STUDY ABOUT THE SEDIMENT LOAD AND THE BED LOAD PATTERN AT GALING RIVER

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ABSTRACT

Sediment is a naturally occurring particle that is broken down by the processes of weathering and erosion, which particles that with varying sizes that can be transported by fluid and flow along the fluid matter. The erosion or any other reason will cause the bed load increase at the river. It will make the river of the depth decrease. As the depth of the river decrease while the volume of the flow rate still same, it will cause the flooding when overflow. This study identified and analyzed about the bed load of this river and found out the sediment pattern from the sedimentation process. The purpose of the study was identified the size and types of sediment, analyzed the bed load discharge and identified the sediment pattern at Galing River. The study conducted at 3 stations, which are located at upstream, middle stream and downstream of the Galing River. The methods used to analyze sediment transport were Schoklitsch formula and Meyer-Peter Muller formula. In this research, the sizes and types of the sediment at Galing River are determined, and the parameter of the grain size diameter need to conduct the sediment transport analysis had been found out. Meyer-Peter Muller and Schoklitsch showed there were less sediment discharge due to the low velocity and several criteria of the Galing River. In addition, the patterns of the bed load are variable in depth within the period of the research; it shows there was movement of particle along the Galing River.

ABSTRAK

Mendapan merupakan zarah semula jadi yang dipecahkan oleh proses-proses luluhawa dan hakisan, zarah dengan pelbagai saiz boleh diangkut oleh cecair dan mengalir bersama-sama perkara cecair itu. Hakisan atau dengan beberapa sebab lain akan menaikkan beban dasar di sungai. Ia akan menjadikan kedalaman sungai berkurangan. Apabila kedalaman sungai berkurangan walaupun jumlah kadar aliran masih sama, ia akan menyebabkan banjir apabila limpahan berlaku. Kajian ini mengenal pasti dan menganalisis tentang beban dasar sungai dan mendapati corak sedimen dari proses pemendapan. Tujuan kajian ini mengenal pasti saiz dan jenis sedimen, menganalisis pelepadan beban dasar dan mengenal pasti corak sedimen di Sungai Galing. Kajian ini dijalankan di 3 stesen , yang terletak di hulu sungai, aliran pertengahan dan hiliran Sungai Galing . Kaedah yang digunakan untuk menganalisis pengangkutan sedimen adalah Schoklitsch formula dan Meyer-Peter Muller formula. Dalam kajian ini, saiz dan jenis sedimen di Sungai Galing dapat ditentukan, dan parameter untuk saiz diameter butiran yang diperlukan untuk menjalankan analisis pengangkutan sedimen telah diperolehi. Meyer-Peter Muller dan Schoklitsch menunjukkan pergerakan sedimen kurang disebabkan halaju yang rendah dan beberapa kriteria Sungai Galing. Di samping itu, berlaku perubahan kedalaman corak beban dasar dalam tempoh penyelidikan; ia menunjukkan wujudnya pergerakan zarah di sepanjang Sungai Galing.

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Q	Flow Rate of water (m^3/s)
A	Cross Sectional Area (m^2)
V	Actual Velocity (m/s)
V_{mean}	Mean Velocity (m/s)
mm	Milimeter
R	Hydraulic radius
km	kilometer
m	meter
g	Gravitational Force (m/s^2)
n_s	Manning's roughness factor
τ_c	Critical Shear Stress
τ_o	Actual Shear Stress
D_s	Mean Diameter (mm)
v	Viscosity (m^2/s)
γ	Specific Weight (N/m^3)
S	Slope
g_s	Bed Load Discharge (lb/sec-ft)
D_m	Effective Diameter (mm)
d	Mean Flow Depth (ft)
D_o	Mean Grain Diameter (inches)
ψ	coefficient depending on the mean size of bed sediment, ft^3/lb/sec

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Sediment is a naturally occurring particle that is broken down by the processes of weathering and erosion, which particles that with varying sizes that can be transported by fluid and flow along the fluid matter. Some of the particles are deposited as a layer of solid particle on the water bed or at the bottom of a body of liquid.

The sediment's size, volume, density, and shape and the strength of the flow are the criterion that causes the sediment transported from one place to another place. The particle will be rise when the flow is strong enough to lift or drag it. Therefore, the sediment will be transported from one place to other places.

The sediment grain size that being moved as bed load is needed to identify first before doing the load calculations and stability analyses. The details of the size of the bed load indicate the size of the material being transported to downstream and the size of material that may be accumulated at upstream.

1.1 BACKGROUND OF STUDY

Kuantan river is the main river that flow in the middle of Kuantan town. Before the river flowing out to south china sea, Kuantan is from Lembing River run through Kuantan city. Galing River is one of the major contributors to Kuantan River and covers the area from Semambu, Bukit Sekilau and flowing out to Kuantan River at the end of Kampung Tok Keratuat.

Galing river has been recorded by the Drainage and Irrigation of Department of Pahang as one of the high potential area to be effected by flood. This river was chosen by the state government for the "1 state 1 river" program. This river also being classified as class IV for its pollution level. This is due to the rapid development the basin area which is lead to many unfortunate events such as flooding, poor water quality, lack of clean water, resources and erosion (Omar, 2010).

The shape of rivers and streams shifts with the interrelationship between erosion, deposition, and transport of sediment. Rivers and streams maintain a dynamic equilibrium between discharge, sediment load, and sediment size (Lane, 1955). Long-term changes in equilibrium observed in the landscape can result from climate change, construction uplift and subsidence and hydrologic changes resulting from human activity such as irrigation diversion and dams.

1.2 PROBLEM STATEMENT

The erosion is one of the factors that cause the bed load increase at the river. It will make the river depth decrease and cause the flooding when overflow. In addition, the type and dimensions of a bed load pattern depend on the properties of the flow, fluid, and bed material. This study will identify and analyze about the bed load at Galing River and find out the sediment pattern from the sedimentation process.

1.3 OBJECTIVE

The research objectives of this study are:

1.3.1 To identify the size and types of sediment at Galing River.
1.3.2 To analyze the bed load discharge of Galing River using selected method.
1.3.3 To identify the sediment pattern/ bed load pattern due to sedimentation process.

1.4 SCOPE OF STUDY

The study will focus at 3 stations, which are located at upstream, middle stream and downstream of the Galing River. There are two methods will be used to calculate bed load. The methods are Schoklitsch formula and Meyer-Peter and Muller formula.

1.5 SIGNIFICANCE OF STUDY

This study can provide the data of bed load which can be used to make future research at Galing River. The patterns of bed load can be identified. The patterns of the bed load are changeable with time; hence this study can find out and determine the pattern of the bed load at Galing River. This research is able to become a reference for the future researcher to compare the data and help them for further research at Galing River.

CHAPTER 2

LITERATURE REVIEW

2.1 SIZE AND TYPES OF SEDIMENT AT GALING RIVER

The sediment's grain sizes provide an indication of the shear stress that must be applied by the medium to give the condition of the transport of the particle. The factors such as source material, topography and transport mechanisms will affect the grain size distribution. Hence, the grain size will be found out by using the difference sieving method. According to Abuodha (2003), the sieving method and settling tube techniques are used to determine the grain size. Sieving method is used to find out the spherical grain particle, while settling tube technique is used to measure the settling velocity of particles in a medium, and translate this size scale. According to Okeyode (2013), the only mechanical sieving method using a Ro-tap shaker was chosen for the dry sediment sample analysis. A small portion of the samples of sediment will be sort mechanically into a set of US mesh sieves using a Ro-tap shaker. A balance used to weighted the fraction retained on each sieve and the pan. Once the cumulative weight percentage was calculated, the grain size was then plotted on the ordinate and form a grain size distribution and a frequency curve for each sample. Both of the method will be able to calculate the statistical parameters of standard deviation, mean, median and used to derive the various grain size parameters.

2.1.1 Geometric Mean

According the principle of grain size distribution, it is able to find out the geometric mean of the sand from the cumulative curve.

Arithmetic method of moments

$$\text{Mean , x} \quad = \quad \frac{\Sigma fm}{100} \qquad (2.1)$$

Logarithmic (original) Folk and Ward (1957) graphical measures

$$\text{Geometric Mean, GM} \quad = \quad \frac{\phi 16 + \phi 50 + \phi 84}{3} \qquad (2.2)$$

According to Simon (2001), sedimentologists are prefer to use the statistic which is expressed geometrically (in meteric units) compare with the logarithmic statistic (in phi units). It is due to the phi scale was seldom applied for others scientist.

2.2 ANALYSIS SEDIMENT LOAD

Normally, there are a lot of methods for analysis the sediment transport of the bed load. Now, three of the methods will be discuss and choose the most suitable method used to conduct the research.

2.2.1 Incipient Motion

Incipient motion of bed particles can be refer as the critical condition between transport and no transport of the particle.

The Shields diagram can be used to evaluate the critical shear stress (the shear stress at incipient motion). To use the Shields diagram, one must first compute the following:

$$\frac{Ds}{v}\sqrt{0.1\left(\frac{\gamma s}{\gamma}-1\right)gDs} \quad (2.3)$$

Which can then be used to locate τ_* on the curve in the Shield diagram. With τ_*, the critical shear stress can be computed by:

$$\tau_c = \tau_* \left(\frac{\gamma s}{\gamma} - 1\right)\gamma Ds \quad (2.4)$$

The actual shear stress can be computed using

$$\tau_0 = \gamma RS \quad (2.5)$$

Then a comparison is made of τ_c and τ_0. If τ_0 is larger than τ_c, transport is expected.

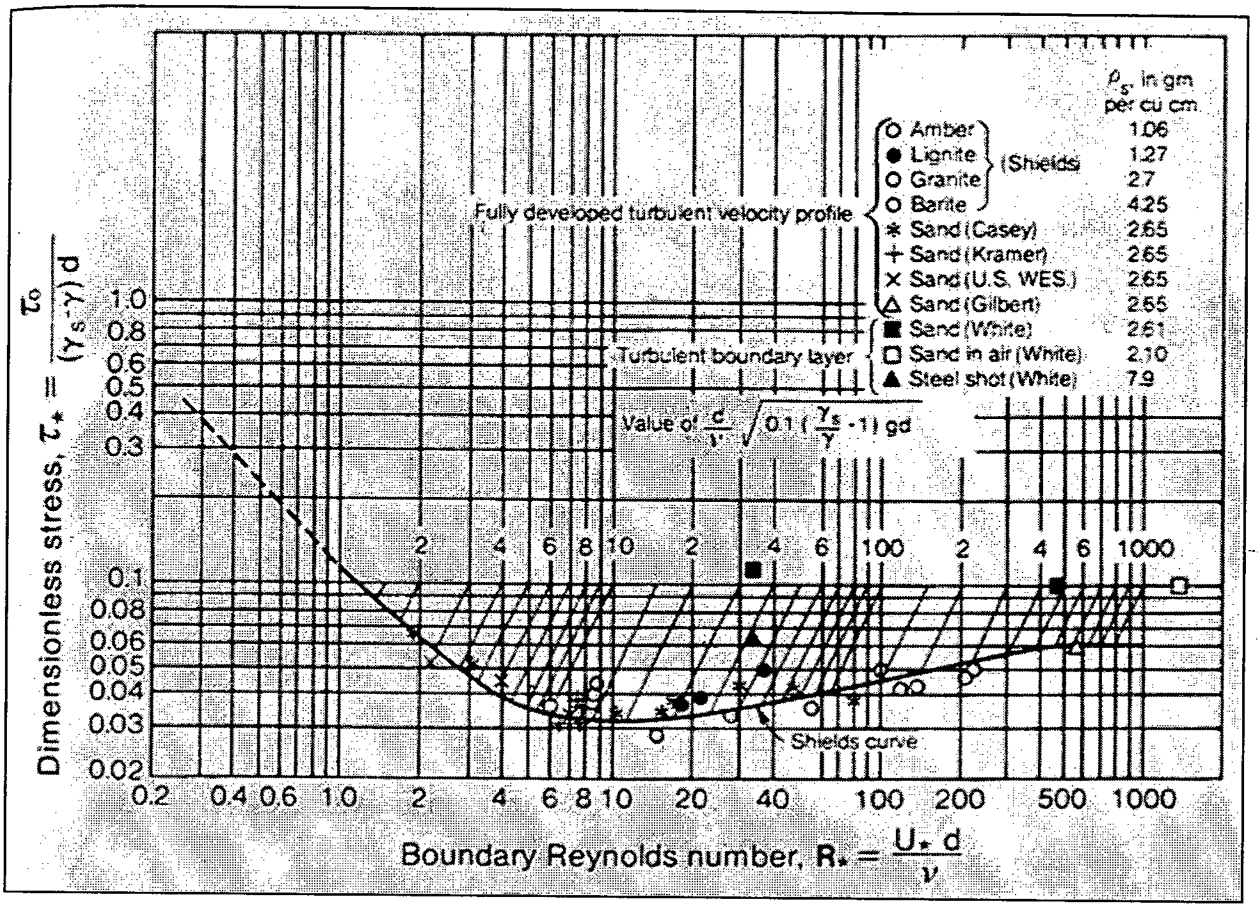

Figure 2.1: Shields diagram

Source:
http://rpitt.eng.ua.edu/Class/StormWaterManagement/M3a%20Characteristics%20and%20
Sources%20Internet%20material/M3a3%20sediment%20movement%20in%20sewers.htm

In principle, incipient motion of particles on a stream bed can be predicted from a balance of the forces acting on the particles. Stefan et.al (2007) stated that on a natural river bed, the exposure of particles to the flow is variable; it is able to be analysis by using the critical Shields parameter of spherical particles. According to Buffington et.al (1997), Shields plot constructed from data that represent initial motion of the bed load material reveals systematic methodological biases of incipient motion definition. However, according to Cao et.al (2006), the implicit nature makes applications rather inconvenient,