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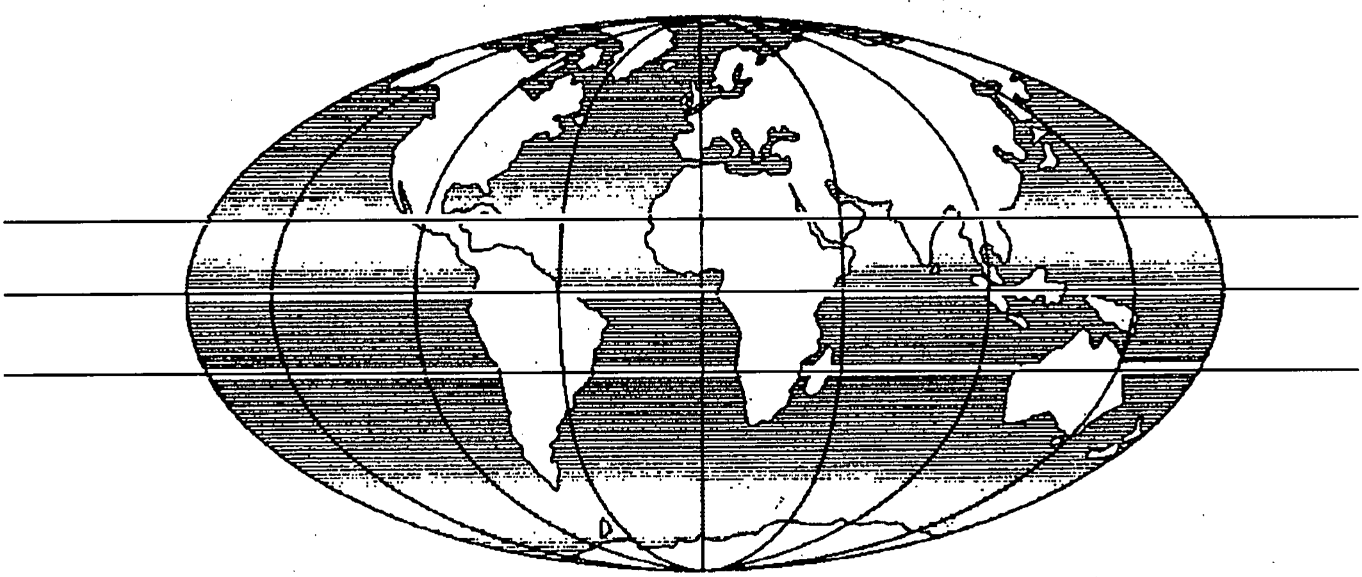

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ACCIDENT DATA COLLECTION AND ANALYSIS: PROGRESS IN THE USE OF THE MICROCOMPUTER PACKAGE *MAAP* IN THE ASIAN REGION

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ABSTRACT:
An efficient accident recording and analysis system is a basic requirement for any country attempting to tackle its road safety problem. 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 Karachi adopted the Package for analysis of its accident data. The first country to adopt the system nationally was Papua New Guinea in 1987. Major trials of the system are currently under way in a number of Asian countries including India, Indonesia, Malaysia, Nepal, the Philippines and Sri Lanka; and recently Fiji became the first country to adopt the latest version of the Package, *MAAPfive*. The introduction of MAAP can be largely independent of the design and content of the accident report form, providing the form is suitable for computer coding. However, in the field trials of MAAP, most of the countries have adopted police accident report forms that incorporate features based on TRL designs. This paper describes recent progress with the implementations of the Package in the Region.

1. INTRODUCTION

The advent of microcomputers has revolutionised the way in which accident data can be stored and analyzed. TRL's Microcomputer Accident Analysis Package, first used in the field in 1983 (Hills and Kassabgi, 1984; Hills and Elliott, 1986), 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. In a recent paper (Hills & Baguley, 1993), we described the use of MAAP in five Asian countries: Papua New Guinea, Indonesia (Bandung), Malaysia, Pakistan (Karachi) and Sri Lanka (Colombo). The analyses presented showed that there can be profound differences between countries in Asia in the nature of their accidents. Using MAAP, it has been found that there can be just as large variations between regions of a country, usually with the major cities showing very different characteristics to rural areas. Thus, it is important for developing countries to analyse their accidents and evaluate countermeasures routinely at regional and local authority levels. For most developed countries, this has been the norm for some time, but it remains rare in developing countries. 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 hazardous locations. The latest version of MAAP, *MAAPfive*, is greatly enhancing this capability, and the first country to implement fully this new version was Fiji at the beginning of 1994 and it is under trial in Papua New Guinea, Malaysia, the Philippines and Nepal.

2. THE NEW FACILITIES OF *MAAPfive*

MAAPfive is written using Microsoft Visual Basic for DOS*, although it can be run from within the Windows* environment. However, the programs use standard Windows-style facilities, such as pull-down menus, scrollable lists and tables, and optional mouse or keyboard entry. Presentation graphics are now incorporated in the cross-tabulation programs, although the macro for use with the QUATTRO/QUATTRO PRO† spreadsheets remains available. Three types of accident mapping can now be used: raster scanned, vector and text. As with earlier versions, histograms of accidents along a route and listings of worst sites are also available. Both the scanned and vector mapping programs incorporate 'polygon analysis', whereby any user-defined area of a map can be defined and accidents in that area can be fully analyzed within *MAAPfive*. Both these programs allow a variety of methods for displaying accidents on a map. To help identify patterns in groups of accidents, the Package has always included a 'Stick Diagram Analysis' facility. This has been considerably enhanced, particularly for the

*Visual Basic for DOS and Windows are trademarks of the Microsoft Corporation. †QUATTRO is the trademark of Borland International.

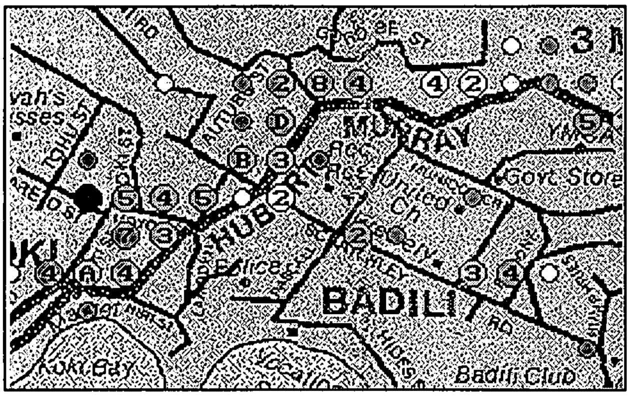

Figure 1(a) Port Moresby 1991 data with location coded to nearest 100m

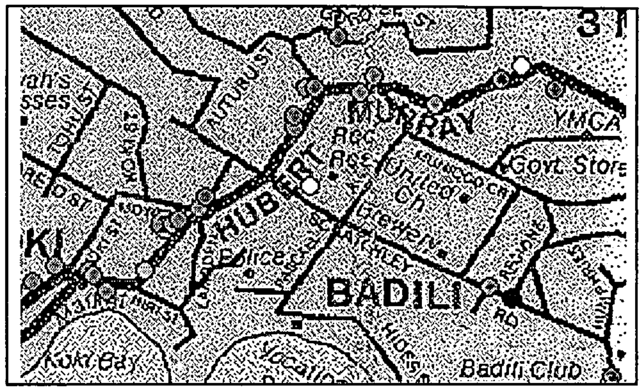

Figure 1(b) Port Moresby 1992 data with location coded to nearest 10m

vector mapping version which offers graphical icons for the symbols. The programs are fully compatible with accident files created with earlier versions of *MAAP*.

In implementing *MAAPfive*, one of the most important changes is that accident locations must now be defined to the nearest 10m to take advantage of the improved graphical facilities. This has required adding an extra digit in coding the X- and Y-coordinates. Figures 1(a) and 1(b) compare the mapping of accidents using 100m and 10m resolutions for Port Moresby, Papua New Guinea.

3. EXCHANGE OF ACCIDENT DATA BETWEEN MAINFRAME DATABASE AND MAAP FORMATS

The Package has always offered its own data entry and database maintenance modules, and these are normally used in the standard implementation of MAAP. However, in a number of installations, the department concerned has wanted to retain the existing well established data entry procedures of a mainframe system, but wish to use the analytical facilities of MAAP. In these cases, transcription programs are written to convert the mainframe data to the MAAP format and the data are regularly downloaded to microcomputer. Malaysia has adopted this procedure (see Section 5). Equally, certain local authority departments (eg South Wales and West Mercia in the UK) have wished to streamline their data entry procedures and have chosen to use the data entry facilities of MAAP when they were still required to provide monthly returns in a national mainframe database format. Again, transcription programs were written for this purpose. When MAAP has been introduced to replace an existing mainframe system, transcription programs have again been used to convert old data files to the MAAP format.

4. IMPLEMENTATION OF *MAAPfive* IN FIJI

In 1992, the Government of Fiji began a National Road Safety Programme funded by the Asian Development Bank. Under this, the ADB Road Safety Advisor (Dr Alan Ross) prepared a "Strategy and Action Plan" for implementation in the current phase of the Fiji Roads Upgrading Project (FRUP II). The recommendations made included the introduction of MAAP, given its successful use in Papua New Guinea since 1987. With close co-operation between the newly formed Traffic Accident Road Safety Unit (TARSU) in the Department of Works and the Fiji Police, a revised accident report form was prepared based on the PNG form. A training programme for the police was carried out and the form became the legal traffic accident report form at the beginning of January 1994. The reports from all over Fiji are received by the Fiji Police's Accident Data Unit, who check and code the forms. The installation of *MAAPfive* in the Accident Data Unit became the first full-scale implementation of this latest version of the Package.

As an example of the on-screen analyses that are now possible with *MAAPfive*, Figure 2 shows an analysis of an area of accidents in Lautoka. The user defines the area by drawing a polygon on the map with the mouse pointer. A location within the polygon can be pointed to and brief details of each accident at that spot can be displayed on the screen. Also, histogram analyses of accidents in the defined area for certain key accident details, such as Accident Severity, Day of Week and Collision Type, can be displayed immediately on the screen. The accidents in the polygon are saved in a "working file", and this can be fully analyzed with the other modules in the package eg crosstabulations, "stick diagram analyses" and graphical presentations of the data. An example of a stick diagram analysis using the Vector Mapping module is shown in Figure 3. In this module, the stick diagram display is

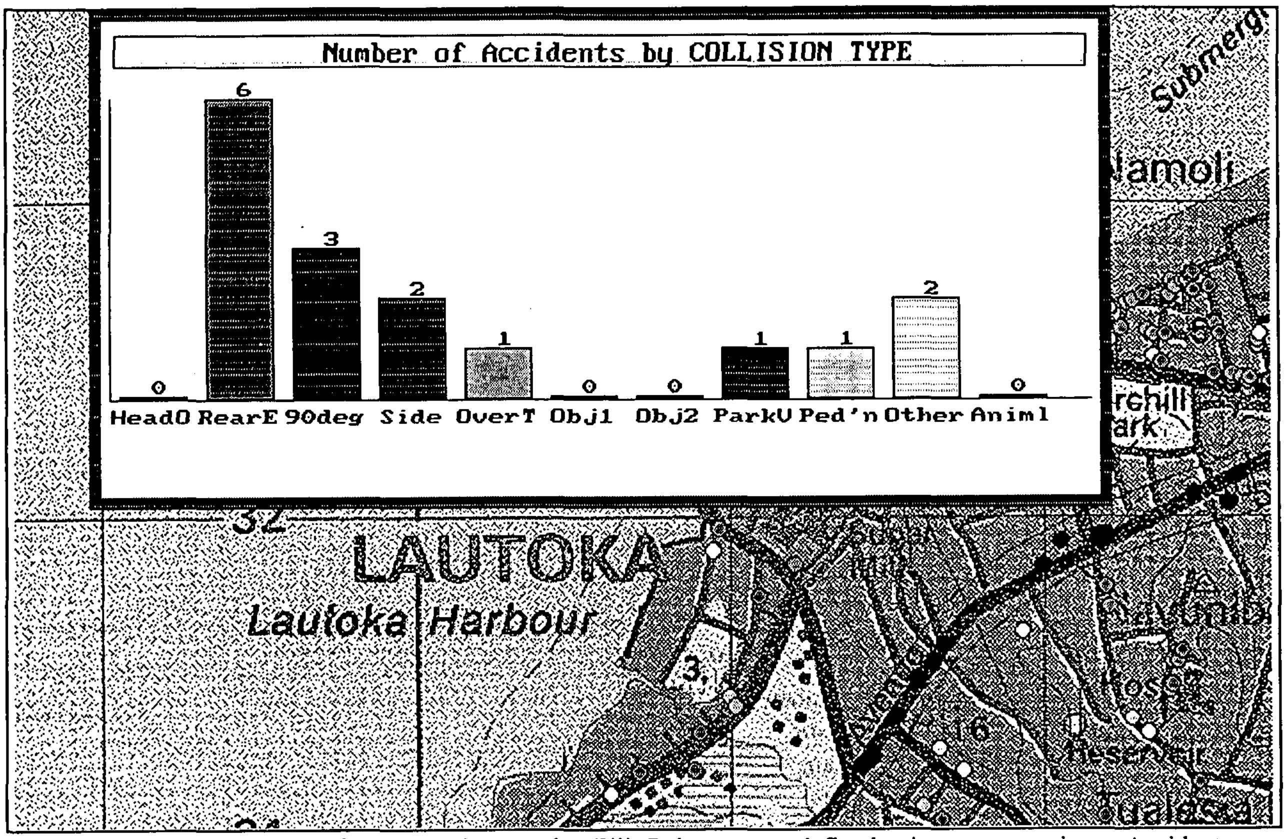

Figure 2 Analysis of area of accidents in Lautoka, Fiji. Polygon area defined using mouse pointer. Accidents in area highlighted in black.

graphically based, and the user can select or design icons to represent appropriate items in the accident record.

5. DEVELOPMENTS IN MALAYSIA

Baguley & Radin (1994) have described recent steps that have been taken to improve the accident database in Malaysia. The recording of details in a standard format by the Royal Malaysia Police only began in 1974 when a mainframe computer system was installed at Police Headquarters, Bukit Aman. This computer is used to store all police statistics, and the function of the road accident database has been primarily to monitor general accident trends across the country. The Police produce an annual publication, Statistical Report Road Accidents Malaysia, which is a good general source of information at the macro level .

However, the database was not easily accessible or useable by highway engineers chiefly because no recording of accident location had been included. In 1989, a redesigned accident coding form was introduced which at least required the recording of the nearest kilometre post for accidents occurring on state or federal roads. The database still contained only limited information as the coding sheet was restricted to a single page. Despite its small size this form tended to require considerable police time to complete owing to the need to look up codes in separate coding books.

Since 1990 the Universiti Pertanian Malaysia (UPM), sponsored by the National Road Safety Council (MKJR), has been carrying out a research programme aimed at improving the accident data collection and analysis system in Malaysia. It was decided that in order to facilitate wider usage of the accident data, particularly by highway authority engineers, the database needed to be available on a microcomputer system. MAAP as chosen as the most appropriate software available for both management and analysis of the data. In cooperation with the Royal Malaysia Police (PDRM), a new report form, POL27, was designed which was intended to be easier to complete and provide more comprehensive data for use by engineers. Among other things, the form contains provision for more comprehensive location data including space for a location sketch as well as a collision diagram.

After a successful Pilot Project using the new form, it was

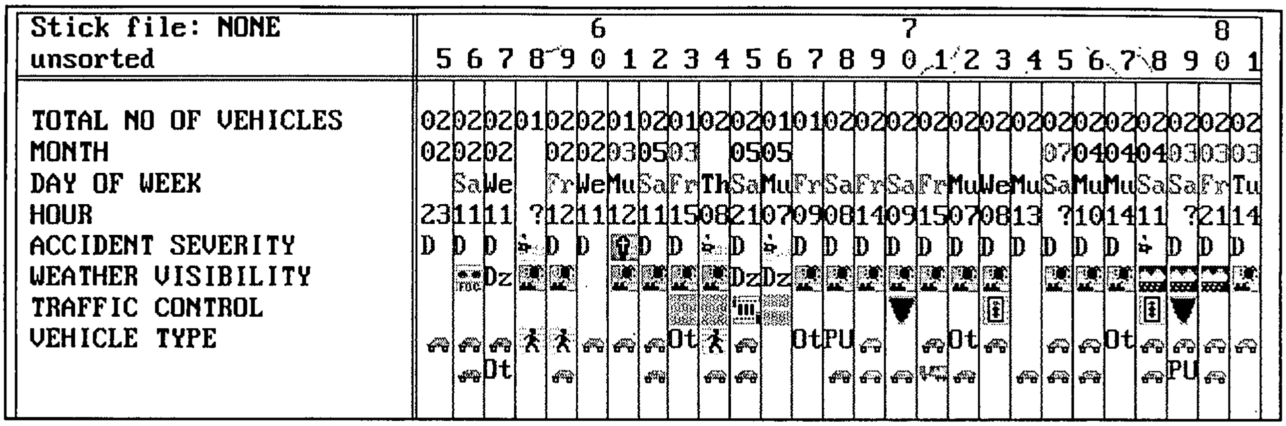

Figure 3 Stick Diagram Analysis in Vector Mapping module using Fiji data. Each vertical "stick" represents a single accident and can contain up to 25 items.

decided to introduce a modified version nationally in January 1992, following an extensive training programme for traffic police officers. As the process of forms being sent to Police Headquarters, Bukit Aman, in Kuala Lumpur for entry onto their mainframe computer (together with other crime data) is well established, this system was retained with the new POL27 form. The data are now downloaded to microcomputer on a monthly basis and the file converted into MAAP format, at which stage it is made generally available and can be interrogated easily using MAAP facilities.

To lighten the police workload, it was agreed that the Public Works Department (JKR) provide assistance on location coding. The Police still record as much information as possible about the accident site and the local JKR District offices are sent copies regularly of the two relevant sheets of each accident form. They are required to check location details of each accident and complete the coding of route number, closest kilometre (or section) post number, and nearest 100m from the relevant post. The completed parts of the forms are then sent to the Highway Planning Unit (HPU) of the Ministry of Works, where the location information is further checked and entered onto computer. This will eventually be merged with the corresponding accident records received from the Police. In theory, the database is now complete for analysis by all interested parties.

The number of recorded accidents in Malaysia is increasing sharply and, as all accidents are required to be reported to the Police, they are currently faced with recording the details of more than 120,000 per year (for 1992). Most of these, of course, involve vehicle/property damage only and a compromise was therefore reached when the new forms were introduced such that the very minor cases, classed as 'no further action' (NFA), would no longer be recorded on computer and thus would not require a POL27 form. For 1992 this has resulted in a total of about 67,000 accidents on computer. Direct comparisons with previous years' data, however, should at least still be valid for those accidents involving injury.

There is currently no coordinate system used to record accident location as in the pilot project, and thus use cannot be made of the geographical mapping facilities available in the latest version of MAAP.

The Public Works Department's research and training establishment, IKRAM, has established a road safety research programme (Shafii, 1991). As part of this, a programme of collaborative research began in 1993 with TRL. One of the priorities for this work has been to assist in 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.

6. DEVELOPMENTS IN INDIA

6.1 Bangalore

Reddi (1993) has recently reported on the introduction of MAAP (v4) in Bangalore through a collaborative programme between the Traffic Police Department, the Transportation Engineering Department of the local university and TRL. There has been a sharp rise in road accidents over the past twenty years as a result of the rapid growth of the human and vehicle population. Because of the shortage of funds for major cost-intensive projects, the city authorities found it necessary to follow a "micro" approach and concentrate on site-specific, low cost solutions. To assist them in identifying and diagnosing the problems sites, they chose to introduce MAAP. Eighty detailed road maps were prepared by

Police Officers and some 20,000 accident records were entered into the computer database. An area covering about 10% of the city and involving six police stations was chosen for detailed study in a pilot project. The worst nodes (major junctions) and links in each police station area were identified using the package and from these 16 nodes and 25 links were identified for further study and analysis. Collision diagrams, stick diagram analyses and comprehensive site studies were used to analyse the accident problems in depth and from these countermeasures proposed for the short term, medium term and long term. A wide range of problems were identified covering road condition, intersection geometry, inadequate rehabilitation, poor regulation and guidance of the traffic, unplanned and unregulated traffic generating activities, and road user behaviour. It was concluded that any road safety plan must "envisage a judicious mix of short and long term, low and high cost, and site-specific and area-based measures for an effective control over road accidents".

6.2 Delhi

TRL has been collaborating with the Indian Institute of Technology in adapting an accident report form designed by Dr G Tiwari and R Patel for use by MAAP. It is planned to use the system in a study of "Fatal Road Crashes in Delhi" funded by the Delhi Traffic Police (IIT,1993).

7. DEVELOPMENTS IN OTHER COUNTRIES IN THE REGION

7.1 Papua New Guinea

MAAP has been the basis of the national system since 1987. Data from the system were used in our earlier comparison of five Asian countries (Hills and Baguley, 1993). *MAAPfive* has been introduced to the accident investigation units of the both at the Department of Transport and the Royal Papua New Guinea Constabulary. All urban accidents since the beginning of 1992 have been coded to the nearest 10m make use of the new scanned mapping facilities (See Figure 1).

7.2 Indonesia

An analysis of data collected in Bandung with MAAP 4.0 was presented in our earlier comparison of five Asian countries (Hills and Baguley, 1993). This was the result of a collaborative program of research between the Institute of Road Engineering, Bandung and TRL. The accident report form, TARF, developed for use with MAAP and adopted by the Indonesian Traffic Police is currently being reappraised. A trial of *MAAPfive* is presently being considered by IRE.

7.3 Nepal

A trial of *MAAPfive* has been established under a Road Maintenance Project with the Department of Roads funded by the Overseas Development Administration (UK). This has involved close collaboration with the Kathmandu Valley Traffic Police. Two rural highways in addition to Kathmandu have been chosen for the trial. An accident report form based on that in use in Papua New Guinea has been adopted for the trial. A Traffic Engineering and Safety Unit (TESU) is being established within the Department of Roads, among other things to use the new data system for the purposes of accident investigation and the evaluation of a rolling programme of accident countermeasures.

7.4 Philippines

A trial of *MAAPfive* has been established as part of the Philippines Highway Management Project with Department of Public Works and Highways (part funded by the World Bank). This has involved close collaboration with the Philippines National Police. An abbreviated (two-sided A4) version of the Papua New Guinea form has been adopted for the trial.

8. DISCUSSION

There were two major reasons why TRL decided to develop MAAP in the early 80's. Firstly, it had been decided to shift the emphasis of the Overseas Centre's research programme towards the evaluation of road safety countermeasures in developing countries and it was clear that this could not be achieved without the introduction of an appropriate computerised recording and analysis system. The second reason for developing MAAP stemmed from the highly successful results that were beginning to come through from local authority accident investigation teams in the UK, such as those of the Greater London Council and Hertfordshire. A number of these teams were established as a direct result of the 1974 Road Traffic Act in the UK. Each local authority was required to:

"prepare and carry out a programme of measures designed to promote road safety, and shall have power to make contributions to the cost of measures for promoting road safety taken by other authorities or bodies."

Using techniques that were developed over the previous decade, these teams were beginning to show extremely high cost-benefit returns from their schemes (Hills and Jacobs, 1981), with First Year Rates of Return well over 100% regularly being reported. These were achieved from a combination of in-depth accident investigation and an emphasis on low-cost remedial measures. The road safety