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New Jersey Department of Transportation Bureau of Research

Research at a Glance

Technical Brief

BUREAU OF RESEARCH

Evaluation of Coefficients Related to Runoff from Roadway Projects

This project evaluated the runoff curve numbers of four land treatments (gravel, vegetation, porous hot mix asphalt (HMA), and bare soil) associated with hydrologic soil groups A, B, C, and D for roadway projects.

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Research Problem Statement

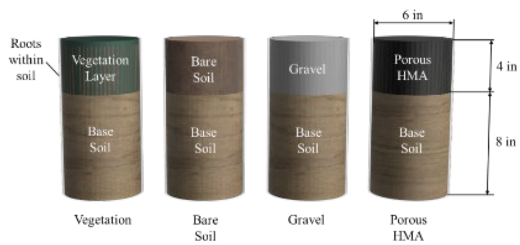
Transportation agencies are required to assess and mitigate the stormwater runoff impacts of certain roadway projects. An agency may need to reconstruct unpaved areas within the Right of Way (ROW), median, and/or under guiderails in roadway projects by applying land treatments. Surface materials that have recently been utilized by New Jersey Department of Transportation (NJDOT) under and adjacent to guiderails include gravel, vegetation, porous hot mix asphalt (HMA), and bare soil with polyester matting. To current methods for runoff calculation, these materials along with their in-situ configurations are new and unique. A widely accepted method for runoff calculation is the National Resources Conservation Service (NRCS) Method. It is based upon applying a Curve Number (CN) to the NRCS function to determine the portion of rainfall that would become runoff. However, existing curve numbers are insufficient for representing new or unique land treatments utilized in roadway design. Therefore, there is a need to obtain the curve numbers for these new or unique land treatments at roadway projects.

Research Objectives

The objective of this research project was to develop new curve numbers for four land treatments, bare soil, gravel, vegetation, and porous HMA, on top of subsoils with a series of hydraulic conductivities, typical of NJDOT highway projects.

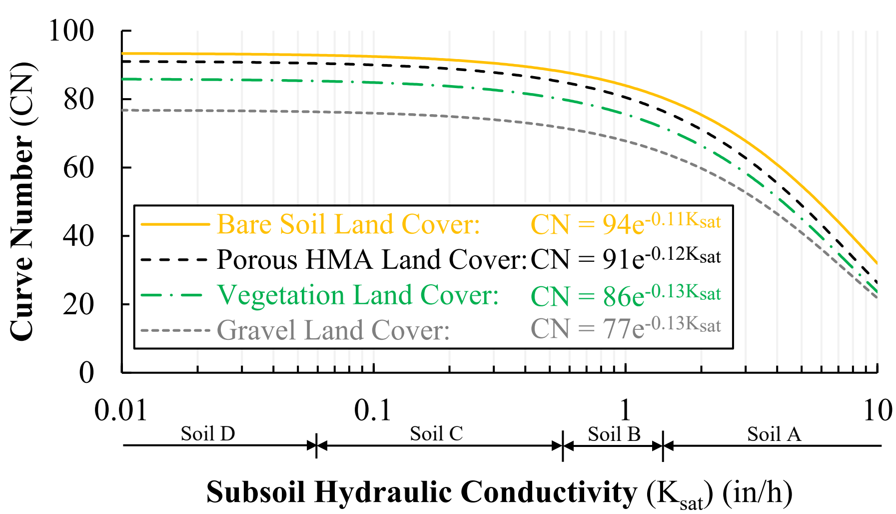
Methodology

Measurements of rainfall and runoff were conducted in the laboratory for the four land treatments (i.e., gravel, vegetation, porous HMA, and bare soil). The NJDOT construction specifications for the land treatments were followed in the design of laboratory setup. Each land treatment was tested in a composite column, where the treatment was installed on top of specific subsoils with ten different hydraulic conductivities. Rainfall, infiltration, and runoff were measured, and regression analyses were conducted to quantify CNs for the four land treatments under laboratory conditions. Laboratory derived CNs were then applied to NJDOT field conditions.



Results

Regression curves and equations for the relationships between CN and saturated hydraulic conductivity of subsoil (K_s) for bare soil, gravel, vegetation, and porous HMA land treatments were established (for depth to groundwater table larger than 40 inches). CNs of bare soil and vegetation agreed well with existing values. CNs of gravel were significantly smaller than existing values, that is, the gravel land treatment would be able to reduce runoff more than expected. CNs of porous HMA is a land treatment for which established values were not available. The CNs developed during this project can be used to predict quantity of runoff from these four land treatments on top of subsoils of any given hydraulic conductivities for any given storm events.



Research Project Manager

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This brief summarizes FHWA-NJ-2023-004, "Evaluation of Coefficients Related to Runoff from Roadway Projects", produced through the New Jersey Department of Transportation Bureau of Research, 1035 Parkway Avenue, P.O. Box 600, Ewing, NJ 08625 in cooperation with the U.S. Department of Transportation Federal Highway Administration.