Porous Pavement Resource Sheet

Background

Problem

Traditional pavement is impermeable to stormwater and snowmelt, which causes:

- Flooding
- Runoff that contains pollutants to flow into our storm drains and waterways
- Erosion from excess runoff during storms
- Groundwater to be used faster than it is being replenished
- The urban heat island effect (high ambient air temperatures in urban areas)

Solution

Porous pavement, also known as permeable pavement, has the structural support that traditional pavement provides, but allows stormwater and snow melt to drain through the pavement. The porous pavement will collect the precipitation and slowly let it infiltrate the soil below or have the precipitation flow through an underground drain. Porous pavement is best used in places that have a lower volume of vehicular traffic load, such as parking lots, trails, sidewalks, low-volume streets, driveways, and playgrounds.

Benefits of Porous Pavement

- Since water drains through the porous pavement, freeze-thaw cycles tend to not adversely affect porous pavement
- Effective at reducing the amount of pollution that reaches waterways
- Less likely to form black ice, so generally needs less road salt
- Often requires less plowing
- Recharges the groundwater
- Provides better traction in rain and snow conditions
- Wicks moisture from the ground, improving evaporation
- Reduces the runoff to stormwater systems

Permeable Pavers By: Mississippi Watershed Management Organization
Source: Flickr

Drawbacks to Consider

- Not as long-lasting in high-traffic areas
- Typically not suited for steeply sloped areas
- Not appropriate for areas that are likely to have hazardous material spills
- Heavy clay soils can limit the usefulness of porous pavement
- Sediment and road salt can block the small pores of the pavement

Best Management Practices

- Limit porous pavement to low-traffic areas
- Have a storm sub-base under the porous pavement, not directly onto soil
- Place porous pavement on a level surface
- Place educational signage nearby
- Prevent sediment from entering the base of the porous pavement during construction
- In the winter, do not use sand, but de-icing material can be used in moderation. Consider salt brine instead
- Do not place snow piles on porous pavement where debris build-up can block pores
- Implement a strong maintenance plan

Case Studies

MINNESOTA DEPARTMENT OF TRANSPORTATION

Introduction

The Minnesota Department of Transportation (MNDOT) with the University of Minnesota in 2015 published a research project on permeable pavement case studies in cold weather climates. The following are key findings from the case studies outlined.

Shoreview, MN-Woodbridge Neighborhood

Replaced conventional asphalt roads in the Woodbridge Neighborhood with pervious concrete, selected due to:

- Underlying sandy soils with infiltration rates of 3 in/hour or more
- Coarse aggregate drainage layer in the pavement system could contain enough water to eliminate the need for discharge to Lake Owasso

Results:

- Infiltration capacity has been maintained at satisfactory levels by vacuuming with a regenerative air sweeper once every six weeks
- Brush cleaning was not utilized as it would push particles into the pavement and result in clogging
- Organics were the main source of clogging. Typically occurred in the top quarter inch of pavement surface
- Salt and heavy vehicle use has caused pavement degradation at specific and isolated areas

MNDOT Test Cells - Concrete

Test cells at the Minnesota Department of Transportation research center.

- Various types of permeable pavements laid on segments of a test roadway
- Truck with trailer are driven 80 times over the segments to simulate low volume traffic

Performance:

- Hydrologic:
  - Pervious concrete over sand has the highest permeability
  - conventional concrete has the lowest permeability
- Structural and Physical:
  - Raveling and weathering of the materials made them rougher over time than the impervious asphalt
  - Low volume traffic did not impact density of the material
  - Pervious concrete had more uniform temperature gradients than conventional concrete
  - Moisture was found to freeze at much greater depths in the pervious concrete
  - Pervious concretes experienced far fewer freeze-thaw cycles than conventional concrete

Permeable pavement bikelane By: Adi Coco From Pexels
Source: Canva

Case Studies

BUFFALO, NY

Introduction

Buffalo, New York, has implemented permeable asphalt in several areas to address stormwater runoff management challenges. This effort was due, in part, by a consent order to manage stormwater overflows. This solution allows rainwater to infiltrate through the pavement and into the ground, reducing runoff and improving water quality

William Street

- Reduced impervious surfaces by 1.3 acres
- Estimated capacity of 284,357 gallons of stormwater that would otherwise be runoff
- Planted 64 street trees

Clarendon Place

- Utilized permeable asphalt pavement materials
- Reduced impervious area by 0.2 acres
- Estimated capacity of 159,335 gallons of stormwater that would otherwise be runoff
- Aimed to reduce combined sewer overflow events in CSO 60, Scajaquada Creek near Hoyt Lake

Porous pavement longevity

- More reveling if dirty and pores are clogged. Also more on heavy traffic areas. Not on walking paths or less used parking lots
- Bike lanes are very deteriorated from 2014. Pot holes from utilities have been patched with regular pavement because can’t purchase small amounts of porous asphalt
- Porous asphalt generally has shorter shelf life too so can’t hang on to it

Ardmore Place

- Restored the historic brick street found under the previous asphalt
- Reduced impervious area by 0.7 acres
- Estimated capacity of 11,973 gallons of stormwater that would otherwise be runoff
- Improves safety by slowing vehicles and reduces stormwater from entering storm sewers

Buffalo, NY By: Sergey Novikov
Source: Canva

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