POROUS CONCRETE SIDEWALKS

How to Build Sidewalks and not Stormwater Ponds

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Benefits of Pervious Concrete
Three Types of Pervious Concrete

- Categorized by the admixture name.
- Difference in surface texture.
- Differences in cost.
- Compressive strength of 2,000 to 3,000 psi.
- Flexural strength of 200 to 300 lbs.
- Voids contents of 10 to 20%.
What is Porous Concrete?

- Porous concrete is a concrete material that has enough voids within it to allow water to pass freely through it.
- All porous concrete has a low water-to-cement ratio.
- Goal is to coat aggregate in cement and compress them together.
Regular Porous Concrete
Stoney Creek Porous Concrete
## Differences in the Types of Pervious Concrete

<table>
<thead>
<tr>
<th>Type of Pervious Concrete</th>
<th>Aggregate Size</th>
<th>Surface Texture</th>
<th>Special Admixture</th>
<th>Finish Technique</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>Large 3/8 inch</td>
<td>Coarse</td>
<td>No</td>
<td>Roller or self consolidating</td>
<td>Lowest</td>
</tr>
<tr>
<td>Stoney Creek</td>
<td>Medium ¼ inch</td>
<td>Medium</td>
<td>Yes</td>
<td>Self consolidating or slip form</td>
<td>Middle</td>
</tr>
<tr>
<td>Perco-Crete</td>
<td>Smallest Sand</td>
<td>Smooth</td>
<td>Yes</td>
<td>Plate Compactor</td>
<td>Highest</td>
</tr>
</tbody>
</table>
Benefits of Porous Concrete

- Does not generate stormwater runoff like traditional pavements. Allows rainwater to enter the soil.
- Recharges the groundwater - this is where we get our drinking water from.
- Protects our streams from damaging impacts of urban stormwater runoff.
- Stays cooler than traditional pavement; reduce in heat island effect.
- Does not trigger stormwater mitigation requirements; results may vary.
# Survey of Residents
## Regular Porous Concrete Concrete Sidewalk

<table>
<thead>
<tr>
<th>In Favor of</th>
<th>Question</th>
<th>Didn’t like</th>
</tr>
</thead>
<tbody>
<tr>
<td>52%</td>
<td>Like the appearance</td>
<td>25%</td>
</tr>
<tr>
<td>49%</td>
<td>Less Slippery</td>
<td>9%</td>
</tr>
<tr>
<td>52%</td>
<td>Would use at home (if $ was the same)</td>
<td>15%</td>
</tr>
<tr>
<td>72%</td>
<td>City should encourage builders to use</td>
<td>11%</td>
</tr>
</tbody>
</table>
Design of Sidewalks

- The subgrade must be uncompacted.
- Storage volume under sidewalk is designed for short-duration, intense rain storms.
- Prevent lateral movement of infiltrated water; check dams are needed.
- The surface must be sloped, in case of failure.
- Protect the edges from traffic.
Design of Materials

- Each material design is aggregate specific:
  - Slight changes in gradation changes the result.
  - Can’t transfer results directly.

- General mix design relationships.
  - Fractured stronger than round.
  - Uniform size more voids than varied size.
  - More W/C stronger than lower W/C.
  - More W/C less voids than lower W/C.

- Bench tests and trials worthwhile.
How Do We Make a Porous Concrete Sidewalk?

- Excavate - don’t forget the check dams.
- Geotextile and drain rock.
Compact, Edge and Cover with Plastic
7 Days Later Work is Complete
Problems with Porous Concrete

It is hard to batch

It is difficult to place
For a Successful Project

- You need:
  - Good quality control at the batch plant.
  - Experienced applicators.
Quality Control

- Water content of all materials.
- Water all ready in the truck.
- Weights of all materials.
- Educated batch plant operators and truck drivers.
- Pre-batch meeting to go over specifications.
- Constant feedback on quality of material.
Experienced Applicators

- Previous porous concrete work.
- Hire a lead or foreman with experience.
- Provide installation videos and instructions.
- Require satisfactory completion of test panels before starting work.
Even with good quality control and experienced applicators, failures will occur.

Olympia routinely has failures of up to 5% of the porous concrete.

Mitigate the risk of failure, clear testing requirements, and make sure owner shares the cost.
Testing of Porous Concrete

- Pressure wash at 3,000 psi, 3 inches, 7 to 60 days after installation.
## Construction Costs

<table>
<thead>
<tr>
<th>Bid item</th>
<th>Year</th>
<th>Total Quantity</th>
<th>Range of Bids</th>
<th>Average Bid Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porous Concrete Sidewalk (SY)</td>
<td>2006</td>
<td>4,290</td>
<td>$88-$119</td>
<td>$106</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>2,295</td>
<td>$66-$102</td>
<td>$84</td>
</tr>
<tr>
<td>Porous Concrete Underdrain System (CY)</td>
<td>2006</td>
<td>1,760</td>
<td>$43-$122</td>
<td>$72</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>580</td>
<td>$44-$131</td>
<td>$72</td>
</tr>
<tr>
<td>Porous Concrete Testing (SY)</td>
<td>2006</td>
<td>4,290</td>
<td>$2.25-$12</td>
<td>$6.70</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>2,295</td>
<td>$7-$8.75</td>
<td>$7.80</td>
</tr>
</tbody>
</table>

Traditional concrete sidewalk bid price of $40 /SY for the same period
Porous Concrete Needs to Be Cleaned

It is hard to keep it clean.
Tree Leaves and Fruit Tend to Clog Porous Concrete
Cleaning can be performed with pressure washing.
Cleaning Can be Performed with a Hard Surface Cleaner
Sweeping Machines can be Used to Clean Porous Concrete
Cleaning Can be Performed by Vacuuming
City of Olympia Porous Concrete Cleaning Program

- Vacuum cleaning once/twice a year (Depending on leaf litter load).
- Expected cost $0.10 per square yard.
- Pressure Washing Cleaning once every 5 to 10 years (depending on effectiveness of vacuum cleaning).
- Expected cost $1.60 per square yard.
Frequently Asked Questions

- **What about freeze/thaw?**
  - No problem, the voids allow the ice crystals a place to grow into.

- **Is it durable?**
  - YES – if it is batched correctly
  - Pressure washing doesn’t lie.
Summary of Porous Concrete Sidewalks

- Has significant stormwater and environmental benefits.
- Is difficult to install correctly.
- Requires trading storm pond maintenance for sidewalk maintenance.
- Can save money on installation depending on project size and land cost.
Future of Porous Concrete

- Futures looks good.
- Porous concrete is accepted by citizens.
- More products on the market.
- More people are getting experience with it.
- More places it can be used.
Porous Concrete Pavers
Porous Concrete Bicycle Lane
Additional Sources of Information about Porous Concrete can be found on the web at:

- Perco-Crete Porous Concrete
  www.percocrete.com

- Stoney Creek Porous Concrete
  www.stoneycreekmaterials.com

- Regular Porous Concrete
  www.washingtonconcrete.org/industry/pervious

- City of Olympia
  www.olympiawa.gov/cityutilities/stormwater/scienceandinnovations