

SOIL IMPROVEMENT FOR TAXIWAY AND APRON DUE TO SOFT GROUND
PROBLEM

ILIAS BIN ABDULLAH

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ABSTRACT

Soft ground created a lot of problems to the structure or pavement. The safety of the aircraft movements through taxiway and parking the aircraft on parking apron is subjected to standard as required by International Civil Aviation Organization (ICAO). Thus, soft soil affected the performance of the pavement by creating defects such as rutting, crack and settlement which might result foreign object damage (FOD) to the aircraft engine. This paper analysed the recommendation soil improvement method, compared the magnitude of settlement from site investigation data using manual simulating and validated the settlement using SIGMA/W software for accuracy. In this study, it was limited to the aircraft loadings of A330 on taxiway and the aircraft loadings of A320 on dispersal area/apron pavement based on Miri Airport condition. This study indicated that the differences displacement from site measurement calculation simulation and the software simulation about 15% for taxiway and 25 % for dispersal area/apron pavement.

ABSTRAK

Keadaan tanah yang lembut menyumbang banyak masalah kepada sesuatu struktur dan permukaan berturap. Keselamatan pesawat semasa pergerakan melalui taxiway dan memakir pesawat di kawasan parking apron merupakan perkara yang begitu dititik beratkan selaras dengan keperluan Pertubuhan Penerbangan Awam Antarabangsa (ICAO). Akibat daripada tanah yang lembut, ianya akan menjejaskan kebolehan struktur permukaan berturap dan akan menyebabkan kecacatan aluran, retak dan mendapan yang akan menyumbang kepada objek atau benda asing (FOD) kepada pesawat terutamanya enjin pesawat. Tesis ini adalah untuk menganalisis cadangan kaedah pembaikan tanah berbanding dengan tahap mendapan yang wujud berpandukan data daripada penyiasatan tapak, pengiraan mendapan dan membandingkan dengan penggunaan perisian SIGMA/W untuk pengesahan. Kajian ini hanya terhad kepada beban pesawat A330 untuk taxiway dan A320 untuk parking apron dipermukaan berturap di Lapangan Terbang Miri. Hasil kajian ini menunjukkan perbezaan mendapan daripada kaedah simulasi pengiraan dan simulasi menggunakan perisian adalah 15% bagi taxiway dan 25 % untuk parking apron.

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LIST OF SYMBOLS

ρd_{max}	-	Laboratory maximum dry density
ρd	-	Field dry density
hz	-	Hertz
f	-	Frequency
a	-	Amplitude
L	-	Linear load
ν	-	Poisson ratio
S_i	-	Immediate settlement
S_c	-	Primary settlement
S_s	-	Secondary compression settlement or creep
H_o	-	Initial height
H_s	-	Solid height
V	-	Volume
σ'	-	Effective stress
σ	-	Normal stress
$\sigma'{}_f$	-	Final effective stress
$\sigma'{}_o$	-	Initial effective stress
e	-	Void ratio
e_o	-	Initial void ratio
C_c	-	Compression index
C_r	-	Recompression index
E	-	Modulus Young
P	-	Force pressure

CHAPTER 1

INTRODUCTION

1.1 Background

The Malaysian economy growth registered about 5% in 2014. (Bank Negara, 2014). Influence from the economy growth, the increasing of the passenger travel using aircraft increase every years. According to Malaysian Airport Holding Berhad (MAHB), in 2014 passenger increments are 4.5 % or 35.8 million passengers per annum (ppa) (MAHB Report 2014). The increasing of the traffic will be affect the strength of the pavement design and also cost of the project. Beside that, soft soil it also one of the major problem. The engineers should have some experience and also knowledge of the mechanical behaviour and the device suitable construction technique to facing soft soil issue. (den Haan, 1997)

The soft soil issue will be created defect to the pavement. It will affected the aircraft movement through taxiway and the parking apron. The International Civil Aviation Organisation (ICAO) and also local National agency (Department Civil Aviation of Malaysia) defined the safety requirement of civil aviation aircraft is main major concern during operating

In particularly, the high water content and low dry density give the exceptionally low shear strength. To strengthen the pavement due to soft soil, soil improvement method is usually use to increase soil bearing capacity of subgrade to avoid settlement.

In the conventional method of pavement design, the engineers' assumption for settlement based on Site Investigation data and the experience. For more reliable information during designing of pavement, tool such as Geo Studio SIGMA software will be assist engineer give extra information about settlement.

1.2 Problem Statement

Soft soil will be affected to the pavement and created the defect such as rutting, cracking and settlement. From that defect, foreign damage object (FOD) occur will be effected to aircraft engine and also reduce the quality of aircraft maneuver at taxiway and also park the aircraft at parking apron. Previous researcher have shown that the shear strength could be increase significantly upon consolidation or settlement and hence some soil improvement method must be adopted to increase the bearing capacity of the soft soil.

In that reason, this thesis is to analyze the reliable method of soil improvement based on conventional method of design to increase the shear strength and bearing capacity of subgrade compare to using Geo studio SIGMA/W software to simulate the effect of settlement.

1.3 Objectives Of The Study

The objectives of this paper are:

- a. To identified soil improvement method required.
- b. To analyze of settlement with on site data soil measurement.
- c. To analyze soil improvement method using Geo Studio Sigma software.

1.4 Scope Of Works

The study focused to increase strength the subgrade by soil improvement method due to consolidation or settlement. There are various limitations on the carried out for this study. They include the following:

- a. Loading subjected on the taxiway and apron pavement related to this study based on loading aircraft A330.
- b. The site investigation data as provided at Miri Airport condition.
- c. Use general parameter available for study based on literature and Geo Studio SIGMA/W software simulation to determine settlement due to aircraft loading.

1.5 Organization Of The Thesis

For more understanding on this thesis, there are five chapter are covered. Description of every chapter is shown as follow:

Chapter 1 : Introduction

This chapter will be explain the introduces the back ground of the project, problem statement, and describe the objective in this study based on the limitation of works components.

Chapter 2 : Literature Review

Literature review present of the literature and relative research associated with the problem addressed in this study. The concept of pavement design using convensional method based on Site Inventigation data and the technique apply during construction to avoid the settlement on the pavement and also using the tool system before construction such as software were be explain in this chapter.

Chapter 3 : Metodology Method

Chapter Three contains the metrodology and procedure used for collection data significant for designing the pavement structure and using finite element commercial software Geo Studio SIGMA/W for support the data.

Chapter 4 : Data Analysis

Chapter Four contains an analysis of the data collected from Site Investigation data result to describe the settlement using manual calculation. By using software, another data were be colleted for analyze.

Chapter 5 : Summary of the finding and recommendation for future researcher.

This chapter were be presenting the finding or summary based on data an analyze at Chapter 4. From that finding, recommendation for the future researcher are expained .

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