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FEASIBILITY OF A CONCEALED DRAINAGE SYSTEMS FOR HOUSING PROJECTS IN MALAYSIA

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Abstract

Most rainfall reaching surface of the earth is disposed in two ways – infiltration and surface runoff. As urbanization occurs, the amount of surface runoff increase resulting in the requirements of proper drainage systems to drain excess water to final discharge point.

Drainage systems in Malaysia are predominantly open channel drainage beginning from building perimeter drains to major river channel. Most authorities related to drainage prefer to maintain the status quo although concealed drainage is widely practiced in other countries.

This paper will attempt to make initial comparison of using concealed drainage systems especially in new housing development in term of design requirement and capital costs compared to open drainage systems.

INTRODUCTION

Located just 2 degree north of equator, Malaysia has the following climate characteristics – fairly uniform temperature, high relative humidity and abundant but seasonal rainfall. The seasonal rainfall known as monsoon – Northeast Monsoon during the month of November to February and Southwest Monsoon during May to August, occasionally cause flooding in areas without proper or inadequate drainage systems.

Drainage systems in new housing development are subjected to approval by various authorities. Time sensitive as it is, housing developers would rather follow conventional way of providing housing infrastructure. Anything different from normal practice will result in a more lengthy approval and construction procedure which in most times unpredictably long and tedious process involving various authorities with different set of rule and opinion.

This study is carried out as an initial effort to established basic guidelines or checklist on the suitability of concealed drainage systems as an alternative or as part of overall drainage system in new housing area considering several parameters related to rainfall intensity, landform and locality. This is done in the hope that the guidelines or checklist will help various parties involve in

housing development including the authorities to be able to quickly decide the best form of drainage system for certain project in certain areas.

At this stage studies related to capital cost and maintenance cost as well as non-cost factors of typical projects are under way.

TYPICAL DRAINAGE FACILITIES IN HOUSING PROJECTS

Provision of drainage facilities in housing development consists of drainage in individual lots, street drainage, main drainage and finally major drain to the final discharge point – most of the time river systems.

Figure 1 : Main Drain from Teluk Kumbar New Township Discharging into Existing Earth Stream

Drainage system is considered as two distinct systems - the initial and the major drainage systems.

- The initial systems includes roadside drains and other local drainage works and should provide for the maximum runoff from initial storm.

- The major system includes the main natural or artificial channels, flood plains, street and other flood routes and should be capable of discharging the runoff from major storm without serious damage to property or loss of life.

Lot Drainage

In open drainage systems, rainfall from the roof fall directly or through vertical down-pipe into house perimeter drain, usually half round drain 225mm diameter. As the invert goes deeper, brickwork on both side of the edge will support the earth around the excavation. There will be sump at junctions.

Street Drainage

Runoff from individual lots will be delivered to street drain which size has been predetermined by the authorities. The minimum is 375mm pre-cast egg-shape

drain. Similar to lot drains, the street drain will have brick-wall to stabilize the excavation if invert level is deeper than the drain size.

Main Drain or Monsoon Drain

This is defined as any drain that requires width of more than 4 feet or 1.2 meter. There will be at least one such drain in any housing development. The exact size will depend on the hydraulics parameters of the area that it serves. This is normally rectangular RC or pre-cast concrete drain. Other types are rubble pitching, rip-rap, or drains with brick-walls.

Final discharge point

Developers will usually be required to construct drainage facilities until final discharge point. Final discharge point is a point where there is major constructed or natural drainage systems serving the locality.

CONCEALED DRAINAGE SYSTEMS

Concealed drainage systems here means storm sewer. Its interconnecting pipe works beginning from house lot to the street and finally to main discharge point. All these works are underground.

Lot Drainage

Rainwater from roof is collected in a gutter then it goes through down-pipe and into collector drain underground which discharge it into the street storm water systems. Water in the lot compound is collected into a pit connected to underground drainage that deliver the runoff to the street systems.

Street Drainage

Water collected in the street is collected into storm sewer network through inlets at various locations.

Main Drain/Trunk Drain

Open channel or concealed drainage of larger diameter/capacity.

Receiving Water

Natural drainage systems or constructed drainage systems.

CAPITAL COST COMPARISON

Total costs are generated based on typical section of an actual drainage section in three housing projects. The project chosen were terrace type as this is the most common type of houses built in residential development in many parts of Malaysia.

Table 1: Project 1 – 38.95 acre

	LENGTH (M)	Drain Size	Capacity (cumecs)	Cost (RM)
Open Drain	3091.2	375	0.207	197824
	599.4	450	0.261	50469.48
	795	600	0.598	81090
	Total			329383.48
	Cost/acre			8456.56
Concealed Drain	1545.5	600dia	0.522	231825
	299.7	600dia	0.522	44955
	397.5	900dia	1.05	75525
	Total			352305
	Cost/acre			9045.06

Table 2: Project 2 – 15.22 acre

	LENGTH (M)	Drain Size	Capacity	Cost (RM)
Open Drain	2300.4	375	0.207	147225.6
	161.4	450	0.261	13589.88
	121.5	600	0.598	12393.00
	Total			173208.48
	Cost/acre			11380.32
Concealed Drain	1150.2	600dia	0.522	172530
	80.7	600dia	0.522	12055.5
	60.75	900dia	1.05	11542.5
	Total			196128
	Cost/acre			12886.2

Table 3: Project 3– 13.24 acre

	LENGTH (M)	Drain Size	Capacity	Cost (RM)
Open Drain	1336.5	375	0.207	85536.00
	76.5	450	0.261	6441.30
	153	600	0.598	15606.00
	Total			107583.3
	Cost/acre			8125.63
Concealed Drain	668.25	600dia	0.522	100237.5
	38.25	600dia	0.522	5737.5
	76.5	900dia	1.05	14535
	Total			120510
	Cost/acre			9101.96

Capital cost analysis indicates higher cost of capital for concealed drainage systems per acre of projects.

CONCLUSION

Based on the studies done on three typical projects, it indicates that concealed drainage systems costs slightly higher than the conventional open drain. Table 4 below shows the comparison of average total cost per acre.

Table 4: Comparison of average total cost/acre

Type	Cost (RM)
Conventional open drain	9320.84
Concealed Drainage	10344.41

From the analysis, concealed drain cost 9.89% higher than the conventional open drain in term of capital cost.

Further studies and analysis regarding other cost and non-cost factors are being carried out. Upon completion these will give overall conclusion with respect to feasibility of concealed drainage systems for housing development in Malaysia.

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