National Cooperative Highway Research Program

RESEARCH RESULTS DIGEST

September 1999—Number 243

Subject Area: IIB Pavement Design, Management and Performance

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Proposed Design Guidelines for Reducing Hydroplaning on New and Rehabilitated Pavements

This digest summarizes proposed design guidelines for reducing hydroplaning on new and rehabilitated pavements developed in NCHRP Project 1-29, "Improved Surface Drainage of Pavements." This digest was prepared by R. Scott Huebner, David A. Anderson, and John C. Warner of the Pennsylvania Transportation Institute. The complete project report is available as NCHRP Web Document 16 at Internet address http://www4.nas.edu/trb/crp.nsf (click on Web Documents).

SUMMARY

The intent of this document is to provide guidance for the selection and application of pavement and roadway design considerations that can be used to minimize the potential for hydroplaning. These proposed design guidelines, as presented in this document, focus on measures that can be used to reduce the potential for hydroplaning on a roadway surface. The speed at which hydroplaning occurs is a function of a number of factors. The one factor that can be controlled through pavement design is water film thickness. Other factors, such as tire pressure, tread depth, and rainfall intensity are clearly not within the control of designers but also affect hydroplaning potential. In this study, and in the PAVDRN computer program, tread depth was assumed to be 3/32 in. (2.38 mm) and tire pressure was assumed to be 24.0 psi (16.75 kPa). These values were selected because the data that were available to the authors for extending the range of the hydroplaning algorithm used in PAVDRN were also based on these assumptions. *(1)* These values are fixed within the PAVDRN program. *(2)* As a consequence, the hydroplaning speeds produced by PAVDRN and given in this report tend to be conservative.

Water film thickness on highway pavements can be controlled through the design process in four fundamental ways: controlling the geometry of the pavement to reduce the distance that the water must flow before it exits the pavement surface, increasing the surface texture depth to reduce the effective water film thickness, removing water from the pavement's surface through appurtenances located within or at the edge of the pavement surface, and providing internal drainage by using surface mixtures such as porous asphalt.

Four key areas need to be considered in order to analyze and eventually minimize the potential for hydroplaning. These areas are environmental conditions, properties of the pavement surface, geometry of the roadway surface, and the use of drainage appurtenances.

Each of these areas and its influence on the resulting hydroplaning speed of the designed section is discussed in detail later in this document.

The *environmental conditions* considered in the proposed design guidelines are rainfall intensity and water temperature. It is water temperature that determines the kinematic viscosity of the water and affects depth of flow. *Pavement surface properties* include surface characteristics such as the texture of the pavement surface and tining and grooving of portland cement concrete (PCC) surfaces. Additionally, the use of permeable pavement surfaces (porous asphalt) can dramatically reduce hydroplaning potential.

Five geometric design sections, one for each of the basic geometric configurations used in