G&P DIGEST

Newsletter of G&P Professionals Group

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LANDSLIDES: HOW & WHY?

There have been a number of landslides in recent years since the notorious landslide incident occurred in 1993 which resulted in the collapse of Block 1 of the Highland Towers that claimed 48 lives. The occurrence of landslide usually prompted many "experts" to put forward their hypothesis or likely causes of the landslide. Some of the hypothesis are quite factual while some are misleading or without proper basis. Here, we attempt to discuss how and why landslides occur and also demystify some of the common misconceptions that often appear in our media about slope safety.

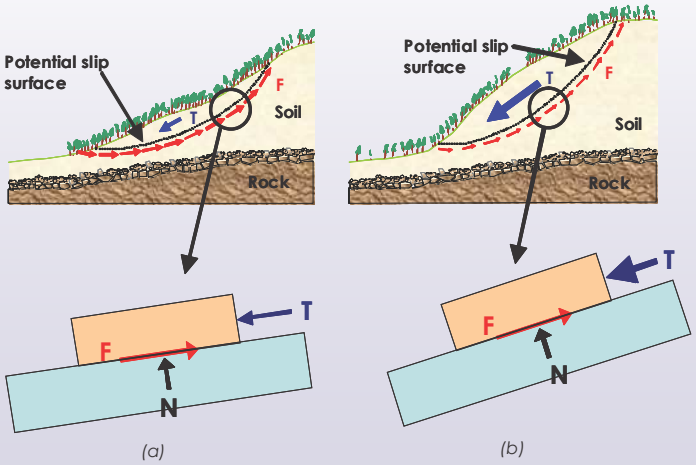


Fig 1: Illustration of slope stability in friction concept. (a) F greater than T; (b) F equals to T
[T = Total Driving Force. F = Total Resisting Force]

HOW DOES LANDSLIDE OCCUR?

In slope stability analysis, the ratio of total resisting forces (F) to total driving forces (T) along most critical potential slip surface is known as Factor of Safety (FOS). A slope is not failing when FOS is greater than 1 while the slope can be unsafe when FOS reaches unity and landslide will occur, as illustrated in Figure 1.

The magnitude of F and T generally depends on the following main factors:

a) Soil properties
b) Slope geometry
c) Groundwater level

WHY LANDSLIDES: FACTORS ATTRIBUTED TO LANDSLIDES

A study on the causes of landslides had been carried out by Gue & Tan (2006) based on 49 investigation cases of primarily large landslides on residual soils. The results of the study are shown in Figure 2.

The results of the study indicate that 60% of the failures are due to inadequacy in design alone, which is generally lack of understanding and appreciation of the subsoil conditions and geotechnical issues.

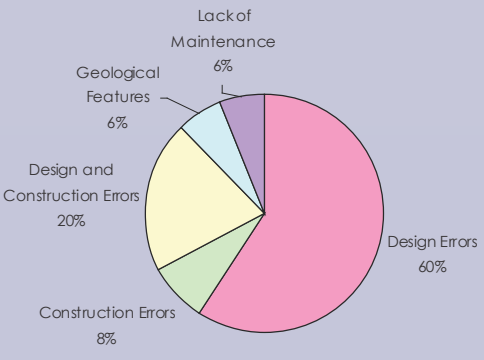


Fig 2: Causes of landslides

FURTHER IMPROVEMENT OF SLOPE MANAGEMENT

Figure 3 summarises the identified key areas where improvement and initiatives are needed in slope management and engineering in Malaysia which include:

a) Streamlining and harmonising existing policies and legislation including review and enhance legal framework in order to provide transparent and consistent guidelines for project application and approval;
b) Formulate and update undergraduate education modules on slope engineering;
c) Setting-up structured professional training and knowledge sharing between practitioners and lecturers through workshops and forums;
d) Tightening construction control by providing competent supervising personnel and strengthening contract enforcement by providing appropriate contractual requirements and penalty clauses;
e) Investment in research and development to enhance safety, environmental protection and sustainability, speed of construction and economical aspects related to slope engineering and management;
f) Promote and enhance awareness of public as well as practitioners on regular slope maintenance.

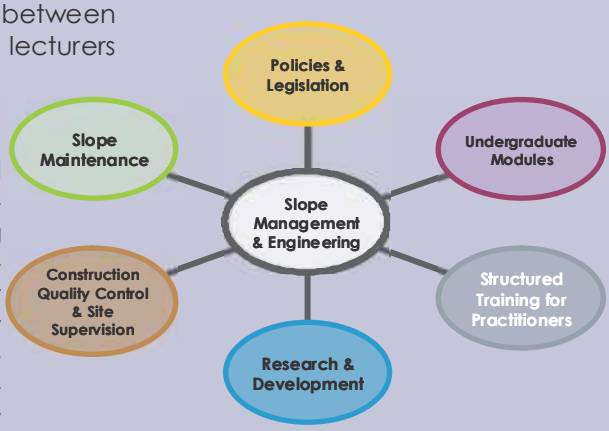
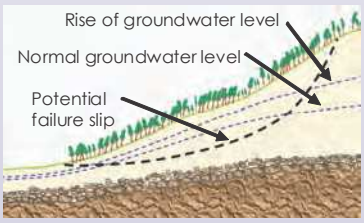


Fig 3: Key areas for improvement in slope management and engineering.

COMMON MISCONCEPTIONS ON LANDSLIDES

#1. "Soil tests showed that the slope is safe"

Soil tests alone do not tell us whether a slope is safe. Rather, soil tests only provide the parameters for engineering analyses and designs of slopes. An engineer needs to study the overall slope in a holistic manner and carry out engineering analyses of the slope to determine the Factor of Safety (FOS) of a slope for appropriate strengthening and protection works.

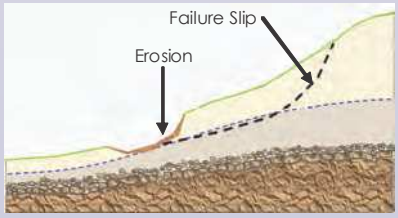


#2. "Heavy rain causes slope failure"

This is not correct, although it may triggers landslips. Increased rainfall saturates slope materials, raises the groundwater table and thus decreases the FOS of the slope. However, properly engineered slopes should not fail as the slopes should have been designed for the most probable water table during heavy rainfall. The exception is when the actual rainfall is greater than the designed return period of rainfall.

#3. "Erosion will not cause slope failure"

This statement is also not entirely correct. Erosion can propagate a slip from toe of the slope towards upslope or from slope crest towards downslope and uncontrolled erosion eventually triggers the slope to fail.



#4. "Retaining walls can always prevent slope failure"

The public may think that any structural solutions like retaining wall is very strong and can retain the slope without problems. However, this may not be the case for improper engineered walls. A retaining wall must be properly designed to the relevant standard Code of Practice by professional engineers for safety.

#5. "Slopes are maintenance free"

Slopes are not always maintenance free and should be regularly maintained by following a maintenance regime, such as clearing clogged drains and patching up localised erosion spots. Poorly maintained slopes will eventually lead to slope failures if unattended.


17 killed in Sandakan landslide

#6. "The slope has been standing for more than 10 years! So it is safe!"

This is not necessarily true as some cases of slope failure show that natural slope can fail suddenly without warning even though it's been standing for years. Hence it is not safe to assume that natural slopes are usually safe and it has to be investigated and analysed.

MAJOR LANDSLIDES IN MALAYSIA

As the area of flat and undulating lands within densely populated cities like Kuala Lumpur and Penang became limited, hillsite development has gained in popularity for the past three decades in these cities. However, concerns and awareness on the hazards of hillsite developments only begun after the collapse of Block 1 of the Highland Towers. Since then, there have been other major landslides resulting in fatalities and severe losses and destruction of properties. A brief discussion of four major landslides occurred in Malaysia is presented here.

Collapse of Block 1 of Highland Tower Apartment (1993)

Highland Towers consisted of three blocks of 12-storey high apartments named simply as Block 1, 2 and 3 respectively. Block 1 which was completed and occupied in 1979 had collapsed on 11th Dec 1993. The collapse occurred after 10 days of recorded cumulative rainfall of 177.5mm and **killed 48 people**.

An investigation by specialists assembled by Majlis Perbandaran Ampang Jaya (MPAJ) concluded that the most probable cause of the collapse of the tower was the failure of the piles foundation induced by the movement of foundation soil beneath the building. The landslide was triggered by **inadequate drainage** on the hillslope that were unable to accommodate surface runoff. The design for **slope and rubble walls** behind and in front of Block 1 were also found to be **inadequate.**

Collapse of Block 1 of Highland Towers Apartment

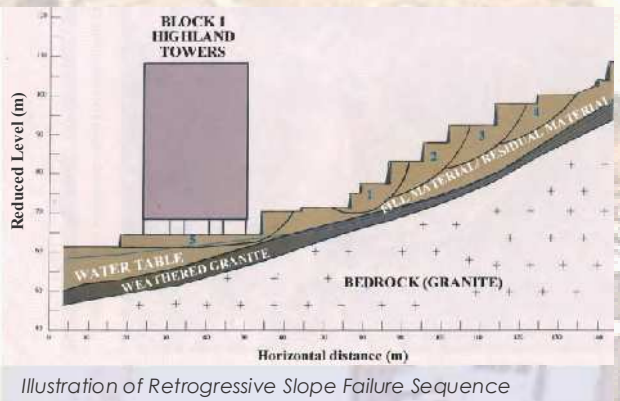


Illustration of Retrogressive Slope Failure Sequence

Rock slope failure at Bukit Lanjan (2003)

On 26th Nov 2003, a massive rock slope failure occurred at Bukit Lanjan Interchange which is part of New Klang Valley Expressway. The failure occurred after a period of heavy rainfall. The substantially large volume of rock debris (**approximately 35,000m^3**) that came to rest and completely blocked the expressway had forced the entire stretch of expressway to be **closed for 6 months** for rehabilitation works.

Immediately after the failure, the Highway Concessionaire commissioned site investigation to assess the likely causes of failure and also to provide geotechnical information required for the design of rehabilitation works. From the site investigation results, it was inferred that the rock slope failure was **a complex wedge type failure**. It was also demonstrated that for the failure to occur, water pressure is required to act on the potentially unstable wedge.

Rock Slope Failure at Bukit Lanjan, 2003

Debris Flow at KM302 of PLUS North-South Expressway Near Gua Tempurung (2004)

Two lanes for southbound traffic bridge of KM302, North-South Expressway near Gua Tempurung were **closed for three months** for rehabilitation works as the result of a debris flow that occurred on 12th Oct 2004. In this incident, tonnes of earth, boulders and trees came crashing along the hill slope.

Three prestressed concrete beams supporting the bridge were damaged and had to be replaced. This incident also caused **an injured victim, public and economic losses;** and **major public inconvenience**.

Debris flow at KM302 of PLUS Expressway

Damaged beam of bridge after hitting by landslide debris

Slope Failure at Putrajaya (2007)

On 22nd March 2007, a massive slope failure occurred at Precinct 9, Putrajaya **burying twenty-three vehicles** and about **1,000 residents were forced to vacate** their homes at 4:30am.

This slope failure **involved a 50m high hill** with man-made slope gradient of about 45 degrees and was located at about **10m from the 15-storey apartment**. It had been **raining heavily** in Putrajaya since the evening of 21st March 2007 until the early morning of 22nd March 2007 before the slope failure happened.

Slope failure at Precinct 9, Putrajaya

CONCLUSION

Malaysia has experienced a surge in landslide incidents due to the growth of hillsite developments since early 1990s and the severity in terms of casualties peaked in mid 1990s. In addition, landslides cause destruction to properties, economic losses as well as inconvenience to the public. Hence, slopes must be properly planned, investigated, analysed, designed, constructed and maintained to ensure safety.

G&P 12th ANNIVERSARY DINNER

MASQUERADE NIGHT @ CITITEL, MID VALLEY

A WORD FROM OUR CEO

Ir. Dr.Gue See Sew:

I am pleased that you all could grace this anniversary that falls on the actual day, the establishment of G&P back in 15th Sept 1999.

Our continued great journey of over 12 years has been full of excitement and challenges for creating a "One Stop Value - Added Engineering Consultancy". Throughout the year of 2011, various successes and achievements have been accomplished.

There is a saying by an Economist, Tim Harford, "Long-lasting profitability for a company comes from having capability others cannot match or others not willing to do". Therefore, Research and Development (R&D) and innovation are necessary. Innovation needs R&D to ensure continuous improvement and to stay competitive in the industry. That is the reason why R&D is one of our four core values of G&P.

THANK YOU.

NEWS FLASH @ G&P

Christmas Party 2011

Characteristic of Malaysian culture also applies in G&P - celebration of various festivals and events.

G&P Christmas Party 2011 was filled with cheerful, exhilarating and joyful activities.

G&P Olympic 2012

G&P Olympic is a yearly event that has been carried out for five consecutive years. This year we have our staff participating in various games including bowling, badminton, basketball, table tennis, etc.

Internal Training @ G&P

G&P's Culture
Internal Training

G&P regularly conducts internal training or colloquium to all Engineers and Engineering Geologists to share their knowledge, experience and lessons learnt from various projects, particularly on daily related design and construction works.

G&P also invited external organisations such as specialist contractors to conduct short presentations to share their construction work experience and to introduce the latest technology or products available in the market.

Discussions on the topic presented are carried out after presentation to allow audiences to raise their suggestions or comments which would improve and benefit all the participants.

Besides, G&P frequently send their Engineers and Engineering Geologists to attend training courses organised by BEM and IEM.

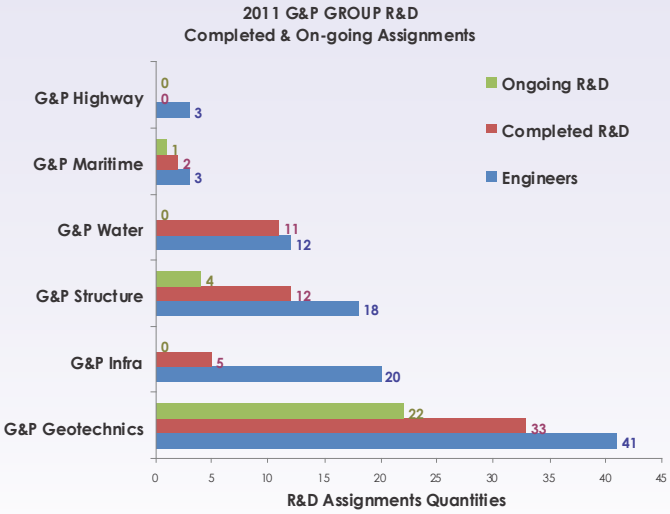
LIST OF SOME RECENT PROJECTS

Project Title	Client
PROPOSED 60 TPH PALM OIL MILL AT PT TUM, TARAKAN, KALIMANTAN TIMUR, INDONESIA	Felda Engineering Services Sdn Bhd
STUDY ON THE FORMATION OF COOLING WATER OUTFALL FOAM AT THERMAL POWER STATIONS AND ITS IMPACT TO THE ENVIRONMENT	TNB Research Sdn Bhd
PROPOSED RECLAMATION OF 170 ACRES OF MIXED DEVELOPMENT AT MUKIM KLEBANG, MELAKA	Listari Marina Sdn Bhd
CONSULTANCY SERVICES FOR MIRI WATER SUPPLY SOURCE DEVELOPMENT IN MIRI, SARAWAK	JKR Sarawak
GREEN BUILDING INDEX (GBI) FACILITATOR FOR ROYCE RESIDENCE, KUALA LUMPUR	Yuk Thung Properties Sdn Bhd
PROPOSED HOUSING DEVELOPMENT ON LOT 2219-LOT 2226, MUKIM SEMENYIH, HULU LANGAT, SELANGOR	Kajang Resources Sdn Bhd

G&P R&D ACHIEVEMENT 2011

G&P's structured R&D allows G&P to continuously revise and improve our design. It is of great importance for business as the level of competitiveness, productivity and innovation can be rapidly increased.

G&P always seeks to keep pace with modern trends and analyses the needs, demands and desires of the clients.



Summary Year 2011

In year 2011, the number of G&P's engineers involved in R&D reached a total of ninety-seven (97).

Under a systematic and structured R&D program, G&P has completed sixty-three (63) R&D assignments, whereas on-going R&D assignment amounted to twenty-seven (27).

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