CH

UNITED NATIONS
ECONOMIC COMMISSION FOR AFRICA

IMPROVEMENT OF PEDESTRIAN AND CHILD SAFETY IN URBAN AREAS

13368

Distr.: LIMITED
TRANSCOM/976

7 December 1994
Original: ENGLISH

IMPROVEMENT OF PEDESTRIAN AND CHILD SAFETY IN URBAN AREAS

road safely, the lack of awareness and courtesy of drivers towards the difficulties that a child might encounter while crossing the road, and the general problem pertaining to lack of appropriate walking and crossing facilities for all pedestrians.

1.2 OBJECTIVES

5. In an endeavour to establish an efficient, transport and communications network that will form the basis for the integration of Africa and to facilitate national and international traffic so as to foster intra-African trade and the achievement of self sustaining economic development, the United Nations General Assembly declared the 1991-2000 that of the Second United Nations Transport and Communications Decade in Africa (UNTACDA II).

6. This global objective of UNTACDA II was translated into 10 objective statements. Objective seven is concerned with the **"Improvement of transport safety and security as well as strengthening transport-related environment protection measures"**, see figure 1. Priority areas identified within UNTACDA II pertaining to road safety improvement are:

(a) Integration of road safety measures

(b) Financing of road safety activities

(c) Training, education, and information dissemination

(d) Accident data collection and treatment

(e) Traffic regulations and enforcement

(f) Low cost physical measures

(g) Priority areas for research

(h) Technology transfer and assistance policy

7. Stemming from priority area (g), priority research topical areas in traffic safety were also identified, these include:

* Research on accident data collection, treatment of data and data analysis
* Research on the interaction between different elements of road infrastructure and safety
* Research on comprehensive and integrated road safety schemes
* Research on law enforcement of different infringements and law enforcement of different road user groups.
* Research on high risk groups, see figure 2.

* Research on road user behaviour, mental conditions, social acceptance, road user psychology

* Research on paratransit

* Research on training, education and information campaigns.

8. Within the above framework of implementing UNTACDA II, ECA has initiated this study on the improvement of pedestrians and children traffic safety in urban areas. The study has the following two main objectives:

(a) To improve the understanding of the pedestrian and children traffic safety problem in urban areas, its root, direct and post causes.

(b) Based on this understanding and appreciation of the problem, this study aims at producing a future integrated safety package. This package is meant to prevent and reduce the potential of pedestrians and children accidents in urban areas.

1.3 SCOPE

9. In this study, a baseline assessment of the traffic safety situation for pedestrians and children in two mega African cities, namely Cairo and Nairobi with populations of approximately 13 million and 2 million in 1994 is carried out.

10. This is meant to improve the understanding of the pedestrian and children traffic safety problem, its root, direct and post causes. Based on this understanding and appreciation of the problem, this study aims at producing a future integrated safety package. This package is meant to prevent and reduce the potential of pedestrians and children accidents in urban areas.

11. The state of the art in traffic safety research and practice is presented, namely the framework for an integrated traffic safety approach. A comprehensive and detailed framework of all the functions and activities involved and their dependencies within the whole process of integrated safety management is developed. Patterns of pedestrians and children accidents, casualty rates, and severity indices in Cairo and Nairobi are identified and presented. This is followed by an in depth investigation of pedestrians and children accidents in the city of Nairobi. The report presents the results of questionnaire surveys that were specially designed with the purpose of measuring the traffic safety behaviour of pedestrians and school children and identifying their perception towards their pedestrian environment in Cairo and Nairobi. In addition a set of criteria was developed and used to generally assess the road traffic safety situation in the cities of Cairo and Nairobi with particular emphasis on areas related to pedestrian and children safety.

12. Policies and remedial measures that are meant to enhance the traffic safety for pedestrians and school children in urban areas as well as to improve their road

environment are presented. These are categorised under 12 fields of action, namely: institutional; urban and transportation planning; educational; training; road and traffic engineering; vehicle engineering; legislative; enforcement; information; health-related measures; school-related measures, and research-related measures. Some of these measures can be adopted by UNECA for improving the traffic safety for pedestrians and children in urban areas in Africa.

13. As part of the research-related measures for improving the traffic safety situation for pedestrians and children, the report concludes with an action plan for further studies that are required to help UNECA in working towards the achievement of the objectives of the programme of the second United Nations Transport and Communications Decade in Africa (UNTACADA II) as related to the road safety problems.

1.4. METHODOLOGY

14. The methodology applied for the case studies is based on the following complementary approaches:

* Reviewing previous road safety research work pertaining to pedestrian and children safety in Cairo and Nairobi.

* Identification of patterns of pedestrians and children accidents in Cairo and Nairobi.

* An in depth investigation of pedestrians and children accidents in the city of Nairobi.

* Measurement of the traffic behaviour of pedestrians and school children in Cairo and Nairobi.

* Identify the most profound difficulties and traffic safety problems that pedestrians face while walking on sidewalks and crossing roads in Cairo and Nairobi (i.e. problems related to the road environment, drivers' behaviour, police enforcement).

* Development of a set of criteria that can be used for baseline assessment and comparison of the road traffic safety situation in countries across the world. Using these criteria, identification of traffic safety experiences and current practices in Cairo and Nairobi was undertaken with particular reference to pedestrian and children road safety.

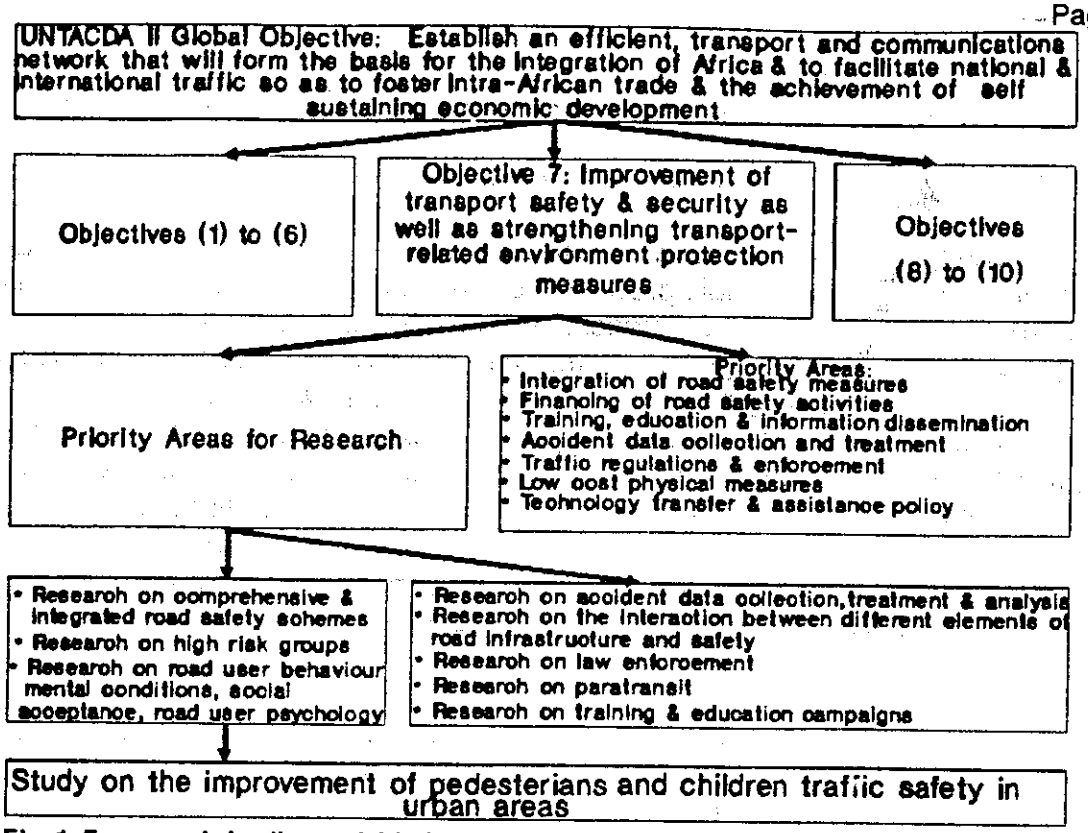

Fig. 1: Framework leading to initiation of the study

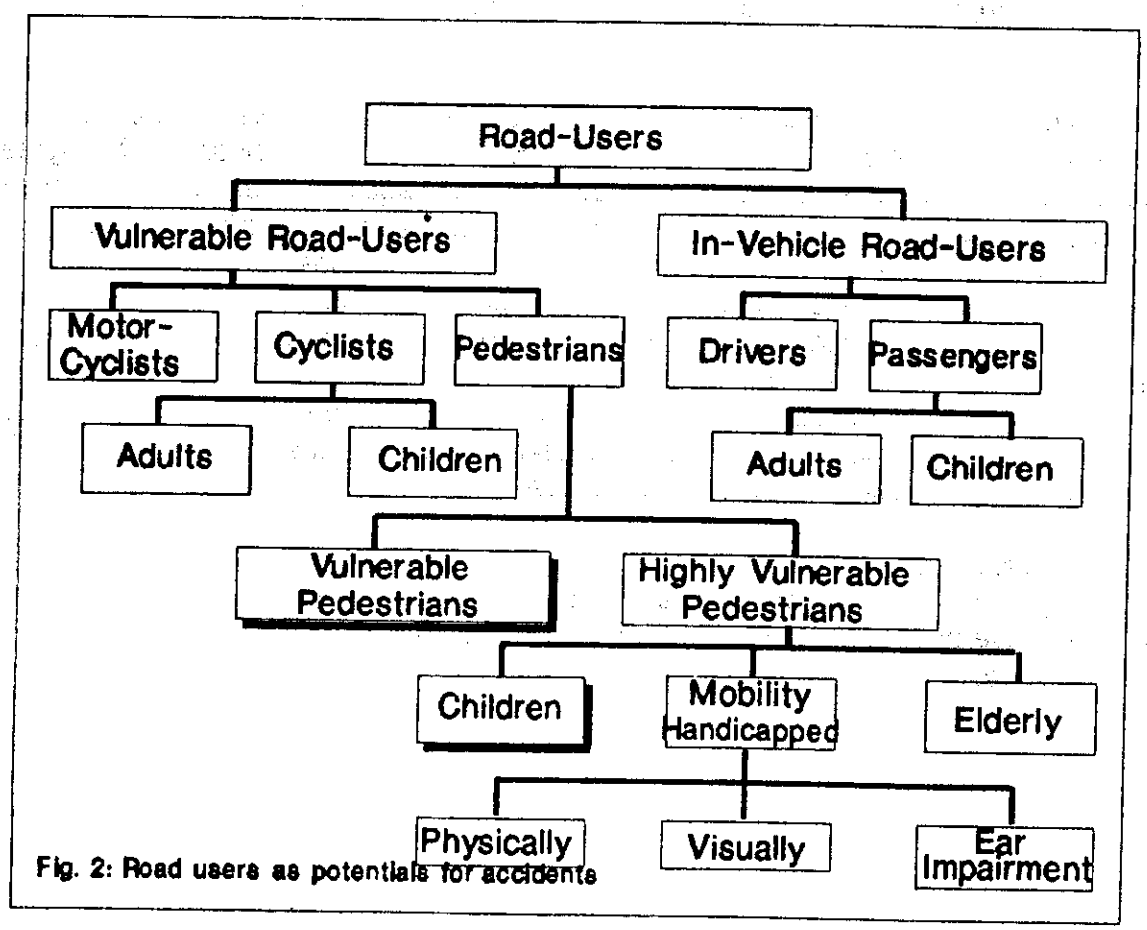

Fig. 2: Road users as potentials for accidents

II. INTEGRATED APPROACH TO ROAD TRAFFIC SAFETY

2.1 TYPES OF INTEGRATED APPROACH TO ROAD TRAFFIC SAFETY

15. "Transportation systems are multi-dimensional in that they are multi-modal, multi-sectoral, multi-faceted, multi-problematic, multi-purpose, multi-operational, multi-organisational, multi-effect, multi-ownership, multi-network, multi-technological, and multi-disciplinary. In complex, large scale systems, like transport, problems are rooted in the basic structure of the system. Actions taken to deal with one problem may create difficulties else where", Abbas and Bell (1994). Road traffic safety is part of this complex transport system. It possesses a lot of the above stated multi-dimensionality. Road safety programmes have gone through several stages, see figure 3, starting from identification of accidents blackspots and single sites treatment, through treatment of accidents based on an area wide approach, and now most of the traffic safety experts across the world are advocating the development of an integrated approach towards road traffic safety, see OECD (1984) & (1990).

16. Two types of integration can be adopted according to the governing circumstances and the priorities. The first can be referred to as the Integrated Approach Within the Road Safety System (IARSS). It involves the systematic coordination of all necessary functions and activities required to assess the traffic safety situation in its totality. It entails the coordination of the multi-disciplinary design and development of traffic safety packages of countermeasures. Lastly it requires the coordination of the efficient and effective multi-disciplinary implementation of this package through the different organisations and agents at the different levels.

17. The second type of integration can be referred to as Integrated Approach Among the Road Safety System and Other Systems (IARSSOS). It involves the systematic coordination of all necessary functions and activities required to assess the traffic safety problem but as one of other considered problems such as traffic congestion, traffic environmental hazards, public transport provision. In this case, each of the considered problems would be assessed in its individual totality as a sperate sub-system as well as in their combined totality as a part of the whole transport system or the urban environment. This would be followed by the multi-disciplinary design and development of integrated packages of countermeasures. Lastly this also entails coordinating the efficient and effective multi-disciplinary implementation of this package through the different organisations and agents at the different levels.

18. "If traffic safety is a prime stimulus, it is likely that traffic safety specialists will play a leading role (active strategy). Alternatively, a reaction may be necessary if other activities have consequences for traffic safety or offer opportunities for additional safety actions (reactive strategy)" OECD (1990).

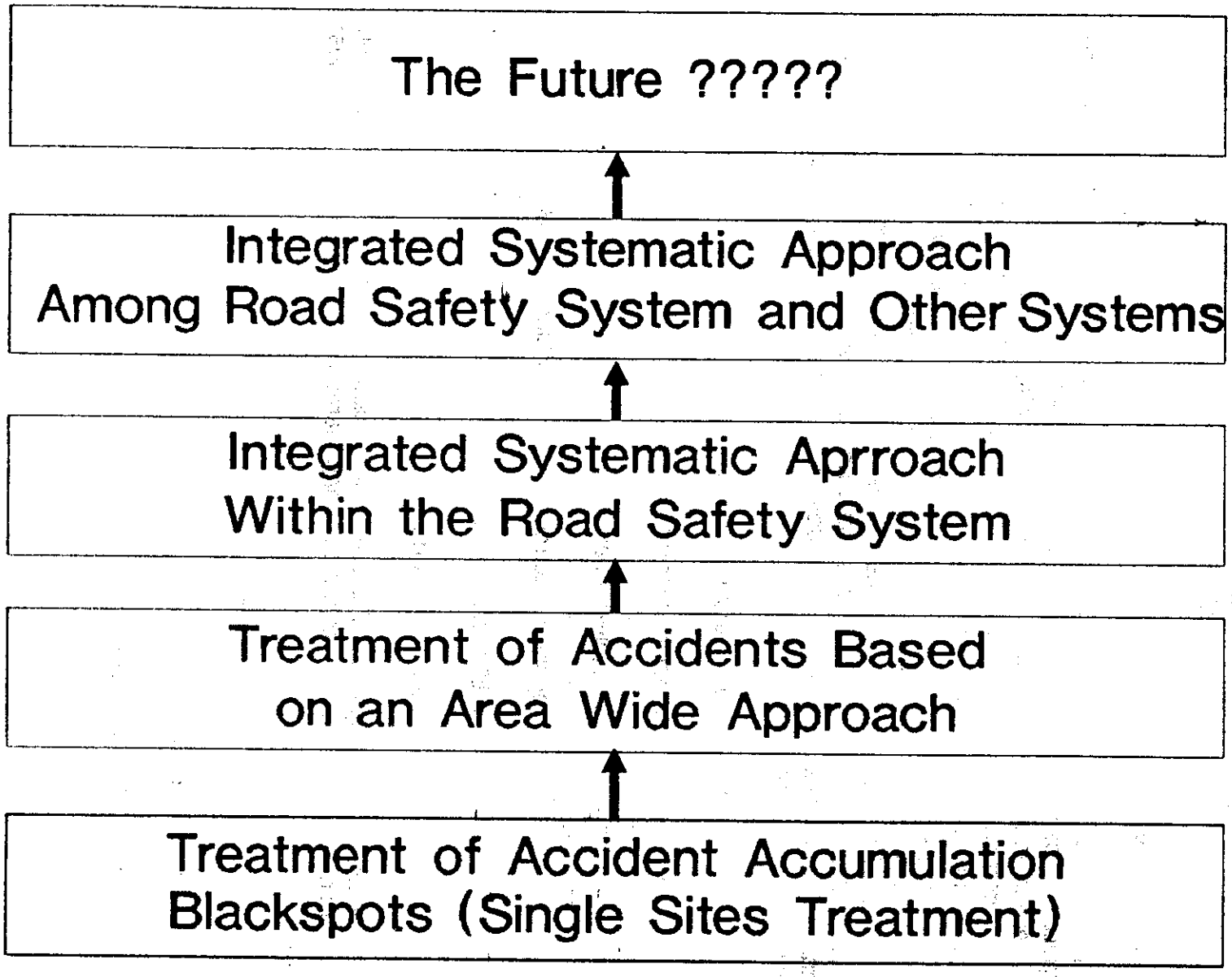

Fig. 3: Development in traffic safety approaches toward accident prevention/reduction

2.2 FRAMEWORK FOR AN INTEGRATED APPROACH TO TRAFFIC SAFETY

19. In this study a comprehensive and detailed framework of all the functions and activities involved and their dependencies within the whole process of integrated safety management is developed, see figure 4. The following subsections discuss each of these activities and its relation to the preceding and the following functions.

2.2.1 Accident Reporting System

20. This activity is vitally important. It constitutes the root of the whole accident investigation process. It is mainly concerned with the collection of accident data. Accident data collection forms/booklets should be carefully designed so as to capture all the necessary information required to perform an overall as well as an in-depth accident data analysis. Meanwhile, the accident reporting form should be designed so as to ensure the easy and speedy completion of reliable and sufficient information concerning the reported accident. In most cases, it is the police officers or traffic police officers who bear the responsibility of completing these forms. Officers should be well trained on how to accurately complete these forms. They should be fully aware of the significance and importance of the different data items included in the form. The form should answer questions pertaining to:

* Where did an accident take place?
* When did an accident take place?
* Who was involved in an accident?
* What happened in terms of fatalities, injuries, damages?
* How did an accident took place?
* Why did an accident happen?

21. In terms of the last question it is always important to remember that an accident could happen as a result of any of the following elements or a combination of these elements:

* The road environment
* The vehicle
* The road-user

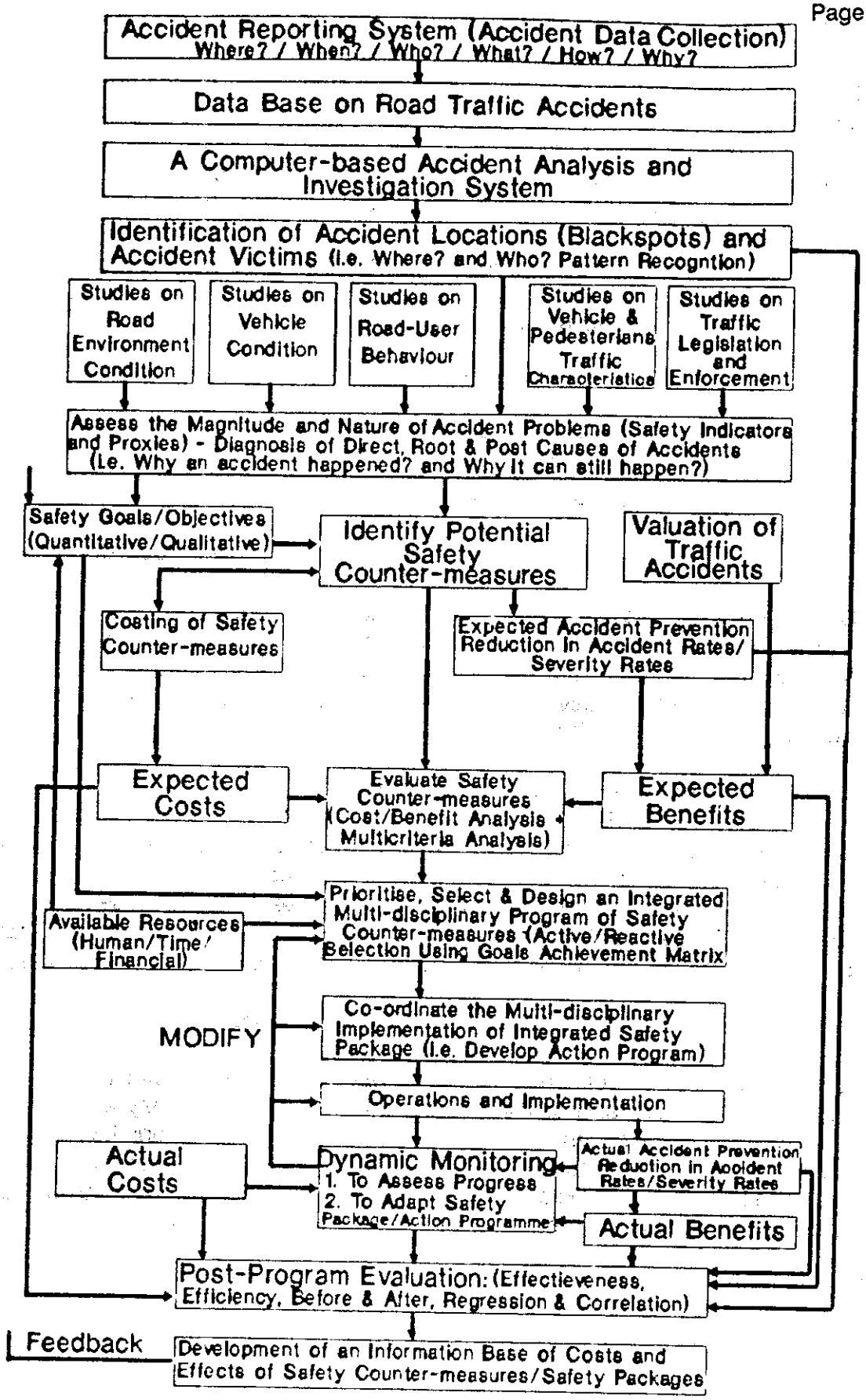

Fig. 4: Framework for an integratedtraffic safety approach

22. Thus it is very vital to establish the condition of the road environment at an accident location, as well as the type and condition of the vehicles involved, and finally the physical and mental state of the road-users involved in an accident, as well as their exact traffic manoeuvres during the accident. According to IHT (1990) there are six main data items that should be included in accident reporting: these are

* basic accident description;
* road types;
* environmental features;
* driver features;
* casualty details; and
* traffic characteristics-related to time and location.

23. There exist several systems of accident reporting both in the developed and the developing countries. One of the most comprehensive accident reporting systems produced by TRRL is the police accident booklet for use in developing countries. This was initially tested and developed in Egypt in conjunction with the Egyptian Academy for Scientific Research and Technology (ASRT).

2.2.2 Data Base on Road Traffic Accidents

24. Once accident forms are completed, a logistic system must exist whereby these forms are collected from various police stations and sent to the accident data analysis office. These forms are then accessed by specialised data entry personal whose role is to code the forms and store the coded data into a computerised data-base on road traffic accidents. It is vitally important to maintain this accident-data base and keep it updated.

2.2.3 A Computer Based Accident Analysis and Investigation System

25. Accident data can be manually analysed. However, with the rapid progress in computer hardware and software it became now relatively easy and cheap to acquire micro-computers with an easy to use (user friendly) accident investigation package installed to perform all the necessary analysis. One of the most popular accident analysis and investigation systems for developing countries is MAAP a microcomputer accident analysis package developed by TRRL, see Hills (1984).

2.2.4 Identification of Accident Locations and Victims Patterns

26. This constitutes the first step in the accident analysis process, getting a general overview of the accident prone locations (i.e. where do accidents usually happen?) as well as the type of victims involved in an accident (i.e. to whom do accidents usually happen?). It is through this general overview of the scale and characteristics of accident data, that some preliminary actions might be taken in the form of low-cost engineering countermeasures to relieve the black spot areas from the road network. Most importantly, based on this general overview decision would be taken as to the direction of the in depth accident investigations such as investigation of particular types of accidents, or investigation of accidents occurring to vulnerable road users, etc.

2.2.5 Diagnosis of Direct, Root and Post Causes of Accidents

27. Once the direction of the in-depth accident investigation has been decided, it is vital to assess the exact magnitude and nature of the particular accident problem. This can be done by establishing the patterns of safety indicators such as accident risk and severity indices. In depth studies of all the direct, root (underlying) and post causes of accidents should be then carried out. This involves the following set of studies:

* Studies on urban planning and transportation planning and management
* Studies on road environment condition
* Studies on vehicle condition
* Studies on road user behaviour
* Studies on pedestrian and vehicle traffic characteristics
* Studies on traffic legislation (rules and regulations) and their enforcement.
* Studies on health-related issues pertaining to accidents severity.

28. These in-depth studies are meant to complement each other in answering two basic questions:

* Why an accident has actually happened?
* Why an accident might still happen in the future?

29. A macro classification of accidents causes and countermeasures is displayed in figure 5. The figure shows that accidents causes and hence countermeasures can be categorised as root causes, direct causes and post accident causes related to accidents emergency and rescue service, medical treatment and in general trauma management. Figure 6 details the root and direct causes leading to accidents. These are mainly traffic - related activities, and participants leading to positive and negative outcomes. As shown in the figure that the road environment, the vehicles,, the drivers, the pedestrians and the

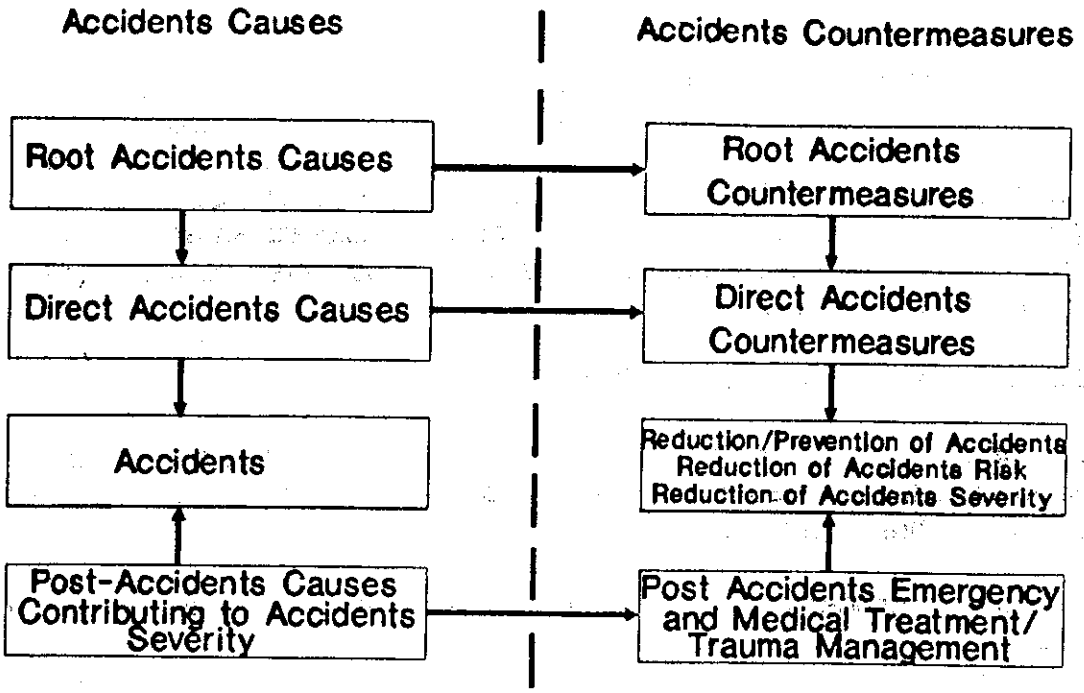

Fig. 5: Macro classification of accidents causes and countermeasures

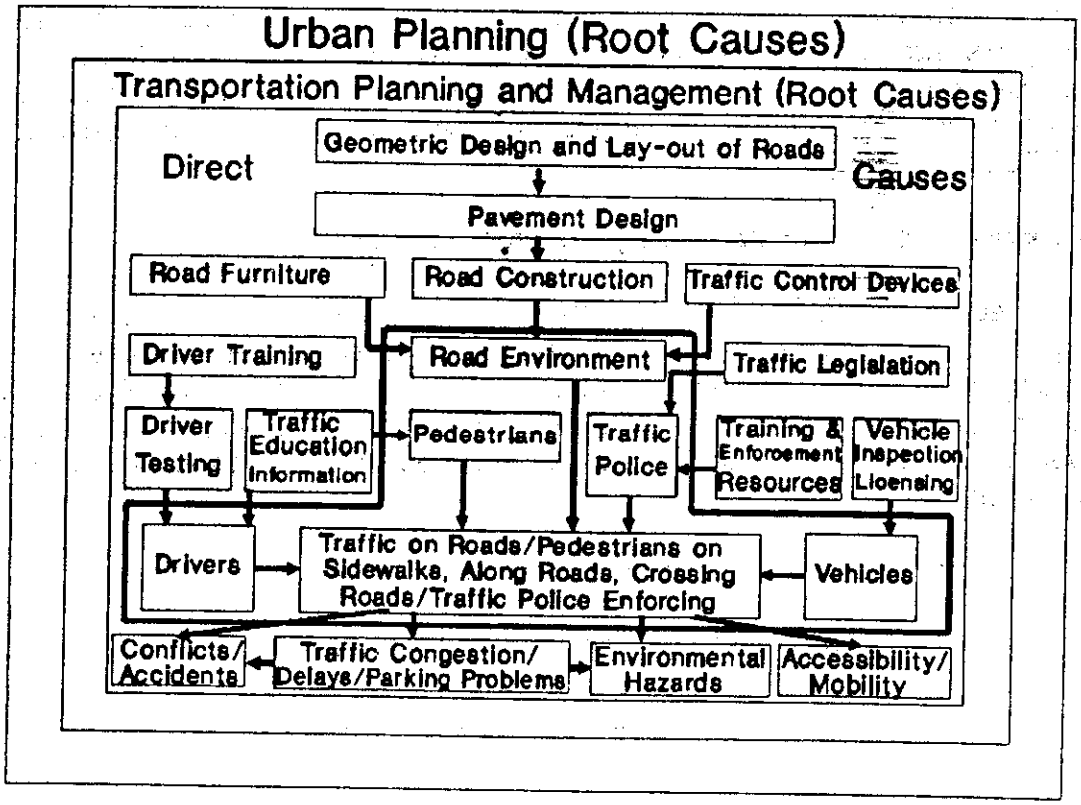

Fig. 6: Traffic-related activities, participants and outcomes

traffic police all interact together in the form of traffic on the road and pedestrians walking on sidewalks or along kerbs as well as crossing roads and traffic police enforcing this interaction. Two types of outcomes result from this interactions, the first is the positive outcome in the form of mobility and accessibility to people and goods. The second is the negative outcomes that are mainly in the form of traffic-related environmental hazards, traffic congestion, delays, parking problems, and conflicts that eventually lead to the occurrence of accidents.

2.2.6 Setting of Safety Goals/Objectives

30. Safety goals or objectives can be either qualitative or quantitative (absolute/relative). These should be clear and well stated. The setting of safety goals depends on three major inputs:

(a) The in-depth diagnosis and assessment of accidents direct, root and post causes.

(b) The available resources in terms of human, time and financial resources

(c) The mission statement, the policies (global objectives) and the targets leading to the setting of the safety objectives. This would also show whether the adopted integration approach is the IARSS or whether it is the IARSSOS. Figure 7 shows a typical proposed example of a mission statement, a global traffic safety policy, safety targets, and safety goals that can be achieved through the IARSS. On the other hand, if the same traffic safety policy, targets and goals are combined with other environment-related and/or traffic congestion-related policies, targets and goals, then these can be achieved through an IARSSOS.

2.2.7 Identification of Potential Safety Countermeasures

31. Based on the thorough diagnosis of the different types of accident causes and taking into account the traffic safety objectives required to be achieved, potential individual and subgroups of traffic safety countermeasures can be identified. These should be chosen so as to be relevantly directed towards alleviating some of the accidents causes as well as relieving some other causes. Towards this end, three values should be determined:

* Expected reduction in accident numbers
* Expected reduction in accident rates (risk)
* Expected reduction in severity rates

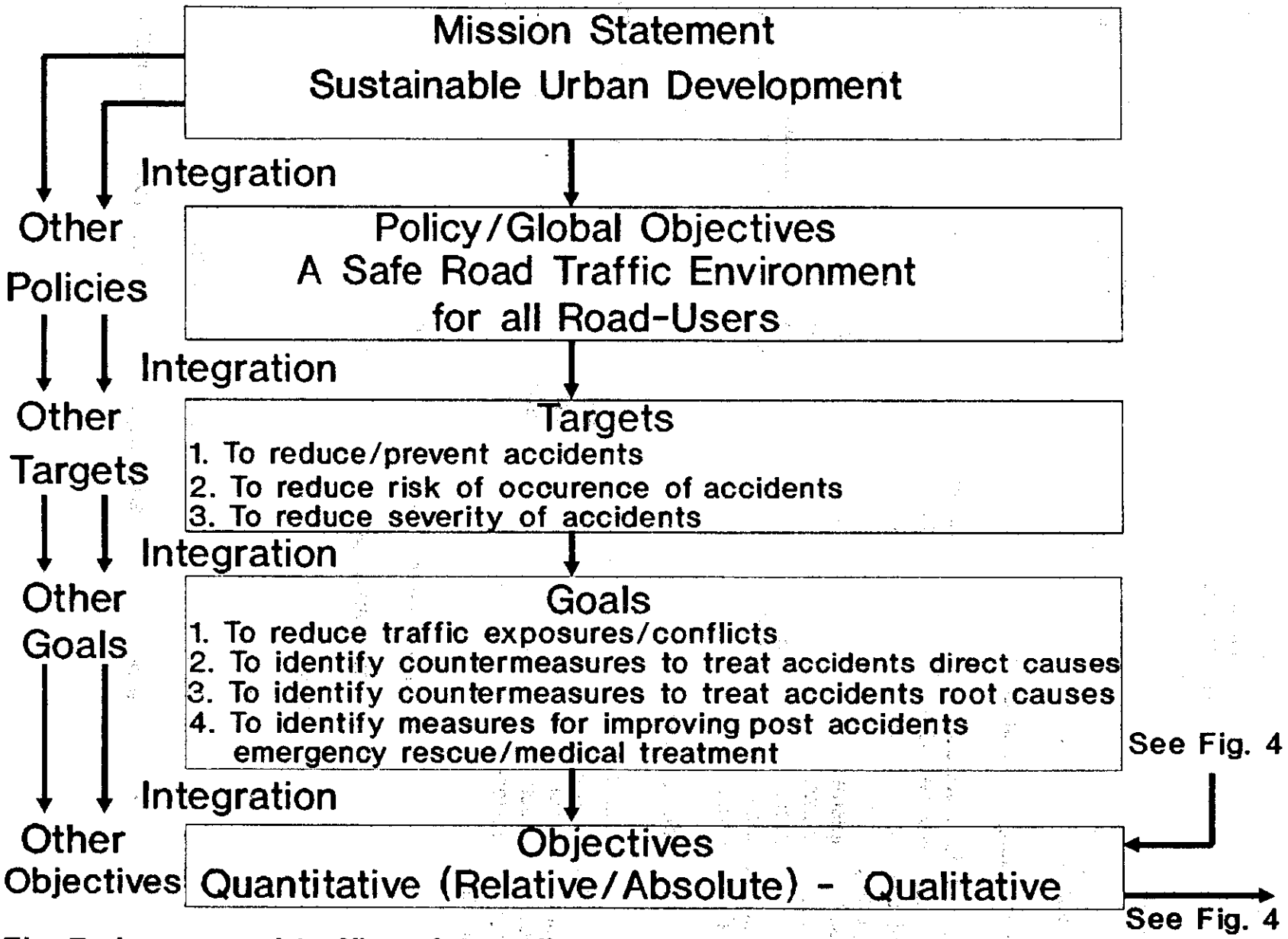

Fig. 7: A proposed traffic safety policy, targets and goals

32. The international road traffic safety literature is full of research publications and manuals that can help to identify potential safety countermeasures and their expected effects. "Although research findings from developed countries can provide some guidance, the inevitable uncertainties surrounding their transfer to developing countries emphasise the need for caution and appreciation" Hills and Jacobs (1981). Manuals and guidelines have also been produced specially for developing countries, see UNECA (1989) and Ross et al. (1990). However, still each country should look carefully at these countermeasures and select and adapt (not adopt) some of these measures to suit its local conditions (physical and cultural). Additionally and most importantly countries should gradually develop an information data base describing the measures that have been applied and their effectiveness within the country's environment.

2.2.8 Costing of Safety Countermeasures

33. This involves costing identified individual or subgroups of traffic safety countermeasures. Costing should include all types of costs such as capital and maintenance costs, staff costs, and a component of fixed costs related to accident data reporting, storage and analysis. A determination of expected costs to be incurred as a result of implementation of countermeasures should be reached. Sometimes as a result of costing a particular countermeasure or a subgroup of countermeasures one realises that it would not fall within the available resources. In this case, other countermeasures should be looked upon that both satisfies the safety objectives as well as fall within the available resources.

2.2.9 Valuation of Traffic Accidents

34. In order to carry out an evaluation of proposed safety countermeasures, one has to determine in addition to the expected costs, the expected benefits. As our objective is mainly to prevent accidents from occurrence, benefits would be simply equal to the costs incurred if such an accident would have not been prevented and hence would have occurred. Several methods exist for the valuation of accident prevention costs. These include:

* The gross output (human capital approach)
* The net output approach
* The life-insurance approach
* The court-award approach
* The implicit public sector valuation approach
* The value of risk-change approach (willingness to pay approach)

35. The papers by Hills and Jones-Lee (1981) and by Silcock (1982) give a comprehensive description of each of these approaches and a comparison among them. Obviously each of these approaches would give a value to an accident prevention different from the other method. However, several criteria should be taken into consideration when selecting which accident valuation method to use, namely the objective of the evaluation as well as the ease of application in terms of data availability and validity of assumptions. In general, it is recommended that developing countries apply the gross output approach as it is well suited to the objective of maximising the wealth of a country. The gross output approach would include the following cost components:

* Present value of the loss of the victim's future output
* Medical treatment costs
* Damage to vehicles or other property costs
* Administrative costs including insurance, police and court
* Other costs including the delays to other vehicles at the scene of the accident.

36. It is further recommended that sums are added to reflect the pain, grief and suffering of those involved in road accidents. The willingness to pay approach is another recommended approach, however it is difficult to apply due to insufficiency of data.

37. Multiplying the expected number of accidents to be prevented, as a result of implementing safety countermeasure(s), by the accident prevention value would produce the benefits expected as a result of implementing the countermeasure(s).

2.2.10 Evaluation of Safety Countermeasures

38. In this stage appraisal of the proposed countermeasures is carried out. This involves weighting the expected benefits against the expected costs. Cost-benefit analysis is suited for doing this type of appraisal. Several forms of cost-benefit analysis exist. The selection of a particular form would depend on several factors such as the scale of the project, the objective, and the time frame expected for benefits to materialise. In all cases it is also recommended to substantiate the cost-benefit analysis with a multi-criteria analysis that can consider the intangibles associated with accident prevention benefits, the possibility of unacceptable effects on traffic environment, the likelihood of increase in other accident types, etc.

2.2.11 Development of an Integrated Package of Safety Countermeasures

39. As other activities and functions, this stage of developing an integrated package of safety countermeasures is considered to be vitally important. It entails prioritising different individual or subgroups of safety countermeasures. This prioritisation can be based on several criteria such as:

* economic appraisal;

* potential in working together to achieve the preset traffic safety objectives/goals within the available resources;

40. Additionally other criteria can be used in the evaluation such as:

* ease of implementation and maintenance;

* level of support and political acceptance, see Silcock and Walker (1981).

41. Most importantly at this stage is that when considering the selection of a package of safety measures to bear in mind whether traffic safety is dealt with as a system on its own (active strategy) or whether it is dealt with as a system with other systems working together to serve several objectives/ goals/ targets/ policies and a particular mission statement (reactive strategy). A prioritisation technique that can be applied at this stage is known as the "Goals Achievement Matrix". Once countermeasures are prioritised, some are selected and packaged together in an attempt to develop an integrated package of safety countermeasures. People involved in this stage would be representing a multi-disciplinary of agents and organisations with sometimes shared/overlapping objectives or alternatively sometimes conflicting objectives.

2.2.12 Coordination of the Implementation of an Integrated Traffic Safety Package

42. An action program for the implementation of the integrated safety package ought to be developed. This entails splitting the implementation of the safety package into parallel and sequential stages and time framing these stages. It also requires establishing the necessary contacts and preparations with the various agents and organisations at the different levels through which the integrated safety package would be implemented. All in all, this is meant to coordinate, harmonise and guarantee the smooth implementation of these stages of the developed integrated safety package through the various organisations.

2.2.13 Operation and Implementation of the Action Program

43. This stage involves the operation of the implementation action programme. This operation involves the supervision, and coordination among the multi-disciplinary agents and organisations at the different levels to implement the developed safety package in accordance with the action program.

2.2.14 Dynamic Monitoring

44. Throughout the implementation of the safety package it is vital to monitor over time the actual effects of the implemented components of the safety package (incurred costs and achieved benefits). In addition monitoring would involve assessing progress in the stages of the implementation action program. Monitoring serves two important purposes:

(a) Realisation of any unexpected effects (positive/negative) as a result of implemented components within the safety package as well as identification of any deviations from original implementation action program.

(b) As a consequence of (a), modifications in the form of alterations or adjustments can be undertaken both in the safety package and/or in the implementation action program.

45. Monitoring should continue after the complete implementation of the action programme by a period of time equal to the time frame taken in the evaluation of countermeasures so as to allow for the whole and full expected benefits to materialise.

2.2.15 Post Program Evaluation

46. After the implementation of the safety package, and the complete realisation of the potential benefits, it becomes necessary to evaluate the whole safety package. There exist several ways to carry out this evaluation, all are considered indicative and all are important to be taken into consideration, some are listed below.

* Effectiveness measures: these include cost effectiveness and benefit effectiveness

  Cost effectiveness = Actual costs / Expected costs

  Benefit effectiveness = Actual benefits / Expected benefits

* Efficiency measures = Actual benefits / Actual Costs

* Before and after studies and statistics, mainly involved with comparing the safety scene after the implementation of the safety package with it before implementation.

  Percentage reduction in number of accidents =
  [(Accidents before - Accidents after) / Accidents before] * 100

  Percentage reduction in accidents rate =
  [(Accidents rate before - Accidents rate after) / Accidents rate before] * 100

  Percentage reduction in accidents severity =
  [(Accidents severity before - Accidents severity after) / Accidents severity before] * 100

* Regression and correlation between safety countermeasures as independent variables and accident reduction/prevention as dependent variable.

2.2.16 Development of an Information Base on Safety Countermeasures and Packages

47. As the above described process would be repeated in future for different locations as well as for other types of accidents, it is indispensable to keep record and document all the information gained during this process. Vital information include:

* description of safety countermeasures

* cost details incurred in implementing countermeasures

* effectiveness, efficiency, and before and after statistics of implemented countermeasures.

III. PEDESTRIANS AND CHILDREN ACCIDENTS IN CAIRO AND NAIROBI

3.1 Road safety research related to pedestrians and children in cairo and Nairobi

48. "In Asia, Africa, the Caribbean and the Middle East more than 40 percent of the road accident deaths were pedestrians compared with only 20 percent in Europe and the United States of America" Downing et al. (1993).

49. Before proceeding into presenting the results of our conducted studies, a review of other previously conducted research that is related to road safety of pedestrians and children in Cairo and Nairobi is presented.

50. In the early 1980's, it was decided to start a national study entitled - Analysis of Traffic Accidents on Rural and Urban Roads in Egypt. Accident analysis and traffic behaviour studies were conducted by the Egyptian Academy for Scientific Research and Technology (ASRT) in conjunction with the Central Traffic Police Department (CTD) and the Transport and Road Research Laboratory (TRRL) during their joint research effort, see ASRT (1991). Accident data was collected for six main rural roads in Egypt and three major districts in Greater Cairo, namely Heliopolis, Azbakia, and Agouza. These urban areas represent different social and traffic intensity patterns. The following represent a point summary of the results of some of these studies conducted during the period 1983-85 that are mainly related to pedestrian and children accidents/safety in three urban districts in Cairo.

* 776 (58 percent) of casualties occurring in the three urban districts were pedestrian casualties.
* The two districts, Azbakia and Agouza, with the worst pedestrian facilities had the highest percentage of pedestrian casualties, 78 percent and 71 percent respectively. Heliopolis where footpaths are generally in good condition and clear of obstructions, had 37 percent pedestrian casualties.
* 74 percent of pedestrian casualties were male.
* 6 percent of pedestrian casualties were fatal
* 17 percent of pedestrian casualties occurred to children under 15 years of age.
* 69 percent of pedestrian casualties occurred while pedestrians were crossing roads.
* Vehicles involved in pedestrian urban accidents were mainly cars or taxis.

* Almost all of the pedestrian accidents occurred at daytime or at night time on lit roads

* Pedestrian open-ended interviews were conducted with 808 pedestrians selected at random from rural and urban research areas

(a) 2 percent of those interviewed thought they sometimes had the right of way over traffic.

(b) School teachers and police were the people most frequently mentioned as a source of instruction in crossing roads safely.

(c) When asked about what precaution do pedestrians do when crossing roads, 58 percent replied that they look both ways before crossing, 11 percent replied that they would let traffic pass before they cross, 11 percent stated that they would find a safe place to cross and stop before crossing.

* Drivers interviews were conducted with 703 drivers stopped at random from rural and urban research areas

(d) Most drivers gave correct answers to the pedestrian crossing questions. All drivers knew that they should stop for pedestrians on crossings, and 76 percent recognised that pedestrians had right of way over motor vehicles at pedestrian crossings.

* The following are some results related to urban accidents in general, however they can be considered as indicative of pedestrian accidents that represent over 50 percent of all urban accidents.

(e) 48 percent of urban accidents occurred at junctions, 52 percent not at a junction

(f) Of these junctions where accidents have occurred, 12 percent were controlled by police, 15 percent were controlled by traffic signals, 43 percent were controlled by police and signals and one percent were controlled by road signs.

(g) April and May with 11 percent of all urban accidents represented the highest proportion

(h) A similar distribution of about 15 percent of accidents were found for all days of the week except for Friday the Muslim day of rest, only 9 percent of urban accidents occurred that day.

(i) Urban accidents peaked with 17 percent at 14-15 hours, where this is the time when government offices close and the streets of Cairo become crowded with commuters.

* It was found that in Cairo less than one percent of the observed drivers chose to stop at uncontrolled pedestrian crossings, and not surprisingly very few pedestrians made use of such crossings.

51. A TRRL study by Jacobs et al. (1981) has looked at the traffic behaviour of drivers in some cities of the developing world including Nairobi. In Nairobi in 1975, 50 percent of observed drivers passed the red signal, but at the time there were only three sets of signals in the city. The work was repeated in 1977 when there were traffic signals at over twenty junctions in the centre of Nairobi, and driver behaviour was found to have improved considerably with the equivalent figure at ten sites (including the original two sites) being 7 percent. It may well be possible that a greater exposure to, and hence familiarity with, traffic signals led to this improvement in driver behaviour. As for the average percentage of drivers choosing to stop for pedestrians at uncontrolled crossings (i.e. zebra crossings) it was almost 17 percent of the studied sample and the average percentage of pedestrians using zebra crossings was 49 percent. Studies were also made in Nairobi of driver behaviour with and without the presence of a police officer standing near to the traffic signals. At all three of the sites where observations were made, there were slight reductions in the proportion of drivers passing the red signal when the police officer was present.

52. A comparison of accidents taking place in cities in developed and developing countries was carried out for Nairobi and Mombasa (Kenya), Surabaya (Indonesia) and Kingston (Jamaica), see Jacobs and Sayer (1977). Whereas in Great Britain 20 per cent of all accidents occurred in the central area of each town, in the cities of the developing countries the equivalent values ranged from 24 to nearly 60 per cent. The differences were attributed to land use and social activity. In most of the developing countries the proportion of pedestrian casualties in the cities was considerably higher than in European countries.

53. Several road safety research studies were undertaken at the University of Nairobi. In studies related to children safety, see Miyanji, (1975 & 1976) it was found that:'

* road accidents ranked 14th among the top killers in all age groups of children and 2nd in the older more exposed school age group of 5-12 years;

* 60 percent of the children involved were unaccompanied at the time of the accident of whom 60 percent were school children;

54. In a review of road accidents in Nairobi for the period 1968 -1972, by Kwamina, Noel and Soin (1975) it was found that:

* children, students and civil servants were greatly involved in road accidents and their casualties resulted in 29 percent of all accident deaths;

* vehicle drivers were responsible for 48 percent of all accidents and the pedestrians were responsible for 36.2 percent of all accidents; 93.9 percent of all accidents were caused by road users.

55. A study undertaken to establish the level of traffic laws violation in selected roads in Nairobi, see Gichaga and Kipkore (1980) indicated how unsafe it is to travel in Nairobi, with 3 percent-5.8 percent of the drivers failing to conform to the traffic lights requirements, 2.8 percent of the drivers failing to stop at a mandatory stop sign and 24 percent of the drivers failing to keep to the proper lanes on a roundabout.

3.2 Patterns of pedestrians and children accidents in Cairo and Nairobi

56. In this section, a general overview of the patterns of pedestrians and children accidents in Cairo and Nairobi is presented. Three types of patterns would be displayed, namely the amount, the rate (risk) and the severity of accidents. Figures 8 & 9 show the overall development over time of the numbers of accidents in three main districts in Cairo and in Nairobi city. Trends for the number of causalities (including fatal and injury) for the three districts in Cairo and for the city of Nairobi are displayed in figures 10 & 11. For the Cairo case, figure 10 shows separately the trends for total causalities as well as for pedestrians casualties. As for Nairobi city, figure 11 shows separately the trends for total causalities, pedestrians casualties, as well as for children casualties (including all types of children traffic accidents).

57. For the three districts in Cairo, figure 12 shows the trend of the proportion of the severity degrees of pedestrians casualties, namely the fatal and injury casualties. As for the Nairobi city figures 13 & 14 display the trends of the proportions of the severity degrees of pedestrian and children casualties respectively, namely the fatal, the seriously injured and the slightly injured casualties.

58. Realising that absolute numbers of traffic accidents do not represent indicative figures to be used for comparison purposes, and that the most meaningful statistic for international comparison are relative values, the trends for pedestrians and children causality rates are displayed in figures 15 & 16. Figure 15 displays the trends of the number of pedestrians casualties as related to the population number as well as to the vehicle kilometres in Nairobi. The figure shows that on average 1.48 pedestrian casualties take place for every 1000 inhabitants and that on average 2.11 pedestrian casualties take place for every 1 million travelled vehicle kilometre. Figure 16 shows that for the three districts in Cairo the average number of pedestrians casualties is almost 69 out of each

100 casualty i.e. more than all other types of casualties combined together (cyclists, motorcyclists, drivers, passengers). As for Nairobi city the average number of pedestrians casualties is almost 47 out of each 100 casualty i.e. almost equal to all other casualties combined together (cyclists, motorcyclists, drivers, passengers). For Nairobi city, figure 16 shows that the average number of children casualties (including all types of children traffic accidents) is almost 16 out of each 100 casualties.

59. Two types of severity indices were computed. The first type can be referred to as macro severity index. This is computed as the number of pedestrians fatalities out of each 100 casualties, see figure 17. The figure shows for the three districts in Cairo the average number of pedestrians fatalities is almost 5 out of each 100 casualty. As for Nairobi the average number of pedestrians fatalities is also almost 5 out of each 100 causalities. The figure also shows that, for Nairobi city, the average number of children fatalities (including all types of children traffic accidents) is almost 1 out of each 100 casualties.

60. The second type of severity rate can be referred to as the micro severity index. This is computed as the number of pedestrians fatalities out of each 100 pedestrians casualties, see figure 18. The figure shows that for the three districts in Cairo the average number of pedestrians fatalities is almost 8 out of each 100 pedestrians casualty. As for Nairobi the average number of pedestrians fatalities is almost 10 out of each 100 pedestrians causalities. The figure also shows that, for Nairobi, the average number of children fatalities (including all types of children traffic accidents) is almost 6 out of each 100 children casualties.

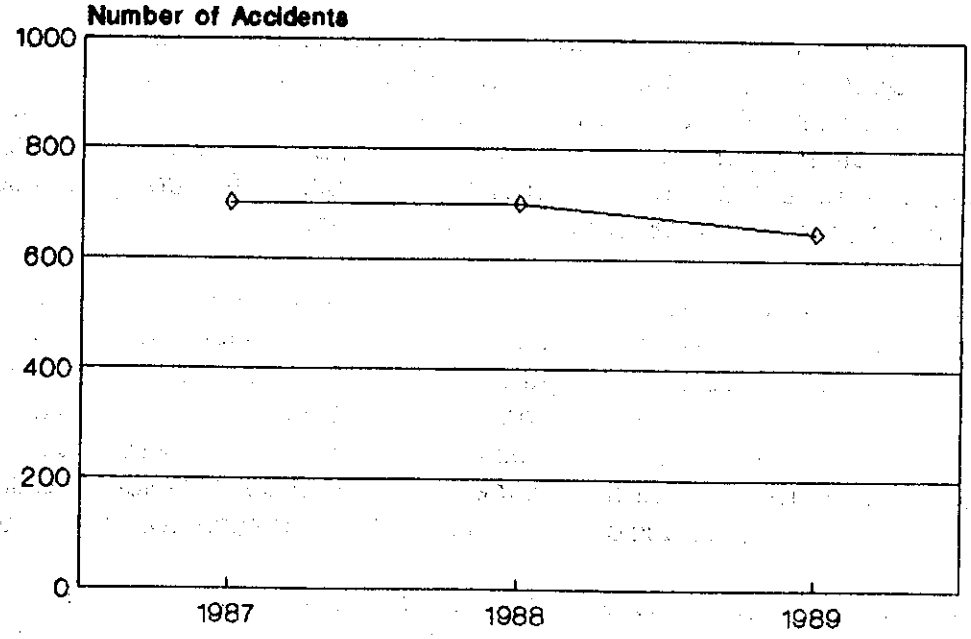

Fig 8: Trend for the number of accidents in 3 districts in Greater Cairo

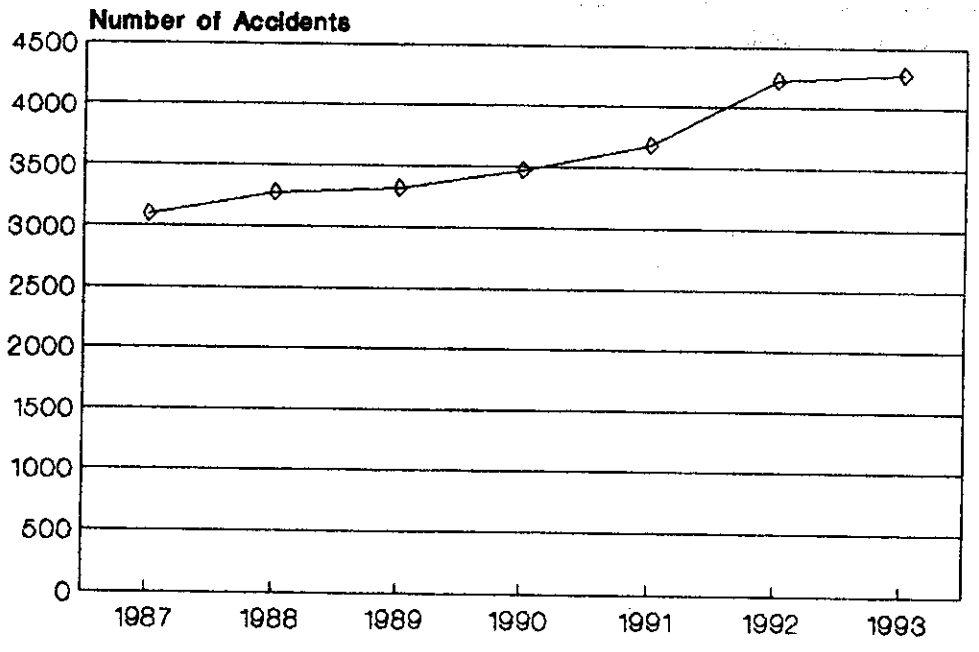

Fig 9: Trend for the number of accidents in Nairobi

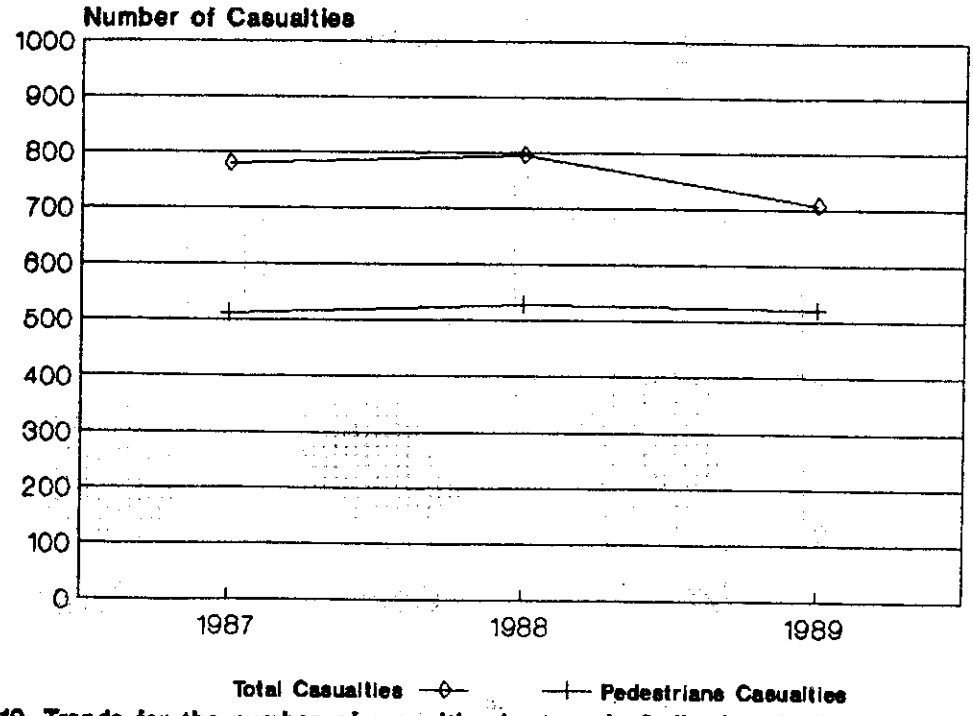

Fig 10: Trends for the number of casualties by type in 3 districts in Greater Cairo

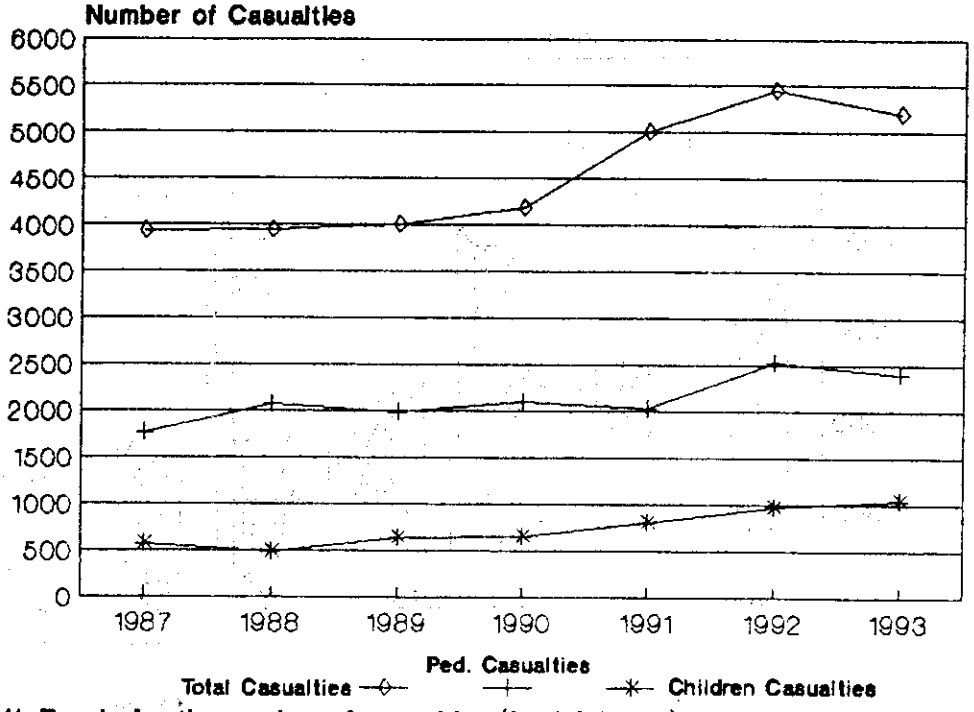

Fig 11: Trends for the number of casualties (fatal & injury) by type in Nairobi

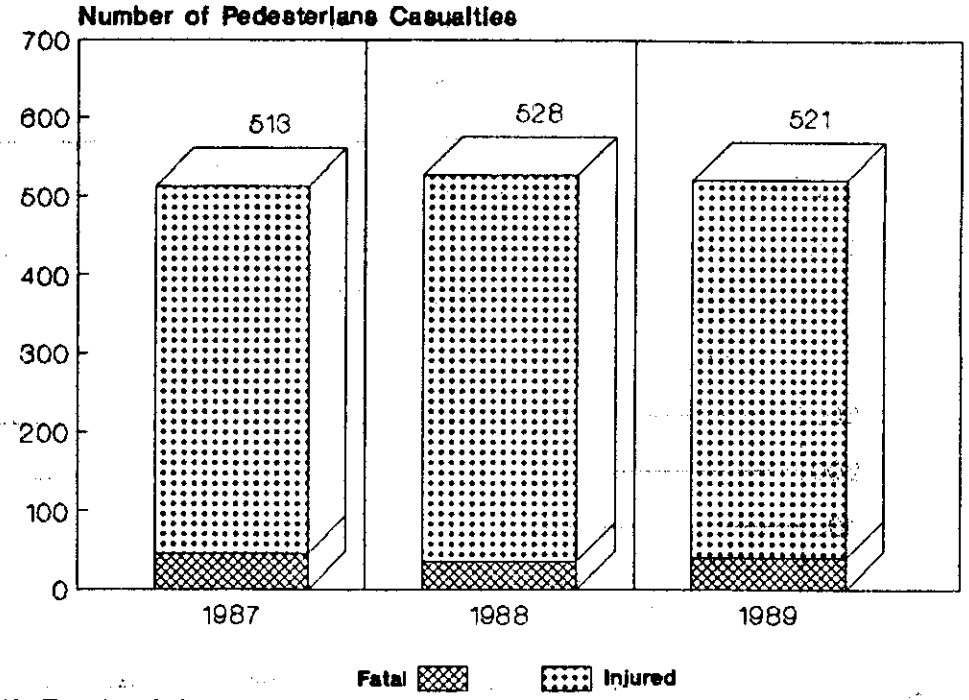

Fig 12: Trends of degrees of severity of pedestrians accidents in 3 districts in Cairo

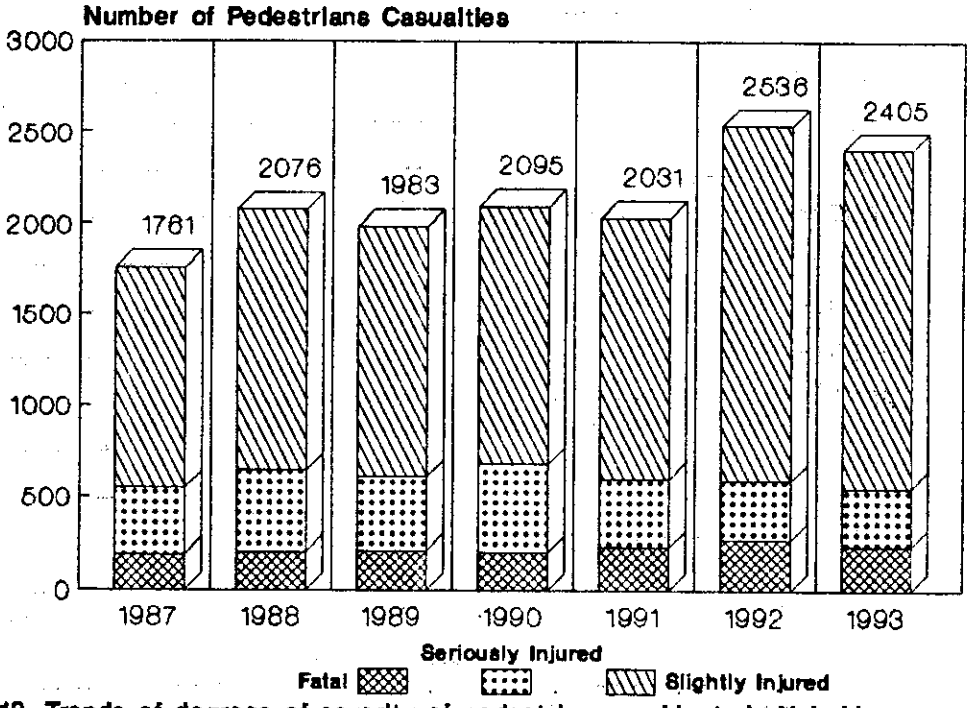

Fig 13: Trends of degrees of severity of pedestrians accidents in Nairobi

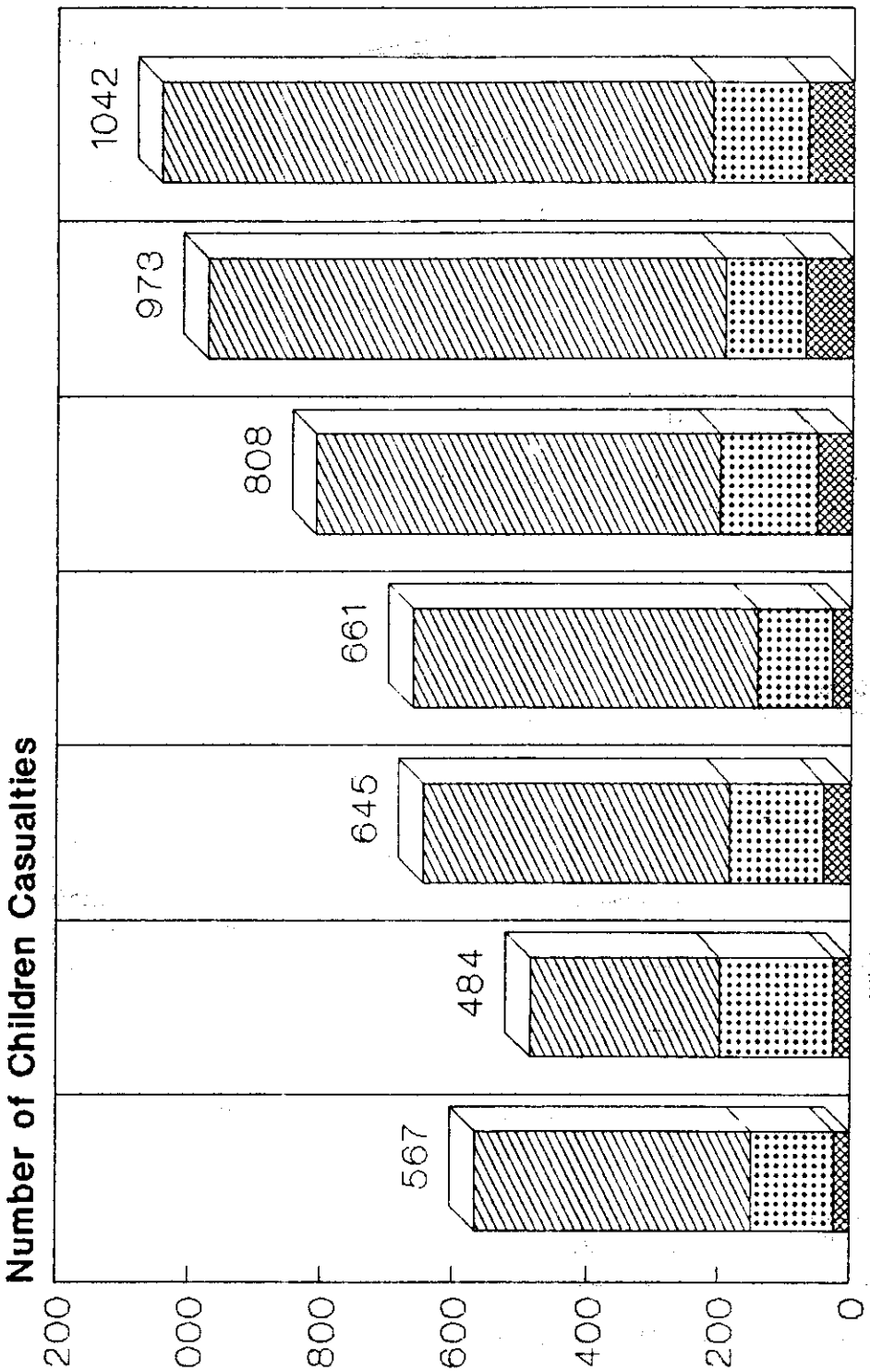

Fig 14: Trends of degrees of severity of children accidents in Nairobi

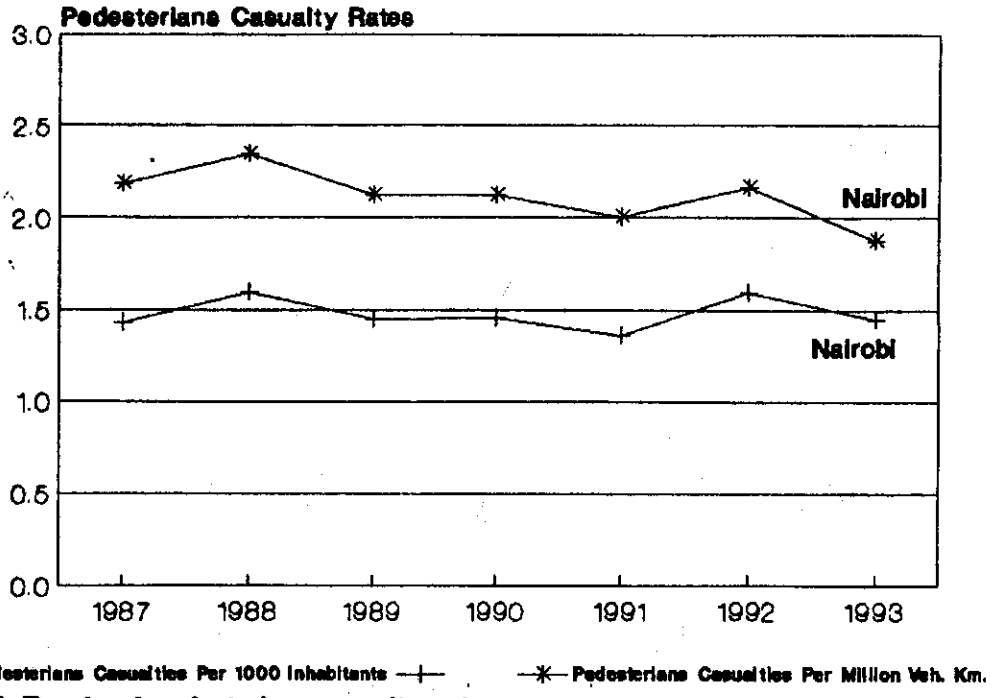

Fig 15: Trends of pedesterians casualty rates

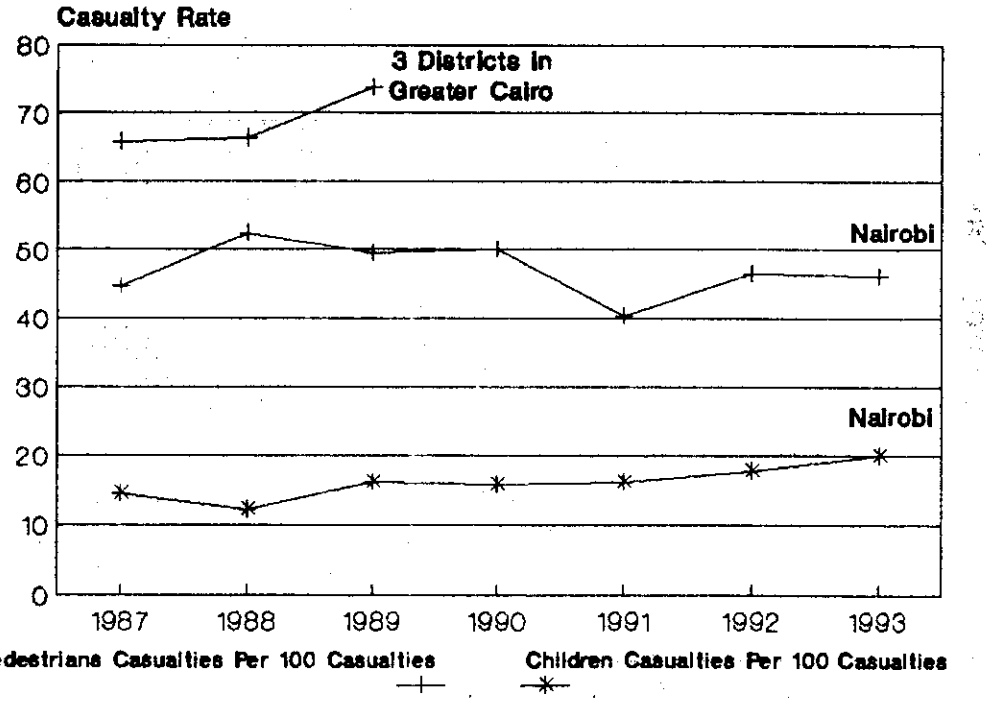

Fig 16: Trends for casualty rates by type in Nairobi & Greater Cairo

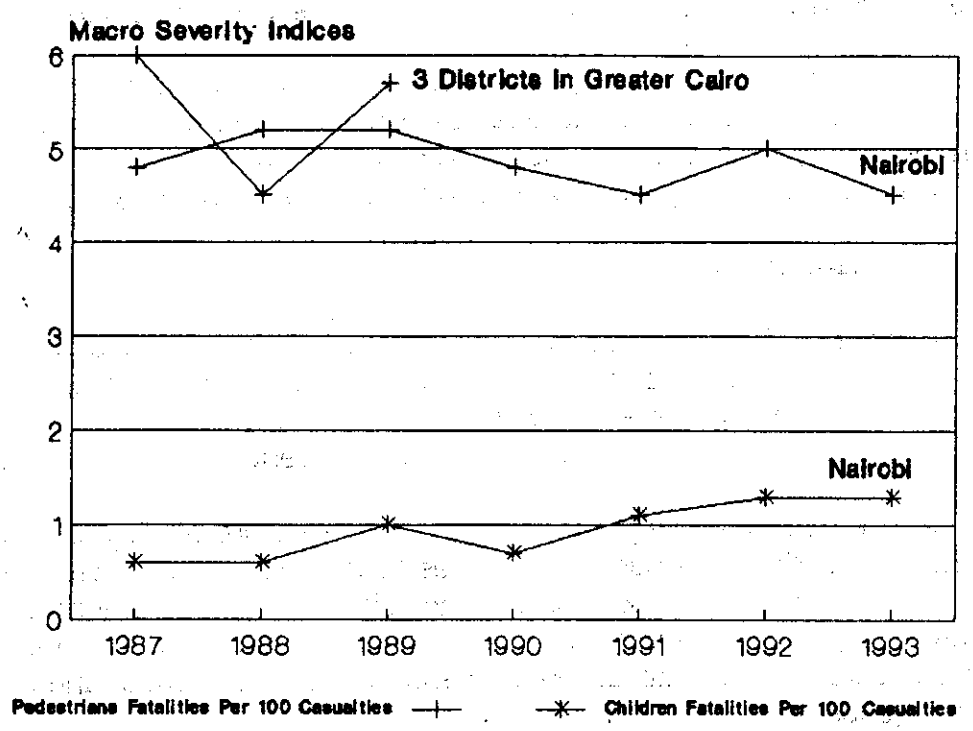

Fig 17: Trends of macro severity indices by type in Nairobi & 3 districts in G. Cairo

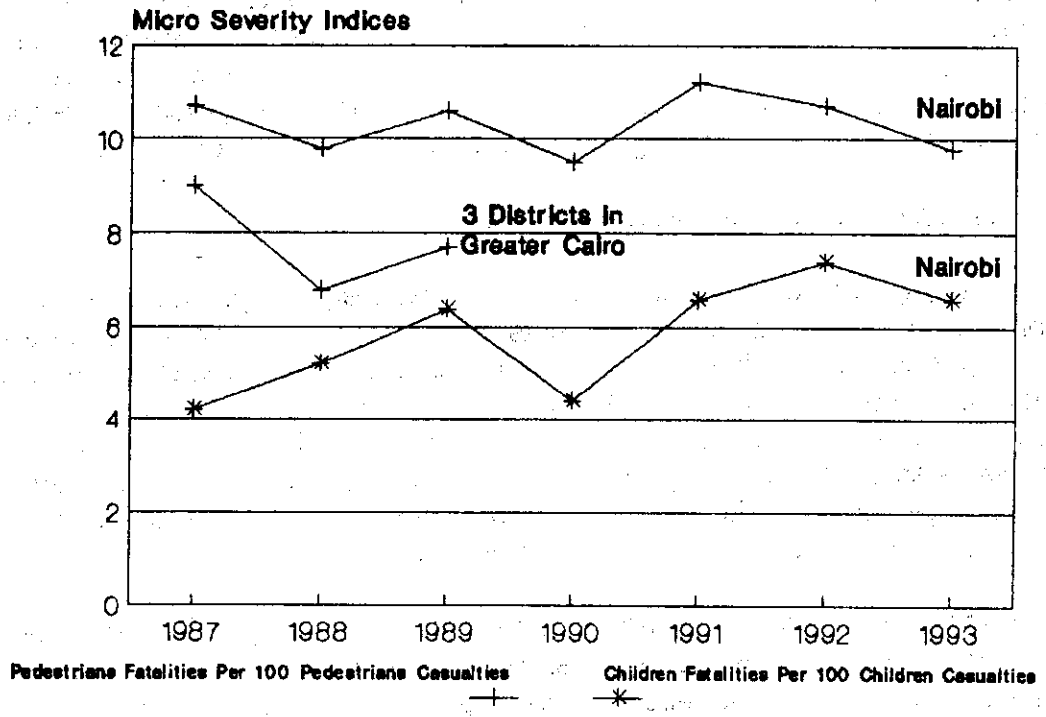

Fig 18: Trends of micro severity indices by type in Nairobi & 3 districts in G. Cairo

3.3 In depth investigation of pedestrians and children accidents in Nairobi

61. An in depth investigation of pedestrians and children accidents in the city of Nairobi has been carried out. Pedestrians accidents in Nairobi were filtered from the main national accident files. Accidents analysed span over the period 1987 to 1993. The number of pedestrians accidents analysed is 450 of which 82 are children pedestrian accidents.

3.3.1 General Analysis

62. As shown in figure 19 that 346 (77 percent) of all pedestrians accidents occur to males while 45 (57 percent) of children accidents occur to boys. Males represent a high proportion of the working force and their walking activity is significant. Thus they have a higher traffic exposure and thus their liability for accident risk is higher than females.

63. The degrees of severity of pedestrian accidents are displayed in figure 20. The figure shows that 68 (15 percent) of all pedestrians accidents are fatal, 109 (24 percent) are serious injuries, and 271 (61 percent) are slight injuries. On the other hand, almost the same proportions represent the severity of children accidents, where 9 (11 percent) of children accidents are fatal, 22 (27 percent) are serious injuries, and 51 (62 percent) are slight injuries.

64. The occurrence of pedestrians accidents is displayed by day of the week and time of the day in figures 21 & 22. Figure 21 shows that Friday (i.e. the start of the weekend) represents the day when accidents are most frequent, where 83 (19 percent) of all pedestrians accidents and 17 (21 percent) of children accidents occurred that day. Figure 22 demonstrates that the highest proportion of pedestrians accidents took place between 17 and 18 hours. This is expected as this is the time when the working day in Nairobi ends and traffic and pedestrian volumes would be at their highest, thus vehicle/pedestrian conflicts would be significant giving more potential for accident occurrence.

3.3.2 Road Environment Related Causes

65. In Kenya, accidents records contain a relatively comprehensive data on the physical condition of roads where accidents have occurred. When these were analysed for the 450 pedestrians accidents, it was found that in almost all cases these road related elements were in a positive condition having no defects. For example, 442 (98 percent) of roads where accidents occurred were tarmac, 426 (95 percent) were dry, 441 (98 percent) were smooth, 448 (99 percent) were with no potholes, 447 (99 percent) were with no damaged edges, 450 (100 percent) were not corrugated, 448 (99 percent) were with no loose stones, 437 (99 percent) had no road works.

66. On the other hand, when geometric features were analysed, these were found to exert a causal effect towards the occurrence of pedestrians accidents. Figure 23 shows how the width of roads has an effect on this type of accidents. The figure demonstrates

that roads with a width ranging from 6 to 8 meters represent a potential hazard for pedestrians, where 83 (24 percent) of accidents occurred on a 6.0 meter wide road, 63 (19 percent) occurred on a 7 metre wide road, and 86 (25 percent) occurred on an 8 metre wide road.

67. It is recognised that three main types of pedestrian accidents can occur

68. Type I: At intersections on pedestrian crossing

(a) before intersection, vehicle straight ahead, pedestrian crossing

(b) after intersection, vehicle straight ahead, pedestrian crossing

(c) vehicle turns left, pedestrian crossing

(d) vehicle turns right, pedestrian crossing

69. Type II: At stretch of road

(a) at stretch of road on pedestrian crossing, vehicle straight ahead, pedestrian crossing

(b) at stretch of road (not on pedestrian crossing), pedestrian crossing and sight obstructed by parked vehicle

(c) at stretch of road (not on pedestrian crossing), pedestrian crossing carriageway

70. Type III: Along the road

(a) vehicle straight ahead, pedestrian walking with back to traffic

(b) vehicle straight ahead, pedestrian walking with face to traffic.

71. Figure 24 shows that 286 (64 percent) of all pedestrians accidents and 60 (73 percent) of children accidents have occurred at stretches of, or along roads. On the other hand, 161 (36 percent) of all pedestrians accidents and 22 (27 percent) of children accidents have occurred at junctions. All junction accidents occurred at junctions where there were no traffic lights and almost no signs, see figure 24.

72. As for the type of junctions which is the most prone for accidents, figure 25 demonstrates that the T-junction type had 120 (75 percent) of all pedestrians accidents and 17 (77 percent) of children accidents occurrences. This is followed by the 4-arm junction where 19 (12 percent) of all pedestrians accidents and 2 (9 percent) of children

accidents have occurred. It looks like the roundabout type of junction is the most safe in relative terms where only 13 (8 percent) of all pedestrians accidents and none of children accidents have occurred at this type of junction.

73. As for other factors related to the road environment such as the illumination of roads as well as external factors such as the weather condition, it was found from the analysis that 395 (88 percent) of all pedestrians accidents have occurred at day light and that 423 (94 percent) of all pedestrians accidents occurred in a clear weather.

74. As for vehicles most involved in pedestrians accidents, figure 26 shows that 191 (42.5 percent) of all pedestrians accidents and 37 (45 percent) of children accidents are inflicted by saloon cars. This is followed by pickup van where 82 (18 percent) of all pedestrians accidents and 25 (31 percent) of children accidents are inflicted by this type of vehicles. Ranking third are the matatus (paratransit minibuses), where 44 (10 percent) of all pedestrians accidents and 7 (9 percent) of children accidents are inflicted by this type of vehicles.

3.3.3 Main Causes for Pedestrians and Children Accidents

75. The Kenyan traffic police are responsible for completing the traffic accident forms known as P41. An accident cause code was developed that contains 98 possible causes for accidents categorised under: drivers, pedal cyclists, pedestrians, passengers, animals, obstruction, vehicle defects, road defects, and weather conditions. From analysing the accidents records it was found that of all pedestrians accidents,

* 125 (28.3 percent) were caused as a result of a driver error;
* 245 (55.4 percent) were caused as a result of a pedestrian error; and
* 72 (16.3 percent) were caused as a result of other causes, see figure 27.

76. As for children accidents the percentages were almost the same, where:

* 21 (25.6 percent) were caused as a result of a driver error;
* 49 (59.8 percent) were caused as a result of a child error; and
* 12 (14.6 percent) were caused as a result of other causes, see figure 27.

77. Further in depth analysis has shown that the main causes for all pedestrians accidents that are related to drivers errors include:

* 47 (10.6 percent) have occurred as a result of excessive speed;

* 25 (5.7 percent) have occurred as a result of drivers misjudging clearance;

* 12 (2.9 percent) have occurred as a result of improper overtaking, and

* 10 (2.3 percent) have occurred as a result of other judgement errors, see figure 28.

78. The figure also shows the main causes for all pedestrian accidents that are related to pedestrians errors include:

* 162 (36.75) have occurred as a result of pedestrian(s) stopping/walking or running of footpath or verge into road;

* 51 (11.5 percent) have occurred as a result of pedestrians crossing the road wrongly; and

* 12 (2.7 percent) have occurred as a result of pedestrians crossing the road masked by stationery vehicles.

79. As for children accidents the main cause behind most of this type of accidents was identified as children stopping/walking or running of footpath or verge into road; where 49 (59.8percent) of children accidents were a result of this cause.

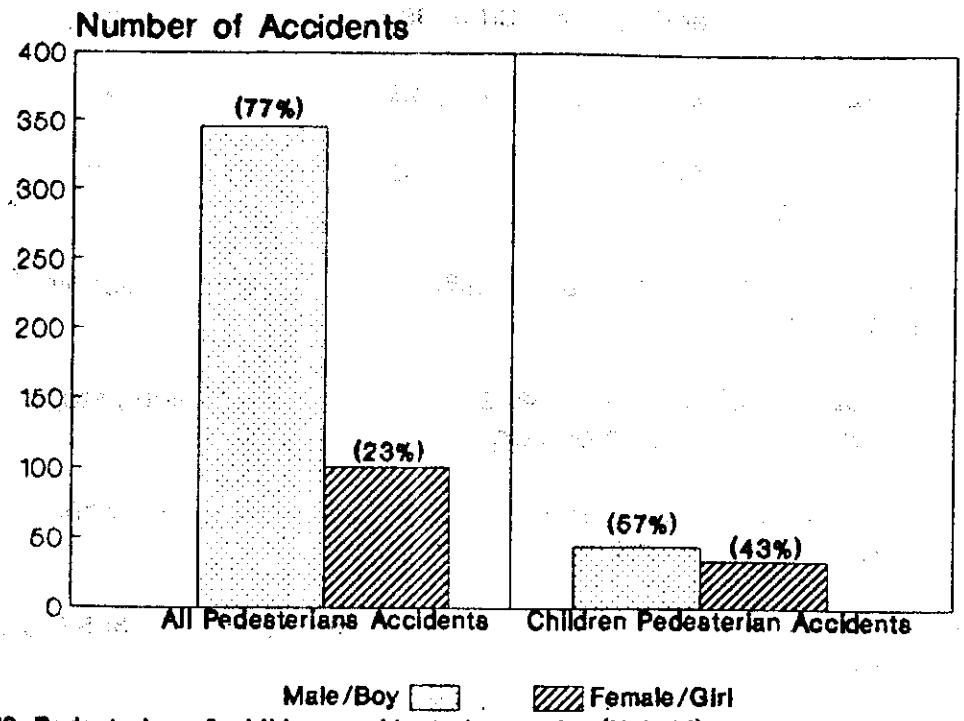

Fig 19: Pedesterians & children accidents by gender (Nairobi)

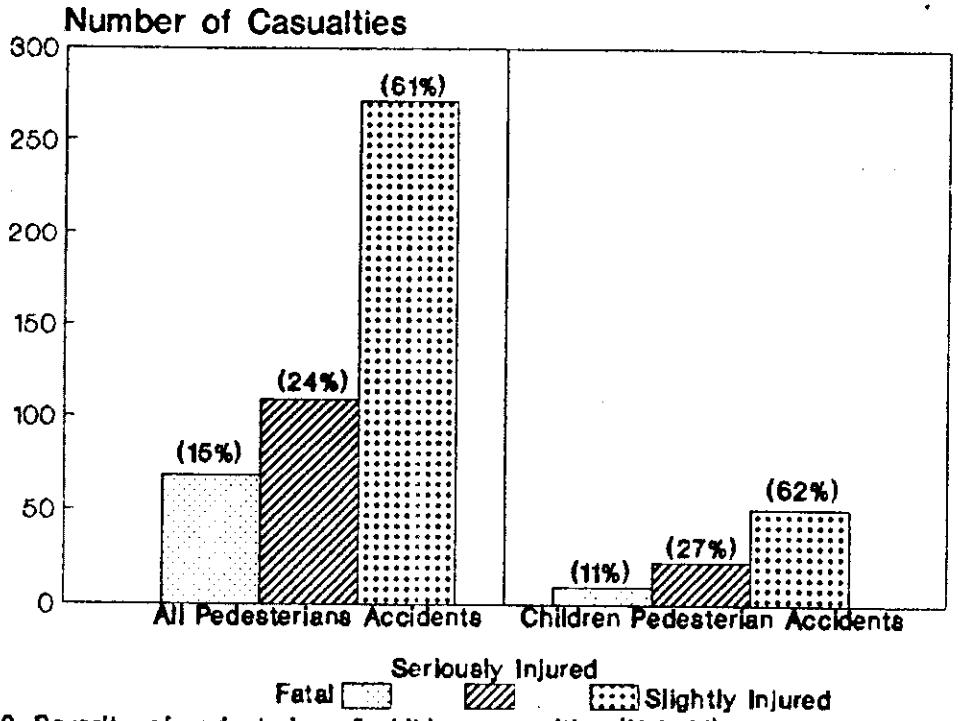

Fig 20: Severity of pedesterians & children casualties (Nairobi)

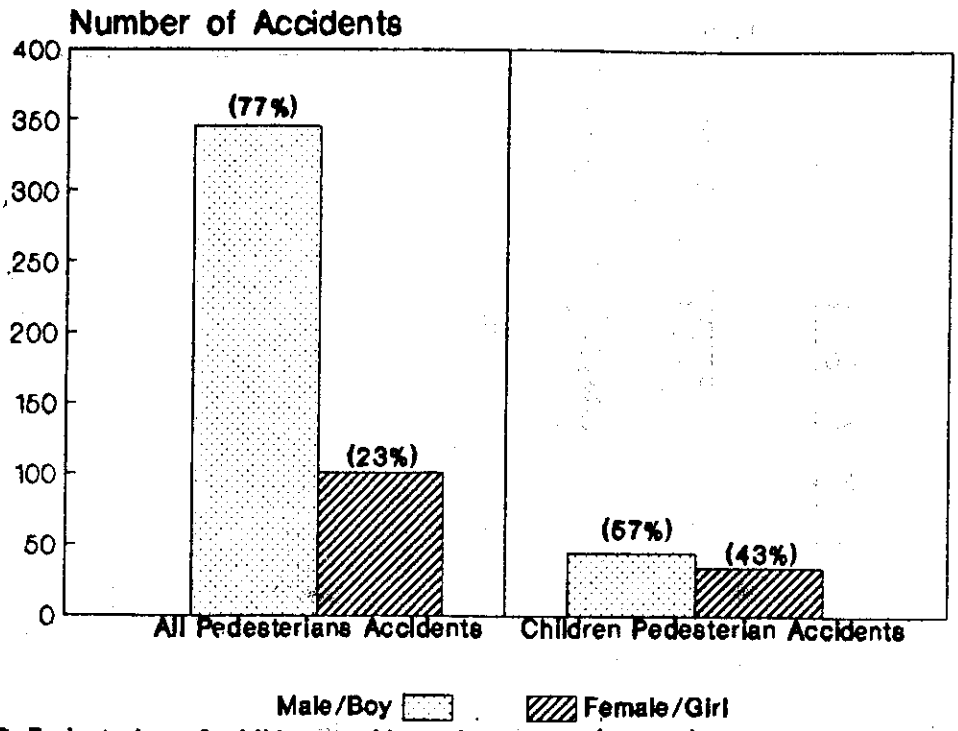

Fig 19: Pedesterians & children accidents by gender (Nairobi)

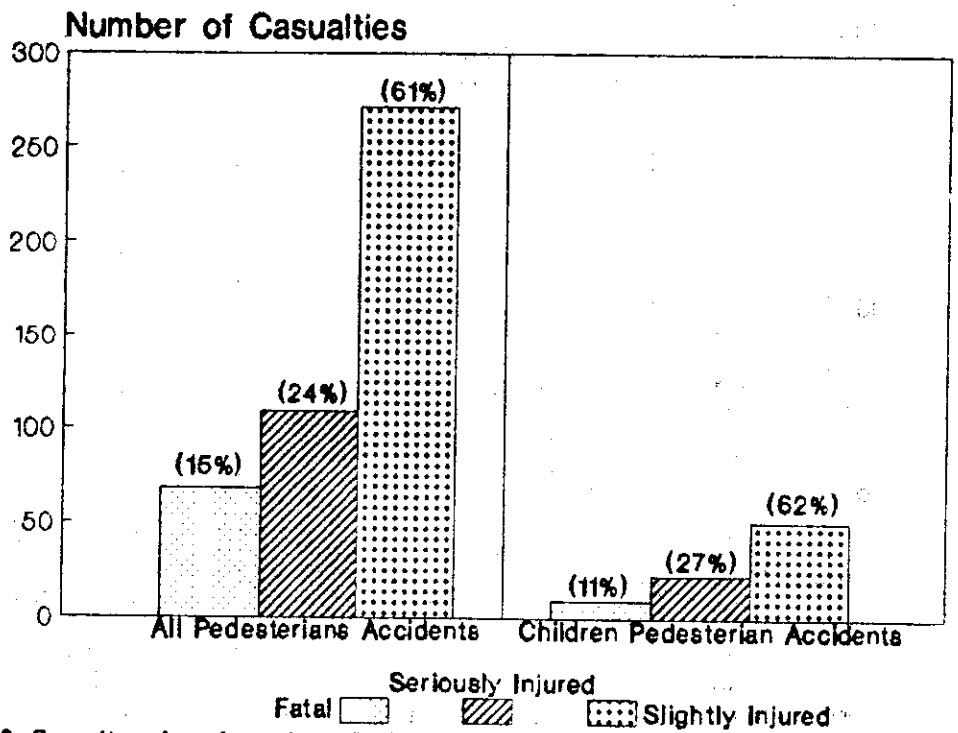

Fig 20: Severity of pedesterians & children casualties (Nairobi)

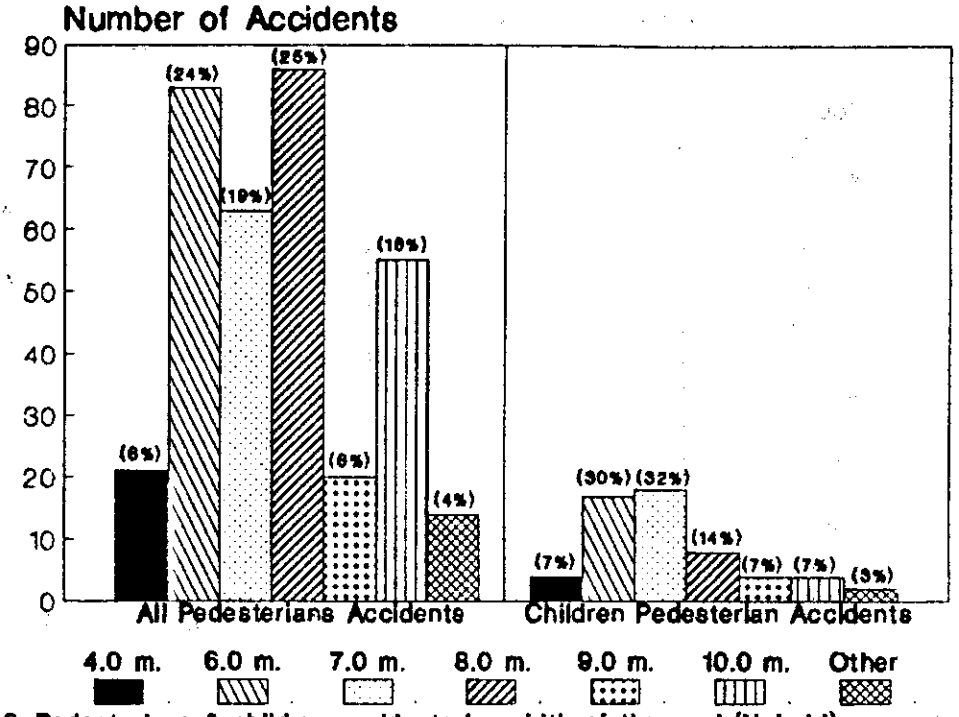

Fig 23: Pedesterians & children accidents by width of the road (Nairobi)

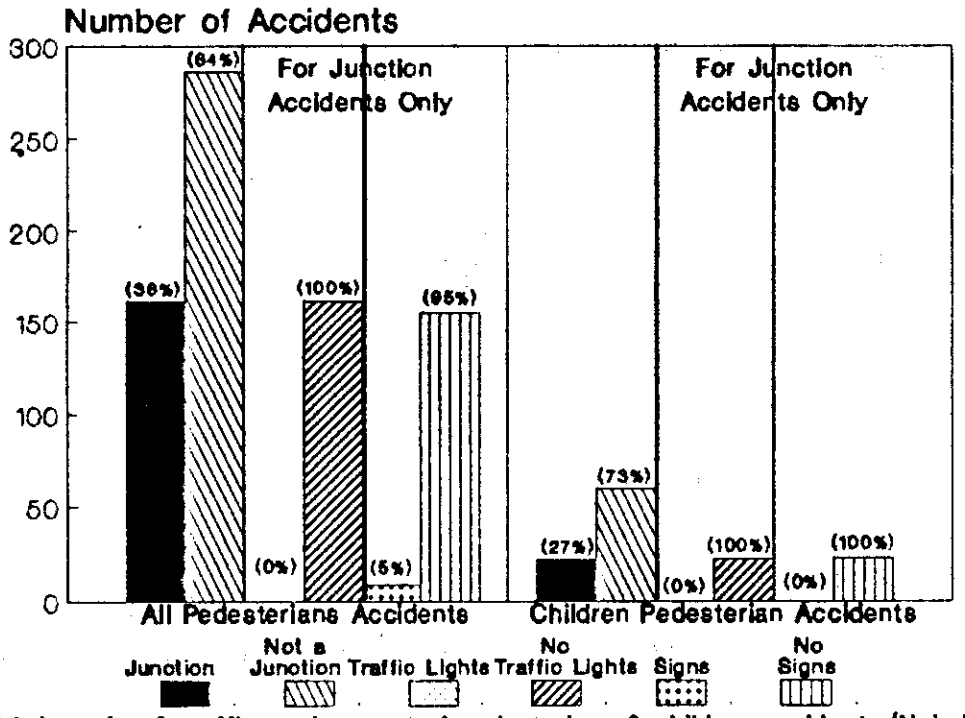

Fig 24: Location & traffic environment of pedesterians & children accidents (Nairobi)

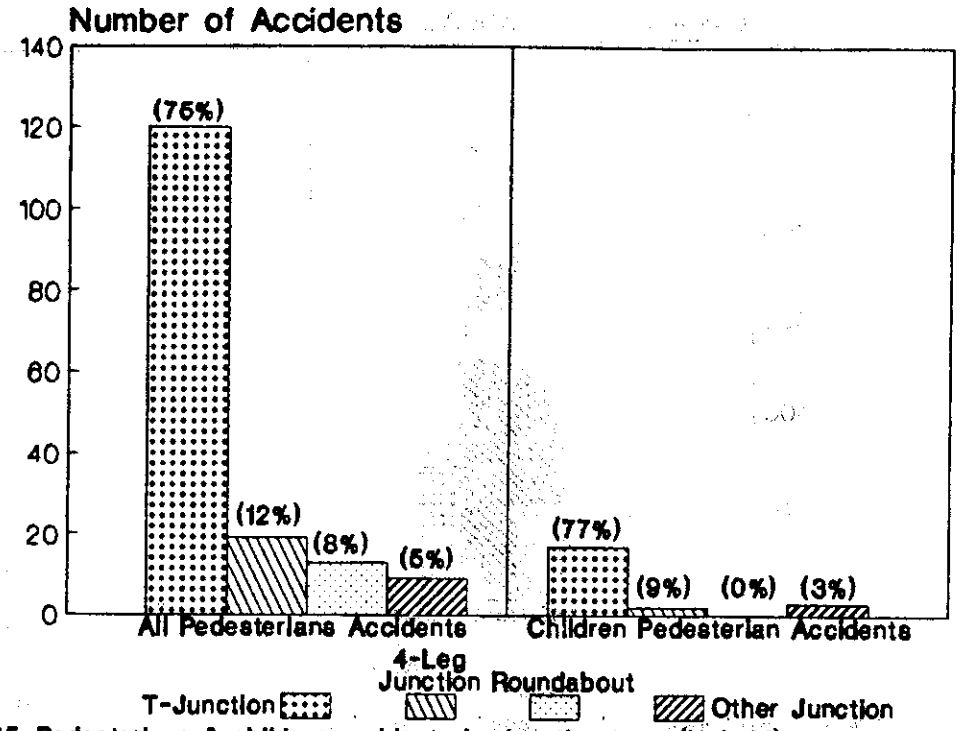

Fig 25: Pedesterians & children accidents by junction type (Nairobi)

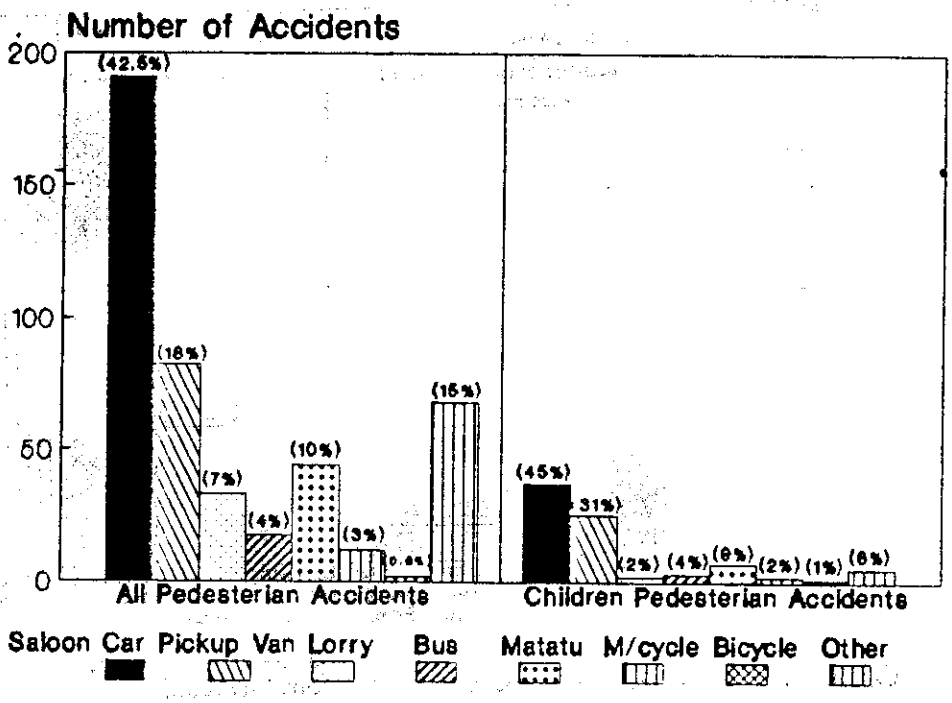

Fig 26: Vehicles involved in pedesterians & children accidents (Nairobi)

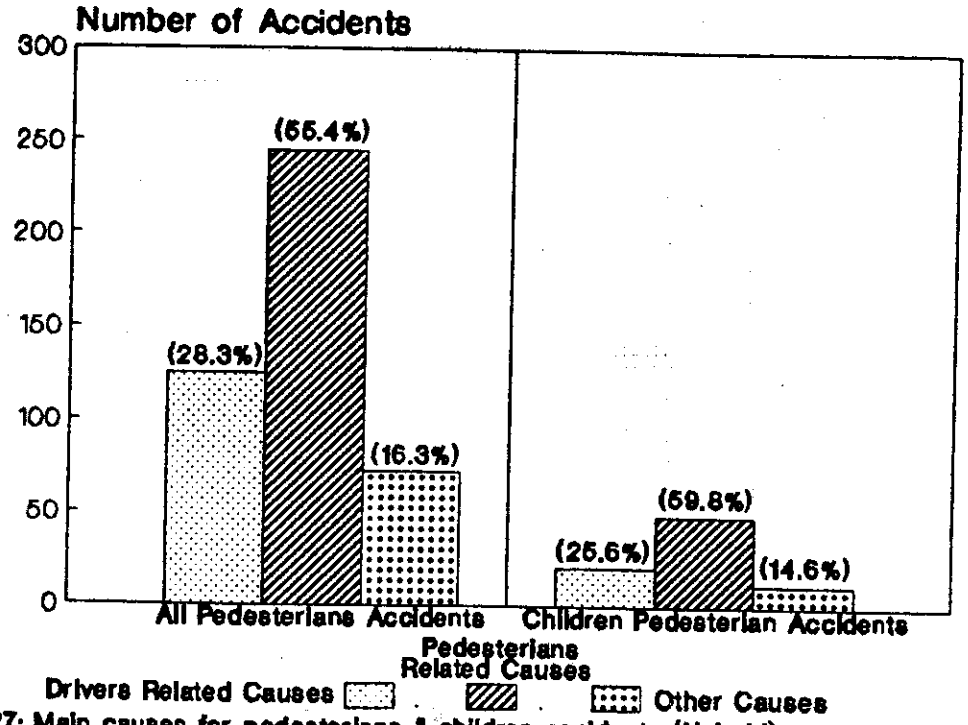

Fig 27: Main causes for pedesterians & children accidents (Nairobi)

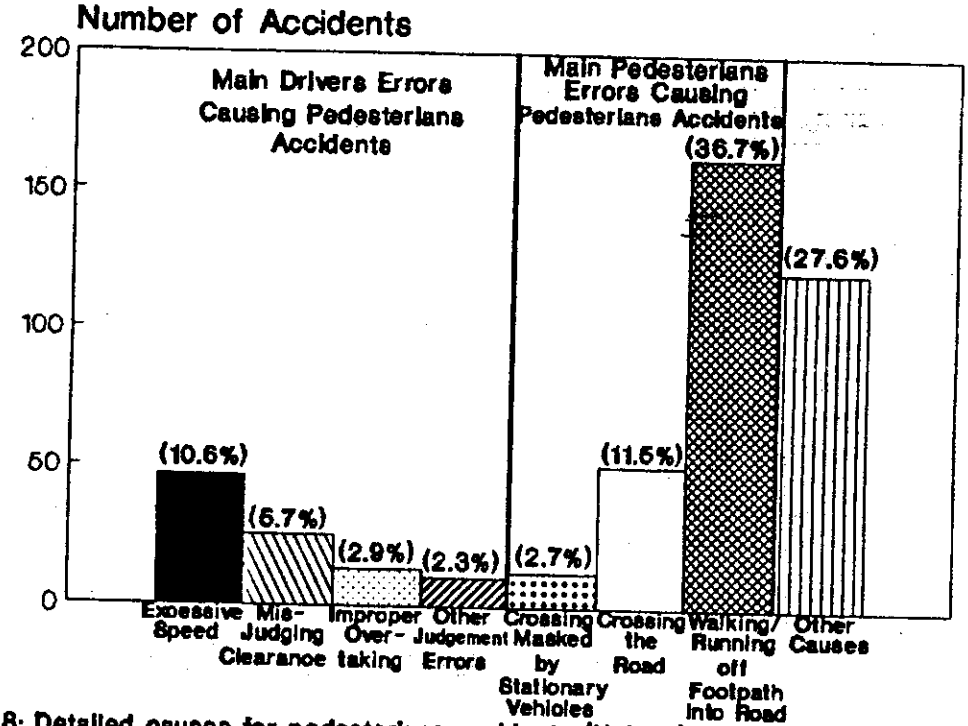

Fig 28: Detailed causes for pedesterians accidents (Nairobi)

IV. TRAFFIC BEHAVIOUR OF PEDESTRIANS AND SCHOOL CHILDREN IN CAIRO AND NAIROBI

4.1 Factors leading to a pedestrian accident

80. The risk of having a pedestrian/child accident is a direct consequence of several factors and elements, see figure 29. These are:

* Traffic behaviour of pedestrians;
* Traffic behaviour of drivers;
* Road Environment (surface condition/geometric alignment/road furniture/speed limits/traffic management and control/traffic congestion);
* Pedestrians environment (sidewalks/crossing facilities);
* Vehicle condition and type;
* Traffic police (presence/behaviour/level of enforcement); and
* Traffic exposure.

81. As reported in Jacobs et al. (1981) that in five developing countries, namely Jamica, Ghana, Botswana, Malaysia, and Hong Kong, road user error was identified as the main cause in at least 70 percent of the road accidents. Although these figures must be treated with caution, nevertheless they do support the finding of the 'on-the-spot' accident investigation carried out in Great Britain that road-user behaviour is the major contributory factor in road accidents.

82. In this study a strong emphasis is given to analysing the traffic behaviour of road users. "Evaluation indicators other than numbers and rates of accidents should be developed based, for instance, on behavioural observations or psychological data", WHO (1989). As shown in figure 29 that traffic behaviour of drivers is a function of three elements:

* Drivers traffic knowledge which in turn is a function of drivers traffic education and information;
* Drivers cognitive skills and abilities (i.e. anticipating traffic risks) as well as perceptual skills (i.e. reaction to anticipated risk and risk acceptance) which in turn is a function of drivers traffic experience. Drivers experience is a function of the level of drivers training, the driving tests, the age and the traffic exposure of drivers; and

* Drivers traffic perception/attitude which in turn is formed under the effect of the road environment, the traffic behaviour of pedestrians as well as the traffic police presence, behaviour and level of enforcement. There are four specific traffic safety attitudes related to drivers. These include: attitude towards compliance with/violation of rules and regulations, attitude towards one's own safety, attitude towards considering the safety of other passengers in the vehicle and attitude towards considering the safety of other road users.

83. This study is mainly concerned with traffic safety for pedestrians and children, with emphasis being given to studying and measuring the traffic behaviour of pedestrians and children. This does not in any way undermine the roles played by the other elements as shown in the figure.

84. The main approach of this study is to measure the pedestrians and children traffic behaviour as a proxy for traffic safety. In addition, problems related to the other components of the pedestrians safety (i.e. road environment, drivers' behaviour, police enforcement) would be identified and judged by the pedestrians. By-enlarge this approach would complement previously presented statistics on pedestrians and children accidents.

85. Looking at figure 29, one can observe that the traffic behaviour of pedestrians - children as pedestrians - is a function of three elements:

* Pedestrians traffic knowledge which in turn is a function of pedestrians traffic education and information;

* Pedestrians cognitive skills and abilities (i.e. anticipating traffic risks) as well as perceptual skills (i.e. reaction to anticipated risk and risk acceptance) which in turn is a function of pedestrians traffic experience. Pedestrians traffic experience is mainly a function of the level of traffic training, the age and the traffic exposure of pedestrians; and

* Pedestrians traffic perception/attitude which in turn is formed under the effect of the pedestrian environment, the traffic behaviour of drivers as well as the traffic police presence, behaviour and level of enforcement. There are three specific traffic safety attitudes related to pedestrians. These include: attitude towards compliance with/violation of rules and regulations, attitude towards one's own safety, attitude towards considering the safety of other road users.

86. This report seeks to provide measures of some of these factors affecting traffic behaviour and hence traffic safety of pedestrians and children in Cairo and Nairobi.

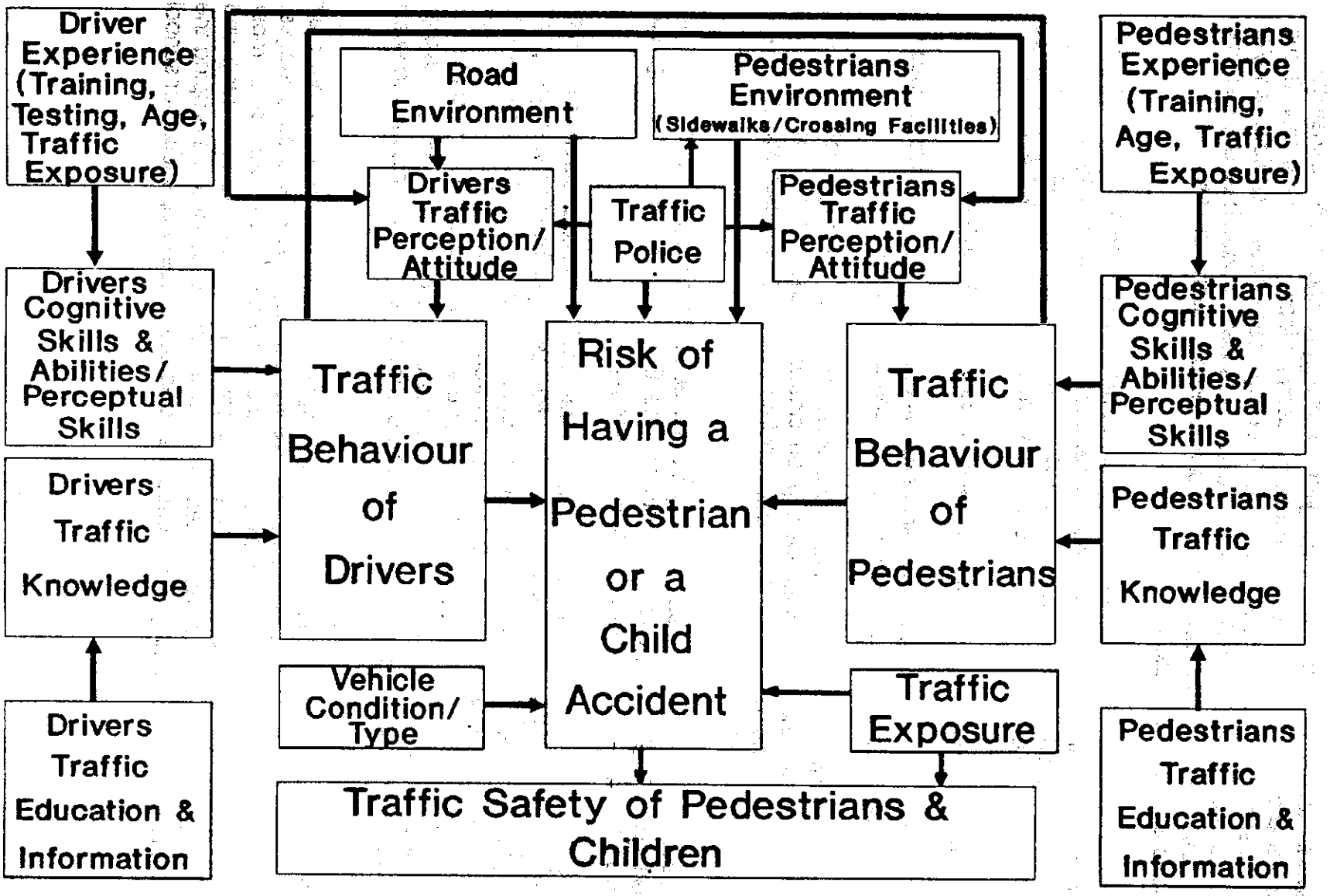

Fig 29: Factors contributing to a pedesterian/child accident

4.2 Method of survey used for pedestrian and children traffic behaviour study

87. Several techniques can be employed to measure the traffic behaviour of pedestrians and children as well as to measure the factors affecting this behaviour. Some of these measures include: attitudinal surveys involving open-ended interviews and/or structured questionnaires, pictorial and slide questions as well as video based questions, laboratory tests with a model, observation of simulated conditions on a test track, and observations of real road situations.

88. In this study, two structured attitudinal type questionnaires were designed. The first to be completed by the pedestrians and the second to be completed by children. In addition monitoring and observations of the road environment as well as of the traffic behaviour of pedestrians and children specially in front of their schools were conducted.

89. The questionnaires were designed mainly to serve two purposes.

* Provide measures of the traffic experience, perception, attitude as well as stated crossing behaviour of pedestrians and children.

* Identify the most profound difficulties and traffic safety problems that pedestrians face while walking on sidewalks and crossing roads, .(i.e. problems related to the road environment, drivers' behaviour, police enforcement).

90. Based on the previously stated study objectives and the insight gained from the pilot meetings, discussions and reviewed studies, the final questionnaire was designed, (see Appendix I for pedestrians questionnaire details).

91. In this study, it was thought to limit the children traffic behaviour survey to school children. Two criteria were considered in reaching this decision. The first was that from a statistical point of view school children can be regarded as a good representation of the whole children population. The second was that from a logistics point of view it was relatively easier and more convenient to conduct the surveys at schools through the normal school working hours. It is to be noted that this do not in any way disregards that in future studies those children who do not attend schools should be included in such surveys.

92. The school children questionnaire was designed to allow children to mark their response in a simple manner. The questionnaire went through several piloting stages, where it was discussed with headmasters/headmistresses, teachers, and most importantly tested on a pilot sample of school children. This helped in refining and improving the questionnaire. Certain criteria were taken into account in developing the questionnaire such as being simple, discernible, and attractive, (see Appendix II for school

children questionnaire details). Both questionnaires were of the multiple choice design. Where appropriate, more than one reply could be given to a question.

4.3 Survey details of pedestrians traffic behaviour study

93. The study identified six main locations in Cairo and three main locations in Nairobi that are characterised by a dense pedestrian movement. Pedestrians were randomly selected and interviewed in these areas. The number of completed questionnaire forms reached 2800 in Cairo and 600 in Nairobi. However after verification of the completed forms and the coding and preliminary analysis of the data, 187 forms of the Cairo case study and 9 forms of the Nairobi case study were rejected for incompleteness or misinformation. Thus the achieved final sample is 2613 pedestrians in Cairo and 591 in Nairobi.

94. Socio-demographic data of the sample of respondents is displayed in table 1. The table shows that the respondents are mainly males falling within the age group of 20 to 30 years. The level of education of most of the respondents in Cairo is higher education, while in Nairobi is secondary school. Most of the respondents in Cairo were students, while in Nairobi the majority of the respondents were government employees. Around 80 percent of the respondents do not own a private car.

4.4 Survey details of school children traffic behaviour study

95. A stratified random sample of school children was chosen. The targeted sample was chosen to represent different parameters such as affluence and physical planning of districts where schools are located, level of education, schooling system, gender and age of school children.

96. The first step in the sampling was to identify districts where a number of schools in these areas would be selected for conducting the survey. In Cairo, two districts were selected, namely Heliopolis and Helwan, see table 2. The first represents a typical highly affluent well planned residential district. On the other hand, Helwan is one of the most densely populated districts in Cairo. It is considered to be a relatively poor blue-collar area with a large number of factories. Schools in the three main areas in Nairobi, namely the central, the east-lands and the west-lands were visited, see table 2.

97. The second step in the sampling procedure involved identifying a number of primary and preparatory schools representing different schooling systems (public, private) in each of the visited areas, see table 2. In doing so, attempts were made to select schools that are geographically distributed to represent different neighbourhoods in each of these districts. In Heliopolis, 9 schools were selected, while in Helwan 11 schools were chosen. In central Nairobi, 2 schools were selected, in east Nairobi 3 schools were selected, while in the west of Nairobi 1 school was selected. Within each school a third sampling process took place in terms of deciding the number of school children at each

grade with which surveys were conducted. A random selection of children at these grades was conducted.

98. Questionnaire forms were completed by 1615 school children in Cairo, of whom 868 (54 percent) are boys and 747 (46 percent) are girls, see table 2. In Nairobi forms were completed by 552 school children, of whom 254 (46 percent) are boys and 298 (54 percent) are girls, see table 2. The forms were completed in the presence of the consultant and the school teachers. In some cases, children were left to complete the questionnaire on their own and whenever a child would encounter any difficulty in responding to one of the questions, he/she would be assisted. In other instances, the questionnaire was explained question by question with the children, allowing the children time to answer each of the questions.

Table 1: Socio-demographic data of the pedesterians respondents

Socio-Demograhic Data \ City	Cairo			Nairobi		
	Responses		Statistics	Responses		Statistics
	No.	%	Mode	No.	%	Mode
Gender						
• Male	1878	74	Male	392	66	Male
• Female	644	26		199	34	
Age Group						
• 15 - 20 Years	795	30	20 - 30 Years	56	9	20 - 30 Years
• 20 - 30	1167	45		318	54	
• 30 - 40	355	14		147	25	
• 40 - 50	186	7		45	8	
• 50 - 60	74	3		16	3	
• > 60	26	1		9	1	
Level Of Education						
• Illiterate	119	5	Higher Education	6	1	Secondary School
• Primary/Preparatory School	159	6		51	9	
• Secondary School	662	25		264	45	
• Higher Education	1551	60		216	37	
• Postgraduate	112	4		50	8	
Employment						
• Employed With Government	504	19	Student	151	26	Employed with Governm.
• Employed With Private Sector	667	25		149	25	
• Self-Employed	138	5		124	21	
• On-Pension	36	2		7	1	
• Unemployed	172	7		73	12	
• Student	1087	42		87	15	
Car-Ownership						
• Yes	508	20	No	103	18	No
• No	2048	80		483	82	

Table 2: Sample representation of the school children survey

Survey Statistics \ City	Cairo			Nairobi		
	Responses		Statistics	Responses		Statistics
	No.	%	Mode	No.	%	Mode
Location (District Name)						
• Helwan (Cairo)	1055	65	Helwan			
• Heliopolis (Cairo)	560	35				
• CBD (Nairobi)				212	38	East Nairobi
• East Nairobi				255	46	
• West Nairobi				85	16	
Type of School						
• Public	1310	81	Public	467	85	Public
• Private	305	19		85	15	
Stage of Education						
• Primary	957	59	Primary	552	100	Primary
• Preparatory	658	41				
Gender of Child						
• Boy	868	54	Boy	254	46	Girl
• Girl	747	46		298	54	

4.5 Results of pedestrians traffic behaviour study

99. The following subsections represent a discussion of the results of the pedestrians traffic behaviour study undertaken in Cairo and Nairobi.

4.5.1 Traffic Experience/Exposure of Pedestrians

100. An attempt is made to produce some indicators of the traffic experience of pedestrians. Traffic experience is considered to be a function of age as well as of traffic exposure. The older a pedestrian is the more likely that he/she has longer experience with traffic. Also, in general the older a person is the more cautious he/she becomes and the more he/she values life. Most of the surveyed pedestrians (in Cairo and Nairobi) fall within the age group of 20-30 years.

101. One can look at traffic exposure of pedestrians in terms of the trips they make. Daily morning trips include mainly work and educational trips. Evening and weekend trips include mainly shopping and recreational trips. The surveyed pedestrians were asked to mark whether for each of the above-mentioned trip purposes, walking would be perceived as constituting a main part or a small part of the journey. As can be shown from figures 30 & 31, walking is perceived to represent a small part of the pedestrians' journeys for work and education. On the other hand, walking represents a main part of pedestrians' journeys for shopping and recreation.

4.5.2 Stated Walking Behaviour of Pedestrians

102. Observations in Cairo and in Nairobi show that there is a notable tendency of pedestrians towards walking along the roads with their backs to traffic. When asked to indicate how frequently do a pedestrian has to leave the sidewalks and walk along roads, in the Cairo case study, 444 (17 percent) indicated that they always do this, 1329 (52 percent) indicated that they sometimes do this, while 809 (31 percent) indicated that they rarely do this, see figure 32. In Nairobi the response was almost similar with 170 (29 percent) indicated that they always do this, 261 (44 percent) indicated that they sometimes do this, while 159 (27 percent) indicated that they rarely do this, see figure 33. The demonstrated tendency of pedestrians to leave the sidewalks and walk along the roads increases the risk of a pedestrian being exposed to a traffic accident.

103. Further to this question, pedestrians were asked whether they walk along the roads with their backs or faces to the direction of traffic. Contrary to what has been expected, the majority of the surveyed pedestrians, 1984 (79 percent) in Cairo and 515 (90 percent) in Nairobi, indicated that they walk with their face to traffic. On the other hand, 538 (21 percent) in Cairo and 57 (10 percent), indicated that they walk with their back to traffic, see figures 34 & 35. However, still, a relatively high number seemed to indicate that they walk along roads with their backs to traffic which further aggravates the potential risk of being exposed to an accident.

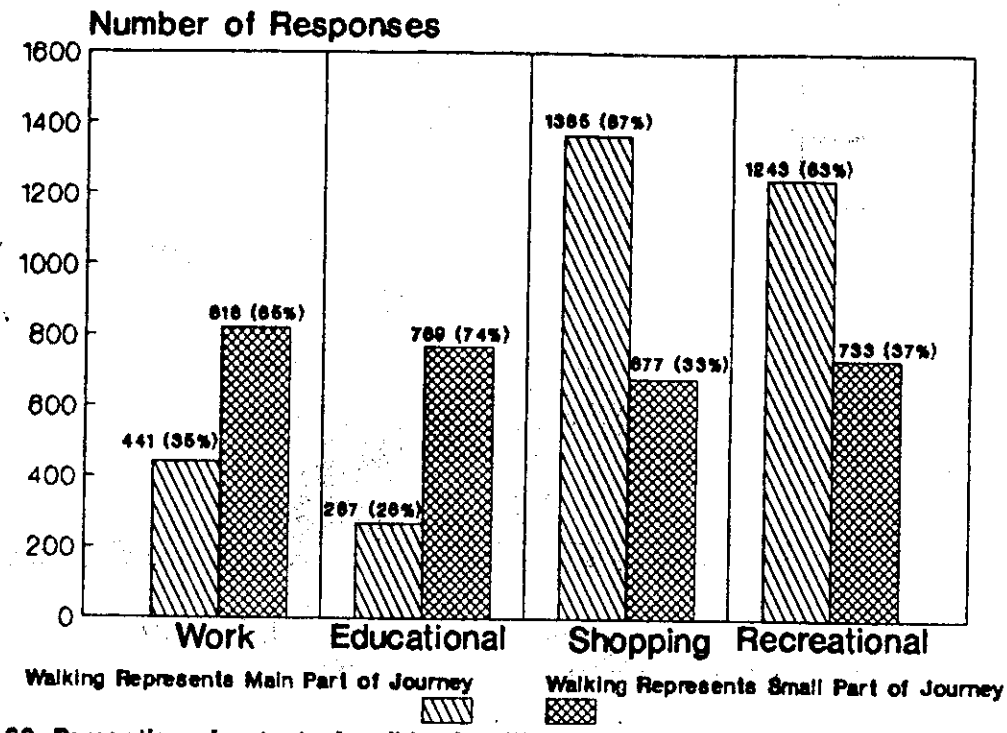

Fig 30: Perception of extent of walking for different journey purposes (Cairo)

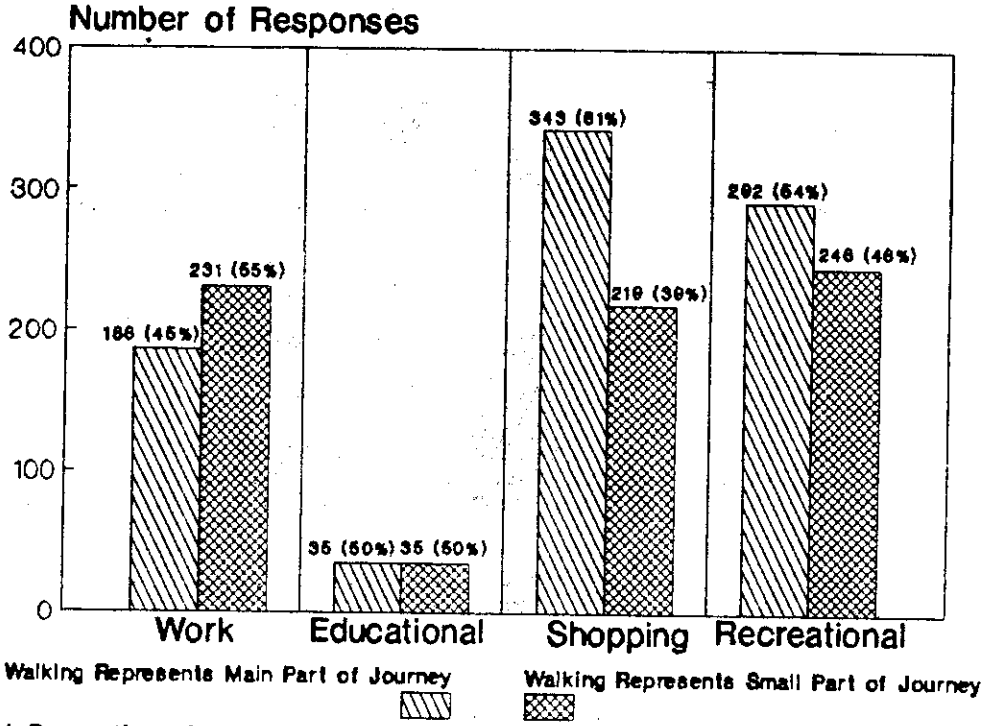

Fig 31: Perception of extent of walking for different journey purposes (Nairobi)

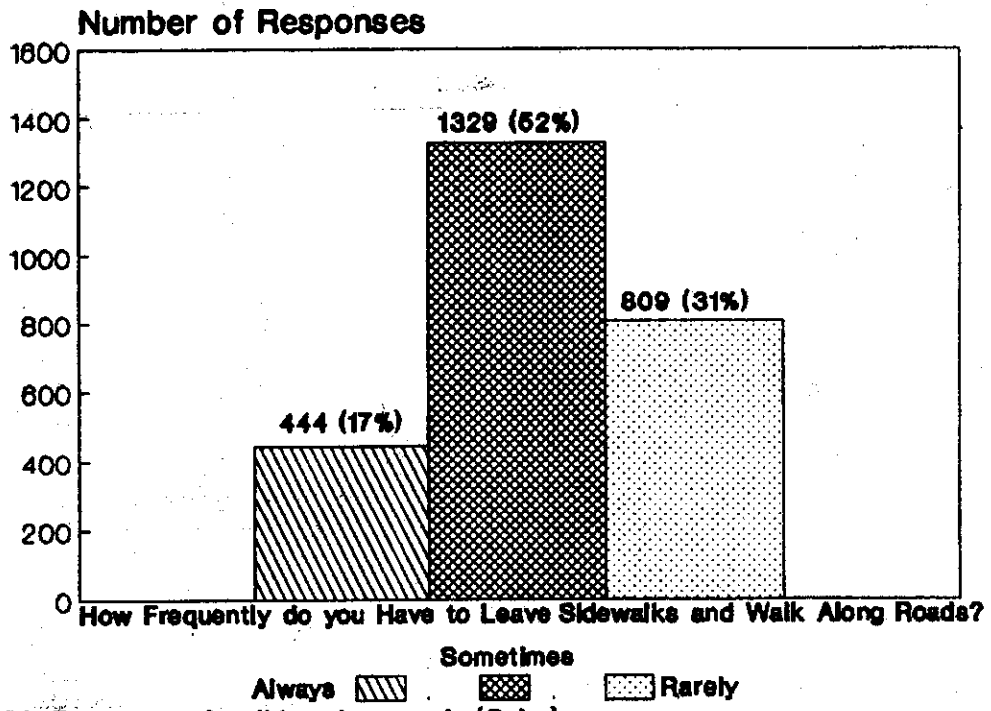

Fig 32: Frequency of walking along roads (Cairo)

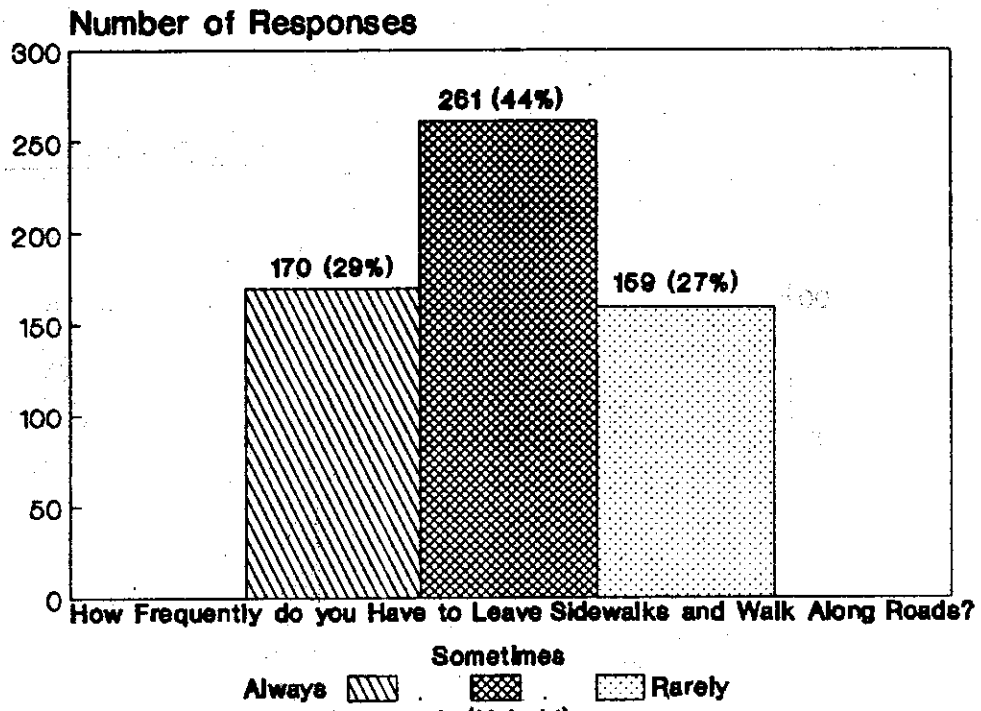

Fig 33: Frequency of walking along roads (Nairobi)

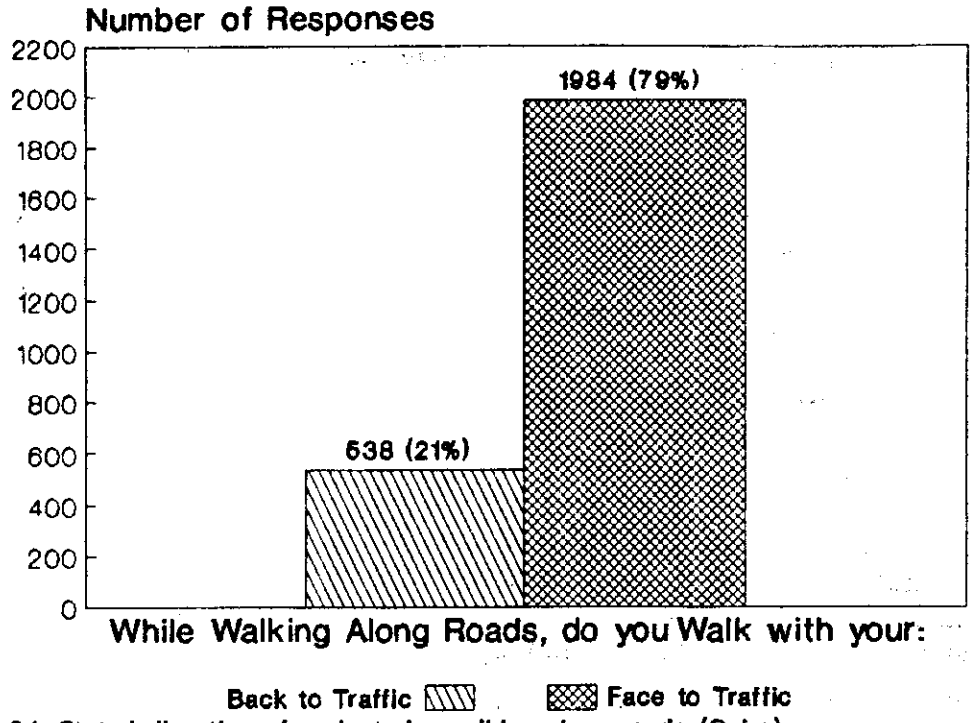

Fig 34: Stated direction of pedesterian walking along roads (Cairo)

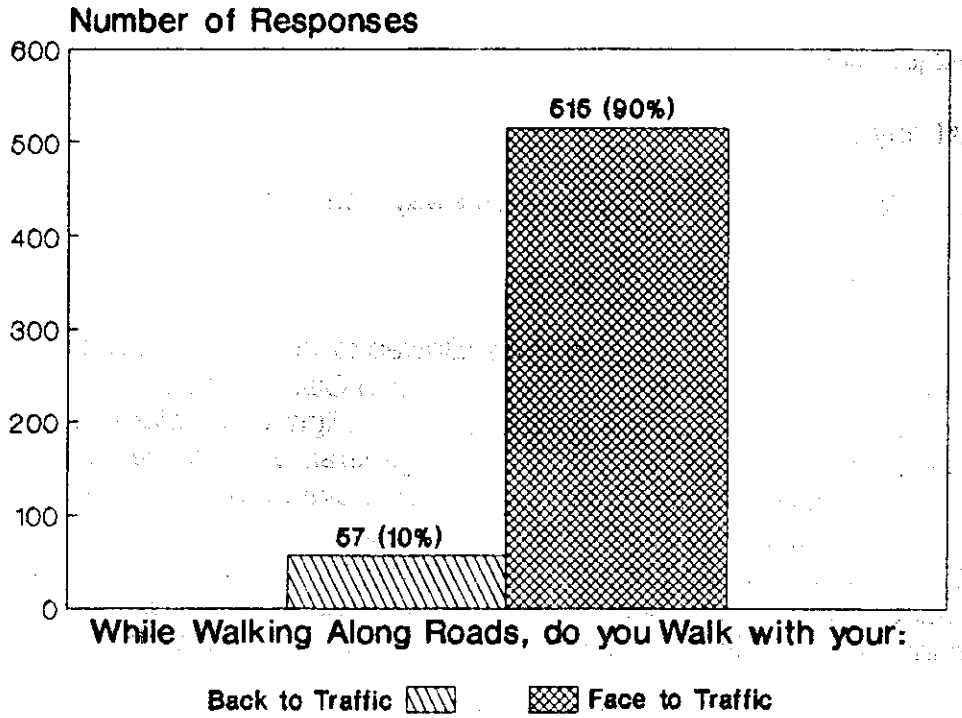

Fig 35: Stated direction of pedesterian walking along roads (Nairobi)

4.5.3 Stated Perception/Attitude of Pedestrians Towards Roads Crossing

104. Road crossing facilities can be categorised into four main types:

* Space segregated crossing facilities (pedestrian footbridges and underpasses)
* Time segregated crossing facilities (traffic signals)
* Priority segregated crossing facilities (zebra crossings)
* Uncontrolled crossing

105. In an attempt to deduce the perception of pedestrians towards traffic safety in Cairo and Nairobi, a simple question was asked as to whether crossing the roads is easy or difficult. The majority of the surveyed pedestrians, 1965 (81 percent) in Cairo and 379 (65 percent) in Nairobi, indicated that they perceive crossing the roads in their cities to be difficult, see figures 36 & 37.

106. Pedestrians were asked a question as to where they would usually cross roads from. Five answers were given to this question, namely:

At traffic lights

At junctions

At any point

At mid-block pedestrian crossings away from junctions

At approaches/exits to bridges.

107. For this question a pedestrian was allowed to indicate a multiple reply. The majority of the surveyed pedestrians, 1242 (48 percent) in Cairo and 257 (44 percent) in Nairobi, have indicated that they would cross roads at traffic lights/mid-block pedestrian crossings i.e. zebra crossings, see figures 38 & 39. In general, one can categorise these choices as being a safe selection of a crossing point. However, other choices or combinations of choices can be categorised as unsafe selection of a crossing point. The figures show that 1328 (52 percent) in Cairo and 331 (56 percent), have indicated that they would tend to cross roads at any of the other unsafe points or a combination of safe and unsafe choice of crossing points. This represents a dangerous crossing attitude that might lead to the occurrence of accidents.

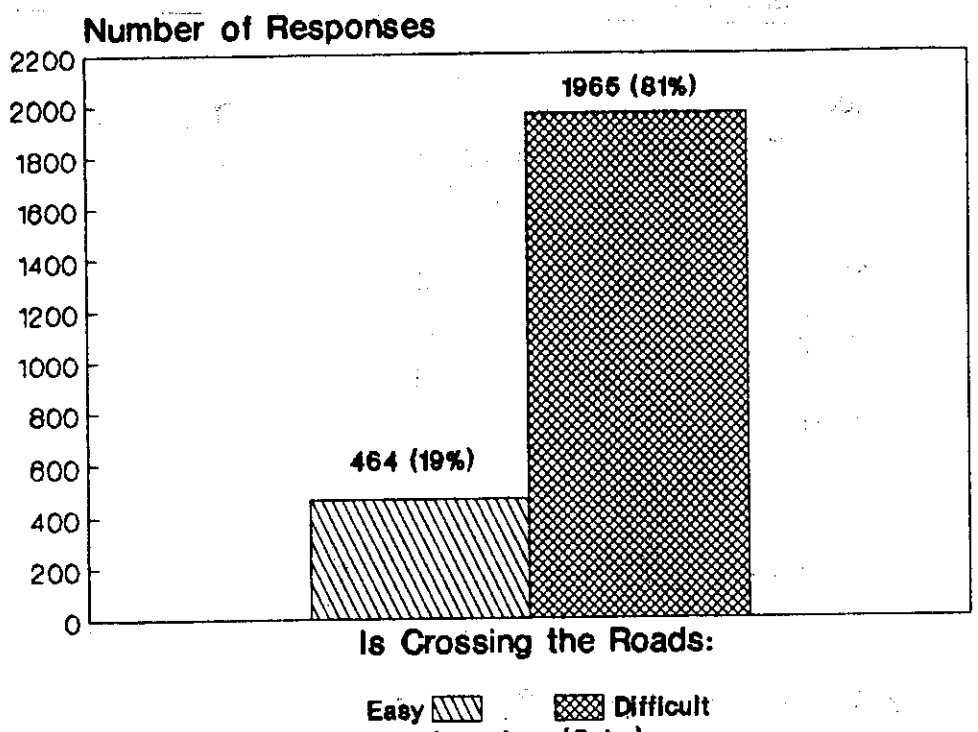

Fig 36: Perception of crossing by pedesterians (Cairo)

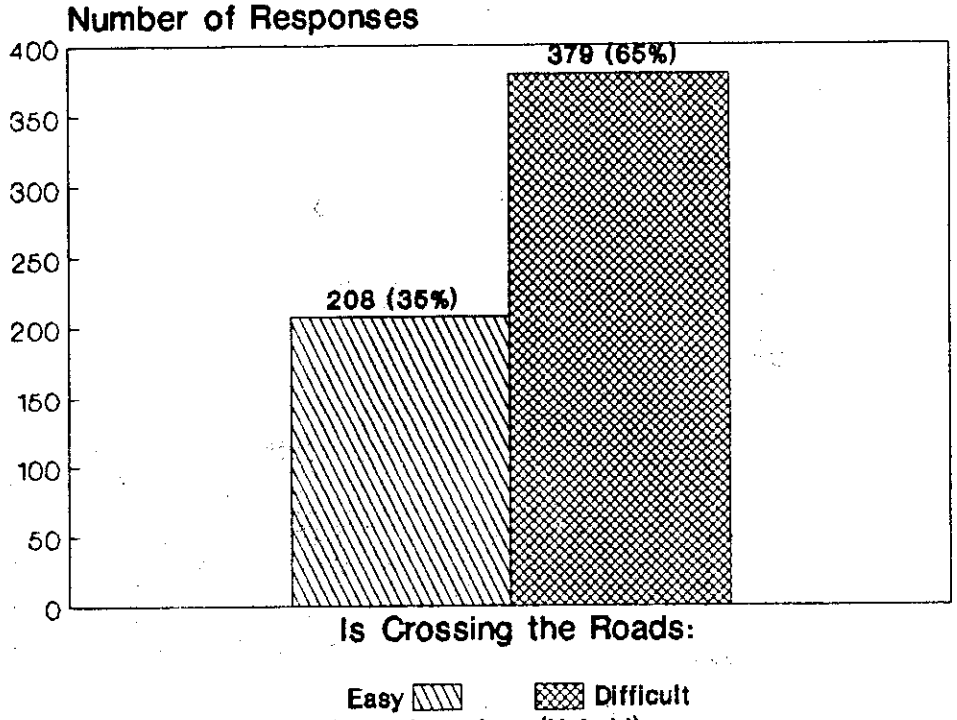

Fig 37: Perception of crossing by pedesterians (Nairobi)

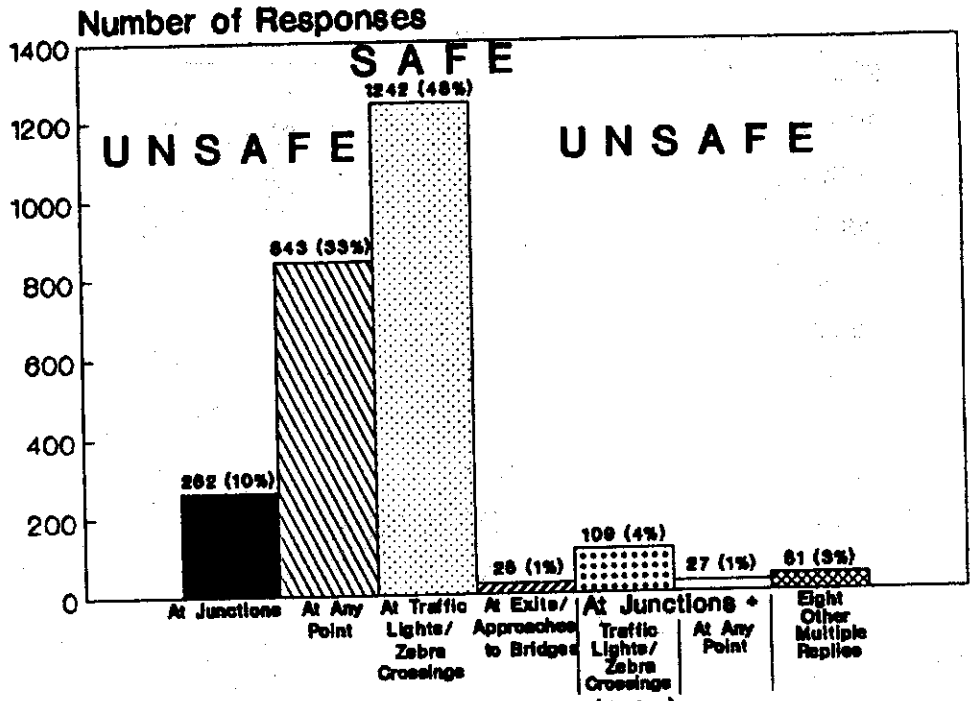

Fig 38: Pedesterians' selection of crossing points (Cairo)

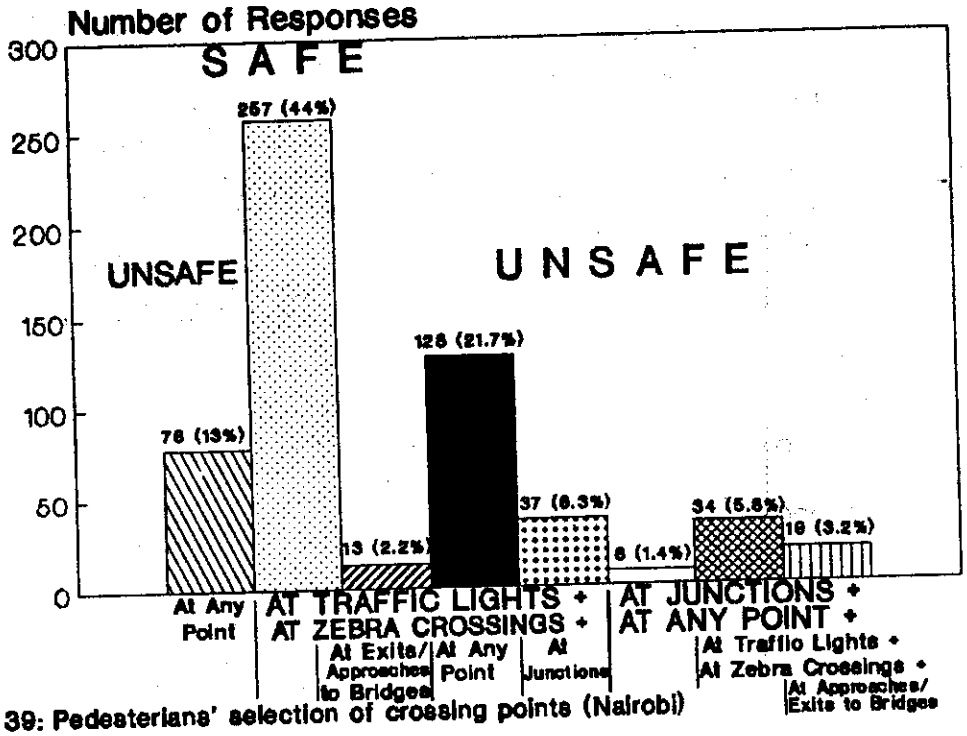

Fig 39: Pedesterians' selection of crossing points (Nairobi)

4.5.4 Stated Crossing Behaviour (Crossing Knowledge) of Pedestrians

108. Pedestrians were asked on what they normally do when they cross the roads. The stated crossing behaviour was assumed to be synonymous to the pedestrians' crossing knowledge as well as to reflect their crossing attitude. A set of choices were given which include:

* Look to cross
* Make sure traffic is far enough
* Continue to look while crossing
* Cross in a group with other people
* Cross on stages manoeuvring vehicles while crossing
* Run

109. For this question a pedestrian was allowed to indicate a multiple reply. Responses were categorised into four categories:

* Perfect (safe) crossing behaviour
* Incomplete (unsafe) crossing behaviour
* Imperfect (unsafe) crossing behaviour
* Dangerous (unsafe) crossing behaviour

110. Two of the multiple replies could be categorised in the complete (safe) crossing behaviour. The first includes pedestrians who chose to look to cross, to make sure traffic is far enough and to continue to look while crossing, 241 (9 percent) in Cairo and 54 (9.2 percent) in Nairobi have indicated this multiple reply. The second multiply reply, considered to represent a safe crossing behaviour, includes those pedestrians who have indicated that they would do the three previously stated actions in addition to crossing in a group with other people. In Cairo, 100 (4 percent) have indicated this combination of replies and in Nairobi, 28 (4.7 percent), see figures 40 & 41. In total 341 (13 percent) in Cairo and 82 (13.9 percent) in Nairobi can be classified as perfect (safe) crossing behaviour.

111. Those pedestrians who chose the following multiple replies:

* look to cross and make sure traffic is far enough, 346 (13 percent) in Cairo, 83 (14.1 percent) in Nairobi;

* look to cross, make sure traffic is far enough, and cross in a group 155 (6 percent) in Cairo, 36 (6.1 percent) in Nairobi;

* look to cross and continue to look while crossing, 70 (3 percent) in Cairo, 42 (7.1 percent) in Nairobi;

* make sure traffic is far enough and continue to look while crossing, 18 (3.1 percent) in Nairobi; all were categorised in the incomplete crossing behaviour, see figures 40 & 41. In total 571 (22 percent) in Cairo and 179 (30.4 percent) in Nairobi can be classified as incomplete (unsafe) crossing behaviour

112. Those pedestrians who chose the following individual replies:

* look to cross, 483 (18 percent) in Cairo and 42 (7.1 percent) in Nairobi;

* make sure traffic is far enough, 239 (9 percent) in Cairo and 29 (4.9 percent) in Nairobi;

* cross in a group, 107 (4 percent) in Cairo and 14 (2.4 percent) in Nairobi;

* continue to look while crossing, 103 (4 percent) in Cairo and 19 (3.2 percent) in Nairobi;

* as well as the multiple reply look to cross and cross in a group, 60 (2 percent) in Cairo and 26 (4.4 percent) in Nairobi;

all were categorised in the imperfect crossing behaviour, see figures 42 & 43. In total 992 (37 percent) in Cairo and 130 (22 percent) in Nairobi can be classified in the imperfect (unsafe) crossing behaviour.

113. Lastly, those pedestrians who chose:

* choices including manoeuvring vehicles while crossing, 69 (3 percent) in Cairo, and 76 (12.8 percent) in Nairobi

* run, 16 (0.7 percent) in Cairo and 1 (0.2 percent) in Nairobi; or to

* do all the available choices, 67 (3 percent) in Cairo and 14 (2.4 percent) in Nairobi;

all were categorised in the dangerous crossing behaviour, see figures 42 & 43. In total 152 (6.7 percent) in Cairo and 91 (15.4 percent) in Nairobi can be classified in the dangerous (unsafe) crossing behaviour.

114. The figures demonstrate that the majority of the surveyed pedestrians in Cairo lay in the category of imperfect crossing, while in Nairobi the majority lay in the category of incomplete crossing . This leads us to suggest that there is a big deficiency in the traffic knowledge of pedestrians in Cairo and Nairobi. The rest of the surveyed pedestrians 549 (21.3 percent) in Cairo and 108 (18.3 percent) in Nairobi indicated several different multiple replies (46 combinations) related to their crossing behaviour. Most of these combinations can be categorised under the dangerous/ imperfect/ incomplete (i.e. unsafe) crossing behaviours. The high number of combinations related to crossing behaviour further demonstrates the lack of consistency and agreement on the right way to cross a road.

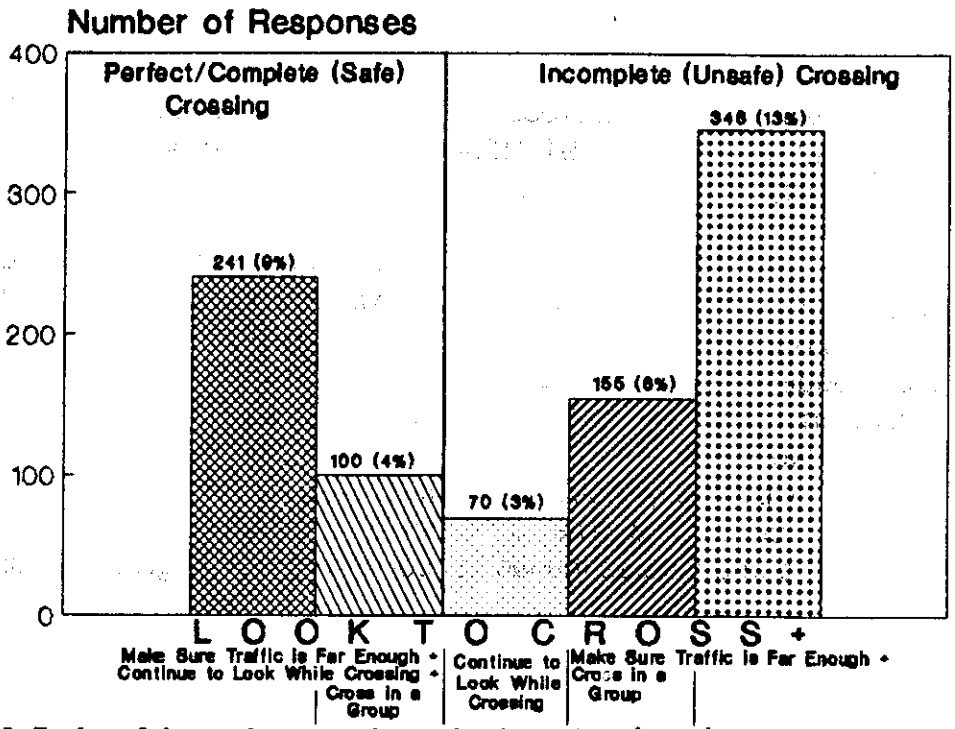

Fig 40: Perfect & incomplete stated crossing behaviour (Cairo)

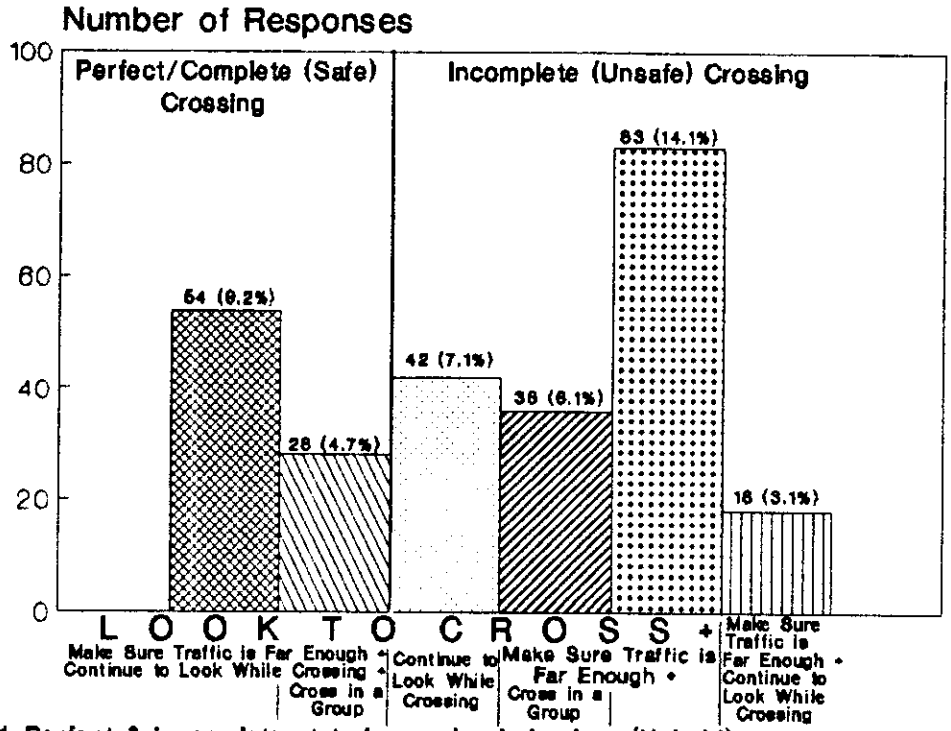

Fig 41: Perfect & incomplete stated crossing behaviour (Nairobi)

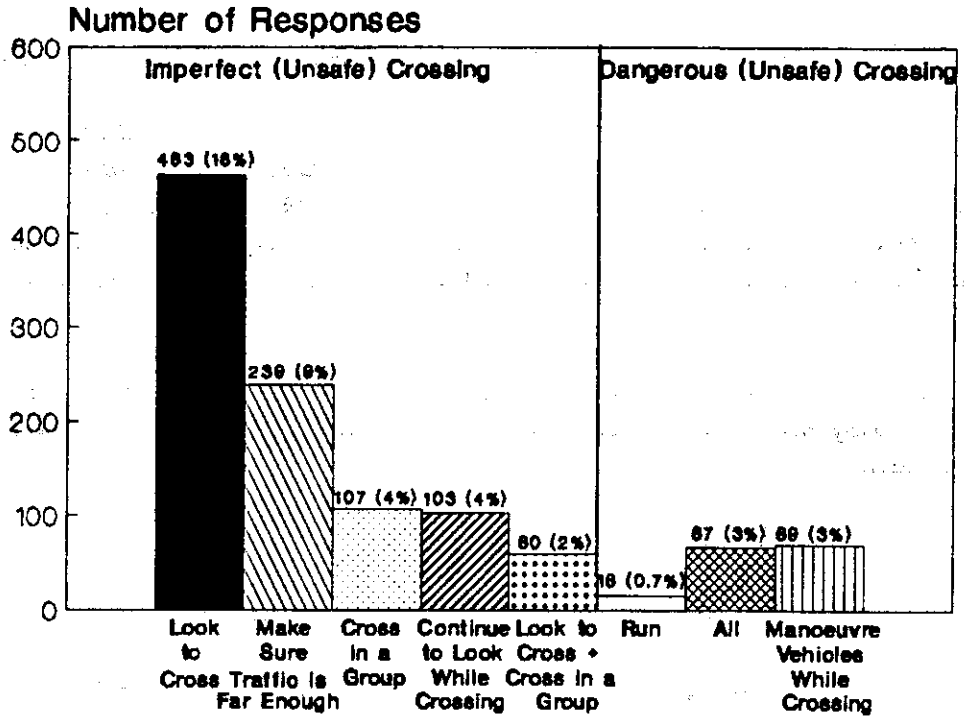

Fig 42: Imperfect & dangerous stated crossing behaviours of pedesterians (Cairo)

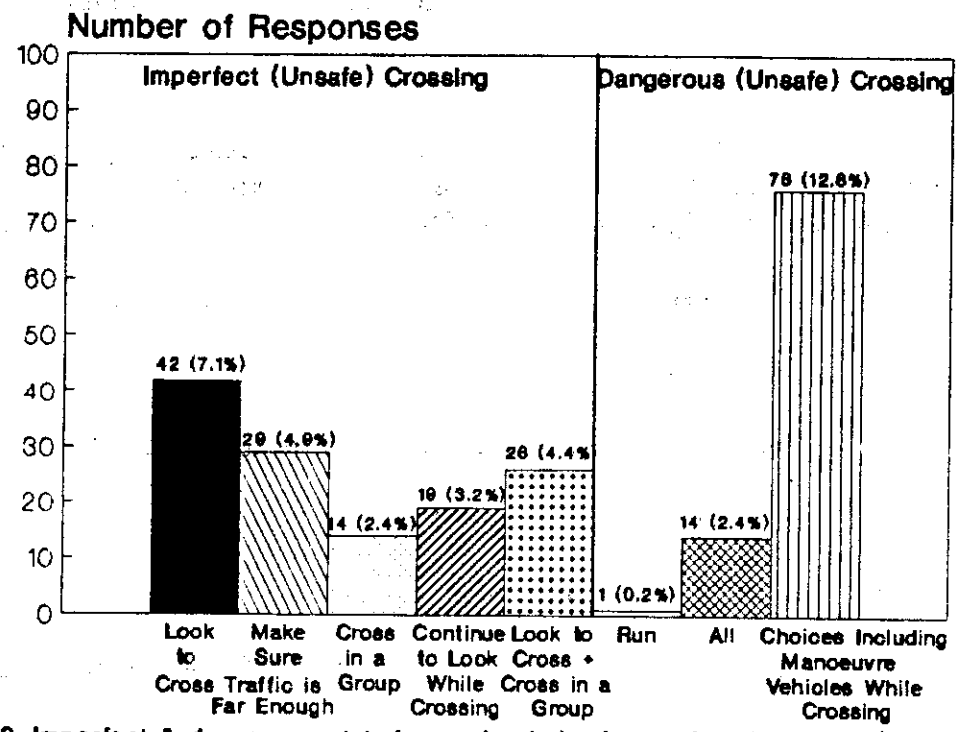

Fig 43: Imperfect & dangerous stated crossing behaviours of pedesterians (Nairobi)

4.5.5 Perception of Pedestrians Towards Sidewalks Mobility Problems

115. In terms of pedestrians mobility on sidewalks, four main criteria governed the inclusion of factors thought to hinder the mobility of pedestrians movement on sidewalks. These are: the width, the physical condition, the clear space, and the lighting of sidewalks. These factors are mainly related to engineering design and maintenance of sidewalks as well as to the enforcement for clear space for pedestrians to move on sidewalks.

116. Pedestrians in Cairo perceive the **narrow width of sidewalks** as the most serious problem that they encounter when moving on sidewalks, see figure 44. This is followed in order of seriousness by:

* Dirty sidewalks;
* Vehicles parked and occupying sidewalks' space;
* Open gutters and/or uncovered electric cables/wires;
* Petty sellers and hawkers occupying sidewalks;
* Unevenness of sidewalks;
* Overcrowding of pedestrians on sidewalks; and finally
* Lack of sufficient sidewalks' lighting.

117. On the other hand, pedestrians in Nairobi perceive the **overcrowding of pedestrians on sidewalks,** as the most serious problem that they encounter when moving on sidewalks, see figure 45. This is followed in order of seriousness by:

* Petty sellers and hawkers occupying sidewalks;
* Narrow width of sidewalks;
* Vehicles parked and occupying sidewalks' space;
* Unevenness of sidewalks;
* Grassy/dirty sidewalks;
* Open gutters and/or uncovered electric cables/wires; and finally
* Lack of sufficient sidewalks' lighting.

118. It is obvious from the above that problems related to limited sidewalks' space as a result of narrow width of sidewalks combined with high pedestrian densities as well as illegal occupation of sidewalks by hawkers and parked vehicles, all in all, result in discomfort and inconvenience for pedestrians, thus hindering their mobility along sidewalks. As demonstrated, this causes pedestrians at many times to leave the sidewalks and walk along the roads exposing themselves to the danger of being involved in a traffic accident.

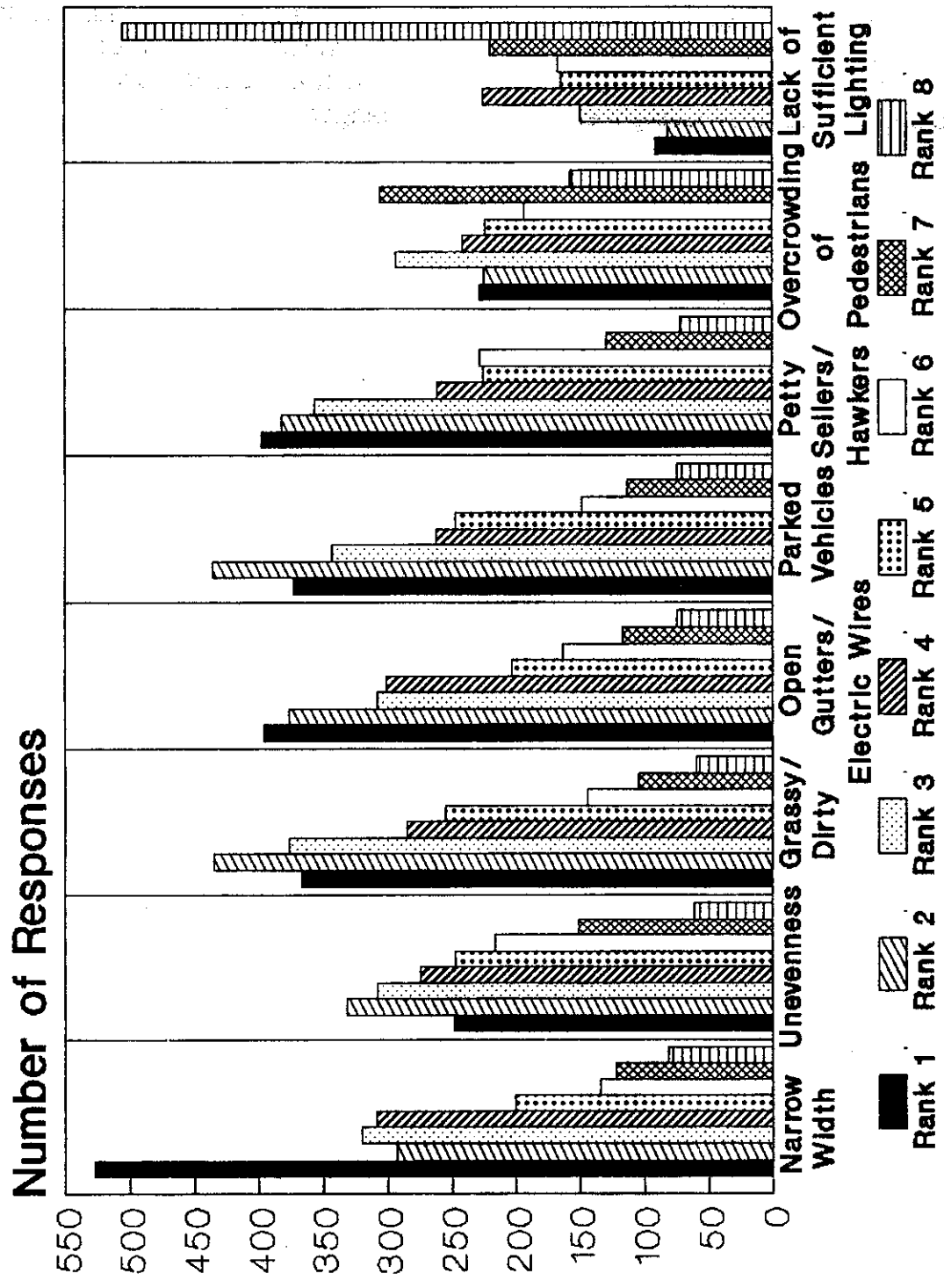

Fig 44: Problems hindering mobility of pedesterians along sidewalks (Cairo)

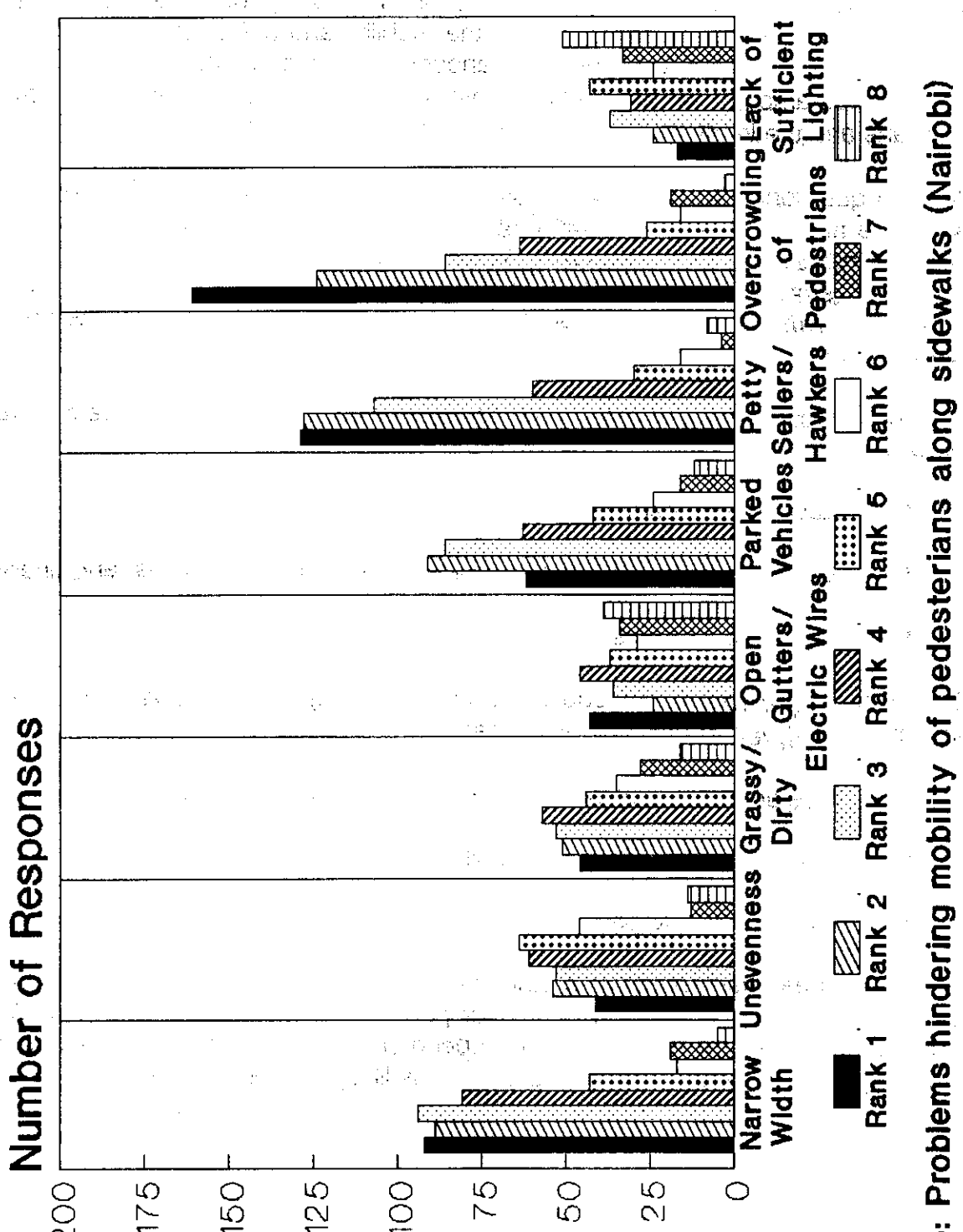

Fig 45: Problems hindering mobility of pedesterians along sidewalks (Nairobi)

4.5.6 Perception of Pedestrians Towards Roads Crossing Safety Problems

119. In addition to mobility of pedestrians on sidewalks, the other component of pedestrian environment is concerned with the mobility and safety of pedestrians while crossing the roads. Factors thought to endanger the safety of pedestrians while crossing roads include: amount of pedestrians crossing facilities, drivers behaviour towards pedestrians and the level of exercised traffic police enforcement.

120. The questionnaire revealed that pedestrians in both cities of Cairo and Nairobi perceive the **high speed of approaching vehicles** as the most profound problem that endangers their safety when attempting to cross roads, see figures 46 & 47. Also, the figures demonstrate that pedestrians in both cities perceive **non-abidance of drivers to pedestrians' traffic rules** as the second serious safety problem encountered while crossing roads.

121. For pedestrians in Cairo, figure 46 shows that these two problems are followed in order of seriousness by:

* Lack of enforcement;
* Limited number of properly designed pedestrian crossings; and finally
* High level of kerbs.

122. On the other hand for pedestrians in Nairobi, figure 47 shows that these two problems are followed in order of seriousness by:

* Limited number of properly designed pedestrian crossings;
* Lack of enforcement; and finally
* High level of kerbs.

123. As has been demonstrated in other studies, this study shows that few drivers are prepared to stop or even to slow down for pedestrians while crossing roads. Thus it could be true that pedestrians who totally depend on their traffic rights at crossing points can be at great risk because of drivers being less likely to stop for them.

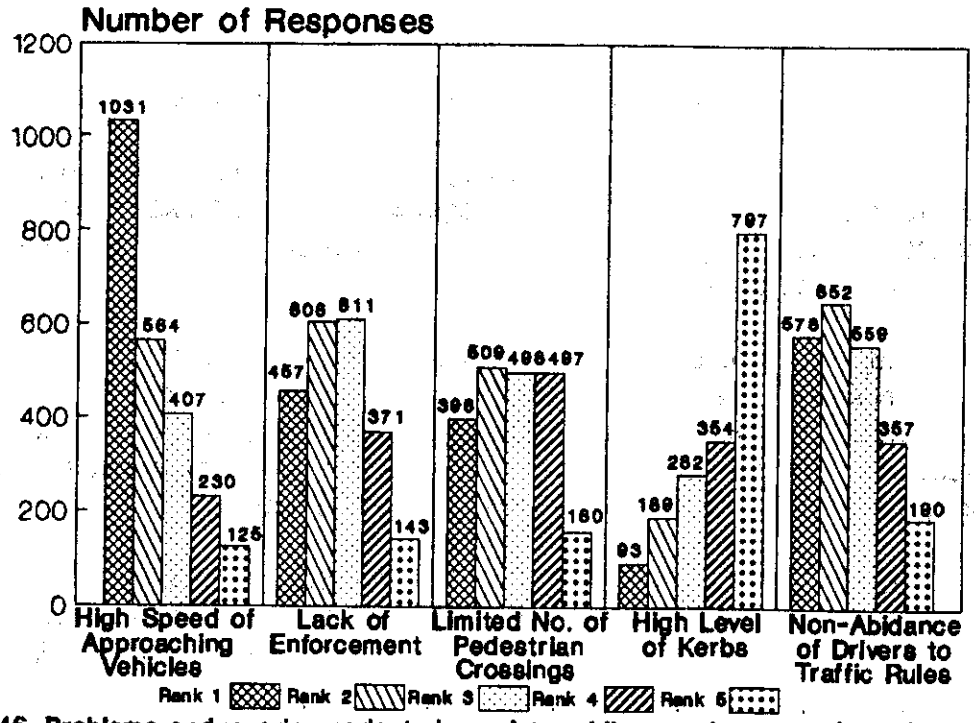

Fig 46: Problems endangering pedesterian safety while crossing roads (Cairo)

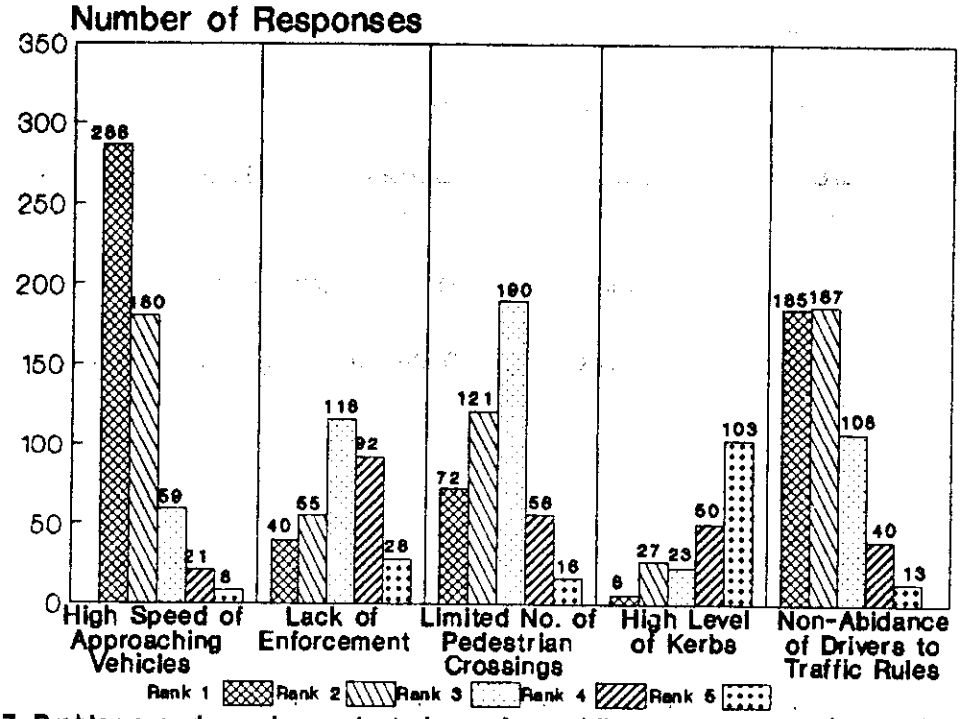

Fig 47: Problems endangering pedesterian safety while crossing roads (Nairobi)

4.5.7 Sources of Pedestrians Traffic Knowledge/Training

124. The questionnaire was concluded by a question through which an attempt was made to infer the sources for traffic knowledge, education and experience of pedestrians. Sources listed include: myself, parents, school, television. Pedestrians were allowed to mark more than one choice.

125. The majority of the surveyed pedestrians, 993 (39 percent) in Cairo and 185 (31.5 percent) in Nairobi have indicated that they have learned how to cross roads and generally how to deal with traffic by themselves, see figures 48 & 49. This demonstrates the almost non existence of any systematic official source for providing the necessary education, training and information related to traffic safety.

126. The figures demonstrate that 781 (31 percent) in Cairo and 47 (8 percent) in Nairobi, have indicated the involvement of parents. Also, 161 (6 percent) in Cairo and 80 (13.5 percent) in Nairobi have stated the involvement of their schools. Figure 48 shows that in Cairo 93 (4 percent) stated the involvement of television.

127. Other multiple replies included:

* myself and parents, 130 (5 percent) in Cairo, 29 (4.9 percent) in Nairobi;
* myself and television, 64 (3 percent) in Cairo;
* myself and school, 85 (14.5 percent) in Nairobi;
* parents and school, 107 (4 percent) in Cairo and 76 (12.9 percent) in Nairobi;
* myself, parents and school, 51 (8.7 percent) in Nairobi;
* myself, parents, school and television, 61 (3 percent) in Cairo and 15 (2.6 percent) in Nairobi.

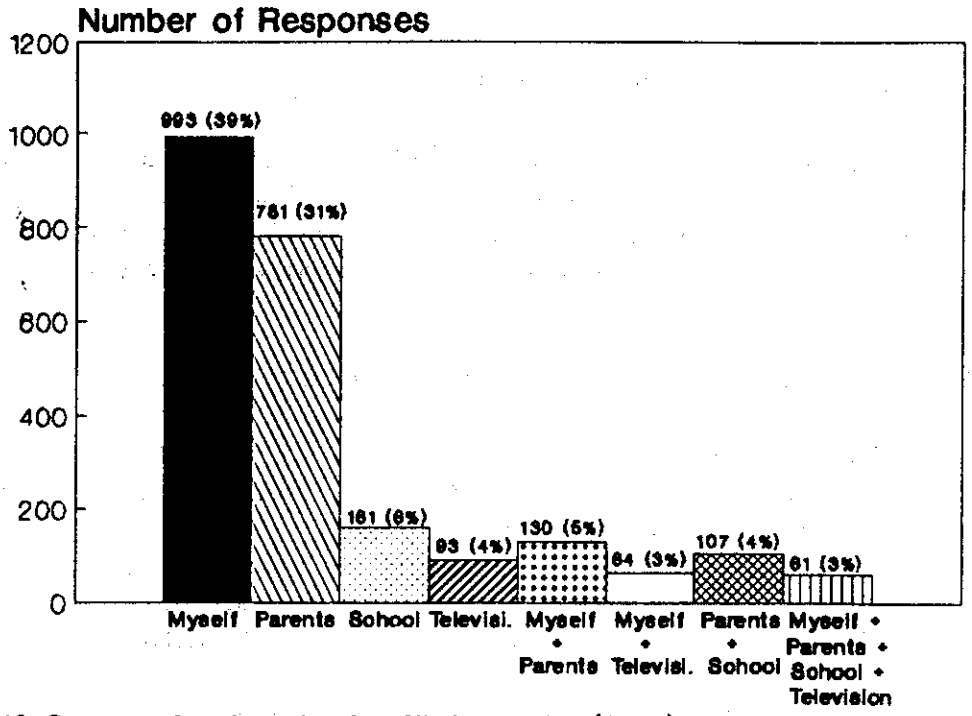

Fig 48: Sources of pedesterians' traffic knowledge (Cairo)

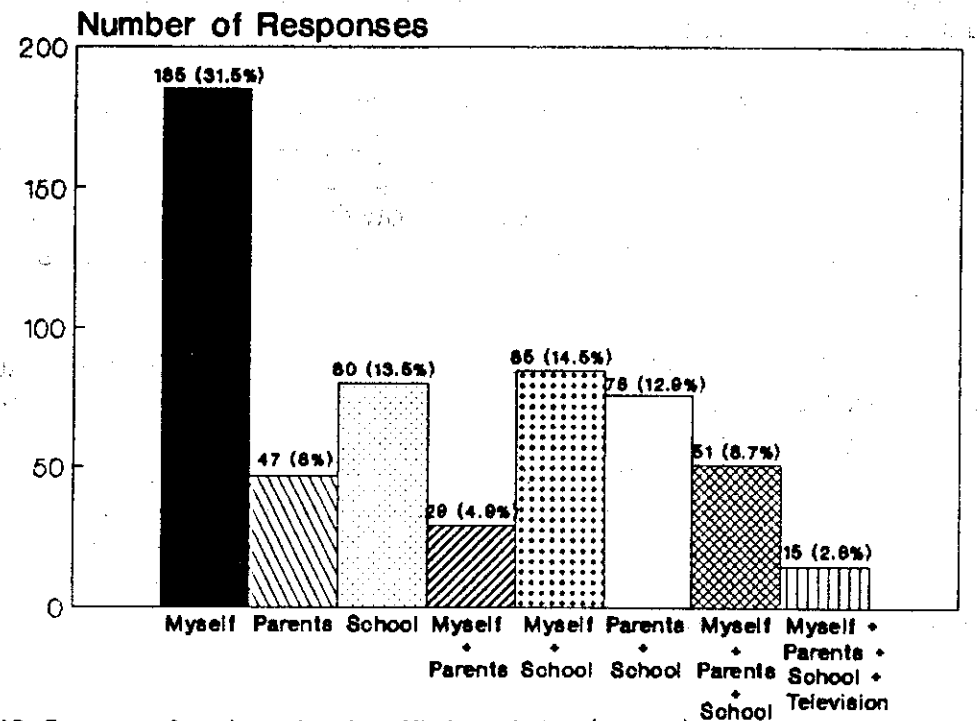

Fig 49: Sources of pedesterians' traffic knowledge (Nairobi)

4.6 Results of school children traffic behaviour study

128. According to Downing et al. (1993), "Third World pedestrian casualties are more likely to be children..... 24 percent of pedestrian fatal accidents in Egypt in 1985-86 involved children under the age of 15 years". The following subsections represent a discussion of the results of the school children traffic behaviour study undertaken in Cairo and Nairobi.

4.6.1 Traffic Experience/Exposure of School Children

129. An attempt is made to produce some indicators of the traffic experience of school children. Traffic experience can be considered as a function of age as well as of traffic exposure. The older a child is the more likely that he/she has longer experience with traffic. The average age of the sample of children completing the questionnaire was 10 years in Cairo and 11 years in Nairobi . In both case studies the standard deviation of children age was 2 years with a minimum of 6 years and a maximum of 16 years.

130. One can look at traffic exposure of school children in two contrasting ways. The first is that the more a child is exposed to deal with traffic, the more traffic experience he/she will gain. This will lead to improving children's cognitive traffic skills and abilities (i.e. anticipation of traffic risks) as well as improving their perceptual skills (i.e. reacting to anticipated risk and risk acceptance). On the other hand, one can say that the more a child is exposed to traffic situations, the more likely that he/she is at a risk of becoming involved in a traffic accident.

131. In an attempt to establish measures for traffic exposure of school children a set of inter-related questions were included in the designed questionnaire. The first question was concerned with determining whether the children perceived their schools to be far or near their homes, see figures 50 & 51. The figures show that 934 (59 percent) of the surveyed children in Cairo and 267 (49 percent) in Nairobi, perceived their schools to be far from their homes.

132. The questionnaire went on to determine how do children arrive to and leave schools, see figures 52 & 53. As shown, 1046 (65 percent) of the surveyed children in Cairo and 329 (65 percent) in Nairobi, come to school on their own. In addition the figures show that 1066 (67 percent) of the children in Cairo and 329 (65 percent) in Nairobi leave school on their own. It could be concluded that most of the surveyed children live far from school and that they come to and leave school on their own. Coming to and leaving school on their own involves a considerable part of the journey where children are exposed to traffic.

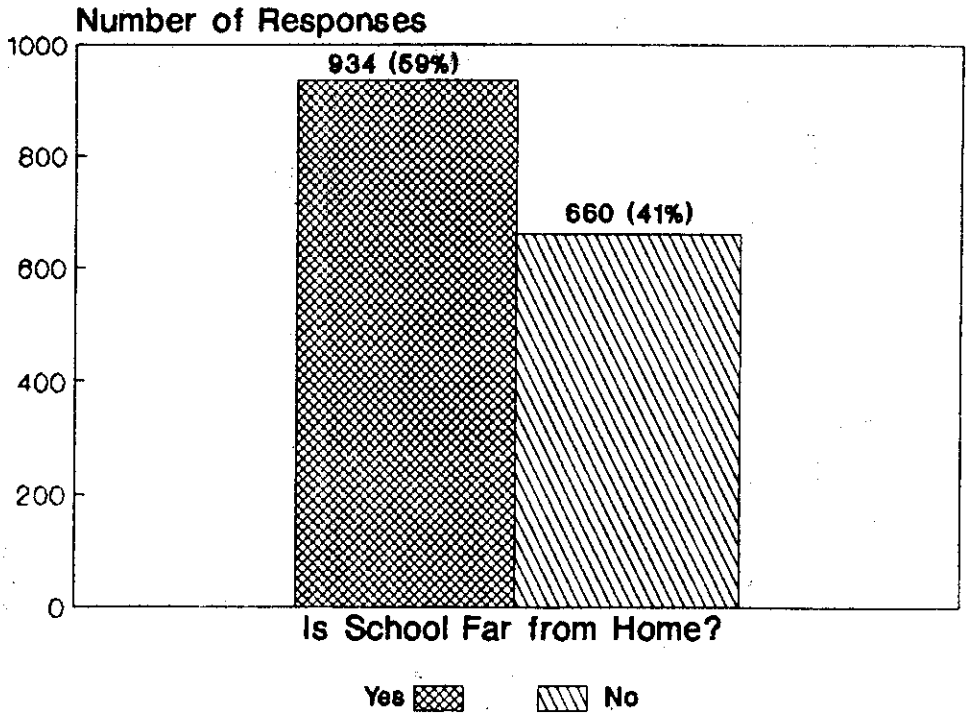

Fig 50: Children perception of distance from home to school (Cairo)

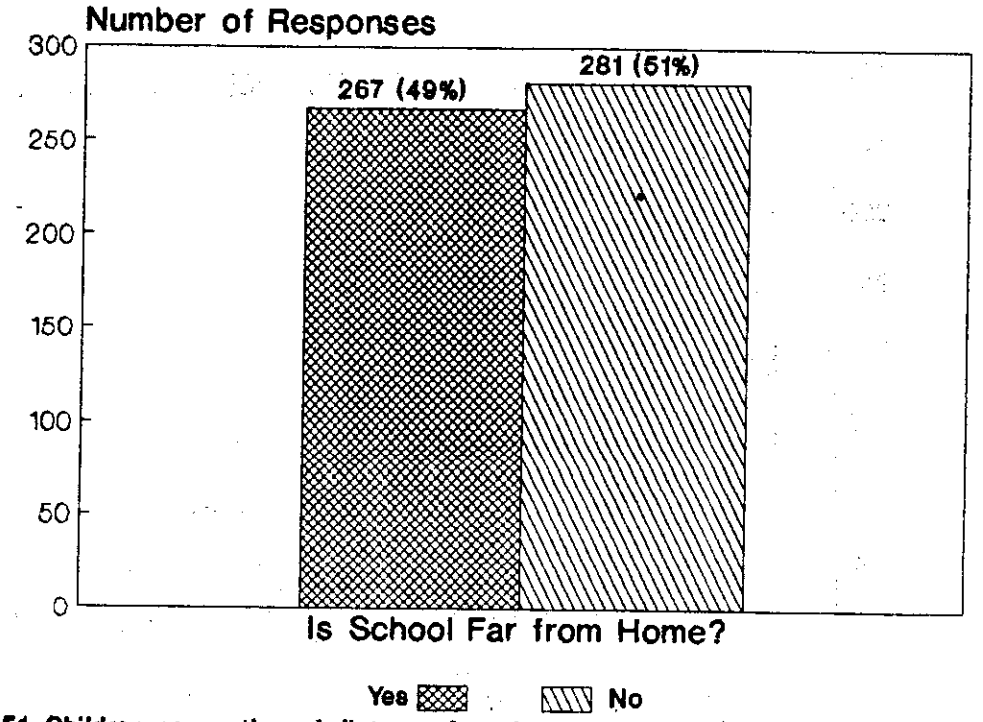

Fig 51: Children perception of distance from home to school (Nairobi)

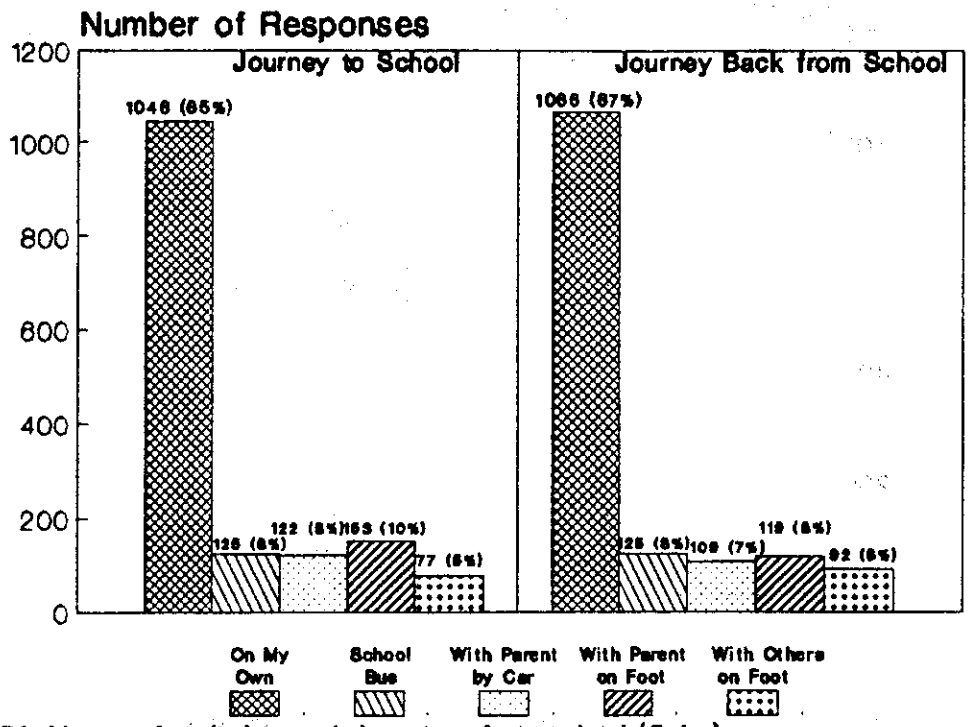

Fig 52: Means of arrival to and departure from school (Cairo)

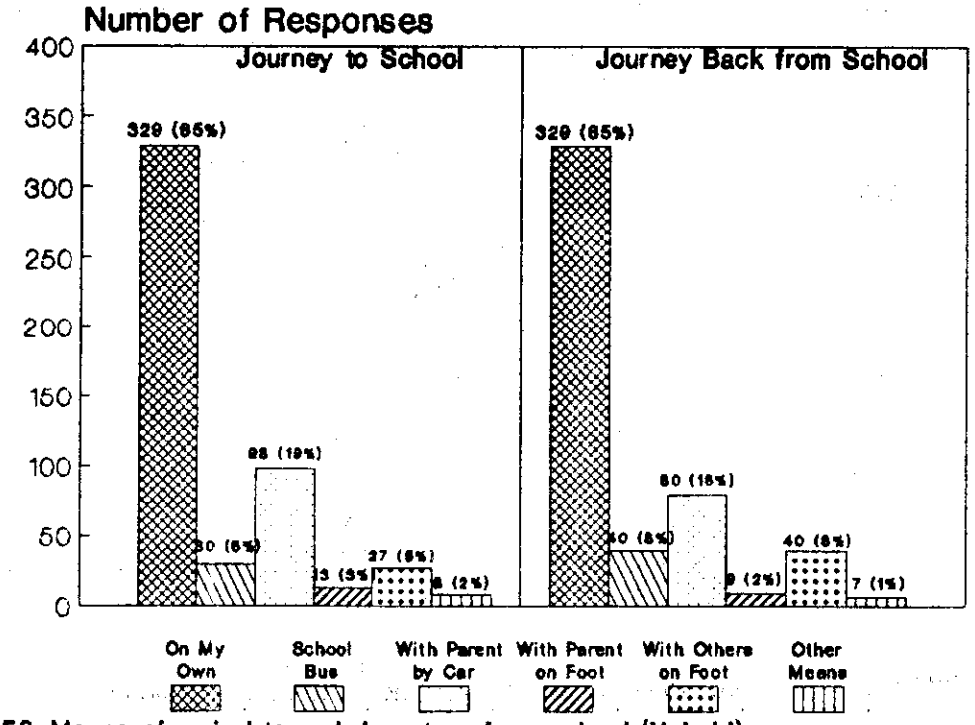

Fig 53: Means of arrival to and departure from school (Nairobi)

133. The average age at which children started to come to and leave school on their own was 7 years in Cairo and 8 years in Nairobi. In the case of Cairo the standard deviation was 1 year with a minimum of 4 years and a maximum of 14 years. In the case of Nairobi the standard deviation was 1 year with a minimum of 3 years and a maximum of 13 years.

134. Thus, we can conclude that the average traffic exposure of school children in Cairo and in Nairobi is 3 years (average current age - average age at which a child was allowed to come to/leave school on his/her own).

135. Discussions with school officials as well as pilot observations revealed that many children arrive early to school. This could be mainly attributed to parents having to travel early to their work and hence preparing their children to go to school at an early time. Figures 54 & 55 demonstrate that 769 (49 percent) of the surveyed children in Cairo and 366 (67 percent) in Nairobi come early to school. The figures also show that 184 (12 percent) of the children in Cairo and 189 (36 percent) in Nairobi indicated that they leave school late.

136. Two inter-related questions were introduced to the children. These were meant to establish the factors that influence the preference of a child to stay inside or outside school if he/she arrives early to school or leaves late from school.

137. Children arriving early at school and staying inside would not be exposed to traffic. However, it was noted that for various reasons children, specially in the case of Cairo, have a tendency to stay outside school mainly to be with their friends either standing or playing, see figures 56 and 57.

138. On the other hand, both in Cairo and in Nairobi the majority of children feel that they would stay inside their schools because they would not be permitted to stay outside in accordance to their schools' regulations, see figures 56 & 58.

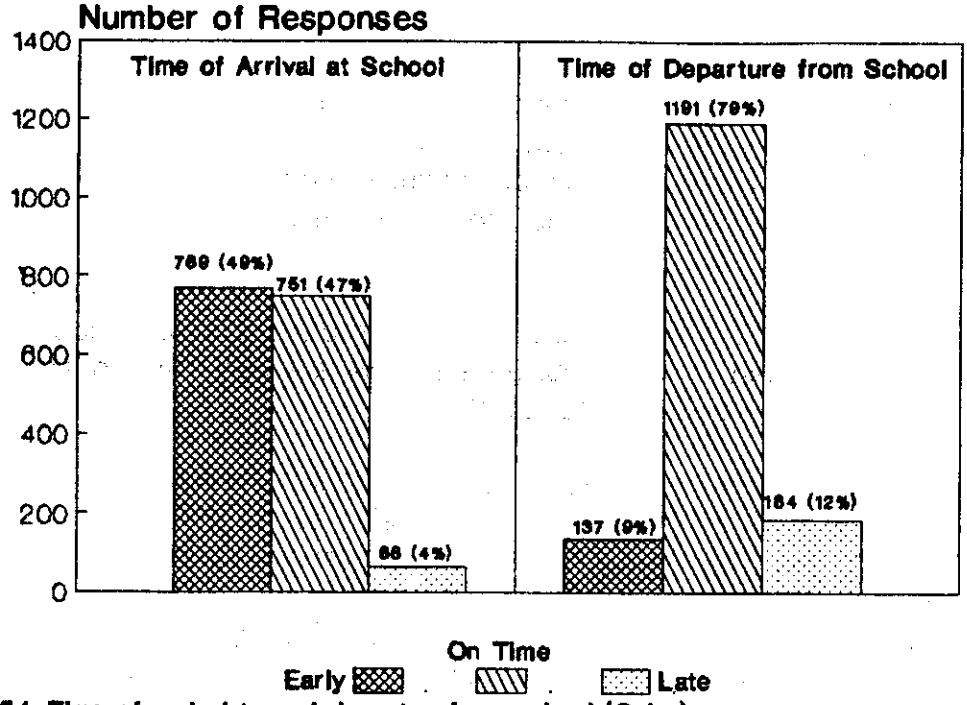

Fig 64: Time of arrival to and departure from school (Cairo)

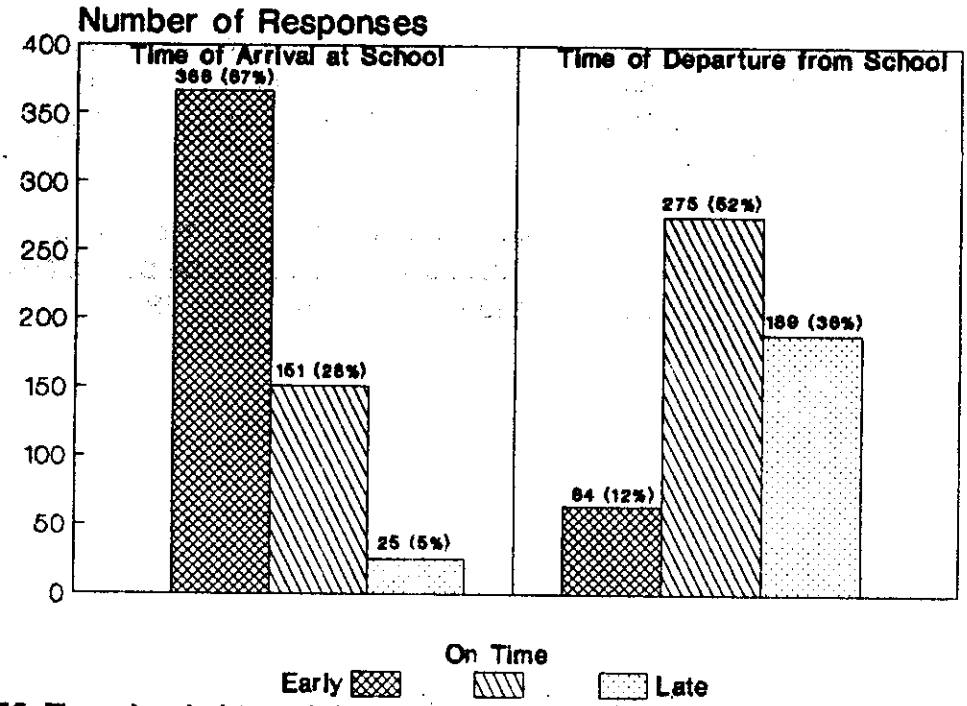

Fig 65: Time of arrival to and departure from school (Nairobi)

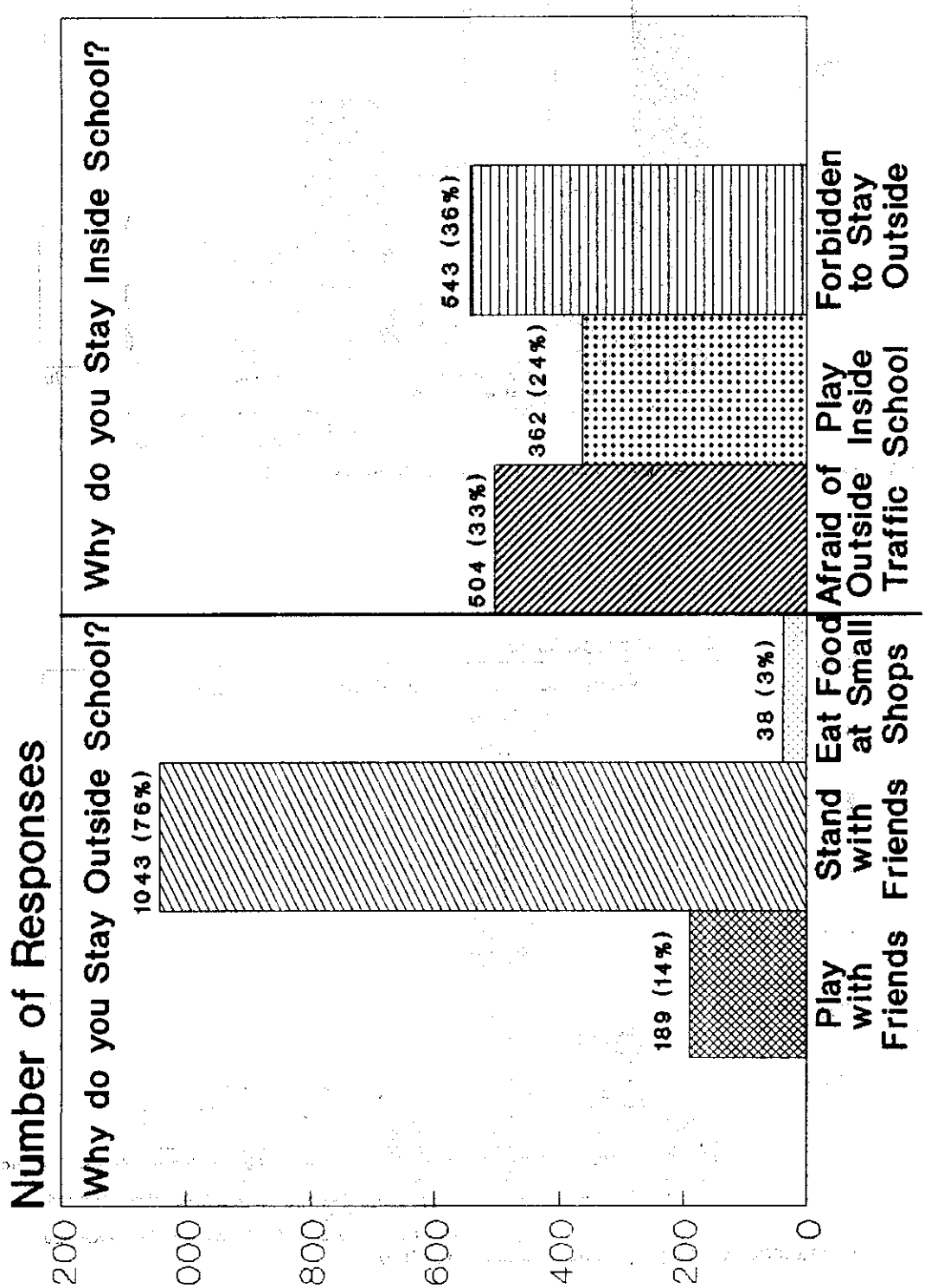

Fig 56: Reasons for children staying outside/inside school (Cairo)

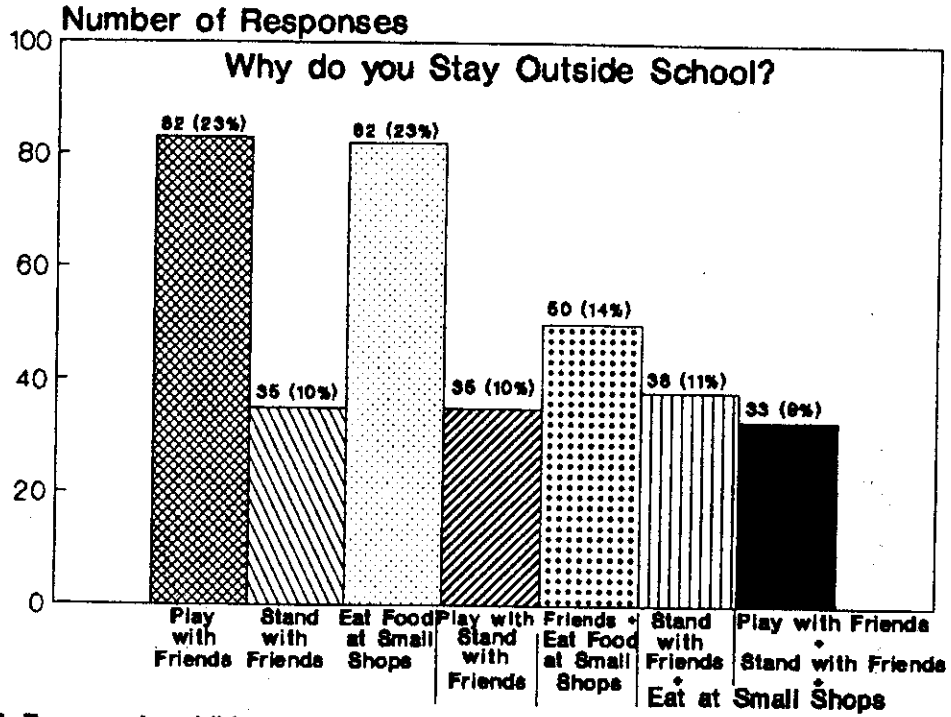

Fig 57: Reasons for children staying outside school (Nairobi)

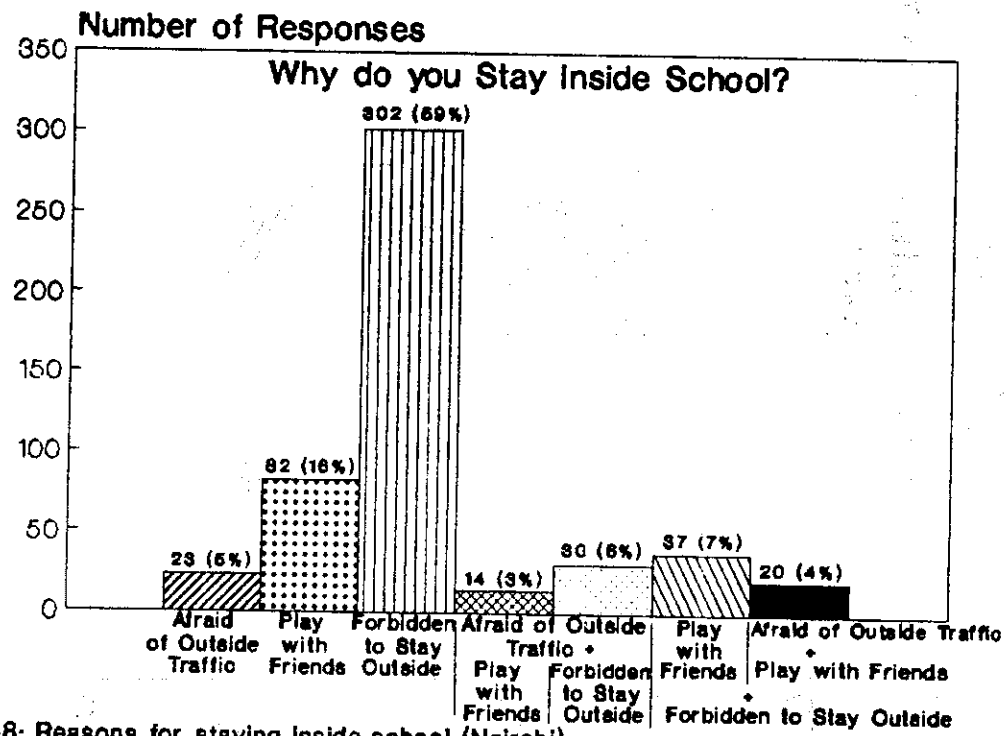

Fig 58: Reasons for staying inside school (Nairobi)

4.6.2 Stated Perception/Attitude of School Children Towards Traffic

139. A feeling of independence amongst the children is indicated where 1173 (76 percent) of the surveyed children in Cairo and 343 (63 percent) in Nairobi stated that they like to come to and leave school on their own, see figures 59 & 60. This probably includes children who have already indicated that they come to and leave school on their own, in addition to some other children who feel that they would like to undergo this experience. However, children were not shy to spell out their feeling of fear of traffic on their way to their schools, see figures 59 & 60. The figures show that 868 (56 percent) of the children in Cairo and 380 (70 percent) in Nairobi stated that they are afraid of traffic on their way to school.

140. In Cairo, 1033 (66 percent) of the children stated also their fear of traffic in front of their schools, see figure 59. However, in Nairobi the majority of the children 283 (52 percent) have indicated that they are not afraid of traffic in front of their schools, see figure 60. An important conclusion can be drawn from this analysis. Due to the fact that 4 of the schools visited in Nairobi were located on very low density roads in residential areas where most of the children lived, the majority of children perceived their schools to be near their homes, see figure 51 as well as stating that they were not afraid of traffic in front of their schools.

141. Regarding the main reasons stated by those children who indicated their fear of traffic, being involved in a traffic accident as well as children stating their fear of cars travelling at high speeds were mostly cited in the Cairo case. This demonstrates the probable existence of potential problems in the locations of schools in Cairo and the traffic hazards present in front of these schools.

142. Despite the generally stated feeling of fear from traffic, a feeling of independence was further emphasised when 1164 (74 percent) of the surveyed children in Cairo and 307 (56 percent) in Nairobi stated that they feel they can deal with traffic movement on their own, see figures 61 & 62. Figure 61 also shows that in the case of Cairo 973 (62 percent) of the children perceived crossing roads to be easy. However, in the Nairobi case, 313 (57 percent) children have indicated that they perceive crossing the road as difficult, see figure 62.

143. In response to whether they would look for specific places to cross from, 1071 (69 percent) of the children in Cairo and 463 (84 percent) in Nairobi stated they would do that, see figures 63 & 64. In response to whether they would hold hands when crossing roads with other adults, 1087 (70 percent) of the children in Cairo and 374 (68 percent) said they would do that, see figures 63 & 64. This demonstrates a safe positive traffic attitude of school children.

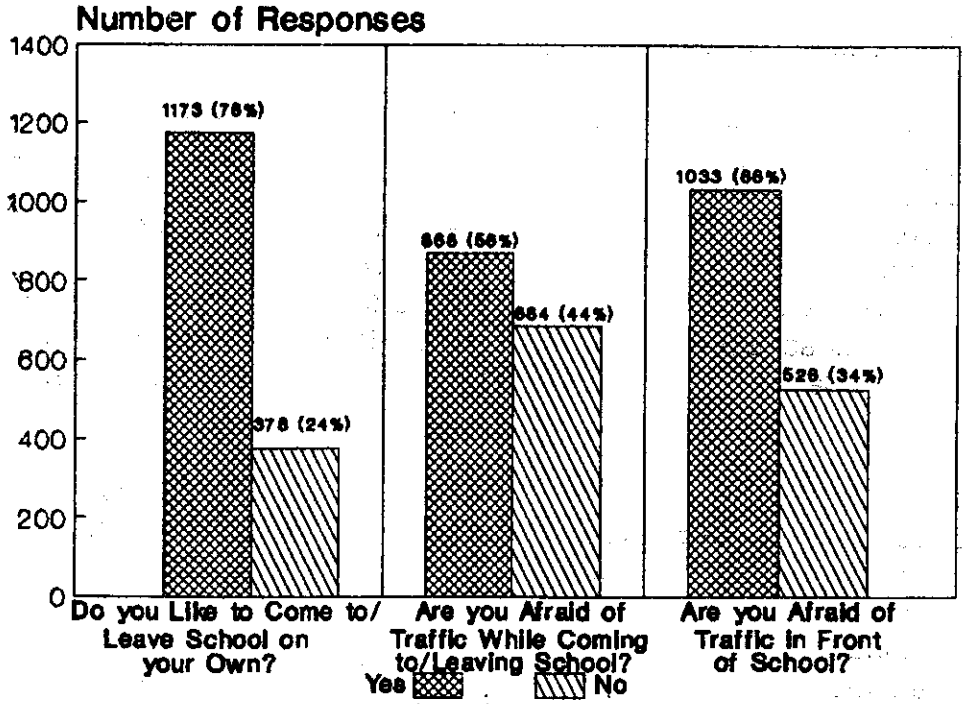

Fig 59: Children perception of traffic (Cairo)

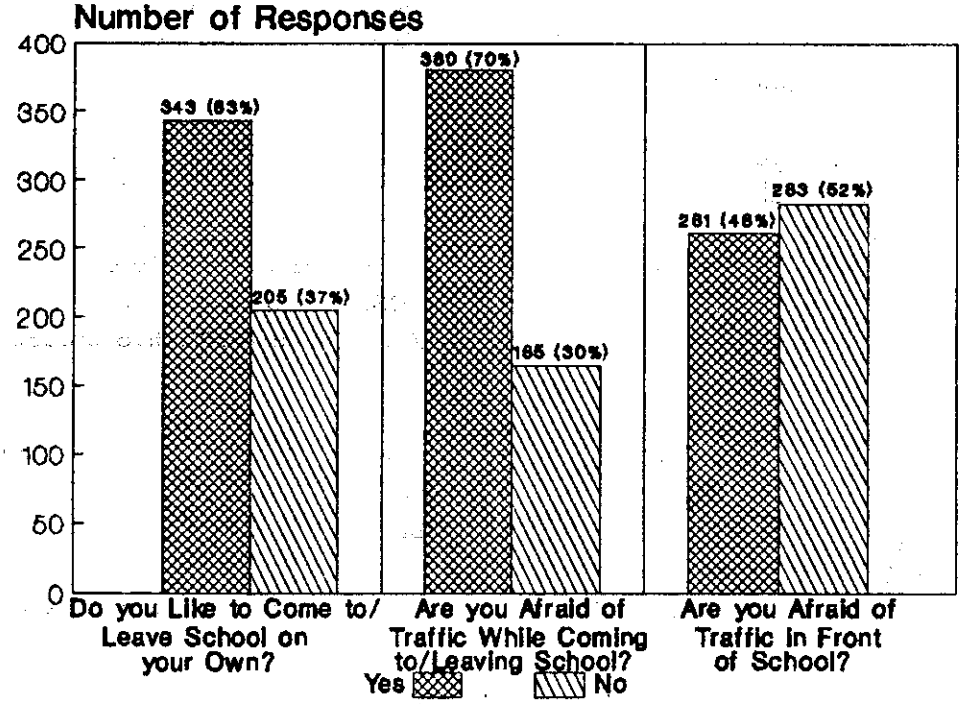

Fig 60: Children perception of traffic (Nairobi)

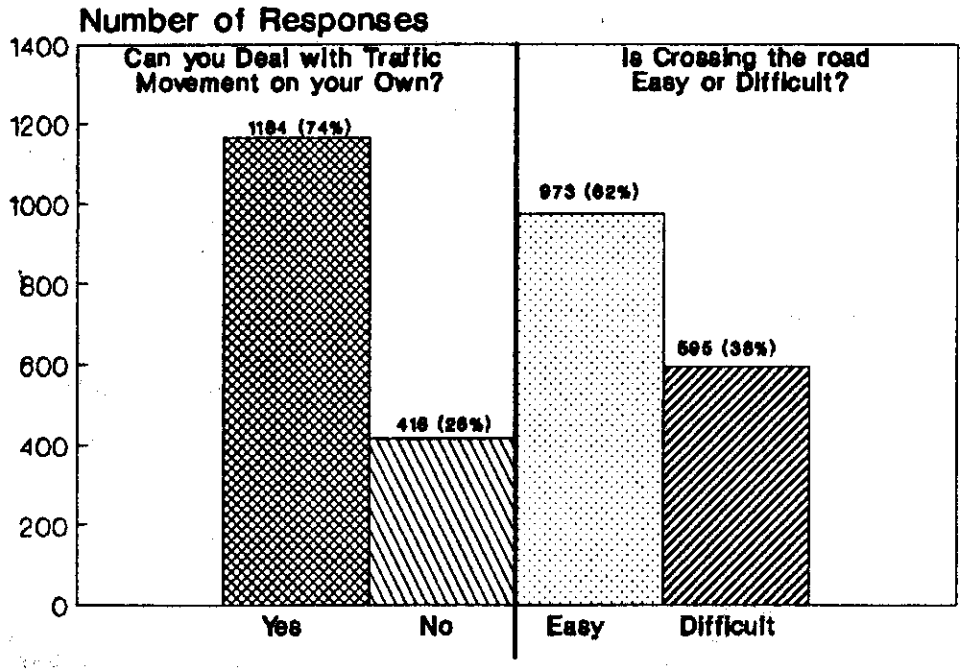

Fig 61: Children perception of crossing roads (Cairo)

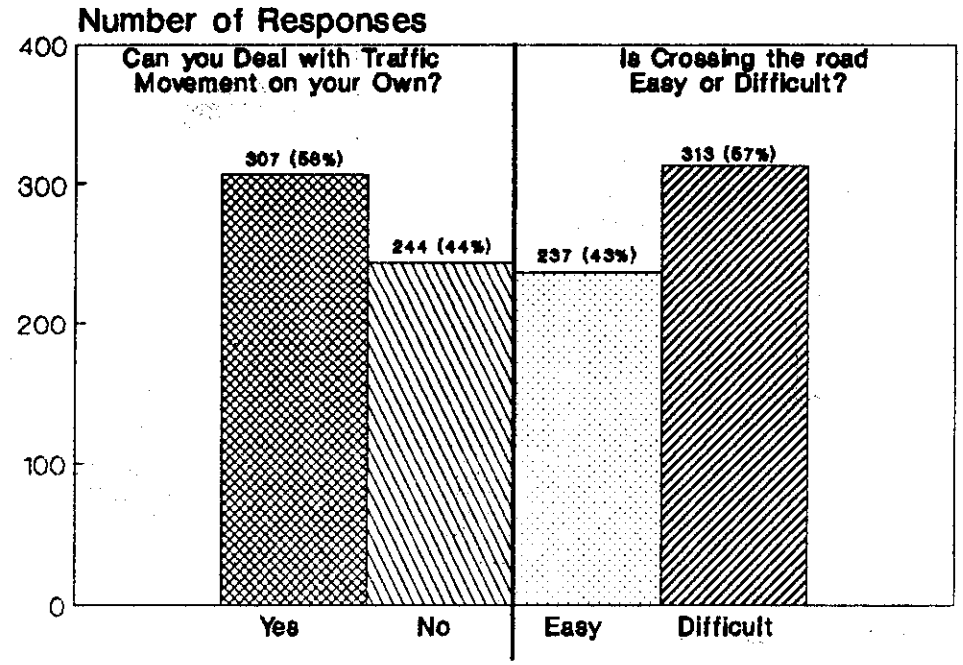

Fig 62: Children perception of crossing roads (Nairobi)

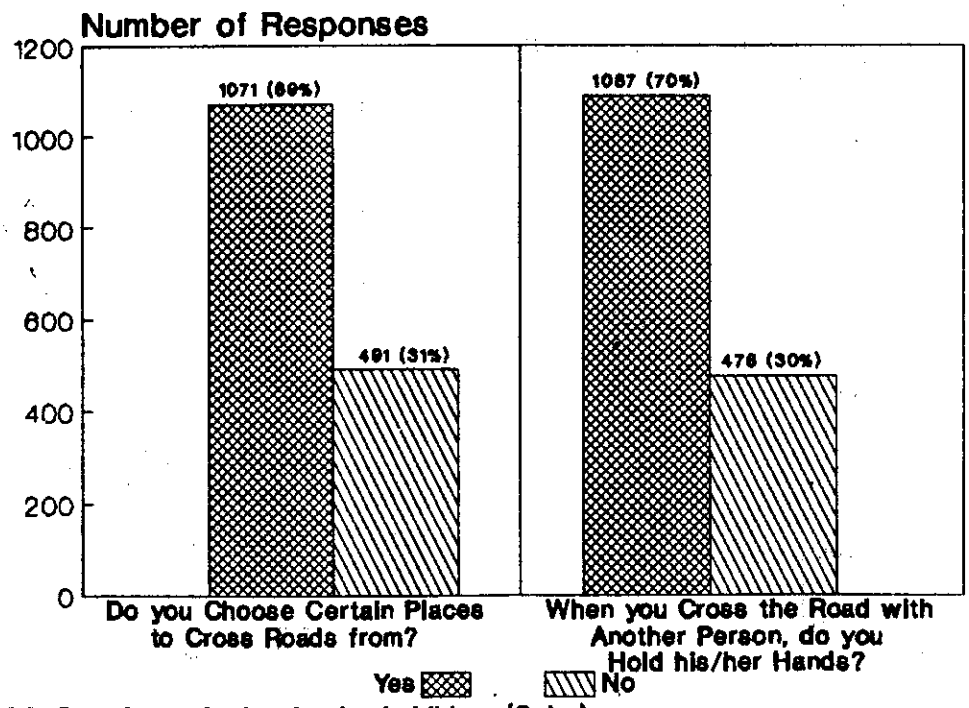

Fig 63: Crossing attitude of school children (Cairo)

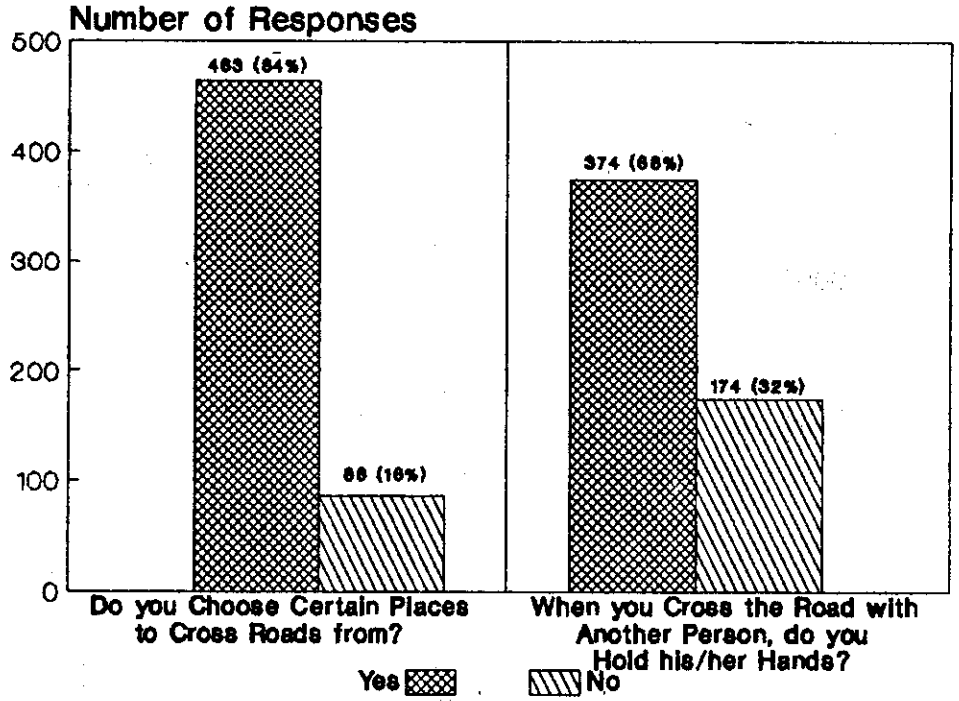

Fig 64: Crossing attitude of school children (Nairobi)

4.6.3 Stated Crossing Behaviour (Crossing Knowledge) of School Children

144. Regarding the frequency of children crossing roads on their own, 793 (51 percent) of the children in Cairo and 146 (27 percent) in Nairobi stated that they always cross roads on their own. In Cairo 489 (31 percent) and 339 (61 percent) in Nairobi sometimes cross roads on their own, while 288 (18 percent) in Cairo and 66 (12 percent) in Nairobi stated that they do not cross roads on their own, see figures 65 & 66.

145. Children were asked on what they normally do when they cross the roads. The stated crossing behaviour was assumed to be synonymous of the children's crossing knowledge. A set of choices were given which include:

* Look to cross
* Make sure traffic is far enough
* Continue to look while crossing
* Cross in a group with other children
* Run

146. Children were allowed to mark more than one choice. Responses were categorised into four categories:

* Perfect (safe) crossing behaviour
* Incomplete (unsafe) crossing behaviour
* Imperfect (unsafe) crossing behaviour
* Dangerous (unsafe) crossing behaviour

147. Two of the multiple replies could be categorised in the complete (safe) crossing behaviour. Those children who chose to look to cross, to make sure traffic is far enough and to continue to look while crossing, 134 (9 percent) in Cairo and 126 (22.9 percent) in Nairobi, were categorised in the perfect (safe) crossing behaviour, see figures 67 & 68. The second multiply reply, considered to represent a safe crossing behaviour, includes those children who have indicated that they would do the three previously stated actions in addition to crossing in a group with other children. In Nairobi, 37 (6.7 percent) children have indicated this combination of replies, see figure 68. In total 134 (9 percent) of surveyed children in Cairo and 163 (29.6 percent) in Nairobi can be classified as perfect (safe) crossing behaviour.

148. Those children who chose the following multiple replies:

* look to cross and make sure traffic is far enough, 173 (11 percent) in Cairo, and 74 (13.4 percent) in Nairobi;

* look to cross and continue to look while crossing, 47 (8.5 percent) in Nairobi;

* make sure traffic is far enough and continue to look while crossing, 30 (5.4 percent) in Nairobi;

* look to cross, make sure traffic is far enough, and cross in a group, 25 (4.5 percent) in Nairobi;

* look to cross, continue to look while crossing and cross in a group, 22 (4 percent) in Nairobi;

all were categorised in the incomplete crossing behaviour, see figures 67 & 68. In total 173 (11 percent) in Cairo and 198 (35.8 percent) in Nairobi can be classified as incomplete (unsafe) crossing behaviour

149. Those children who chose the following individual replies:

* look to cross, 474 (30 percent) in Cairo and 30 (5.4 percent) in Nairobi;

* make sure traffic is far enough, 397 (25 percent) in Cairo and 32 (5.8 percent) in Nairobi;

* continue to look while crossing, 145 (9 percent) in Cairo and 20 (3.6 percent) in Nairobi;

* cross in a group, 55 (4 percent) in Cairo and 29 (5.3 percent) in Nairobi;

* as well as the multiple reply look to cross and cross in a group, 21 (3.8 percent) in Nairobi;

all were categorised in the imperfect crossing behaviour, see figures 67 & 69. In total 1071 (68 percent) in Cairo and 132 (23.9 percent) in Nairobi can be classified in the imperfect (unsafe) crossing behaviour.

150. Lastly, those children who chose running, 40 (3 percent) in Cairo and 1 (0.2 percent) in Nairobi; were categorised in the dangerous (unsafe) crossing behaviour, see figures 67 and 69.

151. The figures demonstrate that the majority of the surveyed children in Cairo lay in the category of imperfect crossing, while in Nairobi the majority lays in the category of incomplete crossing . This coincides with the previously reached conclusion regarding pedestrians in Cairo and Nairobi. This leads us to suggest that there is also a big deficiency in the traffic knowledge of children as well in both Cairo and Nairobi.

152. The rest of the surveyed children, 164 (10 percent) in Cairo and 57 (10 percent) in Nairobi, have indicated several other different combinations (13 in Cairo and 14 in Nairobi) related to their crossing behaviour. Most of these combinations can be categorised under the dangerous/imperfect/incomplete (i.e. unsafe) crossing behaviours. The high number of combinations related to crossing behaviour further demonstrates the lack of consistency and agreement on the right way to cross a road.

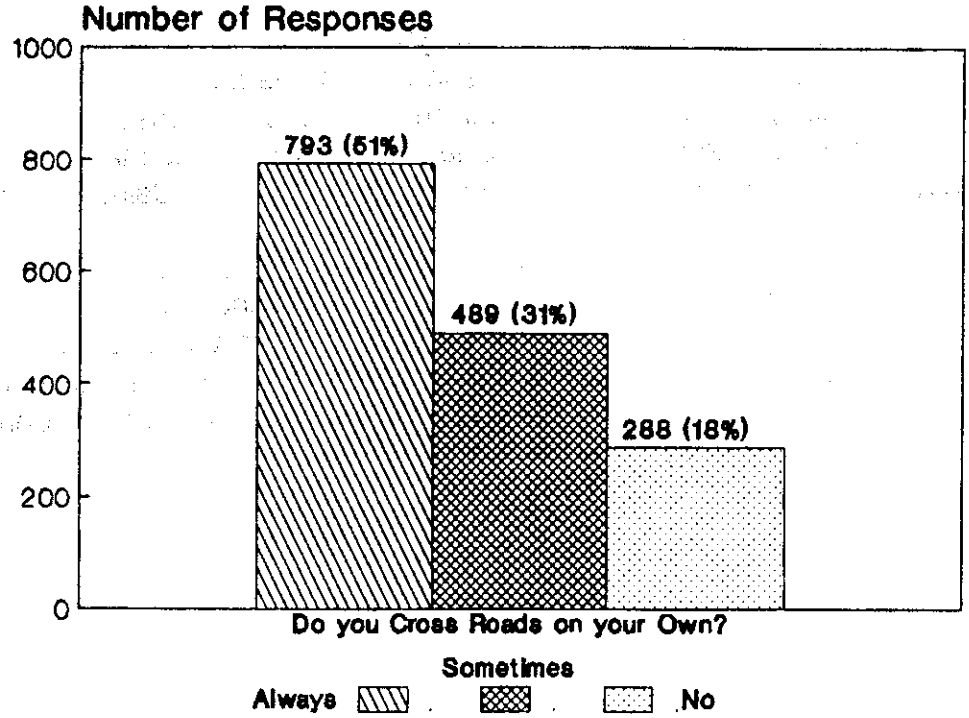

Fig 65: Frequency of school children crossing roads on their own (Cairo)

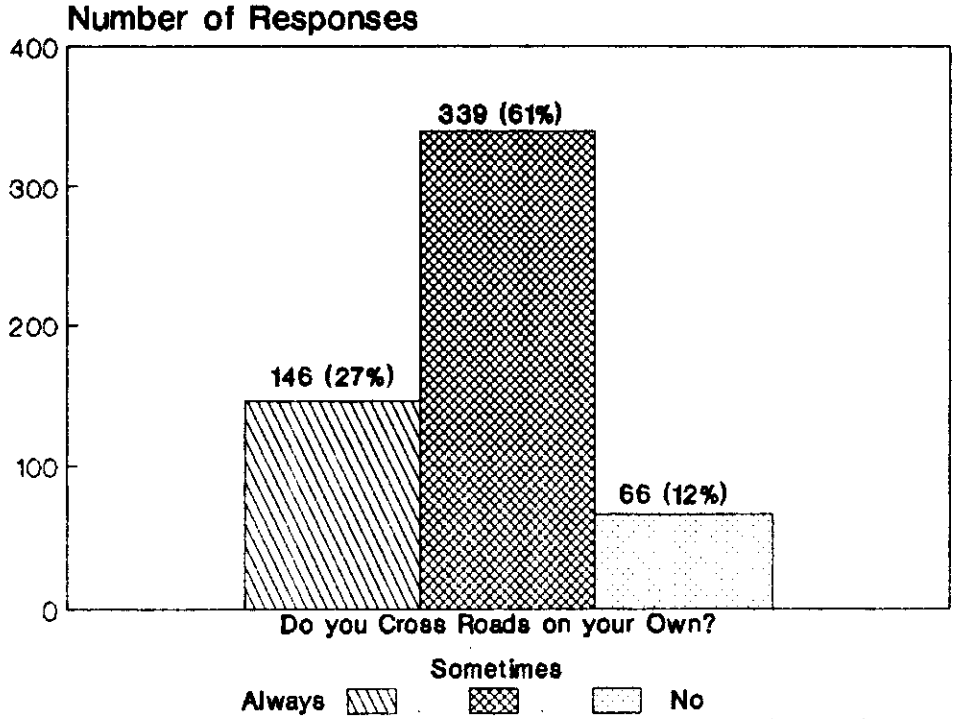

Fig 66: Frequency of school children crossing roads on their own (Nairobi)

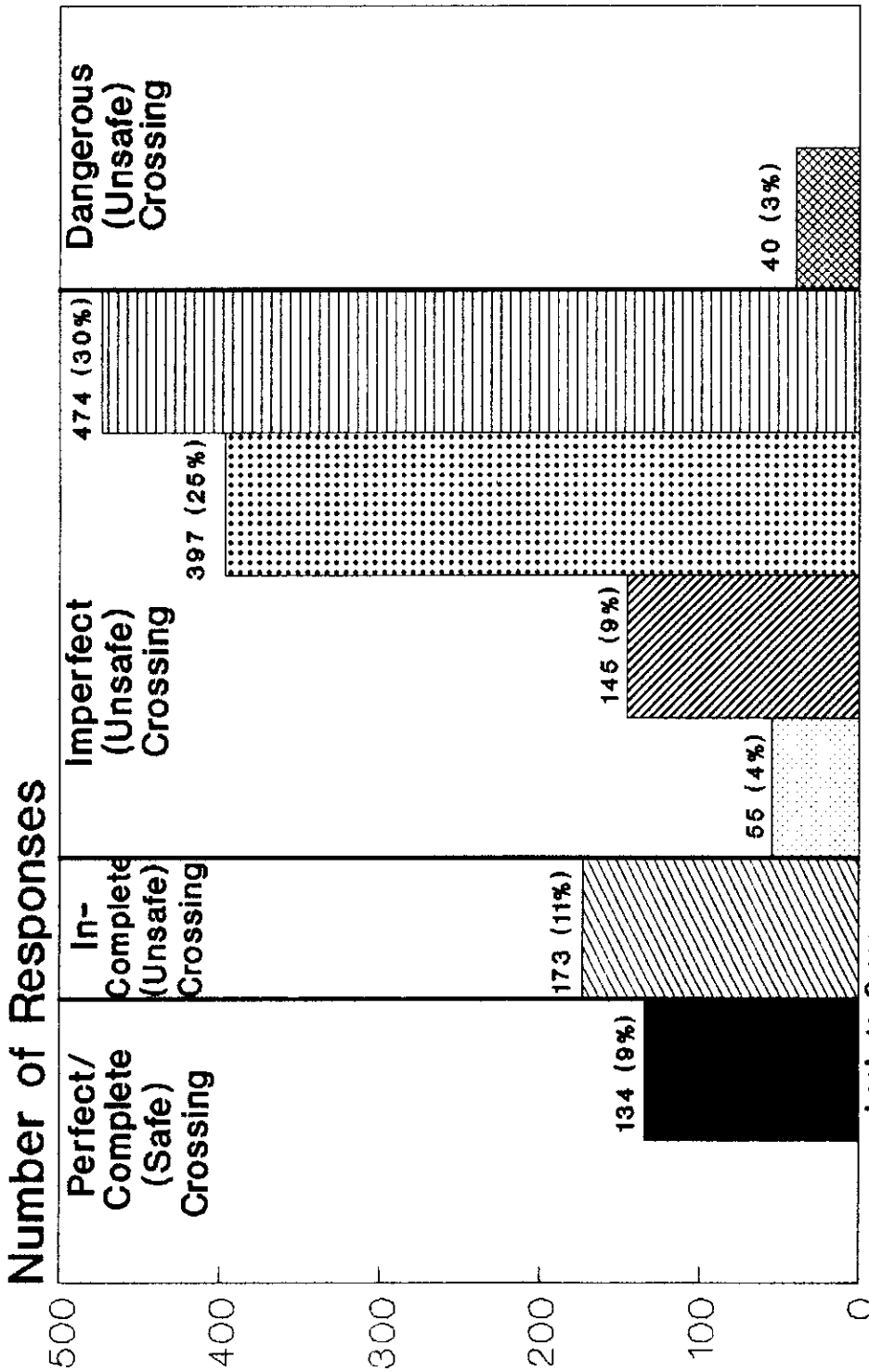

Fig 67: Stated crossing behaviours of school children (Cairo)

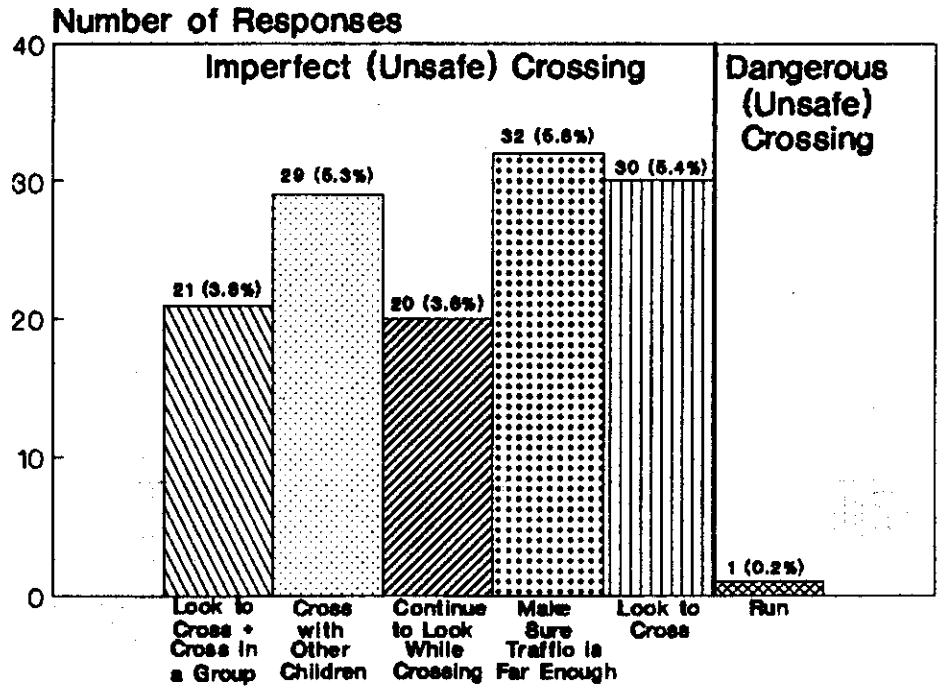

Fig 68: Imperfect and dangerous crossing behaviours of school childrn (Nairobi)

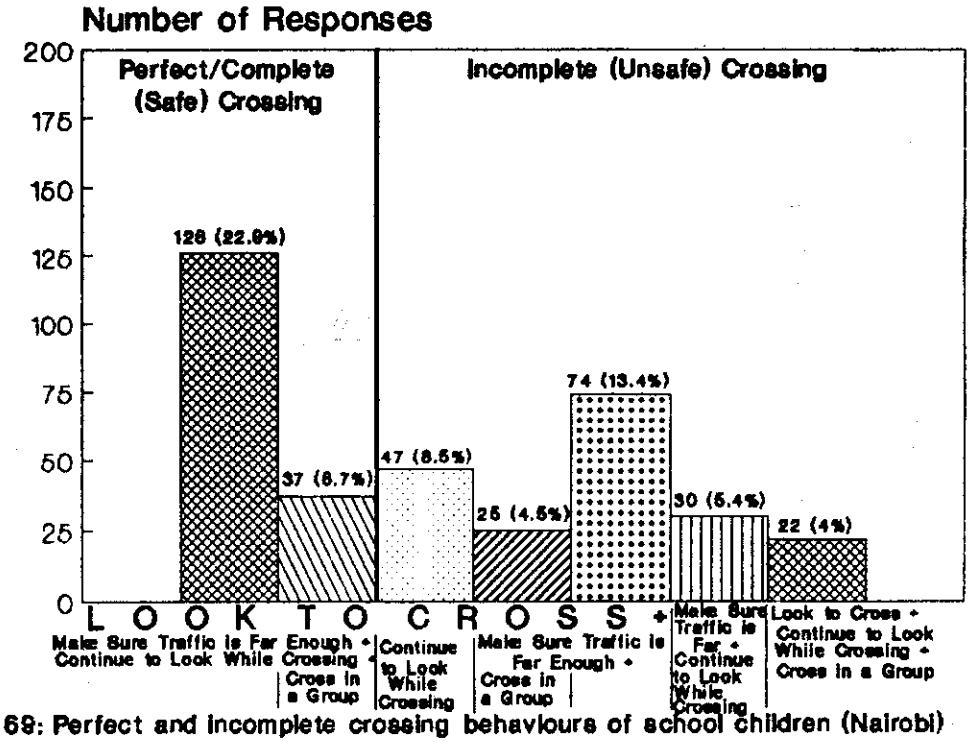

Fig 69: Perfect and incomplete crossing behaviours of school children (Nairobi)

4.6.4 Sources of School Children Traffic Knowledge/Training

153. The questionnaire was concluded by a question through which an attempt was made to infer the involvement of different parties towards the teaching of school children on how to deal with traffic. Sources listed include: parents, school, club, television, other. Children were allowed to mark more than one choice.

154. In Cairo, figure 70 demonstrates that 466 (30 percent) of the children stated the involvement of their schools, 339 (22 percent) stated the involvement of their parents, 287 (19 percent) stated the involvement of their schools and parents, and 222 (14 percent) stated the involvement of parents, school, and television.

155. On the other hand, in Nairobi, figure 71 demonstrates that 180 (32.7 percent) of the children stated the involvement of their schools and parents, 112 (20.3 percent) stated the involvement of parents, school, and television, and 63 (11 percent) stated the involvement of parents, school and other. In this respect it is fair to note that most of the "other" answers were related to the children traffic park in Nairobi. It is obvious from the above analysis that it is mainly the schools and parents who together share the responsibility for educating and training their children on how to deal safely with traffic.

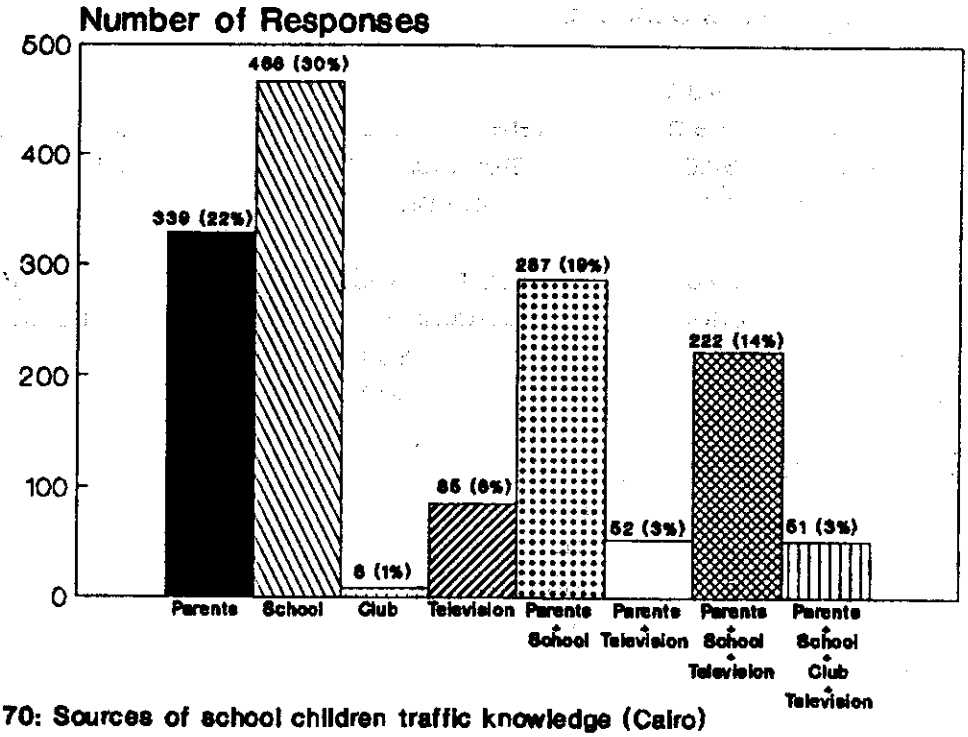

Fig 70: Sources of school children traffic knowledge (Cairo)

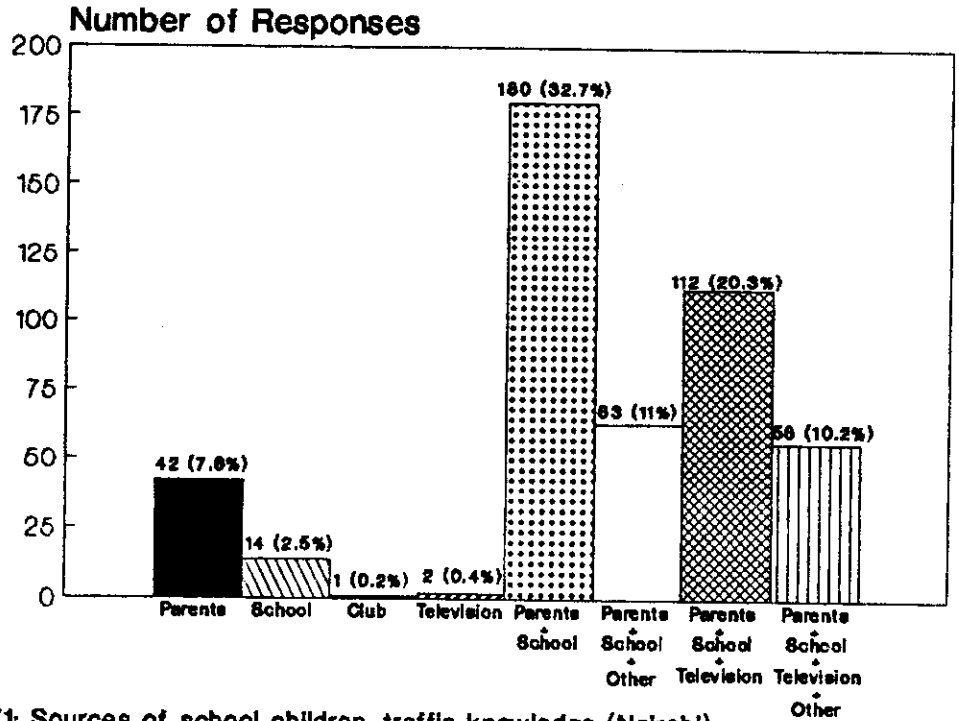

Fig 71: Sources of school children traffic knowledge (Nairobi)

4.7 General assessment of road traffic safety in Cairo and Nairobi

156. Based on experience gained from this study as well as the literature review, a set of criteria was developed that can be used when generally assessing the road traffic safety situation in any country/city as well as when comparing the traffic safety condition among countries. This set of suggested traffic safety criteria is displayed in the following table which semantically assessees the traffic safety situation in the cities of Cairo and Nairobi with particular emphasis on areas related to pedestrians and children safety.

Table 3: General assessment of road traffic safety in Cairo and Nairobi

City	Cairo	Nairobi
Criteria		
* National road safety research project	ASRT with TRRL	Kenya/Finland road safety improvement project
* Traffic safety research	Individual research at concerned university departments	Individual research at concerned university departments
* Traffic safety experts/academics	Exist	Exist
* Traffic safety lobbying	Exist but uncoordinated	Exist and relatively coordinated
* Non government organisations concerned with humanitarian issues and/or the environment	Exist	Exist
* Involvement of international road safety research organisations	TRRL (Overseas Unit)	FINNIDA, TRRL
* Non government organisations concerned with road safety	Egyptian Society for Road Safety (limited educative and information role)	
* Awareness of decision-makers and politicians for road safety	Relatively medium	Relatively medium
* National road safety body	Institute for Traffic Accident Research has just been established in 1994 within the traffic police department	National Road Safety Council since 1982,
* National general safety body	Do not exist	Do not exist
* Policies, targets, goals, objectives on road safety	Almost not existing	Relatively poor

* Accident reporting system	Detailed & Comprehensive 4 booklets (accident, technical, medical, economic)	Relatively detailed, One form (P41), see Lindfors, 1989
* Quality & quantity of completed forms	Far from good	Far from good, see Lindfords 1989
* Maintenance of accidents data-base	Discontinuous	Continuous though logistic problems with collecting P41 Very low returns from the provincial traffic police
* Dissemination of accident data	Tight	Accessible
* Accident analysis system	Micro-computer-based (MAAP), see Hills, 1984	Micro-computer based, (ADS), see Lindfords, 1989
* Identification of accidents locations patterns	Exist	Exist
* Identification of victims patterns	Do not exist	Do not exist
* Studies on road environment condition as related to safety	Few studies	Few studies
* Studies on vehicle condition as related to safety	Few studies	Few studies
* Studies on road-user behaviour as related to safety	Few studies	Few studies
* Studies on traffic characteristics as related to safety	Few studies	Few studies
* Studies on traffic legislation and enforcement	Few studies	Few studies
* Diagnosis of direct accidents causes	Sometimes undertaken	Sometimes undertaken
* Diagnosis of root accidents causes	Do not exist	Do not exist
* Identification of potential countermeasures	Exist but limited, see Gaber & Yarrell, 1990	Exist and implemented within available resources see Gekonge & Granberg, 1989
* Costing of safety countermeasures	Exist but limited, see see Gaber & Yarrell, 1990	Exist, see NRSC manual, 1990

* Valuation of traffic accidents	Exist (detailed collection of accident costs based mainly on gross output + a value for intangibles)	Exist based on national gross output, see NRSC, 1992
* Pre-evaluation of safety countermeasures	Rarely undertaken	Exist, see NRSC manual, 1990
* Post-evaluation of safety countermeasures	Exist but limited, see see Gaber & Yarrell, 1990	Exist, see NRSC manual, 1990
* Manual on local low-cost engineering countermeasures	Do not exist	Exist, see NRSC manual, 1990 but needs updating
* Liaison between traffic police and city engineers	Strong	Strong
* Traffic safety week	Do not exist	Exist
* Children traffic parks	Do not exist	Three parks exist (Nairobi, Kakamega, Kisumu), another is planned for Mombassa
* Radio and television programmes on road safety	A general weekly program entitled "World of Cars"	Weekly programmes on road safety
* Traffic safety posters and leaflets	Almost do not exist	Exist (well designed)
* Sperate traffic safety syllabus for school education	Do not exist	Do not exist
* Planned infusion of traffic safety education through other subjects in the educational curriculum	Do not exist, but sometimes accidental	Exist for all school stages
* Humps on school entrance roads	Not planned, sometimes exist	On school requests, city engineers construct humps
* School warning signs	Rarely exist	Exist
* Traffic signals	Exist and sometimes not functioning	Exist and at many times not functioning
* Operation of traffic signals	Traffic signals at main junctions/squares are automatically operated (pre-programmed fixed time phasing), other junctions & crossing facilities are manually controlled through traffic police presence	Automatically operated by city engineers, (pre-programmed fixed time phasing)

* Zebra crossings	Exist, but not honoured by drivers	Exist, but not honoured by drivers
* Pedestrian bridges & tunnels	A few number exist and in general are relatively under-utilised, except if physical barriers exist to prevent illegal crossing	A few number exist and in general are relatively under-utilised, except if physical barriers exist to prevent illegal crossing
* Sidewalks condition	Exist in medium physical condition, & mostly dirty	Narrow, in poor physical condition, dirty and mostly not existing
* Sidewalks space	Mostly occupied by parked vehicles, shop displays, hawkers	Mostly occupied by petty sellers/hawkers, parked vehicles
* Night Road lighting	Exist and sometimes not functioning	Almost do not exist
* Vehicle inspection	All vehicles	HGV and buses only
* On street vehicle inspection	All vehicles, rarely happens	All vehicles, sometimes happens
* Vehicle age importation restriction	Private cars should not be older than 3 years to be allowed inside the country	No age restriction
* Driving test pass rate	High	Medium
* Driving test theoretical part (Signs)	Well Observed	Well observed
* Driving test theoretical part (Highway Code)	Relatively Neglected	Well observed
* Driving test practical part	Involves driving & performing certain manoeuvres on a test track	Involves driving on the road
* Drivers respect to pedestrians	Limited	Limited
* Drivers respect to traffic rules	Limited	Limited
* Pedestrians respect to traffic rules	Limited	Limited
* Traffic police programme to visit schools and instruct children	Rarely exist	Exist
* Traffic legislation	Exist but need major improvements	Exist but need major improvements
* Traffic police presence in the streets	High presence even at automatically operated traffic signals	Medium presence

* Special training for traffic police	Exist	Exist
* High speed emergency service	One hospital being established with helicopter rescue service (private & government efforts)	Do not exist
* Private sector contribution	Do not exist	Exist through some international oil & car manufacturing companies
* Locally developed highway standards	Being finalised	Follow British design standards
* Inclusion of accident reduction benefits in highway project appraisals	Not included	Not included

V. FINDINGS AND CONCLUSIONS

157. In this study, a baseline assessment of the traffic safety situation for pedestrians and children in two African cities, namely Cairo and Nairobi was carried out. This is meant to improve the understanding of the pedestrian and children traffic safety problem, its root, direct and post causes. Based on this understanding and appreciation of the problem, this study aims at producing a future integrated safety package. This package is meant to prevent and reduce the potential of pedestrians and children accidents in urban areas.

158. The state of the art in traffic safety research and practice was presented, namely the framework for an integrated traffic safety approach. A comprehensive and detailed framework of all the functions and activities involved and their dependencies within the whole process of integrated safety management was developed. Patterns of pedestrians and children accidents, casualty rates, and severity indices in Cairo and Nairobi were identified and presented. This was followed by an in depth investigation of pedestrians and children accidents in the city of Nairobi. The report presents the results of questionnaire surveys that were specially designed with the purpose of measuring the traffic safety behaviour of pedestrians and school children and identifying their perception towards their pedestrian environment in Cairo and Nairobi. In addition a set of criteria was developed and used to generally assess the road traffic safety situation in the cities of Cairo and Nairobi with particular emphasis on areas related to pedestrian and children safety.

5.1 Findings pertaining to pedestrians and children traffic safety in Cairo and Nairobi

159. The following table presents a point summary of the results of the analysis of the pedestrians and children accidents and traffic behaviour surveys in Cairo and Nairobi.

Table 4: Findings of the pedestrian and children traffic safety study

CITY	**Cairo**	**Nairobi**
CRITERIA		
Pedestrians and Children Causality/Severity rates		
* Pedestrian casualty rate per 1000 inhabitants	N.A.	1.48
* Pedestrian casualty rate per 1 million Veh. Km.	N.A.	2.11
* Pedestrian casualty rate	69 percent	47 percent
* Children causality rate	N.A.	16 percent
* Macro pedestrian severity	5 percent	5 percent
* Macro children severity	N.A.	1 percent

* Micro pedestrian severity	8 percent	10 percent
* Micro children severity	N.A.	6 percent

Indicators for Traffic Exposure of Pedestrians by Journey Purpose

* Traffic experience of pedestrians (in terms of age)	20-30 years	20-30 years
* Perception of walking distance (work trip)	small	small
* Perception of walking distance (educational trip)	small	small
* Perception of walking distance (shopping trip)	main	main
* Perception of walking distance (recreation trip)	main	main

Stated Pedestrian Walking Behaviour

* Always walk along roads	17 percent	29 percent
* Sometimes walk along roads	52 percent	44 percent
* Rarely walk along roads	31 percent	27 percent
* Walk along roads with back to traffic	21 percent	10 percent
* Walk along roads with face to traffic	79 percent	90 percent

Perception of Pedestrians Towards Roads Crossing

* Crossing roads is easy	19 percent	35 percent
* Crossing roads is difficult	81 percent	65 percent

Stated Pedestrian Crossing Attitude		
* Choose only safe crossing points (traffic lights/zebra crossings)	48 percent	44 percent
* Choose safe and unsafe crossing points	52 percent	56 percent
Stated Pedestrian Crossing Behaviour		
* Perfect (safe) crossing behaviour	13 percent	13.9 percent
* Incomplete (unsafe) crossing behaviour	22 percent	30.4 percent
* Imperfect (unsafe) crossing behaviour	37 percent	22 percent
* Dangerous (unsafe) crossing behaviour	6.7 percent	15.4 percent
Perception of Pedestrians Towards Sidewalks Mobility Problems		
* Narrow width of sidewalks	1	3
* Grassy/dirty sidewalks	2	6
* Vehicles parked and occupying sidewalks' space	3	4
* Open gutters and/or uncovered electric wires	4	7
* Petty sellers and hawkers occupying sidewalks	5	2
* Unevenness of sidewalks	6	5
* Overcrowding of pedestrians on sidewalks	7	1
* Lack of sufficient sidewalks' lighting	8	8

Perception of Pedestrians Towards Crossing Safety Problems

* High speed of approaching vehicles	1	1
* Non-abidance of drivers to pedestrians' traffic rules	2	2
* Lack of enforcement	3	4
* Limited number of properly designed pedestrian crossings	4	3
* High level of kerbs	5	5

Sources of Pedestrians' Traffic Knowledge

* Myself	39 percent	31.5 percent
* Parents	31 percent	8 percent
* School	6 percent	13.5 percent
* Television	4 percent	Negligible
* Myself and parents	5 percent	4.9 percent
* Myself and television	3 percent	Negligible
* Myself and school	Negligible	14.5 percent
* Parents and school,	4 percent	12.9 percent
* Myself, parents and school	8.7 percent	Negligible
* Myself, parents, school and television	3 percent	2.6 percent

Indicators for Traffic Exposure of School Children

* Perception that distance from home to school is far	59 percent	49 percent
* Perception that distance from home to school is near	41 percent	51 percent

* Children coming to school on their own	65 percent	65 percent
* Children leaving school on their own	67 percent	65 percent
* Average age of surveyed children	10 years	11 years
* Average age at which children started to come/leave school on their own	7 years	8 years
* Average independent period of traffic exposure	3 years	3 years
* Arrive early at school	49 percent	67 percent
* Leave late from school	12 percent	36 percent
* Tendency to stay outside school on early arrival or late departure from school	High	Low
* Reasons for preferring to stay outside	Play and stand with friends	
* Reasons for staying inside	School does not permit staying outside	

Perception of School Children Towards Traffic

* Like to come to school on own	76 percent	63 percent
* Do not like to come to school on own	24 percent	37 percent
* Afraid of traffic on your way to/from school	56 percent	70 percent
* Not afraid of traffic on your way to/from school	44 percent	30 percent
* Afraid of traffic in front of school	66 percent	52 percent
* Not afraid of traffic in front of school	34 percent	48 percent

* Can deal with traffic on my own	74 percent	56 percent
* Can not deal with traffic on my own	26 percent	44 percent
* Crossing roads is easy	62 percent	57 percent
* Crossing roads is difficult	38 percent	43 percent
Stated Children Crossing Attitude		
* Look for certain places to cross roads from	69 percent	84 percent
* Do not look for certain places to cross roads from	31 percent	16 percent
* Hold hands when crossing roads with other adults	70 percent	68 percent
* Do not hold hands when crossing roads with other adults	30 percent	32 percent
Stated Children Crossing Behaviour		
* Always cross roads on own	51 percent	27 percent
* Sometimes cross on own	31 percent	61 percent
* Do not cross roads on own	18 percent	12 percent
* Perfect (safe) crossing behaviour	9 percent	29.6 percent
* Incomplete (unsafe) crossing behaviour	11 percent	35.8 percent
* Imperfect (unsafe) crossing behaviour	68 percent	23.9 percent
* Dangerous (unsafe) crossing behaviour	3 percent	0.2 percent

Sources of Children's Traffic Knowledge

* Parents	22 percent	7.6 percent
* School	30 percent	2.5 percent
* Club	Negligible	Negligible
* Television	6 percent	Negligible
* Parents and school	19 percent	32.7 percent
* Parents and television	3 percent	Negligible
* Parents, school and television	14 percent	20.3 percent
* Parents, school and other	Negligible	11 percent
* Parents, school, club and television	3 percent	Negligible
* Parents, school, television and other	Negligible	10.2 percent

5.2 Conclusions pertaining to pedestrians and children traffic safety in Cairo and Nairobi

160. The following presents a point summary of the conclusions of the analysis of the pedestrians and children accidents and traffic behaviour surveys in Cairo and Nairobi.

5.2.1 Accidents Diagnosis

* For the three districts in Cairo the average number of pedestrians casualties is almost 69 out of each 100 casualty i.e. more than all other types of casualties combined together (cyclists, motorcyclists, drivers, passengers).

* As for Nairobi city the average number of pedestrians casualties is almost 47 out of each 100 casualty i.e. almost equal to all other casualties combined together (cyclists, motorcyclists, drivers, passengers).

* For Nairobi city, the average number of children casualties (including all types of children traffic accidents) is almost 16 out of each 100 casualties.

* Macro severity index was computed as the number of pedestrians fatalities out of each 100 casualties. For the three districts in Cairo the average number of pedestrians fatalities is almost 5 out of each 100 casualty. As for

Nairobi city the average number of pedestrians fatalities is also almost 5 out of each 100 causalities, while the average number of children fatalities (including all types of children traffic accidents) is almost 1 out of each 100 casualties.

* Micro severity index was computed as the number of pedestrians fatalities out of each 100 pedestrians casualties. For the three districts in Cairo the average number of pedestrians fatalities is almost 8 out of each 100 pedestrians casualty. As for Nairobi city the average number of pedestrians fatalities is almost 10 out of each 100 pedestrians causalities, while the average number of children fatalities (including all types of children traffic accidents) is almost 6 out of each 100 casualties.

161. An in depth investigation of pedestrians and children accidents in the city of Nairobi has been carried out. The following is a point summary of this investigation.

* 346 (77 percent) of all pedestrians accidents occur to males while 45 (57 percent) of children accidents occur to boys. Males represent a high proportion of the working force and their walking activity is significant. Thus they have a higher traffic exposure and thus their liability for accident risk is higher than females.

* 68 (15 percent) of all pedestrians accidents are fatal, 109 (24 percent) are serious injuries, and 271 (61 percent) are slight injuries.

* 9 (11 percent) of children accidents are fatal, 22 (27 percent) are serious injuries, and 51 (62 percent) are slight injuries.

* Friday (i.e. the start of the weekend) represents the day when accidents are most frequent, where 83 (19 percent) of all pedestrians accidents and 17 (21 percent) of children accidents occurred that day.

* The highest proportion of pedestrians accidents took place between 17 and 18 hours. This is expected as this is the time when the working day in Nairobi ends and traffic and pedestrian volumes would be at their highest, thus vehicle/pedestrian conflicts would be significant giving more potential for accident occurrence.

* It was found that in almost all accident cases analysed, road related elements were in a positive condition having no defects. For example, 442 (98 percent) of roads where accidents occurred were tarmac, 426 (95 percent) were dry, 441 (98 percent) were smooth, 448 (99 percent) were with no potholes, 447 (99 percent) were with no damaged edges, 450 (100

percent) were not corrugated, 448 (99 percent) were with no loose stones, 437 (99 percent) had no road works.

* Roads with a width ranging from 6 to 8 meters represent a potential hazard for pedestrians, where 83 (24 percent) of accidents occurred on a 6.0 meter wide road, 63 (19 percent) occurred on a 7 meter wide road, and 86 (25 percent) occurred on an 8 meter wide road.

* 286 (64 percent) of all pedestrians accidents and 60 (73 percent) of children accidents have occurred at stretches of or along roads.

* 161 (36 percent) of all pedestrians accidents and 22 (27 percent) of children accidents have occurred at junctions. All junction accidents occurred at junctions where there were no traffic lights and almost no signs

* The T-junction type had 120 (75 percent) of all pedestrians accidents and 17 (77 percent) of children accidents occurrences. This is followed by the 4-arm junction where 19 (12 percent) of all pedestrians accidents and 2 (9 percent) of children accidents have occurred.

* The roundabout type of junction is the most safe in relative terms where only 13 (8 percent) of all pedestrians accidents and none of children accidents have occurred at this type of junction.

* 395 (88 percent) of all pedestrians accidents have occurred at day light and that 423 (94 percent) of all pedestrians accidents occurred in a clear weather.

* 191 (42.5 percent) of all pedestrians accidents and 37 (45 percent) of children accidents are inflicted by saloon cars. This is followed by pickup van where 82 (18 percent) of all pedestrians accidents and 25 (31 percent) of children accidents are inflicted by this type of vehicles. Ranking third are the matatus (micro-buses acting as paratransit mode), where 44 (10 percent) of all pedestrians accidents and 7 (9 percent) of children accidents are inflicted by this type of vehicles.

162. From analysing the accidents records it was found that of all pedestrians accidents:

* 125 (28.3 percent) were caused as a result of a driver error;

* 245 (55.4 percent) were caused as a result of a pedestrian error; and

* 72 (16.3 percent) were caused as a result of other causes.

163. As for children accidents the percentages were almost the same, where:

* 21 (25.6 percent) were caused as a result of a driver error;
* 49 (59.8 percent) were caused as a result of a child error; and
* 12 (14.6 percent) were caused as a result of other causes

164. Further in depth analysis has shown that the main causes for all pedestrians accidents that are related to drivers errors include:

* 47 (10.6 percent) have occurred as a result of excessive speed;
* 25 (5.7 percent) have occurred as a result of drivers misjudging clearance;
* 12 (2.9 percent) have occurred as a result of improper overtaking, and
* 10 (2.3 percent) have occurred as a result of other judgement errors.

165. The main causes for all pedestrians accidents that are related to pedestrians errors include:

* 162 (36.75) have occurred as a result of pedestrian(s) stopping/walking or running of footpath or verge into road;
* 51 (11.5 percent) have occurred as a result of pedestrians crossing the road wrongly; and
* 12 (2.7 percent) have occurred as a result of pedestrians crossing the road masked by stationery vehicles.

166. As for children accidents the main cause behind most of this type of accidents was identified as children stopping/walking or running of footpath or verge into road; where 49 (59.8 percent) of children accidents were a result of this cause.

5.2.2 Pedestrians Traffic Behaviour

* The older a pedestrian is the more likely that he/she has longer experience with traffic. Also, in general the older a person is the more cautious he/she becomes and the more he/she values life. Most of the surveyed pedestrians (in Cairo and Nairobi) fall within the age group of 20-30 years.
* One can look at traffic exposure of pedestrians in terms of the trips they make. Walking is perceived to represent a small part

of the pedestrians' journeys for work and education. On the other hand, walking represents a main part of pedestrians' journeys for shopping and recreation.

* Pedestrians have a tendency to leave the sidewalks and walk along the roads which increases the risk of a pedestrian being exposed to a traffic accident.

* Some pedestrians seemed to indicate that they walk along roads with their backs to traffic which further aggravates the potential risk of being exposed to a traffic accident.

* The majority of the surveyed pedestrians, indicated that they perceive crossing the roads in their cities to be difficult.

* Almost half of the surveyed pedestrians, have indicated that they would cross roads at traffic lights/mid-block pedestrian crossings i.e. zebra crossings. In general, one can categorise these choices as being a safe selection of a crossing point.

* The other half have indicated that they would tend to cross roads at any of the other unsafe points or a combination of safe and unsafe choice of crossing points. This represents a dangerous crossing attitude that might lead to the occurrence of accidents.

* In total 341 (13 percent) in Cairo and 82 (13.9 percent) in Nairobi can be classified as perfect (safe) crossing behaviour.

* In total 571 (22 percent) in Cairo and 179 (30.4 percent) in Nairobi can be classified as incomplete (unsafe) crossing behaviour

* In total 992 (37 percent) in Cairo and 130 (22 percent) in Nairobi can be classified in the imperfect (unsafe) crossing behaviour.

* In total 152 (6.7 percent) in Cairo and 91 (15.4 percent) in Nairobi can be classified in the dangerous (unsafe) crossing behaviour.

* The majority of the surveyed pedestrians in Cairo lay in the category of imperfect crossing, while in Nairobi the majority lay in the category of incomplete crossing. This leads us to suggest that there is a big deficiency in the traffic knowledge of pedestrians in Cairo and Nairobi. The high number of combinations related to crossing behaviour further demonstrates the lack of consistency and agreement on the right way to cross a road.

* Pedestrians in Cairo perceive the **narrow width of sidewalks** as the most serious problem that they encounter when moving on sidewalks. This is followed in order of seriousness by Grassy/dirty sidewalks; vehicles parked and occupying sidewalks' space; open gutters and/or uncovered electric cables/wires; petty sellers and hawkers occupying sidewalks; unevenness of sidewalks; overcrowding of pedestrians on sidewalks; and finally lack of sufficient sidewalks' lighting.

* On the other hand, pedestrians in Nairobi perceive the **overcrowding of pedestrians on sidewalks,** as the most serious problem that they encounter when moving on sidewalks. This is followed in order of seriousness by petty sellers and hawkers occupying sidewalks; narrow width of sidewalks; vehicles parked and occupying sidewalks' space; unevenness of sidewalks; grassy/ dirty sidewalks; open gutters and/or uncovered electric cables/wires; and finally lack of sufficient sidewalks' lighting.

* Problems related to limited sidewalks' space as a result of narrow width of sidewalks combined with high pedestrian densities as well as illegal occupation of sidewalks by hawkers and parked vehicles, all in all, result in discomfort and inconvenience for pedestrians, thus hindering their mobility along sidewalks. As demonstrated, this causes many pedestrians to leave the sidewalks and walk along the roads exposing themselves to the danger of being involved in a traffic accident.

* Pedestrians in both cities of Cairo and Nairobi perceive the **high speed of approaching vehicles** as the most profound problem that endangers their safety when attempting to cross roads. This is followed by **non-abidance of drivers to pedestrians' traffic rules** as the second serious safety problem encountered while crossing roads.

* For pedestrians in Cairo, these two problems are followed in order of seriousness by lack of enforcement; limited number of properly designed pedestrian crossings; and finally high level of kerbs.

* For pedestrians in Nairobi, these two problems are followed in order of seriousness by: limited number of properly designed pedestrian crossings; lack of enforcement; and finally high level of kerbs.

* As has been demonstrated in other studies, this study shows that few drivers are prepared to stop or even to slow down for pedestrians while crossing roads. Thus it could be true that pedestrians who totally depend on their traffic rights at crossing points can be at great risk because of drivers being less likely to stop for them.

* The majority of the surveyed pedestrians in Cairo and Nairobi have indicated that they have learned how to cross roads and generally how to deal with traffic by themselves. This demonstrates the almost non existence of any systematic official source for providing the necessary education, training and information related to traffic safety.

5.2.3 School Children Traffic Behaviour

* The older a child is the more likely that he/she has longer experience with traffic. The average age of the sample of children completing the questionnaire was 10 years in Cairo and 11 years in Nairobi

* It could be concluded that most of the surveyed children live far from school and that they come to and leave school on their own. Coming to and leaving school on their own involves a considerable part of children being exposed to traffic. The average age at which children started to come to and leave school on their own was 7 years in Cairo and 8 years in Nairobi.

* The average traffic exposure of school children in Cairo and in Nairobi is 3 years.

* Children arriving early at school and staying inside would not be exposed to traffic. However, it was noted that for various reasons children, specially in the case of Cairo, have a tendency to stay outside school mainly to be with their friends either standing or playing.

* On the other hand, both in Cairo and in Nairobi the majority of children feel that they would stay inside their schools because they would not be permitted to stay outside in accordance to their schools' regulations.

* A feeling of independence amongst the children is indicated where 1173 (76 percent) of the surveyed children in Cairo and 343 (63 percent) in Nairobi stated that they like to come to and leave school on their own.

* Children were not shy to spell out their feeling of fear of traffic on their way to their schools.

* In Cairo, 1033 (66 percent) of the children stated also their fear of traffic in front of their schools. However, in Nairobi the majority of the children 283 (52 percent) have indicated that they are not afraid of traffic in front of their schools.

* Regarding the main reasons stated by those children who indicated their fear of traffic, being involved in a traffic accident as well as children stating

their fear of cars travelling at high speeds were mostly cited in the Cairo case. This demonstrates the probable existence of potential problems in the locations of schools in Cairo and the traffic hazards present in front of these schools.

* Despite the generally stated feeling of fear from traffic, a feeling of independence was further emphasised when 1164 (74 percent) of the surveyed children in Cairo and 307 (56 percent) in Nairobi stated that they feel they can deal with traffic movement on their own,

* In Cairo, children perceived crossing roads to be easy. However, in Nairobi children have indicated that they perceive crossing the road as difficult.

* The majority of children in Cairo and in Nairobi stated that they would look for specific places to cross from and that they would hold hands when crossing roads with other adults. This demonstrates a safe positive traffic attitude of school children.

* In total 134 (9 percent) of surveyed children in Cairo and 163 (29.6 percent) in Nairobi can be classified as perfect (safe) crossing behaviour.

* In total 173 (11 percent) in Cairo and 198 (35.8 percent) in Nairobi can be classified as incomplete (unsafe) crossing behaviour

* In total 1071 (68 percent) in Cairo and 132 (23.9 percent) in Nairobi can be classified in the imperfect (unsafe) crossing behaviour.

* Those children who chose running, 40 (3 percent) in Cairo and 1 (0.2 percent) in Nairobi; were categorised in the dangerous (unsafe) crossing behaviour.

* The majority of the surveyed children in Cairo lays in the category of imperfect crossing, while in Nairobi the majority lays in the category of incomplete crossing. This coincides with the previously reached conclusion regarding pedestrians in Cairo and Nairobi. This leads us to suggest that there is also a big deficiency in the traffic knowledge of children as well in both Cairo and Nairobi. The high number of combinations related to crossing behaviour further demonstrates the lack of consistency and agreement on the right way to cross a road.

* It is mainly the schools and parents who together share the responsibility for educating and training their children on how to deal safely with traffic.

* Most of the schools in developing countries have a limited playground space. This hinders the running and playing of school children inside their schools. Children thus tend to play in front of schools.

* It was also observed that children tend to leave their schools in running groups, unaware of the traffic in front of their schools. Schools should be located on side lightly trafficked roads.

* In most schools, children receive a very limited traffic education.

VI. PROPOSED POLICIES AND MEASURES FOR IMPROVING TRAFFIC SAFETY FOR PEDESTRIANS AND CHILDREN

167. Based on the study results, background gained from the surveys, interviews conducted with officials, as well as reviewed literature, a set of policies and measures are suggested for improving the traffic safety situation for pedestrians and children in urban areas and to relieve the current problems that they face when walking along sidewalks or whilst crossing roads. These policies and measures are categorised as given below fields of action:

* Institutional;
* Urban and transportation planning;
* Educational;
* Training;
* Road and traffic engineering;
* Vehicle engineering;
* Legislative;
* Enforcement;
* Information;
* Health-related measures;
* School-related measures;
* Research-related measures.

168. These measures should not where deemed necessary have to be treated separately. As a matter of fact, any package of safety countermeasures should include measures from each of these fields of action. These should complement each other and work together in a supportive way so as to tackle the particular traffic safety problem, see figure 72.

6.1 Institutional measures

169. An institutional framework should be put in place to support and ensure continuity of road traffic safety activities in African member states. At the national level there is a need for setting up the following bodies:

(a) A National Road Safety Council to advise government on policy formulation for road safety activities.

(b) A Road Safety Unit to implement all programmes pertaining to road safety.

6.1.1 National Road Safety Council

170. The National Road Safety Council membership would cut across several government and nongovernmental bodies. Members could be drawn from:

* Ministry of Transport
* Municipalities and Local Authorities
* Ministry of Education, Schools, Parents
* Ministry of Justice
* Ministry of Public Health
* Traffic Police
* Traffic Safety Experts and Academics
* Ministry of Information (mass media including television, radio, newspapers)
* Other non-government organisations,
* Road user groups,
* Private companies (insurance, oil, car assembly and manufacturing companies)

171. This council should have support at the highest level in government and should also have a legal entity

6.1.2 Road Safety Unit

172. The Road Safety Unit could be located under ministerial cabinet of one of the most concerned ministries with safety such as the ministry of transport, or the ministry of interior. The unit should draw expertise from various institutions in the country such as transport academics, traffic police, road safety experts, psychologists, doctors, educationist, social workers, etc. The unit should also have provincial/district offices to provide a backup in the field.

173. One of the main tasks of the unit would be to promote road safety through the community and to help and encourage the formation of non-government voluntary organisations who are interested in road safety work.

6.1.3 Other Supportive Activities and Organisations

174. Certain steps, and activities are usually needed in order to set the right scene for the decision-makers and politicians to act towards the establishment of such bodies, see figure 73. Traffic safety lobbying as well as traffic safety research are vitally important in convincing decision makers of the importance for setting such bodies. Other organisations, international, intergovernmental and non governmental, and the donor community also have a major role to play in support of road activities through inter-alia, technology transfer through twinning arrangements, research, training and funding.

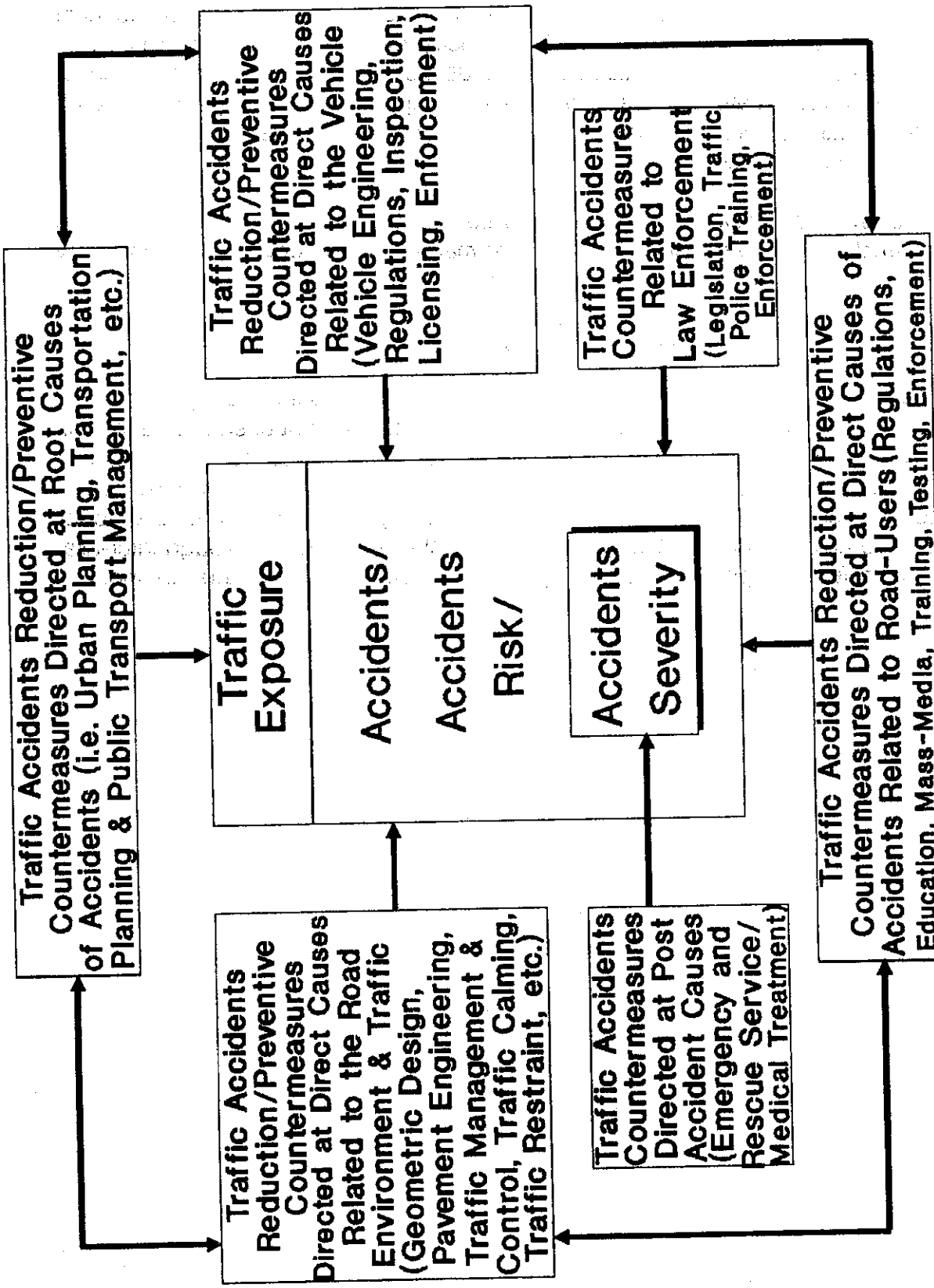

Fig 72: An integrated package of traffic safety fields of action and countermeasures

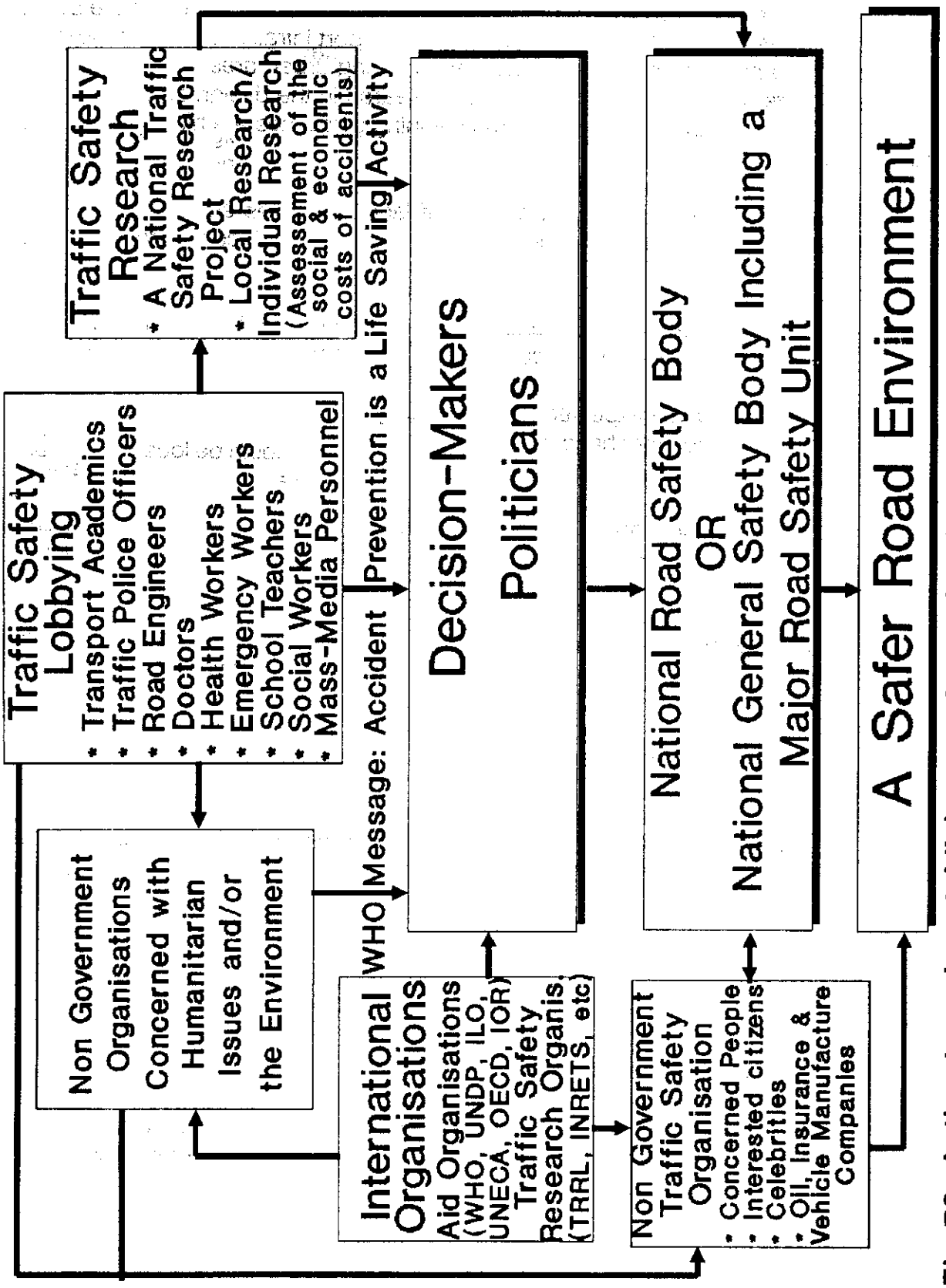

Fig 73: Action towards establishment of a national safety body

6.2 Urban and transportation planning related measures

175. The solution to the problem of preventing traffic accidents lies mainly in the better planning of our cities and the adequate provision of transport infrastructure and facilities. However, this is sometimes difficult to attain in the existing urban areas. Thus the need to reduce accidents will still require considerable research in the design and application of packages of safety countermeasures. Some planning guidelines are highlighted in the following points.

* Incompatible and mixed allocation of land use types should be avoided. Residential areas should be separated from industrial, commercial or office areas.

* Urban planners should consider a functional classification for the road network. More use of the cul-de-sacs grid system in residential areas.

* Activities that are expected to attract heavy traffic should be located on main roads. On the other hand activities expected to attract heavy pedestrian flow should be located on minor roads.

* Urban planners should consider land use plans that minimises the travelling distances, thus encouraging more pedestrian walking rather than vehicle traffic.

* Urban planners should consider in their city planning the possibilities of segregating the movement of pedestrians from that of vehicles.

* Land-use and transport planners should look at choosing safe locations for schools, and allocating substantial space for school playgrounds.

* Provision of better public transport facilities (in terms of fare, frequency, comfort, convenience, etc). This is meant to attract those people who are forced to walk long journeys as a result of their inability to use public transport.

* Provision of public transport facilities that offer a high level of service. These should be introduced to encourage the private-car users into leaving their cars and using public transport facilities.

* Car-pooling should be encouraged.

* All forms of city traffic restraint should be practised such as heavy parking fees, restricted parking areas, city entry tolls, staggered license plate entry, etc.

* Bus stops should be properly located after pedestrian crossing facilities so as to be accessible to pedestrians.

6.3 Education related measures

176. Points raised during meetings with headmasters/headmistresses and teachers included: perception of the problem of traffic safety for school children specially in front of the schools, extent of safety education at school (material, number of hours), school measures to reduce potential traffic hazards in front of their schools, .. etc. Realising that today children constitute a major part of today pedestrians as well as tomorrow drivers and pedestrians, the following set of policies and measures are advocated.

* Road safety should be a separate, graded subject at all schools.

* A strong commitment towards road safety education and training at schools is needed. Ministries of education should focus their efforts towards designing attractive educational and training materials with emphasis on pictorial material.

* Teachers' guidelines for instructing teachers on what and how to teach in terms of traffic safety should be developed.

* Road safety teaching should cover topics such as: where to play safely, how to cross roads, understanding traffic signs and signals, getting to school safely, identifying local dangerous spots, seeing and being seen by traffic, judging distances and speeds, etc.

* Involvement of experts in developing educational and training materials as well as in giving talks and lectures should be encouraged.

* Traffic safety education should be undertaken through community programmes for adults (parents and especially those just arriving from rural areas).

6.4 Training related measures

* Cognitive and perceptual skills as well as positive safe attitude towards road safety ought to be acquired and enhanced. Road safety training should be compulsory in schools. Training can be at simulated environment in the school yard or at traffic parks, or using audio-visual 3 dimensional films or computer simulation. Alternatively and more effective is to train children in real environment.

* Traffic gardens that simulate the real road conditions should be developed. In traffic gardens, children can be trained, through role play exercises, on how to deal with traffic situations.

* It is also of vital importance that children should be taken to suitable real road sites specially in the neighbourhoods of their homes and schools to learn and experience road safety.

* Planned and continuous training of trainers (teachers/ instructors/ people involved in community programmes) is an absolute necessity to efficiently and effectively perform their mission.

* Drivers should not be allowed to apply for a driving test except through driving schools certified to adequately teach and train drivers.

* A uniform nation wide driving instructions booklet should be developed.

* Drivers instructors should be well trained and they should apply for a certificate to become driving instructors. They should be carefully selected in accordance with a pre-set stringent selection criteria.

* Traffic safety personnel (technicians and engineers) should be trained for use of microcomputers for accident data coding and storage as well as for use of accident analysis software for accident data analysis, investigation and countermeasures scheme design and scheme monitoring.

6.5 Road and traffic engineering measures

* The prevention and reduction of accidents should be included in the appraisal of new road schemes (whether new construction, or improvement or maintenance of existing roads) on the basis that these schemes consider in their design and implementation the relevant road safety features.

* Maintenance and surface treatment of sidewalks and road defects, improvement of skid resistance, and reconstruction of severely damaged roads all should be continuously and properly undertaken.

* Sidewalks should be wide enough specially in heavily pedestrianised areas to allow for a more comfortable and easy movement for pedestrians.

* Kerbs should be dropped at pedestrians crossings to ease the crossing.

* Hazardous locations such as open gutters, open electricity kiosks should be fenced and visual and audible warning signs should be installed. Uncovered electric cables should be covered.

* Warning signs and speed control humps should be placed in front of schools.

* Segregated crossing facilities should be thoroughly evaluated and if found feasible should be implemented.

* Local manufacturing of traffic signals, road signs, road markings, guard fences should be encouraged. A traffic safety industry can develop that manufactures, installs and maintains these traffic safety features.

* Management of parking in terms of designating parking space away from highly pedestrianised areas so as to minimise the obstruction to pedestrians' crossing view as well as not hindering their movement on sidewalks.

* In general, all forms of self-enforcing road and traffic engineering measures should be introduced, the simplest of is to increase the number of traffic signals.

* Increase the number of uncontrolled crossing facilities accompanied by publicity and enforcement campaigns.

* Roads which are characterised by a dense pedestrian movement should be considered for full pedestrianisation and alternatives for re-routing traffic to other roads should be thought of.

* Traffic calming measures should be adopted. These measures are meant to reduce the number and the severity of pedestrian/vehicle conflicts.

* Road closure or limiting access in front of schools should be considered.

* On wide roads, stage the crossing through central refuge islands to allow pedestrians to negotiate one traffic stream at a time.

* More use of intersection designs that are speed-self reducing. These include: roundabouts, curves at T-junctions.

* Provide adequate road lighting.

* Maintenance of traffic control devices should well programmed.

6.6 Vehicle engineering measures

* Vehicle safety standards should be set.

* Mandatory regular inspection of all types of vehicles. This should determine road worthiness of vehicles in terms of safety and environmental hazards before being licensed for use on the roads.

* Inspection procedures should be stringent so as not to allow any vehicles with serious defects to operate on the roads.

* Old vehicles should be regularly inspected with the possibility of deciding that these are ultimately not road worthy.

* Maintenance programmes and management systems for the public bus fleet as well as the heavy good vehicles should be emphasised, developed and practised.

6.7 Legislative measures

* Drivers applying for driving licences should demonstrate their knowledge of pedestrian traffic rules and regulation. Inclusion of instructions on how to drive in front of schools in driving instruction booklets

* More tight and stringent driving tests that emphasise the practical as well as theoretical parts.

* Legislations that penalise pedestrians for violating traffic rules and regulations, such as crossing the carriageway at any location, should be issued.

* In general, traffic regulations should be consistently strengthened. Penalties should include: warnings, penalty points, on the spot fines, off the spot fines, traffic driving licence withdrawal, driving suspension, suspended imprisonment, revoking of driving licence.

* Highway codes should be updated and be more coherent and consistent.

* Traffic offenses should be clearly defined and penalties for these offenses should be specified.

* Legislation should be developed that strictly and totally prohibits drinking and driving.

* Standards pertaining to locally assembled and imported cars should be set in terms of age, condition and safety features.

* The court system pertaining to traffic violations should be mainly looking at major cases of traffic accidents or traffic violations. Traffic police should be given more powers to inflict on-the-spot penalties for speeding violations, parking violations, drink and drive violations, running of red lights, .. etc.

* Legislations should consider the rural-urban migration phenomenon characterising most of the developing countries. Rules and regulations should be produced to reduce and prevent this phenomenon. The main issue should be to prevent the spread of unplanned dwellings and areas around our cities.

6.8 Enforcement measures

177. Enforcement measures are fundamental in developing countries. Drivers as well as pedestrians are always reluctant to obey the rules unless they are self enforcing such as traffic lights, speed humps, median barriers, fences. Alternatively and complementary the presence of police officers and their strict enforcement of traffic rules and regulations is always expected to produce good results. As has been shown that traffic behaviour of drivers and pedestrians is a function of their traffic attitude, knowledge and experience. Strict and continuous enforcement is one of the key factors that can bring change to negative traffic attitudes and hence improve the behaviour of road-users towards a more safe traffic behaviour.

* A specialised traffic police unit/department should be established where it does not exist.

* Traffic police to be well trained and equipped. Training should include how to deal with an accident in terms of accident reporting, dealing with victims if any, clearing accident sites, etc.

* Man-power allocated to traffic police should be sufficient to deal both with traffic control as well as enforcing traffic violations.

* Enforce penalising and prohibiting illegal occupation of sidewalks whether by parked vehicles, stall holders, hawkers, petty-sellers, ribbon development on densely trafficked roads. Petty sellers and hawkers should be also totally prohibited from standing in front of schools.

* Strong and adequate enforcement of traffic laws in front of school entrances.

* Crossing police patrols to be located at busy crossing points to assist children to cross these roads while coming to and leaving their schools.

* Increasing the number of uncontrolled traffic management facilities, accompanied by continuous publicity campaigns should be also accompanied at the start by an advisory campaign which is followed after sometime by a strict enforcement campaign.

* A traffic police officer should be present at the times of start and finish of school day so as to ensure the safe crossing of children. This is particularly important for those schools whose entrances are on heavily trafficked roads.

6.9 Information and mass media related measures

* Promoting the awareness and courtesy of drivers towards pedestrians. Mass-media campaign slogans should be carefully selected and targeted correctly.

* Promoting and raising the society awareness of the potential traffic hazards and problems encountered by school children.

* An annual traffic week or a monthly traffic day should be produced. This involves concentrated mass media campaign on traffic safety aspects, press articles, exhibitions, school competitions, posters, and leaflets and pamphlets. Television and radio interviews with officials responsible for traffic safety such as traffic police officers, academics, city engineers, doctors, teachers

* Media campaigns should concentrate on disseminating knowledge to the public regarding the safe use of the road, as well as attempting to change unsafe traffic attitudes

6.10 Health related measures

* Quick emergency service using latest equipment for communication, well trained first aid officers, and high speed mode for victim transportation (sometimes even helicopters if nearest hospital is relatively far).

* Small well equipped medical centres that are specialised in dealing with accident emergency should be located in different areas so as to minimise the time of transporting the victim from accident sites to the medical centres.

6.11 School related measures

* Schools should attempt to choose their entrances to be at lightly trafficked side-roads as well as stagger and select off-peak traffic hours for the start and the end of the school day.

* Schools should keep their gates opened from early morning before the starting school hours and until late evening after the end time of the school day.

* Children should be prohibited to stay outside school.

* Schools with school bus fleets should separate children using the school buses and those children picked up by their parents.

* If space allows, schools are advised to allocate parking spaces for parents who come to pick up their children.

* On dropping children from school buses, bus drivers should ensure dropping children on the right side.

6.12 Research related measures

* Research organisations in the field of transportation and traffic engineering should be established. These organisations should be responsible to perform the following tasks:

  - Develop a unit of highly educated, well trained academics and professionals in the field of transportation and traffic engineering;

  - Conduct specialised research in the areas of transportation and traffic engineering including road safety;

  - Organise training courses, seminars, lectures for engineers, professionals and technicians whose work is related to the areas of transportation and traffic engineering;

  - Act as a consultant for undertaking transportation and traffic related studies including traffic safety studies;

  - Establish research linkages and contacts with international organisations and international research centres;

- Develop and update specialised libraries through which access and dissemination of research publications, information could be maintained ; and

- Organise national and international conferences

* Most traffic safety research ends up by a set of recommendations and measures to be implemented. If these are not implemented, then the evaluation of the effectiveness and efficiency of remedial measures would remain unidentified.

* Specialised transport and traffic research institutes as well as universities should be constantly encouraged and supported. Special research grants to conduct traffic safety research should be offered and consistency maintained.

* A reliable accident data base is crucial for any safety research. Attention needs to be given to the whole process of accident data collection, storage, and analysis to systemise this process and ensure that it is functioning in an adequate and efficient manner. Inadequacies of some present data collection systems include carelessness in completing the accident reporting forms, difficulty in reading third/fourth carbon data recording form, incomplete forms, unclear accident sketches. Errors in data coding and data storage is also very common, as well as sometimes the forms are not at all coded and the accident data-base is not updated.

* Easy and accessible dissemination of accident data to all interested organizations/individuals who need to use the data particularly for research.

6.12.1 An Action Plan for Further Studies

178. Traffic safety research in general ought to address the following:

(a) Future research should be mainly directed at all the activities and functions constituting the integrated traffic safety approach, how to perform these activities in an efficient organised way and how these activities should be coordinated to work together within the framework of an integrated traffic safety approach. This involves research in the following areas:

* Accident reporting systems

* Development and updating of data bases on road traffic accidents and use of a computer based accident analysis and investigation system

* Identification of accident locations and victims patterns

* Diagnosis of direct, root and post causes of accidents including studies on:

  - urban planning and transportation planning and management as related to traffic safety
  - road environment condition as related to traffic safety
  - vehicle condition as related to traffic safety
  - road user behaviour as related to traffic safety
  - pedestrian and vehicle traffic characteristics
  - traffic legislation (rules and regulations) and their enforcement.
  - post accident emergency, medical treatment and trauma management.

* Setting of safety goals/objectives

* Identification of potential safety countermeasures (with a special emphasis on the applicability of low cost countermeasures)

* Costing of safety countermeasures

* Valuation of traffic accidents

* Evaluation of safety countermeasures

* Development of integrated packages of safety countermeasures

* Coordination of the implementation of integrated traffic safety packages

* Operation and implementation of the integrated traffic safety action program

* Dynamic monitoring of the effect of integrated traffic safety packages.

* Post evaluation of integrated traffic safety packages.

* Development of an information base on safety countermeasures and packages

(b) Research should be also looking at the integration of traffic safety countermeasures within a wider framework that encompasses other major activities such as urban planning, environmental protection, traffic management, transportation management, ..etc.

179. Research pertaining to pedestrian and children safety ought to address the following

(a) More road users behavioural studies to look at:

* the exact kind of relationship between knowledge, cognitive processes and attitudes or motivation of drivers and pedestrians.

* the development process with respect to formation of traffic attitudes

* the way differences between gender, age, socio-economic levels, culture, level of education of road users affect their traffic behaviour.

(b) School children as well as pedestrians should be monitored in real world situations. This can be achieved by personal documented observations, and/or monitoring using video cameras. These observations together with the interpretation of the video films recordings can be analysed for the purpose of inferring the pattern of actual traffic behaviour of school children and pedestrians as well as the difficulties that limit their mobility and the traffic hazards that they encounter.

(c) Future research should attempt to identify and define the adequate desired traffic behaviour for school children and pedestrians. The expected gap between the actual levels of traffic behaviour and the factors affecting it and the desired levels can then be identified both in a quantitative and qualitative terms.

(d) Future studies should also look at the level of service of pedestrian movement on sidewalks and while crossing roads (volume, density, speed, delays).

(e) Further studies should be looking at drivers stopping behaviour at junctions and pedestrian crossings facilities as well as at drivers knowledge of pedestrian rules.

(f) Inventories describing the traffic environment around schools and in areas characterised by a high density of pedestrian movements should be developed.

(g) Studies aiming at establishing the institutional arrangements that suits a particular country for dealing with traffic safety issues.

(h) Studies aiming at developing manuals and handbooks for urban and transportation planners to take into account the traffic safety of pedestrians and children in their physical and transportation plans.

(i) Studies into the development of traffic safety educational material as well as developing innovative ways of traffic safety training.

(j) Studies looking at the potential application of road and traffic engineering designs that are mainly developed to cater for pedestrians and not for cars, i.e. self enforcing measures, traffic calming and traffic restraint design principles.

(k) Studies looking at the vehicle condition, maintenance, inspection and licensing.

(l) Studies looking at legislative rules and regulations that ensures the traffic safety of pedestrians and the safe behaviour of both drivers and pedestrians.

(m) Studies looking at enforcement measures that help in enforcing traffic rules and regulations pertaining to pedestrians.

(n) Studies directed towards the design of mass media and information campaigns through which traffic safety knowledge can be disseminated and behavioural changes can be brought about.

(o) Studies directed at how to improve the emergency and rescue service, and the pre-accident medical treatment.

(p) It is crucial to value traffic accidents so as to economically evaluate the worthiness of remedial measures for improving . In valuing children traffic accidents, several quantitative as well as qualitative factors ought to be

considered. Basically the notion of "Children being the Future of Tomorrow" has to be emphasised. Studies looking at valuing traffic accidents should be initiated.

(q) Assessment of the utility of pedestrian bridges and pedestrian tunnels in terms of justification and the problems that discourage pedestrians from using these facilities.

(r) Studies directed at improving the pedestrian environment for all types of pedestrians especially catering for the needs of highly vulnerable road users i.e. the elderly and the mobility handicapped, see Mabrouk and Abbas 1994.

ACKNOWLEDGEMENT

This study was carried out between 10 October and 2 December 1994 by Dr. Khaled A. Abbas, Transportation Consultant, Cairo, Egypt. The part of the study concerned with the traffic behaviour of school children in Cairo is based mainly on a paper entitled **"Traffic Behaviour of School Children in Cairo: Implications for Road Safety",** co-authored by Dr. Abbas and two of his colleagues and recently published, see Abbas et al. (1994).

REFERENCES

* Abbas K. A., and M. G. H. Bell (1994) System Dynamics Applicability to Transportation Modelling. In Journal of Transportation Research (A): Policy and Practice. Vol. 28A, No. 5. Pergamon Press, U.K. pp. 373-400

* Abbas K. A., Mabrouk I., and Al-Araby A. K. (1994) Traffic Behaviour of School Children in Cairo: Implications for Road Safety. Proceedings of the 22nd Planning and Transport Research and Computation (PTRC) European Transport Forum, Seminar J, Traffic Management and Road Safety, Warwick, U.K. pp. 83-99.

* Downing A. J., Sayer I. A., and Zaheer-ul-Islam M. (1993) Pedestrian safety in the developing world. Transport and Road Research Laboratory PA/OSC/006/93, Project reference R5615/7.3, Overseas Unit, Transport and Road Research Laboratory, U.K.

* Egyptian Academy for Scientific Research and Technology (ASRT) (1991) Road Traffic accident analysis. Final Report, ASRT, Transport and Communications Research Committee.

* Gaber A. M., and Yerrell J. S. (1991) Road safety research in Egypt. International Conference for Road Safety and Accidents in Developing Countries. The Academy of Scientific Research and Technology (ASRT), Cairo, Egypt. pp. 1-19

* Gekonge N. N., and Granberg T. (1989) Improving road safety by low-cost engineering countermeasures. Second African Road Safety Congress. United Nations Economic Commission for Africa/Organisation for Economic Cooperation and Development. Addis Ababa, Ethiopia. pp. 251-263.

* Gichaga F.J., and Kipkore S.K. (1980) The study of violation of traffic laws in selected roads in Nairobi. The Fourth African Highway Conference, Nairobi, Kenya.

* Hills B. L., and Jacobs G. D. (1981) The application of road safety counter-measures in developing countries. Traffic Engineering and Control, 22(8/9), pp. 464-468.

* Hills B.L., (1984) A microcomputer road accident analysis package for developing countries. First African Road Safety Congress. United Nations Economic Commission for Africa/Organisation for Economic Cooperation and Development. Nairobi, Kenya.

* Hills P. J., and Jones-Lee M. (1981) The costs of traffic accidents and evaluation of accident prevention in developing countries. Proceedings of the 9th Planning and Transport Research and Computation (PTRC) Summer Annual Meeting, Warwick, U.K.

* Institution of Highways and Transportation (IHT) (1990) Highway safety guidelines: Accident reduction and prevention (International Edition), London, U.K.

* Jacobs G.D., and Sayer I.A. (1977) A study of road accidents in selected urban areas in developing countries. TRRL Report LR775, Transport and Road Research Laboratory, U.K.

* Jacobs G.D., Sayer I.A. and Downing A.J., (1981) A preliminary study of road user behaviour in developing countries. Transport and Road Research Laboratory Supplementary Report 646. Transport and Road Research Laboratory, U.K.

* Lindfors K. (1989) Accident Data Systems - ADS, Kenya - Finland road safety project. Second African Road Safety Congress. United Nations Economic Commission for Africa/Organisation for Economic Cooperation and Development. Addis Ababa, Ethiopia. pp. 200-213.

* Kwamina-Duncan J.W., Noel L.P., and Soin S.S. (1975) A review of road traffic accidents in Nairobi 1968-1973. University of Nairobi.

* Mabrouk I., and Abbas K. (1994) Pedestrian Environment Problems Encountered by the Mobility Handicapped in Cairo. Proceedings of the 22nd Planning and Transport Research and Computation (PTRC) European

Transport Forum, Seminar J, Traffic Management and Road Safety, Warwick, U.K. pp. 101-111.

* Miyanji O.M. (1975) Road traffic accidents in Kenya and in the Capital City Nairobi (With special emphasis on road traffic accidents to children under 12 years of age). University of Nairobi.

* Miyanji O.M. (1976) Road safety and preventive aspects. University of Nairobi.

* National Road Safety Council of Kenya (NRSC) (1990) Manual on accident prevention using low-cost engineering countermeasures. Ministry for Foreign Affairs, Finland - Finnconsult Consulting Engineers, Finland - Ministry of Public Works, Nairobi, Kenya.

* National Road Safety Council of Kenya (NRSC) (1992) Road accident costs in Kenya. Ministry of Public Works, Nairobi, Kenya.

* Organisation for Economic Co-operation and Development (OECD) (1984) Integrated road safety programmes. OECD, Paris.

* Organisation for Economic Co-operation and Development (OECD) (1990) Integrated traffic safety management in urban areas. OECD, Paris.

* Ross A., Baguley C., Hills B., McDonald M., Silcock D. (1990) Towards safer roads in developing countries: a guide for planners and engineers. Overseas Unit, Transport and Road Research Laboratory. U.K.

* Silcock D. T., and Walker R. T. (1981) The evaluation of accident countermeasures for application in residential areas. Transport and Operations Research Group Report No. 39. University of Newcastle upon Tyne, U.K.

* Silcock D. T. (1982) The procedure adopted in various countries for estimating the cost of traffic accidents or valuing their prevention, Transport Reviews, 2(1), pp. 79-106.

* World Health Organisation (WHO) (1989) New approaches to improve road safety. Report of a WHO study group, World Health Organisation Technical Report Series 781, Geneva, Switzerland

* United Nations Economic Commission for Africa (UNECA) (1989) Road safety manual on low - cost engineering countermeasures.

APPENDIX I
QUESTIONNAIRE FOR PEDESTRIANS' TRAFFIC SAFETY

For Official Use

Date:

Time:

6-12 A.M.

12-6 P.M.

Classification of survey location

Square/Round-about

Signalised intersection

Un-signalised intersection

A road between two intersections

Name of survey location:.....

QUESTIONNAIRE FOR PEDESTRIANS' TRAFFIC SAFETY

Dear Friend,

This is a questionnaire specially designed to identify the problems that might endanger your safety while walking on sidewalks or while crossing roads. We would very much appreciate your response to this questionnaire. Note that all questions are choice questions where you can mark your answer by a tick. Questions 8 and 12 are ranking questions where you can put your ranking numbers starting by rank (1) for most difficult (serious).

1. Gender:

   Male
   Female

2. Age:

Age Category	**Choice**
15 - 20	
20 - 30	
30 - 40	
40 - 50	
50 - 60	
More than 60 years	

3. Level of Education:

Level of Education	**Choice**
Illiterate	
Primary/Preparatory school	
Secondary school	
Higher education	
Postgraduate	
Other, please state	

4. Employment or current activity:

Employment	**Choice**
Employed with the government	
Employed with the private sector	
Self-Employed	
On pension	
Unemployed	
Student	
Other, please state	

5. Please indicate the extent of your walking trips for each of the following journey purposes.

Journey Purpose	**Main**	**Small**
Work		
University/College		
Shopping		
Recreation		

6. How frequently do you have to leave sidewalks and walk along roads?

Always
Sometimes
Rarely

7. While walking along roads, do you walk with your

Back to traffic
Face to traffic

8. Rank the following problems in their order of priority in hindering your mobility along sidewalks

Sidewalks' Problems	**Ranking**
Narrow width of sidewalks	
Unevenness of sidewalks	
Grassy/dirty sidewalks	
Open gutters/uncovered electric wires	
Vehicles parked on sidewalks	

Petty sellers and Hawkers occupying sidewalks
Overcrowding of pedestrians on sidewalks
Lack of sufficient sidewalks' lighting
Other, please state

9. Is crossing the road:

Easy
Difficult

10. What do you do when you cross the road? (More than one choice can be marked)

When crossing roads, I	**Choice**
Look to cross	
Make sure traffic is far enough	
Continue to look while crossing	
Cross in a group with other people	
Cross on stages and manoeuvre vehicles	
Run	

11. Where do you usually cross roads

Location chosen for crossing	**Choice**
At Traffic Lights	
At Junctions	
At any point	
At mid-block pedestrian crossings away from junctions	
At approaches/exits of bridges	

12. Rank the following problems in their order of priority in terms of endangering your safety while crossing roads

Roads' Crossing Problems	**Ranking**
High speed of approaching vehicles	
Lack of enforcement	
Limited number of properly designed pedestrian crossing	
High level of kerbs	
Non-abidance of drivers to pedestrian traffic rules	
Other, please state	

13. Who taught you to cross roads? (More than one choice can be marked)

I learned about crossing roads from	**Choice**
Myself	
Parents	
School	
Television	
Other	

14. Do you own a private car:

Yes
No

15. Thank you for you cooperation towards completing this questionnaire, we appreciate if you could state any suggestions or comments that can help to enhance and improve the safety aspects of the pedestrian environment in Cairo.

APPENDIX II

QUESTIONNAIRE FOR SCHOOL CHILDREN TRAFFIC SAFETY

For Official Use

* Date:

* Name of School:

* School Location (District/City/Country):

* Level of Education Offered by School:

Education Level	**Choice**
Primary	
Preparatory	

* System of School:

School System	**Choice**
Public	
Private	

* Type of School

School Type	**Choice**
Boys	
Girls	
Mixed	

* Number of Classes:

* Number of Students:

* School Times

Start Time:
Finish Time:

QUESTIONNAIRE FOR SCHOOL CHILDREN TRAFFIC SAFETY

Dearest Son/Daughter,

Please choose an answer and mark it for the following questions

1. I am a

   Boy
   Girl

2. How old are you?

   .....Years

3. Is school far from home?

   Yes
   No

4. How do you come to - leave from - school?

	Coming	**Leaving**
On my own**		
School bus		
With my parent in the car		
With my parent on foot		
With another person on foot		
Other, please mention		

** **Please write your age when first permitted to come to - leave from - school on your own?**

..... Years

5. When do you usually arrive at - leave from - school?

	Arrive at school	**Leave from school**
Early		
On time		
Late		

6. When you stay outside school, why do you stay outside school?

Why do you stay outside school?	**Choice**
Play with friends	
Stand with friends	
Eat at small shops	

7. When you stay inside school, why do you stay inside school?

Why do you stay inside school?	**Choice**
Afraid of cars outside school	
Play with friends inside school	
School does not permit staying outside	

8. Do you like coming to - leaving from - school on your own?

Yes
No

9. Are you afraid of the movement of cars while coming to - leaving from - school?

Yes Why?.....
No Why?.....

10. Are you afraid of the movement of cars in front of school?

Yes Why?.....
No Why?.....

11. Do you feel that you can deal with the movement of cars on your own?

Yes
No

12. Is crossing the road:

Easy
Difficult

13. Do you choose certain places to cross roads from?

Yes
No

14. When you cross the road with an another person do you hold his/her hands?

Yes
No

15. Do you cross roads on your own?

Yes, always
Yes, sometimes
No

16. What do you do when you cross the road? (More than one choice can be marked)

When crossing roads I	**Choice**
Look to cross	
Make sure traffic is far enough	
Continue to look while crossing	
Cross in a group with other children	
Run	

17. Who taught you to deal with cars in the roads? (More than one choice can be marked)

I learned how to deal with traffic from	**Choice**
Parents	
School	
Club	
Television	
Other	

Points to be raised in the open ended interviews with schools' officials

1. Perception of the problem of traffic safety for school children and specially in front of the schools

2. Extent of safety education at school (material, number of hours)

3. School measures to reduce potential traffic hazards in front of their schools

4. School safety records

5. Suggestions to improve the situation