



Use of Pervious Concrete as an Open Graded Drainage Layer in Pavement Structures

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Introduction

- Changing environmental conditions are causing storm events with larger volumes of precipitation than in past
- Drainage is a key factor in performance of rigid and flexible pavement
- Aspects of drainage:
 - Surface crossfall
 - Urban or rural cross-section and associated drainage systems
- Impermeable pavements typically have impermeable surface with < 8 % voids, and base and subbase layers without excess fines
- Open Graded Drainage Layers (OGDL) can be included between impermeable surface and granular base

Open Graded Drainage Layer

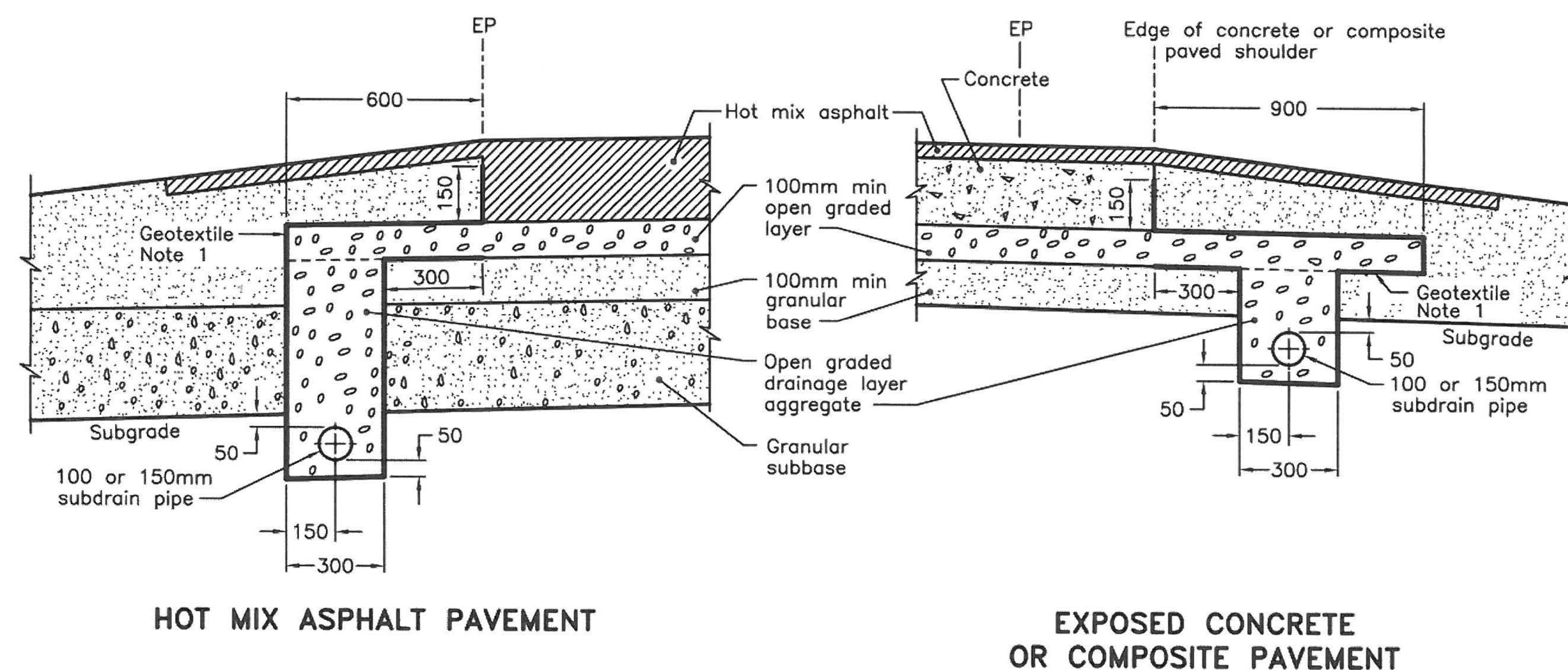
- Open Graded Drainage Layer (OGDL) requires sufficient void content (25 to 50 %), porosity and crossfall to drain through connected voids (pores)
- Applicable for municipal and provincial applications, urban or rural, various traffic levels
- Current material alternatives for OGDL: Unbound granular material, asphalt stabilization, cement stabilization
- OGDL is typically 100 mm thick (OPSD 207.041).

Objectives

- Drainage of water that infiltrates pavement surface layers
- Support of pavement surface layers

Challenges

- Outlets along edge of pavement must be well constructed and maintained
- Portion of surface voids of OGDL are typically filled when a concrete pavement surface is used
- Improperly designed, constructed and maintained OGDL can trap moisture causing poor performance



Open Graded Drainage Layer Alternatives

Unbound Granular OGDL

- Poor construction platform due to lack of stability
- Poor support capacity can cause pavement performance problems
- Performs less consistently than stabilized OGDL (greater presence and fluctuation of moisture)

Asphalt Stabilized OGDL

- Contains 1.8 to 3 % Asphalt Cement (AC)
- Can be a poor construction platform as surface may deform
- Durability can be lost due to moisture damage
- Development of deformation leads to inconsistent support and premature distresses

Cement Stabilized OGDL

- Provides rigid surface for construction and even support for overlying pavement structure
- Requires curing period for sufficient strength gain of cement (MTO requires a minimum of 48 hours)

Pervious Concrete

- High void content concrete material (15 % to 25 %)
- Surface layer over reservoir storage base layer
- Pavement and stormwater infrastructure
- Maintains natural water cycle in urban landscape
- Low Impact Development

Low Compaction Pervious Concrete (Hydromedia)

- Low Compaction Pervious Concrete (LCPC) addresses observed problems of earlier pervious concrete mix designs in Canada
- High slump for easier placement
- Meets current MTO permeability capacity standards for pervious concrete
- Can meet MTO OGDL requirements for void content



Low Compaction Pervious Concrete for Open Graded Drainage Layer

- Characteristics similar to cement stabilized OGDL
- Utilized at the St. Louis-Lambert International Airport from 1995-1997.
- Hydromedia can meet and exceed ODGL void content and drainage requirements in Ontario
- In comparison to cement stabilized OGDL, Hydromedia offers increased strength and efficient construction
- Increased strength by use of low compaction pervious concrete could reduce pavement structure thickness
- OGDL with low compaction pervious concrete has potential benefits for overall pavement structure and may reduce thickness requirements of other layers
- Void sizes in low compaction pervious concrete can be altered by using different sized aggregate
- With more small voids rather than few large voids, the tendency of surface concrete paste to fill the voids can be decreased
- Reduced risk of poor OGDL performance compared to stabilized OGDL

Future Work

- Evaluate extent of reduction in voids filled with surface concrete when size of voids is decreased
- Evaluate potential to reduce pavement structure layer thicknesses when pervious concrete is used as OGDL
- Cost comparison of OGDL alternatives including pervious concrete

Summary

- OGDL can improve pavement performance with proper design and construction
- Low compaction pervious concrete can address current challenges in using OGDL such as:
 - Consistency and ease of placement
 - Effective construction platform
- Additional strength for pavement structure

References

OPSS 320 Construction Specification for Open Graded Drainage Layer

Henderson, V. (2012). *Evaluation of the Performance of Pervious Concrete Pavement in Canada*. Waterloo, Ontario: Department of Civil and Environmental Engineering, University of Waterloo