

FY 2010 RESEARCH PROBLEM STATEMENT

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TITLE ([more info](#))

The Uptake of Metals from Highway Runoff in Pervious Concrete

PROBLEM (Description of need) ([more info](#))

Stormwater quantity and stormwater quality control are two important issues that need to be addressed in roadway and ancillary transportation facility design. One novel material that is being investigated for stormwater quantity control is pervious concrete. There is still substantial amounts of research and development needed before pervious concrete will be accepted as a roadway surface on major roadways especially with respect to strength and durability under frequent loading. However, with the current state of knowledge, pervious concrete could readily be adapted for use on roadway shoulders for stormwater quantity control. It serves two purposes, providing a strong, non-erodible surface on the side of the highway while simultaneously acting as the major stormwater quantity control best management practice (BMP). In fact, due to the distributed infiltration of stormwater that pervious concrete provides, it is considered to be a Low Impact Development (LID) BMP. Current regulations are also requiring that stormwater quality control be provided for highway runoff. It is widely accepted that pervious concrete will provide quality control with respect to suspended solids and will also prevent contaminants from entering the waterways and storm sewers by the natural attenuation in the ground after infiltration. However, the long-term uptake of metals in these shoulder systems is still not known and metals are considered to be a major category of contaminants in highway runoff.

PROPOSED RESEARCH, DEVELOPMENT OR TECHNOLOGY TRANSFER ACTIVITY ([more info](#))

It is anticipated that pervious concrete systems will retain a significant portion of the metals found in runoff from vehicular and other uses through sorption to particulate matter on, within and below the pavement as has been found to occur in studies on porous asphalt and other permeable pavements. Pervious concrete should also have the capacity of filtering out metals associated with runoff solids, similar to other pervious pavement systems. In addition, it is anticipated that metals in the dissolved phase will sorb to the pervious concrete surfaces, unlike the results from studies on organic asphalt pavement systems. Thus the pervious concrete itself may facilitate metal removal from runoff. These predictions are based on a set of adsorption data developed for certain pervious concrete pavers and also on aqueous chemistry results in the water/wastewater research fields which show that dissolved metal ions tend to form complexes in water systems with higher pHs and may even precipitate out as solids. Of particular note is the fact that pervious concrete acts as a natural buffer, keeping the pH range above neutral. This research will investigate the ability of pervious concrete to remove sediments, metals associated with sediment and soluble metals typical in stormwater runoff (copper, cadmium, lead and zinc). Both batch equilibrium data and continuous flow data will be collected in a laboratory environment. The continuous flow experiments will simulate years of typical runoff loadings, providing information on uptake rates, exfiltrate concentrations and long-term loading. The batch experiments can be used to provide equilibrium partitioning information, which can be used to estimate maximum loadings and service lives under extreme conditions.

BENEFITS ([more info](#))

Providing designers and regulators with information on the metal sorptive capabilities of pervious concrete should facilitate its widespread acceptance as a roadway shoulder surface, serving as a LID practice controlling not only stormwater runoff quantities, but also stormwater runoff quality. This information may also be helpful in estimating the stormwater pollutant removal efficacy of other concrete uses, such as recycled concrete aggregate for roadway bases.

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