CIVIL INFRASTRUCTURE IN LAND DEVELOPMENT: THE SUSTAINABLE AND ENVIRONMENTAL CHALLENGES

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ABSTRACT

Intensive housing and land development in Malaysia since the last decade has resulted in the depletion of suitable and cheap spot. This kind of land can now only be found in the area far away from the cities. However, most people choose to be near or not too far from the cities. This has led to the exploration of the less desirable area such as hillside, swampy land, ex-mining land, low lying land, and soft ground areas near rivers or sea.

A study of completed and ongoing development in the above mentioned areas reveal that there are less than adequate guidelines, laws or policies to ensure development in these areas are given proper attention in term of safety and environmental provisions. This paper discussed several case studies related to civil engineering infrastructure and systems and its issues in the planning, design and construction of housing and land development in the difficult and less desirable areas.

Keywords: **Civil Infrastructure, Land Development, Environment.**

INTRODUCTION

Predominantly agricultural during independence, Malaysia has been going through rapid urbanization especially in the last four decades (1960-2000). Intensive housing and land development has resulted in the depletion of suitable and cheap spot. This kind of land can now only be found in the area far away from the cities. However, most people choose to be near or not too far from the cities. This has led to the exploration of the less desirable area such as hillside, swampy land, ex-mining land, low lying land, and soft ground areas near the rivers or sea.

CURRENT SITUATION

Housing and Land Development. The country rate of urbanization has increased from 26.9 in 1970 to 61.8 in the year 2000.Up to the year 2000, it has been founded that there is a shortage of over one million units of houses. The original plan was 3,480,600 units and only 60.3% has been completed [1]. The demand for housing is concentrated in city areas.

Therefore, there is a great pressure for the government and private sectors to explore the difficult areas like hill area and poor ground area like swampy and soft ground areas near the city to provide or to cater for the demand.

TECHNICALLY DIFFICULT AND POOR GROUND AREA

Hillside and Hilly Area. Land development in the hillside and hilly area is unavoidable if the demand for housing near to city center is high. Major cities in Malaysia facing this situation are Penang, Kuala Lumpur and Johor Bahru. Figure 1 is an example of a development in the hillside area in Penang. Retaining wall systems are required to create flat space for buildings.

Figure 1: Example of land development in hilly area

However, development in the hilly and hillside area is usually associated with landslide, erosion, environmental degradation, mud flood and structural stability problems [2,3]

Swampy and Soft Soil Area. Swampy and soft soil area now has become the target of new development because the cost related to the improvement and provision of suitable foundation can be recovered with the high value of the near the city projects. Developers will take all necessary effort to minimize the cost of soil and site improvements using latest construction technologies. Some of the methods are proven effective but some others are still in trial. Usually, cost will be the deciding factor.

Figure 2 shows the use of geotextile in improving bearing capacity of subgrade. Long term issues such as land subsidence and settlement area crucial in the design consideration.

Figure 2: The use of geotextile to improve soil condition

Coastal and Riverside Area. Coastal and riverside area has been the favorite locations for human settlement. This is because these areas provide easy access to trade and food resources. Latest trend in coastal or river side development is the "riverfront" types of development – a development that requires a lot of structures to be constructed very near to the usually weak soil or even underwater.

While it is nice to have river view or sea view, in many instances, these places have been the dumping site for the resident's garbage and unwanted stuff.

Figure 3: River being polluted by garbage [4]

Figure 4: Example of a better planned riverside development

Lowland and Low Lying Area. Low land and low lying area especially those near or below sea level are very vulnerable to flooding and sewerage systems problems.

However, there are places in countries like the Netherland and India who, over the decades, have been able to successfully manage land development and construction of residential and commercial project in such areas.

Land region like Muar and Teluk Intan in Malaysia are very close to sea level. The phenomena of global warming will someday effects these areas. Thus it is very important that an early action plan and development/rehabilitation strategy being put forward.

Former mining land. Extreme heterogeneity and significant changes in lithology and soil properties over short distances can create very unstable ground for buildings. It is in the form of interbedded very soft clay (slime) and very loose and loose sand. This is the result of tin tailings being the end products of mining process [5].

However, two major cities in Malaysia – Kuala Lumpur and Ipoh are situated near former mining areas. These areas are being explored and converted to residential and commercial areas.

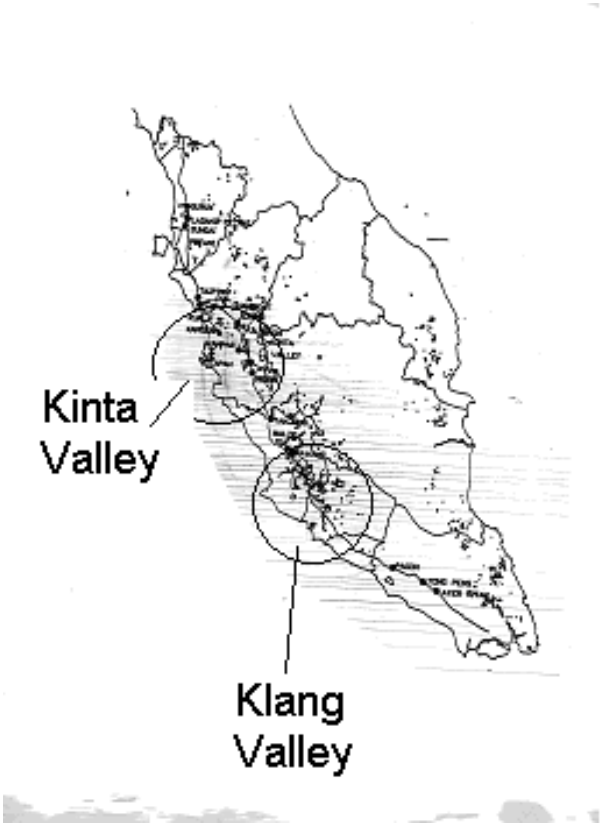

Figure 5: Former mining areas

EXISTING POLICY AND GUIDELINES

Existing law, policy and guidelines related to development in the difficult and environmentally sensitive areas can be categorized into three broad classifications:

1) The federal constitution and the ministerial act
2) Development planning and land use policy
3) Development and construction control policy

Federal Constitution and the Ministrial Function Acts. The federal constitution detailed out the responsibilities of the federal and states governments. Many matters related to natural resources and land development are on the state and concurrent list.

The ministerial function acts and the relevant ministers prescribe the function of the various federal ministers and department and agencies. Table 1 summarizes the role of various department and agencies.

Table 1: Role of Various Ministries and Departments

Ministry/Department	Role and responsibilities
Ministry of Works	Control, manage and supervise development of road, bridges, building, airport, water supply and water resources.
Dept. Of Mineral and Geoscience	Geological studies and control of mining and mining industries
Drainage and Irrigation dept.	Flood control, agricultural irrigation, coastal engineering and river engineering.
Department of Environment (DOE)	Environmental quality control
Urban and Regional Planning Dept.	Development and enhancement of physical, social, economic and environmental systems.
Land and Mines Dept	Land titles and landuse control
Ministry of Housing and Local Govt.	National council for local govt.

Development Planning and Landuse Policy. Existing laws related to planning and landuse policy includes National Land Code, Urban and Regional Planning Act, Structure Plan and Local Plan. However, all these laws rarely cover the specific aspect of land development in the environmentally sensitive and difficult areas.

Development and Construction Control. Most laws and bylaws related to development and construction are enforced by the local authorities. These laws include Local Government Act (Act 171), Street Drainage and Building Act (Act 133), Uniform Building Bylaw 1984, and Earthwork ByLaw.

Land Conservation Act 1960, is under the jurisdiction of Land Office (state and district). This act is to ensure trees and plants are not cut down unnecessarily and indiscriminitely. This act also provide the power to the land office to instruct owners to provide drainage and slope protection and erosion control facilities. Hill areas covered under this Act are Penang Hill and Cameron Highlands.

The Environmental Quality Act is a comprehensive piece of legislation for the prevention, abatement and control of pollution and the enhancement of the environment. The enforcement agency for this legislation is the Department of Environment. Other related laws and regulations are the Sewerage Services Act, Water Supply Act, Mining Enactment and Mineral Development Act and Registration of Engineers Act.

ISSUES AND RECOMMENDATIONS

Slope Stability and Landslide. The frequent occurence of landslide and building collapse near slope is a result of more development takes place in such areas. Inadequate laws and regulation for early planning of such development contributed to the improper design and maintenance strategy.Guidelines and policy on hillslope development is urgently required to ensure safety and environmentally sound. Early warning instrumentations should be included in the policy to ensure better preparation of emergency.

Flash Floods. Land development in the hilly areas changes the landcover consequently the amount of runoff coming to downstream or lower ground areas causing flash flood and mudflow. The newly established Urban Stormwater Management Management Systems [6] must be enforced competently. The existing Environmental Quality Act should be revised to include non-point pollution perevention strategy and guidelines.

Land Settlement and Subsidence. Building on soft soil subgrades are prone to diffrential settlement and land subsidence. Changes in ground water level later in the future will also cause strength or bearing capacity reduction. Uneven or diffrential settlement will cause building cracks and distruption to utility services. For multistorey building with strata title and with ”management corporation” set up, this will cause unnecessary cost escalation, which, ultimately goes to the individual owner. Attention must be given during design stage of such development. A proper legislation and policy for provision of sufficient technical consideration must be established. An insurance scheme for unforseen event must be made compulsory for the developer and also the buyer.

Low Lying Areas. Low lying areas are always subjected to flash flood and always on the receiving end of upstream activities. Drainage discharge is always a major problem when the site

is situated near river or sea. Research and development on, especially, drainage issues in these areas is important. A lot can be learned from countries like the Netherlands and India. However, the technology related to material, systems and construction methods must be locally adapted especially when Malaysia is a country with lots of rainfall.

CONCLUSION

WCED [7] has defined sustainable development as " …development that meets the needs of the present without compromising the ability of the future generations to meets their own needs."

Most of the issues in the technically difficult areas require the application of engineering expertise coupled with sustainable principles. Therefore, on top of proposed regulations or legislations, land development professional such as architects and engineers will play an important role to ensure the safety, economical and sustainable development of such areas. The professionals will ensure the minimum use of non-renewable resources and the use of renewable resources in a sustainable manner. It is also important to minimize the impacts of land development on natural environment and to protect biodiversity.

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