Environmental Preservation with Reinforced Soil Technology

AS global warning becomes a serious concern, many are starting to realise the consequences of overdevelopment. Only a few months ago, development on slopes became such a hot topic that it lead to the launch of a public forum on the issue. Very recently, disaster struck again when a number of people were killed in a landslide.

Is it inevitable that we have to pay the price of development on hill slopes with innocent human lives? Can technology minimise or even prevent the occurrence of such tragedies in the future? Can this technology also be used to minimise pollution and protect the environment? Jurutera seeks the answers to these questions from Engr. Dr Nehemiah Lee Chee Hai, MIEM, P.Eng. Managing Director of Nehemiah Reinforced Soil Sdn Bhd.

What are some of the challenges in soil reinforcement in Malaysia and how can some of these challenges be overcome?

Rainfall is a critical factor in the installation of reinforced soil technology in this country. The level of rainfall at a particular location has to be taken into careful consideration very early on, *i.e.* during the planning and design stage. Failure to do so would result in the collapse of retaining walls as well as landslides.

Besides the level of rainfall, engineers would also have to consider the geological formation of a particular site. The design for a reinforced wall on a steep slope would be very different from a wall that is located on a gentle slope.

For each development, the technology has to be adapted to local soil conditions. There is no such thing as a technology that is suitable for every condition. For example, in certain parts of India, the existing seismic conditions in different zones can be challenging to engineers who are inexperienced. They will have to cater to each situation individually and adapt the technology to suit the local environment.

That is why each project that uses reinforced soil technology is unique. Imported technology may not necessarily have an advantage over local technology, although many are under the impression that the opposite is true.

Some time ago, a foreign technology that was very successful in its home country was brought over to Malaysia. Unfortunately, the technology failed because the engineers did not realise that it was not designed to cope with the intensive rainfall in Malaysia.

Looking ahead, the industry outlook in 2009 is going to be a challenging one. Without a doubt, there will be a slowdown in the economy especially in the housing sector. Projects in the infrastructure sector may be scaled down.

In order to cushion the impact, the Government has to inject more funds into the infrastructure sector as a stimulus for economic growth. A slowdown in the construction industry will have a multiplier effect on the other industry. The Government has taken such initiatives before in the past. I believe that they will continue doing so, especially in times of an economic slowdown.

Another challenge the industry may face is the fluctuating price of raw materials. The rising cost of certain materials has certainly affected industry players, be it big or small. The industry would really benefit from a mechanism that can somewhat stabilise the price of raw materials.

How can the current reinforced soil technology contribute towards environmental preservation?

When there is hill slope development, there would, inevitably, be some form of environmental impact. The question we should ask is, how serious is the impact and how can we minimise it?

With the rapid growth of our population, many lowlands are being used up for development purposes. This has led to development on hill slopes which carries a certain amount of risk and is highly susceptible to environmental damage.

With technological advancements, hill slope development can be made safe. Reinforced soil technology can be used for slope protection as well as prevent slope

failure. To illustrate this point, let us compare the various methods available for the construction of a highway on a mountainous terrain to span across deep valleys.

With the viaduct method, construction of the highway would involve massive hill cutting and a very big foundation would have to be executed. This is also one of the most expensive solutions available.

The other solution is the earth embankment method which involves massive earth filling. To do so, heavy earth compacting equipment would need to be brought in. Although this method is cheaper than the viaduct method, it is still expensive and is not so environmentally friendly.

Another alternative is to carry out massive cutting into the hill slope and removing the earth with heavy excavating equipment. Although the cost of this solution is lower than the viaduct method, the impact on the environment is very serious. In some cases, the whole hill is cut away and the environment is badly affected as large numbers of heavy earth moving trucks are required to either remove the earth or to bring in earth for the embankment method.

The current housing development practise on hill slopes involves a lot of hill cutting and earth filling. Very often, many trees are also chopped down. As a result, soil is washed away and ends up polluting the river as well as causing floods.

Some of these methods are open to slope erosion and landslides. Fortunately, some of the latest reinforced soil technology can prevent this. The advantage of this type of technology is, it requires minimal cutting and filling, reduces construction time and is usually more cost effective.

What are your comments regarding the Selangor government's ban on new development projects on Classes 3 and 4 slopes?

In my opinion, it should not have been a blanket ban. Since no two slopes are the same, each hill slope development should be individually assessed. From the layman's point of view, a slope that is steeper is generally more likely to fail than a slope that is gentler. However, from an engineering point of view, this is not always so.

If a slope is adequately designed and slope protection is adequately carried out, hill slope development, even on Classes 3 and 4 slopes, should not be a problem. With the proper geotechnical and engineering input, as well as proper design and implementation with proper precaution taken for drainage during construction, such development should not fail.

When we compare hill slope development in Malaysia with the situation in Hong Kong, the terrain in Hong Kong is actually more challenging. Yet, Hong Kong engineers are able to address these challenges because they have strong geotechnical expertise there.

In my opinion, one of the most important parts of hill slope development involves maintenance, and in this case, it would be drainage. If the drainage system is well designed and well constructed, it should be able to cater to the intensive rainfall in Malaysia.

How advanced is reinforced soil technology in Malaysia compared to other countries?

I believe we are on par with many countries around the world in terms of the technology. I would like to share an incident that illustrates this point.

Recently, a group of Hong Kong engineers was invited to Malaysia as part of an exchange programme. The Hong Kong engineers wanted to give a talk on soil reinforcement. However, when they arrived and saw the number of reinforced walls in Malaysia, they wanted to invite Malaysian engineers to give a talk on the topic instead. This goes to show the achievements of our engineers.

For a relatively small country, we are also one of the biggest users of reinforced soil technology. Malaysians in general are also quite open minded in terms of embracing new technology.

What are some of the advancements that you hope to see in the future?

Despite all the advancements in the industry, I hope to see more improvement in reinforced soil technology. The discovery of newer materials, which is more cost effective and safer, would be very beneficial so the technology can be used more widely especially for slope strengthening. Indeed, I believe there is a lot of potential there.

Currently, as the technology develops further, it can be used for a wider scope. There is still plenty of room for research and development, and for newer applications. In fact, there is a research that is examining the use steel or geo-synthetic material as reinforcement for soil. There is also another research on the use of recycled tyres as reinforcement. However, there is not much commercialisation for that just yet. ■