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Behaviour of Klang Hospital ponds

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Introduction

Klang Valley is the most urbanized, industrilized and populous region in Malaysia. It is due to the fact that Kuala Lumpur, the Capital City of Malaysia, is located in this region. The Region which is undulating with low hills, consists of areas under the Federal Territory (Kuala Lumpur), and four districts of Darul Ehsan Selangor State, namely Gombak, Hulu Langat, Kelang and Petaling. Fig. 1 shows the location of the valley. It is the centre of the economic activities in Malaysia.

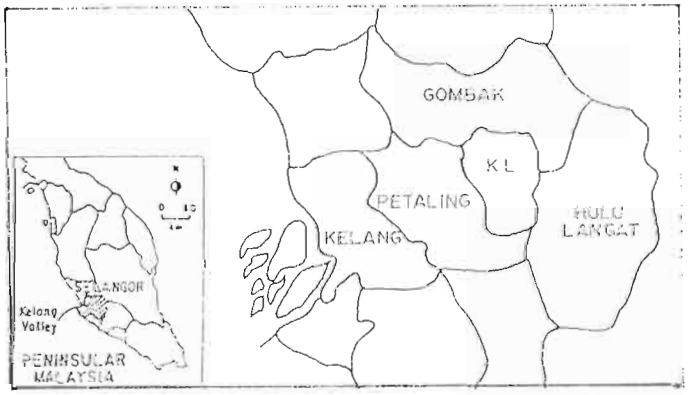

Fig. 1 : Location of Klang Valley

The Malaysian Government is firm in its policy of maintaining clean and healthy living environment. Under the existing laws, such as Local Government Act, the Local Authorities are responsible for maintaining clean urban centres. They are empowered to make by-laws for execution of of its functions.

Table 1 shows the refuse management in the valley, and the responsible authorities for refuse management is shown Table 2. A typical physical composition of refuse in Klang Valley is represented in Table 3.

At present, refuse from residential areas are collected once in every two days, while wastes from commercial centres are collected daily. For a house to house collection service, refuse is placed by the homeowner in a 100 - 120 litres container which is located outside homeowner's property. In high-rise apartment buildings or congested residential areas, refuses usually bagged, are placed by the tenants in a comman storage container. Its size may vary from 1 - 12 cu m. For office and commercial

Table 1: Klang Valley Refuse management

	Kuala Lumpur	Gombak	Hulu Langat	Kelang	Petaling	
Area (Sq.Km)	243.5	652.7	828.8	629.4	486.9	2,841.3
Population(1000) (1985)	1,103.2	205	217.4	341.8	436.72	2,304.1
Pop. Rate (%)	2.1	2.8	2.6	2.6	2.4	Av.=2.5
Urban Centre	7	7	9	3	7	33
Collected Refuse (ton/day)	2,000	395	119	350	413	3,277
Existing disposal Sites	2	5	4	2	5	18
Area of disposal Site (ha)	12	10	-	-	18	-
Cost US$/cap/month*	1.13	1.25	1.04	0.92	0.23	Av.=0.92 (1977)
Cost US$/ton(1976)*	34.0	-	-	-	23.75	Av.=12.5
Disposal methods	Modf. landfill	open dump + land fill	open dump + land fill	open dump + land fill	open dump + land fill	

* Adapted from Abu Baker, 1978.

areas, individual office or commercial centre is responsible to put their refuse in a large storage container with size of 12 cu m. For industrial wastes, it is the responsibility of individual industry, however, they are accepted for disposal at the Local Authority landfill.

In general, there is no onsite handling except for a certain case such as at a newly constructed high-rise building where refuse is placed in a comman large container equiped with a compactor in order to reduce the refuse volume. It is a comman practice that during collection, sorting is done mannually by the crew for usable material recovery, such as glass bottles, paper, cardboard, plastic and aluminium cans.

Refuse containers are usually picked up mannually or mechanically, depend on the container sizes and the types of collection system. For hauled container system which the container size is large, usually 12 cu m, the container is picked up mechanically by a roll-on-roll-off vehicle. Small size containers, about 100 litres in size, are picked up mannually and the containers for stationary container system with size of 1 - 2 cu. m. are picked up mechanically.

In most cases, the collection services are carried out by the local authority staff. However, there are contracted private companies collect refuse from certain areas which are under local government responsibility. Usually three or four crews are assigned for each collection vehicle.

Refuse management problems of the valley have reached an acute level and needed an urgent action for planning, designing and implementation. The most pressing problem is to find alternative for the disposal with an acceptable manner, taking into consideration health and environmental factors and the economic viability of the various alternatives. Those problems are closely related to the shortage of adequate funds, manpower, lack of good management system and expertise (Pillay, 1986). However, civic attitudes of the public could help the effort to improve the refuse management.

Table 2: Responsible Authorities on Refuse Management in Klang Valley

District	Area	Administrative Organization	Department in charge
Kuala Lumpur	the whole K.L area	City Hall	Urban Service Department
Petaling	Petaling Jaya Municipality	PJ Municipal Council	Urban Service Department
	Shah Alam Municipality	Shah Alam Municipal Council	Health Department
	Others	Petaling District Council	Health Department
Gombak	All Areas	Gombak District Council	Health Department
Hulu Langat	All Areas	Hulu Langat District Council	Health Department
Kelang	Kelang Municipality	Kelang Municipal Council	Health Department
	Others	Kelang District Council	Health Department

Table 3: A Typical Physical Characteristic Of Refuse In Klang Valley

Component (% W)	Kuala Lumpur	Kelang
Food Waste	51	44
Paper & Cardboard	28	27
Plastic	8	8
Textiles 2	3	
Wood & Garden Trimming	3	10
Glass	3	3
Metal	5	3
Density kg/m^3	285.8	203.1

Source: Department of Environment, Malaysia.

Collection Analysis

Collection has been the costliest aspects of all. It is estimated to be 60 to 80 percent of the total cost (Tchobanoglous, 1977). Therefore it is the intention of the study, that the collection operation in Klang Valley should be analyzed, hopefully it would be useful for improving the collection system.

Collection time is an important factor that can be used to quantify the collection operation. A simple definition of the collection time, mathermatically is

$$T = \frac{P + h + s}{1 - w} \quad \ldots(1)$$

where T is collection time per trip, p is pickup time per trip, h is haul time per trip, s is at-site time per trip and w is off-route factor which is expressed as a fraction (Tchobanoglous, 1977). For hauled container systems operated in the conventional mode, pickup time refers to the time spent driving to the next container after an empty container has been deposited, the spent picking up the loaded container, and the time required to redeposited the container after its contents have been emptied. For hauled container systems operated in the exchange-container mode, pickup includes the time required to pick up a loaded container and to redeposit the container at the next location after its contents have been emptied (Tchobanaglous, 1977). Haul time refers to the time required to reach the disposal site and at-site time is the unit operation which refers to the time spent at the disposal site and includes the time spent waiting to unload as well as the time spent unloading.

The haul time depends on both haul speed and distance. It has been found that haul time may be defined as

$$h = a + bx \quad \ldots\ldots\ldots\ldots(2)$$

where a and b are empirical constants; a is in h/trip; and b is in h/km (Tchobanaglous, 1977),

The unit operation off-route (w) includes all time spent on activities that are nonproductive from the point of view of the overall collection operation. It may include the time lost due to unavoidable congestion, time spent on equipment repairs and maintenance, time spent for lunch in excess of the stated lunch period, time spent checking in and out in the morning and at the end of the day.

In this study, all the times and distance of a collection vehicle were recorded. By substituting the data into equations (1) and (2), the values of a, b and w are found out. The value of w determines the efficiency of the collection operation.

Results and Discussion

Some of the refuse collection facilities used in Klang Valley is shown as in Table 4.

The result of the study carried out in three areas of the valley, Kuala Lumpur, Gombak and Petaling Jaya Municipality, is shown in Table 5.

A typical relation between haul-time and distance is shown in Fig. 2. The value of "a" was found from the intersection of the line and the haul-time axis, while the value of "b" was found from the slope of the line. These values are important for designing and planning a system of refuse management. For example, when the trip number per day for hauling refuse from a refuse generation place to a designed location of a disposal site or a transfer station, those constants and figures are needed. However, for the case of Klang Valley, other figures of unit operation, such as exact figure of operational cost per unit of volume or weight; or distance should also be studied in order to find a comprehensive planning and design of the refuse collection system.

Table 4 : Refuse Collection Facilities Used in Klang Valley

Facility	Kuala Lumpur	Gombak	Petaling Jaya	Shah Alam
Manual loading compactor	60	8	9	8
Mechanical loading compactor	87			
Open loading	74	28	-	-
Roll-on Roll-off	8		2	1

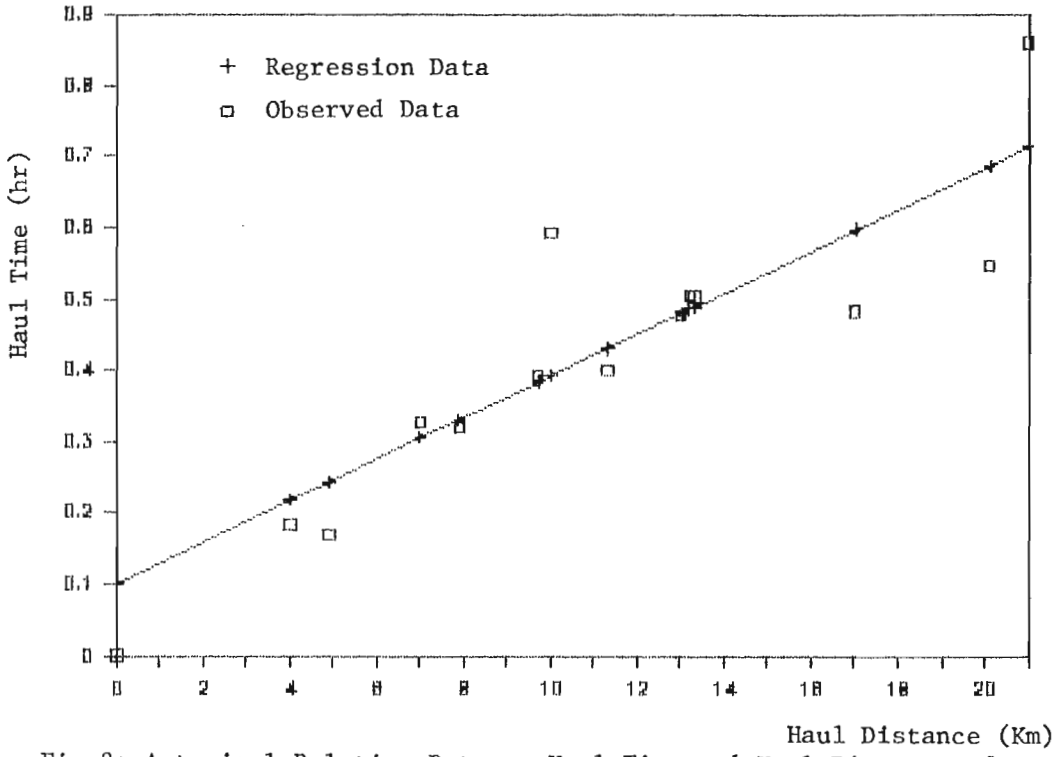

Fig 2: A typical Relation Between Haul Time and Haul Distance of a Loaded Collection Vehicle.

Table 5: The Result of The Refuse Collection System Analyzed in Klang Valley

Unit Operation	Kuala Lumpur scs	Kuala Lumpur hcs	Gombak District scs	Gombak District hcs	Petaling Jaya Municipility scs	Petaling Jaya Municipility hsc
Date	Sept-Dec 86		Feb-Jul 87		Sept-Dec 87	
Collect time (h/trip)	4.7	1.342	2.38		2.37	3.6h/d
a (h/trip)	0.107	0.059	0.085		0.102	0.145
b (h/Km)	0.019	0.016	0.027		0.029	0.024
Pickup time (h/trip)	2.67	0.35	1.39		1.79	0.08
Haul time (h/trip)	0.402	0.323	0.477		0.47	0.58
Haul dist. (km/trip)	4.10	2.7	14.92		11.72	18.7
At-site time (h/trip)	0.12	0.094	0.05		0.16	0.11
Off-route	0.28	0.43	0.273		0.383	0.49

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Abu Bakar Jaafar and A. Maheswaran; "Recovery Against Disposal of wastes for a Sustained National Development", Seminar on the Application of Science and Technology to Development; Ministry of Science, Technology and Environment Malaysia, 1978.

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Tchobanoglous, G.,Theisen, H., Eliassen, R.; "Solid Wastes Engineering and Management"; McGraw-Hill, 1977.

SESSION 1V
COMMUNITY, SANITATION AND WATER SUPPLY

Chairman: Dr Morag Bell
Department of Geography
Loughborough University of
Technology

PAPERS PRESENTED

GEOFFREY A PIGGOTT
Sewering two Asian cities

MANUS COFFFEY
Low cost latrine emptying vehicle

FADIL HAJI OTHMAN
Klang valley refuse collection analysis

DISCUSSION

GEOFFREY A PIGGOTT

1. Mr GHOSH asked what was the sewerage problem in the peri-urban and rural hinterland area of Shanghai in the same catchment and how was it handled.

2. Mr PIGGOTT replied that the major pollutant sources in Shanghai were industrial and not domestic. Domestic wastes generated in the city were handled relatively efficiently and most nightsoil wastes were used as a soil conditioner/fertilizer. As all major industries were located in the city area this was where the major problems lay and these were being tackled first. There appeared to be a reduction in the agricultural demand for nightsoil and the domestic wastes generated in the city would eventually be discharged to the new sewerage system. In the peri-urban and rural areas the author predicted that the nightsoil would continue to be used for agricultural purposes for many years to come, but in the end it may be necessary to consider other forms of sanitation.

3. Mr KAMANIDDIN CHE LAH commented that sludge was a major problem in many developing countries, especially where the trenching method was not adequate. He asked if any of the speakers had any experience of low-cost sludge disposal.

4. Mr PIGGOTT expressed his belief that treatment and disposal should go hand-in-hand. The one could not be separated from the other. Where sludge was to be used for agricultural purposes etc, treatment (anaerobic digestion plus lagooning) was essential. Sludge disposal was usually either capital intensive or labour intensive. In countries where labour costs were low and where the climate was suitable, the use of drying beds for the further treatment and dewatering of digested sludge was a good option, particularly if the dried sludge could be used as a fertilizer. Where large volumes of sludge were generated at large municipal sewage works, disposal was a real problem. Dewatering was essential if, for example, the sludge was to be carted to a landfill site for disposal. The author thought there was no solution to the problem. Each case would have its own solution.

5. Mr KAMNIDDIN CHE LAH wished to know if Brunei and Shanghai were going to charge connection fees and user fees and if so how much.

6. Mr PIGGOTT replied that in the future both Brunei and Shanghai would charge connection fees. Brunei already charged user fees to cover maintenance. As there was little domestic sewage presently being discharged to the existing sewerage network, revenue from domestic users in Shanghai was small. Proposals existed to change user fees for the proposed sewerage project. Domestic charges would be added to existing water billing procedures whilst industry would pay on the basis of flow and concentration. These charges were likely to be commenced, within the next year or two, over the whole city, not just the Stage 1 sewer area construction which would not be completed until 1992/93. The author regretted that he did not have with him the current and proposed changes for Shanghai and Brunei. Affordability studies were carried out as part of the Shanghai project investigation and preliminary design. The proposed charging rates would be affordable to the community and to industry.

7. Mr KAMNIDDIN CHE LAH asked how people in Brunei and Shanghai would be forced to connect to the trunk sewer.

8. Mr PIGGOTT said that Brunei had had difficulties in the past in encouraging people to connect to the sewerage system. It had only been in recent years that the last of the nightsoil systems in Bander Seri Begawan had been replaced. The Government of Brunei currently had no legislation enabling it to force people to connect and the politicians and administrators were reluctant to put pressure under people. Brunei recognised this as a problem area and it was likely that new legislation and procedures would be implemented to assist in this regard. Perhaps another way of encouragement might be to set a higher user fee when the sewer was available to a property and that property was not connected. In Shanghai a new self-funding autonomous Sewerage Authority would be established as part of the

new project. New legislation and procedures would be initiated which would, hopefully, avoid the problems of non-connection. Another approach which was probably worth considering was connections as part of an overall project of sewerage reticulation, pumping stations and treatment and to construct them as part of the project. This approach had been adopted for recent projects in Brunei. Obviously the cost of the connections, and how this fitted in with the overall funding proposals, needed to be considered.

9. Mr KOLSKY asked if there were regions (eg unplanned, peri-urban areas, uneven terrain, narrow streets) where sewerage was inappropriate and if so what were the sanitation proposals for these areas.

10. Mr PIGGOTT explained that a major component of the project design for Shanghai had been in identifying suitable routes for link sewers and major structures. In a city as congested as Shanghai this had been a huge problem and in some areas it was proposed to actually demolish rows of housing to be able to construct sewers and pumping stations. Much of this housing was of a very poor standard and the opportunity was being taken to upgrade it at the same time. This also involved temporary housing whilst construction was in progress.

11. Mr KOLSKY commented that Mr PIGGOTT's paper discussed the issues of environmental quality in terms of DO. He wished to know if there were public health issues involved. If so what were they, how were they addressed and what was the outfall configuration.

12. Mr PIGGOTT said that DO was used as a convenient method of establishing overall loadings on the Huangpu River and its distributaries. The water quality regulations also had specific requirements in terms of metals, pesticides etc, as well as bacteriological standards. Improvements in public health were a major aim of the project but were difficult to quantify. Shanghai's water supply was drawn from the same river system. Water supply intakes had recently been relocated upstream of the city to try to improve drinking water quality. High phenol and metal levels had been a problem in the past. Improvements in the water supply had been coordinated with the sewerage project. The outfall system would consist of twin 3.5 m diameter tunnels each approximately 1.3 km discharging at an average water depth of 13 m. At the downstream end of each tunnel would be a 400 m long diffuser incorporating vertical risers up to the estuary bed. Current velocities in the estuary averaged about 1 m/s and rapid mixing would occur over the full water column. Under the worst conditions of drought estuary flow and peak ourfall discharge the minimum dilution achieved at a radius of about 1 km from the outfall would be 100:1. This would reduce effluent concentrations to background levels or below.

13. Mr KOO HOCK SONG asked how it was proposed to provide sewer facilities to Kampong Ayer.

14. Mr PIGGOTT explained that studies had been carried out to examine possible alternatives for human and solid waste disposal for Kampong Ayer. Consultants had made proposals to provide a sewerage system using a combination of conventional and vacuum sewers. It was proposed that these sewers should drain to sewage treatment plants located onshore. The Brunei Government was currently considering these proposals but it was likely that sewerage would only be provided as part of an overall housing/infrastructure upgrading some time in the future.

MANUS COFFEY

1. Mr GHOSH wished to know how Mr Coffey's firm transferred the technology, selected industrialists and manufacturers and maintained the quality. He also wished to know if it was a commercial venture.

2. Mr COFFEY explained that the intention was to promote local manufacturers wherever it was economically feasible. Manus Coffey Associates Limited were consultants and could provide all the design and production engineering back-up required. This could often involve some re-design to suit locally manufactured components such as engines etc. The complete vehicle could also be provided by a manufacturer in Ireland and this company could also assist with training local personnel. Any "bought-in" components which could not be manufactured locally could be supplied in kit form.

3. Mr LANE asked if it was practicable to add water to slurry high density latrine wastes in order to make them more pumpable.

4. Mr COFFEY said that due to the high density of the wastes it was difficult to get the water to mix with the wastes at the bottom of the pits where they are the most dense and difficult to pump. He was hoping to experiment with some form of mechanical agitator, possibly using a modified post hole auger to mix the wastes with added water.

5. Mr LANE also wished to know if, in introducing new technology however apparently superior, Mr Coffey encountered marketing problems in overcoming the innate conservatism of the client organizations.

6. Mr COFFEY explained that he was working with UNCHS on a report aimed at helping the decision makers to assess the cost/benefit analysis of different systems to enable them to arrive at an informed choice of equipment. This would be followed with a simple computer programme and an algorithm to direct the end users into asking the questions which would lead to a proper analysis of their needs. There were very serious problems with high pressure salesmen convincing uninformed purchasers to buy totally inappropriate vehicles.