CHAPTER 2

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2.1 Introduction

In the tropics, environmental factors play a very important role in influencing processes of weathering. This is especially so as this region experiences high temperatures and abundant rainfall which encourage intense chemical weathering, characterised by the alteration of unstable mineral such as feldspar and an increase in the concentration of secondary iron oxides due to laterization.

Climatic factors such as temperature and moisture regime control the synthesis of the weathered materials. High temperatures (>24°C) and high rainfall favour deep chemical weathering and can lead to the formation of soil rich in kaolinite. Drainage and parent material, however also influence the characteristics of the residual soil that is formed (Mitchell & Sitar, 1982).

Geomorphology is another factor that governs soil formation. Thinner soil horizons are found on steep slopes as more rainwater is lost as surface run-off. Less rainwater infiltrates into the subsurface resulting in thin layers of weathered material.

Over areas of well-drained plateau and gentle slopes, thick profiles of kaolinite and sequioxide rich soils are found. Thinner soil horizons are also due to erosion. Erosion is generally higher in areas which experience higher rainfall compared to areas experiencing lesser rainfall. A bigger part of weathered material is eroded away, leaving only a thin layer of top soil. The steeper the slope, the higher the degree of erosion and therefore, the thinner the top soil.

Topography and drainage play equally important roles in determining the type of clay mineral that is formed, for instance, van der Mermc (in Blight, 1981) observed that reddish kaolinitic soils develop in well drained conditions (on rises) over a norite gabro parent rock, whereas blackish montmorillonite soils develop from an identical parent rock in a poorly drained situation (hollow).

2.2 Topography

The study area generally consists of undulating terrain, which is largely used for growing rubber and oil palm. The early part of the Seremban-Mambau-Siliau road is surrounded on both sides by low hills which rise to about 80 m in the west but to about 100 m in the east (see Fig 2.1). Towards the end of this stretch of road, the hills are up to about 50 m high on the eastern and about 100 m high on the western areas. The road from Siliau returning to Seremban through Rantau however, passes through

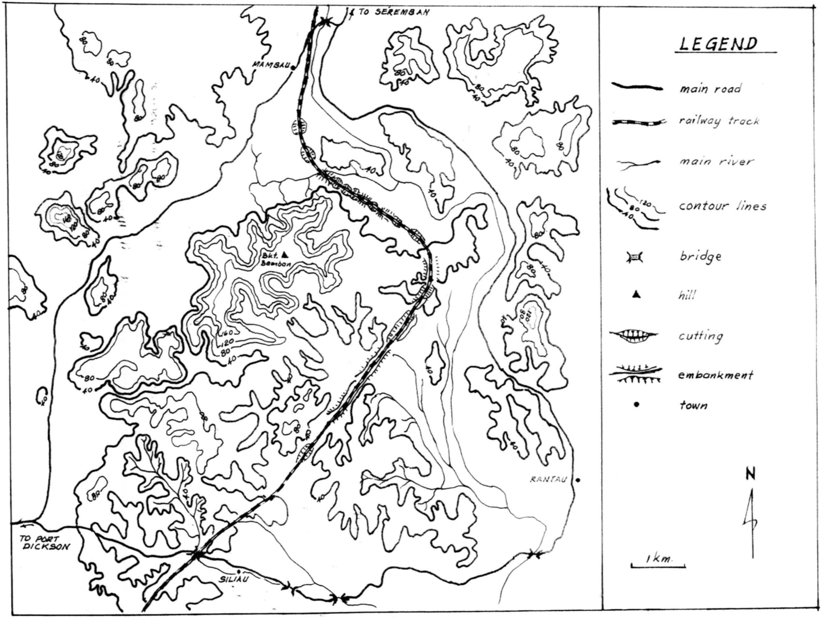


Figure 2.1 Topography and drainage of the study area

hilly areas of up to about 40 m high to the west and about more than 120m to the east of the road.

The railway track however, cuts through areas of varying topography. South of Seremban, it runs through a flat terrain of some 35 m above mean sea level. As it approaches Ng Lim Estate, cuttings are seen on both sides until the Siliau railway station with a few embankments in the vicinity of Tong Lai Loong Estate, Santilata Estate and Ulu Sega. These cuttings and embankments are about 40 m high on both sides of the track.

In general, topographic changes of the area bordered by the roads Seremban-Mambau-Siliau and Siliau-Rantau-Seremban can be summarised as follows : lowland of up to about 30-40 m above mean sea level on both sides with areas of steeper hills of up to about 40-200 m above mean sea level towards the centre. These higher areas are all concentrated within the Bemban Hills.

2.3 Drainage

The study area is drained by the Linggi, Bemban, Siliau and Sega rivers. The Linggi River and its tributaries cover the area between Seremban and Kampung Linsum. As the rivers reach lower land, they meander more and form small lakes. The

Bemban River drains the area between Kampung Bemban and Kampung Bemban Hilir while Siliau and Sega rivers drain the southern part of the study area.

2.4 Rainfall

Meterological data obtained from the Malaysian Meterological Department (Appendix I) indicates that there has been a small increase in the annual rainfall experienced in the area (see Fig 2.2) between 1981-1995 except for a drop in the years 1983 and 1990, when the state of Negeri Sembilan experienced drought. The highest annual rainfall recorded is 2849.3mm (1993) whilst the lowest is 1574.4 mm (1990). There also appears to be an increase in the number of rainy days over the last fourteen years (see Figure 2.3) with the highest annual number of rainy days being 232 days in 1993 and the lowest number of 55 days in 1981.

The monthly rainfall pattern (Fig 2.2) indicates that heavy rainfall is usually experienced during the months of September to December and between March and May. This corresponds with the transition period between the Southwest and Northeast Monsoons, and Northeast and Southwest Monsoons respectively. There is also a general increase in the number of rain days per month (Appendix II) during the above mentioned periods (see Fig 2.3).

Monthly Rainfall Chart For Seremban (1981-1995)

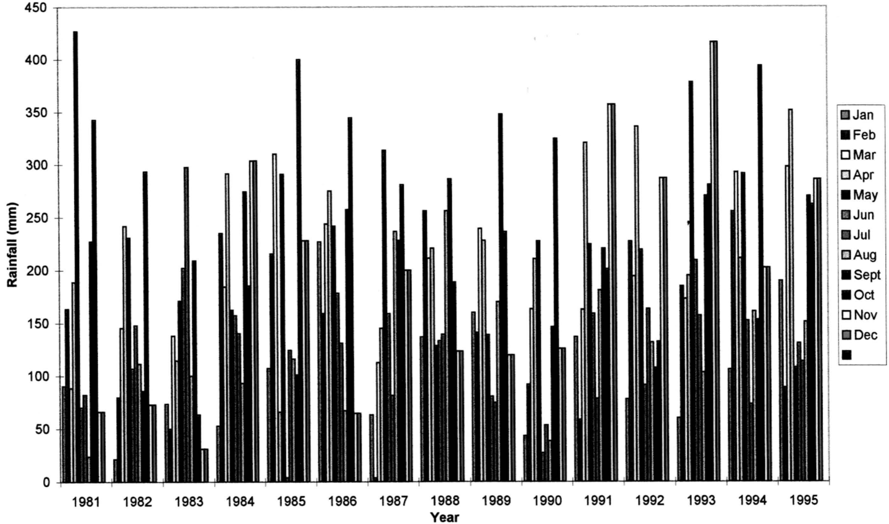
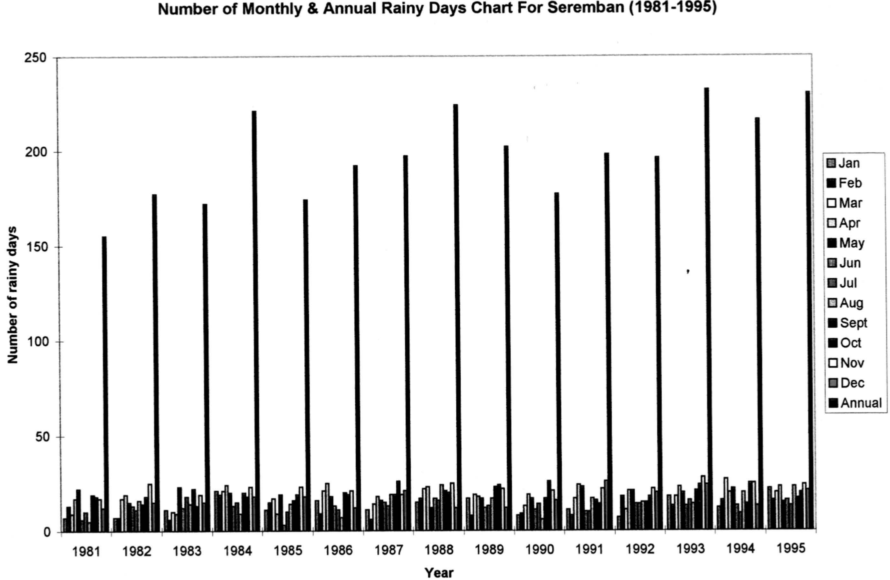


Figure 2.2



Number of Monthly & Annual Rainy Days Chart For Seremban (1981-1995)
Number of rainy days
250
200
150
100
50
0
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
Year
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec
Annual

Figure 2.3

It is postulated that this general trend towards increased rainfall is a factor that may contribute to the increasing number of landslides and slope failures in the study area.

2.5 Temperature

Data obtained from the Malaysian Meterological Department indicates that the annual mean minimum temperature experienced has been 23 to 24 °C (Appendix III) and the annual mean maximum temperature 31 to 32°C (Appendix IV) with no big variation over the last fourteen years (ref. Figure 2.4a & 2.4b). It is obvious that these somewhat constant temperature conditions do not influence the stability of slope cuts in the study area.

2.6 Groundwater

No visible seepage of surface water was noted on any of the existing cut slopes along roads in the study area. Raj (1983) however, has identified a zone of unconfined groundwater table located in morphological horizon IIC (most weathered bedrock) of the weathering profiles over quartz-mica schist in the Seremban area. In the low lying terrain through which the railway line passes furthermore, seepage can be

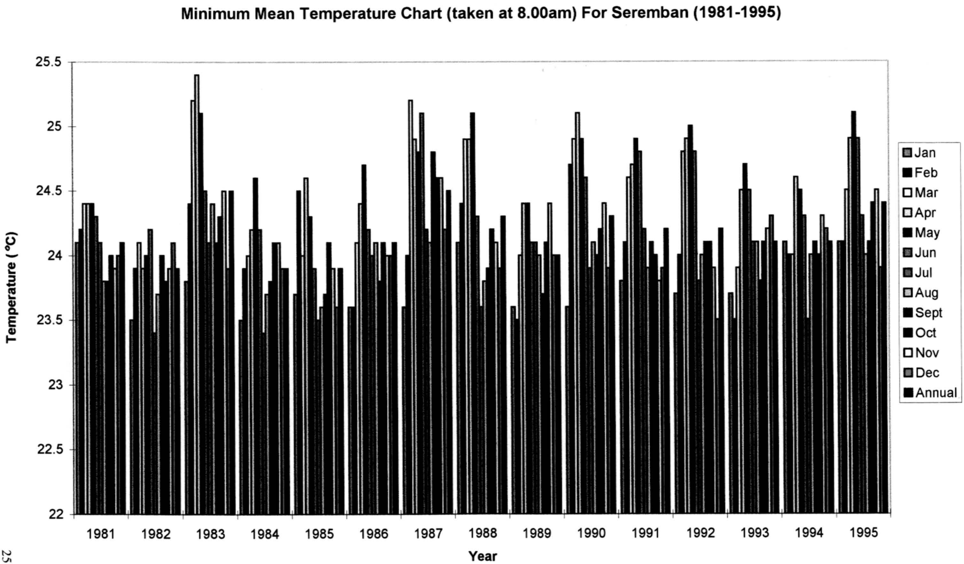

Minimum Mean Temperature Chart (taken at 8.00am) For Seremban (1981-1995)
Temperature (°C)
25.5
25
24.5
24
23.5
23
22.5
22
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
Year
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec
Annual

Figure 2.4a

Maximum Mean Temperature Chart (Taken at 2.00pm) for Seremban

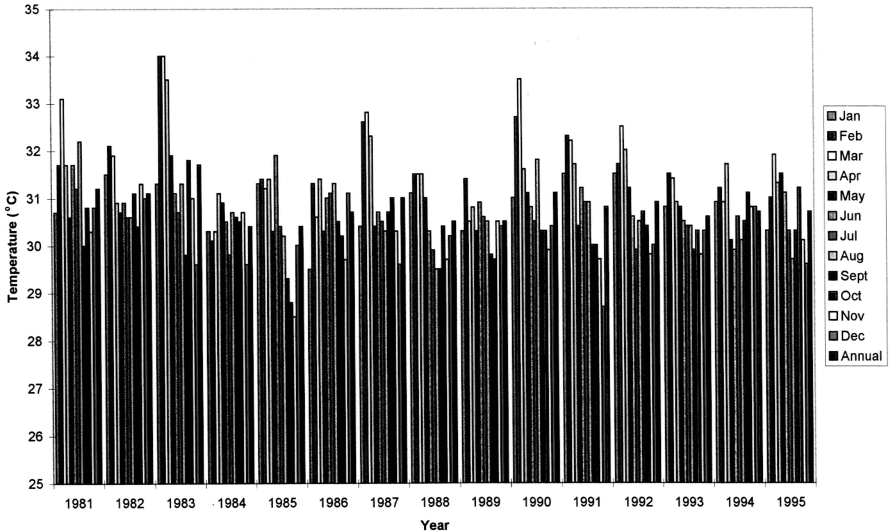


Figure 2.4b

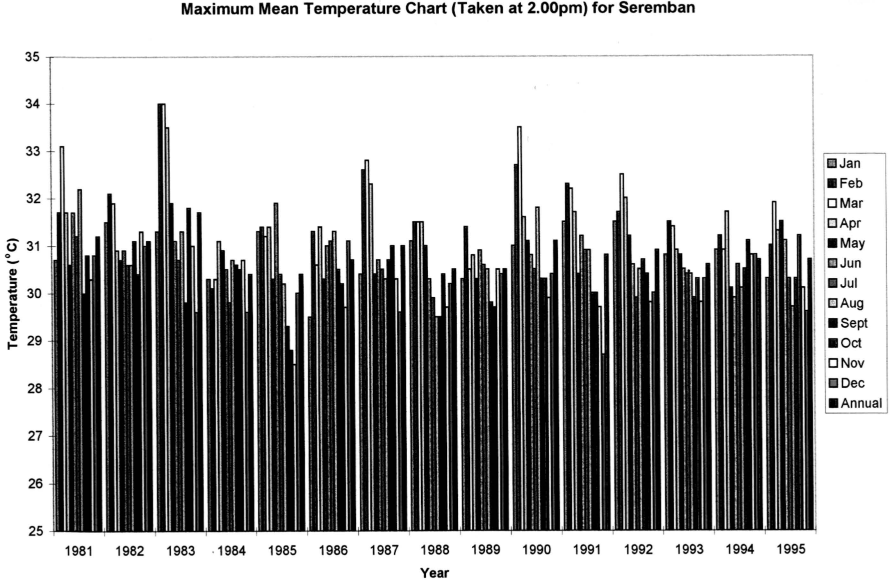

Maximum Mean Temperature Chart (Taken at 2.00pm) for Seremban
35
34
33
32
31
30
29
28
27
26
25
Temperature (°C)
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
Year
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec
Annual

Figure 2.4b

seen during the wetter (rainy) seasons; thus indicating the rise of an unconfined groundwater table.

2.7 Summary

In general the study area is situated in an undulating terrain of low hills of up to about some 160 m high in the centre surrounded by lower hills of up to about 80m-40 m. The Seremban-Mambau -Siliau and the Siliau-Rantau-Seremban roads cut through areas of up to about 40 m high or less. Four main rivers drain the study area, namely the Linggi, Bemban, Siliau and Sega rivers. The study area experiences a warm and humid climate of somewhat constant temperature with a minimum of about 24°C and a maximum of about 32°C. The total rainfall experienced shows a fluctuating pattern between a minimum of about 1574.4 mm and a maximum of about 2211.8 mm. Although no seepage was visible during the course of field studies, a zone of unconfined groundwater is [redacted] seen in cuts in low lying terrain; the groundwater table being located in morphological horizon IIC of the weathering profile.