LOG OF BORING No. BH-4L

PROJECT NAME. THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

LOCATION. LAM INTRA FINAL DISPOSAL SITE

OWNER

DEPTH, m.	SAMPLE No.	TYPE OF SAMPLE	SAMPLE DIST / RECOVERY	DESCRIPTION OF MATERIAL
25	17	SS		
	18	SS		
	19	SS		
30	20	SS		Silty CLAY trace fine sand, brown
				some li-grey, hard.
	21	SS		(CH)
	22	SS		
35	23	SS		
	24	SS		
	25	SS		
	26	SS		
40	27	SS		40.95 m
				END OF BORING
45				
50				

GRAPHIC LOG

○ Natural Water Content
× Plastic Limit
△ Liquid Limit
(%)
20 40 60 80 100

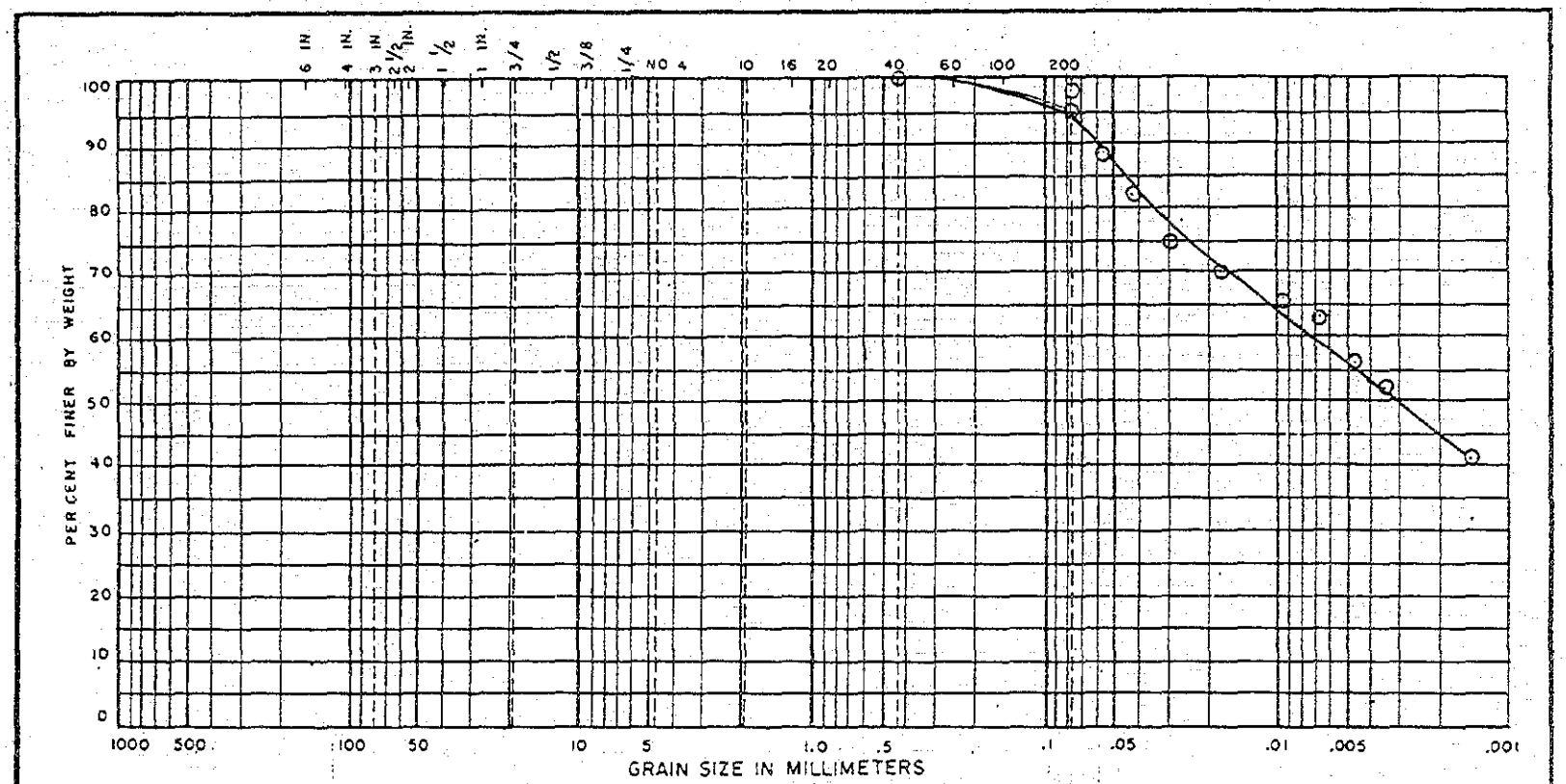
○ Su (UC) ● Su'(UC)
△ Su (FV) ▲ Su'(FV)
× Qp/2
(t/m²)
2.5 5 7.5

□ SPT, N (Blow/ft)
20 40 60

31
35
38
37
44
41
40
40
34
57
64

	BORING STARTED. 23/9/90	RIG.PORTABLE	WL.-1.00 M. 24 HRS. AFTER BORING.
	BORING FINSHED. 25/9/90	FOREMAN. PC	JOB No. 2870

ak



COBBLES	GRAVEL		SAND			SILT. OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. or DEPTH	CLASSIFICATION	NAT. WC	LL	PL	PI	REMARKS
BH-1, ST-1	0.50-1.50m	CH	30.5	71.0	22.6	48.4	

GRADATION CURVES

PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

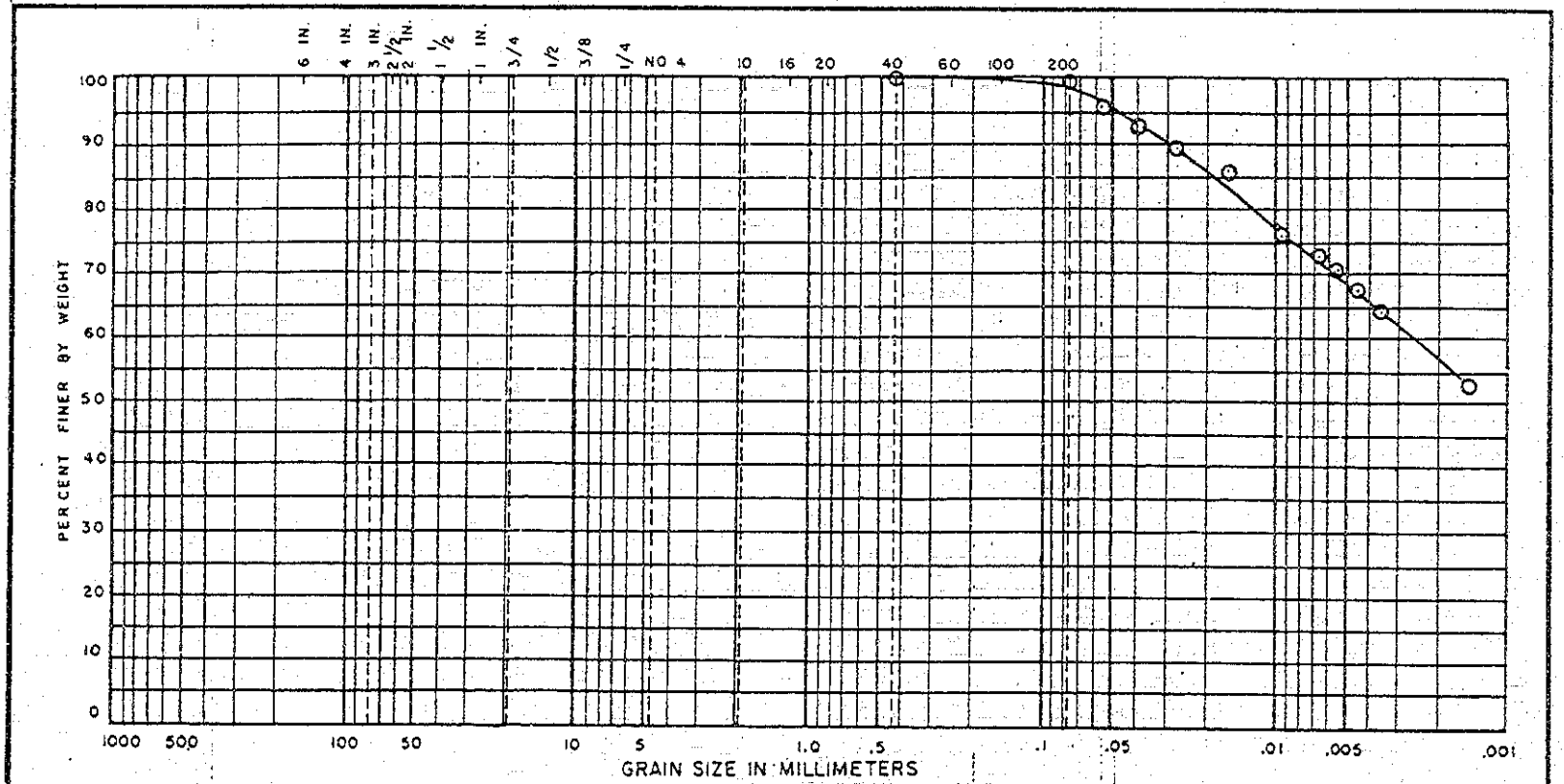
MATERIAL LAM INTRA DISPOSAL SITE

SOURCE :

DATE 19/10/90

SHEET ____ OF ____

STS ENGINEERING CONSULTANTS CO., LTD.



SAMPLE NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
BH-1, ST-4	4.00-5.00	CH	84.1	99.5	31.6	67.9	

GRADATION CURVES

PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

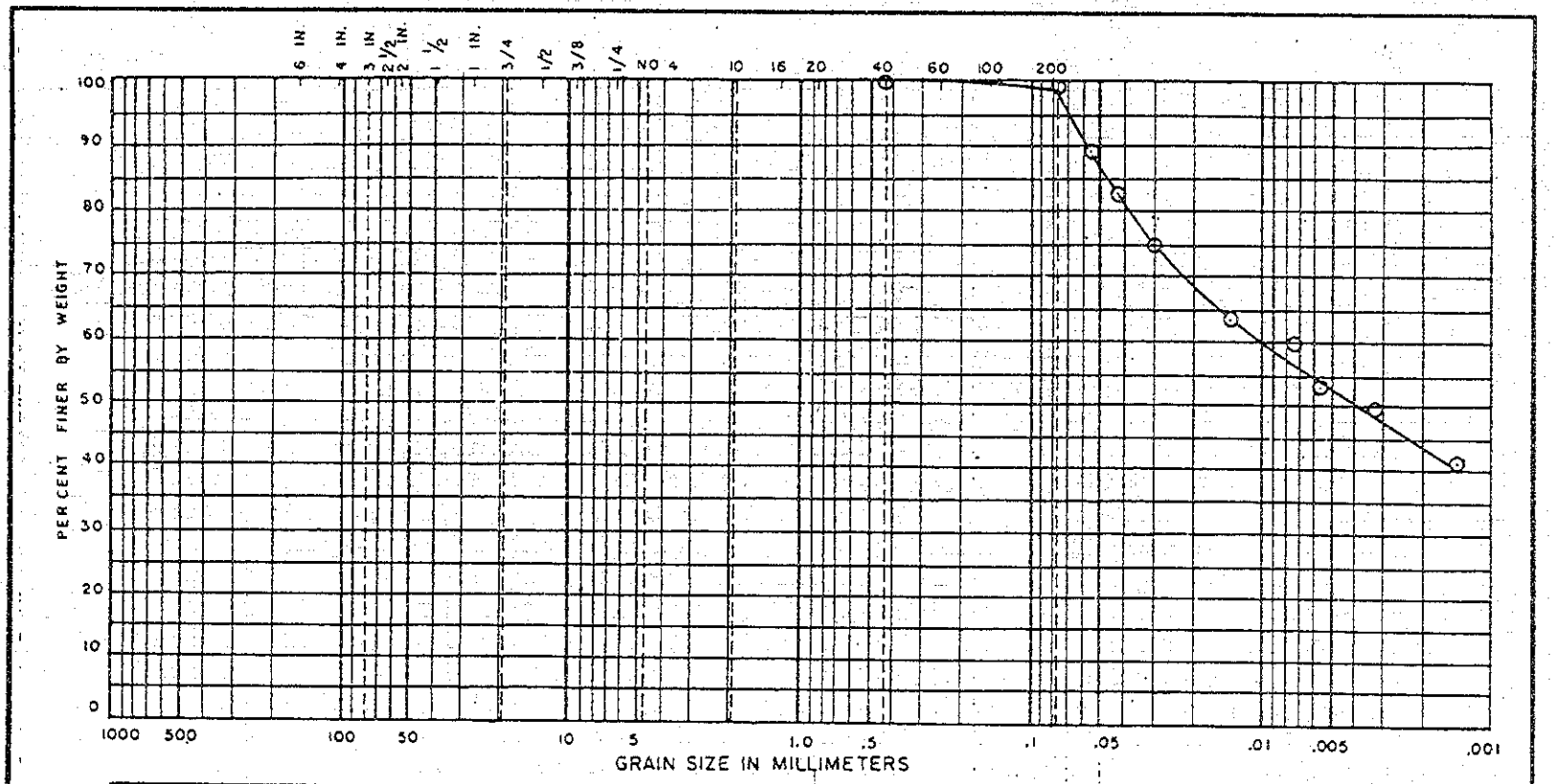
MATERIAL: LAM INTRA DISPOSAL SITE

SOURCE :

DATE 19/10/90

SHEET ____ OF ____

STS ENGINEERING CONSULTANTS CO., LTD.



SAMPLE NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
BH-2,ST-3	4.00-5.00	CH	84.0	88.5	28.7	59.8	

GRADATION CURVES

PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

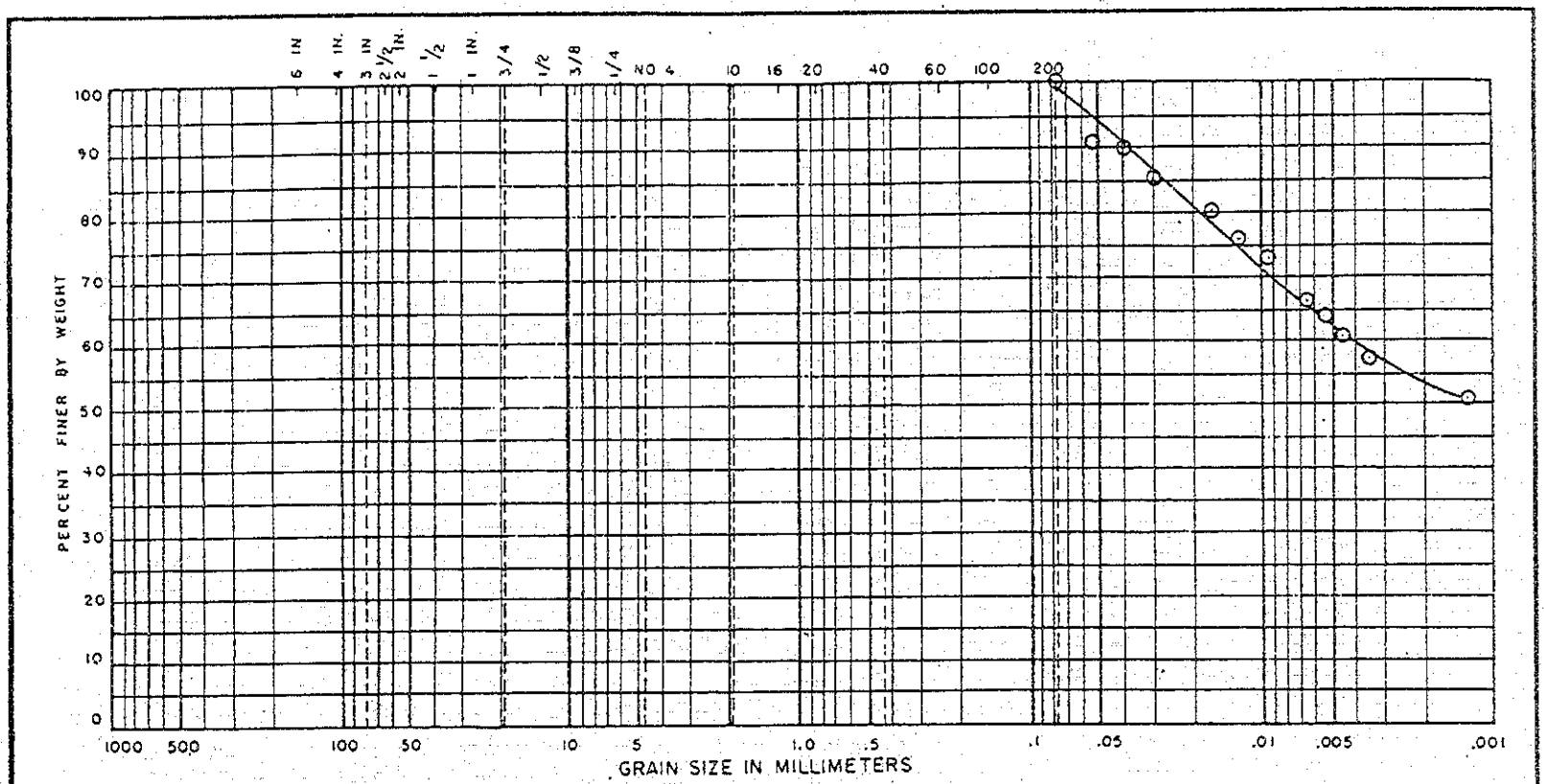
MATERIAL: LAM INTRA DISPOSAL SITE

SOURCE :

DATE 19/10/90

SHEET____ OF____

STS ENGINEERING CONSULTANTS CO., LTD.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
BH-2, ST-7	8.50-9.50	CH	61.1	79.8	33.2	46.6	

GRADATION CURVES

PROJECT: THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

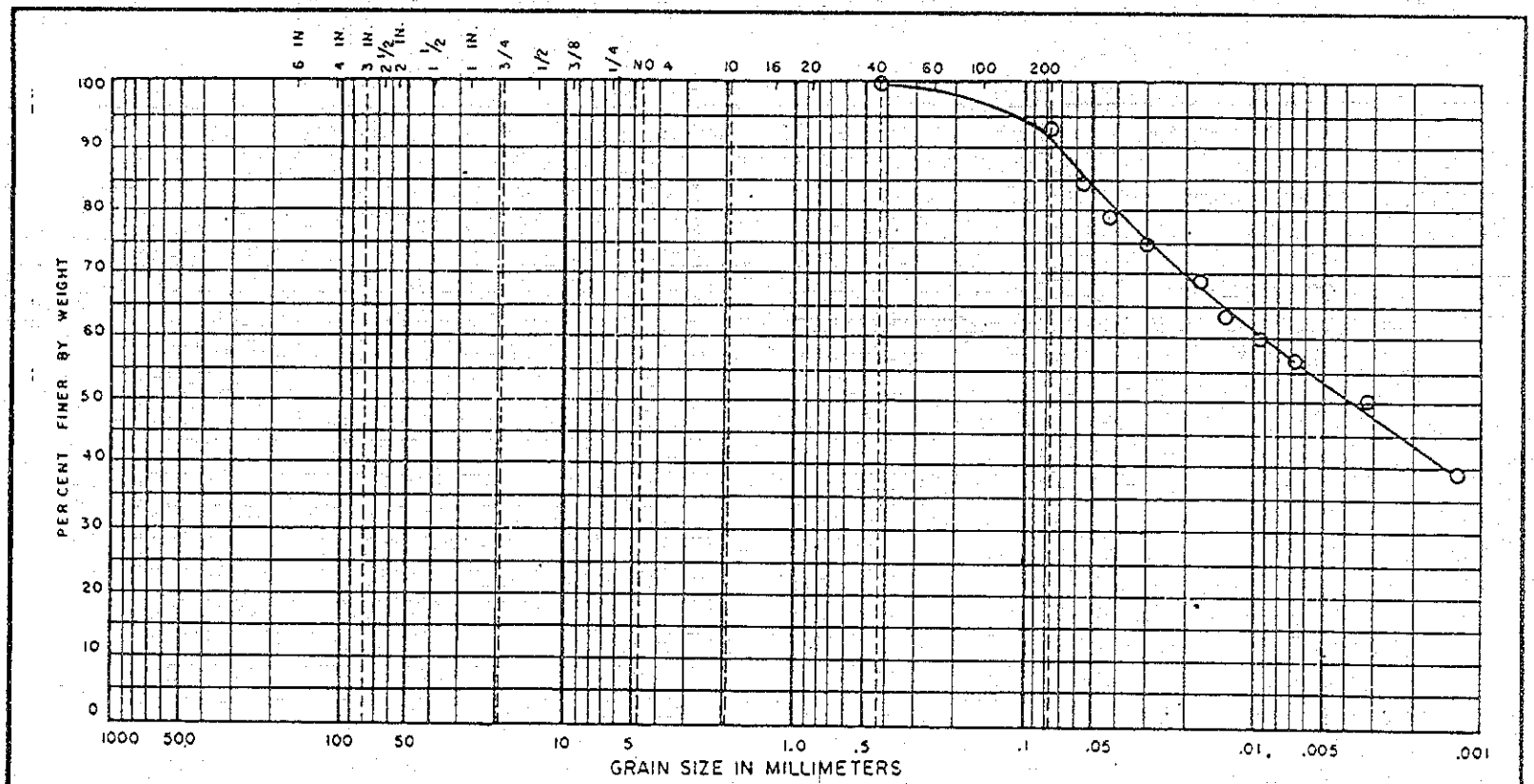
MATERIAL: LAM INTRA DISPOSAL SITE

SOURCE :

DATE 19/10/90

SHEET ____ OF ____

STS ENGINEERING CONSULTANTS CO., LTD.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
BH-3, ST-1	0.50-1.50	CH	64.2	74.4	33.4	41.0	

GRADATION CURVES

PROJECT : THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

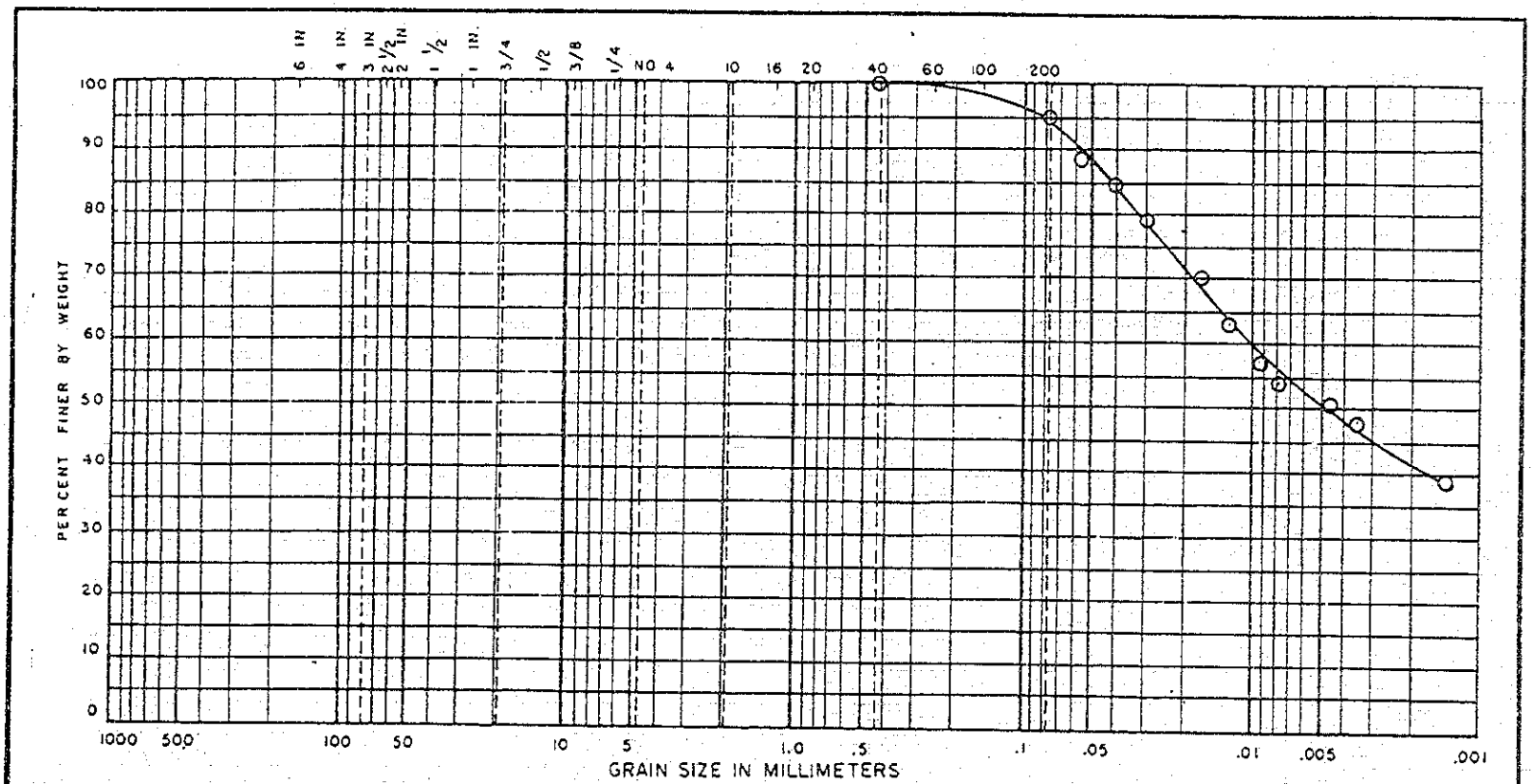
MATERIAL : LAM INTRA DISPOSAL SITE

SOURCE :

DATE : 19/10/90

SHEET ____ OF ____

STS ENGINEERING CONSULTANTS CO., LTD.



SAMPLE NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
BH-3, ST-4	4.00-5.00	CH	78.1	80.6	29.6	81.0	

GRADATION CURVES

PROJECT: THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

MATERIAL: LAM INTRA DISPOSAL SITE

SOURCE :

DATE 19/10/90

SHEET ____ OF ____

STS ENGINEERING CONSULTANTS CO., LTD.

FIELD PERMEABILITY TEST

(Falling head type)

Project SOLID WASTE MANAGEMENT Location LAM INTRA Job No. 2870

Date 3/10/90 Boring No. BH-1L Depth 20.00 m. from (

Ground water level; before test 5.85 m. after test 4.16 from GL m

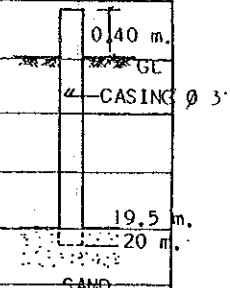
Casing used 19.50 m. Size Ø 7.5 cm.

Height of casing above ground surface +0.40 m

Depth to bottom of hole 20.00 m. Diameter 7.5 cm.

Material SAND

Time			Length of Decrease from casing surface (cm.)	Remarks
From	To	Elapsed time		
10.54 AM.		15 sec.	2.5	
		30 sec	3.3	
	10.55	60 sec.	4.2	
	10.56	2 min.	7.7	
	10.58	4 min	10.5	
	11.02	8 min	12.0	
	11.09	15 min	19.0	$k=7.10\times10^{-5}$
	11.24	30 min	29	cm/sec.
	11.54	60 min	45	
	12.54	120 min	65.5	
	13.24 PM.	150 min	77	
	14.14 PM.	200 min	96	
	14.54 PM.	240 min	1.10 m.	
	15.54 PM.	300 min	1.29 m.	
	16.54 PM.	360 min	1.50 m.	



FIELD PERMEABILITY TEST

(Falling head type)

Project SOLID WASTE MANAGEMENT Location LAM INTRA Job No. 2870

Date 3/10/90 Boring No. BH-1L Depth 20.0 m.from GL

Ground water level; before test 5.85 m. after test 4.16 m.from GL

Casing used 19.50 m. Size ℓ 7.5 cm.

Height of casing above ground surface +0.40 m

Depth to bottom of hole 20.0 m. Diameter 7.5 cm.

Material SAND

Time			Length of Decrease	Remarks
From	To	Elapsed time		
	17.54	420 min	1.69 m.	
	18.54	480 min	1.85 m.	
	19.54	540 min	2.00 m.	
	20.54	600 min	2.24 m.	
	21.54	660 min	2.39 m.	
	22.54	720 min	2.70 m.	
	23.54	780 min		
	24.54	840 min		
	11.54 AM.	25 hrs.	4.56 m.	

FIELD PERMEABILITY TEST

(Falling head type)

Project SOLID WASTE MANAGEMENT Location LAM INTRA ROAD Job No. 2870

Date 16/10/90 Boring No. BH-3L Depth 20.00 m.from GL

Ground water level; before test 11.33 m. after test 1.18 from GL m

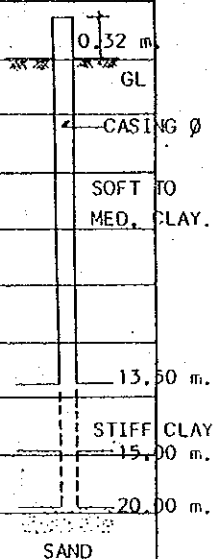
Casing used 13.50 m. Size Ø 7.5 cm.

Height of casing above ground surface 0.32 m

Depth to bottom of hole 20.00 m. Diameter 7.5 cm.

Material SAND

Time			Length of Decrease from casing surface (cm.)	Remarks
From	To	Elapsed time		
9.00AM		15 sec.	1	
		30 sec.	2	
	9.01	60 sec.	3	
	9.03	3 min	5.5	
	9.07	7 min	14	
	9.15	15 min	24	
	9.30	30 min	36	
	10.00	60 min	45	
	11.00	120 min	54	
	13.00	240 min	65	
	15.30	390 min	72	
	18.50	590 min	77	
	22.50	830 min	90	
	9.00 AM	1440 min	1.10 M.	

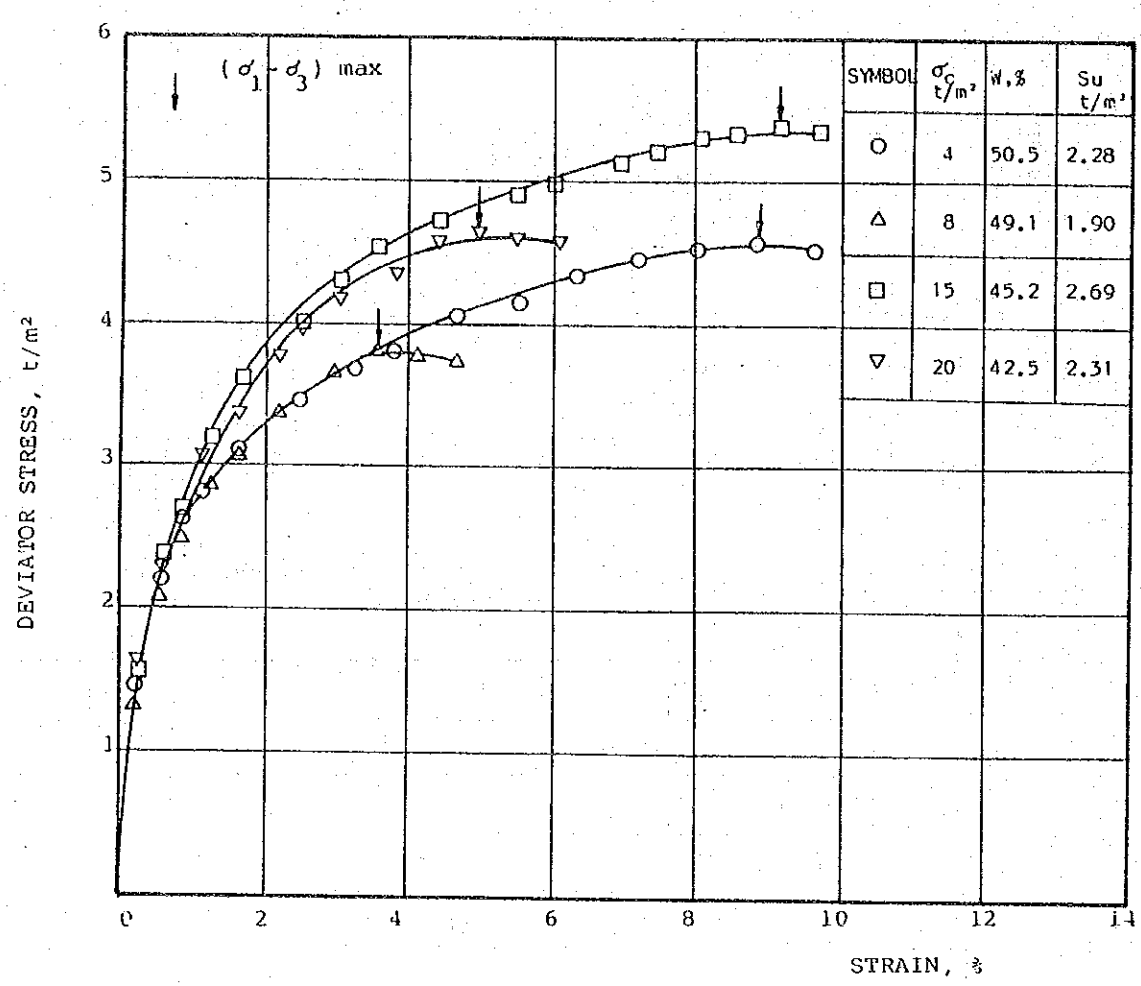


k = 1.89x10^{-5} cm/sec.

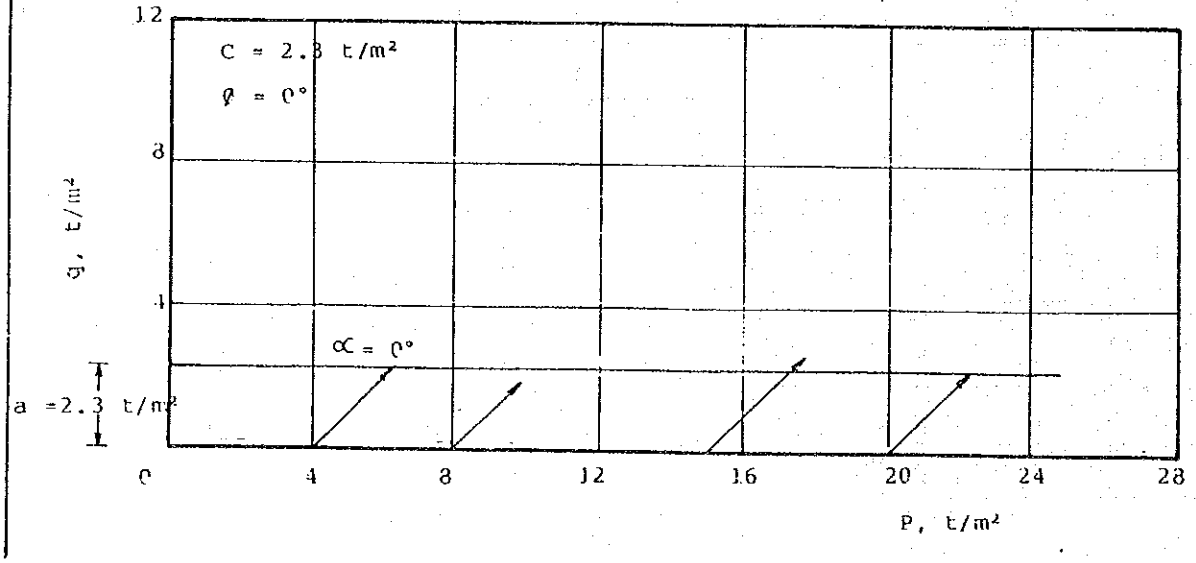
PROJECT THE STUDY ON BANGKOK-SOLID WASTE MANAGEMENT

BORING NO. BH-1L SAMPLE NO. ST-1

DEPTH 0.50-1.50 m.



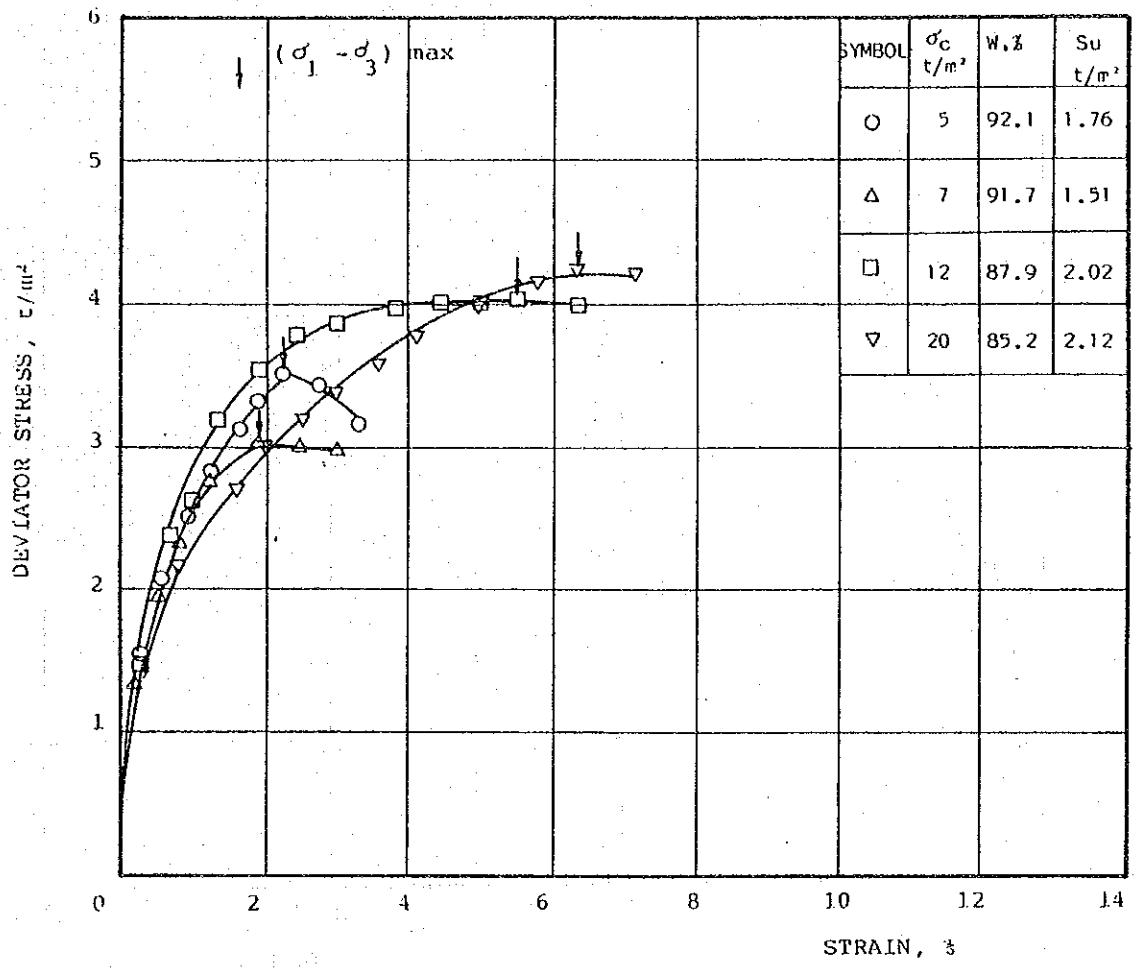
SYMBOL	σ_3 t/m²	W,%	Su t/m²
○	4	50.5	2.28
△	8	49.1	1.90
□	15	45.2	2.69
▽	20	42.5	2.31



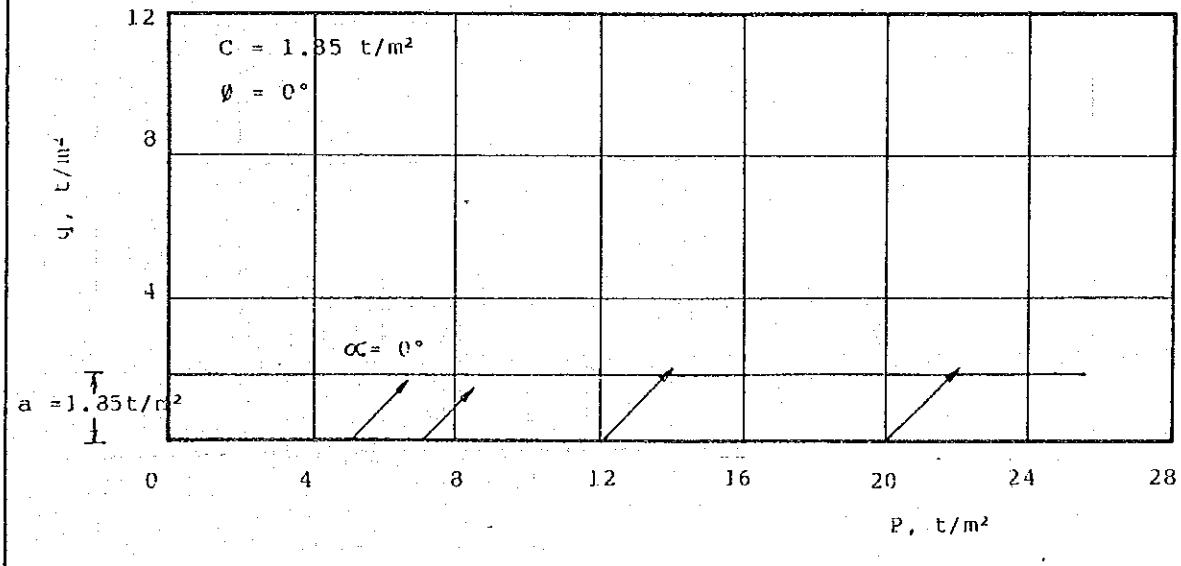
PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

BORING NO. BH-1L SAMPLE NO. ST-4

DEPTH 4.00-5.00 m.



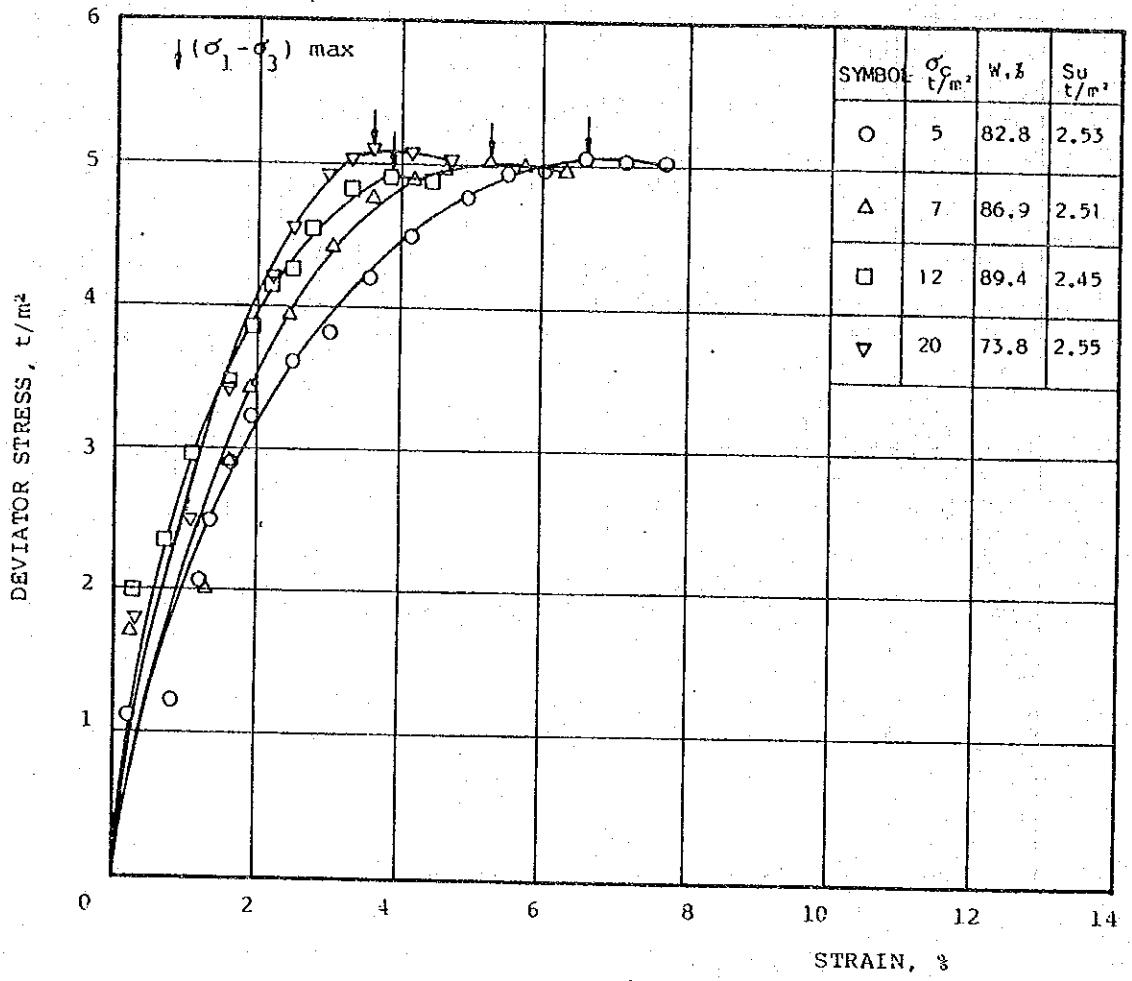
SYMBOL	σ_c t/m²	W.%	Su t/m²
○	5	92.1	1.76
△	7	91.7	1.51
□	12	87.9	2.02
▽	20	85.2	2.12



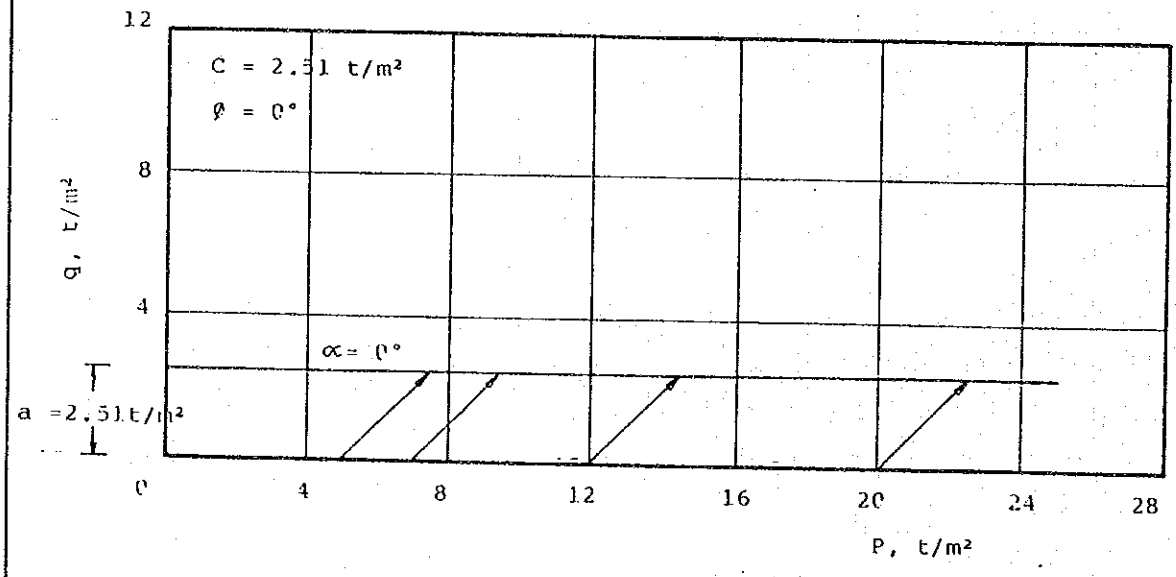
PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

BORING NO. BH-2L SAMPLE NO. ST-3

DEPTH 4.00-5.00 m.



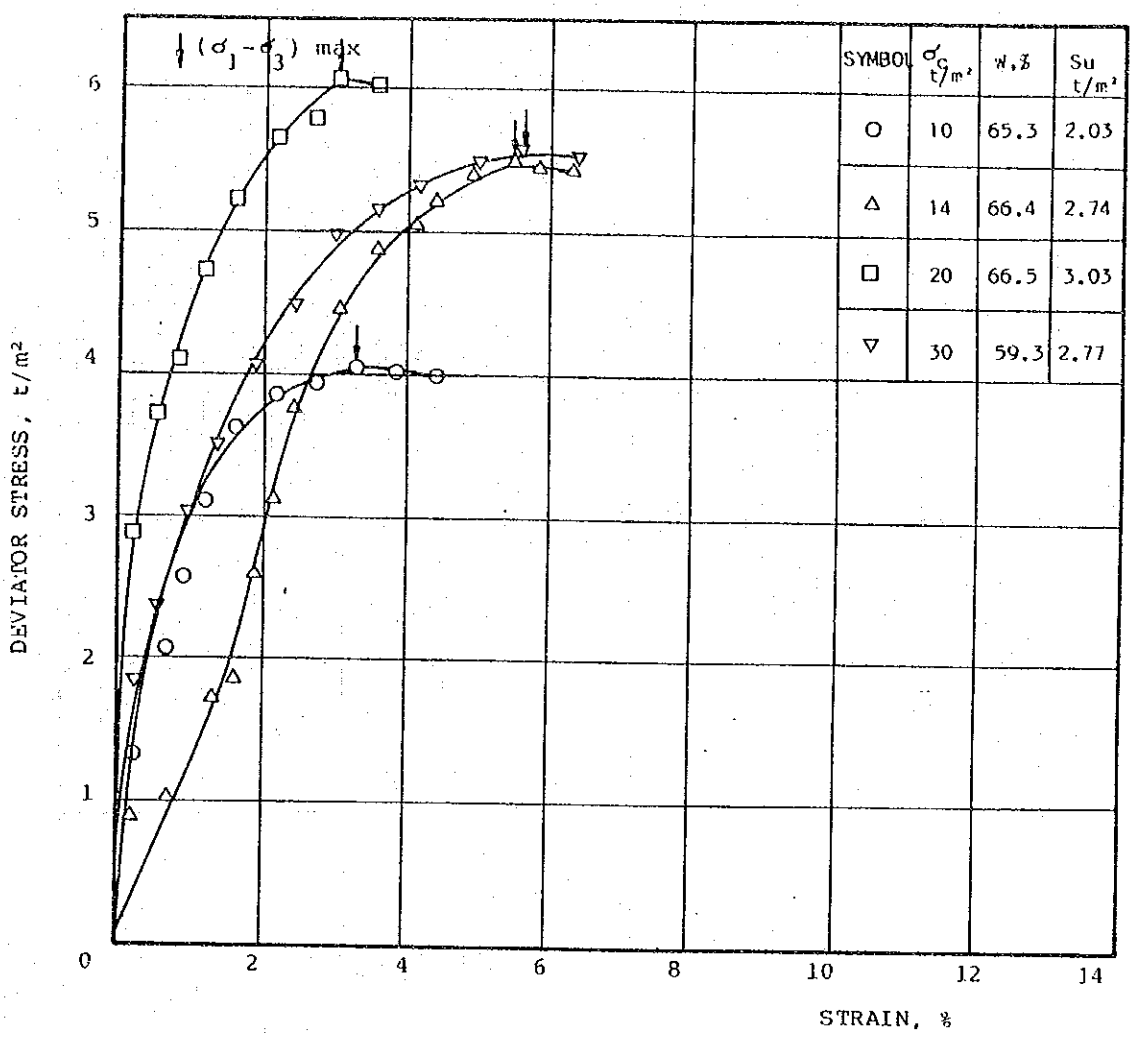
SYMBOL	σ_c t/m²	W, %	Su t/m²
○	5	82.8	2.53
△	7	86.9	2.51
□	12	89.4	2.45
▽	20	73.8	2.55



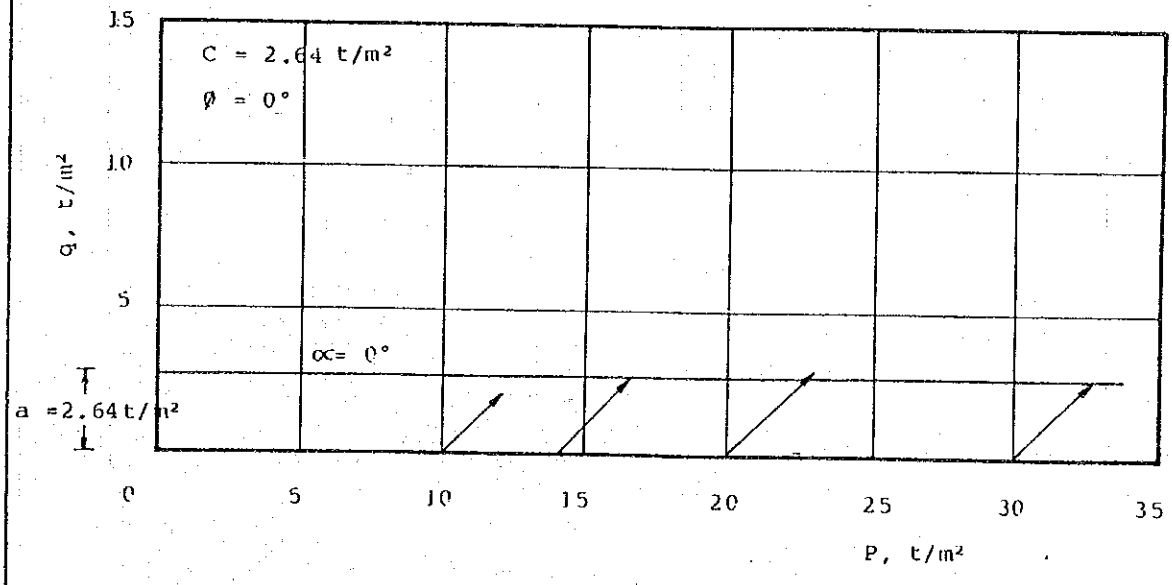
PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

BORING NO. BH-2L SAMPLE NO. ST-7

DEPTH 8.50-9.50 m.



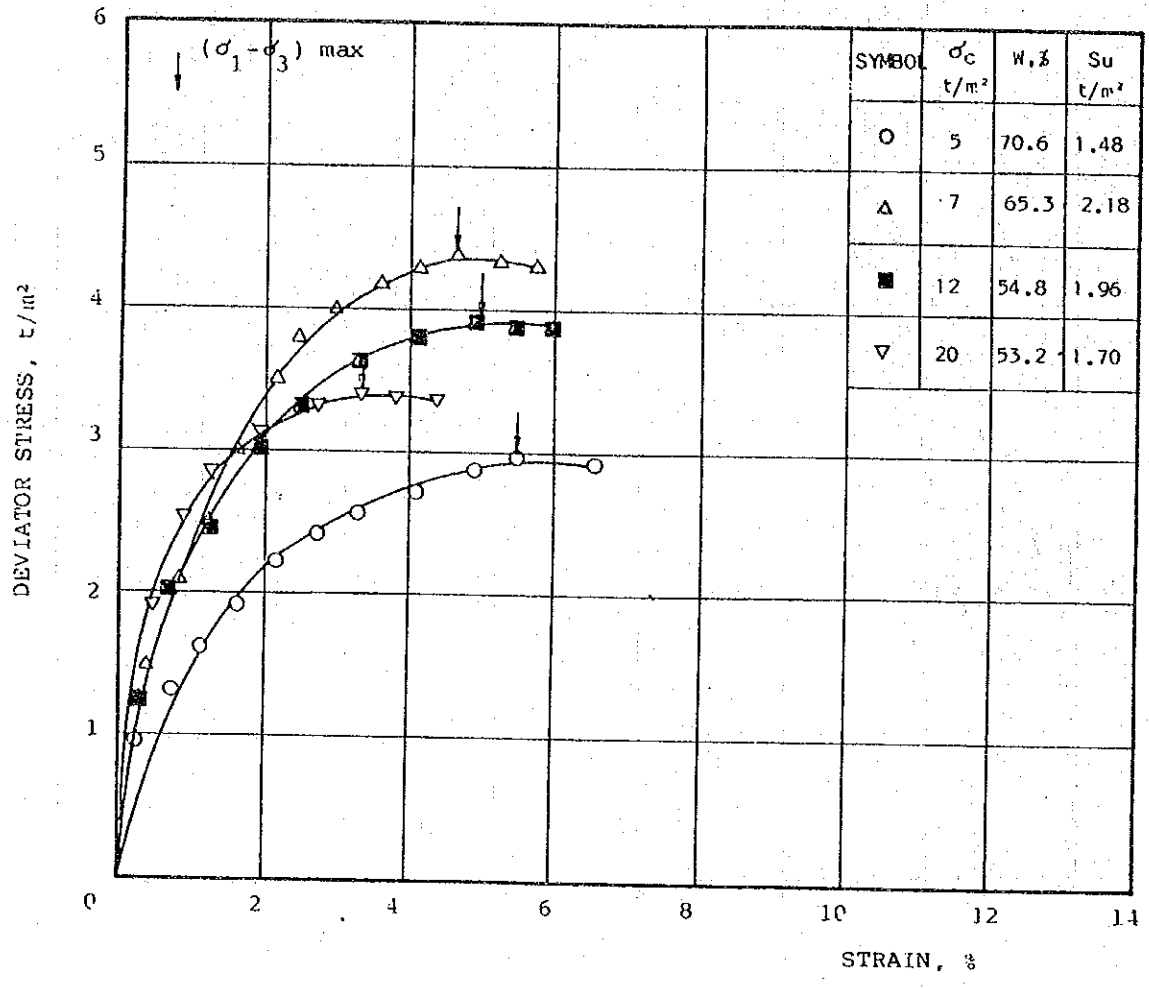
SYMBOL	σ'_c t/m²	W,%	Su t/m²
O	10	65.3	2.03
△	14	66.4	2.74
□	20	66.5	3.03
▽	30	59.3	2.77



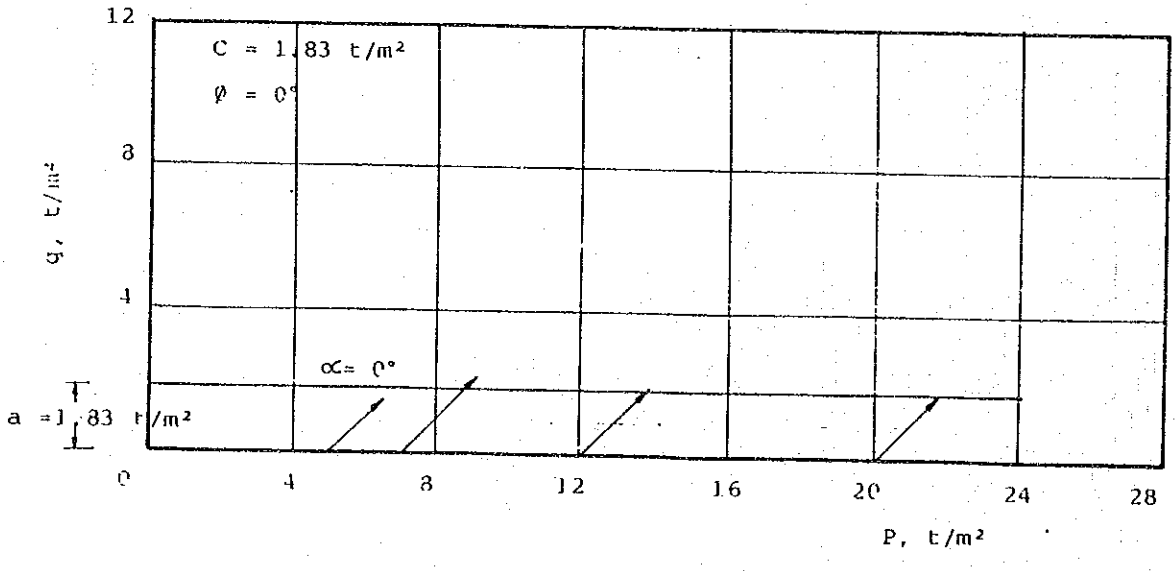
PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

BORING NO. BH-3L SAMPLE NO. ST-1

DEPTH 0.50-1.50 m.



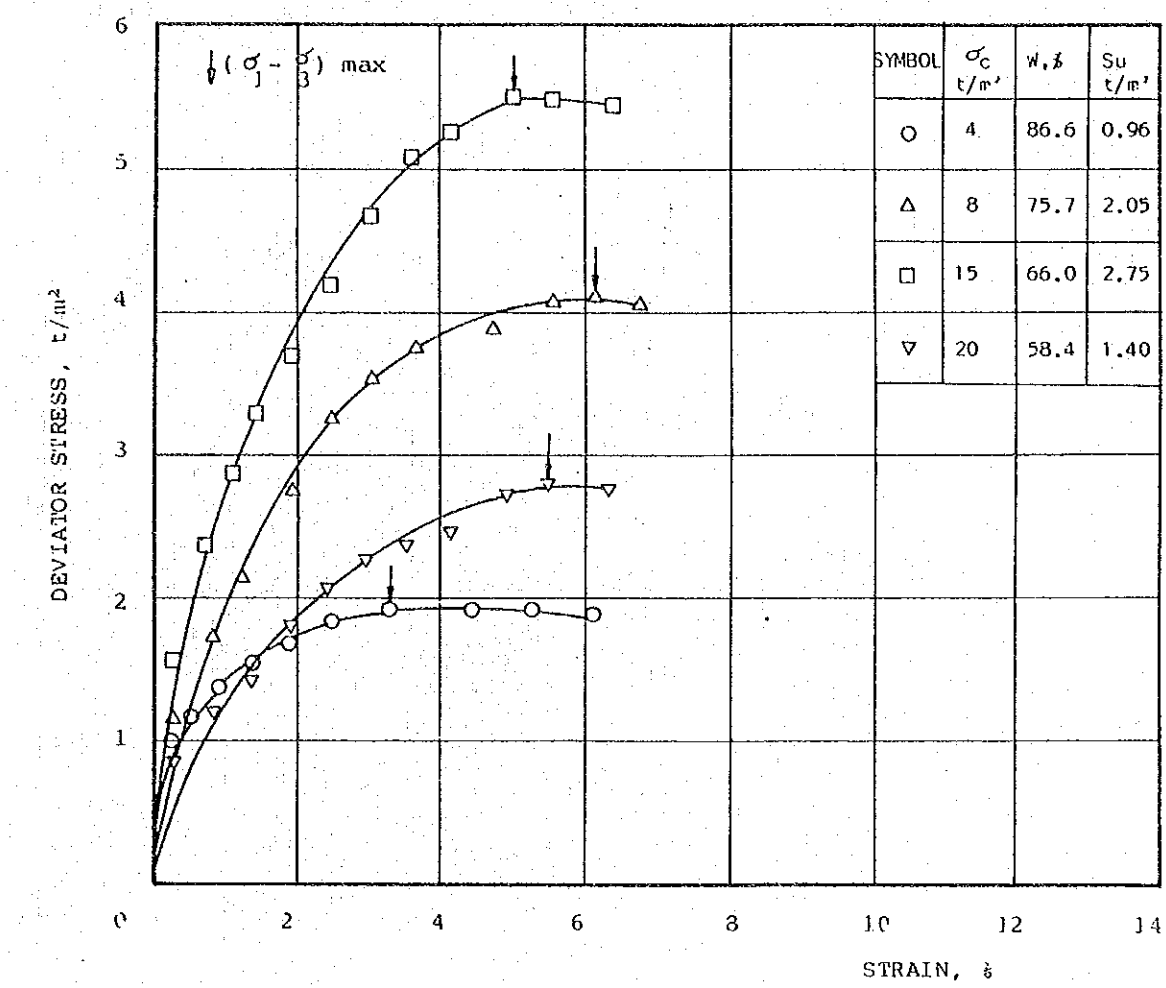
SYMBOL	σ_c t/m²	W,%	Su t/m²
O	5	70.6	1.48
Δ	7	65.3	2.18
■	12	54.8	1.96
▽	20	53.2	1.70



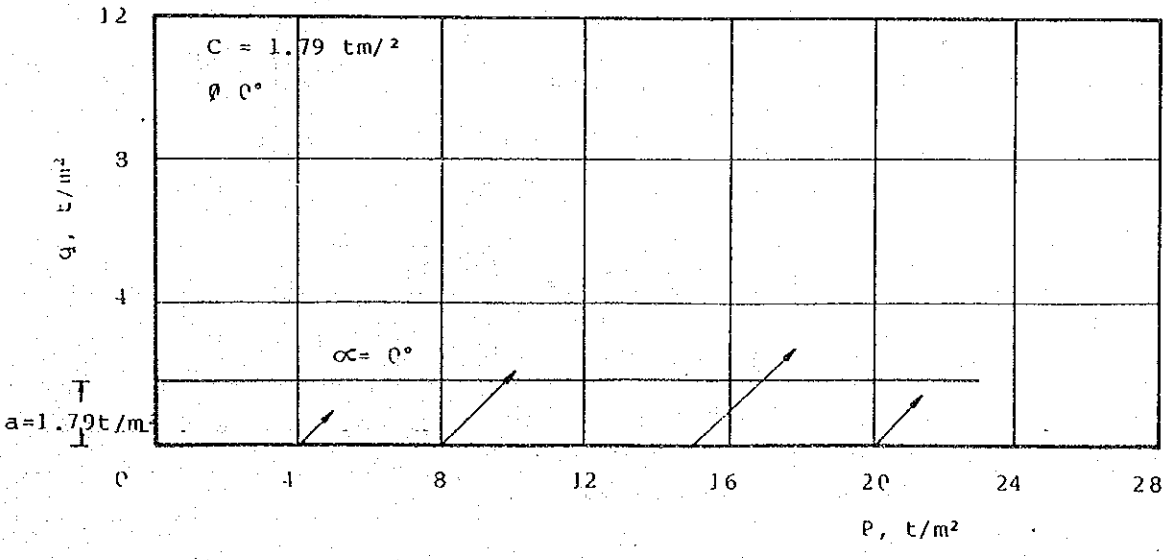
PROJECT THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT

BORING NO. BH-3L SAMPLE NO. ST-4

DEPTH 4.00-5.00 m.

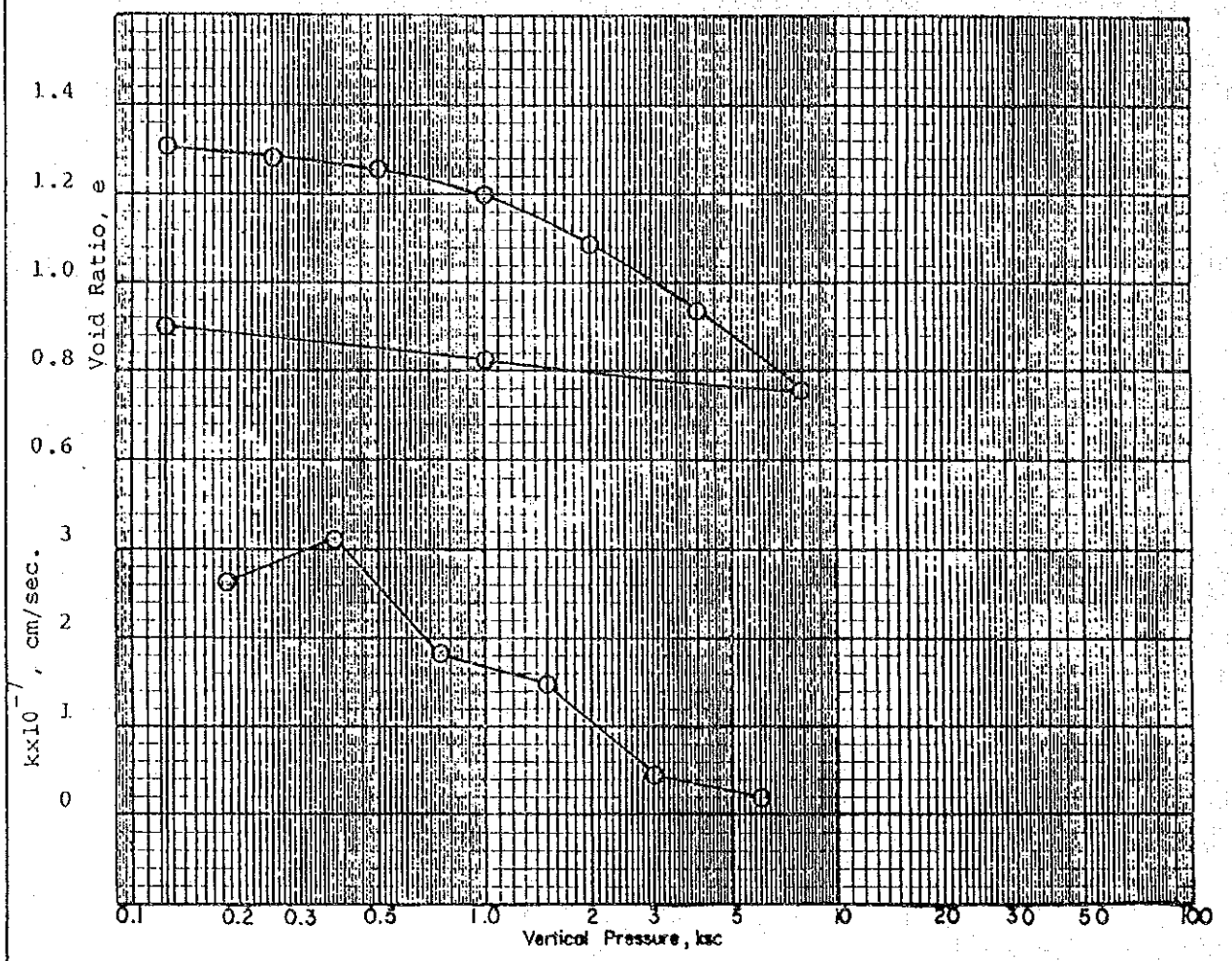


SYMBOL	σ_c t/m²	W, %	Su t/m²
○	4	86.6	0.96
△	8	75.7	2.05
□	15	66.0	2.75
▽	20	58.4	1.40



CONSOLIDATION TEST RESULTS

Project: THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT	Location: LAM INTRA		Job No. 2870
Boring No. BH-1L	Sample No. ST-1	Depth 0.50-1.50 m.	Date 17/10/90

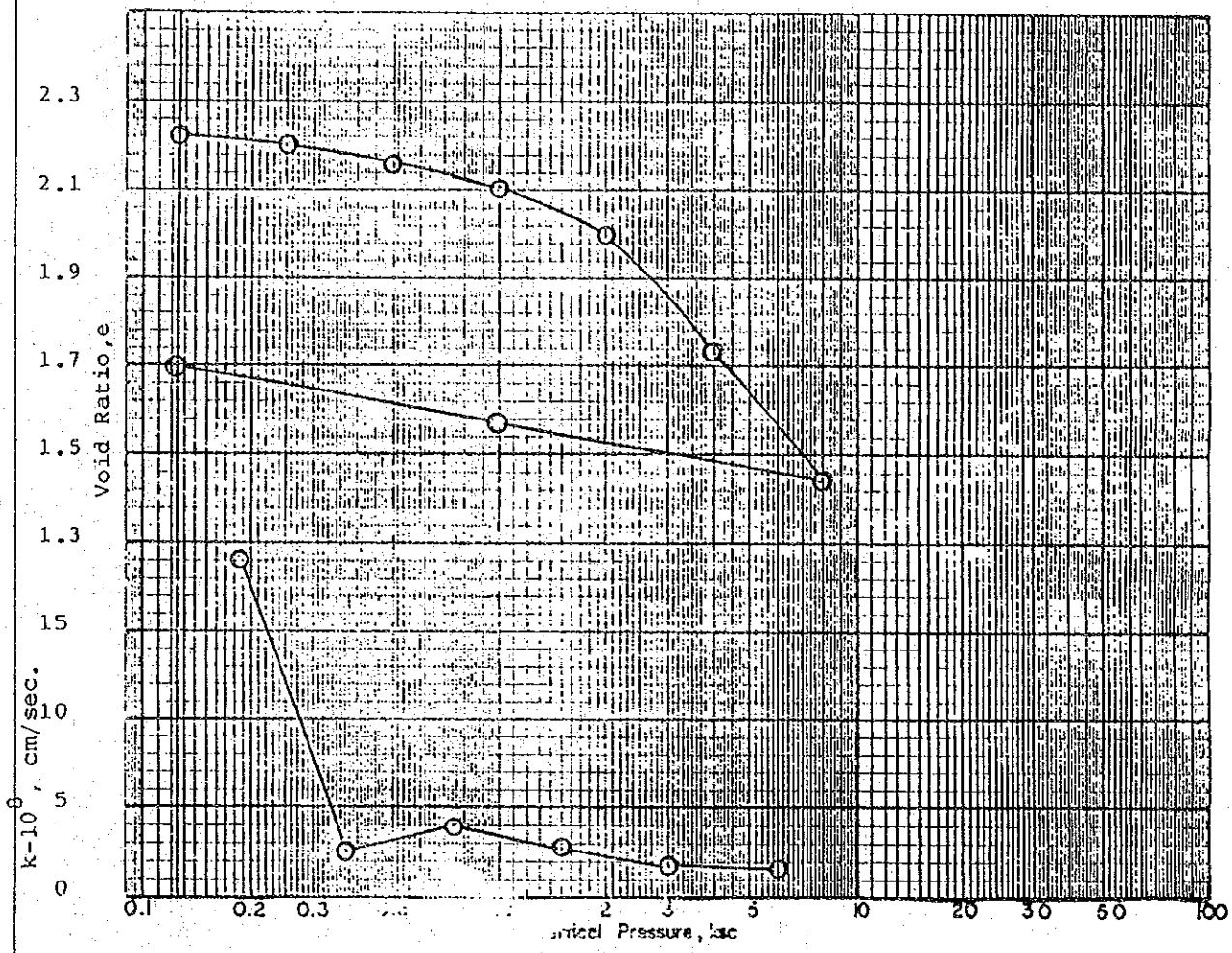


Pressure Ksc	50% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Void Ratio, e
Initial	—	—	1.31
0.125	—	—	1.30
0.25	0.8	40.4	1.29
0.50	0.55	57.6	1.26
1	0.8	38.2	1.20
2	0.9	31.9	1.09
4	1.8	14.1	0.94
8	2.2	9.7	0.75
16			

		initial	Final	
Height of Sample, H	cm.	2.0		
Water Content, W	%	49.2		
Degree of Saturation, S	%	99.0		
Solid Height of Sample, Hs		0.87		cm.
Diameter of Sample D		6.35		cm.
Wet Unit Weight γ_t		1.70		g/cc
Dry Unit Weight γ_d		1.14		g/cc
Liquid Limit LL		71.00		%
Plastic Limit PL		22.60		%
Compression Index, Cc		0.52		
Recompression Index, Cr		0.07		
Specific Gravity G		2.63		

CONSOLIDATION TEST RESULTS

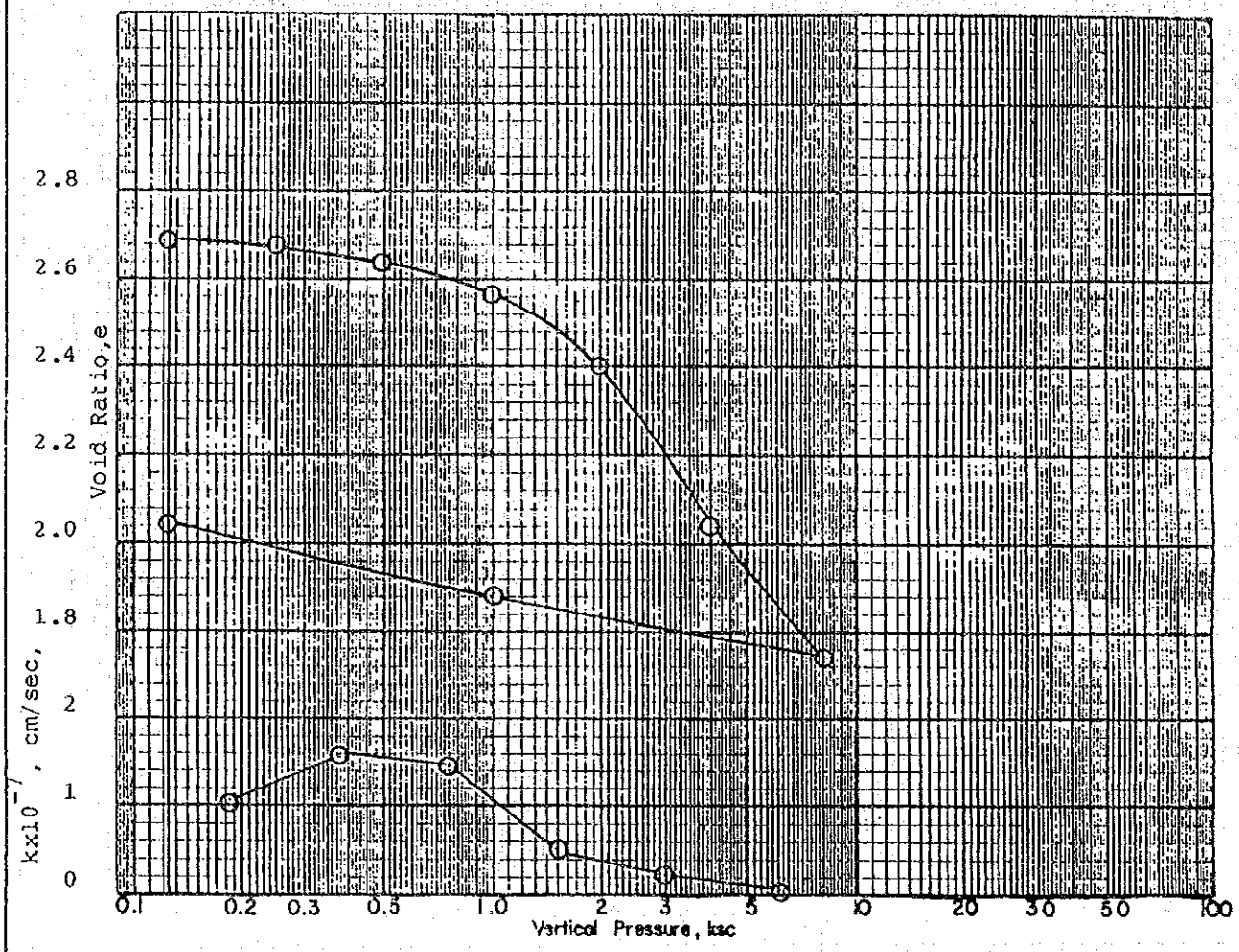
Project	THE SUTDY ON BANGKOK SOLID WASTE MANAGEMENT	Location	LAM INTRA	Job No.	2870
Boring No.	BH-1L	Sample No.	ST-4	Depth	4.00-5.00 m.
				Date	22/10/90



Pressure	50% Consol	Coef. of Consolidation	Void		initial	Final
Ksc	Time min	Cv, 10^{-4} cm^2/sec	Ratio, e	Height of Sample, H cm.	2.0	
				Water Content, W %	79.7	
Initial	—	—	2.24	Degree of Saturation, S %	93.0	
0.125			2.23	Solid Height of Sample, Hs	0.62	cm.
0.25	1.2	26.7	2.20	Diameter of Sample D	6.35	cm.
0.50	5.0	6.3	2.16	Wet Unit Weight γ_t	1.45	g/cc
1	2.5	12.3	2.11	Dry Unit Weight γ_d	0.81	g/cc
2	3.9	7.5	2.00	Liquid Limit LL	99.50	%
4	12.0	2.2	1.73	Plastic Limit PL	31.60	%
8	12.0	1.8	1.46	Compression Index, Cc	0.96	
16				Recompression Index, Cr	0.09	
				Specific Gravity G	2.61	

CONSOLIDATION TEST RESULTS

Project	THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT	Location	LAM INTRA	Job No.	2870
Boring No.	BH-2L	Sample	ST-3	Depth	4.00-5.00 m.
Date	18/10/90				

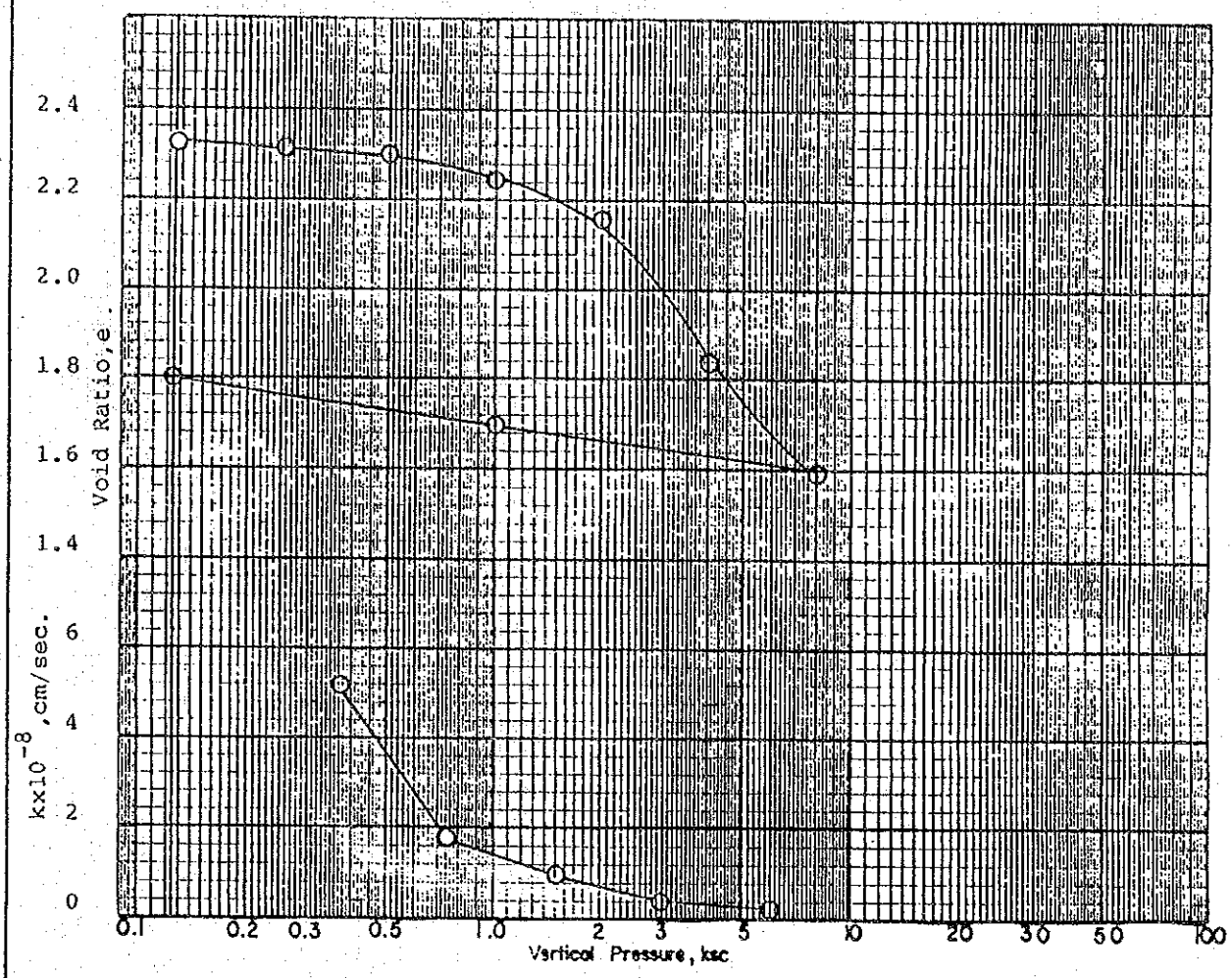


Pressure Ksc	50% Consol Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Void Ratio, e
Initial	—	—	2.72
0.125	—	—	2.71
0.25	2.0	16.2	2.68
0.50	1.0	31.6	2.64
1	0.75	40.9	2.57
2	2.8	10.3	2.39
4	5.0	5.0	2.04
8	3.9	5.1	1.74
16			

		initial	Final
Height of Sample, H	cm.	2.0	
Water Content, W	%	99.3	
Degree of Saturation, S	%	97.0	
Solid Height of Sample, Hs		0.54	cm.
Diameter of Sample D		6.35	cm.
Wet Unit Weight γ_t		1.42	g/cc
Dry Unit Weight γ_d		0.71	g/cc
Liquid Limit LL		88.50	%
Plastic Limit PL		28.70	%
Compression Index, Cc		1.10	
Recompression Index, Cr		0.09	
Specific Gravity G		2.65	

CONSOLIDATION TEST RESULTS

Project	THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT	Location	CAM INTRA	Job No.	2870
Boring No.	BH-2L	Sample :	ST-7	Depth 8.50-9.50 m.	Date 27/10/90

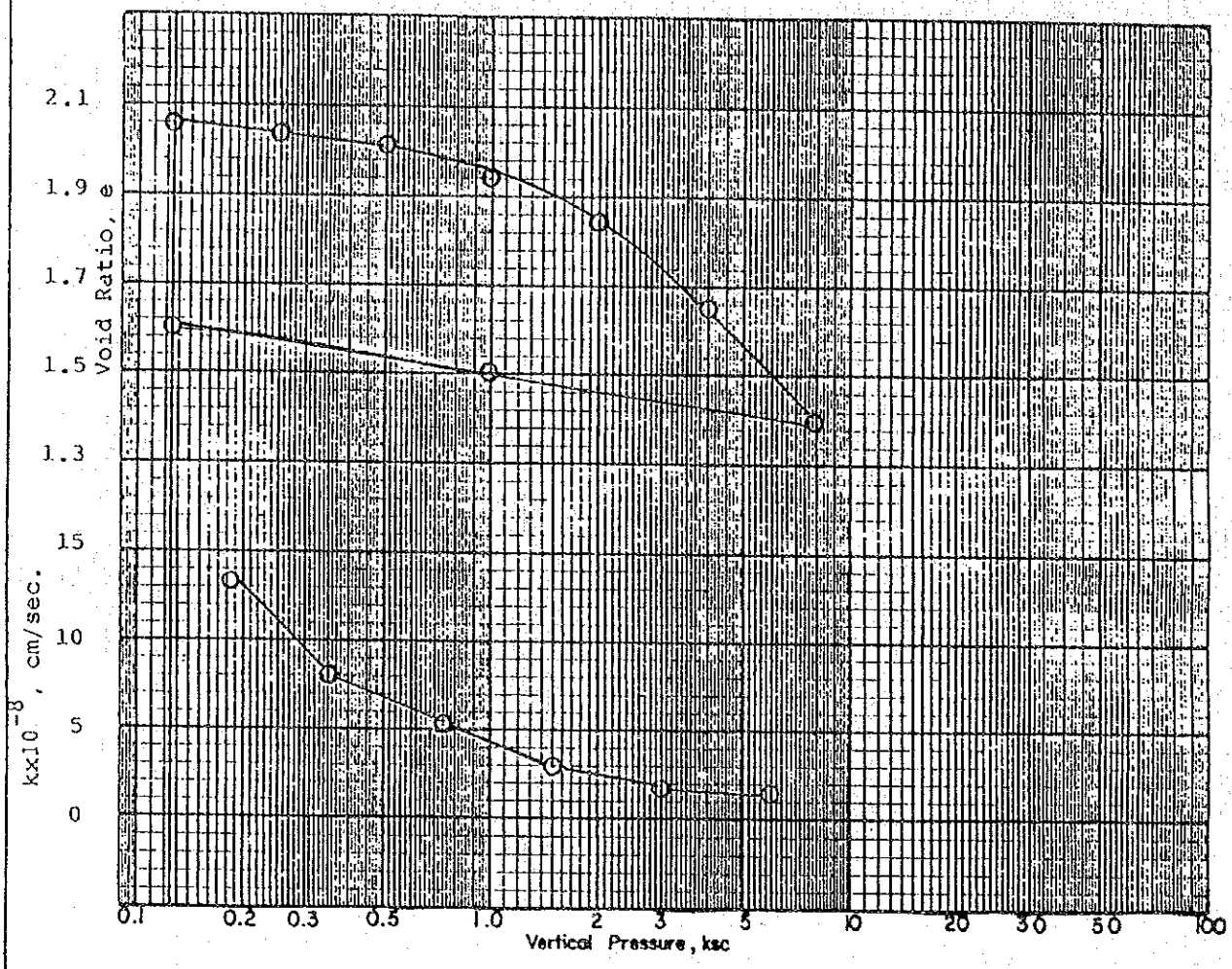


Pressure Ksc	50% Consol Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Void Ratio, e
Initial	—	—	2.33
0.125	—	—	2.33
0.25	—	—	2.32
0.50	1.8	17.9	2.30
1	5.0	6.3	2.25
2	9.5	3.2	2.15
4	29.0	0.9	1.85
8	24.0	0.9	1.60
16			

		initial	Final
Height of Sample, H	cm.	2.0	
Water Content, W	%	81.0	
Degree of Saturation, S	%	93.0	
Solid Height of Sample, Hs		0.60	cm.
Diameter of Sample D		6.35	cm.
Wet Unit Weight γ_t		1.45	g/cc
Dry Unit Weight γ_d		0.80	g/cc
Liquid Limit LL		79.80	%
Plastic Limit PL		33.20	%
Compression Index C_c		0.98	
Recompression Index C_r		0.06	
Specific Gravity G		2.67	

CONSOLIDATION TEST RESULTS

Project: THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT	Location: LAM INTRA		Job No. 2870
Boring No. BH-3L	Sample No. ST-1	Depth 0.50-1.50 m.	Date 22/10/90



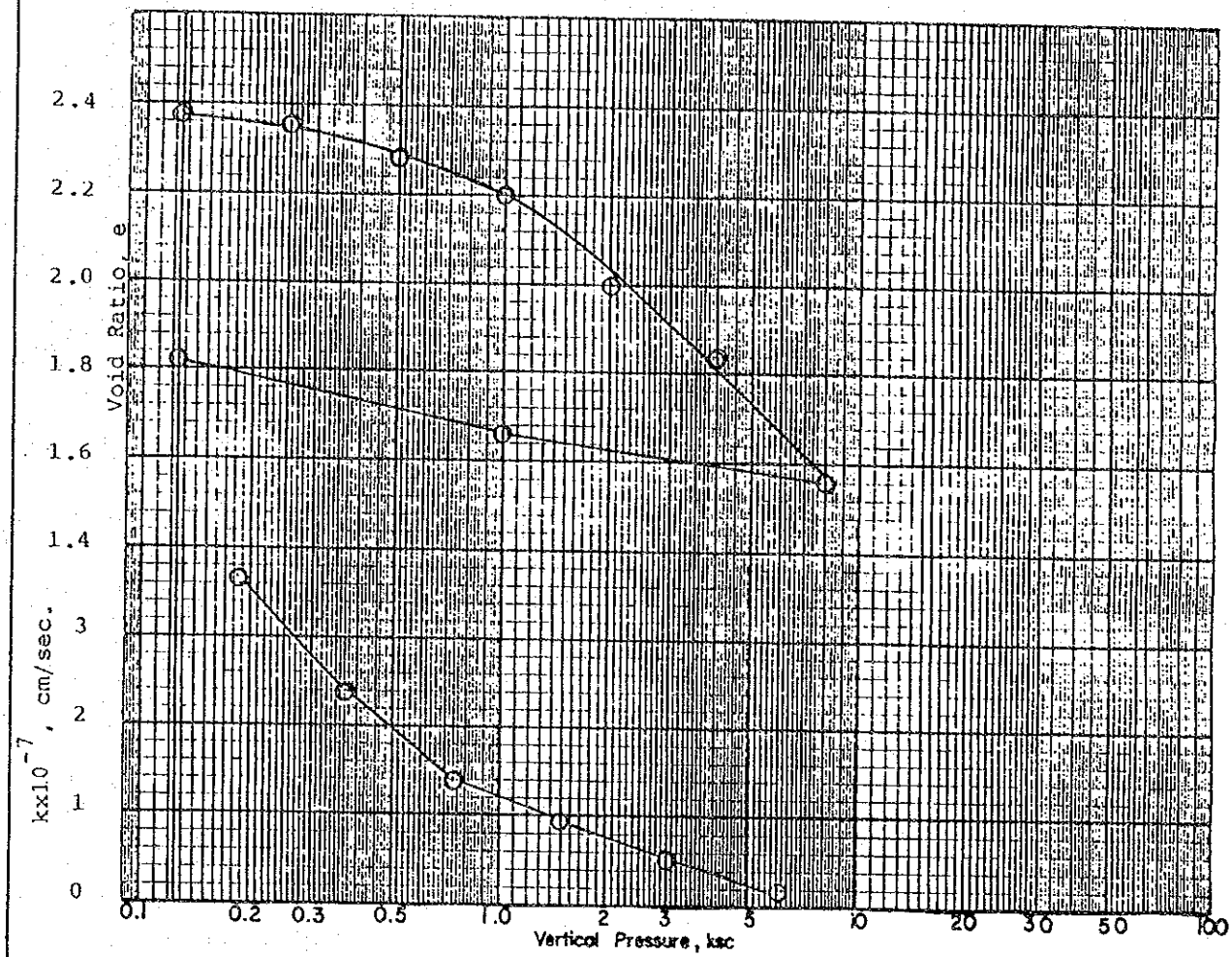
Pressure Ksc	50% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Void Ratio, e
Initial	—	—	2.06
0.125			2.055
0.25	1.1	29.4	2.04
0.50	1.6	19.9	2.01
1	1.9	16.3	1.95
2	3.4	8.7	1.85
4	10.0	2.6	1.65
8	12.0	1.9	1.41
16			

		initial	Final
Height of Sample, H	cm.	2.0	
Water Content, W	%	74.7	
Degree of Saturation, S	%	95	
Solid Height of Sample, Hs		0.64	cm.
Diameter of Sample D		6.35	cm.
Wet Unit Weight γ_t		1.49	g/cc
Dry Unit Weight γ_d		0.85	g/cc
Liquid Limit LL		74.4	%
Plastic Limit PL		33.4	%
Compression Index Cc		0.76	
Recompression Index Cr		0.10	
Specific Gravity G		2.61	

CONSOLIDATION TEST RESULTS

Project	Location	Job No.
THE STUDY ON BANGKOK SOLID WASTE MANAGEMENT	LAM INTRA	2870

Boring No.	Sample No.	Depth	Date
BH-3L	ST-4	4.00-5.00 m.	17/10/90



Pressure Ksc	50% Consol Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Void Ratio, e
Initial	—	—	2.39
0.125	-	-	2.38
0.25	0.7	46.1	2.35
0.50	0.95	33.1	2.29
1	1.1	27.4	2.20
2	1.7	16.4	2.01
4	1.1	22.3	1.85
8	2.4	8.7	1.55
16			

		initial	Final	
Height of Sample, H	cm.	2.0		
Water Content, W	%	83.3		
Degree of Saturation, S	%	93.0		
Solid Height of Sample, Hs		0.59		cm.
Diameter of Sample D		6.35		cm.
Wet Unit Weight γ_t		1.43		g/cc
Dry Unit Weight γ_d		0.78		g/cc
Liquid Limit LL		80.6		%
Plastic Limit PL		29.6		%
Compression Index, Cc		0.78		
Recompression Index, Cr		0.11		
Specific Gravity G		2.65		

Part IV

Evaluation

of

the Compaction and Binding System

and

the Seashore Landfill in Bang Khun Thian

Chapter 12 Compaction and Wrapping System

12.1 Background

This idea was initially introduced by an Australian consultant. Compaction and wrapping system has conceptually two advantages such as: volume reduction and creation of fill materials. Since the waste of Bangkok has 50% moisture and many variable materials like paper, plastic, metals and bottles are sorted out, the waste could be compressed and compacted to about 1/4 of original volume. It means that a disposal site could be used 4 times more than usual waste and cost of haulage could be reduced.

On the other hand, since the demand for fill material is great due to continuing land settlement in Bangkok, the BMA expects that waste compacted and wrapped with the system will be utilized as the fill materials. In response to the BMA's request, the JICA Study Team immediately studied this matter.

12.2 Plan of Compaction and Wrapping System

12.2.1 Basic Concept of the Compaction and Wrapping System

1) Compaction and Wrapping System

The waste is compressed in a compaction machine with 75% reduction of volume. At this process, 10% of waste water is removed. After compressing, the waste is bound to keep the waste in the pressed volume. Then, the waste is wrapped. The process of compaction and wrapping system is illustrated in Fig. 12.2-1.

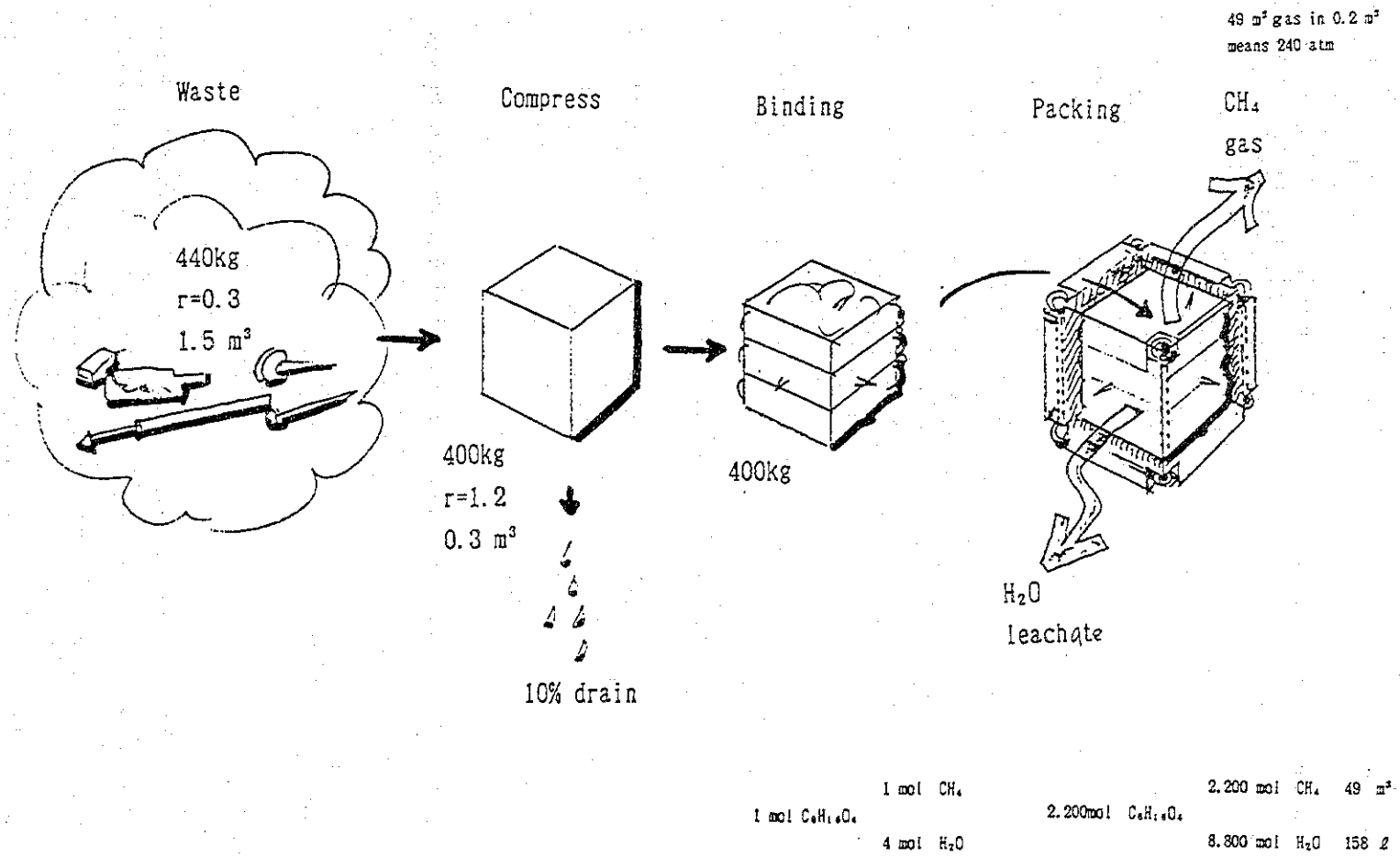


Fig. 12.1-1 Compaction & Wrapping System

2) Compaction from Hydraulic Point of View

(1) Compaction

Standard hydraulic pressure system uses either 140 km/cm^2 or 250kg/cm^2 as shown in Fig. 12.2-2.

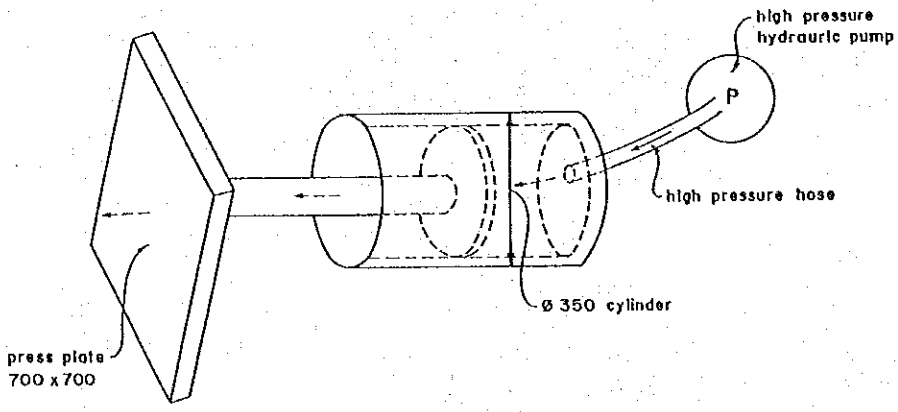


Figure 12.2-2 Compaction Unit

Using 250 kg/cm^2 high pressure hydraulic pump and sealing equipment and ϕ350 drum cylinder, 240t force can be get.

$$\frac{(35\text{cm})^2}{2} \times \pi \times 250\text{kg/cm}^2 = 240\text{t}$$

A pressure force of 50kg/cm^2, at maximum, can be generated by using a pressplate (700 x 700).

$$\frac{240\text{t}}{4900\text{cm}^2} = 50\text{kg/cm}^2$$

(2) Wrapping

Pressed waste is going to expand its volume once the pressure is released. It is, therefore, necessary to bind it or use some other way to keep the waste in a pressed position. The binding or fixing is additional cost.

An aerobic decomposition (bio-chemical reaction) still continues even the waste is compacted and wrapped.

Since the wrapped waste is heaby and large in size, it is not easy to handle,needing forklifts, crane or special power tools.

12.2.2 Technical Problems

1) Relationship between Pressure Force and Volume Reduction Ratio

The relationship between pressing force and reduction ratio of mixed municipal solid waste is shown in Fig. 12.2-3.

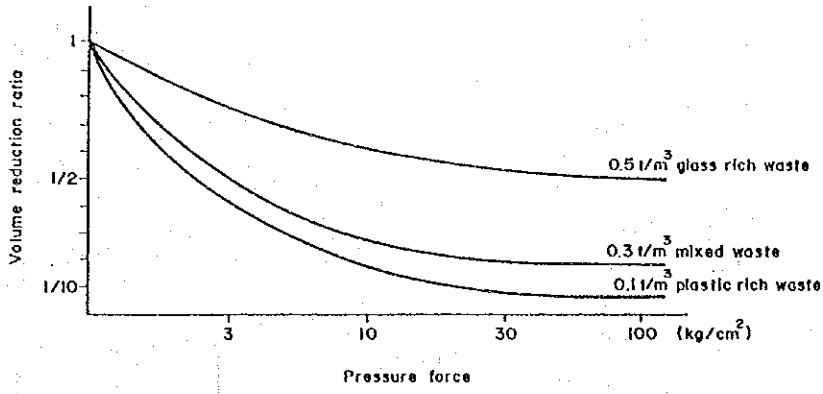


Fig. 12.2-3 Relationship between Pressure Force and Volume Reduction Ratio

After loaded on compactor car, weight/volume ratio of typical waste in Bangkok is 0.3 t/m^3 on average.

10-30 kg/cm^2 hydraulic pressure will be required for compacting the mixed waste up to 1.2 t/m3, which corresponds to 25% of the original volume (0.3 t/m^3). 1.2 t/m^3 is almost a limit of practical compaction, as shown in the Fig. 12.2-3, the use of any additional force (over 30 kg/m^2) would not contribute the further volume reduction.

2) Pressure Force

To get higher pressure force, several methods are considered, but high compaction machines are not practical as they prevent the compaction system being economically feasible.

As small press plate generates higher pressure, however, it has small capacity because machine cycle is constant and pressing frequency cannot be increased.

A big plate with many cylinder units compresses a larger volume of waste, however, it is very costly and is difficult to mechanically control. Moreover, large hydraulic pumps need a major oil cooling system, which are costly and are technically more complicated.

3) Wrapper

The wrapper needs many small holes for the waste water to flow out. However, the small holes will choke with the pressed waste. This could make the machine inefficient, and clearing of the small holes is difficult.

4) Wrapping

The wrapped waste needs to be placed in an orderly manner so that it will occupy less space as shown in Fig. 12.2-4.

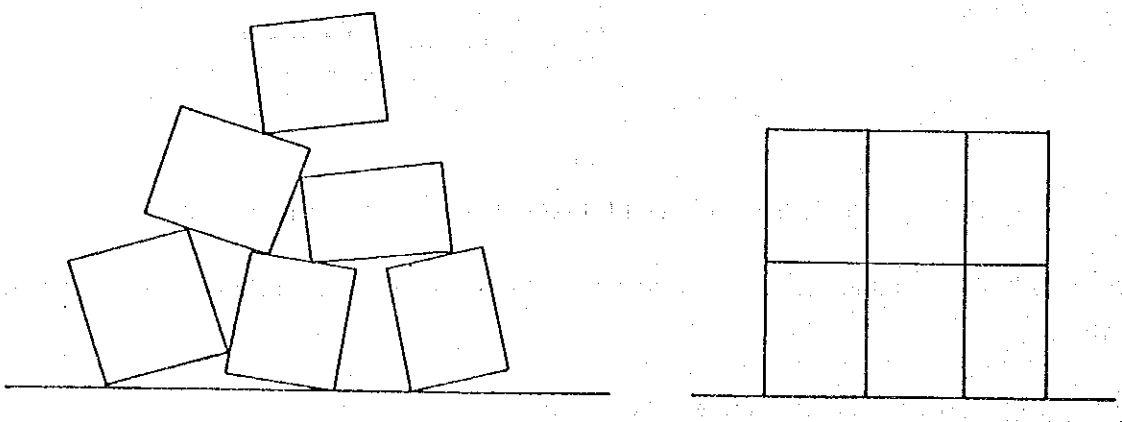


Fig. 12.2-4 Disposing Wrapped Waste

The size of one block may differ from another because the compressibility of waste differs from one block (of waste) to another. This might make it difficult to place the waste blocks in orderly manner at landfill site.

12.3 Specifications of Compaction and Wrapping System

Specifications of the compaction and wrapping system is shown in Table 12.3-1.

Table 12.3-1 Specifications of Compaction and Wrapping System

Items	Specification	
Capacity	500 t/d 20 hours/day 1,700m^3/d (w/v = 0.3)	
Input Vessel Vol.	1650 x 1200 x 700 =	1.39m^3
Output Packing	700 x 700 x 700 =	0.34 m^3 (400 kg)
Volume Reduction Ratio		1/4
Working Cycle	3 minutes/cycle	
Packing Block per Hours	20 block/h x 31 lines	

12.4 Cost Estimation

It is estimated that the construction cost of the compacting and wrapping system alone would cost roughly 220 million Baht. In addition, the seashore landfill structure will be required even if the proposed compacting and wrapping system is used. Total cost of this option (compacting and wrapping system) will be 700 million Baht (220 million Baht + 480 million Baht). Details of the construction cost and the annual operation cost is shown in table 12.4-1.

Table 12.4-1 Cost of Compaction and Wrapping System

(Million Baht)

		Cost	
		With Wrapping	Without Wrapping
1.	Construction Cost		
	Mechanics & Electrics	180	160
	Architecture	10	9
	Water Treatment	30	30
	Total	220	199
2.	Operation Cost		
	Labour	2	2
	Maintenance	6	5
	Repair	8	7
	Total	16	14
3.	Annual Cost Estimation		
	Annual Cost for Construction	30	28
	Annual Operation Cost	16	14
	Total	46	42
4.	Unit Cost per Tonnage		
	46 MB/500 x 300 = 307 Baht/t		280B/t
	(it does not contain transportation to land-fill & cost of land)		

12.5 Conclusions

12.5.1 Difficulty in Reduction of Waste Volume and Water Content by Compaction

Bangkok waste has a specific gravity of 0.3 when loaded into collection vehicles, and the volume reduction effect by compaction remains approximately 1/4, i.e. specific gravity of the compacted waste will be 1.2. Further compaction is not possible or practical from a mechanical and economic point of view.

Waste will still contain some water after compaction. Water will be retained in papers and spaces between waste materials. The water content after the compaction will remain about 10%.

12.5.2 Problems Arising after Disposal of Wrapped Waste into Seashore

1) Wrapping materials (plastic) can be broken easily by glass or metal pieces contained in the compacted waste and by high gas pressure which will be generated as a result of decomposition.

2) Wrapped waste will eventually shrink substantially as a result of decomposition into water and gas. The final amount of waste will be about 10% of the original amount. This implies that a landfill area filled with wrapped waste will continue to sink, requiring a long period of time before construction of structures will be possible.

3) The seashore may be contaminated by leachate coming out of wrapped waste as wrapping materials can easily be broken. There is also a possibility of methane gas explosion, unless preventative measures are taken.

4) The compaction and wrapping system is not feasible from an economic point of view. Large investments will be required for the production and transportation of wrapped waste. It is very likely that the cost will be higher than the price (100 Baht/m3) of ordinary fill material (soil).

12.5.3 Volume Reduction Effect

Although the objective of the compaction system is to reduce waste volume, the system is not particularly superior to the ordinary landfill method in terms of waste volume reduction effect. Waste volume can be reduced greatly (to the level of 1.0 t/m3) by the ordinary landfill, machine methods with compaction applied immediately after landfilling.

Although, the ultimate volume reduction effect will be greater under the ordinary landfill system than under the compaction and wrapping system, the waste decomposition is quicker under the landfill with aerobic conditions than under the compaction and wrapping system, which creates anaerobic conditions of waste reduction.

12.5.4 Cost Reduction in Secondary haulage

The compaction and wrapping system is not particularly superior to a simple transfer station system in terms of reducing costs of secondary haulage. Maximum loading amount is limited by the highway code, to approximately 10 tons per vehicle. This amount of waste (without compaction) can be carried by trailers.

12.5.5 Japanese Experience

Many compaction and wrapping facilities were constructed in Japan around 1975. All the facilities using of mixed waste failed due to both technical and economic problems. At present this system is not utilized by any local authorities and the Government of Japan does not recognize this system as feasible.

The compaction and binding system, however, is applied to plastic waste and incombustible waste such as cans, bottles and ceramics, in which case waste separation at generation sources is needed.

As a conclusion and wrapping system is not feasible from a technical or economic view point unless it is applied to separated waste. Waste separation, however, requires citizens' cooperation.

The same conclusion can be drawn for the waste sorting facility.

Chapter 13 Seashore Landfill in Bang Khun Thian

13.1 Background

The future volumes of waste indicates that even if incineration can be introduced in the near future, landfill will form a major part the solid waste management process. This means that land acquisition for the final disposal site is a basic and important matter. Therefore, the BMA should make efforts necessary to obtain land. The BMA should organize a special committee for land acquisition which consists of not only top BMA officials, but also representatives from relevant agencies. However, the BMA's current efforts for land acquisition have been obstructed by regulations on the "Standard Price". Therefore the BMA wants to select an easy method of land acquisition, which is the plan for a seashore landfill in Bang Khun Thian. The main obstructions in obtaining land are :

1. Land owners do not want to sell the land, because land prices go higher every year, oweing to increasing demand for land by local and foreign developers.
2. Market prices are much higher than standard prices by as much as 2 - 15 times.

13.2 Plan of Seashore Landfill in Bang Khun Thian

13.2.1 Structure of Sanitary Landfill

In view of the situation where the BMA wishes to complete the seashore landfill within four (4) years, the JICA Study Team has planned that the landfill site should have a capacity to receive 3,000 t/day of waste for three (3) years considering the construction of the site will take another one year before the start of the landfill operation. It would be difficult to transport more than 3,000 tons of waste per day into the site. Having made those assumptions, the planned landfill site has a total area of 1 km^2 approximately, of which the area used for garbage disposal is 0.75 km^2.

The landfill site will have the following structures:

1. Permanent barrier
2. Temporary barriers (both outside & inside of the permanent barrier) (Temporary barriers are necessary for the construction of the permanent barriers)
3. Leachate reservoir pond
4. Leachate treatment facility

A plan and cross-section of the landfill facilities are shown in Fig. 13.2.1 and Fig. 13.2.2 respectively.

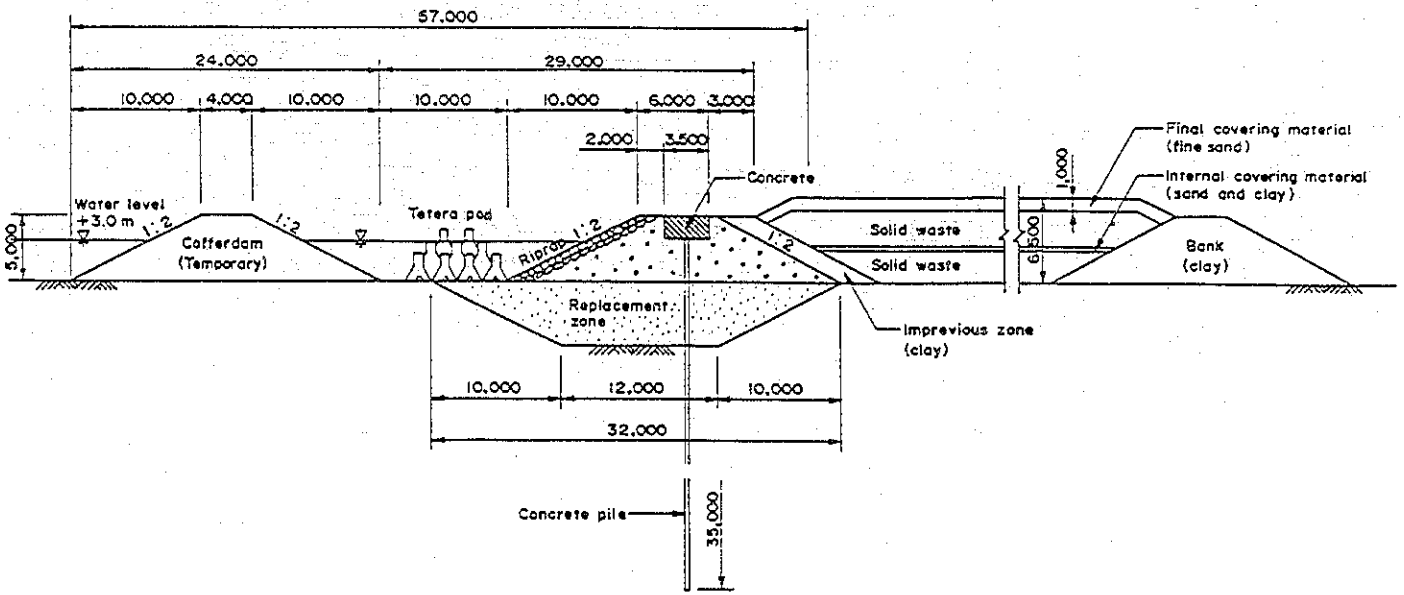


Fig. 13.2-1 Outline and Standard Section of Seashore Site

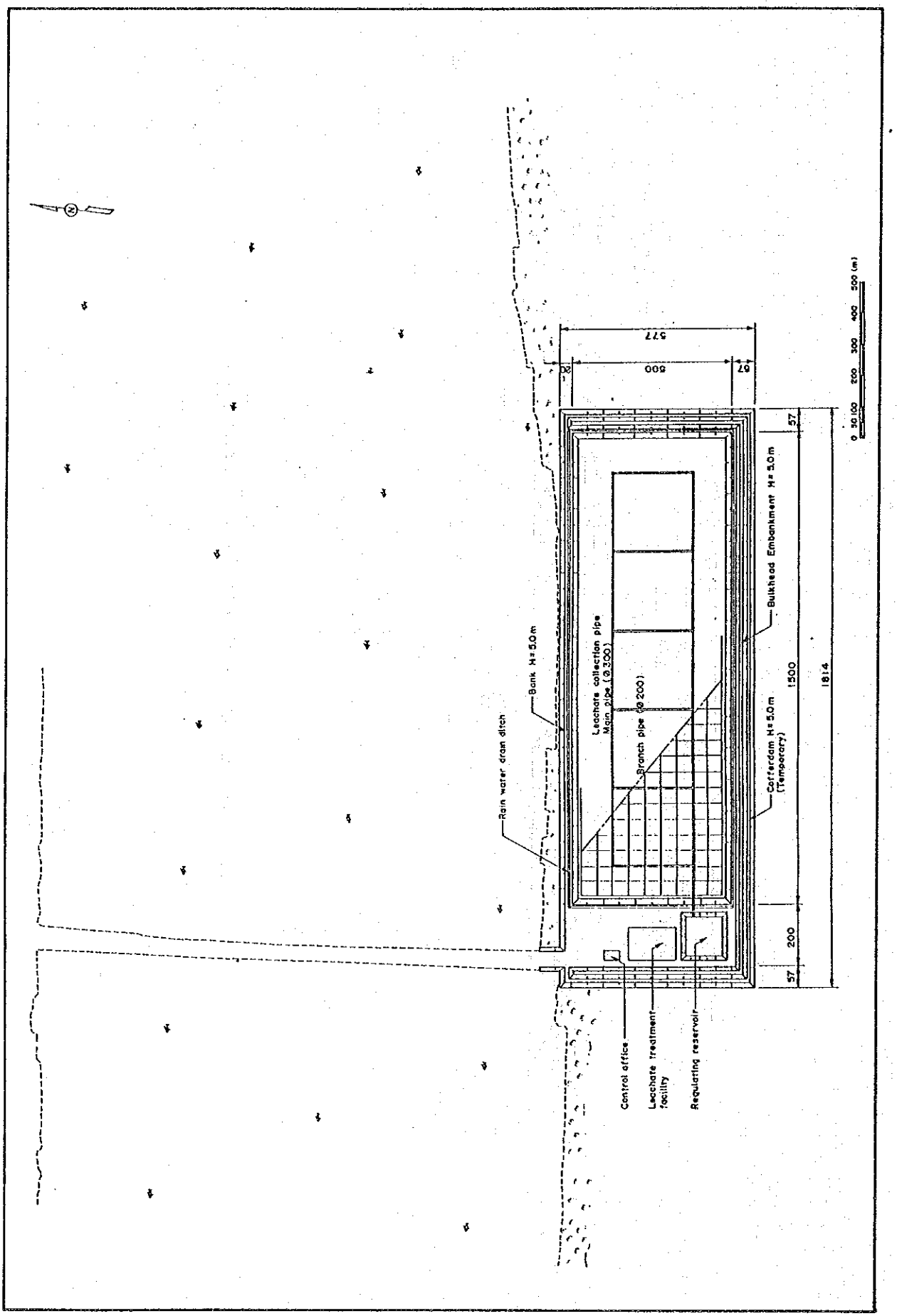


Fig. 13.2.2 Plan of Seashore Site

The existing clay layer in the sea bed has low permeability which is helpful to retain leachate. It is economical to use such clay as lining material, artificial membranes such as rubber or PVC lining would not be needed.)

Daily soil covering and leachate treatment facilities will be required from sanitary and environmental point of view.

Detailed specifications of the seashore landfill are shown in Table 13.2.1.

Table 13.2.1 Specifications of the Seashore Landfill in Bang Khun Thian

Item	Specification
1. Site area:	930,000 m^2 (1,736 m x 536 m)
2. Waste disposal area:	750,000 m^2 (1,500 m x 500 m)
3. Capacity (Volume)	4,800,000 m^3 (waste disposal volume 3,500,000 m^3)
4. Amount of Waste received: (3,000 t/day x 300 days/year x 3 years)	2,700,000 t
5. Final height of landfill:	6.5 m
- Total height of waste:	5 m (1st layer 2.5 m + 2nd layer 2.5 m)
- Total height of cover soil:	1.5m (top cover soil 1m, Intermediate layer 0.3m and sub-layers 0.1m + 0.1m)
6. Permanent barriers	
1) Length:	1.736 m (longest barrier) 536 m (side barrier)
2) Width:	9 m on the top 29 m at the bottom
3) Height:	5 m
4) Length of pile: (Piles will be placed at an interval of 5m)	35 m
5) Materials used:	sand, stone, clay and concrete
7. Temporary barriers (Outside of the permanent barrier)	
1) Length:	1,814 m (longest barrier) 577 m (side barrier)
2) Width:	4 m on the top 24 m on the bottom
3) Height:	5 m
4) Materials:	clay dredged
8. Leachate treatment facilities	
1) Capacity:	1700 m^3/day
9. Leachate reservoir pond	
1) Capacity:	300,000 m^3

13.2.3 Environmental Consideration

The existing Mangrove on the project site will be destroyed due to the construction of the seashore structures. The Mangrove nearby the project site might also be affected due to the changes in the sea water current and other factors that might be caused due to the construction and operation of the landfill. The protection of the mangrove, however, is an international issue, and considered important to Thailand. An environmental study, therefore, will be needed before the implementation of the plan.

13.3 Alternatives

There are alternatives existing such as:

1) Seashore disposal with barriers

2) Seashore disposal with compaction and wrapping system

Even if the compacting and wrapping system is applied, the barriers and leachate treatment facilities will be required because wrapped blocks may be ruptured, and leachate and gas, which would be generated in the blocks as a result of the waste decomposition, would come out of the blocks. This necessitates the construction of barriers and leachate treatment facilities. Consequently, the option with the compacting and wrapping system will cost more than the seashore landfill option. The cost difference between the two options will be the cost of the compacting and wrapping facility alone (220 million Baht).

In Japan, some local authority tried "Compacting & Asphalt Coating System". They carried and left the asphalt-coated-waste blocks (1 cubic meter) in valleys of the mountains or river-sides. This project, however, failed because the asphalt coating failed with time and the leachate came out of the blocks, which then contaminated the water resources nearby. At present there are no local authorities in Japan, which use this "Compacting & Wrapping System".

In the case a choice has to be made between 1) the seashore landfill and 2) the compacting and wrapping system, the former is recommended.

13.4. Economic Evaluation

13.4.1 Cost of the Seashore Landfill

Construction costs are estimated as shown in Table 13.4.1. Total cost of construction is 696 million Baht including 560 million Baht for site Construction and 136 million Bahts for leachate treatment facilities.

Table 13.4.1 Cost of the Seahole Landfill

	Work Item	Cost (x 1,000B)
(1)	Site construction	
	Cofferdam	40,600
	Replacement	50,000
	Bulkhead embankment	52,850
	Impervious zone (clay material)	7,540
	Earth filling	86,400
	Pile	20,628
	Concrete and beam	29,046
	Leachate collection facility	6,023
	Rain water drain ditch	4,400
	Concrete block	42,000
	Fence	380
	Cover material	146,800
	Contingency, Overhead & Other Expenditure	73,333
	Sub Total	560,000
(2)	Leachate treatment facility	
	1,700m^3/d x 0.08 mil/m^3	136,000
(3)	Total cost (1) + (2)	696,000 Bath

13.4.2 Economic Evaluation

The seashore landfill might be feasible as a park. If the seashore landfill project is to be justified, the total benefit of the project must be greater than the total project cost. The total cost is estimated at 952 million Baht (Construction cost 696 million Baht + 3-year-operation cost 256 million Baht). The total project benefits consist of 1) waste disposal benefit and 2) value of the park to be constructed. The waste disposal benefit can be estimated in terms of the opportunity cost required for a typical sanitary landfill (inland), which was estimated at 437 million Baht. (Construction cost 167 million Baht + 3-year-operation cost 189 million Baht +

land purchase cost 81 million Baht). Given this cost conditions, the expected value of the planned park land must be greater than 515 million Baht or 1.1 million Baht per rai if the project is to be justified. Whether or not the park construction project would be justified depends on how the BMA and the citizen evaluate the value of the planned park.

Note:

1. The cost estimation of the typical inland landfill was made assuming a sanitary landfill disposal site would be constructed in Lat-Kabang.

2. Total area of the planned park will be 750,000 m2 (1,500 m x 500 m) or about 469 rai, which is used to calculate the break even value of one rai of the planned park land: 1.1 million Baht/rai (515 million Baht / 469 rai = 1.1 million Baht/rai)

13.5. Conclusion

(1) Seashore disposal with barriers is superior to seashore disposal with compaction and wrapping system since the former is less costly than the latter. The latter will require the construction of barriers and leachate treatment facilities as in the former, because wrapping blocks may be broken by glass pieces or high gas pressure.

(2) The seashore disposal in Bang Khun Thian is more costly and less desirable than a typical inland landfill. The seashore disposal will possibly cause some environmental problems such as destruction of the existing Mangrove.

(3) A careful study will be needed to evaluate the environmental impacts which would occur over a long period of time.

(4) Initially, the BMA wished that the seashore landfill would be completed in four years, so that the created land could be converted into a public park. The completion of the landfill in four years does not seem possible. It was estimated that it would take more than 17 years to complete the landfill in the entire project area (2,735 rai), assuming 3,000 tons/day or waste would be carried into the site. The landfill could be completed in a shorter time if soil or sand were purchased and used as fill material. However, this would be too costly.

Appendix Computer Program Used for Preparation of Figures

Appendix Computer Program Used for Preparation of Figures

These programs are used for visualization of data, which are incorporated in the following figures of the Master Plan.

Fig. 2.2-2 Population by Districts (1989)
Fig. 3.2-1 Waste Generation and Collection Amount by Districts (1989)
Fig. 4.1-3 & Fig. 4.1-4 Waste Collection & Disposal Amount (1990, 1991)
Fig. 8.1-1 The Future Disposal Plan (1991 - 2000)

```
10 '***************************** BKK     ***********************************
*
20 '
30 '
40 '  BMA SOLID WASTE MANAGEMENT STUDY
50 '
60 '
70 '*********************************************************************
80 OD=8:DIS1=14:YS=1984:PFG=1:YB=1980:YES=1990:YE=2000:DN=1990-YS :SY=YS-198
1
81 DTR=.4 :DIS2=DIS1 :POPR=.0016'(1/625)
82 SWWR=.0025'(1/400)
100 OPTION BASE 1
110 DIM WDT#(25),Y(15),LS(25),CVE(37,9),VCVE(37,5),PICSET(37)
111 DIM WKER(37,6),AREA(36),SETAI(36)
112 '
120 '
121  GOSUB *GOMI
122 'GOSUB *WKER
123  GOSUB *COLLVEHICLE
130  GOSUB *INIT
139  FOR K=DIS1 TO DIS2
140  DEF FNXP(XM)=(XM-45)*2700/350 :DEF FNYP(YM)=( 58 -YM)*1100/190
141  GOSUB *MAPBKK
142  GOSUB *MAPCIRCLE
148  GOSUB *SWWMOD
150 GOSUB *GRAPH
151 'LPRINT K;DIS$(K);"      ";DISA$(K)
152 FOR I=SY TO OD
153  IF POP#(K,I)=0 THEN 345
154 WDT#(I)=SWW=(K,I)*1000000#/POP#(K,I)/365#/CLL#(K,I):NEXT
160 PSET ((YS-YB)*100,-WDT#(SY)*DTR),7
161 CIRCLE ((YS-YB)*100,-WDT#(SY)*DTR),12
170 FOR YEAR=YS   TO   YS+DN-1
180 LINE -((YEAR-YB)*100,-WDT#(YEAR-YB-1)*DTR),7
190 CIRCLE ((YEAR-YB)*100,-WDT#(YEAR-YB-1)*DTR),12:NEXT
191 PSET ((YS-YB)*100,-SWW#(K,SY)*SWWR),7
192 CIRCLE ((YS-YB)*100,-SWW#(K,SY)*SWWR),9,,,,F,7
193 FOR YEAR=  YS TO   YS+DN-1
194 LINE -((YEAR-YB)*100,-SWW#(K,YEAR-YB-1)*SWWR),7,,1010
195 CIRCLE ((YEAR-YB)*100,-SWW#(K,YEAR-YB-1)*SWWR), 9,,,,F,7:NEXT
196 PSET ((YS-YB)*100,-POP#(K,SY)*POPR  ),7
197 CIRCLE ((YS-YB)*100,-POP#(K,SY)*POPR  ),5,,,,F,7
198 FOR YEAR=  YS TO   YS+DN-1
199 LINE -((YEAR-YB)*100,-POP#(K,YEAR-YB-1)*POPR  ),7,,1111
200 CIRCLE ((YEAR-YB)*100,-POP#(K,YEAR-YB-1)*POPR  ), 5,,,,F,7:NEXT
201 PSET ((YS-YB)*100,-CLL#(K,SY)*1000),7
202 CIRCLE ((YS-YB)*100,-CLL#(K,SY)*1000),1,,,,F,7
203 FOR YEAR=  YS TO   YS+DN-1
204 LINE -((YEAR-YB)*100,-CLL#(K,YEAR-YB-1)*1000),7,,3030
205 CIRCLE ((YEAR-YB)*100,-CLL#(K,YEAR-YB-1)*1000), 1,,,,F,7:NEXT
206 '
210 FOR J=1  TO DN: Y#(J)=WDT#(SY+J-1):NEXT
220 GOSUB *LS
230 '
240  PSET ((YES-YB)*100,-(A+B*YES)*DTR),7
241 CIRCLE ((YES-YB)*100,-(A+B*YES)*DTR),12
250 FOR YEAR=YES TO YE
260 LINE -((YEAR-YB)*100,-(A+B*YEAR)*DTR),7
261 CIRCLE ((YEAR-YB)*100,-(A+B*YEAR)*DTR),12,,,,F,0
270 LS(YEAR-YES+1)=(A+B*YEAR)
280 NEXT
281  YEAR=YES:PSET ((YES-YB)*100,-POPF#(K,YEAR-YES+1)*POPR ),7
282 CIRCLE ((YES-YB)*100,-POPF#(K,YEAR-YES+1)*POPR ),5,,,,F,7
283 FOR YEAR=YES TO YE
284 LINE -((YEAR-YB)*100,-POPF#(K,YEAR-YES+1)*POPR ),7,,1111
285 CIRCLE ((YEAR-YB)*100,-POPF#(K,YEAR-YES+1)*POPR ),5,,,,F,7
286 NEXT
287  YEAR=YES:PSET ((YES-YB)*100,-CLLF#(K,YEAR-YES+1)*1000 ),7
288 CIRCLE ((YES-YB)*100,-CLLF#(K,YEAR-YES+1)*1000 ),1
289 FOR YEAR=YES TO YE
290 LINE -((YEAR-YB)*100,-CLLF#(K,YEAR-YES+1)*1000 ),7,,3030
291 CIRCLE ((YEAR-YB)*100,-CLLF#(K,YEAR-YES+1)*1000 ),1,,,,F,7
292 NEXT
293  YEAR=YES:PSET ((YEAR-YB)*100,-CLLF#(K,YEAR-YES+1)/1E+06*365*POPF#(K,YEA
R-YES+1)*LS(YEAR-YES+1)*SWWR),7
294 CIRCLE ((YEAR-YB)*100,-CLLF#(K,YEAR-YES+1)/1E+06*365*POPF#(K,YEAR-YES+1)
*LS(YEAR-YES+1)*SWWR),9,,,,F,7
295 FOR YEAR=YES TO YE
296 LINE- ((YEAR-YB)*100,-CLLF#(K,YEAR-YES+1)/1E+06*365*POPF#(K,YEAR-YES+1)*
LS(YEAR-YES+1)*SWWR),7,,1010
297 CIRCLE ((YEAR-YB)*100,-CLLF#(K,YEAR-YES+1)/1E+06*365*POPF#(K,YEAR-YES+1)
*LS(YEAR-YES+1)*SWWR),9,,,,F,7
298 SWWF#(K,YEAR-YES+1)=CLLF#(K,YEAR-YES+1)/1E+06*POPF#(K,YEAR-YES+1)*LS(YEA
```

```
R-YES+1)*365
299 NEXT
300 '
310 FOR YEAR=YES TO YE
320   PRINT USING "###############";YEAR;: PRINT USING "########";SWWF#(K,YEAR
-YES+1):NEXT
321 'LPRINT USING "###############";YEAR;:LPRINT USING "########";SWWF#(K,YEAR
-YES+1):NEXT
330 LOCATE 55,0:PRINT K;" ";DIS$(K);" ";DISA$(K)
331  IF PFG=1 THEN 340 ELSE 345
340  COPY 5
345 'LPRINT
346 'NEXT
350  NEXT:END
500 '
510 '
520 '
530 '
540 '
1000 *GRAPH
1010 CONSOLE 0,25,0,0
1011 SCREEN 2,1,0,1
1012 VIEW (0,0)-(639,399),0,7
1020 CLS 3
1030 WINDOW (-300,-1200)-(2700,300)
1040 '
1050 LINE (-300,-1200)-(2700,300),7,B,3030
1060 '
1500 *XYGRAPH
1510 LINE (0,0)-(0,-1100)
1520 FOR I=100 TO 1000 STEP 100
1530 LINE (0,-I)-(-20,-I):LINE(0,-I)-(2600,-I),7,,33 :NEXT
1535 RESTORE *YAXISDATA
1539 FOR I=0 TO 1000 STEP 100
1540 FOR J=1 TO 4:READ Y$:KCORD=VAL("&H"+Y$)
1550 PUT (MAP(-300+38*J,0),MAP(-I-30,1)),KANJI(KCORD),PSET,7,0:NEXT:NEXT
1560 *YAXISDATA
1570 DATA 2002,2002,2002,10, 2002,100,10,10, 2002,300,10,10,2002,500,10,10,
2002,700,10,10, 2002,900,10,10, 2002,B00,10,10, 2002,D00,10,10, 2002,F00,10,
10, 2002,1100,10,10, 100,10,10,10
1580 '
1610 LINE (0,0)-(2600,0)
1620 FOR I=100 TO 2500 STEP 100
1630 LINE (I, 0)-( I ,20):LINE(I, 0)-(I,-1100),7,,33 :NEXT
1635 RESTORE *XAXISDATA2
1639 FOR I=  0 TO 2500 STEP 100
1640 FOR J=1 TO 2:READ X$:KCORD=VAL("&H"+X$)
1650 PUT (MAP(I-110+38*J,0),MAP(60,1)),KANJI(KCORD),PSET,7,0:NEXT:NEXT
1660 *XAXISDATA
1670 DATA 100,10, 100,100, 100,300, 100,500, 100,700, 100,900, 100,B00, 100,
D00, 100,F00, 100,1100, 300,10, 300,100, 300,300, 300,500, 300,700, 300,900,
 300,B00, 300,D00, 300,F00, 300,1100, 500,10, 500,100, 500,300, 500,500, 500
,700, 500,900
1671 *XAXISDATA2
1672 DATA F00,10, F00,100, F00,300, F00,500, F00,700, F00,900, F00,B00, F00,
D00, F00,F00, F00,1100, 1100,10, 1100,100, 1100,300, 1100,500, 1100,700, 110
0,900, 1100,B00, 1100,D00, 1100,F00, 1100,1100, 300,10,  10,100, 10,300,  10
,500, 10,700, 10,900
1679 'COPY2
1680 RETURN
2000 '*****************************  LS  *********************************
2001 *LS
2010 X1#=0:Y1#=0:Z1#=0:X2#=0:Y2#=0
2020 FOR J=1 TO DN
2030 JJ#=(J+YS-1)
2040 X1#=X1#+JJ#
2050 Y1#=Y1#+Y#(J)
2060 Y2#=Y2#+Y#(J)*Y#(J)
2070 Z1#=Z1#+JJ#*Y#(J)
2080 X2#=X2#+JJ#*JJ#
2090 NEXT J
2100 A=(X2#*Y1#-Z1#*X1#)/(DN*X2#-X1#*X1#)
2110 B=(X1#*Y1#-Z1#*DN)/(X1#*X1#-DN*X2#)
2120 R=(Z1#-X1#*Y1#/DN)*(Z1#-X1#*Y1#/DN)/(X2#-X1#*X1#/DN)/(Y2#-Y1#*Y1#/DN)
2130 LOCATE  8, 0:PRINT "y=";A;"+";B;"x      ";"r=";R
2131 'LPRINT "y=";A;"+";B;"x      ";"r=";R
2140 RETURN
3000 *INIT
3010 IF K>DIS1 THEN 3040
3020 DIM POP#(36,8),SWW#(37,8),CLL#(36,8),DIS$(37),DISA$(37)
3030 DIM POPF#(36,11),SWWF#(37,11),CLLF#(36,11)
3031 DIM TPOP#(8),TSWW#(8),ACLL#(8)
```

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3032 DIM TPOPF#(11),TSWWF#(11),ACLLF#(11)
3040 RESTORE 3070
3050 FOR I=1 TO 37
3060 READ DISS(I),DISAS(I):NEXT
3066 DATA "aa"gh
3070 DATA "Phra Nakhon",PNK,"Pom Prab",POP,"Sam Pan Thawong",SPW,"Phatum Wan
",SPW,"Bang Rak",BAR,"Yanawa",YNW,"Satorn",SAT,"Bang Kho Leam",BKL,"Dusit",D
US,"Bang Sue",BAS
3071 DATA "Phaya Thai",PYT,"Rat Thewee",RTY,"Huay Khwang",HUK,"Phra Khnong",
PKN
3080 DATA "Klong Toi",KLT,"Praweat",PWA,"Bang Khen",BAK,"Dong Muang",DOM,"Ch
atchak",JTJ,"Bang Kapi",BKP,"Ladprad",LAP,"Bung Kum",BUK,"Nong Chok",NOJ,"Mi
n Buri",MBR,"Lad Kra Bang",LKB,"Thon Buri",TBR,"Klong San",KLS,"Bankok Noi",
BKN,"Bang Prat",BAP
3090 DATA "Bangkok Yai",BKY,"Pasi Charoen",PSJ,"Bang Khun Thian",BKT,"Chom T
hong",JOT,"Taling Chan",TLC,"Rat Burana",RBN,"Nong Khaem",NOC,"DPC",DPC
3100 'CLS
3110 'FOR I=15 TO 37
3120 'PRINT I,DISS(I),DISAS(I):NEXT
3130 '
3200 RESTORE 3250
3210 FOR I=1 TO 36
3220 FOR J=1 TO 8
3230 READ POP#(I,J):NEXT:NEXT
3240 '
3250 DATA 117649,113376,112332,114124,111875,104791,102382,102382
3251 DATA 189207,92950,89330,89539,87955,83412,81440,81440
3252 DATA 75581,53504,52816,52397,51121,50089,48377,48377
3253 DATA 233978,114820,157330,155868,143199,145110,146499,146499
3254 DATA 141667,88869,88197,91088,90672,88554,87175,87175
3255 DATA 386843,392279,396420,410288,415703,414235,412311,115132
3256 DATA  ,,,,,,,148242
3257 DATA  ,,,,,,,148897
3258 DATA 546868,550369,558832,565339,562990,561979,572455,267601
3259 DATA  ,,,,,,,304854
3260 DATA 520507,346319,357726,360603,359604,350780,340473,228234
3261 DATA  ,,,,,,,112239
3262 DATA 231069,235739,239742,247274,255774,262262,265164,265164
3263 DATA 559812,578541,594902,614854,629386,650572,664248,190044
3264 DATA  ,,,,,,,276978
3265 DATA  ,,,,,,,197226
3266 DATA 429977,457544,483717,520861,548078,581508,606201,199670
3267 DATA  ,,,,,,,206925
3268 DATA  ,,,,,,,199606
3269 DATA 314780,335171,356033,386005,409785,442420,478748,214519
3270 DATA  ,,,,,,,116595
3271 DATA  ,,,,,,,147634
3272 DATA 51799,54011,54952,56863,57704,60142,61417,61417
3273 DATA 61349,64266,66966,70289,74052,81110,86558,86558
3274 DATA 45303,48836,50541,56023,59070,63875,65311,65311
3275 DATA 268662,267767,267616,273542,274176,274949,269975,269975
3276 DATA 139310,139736,139444,142590,143719,146781,145901,145901
3277 DATA 388325,283296,285265,291035,294938,297324,298390,153018
3278 DATA  ,,,,,,,145372
3279 DATA 103365,104024,104716,107486,106732,108171,107548,107548
3280 DATA 196138,207409,211125,219606,228202,236572,243195,243195
3281 DATA 223388,232532,240835,254597,265453,286165,300858,118609
3282 DATA  ,,,,,,,182249
3283 DATA 72608,78995,81349,85559,90135,98552,104538,104538
3284 DATA 122614,127726,131550,140245,148166,154177,157124,157124
3285 DATA 47487,50248,52946,57303,60426,65822,70491,70491
3286 DATA 5468286,5018327,5174682,5363378,5468915,5609352,5716779,5716739
3287 '
3288 'FOR I=1 TO 36
3289 'FOR J=1 TO 8
3290 'PRINT I,POP#(I,J):NEXT:NEXT
3291 FOR J=1 TO 8
3300 READ TPOP#(J):NEXT
3310 'FOR J=1 TO 8:PRINT TPOP#(J):NEXT
3320 '
3400 RESTORE 3450
3410 FOR I=1 TO 37
3420 FOR J=1 TO 8
3430 READ SWW#(I,J):NEXT:NEXT
3440 '
3450 '
3451 DATA 83741,64028,66255,68675,70744,73430,69999,66063
3452 DATA 28923,55387,32273,34252,36208,36109,34497,32855
3453 DATA 22578,22098,21995,25043,27466,27295,24211,21602
3454 DATA 46201,50688,42698,47698,57236,56471,51026,52533
3455 DATA 41140,44387,40073,43607,48392,48963,44796,44320
3456 DATA 64769,62731,65364,95619,107091,116158,114830,72123
3457 DATA  ,,,,,,,26419
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519,214519
3671 DATA 116595,116595,116595,116595,116595,116595,116595,116595,116595,116
595,116595
3672 DATA 147634,147634,146734,147634,147634,147634,147634,147634,147634,147
634,147634
3673 DATA 62747,64105,65493,66910,68359,69839,71350,72895,74473,76085,77732
3674 DATA 90962,95591,100455,105566,110938,116582,122514,128748,135299,14218
4,149419
3675 DATA 68553,71956,75528,79278,83213,87344,91680,96231,101008,106022,1112
85
3676 DATA 270345,270715,271086,271457,271829,272201,272574,272947,273321,273
696,274070
3677 DATA 146955,148016,149085,150161,151246,152338,153438,154546,155662,156
786,157919
3678 DATA 153018,153018,153018,153018,153018,153018,153018,153018,153108,153
018,153018
3679 DATA 145372,145372,145372,145372,145372,145372,145372,145372,145372,145
372,145372
3680 DATA 108147,108749,109355,109963,110576,111191,111811,112433,113059,113
689,114322
3681 DATA 249733,256447,263341,270420,277690,285155,292821,300693,308777,317
078,325602
3682 DATA 118609,118609,118609,118609,118609,118609,118609,118609,118609,118
609,118609
3683 DATA 187148,192180,197346,202652,208099,213694,219439,225338,231396,237
617,244005
3684 DATA 109535,114771,120257,126006,13029,138340,144953,151882,159142,1667
50,174721
3685 DATA 162643,168357,174271,180392,186729,193288,200078,207106,214382,221
912,229707
3686 DATA 74582,78911,83491,88337,93464,98889,104629,110702,117127,123925,13
1118
3687 DATA 5802490,5889527,5977870,6067538,6158551,6250930,6344694,6439864,65
36462,6634509,6734027
3700 'FOR I=1 TO 36
3710 'FOR J=1 TO 11
3720 'PRINT I,POPF#(I,J):NEXT:NEXT
3730 FOR J=1 TO 11
3740 READ TPOPF#(J):NEXT
3750 'FOR J=1 TO 11
3760 'PRINT J,TPOPF#(J):NEXT
3770 '
3800 RESTORE 3850
3810 FOR I=1 TO 36
3820 FOR J=1 TO 8
3830 READ CLL#(I,J):NEXT:NEXT
3840 '
3850 '
3851 DATA 1,1,1,1,1,1,1,1
3852 DATA 1,1,1,1,1,1,1,1
3853 DATA 1,1,1,1,1,1,1,1
3854 DATA 1,1,1,1,1,1,1,1
3855 DATA 1,1,1,1,1,1,1,1
3856 DATA .750,.777,.804,.830,.857,.884,.911,.938
3857 DATA .750,.777,.804,.830,.857,.884,.911,.938
3858 DATA .750,.777,.804,.830,.857,.884,.911,.938
3859 DATA .816,.817,.818,.818,.819,.820,.820,.821
3860 DATA .870,.888,.907,.926,.944,.936,.981,1
3861 DATA .943,.951,.960,.968,.976,.984,.992,1
3862 DATA .808,.816,.825,.833,.842,.850,.859,.867
3863 DATA .808,.816,.825,.833,.842,.850,.859,.867
3864 DATA .924,.935,.946,.957,.968,.978,.989,1
3865 DATA .906,.919,.933,.946,.960,.973,.987,1
3866 DATA .924,.935,.946,.957,.968,.978,.989,1
3867 DATA .738,.724,.711,.697,.683,.669,.656,.642
3868 DATA .726,.708,.690,.672,.654,.637,.619,.601
3869 DATA .807,.834,.862,.890,.917,.945,.972,1
3870 DATA .786,.816,.847,.878,.908,.939,.969,1
3871 DATA .618,.593,.568,.542,.517,.492,.466,.441
3872 DATA .786,.816,.847,.878,.908,.939,.969,1
3873 DATA .126,.119,.111,.104,.096,.089,.081,.074
3874 DATA .797,.797,.798,.798,.798,.798,.798,.798
3875 DATA .494,.490,.486,.482,.477,.473,.469,.465
3876 DATA .669,.692,.716,.739,.761,.785,.808,.831
3877 DATA .728,.759,.790,.821,.852,.884,.915,.946
3878 DATA .521,.560,.600,.639,.678,.717,.757,.796
3879 DATA .582,.642,.702,.761,.821,.881,.940,1
3880 DATA .511,.494,.477,.459,.442,.425,.408,.391
3881 DATA .755,.778,.802,.825,.848,.871,.894,.917
3882 DATA .603,.605,.607,.609,.611,.613,.615,.617
3883 DATA .755,.778,.802,.825,.848,.871,.894,.917
3884 DATA .390,.407,.424,.441,.458,.475,.492,.509
3885 DATA .761,.722,.682,.642,.603,.563,.524,.484
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3458 DATA  ,,,,,,,15359
3459 DATA 110898,101594,90294,88951,104368,129500,126884,111405
3460 DATA  ,,,,,,,0
3461 DATA 77716,84381,83111,108847,120552,130339,129527,104368
3462 DATA  ,,,,,,,13714
3463 DATA 33969,44158,37712,61612,68383,72924,71811,66929
3464 DATA 104482,132164,104598,116519,144544,163058,150816,123936
3465 DATA  ,,,34219,38376,42335,40511,50092
3466 DATA  ,,,,,,,11802
3467 DATA 50238,67986,75292,94174,112168,130726,157493,99528
3468 DATA  ,,,,,,,20438
3469 DATA  ,,,,,,,30240
3470 DATA 29349,32292,31113,64390,88757,108902,113770,98505
3471 DATA  ,,,,,,,4790
3472 DATA  ,,,,,,,12996
3473 DATA 1682,1747,1456,1274,1953,1984,1955,1888
3474 DATA 9790,9703,10005,6059,11154,13293,13359,13043
3475 DATA 3967,4935,4026,3997,6023,9936,9480,11467
3476 DATA 32226,31674,33270,35292,41117,47591,48567,45107
3477 DATA 35946,35890,30864,32609,37128,42101,42926,40131
3478 DATA 43200,47868,45771,47786,47414,55389,67349,68148
3479 DATA  ,,,9545,16691,22218,22708,21723
3480 DATA 15817,17056,17184,19739,22207,25176,25638,24369
3481 DATA 19256,18923,16005,29890,34814,38499,42356,40332
3482 DATA 21157,22808,24692,26185,33142,39847,43096,30299
3483 DATA  ,,,,,,,13331
3484 DATA 4013,4419,3927,4953,6004,7269,7453,8998
3485 DATA 15384,15676,16086,25254,28423,30982,32509,31148
3486 DATA 3083,3599,4639,5968,7115,9614,10921,11532
3487 DATA 22753,17578,34474,57820,46774,50273,47811,57896
3488 DATA 922379,993770,933177,1189973,1364243,1529385,1546291,1499429
3500 FOR I=1 TO 8
3510 READ TSWW#(I):NEXT
3520 'FOR I=1 TO 37
3530 'FOR J=1 TO 8
3540 '
3550 'PRINT I,SWW#(I,J):NEXT
3560 'NEXT
3570 'FOR J=1 TO 8
3580 'PRINT TSWW#(J):NEXT
3590 '
3600 RESTORE 3650
3610 FOR I=1 TO 36
3620 FOR J=1 TO 11
3630 READ POPF#(I,J):NEXT:NEXT
3640 '
3650 '
3651 DATA 102382,102382,102382,102382,102382,102382,102382,102383,102382,102
382,102382
3652 DATA 81440,81440,81440,82440,81440,81440,81440,8144081440,81440,81440
3653 DATA 48377,48377,48377,48377,48377,48377,48377,48377,48377,48377
3654 DATA 152571,158894,165479,172337,179480,186918,194665,202733,211135,219
885,228999
3655 DATA 87175,87175,87175,87175,87175,87175,87175,87175,87175,87175
3656 DATA 115132,115132,115132,115132,115132,115132,115132,115132,115132,115
132,115132
3657 DATA 148242,148242,148242,148242,148242,148242,148242,148242,148242,148
242,148242
3658 DATA 148897,148897,148897,148897,148897,148897,148897,148897,148897,148
897,148897
3659 DATA 267601,267601,267601,267601,267601,267601,267601,267601,267601,267
601,267601
3660 DATA 304854,304854,304854,304854,304854,304854,304854,304854,304854,304
854,304854
3661 DATA 228234,228234,228234,228234,228234,228234,228234,228234,228234,228
234,228234
3662 DATA 114461,116727,119038,121395,123798,126249,128748,131297,133896,136
547,139259
3663 DATA 270414,275767,281226,286794,292472,298262,304167,310188,316329,322
592,328978
3664 DATA 190044,190044,190044,190044,190044,190044,190044,190044,190044,190
044,190044
3665 DATA 276978,276978,276978,276978,276978,276978,276978,276978,276978,276
978,276978
3666 DATA 197226,197226,197226,197226,197226,197226,197226,197226,197226,197
226,197226
3667 DATA 199670,199670,199670,199670,199670,199670,199670,199670,199670,199
670,199670
3668 DATA 206925,206925,206925,206925,206925,206925,206925,206925,206925,206
925,206925
3669 DATA 199606,199606,199606,199606,199606,199606,199606,199606,199606,199
606,199606
3670 DATA 214519,214519,214519,214519,214519,214519,214519,214519,214519,214
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3886 DATA .444,.428,.412,.396,.380,.365,.349,.333
3887 DATA .785,.788,.792,.795,.799,.803,.806,.810
3900 FOR J=1 TO 8
3910 READ ACLL#(J):NEXT
3920 'FOR I=1 TO 36
3930 'FOR J=1 TO 8
3940 'PRINT I,CLL#(I,J):NEXT:NEXT
3950 'FOR J=1 TO 8
3960 'PRINT ACLL#(J):NEXT
3970 '
4000 RESTORE 4050
4010 FOR I=1 TO 36
4020 FOR J=1 TO 11
4030 READ CLLF#(I,J):NEXT:NEXT
4040 '
4050 '
4051 DATA 1,1,1,1,1,1,1,1,1,1,1
4052 DATA 1,1,1,1,1,1,1,1,1,1,1
4053 DATA 1,1,1,1,1,1,1,1,1,1,1
4054 DATA 1,1,1,1,1,1,1,1,1,1,1
4055 DATA 1,1,1,1,1,1,1,1,1,1,1
4056 DATA .943,.947,.951,.956,.960,.965,.969,.974,.978,.983,.988
4057 DATA .943,.947,.951,.956,.960,.965,.969,.974,.978,.983,.988
4058 DATA .943,.947,.951,.956,.960,.965,.969,.974,.978,.983,.988
4059 DATA .825,.829,.833,.836,.840,.844,.848,.852,.856,.860,.864
4060 DATA 1,1,1,1,1,1,1,1,1,1,1
4061 DATA 1,1,1,1,1,1,1,1,1,1,1
4062 DATA .871,.875,.879,.883,.887,.891,.895,.900,.904,.908,.912
4063 DATA .871,.875,.879,.883,.887,.891,.895,.900,.904,.908,.912
4064 DATA 1,1,1,1,1,1,1,1,1,1,1
4065 DATA 1,1,1,1,1,1,1,1,1,1,1
4066 DATA 1,1,1,1,1,1,1,1,1,1,1
4067 DATA .645,.648,.651,.654,.657,.660,.663,.666,.669,.672,.676
4068 DATA .603,.606,.609,.612,.615,.618,.621,.623,.626,.629,.632
4069 DATA 1,1,1,1,1,1,1,1,1,1,1
4070 DATA 1,1,1,1,1,1,1,1,1,1,1
4071 DATA .443,.445,.447,.449,.452,.454,.456,.458,.460,.462,.464
4072 DATA 1,1,1,1,1,1,1,1,1,1,1
4073 DATA .074,.075,.075,.075,.076,.076,.076,.077,.077,.078,.078
4074 DATA .802,.805,.809,.813,.817,.821,.824,.828,.832,.836,.840
4075 DATA .467,.470,.472,.474,.476,.478,.481,.483,.485,.487,.490
4076 DATA .835,.839,.843,.847,.851,.855,.859,.863,.867,.871,.875
4077 DATA .950,.955,.959,.964,.968,.973,.977,.982,.987,.991,.996
4078 DATA .800,.803,.807,.811,.815,.819,.822,.826,.830,.834,.838
4079 DATA 1,1,1,1,1,1,1,1,1,1,1
4080 DATA .393,.394,.396,.398,.400,.402,.404,.406,.407,.409,.411
4081 DATA .922,.926,.930,.935,.939,.943,.948,.952,.957,.961,.966
4082 DATA .620,.623,.626,.629,.632,.635,.638,.640,.643,.646,.650
4083 DATA .922,.926,.930,.935,.939,.943,.948,.952,.957,.961,.966
4084 DATA .511,.515,.516,.518,.521,.523,.526,.528,.531,.533,.536
4085 DATA .487,.489,.491,.494,.496,.498,.500,.503,.505,.508,.510
4086 DATA .335,.336,.338,.340,.341,.343,.344,.346,.348,.349,.351
4087 DATA .814,.818,.822,.825,.829,.833,.837,.841,.845,.849,.853
4100 FOR J=1 TO 11
4110 READ ACLLF#(J):NEXT
4120 'FOR I=1 TO 36
4130 'FOR J=1 TO 11
4140 'PRINT I,CLLF#(I,J):NEXT:NEXT
4150 'FOR J=1 TO 11
4160 'PRINT ACLLF#(J):NEXT
4170 RETURN
4200  *COLLVEHICLE'****** COLLECTION VEHICLE ******************************
4201 RESTORE 4261
4210 FOR I=1 TO 37
4220 FOR J=1 TO 9
4230 READ CVE(I,J)
4240 NEXT:NEXT
4250 '
4260 DATA 1,1,1,3,,15,12,5,38
4261 DATA 1,1,1,3,,15,12,5,38
4262 DATA 1,,4,12,,,5,,22
4263 DATA 1,1,,2,,8,3,,15
4264 DATA 1,,1,9,,2,11,3,27
4265 DATA 1,,3,4,,5,10,,23
4266 DATA 1,,1,,,1,10,3,16
4267 DATA  ,,3,5,,4,7,2,21
4268 DATA  ,,1,3,,2,8,3,17
4269 DATA 1,,9,8,1,6,14,1,40
4270 DATA  ,,9,7,,2,5,2,25
4271 DATA 1,,,3,,,18,2,24
4272 DATA  ,,2,2,1,1,12,2,20
4273 DATA 1,,1,7,,2,6,1,29
4274 DATA  ,,5,3,,2,9,2,47
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4275 DATA 1,4,4,4,1,21,9,6,50
4276 DATA  ,,2,3,,,1,1,7
4277 DATA  ,,,3,,,6,,9
4278 DATA  ,,1,1,,3,7,2,14
4279 DATA 1,,2,6,,4,9,3,25
4280 DATA 1,,,9,,,8,2,20
4281 DATA  ,,1,5,,,4,1,11
4282 DATA  ,,1,1,,,1,5,1,9
4283 DATA 1,,,1,,,1,1,4
4284 DATA 1,,1,3,,,5,2,12
4285 DATA 1,,,2,,,1,3,7
4286 DATA 1,,1,7,,4,9,2,24
4287 DATA 1,,1,7,,3,5,2,19
4288 DATA 1,5,1,6,,1,3,1,18
4289 DATA  ,,1,5,,4,9,1,20
4290 DATA 1,,2,4,,,2,2,11
4291 DATA 1,1,1,6,,5,9,3,26
4292 DATA 1,,1,4,,,2,1,10
4293 DATA  ,,1,6,,,5,1,13
4294 DATA 1,1,1,1,,,4,1,9
4295 DATA 1,,2,8,,,5,3,19
4296 DATA 1,,1,1,,,3,2,8
4297 DATA 1,2,29,21,12,23,10,54,152
4298 DATA 25,18,96,193,15,132,258,123,860
4299  FOR I=1 TO 37
4300  VCVE(I,1)=CVE(I,1)*3+CVE(I,2)*6+CVE(I,3)*10+CVE(I,4)*12
4301  VCVE(I,2)=CVE(I,5)*4+CVE(I,6)*7.5+CVE(I,7)*10
4302  VCVE(I,3)=CVE(I,8)*8
4303  VCVE(I,4)=VCVE(I,1)+VCVE(I,2)
4304  VCVE(I,5)=VCVE(I,1)+VCVE(I,2)+VCVE(I,3)
4310 '
4320  NEXT
4330 RETURN
5000 *MAPBKK
5001 'GOTO 5070
5010 CONSOLE 0,25,0,0
5011 SCREEN 2,1,0,1
5012 VIEW (0,0)-(639,399),0,7
5020  CLS 3
5030 WINDOW (-300,-3200)-(2700,1000)
5040 '
5050 LINE (- 295,-3190)-(2695, 985),7,B,3030
5051 'END
5060 'DEF FNXP(XM)=(XM-45)*2700/350 :DEF FNYP(YM)=( 58 -YM)*1100/190
5070 RESTORE 5150
5080 READ XM,YM
5090 PSET (FNXP(XM),FNYP(YM)),7
5100 FOR I=1 TO 80
5110 READ XM,YM
5120 LINE-(FNXP(XM),FNYP(YM)),7
5130 NEXT
5140 '
5150 DATA  49,177, 94,177,118,175,120,174,121,172,136,177,140,182,141,183
5160 DATA 139,186,154,200,156,202,169,255,185,250,186,254,194,253,197,249
5170 DATA 204,248,206,243,217,242,223,237,228,240,231,241,242,236,283,24
5180 DATA 347,252,341,202,348,201,345,195
5181 DATA 359,181,346,170,330,143,317,120
5190 DATA 288,132,241,133,242,124,234,102,219,108,212,108,208, 99,172,106
5200 DATA 180,116,179,119,175,124,165,127,161,126,159,123,159,112,157,109
5210 DATA 153,108,145,114,145,113,143,106,144, 96,142, 91,143, 79,145, 78
5220 DATA 146, 73,136, 70,135, 72,126, 69,123, 74,119, 69,118, 75,110, 76
5230 DATA 106, 44,109, 39,112, 18, 86, 13, 85, 32, 93, 44, 91, 53, 81, 51
5240 DATA  72,70,71,82,60,93,51,95,52,103,52,105,48,120,50,144,49,177
5270 FOR I=1 TO 20 STEP 2
5271 RESTORE 5181 :READ XM,YM:PSET(FNXP(XM),FNYP(YM)),7
5272 FOR J=1 TO 50:READ XM,YM
5273 LINE-(FNXP(XM),FNYP(YM)+I),7
5274 NEXT:NEXT':END
5275 RESTORE 5350
5280 READ XM,YM
5290 PSET (FNXP(XM),FNYP(YM)),7
5300 FOR I=1 TO 14
5310 READ XM,YM
5320 LINE-(FNXP(XM),FNYP(YM)),7
5330 NEXT
5340 'RIVER
5350 DATA 140,182,143,178,130,156,128,153,129,148,129,147,130,146,132,144
5360 DATA 139,139,139,133,132,126,131,124,131,122,131,119,145,113
5370 RESTORE 5450
5380 READ XM,YM
5390 PSET (FNXP(XM),FNYP(YM)),7
5400 FOR I=1 TO 14
5410 READ XM,YM
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5420 LINE-(FNXP(XM),FNYP(YM)),7
5430 NEXT
5440 'RIVER LEFT
5450 DATA 141,183,144,178,143,176,135,163,129,153,130,147,133,145,140,140
5460 DATA 140,134,140,133,139,131,132,124,132,120,145,114,147,113
5470 RESTORE 5550
5480 READ XM,YM
5490 PSET (FNXP(XM),FNYP(YM)),7
5500 FOR I=1 TO 2
5510 READ XM,YM
5520 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
5530 NEXT
5540 'DISTRICT1
5550 DATA 135,163,140,158,134,145
5600 RESTORE 5680
5610 READ XM,YM
5620 PSET (FNXP(XM),FNYP(YM)),7
5630 FOR I=1 TO 3
5640 READ XM,YM
5650 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
5660 NEXT
5670 '2
5680 DATA 140,158,143,154,144,150,140,140
5700 RESTORE 5780
5710 READ XM,YM
5720 PSET (FNXP(XM),FNYP(YM)),7
5730 FOR I=1 TO 1
5740 READ XM,YM
5750 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
5760 NEXT
5770 '3
5780 DATA 136,150,142,145
5800 RESTORE 5880
5810 READ XM,YM
5820 PSET (FNXP(XM),FNYP(YM)),7
5830 FOR I=1 TO 4
5840 READ XM,YM
5850 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
5860 NEXT
5870 '4
5880 DATA 144,150,158,150,159,138,157,138,142,144
5900 RESTORE 5980
5910 READ XM,YM
5920 PSET (FNXP(XM),FNYP(YM)),7
5930 FOR I=1 TO 1
5940 READ XM,YM
5950 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
5960 NEXT
5970 '5
5980 DATA 157,138,140,135
6000 RESTORE 6080
6010 READ XM,YM
6020 PSET (FNXP(XM),FNYP(YM)),7
6030 FOR I=1 TO 4
6040 READ XM,YM
6050 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6060 NEXT
6070 '6
6080 DATA 145,114,148,124,147,125,160,134,161,126
6100 RESTORE 6180
6110 READ XM,YM
6120 PSET (FNXP(XM),FNYP(YM)),7
6130 FOR I=1 TO 1
6140 READ XM,YM
6150 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6160 NEXT
6170 '7
6180 DATA 159,138,160,134
6200 RESTORE 6280
6210 READ XM,YM
6220 PSET (FNXP(XM),FNYP(YM)),7
6230 FOR I=1 TO 1
6240 READ XM,YM
6250 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6260 NEXT
6270 '8
6280 DATA 147,125,139,131
6300 RESTORE 6380
6310 READ XM,YM
6320 PSET (FNXP(XM),FNYP(YM)),7
6330 FOR I=1 TO 3
6340 READ XM,YM
6350 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
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6360 NEXT
6370 '9
6380 DATA 143,176,153,175,148,162,144,150
6400 RESTORE 6480
6410 READ XM,YM
6420 PSET (FNXP(XM),FNYP(YM)),7
6430 FOR I=1 TO 3
6440 READ XM,YM
6450 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6460 NEXT
6470 '10
6480 DATA 153,175,156,185,152,188,155,201
6500 RESTORE 6580
6510 READ XM,YM
6520 PSET (FNXP(XM),FNYP(YM)),7
6530 FOR I=1 TO 5
6540 EAD XM,YM
6550 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6560 NEXT
6570 '11
6580 DATA 153,175,164,174,158,160,165,154,160,152,148,162
6600 RESTORE 6680
6610 READ XM,YM
6620 PSET (FNXP(XM),FNYP(YM)),7
6630 FOR I=1 TO 3
6640 READ XM,YM
6650 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6660 NEXT
6670 '12
6680 DATA 165,154,167,152,166,150,158,150
6700 RESTORE 6780
6710 READ XM,YM
6720 PSET (FNXP(XM),FNYP(YM)),7
6730 FOR I=1 TO 7
6740 READ XM,YM
6750 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6760 NEXT
6770 '13
6780 DATA 164,174,168,174,169,176,178,176,181,158,183,149,179,146,166,150
6800 RESTORE 6880
6810 READ XM,YM
6820 PSET (FNXP(XM),FNYP(YM)),7
6830 FOR I=1 TO 5
6840 READ XM,YM
6850 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6860 NEXT
6870 '14
6880 DATA 175,123,183,128,187,128,199,128,207,108,212,108
6900 RESTORE 6980
6910 READ XM,YM
6920 PSET (FNXP(XM),FNYP(YM)),7
6930 FOR I=1 TO 4
6940 READ XM,YM
6950 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
6960 NEXT
6970 '15
6980 DATA 183,149,187,147,188,143,185,142,199,128
7000 RESTORE 7080
7010 READ XM,YM
7020 PSET (FNXP(XM),FNYP(YM)),7
7030 FOR I=1 TO 11
7040 READ XM,YM
7050 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7060 NEXT
7070 '16
7080 DATA 187,147,199,150,206,149,213,146,218,152,223,151,228,157,242,158,24
2,156,240,154,240,133,241,133
7100 RESTORE 7180
7110 READ XM,YM
7120 PSET (FNXP(XM),FNYP(YM)),7
7130 FOR I=1 TO 13
7140 READ XM,YM
7150 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7160 NEXT
7170 '17
7180 DATA 197,249,197,239,177,215,177,207,178,199,195,200,196,205,213,206,21
3,202,221,205,228,208,226,211,228,222,228,240
7200 RESTORE 7280
7210 READ XM,YM
7220 PSET (FNXP(XM),FNYP(YM)),7
7230 FOR I=1 TO 1
7240 READ XM,YM
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7250 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7260 NEXT
7270 '18
7280 DATA 177,207,156,202
7300 RESTORE 7380
7310 READ XM,YM
7320 PSET (FNXP(XM),FNYP(YM)),7
7330 FOR I=1 TO 1
7340 READ XM,YM
7350 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7360 NEXT
7370 '19
7380 DATA 178,199,178,176
7400 RESTORE 7480
7410 READ XM,YM
7420 PSET (FNXP(XM),FNYP(YM)),7
7430 FOR I=1 TO 10
7440 READ XM,YM
7450 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7460 NEXT
7470 '20
7480 DATA 178,176,191,173,194,177,193,183,198,186,206,169,209,169,207,165,21
0,161,217,162,218,152
7500 RESTORE 7580
7510 READ XM,YM
7520 PSET (FNXP(XM),FNYP(YM)),7
7530 FOR I=1 TO 6
7540 READ XM,YM
7550 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7560 NEXT
7570 '21
7580 DATA 198,186,199,198,209,198,213,194,219,195,219,200,221,205
7600 RESTORE 7680
7610 READ XM,YM
7620 PSET (FNXP(XM),FNYP(YM)),7
7630 FOR I=1 TO 4
7640 READ XM,YM
7650 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7660 NEXT
7670 '22
7680 DATA 221,205,229,197,228,193,243,164,242,158
7700 RESTORE 7780
7710 READ XM,YM
7720 PSET (FNXP(XM),FNYP(YM)),7
7730 FOR I=1 TO 14
7740 READ XM,YM
7750 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7760 NEXT
7770 '23
7780 DATA 284,242,282,224,286,222,281,215,288,201,291,201,291,189,288,186,28
8,176,286,173,286,167,298,166,304,159,319,160,330,143
7800 RESTORE 7880
7810 READ XM,YM
7820 PSET (FNXP(XM),FNYP(YM)),7
7830 FOR I=1 TO 5
7840 READ XM,YM
7850 LINE-(FNXP(XM),FNYP(YM)),7,&H3333
7860 NEXT
7870 '24/25
7880 DATA 243,164,255,164,257,161,280,167,281,174,286,173
7900 RESTORE 7980
7910 READ XM,YM
7920 PSET (FNXP(XM),FNYP(YM)),7
7930 FOR I=1 TO 8
7940 READ XM,YM
7950 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
7960 NEXT
7970 '26
7980 DATA 131,122,127,122,125,130,120,129,120,134,120,138,123,136,128,137,13
0,146
8000 RESTORE 8080
8010 READ XM,YM
8020 PSET (FNXP(XM),FNYP(YM)),7
8030 FOR I=1 TO 1
8040 READ XM,YM
8050 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8060 NEXT
8070 '27
8080 DATA 132,144,132,126
8100 RESTORE 8180
8110 READ XM,YM
8120 PSET (FNXP(XM),FNYP(YM)),7
8130 FOR I=1 TO 4
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8140 READ XM,YM
8150 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8160 NEXT
8170 '28
8180 DATA 128,148,116,148,111,162,118,167,129,155
8200 RESTORE 8280
8210 READ XM,YM
8220 PSET (FNXP(XM),FNYP(YM)),7
8230 FOR I=1 TO 1
8240 READ XM,YM
8250 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8260 NEXT
8270 '29
8280 DATA 118,167,120,173
8300 RESTORE 8380
8310 READ XM,YM
8320 PSET (FNXP(XM),FNYP(YM)),7
8330 FOR I=1 TO 2
8340 READ XM,YM
8350 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8360 NEXT
8370 '30
8380 DATA 116,148,116,140,120,138
8400 RESTORE 8480
8410 READ XM,YM
8420 PSET (FNXP(XM),FNYP(YM)),7
8430 FOR I=1 TO 18
8440 READ XM,YM
8450 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8460 NEXT
8470 '31
8480 DATA 120,134,117,134,117,132,113,131,112,127,105,130,104,123,105,121,93
,116,82,127,72,126,71,136,65,137,59,144,61,144,60,153,84,152,105,144,116,148
8500 RESTORE 8580
8510 READ XM,YM
8520 PSET (FNXP(XM),FNYP(YM)),7
8530 FOR I=1 TO 7
8540 READ XM,YM
8550 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8560 NEXT
8570 '33
8580 DATA 105,121,110,110,110,103,121,102,130,113,129,117,125,118,127,122
8600 RESTORE 8680
8610 READ XM,YM
8620 PSET (FNXP(XM),FNYP(YM)),7
8630 FOR I=1 TO 1
8640 READ XM,YM
8650 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8660 NEXT
8670 '34
8680 DATA 50,144,59,144
8700 RESTORE 8780
8710 READ XM,YM
8720 PSET (FNXP(XM),FNYP(YM)),7
8730 FOR I=1 TO 3
8740 READ XM,YM
8750 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8760 NEXT
8770 '35
8780 DATA 121,102,121,105,126,83,123,74
8800 RESTORE 8880
8810 READ XM,YM
8820 PSET (FNXP(XM),FNYP(YM)),7
8830 FOR I=1 TO 2
8840 READ XM,YM
8850 LINE-(FNXP(XM),FNYP(YM)),7,,&H3333
8860 NEXT
8870 '36/32
8880 DATA 93,116,63,105,52,103
8881 'COPY 5:END
8890 'DISTRICT CENTER
8900 RESTORE 8950
8901 DIM DISPX(37),DISPY(37)
8910 FOR I=1 TO 37
8920 READ DISPX(I),DISPY(I):NEXT
8930 RETURN
8940 '
8950 DATA 133,155,140,151,138,145,152,145,145,139,153,118,149,132,140,122,14
4,166,150,185
8960 DATA 156,166,151,154,170,162,192,115,176,136,217,132,203,223,180,233,16
4,189,200,162
8970 DATA 185,190,221,178,317,206,257,200,280,148,127,133,136,136,121,156,12
7,169,123,13
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8980 DATA 90,134,95,85,118,118,80,165,134,97,65,122,370,60
10000 '*************************************************************************
*
10001     *MAPCIRCLE
10002 PAI=3.14159:VOLM=.5 :DIA=20 :DIAS=50
10003 TILE$=CHR$(&H1)+CHR$(&H0)
10004 GOSUB *PICSET
10005 CIRR=4 :RING=7  :RINGS=2
10006 '
10009 FOR TYE=1 TO 1
10010 '
10012 'CIRCLE (FNXP(30),FNYP(234.5)),SQR(500 *CIRR)
10013 'CIRCLE (FNXP(30),FNYP(239.5)),SQR(200 *CIRR )
10014 'CIRCLE (FNXP(30),FNYP(242)),SQR(100*CIRR) ':END
10015 FOR L=  1 TO 37 'STEP -1
10016 I=PICSET(L):FFF#=TRIP#(I)/CVE(I,9)/VOLM     ':FFE#=WKER(I,6)/VOLM
10017 'FOR J= 0  TO  FFE#    STEP  RING
10018 'CIRCLE  (FNXP(DISPX(I)-J/20),FNYP(DISPY(I)+J)),DIA,7,,,,F,0:NEXT
10019 FOR J= 0  TO  FFF#   STEP  RINGS
10020  CIRCLE  (FNXP(DISPX(I)-J/20),FNYP(DISPY(I)+J)),DIA,7,,,,F,0'SQR(POP#(
I,8)
10021 'CIRCLE  (FNXP(DISPX(I)),FNYP(DISPY(I))),SQR(POPF#(I,11)/80  )
10022 'CIRCLE  (FNXP(DISPX(I)),FNYP(DISPY(I))),SQR(SWW#(I,8)*10/365),7,,,,F,
0
10023 'IF CLL#(I,8)=1 THEN 10030
10024 'CIRCLE  (FNXP(DISPX(I)),FNYP(DISPY(I))),SQR(SWW#(I,8)/30/CLL#(I,8)),7
,0,2*PAI*(1-CLL#(I,8)) ,,F,7
10025 'CIRCLE  (FNXP(DISPX(I)),FNYP(DISPY(I))),SQR(SWW#(I,8)/POP#(I,8)/365#*
1000000#/CLL#(I,8) ),7,,,,F,0
10026  'LPRINT I,SWW#(I,8)/POP#(I,8)/365#*1000000#/CLL#(I,8)
10027  'CIRCLE  (FNXP(DISPX(I)),FNYP(DISPY(I))),SQR((CVE(I,6)+CVE(I,7))*CIRR
),7,,,,F,0
10028  'CIRCLE  (FNXP(DISPX(I)),FNYP(DISPY(I)+J)),SQR(VCVE(I,5)*CIRR),7,,,,F
,0
10029 NEXT:NEXT :NEXT
10030  FOR J=0 TO   62/VOLM STEP RINGS:CIRCLE (FNXP(30-J/20),FNYP(234.5+J)),
DIA,7,,,,F,0 :NEXT
10040 'GOSUB *SHOBUN
10041 FOR I=1 TO 37
10042 LPRINT USING "&           &";DIS$(I);
10043 LPRINT USING"####.#";TRIP#(I)/31/CVE(I,9)
10044 NEXT
10045 'COPY 5
10050 END
10090 *PICSET
10091 RESTORE 10094
10092 FOR I=1 TO 37
10093 READ PICSET(I):NEXT
10094 DATA 19,10,11,9,12,29,28,1,2,3,4,5,30,27,26,7,6,8,33,35,34,31,36,32,18
,17,21,13,22,20,15,16,14,24,25,23,3
10095 RETURN
11000 *SWWMOD
11010 FOR I=4 TO 8
11020 SWW#(6,I)=SWW#(6,I)+SWW#(7,I)+SWW#(8,I)
11021 POP#(6,I)=POP#(6,I)+POP#(7,I)+POP#(8,I)
11030 SWW#(9,I)=SWW#(9,I)+SWW#(10,I)
11031 POP#(9,I)=POP#(9,I)+POP#(10,I)
11040 SWW#(11,I)=SWW#(11,I)+SWW#(12,I)
11041 POP#(11,I)=POP#(11,I)+POP#(12,I)
11050 SWW#(14,I)=SWW#(14,I)+SWW#(15,I)+SWW#(16,I)
11051 POP#(14,I)=POP#(14,I)+POP#(15,I)+POP#(16,I)
11060 SWW#(17,I)=SWW#(17,I)+SWW#(18,I)+SWW#(19,I)
11061 POP#(17,I)=POP#(17,I)+POP#(18,I)+POP#(19,I)
11070 SWW#(20,I)=SWW#(20,I)+SWW#(21,I)+SWW#(22,I)
11071 POP#(20,I)=POP#(20,I)+POP#(21,I)+POP#(22,I)
11080 SWW#(28,I)=SWW#(28,I)+SWW#(29,I)
11081 POP#(28,I)=POP#(28,I)+POP#(29,I)
11090 SWW#(32,I)=SWW#(32,I)+SWW#(33,I)
11091 POP#(32,I)=POP#(32,I)+POP#(33,I)
11100 NEXT
11110 FOR I=1 TO 11
11120 SWWF#(6,I)=SWWF#(6,I)+SWWF#(7,I)+SWWF#(8,I)
11121 POPF#(6,I)=POPF#(6,I)+POPF#(7,I)+POPF#(8,I)
11130 SWWF#(9,I)=SWWF#(9,I)+SWWF#(10,I)
11131 POPF#(9,I)=POPF#(9,I)+POPF#(10,I)
11140 SWWF#(11,I)=SWWF#(11,I)+SWWF#(12,I)
11141 POPF#(11,I)=POPF#(11,I)+POPF#(12,I)
11150 SWWF#(14,I)=SWWF#(14,I)+SWWF#(15,I)+SWWF#(16,I)
11151 POPF#(14,I)=POPF#(14,I)+POPF#(15,I)+POPF#(16,I)
11160 SWWF#(17,I)=SWWF#(17,I)+SWWF#(18,I)+SWWF#(19,I)
11161 POPF#(17,I)=POPF#(17,I)+POPF#(18,I)+POPF#(19,I)
11170 SWWF#(20,I)=SWWF#(20,I)+SWWF#(21,I)+SWWF#(22,I)
11171 POPF#(20,I)=POPF#(20,I)+POPF#(21,I)+POPF#(22,I)
```

```
11180 SWWF#(28,I)=SWWF#(28,I)+SWWF#(29,I)
11181 POPF#(28,I)=POPF#(28,I)+POPF#(29,I)
11190 SWWF#(32,I)=SWWF#(32,I)+SWWF#(33,I)
11191 POPF#(32,I)=POPF#(32,I)+POPF#(33,I)
11200 NEXT
11210 RETURN
12000 '********************* SHOBUN *********************************
12010 *SHOBUN
12011 'DIAS=50
12020 RESTORE 12050
12030 FOR I=1 TO 4
12040 READ SMX(I),SMY(I):NEXT
12050 DATA 54,130,233,132,192,219,35,20
12060 FOR I=1 TO 4
12070 READ COMP(I):NEXT
12080 DATA 100,100,0,0
12090 FOR I=1 TO 4
12100 READ LFIL(I):NEXT
12101 DATA 1500,1500,500,500
12110 FOR I=1 TO 4
12111  FFG=COMP(I)/VOLM/(DIAS/DIA)^2
12112 'FFG=LFIL(I)/VOLM/(DIAS/DIA)^2
12113  IF FFG=0 THEN GOTO 12140
12114 FOR =0 TO FFG STEP RINGS
12120 CIRCLE (FNXP(SMX(I)-J/20),FNYP(SMY(I)+J)),DIAS,7,,,,F,0
12130 NEXT
12140 NEXT
12150  FOR J=0 TO 100!/VOLM/(DIAS/DIA)^2 STEP RINGS:CIRCLE (FNXP(20-J/20),FN
YP(224.5+J)),DIAS,7,,,,F,0 :NEXT
12160 RETURN
12500  FOR J=0 TO 200!/VOLM STEP RING:CIRCLE (FNXP(30-J/20),FNYP(234.5+J)),D
IA,7,,,,F,0 :NEXT
13000 '************************ WKER ************************************
13010 *WKER
13020 '
13021 DATA 25,221,265,1,,512
13022 DATA 26,118,139,16,,299
13023 DATA 15,63,118,11,,207
13024 DATA 32,119,166,5,,322
13025 DATA 22,88,141,6,,257
13026 DATA 56,241,281,20,,598
13027 DATA  ,,,,,0
13028 DATA  ,,,,,0
13029 DATA 71,239,327,15,,652
13030 DATA  ,,,,,0
13031 DATA 50,206,363,7,,628
13032 DATA  ,,,,,0
13033 DATA 23,111,183,5,,322
13034 DATA 37,129,158,12,,336
13035 DATA  ,,,,,0
13036 DATA  ,,,,,0
13037 DATA 54,187,234,19,,494
13038 DATA  ,,,,,0
13039 DATA  ,,,,,0
13040 DATA 58,211,199,3,,471
13041 DATA  ,,,,,0
13042 DATA  ,,,,,0
13043 DATA 3,9,34,2,,48
13044 DATA 13,40,63,,,121
13045 DATA 7,25,50,2,,84
13046 DATA 23,83,167,21,,294
13047 DATA 19,71,159,10,,259
13048 DATA 10,69,143,4,,228
13049 DATA  ,,,,,0
13050 DATA 11,53,94,8,,166
13051 DATA 25,89,196,9,,319
13052 DATA 29,101,96,7,,233
13053 DATA  ,,,,,0
13054 DATA 10,47,55,1,,113
13055 DATA  ,,,,,0
13056 DATA 6,24,100,2,,132
13057 DATA ,,,,,,0
13058 DATA 645,2629,3838,186,7298
13060 RESTORE 13020
13070 FOR I=1 TO 37
13071 FOR J=1 TO 6
13080 READ WKER(I,J):NEXT:NEXT
13090 '************************ AREA ********************************
13091 DATA 5536,1931,1416,8369,5536,16662,9326,10921,10665,11545
13092 DATA 10265,7164,22679,33887,27193,82479,76613,59789,32908,48904
13093 DATA 30476,69903,236261,174331,123859,8626,6051,10515,12789,6180
13094 DATA 53947,155432,25724,79698,42874,48283,1568737
13100 RESTORE 13091
```

```
13110 FOR I=1 TO 36
13120 READ AREA(I):NEXT
13130 '************************ SETAI ******************************
13131 DATA 41407,22072,15295,39977,22107,21569,3170,26116,22854,33909
13132 DATA 49436,30469,43527,28438,52057,30145,24410,28388,33477,60456
13133 DATA 27387,31850,8287,11175,11554,46278,35238,26617,33917,23920
13134 DATA 39261,19412,34116,24876,20914,12050,1064751
13140 RESTORE 13131
13150 FOR I=1 TO 36
13160 READ SETAI(I):NEXT
13170 RETURN
14000 *GOMI
14001 DIM GOMI#(37),TRIP#(37)
14010  RESTORE 14020 'TOTAL
14011 'RESTORE 14070 'WACHARAPOL
14012 'RESTORE 14100 'ON-NUT COMPOST
14013 'RESTORE 14120 'ON-NUT OPENDUMP
14014 'RESTORE 14140 'NONGKHAEM COMPOST
14015 'RESTORE 14160 'NONGKHAEM OPENDUMP
14020 DATA 6618,3197,2017,4438,3781,3640,3800,3556,6414,4721,5799,4683,7722,
5721,3334,1520,4068,4895,6884
14030 DATA 6707,2972,3690,231,1503,1223,4531,3729,3307,3798,2448,4525,2107,3
265,1031,3388,1369,3993
14031 DATA 1725,892,557,1031,848,822,1081,1024,1471,1172,1100,1009,2180,1874
,1181,608,861,1169,1635
14032 DATA 1590,859,914,103,438,513,1333,1046,877,961,717,1387,598,878,296,9
60,580,1304
14040 FOR I=1 TO 37
14050 READ GOMI#(I):NEXT
14051 FOR I=1 TO 37
14052 READ TRIP#(I):NEXT
14060 '
14070 DATA 0,0,0,0,0,0,0,0,3560,4340,5403,3154,5088,0,0,0,4062,4879,6884
14080 DATA 2247,2392,2665,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1271
14090 RETURN
14100 DATA 0,0,0,455,832,83,59,0,47,0,145,320,484,947,25,136,0,0,0
14110 DATA 1295,58,73,13,129,102,0,0,0,0,0,0,0,0,0,0,0,159
14120 DATA 0,3,148,3978,1976,436,1191,1,436,263,251,1000,2151,4774,3309,1384
,0,0,0
14130 DATA 3166,522,952,217,1373,1122,0,0,0,0,0,0,0,0,0,0,0,1299
14140 DATA 500,141,20,0,48,117,61,69,170,9,0,7,0,0,0,0,0,0,0
14150 DATA 0,0,0,0,0,0,123,44,125,179,49,54,40,60,37,69,19,13
14160 DATA 6118,3053,1849,5,925,3003,2490,3486,2201,109,0,202,0,0,0,0,6,15,0
14170 DATA 0,0,0,0,0,0,4408,3685,3182,3619,2399,4471,2067,3205,994,3319,1350
,1252
```

```
10 '*************** FINANCE ***********************************************
20 '
30 '
40 '
50 '       1990-11-29   K.M
60 GOSUB *INIT
70 '*****************************************************************************
71   GOSUB *MBDATA
90 GOSUB *GRAPH
91 GOSUB *READDATA
92 'GOSUB *ORESEN
93 GOSUB *BOU
94 GOSUB *POUT
100 END
110 *INIT
120 OPTION BASE 1
130 DIM WDT(25),Y(15),LS(25),GOMI#(12),MINKAN#(12),COMP#(12),INCINE#(12)
131 DIM BMASL#(12),BMABG#(12),COSTC#(12),COSTP#(12),COSTI#(12),COSTS#(12)
132 DIM COSTB#(12),COSTSL#(12),CUNIT#(12)
133 FLAG=0
140 RETURN
150 '
160 '*****************************************************************
170 '
180 '
190 '
200 '
210 '
220 GOSUB *GRAPH
230 'CIRCLE ((YS-YB)*100,-WDT(1)*DTR),12
240 'PSET ((YS-YB)*100,-WDT(1)*DTR),7
250 'FOR YEAR=1982 TO 1982+DN-1
260 'LINE -((YEAR-YB)*100,-WDT(YEAR-YB-1)*DTR),7
270 'CIRCLE ((YEAR-YB)*100,-WDT(YEAR-YB-1)*DTR),12:NEXT
280 'LOCATE 10,26 :PRINT "Phra Nakhon";
290  END
300 'FOR J=1 TO DN: Y(J)=WDT(J):NEXT
310 'GOSUB *LS
320 '
330 'PSET ((YES-YB)*100,-(A+B*YES)*DTR),7
340 FOR YEAR=YES TO YE
350 LINE -((YEAR-YB)*100,-(A+B*YEAR)*DTR),7,,&HF99F
360 'LS(YEAR-YES+1)=(A+B*YEAR)
370 'NEXT
380 '
390 'FOR YEAR=YES TO YE
400 'PRINT USING "##############";YEAR;:PRINT USING "#######.#";LS(YEAR-YES+1
):NECLS 3
410  LOCATE 10,22 :PRINT "Phra Nakhon";
420 'COPY 2
430 'NEXT :END
440 '*********************************  DATA ******************************
450 DATA 100,120,140,160,180,200,210,240,260,340,400,460,450,600,520,390,430
,600,700,580,1000
460 DATA 100,120,140,160,180,200,210,240,260,340,400,460,450,600,520,390,430
,600,700,580,1000
470 DATA 100,120,140,160,180,200,210,240,260,340,400,460,450,600,520,390,430
,600,700,580,1000
480 '
490 *GRAPH
500 CONSOLE 0,25,0,0
510 SCREEN 2,1,0,1
520 VIEW (0,0)-(639,399),0,7
530 CLS 3
540 WINDOW (-300,-1600)-(2700,200)
550 '
560 LINE (-300,-1600)-(2700,200),7,B,3030
570 '
580 *XYGRAPH
590 LINE (0,0)-(0,-1550)
600 FOR I=100 TO 1500 STEP 100
610 LINE (0,-I)-(-20,-I):LINE(0,-I)-(2600,-I),7,,33 :NEXT
620 RESTORE *YAXISDATA
630  FOR I=0 TO 1500  STEP 100
640  FOR J=1 TO 4:READ Ys:KCORD=VAL("&H"+Ys)
650  PUT (MAP(-300+38*J,0),MAP(-I-30,1)),KANJI(KCORD),PSET,7,0:NEXT:NEXT
660 *YAXISDATA
670 DATA 2002,2002,2002,10, 2002,300,10,10, 2002,700,10,10, 2002,B00,10,10,
2002,F00,10,10,  100, 10,10,10,  100,300,10,10,  100,700,10,10,  100,B00,10,
10,  100, F00,10,10, 300,10,10,10, 300,300,10,10, 300,700,10,10, 300,B00,10,
10
680 DATA 300,F00,10,10, 500,10,10,10
690 LINE (0,0)-(2600,0)
```

```
700 FOR I=100 TO 2500 STEP 100
710 LINE (I, 0)-( I ,20):LINE(I, 0)-(I,-1550),7,,33 :NEXT
720 RESTORE *XAXISDATA2
730  FOR I=  0 TO 2500 STEP 100
740  FOR J=1 TO 2:READ Xs:KCORD=VAL("&H"+Xs)
750  PUT (MAP(I-110+38*J,0),MAP(60,1)),KANJI(KCORD),PSET,7,0:NEXT:NEXT
760 *XAXISDATA
770 DATA 100,10, 100,100, 100,300, 100,500, 100,700, 100,900, 100,B00, 100,D
00, 100,F00, 100,1100, 300,10, 300,100, 300,300, 300,500, 300,700, 300,900,
300,B00, 300,D00, 300,F00, 300,1100, 500,10, 500,100, 500,300, 500,500, 500,
700, 500,900run
780 *XAXISDATA2
790 DATA F00,10, F00,100, F00,300, F00,500, F00,700, F00,900, F00,B00, F00,D
00, F00,F00, F00,1100, 1100,10, 1100,100, 1100,300, 1100,500, 1100,700, 1100
,900, 1100,B00, 1100,D00, 1100,F00, 1100,1100, 300,10,  10,100, 10,300,  10,
500, 10,700, 10,900
800 'COPY2
810 RETURN
820 '*****************************  LS  *********************************
830 *LS
840 X1=0:Y1=0:Z1=0:X2=0:Y2=0
850 FOR J=1 TO DN
860 JJ=(J+YS-1)
870 X1=X1+JJ
880 Y1=Y1+Y(J)
890 Y2=Y2+Y(J)*Y(J)
900 Z1=Z1+JJ*Y(J)
910 X2=X2+JJ*JJ
920 NEXT J
930 A=(X2*Y1-Z1*X1)/(DN*X2-X1*X1)
940 B=(X1*Y1-Z1*DN)/(X1*X1-DN*X2)
950 R=(Z1-X1*Y1/DN)*(Z1-X1*Y1/DN)/(X2-X1*X1/DN)/(Y2-Y1*Y1/DN)
960 LOCATE  8, 0:PRINT "y=";A;"+";B;"x      ";"r=";R
970 RETURN
1000 *READDATA'*************************************************
1010 RESTORE 1030
1011 FOR I=1 TO 12
1020 READ GOMI#(I):NEXT
1030 DATA 4108,4770,5108,5458,5819,6193,6579,6977,7389,7815,8254,8708
1040 '
1110 RESTORE 1121
1111 FOR I=1 TO 12
1120 READ MINKAN#(I):NEXT
1121 DATA 1000,1300,800,5900,5800,6150,6750,7200,4030,4330,5260,5780
1122 RESTORE 1125
1123 FOR I=1 TO 12
1124 READ BMASL#(I):NEXT
1125 DATA 3100,3470,4300,1000,0,500,700,1030,2800,2900,2500,2000
1130 '
1131 RESTORE 1134
1132 FOR I=1 TO 12
1133 READ BMABG#(I):NEXT
1134 DATA 6900,8600,9140,9862,10641,11482,12389,13368,14036,14738,15475,1624
8
1135 RESTORE 1138
1136 FOR I=1 TO 12
1137 READ COMP#(I):NEXT
1138 DATA 0,0,0,0,400,400,400,400,400,400,400,400
1139 RESTORE 1142
1140 FOR I=1 TO 12
1141 READ INCINE#(I):NEXT
1142 DATA 0,0,0,0,3,3,3,153,153,153,153,473
1145 FOR I=1 TO 12
1146 READ CUNIT#(I):NEXT
1147 DATA 300,292,294,292,296,294,296,310,321,324,328,331
1190 RETURN
1200 *ORESEN'*************************************************
1210 PSET((1+1)*100,-GOMI(1)*.1)
1220 FOR Y=1 TO 19
1230 LINE-((1+Y)*100,-GOMI(Y)*.1),7
1240 CIRCLE((1+Y)*100,-GOMI(Y)*.1),10,,,,,F
1250 NEXT
1260 RETURN
1299 *BOU   '*************************************************
1300 RETURN '*************************************************
1301 GOSUB *CAL
1302 CHAN=2E+06 :TILE$="&HAA002200"
1303 PSET((1+7)*100,0)
1304 FOR Y=1 TO 12
1305 PSET((.5+Y+7)*100,-0):LINE-((1.5+Y+7)*100,-BMABG#(Y)*135000!/CHAN),7,BF
,0
1306 PSET((.5+Y+7)*100,-0):LINE-((1.5+Y+7)*100,-BMABG#(Y)*130000!/CHAN),7,BF
,0
```

```
1307 PSET((.5+Y+7)*100,-0)
1308 LINE-((1.5+Y+7)*100,-BMABG#(Y)*110000!/CHAN),7,BF,7
1309 NEXT
1310 IF FLAG=1 THEN GOTO 1360
1311 '
1320 FOR Y=1 TO 12
1330 PSET((.8+Y+7)*100,-0)
1340 LINE-((1.2+Y+7)*100,-COSTC#(Y)/CHAN),0,BF,7
1341 '
1342 LINE-((.8+Y+7)*100,-(COSTC#(Y)+COSTP#(Y))/CHAN),0,BF,0
1343 '
1344 LINE-((1.2+Y+7)*100,-(COSTC#(Y)+COSTP#(Y)+COSTI#(Y))/CHAN),7,BF,TILE$
1345 '
1346 LINE-(( .8+Y+7)*100,-(COSTC#(Y)+COSTP#(Y)+COSTI#(Y)+COSTSL#(Y))/CHAN),7
,BF,0
1347 LINE-((1!+Y+7)*100,-(COSTC#(Y)+COSTP#(Y)+COSTI#(Y)+COSTS#(Y))/CHAN),7,B
F,0
1348 '
1350 NEXT
1360 LINE (0,0)-(2600,0)
1366 'COPY 5
1390 RETURN
1400 *POUT'*****************************************************************
1410 COPY 5
1420 RETURN
1500 *CAL
1501 DY=365*1.01
1510 FOR I=1 TO 12
1511 'IF I<8 THEN GOTO 1512 ELSE GOTO 1520
1512 'COSTC#(I)=GOMI#(I)*300*DY:GOTO 1530
1520 COSTC#(I)=GOMI#(I)*CUNIT#(I)*DY
1530 COSTP#(I)=COMP#(I)*853*DY
1540 COSTI#(I)=INCINE#(I)*1371*DY
1550 COSTS#(I)=MINKAN#(I)*250*DY
1555 '
1556 '
1560 '
1561 IF I=1 THEN 1562 ELSE 1563
1562 COSTB#(I)=BMASL#(I)*185*DY :GOTO 1580
1563 IF I<4 THEN 1564 ELSE 1570
1564 COSTB#(I)=BMASL#(I)*260*DY :GOTO 1580
1570 COSTB#(I)=BMASL#(I)*320*DY
1580 COSTSL#(I)=COSTS#(I)+COSTB#(I)
1590 NEXT
1600 RETURN
2000 *MBDATA'*****************************************************************
2001 FLAG=1
2010 DIM INV(11,25)
2020  RESTORE 3010
2021 'RESTORE 3510
2022 'RESTORE 4010
2023 'RESTORE 5010
2030 FOR MB=1 TO 19
2040 FOR Y=1 TO 10
2050 READ INV(Y,MB)
2060 NEXT
2070 NEXT
2080 FOR Y=1 TO 10
2090 INV(Y,20)=INV(Y,1)+INV(Y,2)
2100 INV(Y,21)=INV(Y,3)+INV(Y,4)+INV(Y,5)+INV(Y,6)+INV(Y,7)
2110 INV(Y,22)=INV(Y,8)+INV(Y,9)+INV(Y,10)+INV(Y,11)+INV(Y,12)+INV(Y,13)+INV
(Y,14)
2120 INV(Y,23)=INV(Y,20)+INV(Y,21)+INV(Y,22)+INV(Y,15)+INV(Y,16)
2130 INV(Y,24)=INV(Y,17)+INV(Y,18)+INV(Y,19)
2140 INV(Y,25)=INV(Y,23)+INV(Y,24)
2150 NEXT
2160 FOR Y=1 TO 10
2161 PRINT Y+1990;
2170 PRINT USING "###,###";INV(Y,20),INV(Y,21),INV(Y,22),INV(Y,23),INV(Y,24)
,INV(Y,25)
2180 NEXT' :END
2190  GOSUB *GRAPH
2200  GOSUB *READDATA
2202  GOSUB *BOU
2300 *BOUEX '*************************************************************
2310 TILE$="&HAA002200"
2313 '
2314 FOR Y=1 TO 10
2315 PSET((.8+Y+9)*100,-0)
2316 LINE-((1.2+Y+9)*100,-(INV(Y,15))/2),7,BF,7 '***************
2317 '
2318 LINE-((.8+Y+9)*100,-(INV(Y,15)+INV(Y,5)+INV(Y,12))/2),7,BF,0 '*********
*
```

```
2319 '
2320 LINE-((1.2+Y+9)*100,-(INV(Y,15)+INV(Y,5)+INV(Y,12)+INV(Y,6)+INV(Y,13)+I
NV(Y,7)+INV(Y,14))/2),7,BF,TILES
2321 '
2322 LINE-(( .8+Y+9)*100,-(INV(Y,25))/2),7,BF,0
2323 '
2326 LINE-((1!+Y+9)*100,-((INV(Y,25)-(INV(Y,20)+INV(Y,3)+INV(Y,4)+INV(Y,8)+I
NV(Y,9)+INV(Y,10)+INV(Y,11))))/2),7,BF,0
2327 '
2328 LINE (0,0)-(2600,0)
2329 NEXT
2330 GOSUB *POUT
2340 END
2919 '
3000 '************* MATRIX DATA ***************************************
3010 DATA 95,0,0,0,0,0,0,0,0,0
3020 DATA 0,0,0,392,0,0,0,0,0,280
3030 DATA 0,178,178,0,0,0,0,0,0,0
3040 DATA 0,0,0,0,275,275,0,0,0,0
3050 DATA 100,270,0,0,0,0,0,0,0,0
3060 DATA 0,0,490,490,229,0,0,280,280,73
3070 DATA 8,32,0,0,0,0,0,0,0,0
3080 DATA 0,0,0,20,27,37,39,42,45,0
3085 DATA 0,0,0,0,0,0,47,47,55,56
3090 DATA 16,0,0,0,0,0,0,0,0,0
3100 DATA 104,121,0,0,0,0,0,0,0,0
3110 DATA 0,0,121,116,114,113,110,110,108,112
3120 DATA 0,0,1,1,4,25,26,32,67,63
3130 DATA 0,0,4,4,5,5,6,7,6,6
3140 DATA 548,586,627,666,714,792,866,923,993,1008
3150 DATA 15,15,16,16,17,17,18,18,19,20
3160 DATA 0,110,120,128,135,146,75,75,97,97
3170 DATA 0,219,241,263,285,307,110,110,148,148
3180 DATA 88,252,181,197,219,241,219,252,283,339
3190 DATA 1,2,3,4,5,6,7,8,9,10
3500 '************* dup     DATA ***************************************
3510 'DATA 95,0,0,0,0,0,0,0,0,0
3511 DATA 0,0,0,0,0,0,0,0,0,0
3520 'DATA 0,0,0,392,0,0,0,0,0,280
3521 DATA 0,0,0,0,0,0,0,0,0,0
3530 DATA 0,0,0,59,59,59,60,60,59,0
3540 DATA 0,0,0,0,0,0,0,37,37,37,37
3550 DATA 0,0,25,25,25,25,25,25,25,25
3560 DATA 0,0,0,0,0,81,81,81,81,123
3570 DATA 0,0,3,3,3,3,3,3,3,3
3580 DATA 0,0,0,20,27,37,39,42,45,0
3585 DATA 0,0,0,0,0,0,47,47,55,56
3590 DATA 16,0,0,0,0,0,0,0,0,0
3600 DATA 104,121,0,0,0,0,0,0,0,0
3610 DATA 0,0,121,116,114,113,110,110,108,112
3620 DATA 0,0,1,1,4,25,26,32,67,63
3630 DATA 0,0,4,4,5,5,6,7,6,6
3640 DATA 548,586,627,666,714,792,866,923,993,1008
3650 DATA 15,15,16,16,17,17,18,18,19,20
3660 DATA 0,110,120,128,135,146,75,75,97,97
3670 DATA 0,219,241,263,285,307,110,110,148,148
3680 DATA 88,252,181,197,219,241,219,252,283,339
3690 DATA 1,2,3,4,5,6,7,8,9,10
4000 '************* loan    DATA ***************************************
4010 DATA 95,0,0,0,0,0,0,0,0,0
4020 DATA 0,0,0,11,11,11,44,43,42,49
4030 DATA 0,5,10,10,25,39,38,38,37,36
4040 DATA 0,0,0,0,7,14,14,37,60,59
4050 DATA 100,270,0,0,0,0,0,0,0,0
4060 DATA 0,0,13,26,32,73,113,138,144,143
4070 DATA 8,32,0,0,0,0,0,0,0,0
4080 DATA 0,0,0,20,27,37,39,42,45,0
4085 DATA 0,0,0,0,0,0,47,47,55,56
4090 DATA 16,0,0,0,0,0,0,0,0,0
4100 DATA 104,121,0,0,0,0,0,0,0,0
4110 DATA 0,0,121,116,114,113,110,110,108,112
4120 DATA 0,0,1,1,4,25,26,32,67,63
4130 DATA 0,0,4,4,5,5,6,7,6,6
4140 DATA 548,586,627,666,714,792,866,923,993,1008
4150 DATA 15,15,16,16,17,17,18,18,19,20
4160 DATA 0,110,120,128,135,146,75,75,97,97
4170 DATA 0,219,241,263,285,307,110,110,148,148
4180 DATA 88,252,181,197,219,241,219,22,283,339
5000 '************* subcidy duplication ********************************
5010 DATA 48,0,0,0,0,0,0,0,0,0
5020 DATA 0,0,0,5,5,5,21,21,20,24
5030 DATA 0,2,4,4,11,18,18,18,18,17
5040 DATA 0,0,0,5,5,5,21,21,20,24
```

```
5050 DATA 0,0,0,0,4,8,8,20,31,30
5060 DATA 0,0,7,14,17,37,56,69,72,71
5070 DATA 4,16,0,0,0,0,0,0,0,0
5080 DATA 0,0,0,20,27,37,39,42,45,0
5085 DATA 0,0,0,0,0,0,47,47,55,56
5090 DATA 16,0,0,0,0,0,0,0,0,0
5100 DATA 104,121,0,0,0,0,0,0,0,0
5110 DATA 0,0,121,116,114,113,110,110,108,112
5120 DATA 0,0,1,1,4,25,26,32,67,63
5130 DATA 0,0,4,4,5,5,6,7,6,6
5140 DATA 548,586,627,666,714,792,866,923,993,1008
5150 DATA 15,15,16,16,17,17,18,18,19,20
5160 DATA 0,110,120,128,135,146,75,75,97,97
5170 DATA 0,219,241,263,285,307,110,110,148,148
5180 DATA 88,252,181,197,219,241,219,252,283,339
```