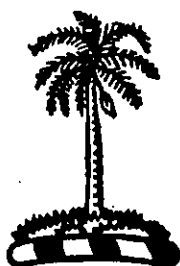


**URBAN TRANSPORT STUDY  
IN  
GREATER METROPOLITAN AREAS  
OF  
GEORGETOWN, BUTTERWORTH AND BUKIT MERTAJAM  
MALAYSIA**

**A STUDY OF THE EXISTING  
SITE CONDITIONS**

**OUTER RING ROAD PROJECT (PHASE II)  
TECHNICAL REPORT-08**



**MARCH 1981**

**JAPAN INTERNATIONAL  
COOPERATION AGENCY**

**GOVERNMENT OF  
MALAYSIA**

**URBAN TRANSPORT STUDY  
IN  
GREATER METROPOLITAN AREAS  
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GEORGETOWN, BUTTERWORTH AND BUKIT MERTAJAM**

**MALAYSIA**

**A STUDY OF THE EXISTING SITE CONDITIONS  
OF THE OUTER RING ROAD**

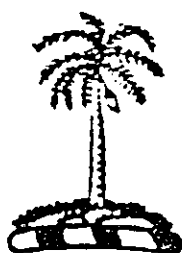
**OUTER RING ROAD PROJECT (PHASE II)**

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**TECHNICAL REPORT - 08**



**MARCH 1981**

**08 20**

**JAPAN INTERNATIONAL  
COOPERATION AGENCY**

**GOVERNMENT OF  
MALAYSIA**

国際協力事業団	
受入 月日 5'84.15.16	F13
登録No. (04601)	73 SDF

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**AI. SOCIO-CULTURAL CONSIDERATIONS.-**

The kind of environmental impacts that will presumably take place and the steps that should be implemented for mitigating the impacts have been investigated in the Environmental Study. The discussions were mainly focused on the functional aspects or direct type of impacts. Therefore, it is intended that reference be made here to the supplementary socio-cultural aspects or indirect type of impacts of the proposed road. The role of roads in the human environment, the socio-cultural potential of George Town, and the socio-cultural requirement of the proposed Outer Ring Road is to be discussed.

#### Road and Environment

Roads have been, historically, one of the two essential elements of the physical pattern in an urban environment; network and grain. 'Network' refer to roads, city water, electricity, sewage, gas supply and the other, so called, urban infrastructure. 'Grain' refers to spatial infills in the meshes of network; housing, institutions, commerce and industries and so forth. The road as a main component of network has various implication on the environment.

- 1) A road has been one of the most consistent elements to be maintained in cities as part of the historical environment. It means that the road will serve the environment for hundreds of years particularly if the road is a major one.
- 2) A primary road the potential for economic and social development of the environment along the road. Considering the unexpected impacts of uncontrolled development induced by this potential, it is necessary that the development control plan along the road should accompany the proposals of road developments.
- 3) There are obvious actions and reactions between road and environment; the convenience on traffic and the environmental disturbance. It is presumably natural that the mitigation and compensation cost for the road development will be getting higher and higher in the future.



According to social consensus, there are two problem solving approaches: to design the environmental mitigation measures in correspondence with the degree of disturbance or to decide the design dimensions of roads in order to make it possible to minimize the disturbance. Those two approaches should be examined when being applied.

- 4) Some type of roads can attract tourists like boulevards, parkways, promenades, and shopping streets, as in Paris, London, Tokyo, New York and so on. Therefore, the functions of the road should be programmed to integrate supplementary functions of roads reflecting the nature of the total environment.
- 5) The usage of roads may be varied depending upon different environmental and social circumstances. The behavioural needs of people may reflect the usage pattern of roads, so that proposed functions and role of road should take the behavioural characteristics of traffic into consideration.
- 6) Roads may give ecological impacts in natural environments. Air pollution is considered a predominant impact of road to the nature. The source of air pollution is directly related to the mechanism of vehicles in terms of exhausted fumes, and great improvement on exhausting mechanism can be expected to be not far in the future.
- 7) Road is one of the spaces where people spend sometime in driving and walking, therefore, the road should provide safety and comfortable conditions. The landscape design of road based on driving psychology, and human engineering should be considered.

## 2. Socio-Cultural Aspects of George Town

Penang is the second largest city in Malaysia, and the regional centre of North Peninsular Malaysia. George Town has a distinctive townscape both in old residential areas and downtown areas; British colonial-style houses, with fully matured roadside trees in the residential area and Chinese shophouses in the downtown area, British colonial institutional buildings in the central district and many religious buildings.

These features of the environment contribute to Penang Island being a well known tourist resort. Residents express strong feelings of identity to the town and tourists appreciate the abundant natural beauty. There are sufficient hospitals, medical centers and foreign schools which are supporting factors for attracting long stay tourists and foreign workers.

Fig. 1 shows the distribution pattern of religious facilities. Large number of temples, mosques, churches and wide areas of graveyards are proof of the significant importance of religion in Penang Island.

The distribution of colonial buildings and roadside trees shown in Fig. 2 and Fig. 3 respectively are features in the northern half of the town.

The number and the location of major restaurants and eating stalls is also a supporting factor for the development of tourism (See Fig. 4) as well as well facilitated schools and health facilities (Fig. 5).

The number of hotels and travel agents also show clearly that the town has strong involvement in the active business of tourism. (Fig. 6).

FIG. 1

1980

RELIGIOUS BUILDINGS

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE

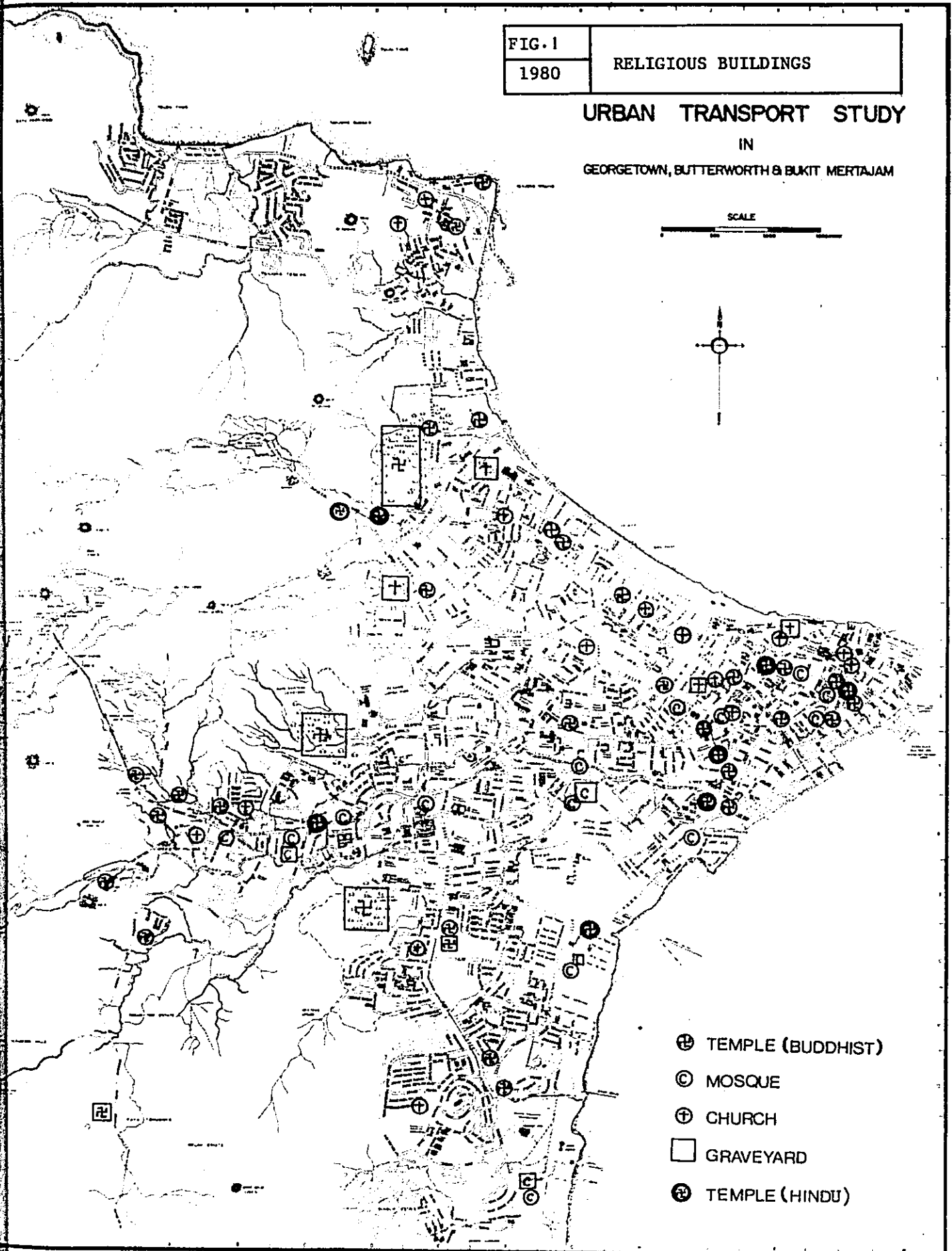


FIG. 2

1980

COLONIAL STYLE BUILDINGS

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE

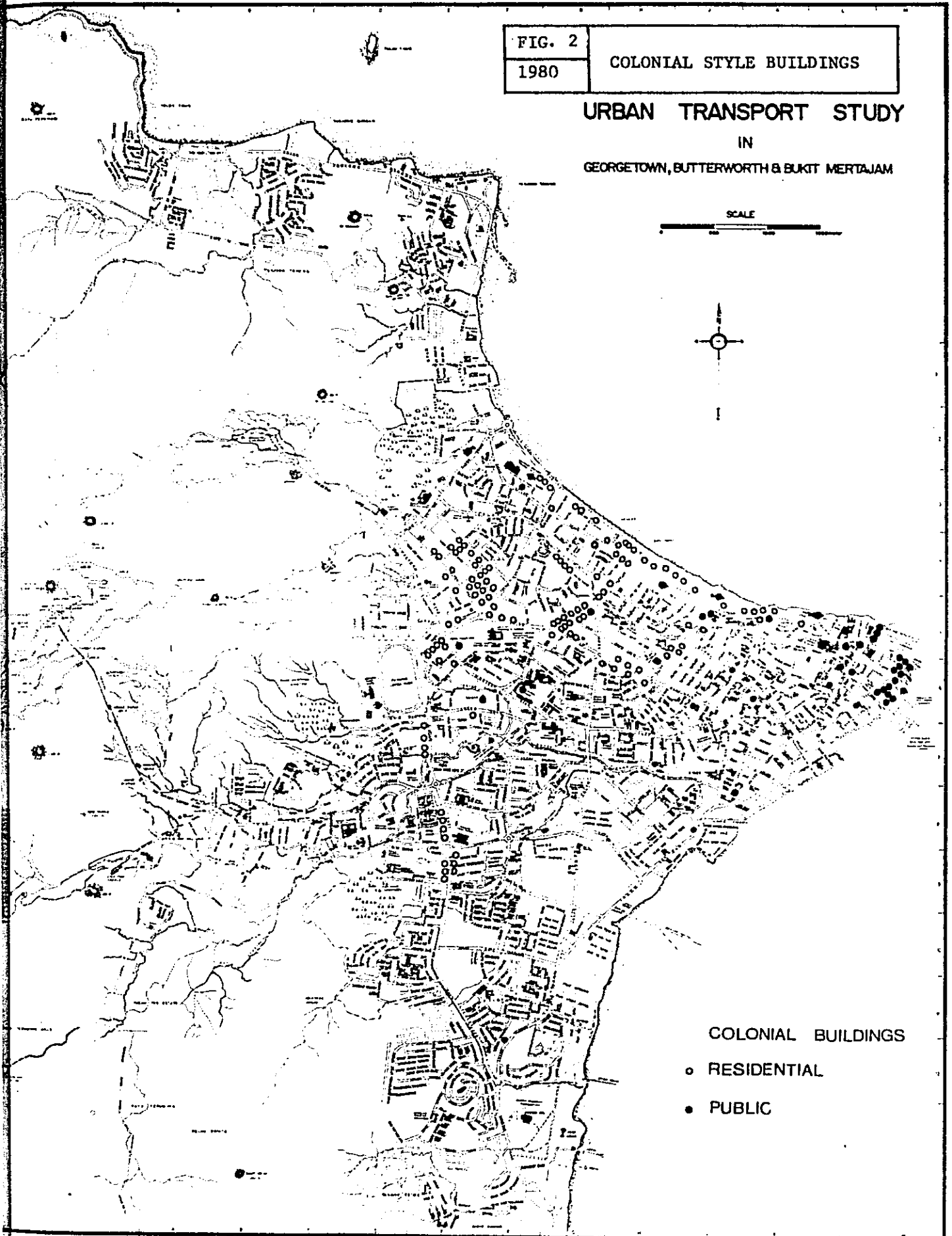


FIG. 3

1980

ROADSIDE TREES AND

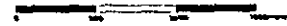
RECREATIONAL AREAS

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE



- Roadside trees
- ▨ Recreational

FIG.4

1980

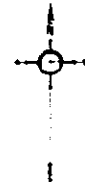
TOURIST AND RESIDENT  
ATTRACTIONS

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE



○ RESTAURANT

□ EATING STALLS

FIG. 5

1980

HEALTH AND  
EDUCATIONAL FACILITIES

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE



- FOREIGN SCHOOL
- ⊕ HOSPITAL
- ⊗ WELFARE HOME

BATU FERINGGI  
AREA

FIG. 6

1980

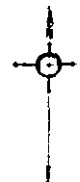
TOURIST FACILITIES

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE



HOTEL AND TRAVEL AGENTS



HOTEL



TRAVEL AGENCIES



3.

Socio-Cultural Aspects for the Proposed Outer Ring Road

The various environmental impacts of roads are differentiated depending upon the quality and the type of the environment. When a proposed road runs in an undeveloped area, it will mainly function as an essential backbone of a new environment and it will act as a base for economic development for the surrounding area. On the other hand, the new road planned in a fully matured town is apt to take the appearance of an alien body in the environment. It means that the proposal of a new road may not necessarily be free from social and psychological conflicts in the community. Therefore, the evaluation of the quality and potential of the proposed Outer Ring Road should be discussed.

1. The Outer Ring Road is planned to be an intra-urban primary road in the total hierarchical system. The clear functional and spatial definition can be effective in setting up the legibility of the urban environment which is necessary for a better human environment.
2. The Outer Ring Road will form the physical edge of George Town in combination with the topographical periphery. Therefore, it will become one of the essential visual elements to identify the territory of George Town.
3. The Outer Ring Road running at a level of 30m (100') to 60m (200') above the sea level provides various views of the town from the road and can create a new tourist attraction in Penang as a parkway road system.
4. The parkway road system is connected with the coastal road along northern seashore, and the coastal road itself can become a segment of the total parkway system. Therefore, it is desirable to plan a seashore recreational space along the north coastal road.
5. The Outer Ring Road can contribute to upgrade the quality of existing landscape if vegetation and landscape design is given emphasis. It is expected to become one of the landscape infrastructure in the town.

4.

A SURVEY OF A SECTION OF THE OUTER RING ROAD SITE

The Outer Ring Road passes along the north through Gurney Drive which is a significant landmark for Penang Island. In order to have an idea of the general activities in the area, the following survey was done.

4.1

A Survey of Gurney Drive, Attempting to Observe and Identify the Activities of this Area

Gurney Drive is a popular spot of Penang Island which is a stretch of area in the north that faces the sea. It is identified for its scenic beauty, not only because of its beach but also because of the overall environment, i.e., the existence of intermittent trees along the shore with unique shaped lamp posts in between. Alongside the shore, there is a pedestrian pavement on which are set benches for those who wish to relax. However, it is not only famed for its aesthetic beauty but this area is also one where there is a lot of business activity from which many earn their livelihood. Penang is sometimes identified by Gurney Drive which provides a place of relaxation in the heart of the busy city. It is also the spot chosen for annual boat races and other cultural festivals.

In order to identify the types of activity that take place in Gurney Drive, a simple survey was done by observation of the area over a whole day. It can generally be said the place takes on a new picture from morning to evening although the activities in the afternoon and evening are basically the same, only differing by degree. In the early morning, the place is rather quiet with little or no event taking place but it transform into a buzzing arena of activity in the evening. Below is a description of the nature of activities that go on and they are presented according to the different zones in the area since there appear a distinct pattern by zone.

### The Sea

There were 4 fishing boats out at sea in the morning. Most crab catching is done in the morning and fishing in the afternoon. However, in the late afternoon and evening there were no fishermen out at sea but there were 2 young boys swimming.

These fishermen work full-time and although most of them live in the area itself, there are also those who come from Tanjong Tokong. Their catch for the day is either sold to passers-by or to the market.

### The Beach

One of the most prominent activities on the beach, especially in the morning, is the catching and collecting of worms by young boys, old men and some old women. These worms are collected in a bucket and sold to a nearby hut which, in turn, sells them as fishing bait to those who come to fish in the evening. These 'worm-catchers' get their daily earnings doing so.

Another activity on the beach is digging and collecting of 'siput', which is a type of shell the flesh of which is edible, and mussels. These activities are carried out only during certain seasons. Later, in the evening, their catch is displayed for sale. These people engage thus either as a pastime or as a means of earning some extra money.

### The Shore

Here, the activities increase consistently from morning to evening. There were 20 fishing boats 'parked' on shore and a couple of fishermen emptying their catch. In the afternoon not only were there many more fishing boats parked but the shore was used as a market place by these fishermen to sell their catch. Also, other fishermen were just hauling in their boats and others still were emptying and sorting out their catch.

These activities were carried on in a much greater degree and the place thronged with people in the evenings. It seemed quite hectic with many types of business activity.

#### The Pavement

People use the pavement in the morning as a place of leisure. There were joggers, cyclists and others having a long chat or simply relaxing on the benches available. Later in the afternoon and evening, the pavement is filled with people such as, hawkers, fruit stalls, strollers, children playing, etc. Families also come here in the evenings for dinner by the sea.

#### The Road and Beyond

There was hardly any traffic in the morning but in the evening there were cars parked closely on the roadside throughout the length of Gurney Drive. This route is used by L-licensed drivers in the morning and afternoon because of the very small traffic volume.

Across the road is situated some residences including some fishermen's huts. Situated here is also a small hut that engages in retail trade of worms. This 'shop' opens for business in the late afternoon. It is also during this time that the restaurants and stalls closeby prepare to open for business.

The activities mentioned above are those noted during one day and although we can generalise and say that these are the activities for the area, it must be taken into account that Gurney Drive is also the spot chosen for festival celebrations, dragon boat races, variety and cultural shows, etc during which time and season there will definitely be a difference of events.

USUAL ACTIVITIES IN GURNEY DRIVE

<div>TIME</div> <div>ZONE</div>	mid-morning (10 a.m - 12 noon)	afternoon (3.30 p.m - 4.30 p.m)	evening (5.30 onwards)
SEA	Catching crabs	Fishing	Swimming
BEACH	Worm catching 'Siput' digging	Worm catching 'Siput' digging Mussel digging	'Siput' digging Mussel digging Fishermen haul- ing boats in
SHORE	Fishing boats parked Preparing dragon boats Fishermen clearing net	More fishing boats parked Selling crabs Fishermen clearing net	Fishing boats parked Others coming in Selling crabs, fish
PAVE- MENT	Jogging, relaxing, cycling	Hawking Buying and Selling Children playing	Hawking Strolling Buying and Selling Relaxing
ROAD	Few cars. Few people L-licensed drivers	Hut selling worms More cars Many L-licensed drivers	Hut selling worms Much more cars Cars parked by roadside
Residence and Businesses	Selling worms to hut	Selling worms to hut Hut selling worms	Hut preparing to sell worms Restaurants open for business

AII. BUILDING SURVEY ALONG THE OUTER RING ROAD.

OBJECTIVE OF STUDY AND DATA COLLECTED

A physical survey was carried out all along the Outer Ring Road.  
The objective of this survey was:

- 1) to study the roadside environment.
- 2) to estimate the number of buildings affected,  
their use and the required compensation.

The data collected for buildings that were affected include:

- 1) building use
- 2) number of stories
- 3) condition of building
- 4) building material
- 5) building type
- 6) approximate built-up area

(this was not documented due to the slight inaccuracy of estimation)

The data collected for the buildings along the road that need  
not be demolished include:

- 1) the building use
- 2) the distance of building to the new road
- 3) the type of building

Left side	For affected buildings	Right side

- 1) The central column is used to document data on any building that has to be demolished for road construction.
- 2) The side columns are used for documenting the data of the roadside condition (for both the right and left sides) after additional space has been taken for road construction.

Cross-wise, the tables are not to scale but the longitudinal scale is 1 : 3000. The length-wise measurement of each lot is thus an estimate of the frontage length.

[illegible]

AII - 2



LEGEND FOR PHYSICAL STRUCTURE SURVEY

A) Type of Building

t : terrace  
sd: semi-detached  
d : detached  
f : flat

B) Landuse & Building Use

r : residential  
c : commercial  
i : institutional  
(it - indian temple)  
ct - chinese temple  
m - mosque  
st: sub-station

C) Number of Storey

ss: single storey  
ds: double storey  
3s: three storey

D) Condition of Building

g : good  
f : fair  
p : poor

E) Material

b : brick  
bt: brick and timber  
zb: zinc and brick  
gb: glass and brick  
t : timber

Fig.7

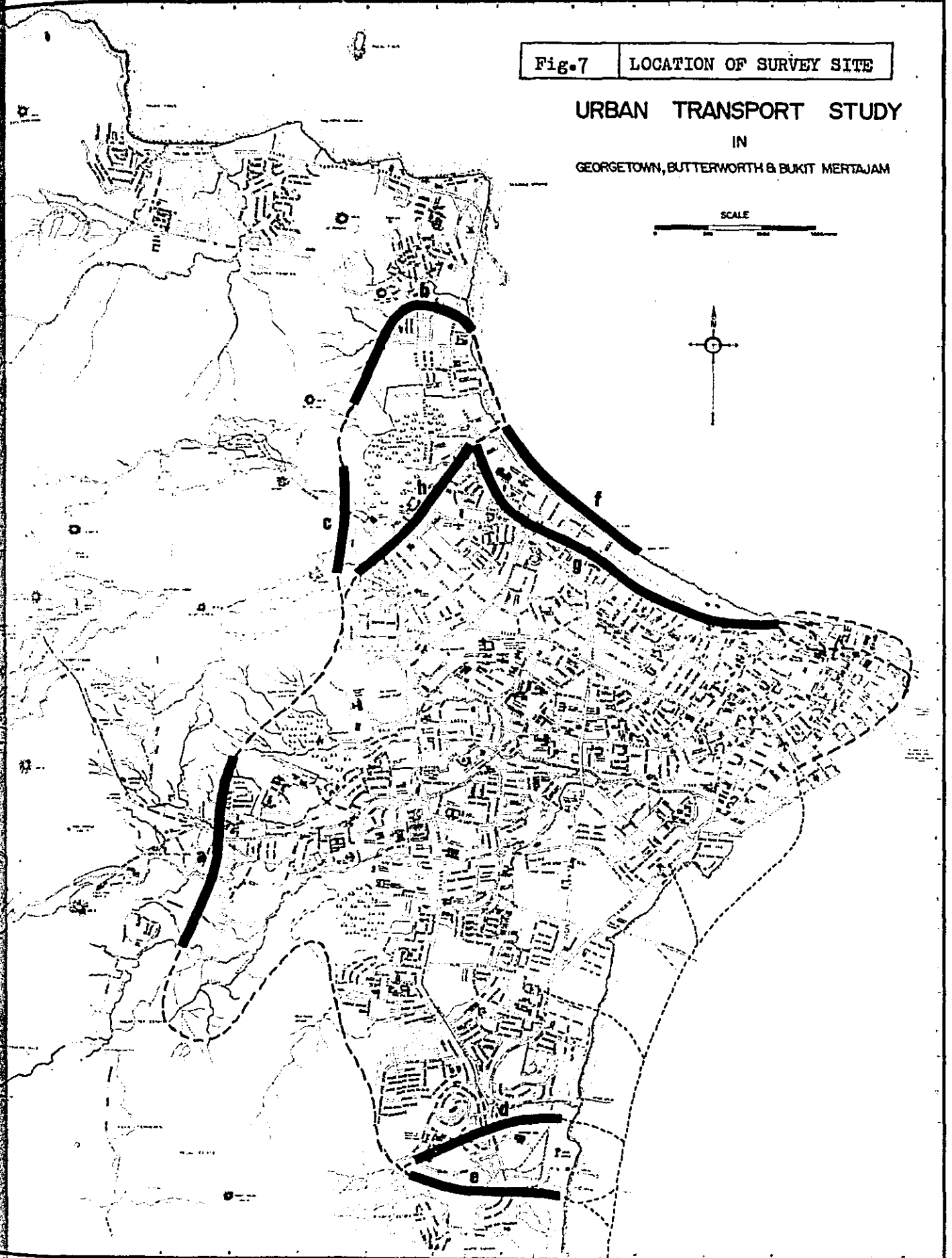
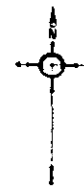
LOCATION OF SURVEY SITE

# URBAN TRANSPORT STUDY

IN

GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

SCALE



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

ALL-5



## LEFT SIDE

RIGHT SIDE

ALL-7

Section: d  
RIGHT SIDE

ALL-8

RIGHT SIDE

LEFT SIDE

			FOR AFFECTED BUILDINGS																	
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE			NOS. OF STOREY			CONDITION			MATERIAL			TYPE			LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
			L	C	R	L	C	R	L	C	R	L	C	R	L	C	R			
		road																2r	20'-0"	sd ss
sd	110'-0"	r			2r			ss			f			b			sd	2r	20'-0"	sd ss
sd	110'-0"	r			2r			ss			f			b			sd	2r	20'-0"	sd ss
sd	110'-0"	r			2r			ss			f			b			sd	2r	20'-0"	sd ss
sd	110'-0"	r			2r			ss			f			b			sd	2r	20'-0"	sd ss
d ss	25'-0"	r			2r			ss			f			b			sd	2r	20'-0"	sd ss
		road			r			ds			g			b			d	2r	20'-0"	sd ss
d sd		r			2r			ss			f			b			sd	2r	20'-0"	sd ss
		road			r			ss			f			b			sd	2r	20'-0"	sd ss
d ds		r			r			ss			f			b			d	2r	40'-0"	sd ss
					r			ss			f			b			d	2r	35'-0"	sd ss
		road			r			ss			f			b			d	2r	30'-0"	sd ss
		road			r			ss			f			b			d	2r	25'-0"	sd ss
					r			ss			f			b			d	2r	20'-0"	sd ss
		road			r			ss			f			b			d	road		
		road			r			ss			f			b			d	mosque	30'-0"	d ss
			r		r			ss			g			b			d	r	20'-0"	flats 5s
d ss	30'-0"	r			g			ss			f			t			d	r	20'-0"	5s
sd	120'-0"	road			g			ss			f							road		d
sd	50'-0"	r			g			ss			f							r		d
																		road		
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																		r		d
																		road		
																		r	70'-0"	t
																		r	70'-0"	t
																		field		

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
ds d	20'-0"	r under construction						SEA		
ds row	180'-0"	i French College								
ds 3s row	80'-150'	i St Xavier								
d ds		i								
		vacant land								
d ds		r								
		vacant land								



Section: f-2


LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
		road								
			2 c	ds	f	bl	d			
d ds	30'-0"	c		ds	f	t	d			
		road								
d ds	40'-0"	c								
		open space								
			8 r	ds	f	b	t			
ss d	40'-0"	r								
		road								
			4 r	ss	f	b	ds			
ss d	50'-0"	2 r								
			r r	ds ds	f f p	b b t	s ds d			
		vacant land								
		road								
ds d	20'-0"	4 c								
ds d	80'-0"	r								

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
ds d	50'-0"	r								
ds d	50'-0"	r								
ds d	50'-0"	2r								
		road								
ds d	100'-0"	r								
ds d	60'-0"	r								
ds d	80'-0"	r								
		vacant land								
		vacant land								
		road								

**LEFT SIDE**

RIGHT SIDE

[illegible]

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
d ss	15'-0'	r						vacant land		
d ss	10'-0'	r	i	ds	f	b	t			
d ss	10'-0'	i								
		lane								
d ss	30'-0'	r								
d ss	20'-0'	r	r	ds	f	bt	d			
		lane						lane		
d ss	15'-0'	r								
			r	ss	f	b	d	right of way		
			r	ss	f	b	d			
			r	ss	f	b	d			
		vacant land	r	ss	f	b	d			
		vacant land						road		
		road								
d ss	35'-0'	r	r	ss	f	b	d			
d ds	30'-0'	r	r	ss	f	b	d			
d ds	8'-0"	r						road		
		road								
d ds	8'-0"	r	br	ds	g	b	sd			
	20'-0'	i temple	c	ss	f	gb	d	road		

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS									
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING		
		road										
sd ss	15'-0'	8r	5r	5r	ss	f	q					
			5r	5r	ds	f	f	lane				
				ds		b	b	vacant land				
flats		90r under construction		ds		b	qb	store	40'-0'	d		
		road	r	ds		b		r	40'-0'	d ds		
d ss	10'-0'	2store r						vacant land				
d ds	30'-0'	r						under construction				
d ds	40'-0'	r						road				
		vacant land						petrol stn.	20'-0'	d ss		
d ss		mosque						french institute	25'-0'	d ds		
		path						private road				
	20'-0'	r	r	ds	ds	f	p					
d ds	20'-0'	r	r	ds		f	b					
d ds	30'-0'	r						vacant land				
d ss	30'-0'	r						vacant land				
d ds	60'-0'	r										
		road	r	ds		p	bt					
d ds	30'-0'	r	2r	ds		f	b					
d ds	30'-0'	r						road				
d ds	30'-0'	r										
d ds	35'-0'	r										
d ds	40'-0'	r	r	ds		f	b					
d ds	30'-0'	2r	r	ds		f	b					

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
		road					vacant land			
d ds	30'-0"	r								
		road						road		
		road	r	ds	f	b		d		
d ds	120'-0"	r						vacant land		
								r	65'-0"	d ds
								r	65'-0"	d ds
d ds	80'-0"	r						r	70'-0"	d ds
		vacant land						i	170'-0"	d ds
		apartments (under demolition)						r	170'-0"	d ds
d ds	60'-0"	2r								
		path/drain								
d ds	80'-0"	r						r	90'-0"	d ds

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
d ds	70'-0"	c						vacant land		
d ds	70'-0"	r						r	35'-0"	
								private road		
d ds	70'-0"	i						r	35'-0"	d ds
		road	r	ds	f	b	d			
		vacant land	c	ds	f	b	d			
		vacant land								
		road								
d ds	40'-0"	i								
d ds	40'-0"	r						c hotel		d ds d ss
d ds	30'-0"	r								
d ds	40'-0"	r						r	25'-0"	d ds
		road								
d ds	80'-0"	i reg. off. & sch						road		
								c citi bank	20'-0"	
		i								

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS									
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING		
ss ds 3s	50'-0"	i Sek Ren Keb Perem Island	i	3s	f	b	d					
d ds	30'-0"	i Maktab Perguruan	r	ss	p	b	d					
d ds	20'-0"	r	r	ds	f	b	d					
d ds	20'-0"	r	r	ds	f	b	d					
d ds	20'-0"	r	r	ds	f	b	d					
		road						drain				
								r	20'-0"	ds d		
ds ss	60'-0"	i Shih Chung	i	ds	f	b	d					
ss d	10'-0"	essa										



LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS															
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY			CONDITION			MATERIAL			TYPE			LANDUSE	DIST. OF BLDG TO NEW ROAD	TYPE OF BUILDING
			L C R	L C R	L C R	L C R	L C R	L C R	L C R	L C R	L C R	L C R	L C R					
		vacant land		r	r	r	ss	ss	ss	f	f	f	t	d	d	d		
			r	r	r	r	ss	ss	ss	g	g	g	b	d	d	d		
			r	r	r	r	ss	ss	ss	g	g	g	b	d	d	d		
			r	r	r	r	ss	ss	ss	g	g	g	b	d	d	d		
		road	r	r	r	r	ss	ss	ss	g	g	g	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
d ss	23'-0"	r	r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
d ss	45'-0"	r	r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
		road	r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss	ss	f	f	f	b	d	d	d		
			r	r	r	r	ss	ss										

LEFT SIDE

RIGHT SIDE

			FOR AFFECTED BUILDINGS							
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE	NOS. OF STOREY	CONDITION	MATERIAL	TYPE	LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
ss ds d row	20'-0" - 40'-0"	St i Nicholas						r under construction		
			r r r	r i	ss ss	f g	d d			
			r	ds	f p	b z	d	road		
		road	5r	-	-	b b	-	vacant land		
sd ds	30'-0"	2 r								
ss d	35'-0"	sub st								
d ds	55'-0"	r								
		vacant land								
		vacant la d								
			c r	r r r	ss ss	f f f	d d d			
		cul-de-sac	r	ds	g	b	d			
d ss	20'-0"	r	r r r	ss ss	f f f	b b b	d d d			
d ss	20'-0"	r						road		
d ss		r								

**LEFT SIDE**

RIGHT SIDE

			FOR AFFECTED BUILDINGS																	
TYPE OF BUILDING	DIST OF BLDG TO NEW ROAD	LANDUSE	BUILDING USE			NOS. OF STOREY			CONDITION			MATERIAL			TYPE			LANDUSE	DIST OF BLDG TO NEW ROAD	TYPE OF BUILDING
						r	r	r												
		road																		
			c	5	c	9	c													
			12	r																
						ss														
						5	s	ds	ds											

**B. SITE EVALUATION.**

## 1. Objective of the Study

The objective of the study is to provide a guideline in the search for an optimum route which will cause the least environmental deterioration and face the least difficulties in construction work.

The method of analysis especially adopted in the study is suited to evaluate the macro-characteristics of a wider region so that the possible route can be examined by a wider view of various regional conditions. Emphasis is given to the identification of areas with any serious problems that may become a constraint to road construction.

## 2. Methodology

The method for the study is the mesh-system whereby various site conditions are shown according to the value of each cell. Maps with different site conditions are overlaid on each other to produce secondary data.

The process of study is as follows:-

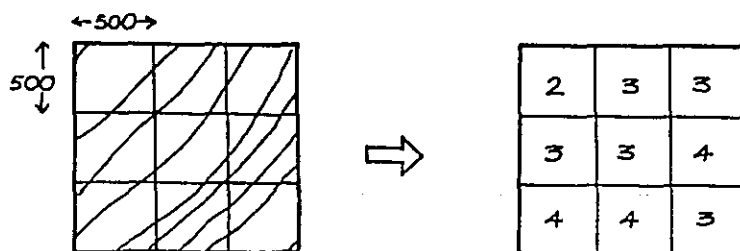
### 2.1 Division of the Study Area

The study area which is identified as the fringe of George Town is divided into cells of size 500' x 500'. Although more accuracy on site conditions can be obtained if the size of cells is smaller, the non-availability of information and lack of time for the study limits the cell size to be 500' x 500'. The size selected is considered sufficient as a general guideline for route search.

### 2.2 Preparation of Mesh Maps

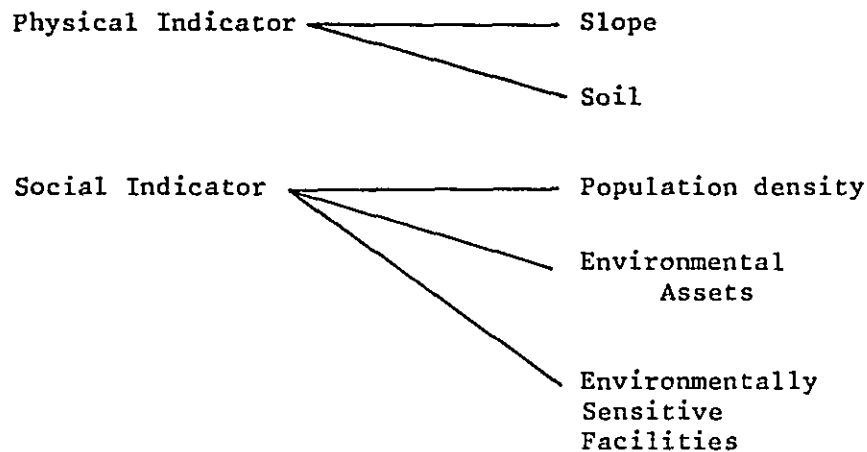
Graphical information of each cell is converted into digitalized information by classifying each cell according to the different categories.

Fig. 8. PREPARATION OF MESH MAP eg. for slope analysis



Indicators used for the study should represent the physical and social characteristics of the site and should be independent of each other.

Five indicators are selected as follows:-



### 2.3 Overlap of Maps

Each site condition shown in the form of a mesh map is overlaid with another.

In each step of overlaying mesh maps the decision table which gives a value to each cell is prepared.

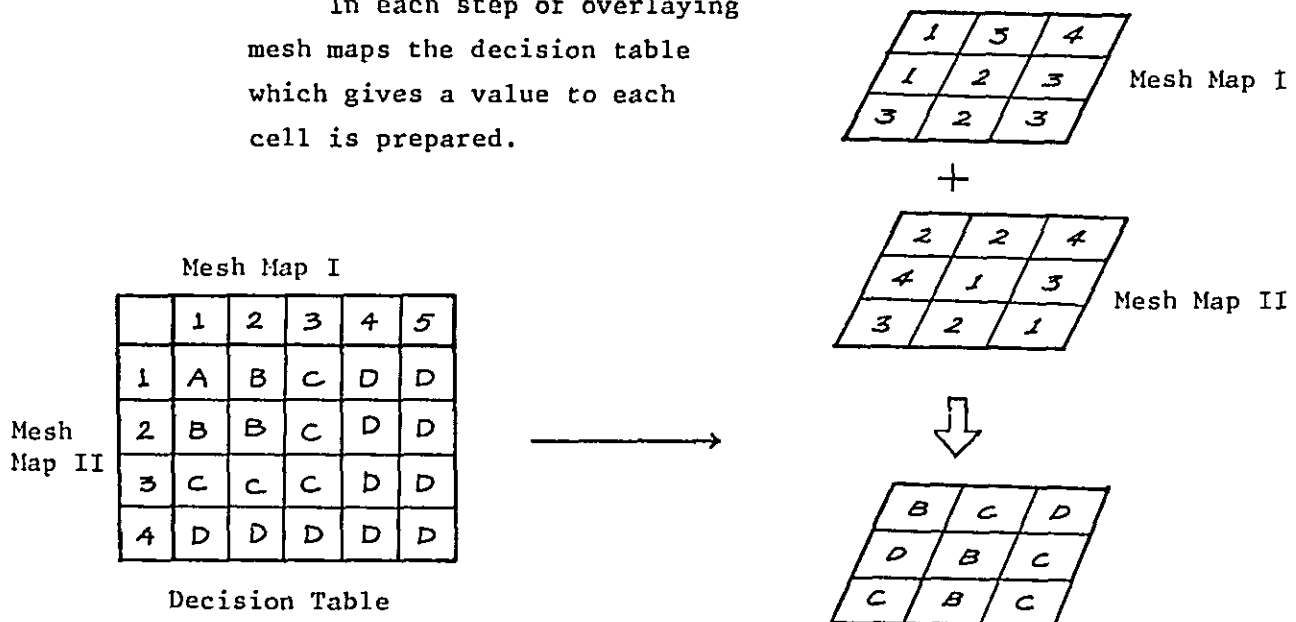


Fig. 9. METHOD OF OVERLAYING MESH MAPS

Two mesh maps are overlaid at a time. The flow of this process is shown in Fig. 10.

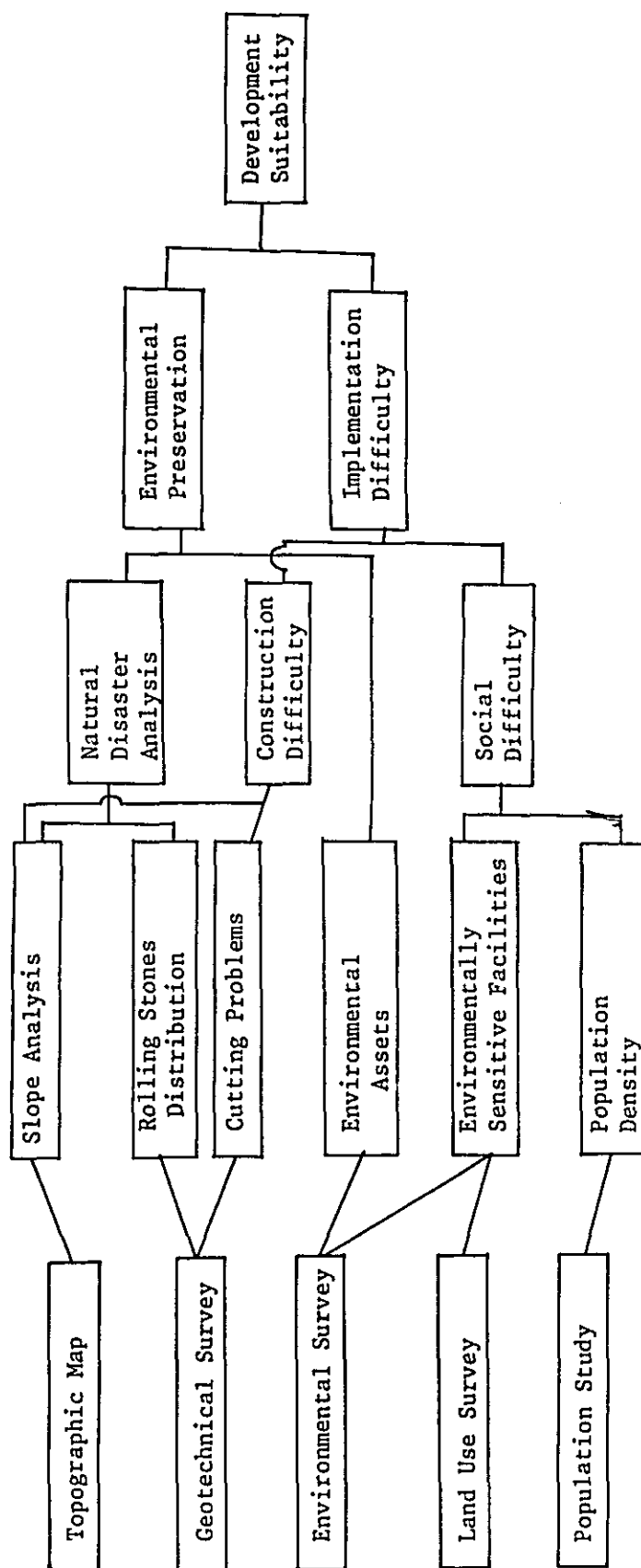


Fig. 10. FLOW CHART OF EVALUATION

### 3. Site Condition Analysis

The indicators of the site condition are as below :

- 1) Slope analysis
- 2) Cutting problem of rock
- 3) Problem of rolling boulders
- 4) Environmental assets
- 5) Sensitive facilities

#### 3.1 Slope Analysis (refer Fig. 11)

The slope or gradient was categorized according to the feasibility for road and building construction.

Four classes were identified as follows:-

- |             |                   |   |
|-------------|-------------------|---|
| Category 1) | 0 - 9%            | - road and building construction can be carried out easily.   |
| 2)          | 10 - 19% slope    | - building construction is still feasible but road construction may not be economically feasible.               |
| 3)          | 20 - 49% slope    | - building and road construction becomes not feasible economically although construction may still be possible. |
| 4)          | 50% & above slope | - construction of road or building is almost impossible.  |

The slope was taken as the steepest gradient for any cross-section of each cell.

#### 3.2 Geotechnical Analysis

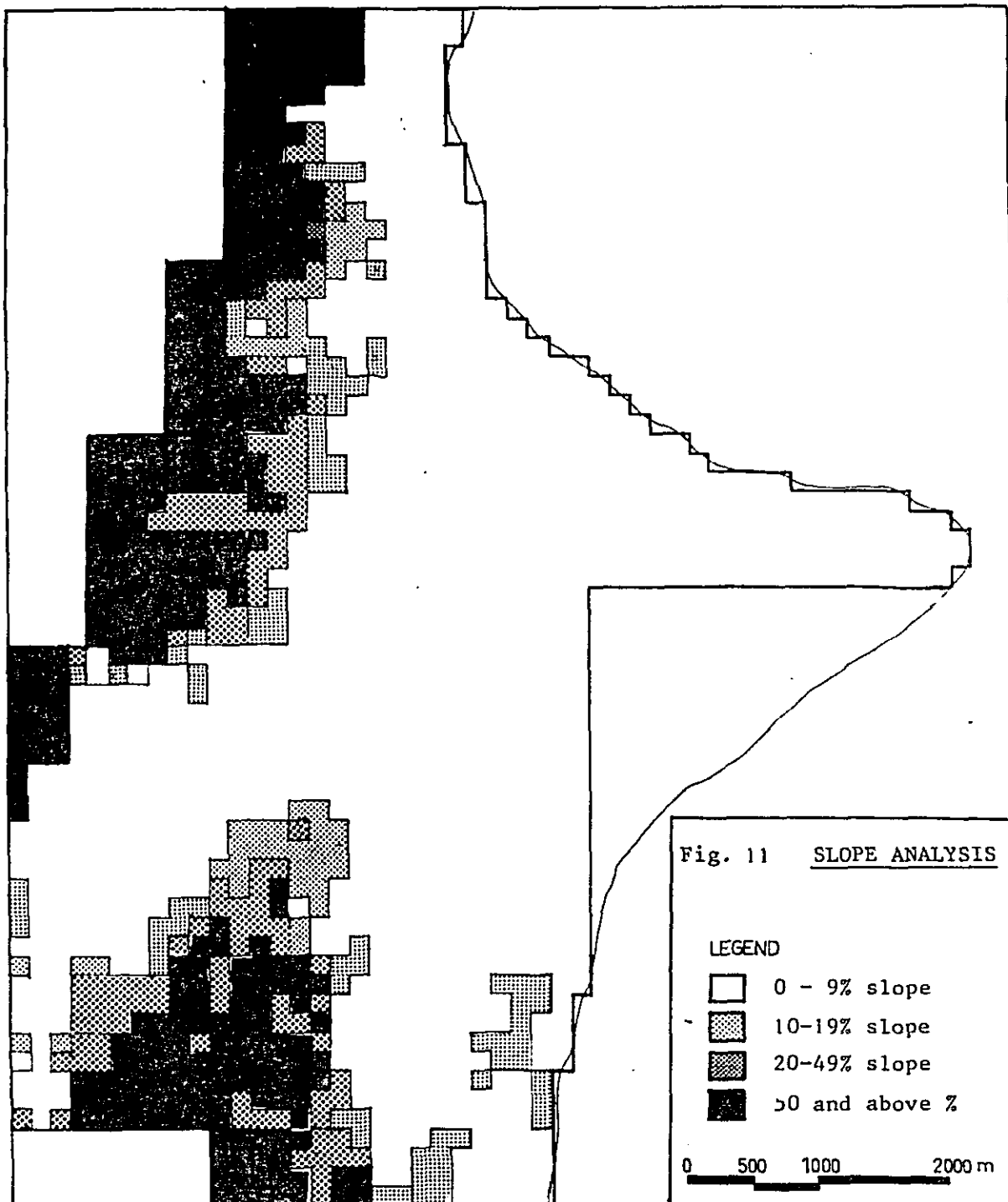
Two major problems of the geotechnical condition in the study area which may affect road construction are taken into account. These 2 problems are as follows:-

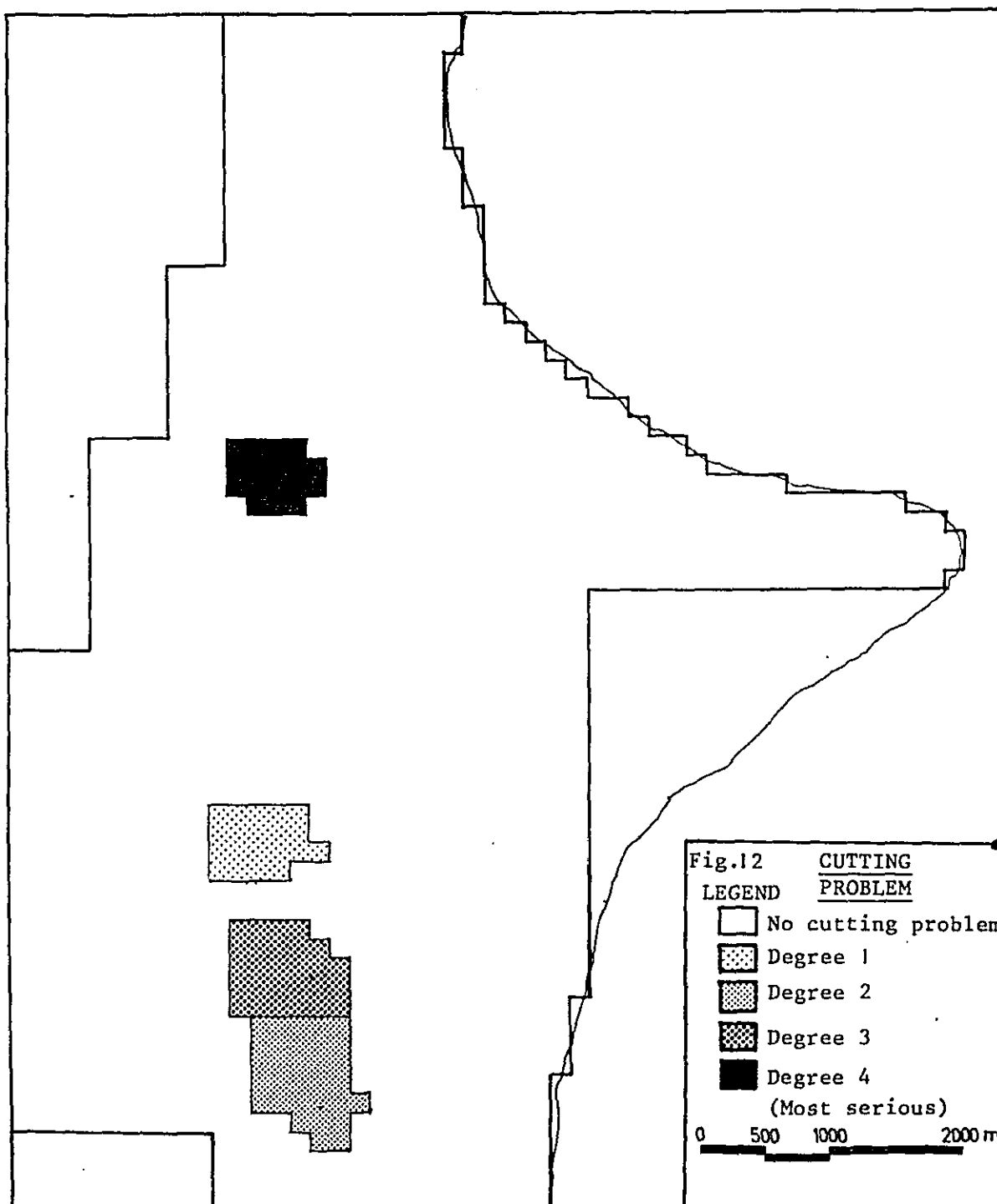
- 1) Cutting problem
- 2) Problem of rolling boulders.

##### 3.2.1 Cutting Problem (refer Fig. 12)

The hardness of certain rocks makes cutting difficult and would incur higher construction cost. According to the field survey conducted, some areas are classified to be of hard rock.







### 3.2.2 Problem of Rolling Boulders (refer Fig. 13)

Large boulders are frequently found on some of the slopes. These boulders could roll down the slope and cause destruction of the nearby properties if disturbed.

These area where many boulders exist is identified and classified according to the seriousness of the problem.

### 3.3 Environmental Assets (refer Fig.14)

An attempt to categorize the environmental assets was done by allocating points to each grid based on the following factors:-

- 1) landscape assets like roadside trees, greenery and views.
- 2) building assets like their architectural, cultural and historical interest.
- 3) urban design composition.
- 4) special facilities eg. the race course, park etc.

The area along Gurney Drive and some parts of the hill-land is identified to have assets.

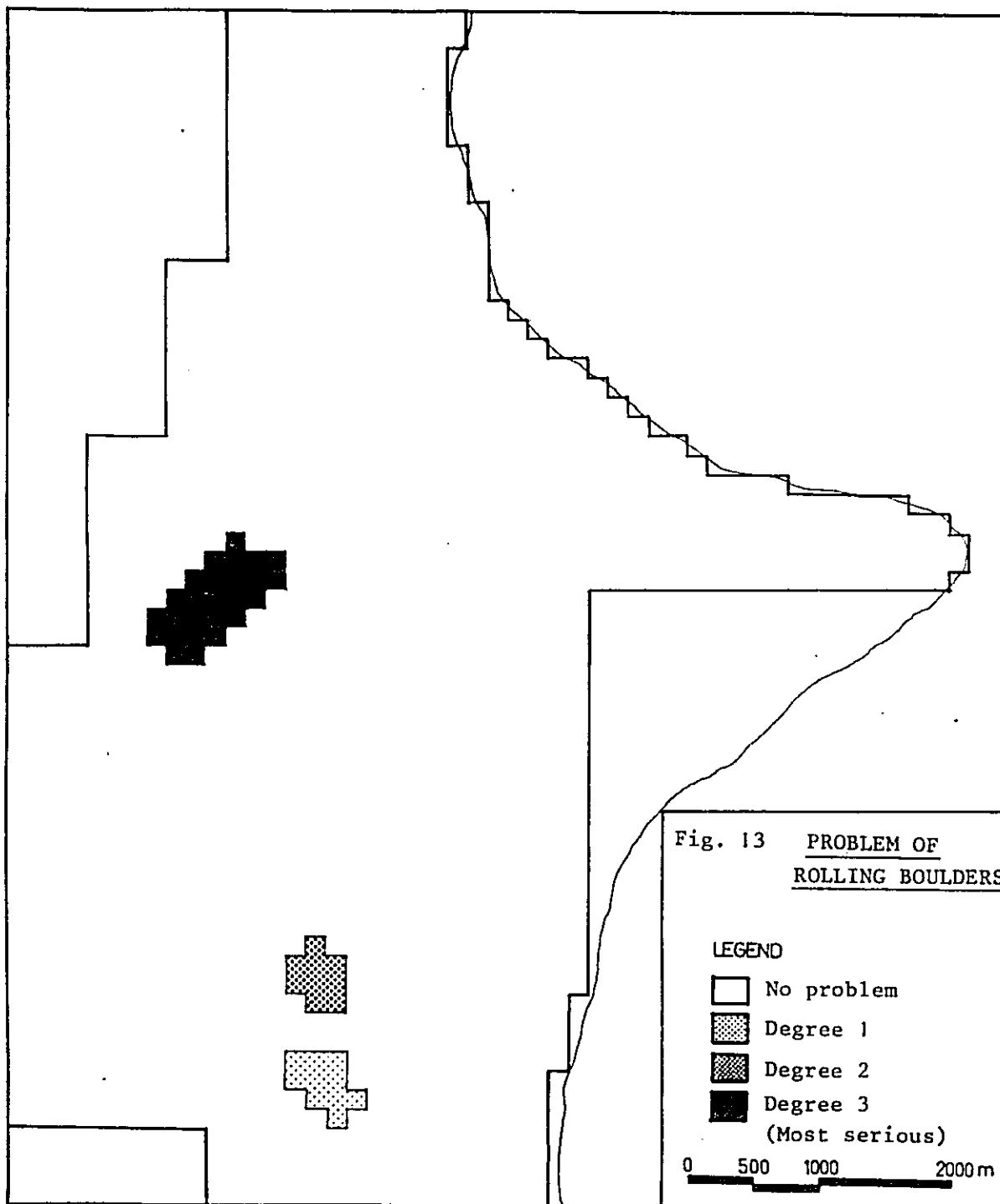
### 3.4 Environmentally Sensitive Facilities (refer Fig.15)

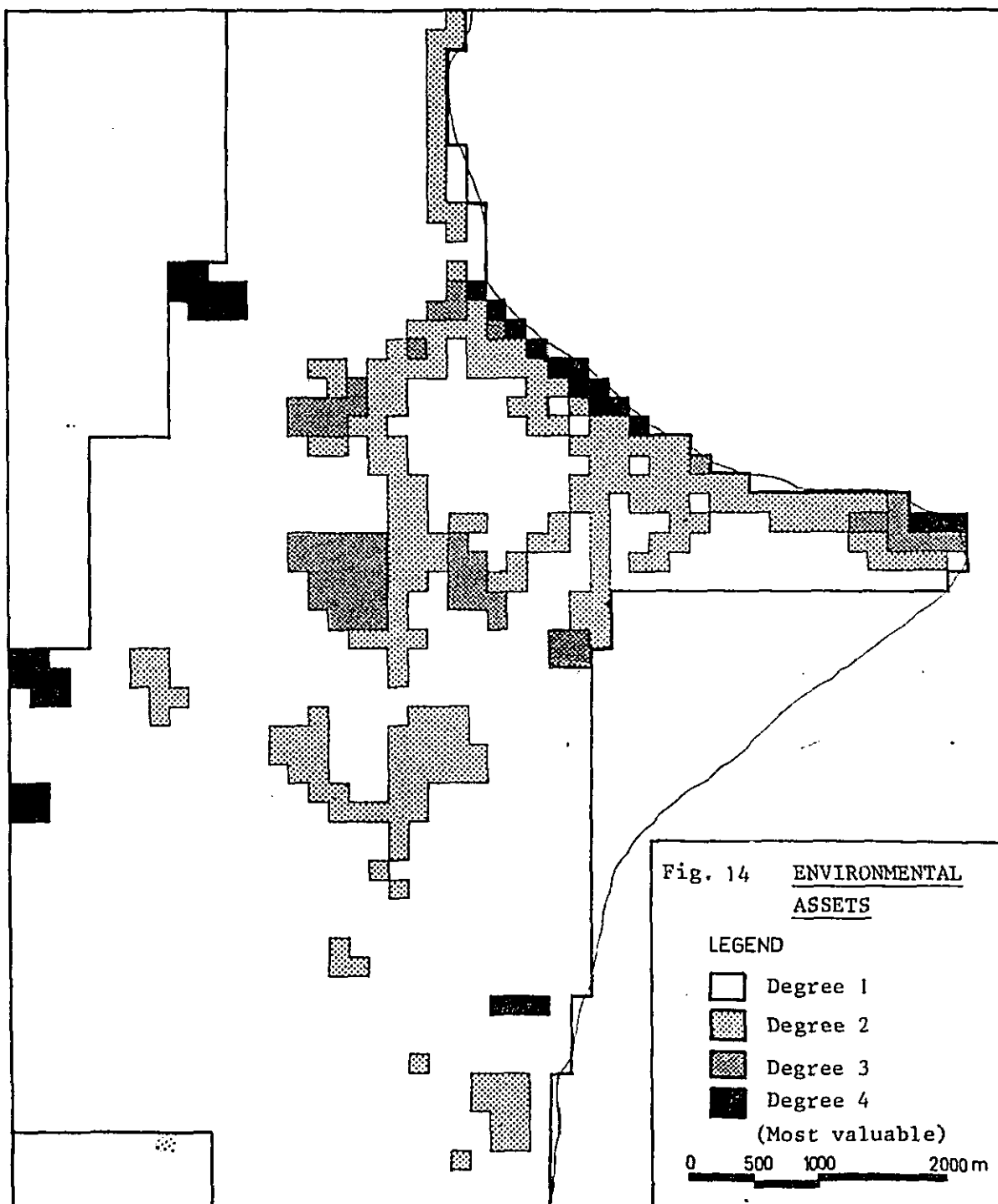
Sensitive areas are taken to be those areas which are highly affected by noise and air pollution, visual intrusion or other social and cultural disruption that may be introduced with any road construction.

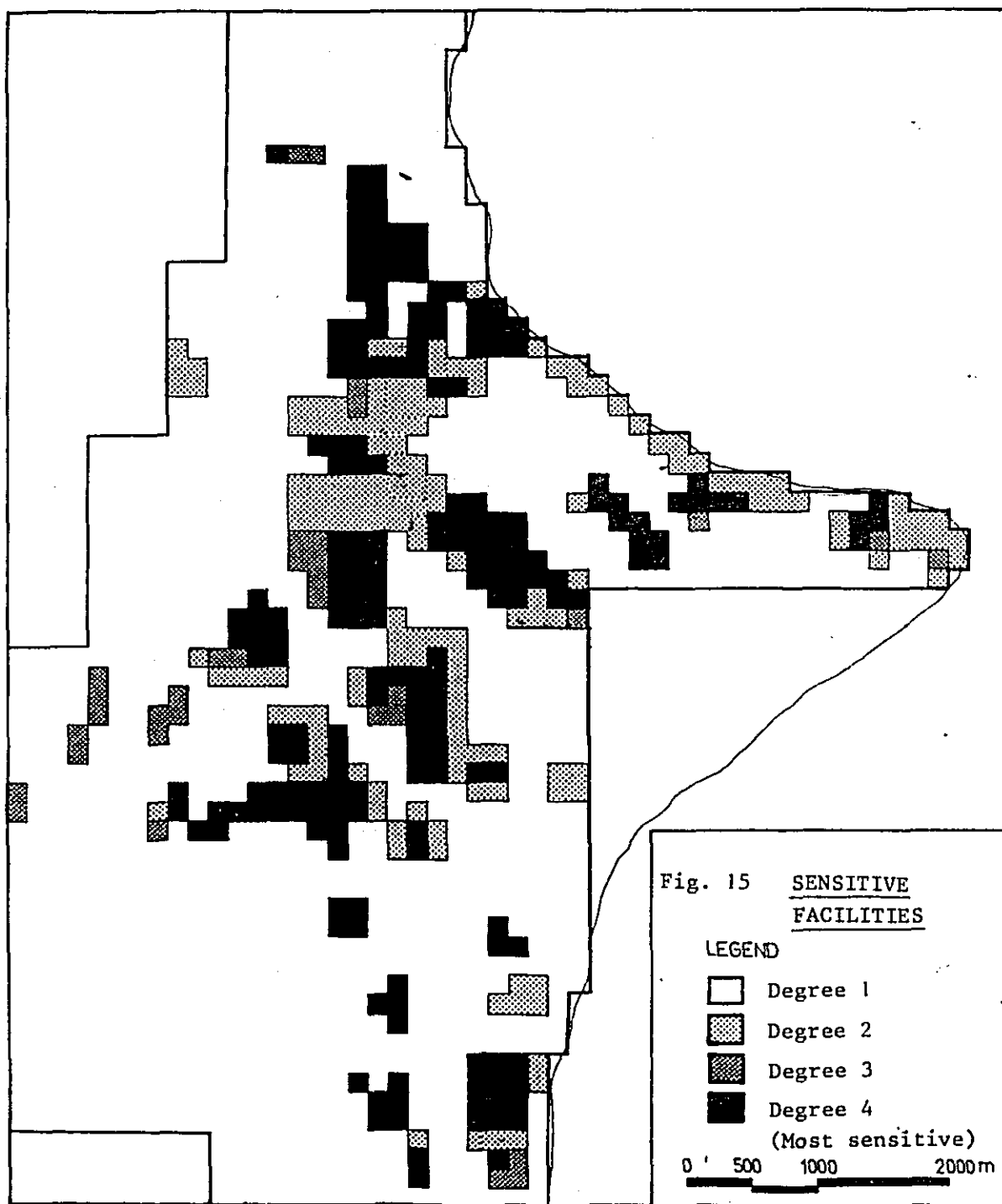
Sensitive facilities are ranked as follows starting with the most sensitive facilities:

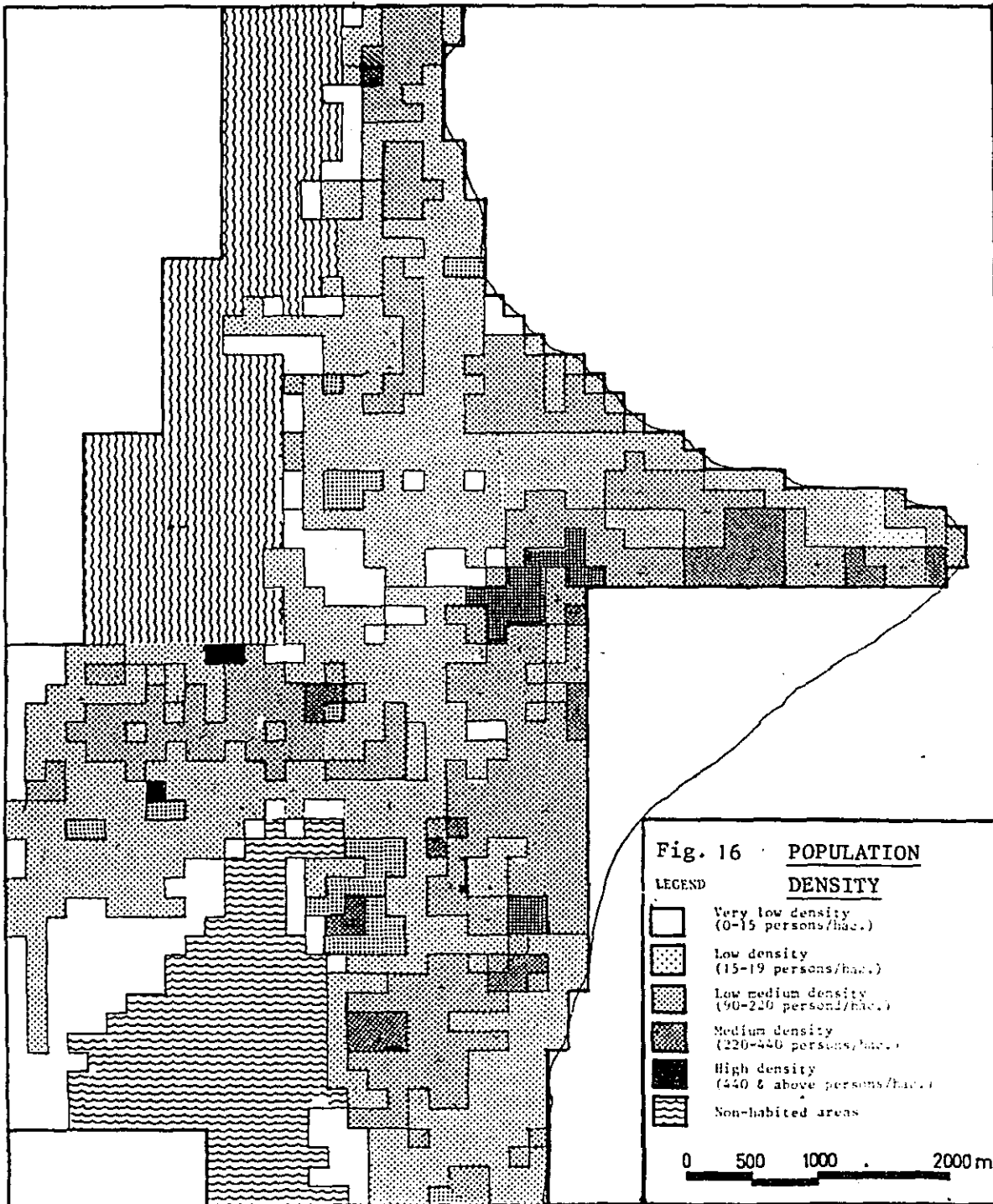
- 1) schools, hospitals, cemeteries
- 2) places of worship
- 3) other public institutions like government buildings, cultural buildings, etc.

Cells with sensitive facilities are therefore categorized according to the type of sensitive facilities contained.









## 3.5

Population Density (refer Fig. 16)

The classification into categories was done by adapting the interim zoning classification.

Table 1 POPULATION DENSITY CLASSIFICATION

Category	Density Classification	Interim Zoning Density
	persons per ha.	Persons per ha.
0	non-habited	
1	0 - 15	
2	15 - 90	Low Density (15 - 90)
3	90 - 220	Low Medium (90 - 220)
4	220 - 440	Medium (220 - 440)
5	440 -	Medium High ( 440 - 880)
		High (880 - )

The density is taken as the gross population density for each cell. As the cells are small in size, the first category of very low density was added in order to differentiate areas which have very low density but are not uninhabited. The 'medium high' and 'high' density categories classified in the interim zoning plan were combined into one category as there are few areas with these two categories.

Most of the residential areas are classified into two categories (15 - 90 per ha and 90 - 220 per ha ). In general, the nearer the city center the higher is the density.



#### 4. Evaluation

##### 4.1 Natural Disaster (refer Fig. 17)

This analysis intends to identify the area where it may be possible for natural disaster to occur if any land reform is undertaken. The major cause of the expected disaster in the study area is supposed to be the rolling down of boulders.

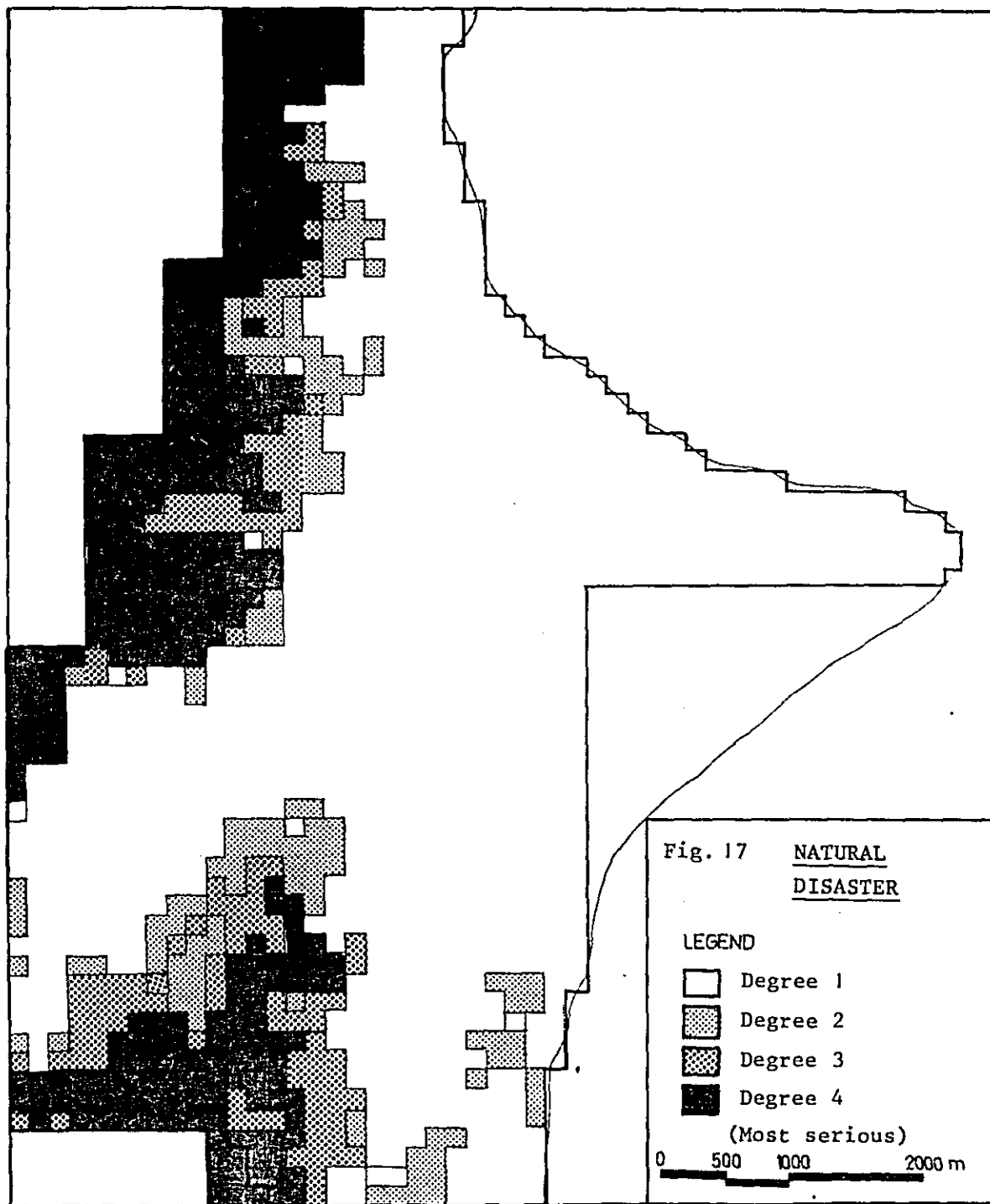
The decision table is prepared in order to classify the area according to the possibility of such a case.

Table 2  
DECISION TABLE : DEGREE OF POSSIBLE OCCURANCE OF  
NATURAL DISASTER

Slope Boulders		→ Steep			
		1	2	3	4
↓ Many	1	A	B	C	D
	2	B	C	D	D
	3	B	D	D	D
	4	C	D	D	D

Note : Category D has the highest degree of possible occurrence of natural disaster.

The hill-land in the north-west and south-west are found to be the most serious regarding the problem of natural disaster.



## 4.2

Construction Difficulty (refer Fig. 18)

The degree of physical difficulties in construction adopted in this analysis is subject to the steepness of slope and the hardness of the hill. The decision table is as follows:

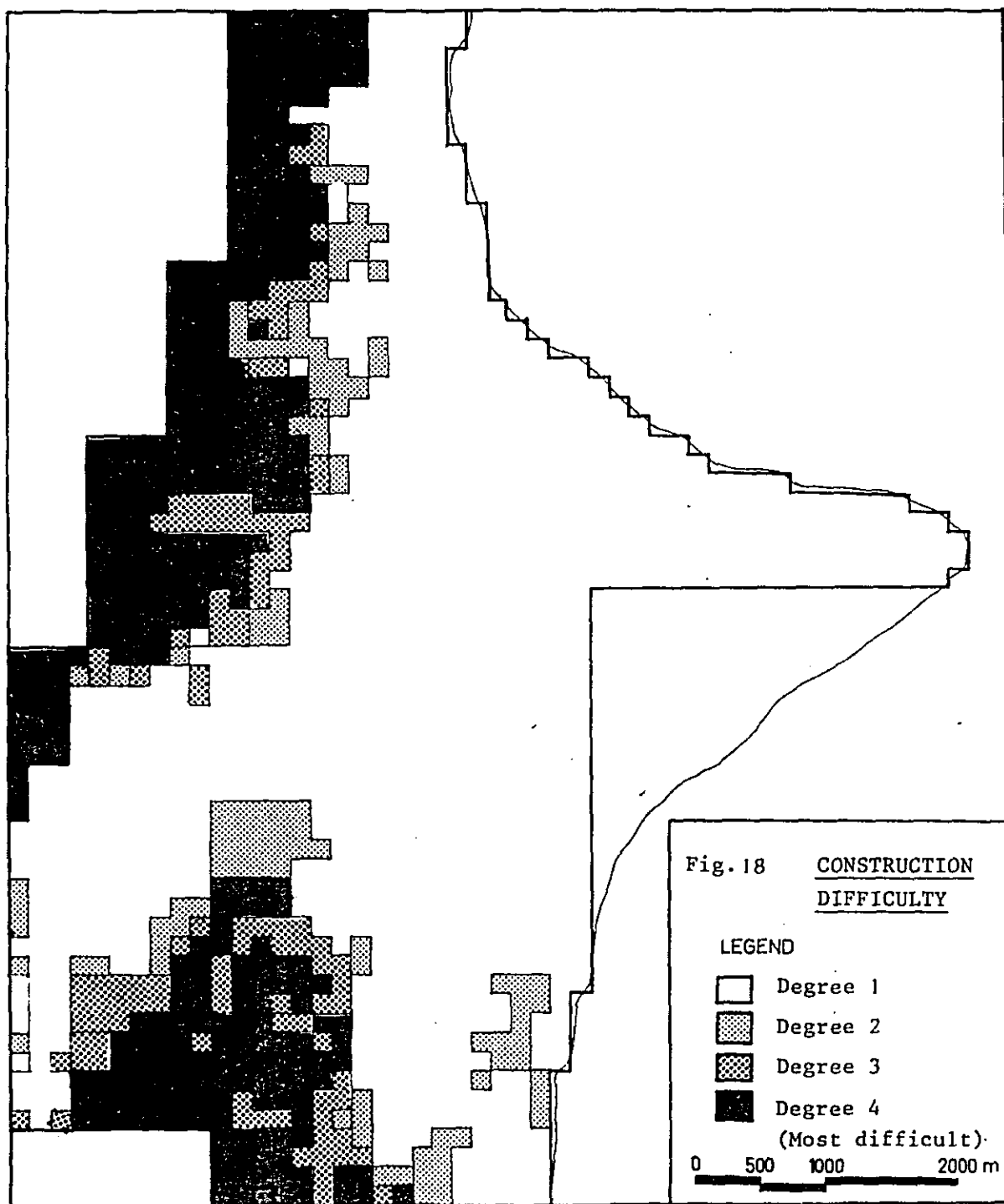
Table 3

DECISION TABLE : DEGREE OF CONSTRUCTION DIFFICULTY

Slope Cutting difficulty		→ Steep			
		1	2	3	4
↓ Difficult	0	A	B	C	D
	1	B	B	C	D
	2	B	B	D	D
	3	C	C	C	D
	4	C	C	D	D

Note : Category D has the highest degree of difficulty.

Most of the hilly area is identified as comparatively difficult to construct any road.



## 4.3

Social Difficulty (refer Fig. 19)

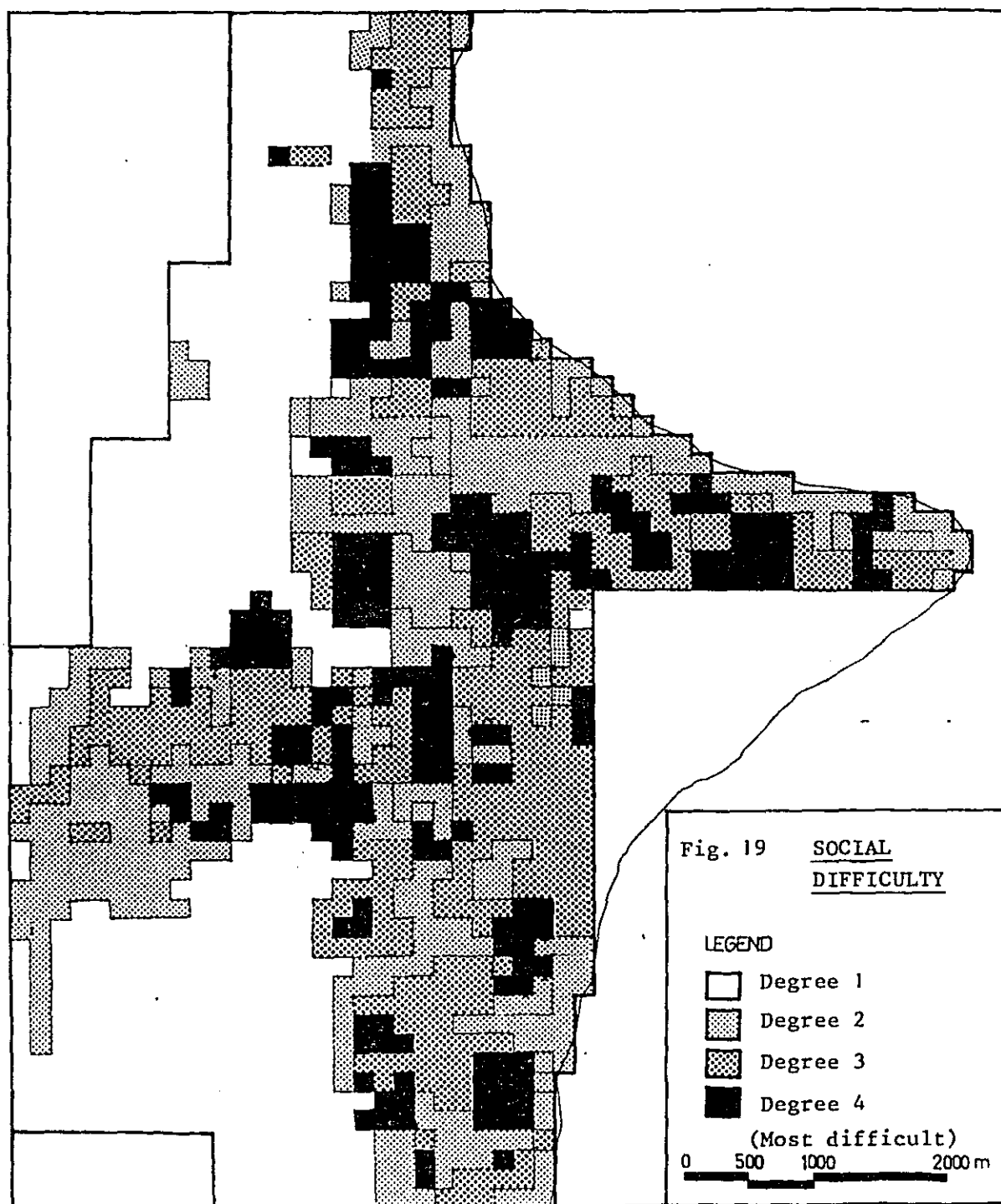
In this analysis the social difficulties which may be encountered in an implementation is subject to the population density and the existence of the sensitive facilities. The decision table is prepared as follows:

Table 4  
DECISION TABLE : DEGREE OF SOCIAL DIFFICULTY

Population Density Sensitive Facilities		→ high				
		1	2	3	4	5
↓ Sensitive	1	A	B	C	D	D
	2	B	B	C	D	D
	3	C	C	C	D	D
	4	D	D	D	D	D

Note : Category D has the highest degree of social difficulty.

The areas with some social difficulties are scattered around the study area except the hilly areas.



Environmental Preservation (refer Fig. 20)

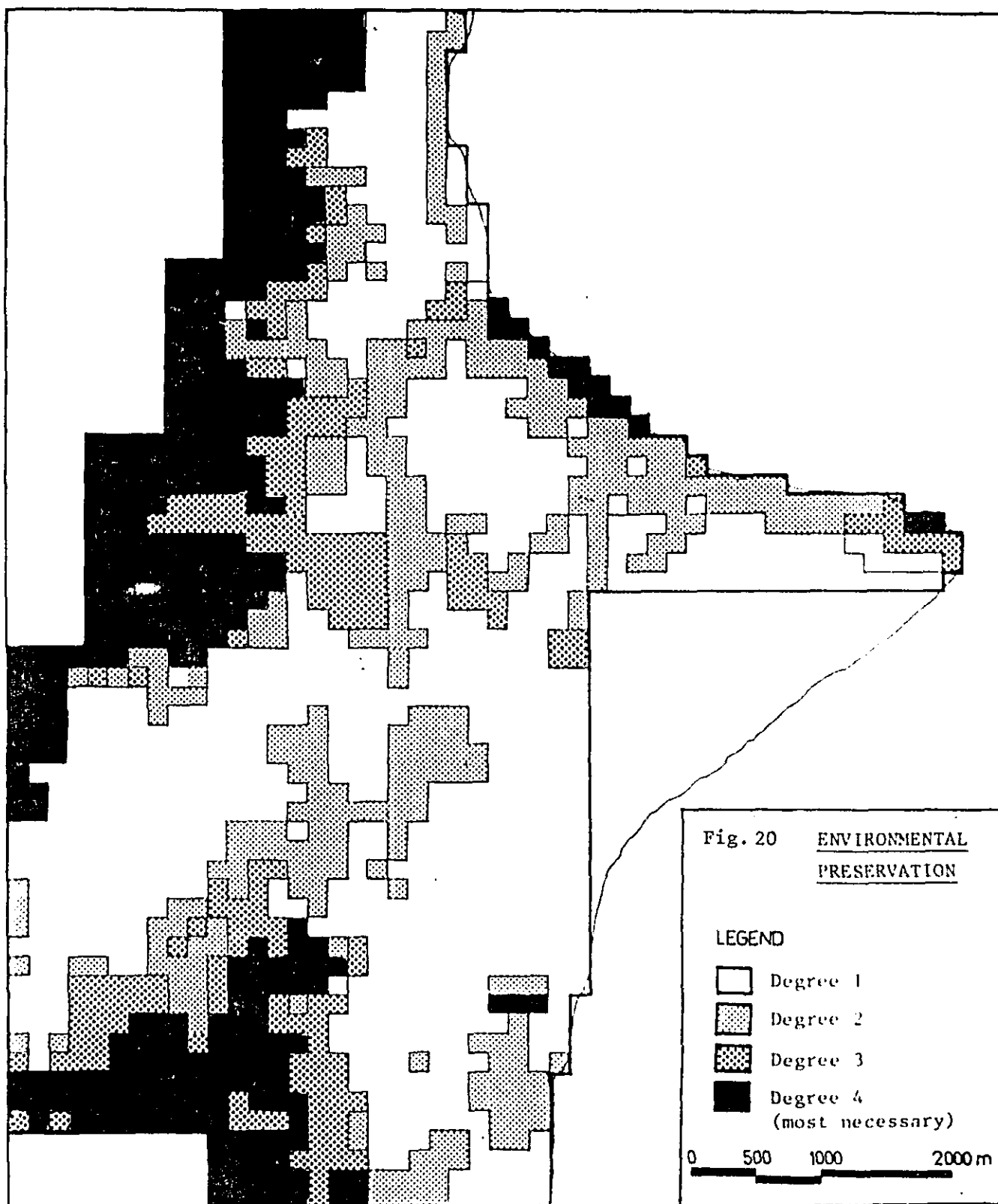
This analysis intends to identify the area which has an environmental value and needs to be preserved.

Whereby justification for preserving the present condition lies in the good quality of the environment and the possibility of the disaster, the decision table is designed as follows:

Table 5  
DECISION TABLE : DEGREE OF NEED FOR  
ENVIRONMENTAL PRESERVATION

Environmental Natural Assets Disaster	A	B	C	D
A	A	B	C	D
B	B	B	C	D
C	C	C	D	D
D	D	D	D	D

Note : Category D has the highest degree of need for environmental preservation.





## 4.5

Implementation Difficulty (refer Fig. 21)

Difficulties in implementation the project is due to construction and social difficulty which have already been evaluated.

The cells identified to be less difficult is the site where the road is economically feasible to be constructed.

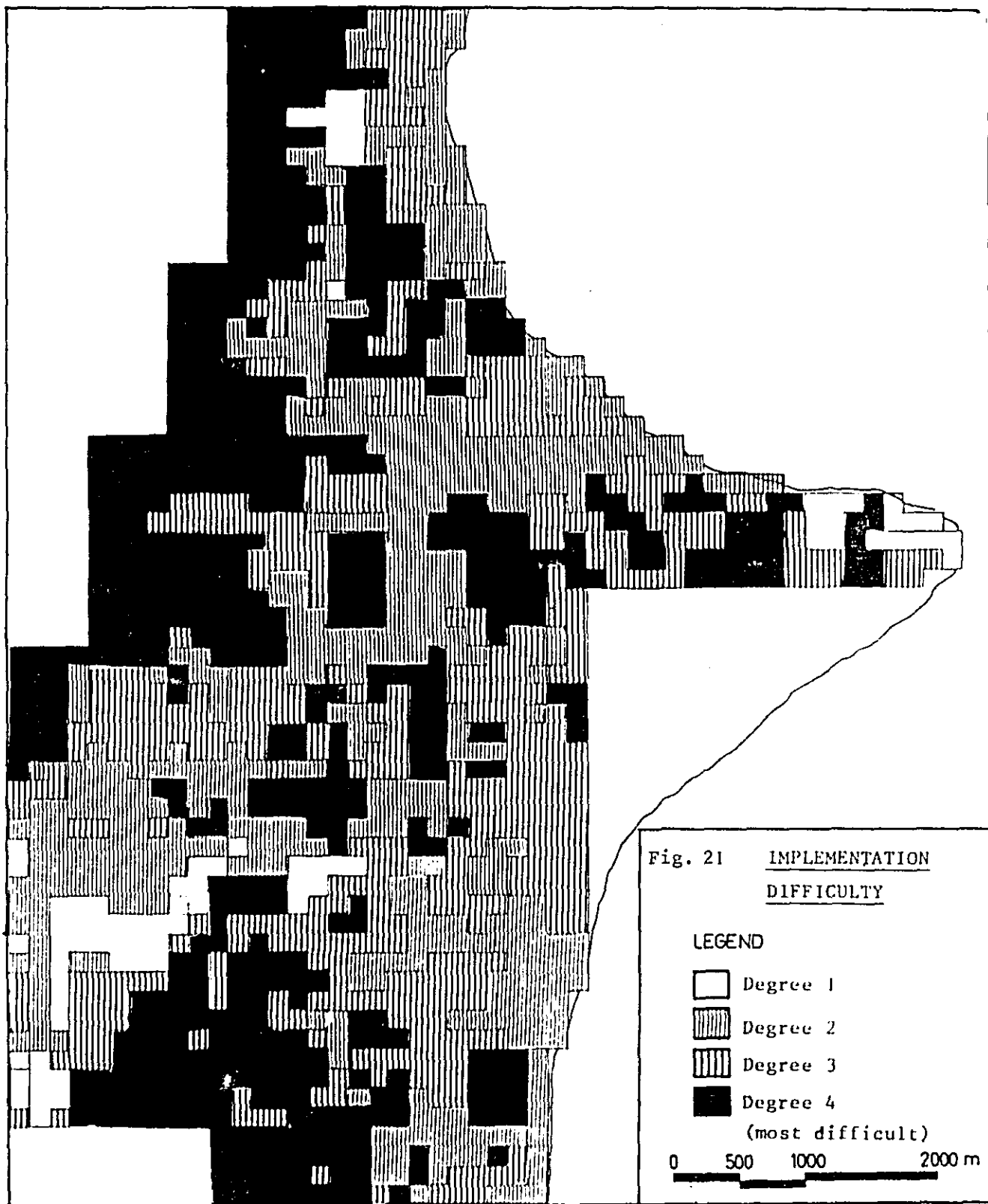
Table 6

DECISION TABLE : DEGREE OF IMPLEMENTATION  
DIFFICULTY

Social Difficulty Construction Difficulty	A	B	C	D
	A	B	C	D
A	A	B	C	D
B	B	B	C	D
C	C	C	C	D
D	D	D	D	D

Note : Category D has the highest degree of implementation difficulty.

The most difficult areas are mainly distributed at the hilly region due to the steep slopes here. In the lower terrain region, some areas are also observed to be most difficult due to the high density of population.



Development Suitability (refer Fig. 22)

The result of this evaluation is almost the same as that of the map of implementation difficulty. However, consideration must be taken into account as to the preservation of the present environment.

Table 7

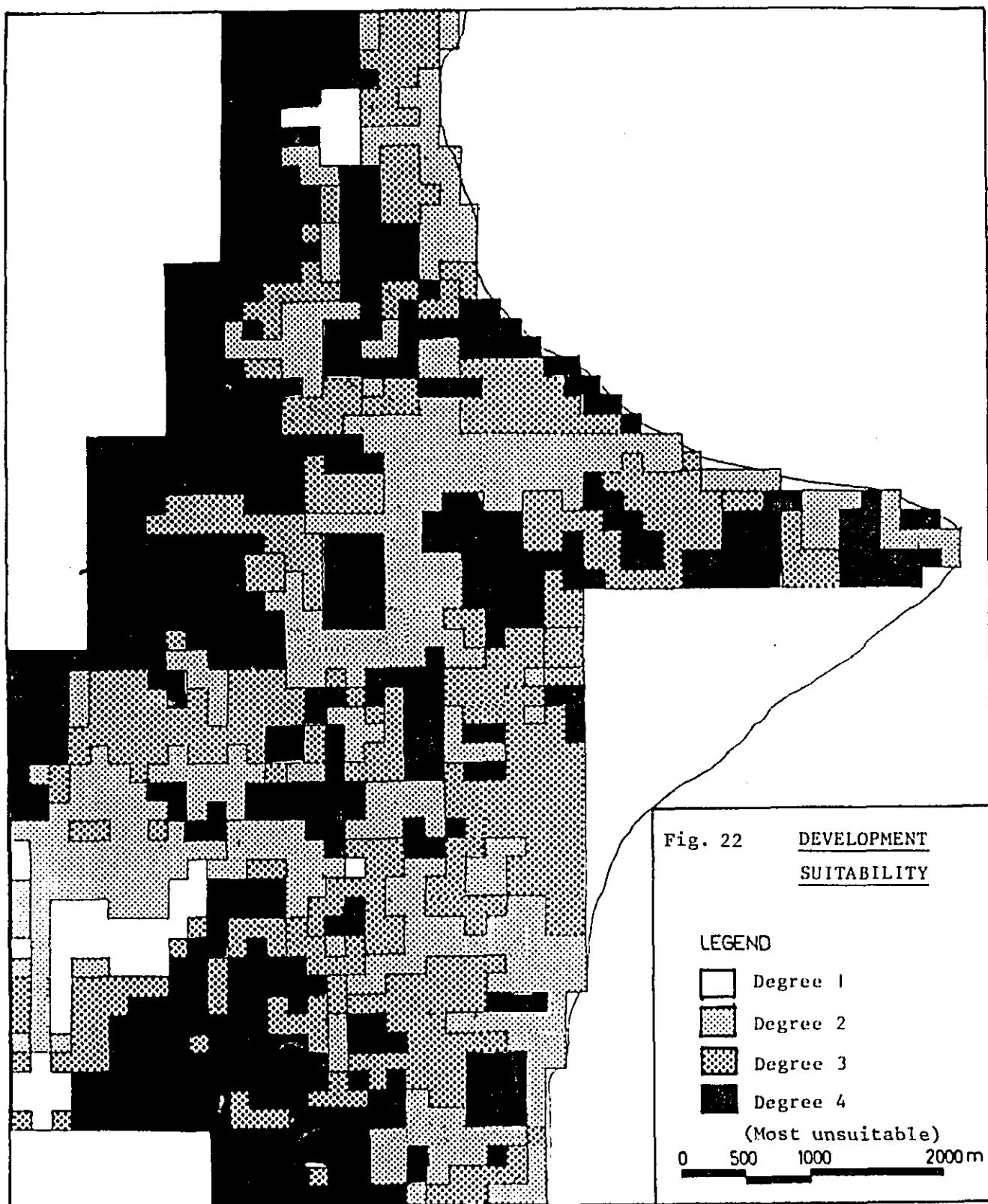
DECISION TABLE : DEGREE OF DEVELOPMENT  
SUITABILITY

Environmental Preservation Implementation Difficulty	A	B	C	D
A	A	B	C	D
B	B	B	C	D
C	C	C	C	D
D	D	D	D	D

Note : Category A is most suitable and category D is Most unsuitable.

Most of the area along the Outer Ring Road is classified as rather unsuitable for development due to the location of steep hills, dense population and sensitive facilities such as cemeteries. However, a narrow passage which may allow the road to pass through without much conflict with the present environment is sometimes found.

Most critical areas in terms of development suitability are the areas from Bagan Jermal to Ayer Itam, especially at Batu Gantong and the residential area of Glugor where a more careful search for a route is necessary.



5. Limitation of the study

Since the size of the cell is 500 ft. square, this method cannot take into account the precise change of site conditions which happens within a cell. Also, there is another basic limitation of the method that the correlation between cells for instance, community cohesion problems or a limitation of the road gradient cannot be analysed since each cell is evaluated independently. Also the priority between different decisions were done subjectively by planners.

However, the objective of this study is only to search for a possible route. The result of the study is therefore informative enough to obtain a macro-view on the possible route of the Outer Ring Road.

