

PERFORMANCE COMPARISON OF ABUTMENT AND RETAINING WALL DRAINAGE SYSTEMS

BACKGROUND

Control of water infiltration and providing adequate drainage are critical to the performance of retaining walls and abutment walls. Current Ohio Department of Transportation (ODOT) practice for drainage of structures specifies the use of a two-foot porous backfill with filter fabric. ODOT is seeking alternative drainage systems that are more cost- and time-effective, durable, and at the same time, have comparable or superior drainage capability compared to the current practice.

RESEARCH CONTEXT

A prefabricated composite drainage system (PCDS) is proposed as an alternative drainage method for bridge abutments and retaining walls. The goal of this study is to 1) compare the performance and cost of PCDS and traditional drainage system and 2) develop specifications for PCDS as structure drains.



VS



	Prefabricated Composite Drainage System (PCDS)	Two feet porous backfill with filter fabric
PROCEDURE	Streamlined, straightforward, installed before backfilling	Staged, cumbersome, installed with backfilling
MATERIAL	Lightweight, requires less storage space	Heavy weight, requires more storage space
QA/QC	Easy to control	Hard to control
LABOR	Less labor intensive	More labor intensive
TIME	Less time	More time
COST	Very cost effective	Less cost effective
PERFORMANCE	Good	Good
CONTRACTORS' VIEW	More advocative	Less advocative

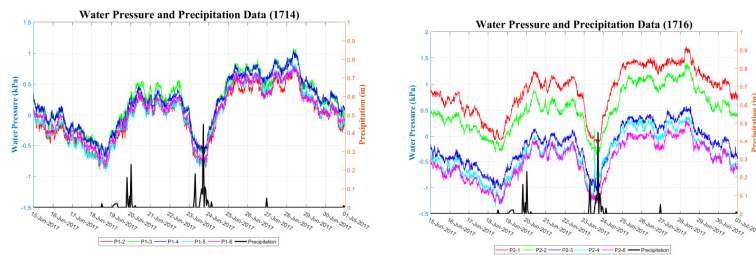
**COST SAVING:
40%**



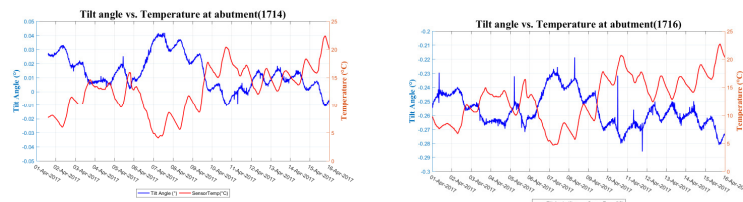
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RESEARCH APPROACH

- State Wide Survey and Literature Review on State of Practice of Structure Drainage Systems
- Laboratory Testing of Select PCDS Products
- Field Evaluation of Installation and Performance of Structure Drainage Systems
- Cost Analysis and Comparison
- Specification Development for PCDS



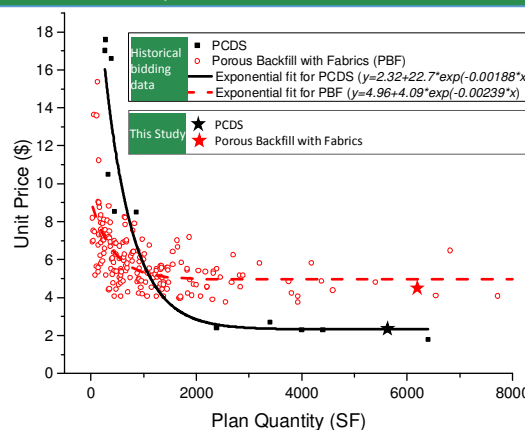
The pore water pressure in the backfill was maintained at low levels with both drainage systems. (Left: with PCDS; Right: with Porous Backfill)



The very limited tilt of the abutments correlates very well to the temperature and was mainly caused by the thermal expansion of the steel bridge deck (Left: with PCDS; Right: with Porous Backfill)

Historical bidding data revealed that for large plan quantities (>1,000 SF), PCDS is more cost effective than the porous backfill system.

In the current study, it is found that adoption of PCDS resulted in a cost saving of more than 40%.



KEY FINDINGS

- Currently specified drainage system works satisfactorily in general; but contractors generally advocate the adoption of PCDS;
- 21 state DOTs specified PCDS as structural drains; a wide variety of commercial PCDS products are available;
- It is found that tested values for some properties of some products didn't match the manufacturer listed values. Recommendations on the selection of proper standard testing methods and suggestions on the selection of factor of safety in design are discussed;
- Field observation and feedback from the contractor reveal that installation of PCDS systems are less labor intensive and more time effective;
- Field performance of two drainage systems are evaluated with *in situ* instruments including piezometers, tiltmeters and flumes. The data analysis suggests that the PCDS have comparable drainage capability to the traditional system;
- Cost analysis from the ODOT historical bidding data and the actual cost at the tested sites demonstrates that PCDS costs 40% less than the traditional process;
- Based on the findings, draft specifications were developed to specify the material and construction requirements for PCDS.