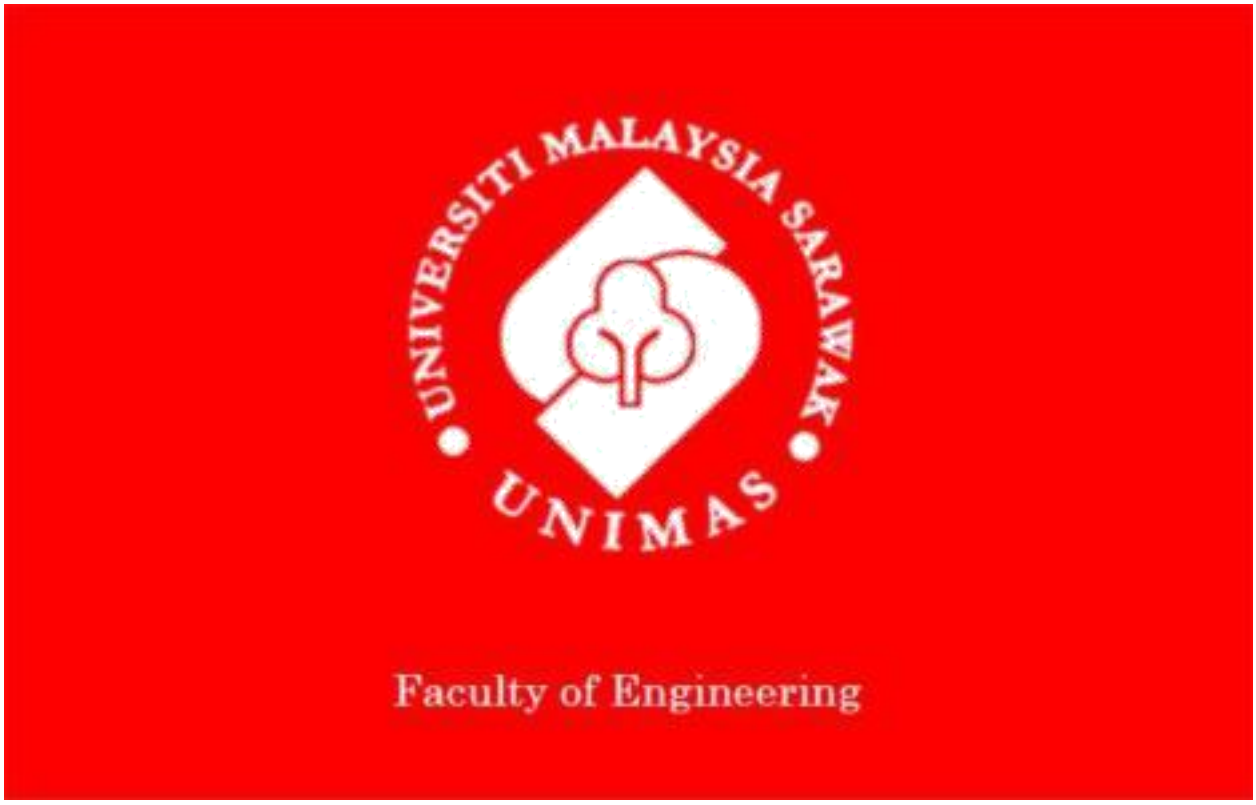

DESIGN OF HORIZONTAL SLOPE PIPE WITH DIFFERENT OPENING SIZES OF GEOTEXTILE

KHUZARINA BINTI MARZUKI

Bachelor of Engineering with Honours

(Civil Engineering)

2017/2018

UNIVERSITI MALAYSIA SARAWAK

Grade: _____

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Final Year Project Report /
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PhD

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DESIGN OF HORIZONTAL SLOPE PIPE WITH DIFFERENT OPENING SIZES OF GEOTEXTILE

KHUZARINA BINTI MARZUKI

A dissertation submitted in partial fulfillment

of the requirement for the degree of

Bachelor of Engineering with Honours

(Civil Engineering)

Faculty of Engineering

Universiti Malaysia Sarawak

2017/2018

To my beloved family and friends

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ABSTRACT

This study evaluates the effectiveness of horizontal slope pipe wrapped with different apparent opening size (AOS) of double-layer geotextile installation in terms of increasing the water discharged and simultaneously reducing the sediment produced. Several studies have been accomplished so far by past researchers regarding the design of drain with various parameters including the use of geotextile as drain envelope in order to improve horizontal slope drainage system. Their studies result in having more water discharged with high sediment produced and vice versa. Four experiments were carried out in this study which are Experiment 1 (AOS Inner and Outer Geotextile = 0.26 mm), Experiment 2 (AOS Inner and Outer Geotextile = 0.19 mm), Experiment 3 (AOS Inner Geotextile = 0.19 mm, AOS Outer Geotextile = 0.26 mm) and Experiment 4 (AOS Inner Geotextile = 0.26 mm, AOS Outer Geotextile = 0.19 mm). It is distinguished by the used AOS of 0.19 mm or/and 0.26 mm in the double-layer system. The detailed of the double-layer system are; (i) wrapped around the High Density Polyethylene (HDPE) pipe with a diameter of 25 mm indicate as inner geotextile (ii) wrapped around the quarry gravel which act as filter material indicate as outer geotextile. A caging was used to ease the installation of pipe and quarry gravel. It was placed at the bottom of a model box with a dimension of 25 cm width, 25 cm height and 56 cm length. The model box was filled with sand which was compacted by application of hand pressure. The rainfall event was introduced with the aid of a rainfall simulator.

From the experiments performed, Experiment 1 has the highest percentage of water discharge and sediment which is due to the large AOS of 0.26 mm used on both inner and outer geotextile. The large AOS of 0.26 mm eases the flow of water but unable to retain the smaller particle of sand. Experiment 2 does not perform well in respect of having the lowest water discharged with high sediment produced. The design causes the water to trap in the sand which makes the sand quickly fully covered with water and takes time before it can pass through the geotextile to be discharged. Meanwhile, Experiment 3 has the lowest amount of sediment produced but the discharged flow is very inconsistent during the entire process which is believed to be due to AOS of 0.19 mm wrapped around the pipe causing difficulty for water movement into the pipe to be discharged. Experiment 4 is the most effective design because it has the second highest percentage of water discharged which is 19.95% against mass of water introduced and also second lowest

amount of sediment produced with a value of 0.094 g. Therefore, it can be concluded that the application of double-layer system with the used of two different AOS of geotextile on the design has significantly increased the filtration capacity and facilitate the water discharged.

ABSTRAK

Kajian ini menilai keberkesanan paip cerun mendatar dibalut dengan dua lapisan geoteksil yang mempunyai saiz pembukaan jelas (AOS) yang berbeza dari segi meningkatkan air yang dikeluarkan dan pada masa yang sama mengurangkan sedimen yang terhasil. Beberapa kajian telah dicapai setakat ini oleh penyelidik terdahulu mengenai reka bentuk saliran dengan pelbagai parameter termasuk penggunaan geotekstil sebagai penapis saliran untuk meningkatkan sistem saliran cerun mendatar. Kajian mereka menghasilkan lebih banyak air yang dikeluarkan dengan sedimen yang tinggi dan sebaliknya. Empat eksperimen telah dijalankan dalam kajian ini iaitu Eksperimen 1 (AOS Geoteksil Dalaman dan Luaran = 0.26 mm), Eksperimen 2 (AOS Geoteksil Dalaman dan Luaran = 0.19 mm), Eksperimen 3 (AOS Geoteksil Dalaman = 0.19 mm, AOS Geoteksil Luaran = 0.26 mm) dan Eksperimen 4 (AOS Geoteksil Dalaman = 0.26 mm, AOS Geoteksil Luaran = 0.19 mm). Ia dibezakan oleh AOS yang digunakan iaitu 0.19 mm atau / dan 0.26 mm dalam sistem dua lapisan. Perincian sistem dua lapisan adalah; (i) dibalut sekeliling paip ketumpatan tinggi polyethylene (HDPE) dengan diameter 25 mm sebagai geotekstil dalaman (ii) dibalut sekeliling batu kerikil yang bertindak sebagai geotekstil luar. Sangkar digunakan untuk memudahkan pemasangan paip dan batu kerikil. Ia diletakkan di bahagian bawah kotak model dengan dimensi 25 cm lebar, 25 cm tinggi dan 56 cm panjang. Kotak model diisi dengan pasir yang dipadatkan dengan menggunakan tekanan tangan. Kejadian hujan diperkenalkan dengan bantuan simulator hujan.

Keputusan daripada eksperimen yang dilakukan mendapati Eksperimen 1 mempunyai peratusan air dan sedimen yang tertinggi disebabkan oleh AOS yang besar iaitu 0.26 mm yang digunakan pada kedua-dua geotekstil dalaman dan luaran. AOS yang besar ini memudahkan aliran air tetapi tidak dapat menapis zarah pasir yang lebih kecil. Eksperimen 2 mempunyai pencapaian yang kurang baik kerana mempunyai air terendah yang dikeluarkan dengan sedimen yang banyak. Reka bentuk ini menyebabkan air terperangkap di pasir yang membuat pasir dengan cepat dipenuhi dengan air dan mengambil masa untuk melalui geotekstil dan dikeluarkan. Sementara itu, Eksperimen 3 mempunyai jumlah sedimen yang paling rendah tetapi aliran yang dikeluarkan adalah tidak konsisten sepanjang proses dijalankan yang dipercayai disebabkan oleh AOS 0.19 mm yang dililit di sekitar paip menyebabkan kesukaran pergerakan air ke dalam paip untuk dikeluarkan. Eksperimen 4 adalah reka bentuk yang paling berkesan kerana ia

mempunyai peratusan kedua tertinggi air iaitu 19.95% daripada jumlah air yang diperkenalkan dan juga jumlah sedimen kedua terendah dengan nilai 0.094 g. Oleh itu, dapat disimpulkan bahawa penggunaan sistem dua lapisan dengan penggunaan dua AOS geotekstil yang berbeza pada reka bentuk telah dapat meningkatkan keupayaan penapisan dan memudahkan air untuk dikeluarkan.

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