2009

Parking Lot Discharge Study

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Porous Asphalt Pavement

For the East Middle School Parking Lot
Water is made up of atoms.

Two hydrogen atoms bonded with an oxygen atom makes up a water molecule ($\text{H}_2\text{O}$).

A molecule that has electrically charged areas is called a polar molecule. A substance that contains polar molecules is called a polar substance.

The positive hydrogen ends of one water molecule attract the negative oxygen of nearby water molecules. As result, water molecules tend to stick together.

The combined force of attraction among water molecules and with the molecules of surrounding materials is called capillary action.
A solution is a mixture that dissolves in liquid easily.

One reason that water is able to dissolve many substances is that it is polar.

The charged ends of the water molecule attracts the molecules of other polar substances.

Sugar is a familiar polar substance.

As those sugar molecules dissolve other sugar molecules are exposed to the water.

A non-polar molecule does not dissolve easily.
Watersheds

- The land area that supplies water to a river system is called a watershed.
- Watersheds are also called drainage basins.
- All the water in a river system drain into the main river.
- A river can flow into another larger river.
- When rivers join another river system, areas they drain become part of a larger watershed.
- Some watersheds are very small.
- You can identify a river’s watershed on a map by drawing an imaginary line around a region drained by all tributaries.
- The watershed of a stream that flows down a hill into a river, is just that hillside - maybe a square kilometer or two.
A underground layer of rock or sediment that holds water is called an aquifer.

They can range in size.

It provides water and crops for some people.

The water is actually moving and seeps through the layers of the earth, but takes a long time to come back to the surface.

It moves about 10m a year.

The more permeable the rock and the more slopes there are, the slower the water runs and absorbs most of the water.
Runoff

- Water runoff is a problem.
- It is a problem because when you have a slope and it rains all the water flows downward.
- All of the toxic and filthy material such as gas, mud, dirt, rocks, and more materials move with water.
- Then the water takes it down to an area or into the sewers that then lead to a body of water.
- All of that material gets put into the body of water and organisms living in it can get harmed.
- Also it will cause more pollution.
The Water Cycle

condensation → precipitation

transpiration

runoff

evaporation

condensation

runoff

evaporation

Trees
How do weather conditions affect asphalt

- When temperatures change, it stresses the material in asphalt.
- In cold weather, precipitation can build up on the driveway, causing water to seep into the semi-porous surfaces.
- When water freezes it expands and then cracks form.
- After more water seeps through the cracks, the situation gets worse.
- Also, the buildup of car oil and the chemicals used to melt snow and ice during the winter can help break down the asphalt surface even more.
<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Thickness/Composition</th>
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</thead>
<tbody>
<tr>
<td>4 inches thickness of porous Asphalt</td>
<td></td>
</tr>
<tr>
<td>4 inches thickness of ¾ inch crushed stone</td>
<td></td>
</tr>
<tr>
<td>8-12 inches thickness of open graded reservoir subbase</td>
<td></td>
</tr>
<tr>
<td>4 inches thickness of ¾ inch &gt; crushed stone for frost protection</td>
<td></td>
</tr>
<tr>
<td>Soil permeability</td>
<td>&gt;0.5 in/hr</td>
</tr>
</tbody>
</table>
Advantages

- Recharges groundwater so that it goes into an underlying aquifer.
- We will not have to use as much on piping, catch-basins, retention ponds, curbing, etc.
- Maintains recharge and capacity when frozen.
- Less salt or sand used to melt the ice on the lot.
- Pavement is meant to last about 20 years and still be in good condition!
- We will not be polluting as much water, rivers, lakes and streams.
- We will not have to repave the parking lot as much therefore, saving the school/school system a lot of money that will be able to go to the school.
Disadvantages

- You may only use a Vac-Assisted dry sweeper.
- May need the proper construction stabilization and erosion to prevent clogging.
- Need the right quality of materials for success.
- You may not use accidental seal coating or similar surface treatment will result in a failure to this project.
Cost

- The cost should be about 20-25% higher than regular dense mix asphalt but it will pay off later in the process.
- You won’t have to pay for salt or sand.
- You won’t slip as much on ice.
- You won’t have to pay for repairs.
- Or piping underneath for the runoff water etc.
- With dense mix asphalt the cost for the parking lot would be roughly $102,000.00.
- With porous asphalt the cost of the parking lot would be roughly $123,000.00.
- The parking lot is about 25,434.84 feet squared.
- The total volume of the runoff of the pavement is 305,218.08 cubic inches.
Layers

- For the porous asphalt you need the correct amount of layers of the correct materials for the water to go through the pavement.
- You will have five layers of different materials.
- The bottom layer would be 0.5 inch/hours of soil permeability.
- The next layer will be four inches thickness of \(\frac{3}{4}\) inches crushed stone for frost protection.
- The next layer in the middle is 8-10 inch thickness of open-graded reservoir sub base.
- Then another layer of four inch (thickness) of \(\frac{3}{4}\) crushed stone.
- Then finally four inches of porous asphalt.
Steps

- 1) Rainfall lands on the parking lot surface.
- 2) Where it flows through the “pores” in the pavement.
- 3) Into the “bed” below.
- 4) Recharging the aquifer and the groundwater.
Monataquit River
Porous Asphalt Pavement
Regular Dense Mix Asphalt
Demonstration

Click on the drop of water to see an example video of porous asphalt pavement. Watch as the water disappears into the ground.
Thanks for watching!