C30 The Characterization of Binary-Output Walkway-Safety Tribometric Instruments by Characteristic Functions: Part 2

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Attending this presentation, attendees will learn how to characterize the performance of a generally used tribometer, viz., the PIAST

Pedestrian/walkway accidents are the second largest generator (after vehicle accidents) of direct, morbidity, and mortality costs. They are the single greatest cause of accidental deaths among the elderly. There is a significant amount of litigation that revolves around fall accidents. Slip-precipitated accidents arguably constitute the largest generator of pedestrian/walkway accidents. The impact of this paper will be to give insight into the characterization of walkway-safety tribometers. This is important to the forensic community because the measurement of pedestrian friction is a complex matter, and the better an engineer or scientist's understanding of the measuring process, the more likely that obtained results will hold up to critical scrutiny.

At the 2004 American Academy of Forensic Sciences meeting, the authors presented a paper entitled, "The Characterization of Binary-Output Walkway-Safety Tribometric Instruments by characteristic functions." This work expands upon that base. To briefly recap that paper, the authors discussed the development of a low-friction, weighted sled, based upon a roller-bearing-equipped machine-tool carriage slide, to serve as a highly repeatable 'test surface. To this test sled was connected a set of weights, which simulated the lateral force present in a friction situation. A Slip Test Portable Inclinable Articulated Strut Tribometer (PIAST) was operated using the weighted sled to define the characteristics of the tribometer (actually, the operating characteristics of the tribometer, test-sled acting in concert). This was accomplished by repeatedly operating the tribometer at a given setting and recording the number of times (out of ten) that a slip was observed. The independent variable was whether or not the PIAST's test foot slipped, and logistic regression was utilized to model the test data. This paper expands upon the previous work in two significant directions: (a) the tribometer has been tested using a given test foot (1/4 inch thick Neolite® Test Liner (NTL)) under a wide range of surcharges (the weight attached to the test sled) and (b) using variants of test-foot drop height and test-foot thickness at a constant surcharge. The results are presented below.

(a) Varying the Test-Sled surcharge

It can be seen that in the surcharge regime used in these tests, the PIAST's sensitivity appears to remain roughly constant. This is seen by noting that the slopes of the curves do not vary appreciably as the surcharge is varied.

It can also be seen that the friction-sled itself has little effect upon the testing. This is seen by noting that, with zero surcharges, the probability of a slip at the PIAST's zero setting is 0.6; if there had been no influence, the Probability of a slip at that point would have been 0.5. To obtain a slip Probability of a 0.5, the tribometer's minimum setting (its zero point) was moved to –0.001—a tenth off the PIAST's finest scale division—beyond zero.

(b) Varying the test-foot thickness

Of import here is the fact that the test foot configuration, and not just its composition bears at least a small effect upon the test results. In the idealized (Amontons Coulomb) world that was studied in college physics, friction was hypothesized to be a function of solely of the materials in contact. While that simplification may provide an adequate underpinning for conducting walkway-safety tribometry tests, there are circumstances where the Amontons-Coulomb model may turn out to be an oversimplification. Here using a thicker test foot generated slightly more friction, presumably because the thicker pad was able to absorb more energy due to hysterisis effects.

We will be expanding this work in the future, notably to study other binary-output tribometers.

Reference:

Marpet M and Medoff H, "The characterization of binary-output walkwaysafety tribometric instruments by characteristic functions" in *Proceedings of the American Academy of Forensic Sciences (w003).*

Walkway Safety, Tribometry, Slip Fall

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