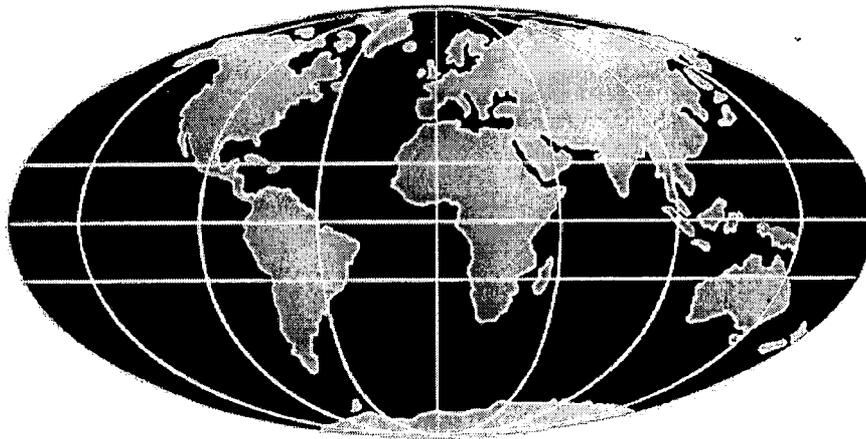




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Road safety in urban Santa Fé de Bogotá D.C.

Seguridad vial en la Ciudad de Santa Fé de Bogotá D.C.

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ABSTRACT: The City authorities in Santa Fé de Bogotá have recognised that the city has a serious road traffic accident problem. This concern prompted the City authorities to decide to start the project for development of an accident data system for Bogota. The systems which were available, were of little use for accident investigation in relation to engineering remedial measures. A road safety project was therefore initiated by the Secretaría de Tránsito y Transporte, the transport authority in the city. The project consisted of two main parts, the establishment of an accident data system, and the establishment of an accident investigation unit.

RÉSUMÉ: Les responsables locaux de Santa Fé de Bogotá ont reconnu que la ville avait un sérieux problème de sécurité routière. De ce fait, ils ont décidé de lancer un projet de base de données "Accident" pour Bogotá. Les systèmes existants n'offrent pas les spécifications requises en matière d'enquête accidents en relation avec les mesures correctrices. En conséquence, la Secretaría de Tránsito y Transporte, autorité compétente pour la ville, a initié un projet de Sécurité Routière. Le projet est composé de deux parties principales, la constitution d'une base de données Accident et l'établissements d'une unité Enquête après accident.

RESUMEN: Las autoridades de Santa Fé de Bogotá han identificado que la ciudad tiene un serio problema de accidentalidad vial. Esta preocupación, motivó a las autoridades del Distrito Capital, adelantar un proyecto para el desarrollo de un sistema de manejo de la información sobre accidentalidad en Bogotá. El sistema existente no tenía mucha aplicación desde el punto de vista de la investigación en seguridad vial, y en relación con el análisis de medidas remediales de Ingeniería. En consecuencia, se inició un proyecto de seguridad vial, para la Alcaldía Mayor de Santa Fé de Bogotá, liderado por autoridad local correspondiente, la Secretaría de Tránsito y Transporte - STT. El proyecto estuvo constó de dos partes principales, el establecimiento de un sistema de manejo de datos de accidentalidad, y la conformación de una Unidad de Investigación sobre accidentalidad.

1 INTRODUCTION

1.1 Concern

The City authorities in Santa Fé de Bogotá recognised that the city has a serious road traffic accident problem. This concern prompted the City authorities to decide to initiate a project for the development of an accident data system for Bogota. The systems which were available, were of little use for accident investigation in relation to engineering remedial measures.

1.2 Project Design

The project consisted of two main parts, the establishment of an accident data system, and the estab-

lishment of an accident investigation unit. There were five elements in the project plan:

1. Accident attendance.
2. Location of accident data and data entry.
3. Data analysis.
4. Accident investigation unit.
5. Road Safety Action Plan for Bogotá.

1.3 Project Period

The project started officially on 13th January 1998. The first visit of the consultants took place in January, February and March 1998. The second and third visits were in May/June and September/October with the final visit in January 1999.

1.4 Bogotá's problem

Concern over road deaths was being expressed by local politicians and by the local and national press. The Bogotá problem relates particularly to pedestrian accidents.

1.5 Remedial Action

Remedial action taken prior to the project, includes an education programme designed to raise respect for red lights at traffic signals and drink drive enforcement campaigns aimed specifically at week-end and holiday travel. Legislation requiring wearing of seat belts and crash helmets was introduced at the same time. A publicity program to encourage cyclists and motor cyclists to wear helmets is ongoing at present. These measures have had some effect.

1.6 This Paper

This paper describes the road safety problem and the work undertaken during the project period.

2 SCALE AND NATURE OF THE PROBLEM

2.1 Present Position

The road safety situation in Bogotá is by any standard serious. Table 1 below shows the number of deaths and injuries caused by road accidents in Bogotá from 1991 to 1996. In 1996 there were 1073 deaths on the road in Bogotá with 71 % of the deaths being pedestrians. Compared with similar size cities in the industrialised world, this figure is very high. The number of deaths in the whole of Colombia in 1996 was 7445. At 32 deaths per 10,000 registered vehicles, this is nearly 26 times the rate of deaths in countries like the UK, Sweden, Denmark and Norway.

2.2 Causal Links

In Bogotá the high number of pedestrian fatalities is undoubtedly linked to the use of alcohol. The number of deaths and injuries are greater toward the end of the week, particularly Saturday and Sunday mornings, after the traditional nights for the enjoyment of alcoholic drink. There is also no doubt that the major reason is the total lack of facilities for pedestrians to cross the road or even to walk along roads.

2.3 Pedestrian facilities

On some major roads, pedestrians are expected to cross 4 or more lanes of traffic without any form of

Table 1: Road Accident Deaths and Injuries in Bogotá

| | 1991 | 1992 | 1993 | 1994 |
|----------|------|------|-------|-------|
| Deaths | 1089 | 1284 | 1260 | 1341 |
| Injuries | 5086 | 5086 | 11505 | 13392 |
| Total | 6175 | 6370 | 12765 | 14733 |

| | 1995 | 1996 | Total |
|----------|-------|-------|-------|
| Deaths | 1139 | 1073 | 7186 |
| Injuries | 15906 | 10454 | 61429 |
| Total | 17045 | 11527 | 68615 |

crossing facility or with badly designed facilities. Research has shown that pedestrian safety is seriously compromised if pedestrians are expected to cross more than 2 lanes. It is very difficult for pedestrians to walk along the land between the kerb and the building line, (Figure 1) as he has to walk around parked cars, climb walls and other obstacles. The surface is varied, in a bad state of repair and with the obstacles in the way, it is impossible to use a wheelchair.

2.4 Road Infrastructure

The road infrastructure in Bogotá has been designed primarily with the motorised traffic in mind with little consideration given to pedestrian requirements. The major routes in the city are of variable design, some of very poor design from a road safety point of view, with dual carriageways with between 2 to 6 lanes in each direction. The major problem in terms of road safety in Bogotá is therefore the provision of pedestrian facilities which pedestrians are either likely to, or forced to use by restricting their other options.

2.5 Road User Behaviour

Road user behaviour in Bogotá is very bad. Red light violation is extremely common. Pedestrians are not regarded, by the drivers, as legitimate road users.



Figure 1: Indiscriminate parking on the footpath and surface making it difficult for pedestrians

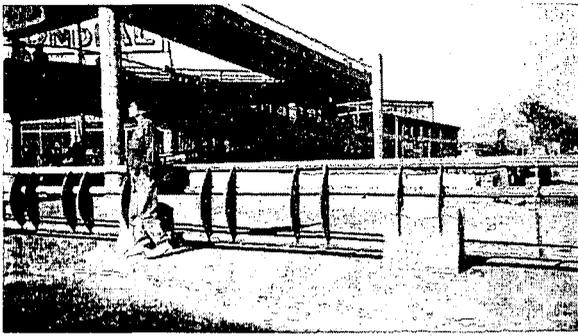


Figure 2: Poorly designed pedestrian guardrail

Outside peak hours, speeds tend to be very high on main routes, which adds to the potential hazard by both pedestrians and vehicle occupants.

2.6 Pedestrian Guardrail

Where pedestrian guardrail has been used, it is often of a dangerous design. This can be seen in Figure 2. The vertical curved plates on the roadside are particularly dangerous as car which hits the guardrail would sustain serious damage, and likely cause serious injury to its driver and passengers.

3 ACCIDENT ATTENDANCE

3.1 The Traffic Police (*La Policía de Tránsito*) and the Judicial Police (*La Fiscalía*)

Bogota has a dedicated traffic police force. The *Policía de Tránsito* in Bogotá are part of the National Police and are responsible for the detection and enforcement of traffic offences and the recording of details following accidents. The Traffic Police complete the accident report forms as part of their accident attendance. This form is the basis for the accident data base, and is completed reasonably well by the Police.

3.2 Accident Management

If involved in an accident, causing injury to a person or damage, drivers are obliged to stop and remain at the scene, with their vehicles in situ, until the arrival of the Traffic Police. The Traffic Police are not prompt at attending the accident location. These often serious delays can cause both danger to other road users and, more commonly in Bogotá, serious congestion. It is suspected that there is an under-reporting problem, particularly with minor injury and damage only accidents, as a result of the long waiting time. On arrival at the location of the accident the police action is determined by the degree of severity of the accident. There are three degrees of severity, fatal, injury or damage only. Fatal and in-

jury accidents are investigated further by the *Fiscalía*. Damage only accidents are simply recorded and any infringements noted and appropriate tickets issued. In injury accidents, the Traffic Police transport drivers to the office of the *Fiscalía* where any further investigations are carried out. Following road death the *Fiscalía* attend the scene and the vehicles are left in place until they have completed the initial investigation.

3.3 Training of the Police

Only very limited training of police officers were possible under the Terms of Reference for the Project. Much more training is desirable, but had not been allowed for in the Project. However, in the January 1998 a training day was held for selected officers from the Traffic Police. The training was held to address the minor problems discovered on the accident report forms. Further training of selected police officers was carried out in January 1999 in aspects of forensic accident investigation. This training should be built upon, and advice was given with regards to courses available in the UK.

3.4 Technical Notes

Detail technical notes were prepared as advice for the police on the subjects covered in the all too brief seminars.

4 LOCATION OF ACCIDENT DATA AND DATA ENTRY

4.1 The Accident Data System

The Terms of Reference for the project specified that a major part of this project should consist of the installation a new microcomputer based road accident data system. The Transport Research Laboratory has developed a system named MAAP (Microcomputer Accident Analysis Package), which was originally developed for use in developing countries. The system, which was DOS based, has been installed as the main analysis tool for road accident in many countries in South America, Africa, Asia and the Pacific. The system has developed over a number of years as needs were identified, and many additional analysis tools have been added. Similarly, as computers have improved, the system has been refined, been converted to operate in Windows, and become more user friendly at the same time as graphics have replaced character based facilities.

4.2 A City-wide Database

Over 45,000 road accidents are recorded in Bogotá every year. The full data from the police accident

reports was entered into the database system of Fondo de Prevencion Vial Nacional, a national road safety organisation funded by the insurance industry. It is generally agreed that this has been an excellent system as it has provided a city-wide database. However, the la Secretaría de Tránsito y Transporte (STT) needed to take over this to obtain a comprehensive database which was also useful to the engineer.

4.3 Location of accidents

The location of an accident is one of the most essential pieces of information to be recorded. The Colombian accident report form requires the reporting officer to give the street address of the accident location. Whilst the street address for many accidents can give quite an accurate location for the accident, for many accidents, it is of little use to the accident investigator. However, the reporting officer also normally draws a sketch of the accident that, if done well, can give an almost precise location for the accident. A number of countries require the police reporting officer to give the geographical co-ordinates ('Eastings' and 'Northings'). However, these locations are not always accurate. Therefore, the police co-ordinates are checked by someone specially trained in coding locations. As a result, the TRL always recommends that in all implementations of the MAAP computer system, a specialist member of the office unit should be trained to do the location coding, thus avoiding the need for a massive training programme for all police recording accidents.

4.4 Checking and Data Entry

The checking of the data, and the data entry is now carried out by two members of staff in the new Accident Investigation Unit. The data is entered straight into the newly established MAAP for Windows accident data system.

5. DATA ANALYSIS

5.1 MAAP for Windows

MAAP for Windows is relatively new, and has been developed to run in the up-to-date Windows 98 operating system. It is the latest system which has been installed for use in Bogotá.

5.2 Hardware

As part of the requirements for this project, one computer was purchased for the use of the project staff mainly as a word processing tool. A further two computers have been purchased for the use of the

STT Accident Investigation Unit. The MAAP system has been installed on these computers, and the two have been networked.

5.3 Installation of Software

The installation and adaptation of MAAP to suit the circumstances in Bogotá has required a much greater effort than was originally envisaged. This has been largely due to the problem of locating accidents within the system to the place they happened on the ground. One major reason for these problems is the very complicated street name/number system which is used in Bogotá. A GIS based map locating system is now operating.

6 TRAFFIC ENGINEERING IN BOGOTÁ

6.1 Priority to Motorised Traffic

Traffic management has been carried out in Bogotá over the years, mainly aimed at keeping traffic moving as fast as possible. Bogotá employs traffic signals extensively, and most signal sets are relatively new, but using reasonably old technology.

6.2 One-way Streets

One-way streets have been employed extensively throughout the city, even down to the streets in mainly residential areas. The one way system is very badly signed and marked. This indicates that the only priority has been to keep traffic moving. Many wide one way streets speed the traffic up, which is hazardous to pedestrians, and is making it difficult for pedestrians to cross 4 lanes of traffic without any assistance in the form of pedestrian refuges or pedestrian crossings. However, some recent work in one of the main north-south routes in northern Bogotá, has the purpose of narrowing down the road space used by vehicles, and to widen the area used by pedestrians. This has substantial safety benefits for pedestrians.

6.3 Traffic Safety Engineering Improvements

Investigation of the existing databases in Bogotá during the first visit revealed that by far the major accident problem in the city was pedestrians being hit, often on the major roads, and frequently killed by the impact. The pedestrian problem also applies to most of the major road network with concentrations along certain lengths. When examining the network, it was quite obvious to a road safety professional that the total lack of pedestrian facilities, apart from pedestrian bridges, must be the major cause of this problem. The number of potential sites which could be used for more thorough investiga-

tion, and which subsequently could be used as a demonstration site for the purpose of training STT staff, were so many that a decision had to be taken on a pragmatic basis. Two sites were therefore chosen:

1. Carrera 30 from Calle 6 to Calle 13; and
2. Autosur from Avenida 68 to Avenida Boyacá.

Accident data from these sites was collected from the database at STT and analysed, and analysis was carried out by Medicina Legal y Ciencias Forenses (a legal forensic bureau) on their database. The data was plotted, and detailed analysis was obtained about where within the sites the problem is particularly serious. The Accident Investigation Unit made several site visits with and without the consultants and the findings were discussed at length with the consultants and Medicina Legal staff.

6.4 Surveys and physical Data Collection

A team of sociologists were consulted, and their proposed approach was discussed. The Accident Investigation Unit asked the sociologists to carry out a number of surveys of the sites. This included:

- a) Still photographs to be taken;
- b) Video recording taken of the sites;
- c) Surveys of traffic volumes to be carried out; and;
- d) Surveys of pedestrians crossing the roads to be carried out in 100 metre sections along each site.

The collection of additional information was agreed which was more in the sociological field of work. This included:

- e) Interview surveys attempting to establish where people were coming from and going to when they cross the road at the site; and
- f) Attempting to establish whether or not the persons crossing the road in these locations are aware of the danger of crossing in these locations, and in fact feel it is dangerous when crossing.

This information subsequently led to a suggestion of several potential solutions to the problem.

6.5 Physical Accident Site Improvements

At the start of the project, it was hoped that physical accident site improvements would have been done by the end of the project period. However, for a number of reasons, this has not been possible. The STT Accident Investigation Unit therefore have follow up this work, determined final design, arranged for the design work to be completed, established where funding was available from, and will in due course supervise the final works.

7 ACCIDENT INVESTIGATION UNIT IN THE STT

7.1 Establishment of Accident Investigation Unit

The establishment of the Accident Investigation Unit has been a major problem during this project, due to very late appointment of staff for the Unit. For that reason, the staff were not available to work with the consultants for the first half of the contract period. The Unit has now been established, and consists of one senior engineer, one systems technician, and two staff to enter data. This level of staffing is below that which was recommended by the consultants. However, the Unit head is committed to the task of improving road safety, and hopefully further staff will be appointed in due course.

7.2 Training of Staff

The intention of the consultant was to bring selected staff to the Royal Society for Prevention of Accidents' (RoSPA) Accident Investigation and Prevention course in Birmingham, United Kingdom. This is a very highly regarded course, which is of great valuable for those attending. For various reasons, this has not been possible. The consultants have attempted to give the staff as much training locally as has been possible. A local course has been arranged by the consultant's local representative in Bogotá to attempt to replace some of the content of the RoSPA course.

8 ROAD SAFETY ACTION PLAN

8.1 A costed Road Safety Action Plan

A costed Road Safety Action Plan for Bogotá has been prepared for a five year period after the present project. The first page of that plan is shown in Figure 3, and the whole plan will be shown in the conference presentation. The primary objectives of this Project and therefore of this plan is road safety engineering and the collection and analysis of accident data. However, road safety is a multi-disciplinary subject. Therefore the plan also includes some important aspects related to public education and traffic policing. The plan, which is in a tabular form, schedules 58 activities over the five year period, and is costed to US\$ 2,052,000. This is a relatively small investment over such a time period, and should be easily achieved provided the city authorities are committed to improve safety on the roads of Bogotá.

Figure 3: Example of the Road Safety Action Plan for Bogotá (Page 1 of the Action Plan)

| Road Safety Action Plan for the City of Santafé de Bogotá | Time Schedule | | | | | | Expenditure Profile (US dollars, thousand) | | | | | | | | |
|---------------------------------------------------------------------------------|---------------|------|------|------|------|------|--------------------------------------------|------|------|------|------|-------|------------------------------|--------|------------|
| | Description | 1999 | 2000 | 2001 | 2002 | 2003 | 1999 | 2000 | 2001 | 2002 | 2003 | Total | Potential Sources of Funding | | |
| | | | | | | | | | | | | | | Bogota | World Bank |
| A. Accident Data Collection | | | | | | | | | | | | | | | |
| — A1- Data Collected by Colgrabar | | | | | | | 50 | | | | | 50 | ✓ | | |
| — A2- 1 person appointed to enter data at STT | | | | | | | 5 | | | | | 5 | ✓ | | |
| — A3- STT enters all data from the Police into the MAAP System | | | | | | | 10 | 10 | 10 | 10 | 10 | 40 | ✓ | | |
| — A4- Cooperation established so all fatal accidents are entered on MAAP System | | | | | | | 0.5 | 2 | 2 | 2 | 2 | 8.5 | ✓ | | |
| — A5- Very serious casualties followed up for 30 days after accident | | | | | | | 1 | 2 | 2 | 2 | 2 | 7 | ✓ | | |
| — A6 STT data checked routinely against Medicina Legal data for fatalities | | | | | | | 0.5 | 1 | 1 | 1 | 1 | 3.5 | ✓ | | |
| B. Accident Investigation Unit in STT | | | | | | | | | | | | | | | |
| — B1- Staffing increased to 4 staff | | | | | | | 2 | 2 | | | | 4 | ✓ | | |
| — B2- Two staff trained overseas | | | | | | | | | | | | 0 | ✓ | | |
| — B3- Staffing increased to 6 staff | | | | | | | 1 | 3 | | | | 4 | ✓ | | |
| — B4- Further staff training overseas | | | | | | | 6 | 6 | | | | 12 | ✓ | | |
| — B5- Six permanent staff fully employed by Accident Investigation Unit | | | | | | | 47 | 46 | 47 | 46 | 46 | 186 | ✓ | | |
| — B6- Unit fully functioning in close cooperation with Unit at IDU | | | | | | | | | | | | 0 | | | |
| C. Accident Remedial Unit in IDU | | | | | | | | | | | | | | | |
| — C1- Unit formally established | | | | | | | 3 | | | | | 3 | ✓ | | |
| — C2- 2 Staff trained overseas | | | | | | | 17 | | | | | 17 | ✓ | | |
| — C3- Unit adequately staffed (6 members of staff) | | | | | | | 47 | 46 | 47 | 46 | 46 | 186 | ✓ | | |
| — C4- Staffing increases as necessary as work increases | | | | | | | | | | | 10 | 20 | ✓ | | |
| — C5- Unit fully functioning in close cooperation with Unit at STT | | | | | | | | | | | | 0 | ✓ | | |

9 CONCLUSION

9.1 A project such as the one undertaken in the City of Santa Fé de Bogotá is only a beginning of the solution to a serious road accident problem. In the more industrialised countries of Western Europe, the improvement in road safety to the level of the present day has taken some 60 years. Providing the authorities in Bogotá has the commitment to tackle this serious problem with both effort and investment, there is no reason why a position such as in those countries cannot be attained in a much shorter period through transfer of experience, maybe in between 10 and 20 years. This clearly also involves a commitment from the national government of Colombia, as the capital city is not isolated for the rest of the country. The authors have seen some good signs from the authorities. These signs will hopefully be transformed into action and success in the years to come.

10 REFERENCES:

TRL (UK) & STT (Bogotá): Final Report