

ASSESSMENT OF SOIL EROSION BY SIMULATING RAINFALL ON AN EQUATORIAL ORGANIC SOIL

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Abstract –Soil erosion occurs on construction sites partly due to site clearing that exposes the land to the erosive power of rainfall. A proposed construction project requires the submission of an Environmental Impact Assessment (EIA) to assess the impact of the project on the environment. Assessment of soil erosion is included in the EIA, but the equation to estimate soil erosion known as the Universal Soil Loss Equation (USLE) is only applicable to a soil containing up to four percent organic matter. This limitation of USLE requires an alternative that can predict soil erosion on an organic soil. This study attempts to assess erosion that occurs on an organic soil by simulated rainfall. Field soil samples were reconstructed into three shapes and exposed to simulated rainfall. Results indicate that the amount of organic soil loss decreases with increasing duration of rainfall. Particle size distribution shows that particles with sizes finer than coarse sand (1.7 mm) remained on the slopes. Equations were developed from the graphs of soil loss versus duration of simulated rainfall to estimate soil loss occurring on slopes covered by an organic soil. The outcome of this study can be a precursor to developing an equation to estimate soil erodibility of a slope overlain by an organic soil.

Keywords: Soil erosion, organic soil, simulated rainfall, sediment yield.

1.0 INTRODUCTION

Road construction projects are developing in the country as an infrastructure to connect different places and to spur economic growth. Studies have been conducted on soil erosion occurring on construction sites, such as on highway embankments [1], roadside slopes [2] and soil deposits [3]. Soil erosion occurs on construction sites due to site clearing that exposes the land surface to erosion by rainfall and human activities.

An assessment of soil erosion on a proposed construction project is essential as it is included in the Environmental Impact Assessment (EIA), a legal document that is compulsory to be submitted for approval of the intended project. The provided equation to estimate soil erosion (USLE) is limited to land where the soil has a maximum organic matter content of four percent [4]. An assessment of soil erosion on a construction site with the soil containing more than four percent of organic matter such as an organic soil or peat would bring about errors. Therefore, an equation to estimate soil erosion on an organic soil should be developed. The aim of this study is to investigate the extent of soil erosion occurring on organic soil by simulating rainfall at a laboratory in Universiti Malaysia Sarawak, Malaysia. The scope of this study includes determining the characteristics of collected soil samples, conducting simulated rainfalls on three shapes of soil slopes, analysing the soil samples for particle size distribution, and analysing runoff samples for sediment yield. The assessment of soil erosion conducted on an equatorial organic soil would bring about an understanding of erosion that is occurring on a land that comprises an organic soil. Furthermore, relevant authorities and engineering consultants would be able to assess soil erosion on an organic soil with more accuracy.

Many researchers have designed and constructed different types of rainfall simulators for various objectives such as erosion, infiltration and sediment transport [5]–[7]. Rainfall simulators have several advantages over natural rainfall as the rainfall characteristics can be controlled and repeated at a suitable time [8]. However, rainfall simulators have other shortfalls such as difficulty in reproducing rainfall intensity fluctuations, distribution of drop sizes, and varied values of kinetic energy of raindrops. Without rainfall simulation, the study of soil erosion requires high temporal resolution and long-term