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Pavement Surface Characteristics as Influenced by Material Properties

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Abstract

Skid resistance is the most important property of pavement surface that must be taken into consideration in the design of roads and should be adequate to resist skidding of vehicles to ensure the safety of human life and economic.

The aim of the study is to investigate the effects of several variables: aggregate maximum size (1", ¾",and ½"), mix ratio(1:1.5:3, 1:2:4, and 1:3:6), finishing conditions (rough and smooth),water to cement ratio (0.65, 0.55, and 0.45) and surface conditions (wet and dry) on the skid resistance of rigid pavement and the effects of aggregate maximum size (1",¾",and ½"), asphalt content (4.1,4.7,5.3,and 6), gradation limit(fine gradation, intermediate gradation, and coarse gradation), and surface conditions (wet and dry) of flexible pavement, and then to control the variables in the design and construction phases of highway in order to obtain the best possible of pavement performance.

The British Pundume Tester (ASTM E303) and the Volumetric Method (Sand Patch) (ASTM E965) are the main tests for the skid resistance in addition to fundamental tests such Marshall, Compressive Strength, Tensile Strength, and Modulus of Elasticity, in order to examine the properties of the mixture for concrete and asphalt surface. Although, from safety point; it is negative to increase skid resistance but this increasing lead to increasing of tire wearing and levels of noise.

Three cases of flexible and rigid pavements are selected to investigate the effects of several variables (speed, traffic volume, density and texture depth) on the noise level, using Statistical Passby (SPB) and Controlled Passby (CPB). Sound level pressure has been increased by 104% for increased in traffic volume from 1400 to 1868 veh/hr, 119% and 117% for increased in vehicle speed on rigid pavement and flexible pavement respectively from 20 km/hr to 50 km/hr and 105% for increased in texture depth of pavement.

The skid resistance (F60) has been increased by 103% for increased in aggregate maximum size from ½" to ¾",112% for replace the mix ratio from 1:1.5:3 to 1:2:4 and 115% for replace the smooth to rough as concrete finishing conditions and decreases the water/cement ratio from 0.55 to 0.45 has increased the skid resistance (F60) by 122% ; while for flexible pavement the skid resistance (F60) has been increased by 118% for increased in aggregate maximum size from ½" to ¾", asphalt content of paving mixtures from 4.7% to 5.3% causes an decreased skid resistance by 93% and the skid resistance increases using coarse gradation.

From the experimental work, it was found that; the variable that more control on the skid resistance of flexible pavement is maximum aggregate size. The variables that more control on the skid resistance of rigid pavement is mix ratio, water/cement ratio and finishing conditions.

A regression equation has been obtained to predict the Friction Number (F60) as related to aggregate maximum size, mix ratio, finishing conditions, and water to cement ratio of rigid pavement and the effects of aggregate maximum size, asphalt content, and gradation of flexible pavement.