Use of geological knowledge in building a house construction essay

A house provides warmth, security and comfort for us human. In order to build houses that meet the safety requirements and occupants' expectations, geological knowledge is important as a base for the construction of these buildings. A house is not build on a fluffy cloud, but on a solid ground where we have to first mount slab or lay concrete beams as the main foundation systems. It is also a common construction technique in wet and coastal areas where houses are put up on posts.

Before the decision to purchase a land or home is made, the type of ground where the house is going to be built on must first be determined. It is important to have a stable soil because there could be many drawbacks if the ground is unstable. If a house is built over loose soil conditions, the house will slowly sink. And if a house is built over an old dump site, it may be exposed to gases from the toxic waste below the surface.

Units of houses that are to be put up on hill slopes must consider various factors including the slope gradient, soil and rock engineering properties, drainage system, ground water table, geological factor and rainfall intensity. Hill slopes and elevated areas must be assessed holistically, taking into account those factors that are inter-dependent. Local authorities should advise house buyers by providing geological reports related to the proposed site before these buyers are to make decision on whether to buy properties residing near hill slopes.

In Malaysia, slopes have been classified into four classes and four levels of height. Class 1 is for slopes of less than 15 degrees, Class 2 for slopes of between 15 and 25 degrees, Class 3 for slopes of 25 to 35 degrees and Class

4 where slopes are more than 35 degrees. There exist guidelines that ban building activities on slopes of more than 35 degrees. Besides, slopes with granite and schist have a layer of soil in between and are prone to landslides.

In advancement, man-made slope disasters can be minimised by focusing on three technical phases, namely planning, during construction and post-construction activities. In the “ planning phase”, submitting engineers must undertake a detailed investigation of the soil condition prior to drawing up the building plan so that accurate engineering measurements can be formulated to ensure the building can stand firmly on the ground. Under “ during construction phase”, periodic inspection by the regulatory authorities should be implemented to ensure that the construction is executed according to the design requirements and safety aspects. Lastly, during the “ post-construction phase”, monitoring instrumentation and periodic slope maintenance should be carried out. By having proper slope maintenance, signs of slope instability can be detected earlier and minor slope repair can be done, thus minimising the risk of large-scale slope failure. The cost of major slope repair is much more expensive than carrying out maintenance works.

Nevertheless, slopes’ stability can be maintained by terracing and ploughing contour to prevent soil being washed downhill, planting tree belts to provide windbreaks and retention of straw and crop litter to protect the surface from erosion. Usually, benching, constructing retaining walls, shotcreting and putting up steel nets are some other methods of maintaining a slope.

In addition, authorities must ensure the intensity and direction of underground water flow, type of rocks in the soil and ability of retaining structures to support the ground. Developers must have flexible pipe fittings installed to avoid water leaks while in mudflow areas, channels or deflection walls are to be built to direct the flow of water around buildings.

Inclusively, some of the precipitation that falls onto the land infiltrates into the ground to become ground water. Once in the ground, some of this water travels close to the land surface and emerges very quickly as discharge into streambeds. However, because of gravity, much of the rain water continues to sink deeper into the ground. Water can move both horizontally or vertically once it meets the water table (below which the soil is saturated). Water moving downward can also meet more dense and water-resistant non-porous rock and soil, which causes it to flow in a more horizontal fashion. The direction and speed of groundwater movement is determined by the various characteristics of aquifers and confining layers of subsurface rocks in the ground. This event can cause geo-hazards because when water flows underground without being monitored, landslide or sinking of soil can take place.

After identifying the geological factors related to the ground where the house is to be built on, we next identify the geological aspects that contribute to the construction of the house itself. Walls of a house can be made of so many different materials such as mud and clay, rock, wood, bricks or concrete. The deciding factor is usually connected with the quality of the soil being used. Larger amounts of clay usually mean using the cob/adobe style, while low clay soil is usually associated

with sod building. Soil and especially clay is good thermal mass. Homes built with earth tend to be naturally cool in the summer heat and warm in cold weather. In Malaysia, houses are made of either clay or sand bricks. Clay bricks are a little more expensive than sand bricks but clay bricks are more practical to Malaysian houses as they are naturally cool in the Malaysian heat.

Rock structures are the longest durable building material available, and are usually readily available. There is a simple rule to follow on building a solid rock wall; durable and strong stones must be used. Rock is a very dense material so it gives a lot of protection and must be impervious to moisture. Some of the best rocks to be used are those made of hard shale or schist because they have natural flat cleavage planes when split. Its main draw-back as a material is its weight and awkwardness. Its energy density is also considered a big draw-back, as rock is hard to keep warm without using large amounts of heating resources.

A house is not complete without a roof. Nowadays, there are many types of roofing materials being used to shelter a house. On the other hand, developers must also consider the slanting of roof and geographical location of a house. The most common roofing material use in Malaysia is clay/concrete roof tiles for urban house dwellers and metal shingles for rural houses. Both concrete and clay tiles have longer lifespan, require low maintenance and are resistant to rot and insects. Then again, clay is very heavy and also fragile. For buildings in equatorial regions with warm and humid climate like Malaysia, the roof has been said to be a major source of heat gain. According to the Mean Radiant Temperature (MRT), the principle

of earth-base materials provide natural cool also apply to roof whereby although the most expensive, clay roof tiles can keep a house cool in the Malaysia heat as it is proven to have the best thermal performance with respect to MRT. The highly recommended material for reflective insulator is double-sided aluminium foil which can be used to replace mass insulation materials due to higher thermal performance. Hybrid ceiling proved to have the best performance in reducing thermal radiation into the interior space, followed by plaster board and cement board.

In order to complete the house, flooring materials are needed. The geological aspect of the house must first be clarified. If the house is located in a moisture area, use flooring material that does not rot and will not absorb water, such as stone, marble and granite, or concrete slabs, whereas in a very cold area, material such as linoleum is used. Some stone tiles such as polished granite, marble, and travertine are very slippery when wet but they keep mold and mildew away. Some of the softer stone such as limestone tiles are not suitable for very heavy traffic floor areas. As recently as the 1970s, wall-to-wall carpeting was a standard selection for homeowners who were purchasing new flooring. Linoleum was popular in the kitchen, and bathrooms were often covered with inexpensive vinyl tiles. It also used to be that granite and marble surfaces or rougher, more rustic stone materials seen only in vacation cabins or backyard patios. Nowadays, floors of houses are assortments of all these classified materials.

Lastly, up until the 1970s, asbestos has been the most popular material for ceiling tiles. It is only recently found that asbestos is unsafe if the material is airborne; hence, contaminated ceiling tiles are risky if damaged. Ceiling tiles

are lightweight tiles fabricated from perlite, mineral wool, and fibers (from recycled paper) are used in the interior of buildings. They are placed on a steel grid and they provide thermal but especially sound insulation. Here in Malaysia, it is proven that hybrid ceiling (combination of aluminium foil and rockwool) is able to produce the lowest MRT followed by plaster board and cement board.

In a nutshell, the acquirement of comprehensive knowledge of the house foundation, materials to use and expert’s advice is important. These skills are geological knowledge needed in building a perfect house.

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