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A METHODOLOGY TO INVESTIGATE COST COMPARISON BETWEEN SOIL NAILING AND SHEET PILING METHODS

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ABSTRACT

Quantitative Analysis Draft Slope protection includes all acts and measures taken to prevent erosion on slopes and hence limit the separation or sliding of rocks from the slopes. Its primary goal is to maintain the structure's integrity, prevent accidents, and avoid material damage or human fatalities. The implications of slope failure are not only providing an adverse effect to physical damages but require a large amount of money to pay as compensation to the impacted damages. Various methods of slope protection have been recognised nowadays, but this study focuses only on two slope protection methods, i.e. soil nailing and sheet piling. Thus, this video is prepared with the objective to present a methodology proposed for the study to investigate cost comparison between the soil nailing and sheet piling methods. A quantitative research strategy is proposed as a methodology for the study that is designed with a comprehensive literature review and survey to interview people that have established knowledge, skills or experience in soil protection methods. The study will review the available literature to identify the comparison between the sheet piling and soil nailing methods, associated with the construction methods, cost-efficiency, maintenance viability and long-term performance. The study is expected to provide cost differences, maintenance demand, longevity, and sustainable performance between the sheet piling and soil nailing methods. The study also will identify strategies that can be recommended to improve the quality of cost data used as reliable input for the cost estimation of sheet piling and soil nailing methods.

Keywords: Slope protection; soil nailing; sheet piling; cost comparison.

INTRODUCTION

Landslides are a serious geologic hazard common to many parts of the world. Landslides inflict billions of ringgits in property damage and hundreds of deaths and injuries worldwide each year. In Malaysia, from 1973 to 2007, some 440 landslides were reported. Of these, 31 cases involved fatalities. In

addition, there are thousands more ‘unreported’ minor slope failures and landslides (National slope master plan, 2009-2023). According to Azmi et al. (2024), slope protection's major goal is to preserve the stability of both naturally occurring and artificially created slopes, protecting both human life and infrastructure. By stopping the loss of soil and plants, it also plays a critical part in protecting the ecosystem. Slope protection techniques that work well might lessen the effects of natural disasters that can cause slope failures, like intense rainstorms or earthquakes. Slope protection strategies also contribute to the preservation of soil fertility, which is necessary for both agriculture and natural vegetation, by stabilising the ground. The case study reveals that Malaysia is facing issues with slope failure, with one such incident occurring at Jalan Serdang and Jalan E6 intersection in Taman Melawati. The landslide occurred due to a failing drainage system, causing water to overflow over the slope surface and uprooting trees. The Ministry of Works (KKR) has proposed using soil nailing to restore the slope, which will be discussed with the Ampang Jaya Municipal Council (MPAJ) and private developers. Another incident occurred at Jalan Wawasan 3/9 in Puchong, affecting nine terrace houses and four cars. The proposed solution is to apply sheet piling. The main objective of piling is to improve safety and stability, preventing further soil movement. Restoration projects include building a monsoon drain, soil filling, and slope reinforcement.

Many previous research has discussed the issues about slope protection methods and determining the best slope protection method. When selecting the best slope protection method, strength and durability are always considered, but cost has gotten less attention. It is essential to study the economic aspect of the slope protection method as not only to look for its initial cost but also the maintenance cost that may cost more. Thus, this paper and video will discuss more about two methods applied in previous cases of slope failure at Taman Melawati and Taman Wawasan which are soil nailing and sheet piling methods including the efficiency, feasibility, reliability, durability, life span and economic perspective. Moreover, there is limited study focusing on soil nailing and sheet piling especially on the cost involved in the construction. Thus, based on the difficulties raised above, this study on the cost comparison of the two methods, sheet piling and soil nailing, will be carried out.

Therefore, these paper and video are prepared to present a designed methodology to investigate cost comparison between soil nailing and sheet piling methods with the aim is to study the cost effectiveness of sheet piling in comparison with soil nailing in slope protection and the objectives are to review and compare the construction methods used in sheet piling and soil nailing, to compare the cost-effectiveness, maintenance viability and long-term performance between sheet piling and soil nailing slope protection methods and to find ways or strategies that can be recommended to improve the quality of cost data for sheet piling and soil nailing.

METHODOLOGY

Research methodology is a systematic way in problem solving. It is a science of studying how research is to be carried out. Essentially, research methodology is the procedures by which researchers go about their work of describing, explaining and predicting phenomena. It is also defined as the study of methods by which knowledge is gained. Its aim is to give a work plan for research (Goundar, 2012). Saraswati

and Devi (2023) explained that collecting data in numerical form and using statistical analysis involves the quantitative method. This is to identify patterns, relationships, and generalizability. Common quantitative methods include surveys, experiments, as well as structured observations. These methods provide a broader understanding of the research topic, often involving a larger sample size. Meanwhile, Goundar (2012) defines quantitative research as based on the measurement of quantity or amount. The process is expressed or described in terms of one or more quantities.

To achieve the research aim, a quantitative research strategy is proposed as the chosen methodology designed for the study due to some reasons. Firstly, there are so many soil erosion issues in Malaysia and the number is larger because Malaysia received heavy rainfall, soil condition problems and so on. Secondly, there are so many people that have knowledge or skills or experiences on soil erosion that can be involved in the study. Thus, the survey is more superior than the focused group. Thus, this study will apply quantitative methods.

As for this study, case study, survey and literature review will be applied. For the case study, the proposed areas to be focused are Jalan Wawasan 3/9 Taman Wawasan, Puchong and Jalan Serdang and Jalan E6 intersection, Taman Melawati where soil erosion has occurred. Meanwhile, the survey will be focused on only 30 respondents that fulfil the criteria in order to ensure the quality of data.

Table 1. The proposed research approaches for the methodology of study.

Proposed Methods	Data collection and analysis	Expected Findings
Case study through condition assessment of cost data	Cost breakdown for each method will be collected and will be analysed to find the differentiation of both methods.	A comparison of the cost efficiency and feasibility of sheet piling and soil nailing, highlighting which method offers better performance, lower maintenance costs, and greater practicality.
Surveys	30 respondents are required to fill the surveys. The result from the surveys will be discussed.	A clear strategy to improve the quality of cost data for sheet piling and soil nailing as well as the differentiation of cost involved for each method.
Literature reviews	Clear reviews on both methods, soil nailing and sheet piling as well as the costs involved.	A clear differentiation between sheet piling and soil nailing in terms of structural behaviour, installation methods, and lifespan.

CONCLUSION

A methodology is designed and proposed for the study to investigate cost comparison between soil nailing and sheet piling methods. The literature study has established there are very limited studies reported on the methodology to investigate cost comparison between soil nailing and sheet piling methods. Hence, the quantitative research strategy has been proposed as the methodology designed for the study to procure data of condition assessment for sheet piling and soil nailing methods in slope protection. The quantitative research strategy is incorporated with a primary data collection, i.e., the surveys to collect comprehensive firsthand data as well as the secondary data collection for example the case study through condition assessment of cost data and the literature reviews to dig deeper into the two methods details. These are to achieve the aim and objectives of this study.

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