics and Design Flexibility
  - Pavement Variability through Pigments

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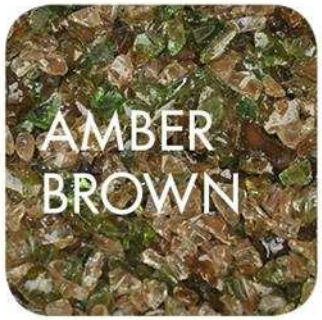
Color Options



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- Stormwater Management Benefits:
  - High Porosity (38%) Reduces Impervious Area & Stormwater Runoff; Additional Storage in Aggregate Base Depth
  - Open Surface Area Allows Groundwater Recharge if desired
  - Natural Water Storage Capability; On-Site LID-BMP
  - Porosity Comparable to Open-Graded Base Course (OGBC)
  - Reduces or Eliminates Need for Stormwater Ponds
  - Complements Stormwater Storage/Removal/Treatment Systems

FilterPave®

- Significant Capability to Infiltrate High Flows

FilterPave®

- Environment/Sustainability:
  - Eco-Friendly Pavement Utilizes High Percentage (96%) Recycled Materials.
  - Makes Productive Use of 100% Post-Consumer Recycled Glass that is Otherwise Landfilled.
  - Eco-Safe Adhesive is Comprised of 2/3 Natural Plant-Based Resin
  - Extremely Low Carbon Footprint; Negligible Contribution in the Creation of Hydrocarbons in the Manufacture of its Components.

FilterPave Composition

- **FilterPave® Components:**
  - Utilizes 100% Post-Consumer Recycled Glass, Treated to remove waste and sharp edges, Mixed with a small percentage of Granite
  - Patented Polymer Binder
  - Color Pigments
  - Optional Stabilizing Top Coat

FilterPave®

- Environment/Sustainability:
  - Eco-Friendly Pavement Utilizes High Percentage Recycled Glass

MYTH…Bottles that consumers clean and sort are recycled at recycling centers and reused.

FACT… EPA estimates that 78% of bottles sent to recycling centers are not reused, but instead sent to landfills and used as cover.

FilterPave Eco-Friendly Pavement

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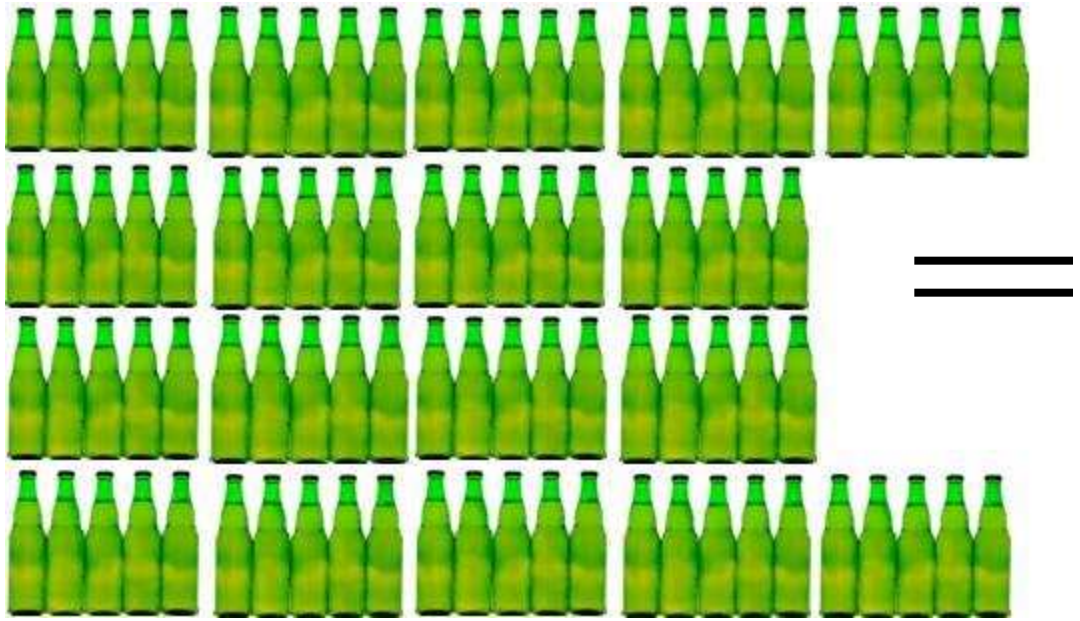
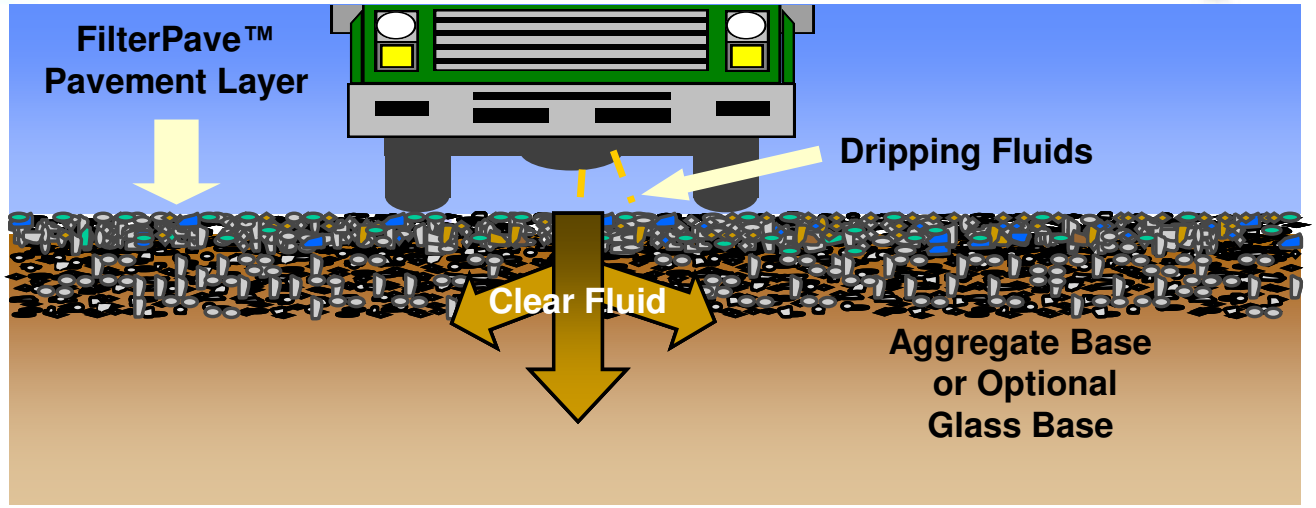
FilterPave®

- Environment/Sustainability:
  - Eco-Friendly Pavement Utilizes High Percentage Recycled Glass



Up to 450 typical glass beverage bottles are used in just one square meter of FILTERPAVE pavement .

FilterPave Eco-Friendly Pavement



- **Captures Hydrocarbons**
  - Removes Oil Products from Surface Runoff
  - Reduces Non-Point Source Pollution
  - Patented Glass Production Technique Adsorbs Hydrocarbons

FilterPave Green Building

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Contributes to LEED Credits:

- **Sustainable Sites. . .**
  - **Credit 5.1: Site Development**
    - **Protect or Restore Habitat:** Reduce or eliminate need for detention ponds enabling more of site area to remain natural
  - **Credit 6.1 & 6.2: Stormwater Management**
    - **Quantity Control:** Reduce amount of stormwater leaving site
    - **Quality Control:** Hydrocarbon adsorption by glass, and when used in conjunction with Treatment System
  - **Credit 7.1: Heat Island Effect**
    - **Non-Roof:** Cooler than non-porous pavements and porous asphalt. Similar to porous concrete
- **Materials and Resources…**
  - **Credit 4.1 & 4.2: Recycled Content Post Consumer**
    - **Recycled Content 10% & 20%:** Glass is 100% post consumer
  - **Credit 5.1 & 5.2 Regional Materials (within 500 miles of source)**
    - **Regional Materials 10% & 20%:**
    - Glass currently supplied from Northern WI; Denver and NY Sources Soon; More to be Added in Future.

U.S. GREEN BUILDING COUNCIL MEMBER

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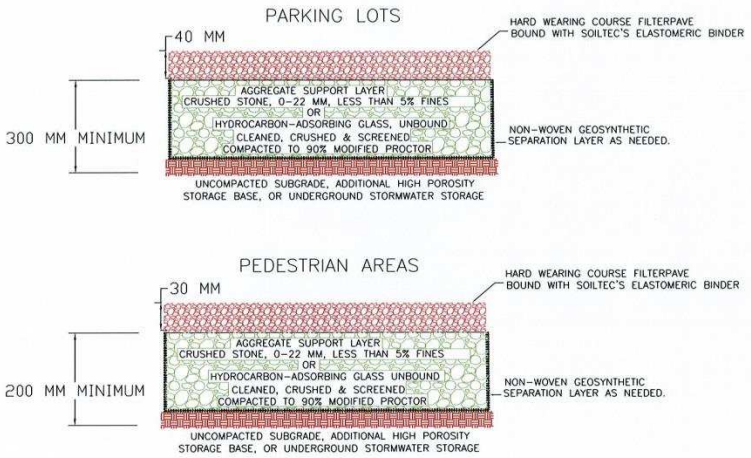
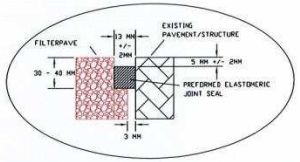
Typical Cross Sections

FILTERPAVE®

GLASS PROPERTIES- THE GLASS SHALL BE PROCESSED USING SOILTEC'S PATENTED PROCEDURE FOR USE IN THE FILTERPAVE POROUS PAVEMENT SYSTEM. ONLY GLASS PURCHASED THROUGH SOILTEC OR AN AUTHORIZED AGENT IS ACCEPTABLE.

BINDER PROPERTIES- THE BINDER SHALL BE A UNIQUE ELASTOMERIC BINDING MATERIAL MANUFACTURED SPECIFICALLY FOR USE IN THE FILTERPAVE POROUS PAVEMENT SYSTEM. ONLY BINDER PURCHASED THROUGH SOILTEC OR AN AUTHORIZED AGENT IS ACCEPTABLE.





ABUTTING FILTERPAVE TO EXISTING PAVEMENT/STRUCTURES
(WHEN JOINT IS REQUIRED)

NOTES: 1) BASE DEPTHS SHOWN ARE MINIMUMS FOR STRUCTURAL STRENGTH. POOR SUBGRADE PERMEABILITY AND/OR AREAS WITH HIGHER THAN AVERAGE RAINFALLS MAY REQUIRE MORE BASE AS A STORAGE RESERVOIR.

2) SUBGRADE TO BE EVALUATED FOR CBR VALUE/ EV2 VALUE AND PERMEABILITY IN ALL CASES

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FILTERPAVE®
POROUS PAVEMENT SYSTEM

FILTERPAVE IS A REGISTERED TRADEMARK/ PRODUCT OF SOILTEC GMBH.

DATE	NOVEMBER 2012	FILE NAME	FILTERPAVE_EN_DWG
SCALE	NTS	SHEET	1

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Section-Water Storage

12” of Open Graded Base Course with 40% Void Space Yields

- 4.8 inches of water storage

1.5” FilterPave Depth with 38% Void Space Yields

- An Additional 1.3 inches of Water Storage

Over 6” of Water Storage in the Cross Section

- Water Can Then
  - Be Allowed to Infiltrate
  - Sheet Flow to a Swale
  - Be Captured in an Underground Storage System

Areas of Primary Application

- Parking Areas (Drive Lanes and/or Parking Stalls)
- Parking Features (Rain Gardens, Medians, Runoff from Impervious Surfaces)
- Alleys
- Driveways
- Sidewalks/Walkways
- Pedestrian Malls/Patios
- Trails
- Boat Ramps
- Architectural Landscape Features
- Storage Areas
- Integrates well with other pavement systems (asphalt, concrete, pavers)

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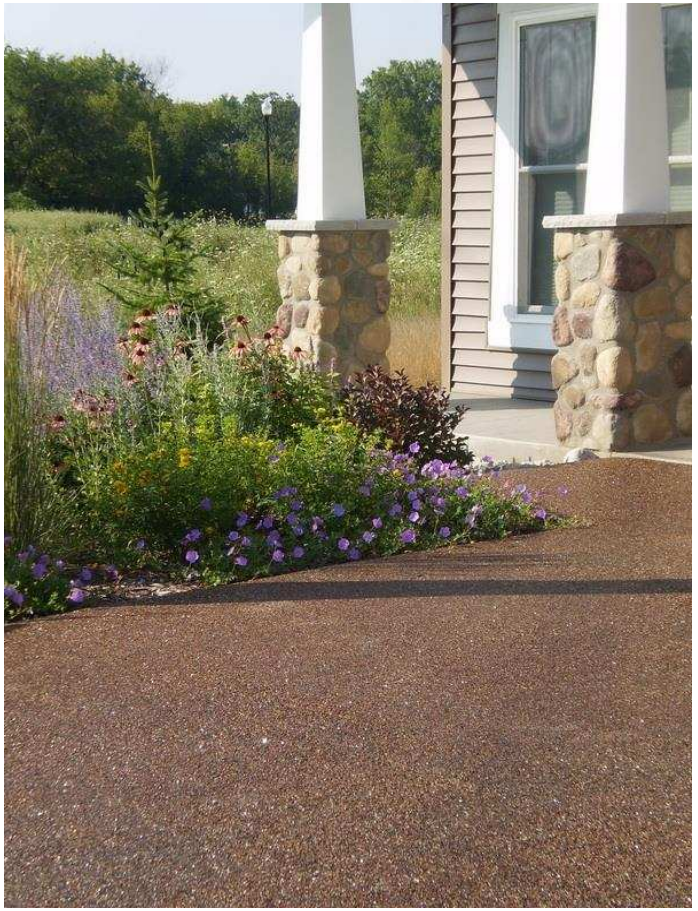
FilterPave Sidewalks



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FilterPave Sidewalks

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FilterPave Pedestrian Areas

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FilterPave Pedestrian Areas

FilterPave Pedestrian Areas

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FilterPave Driveways

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FilterPave Driveways

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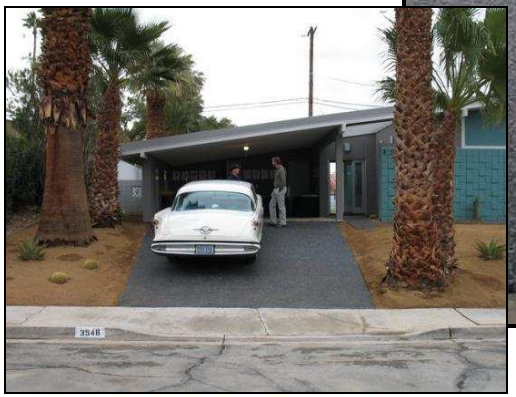
FilterPave Driveways



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FilterPave Driveways

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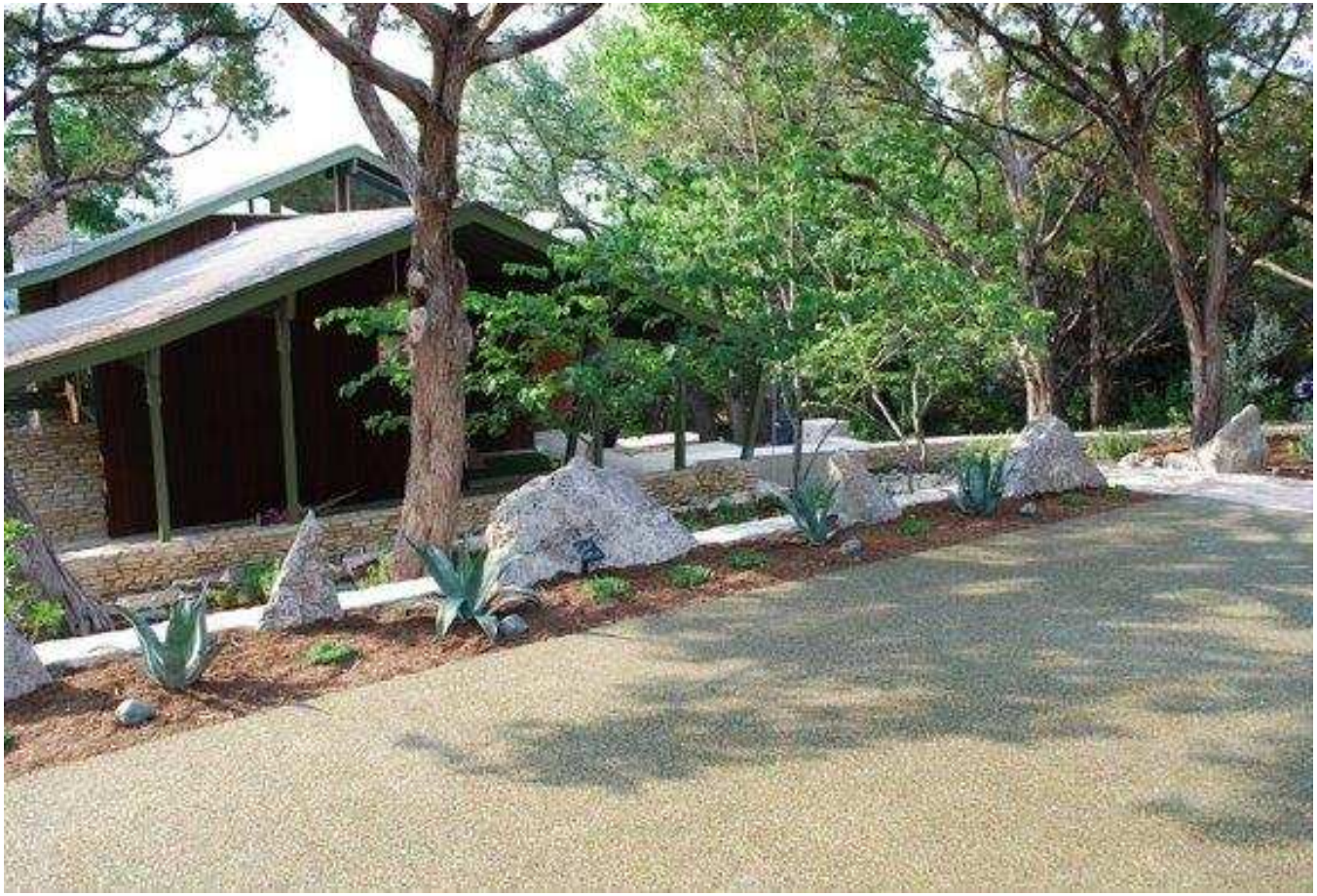
FilterPave Driveways



FilterPave Trails/Walkways

FilterPave Trails/Walkways

FilterPave Golf Cart Pathways

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FilterPave Boat Landing/Parking

FilterPave Boat Landing/Parking

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FilterPave Parking Areas

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FilterPave Parking Lots: ADA-Accessible

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Design Flexibility: Pigment Options

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Design Flexibility: Pigment Options

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FilterPave® Installation Process

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Specialized Volumetric Mixers

FilterPave Installed by Qualified Certified Contractors

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Preparing the Base

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Forming the Area

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Formed Areas

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Loading the Mixer

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Mixing the FilterPave Glue

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Spreads/Finishes Much Like Concrete

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Finishing with Hand Tools/Power Screed

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Finishing with Hand Tools/Power Screed

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FilterPave Installation

- Installation Crew Required – 4 or 5 Men

- Equipment needed
  - Mixer
  - Loading Vehicle
  - Asphalt Rakes
  - Power Screed or a Vibra Strike
  - 2 x 4's, Fresno, Hand Screed

- Installation Rate
  - Glass & Polymer into forms (2.5-4") – ~100 sqm/hour per crew of 5
  - Glass & Polymer for small jobs-dependent upon shape and complexity of forms
  - Cure Time – 1- 2 hours, drive upon after 3 to 7 days

FilterPave® Pavement In Snow / Ice

- **Reduces Freeze-Thaw Effect** due to high porosity, flexible binder and high porosity base
- **Offers High Flexural Modulus and Strength** from the Elastomeric binder
- **Minimizes Water Ponding** and the black ice effect.
- **Requires Less De-Icing Material** (Porous pavement research UNH Stormwater)
- **High (38%) Void Space** allows for 50% permeability loss due to fines/sand/grit while maintaining overall porosity of other porous pavements.
- **Inert to Salt & Chemicals** (avoid sanding as particles fill some void space)

Long Lasting Hard-Surfaced Porous Pavement

- 10-20 Year Normal Life
- Can be Repaired
- Cuts with Concrete Saw

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Maintenance

- Flexibility from Elastomeric Binder minimizes potential for cracking resulting in less maintenance requirements than porous asphalt or pervious concrete.
- Requires Vacuuming like other porous solutions to maintain permeability.
- Plowing OK – Use rubber blades or plow up one inch
- Salting OK, but requires less than non-porous pavements
- Snow blowing OK
- Spot repairs (dumpster drags, heavy gouges, excavation) OK

FilterPave has the Potential to Meet the Unmet Need

- **FilterPave**
  - **High Infiltration Rate:** initial rates of 1900 in/hr, long term clogging test rates still over 100 in/hr.
  - **High Permeability:** C-Factor 0.05 - 0.10
  - **High Albedo:** Reflects rather than absorbs light. SRI index 49 - 62
  - **High Hydrocarbon-Adsorbing Quality:** Captures max. 15 oz. oil per cubic foot – equivalent to over 100 years runoff at 15 mg/l per storm
  - **Compliance to SW Mandates:** Helps to Meet Stormwater Quality Standards, Avoid SW Utility Fees
  - **Low Environmental Impact:** High Recycled Material Content, Low Carbon Footprint / Eco-Efficiency

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Technical Information

ATTRIBUTE	RESULTS	TEST METHOD
raw material	recycled glass gravel: 100 % recycled and special broken recycled glass, gradation = 2-4 mm	transmission of grain size according DIN 18123
binding material	Polyurethan, FilterPave > 50 % recycled	
chemical persistence	consistent	
tensile strength (NEAT Elastomer)	17.170 kN/m² - 7 days 21.980 kN/m² - 21 days	ASTM D412 + D638
stretching at max. tensile strength (NEAT Elastomer)	50 % - 28 days	ASTM D412 + D638
splitting tensile strength	22.000 kN/m² - 24 hours waterstored	DIN EN 1338, Annex F
tear strength	4.120 kN/m² - 7 days	ASTM D624
bending tensile strength	3.435 kN/m²	ASTM C78/ DIN EN 12390-5
flexural modul	515 Nm	
uniaxial compressive strength	5.500 kN/m² - 7 days 8.240 kN/m² - 28 days	ASTM C39 ASTM D2166
uniaxial compressive strength	6.300 kN/m²	DIN EN 12390-3
friction coefficient	static (wet/dry): 0.90 – 1.05 kinetic (wet/dry): 0.75 – 0.85	ASTM D1895
abrasion according Böhm	loss of volume 19.000 mm³/5000 mm²	DIN EN 1338, Annex H

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ATTRIBUTE	RESULTS	TEST METHOD
water permeability	Kv = 2,3 x 10-3 m/s (vertical) KH = 3,5 x 10-3 m/s (horizontal)	TP-Asphalt-StB, Part 19
Porosity	0,40- 0,47 %	
grain loss	22,3 masse-%	TP Asphalt-StB, Part 17
sliding resistance	USRV = 44	DIN EN 1338
resistance against change of frost and dew	loss of mass per areal unit L = 0,004 kg/m²	DIN EN 1338
drain coefficient	0,05 – 0,10 % (percentage of flow water; for comparison asphalt, concrete ca. 0,75 – 0,95)	
Solar Reflexions Index	Jade green 62 % Amber 61 % Sedona red 53 % Topaz 51 % Saphire blue 49 % Natural Blend 65 %	ASTM E1980
hydrocarbon bonding	15 kg per m³ FilterPave®	University Wisconsin

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….for the smaller things in life…

FILTERPAVE® kit

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FilterPave Kit - Projekte

CI-Designs

Mars Corp. European Head Office

FilterPave Kit - Projekte

FilterPave Kit - Projekte

FilterPave Kit - Projekte

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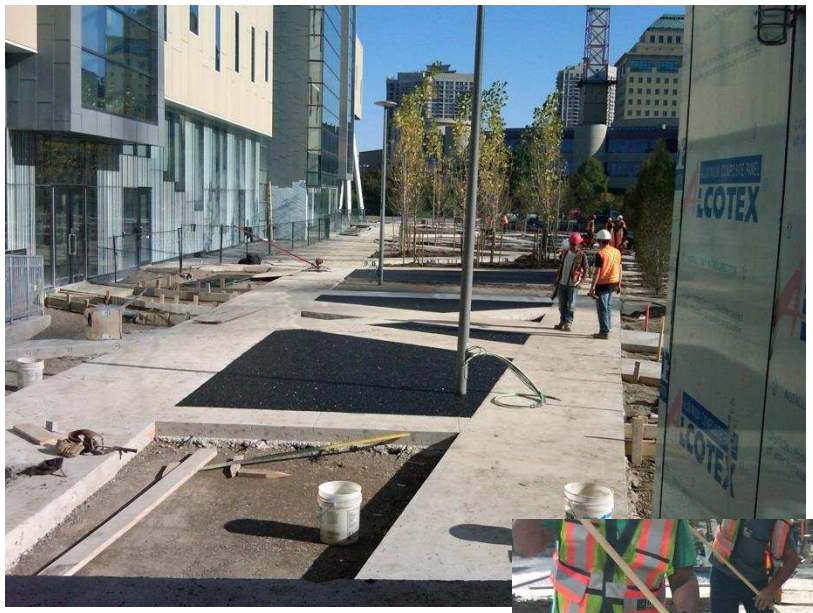

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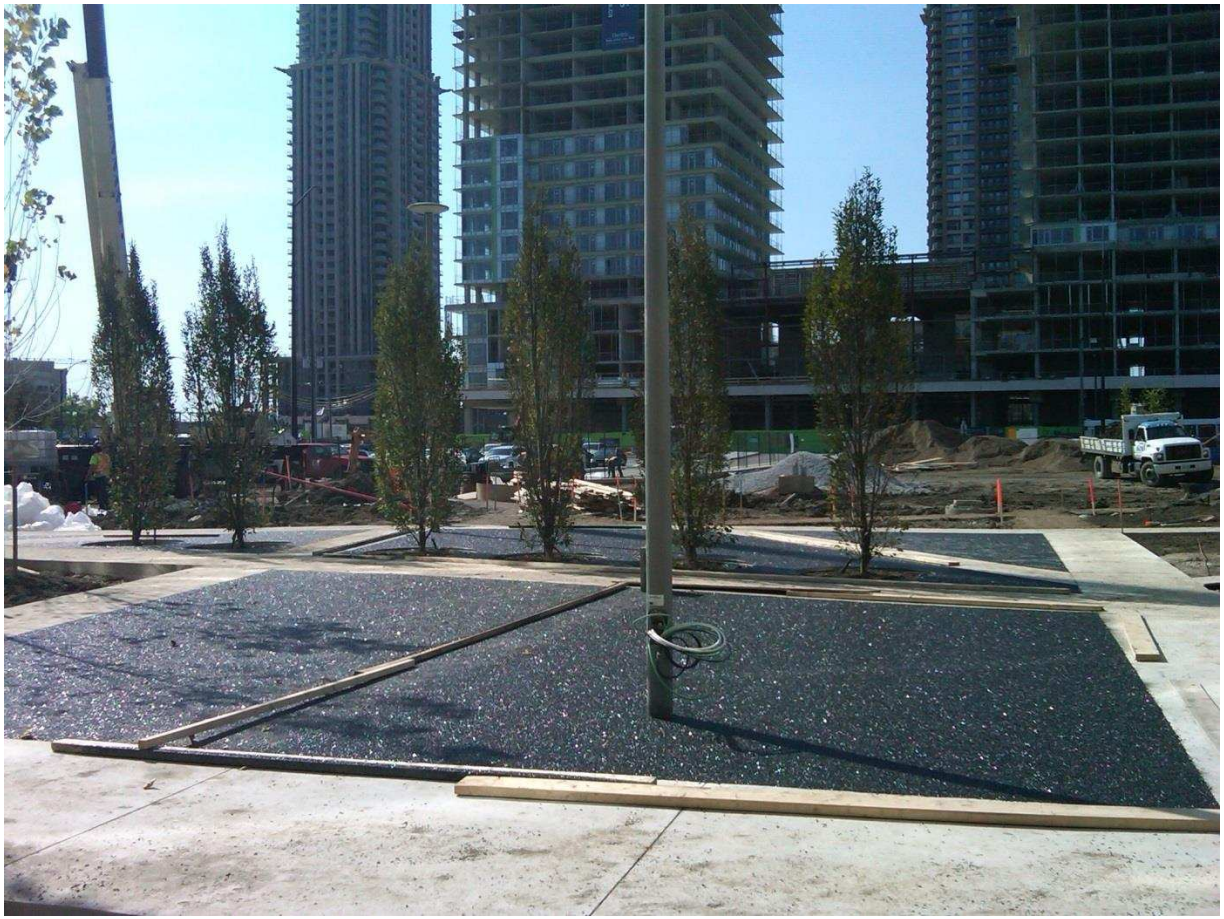
FilterPave Kit - Projekte



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Marketing

…did i miss something ???

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Thank you for your attention !