



PERVIOUS PAVEMENT: HOW'S IT WORKING?

Bloomington's Experiences with Pervious Bituminous
and Concrete Parking Lots

Scott Anderson, PE

Steve Segar, PE

City Engineers Association of Minnesota, Jan. 25, 2012

WHAT WE BUILT: PERVIOUS BITUMINOUS HARRISON PARK PARKING LOT, 2008



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W. Old Shakopee Rd.



W. 100th St.

James Ave. S.

WHAT WE BUILT: PERVIOUS CONCRETE PUBLIC WORKS, JAMES AVE. EAST LOT, 2010



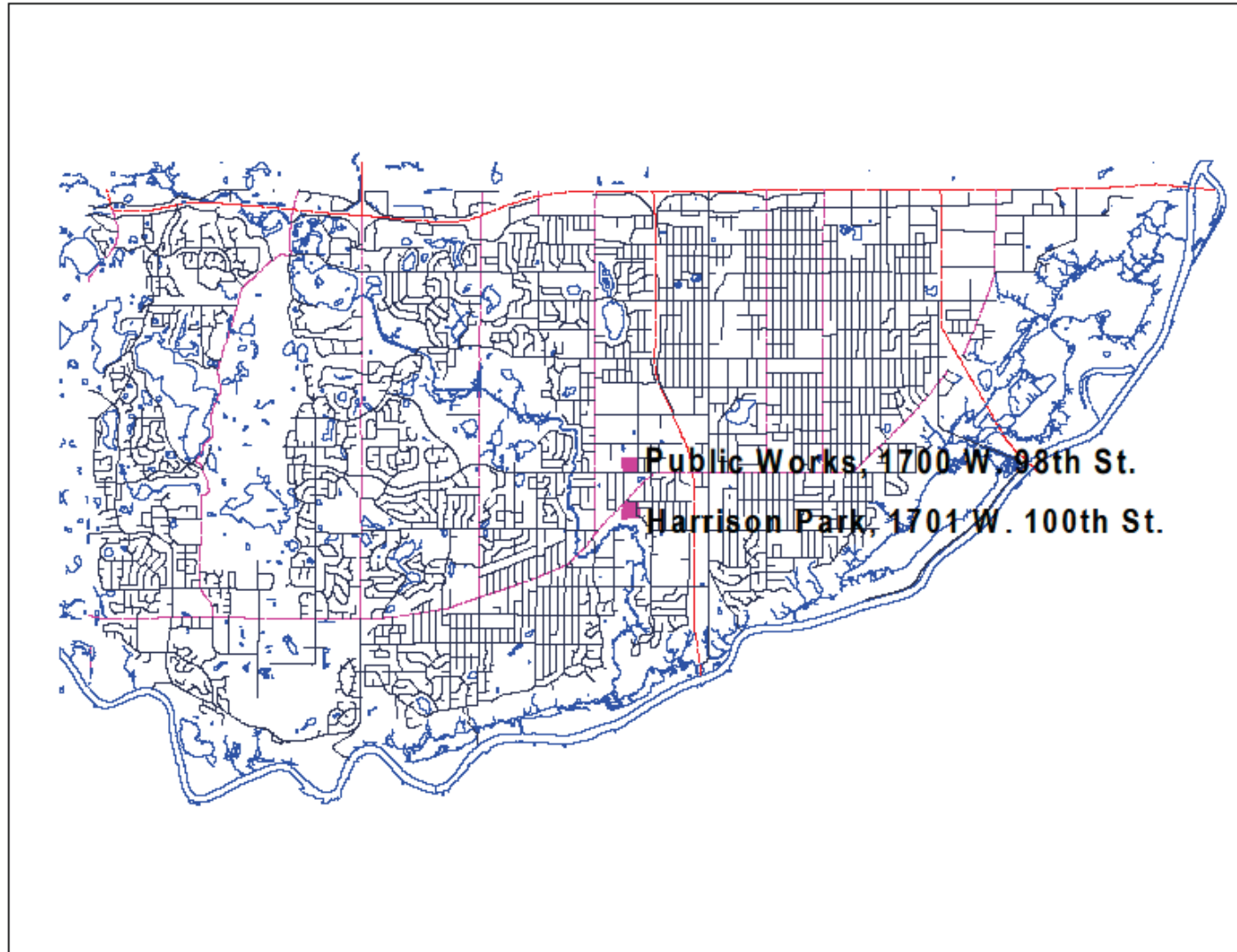
WHAT WE BUILT: PERVIOUS CONCRETE PUBLIC WORKS, JAMES AVE. EAST LOT, 2010

James
Ave. S.

W. 98th St.



CITY OF BLOOMINGTON: PROJECT LOCATIONS



WHY PERVIOUS PAVEMENTS INSTEAD OF CONVENTIONAL PAVEMENTS?

- Aging, failed pavements
- Drainage problems
- Erosion concerns
- Non-degradation goals (MS4 Permit)
 - Increased Infiltration
 - Reduce peak runoff
 - Reduce stormwater pollution
- Direct runoff to Nine Mile Creek
- Sustainable Bloomington commitment
- Education of City employees, citizens, developers, etc.
- Close proximity to monitor performance

HARRISON PARK: DESIGN & CONSTRUCTION

- Soil boring, sand (SP) down to 11'
- Sized for 2" runoff from contributing area (1.75ac)
- 5% grade, benched sub-grade at 1' contours



HARRISON PARK: DESIGN & CONSTRUCTION

- Subgrade compaction, use tracked equipment
- Granite recharge bed, higher cost, \$31/ton
- Non-woven fabric



HARRISON PARK: DESIGN & CONSTRUCTION

- Redi-mix trucks, no problems on crushed granite
- Choker course, fine grading, some pickup and rutting
- Used front-end loader to feed paver



HARRISON PARK: DESIGN & CONSTRUCTION

- Pervious pavement paving is exciting!
- Tried several compaction techniques, let it cool
- Two passes with steel drum, roller marks



HARRISON PARK: DESIGN & CONSTRUCTION

- Two raingardens
- Wet plant species – Accepts runoff from neighboring apartment parking lot & overflow from Park
- Drought tolerant – Parking lot median



HARRISON PARK: DESIGN & CONSTRUCTION

- More care during plant & turf restoration
- Protect pavement with tarps, fabric or plywood
- Construction phasing



HARRISON PARK: MAINTENANCE

- Fall and Spring – Sweep with regenerative air sweeper
 - Contracted for first two seasons
 - City purchased regenerative air sweeper in 2010
 - Leaf blowers work to get debris in corners & tight spots
 - City sweeps streets twice annually, pick up Pelicans with curb brooms, followed by regenerative air sweeper



HARRISON PARK: MAINTENANCE

- Winter – Plow only, alternating yearly plowing only one half of lot, with 1 ton plow truck. Access drive is salted and sanded at entrance.
- Summer – Pick up trash & debris, refuse container is serviced with 1 ton truck. Mower discharge away from pavement.



HARRISON PARK: MAINTENANCE/OBSERVATIONS

- In-house training of Maintenance Crews
- Seasonal observation/monitoring
 - Winter for ice, plow damage, solar de-icing
 - Spring for refreeze and plow damage
 - Summer, during rain events and raingarden weeding
 - Fall, leaf debris, weeding and sweeping review
 - Low volume and light vehicles, little damage or distress



HARRISON PARK: OBSERVATIONS

- Refreeze, spring thaw, March 26, 2009
- Note some plow abrasion on pervious lot



Pervious Pavement

Regular Pavement



HARRISON PARK: OBSERVATIONS

- Rain event, August 19, 2009
- >1" in 15 minutes peak intensity



Pervious Pavement

Regular Pavement



HARRISON PARK: OBSERVATIONS

- Rain event, August 19, 2009
- >1" in 15 minutes peak intensity



Impervious access driveway
onto pervious parking lot

Shared raingarden full from
neighboring apartment parking lot



HARRISON PARK: OBSERVATIONS

- Rain event, October 6, 2009
- 1.4" for the day, no intensity data



Surface plugging from impervious driveway pavement runoff

HARRISON PARK: OBSERVATIONS

- Rain event, May 13, 2010
- 0.60" rain



Similar surface plugging from
impervious driveway pavement runoff

Good performing pervious pavement,
"matte" texture



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Sandy soil, no soil boring, staff experience
- 0.25 ac contributing area, match existing lot
- 5% grade, benched subgrade at 1' contours
- Safety, ice from roof runoff and irregular pavement



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Displaced, inconvenienced & concerned employees
- Subgrade compaction
- Non-woven fabric



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Crushed limestone, locally sourced , high quality, \$27/ton
- No choker course; some rutting, but fixable
- Tight quarters



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Redi-mix Assoc. certifications for pervious concrete
- Planned test panel, but time was getting tight
- Mix design, testing were a little unknown
- Very stiff mix: mix design, 2" slump, 0.30 w/c ratio, aggregate size 3/8" to #8, pervious admixture



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Roller screed on forms, hand finished edges
- Four passes, on two consecutive days
- Minimal hand work, preserve surface voids



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Tooled joints @ 40'
- Used skid loader to haul on last pass, rutting
- Seven days wet cured



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Thin clear poly under coated burlap curing blankets, Burlene, preserves surface w/c ratio
- Saturated curing blankets on-site
- Secured with rebar, problems w/ windy conditions



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Saw cut @ 10', approved isolation joint spacing plan
- Wet saw creates slurry, washed off surface



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Raingarden sized to fit existing turf area, not sized for runoff volume
- Saved a nice shade tree
- Worked around existing gas and fiber optic



PUBLIC WORKS EMPLOYEE PARKING LOT: DESIGN & CONSTRUCTION

- Raingarden and overflow to ex. storm sewer for roof drains
- 0.35 ac contributing area, roof drains



PUBLIC WORKS EMPLOYEE PARKING LOT: MAINTENANCE

- Fall and Spring – Sweep with regenerative air sweeper
- Winter
 - Plowing with rotary broom, reduced damage, but inefficient in bigger snow events as occurred in 2010/11
 - Switched to conventional plows in 2011/12
 - No sanding or granular salt
 - Brine solution used when icy, not effective for pretreatment or residual effect
- Summer – Avoid contamination during landscaping projects, mowing, etc.

PUBLIC WORKS EMPLOYEE PARKING LOT: OBSERVATIONS

- It drains, some clogging of surface from grit off impervious surfaces



PUBLIC WORKS EMPLOYEE PARKING LOT: OBSERVATIONS

- Estimated 90% reduction in annual runoff for entire project, 0.6 acres total project area



PUBLIC WORKS EMPLOYEE PARKING LOT: OBSERVATIONS

- ◉ November 30, 2010 – Extremely icy, temperature drop during AM caused freezing of precipitation on the surface of pervious concrete, but regular pavements stayed wet. Brine truck to the rescue.



PUBLIC WORKS EMPLOYEE PARKING LOT: OBSERVATIONS

- Spalling at tooled and hand finished edges
 - Early salt application or increased w/c ratio?
 - <1" deep, 2-3" wide
 - Patching or ?



PERVIOUS PAVEMENT: EDUCATION

- Nine Mile Creek Watershed District Annual Tour
- Minnesota Association of Watershed Districts Tour
- Bloomington Website
- Bloomington Cable TV
- Briefing Newspaper
- Bloomington Home Improvement Fair

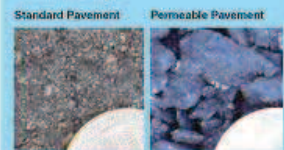


PERVIOUS PAVEMENT: EDUCATION

○ Harrison Park Interpretive Sign, on-site and events

What is a Permeable (Porous) Pavement Parking Lot?

Porous pavement has a pavement surface that allows rainwater to seep into a stone reservoir underneath. The reservoir temporarily stores the surface runoff before infiltrating it into the subsoil. Porous pavement is manufactured without the "fine" materials and incorporates void spaces that allow for infiltration. See example at right.



What are the Benefits of this Permeable Pavement Lot?

- Improved water quality.
- Reduced quantity of stormwater runoff.
- Reduced flash flooding.
- Less impervious land coverage.
- Retention, filtration and cooling of stormwater.
- Minimized erosion.
- Increased Creek base flows during low flow periods.
- Binding of heavy metals and toxins that come off the parking lot.

Does a Permeable Pavement Work?

To test the absorption of the Harrison Park parking lot, Public Works staff poured 250 gallons of water onto the surface. In a matter of seconds, the pavement sucked up the water like a sponge.

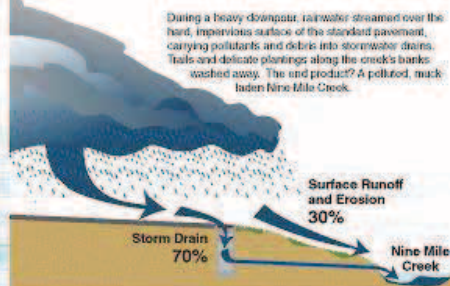


Harrison Park Reducing Stormwater Pollution by 90 Percent

Before

Standard Pavement

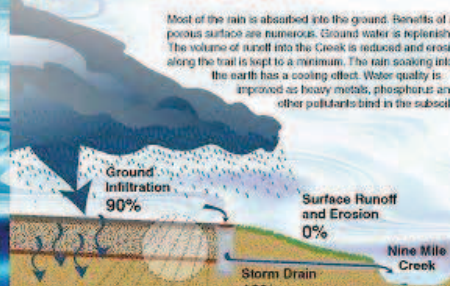
During a heavy downpour, rainwater streamed over the hard, impervious surface of the standard pavement, carrying pollutants and debris into stormwater drains. Trails and delicate plantings along the creek's banks washed away. The end product? A polluted, mud-laden Nine Mile Creek.



Now

Permeable Pavement

Most of the rain is absorbed into the ground. Benefits of a porous surface are numerous. Ground water is replenished. The volume of runoff into the Creek is reduced and erosion along the trail is kept to a minimum. The rain soaking into the earth has a cooling effect. Water quality is improved as heavy metals, phosphorus and other pollutants bind in the subsoil.



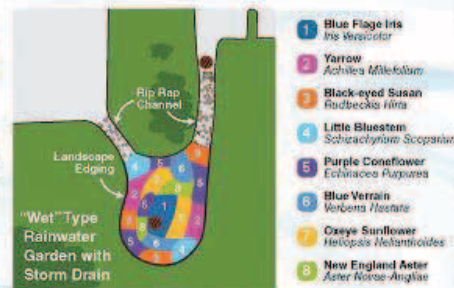
Porous Asphalt Pavement

- 3" Open-grade asphalt - Allows stormwater to flow through to the stone recharge bed.
- 2" Filter course - Single sized, crushed granite aggregate (80%) stabilizes surface for paving.
- 18" 24" Stone reservoir bed - Large, single sized, crushed stone with 40% voids stores stormwater for infiltration.
- 2" Filter course.
- Non-woven geotextile - Protects stone recharge bed.
- Uncompacted, sandy subsoil.

Rainwater Garden Cross-Section



Rainwater gardens are supposed to catch and contain stormwater runoff. Since flowing water causes erosion which will wash out mulch, it is important to protect the inlet and outlet to the garden. Rocks and riprap will slow and reduce the force of the rainwater.



"Dry" Type Rainwater Garden in Parking Median



Why a Rainwater Garden?

A rainwater garden collects runoff from surrounding areas during a rain. It slows the runoff and filters pollutants before they enter water bodies. These shallow pools are filled with plants that can tolerate an occasional drenching and moist conditions.



During a storm the rain gathers in this "wet" type rainwater garden. See example at center left.



Designed to absorb water, the garden should filter most of the water into the soil within 24 hours.



Even during a dry spell, a rainwater garden is an attractive addition to the landscape.



"Dry" type gardens are used in parking medians that do not get as much rainwater. See example at left.

HARRISON PARK: FLUSH TESTS!



250 gallons on pervious asphalt, September 2008

HARRISON PARK: FLUSH TESTS!



250 gallons on impervious asphalt draining onto
pervious asphalt, September 2008

PERVIOUS PAVEMENT: SUSTAINABILITY



Bloomington Today, Cable TV News, Fall 2011



QUESTIONS ???

Contact info:

City website:

www.ci.bloomington.mn.us

Steve Segar, PE

Ph. 952-563-4533

Email: ssegar@ci.bloomington.mn.us

Scott Anderson, PE,

Ph. 952-563-4867

Email: smanderson@ci.bloomington.mn.us

City of Bloomington, Engineering Division

1700 W. 98th St.

Bloomington, MN 55431