DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Sustainable Mitigation of Storm Water Runoff Through Fully Permeable

Develop a program to identify and address pedestrian safety problems in California, with the goal of reducing pedestrian fatalities and injuries.

Environmental

MAY 2019

Project Title:
Sustainable Mitigation of Storm Water Runoff Through Fully Permeable Pavement

Task Number: 2982

Start Date: April 1, 2016

Completion Date: December 25, 2017

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WHAT IS THE NEED?

A preliminary catalogue-type design procedure based on region (rainfall), storm event design period, design, traffic, design truck speed, surfacing (HMA or PCC), subbase type, and the shear stress-to-shear strength ratio at the top of the subgrade has been developed by the University of California Pavement Research Center (UCPRC) for preliminary design of fully permeable pavement test sections in California.
The main objective of this research is to validate and calibrate the structural design of fully permeable pavement design for sustainable storm water management and best management practice (BMP) to provide low-impact infrastructure and efficient system operation. The pavement structure will be designed to serve as a reservoir to store water during storms periods to minimize storm water runoff. Rigid (concrete) and flexible (asphalt concrete) fully permeable pavement options are considered.

WHAT WAS OUR GOAL?

This study will help incorporate a fully permeable pavement design method for pavement use, mitigate storm water runoff and provide a green construction alternative.

WHAT DID WE DO?

The scope of the work was focused on the various tasks:

- Literature review was conducted to study the design approach for the fully permeable pavement.
- Soil exploration was conducted to determine permeability and other properties of the subgrade soil.
- Based on the permeability of subgrade, traffic, design storm event, no of lanes, and traffic speed, the fully permeable

pavement for the asphalt and concrete section was designed.
- The test section was built with instrumentation such as load cells and strain gages.
- The traffic volume count was conducted.
- The data was collected from the test sections and analyzed.
- The final report has been drafted.

WHAT WAS THE OUTCOME?

Key observations from the research include:
- The collected data has revealed that there is a significant difference in the performance of the asphalt and concrete test sections.
- The asphalt test section data results show that high readings of vertical pressure on the top of subgrade was recorded when compared with concrete section.
- The vertical strain in the transverse direction at the bottom of the asphalt surface section was recorded and is high compared to the concrete surface test section.
- The vertical strain in transverse direction at the bottom of the concrete surface section was low when compared to the vertical strain in longitudinal direction.
- As the time lapsed, distresses on the pavement were observed. Raveling and longitudinal cracking distress were observed on the concrete test section.
- Improper practice lead to surface depression and failure of a longitudinal strain gage in the asphalt section.
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The test sections (asphalt and concrete pavements) exhibited a satisfactory performance in terms of distresses. Both the test sections performed well in infiltrating the stormwater where 2017, was considered one of the wettest year in California.

WHAT IS THE BENEFIT?

The collected data will be analyzed and used to evaluate the performance of the fully permeable pavement. The results will be used to validate and calibrate the structural design procedure proposed by the UCPRC for the fully permeable pavements that can withstand high speed and truck traffic on roads. These pavements will provide sustainable storm water mitigation, best management practice (BMP), minimize the adverse effects of storm water runoff.

LEARN MORE

https://ncst.ucdavis.edu/project/sustainable-mitigation-of-stormwater-runoff-through-fully-permeable-pavement/

IMAGES

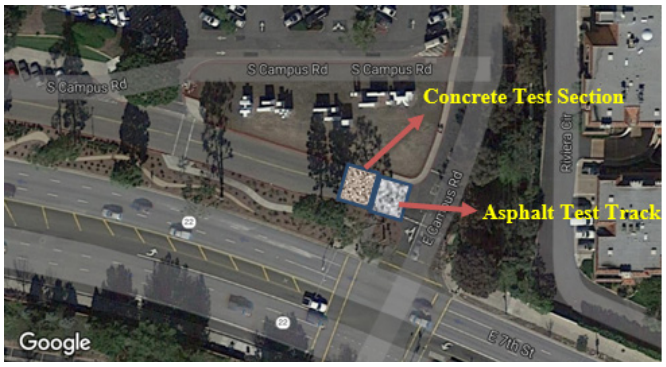

Figure 1: Aerial view of test sections

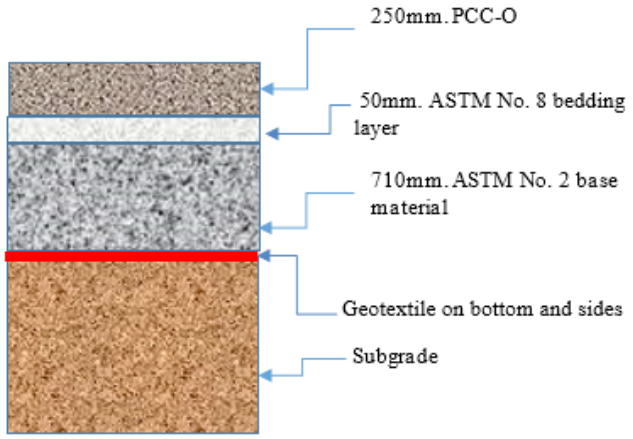

Figure 2: Concrete Test Section Design

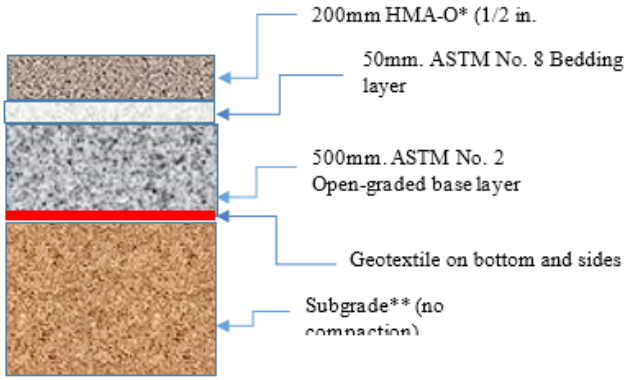

FIgure 3: Asphalt Test Section Design

Figure 4: Comparison of conventional (left) and fully permeable asphalt pavement (right).

Figure 5: Fully permeable concrete pavement