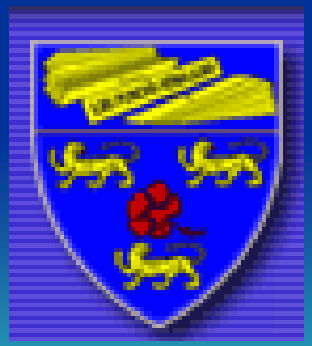
IEM-GSM Oktoberforum 2005: "Case Histories in Engineering Geology and Geotechnical Engineering", 4th Oct. 2005, Petaling Jaya

DISCONTINUITIES STUDY AND ROCK SLOPES STABILITY ANALYSIS FOR ROCK MASS AT DAMANSARA AREA, P.JAYA



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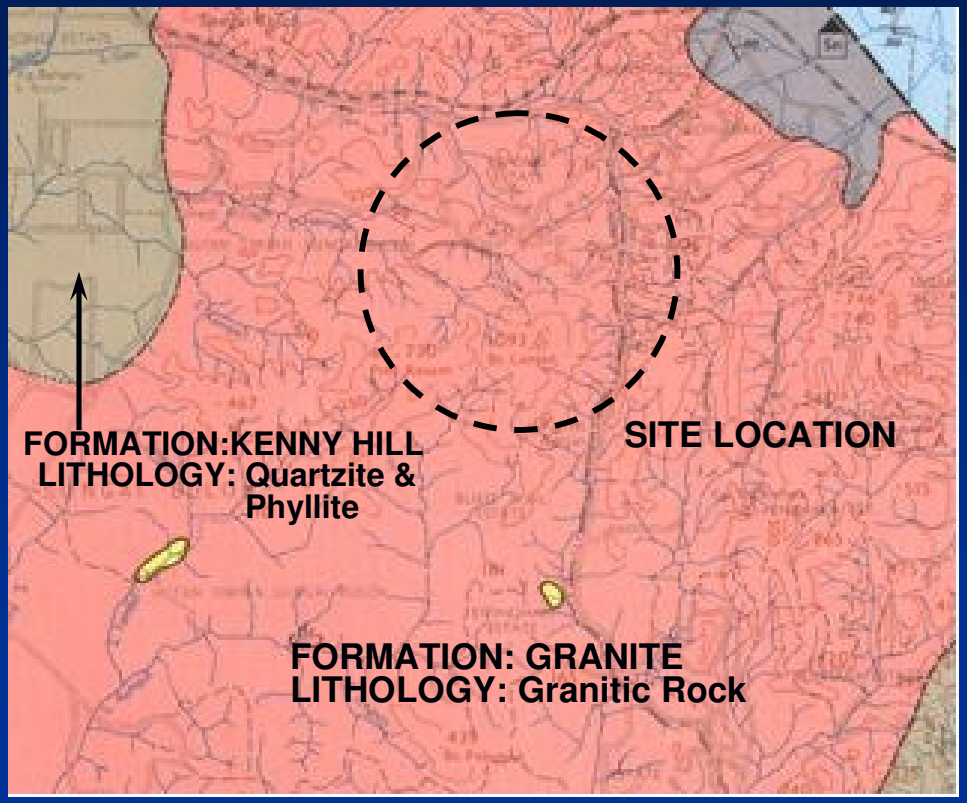
Scope Discuss

- Introduction
- Geology of the site
- Method of Study
- Result of Study
- Potential Hazards & Mitigation Measures
- Discussion & Conclusion

Introduction

- Study area: 5 areas in Damansara area
- Some of the sites are located at the road side while the others are in housing area
- Most of the sites were secondary forest previously

Geology of the Site



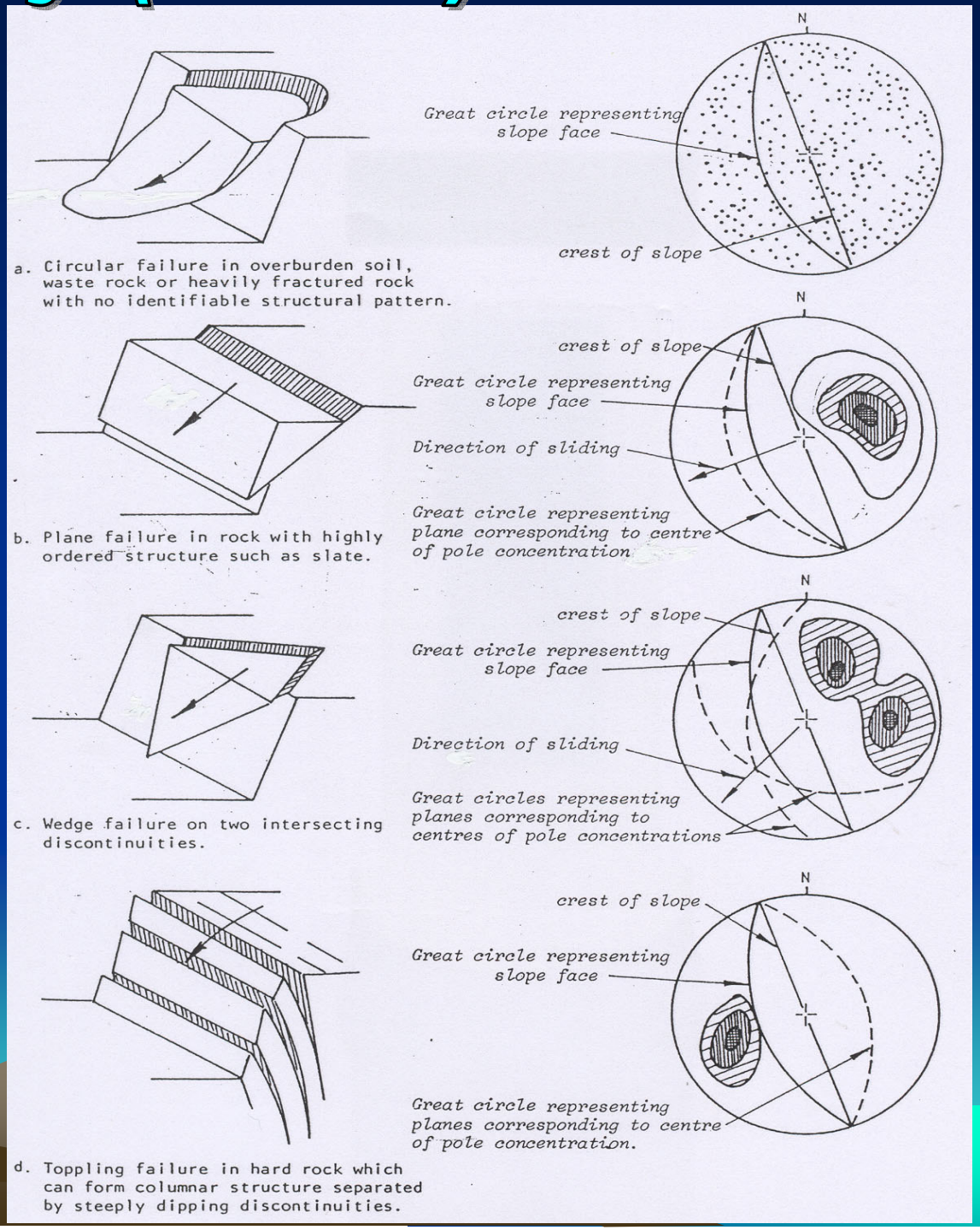
- The site is underlain by KL Granite
- Weathering profile: Grade II to VI
- Granite rocks are whitish grey and dark grey in colour with iron stained markings
- Chemical weathering is the main character for the weathering process
- Exposed rock is generally Grade II and III

Method of Study

- Systematic data collection and presentation
- Geological mapping using 'Line Mapping' method
- Walkover survey along the rock slope before collecting data
- Photographs for documentation and identify the potential failure mode during analysis and design stage
- Skylift was used to access to the upper part of some high rock slopes

Method of Study (Cont')

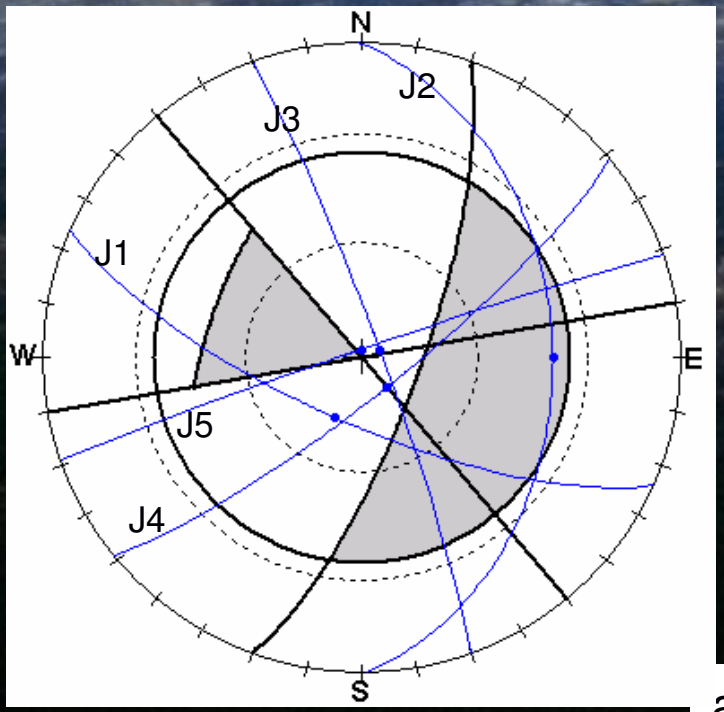
- Determination of possibility of slope instability from the orientation of the discontinuities - Kinematic Analysis
- This determination is accomplished by stereoplots analysis
- 4 types of typical failure modes, namely circular failure, plane failure, wedge failure and toppling failure

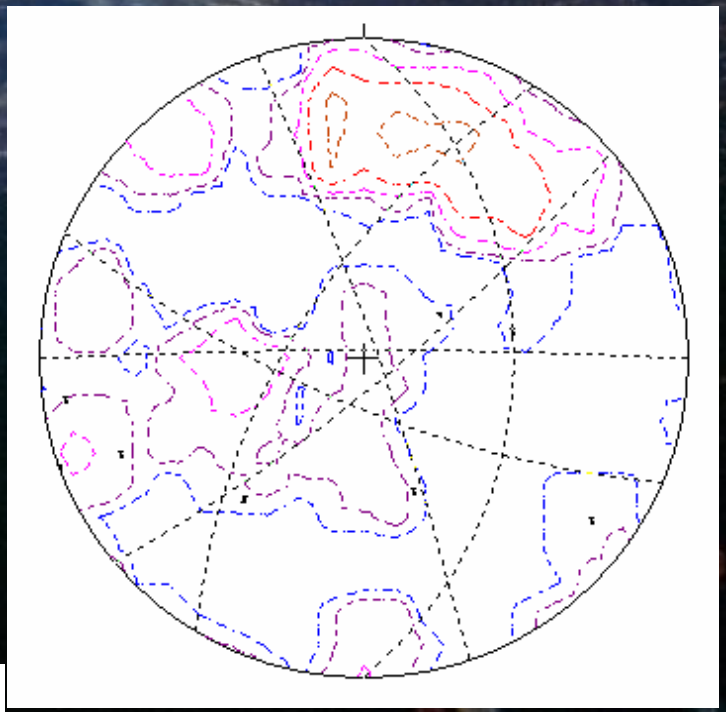


Results of Study

Zone A

- Located at the northeast part of the Damansara Hill
- Major Discontinuities: J1 (203/73), J2 (090/40), J3 (071/85), J4 (140/80) and J5 (360/88)
- Potential Wedge Failure: J1 & J2, J2 & J4, J2 & J5
- Potential Plane Failure: J2



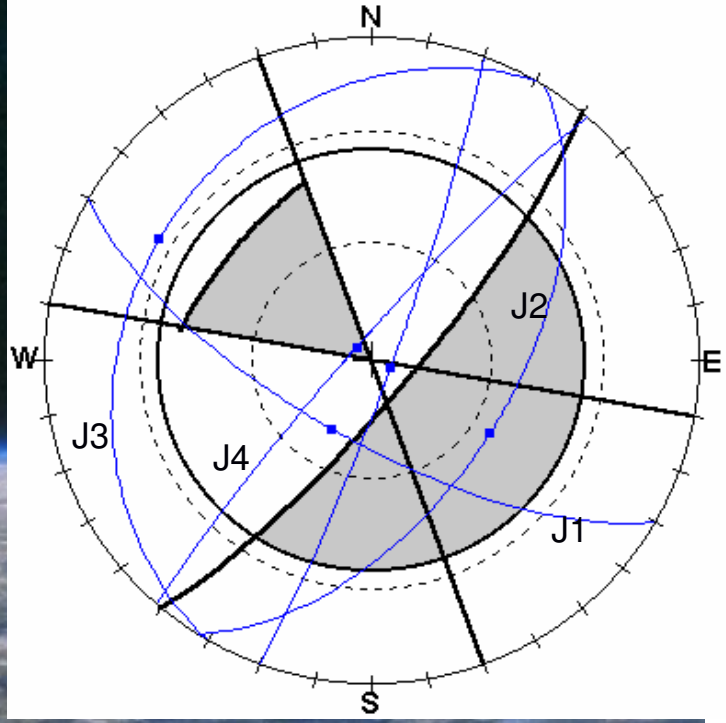


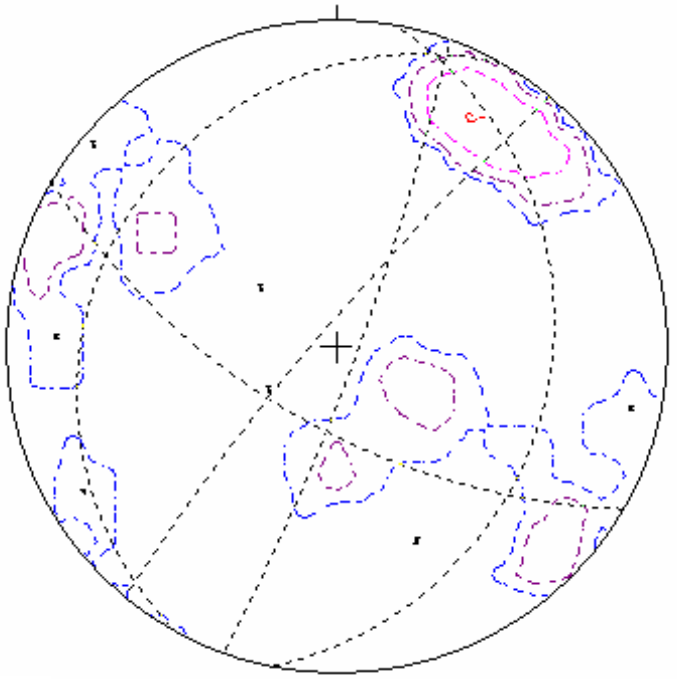
a) Zone A

Zone B

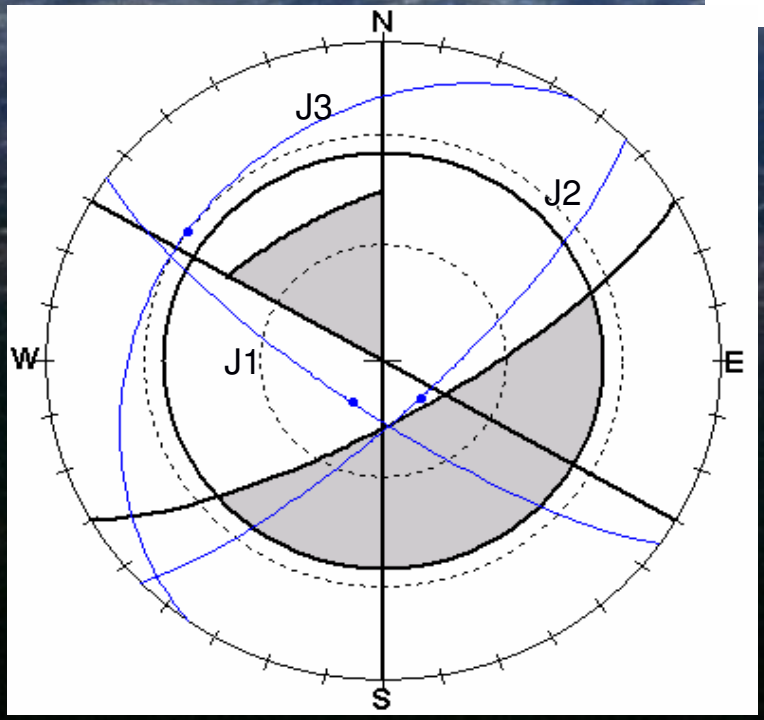
This zone has been divided into Zone B1 and B2.
Zone B1 was located at the highest part of the Damansara Hill
Major joints: J1 (210/70), J2 (110/85), J3 (300/26), J4 (310/85)
Potential Wedge Failure: J1 & J2
Potential Toppling Failure: J4

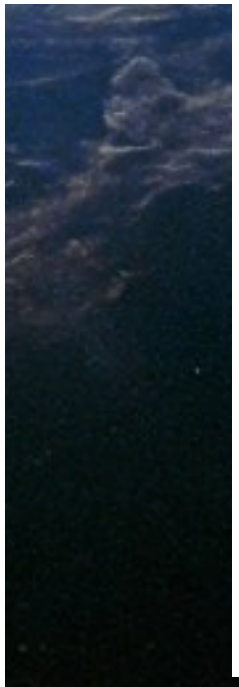
Zone B2 located at the southern part of the study area.
Three possible failure identified are circular, plane and wedge failure from the three major discontinuities of J1 (215/77), J2 (136/77, and J3 (305/30)
Analysis on the pole plot shows that the discontinuities data scattered randomly - possibility of circular failure
Potential Wedge Failure: J1 & J2
Potential Plane Failure: J1

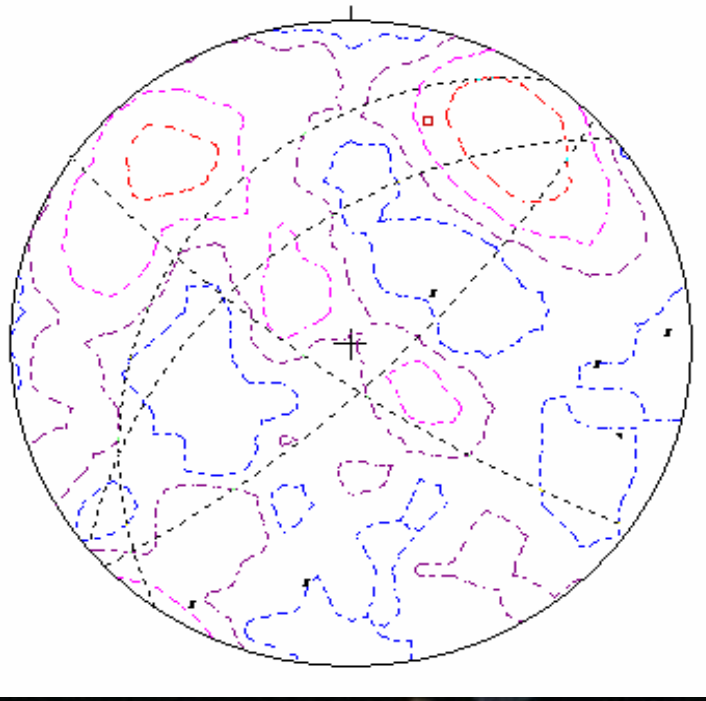




b) Zone B1



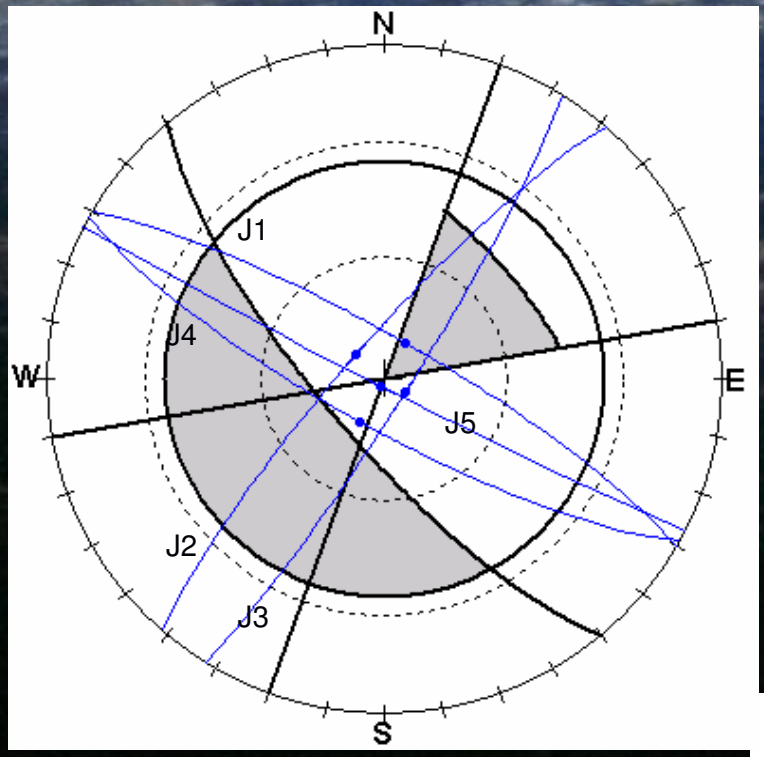


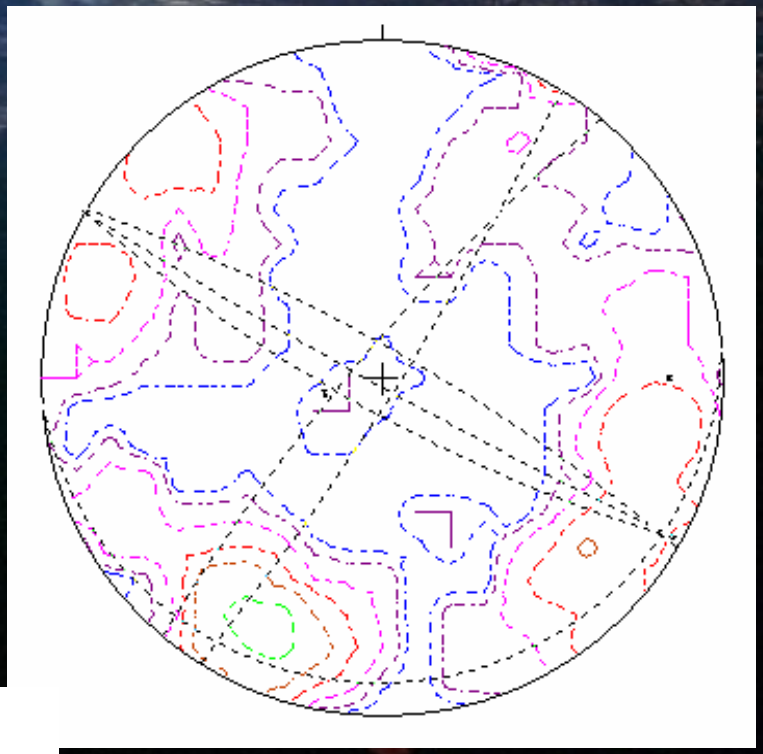


c) Zone B2

Zone C

Zone C is located at the Damansara business centre area at the southern part of the Damansara hill.
Major discontinuities: J1 (030/80), J2 (310/81), J3 (122/84), J4 (209/88) and J5 (209/78)
Potential Wedge Failure: J2 & J4
Potential Toppling Failure: J1

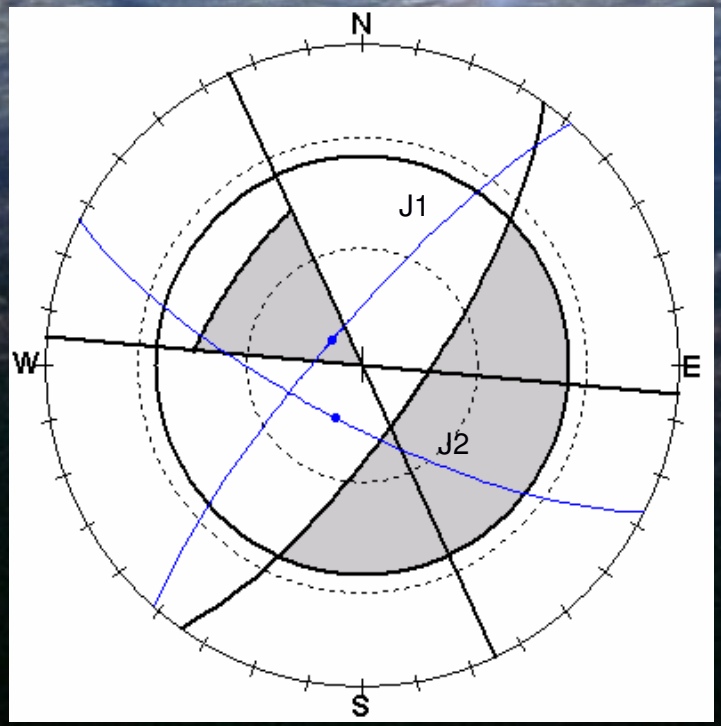


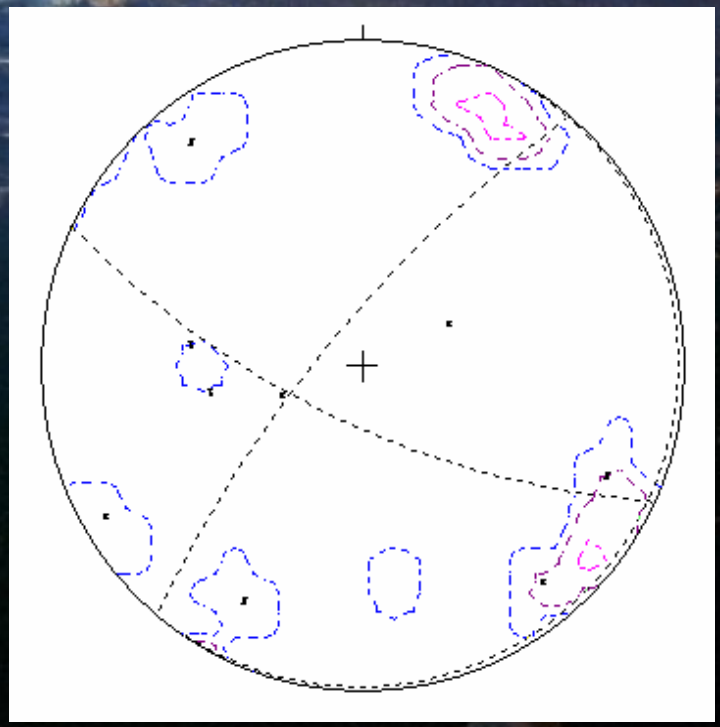


a) Zone C

Zone D

Zone D is located at the northwest part of the study area
Major discontinuities: J1 (310/80), J2 (208/75),
Potential Toppling Failure: J1

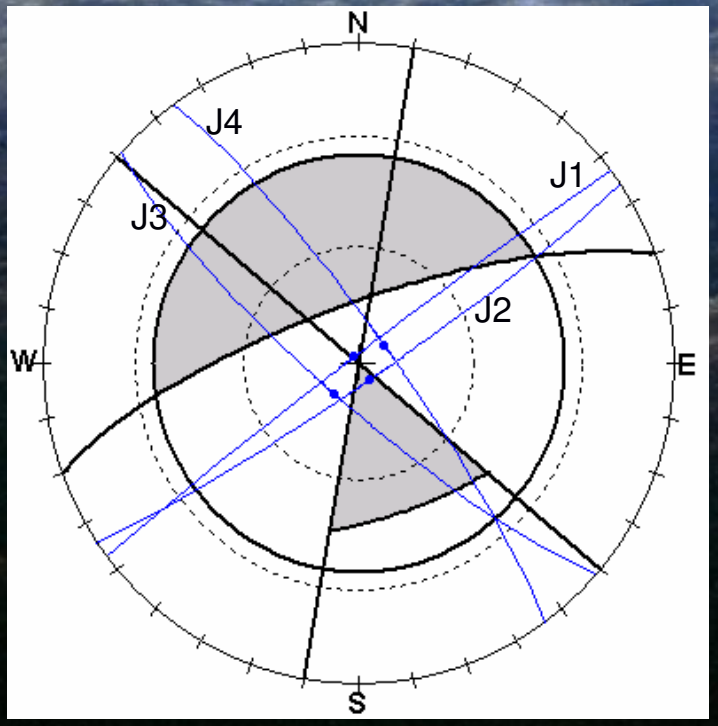


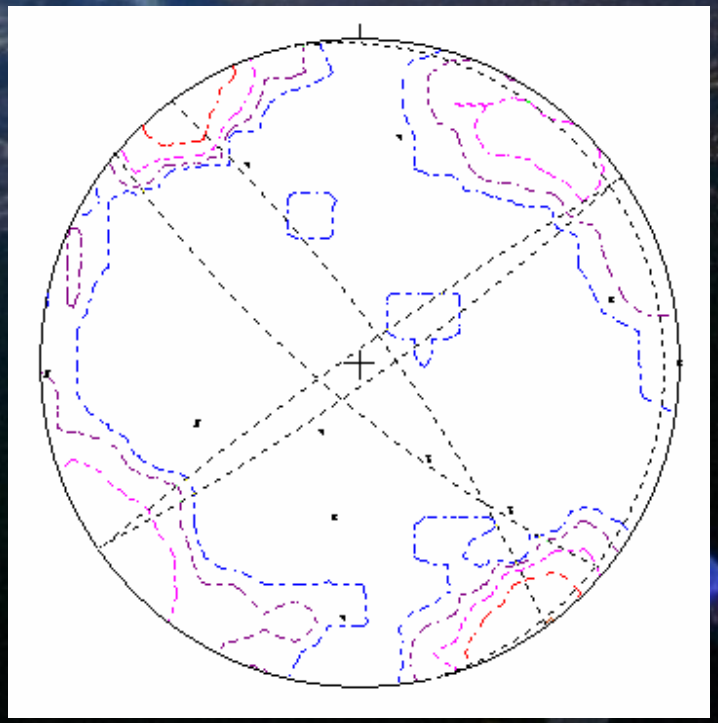


b) Zone D

Zone E

Zone E located far to the Northeast part of the Damansara area.
Major discontinuities: J1 (325/88), J2 (145/85), J3 (220/80), J4 (054/82)
Potential Toppling Failure: J2





c) Zone E

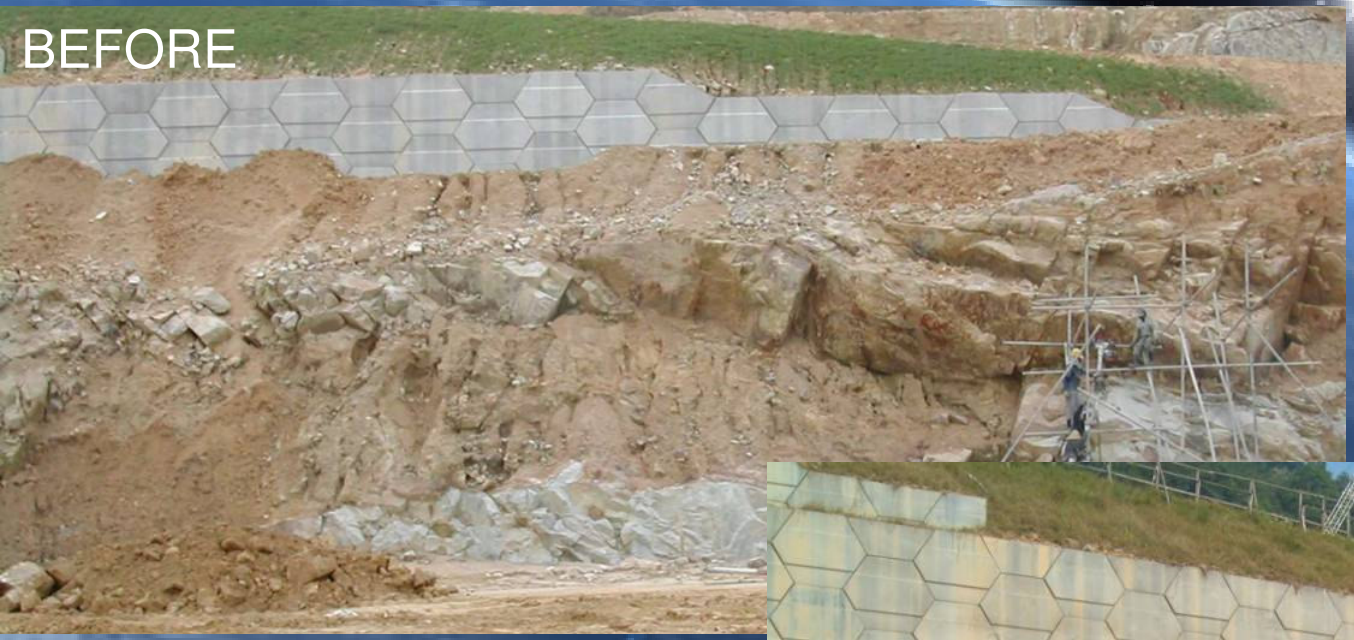
Potential Hazards & Mitigation Measures

- Development of hilly terrain involves site clearing and removal of trees
- Slope erosion and landslide are the primary concerns of the environment impacts
- Falling of loose boulders or rock fragments, sliding of unstable blocks and rockfalls could also occur at exposed or blasted rock slopes.

- In addition to kinematic analysis, factor safety analysis were carried out to determine the quantum of the slope stabilisation required to prevent any possible failure
- Rock slopes were stabilised with:
  1. Spot bolting (with tensioned rock bolts and rock dowels)
  2. Scaling (removal of debris, rock fragments and small boulders)
  3. Shotcrete with wire mesh reinforcement and rock horizontal drain
- For shotcreting, weephole drain shall be installed properly to prevent build-up of water pressure

Completed Stabilisation Measures

Zone A Rock Slope

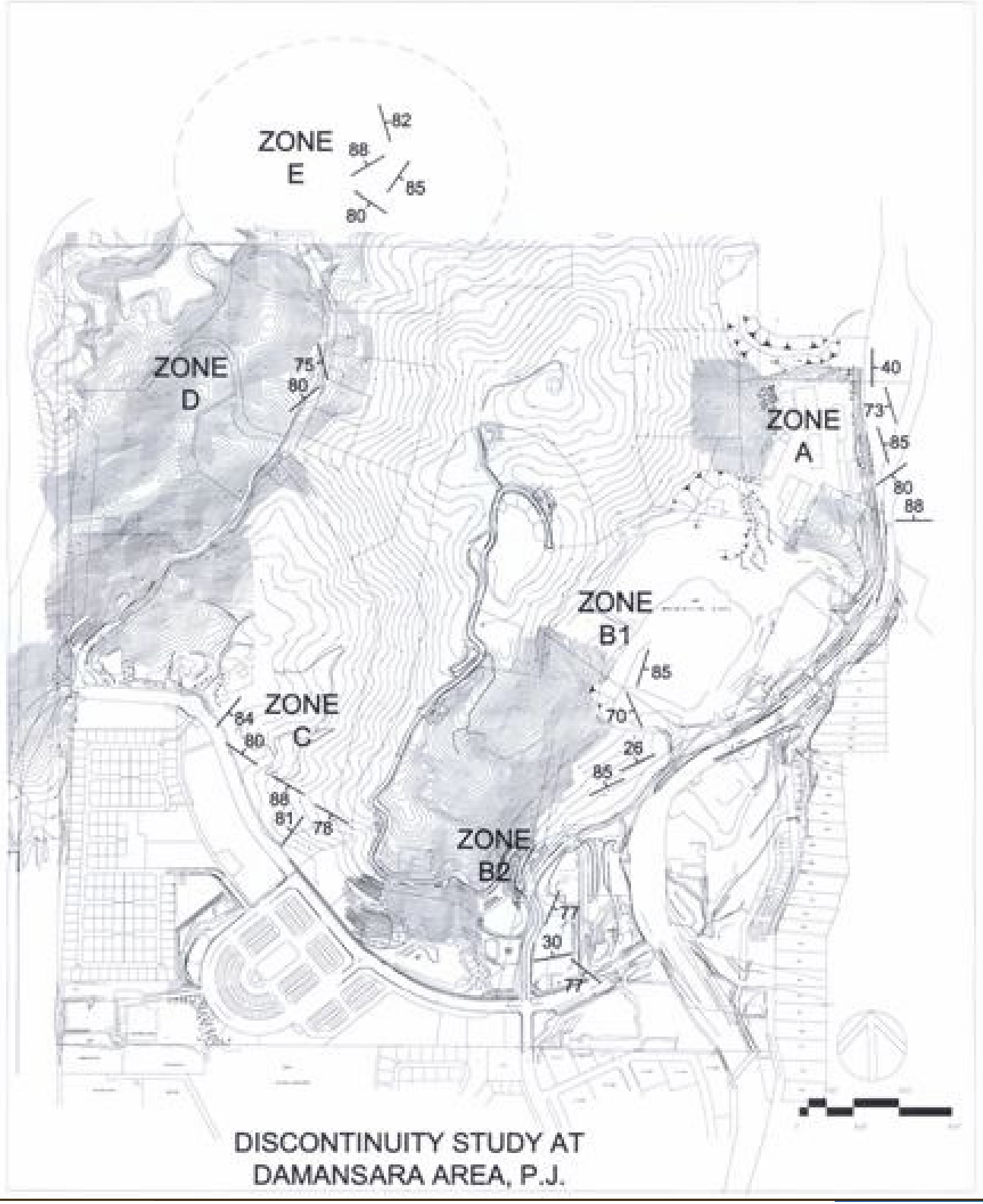


Zone C Rock Slope

Zone E Rock Slope

Discussion & Conclusion

- From the kinematic analysis, possible failure modes consists of circular, plane, wedge and toppling failures for rock slopes under this study
- Two common trends of discontinuities can be observed at each zone, which are discontinuities plane of 300^{o}-310^{o} with dip of 80^{o}-85^{o} and 200^{o}-210^{o} with dip of 70^{o}-80^{o}
- This suggests presence of relatively homogenous trends of discontinuities of Granite hill at Damansara area
- More detailed kinematic and safety factor analyses are required to identify localised unstable blocks and suitable slope stabilisation measure



DISCONTINUITY STUDY AT
DAMANSARA AREA, P.J.

Area	Zone A	Zone B1	Zone B2	Zone C	Zone D	Zone E
Slope Face Orientation	110°/ 75°	130°/ 80°	150°/ 75°	230°/ 75°	125°/ 70°	340°/ 75°
Major Discontinuities	J1– 203°/73° J2– 090°/40° J3– 071°/85° J4– 140°/80° J5– 360°/88°	J1– 210°/70° J2– 110°/85° J3– 300°/26° J4– 310°/85°	J1– 215°/77° J2– 136°/77° J3– 305°/30°	J1– 030°/80° J2– 310°/81° J3– 122°/84° J4– 209°/88° J5– 209°/78°	J1– 310°/80° J2– 208°/75°	J1– 325°/88° J2– 145°/85° J3– 220°/80° J4– 054°/82°
Potential Failure Mode	Wedge/ Plane	Wedge	Wedge/ Plane/ Circular	Wedge/ Toppling	Toppling	Toppling
Mitigation measure	**Completed** Rock bolt Rock dowel Shotcrete HD	**Proposing**	**Completed** Rock bolt Rock dowel Shotcrete HD	**Completed** Rock bolt Rock dowel Shotcrete HD	**On-going** Rock bolt Rock dowel Shotcrete HD	**Completed** Rock bolt Rock dowel Shotcrete HD

Table 1: Summary of rock slope condition

* HD- Rock horizontal drain


Question and Answer

Thank You !