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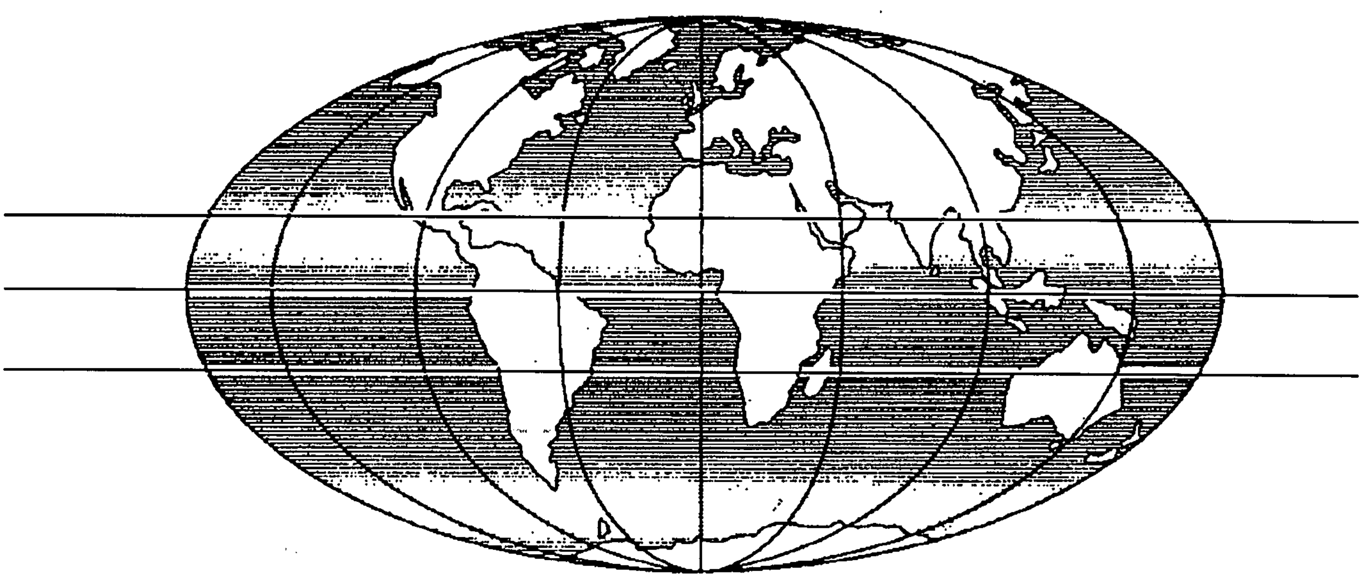

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THE USE OF THE MICROCOMPUTER PACKAGE MAAP IN FIVE ASIAN COUNTRIES

by

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ABSTRACT

An efficient accident recording and analysis system is a basic requirement for any country attempting to tackle its road accident problem on a rational basis. In 1975, the Overseas Centre of TRL reported a survey of accident data recording and analysis systems in operation in developing countries, including 10 Asian countries. It was found that at that time, very few developing countries had computerised systems, and as a consequence only very basic analysis of their data was being carried out. The Overseas Centre began development of a Microcomputer Accident Analysis Package (MAAP) at the beginning of the 1980's and, at the same time, it began experimenting with new designs of police accident report forms that were intended to be both easy-to-use and compatible with computer coding.

The first trials of MAAP took place in Egypt in 1983, and in 1986 the Karachi Development Authority adopted the Package for analysis of its accident data. The first countries to adopt the system nationally were Papua New Guinea and Botswana in 1987. Major trials of the system currently under way in Asia are taking place in regions of China, Indonesia, Malaysia and Sri Lanka. Both the Indonesian and Malaysian police have adopted accident report forms nationwide that are based on TRL designs. This paper describes and compares the very different implementations of the Package in five of these countries: Indonesia, Malaysia, Pakistan, Papua New Guinea and Sri Lanka.

1. INTRODUCTION

The Overseas Centre of TRL began its research into the problems of road accidents in developing countries in 1972 (Jacobs, 1977). As the research programme progressed during the 1970's, it became increasingly apparent that there was an urgent need to turn attention to the problem of road accident data collection and analysis. Manual analysis of accident records was considered by some at that time to be "appropriate" for developing countries, but in practice it was found to be a very slow, inconsistent and error-prone process. Computer analysis was clearly required but a survey had found few developing countries were using computers for their database (Jacobs et al, 1975). At that time, there was widespread concern among international aid agencies about the appropriateness of mainframe computing in developing countries, largely because of staffing and maintenance problems.

When microcomputers became available at the beginning of the 1980's, they were immediately seen by the TRL research team as offering a very real opportunity to resolve this problem. Microcomputers potentially offered a number of advantages to developing countries over mainframes. They were (i) very cheap; (ii) physically robust and tolerant of difficult environments; (iii) relatively easy to maintain; (iv) readily accessible to the user; and (v) much less intimidating than mainframes. In addition, the style of programming that developed with microcomputers, with its emphasis on interaction and 'user friendliness', seemed to be particularly helpful to developing country users.

It was against this background that the Overseas Centre of TRL began development of its Microcomputer Accident Analysis Package (MAAP) in 1981. The package was originally developed as part of a co-operative programme of road safety research with the Egyptian Government. In parallel with the Package, an easy-to-use police accident report booklet was also developed (Gaber & Yerrell, 1985). The Package was first described in Hills and Kassabgi (1984) and Hills and Elliott (1986). It has gone through a process of continuing development as experience and the number of active users in developing countries has grown. These developments, which included bilingual versions and versions in Arabic and Chinese, were partly carried out under contract by the Transportation Research Group of Southampton University.

The Karachi Traffic Engineering Bureau in Pakistan adopted the system in 1986, and Papua New Guinea and Botswana were the first countries to adopt it as their national system in 1987. The Package now has over 80 licensed users world-wide and it has been adopted or is under full scale field trials in some 18 countries. It is now beginning to be adopted by a number of developed country users. A major upgrade of MAAP (Version 5) is near completion, with new facilities that include both scanned and vector mapping of accidents.

The main purpose of this paper is to describe the implementation of MAAP in five Asian countries: Papua New Guinea, Indonesia (Bandung), Malaysia, Pakistan (Karachi) and Sri Lanka (Colombo). With the data that is now accumulated, a comparison of some of the detailed characteristics of road accidents between these countries is also presented.

2. THE IMPLEMENTATION OF MAAP IN THE FIVE COUNTRIES

This section briefly describes how the Package was introduced in each country and compares the accident record formats that have been adopted. In each case, the implementation has involved the design and pilot testing of an accident report form; the configuration of the software; the development of coded maps for urban areas to enable link-node-cell and coordinate analyses (for rural highways the system depends on kilometre posts); and a considerable amount of hands-on training. The whole process requires the establishment of close working relationships between government departments, usually the traffic police and the relevant highway and transport ministries. The system is aimed at identifying patterns of accidents, prioritising hazardous sites or areas, assisting in the selection of appropriate remedial actions and, ultimately, evaluation.

2.1 Papua New Guinea

The first trial of MAAP in Papua New Guinea began in 1986 as part of the PNG Road Safety Study carried out for their Department of Transport (DoT) under an Asian Development Bank-funded project. The existing mainframe accident recording system in PNG began operation with the Royal Papua New Guinea Constabulary (RPNGC) in 1980. An excellent office system had already been established by the RPNGC to collect, code and store over 5000 accidents per year from the 20 provinces. However, by 1985/6 the mainframe computer was suffering considerable operating difficulties leading to major delays in updating accident records and producing analyses. Some key pieces of information were also found to be missing in the accident report form.

The opportunity was therefore taken in 1986 to carry out a trial of a revised accident report form and of entering the data onto the MAAP system. Following the success of this trial, the system became the official national database from January 1st, 1987. Existing mainframe records were downloaded and transcribed to the MAAP system, so that there is now an accident database of over 40,000 records. The RPNGC and DoT produced their first major publication from the MAAP system, "Road Accidents Papua

New Guinea 1987", in 1989. The extensive analyses laid the foundation of the road safety programme in PNG. The main findings showed an accident pattern very different in nature to that found in a typical developed country and a number of these will be discussed in later sections. At present, all accident coding is carried out by the RPNGC and all computer data entry is managed by the DoT.

2.2 Bandung, Indonesia

The Institute of Road Engineering (IRE), Bandung and the TRL Overseas Centre have had a long history of co-operative research and, in 1988, an opportunity arose to collaborate on a road safety project with the World Bank-funded Bandung Urban Transport Project (BUTP). An experimental accident report form based on earlier TRL research was developed and the text screens of MAAP were translated into Bahasa Indonesia. The system was installed with Bandung Traffic Police on an experimental basis during 1988 and a very detailed analysis of the database was published in 1990 (Lundebye and Harahap, 1990). The pattern of accidents was again very different from a typical developed country and, as will be discussed, was also very different from the pattern found in Papua New Guinea. As a result of this trial, the national Traffic Police began a programme of collaborative development of the system with IRE. Further trials of MAAP (re-titled for Indonesia "Triple-L") began in Semerang in 1990. Nationally, there are about 30,000 accidents recorded per year in Indonesia.

In 1991, the TRL began a World Bank-funded Training and Research Programme Phase II (TARPII) project at IRE. This contained a major road safety component which involved close collaboration with the national Traffic Police. This led to: (i) the development and trial of a national road accident report form; and (ii) the establishment in 1992 of Triple-L in Surabaya and a rural area, Polwakarta. A programme of accident investigation and countermeasures was established for Bandung (Thompson and Rudjito, 1992) and an "Interim Accident Investigation Manual for Indonesia" developed. Overall responsibility for road accidents passed to the Ministry of Transport and Communications in 1992 and the role of this Ministry is being developed under a separate World Bank-funded project. The new design of accident form was adopted at the national level from March 1993. At present, all coding and computer data entry are handled by the Traffic Police with IRE support.

2.3 Malaysia

The Royal Malaysia Police have a long established mainframe system for storing and analysing road accidents. It is used primarily to produce an annual report containing detailed statistics for each year's accidents at the national level (currently over 100,000 are recorded per year). Whilst this system has many excellent features, it was not well suited for analysis of accidents at a local level, with the coding of accident locations and lack of geometric information being particular problems. In 1990, the Sub-Committee for Research, Development and Evaluation of the National Road Safety Council (MKJR) of Malaysia began an accident investigation research programme at the University Pertanian of Malaysia. This involved (i) the design of an experimental accident report form using earlier TRL designs as a starting point; (ii) the establishment of a Bahasa Malaysia version of MAAP, reconfigured by TRL for the experimental booklet; (iii) the entry of data for sections of a national highway (Radin Umar and Aminuddin, 1990); and (iv) the establishment of demonstration projects using the new booklet and microcomputer system for the cities of Shah Alam and Seremban, involving the production of specially coded maps and participation of the local police stations. Initial results were reported by Radin Umar and Aminuddin (1992). As a result of these successful trials the MKJR and the Royal Malaysia Police further developed the report form, and the new design was introduced as the national accident report form from 1st January 1992. A transcription program was developed by TRL to enable the downloading of data from the Police mainframe to the microcomputer system, and to convert existing pilot data to the new format.

Within the Ministry of Works (MOW), the Highway Planning Unit (HPU) has been developing its capability to identify and investigate high risk areas since the early 1980's, and as part of this, HPU and the Public Works Department (JKR) have been engaged since 1990 in a World bank-funded project aimed at treating the worst 42 accident blackspots in the country. In 1992, the HPU decided to adopt MAAP for its long term programme of work, and has recently been actively involved in trying to improve the accident location recording for this database. The Public Works Department's research and training establishment, IKRAM, is in the process of establishing a road safety research programme (Shafii, 1991); and in 1993 a programme of collaborative research began with TRL. After improving the quality of the accident location data, MAAP will be will be used to identify specific engineering features that are hazardous and to evaluate various accident countermeasures.

2.4 Karachi, Pakistan

The Traffic Engineering Bureau was first established within the Karachi Development Authority in 1981. With the success of a number of traffic management schemes, the TEB quickly grew. To speed up the process of scheme implementation, the TEB drew up a Traffic Engineering Act which was subsequently passed by the Sind Provincial Parliament. Amongst its projects, the TEB developed an accident coding sheet and established its own team of accident investigators who worked closely with the Traffic Police. In 1986, as a result of collaboration between the TRL and TEB, a special version of MAAP was produced for use with the TEB accident report form. Coded maps of Karachi were also developed. Monthly and annual reports of accident statistics have been regularly produced using this system. At present, all coding and data entry is carried out by the TEB team who make regular visits to the police stations and currently record the details of about 1100 accidents per year.

Cooperative research between TRL and TEB has further developed with a pedestrian safety project (Sayer et al, 1991; Downing and Zaheer, 1993). MAAP has also been configured for the City of Islamabad where the National Traffic Research Centre (NTRC), in a collaborative exercise with TRL, is hoping to establish a database system appropriate for national use.

2.5 Colombo, Sri Lanka

The Traffic Police of Sri Lanka currently record over 30,000 accidents annually. These data are collated and checked at the Police Headquarters in Colombo and then sent to the central government's Department of Census and Statistics for storage on a mainframe computer. The police currently produce standardised quarterly national accident statistics and an annual summary from the Department's regular printouts; however, much of the data for these reports has to be prepared by hand from the computer printouts. The Sri Lankan authorities have for several years been increasingly dissatisfied with the deficiencies in the existing computerised system. For example, it is not capable of identifying the exact location of blackspots, and requests for particular information often take considerable time to process. As a result, the TRL has been involved in an ODA-funded project to introduce MAAP on a trial basis in part of Colombo. The pilot area chosen included the central part of Colombo and an 8 km corridor following the coastal road south. For compatibility with the existing system, only very minimal changes were made to the existing accident report form. At present, both coding and computer data entry are being carried out at Police Headquarters. It is hoped that the pilot area, which has now been in operation for about 20 months, will soon be extended.

3. COMPARISON OF COMPUTER ACCIDENT RECORD FORMATS

Table 1 compares the structure and selected items of the accident computer record formats adopted by the five countries. For each country, the data are precoded (with a few exceptions) on the police accident report forms and can be entered directly into the microcomputer without the need for a coding sheet.

Table 1 Item Analysis of Computer Accident Record Formats

(a) The Whole Forms						
	Number of Items in Section					
Section of Form	PNG	Indonesia	Malaysia	Karachi	Sri Lanka	TRL(1988)
General Details	54	57	51	42	33	52
Vehicle Details	11	14	12	14	7	9
Driver Details	14	11	12	9	9	7
Passenger Details	8	9	8	5	9	8
Pedestrian Details	7	8	8	5	7	8
TOTAL NO OF ITEMS	94	99	91	75	65	84
(b) "General Details" Sections						
Item Type	Number of Items					
Site Description	14	19	18	13	4	17
Site Location Coding	14	10	10	7	9	12
Other Details	26	28	23	22	20	23
TOTAL ITEMS	54	57	51	42	33	52
(c) Comparison of Selected Items						
Item	Number of Options in Item					
Vehicle Type	8	18	20	9	26	13
Vehicle Manoeuvre	14	17	12	9	13	14
Injury Severity	3	3	3	3	3	2
Passenger Location	8	11	3	4	-	9
SEAT BELT (HELMET)						
Driver	-	3(1)	2(4)	-	2(2)	2
Passenger	-	3(1)	2(4)	-	2(2)	2
ALCOHOL (DRUGS)						
Driver	4	1(1)	3(1)	-	2	1(1)
Passenger	2	-	-	-	1	-
Pedestrian	-	-	1(1)	-	1	1

A comprehensive comparison of all items included in the forms is given in the Appendix. They are compared with a TRL guideline design accident form produced specifically for use in developing countries in 1988. This form was the starting point for the current accident forms in Indonesia and Malaysia and an earlier version had a significant influence upon the design of the Papua New Guinea form. Perhaps the main influence of the TRL guideline design has been to include more engineering features of the accident site in the forms. It can be seen from Table 1 that the total number of items varies from 65 to 99, the main difference being in the "site description" details. It will also be seen that for certain items there are major differences in the number and categories of options. A more detailed analysis is given in the Appendix. It shows that there are 156 different items over the five countries. A particular problem is that, in several instances, combinations of items will appear under a single item in a particular form but without the option of multiple choice. This can lead to confusion for the reporting officer as to which option to select. Also, there are a few items which are recorded on a country's report forms but are not included in the computer record format.

Since the TRL 1988 guideline design form was produced, it has been realised that a number of improvements could be made, in particular, the addition to the computer records of text descriptions of the accident and its location. Such text fields are now available in MAAP and they can be used for text string searches - usually for items not coded in the form, for example, "BUS STOP".

4. COMPARISON OF ACCIDENT DATA

This paper focuses on only the main trends in the full data sets using the cross-tabulation facilities of MAAP. The many other in-depth analysis features of MAAP, such as the identification and analysis of the worst accident locations and the use of so-called "Stick Diagram Analyses", are described elsewhere (Hills and Elliott, 1986).

The accident data used for comparison in Figures 1 to 9 are shown in Table 2. These were the latest years available to TRL at the time of writing. In considering the results, it must be emphasised that in the cases of Papua New Guinea and Malaysia the data are countrywide and involve both urban and rural accidents whereas for Bandung, Karachi and Colombo, they are almost entirely urban accidents.

Table 2 The accident datasets used for comparison

	Period of dataset	No. of accidents in dataset
Papua New Guinea	1991 (12 months)	4485
Bandung	1990 (12 months)	1059
Malaysia	1992 (10 months)	37955
Karachi	1991 (12 months)	1261
Colombo	1991/92 (10 Months)	946

Severity of Injuries:
Figure 1 shows a marked difference between the injury severity profiles of recorded accidents in the five countries. The reasons for this include differences in (i) the urban/rural split; (ii) the classification of severe/hospitalised and minor/not hospitalised injuries; and (iii) the levels of under-reporting of different severities of accidents. Papua New Guinea, Indonesia and Malaysia classify non-fatal injuries as Hospitalised or Not Hospitalised, whereas Karachi and Colombo use Severe (Grievous) and Slight (Non-Grievous). Malaysia has adopted the international standard of "death within 30 days" in defining a fatality.

Class of Road Users Injured:
Figure 2 shows profound differences between countries in the road users most at risk. Motor-cycles are the most common form of transport in many SE Asian countries, and given their vulnerability, it is no

surprise that they are the largest or second largest class of casualty in all countries except PNG, where there are few motor-cycles. On the other hand, there is a very high incidence of Pick-up casualties (45%) in PNG, reflecting the fact that many passengers travel in the unprotected rear sections of these vehicles and the fact that roll-over accidents are the most common collision type (Figure 3). Pedestrians are the one major class of casualty common to all countries, being either the largest or second largest class. This again reflects the vulnerability of this road user and in the case of PNG, the high number of pedestrians walking on rural highways.

Such analyses help establish the priorities in a country's road safety programmes. For example, the Malaysian Road Safety Council is making a special study of motor cycle accidents and the effectiveness of special motor cycle lanes. In PNG, as a result of the analyses using MAAP, the Department of Transport is building footpaths alongside rural highways (Hills, Thompson and Kila, 1992) and the PNG Department of Works is experimenting with safer designs of drainage ditches; also, in collaboration with the insurance industry, the DoT is hoping to run a field trial of a TRL-designed protective framework for the rear of Pick-ups.

Collision Types
Figure 3 shows that Side or 90 degree collisions are the most common cause of injury in Malaysia, but in PNG it is Rollover collisions that cause the greatest incidence of injuries. The main injury accidents in PNG occur largely in the mountainous areas where the highways have many bends and the drainage ditches have not been designed with safety in mind (see above). In Bandung, collisions with Pedestrians are the major problem.

Urban v Rural Injuries:
Figure 4 shows that, despite Side or 90 degree collisions causing the most injuries in Malaysia, accidents in Rural areas account for more injuries than in cities, towns or villages. In PNG, nearly 70% of injuries occur in Rural areas. Higher speeds, and therefore worse accident severities, combined with the problems of medical recovery, are contributory to these findings. In PNG, the problems of highway design and the incidence of pedestrians walking on rural highways described above are known to contribute to this finding.

Number of Vehicles in Casualty Accidents
Figure 5 shows that for PNG, over 70% of casualties occur in accidents involving only one vehicle, these being almost entirely made up of "Roll-over", "Pedestrian" and "Hitting an object Off the Road" collisions. This contrasts with the other countries, where two-vehicle casualty accidents predominate, reflecting the higher density of traffic, the more urbanised environments and possibly behavioural problems, such as a greater reluctance to give way.

Age Profiles of Casualties
Figure 6 shows that over the whole age range, there are very similar age profiles but the peak age bands for Malaysia and Bandung are 16-25 whereas for the other countries, the peak is 21-30. For pedestrian casualties, there is a sharp peak in Malaysia and PNG for 6-10 year olds, but for Karachi and Colombo, the peak age group for pedestrian casualties is 26-30. In Malaysia, the young child pedestrian casualties occur most frequently whilst crossing the roads in residential areas, often near schools, and predominantly involve motorcyclists.

Hour of Day
Figure 8 shows very similar patterns over all countries with the exception of a higher incidence in the two hours after midnight in Bandung. It has been found that where a 24-hour clock is not used in the accident report form, some police reporting officers incorrectly code midday as 12 am. For this reason, a 24-hour clock is now recommended.

Day of Week

The only country to show a strong variation across the week is PNG (Figure 9). This is almost certainly associated with the weekend alcohol problem. A joint DoT/TRL roadside survey of over 900 drivers found that between the hours of 10 pm and 2 am in the capital Port Moresby, 24% of drivers were over 80 mg per 100ml, the UK legal limit. Similar surveys in the UK have found only about 1% of drivers over this limit.

5. DISCUSSION AND CONCLUSIONS

The advent of microcomputers has revolutionised the way in which accident data can be stored and analysed. The TRL's Microcomputer Accident Analysis Package, first used in the field ten years ago, is now being widely used in developing countries and the size of the database of accidents is now reaching a stage at which in-depth comparisons can be made between countries or cities where it has been implemented. The analyses presented in this paper show that there can be profound differences between countries in Asia in the nature of their accidents. Although not directly analysed here, it has been found that there can be just as large differences between different regions of a country, usually with the major cities showing very different characteristics to rural areas. Thus, it is as important for developing countries as for developed countries to analyse their accidents and evaluate countermeasures at regional and local authority levels. Although it is readily able to handle the analysis of accidents at a national level, the development of MAAP has always been primarily aimed at users at a local authority level, particularly with its facilities for identifying particularly hazardous locations. The latest version of MAAP (v5) is greatly enhancing this capability, and an example of the graphical analyses that can be produced is shown in Figure 10.

The analysis of the accident report forms adopted shows considerable variations between countries in length, format and content. The balance between the need for good in-depth data and the time required by police to fill in the report form still causes considerable argument in developed countries and inevitably leads to differences in formats. Despite the variations, there is a large group of questions that are common for the five countries and this could be one of the starting points for developing an internationally-agreed core set of questions and definitions for the Region.

A step-by-step procedure for introducing the MAAP system has generally been adopted in each country, starting with a demonstration project, and then selected regional trials, before any national changes are enacted. This gradual approach enables any teething troubles to be sorted out progressively. Going nationwide too quickly can produce major problems; for example, a fairly major change of report form can lead to poorly completed accident records (particularly location coding) and complaints of excessive time required to fill in the form.

Taking the data from the five countries together, the analysis of casualties suggest that Pedestrians and Motor-cyclists should be specially targeted for investigation and countermeasure programmes. Two country-specific problems have been noted: the 6-10 year old pedestrian problem in Malaysia and the Pick-up casualty problem in PNG. The major differences between patterns of accidents in the five countries are attributable to differences in stage of development, the physical nature of countries or cities in the study areas, vehicle fleets, social attitudes and behaviour. For example, vehicles readily give way to pedestrians on a pedestrian crossing in PNG, but in certain Asian countries, this rarely occurs. The benefits of countermeasures will therefore not always be transferrable, and it becomes important for all countries to evaluate their schemes themselves. This then comes back to the fundamental need to have a good recording and analysis system.

6. ACKNOWLEDGEMENTS

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7. REFERENCES

DOWNING A and M ZAHEER (1993). Pedestrian safety in the developing world. Proceedings of Conference on Asian Road Safety, Kuala Lumpur, 25-28 October, 1993.

GABER M.A and S YERRELL (1985). Analysing the Road Safety Problems in Egypt. 10th Congress of the International Association for Accident and Traffic Medicine, Tokyo, 1985.

HILLS B.L. and M KASSABGI (1984). A microcomputer road accident analysis package for developing countries. Proceedings of Annual Summer Meeting of PTRC, Brighton, 1984.

HILLS B L and G J ELLIOTT (1986). A microcomputer accident analysis package and its use in developing countries. Proceedings of Indian Road Congress Road Safety Seminar, Srinigar, 1986.

HILLS B L, N T THOMPSON and K KILA (1991). Accident reduction research in Papua New Guinea. Proceedings of 19th Summer Annual Meeting. University of Sussex. 9th-13th September, 1991. London: PTRC Education and Research Services.

JACOBS G D (1977). Research on road accidents in developing countries. Traffic Eng & Control, 18,4.

JACOBS G D, BARDSLEY M N AND I SAYER (1975). Road accident data collection and analysis in developing countries. TRRL Laboratory Report 676, Crowthorne.

LUNDEBYE S AND G HARAHAP (1990) Annual report on road accidents 1989 in city of Bandung. Institute of Road Engineering, Bandung, 1990.

RADIN UMAR RS and A AMINUDDIN (1990). Accident Investigation Model for Seremban-Port Dickson Highway. In: Proc. International Seminar on Road Safety, JKR/JICA, Kuala Lumpur, 1990.

RADIN UMAR RS and A AMINUDDIN (1992). Sistem Diagnosis Kemalangam Jalanraya, Ibu Pejabat Polis Daerah Seremban dan Shah Alam. Jawatankuasa 3P, Res Rept 1, Majis Keselamatan Jalan Raya (MKJR), 1992.

SAYER I A, C J BAGULEY and A J DOWNING (1991). Low-cost engineering measures in Egypt, Ghana and Pakistan. Proceedings of 19th Summer Annual Meeting. Uni of Sussex. 9th-13th Sept. London: PTRC.

M SHAFII, S M. (1991) Road Safety in the 90's: the challenge to JKR Engineers. Laporan Teknikal no 26, Institut Latihan dan Penyelidikan (ILP), Jabatan Kerja Raya Malaysia (JKR), Kajang, 1991.

THOMPSON N and D RUDJITO (1992) Traffic accident investigation in Indonesia. Proceedings of 7th REAAA Conference, Vol 3, Singapore 22-26 June, 1992.

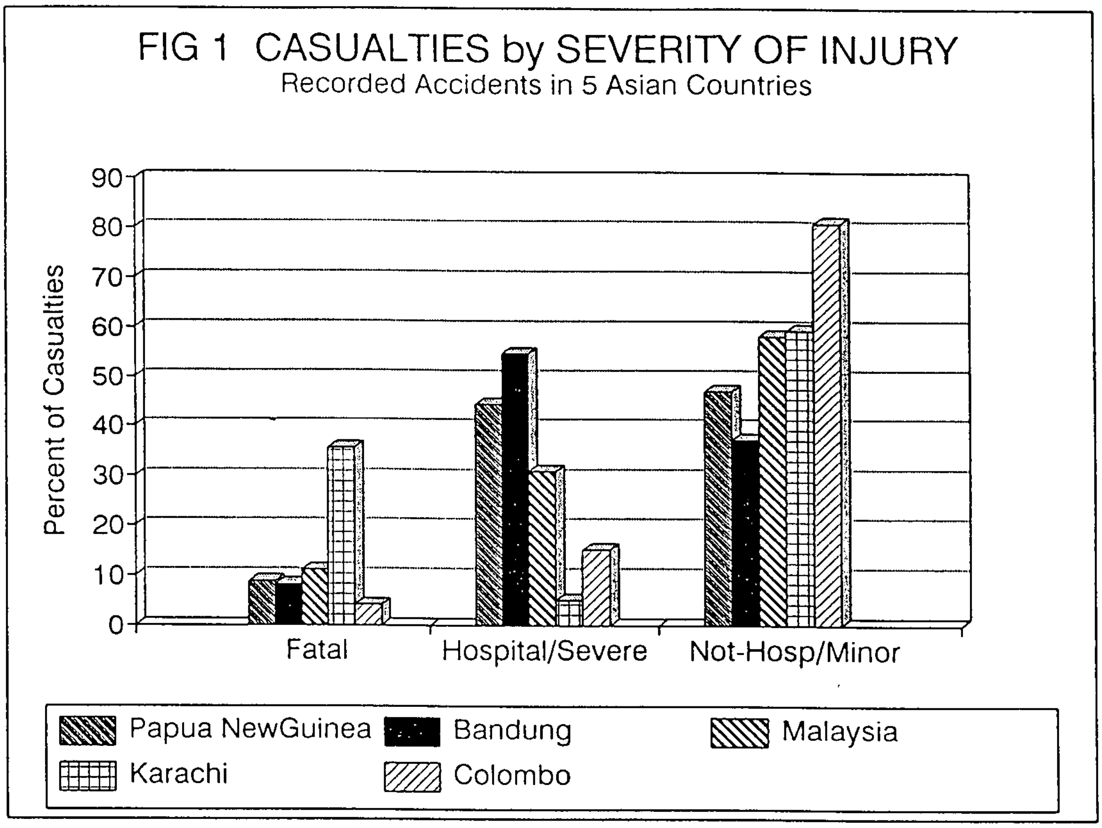


FIG 1 CASUALTIES by SEVERITY OF INJURY
Recorded Accidents in 5 Asian Countries
Percent of Casualties
90
80
70
60
50
40
30
20
10
0
Fatal
Hospital/Severe
Not-Hosp/Minor
Papua NewGuinea
Bandung
Malaysia
Karachi
Colombo

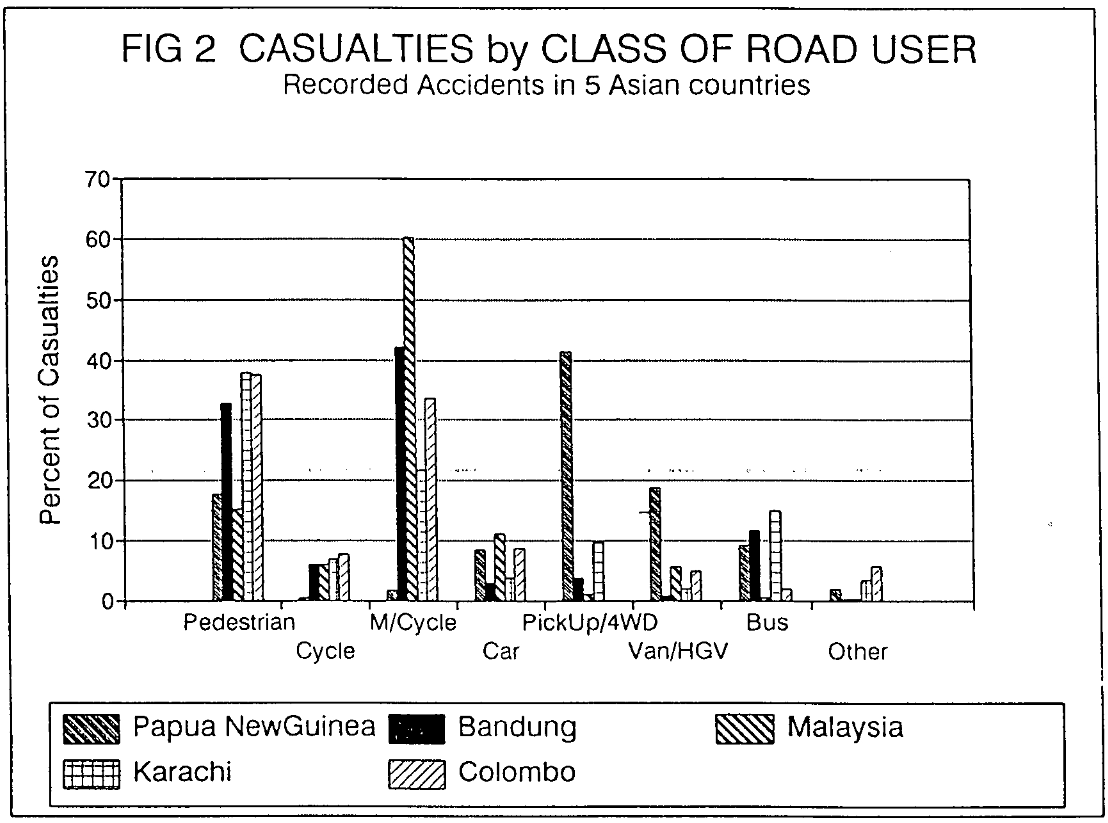


FIG 2 CASUALTIES by CLASS OF ROAD USER
Recorded Accidents in 5 Asian countries
Percent of Casualties
70
60
50
40
30
20
10
0
Pedestrian
Cycle
M/Cycle
Car
PickUp/4WD
Van/HGV
Bus
Other
Papua NewGuinea
Bandung
Malaysia
Karachi
Colombo

FIG 3 CASUALTIES by COLLISION TYPE

Recorded accidents in 3 Asian countries

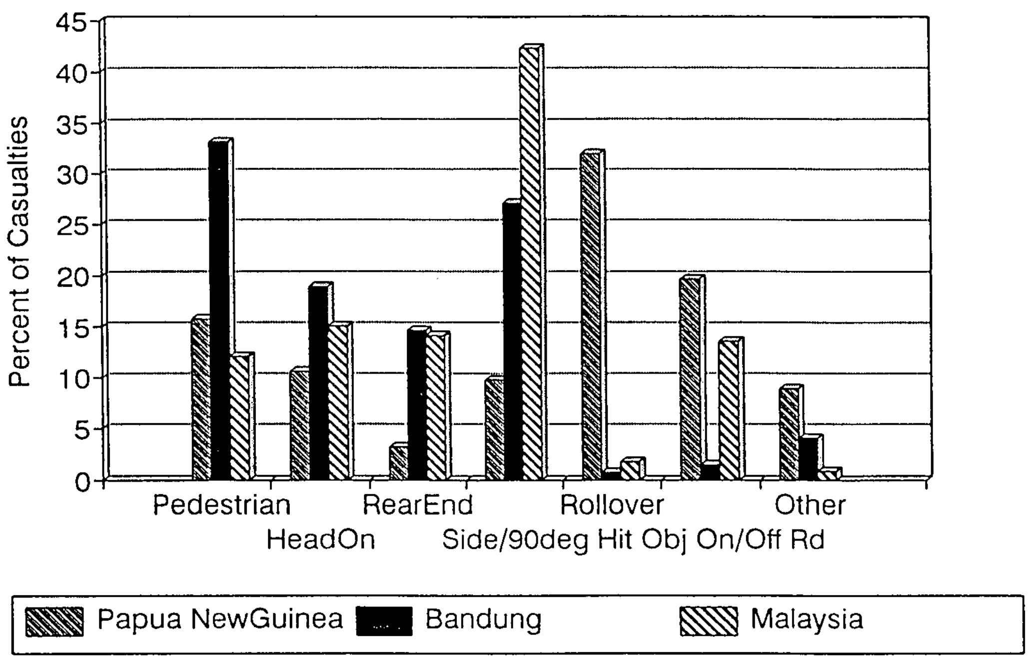
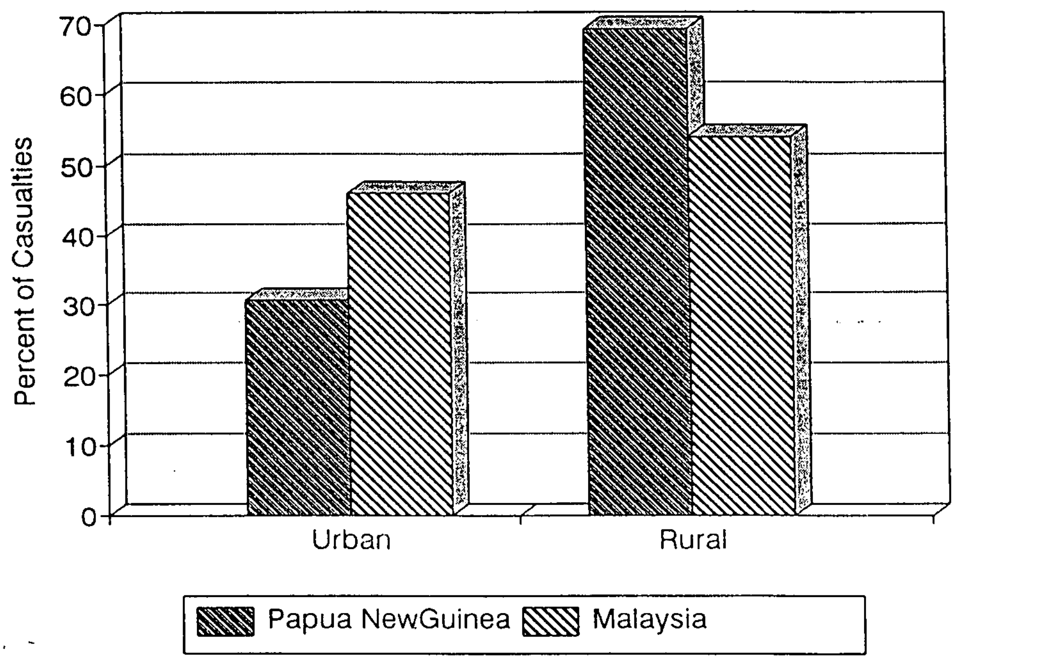


FIG 4 CASUALTIES by URBAN/RURAL LOCAT'N

Recorded accidents in 2 Asian countries



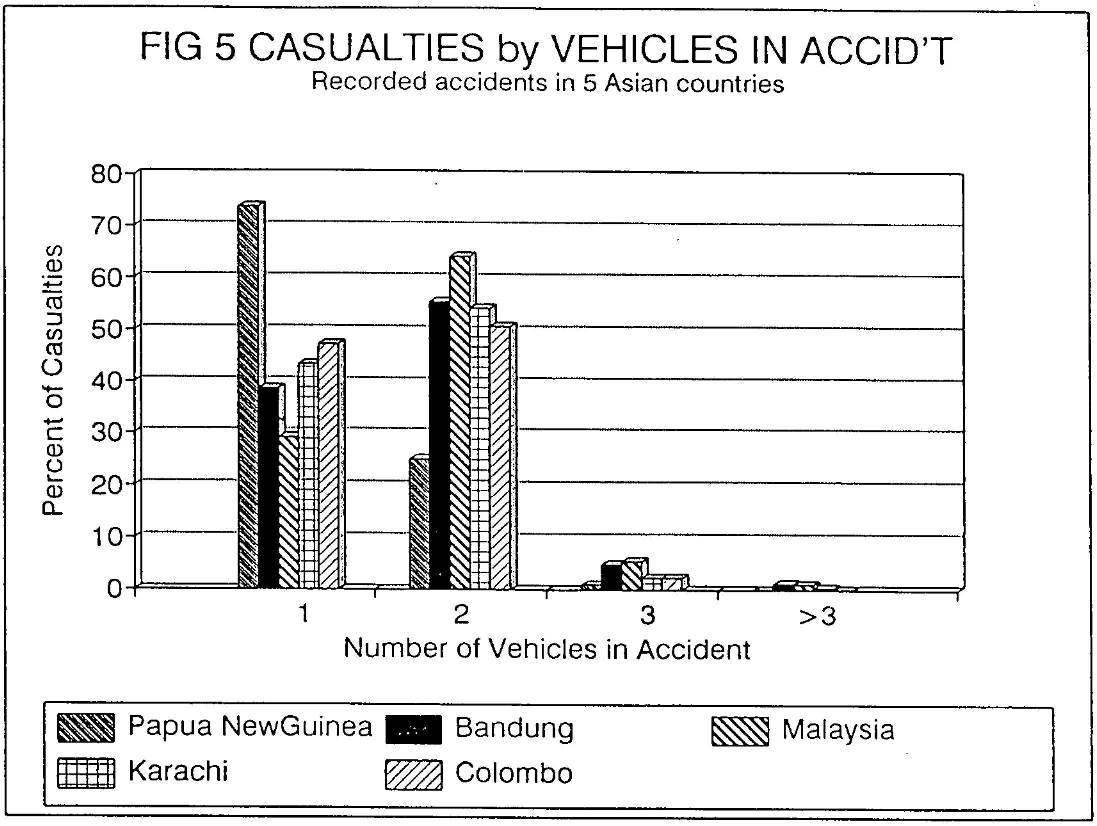


FIG 5 CASUALTIES by VEHICLES IN ACCID'T
Recorded accidents in 5 Asian countries
Percent of Casualties
80
70
60
50
40
30
20
10
0
1
2
3
>3
Number of Vehicles in Accident
Papua NewGuinea
Bandung
Malaysia
Karachi
Colombo

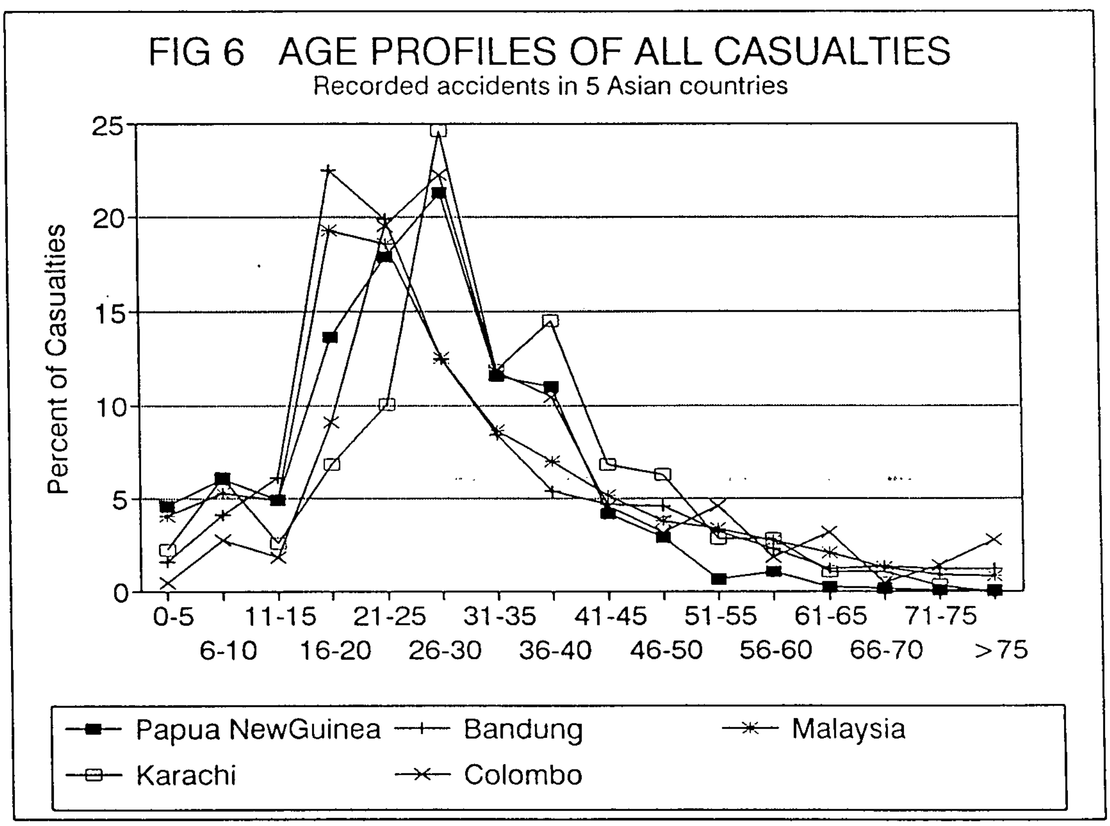


FIG 6 AGE PROFILES OF ALL CASUALTIES
Recorded accidents in 5 Asian countries
Percent of Casualties
25
20
15
10
5
0
0-5
11-15
21-25
31-35
41-45
51-55
61-65
71-75
6-10
16-20
26-30
36-40
46-50
56-60
66-70
>75
Papua NewGuinea
Bandung
Malaysia
Karachi
Colombo

FIG 7 AGES OF PEDESTRIAN CASUALTIES

Recorded accidents in 5 Asian countries

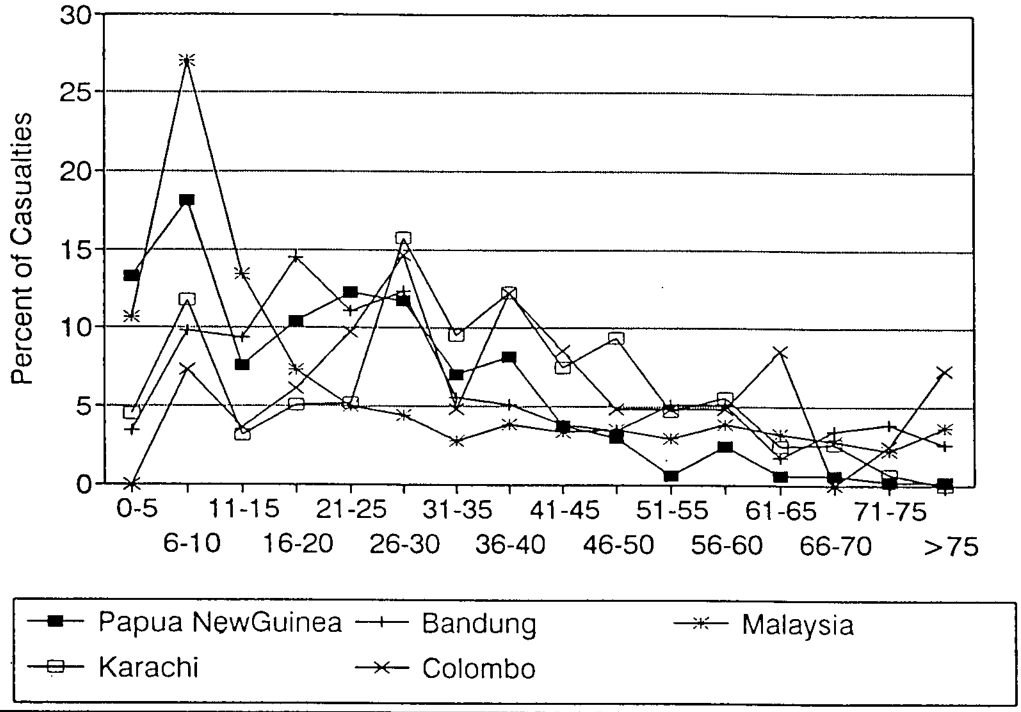
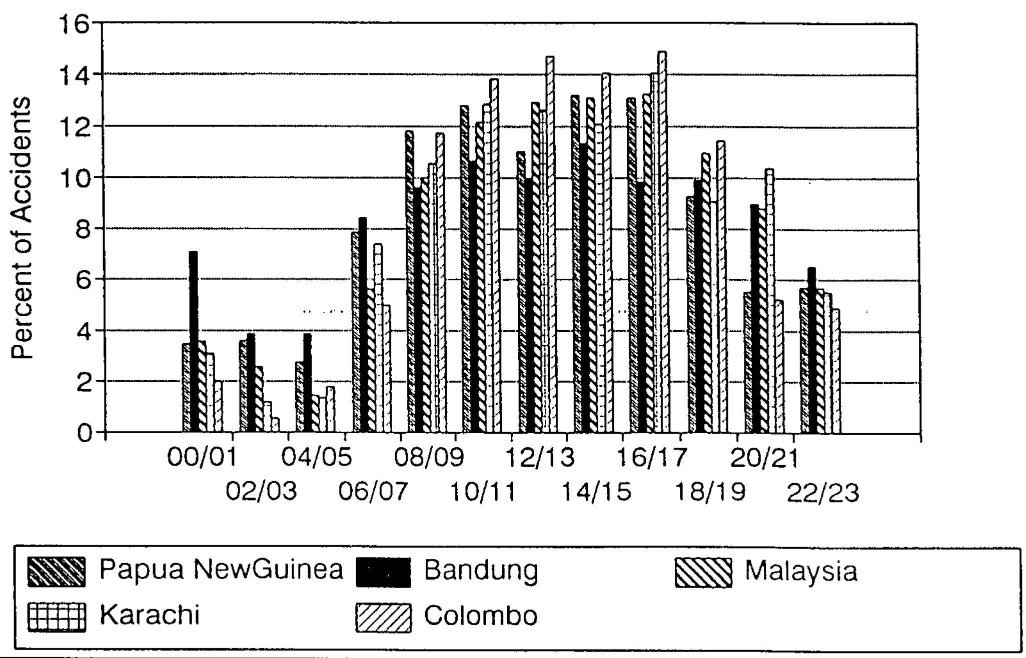


FIG 8 ACCIDENTS by HOUR OF DAY

Recorded accidents in 5 Asian countries



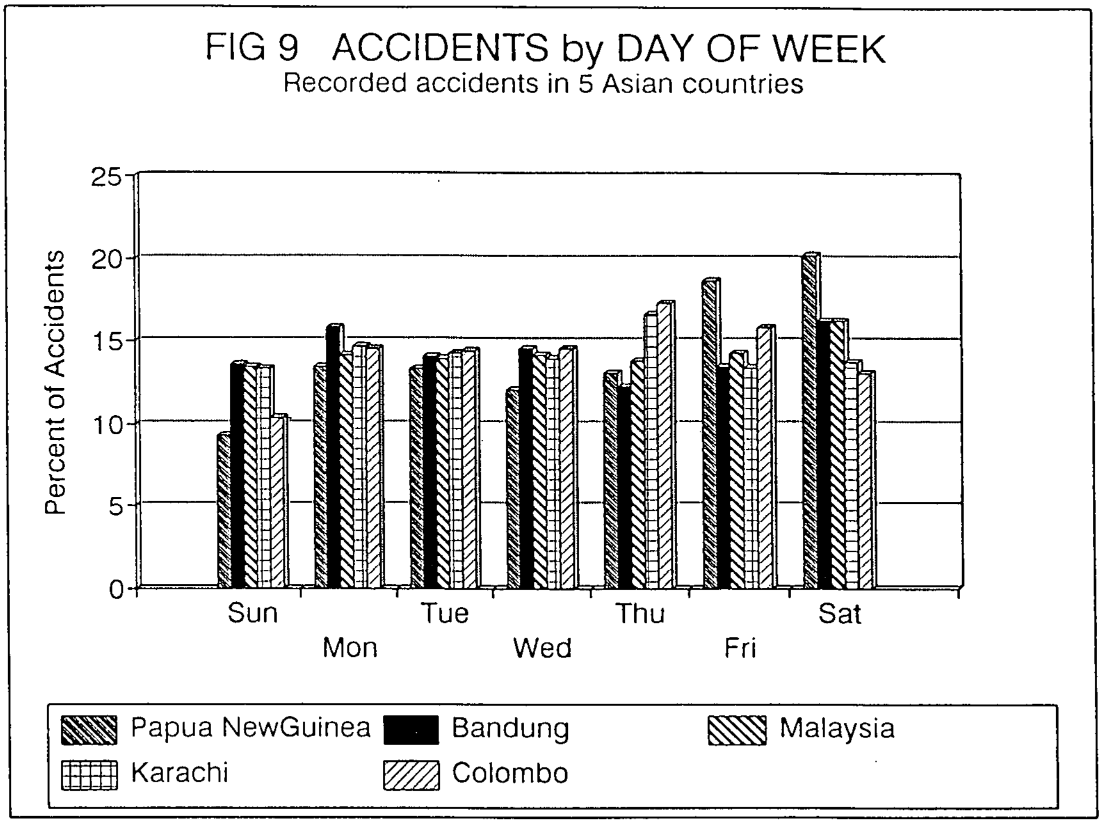
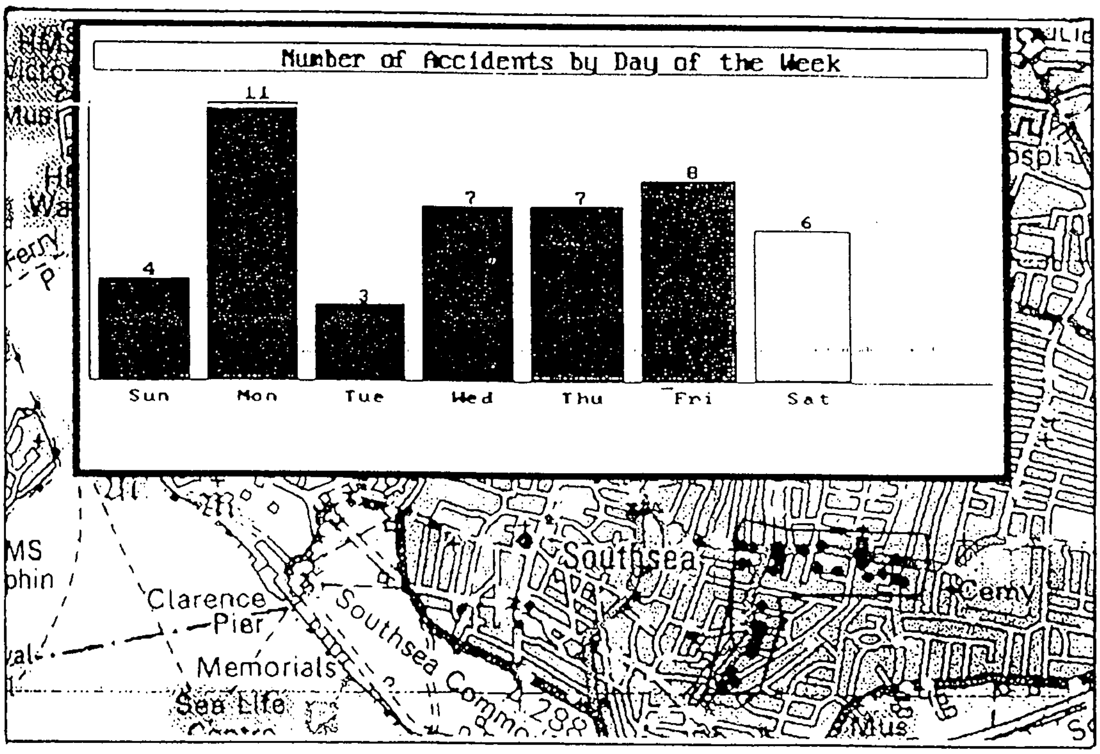


FIG 10 MAAPv5: Example of Polygon Analysis of accidents using scanned mapping (original in color)



APPENDIX

COMPARISON OF ITEMS CODED IN MAAP COMPUTER ACCIDENT RECORD

	PNG	INDONESIA	MALAYSIA TEB	KARACHI	COLOMBO	TRL'88
GENERAL DETAILS						
1 PROVINCE/STATE	●	●	●		●	●
2 CITY NAME(text)	●					●
3 TOWN/VILLAGE CODE	●	●	●	●	●	●
4 POLICE REGION	○	●	○	●		
5 POLICE AREA/DISTRICT	○	●	○	●	●	
6 POLICE STATION NO:	●	●	●	●	●	●
7 POLICE ACCIDENT NO:	●	●	●	●	●	●
8 COMPUTER NUMBER		●		●		●
9 YEAR	●	●	●	●	●	●
10 MONTH	●	●	●	●	●	●
11 DATE IN MONTH	●	●	●	●	●	●
12 DAY OF WEEK	●	●	●	●	●	●
13 NATIONAL HOLIDAY		●				
14 HOUR	●	●	●	●	●	●
15 MINUTES	●	○	○	●	○	○
16 AM/PM	●	○	○	○	○	○
17 TOTAL NO OF VEHICLE	●	●	●	●	●	●
18 NO.VEHICLES DAMAGED	●	●	●			●
19 TOTAL/VEHICLE DAMAGE COST		●	●			
20 PROPERTY DAMAGE COST			●			
21 NO.DRIVERS/RIDERS KILLED	●	●	●	●	●	●
22 NO.DRIVERS/RIDERS INJURED	●	●	●	○	○	●
23 NO.PASSENGERS KILLED	●	●	●	●	●	●
24 NO.PASSENGERS INJURED	●	●	●	○	○	●
25 NO.PEDESTRIANS KILLED	●	●	●	●	●	●
26 NO.PEDESTRIANS INJURED	●	●	●	○	○	●
27 ACCIDENT SEVERITY	●	●	●	●	●	
LOCATION DETAILS						
28 WEATHER/VISIBILITY	●	●	●	●		●
29 LIGHT CONDITIONS	●	●	●	●	●	●
30 ROAD GEOMETRY	●	●	●	○		●
31 ROAD GRADIENT	○	○	●			
32 ROAD SEPARATION	●	●	●	●		●
33 TRAFFIC MOVEMENT	●	●	●	●		●
34 ROAD WIDTH	●	●	●			
35 SHOULDER WIDTH	●	●	●			●
36 SHOULDER TYPE	●	●	●			●
37 SHOULDER POSITION		●				
38 ROAD SURFACE TYPE	●	●	●			●
39 SURFACE CONDITION	●	●	●	●	●	●
40 ROAD SURFACE QUALITY	○	●	●	●		●
41 ROAD DEFECT/RESTRICTION	○	○	●			
42 JUNCTION TYPE	●	●	●	●	●	●
43 TRAFFIC CONTROL	●	●	●	●		●
44 INTERSECTION MARKING					●	
45 PED'N CROSSING (see 125)	○	○		●		○
46 SPEED LIMIT		●	●			●
47 ROAD TYPE		●	●	●		
48 URBAN/RURAL	●	●	●		●	●
49 ENVIRONMENT TYPE		●	●			
50 HIT & RUN	●	●	●		●	●
51 COLLISION TYPE	●	●	●			●
52 MOVEMENT BEFORE ACCIDENT (see 65)				●	●	

● FULL ITEM ○ INCLUDED IN OTHER ITEM ◘ ON FORM BUT NOT CODED

APPENDIX (Continued)

	PNG	INDONESIA	MALAYSIA	KARACHI TEB	COLOMBO	TRL'88
LOCATION DETAILS (Continued)						
53 RD USER MOVEMENT CODE (see 65)				●		
54 ROADWORKS	●	●		●	○	●
55 ROAD NARROWING(CONDITION)		●	○		(●)	●
56 OBSTACLE STRUCK				●	○	
57 ANIMAL FAULT			●	○	○	
VEHICLE DETAILS						
58 VEHICLE MAKE/MODEL	●	●	●	●	◘	●
59 VEHICLE YEAR/AGE	●	●	●	●	●	●
60 REGIST. PROVINCE	●					
61 VEHICLE REGISTRATION	◘	●	●	●	◘	◘
62 VEHICLE CLASS		●				
63 VEHICLE TYPE	●	●	●	●	●	●
64 OWNERSHIP/USAGE	●	●	●			
65 VEHICLE MANOEUVRE	●	●	●	●	●	●
66 VEHICLE DAMAGE	●	●	●	●	●	●
67 NOSE-TO-TAIL	●					
68 FEATURE OF COLLISION					●	
69 GOODS VEHICLE TYPE (see 63)		●				
70 VEHICLE LOADING	●	●		○	○	●
71 FITNESS CERTIFICATE	◘			●		
72 LIGHTS/DEFECT	●	●		●		●
73 TYRE CONDITION/DEFECT	○	●		●		
74 DEFECT3		●		●		
75 GENERAL DEFECTS	●	●	●	●	●	
76 VEHICLE MODIFICATION			●			
77 VEHICLE SKIDDED				●		
78 LENGTH OF SKID MARKS		◘	●			●
79 TYRE BURST		○	●			●
80 FOREIGN VEHICLE			●			
81 OVERTURNING	○	○	○	●	○	○
82 CAUGHT FIRE				●		
DRIVER DETAILS						
83 DRIVER SEX	●	●	●	●	●	●
84 DRIVER/RIDER AGE	●	●	●	●	●	●
85 DRIVER RACE	●	●	●			
86 DRIVER/RIDER INJURY	●	●	●	●	●	●
87 PART OF BODY INJURED	●	●	●			●
88 SEAT BELT/PROTECTION		●	●		●	●
89 M/CYCLE HELMET		○			●	■
90 DRIVER QUALIFICATION		●	●			
91 DRIVER OCCUPATION		●	●			
92 LICENCE NUMBER	●	◘	◘			●
93 LICENCE TYPE		●	●			
94 PROVINCE OF ISSUE	●					
95 LICENCE STATUS	●	●	●	●	●	
96 DRIVER EXPERIENCE	●		○	●	●	
97 DRINK DRIVING(/DRUGS)	●	●(●)	●		●	●(●)
98 DRIVERS ERRORS	●		●	●	●	
99 OFFENCE-PRIMARY/SPEED	●			●	●	
100 OFFENCE - SECONDARY	●					
101 OFFENCE - TERTIARY	●					
102 VISION OBSCURED				●	○	
103 HIT & RUN (see 50)				●		
PASSENGER DETAILS						
104 PASS'R VEHICLE CODE	●	●	●	●	●	●
105 PASSENGER CLASS					●	

● FULL ITEM ○ INCLUDED IN OTHER ITEM ◘ ON FORM BUT NOT CODED ■ NOW RECOMMENDED

APPENDIX (Continued)

	PNG	INDONESIA	MALAYSIA	KARACHI TEB	COLOMBO	TRL'88
PASSENGER DETAILS (Continued)						
106 PASSENGER SEX	●	●	●	●	●	●
107 PASSENGER RACE			●			
108 PASSENGER AGE	●	●	●	●	●	●
109 PASSENGER INJURY	●	●	●	●	●	●
110 PART OF BODY INJURED	●	●	●			●
111 SEAT BELT/PROTECTION		●	●		●	●
112 PILLION WEARING HELMET		○	○		●	■
113 POSITION IN VEHICLE	●	●	●			●
114 LIQUOR AFFECTED	●					
115 PASSENGER ACTION	●			●	●	●
116 PASSENGER AT FAULT?					●	
117 PASSENGER EDUCATION		●				
118 PASSENGER OCCUPATION		●				
PEDESTRIAN DETAILS						
119 PEDESTRIAN SEX	●	●	●	●	●	●
120 PEDESTRIAN AGE	●	●	●	●	●	●
121 PEDESTRIAN RACE			●			
122 PEDESTRIAN INJURY	●	●	●	●	●	●
123 PART OF BODY INJURED	●	●	●			●
124 PEDESTRIAN ACTION	●	●	●	●	●	●
125 PEDESTRIAN LOCATION	●	●	●	●	○	●
126 ALCOHOL SUSPECTED			○			●
127 PEDESTRIAN AT FAULT?					●	
128 SCHOOL PUPIL	●		●			●
129 PEDESTRIAN EDUCATION		●				
130 PEDESTRIAN OCCUPATION		●				
131 PEDESTRIAN CLASS					●	
132 STRUCK BY VEHICLE NO.					●	■
LOCATION CODING						
133 MAJOR ROAD CODE	●	●	●		●	●
134 MINOR ROAD CODE	●					●
135 KILOMETRE POST	●	●	●		●	●
136 100 METRES	●	●	●		●	●
137 URBAN ROAD CODE 1	●					
138 URBAN ROAD CODE 2	●					
139 URBAN ROAD CODE 3	●					
140 MAP SERIES	●	●	●	●	●	●
141 MAP CODE	●	●	●	●	●	●
142 X CO-ORDINATE	●	●	●	●	●	●
143 Y CO-ORDINATE	●	●	●	●	●	●
144 NODE 1	●	●	●	●	●	●
145 NODE 2	●	●	●	●	●	●
146 DIRECTION OF TRAVEL	●	●	●	●	●	●
POLICE REPORTING OFFICER						
147 ATTENDED	●					
148 COMPLETE	●	●				●
149 ACCIDENT CAUSE		●	○		●	●
150 MAJOR OFFENDER	●		○			
151 ACCIDENT INVESTIGATOR				●		
152 POLICE INVESTIGATOR				●		
153 VEHICLE EXAMINER				●		
154 PROSECUTION RECOMMENDED?					●	
155 PLAIN LANGUAGE DESCRIPTION OF ACCIDENT						■
156 PLAIN LANGUAGE DESCRIPTION OF LOCATION						■

● FULL ITEM ○ INCLUDED IN OTHER ITEM ◘ ON FORM BUT NOT CODED ■ NOW RECOMMENDED