NO. 59

STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK FOR THE GOVERNMENT OF MALAYSIA

ANNEX

March 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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STUDY ON ESTABLISHMENT
OF
KULIM HI-TECH INDUSTRIAL PARK
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ANNEX

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The Study Reports of Kulim Hi-Tech Industrial Park consist of the following four (4) volumes.

Volume 1 : SUMMARY

Volume 2 : MAIN REPORT

Volume 3 : ANNEX

Volume 4 : GUIDELINE (DRAFT) FOR BASIC PLAN AND DESIGN OF HI-TECH INDUSTRIAL PARK

This is the Volume 3 : ANNEX.

STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK

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ABBREVIATIONS

(1) Plan

5MP	:	Fifth Malaysia Plan
6MP	:	Sixth Malaysia Plan
NDP	:	National Development Policy
OPP2	:	Second Outline Perspective Plan

(2) Domestic Organization

DOE	:	Department of Environment
DOS	:	Department of Statistics
EPU	:	Economic Planning Unit
ICU	:	Implementation and Coordination Unit
IMR	:	Institute of Medical Research
DID (JPT)	:	Drainage and Irrigation Department
PWD (JKR)	:	Public Works Department
MARDI	:	Malaysian Agricultural Research and Development Institute
MHA (LLM)	:	Malaysia Highway Authority
MIDA	:	Malaysian Industrial Development Authority
MIMOS	:	Malaysian Institute of Microelectronics System
MITI	:	Ministry of International Trade and Industry
MLRD	:	Ministry of Land and Regional Development
MOF	:	Ministry of Finance
MOH	:	Ministry of Health
MOPI	:	Ministry of Primary Industries
MOHLG	:	Ministry of Housing and Local Government
NDPC	:	National Development Planning Committee
KSDC (PKNK)	:	Kedah State Development Corporation
PORIM	:	Palm Oil Research Institute of Malaysia
PPC	:	Penang Port Commission
RDA	:	Regional Development Corporation
RRIM	:	Rubber Research Institute of Malaysia
SEDC	:	State Economic Development Corporation
SEPU	:	State Economic Planning Unit
SIRIM	:	Standard and Industrial Research Institute
STM	:	Malaysia Telecommunication Company
TEN	:	Tenaga Nasional
TPM	:	Technology Park Malaysia
UDA	:	Urban Development Authority

(3) International or Foreign Organization

ADB	:	Asian Development Bank
IBRD	:	International Bank Reconstruction Development

ILO	:	International Labor Organization
IMF	:	International Monetary Fund
JICA	:	Japan International Cooperation Agency
MITI	:	Ministry of International Trade and Industry
MOC	:	Ministry of Construction, Japan
OECD	:	Organization of Economic Cooperation Development
OECF	:	Overseas Economic Cooperation Fund, Japan
UNIDO	:	United Nations Industrial Development Organization
UNDP	:	United Nations Development Program
WHO	:	World Health Organizations

(4) Others

B	:	Benefit
BOD	:	Biochemical oxygen demand
C	:	Cost
CIF	:	Cost, insurance and freight
COD	:	Chemical oxygen demand
D & I	:	Domestic and industrial
FIRR	:	Financial Internal Rate of Return
EL.	:	Elevation above mean sea level
Fig.	:	Figure
FOB	:	Free on Board
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
HWL	:	Reservoir high water level
LWL	:	Reservoir low water level
TWL	:	Top Water Level
O & M	:	Operation and maintenance
Ref.	:	Reference
SITC	:	Standard International Trade Classification
SS	:	Suspended Solid
TEU	:	Twenty feet Equivalent Unit
ADT	:	Average Daily Traffic

ABBREVIATIONS OF MEASUREMENT

Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer
ft	=	foot
yd	=	yard

Atea

cm^2	=	square centimeter
m^2	=	square meter
ha	=	hectare
km^2	=	square kilometer

Volume

cm^3	=	cubic centimeter
l	=	litre
kl	=	kilolitre
m^3	=	cubic meter
gal.	=	gallon

Weight

mg	=	milligram
g	=	gram
kg	=	kilogram
ton	=	metric ton
lb.	=	pound

Time

s	=	second
min	=	minute
h	=	hour
d	=	day
y	=	year

Electrical Measurement

V	=	Volt
A	=	Amphere
Hz	=	Hertz (cycle)
GHz	=	Gigahertz
W	=	Watt
kW	=	kilowatt
MW	=	Megawatt
GW	=	Gigawatt
pr	=	pair

Other Measures

%	=	percent
PS	=	horsepower
°	=	degree
'	=	minute
"	=	second
10^3	=	thousand
10^6	=	million
10^9	=	billion

Derived Measures

m^3/s	=	cubic meter per second
cusec	=	cubic feet per second
mgd	=	million gallon per day
kWh	=	Kilowatt hour
MWh	=	Megawatt hour
GWh	=	Gigawatt hour
kWh/y	=	kilowatt hour per year
kVA	=	kilovolt amphere
BTU	=	British thermal Unit
psi	=	pound per square inch
lcd	=	litre per capita per day
Kb/s	=	Kilobit/second
Mb/s	=	Megabit/second

Currency

M$	=	Malaysian Ringgit
US$	=	US Dollar
¥	=	Japanese Yen
	=	
	=	

CONVERSION FACTORS

	From Metric System			To Metric System		
Length	1 cm	=	0.394 inch	inch	=	2.54 cm
	1 m	=	3.281 ft	1 ft	=	30.48 cm
			1.094 yd	1 yd	=	91.44 cm
	1 km	=	0.621 mile	1 mile	=	1.609 km
Area	1 cm^2	=	0.155sq.in	1 sq.ft.	=	0.0929 m^2
	1 m^2	=	10.76 sq.ft	1 sq.yd.	=	0.835 m^2
	1 ha	=	2.471 acres	1 acre	=	0.4047 ha
	1 km^2	=	0.386 sq.miles	1 sqmile	=	2.59 km^2
Volume	1 cm^2	=	0.610 cu in	1 cu ft.	=	8.32 lit
	1 lit	=	0.220 gal (imp)	1 cu yd	=	0.765 m^3
	1 kl	=	1 kl = 6.29 barrels	1gal (imp)	=	4.55 lit
	1 m^3	=	35.3 cu.ft.	1 gal (US)	=	3.79 lit
	10^6 m^3	=	811 acre ft.	1 acre ft	=	1233.5 m^2
Weight	1 g	=	0.0353 ounce	1 ounce	=	28.35 g
	1 kg	=	2.20 lb.	1 lb.	=	0.4536 kg
	1 ton	=	0.984 long ton	1 long ton	=	1.016 ton
		=	1.102 short ton	1 shortton	=	0.907 ton
Energy	1 kWh	=	3,413 BTU	1 BTU	=	1 BTU
Temperature	℃	=	(F - 32) x 5/9	F	=	1.8 C + 32
Derived Measures	1 m^3/s	=	35.3 cusec	1 cusec	=	0.028 m^3/s
	1kg/cm^2	=	14.2 psi	1 psi	=	0.703 kg/cm^2
	1ton/ha	=	891 lb/acre	1 lb/acre	=	1.12 kg/ha
	10^6m^3	=	810.7 acre ft.	1 acre ft	=	1,233.5 m^3
	1m^3/s	=	19.0 mgd	1 mgd	=	0.0526 m^3/s
Local	1 lit		0.220 gantang	1 gantang		4.55 lit
	1 kg		1.65 kati	1 kati		0.606 kg
	1 ton		16.5 pikul	1 pikul		60.6 kg

Exchange Rate (average in the month of May, 1991)

M$ 1	Y 50.065
M$ 1	US$ 0.7841

INDUSTRIAL TERMINOLOGY

ACM	Advanced Compound Material
AI	Artificial Intelligence
ATM	Asymmetric Transfer Mode
CAD	Computer Aided Design
CD	Compact Disk
CFRC	Carbon Fiber Reinforced Concrete
CFRP	Carbon Fiber Reinforced Plastic
CG	Computer Graphics
CIM	Computer Integrated Manufacturing
CISC	Compound Imperative Set Computer
CMOS	Complementary Metal-Oxide Semiconductor
DDS	Drug Delivery System
DRAM	Dynamic Random Access Memory
FRP	Fiber Reinforced Plastic
HDTV	High Definition Television
IFN	Interferon
ISDN	Integrated Services Digital Network
LAN	Local Area Network
LCD	Liquid Crystal Digital
LD	Laser Disk
LSI	Large Scale Integrated Circuit
MMC	Material of Metallic Compound
MSI	Middle Scale Integrated Circuit
NC	Numerically Controlled
PAN	Polyacrylic Nitril
PCB	Printed Circuit Board
RISC	Reduced Imperative Set Computer
ROM	Read Only Memory
SIS	Strategic Information System
SOR	Synchrotron Orbit Radiation
SRAM	Static Random Access Memory
SSI	Small Scale Integrated Circuit
SST	Super Sonic Transport
STM	Scanning Tunneling Microscope
STN	Super Twist Nematic
TFT	Thin Film Transistor
ULSI	Ultra-Large-Scale Integrated Circuit
VLSI	Very Large Scale Integrated Circuit
VTR	Video Tape Recorder

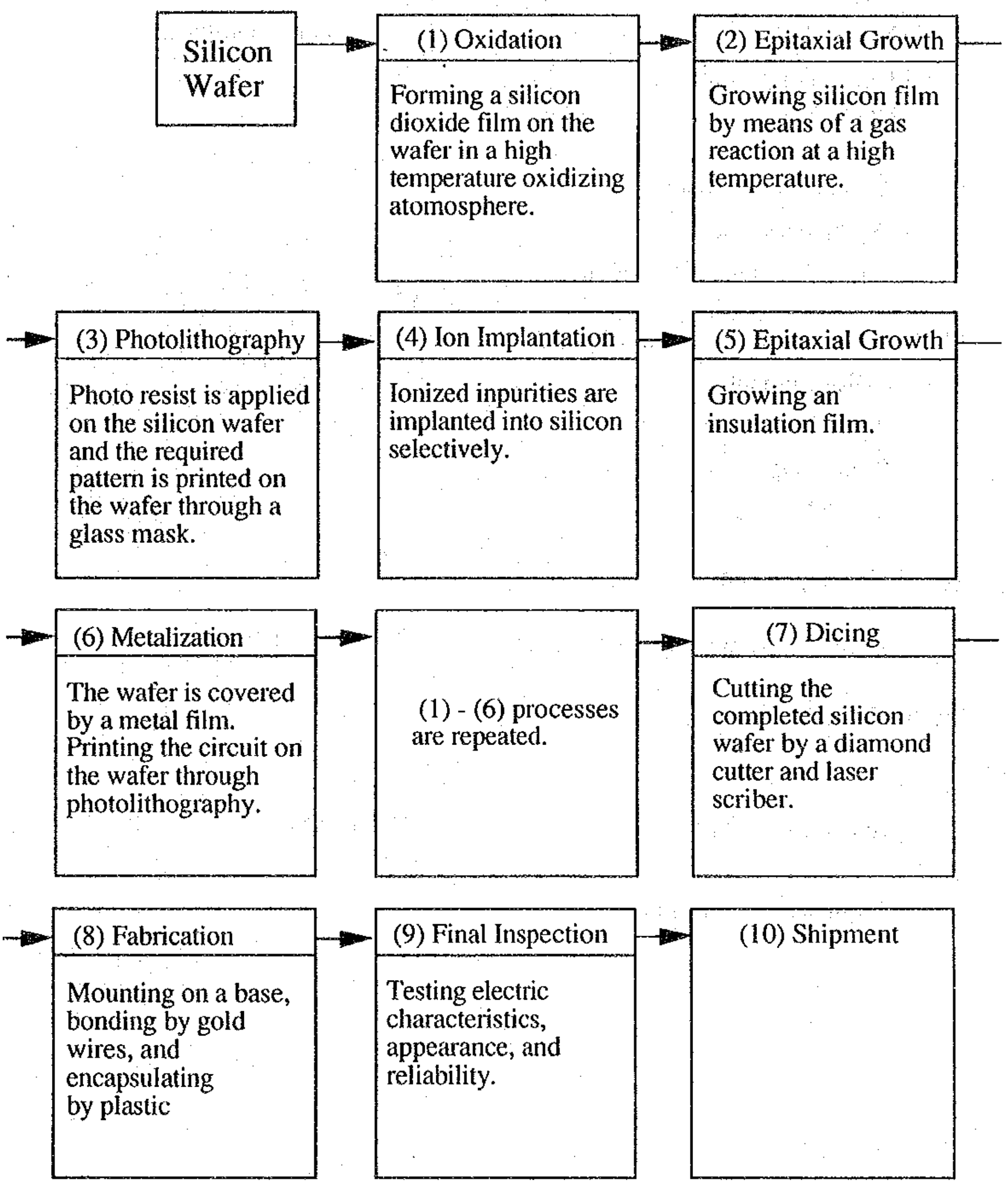
ANNEX 1

ESTATE PLANNING

1. ESTATE PLANNING

1.1 Target Industries

There exist already almost all the products listed in Chapter 3 in Malaysia. But all of them are only manufacturing of assembly process. For example, in the IC industries, major companies in the world have set up factories in all Malaysia, but their processes involve only <u>fabrication and final inspection</u>. The whole process of IC industry are roughly as follows:



Targeted IC industry, here, is involving whole processes in IC factories.
Targeted industries at the promotion stage are tentatively proposed as follows:

(1) Electronics Equipment

1) Audio - visual equipment

- TV : Color TV Tube (Large Scale)
  HDTV
  LCD (Projection TV)
- VTR : Digital VTR
- Video Camera : Integrated Disc and Camera
- Digital Audio Tape
- CD Player

2) Communication Equipment

- Digital Facsimile
- Digital Exchange Equipment

3) Computer and its related industries

- Office Computer
- Work Station
- Print Server
- CD-ROM

4) Office Equipment

- Digital Copy Machine (Full color)

(2) Electronic Parts

1) Device

- Integrated Circuit : 16M DRAM
  ASIC
- Liquidity Crystal Device

2) General Electric Parts

- Switch
- Connectors
- PCB
- Flexible Disc

(3) Opt-electronics Equipment and Related Industries

1) Opt-electronics Equipment
- Optical Sensor
- Optical Disc : CD-ROM

2) Opt-electronics Parts
- LED : CO_2 Laser
YAG Laser
- Optical Fiber
- Optical Connector

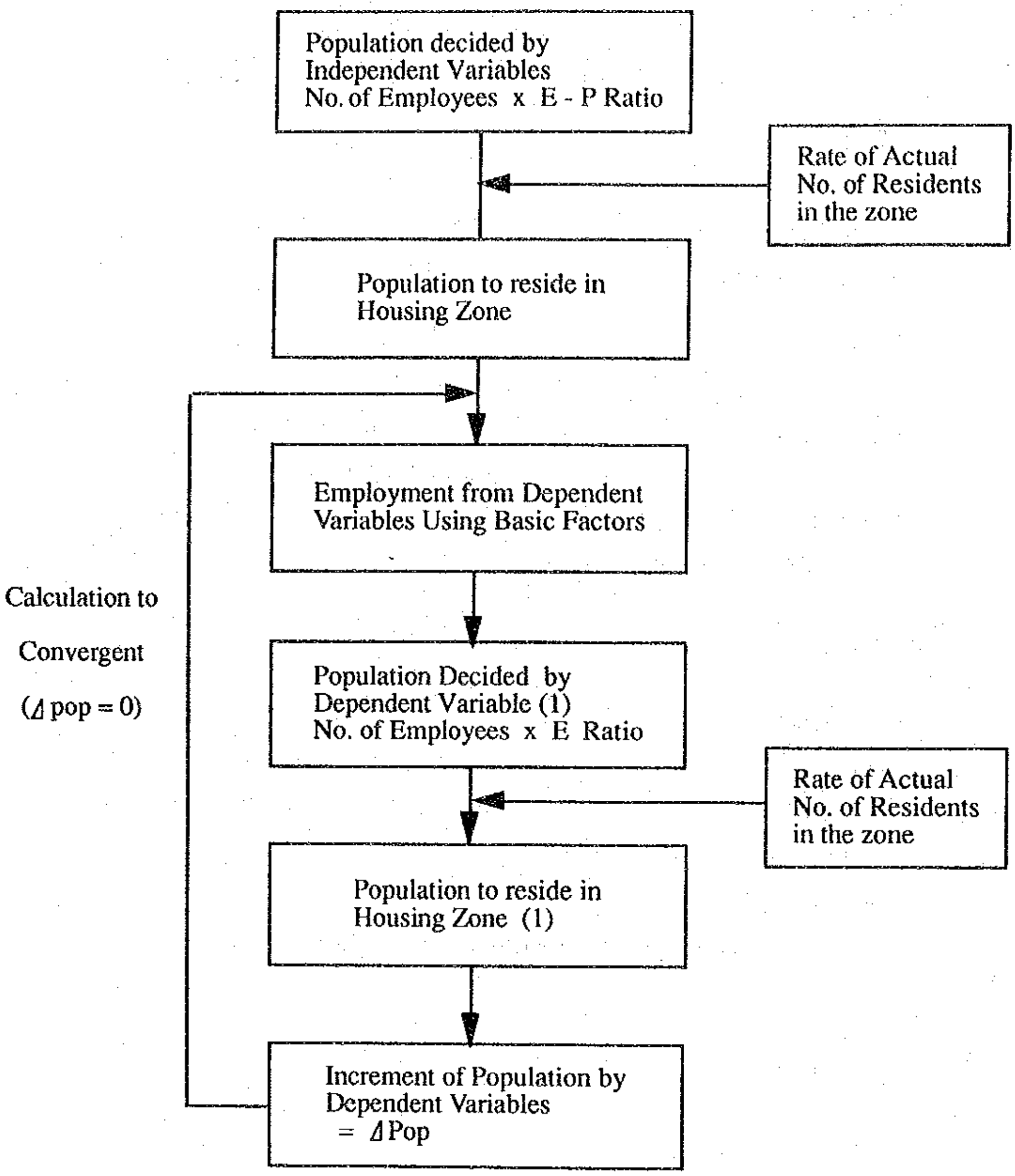
(4) Machinery

- Metal Machine Tools : NC Machine Tool
CNC Machine Tool
- Laser Beam Machine Tool
- Plastic Processing Machinery

(5) Supporting Industries

- Bearings : Ultra Precise Bearings (including R&D function)
- Moulds : Precision Moulds
- Platting and Heat Treatment
- Metal Press Industries
- Plastic Precision Products for Electronics Industries

1.2 Population Projection



Dependent Variable
Employment of
Shopping, Admi.,
Service, Teachers

Dependent Variable is decided based on the population.

Independent Variable
Employment of
Hi-Tech Industries,
R & D Institutes,
Hotel, Golf, Sports

E - P Ratio
= Employment - Population Ratio

Fig. 1.1 Procedure of Population Projection

Table 1.1 Basic Factors of Population Projection

1.	Shopping Center	Shop area 0.5m^2/pop. 8m^2/employee
2.	Post Office	150 employees/100,000 pop.
3.	Police Station	100 employees/100,000 pop.
4.	Administration	600 employees/100,000 pop.
5.	Bank	1 shop/10,000 population 50 employees/shop
6.	Other Services (Gas station, Barber, Laundry etc.)	20 shops/10,000 population 10 employees/shop
7.	Restaurant	10 shops/10,000 population 10 employees/shop
8.	Clinic	1 clinic/2,000 population 10 employees/clinic
9.	School	
	Kindergarten	7 pupil/100 population 150 pupil/kindergarten 15 employees/kindergarten
	Primary School	14 pupil/100 population 350 pupil/school 16 employees/school
	Secondary School	86 students/1,000 population 1,050 students/school 50 employees/school

Source : The Study on the Development Project of Laem Chabang Coastal Area, JICA Population and Housing Census of Malaysia, 1980

Table 1.2 Number of Employees

Employment	No. of Employees	
	Overall Plan	1st Phase
1. Hi-Tech Industries	15,540	12,540
2. Public R&D Institute	100	100
3. Private R&D Institute	1,800	
4. University	100	100
5. Shopping Center	2,900	1,000
6. Post Office	70	25
7. Police Station	50	15
8. Administration	280	90
9. Bank	250	100
10. Office	500	
11. Other Services	940	320
12. Hotel	150	150
13. Restaurant	470	160
14. Clinic	120	40
15. School		
Kindergarten	330	120
Primary school	300	110
Secondary school	200	100
International school	10	10
16. Golf Course	70	70
17. Sports Facilities	20	20
Total	24,200	15,070

Table 1.3 Number of Population and Families for Overall Plan

	No. of Employees	Population (1)	Population in Estate (2)	No. of Families	(2) / (1)
1. Hi-Tech Industries	15,540	60,600	26,600	6,820	0.44
2. Public R&D Institute	100	400	400	100	1.00
3. Private R&D Institute	1,800	7,000	5,600	1,440	0.80
4. University	100	400	160	40	0.40
5. Shopping Center	2,900	11,300	6,640	1,700	0.59
6. Post Office	70	300	150	40	0.50
7. Police Station	50	200	100	30	0.50
8. Administration	280	1,100	880	230	0.80
9. Bank	250	1,000	500	130	0.50
10. Office	500	2,000	1,000	260	0.50
11. Office Services	940	3,700	1,850	470	0.50
12. Hotel	150	600	235	60	0.39
13. Restaurant	470	1,800	900	230	0.50
14. Clinic	120	500	300	80	0.60
15. School					
Kindergarten	330	1,300	650	170	0.50
Primary School	300	1,200	600	150	0.50
Secondary School	200	800	400	100	0.50
International Sc.	10	40	40	10	1.00
16. Golf Course & Sport s Facilities	90	400	35	10	0.09
TOTAL	24,200	94,640	47,040	12,070	0.50

Table 1.4 Population Projection in The First Phase Development

		(1) No. of Employee	(2) Ratio of (1) to Resident /1	(3) Population	(5) No. of Family
1.	Hi-Tech Industries	12,540	0.32*	15,680	4,020
2.	Public R&D Institute	100	1.0*	390	100
3.	University	100	0.4	160	40
4.	Shopping Center	1,000	0.4	1,560	400
5.	Administration**	130	0.4	195	50
6.	Bank	100	0.4	150	40
7.	Other Services	320	0.4	490	125
8.	Hotel	150	0.4	235	60
9.	Restaurant	160	0.4	240	60
10.	Clinic	40	0.4	60	15
11.	School	340	0.4	550	140
12.	Golf Course Sports Facilities	90	0.1	35	10
	TOTAL	15,070		19,745	5,060

/1 : Resident in the Estate

* : The percentage of employees to reside in the estate is assumed to be 40% normally. For the Hi-Tech Industries,the rate is assumed to be 32%, considering the occupancy ratio of the estate until the year 1995 (80%).

All the employees of Public R&D Institutes will reside in the estate. The employees of managers' class will also reside in the estate.

** : Administration includes Post Office and Police

ANNEX 2

BASIC DESIGN OF FIRST PHASE INDUSTRIAL ZONE

2. BASIC DESIGN OF FIRST PHASE INDUSTRIAL ZONE

2.1 Site Condition

Location/topography

The Project site is located at 20 km east from Penang Port and 23 km east from Penang International Airport.

The proposed area of Kulim Hi-Tech Industrial Park is 1,450 ha in total with a maximum south-north distance of 7.0 km and 3.0 km of east-west. The site is situated in the Bukit Mertajam Plantation Estate which is currently occupied by oil palm and rubber trees.

The highest hill in the Hi-Tech Industrial Park is Bukit Jerutong of EL. 137 m, and the hill of EL. 61 m in the first phase Industrial Zone. The topography of the Industrial Zone is characterized by gentle slopes with 3 to 10 % gradient from the highest point. The Gunung Bongsu forest reserve lies to the east of these estates. A Hindu cemetery of about 5,000 m^2 exists in the southern part of the first phase Industrial Zone (Shimanan Kubur Hindu).

Geology

Geological investigation shows the subsoil for the proposed site is generally made up of stiff to very stiff clayey silt and silty clay. Soft silty clay was found to a depth of 3.0 m below ground level at borehole No. 1 and No. 3.

Meteorology/Hydrology

Mean annual meteorological values are as follows.

- Temperature : 28 °C
- Humidity : 72 %
- Rainfall : 2,686 mm

Rainfall pattern is heavy in April to May and September to October throughout the year.

2.2 Land Layout Plan

In preparing the layout plan, the following elements were taken into consideration.

<u>Element on overall</u>

- To maintain the present hill as a community park and landmark .

<u>Element on factory lot</u>

- To satisfy the required number of lots and their space for Hi-Tech and supporting industries assuming the targeted industries to be introduced.

- These lots are integrated and or divided into larger or smaller size lots to meet the requirements of the factories.

<u>Element on Urban block</u>

- Skill development centre, administration core and other supporting and related facilities are to be located at the Urban block between Industrial Zone and Housing Zone in order to ensure convenience for habitants and integration of activities.

<u>Element on R & D block</u>

- R & D facilities are to be located on the hill side in order to promote research in a quiet and natural environment, and to ensure close relationship with the industries.

2.3 Land Preparation Plan

The design conditions/standards stipulated below will be applied for the design of land preparation. However, those conditions with values should be reviewed in the detailed design stage focussing on the geological survey results.

a) Design elevation of factory lots should consider easy access to the factory and installation of the drainage pipes

b) Factory land gradient of 0.5 to 1.0 %

c) Cut and fill slope : 1 : 1.5 to 2.0 to enable greenification

d) Drainage ditch should be provided.

e) Berm should be provided more than 5.0 m height of cut and fill slope

f) Stability check should be done.

g) Cutting and filling slopes should be protected by turfing, wall or other structures.

h) The following swell and shrinkage factors are applied.

Material	Loose/bank	Embank/bank
Common soil	1.20	0.90
Coarse, sand & gravel	1.15	1.02
Rock	1.60	1.15

i) All suitable material excavated in the site shall be used for the embankment.

J) Embankment criteria shall be determined after the trial embankment.

k) Earthworks should be free form standing water.

l) Earthmoving works will be planned for 10 working months in net and be completed in June 1993 stated with April 1991 considering weather condition and holidays.

m) Hauling distance should be minimized as far as possible.

n) Topographic map of 1 : 200, 1,000 and 3,000 are mainly used.

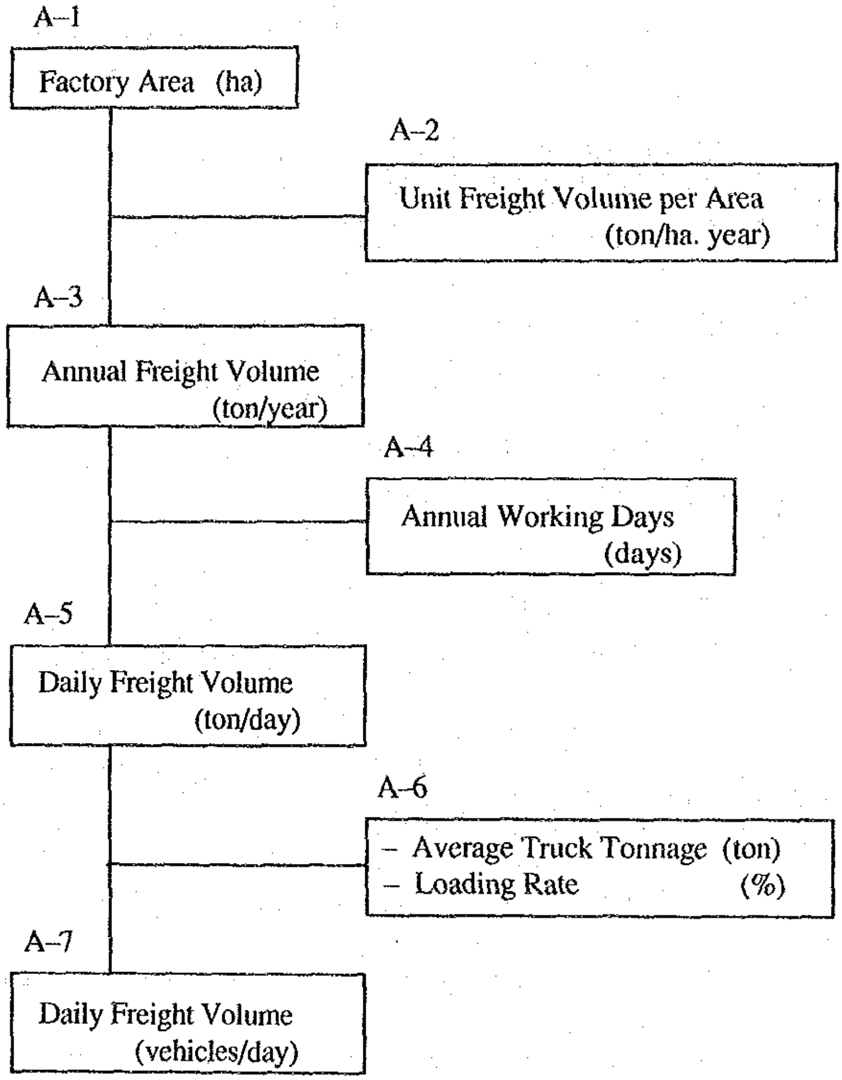
o) The following Malaysian standard/criteria are to be referred to.

- Town and country planning act, 1976
- Local government act, 1976
- Uniform building by low, 1984

2.4 Road Network

(1) Traffic Demand forecast within I/Z

(a) Daily Freight Traffic Volume



A-1) Factory area : 135 ha

A-2) Unit freight volume per area : 3,000 ton/ha.year

3,000 ton/ha.year is for electric and mechanical industry, source is "Design Standard of Core Industrial Estate (Draft) 1980, Japan"

A-3) Annual Freight volume : 405,000 ton/year

A-4) Annual Working days : 250 days

A-5) Daily freight volume : 405,000 / 250
= 1,620 ton/day

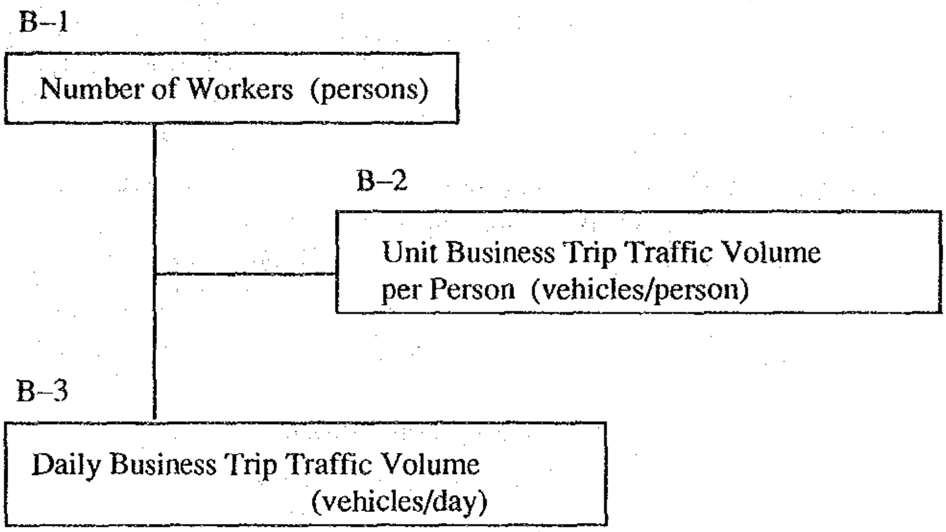
A-6) – Average Truck tonnage : 4 ton/vehicle

– Loading rate : 60% (average)
(in: 100%, out: 20%)

A-7) Daily freight volume : 1,620 / 4 / 0.6

= <u>675 vehicles/day</u>

(b) Daily Business Trip Traffic Volume

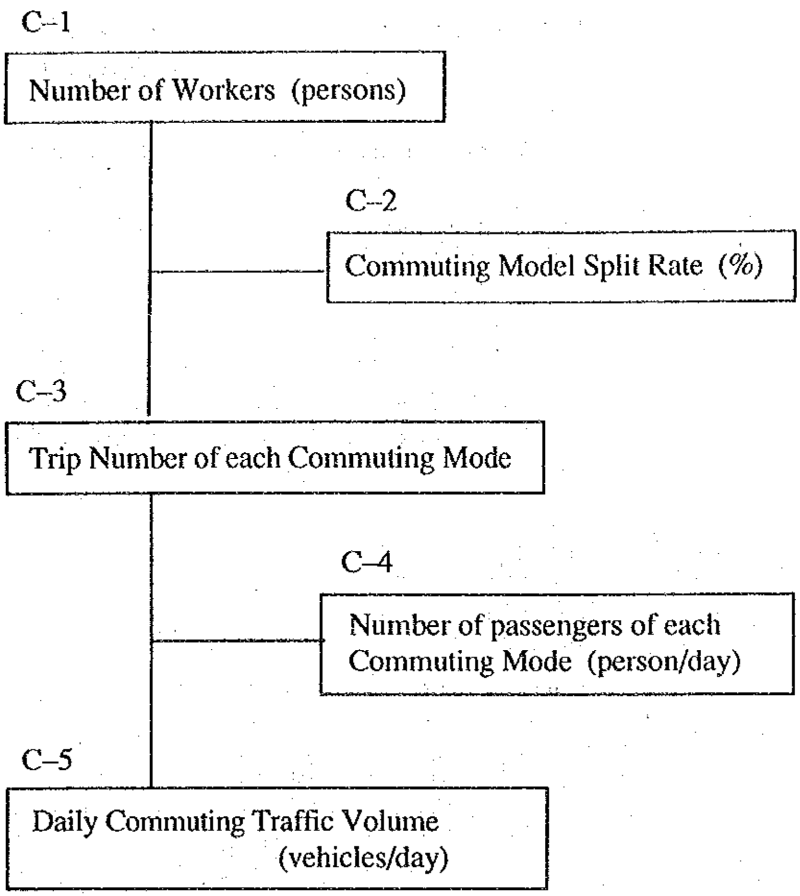


B-1) Number of Workers : 12,540 persons

B-2) Unit business trip traffic volume per person :
0.045 vehicles/person
(source : "Design Standard of Core Industrial Estate
(Draft) 1980, Japan)

B-3) Daily business trip traffic volume :
12,540 x 0.045 = <u>1,129 vehicles/day</u>

(c) Daily Commuting Traffic Volume



C-1) Number of Workers : 12,540 persons

C-2) Commuting modal split rate :

1) Sedan : 10%
2) Bus : 50%
3) Motorbike : 10%
4) Public bus : 20%
5) Walking : 10%

Note : JICA estimate based on interview survey

C-3) Trip numbers of each commuting mode :

1) Sedan : 1,254 x 2 trips/day
2) Bus : 6,270 x 2 trips/day
3) Motorbike : 1,254 x 2 trips/day

C-4) Number of passengers :

1) Sedan : 1.25 persons/vehicle
2) Bus : 30 persons/bus
3) Motorbike : 1.0 person /bike

C-5) Daily Commuting traffic volume :

1) Sedan	:	1,254 x 2 / 1.25	=	2,006 vehicles/day
2) Bus	:	6,270 x 2 / 30	=	418 vehicles/day
3) Motorbike	:	1,254 x 2 / 1.0	=	2,508 vehicles/day
Total 1) + 2) + 3)			=	4,932 vehicles/day

(d) Daily Generated Traffic Volume:

(a) + (b) + (c) = 6,736 vehicles/day
= 6,800 vehicles/day

(e) Arterial Road No. 1 : 78 ha (57%)
6,800 x 0.57 = 3,900 vehicles/day
Arterial Road No. 2 : 57 ha (43%)
6,800 x 0.43 = 2,900 vehicles/day
on arterial road : maximum 3,900 vehicles/day

(f) Collector Road No. 1 : 20 ha (15%)
6,800 x 0.15 = 1,000 vehicles/day (maximum on collector road)

(2) Traffic demand forecast of new primary access road

(a) Industrial Zone

First Phase : 6,800 vehicles/day
Second Phase :
6,800 x 63 / 135 = 3,200 vehicles/day
(Total) : 10,000 vehicles/day

(b) Urban Zone

Net area : 10% of (30 + 13) ha = 4.3 ha
406* persons/day.ha x 4.3 = 1,800 vehicles/day
*Unit user number of commercial area

(c) Other Zones

– Number of Employees : 3,300 persons

• R & D	1st	800 persons
	2nd	100 persons
• Housing	1st	1,700 persons
	2nd	600 persons
• Amenity	1st	100 persons

– Modal split ratio:
(Assumed by JICA based on interview survey)

• Sedan	10%	1.5 persons/sedan
• Bus	60%	20 persons/bus
• Bike	10%	1.0 persons/bike

3,300 x 0.1 / 1.5 x 2	=	440
3,300 x 0.6 / 20 x 2	=	198
3,300 x 0.1 / 1.0 x 2	=	660
(Total)	:	1,300 vehicles/day

(d) Distribution to directions

(a) + (b) + (c) =	:	13,100 vehicles/day
To Kulim town 70%	:	9,200 vehicles/day (JICA assumption)
To E-W Highway 30%	:	3,900 vehicles/day

(e) Converted traffic volume from existing road

16 hrs traffic volume in 2013 (by JKR)	:	6,910 vehicles
Converted ratio	:	50% (JICA assumption)
Converted volume	:	3,500 vehicles

(f) Estimated daily traffic volume of new primary access road

(d) + (e) : 9,200 + 3,500 = 12,700 vehicles/day

(3) Road length and area

(a) Primary access road : 5.6 km

The alignment and profile pf the primary access road beside the Industrial Zone are shown in Fig.2.4.1.

(b) Arterial road (Total) : 4.586 km

No. 1 : 2.936 km

No. 2 : 1.650 km

The alignments and profiles of arterial roads are shown in Figs. 2.4.2 to 2.4.3.

(c) Collector road (Total) : 4.175 km

No. 1 : 1.082 km

No. 2 : 1.060 km

No. 3 : 0.998 km

No. 4 : 1.035 km

The alignments and profiles of collector roads are shown in Figs. 2.4.4 to 2.4.7

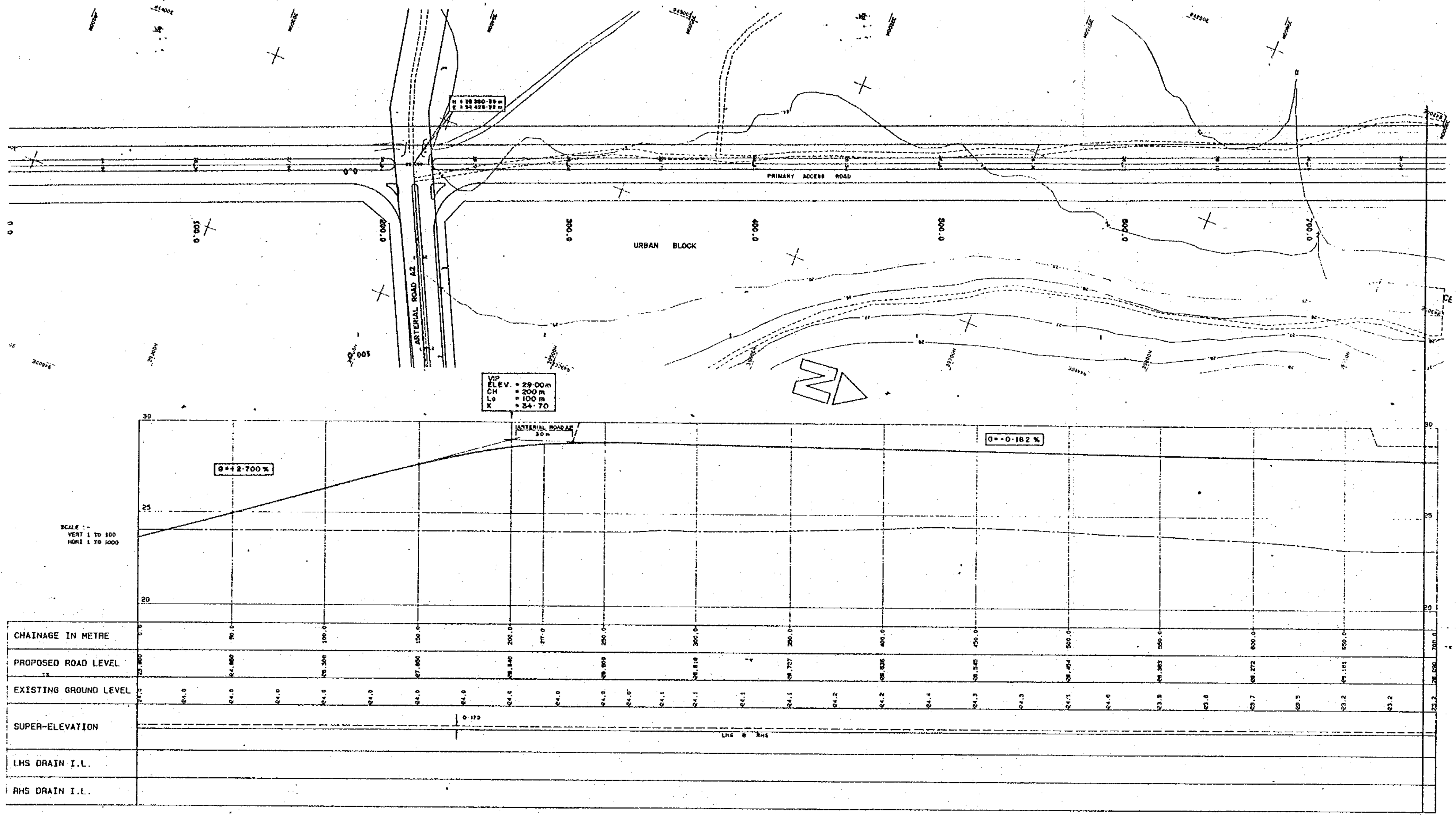
(b) + (c) = 8.761 km

(d) Road area within I/Z

$4,586 \times 30 + 4,175 \times 20 = 221,080 \text{ m}^3$

$= \underline{22 \text{ ha}}$

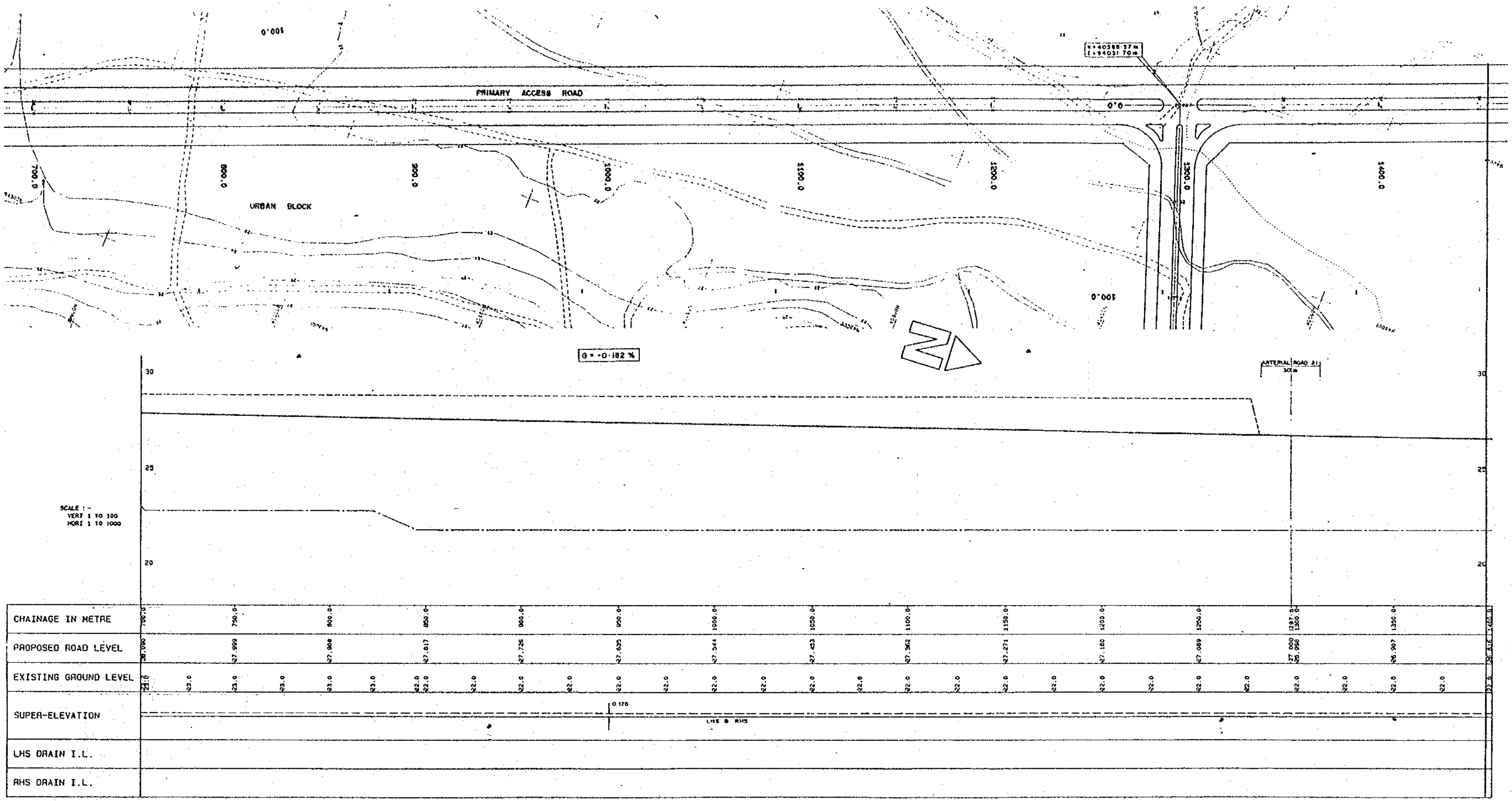
Fig. 2.4.1(1)



PRIMARY ACCESS ROAD

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF PRIMARY ACCESS ROAD BESIDE INDUSTRIAL ZONE

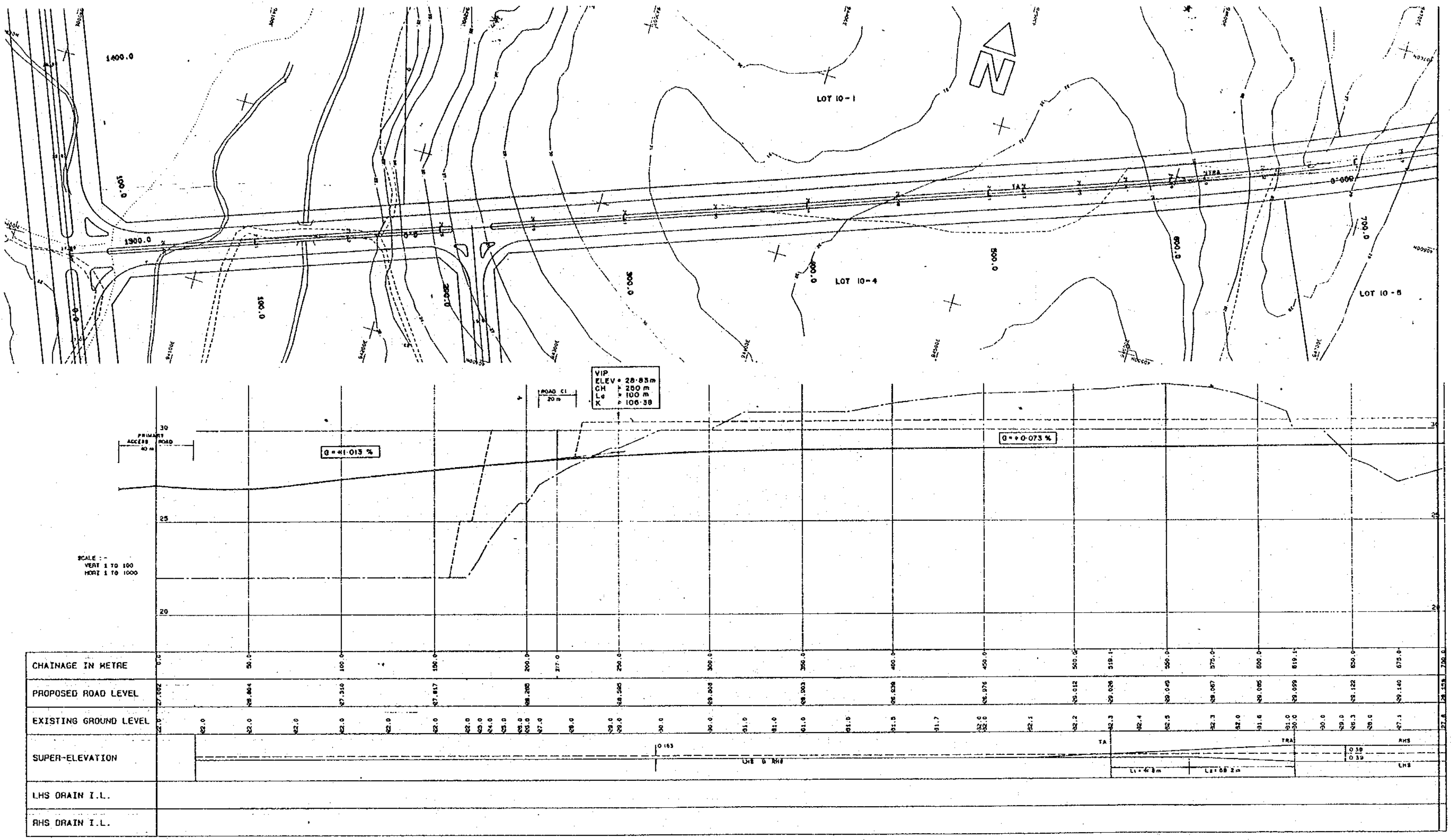
Fig. 2.4.1(2)



PRIMARY ACCESS ROAD

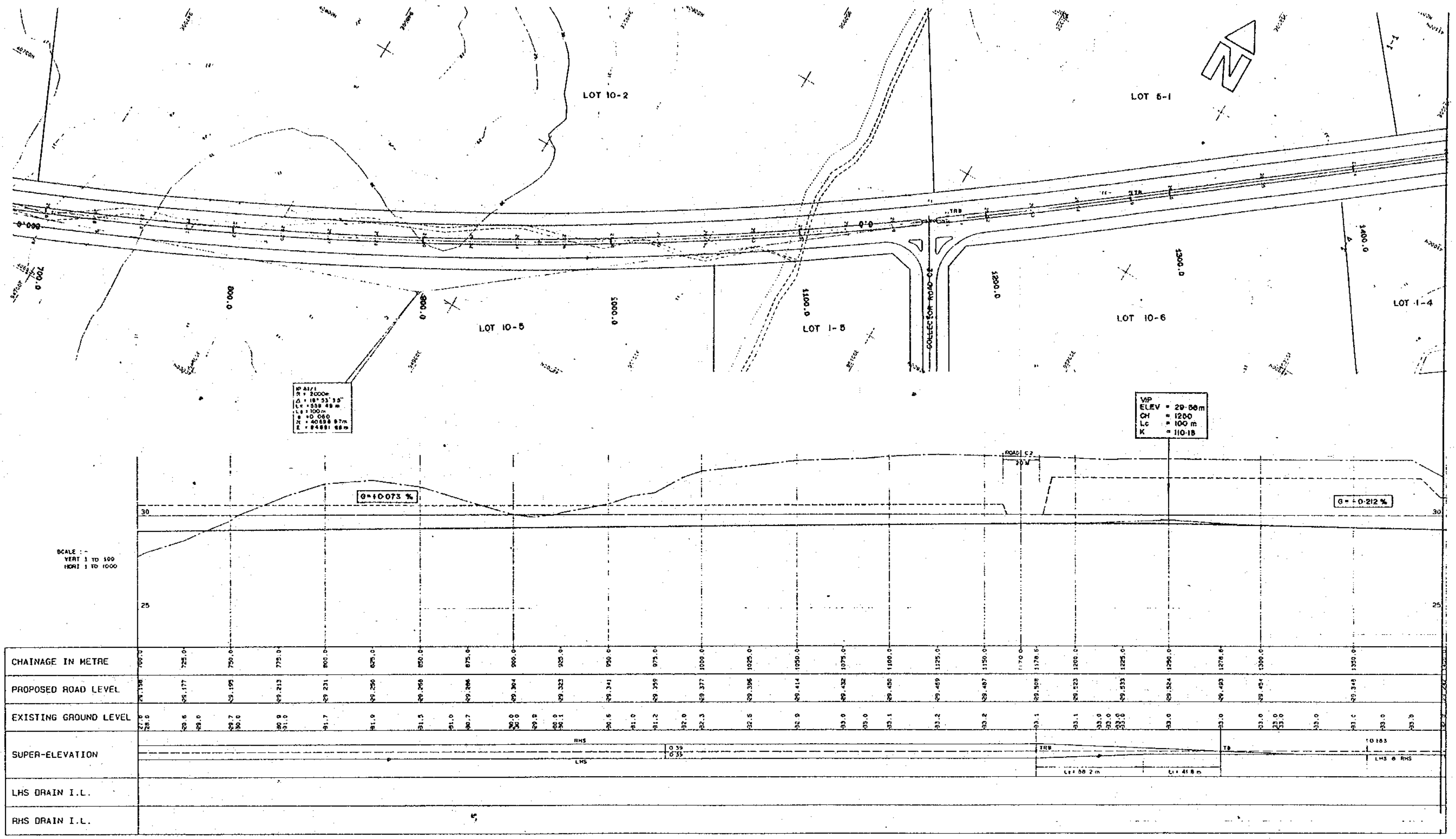
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF PRIMARY ACCESS ROAD BESIDE INDUSTRIAL ZONE

Fig. 2.4.2(1)



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.1

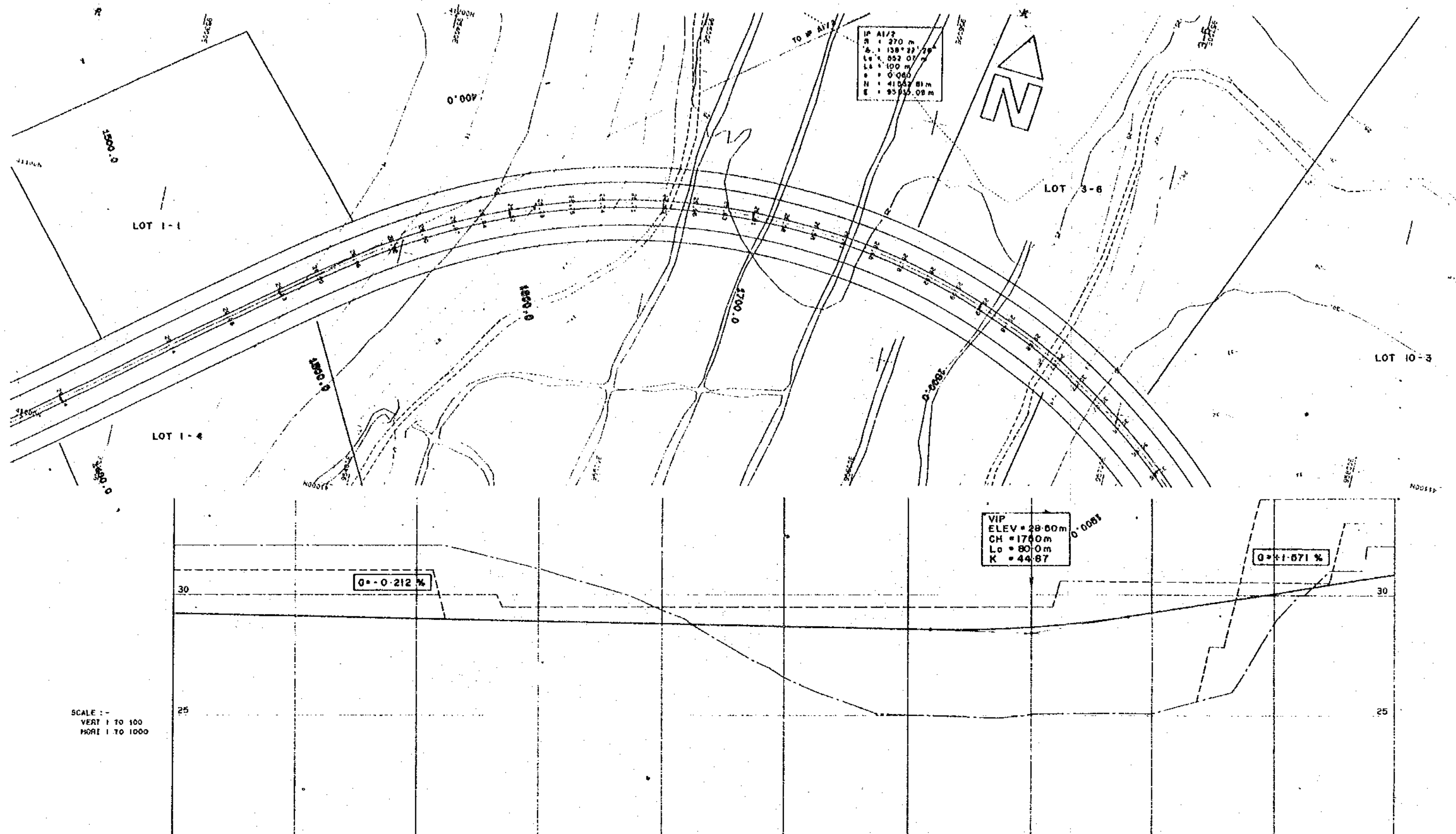
Fig. 2.4.2(2)



ROAD A1

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.1

Fig. 2.4.2(3)



CHAINAGE IN METRE	PROPOSED ROAD LEVEL
1400.0	29.242
1450.0	29.136
1476.2	29.080
1500.0	29.030
1516.7	28.995
1533.3	28.959
1550.0	28.924
1563.1	28.896
1576.2	28.868
1588.1	28.843
1600.0	28.818
1612.5	28.792
1625.0	28.765
1637.5	28.738
1650.0	28.712
1662.5	28.685
1675.0	28.659
1687.5	28.632
1700.0	28.606
1712.5	28.580
1725.0	28.576
1737.5	28.611
1750.0	28.678
1762.5	28.781
1775.0	28.918
1787.5	29.090
1800.0	29.286
1812.5	29.482
1825.0	29.679
1837.5	29.875
1850.0	30.071
1862.5	30.268
1875.0	30.464
1887.5	30.661
1900.0	30.857

EXISTING GROUND LEVEL: 32.0, 32.0, 32.0, 32.0, 32.0, 32.0, 31.9, 31.5, 31.1, 31.0, 30.7, 30.3, 30.0, 29.9, 29.4, 29.0, 28.8, 28.0, 28.0, 27.3, 27.0, 26.6, 26.0, 26.0, 25.5, 25.1, 25.0, 25.0, 25.0, 24.9, 24.9, 25.0, 25.1, 25.1, 25.1, 25.1, 25.1, 25.4, 25.8, 26.0, 26.7, 27.0, 28.0, 28.8, 29.0, 30.0, 30.0, 31.0, 31.0, 31.0, 32.0, 32.0

SUPER-ELEVATION: LHS & RHS 0.163; TA; L1 = 41.8m; L2 = 58.2m; THA; LHS 0.39; RHS 0.39

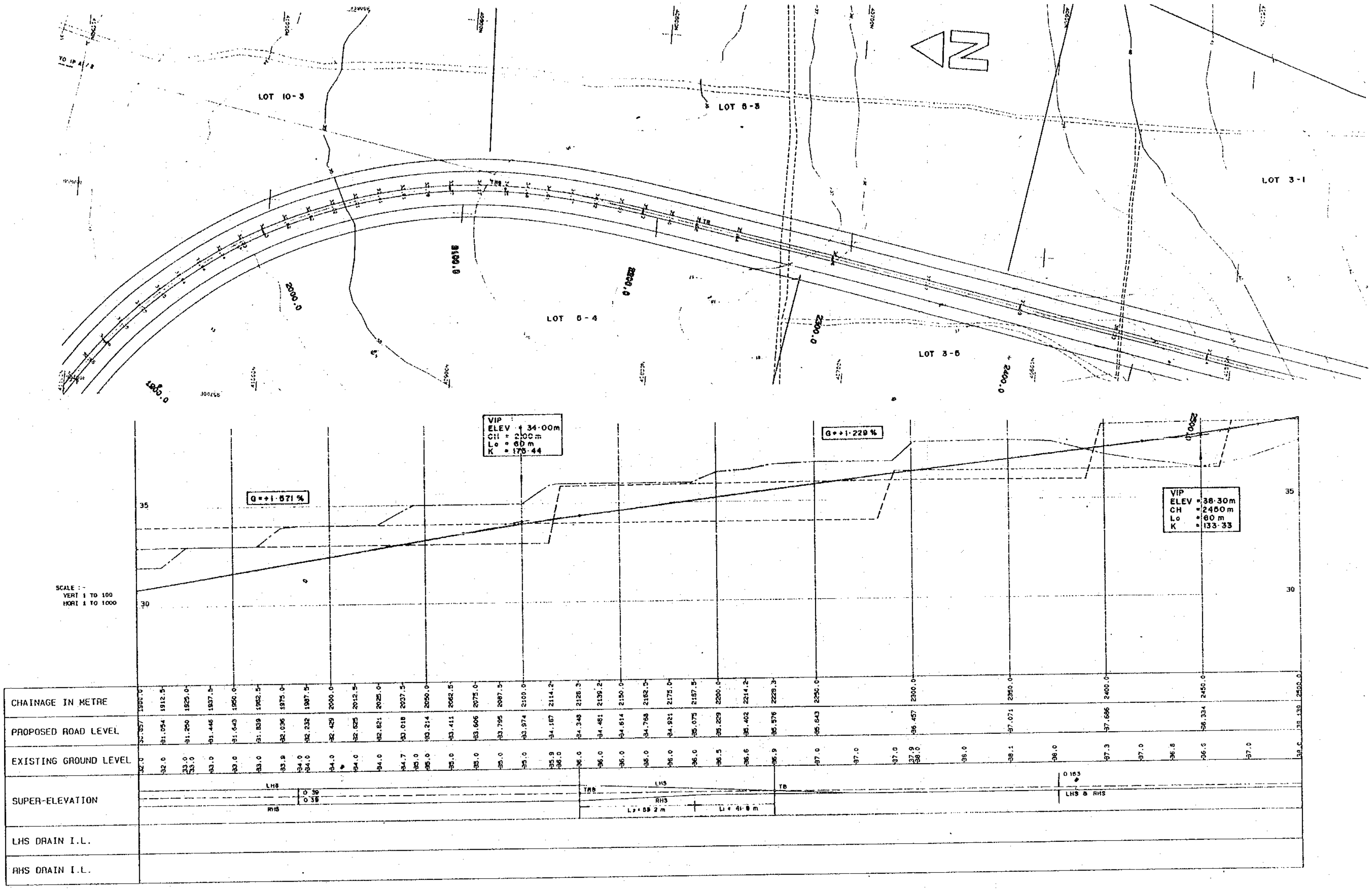
LHS DRAIN I.L.

RHS DRAIN I.L.

ROAD AI

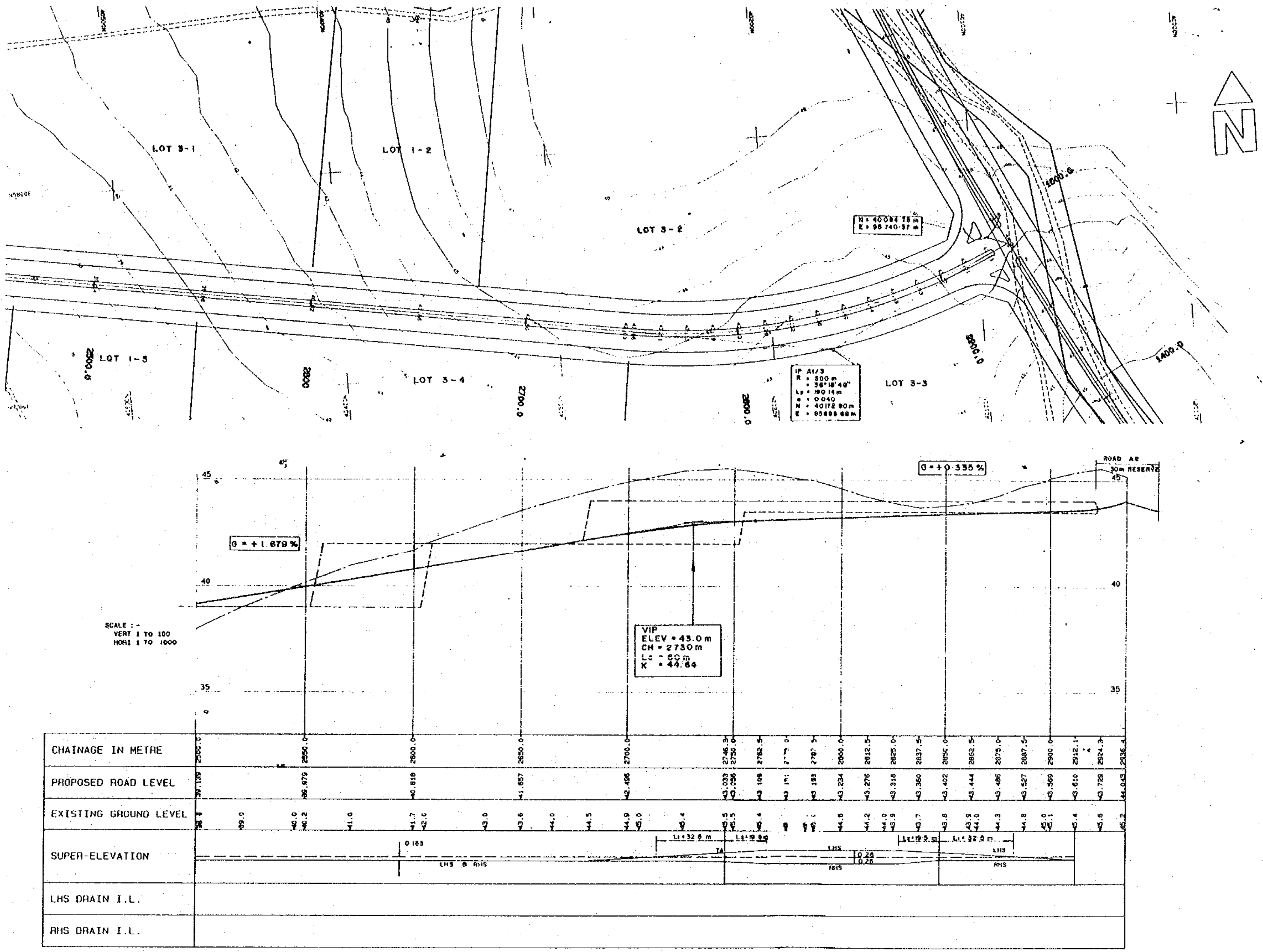
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.1

Fig. 2.4.2(4)



ROAD AI

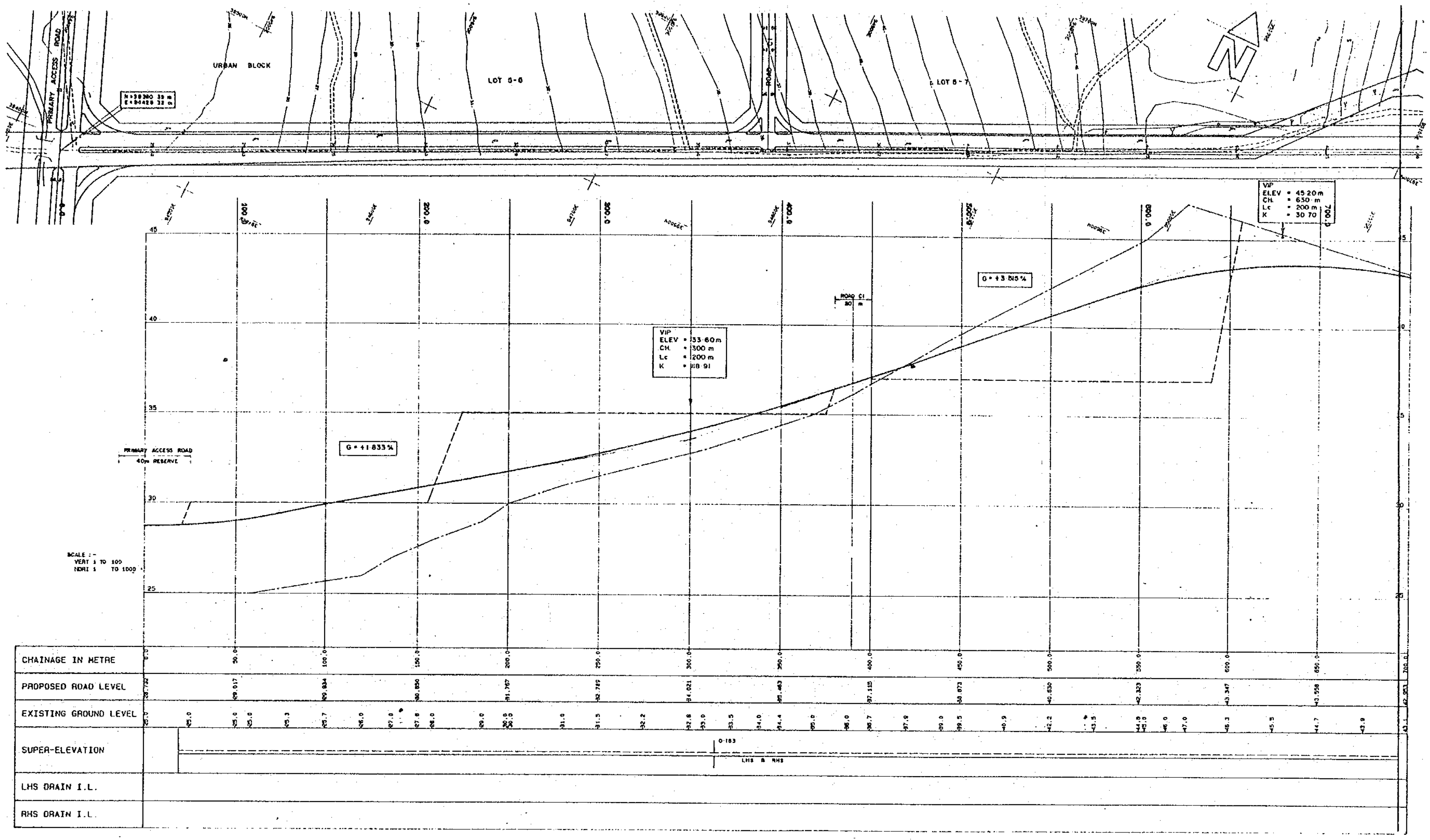
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.1



ROAD A1

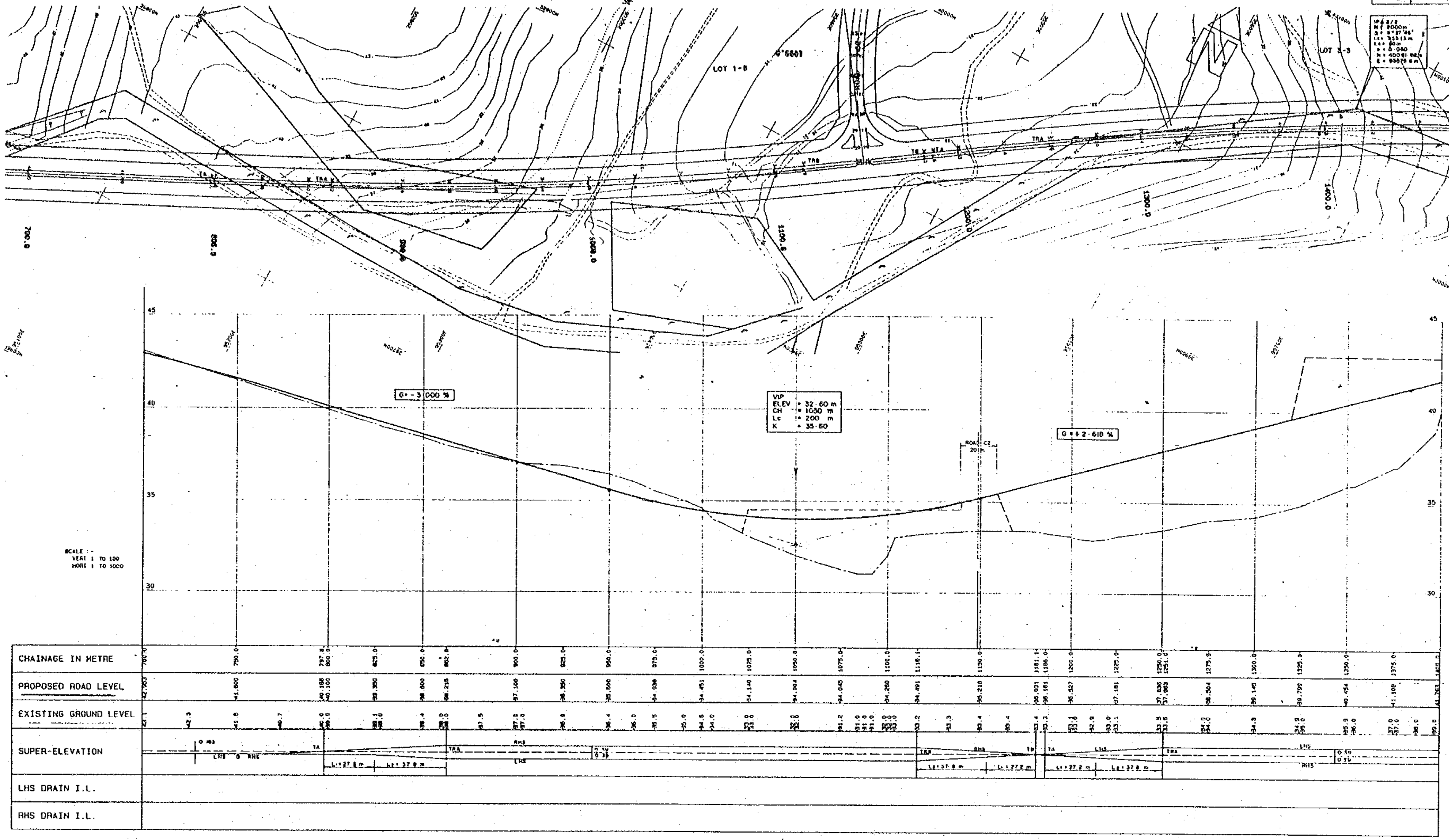
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.1

Fig. 2.4.3(1)



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.2

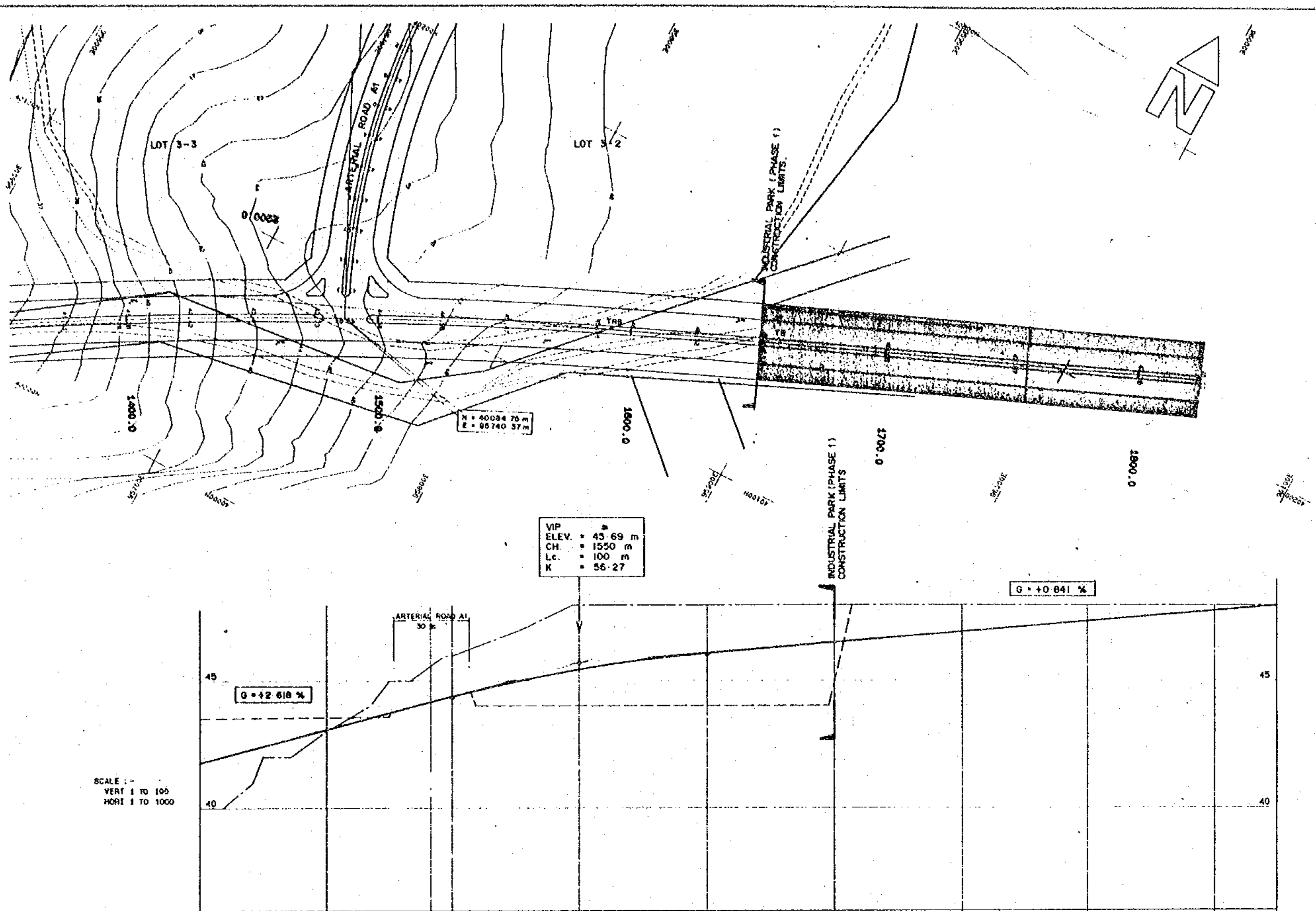
Fig. 2.4.3(2)



ROAD A2

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.2

Fig. 2.4.3(3)



CHAINAGE IN METRE	1400.0	1425.0	1450.0	1475.0	1500.0	1525.0	1550.0	1586.2	1600.0	1625.0	1650.0	1651.2	1700.0	1750.0	1800.0	1824.8
PROPOSED ROAD LEVEL	41.763	42.417	43.072	43.726	44.381	44.980	45.458	45.977	46.111	46.321	46.531	46.541	46.952	47.372	47.793	48.001

SUPER-ELEVATION: LHS, RHS, 0.39, 0.39, TSB, LHS, TB, Ls = 37.8 m, Lt = 27.2 m, 0.163, LHS & RHS

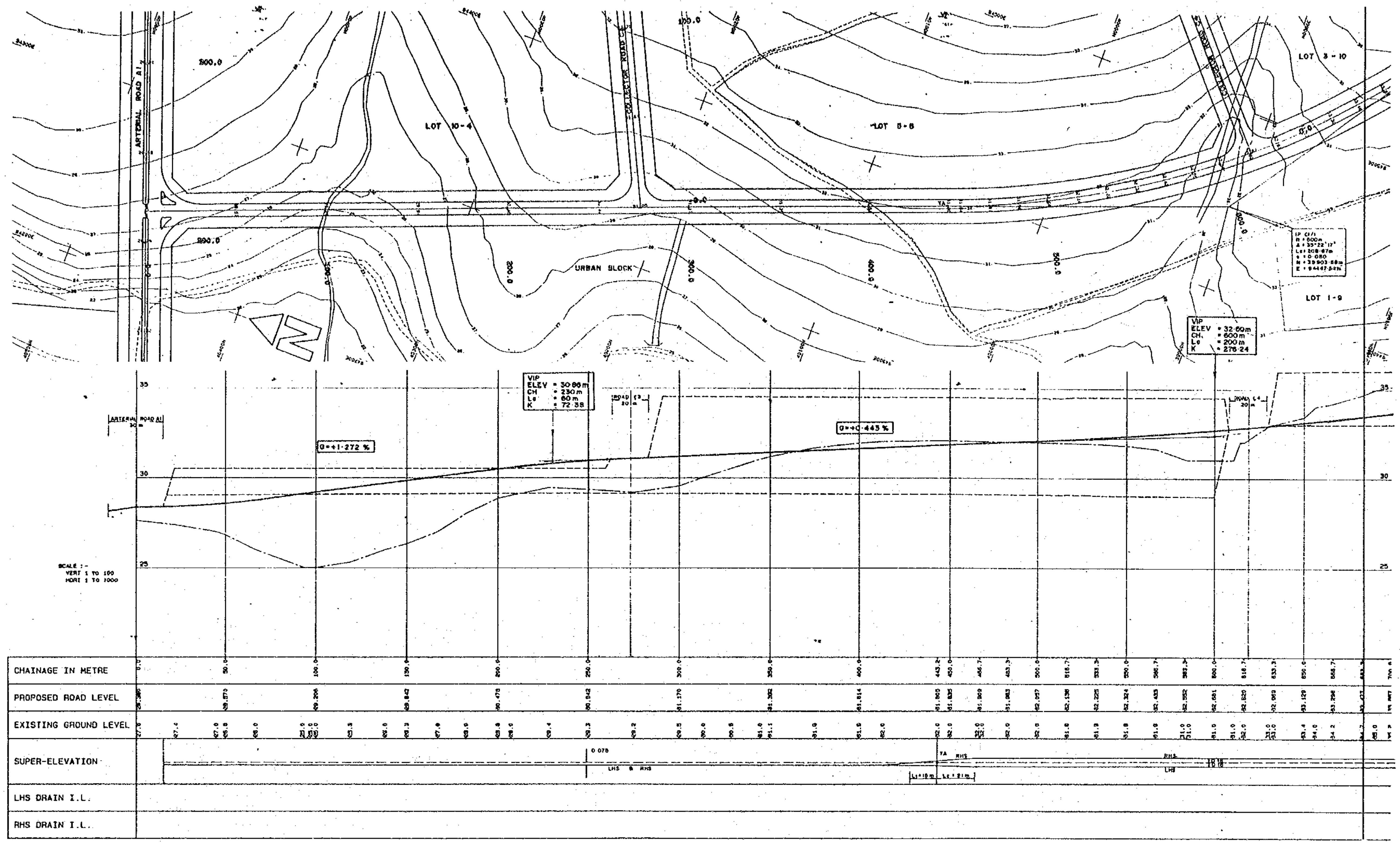
LHS DRAIN I.L.

RHS DRAIN I.L.

ROAD A2

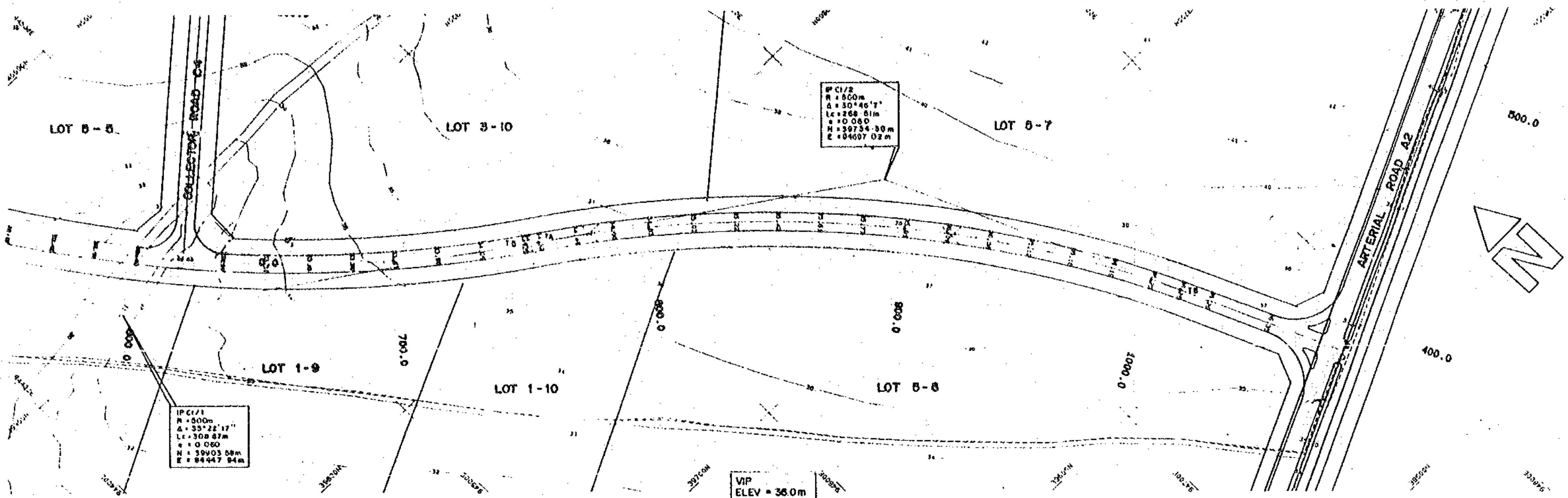
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF ARTERIAL ROAD NO.2

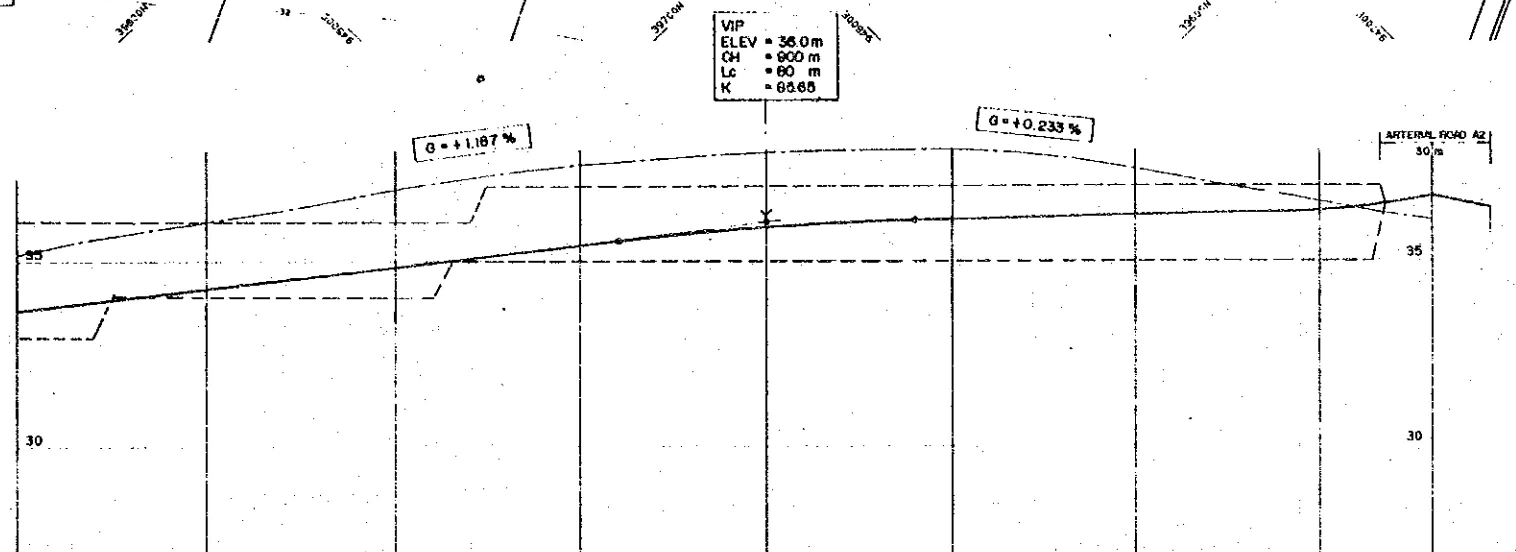
Fig. 2.4.4(1)



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.1

Fig. 2.4.4(2)





CHAINAGE IN METRE	PROPOSED ROAD LEVEL	EXISTING GROUND LEVEL
700.0	33.657	35.2
716.7	33.861	35.5
733.3	34.056	35.8
750.0	34.250	36.0
751.9	34.272	36.1
756.3	34.323	36.2
770.9	34.493	36.4
785.4	34.653	36.6
800.0	34.833	36.9 / 37.0
816.7	35.028	37.2
833.3	35.222	37.4
850.0	35.417	37.6
866.7	35.609	37.7
883.3	35.774	37.9
900.0	35.907	37.9
916.7	36.007	38.0
933.3	36.075	38.0 / 38.0
950.0	36.117	38.0 / 38.0
966.7	36.156	37.9
983.3	36.194	37.8
1000.0	36.233	37.5
1012.4	36.262	37.3
1024.8	36.291	37.0 / 37.0
1050.0	36.350	36.6
		36.3
1081.7	35.746	36.1

SUPER-ELEVATION

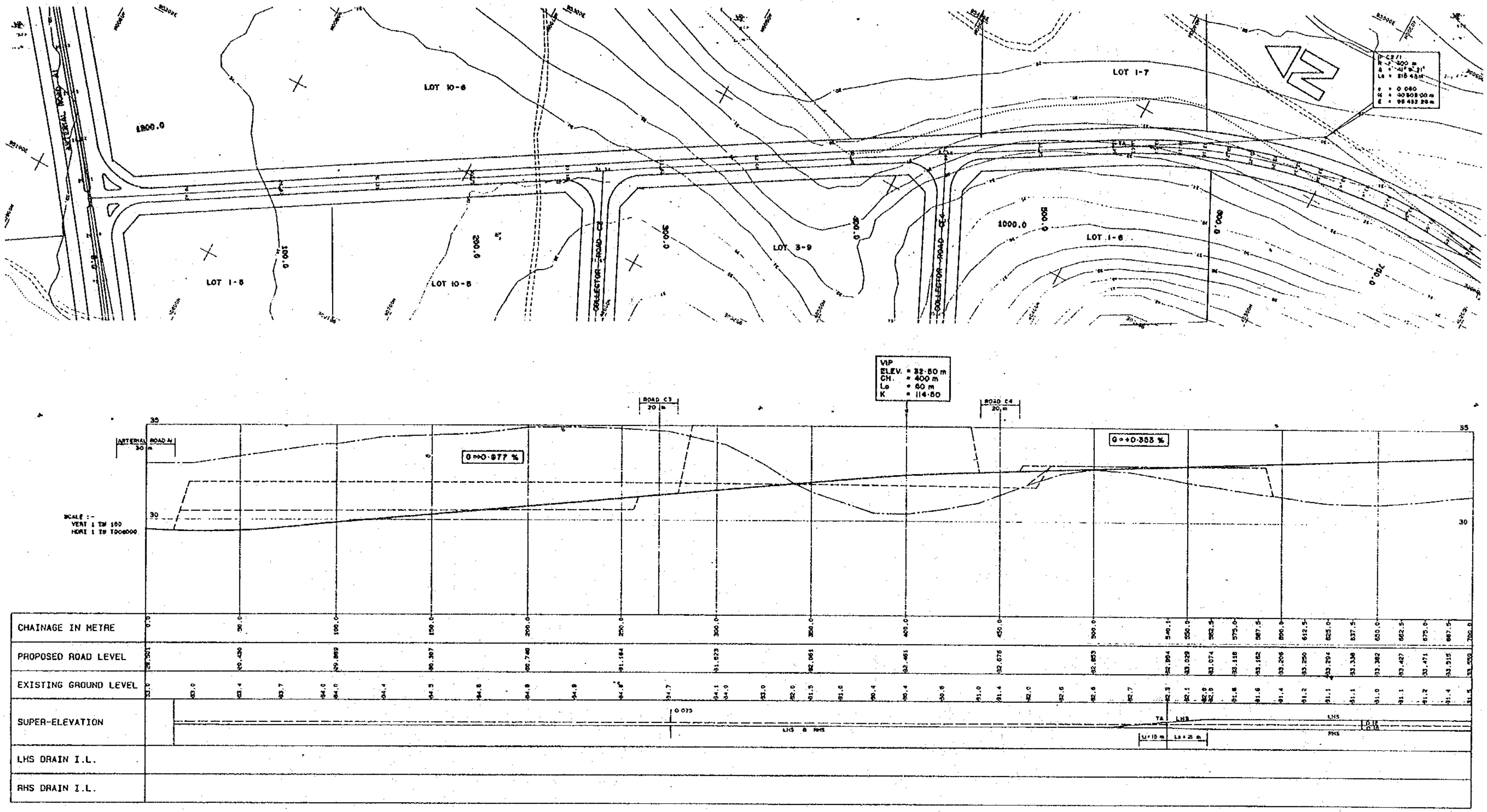
LHS DRAIN I.L.

RHS DRAIN I.L.

ROAD C1

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.1

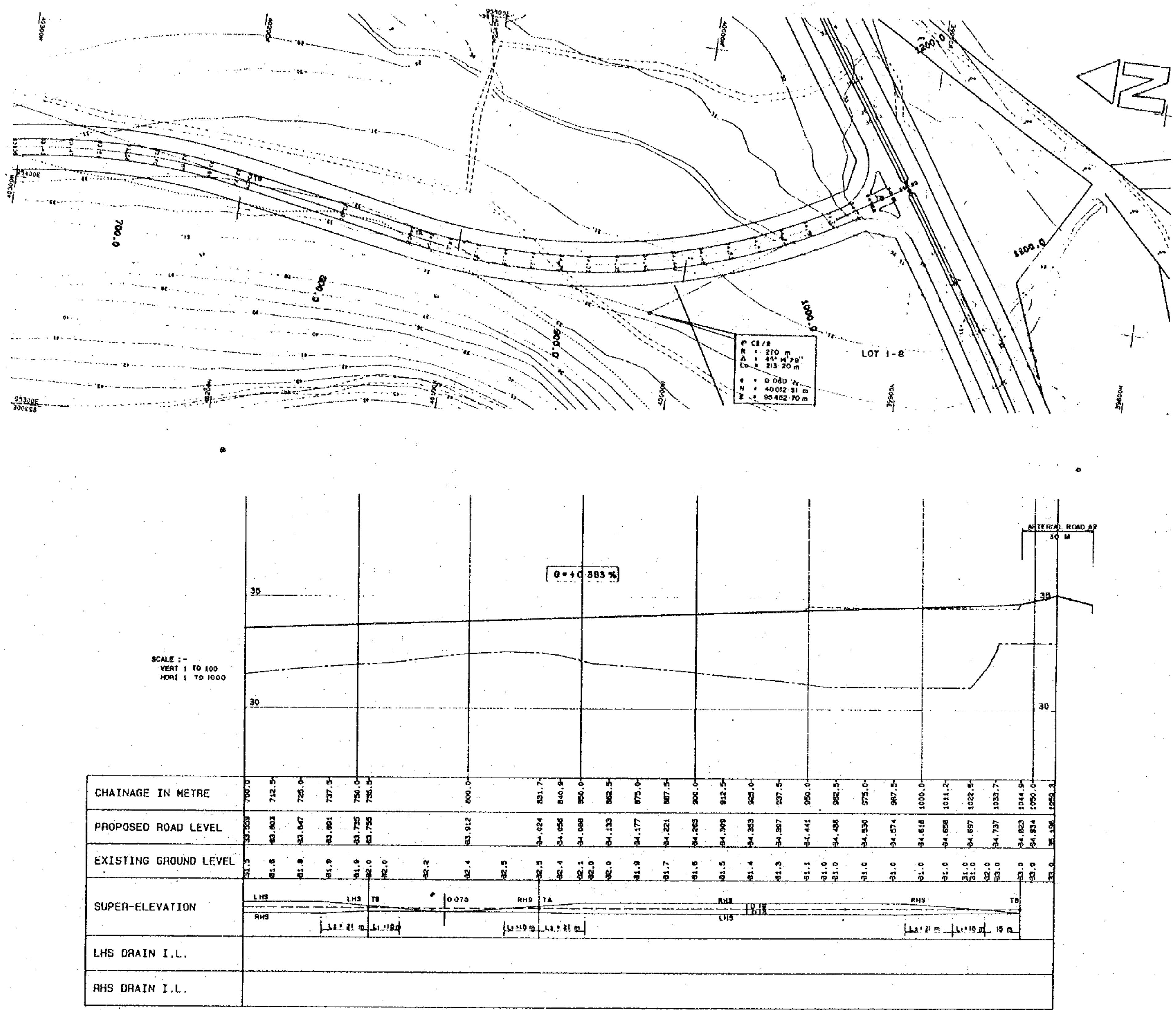
Fig. 2.4.5(1)



ROAD C2

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.2

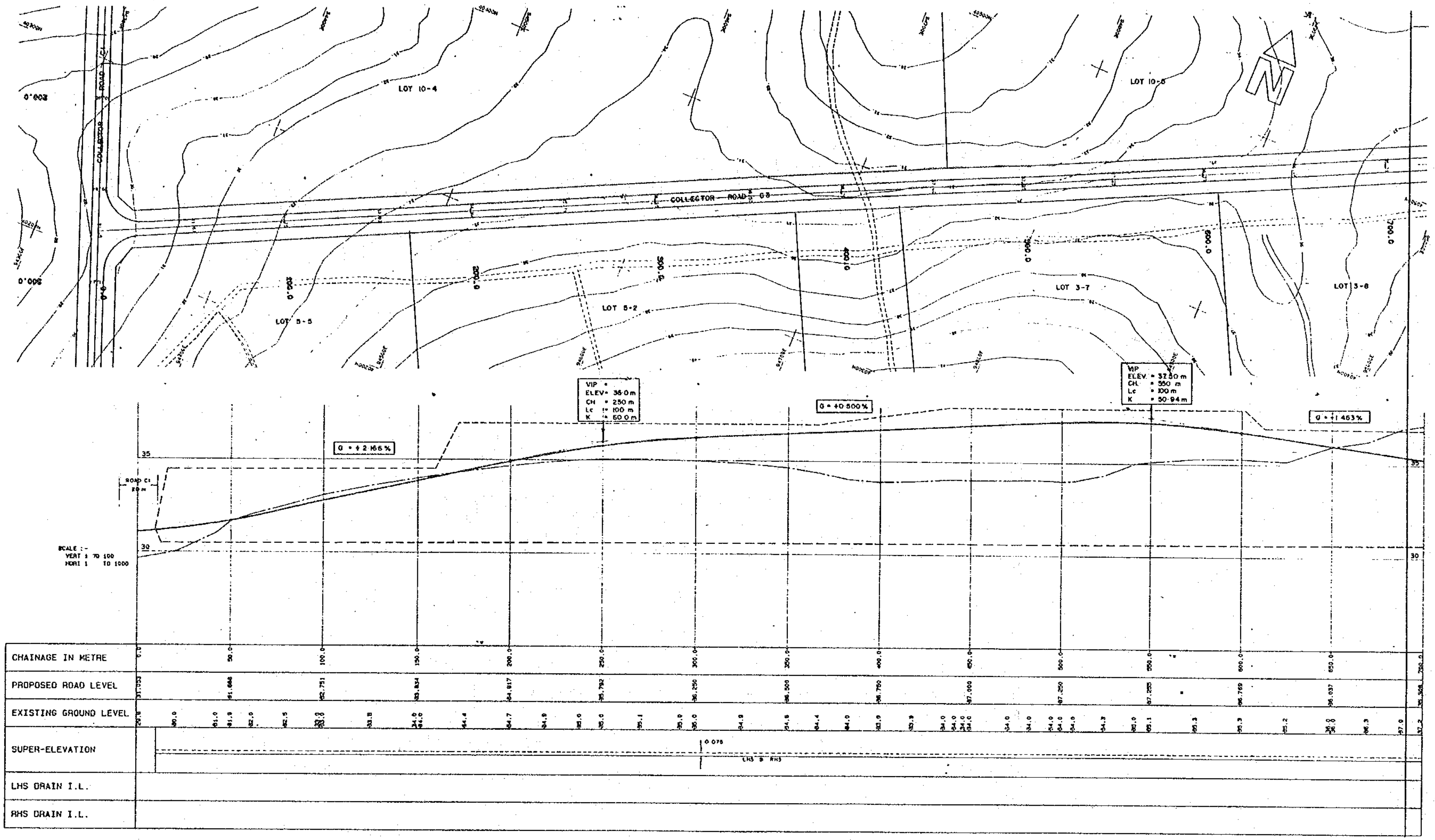
Fig. 2.4.5(2)



ROAD C2

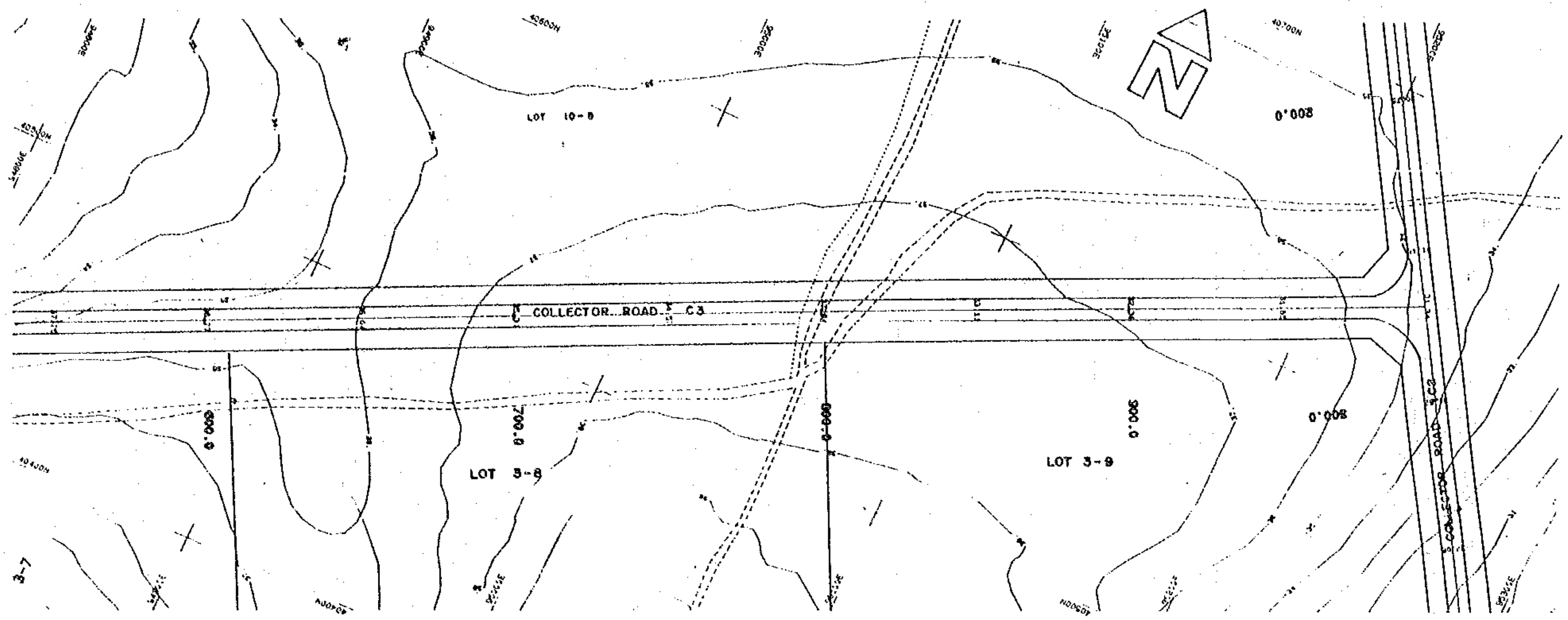
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.2

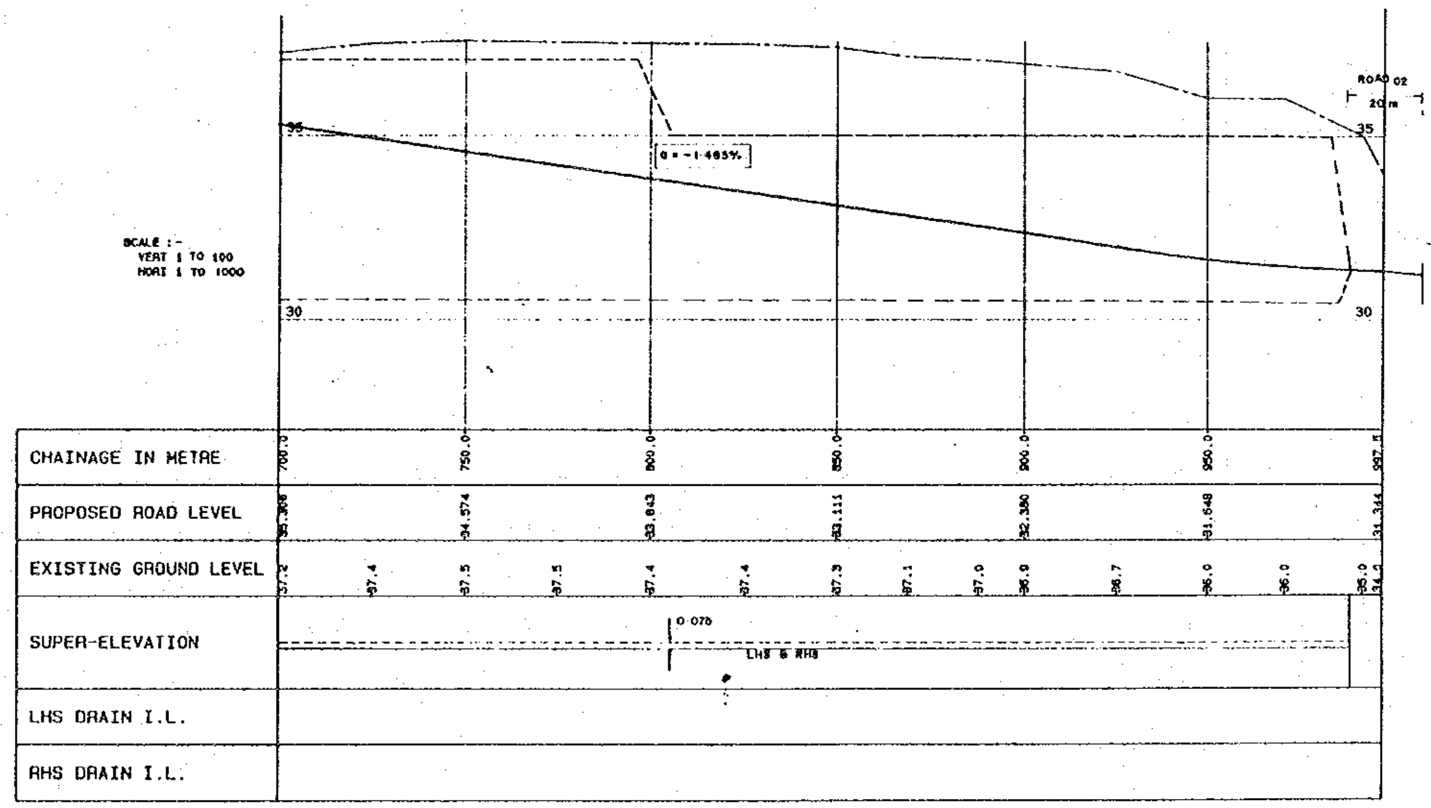
Fig. 2.4.6(1)



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.3

Fig. 2.4.6(2)

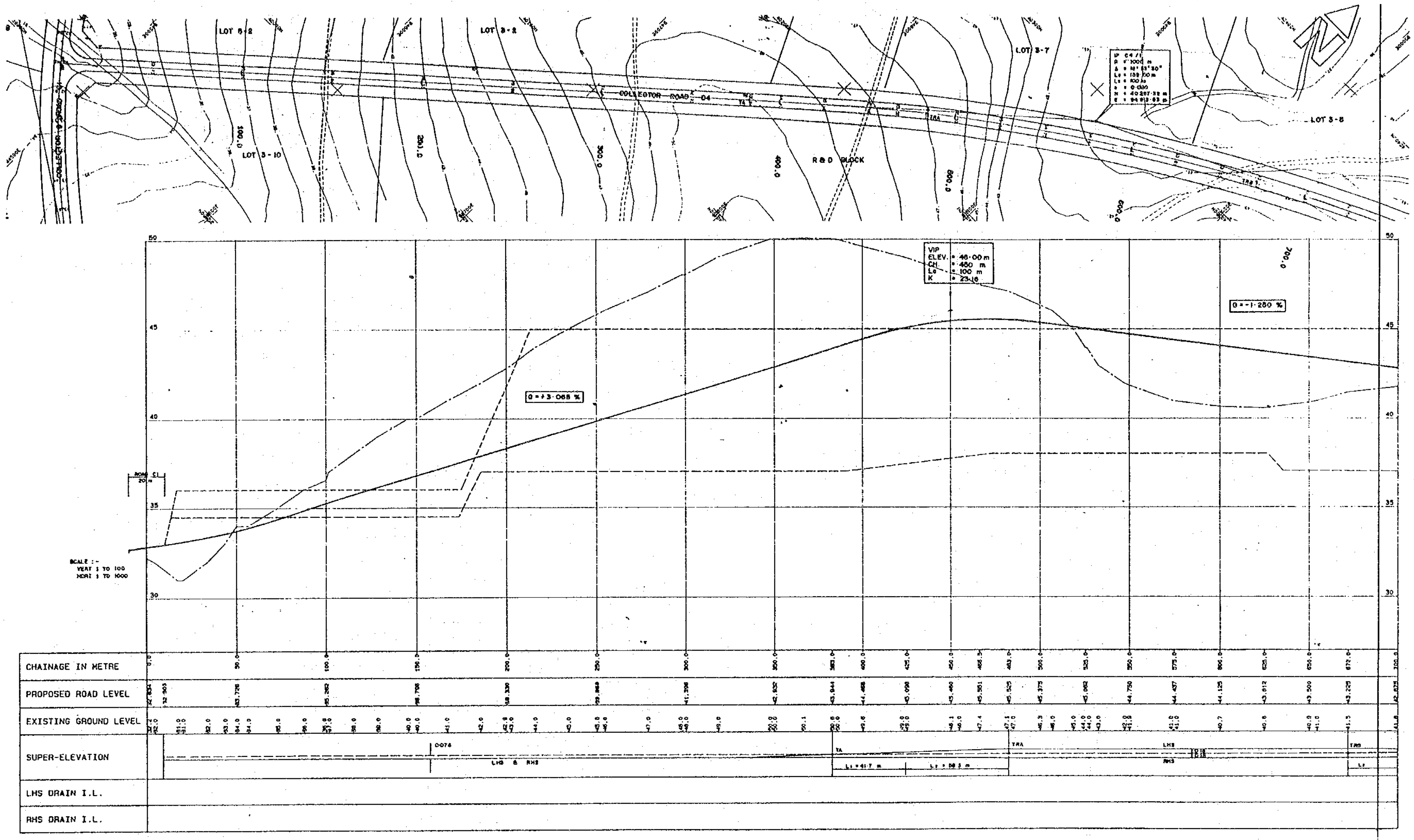




ROAD C3

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.3

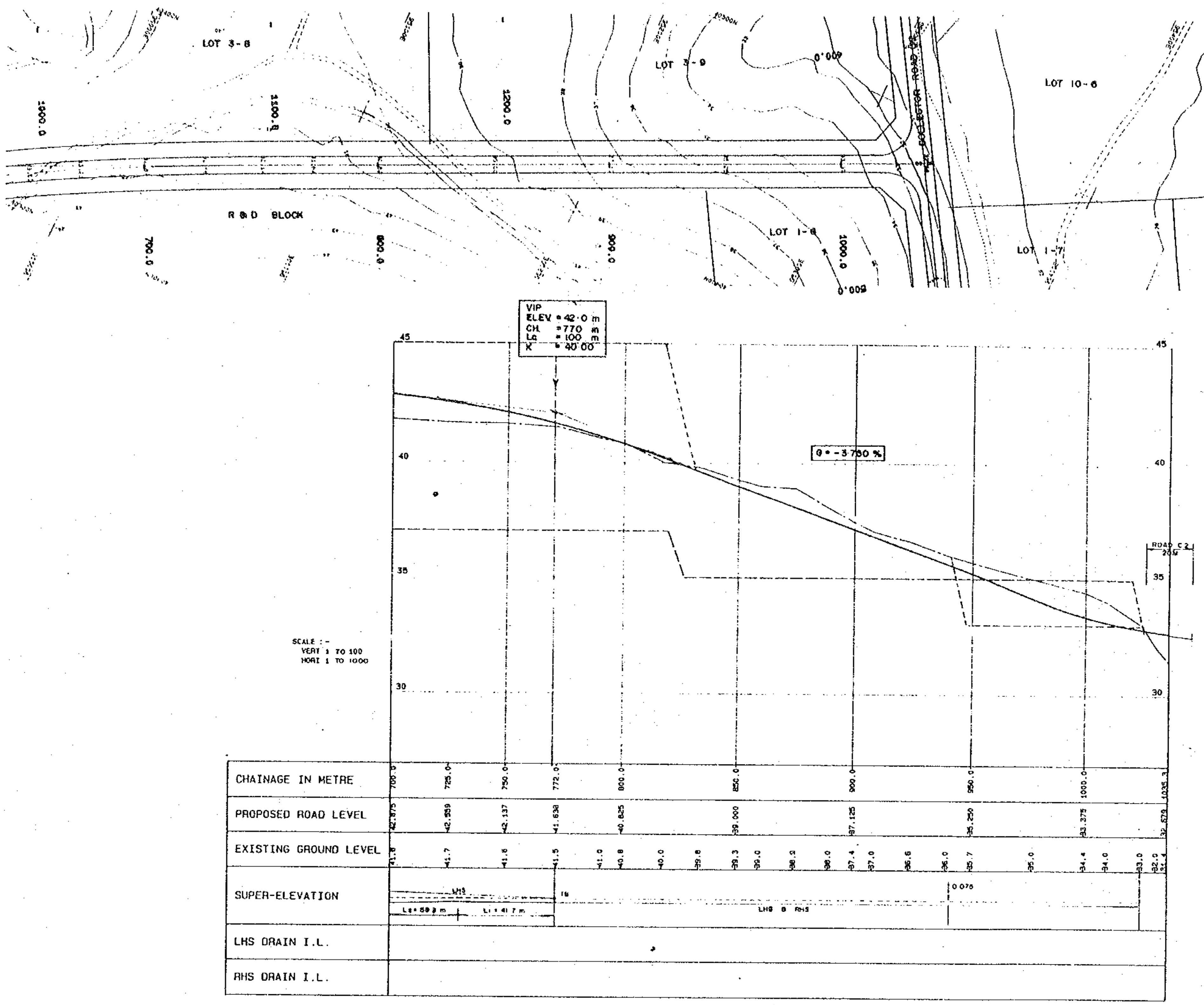
Fig. 2.4.7(1)



ROAD C4

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.4

Fig. 2.4.7(2)



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ALIGNMENT AND PROFILE OF COLLECTOR ROAD NO.4

2.5 Power Supply System

2.5.1 Power Demand

(1) Service area

		1st phase	2nd phase	Total
– Hi-Tech Industrial zone	:	236 ha	110 ha	346 ha
– Urban zone	:	101 ha	28 ha	149 ha
– R & D/Urban zone	:	75 ha	90 ha	165 ha
– Housing zone	:	188 ha	290 ha	478 ha
– Amenity zone	:	100 ha	173 ha	273 ha
– Institutional zone	:	-	37 ha	37 ha
Total	:	700 ha	728 ha	1,448 ha

(2) Power demand forecast for industrial zone in Phase 1

According to the land use plan and categorized load configuration as described above, 135 ha out of 236 ha are applied for the power demand forecast. In addition to the above, power demand for utilities such as lighting, pump station and drainage plant, is also included.

Referring to the past record of power demand of similar high tech industrial estates in Japan, the power demand at the full operation of the factories is about 40 VA/sq.m on average taking into account the demand factor and diversity factor inside each industry. The power demand for the Kulim Hi-Tech Park is forecasted as follows:

Power demand	:	135 ha x 40 VA/m^2 = 54 MVA
Others	:	1 MVA (Treatment Plant 0.3 MVA + Admin. centre 0.1 MVA and others 0.5 MVA)
Total	:	55 MVA

(3) Power demand forecast for industrial zone in Phase 2

By the same computation method, power demand for the industrial zone in Phase 2 is forecasted as follows:

Power demand : 90 ha x 40 VA/m^2 = 39 MVA

(4) Power demand forecast for urban zone in Phase 1

Referring to the past record of power demand of similar industrial parks in Japan, the power demand at the full operation of facilities in urban zone is about 10 VA/sq.m on average taking into account the demand factor and diversity factor inside each facility. The power demand for the urban zone is forecasted as follows:

Power demand : 101 ha x 10 VA = 10 MVA

(5) Power demand forecast for urban zone in Phase 2

By the same computation method, power demand for urban zone in Phase 2 is forecasted as follows:

Power demand : 28 ha x 10 VA = 2.8 MVA

(6) Power demand forecast for housing zone in Phase 1

As indicated in the Progress Report (2) of Master Plan Study, 22,500 of population will live in the Housing Zone, and 7953 households in total for Phase 1 are required in the Housing Zone.

For this purpose, following housing units are to be provided for population living in the housing zone:

Housing Unit	Unit/ha	Type	Area
Low density			
Mixed density	24	Apart./Terrace	145 ha
High density	45	Flats	112 ha

On the other hand, from the recent basic data of TEN the power demand per housing unit is given as follows:

Housing Unit	Unit/ha	Type	Basic Demand
Low density			
Mixed density	24	Apart./Terrace	3 kVA/unit
High density	45	Flats	2 kVA/unit

On the basis of above assumption and data from TEN, power demand for housing zone in Phase 1 is forecasted as follows:

High Density : 72 ha x 2 kVA/unit x 45 unit/ha = 6,840 kVA

Mixed Density : 108 ha x 3 kVA/unit x 24 unit/ha = 7,776 kVA

Total Power Demand in Phase 1 = 14,256 kVA

Say 14.3 MVA

(7) Power demand forecast for housing zone in Phase 2

As indicated in the Master Plan Study, 36,015 of population will live in the Housing Zone, and 9,005 households in total for Phase 2 are required in the Housing Zone.

For this purpose, following housing units are to be provided for population living in the housing zone:

Housing Unit	Unit/ha	Type	Area
Low density	13	Bungalow/semi D.	112 ha
Medium density	20	Terrace house	145 ha
High density	40	Apartment	33 ha

On the other hand, from the recent basic data of TEN the power demand per housing unit is given as follows:

Housing Unit	Unit/ha	Type	Basic Demand
Low density	13	Bungalow/semi D.	4 kVA/unit
Mixed density	20	Terrace house	3 kVA/unit
High density	40	Apartment	3 kVA/unit

On the basis of above assumption and data from TEN, power demand for housing zone in Phase 1 is forecasted as follows:

Low Density : 112 ha x 4 kVA/unit x 13 unit/ha = 5,824 kVA

Medium D. : 145 ha x 3 kVA/unit x 20 unit/ha = 8,700 kVA

High Density : 33 ha x 3 kVA/unit x 40 unit/ha = 4,455 kVA

Total Power Demand in Phase 2 = 18,979 kVA

Say 19 MVA

(8) Power demand forecast for R & D, Amenity, Institutional zones and Utilities in Phase 1

From the Master Plan Study, necessary facilities in Phase 1 are considered and power demands are forecasted as follows:

R & D zone:	Polytechnic	2.0 MVA
	Public R & D	0.5 MVA
Amenity zone:	Golf course	0.5 MVA
	Sports Complex	0.5 MVA
Utilities:	Retention pond	0.5 MVA
	C.T.P.	0.5 MVA
Total power demand in Phase 1		4.5 MVA

(9) Power demand forecast for R & D, Amenity, Institutional zones and Utilities in Phase 2

From the Master Plan Study, necessary facilities in Phase 2 are considered and power demands are forecasted as follows:

R & D zone:	University	4.0 MVA
	Private R & D	0.5 MVA
Amenity zone:	Golf course	1.0 MVA
	Theme park	2.0 MVA
Utilities:	Retention pond	0.5 MVA
	C.T.P.	0.5 MVA
Total power demand in Phase 1		8.5 MVA

(10) Total power demand forecast

As the result of power demand determination for both industrial and other zones in Phase 1 and Phase 2, power demand forecast in this Hi-Tech Industrial Park is summarized in Table 2.5.1 and as explained below.

Referring to the past record of load factor and load pattern of the similar high tech industrial park in Japan and basic data of TEN, the load factor and pattern are as follows:

(a) Daytime load of housing zone in weekday is comparatively low, but night time load is to be high. Load factors are assumed as 0.3 for daytime and 0.8 for night time.

(b) Day and night time load of industrial zone are almost same because 24 hours shifting work is required for the high tech industries. Load factor for industrial zone is assumed as 0.9 for day and night time.

(c) On the other hand, daytime load of urban zone is to be high because commercial center block is included. Night time load is to be low. Load factor of urban zone is assumed as 0.8 for daytime and 0.5 for night time.

(d) Daytime and night time load factors of R & D, Amenity, Institutional zones and Utilities are assumed as follows:

R & D zone: Daytime; 0.6 night time; 0.1
Amenity zone: Daytime; 0.5 night time; 0.6
Institutional zone: Daytime; 0.8 night time; 0.8
Utilities: Daytime; 0.6 night time; 0.4

Total power demand is calculated as follows:

	Phase 1	Phase 2
Industrial Zone	55 MVA	40 MVA
Urban Zone	10 MVA	4 MVA
Housing Zone	14.3 MVA	19 MVA
R & D Zone	2.5 MVA	4.5 MVA
Amenity Zone	1 MVA	3 MVA
Institutional Zone	-	2 MVA
Utilities	1 MVA	1 MVA
Total	83.8 MVA	73.5 MVA
	Say 84 MVA	Say 74 MVA

Therefore, in consideration of 5 % allowance due to distribution loss and voltage drop(TEN's past record), 90 MVA substation for power receiving is recommended for Phase 1 and 90 MVA capacity is augmented in Phase 2. Finally 180 MVA substation is required for the Kulim Hi-Tech Industrial Park.

2.5.2 Basic Plan

This basic plan consists of primary power supply (transmission line), substation and secondary power supply (distribution line).

(1) Transmission line

For transmitting power to the Kulim Hi-Tech Park, construction of new 132kV transmission lines should be done in Phase 1 as explained below.

(a) Construction of a 132kV transmission line between the existing Kulim substation and a new substation

(i) Line voltage : 132kV

(ii) No. of circuit : 2 circuits

(iii) Line length : – Approximately 6km in total, overhead line (Standard of TEN)

(iv) Conductors : ACSR 1c x 3,300mm^2 for overhead line (Standard of TEN) GSW 55mm^2 for overhead earth line

(b) Construction of 132kV transmission line between the TEN's grid substation (Sungai Petani s/s)and new substation

(i) Line voltage : 132kV

(ii) No. of circuit : 2 circuits

(iii) Line length : Approximately 40km in total provided that the line is interconnected with Sungai Petani substation, overhead line

(iv) Conductors : ACSR 300mm^2 for overhead line (Standard of TEN's)
GSW 55mm^2 for overhead earth line

For interconnection of these 132kV transmission lines, expansion of outgoing feeder bay is required at the respective Kulim and Sungai Petani substations.

(2) Substations

The basic design of new substations is given below:

(a) Main substation (132/33/11kV)

(i) Location : At the Administration zone, center point of Phase 1 and Phase 2 electric loads.

(ii) Type : Indoor GIS type (132kV side)

Type of substation is selected for the following reasons:

- avoiding direct lightning strike damage
- environmental harmony
- reduction of manpower for maintenance
- obtaining high security(encased charging point)

(iii) Capacity : 180 MVA on the basis of power demand forecast

- 90 MVA for Phase 1
- 90 MVA for Phase 2

(iv) Arrangement and composition of switchgear

132kV and 33kV bus : double bus
Even in the case of one bus fault, operation can be done using another bus (without long time power stoppage)

33kV and 11kV switchgear : indoor metal-clad type
Easy for operation and maintenance and avoiding direct lightning stroke damage (high reliability) comparing to conventional type switch-gear; and space reduction.

132kV protective relaying system (See Remarks)	:	Pilot wire relaying system between Kulim substation and new substation, and directional distance relaying based on distance relay with three zone protection by PLC between Sungai Petani substation and new substation. High speed reclosing function should be supported for power system stability.
SCADA	:	Provision only should be done.
(v) Power Transformer	:	Outdoor oil immersed type Transformer with fire protection wall and on-load tap changing equipment for line voltage drop compensation.

45 MVA (2 sets) in Phase 1 and 45 MVA (2 sets) in Phase 2 are by TEN's Policy.

(Remarks):

There are many methods for enhancing the stability of power system. In general, the following methods are taken for power system:

(a) Insertion of a series of condenser to the power line

(b) Insertion of dynamic breaking resistors to power line near power stations

(c) Adoption of super high speed power system stabilizer (PSS) for generators (high speed control of generator voltage)

(d) Adoption of high speed valve control for steam turbine

(e) Adoption of high speed trip of transmission line fault

In this project, only item (e) can be applied for enhancing stability of power transmission line. For realization of this matter, protection scheme shall be of high speed type as mentioned therein.

---

(3) Distribution line

On the basis of TEN's policy and specific requirements coming from high-tech industries, 33kV and 11kV distribution lines are planned as follows:

(a) 33kV distribution line

From the power demand forecast, there are six consumers exceeding 4MVA receiving capacity in Phase 1. Power for these consumers is supplied by 33kV distribution line. In order to secure a reliable power supply and to increase the line capacity, a 33kV distribution line is so designed that the line is connected in a ring formation and arranged by means of double circuits. One circuit of 33kV line should not be loaded above 15MVA because of power sending capacity of power cable, voltage drop compensation and effect due to fault.

In addition to the above, automatic line sectionalizer should be arranged at the respective consumers on the line to avoid long time power stoppage of the line and to minimize the power stoppage section.

Based on the above, major features of the 33kV distribution lines are summarized as follows:

(i)	Line voltage	:	33 kV
(ii)	No. of line	:	12 lines at main substation (Phase 1) 12 lines at distribution substation (Phase 1) 4 lines at main substation (Phase 2) 8 lines at distribution substation (Phase 2)
(iii)	Conductor	:	33kV XLPE 1c x 3,300 mm^2 (Standard of TEN, but the size will be determined in detailed design stage)
(iv)	Operation system	:	Low speed autoclosing system (See remarks)

(Remarks):

The Automatic Power Distribution System is one of the most important kernels in history. High and low voltage automatic and manual switches are the supporting devices for it.

Those switches have changed and become sophisticated with time. Automatic fault-section detecting apparatus, snapped-wire detecting apparatus and automatic supervisory voice announcing apparatus utilizing telephone line play a certain part of the automatic power distribution system.

The Power Distribution System (PDS) consists of a automatic line sectionalizer and controller, which divides the distribution line into several sections, and a circuit breaker at the substation. In case of trouble, PDS detects and isolates the troubled section automatically as soon as possible. Therefore, PDS can minimize the power stoppage section and time till power re-supply.

PDS can be operated with the Telemetering System (TM), Supervisory System (SV) and Mini-Computer System (Mini-Com). TM and SV pick up necessary information in the substation (feeder current, bank voltage, bank current, monitoring the CB operation and protection relays). Mini-Com is utilized to control the switches and the remote terminals, and gives the condition of switches operation geographic informations, diagram of the distribution network, trouble section and line condition.

The following two kinds of control methods can be utilized for the system.

Pulse Code Signal	:	This method, using 2 signal lines, is suitable for controlling many pole switches in a limited area, such as urban area.
Ripple Signal	:	This method is to transmit the control signals through high voltage (33 kV) power distribution lines without any control cable. This method is suitable for controlling many pole switches which are dispersed in a wider area, such as suburban area.

The above two methods have the following advantages.

- Quick on/off operation of pole switches

(Enhancement of the supply reliability)

- Although the failing point remains to be recovered manually, the switch does not need manual operation in most cases. This is especially effective on large-scale power failure.
- Efficient utilization of the facilities according to the load conditions can be considered.
- Information about management of power load planning becomes available.

Consequently, ripple signal system for control of the system is applied for the Kulim Hi-Tech Park because of reduced control cable construction and easy operation and maintenance.

(b) 11kV distribution line

11kV distribution line is designed for power supply to consumers of 4MW or less receiving capacity. For the same reasons mentioned above (a), automatic line sectionalizer is also arranged at the respective consumers for automatic power distribution system. In order to secure reliable power supply to the consumers, double circuits and ring connection formation should also be made on the 11kV distribution line.

The major features of the 11kV distribution lines are summarized as follows:

(i)	Line voltage	:	11 kV
(ii)	No. of lines	:	12 lines at main substation (Phase 1) 32 lines at distribution substations (Phase 1) 0 line at main substation (Phase 2) 26 lines at distribution substation (Phase 2)
(iii)	Conductor	:	11kV XLPE 1c x 3,300 mm^2 or 180mm^2 (Standard of TEN, but the size will be determined in the detailed design stage)
(iv)	Operation system	:	Low speed autoclosing system (Refer to 33kV control system)

2.5.3 Implementation Plan

Taking into account the tight schedule for implementation and the funds available, this report explains a basic plan adequate for the urgent completion of transmission, substation, and distribution network for the Kulim Hi-Tech Park. A stage-wise method is taken up for the implementation of the power supply system.

In case the available funds do not allow implementation of these works as scheduled and or construction period is not sufficient taking normal contractual procedures, a part of the works may be delayed. However, the total system should not be reduced.

The work to be implemented within the target date under limited available funds should be done to the priority given by the Government in the following order for the Kulim Hi-Tech Park, where

(a) the interconnection between substation or lines is required for delivery of power from the TEN's Grid for reliable and stable power supply to the important demand in the Park,

(b) the power supply expected in 1993 will be made by reliable distribution network through newly constructed substation in the Park. Distribution lines will be constructed by stage wise method.

Geographically, the development to be made under Phase 1 is located at the northern part of the project site and power demand is concentrated in the industrial areas. As the power demand of more than nine tenth in the Kulim Hi-Tech Park is in Industrial areas, the basic plan for power supply is made emphasizing on these areas.

An ordinary conceivable time schedule would be as follows, even when planned on an urgent implementation basis:

Detailed design and tender document	January, 1992 (start)
Tender call	2 months
Tender evaluation and contract awarding	2 months
Manufacturing land shipment of material	8 months
Overseas and inland transport	2 months
Site erection	6 months
Total	22 months

Therefore, even if the detailed design is started in the beginning of February 1992, the completion date will be the end of May 1992 at the latest. The completion is actually required much earlier than this date.

The total time requirement by the contractor, namely from contract awarding to work completion, is estimated at 16 months in the above schedule. Although this estimate seems very tight, it is assumed that this time requirement may be shortened by one month for site erection. The total requirement for construction is thus 15 months.

The conceivable steps of extra-ordinary procedure other than the said above are as follows:-

(1) Immediately after the funds are available for the project, the tender call should be made to selected Tenderers.

(2) A tender is called for selected Tenderers at the beginning of January, 1992, giving 10 days for presentation of offers and 20 days for estimation, and the selection of successful tenderers is to be made within one month by the Employer based on a simple but substantial evaluation of tenders (eliminating non-substantial documentation and comparison tables). Within one month thereafter, the Employer is to issue a Award of Contract to the selected tenderer, so that the Contractor may commence fabrication of materials immediately. The formal contract agreement will be made within a month from the issue of Award of Contract.

    Thus, the Contractor may start his work from the beginning of the 3rd month, and ship the first lot of goods by the middle/end of the 8th month.

    The civil and building construction work will be commenced upon contract signing and the site erection work will be commenced upon arrival of the first lot of goods from the middle of the 10th month, although preparatory works will begin at the end of the 2nd month after the Tender call. The procurement of distribution line materials and equipment will be commenced from the 5th month, because the Contractor of the substation is selected in the 4th month. After 6 months for manufacturing, site erection work will be commenced for coming consumers in order.

2.6 Water Supply System

2.6.1 Design Criteria & Standards

Design criteria and standards are published in three volumes by the Water Supplies Branch, PWD in 1989 and 1990. The contents are listed as follows:

Volume 1	:	Section 1 Feasibility Study
	:	Section 2 Design Low Flow estimation
	:	Section 3 Water Quality
	:	Section 4 Ground Water Investigation
	:	Section 5 Water Demand
	:	Section 6 Water Treatment Process
Volume 2	:	Section 7 Intake Works
	:	Section 8 Aerators and Mixing Devices
	:	Section 9 Flocculation and Sedimentation Tanks
	:	Section 10 Filters
	:	Section 11 Treatment Plant Layout
	:	Section 12 Mechanical Equipment and Installations
	:	Section 13 Electrical Equipment and Installations
Volume 3	:	Section 14 Water Distribution Systems
	:	Section 15 Storage Tanks and Reservoirs
	:	Section 16 Water Supply Plumbing Systems
	:	Appendix Explanatory Handbook on the water Supply Rules

2.6.2 Design Conditions

(1) Unit consumption rate

Unit consumption rates as shown below are adopted from Japanese and Malaysian standards and recommended to be reviewed by collecting related data as much as possible for water supply projects in Malaysia.

Table 2.6.1 Unit Consumption Rate

Per capita consumption	:	320 lcd	Golf course	:	
Employee in Factory	:	160 lcd	Tennis courts	:	160 lcd
Public R&D institute	:	80 lcd	Football stadium	:	13,620 l/d
Science Technology Exchange Plaza	:	80 lcd	Gymnasium	:	120 lcd
			Hotels	:	1,430 lcd
Skill Development Center	:	80 lcd	Condominium	:	1,135 l/unit/d
			Bungalow	:	2,270 l/unit/d
Community hall	:	500 l/d	Semi-detached/double storey terrace house	:	1,590 l/unit/d
Religious Institutions	:	4,540 l/d			
Police station	:	160 lcd	Low cost house	:	1,135 l/unit/d
Police box	:	160 lcd			
Fire station	:	160 lcd	Shophouses (1 storey)	:	2,270 l/unit/d
Post office	:	160 lcd	Shophouses (2 storey)	:	2,730 l/unit/d
Schools	:	45 lcd	Shophouses (3 storey)	:	4,090 l/unit/d
Kindergarten	:	45 lcd	Shophouses (4 storey)	:	4,550 l/unit/d
Super market	:	4,550 l/d			
Restaurant	:	64 lcd			
Banks	:	120 lcd			
Clinic	:	160 lcd			

(2) Water demand projection for the whole Park

Water demand of the first phase Industrial Zone was estimated by the JICA Study Team and those of the other zones were estimated by the Malaysian Master Plan study team. In accordance with the agreed minutes of technical committee meeting on 21st January 1992, these demands were modified from the Draft Final Report as shown below.

1) Water demand estimated by the JICA Study Team

(a) First Phase Industrial Zone

Industrial water demand	:	24,745 m^3/d (ref. Table 2.6.2)
Employee Served	:	12,540 (ref. Table 2.6.2)
Per capita consumption	:	160 lcd (=320/24 x 12)
Service factor	:	1.0
Domestic water demand	:	2,006 m^3/d
Administration Centre	:	371 m^3/d

Public R & D institutes	:	250 m^3/d
Total	:	27,372 m^3/d (1st phase)

2) Water demand estimated by the Master Plan study team

(a) Second Phase Industrial Zone

Industrial water demand	:	10,397 m^3/d
Employee Served	:	10,856
Domestic water demand	:	1,737 m^3/d
Total	:	12,134 m^3/d (2nd phase)

(b) R & D/Urban Zone

Town centre	:	873 m^3/d
Government use	:	809 m^3/d
University	:	1,600 m^3/d
Polytechnic	:	400 m^3/d
R & D institute	:	400 m^3/d
Total	:	4,082 m^3/d

(c) Housing Zone

High density units	:	7,235 m^3/d
Shophouses	:	651 m^3/d
Medium density units	:	10,317 m^3/d
Shophouses	:	449 m^3/d
Low density units	:	2,994 m^3/d
Shophouses	:	95 m^3/d
Total	:	21,741 m^3/d

(d) Amenity Zone

Golf club	:	90 m^3/d
Sport complex	:	843 m^3/d
Theme park	:	2,056m^3/d
Total	:	2,989 m^3/d

3) Total water demand : 68,318 m^3/d

4) Unaccounted for water : 15%

5) Water requirement from JKR water supply system : 80,400 m^3/d = 68,318/(1-0.15)

Breakdown is presented in Tables 2.6.2 and 2.6.3.

2.6.3 Basic Design

Basic design values were also modified from the Draft Final Report taking into account the modified water demands. Hydraulic calculation of the distribution trunk main is as shown in Table 2.6.4. The pipe diameter is determined based on the result of flow net calculation.

The summary of water supply system is as follows:

<u>Service Reservoirs</u>

R1 Reservoir

Location	:	on Bukit Jelutong
Service area	:	R&D/Urban, Housing and Amenity Zones
Design capacity	:	33,900 m^3 = (4,082+21,741+2,989)/.85
Area	:	5,600 m^2 (43 m x 43 m x 3 units)
High Water Level	:	295 ft. (90 m)
Low Water Level	:	275 ft. (84 m)
Design discharge to service area	:	4,238 m^3/h = (4,082+21,741+2,989)/.85 x 1.2 x 2.5/24

R2 Reservoir

Location	:	on the hill in the 2nd phase Industrial Zone
Service Area	:	1st phase Industrial Zone
Design capacity	:	32,000 m^3 = 27,372/.85
Area	:	5,400 m^2 (49 m x 55 m x 2 units)
High Water Level	:	230 ft. (71 m)
Low Water Level	:	213 ft. (65 m)
Design discharge to service area	:	4,025 m^3/h = 27,372/.85 x 1.2 x 2.5/24

R3 Reservoir

Location	:	on the hill in 2nd phase Industrial Zone
Service Area	:	2nd phase Industrial Zone

Design capacity	:	14,000 m^3 = 12,134/.85
Area	:	2,400 m^2 (40 m x 30 m x 2 units)
Design discharge	:	1,784 m^3/h
to service area		= 12,134/.85 x 1.2 x 2.5/24

Distribution trunk main

Location	:	from R1 to R2
Design discharge	:	0.645 m^3/s = (4,025+1,784)/2.5/3,600
Length	:	3,940 m
Material	:	steel pipe
Diameter	:	750 mm

Distribution network

Location	:	1st phase Industrial Zone
Material	:	steel pipe, uPVC or high density poly-ethylene pipe

Table 2.6.2 Water Demand of Model Plant

	Products	Production	Site Area (m^2)	Floor Area (m^2)	Employee	Industrial Water Supply (m^3/d)	Industrial Water Recycle (m^3/d)	Industrial Water Total (m^3/d)	Domestic Water (m^3/d)
1	LSI	80 x 10^6 Pcs/Mt	200,000		2,500	15,900	4,100	20,000	400
2	Personal Computer	90,000 Pcs/Mt	100,000	20,000	700	160	40	200	112
3	Color TV	60,000 Units/Mt	200,000	80,000	2,000	500	100	600	320
4	NC Machine Tool	100 Pcs/Mt	50,000	10,000	140	10		10	22.4
5	Magnetic Disc Drive	20,000 Pcs/Mt	150,000	15,000	600	200	200	400	96
6	Bearing	10 x 10^6 Pcs/Mt	100,000	25,000	400	35		35	64
7	Magnetic Head	120,000 Pcs/day	15,000	5,000	400	60	70	130	64
8	Printed Circuit Board	70 x 10^6 ¥/Mt	3,000	750	60				9.6
9	Compact Disk	1,000 Pcs/Mt	10,000	2,500	160	45	20	65	25.6
10	Connector	10 x 10^6 ¥/Mt	100,000	15,500	350	100	90	190	56
11	Plastic Form		3,000	1,000	70	30	120	150	11.2
12	VTR	25 Unit/Mt	100,000	35,000	550	250	50	300	88
13	LCD(excl. Assemble) 200x250mm	100,000 Pcs/Mt	5,000	2,300	150	50		50	24
14	LCD(excl. Assemble) 200x250mm	100,000 Pcs/Mt	5,000	2,300	150	50		50	24
15	Other Supporting Industries				4,310	7,355		7,355	689.6
	Total		104 (ha)	21 (ha)	12,540	24,745	4,790	29,535	2,006

Table 2.6.3: Water Demand For Kullm Hi-Tech Industrial Park.

Item	Density Category	Unit Type	No. of Unit	Unit Demand m^3/Unit/Day	Water Demand m^3/Day	Remarks
1.	High	LC	3,262	1.135	3,702.37	LC:Low Cost
		SH	109	3.41	371.69	SH:Shophouse
2.	UZ	GU			808.80	UZ:Urban Zone GU:Government Use
3.	Medium	SD	2,024	1.59	3,218.16	SD:Semi-Detached
		SH	67	3.41	228.47	
4.	Medium	SD	867	1.59	1,378.53	
5.		SH	867	1.59	1,378.53	
6.	High	LC	2,446	1.135	2,776.21	
		SH	82	3.41	279.62	
7.	Medium	SD	1,221	1.59	1,941.39	
		SH	40	3.41	136.40	
8.	High	LC	667	1.135	757.05	
9.	Low	B	252	2.27	572.04	B:Bungalow
		B	222	2.27	503.94	
		GC			45.46	GC:Golf Couerc
10.		U	20,000	0.08	1,600.00	U:University
11.		PI	5,000	0.08	400.00	PI:Polytechnic
12.		R&D	5,000	0.08	400.00	
13.		GC			45.46	
14.	Medium	SD	1,638	1.59	2,604.42	
15.	Medium	SD	739	1.59	1,175.01	
		SH	25	3.41	85.25	
16.	Low	B	534	2.27	1,212.18	
		SH	18	3.41	61.38	
17.	Low	B	311	2.27	705.97	
		SH	10	3.41	34.10	
18.		TP			2,055.70	TP:Theme Park
19.		SC			842.50	SC:Sport Complex
					28,815.06	

Souurce : Table 7.12 in the Progress Report 2 of the Master Plan Study for Kulim Hi-Tech Industrial Park, January 1992.

Table 2.6.4 Hydraulic Calculation of Distribution Pipe

*** HEAD LOSS CALCULATION IN PIPES ***

********** INPUT DATA ***********		************* RESULTS ************			
* Project :	KULIM HI-TECH PARK				
* Section :	R1 to R2 (R3)	* Upstream LWL	=	83.82 m	*
* Upstream LWL :	83.82 m	* Total head loss	=	12.929 m	*
* Pipe Length :	3,941 m	* Other head losses	=	0.608 m	*
* Pipe Diamete :	0.75 m	* Downstream WL *			*
* Design Flow :	0.65 m3/s	* Calculated HWL	=	70.891 m	*
* Downstream WL:	70.104 m	* Design HWL	=	70.104 m	*
*	Required pump head to maintain design flow =			-0.787 m	*

Velocity V : 1.471 m/s

V^2/2g = 0.1104 m

Reduction of C Value of H-W eq.

C value reduction = 0.8 ** INPUT DATA **

Selection of C Value

Pipe Material	C Value	
New cast iron pipe (unlined)	130	
Average used cast iron pipe	100	
Steel, riveted joints, coated	110	
Old steel, riveted joints, coated	90	
Steel, welded jt, coated or lined	140	Selected
Wood stave	130	
Plastic	130	
Other	?	

Selected C = 140 <== INPUT DATA

Adjusted C = 112

Friction loss for the Section = 12.321 m

Number of valves, bends, joints etc. ** INPUT DATA **

Element	K Value	Number	Loss(m)
90 ELBOW, standard	1	2	0.221
90 ELBOW, long	0.6		0.000
45 ELBOW	0.2	2	0.044
22.5 ELBOW	0.15		0.000
Venturimeter	0.14		0.000
Y branch	1	1	0.110
Entrance, flush	0.5		0.000
Entrance, projecting	1	1	0.110
Entrance, rounded	0.05		0.000
TEE into force main K=0.5~1.2	1		0.000
Inflow TEEs along force main	0.5		0.000
Outflow TEEs along force main	0.1		0.000
TEE from force main K=1~1.5	1.2		0.000
Full open gate valve	0.12	1	0.013
Full open butterfly valve	0.25		0.000
Check valve	2		0.000
Expansion cone (Enter K)	1		0.000
Reducer (Enter K)			0.000
Exit	1	1	0.110
Others			0.000
TOTAL LOSS			0.608 m

2.7 Telecommunication System

2.7.1 Demand Forecast of Telephone Lines

(1) Data on telephone lines by industrial estate in Kedah

Table 2.7.1 Telephone lines for the Industrial Estates in Kedah

Name of I/E	Provided Line a	Lines in Use b	Factories in Operation c	Area in Operation (ha) d	Employee e
A	1,820	654	91	22	1,400
B	581	187	58	137	18,300
C	199	40	16	28	2,600
D	222	100	46	107	26,900
Total	2,822	981	211	294	49,200

(Source : KEDAH STATE)

(a) Relation between provided lines and lines in use

Fig. 2.7.1 shows the relation between provided telephone lines and telephone lines in use in four industrial estates in Kedah. From the figure we find capacity in cable pairs is enough, about a three to one ratio of provided lines/lines in use as follows:

(a)/(b) = 2,822/981 = 2.9 (a), (b) from Table 2.7.1

(b) Mean value of demand factor

Other demand factors are calculated from Table 2.7.1 as follows:

Provided lines/ha	=	(a)/(d)	= 9.7
Provided lines/factory	=	(a)/(c)	= 13.3
Provided lines/100 Employees	=	(a)/(e) x 100	= 5.7

(2) Data of telephone lines in individual factories

The data of individual factory bases is shown in Fig. 2.7.2 and Fig 2.7.3. This data was collected by hearing from some Hi-Tech factories in industrial estates in Malaysia.

(a) Fig. 2.7.2 is relation between the number of employee and number of telephone lines of each factory. The distribution of data shows that the relation is different by the kind of factory. In Fig. 2.7.2, three lines indicate three kinds of factory group. The number of lines increase with the increase of employees in each group.

(b) Fig. 2.7.3 shows the relation between the area (ha) of each factory and lines per unit area (1 ha) of each factory. This figure indicates that lines/ha decreases with the increase of the factory area.

The line in the Fig. 2.7.3 is assumed demand factor (lines/ha/factory to ha/factory).

(3) Calculation process of telephone demand

Table 2.7.2 indicates the calculation process of telephone demand for 1,450 ha including housing zone and Phase 2. On the Table 2.7.2 the figures on columns of Phase 1 and Phase 2 are the quantity of each item.

The figures on column of demand factor in the Table are assumed as follows:

(a) Factory Area : (ref. Figs. 2.7.2 and 2.7.3)

- Number of factory : 20 lines/factory
- Width of area : 5 lines/ha
- Number of employee : 10 lines/100 employee
- Lot of Land : 10 ha = 50 lines, 5 ha = 40 lines, 3 ha and 1 ha = 30 lines

(b) Housing Zone

		Number of houses	Number of inhabitant
– bungalow type	:	2 lines/house	0.3 lines/inhabitant
– semi-detached type	:	1 lines/house	0.2 lines/inhabitant
– low-cost type	:	0.5 lines/house	0.3 lines/inhabitant

(c) Others : Administration centre, city centre, school, etc.

- Demand Factor : 0.1 ~ 0.7/person (shown in Table 2.7.2)

2.7.2 Demand Forecast of Toll Traffic

(1) Calling rate

Forecasting the traffic, the number of subscribers should be separated into a high calling rate group as Industry Zone subscribers and low group as Housing Zone subscribers as follows:

Industry Zone : 0.20 Erlang
Housing Zone : 0.05 Erlang

(2) Toll traffic ratio

Toll traffic is the flow to/from outside of the local area, and the toll traffic ratio, (toll traffic)/(total traffic), is as follows:

Industry Zone : 70 %
Housing Zone : 30 %

(3) Toll traffic

The toll traffic via trunk circuit is calculated as follows:

Year	1993	1998	2003	
toll traffic	210	310	470	unit : Erlang

2.7.3 Demand for Other Telecommunication Services

(1) Telex

The number of telex subscribers is decreasing by absorption of new services.

(2) Telefax

The demand is included in demand for telephones.

(3) Maypac, Maysis, Datel

There is a rapidly increasing demand for data transmission. Maypac is the most important system for computer communication, so service should be provided from initial stage of Phase 1.

(4) Leased Circuit

IBS (Intelsat Business Service) is one of the leased circuit services using satellite telecommunication provided by STM.

The service will be required from the initial stage for the Industrial Estate. A demand survey should be taken for the factories who want to come this Estate.

(5) Car telephone

The subscribers of car telephones as ATUR 550 by STM is increasing rapidly, and presently numbers 54,000 which is about 5 % of telephone subscribers is on service. The initial service for Kulim Hi-Tech Industrial Park will be provided by the existing system.

(Note) Public Telephone : The ratio is less than 2 % of the total number of telephones. The demand is included in the overall telephone demand.

2.7.4 Basic Design of Duct

(1) Demand and cable pair for Industry Zone

Number of cable pairs is 1.4 times of 2003 year demand. Demand forecast and cable pair for each area are as follows:

Phase 1 Industry Zone

Area of lot	No. of lot	Demand/lot	Cable Pair/lot
10 ha	6	50	70
5 ha	7	40	60
3 ha	10	30	50
1 ha	10	30	40
Admi. & City centre	1	240	300

(2) Basic Design of duct for whole area (1,450 ha)

Fig. 2.7.4 and 2.7.5 are the cable Pair Distribution Plan and Primary cable Plan respectively, and these introduce the Duct Plan which is shown in Fig. 2.7.6.

2.7.5 Teleport

(1) Overview of teleport

(a) Current situation of teleport

- The teleport is a combination of "Installation of Telecommunication Infrastructure" and "Real Estate"
- Since society is changing form an era where "goods" move around in one where "data" moves, the teleport is now added as the third type of port after seaports and airports.
- Since the teleport was born in New York in 1982, it has been spreading in North America and to Europe and Japan.
- There are 50 or more teleport projects in the world. About 10 of them are in service. Most of them are located in North America and some are in service in Japan and the Asian Pacific region.

(b) Activity of WTA (World Teleport Association)

This is an international voluntary organization established for encouragement and promotion of teleports. It was founded in 1985. The WTA has its headquarters in New York and has a membership of 124 or more organizations. This organization has five regional associations: Asia, Africa/Middle East, Europe, North America and Latin America. The Asian members include Hong Kong, Taiwan, Republic of Korea, Australia, and Japan.

(2) Definition and role of Teleport

(a) Definition

The World Teleport Association defines teleport as follows:

"An access facility to satellite or other long haul telecommunications media incorporating a distribution network serving the greater regional community and often associated with a related real estate or other economic development".

(b) Basic Constituent Elements

The basic element which constitute a teleport are:

- Long-distance communication media (satellite communication and optical fiber, etc.)

- Local info-communication network (LAN and intelligent buildings, etc.)

- Local development project (urban re-development, etc.)

(c) Role played by Teleport

- In the midst of environments where basic telecommunication networks are already installed, they coordinate high-level, versatile, and low cost service needs

- Since access to information serves as a life for the development of every enterprise and city, they contribute to the re-development of cities and development of specified areas by the installation of the info-communication infrastructure.

(3) Example : Tokyo Teleport

- LAN : Optical Fiber Local Area Network in the Area

- Telecom-Centre building

Telecommunication equipment (Exchange, Transmission equipment, etc.) and following function and equipment.

- Satellite earth station

- Common use facility : TV conference room, exhibition and experience room, etc.

- Urban management : Security management, Automatic metering of electricity, gas, water, etc.

- CATV

Table 2.7.2 Calculation Process of Total Demand

	Phase 1	Phase 2	Demand Factor
1. Industry Zone			
(1) Factory Area			
(a) Factory	64	28	20
(b) Area (ha)	259	110	5
(c) Employee	12,840	5,500	10/100
(d) Lot of Land			
10 ha	6		50
5 ha	7		40
3 ha and 1 ha	20		30
Total	33	15	36
(2) Employees of Administration Center			
– administration core	100		0.7
– Public R & D Institute, Skill Development Centre, etc.	200		0.2
2. R & D/Urban Zone			
(1) Employees of City Centre			
– office building	500		0.7
– shopping center	50		0.7
(2) Employees of R & D			
– university	130		0.7
– private R & D Institute		100	0.7
3. Housing Zone			
(1) House			
(a) Number of House			
– bungalow type	300	130	2
– semi-detached type	2,520	1,040	1
– low-cost type	3,460	1,470	0.5
(b) Number of Inhabitant			
– bungalow type	1,740	780	0.3
– semi-detached type	14,620	6,030	0.2
– low-cost type	5,450	3,530	0.3
(2) Employees of School			
– 4 kindergarten	40	10	0.2
– 4 primary school	120	30	0.2
– 2 secondary school	60	30	0.2
– 1 high school	30	30	0.2
– 1 international	50		
(3) Employees of Community	165	55	0.7
– 3 supermarket			
– 6 restaurant			
– 2 post office, etc.			
4. Amenity Zone			
– Golf Club house	5		0.1
– Sport facilities	25		0.1

[Note of Table 2.7.2]

(i) Telephone demand for factories

Total demand for the Factory Area is determined from the results of 4 different ways of estimation given below. 1,200 subscribers were selected for Phase 1 and 600 for Phase 2.

Basis	Phase 1	Phase 2
– Number of factory	1,280	560
– Area (ha)	1,250	550
– Workers	1,280	550
– Land Lot	1,180	540
Selected	1,200	600

ii) Telephone demand for houses

Total demand for the houses is determined from the results of 2 different ways of estimation given below. 5,000 subscribers were selected for Phase 1 and 2,200 for Phase 2.

	Phase 1	Phase 2
a) Houses		
– bungalow type	600	260
– semi-detached type	2,520	1,040
– low-cost type	1,730	735
Total	4,850	2,035
b) Residents		
– bungalow type	520	240
– semi-detached type	2,200	1,210
– low-cost type	1,640	1,060
Total	4,360	2,500
Selected	5,000	2,200

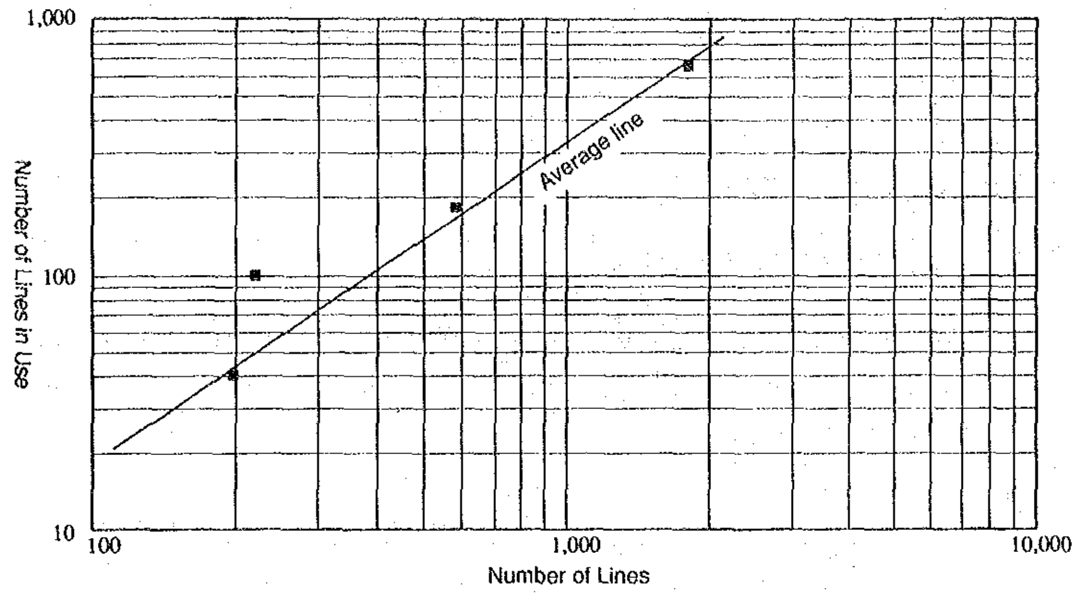


Fig. 2.7.1 Relationship between Telephone Lines and Lines in Use

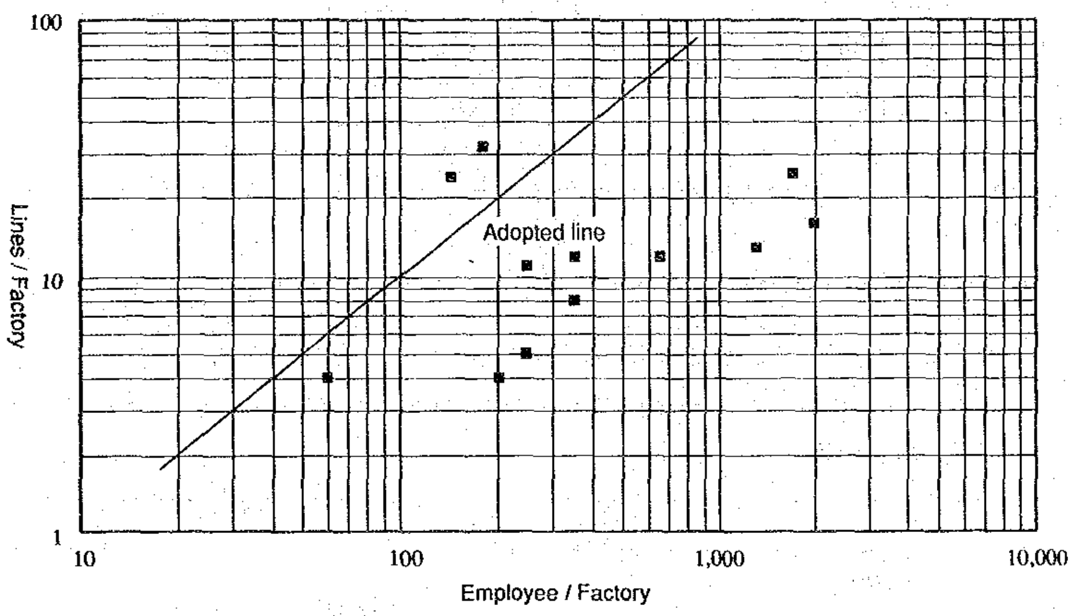


Fig. 2.7.2 Relationship among Telephone lines, Employees and Factory

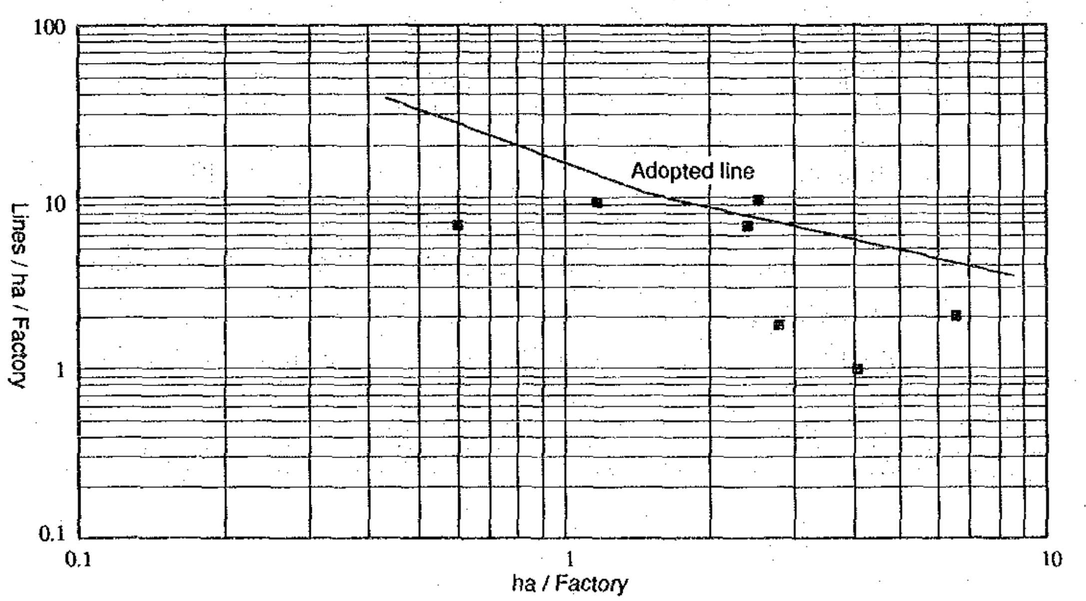
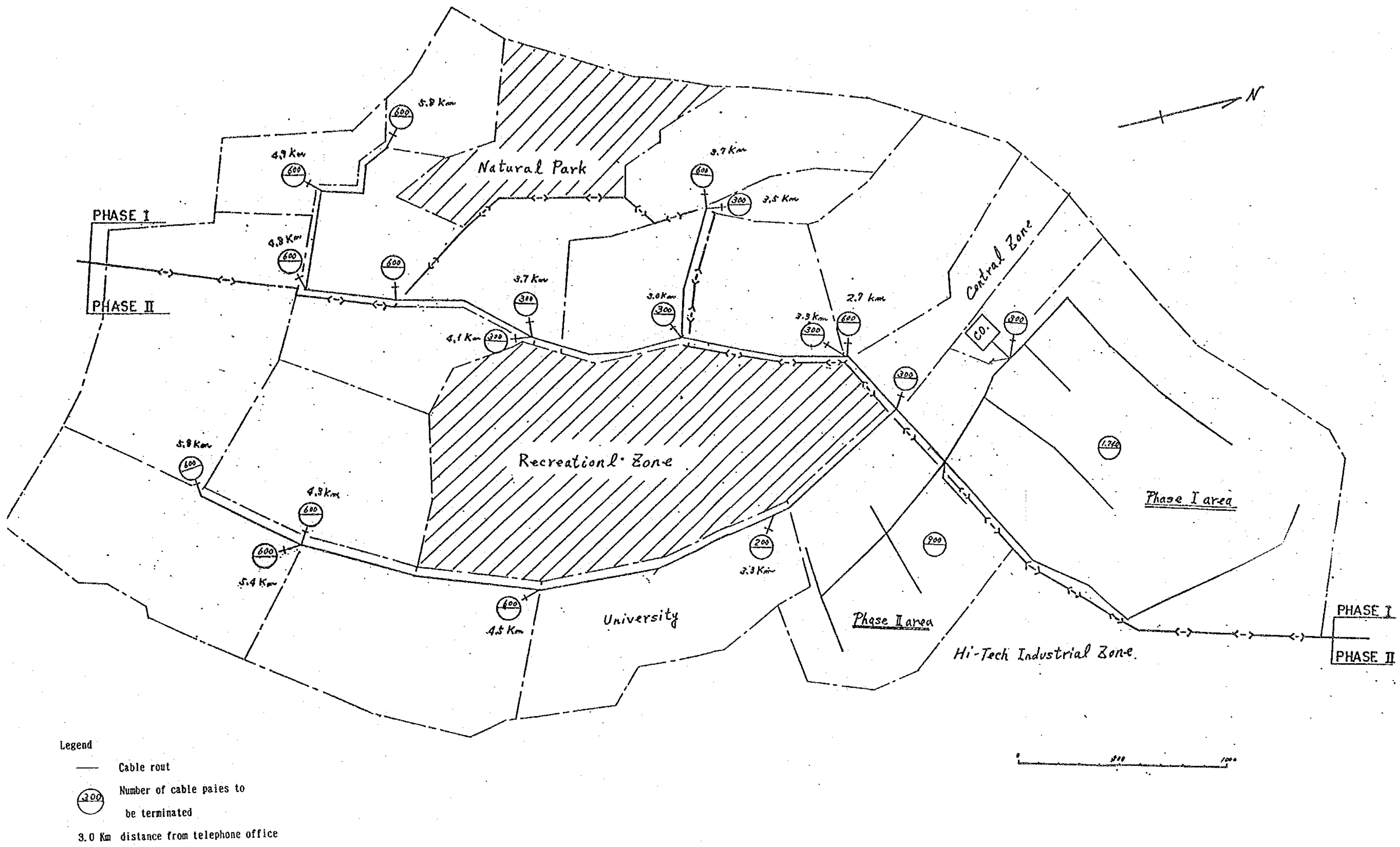


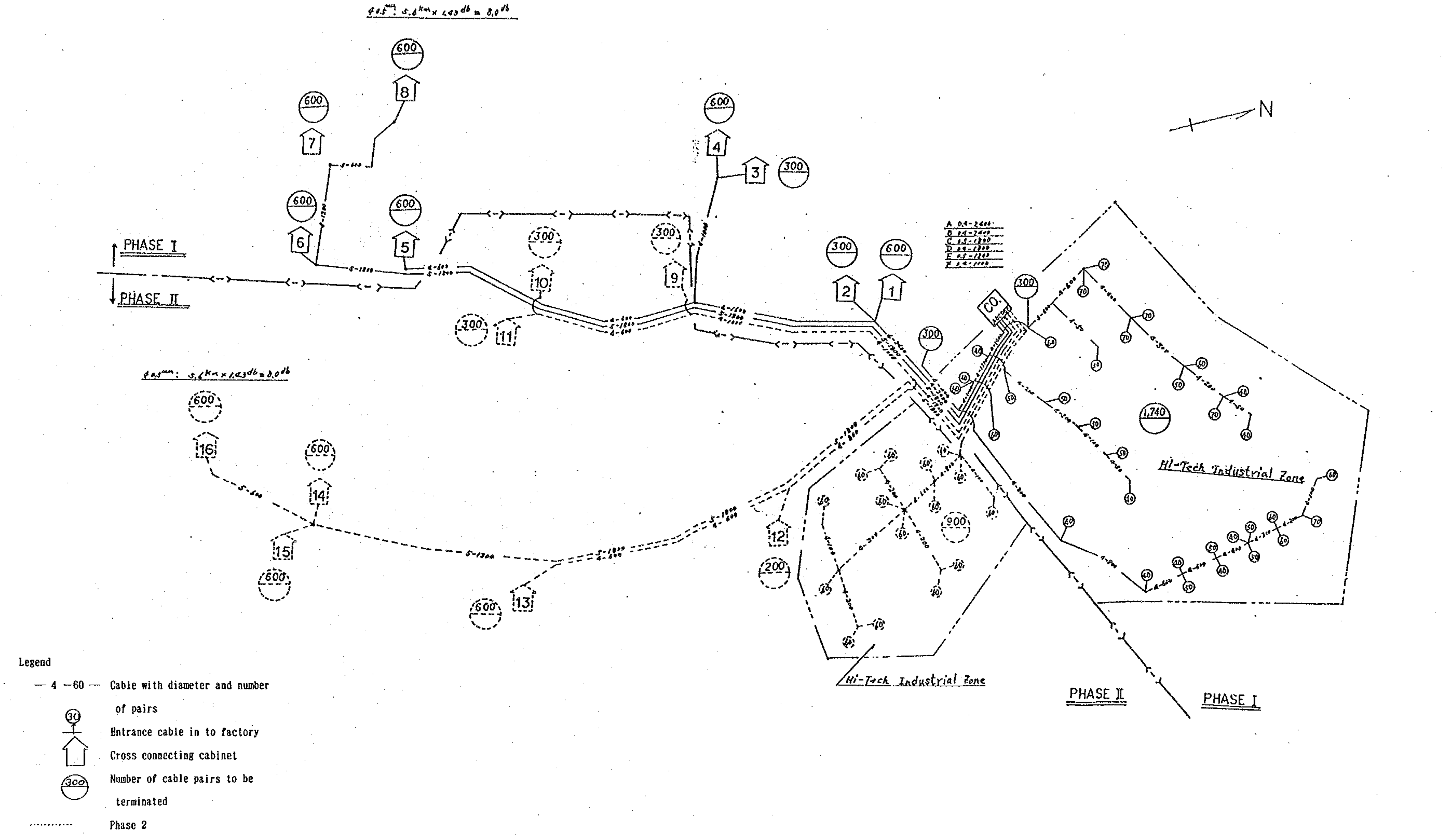
Fig. 2.7.3 Relationship among Telephone lines, Factory Area and Factory

Fig. 2.7.4



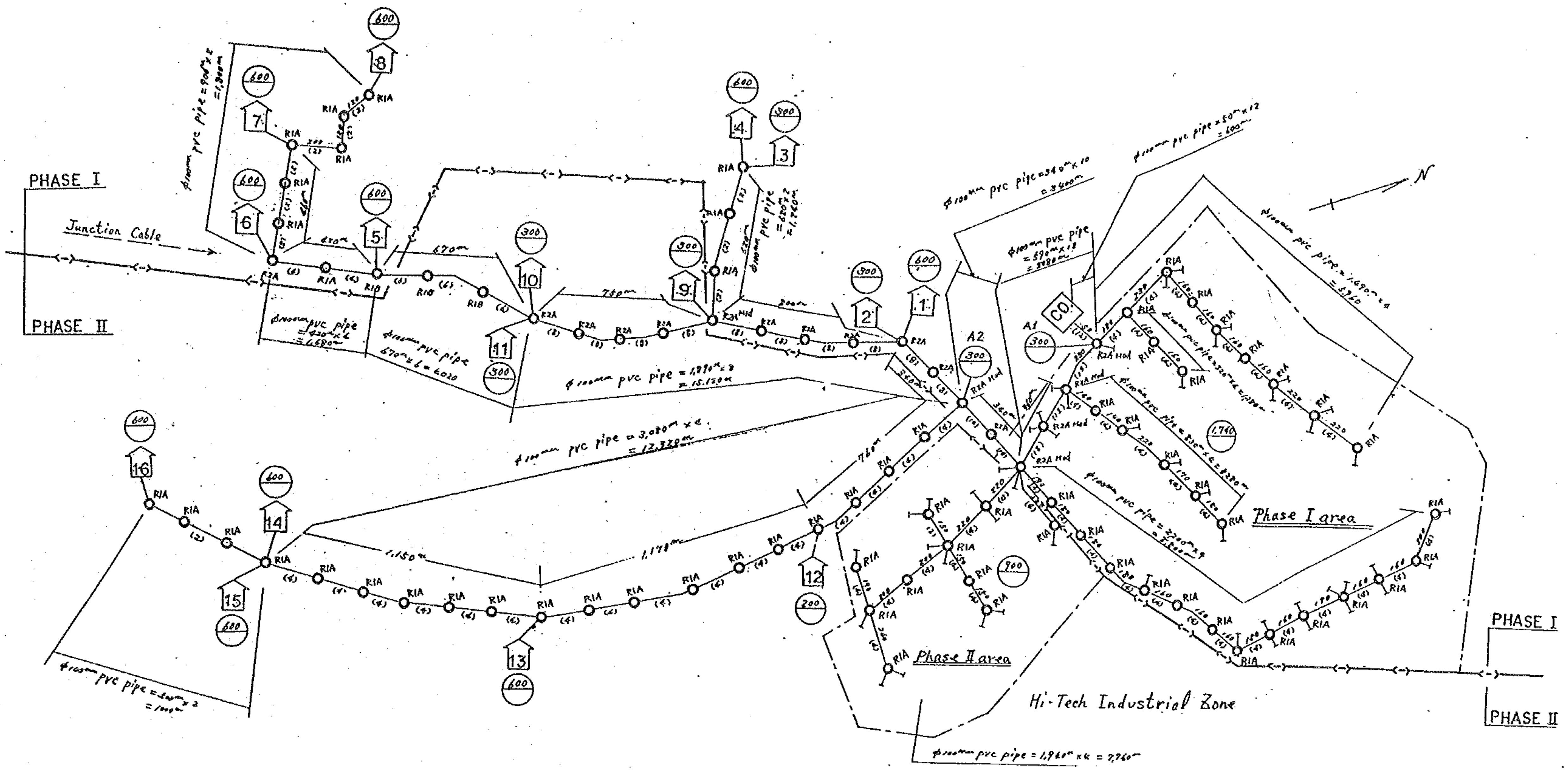
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE CABLE PAIR DISTRIBUTION PLAN

Fig. 2.7.5



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE PRIMARY CABLE PLAN

Fig. 2.7.6



Legend

- ◎ Manhole
- (6) Duct rout with number of duct to be lied
- Cross connecting cabinet
- (300) Number of cable paies to be terminated

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DUCT PLAN

2.8 Drainage and Sewerage System

2.8.1 Proposed Separate Sewerage System

Pollutant load of organic meter in target factory is shown in Table 2.8.1.

As waste water of target factory has very few pollutant load of organic matter, it belongs to the category of inorganic waste water. The industrial waste water of a target factory should be handled by an individual treatment plant, separately from miscellaneous waste water.

2.8.2 Present Water Quality of Jarak River Basin

Water sampling was carried out by the JICA Study Team at 3 points on June 14, 1991 as shown in Fig. 2.8,1. Water quality was analyzed by Malayan Testing Laboratory Sdn. Bhd. The results of analysis indicate that the present water quality is clean (refer to Table 2.8.2).

So the effluent limits of the Industrial Zone are recommended to be more strict than Standard B in consideration of EIA, conducted by Geotechnical and Environmental Associates Sdn. Bhd.

2.8.3 Drainage

(1) Return period

The return period of the development area shall be decided by the grade of the river carrying the flood and by the situation of adjacent areas. Standard return periods of industrial estates in Japan is generally 5 - 10 years.

The standard return period of a retention pond in Japan is usually decided as follows:

Type of dam	:	30 - 50 years
Type of digging or underground	:	5 - 10

However, it is the recent policy in Japan to reconstruct a city to take adequate counter measures against floods due to increased development. The technopolis in Japan tends to adopt the following return periods:

Drainage facilities	:	more than 20 years
Retention pond	:	more than 30 years

Moreover, the problem of environmental pollution by Hi-Tech factories has been serious in Malaysia. The development of the Hi-Tech Industrial Zone should not give the residents any anxiety.

The return period of main drainage should be 100 years according to the Urban Drainage Design Standards and Procedures for Peninsular Malaysia. But the present return period of the river is only 2 years. As it is impossible for the river to be improved by DID at once, the return period of the retention pond should be 100 years, instead of the river.

As a result of discussion with DID, the return period for the Hi-tech Park in Kulim was decided as follows:

Drainage facilities	:	20 years
Retention pond	:	100 years

(2) Rainfall intensity at Kulim

Rainfall intensity at Kulim was computed by the Programme RAINFALL to suit the rainfall charts as given in the Urban Drainage Design Standards & Procedures for Peninsular Malaysia. (The input was the data of Butterworth Station No. 5303053 shown in the Estimation of the Design Rainstorm in Peninsular Malaysia, 1982 published by MOA, as the rainfall data in Kulim is not available.) The expression of each return period is as follows:

$$I(100\ years) = 14{,}625/(t+36.8)$$
$$I(20\ years) = 11{,}534/(t+40.7)$$
$$I(5\ years) = 8{,}348/(t+43.0)$$
$$I(2\ years) = 5{,}357/(t+38.7)$$

(3) Overall run-off coefficient : 0.65 (see the following table)

Table Overall Runoff Coefficient

Individual Surface Characteristics	Area Ai (ha)	Runoff Coefficient Ci	Ai * Ci
Factory	135.00	0.65	87.75
R & D	6.00	0.65	3.90
Central Area	7.00	0.80	5.60
Green Belt & Park	38.50	0.20	7.70
Road	24.00	0.85	20.40
Malt-Retention pond	11.30	1.00	11.30
Drainage (River)	7.20	1.00	7.20
DIP/IDWY	15.00	0.75	11.25
Others	6.00	0.65	3.90
Total	250.00		159.00
Overall Runoff Coefficient		0.65	

(4) Flow rate of drainage shown at Table 2.8.3 (1) & (2).

2.8.4 Proposed Multiple Purpose Retention Pond

The flood run off will obviously be greater from the Industrial Zone than the present rubber plantation, therefore, the peak flow will increase too. In order to avoid harmful impacts, provision of a flood control structure on the site is necessary. Moreover, the multiple purpose retention pond is proposed in order to utilize the land effectively with suitable landscaping. The basic concept and design of the multiple purpose retention ponds are accepted by DID in KEDAH. The computation is as follows:

(1) Rainfall Intensity : $I = 14{,}625/(t+36.8)$

(2) Traveling time : Calculated by the Uniform flow velocity

$t_c = t_1 + L/V/60$; $L = 1{,}140$ m

$t_1 = 7$ min (5 - 10 min)

$V = 2.1$ m/s (by Kraven)

(3) Allowable discharge to the Jarak basin according to DID's instruction :

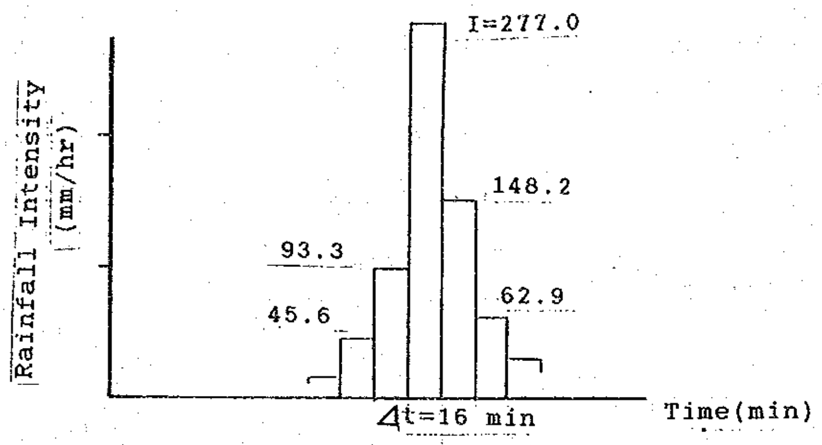
Present return period of 2 years

I = 5,357/(t+38.7)

Therefore ;

Parit Bunian river (covering area : 120 ha)	:	11.43 m^3/s
Ayer Merah river (covering area : 130 ha)	:	12.38 m^3/s
Total allowable discharge	:	23.81 m^3/s

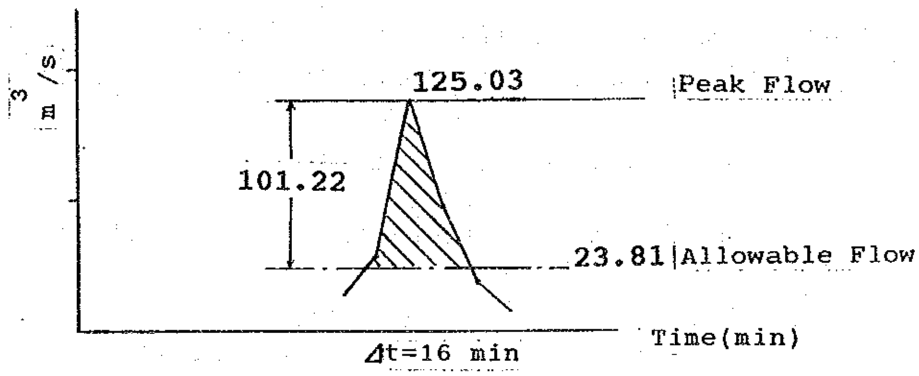
(4) Hyetograph



(5) Hydrograph

Run-off coefficient after development	:	0.65
Run-off coefficient before development	:	0.35

(according to Standard for Retention Pond Preventing from Flood in Japan)



Referring to the above hydrograph, the volume of the retention pond should be roughly V = 170,050 m^3.

The volume of sedimentation after development will be roughly V = 1.5 m^3/ha/year x 250 ha x 10 years = 3,750 m^3.

So, the required capacity of retention pond shall be roughly V = 173,800 m^3.

The retention pond could be used both for flood control and public facilities, such as a park or a tennis court.

The result of pondage is as follows ;

(Area of Pond)		Covering-Area	Reserve-Capacity	Water-Depth
Pond-1	(2.5 ha)	50 ha	34,760 m^3	1.94 m
Pond-2	(4.5 ha)	70 ha	48,664 m^3	1.55 m
Pond-3	(6.5 ha)	130 ha	90,376 m^3	1.68 m

2.8.5 Enlargement of the Ayer Merah river and the Parit Bunian River

Since the capacity of the Jarak basin is less than the return period of 2 years, this area has frequently suffered from flood. The river should be enlarged by DID at least for a return period 5 years. The site of the rivers within the Industrial Zone should be secured enough for improvement of the river by DID in the future corresponding to the peak flow for a return period of 100 years. The calculation is as follows ;

(1) Area of the Parit Bunian river basin No.1 : 285 ha
Area of the Aye Merah river basin No.2 : 770 ha

(2) Run-off coefficient : 0.35 (in case of farm and mountain of gentle gradient)

(3) Traveling time of No.1 : 10 + 3,000 m/2.1/60 = 34 min
Traveling time of No.2 : 10 + 4,000 m/2.1/60 = 42 min

(4) Rainfall intensity of No.1 (100 years) : I = 206.6
Rainfall intensity of No.2 (100 years) : I = 185.6

(5) Peak flow of No.1 : 57.26 m^3/s
Peak flow of No.2 : 138.94 m^3/s

(6) Discharge capacity by Manning formula
n = 0.035, Slope = 0.004

As a result of discussion with DID, work items for the improvement of the rivers are assigned as follows :

ITEM	KSDC	DID
1) Land Acquisition		
– within the Industrial Park	O	
– outside of the Industrial Park		O
2) Construction within the Industrial Park		
– Shaping & turfing	O	
– Rubble pitching		O
3) Construction outside of the Industrial Park		O
4) Construction of Retention Pond	O	
5) Maintenance		
– Rivers		O
– Retention Pond	O	

2.8.6 Sewerage

The flow rate of sewer collection pipe is shown in Table 2.8.4.

2.8.7 Proposed Central Waste Water Treatment Plant

(1) Typical treatment method & removal rate of BOD

High Trickling Filter		:	70 %
Aerated Lagoon		:	70 %
Standard Trickling Filter	(STF)	:	90 %
Standard Activated Sludge	(SAS)	:	90 %
Total Oxidation Process	(TOP)	:	90 %
Oxidation Ditch Process	(ODP)	:	90 %
Oxidation Pond Process	(OPP)	:	90 %

Necessary removal rate of BOD is 90 %.

(2) Characteristics

Treatment Type	STF	SAS	TOP	ODP	OPP
Operation / Maintenance Work	/	X	O	O	O
Construction Cost	O	O	/	O	O
Energy Consumption	O	/	/	/	O
Building Lot	X	O	/	/	X
Sludge Quantity	/	X	/	/	O
Inflow Fluctuation	X	/	/	/	X
Environmental Affect	X1	/	O	/	X2
Total Grading	X	/	O	O	O

Note O : Profitable
/ : Average
X : Disadvantage
X1 : It will cause side effects such as breeding of flies and odor.
X2 : It will cause side effects such as odor.

(3) Oxidation Pond Process

The oxidation pond process is popular and believed to be the appropriate process for water treatment in Malaysia. However, as the process causes serious trouble because of odor, its adaptability must be considered carefully. Although this process has no excess sludge theoretically, there is some literature on the deterioration of water quality caused by excess sludge.

(4) Proposition

Oxidation ditch process is proposed.

(5) Process Design of Oxidation Ditch Process

(a) Process requirements

- Grit chamber
- Lift pump pit for equalization
- Oxidation ditch for aeration
- Sludge sedimentation tank

- Disinfection tank
- Sludge treatment process with sludge thickener and drying bed

(b) Grit chamber

– Number of grit chamber	:	2 units
– Slope of bottom	:	1/100 - 2/100
– velocity	:	0.3 m/sec
– retention period	:	30 - 60 sec
– Surface loading	:	1,800 $m^3/d/m^2$
– Generation rate of grit	:	0.005 - 0.02 m^3/1,000 m^3
– Min.grain size	:	0.2 mm
– Specific gravity of sand	:	2.65
– Necessary surface area	:	3,613/2/1800 = 1.0 m^2
– Amount of grit	:	3,613 x 1/2 x 0.02/1000 =0.03613 (0.072 m^3)
– Necessary volume	:	225.81 x 1/2 x 30/(60 x 60) =0.940875
– Necessary section	:	225.81 x 1/2 x 1/(60 x 60) x 1/0.3=0.10
– Size	:	0.7^W x 1.5^L x 1.0^H x 2
– Sand submersible pump	:	1.5 kw x 4

(c) Pump pit

– Necessary volume	:	226 m^3 (Hourly Max. Waste Water)
– Number of pit	:	2 units
– Size per unit	:	$4.O^W$ x 15.0^L x 2.0^H
– Lift pump	:	5 kw x 6 Detachable pumps

(d) Oxidation ditch

– Aeration time	:	24 hrs
– BOD-SS loading	:	0.05 kg-BOD/kg-SS/day
– BOD-volumetric loading	:	0.2 kg-BOD/m^3/day
– MLSS	:	4,000 ppm
– Return sludge ratio	:	150 %
– Necessary volume	:	3,613 m^3
– Number of ditch	:	2 units
– Size per unit	:	O/8.3 x 90 x 2.5

- Removal BOD : 650 kg/d
  = 3,613 x (200-20)/1000
- Air to flow ratio : 35 m^3/Removal BOD kg
- Consumption of Air : 16 m^3/min = 650 x 35/24/60
- Conversion factor : 0.277 O_2kg/m^3
- Necessary Total oxygen : 4.4 kg-O_2/min
- Safety factor : 20 %
- Necessary Total Air : 20 m^3/min
- Number of Aerator : 4 units
- Aerator : 5 m^3/min x 10 kw x 4 units

(e) Settling tank
- Surface loading : 20 m^3/m^2/d
- Settling time : 2.5 hrs
- Necessary volume : 376.4 m^3 = 3,613 x 2.5/24
- Necessary surface area : 180.7 m^2 = 3613/20
- Number of tank : 2 units
- Size per tank : o/ 10.0 m x 2.5 m
- Return sludge pump : 11 kw x 4 units
- Excess sludge pump : 0.25 kw x 4 units
- Clarifier : 0.2 kw x 2 units

(f) Disinfection tank (if necessary)
- Chlorine dosages : 10 ppm
- Contact time : 15 min
- Necessary volume : 37.64 m^3 =3,613 x 15/24/60
- Number of tank : 2 units
- Naclo pump : 0.2 kw x 2 units
- Naclo volume : 0.16 l/min
- Dissolution tank : 1 m^3 x 2 units

(g) Sludge thickener
- Removal rate of SS : 80 % (250 ppm - 50 ppm)
- Water content : 99 %
- Excess sludge volume : 72.26 m^3/day
  = 3,613 x 250 x 1/10^6 x 1/(1-0.99) x 0.8
- Excess solids : 723 kg/d
  = 72.26 x 0.01 = 0.7226 t/d

- Total solids loading : 75 kg/m^2/day (60 - 90)
- Necessary surface area : 9.64 m^2 = 723/75
- Thickener time : 12 hrs
- Necessary volume : 36.13 m^3 = 72.26 x 12/24
- Number of thickener : 2 units
- Size per tank : O/ 2.5 m x 4 m
- Sludge draw off pump : 0.2 kw x 4 unit

(h) Dry bed

- Thickened sludge concentration : 2 %
- Drying time : 7 days
- Draw out interval : 5 days
- Sludge depth : 25 cm
- Necessary surface area : 10,117 m^2 = 72.26 x 7 x 5/0.25
- Necessary surface area : 3467 m^2 for 2nd phase
- Size : 90 m x 180 m

2.8.8 Recommendation of Agreement/Memorandum for Deterioration of Water Quality

Each industry must make an agreement on prevention of public nuisance with DOE, and moreover, each industry should have to make the agreement/memorandum for deterioration of water quality from being caused in connection with business activities with KSDC and with the management company to be established under KSDC. If each industry and KSDC/Management company exchanges the agreement/ memorandum, it becomes easy not only for KSDC to secure the prevention of public nuisance but also for the management company to carry out the effective monitoring, operation, and maintenance smoothly.

Contents of the agreement/memorandum shall be recommended as follows :

(1) Purpose of agreement/memorandum

(2) Effluent standards for the Kulim Hi-Tech Industrial Park

(3) Each industry's obligation for countermeasures against deterioration of water quality ;

- Individual treatment plant set by each industry

- Inspection pond with fish set by each industry
- To meet the requirements of the effluent standards enacted by KSDC

(4) Maintenance of facilities set by each industry ;

Each industry shall maintain the facilities for environmental pollution control fully and appropriately.

(5) Reporting and investigation ;

KSDC/Management company shall be able to ask each industry to submit a report in order to ensure effective monitoring and, if necessary to visit the plant or other facilities for investigation.

(6) Pre-notification on the change of planning by each industry

(7) Penalty or measures to be taken when violating the agreement/ memorandum ;

When violating the agreement/memorandum, KSDC/Management company shall instruct each industry to take a corrective action immediately or to stop the business activities at once.

(8) Indemnity

If KSDC/Management company or other third parties should suffer losses in connection with business activities of each industry, each industry shall indemnify them.

(9) Charge on monitoring, operation and maintenance ;

KSDC/Management company shall be able to charge a fee for monitoring, operation and maintenance of the following facilities to each industry.

- Drainage facilities including retention ponds
  (Charged in proportion to an area of factory lot)
- Waste water collection pipe
  (Charged in proportion to number of workers each factory)
- Central waste water treatment plant
  (– ditto –)

Table 2.8.1 Pollutant Load per Unit Activity of Source (investigated by Environment Agency in Japan)

TYPE OF FACTORY	DISCHARGE PER UNIT PRODUCT (m^3/d • 10^6 YEN)	BOD		COD		SS	
		ppm	unit (g/d • 10^6 YEN)	ppm	unit (g/d • 10^6 YEN)	ppm	unit (g/d • 10^6 YEN)
Semiconductor	0.400	10.000	4.000	30.000	12.000	100.000	40.000
Integrated Circuit	1.003	10.000	10.000	30.000	30.100	100.000	100.000
Electronic Tube	0.513	10.000	5.130	30.000	15.400	100.000	51.300
Personal Computer	0.415	10.000	4.150	30.000	12.500	100.000	41.500
Electronic parts	0.163	10.000	1.630	30.000	4.890	100.000	16.300
X rays Apparatus	0.038	10.000	0.380	30.000	1.140	100.000	3.800
TV Receiver	0.099	10.000	0.990	30.000	2.970	100.000	9.900
Wireless Machinery	0.036	10.000	0.360	30.000	1.080	100.000	3.600
Wire Machinery	0.115	10.000	1.150	30.000	3.450	100.000	11.500
Audio Machinery	0.025	10.000	0.250	30.000	0.750	100.000	2.500
Electric Machinery	0.104	10.000	1.040	30.000	3.120	100.000	10.400
Electric Meter	0.029	10.000	0.290	30.000	0.870	100.000	2.900
Precision Machine	0.078	10.000	0.780	10.000	0.780	100.000	7.800
Analyzer	0.180	10.000	1.800	10.000	1.800	100.000	18.000
Labo-Equipment	0.026	10.000	0.260	10.000	0.260	100.000	2.600
Plastic Form	0.292	10.000	2.920	10.000	2.920	100.000	29.200
Plastic Product	0.563	10.000	5.630	10.000	5.630	100.000	56.300
Electric Plating	0.488	10.000	4.880	20.000	9.760	30.000	14.600
Metal Heat Treatment	1.119	10.000	11.200	20.000	22.400	100.000	112.000
Metal Stamping	0.097	10.000	0.970	20.000	1.940	100.000	9.700
Bearing	0.238	10.000	2.380	10.000	2.380	100.000	23.800
Cable/Die-cast	0.436	50.000	21.800	10.000	4.360	30.000	13.100
Machine Tools	0.090	40.000	3.600	40.000	3.600	30.000	2.700
Motor Parts	0.382	50.000	19.100	90.000	34.400	100.000	38.200
Ceramics	0.184	3.000	0.552	3.000	0.552	2700.000	497.000
Carbon ROD	0.963	7.000	6.740	10.000	9.630	30.000	28.900
Storage Battery	0.229	10.000	2.290	30.000	6.870	100.000	22.900