THE BEHAVIOUR OF CHILD PEDESTRIANS

at

DARWIN PRIMARY SCHOOLS

Prepared by:

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For

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Abstract

The purpose of the research was to examine the effect that the education program *Out and About* had on the behaviour of child pedestrians as they travelled to and from Darwin primary schools. The study primarily focussed on children's level of compliance to road crossing behavioural elements. Pre and post education observation sessions were conducted at 16 schools, resulting in 3198 subject observations. It was found that all subjects had a low compliance rate to three critical road crossing behavioural elements: stopping at kerbside; observing for traffic prior to crossing the road; and monitoring traffic while crossing the road. Emanating from the study are 14 recommendations.

Keywords

Education	School	Children	Pedestrians	Video
Behaviour	Unobtrusive Observations		*Out and About*	

Notes

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- (c) reports based on analyses of FORS' statistical data bases are published in the SR series;
- (d) minor reports of research conducted by other organisations on behalf of FORS are published in the MR series.

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EXECUTIVE SUMMARY

This study, undertaken in 1993-1995, investigated the teaching of the road safety program *Out and About* to determine the effect it had on the pedestrian behaviour of children as they travelled to and from Darwin primary schools.

Contents of the chapters in this report are as follows:

Chapter 1

In this Chapter is an outline of the concept of health promotion is provided. Comments are made on the consequent refocussing of health priorities and strategies designed to promote the health and well-being of Australians. Information is presented on the specific health problem and magnitude of childhood unintentional injury. The relationship between children, learning and pedestrian safety education offered in Darwin Primary Schools Education Programs by the Road Safety Council of the Northern Territory (NT) is examined.

Chapter 2

Literature pertaining to child pedestrian safety and behaviour, in particular, the elements associated with road crossing and the effect road safety programs have on this behaviour, is examined and discussed in this Chapter. Therefore, this literature review is selective rather than all encompassing. Specifically, the literature review pays attention to: Piaget's theory of cognitive development; physical, cognitive and behavioural capabilities and limitations of children as pedestrians; adult pedestrians as role models; adults' expectations of children as pedestrians; task analysis of child road crossing behaviour; and an overview of road safety education programs and their effectiveness on children's behaviour.

Chapter 3

The purpose of this research was to examine child pedestrian behaviour, in particular road crossing activities, before and after exposure to the road safety education program *Out and About*. In this Chapter a summary is made of the development, design, implementation and evaluation of the program. Further information is drawn from an evaluation conducted by Rush and Castor (1989,1988) of the primary school package.

Chapter 4

Details of the study methodology form the basis of this Chapter. Aspects outlined are: a brief description of the pilot study; resultant design and methodology of the main study; processes

involved in identifying and negotiating with schools to participate in the study; format used for analysing the data; procedures undertaken to gain approval to engage in the research; and limitations of the study.

Chapter 5

Results of the research observation sessions on primary school children's pedestrian behaviour and analysis of the data are presented in Chapter 5. Initially, subject demographic, context environmental, school demographic and extraneous variable results are presented. Subjects' road crossing behaviour, in relation to the *Out and About* program, forms the latter part of this Chapter.

Chapter 6

This Chapter has two main components: interpretation of the results using an epidemiological framework; and limitations of the results for general application.

Chapter 7

Based on data analysis and subsequent discussions, fourteen (14) recommendations are outlined in this Chapter.

Finally, this report found that all subjects had a high compliance rate to the following road crossing behavioural elements:

- refrained from crossing between parked vehicles;
- crossed within designated area;
- view of approaching traffic not obstructed by vehicle parked on left;
- view of approaching traffic not obstructed by vehicle parked on right;
- crossed the road at walking pace;

and

- crossed the road at a right angle to the kerbside, that is, straight.

There was poor compliance to the elements:

- stopped at kerbside prior to crossing the road;

- appeared to monitor traffic by moving head to the right-left-right, prior to crossing the road;

and

- appeared to monitor the traffic whilst crossing the road.

The results of this study indicate that, as taught at the time the research was conducted, the road safety program *Out and About* did not have any obvious beneficial effect on the behaviour of child pedestrians as they travel to and from Darwin primary schools.

SUMMARY OF RECOMMENDATIONS

Title	Recommendation Number	Recommendation
Teaching of the *Out and About* Program to Children (page 90)	1	The road safety education program *Out and About*, as presented to Darwin primary school children, should be expanded to incorporate appropriate behavioural modification format and techniques.
Road Safety Education in Darwin primary schools (page 90)	2	Road safety education programs, as offered by the Road Safety Council of the Northern Territory to primary schools in the Darwin area, are made a compulsory subject within the school syllabi.
Traffic Observance at Intersection and T Junctions (page 91)	3	Kerbside drill be broadened to include teaching children to look behind prior to and whilst crossing the road at an intersection or T junction.
Primary School Teachers' Road Safety Education In-service (page 91)	4	In collaboration with the Road Safety Council of the Northern Territory, in-service programs are designed and conducted for selected teachers who teach the road safety curriculum within Darwin primary schools.
Parents' Involvement in Children's Pedestrian Safety (page 92)	5	Strategies are developed and implemented which promote the vital role parents' play in the promotion of child pedestrian safety.

Title	Recommendation Number	Recommendation
Expansion of Children's Crossing Supervisors' Education and Role (page 92)	6	The Road Safety Council of the Northern Territory *Children's Crossing* Supervisor's education program to include teaching children critical road crossing behaviours.
Non-Compliance to critical road crossing behavioural elements (page 93)	7	Research efforts should be directed towards identifying why there was such a low compliance rate to the road crossing elements: stopping at kerbside; observing and monitoring traffic prior to and whilst crossing the road.
Reversing from Angle Parking Outside Schools (page 93)	8	Research should be undertaken to determine if angle parking of vehicles outside primary schools is an appropriate and safe practice.
Modification of Kerbs at *Children's Crossings* (page 93)	9	Kerbs at *Children's Crossings* are modified to road level thus facilitating ease of access for the users.
Potential Pedestrian Hazard Caused by Road Design (page 94)	10	Design changes are made to the section of road or bridge near a particular school to provide safe road crossing conditions for children living in the area.
Standardisation of School Zone Speed Limits (page 94)	11	Speed limits outside all schools in the greater Darwin area are standardised.

Title	Recommendation Number	Recommendation
Infringement of Traffic Regulations (page 94)	12	Develop and implement appropriate strategies designed to discourage drivers from speeding in the vicinity of primary schools and illegally parking near *Children's Crossings*.
Schools' Pedestrian Safety Initiatives (page 95)	13	Positive pedestrian initiatives developed and implemented by some Darwin primary schools should be disseminated to other schools and the Road Safety Council of the Northern Territory, for their information and if appropriate, adoption.
Publicity Regarding Children's Limitations as Pedestrians (page 95)	14	Media campaigns should focus on the physical and cognitive limitations which confront child pedestrians.

CHAPTER 1

1. INTRODUCTION

In this chapter, an overview of a major research project of child road safety is presented with a background to the research topic, and an investigation into the effectiveness of road safety education in Darwin in the Northern Territory of Australia (NT). The concept of health promotion and the consequent refocussing of health priorities and strategies designed to promote the health and well-being of Australians are introduced. Information is presented on the specific health problem of childhood unintentional injury. The magnitude of this problem is outlined in this chapter.

The relationship between children, learning and pedestrian safety education offered in Darwin Primary Schools Education Programs by the Road Safety Council of the N T is examined. The adopted framework used in the research, the context of the problem, purpose, significance and limitations of the study are defined.

1.1 Background to the Research

Preventive strategies have long been recognised as effective mechanisms for promoting and maintaining the health of individuals and communities. Examples of how these strategies have worked can be traced back to the nineteenth century. In the 1850's John Snow successfully linked cholera outbreaks to contaminated drinking water (Valanis 1986:5). The use of immunisations to reduce the possibility of individuals contracting a communicable disease in the event of exposure has been a very successful health promotion strategy (Weller 1991:36). *Worksafe Australia* was established in 1986 with the principal functions of '... policy and standards development by consultation, the collection and dissemination of data on occupational health and safety, research and training ...' (Sax 1989:227). These few examples illustrate the range of health strategies designed to improve the health status of individuals and communities. Once the cause of a health problem becomes known, interested groups in the health sector seek strategies to eliminate the problem and/or advance concepts which promote a healthy lifestyle.

A range of approaches aimed at prevention rather than a cure can be employed in health promotion including methods designed to change living conditions, lifestyles and social environments. Support for this view can be referenced to Bates and Winder (1984) who defined health promotion as:

> any combination of health education and related organisational, political and economic interventions designed to facilitate behavioural and

> environmental adaptations that will improve or protect health (Bates & Winder (1984) cited in Egger, Spark & Lawson 1990:5).

Since the late nineteen seventies, the notion of health promotion has been advanced by international groups and various governments as a positive means of improving health whilst at the same time being cost-effective.

1.1.1 International Perspective on Health Promotion - Primary Health Care

In recent years, finite financial resources and increasing costs associated with health care have contributed to the need for international and national organisations, governments and professional health organisations to focus on the importance of illness prevention instead of treatment of disease (World Health Organisation (WHO) 1986; World Health Organisation (WHO)1978). These organisations have highlighted the significance of identifying patterns of health and disease and the importance of individuals and groups adopting behaviours which reflect a healthy lifestyle, thus minimising health problems. Two catalysts for refocussing health care have been the WHO and the *Ottawa Charter for Health Promotion.* The WHO's 1978 Alma Ata Declaration, *Health For All By The Year 2000* (Vuori 1984; WHO 1978) codified the concepts of primary health care. This strategy included identification of current health problems, methods of preventing, controlling and treating such problems, health education and disease prevention.

Primary health care was perceived as a multi-focal concept which has a number of characteristics including a philosophy, set of activities, level of care and strategy for organising health care (Vuori 1984). Exploration of primary health care identifies some of the components as intersectoral cooperation, community action, self-determination, social justice and equity, appropriate funding and legislative frameworks and programs which facilitate changes that will improve the health status of individuals and communities (Vuori 1984).

For primary health care to be successful, the various characteristics outlined need to be adopted by governments, communities and all providers of health care. The ultimate aim of primary health care is to influence community members to adopt a health promoting lifestyle.

The second catalyst for refocussing of health care, the *Ottawa Charter for Health Promotion* (WHO 1986) provided a framework for individuals, groups, organisations, communities and governments to take responsibility for identifying and addressing issues which impinge on the health and well-being of the public. Broad health promotion strategies included the need for governments to enact legislation as well as initiating monetary, organisational, educational and environmental changes designed to encourage communities and individuals to have control over and improve their health. *The Ottawa Charter for Health Promotion* noted that

for health promotion to be effective a diverse range of activities was necessary. The activities required were stated as: initiating healthy public policy; reorienting health services; creating supportive environments; strengthening community action; and developing personal skills (WHO 1986).

1.1.2Australian Perspective on Health Promotion

For some years now the Australian Government, with other governments and international organisations, has shared the need to change its focus on health and disease. The Australian Government has become concerned about national mortality and morbidity patterns, available health related services and their cost, and the need to improve and maintain the health status of Australians. Evidence of this can be found in the commissioning of a number of major projects designed to: investigate the national health status; report on the outcomes of medical care; and make recommendations designed to improve community health status through setting goals and targets designed to promote health and prevent illness (Jolly & Wigg 1994; Nutbeam, Wise, Bauman, Harris & Leeder 1993; Australian Institute of Health and Welfare 1992; Jolly 1992; Australian Institute of Health 1990; Health Targets and Implementation Committee 1988; Better Health Commission 1986).

The *Better Health Commission* (1986) investigated and reported on the health status and concerns of the Australian Community. This Commission determined cardiovascular disease, nutrition and injury as three of the major health concerns. In 1988, the Health Targets and Implementation Committee was then established and commissioned to develop national health goals and targets for these three major health problems plus a number of other key areas. Based on their findings, the Health Targets and Implementation Committee (1988) proposed a number of national health priority areas important to this research, which included improved injury prevention.

As a result of the 1988 publication of the national health goals and targets, the National Better Health Program was established, which resulted in a range of activities and organisations whose charter was to promote better health in Australia (Nutbeam *et al.* 1993).

In 1989 and 1990 the Australian Institute of Health, in publishing findings of surveys conducted to identify the health status of Australians, showed a major shift in diseases affecting developed societies. The report indicated that:

> The major diseases affecting developed societies such as Australia are no longer the infectious diseases, but those associated with lifestyle and related social and environmental factors. Several categories of disease warrant closer examination because a substantial proportion of deaths from these causes could be prevented (Australian Institute of Health 1990:41).

A product of the National Better Health Program was the establishment of the National Injury Surveillance Unit (NISU) under the auspices of the Australian Institute of Health (AIH) (Vimpani & Hartley 1991:2). At a national level, this organisation has the responsibility of monitoring the incidence of injury and providing support and assistance to groups interested in preventing injury.

In 1992, the health of children and youth was addressed by the government through the establishment of a project committee, under the guidance of Dr Diana Jolly. The team was commissioned to outline the health issues of significance to children and youth, and to develop broad goals, targets, indicators, policies and strategies to address the stated health issues (Jolly 1992:11). The goals specified were designed to:

1 Reduce the frequency of preventable premature mortality.
2 Reduce the impact of disability.
3 Reduce the incidence of vaccine - preventable disease.
4 Reduce the impact of conditions occurring in adulthood but which have their origins or early manifestations in childhood or adolescence.
5 Enhance family and social functioning (Jolly 1992:11).

It was reported by Jolly (1992:12) that after one year of age, injury was the leading cause of childhood and youth mortality and morbidity. Furthermore, it was ascertained that injuries were frequently caused by traffic accidents.

Each of the aforementioned agencies alluded to injury as one of the commonest health problems currently occurring in Australia. In many instances these injuries could have been prevented.

1.2 Unintentional Injury

In order to represent the characteristic of 'unexpected' events, a change in terminology was recommended. This change shifted the perception of accidents to unintentional injuries. Thus, contemporary public health experts have preferred the term *unintentional injury* instead of the word *accident* (Green & Anderson 1986:519). This change from an *accident* which '... implies an unavoidable event...' (Report of the National Health Goals and Targets Implementation Working Group on Injury Prevention and Control 1994:8), to *unintentional injury*, highlights the difference between causes of accidents. Accidents in which there is a definite intention to cause harm either to self or another, such as suicide, homicide and child abuse are referred to as *intentional injuries*. Whereas, other accidents which are unexpected and not intentional, such as falls, burns, poisoning, transport accidents and drowning are referred to as *unintentional injuries*. This clarification between *accident* and *unintentional*

injury is important in this research given the style of data collection and subsequent analysis. This aspect will be addressed later in the chapter.

1.2.1 Unintentional Injury: An International Perspective

Unintentional injury is an international problem which affects all age groups. The National Academy of Sciences in 1966 stated injuries as 'the neglected disease of modern society' (Rivara & Mueller 1987:13). Evidence shows that from an international perspective there has been little change in the significance of injury due to child mortality and morbidity in western countries. This view is internationally well supported (Avery & Jackson 1993; Bouchard 1992; Wilson, Baker, Teret, Shock & Garbarino 1991). It was stated by Avery and Jackson (1993:2) that accidents were the leading cause of childhood deaths in England and Wales. Furthermore, Wilson *et al.* (1991:3) reported that 10,000 children die as a result of injury each year in the United States of America. Bouchard (1992:1) stated that:

> Every five hours a child in Canada dies of an injury. In that same five hours, 40 children are hospitalised, and 25 hundred more need attention in emergency rooms.

Rivara and Mueller (1987), when discussing the rationale for preventing unintentional injuries outlined the costs such injuries incur. They suggested that there were two major categories associated with unintentional injury: direct and indirect costs. *Direct costs* were those associated with '... resources used to prevent, detect, treat, and rehabilitate the health problem ...' (Rivara & Mueller 1987:15). *Indirect costs* include suffering, disability and/or loss of potential life years for the injured child, as well as the impact such an injury has on the child's family. To address childhood unintentional injury from an economic and social perspective internationally, is a challenge currently confronting professionals from a number of disciplines and the community at large.

1.2.2 Unintentional Injury: An Australian Perspective

By 1993, unintentional injury as a leading cause of death had become a national issue in Australia. The National Injury Surveillance Unit indicated that:

> Injury is a leading cause of death in Australia accounting for 7489 deaths in 1992 or 6.1% of all deaths. ... Injury is the principle [sic] cause of death of both males and females between the ages of 1-44 years (Report of the National Health Goals And Targets Implementation Working Group On Injury Prevention And Control 1994:2).

The National Injury Surveillance endorsed research findings which suggested that the characteristics and circumstances of unintentional injury differ by age. In addition, in the Report of the National Health Goals And Targets Implementation Working Group On Injury

Prevention And Control (1994:13), it was indicated that transport-related injury was a major cause of injury and death for the age group 0-14 years.

This category of unintentional injury was also reported by Jolly and Wigg (1994) as the leading cause of death in people aged from 0-24 years. They specified the major causes of injury as ' ... drowning, motor vehicle accidents (passengers or pedestrians) and accidents in the home' (Jolly & Wigg 1994:15).

The Australian Bureau of Statistics (ABS) (1992) made available information pertaining to the percentage of people, who in 1989-1990 reported an illness or injury which resulted from an accident. It is reported that in the 5-14 year age group, 8.9% of the people indicated that their accident occurred on the path, road or highway (ABS 1992:4). These Australian statistics are further reinforced by Boss, Edwards and Pitman (1995:103) who stated that 'The loss of life as a result of accidents up to age 15 adds up to more than 500 a year.' They continued: 'There are approximately 3.7 million children up to the age of 15 years and about half require medical attention because of unintended injury' (Boss *et al.* 1995:104). In 1991, 12.6% of Australian child pedestrians aged 0-14 years died and 26.2% were admitted to a hospital as a result of road injury (Dolinis, O'Connor & Trembath 1995:2).

From this information it can be seen that in Australia, a leading cause of childhood mortality and morbidity is traffic related accidents. The significance of injury as a major cause of mortality and morbidity in Australia was supported by numerous agencies (National Injury Surveillance Unit 1995; Nutbeam *et al.* 1993; Australian Institute of Health 1990; Australian Institute of Health 1989; Health Targets & Implementation Committee 1988). The importance of prevention of unintentional injuries to infants, children and young people was perceived as a priority by Jolly and Wigg (1994).

1.2.3 A Northern Territory Perspective Into Childhood Unintentional Injuy

Clearly, at a national level there is increasing concern about the rising incidence of unintentional injury as a significant cause of childhood morbidity and mortality. The same cannot be said for the incidence of this health problem in the Northern Territory, the research site for this study.

Northern Territory mortality and morbidity patterns for the period 1979-1983 were reported by Devanesen, Furber, Hampton, Honari, Kinmonth and Peach (1986:40). For children in the 0-14 year age group a leading cause of mortality and death was unintentional injury. Motor vehicle accidents were the commonest external causes of injury. The other causes of unintentional injury in this age group were found to be poisoning and drowning (Devanesen *et al.* 1986:26).

Motor vehicle traffic accidents were shown to be the most frequent cause of death in Northern Territory children in the period 1978-1985 (Vimpani, Doudle & Harris 1988). It was found that these deaths were predominantly due to a collision between two or more motor vehicles, pedestrian-motor vehicle collisions and motor vehicle accidents which did not involve another vehicle.

In July 1993, Child Accident Prevention Foundation of Australia (Kidsafe), Northern Territory Division, commenced an Injury Surveillance System at Royal Darwin Hospital (RDH). Over a period of ten months, it was found that the main causes of injuries to children were: falling; being struck by an object; cutting injuries; bicycle and car accidents; injuries directly or indirectly caused by animals and poisoning (Northern Territory Division, Child Accident Prevention Foundation of Australia 1994:1).

1.2.4 Child Pedestrians and Unintentional Injury

It is important to examine fatalities which result from injury to pedestrians given their significant occurrence. Statistically, in the United States of America, one-sixth of traffic fatalities results from injury to pedestrians (Malek, Guyer & Lescohier 1990:301). In adopting the following definition of *pedestrian* espoused by Pitt, Guyer, Hsieh and Malek (1990:558):

> a person standing, walking, running, crouching, bending, sitting, roller skating or using a skateboard in a highway, street or other traffic way ...

it is not difficult to anticipate the frequency of unintentional injury, given the range of actions displayed.

Detailed analyses of child pedestrian accidents as presented by Snyder and Knoblauch (1971) were cited by Malek *et al.* (1990). The commonest types of child pedestrian accidents were associated with children's impetuous and impulsive behaviours. This was evidenced in children suddenly crossing the road either by what they referred to as *mid-block darting* (55.2%) and *intersection dash* (10.7%) (Malek *et al.* 1990:304). Other common causes of child pedestrian unintentional injury were found to be associated with children walking along the road and those hit by a reversing vehicle (Malek *et al.* 1990).

Another area of significance to this research includes road users. The term, *unprotected road-users* refer to motorcyclists, bicyclists and pedestrians. A recent review of unprotected road-users in Australia was undertaken by Dolinis *et al.* (1995). The researchers found that:

> There were 656 unprotected road-user deaths registered in Australia in 1991. Pedestrians accounted for 53% of the cases ... (Dolinis *et al.* 1995:1).

For the same period the researchers found that there were 15199 hospital separations for unprotected road-users. The term *hospital separation* refers to any inpatient who leaves the hospital irrespective of the circumstance, for example, discharge, transfer to another hospital and death. Pedestrians accounted for 3989 of these separations, with approximately one-fifth of them being children in the 5-14 year's age group (Dolinis *et al.* 1995:1-2). Based on this information, it can be understood why childhood pedestrian unintentional injury was a priority area outlined in the *Health Goals and Targets for Australian Children and Youth Report* (Jolly 1992).

1.3 Children and Learning

A description of the ability of children to react to potential dangers within their environment is important in order to understand how to provide children with appropriate behaviour patterns. This ability will depend on their biophysical, social, motor and cognitive development. Biophysical development is reflected in a child's increase in growth, height, muscular and skeletal development throughout childhood, although at a slower rate than during infancy (Schuster & Ashburn 1986). Motor development pertains to a combination of gross and fine motor skills (Schuster & Ashburn 1986). Gross motor skills they describe as consisting of balancing, walking, running, jumping, kicking and similar activities. Fine motor skills address a range of activities including throwing, catching, picking-up, grasping and manipulating items. As children progressively learn that they can combine gross and fine motor skills their activities tend to become more complicated.

Social development involves behaviour patterns which are in accordance with social and moral standards. This process is enhanced by imitation and reinforcement. Social development is cumulative, interactive and a lifelong process. According to Whaley and Wong (1991), three groups which have a major influence on a child's socialisation process are family, schools and peers. Cognitive development involves children being able to: '...make sense out of their environment rather than react unthinkingly to it ...' (Biggs & Telfer 1987:19). Such development is demonstrated by a child's maturation and level of understanding which includes an ability to differentiate and classify objects and events, identify differences based on temporal and spatial relationships, identify causal relationships, make judgements, predict outcomes and solve problems in relation to knowledge base and memory (Schuster & Ashburn 1986). School-age years are when the acquisition and interaction of motor, cognitive and social skills are increased. This is especially so during middle and late childhood. It is during these periods of development that children undertake primary school education. This is of critical importance to this study since this age group was the focus of the research.

Two processes associated with learning were discussed by Biggs and Telfer (1987:45). These are the cognitive processes and activation. Cognitive processes are concerned with paying attention to an activity, for example reading, listening and rote learning which involves repeating the information until there is a high degree of accuracy. Meaningful learning occurs when the information is coded, learned with understanding and able to be utilised in a different situation. Memorising comprises scanning and coding the material and then transferring it to working or short term memory where the information is retained for a short period of time unless it is transferred to long-term memory. It is in long-term memory that information which has been memorised can be recalled for later use. Effective learning is dependent on a person's ability to activate all components of the cognitive processes.

Learning does not occur in isolation from other developmental processes. The learning process may be intentional such as information provided to children by parents, teachers, peers or specific organisations and groups, for example Boy Scouts, St. John Ambulance Association and sporting groups. Learning may also be unintentional. Unintentional learning may be the result of children observing and imitating another person or it may be based on how different people react to a given situation or event. As a result of this form of learning, known as social learning, the child is socialised into appropriate societal skills, behaviours and values.

Discussing the importance of social learning to child development, Smart and Smart (1977:642) state:

> Socialization refers to both the present and the future. ... The child learns some specific information and skills, as well as values and attitudes. Thus, he is gradually socialized into his family, community, and nation through a process that maintains the values and behaviour patterns of that group.

Therefore, it is usual for a child to develop and learn simultaneously. In childhood, learning also tends to be an active process. This period of learning is often associated with the child being more at risk of harm due to unintentional injury. This is because children tend to be unaware of pending danger or dangerous behaviours, such as darting out onto the road in front of oncoming traffic. Often such inappropriate behaviour is due to a number of factors including childhood curiosity, risk taking and spontaneous actions.

The education of children must deal with providing them with the necessary motor and behavioural skills and intellectual ability to use the skills wisely, and with fostering a sense of social responsibility throughout the processes of growth. Part of social responsibility is learning to discriminate right from wrong. Teaching children that there is a right and wrong way of undertaking a task can be incorporated into teaching children general safety concepts.

Two particularly important areas for the safety of children are firstly awareness of potential traffic related dangers and secondly learning positive pedestrian behaviours. It is through the use of a variety of learning strategies including general instruction, role modelling, memorisation and reinforcement of traffic and related pedestrian rules that children can relate to a given situation and choose appropriate action(s) resulting in learned positive pedestrian behaviours. Thus, children demonstrate that they have successfully learnt to adapt their behaviour to the traffic situation. The acquisition of such skills could result in a reduction of traffic related injuries in children.

1.4 Road Safety Council of the Northern Territory Primary School

The following description of the Road Safety Education program in Darwin shows how active learning was encouraged. In 1994, the Field Officer, responsible for the road safety education for Darwin primary school students predominantly utilised the Federal Office of Road Safety (FORS) *Out and About* Road Safety programs. The format of the program consisted of lessons conducted at primary schools and in a simulated environment at the Council's Parap Education Centre. This Centre consists of an indoor classroom which contains a model road system and an outdoor scaled down street environment. The Field Officer tended to utilise a *modelling* teaching technique for classroom and outdoor education sessions. In the classroom environment the Field Officer verbalised the correct pedestrian behaviour and then reinforced the instruction by writing the information on a white board. Through a variety of questioning techniques children were encouraged to explain the various safety aspects which should be considered as a child walks along the path and subsequently crosses a road. Responses were reinforced by the Field Officer acknowledging that they were correct through the use of praise and smiles. Behaviours were further reinforced using educational videos that featured either a well-known personality or symbolic animal characters such as *Hairy Nosed Wombat, Koala, Marsupial Mouse, Yellow-Bellied Glider Possum, Platypus* and *Bilby* to depict correct pedestrian behaviour in a range of settings. For children in the 5-7 year age groups, the duration of these classroom sessions tended to be approximately 30 minutes. The combined classroom and outdoor sessions varied in duration: 45-60 minutes and upwards for children in the age groups 8-10 years and 11-13 years.

Classes conducted outdoors at the Road Safety Centre involved the children practising road crossing, general pedestrian and bicycle behaviours. A similar modelling teaching technique with positive reinforcement was used by the Field Officer. Where appropriate, other teaching resources were utilised and/or adapted to meet the learning needs of specific age groups. Children viewed photographs and/or current newspaper items and were asked to think about the subject and respond to specific questions on road safety behaviours. Road safety pictures designed to be coloured in, stickers and posters were given to different groups of children as a

further mechanism to reinforce the correct safety message. From time to time the animated animal character *Hector the Cat* made a visit to various primary schools. The purpose of such visits was for *Hector* to reinforce the importance and use of appropriate road safety behaviours.

In addition to modelling, the education program also utilised stimulus and response strategies in a simulated environment which represented local road systems.

1.5 Theoretical Framework

This section describes how epidemiology has been adopted as a framework for this research. The first aspect of health promotion is to ascertain who is affected as a result of a health problem and to identify what factors are associated with its occurrence (Rivara & Mueller 1987:13-14). This stage of the investigation is commonly referred to as epidemiology. Since the nineteenth century when John Snow linked a cholera outbreak to contaminated water from a particular pump in Broad Street, London, epidemiology has been used as a framework for research (Valanis 1986).

1.5.1 Epidemiology

Epidemiology has been defined by Valanis (1986:7) as:

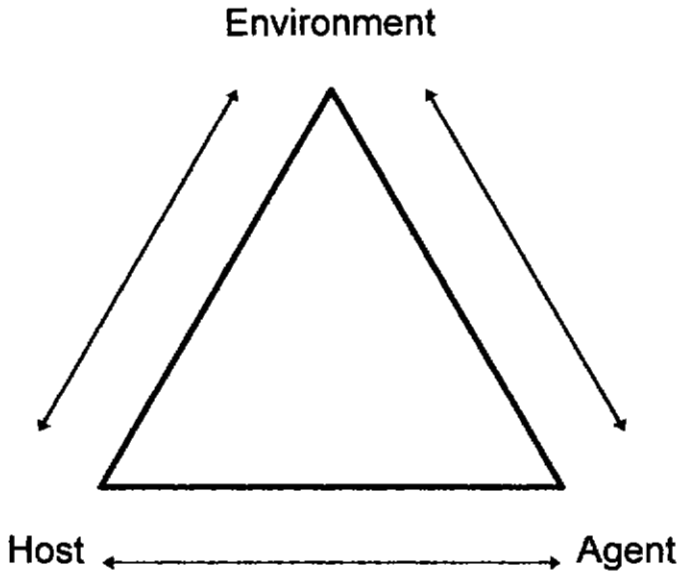
> ... the study of the distribution of states of health and the determinants of deviations from health in human populations.

Traditionally, the framework used in this form of research consists of three factors which collectively are referred to as the epidemiological triad (Valanis 1992; Sleet, Egger & Albany 1991; McMurray 1990). This triad refers to the interaction of the host, the causative agent and the environment. Initially the host was perceived to be the person with the disease, the agent was the factor, object, organism or structure which caused the disease and the environment was primarily the internal and external surroundings or conditions which can contribute to the agent effecting the host.

Today, these concepts have been broadened so that they can be applied to a range of health issues. The agent may be referred to as the vector, stimulus or cause which produces a biological, chemical, physical or mechanical outcome, for example flies, mosquitoes, alcohol, motor vehicles, poisons, ultraviolet rays and falls. The host is the individual or group being studied. Examples of host factors include: age, sex and personal and behavioural characteristics of the individual. Environmental factors can be very diverse and may include water, air, food, waste products, geographical and domestic location, month and time of day, weather, season, stressors, social support, social interaction, traffic, animals and physical

features for example, potholes, slippery surfaces, uneven pathways, steps and tree branches. The epidemiological triad is illustrated in Figure 1.1.

Figure 1.1 The Epidemiological Triad



Originally epidemiological factors determined susceptibility and exposure to disease. However, the concept of epidemiological research has been broadened to analyse a diverse range of situations. Recent changes in health milieu orientation from disease to wellness have witnessed a broadening of the epidemiological triad from a disease orientation to include a health problem or issue. In the United States of America the application of epidemiological concepts has been used in the development of health promotion target activities (Green & Anderson 1986:62). Education, behaviour modification, advertising, engineering, regulation, legislation, and physical, socio-cultural economic and media influences are some of the health promotion activities which could be utilised in achieving health targets (Green & Anderson 1986:63). Thus, by identifying preventable causes of adverse health conditions, preventive strategies including education programs can be developed and implemented to minimise the likelihood of that condition occurring.

It was reported by Hawe, Degeling and Hall (1990:203,214) that epidemiology now addresses behavioural and social issues. Broadening the scope of epidemiology to include a wider range of conditions has resulted in the identification of multiple social and/or behavioural interactions which have the potential to contribute to a health problem. The concept that there may be a number of actual or potential causes of health problems was

supported by McMurray (1990:213). Multiple causes of ill health was referred to as the *Web of Causation Model* (McMurray 1990). An example of multiple causation of ill health is a pedestrian who is injured and to whose injury numerous factors may have contributed, for example, age of pedestrian, an unroadworthy vehicle, poor visibility and slippery road surface. The interrelationship of such factors constitutes the *Web of Causation.*

It is suggested that modern epidemiology has three purposes (Valanis 1992:7). These are to identify causes of health deviations; provide data upon which intervention strategies can be developed to prevent or control the health problem; and to provide data which maximises the timing and effectiveness of interventions.

In summary, the development of epidemiology has evolved from a theoretical framework which specified the aetiology of disease and injury and also outlined intervention strategies designed to prevent disease, injury and disability. In view of these evolutionary changes to epidemiology, it is timely to broaden and adapt the framework to identify and describe behavioural patterns exhibited by groups or populations in their environment. In particular, behavioural patterns which constitute potential risk factors for disease, injury and/or disabilities could be researched utilising an epidemiological framework. Broadening of the study of epidemiology is in keeping with the philosophy of primary health care, especially health promotion strategies. Epidemiological research findings could be utilised to further develop national campaigns designed to promote healthier lifestyles and prevent unnecessary injuries, disabilities and /or deaths.

1.6 Context of the Problem

Children are often the innocent victims of traffic-related injury. Although a number of studies have evaluated the curriculum of road safety education programs conducted in Australian schools (Penna 1994; Marsh & Hyde 1990; Rush & Castor 1988; Elliott 1985), little attention has been given to the effect such programs have on the behaviour of children as pedestrians (Penna 1994). Basically researchers have focussed on the content, teaching aids and strategies employed in these education programs. Therefore, if causes of pedestrian injury are known and education programs have been designed and implemented to address such factors, then it is timely to evaluate the effect such education programs are having on children's pedestrian behaviour.

In this research, the pedestrian behaviour of children is examined in relation to one education program, namely the *Out and About* program as outlined in section 1.8 and Chapter 3, offered to Darwin Primary Schools by the Road Safety Council of the Northern Territory (RSCNT).

1.7 Purpose of the Study

The purpose of the research was to examine the effect road safety education has had on the behaviour of children as pedestrians travelling to and from Darwin primary schools. This was achieved by monitoring the extent to which children changed their pedestrian behaviour in an effort to reduce their risk of unintentional injury. An additional aspect of the research was the monitoring of the children to identify if the change in the child's pedestrian behaviour was maintained for a given period of time. In addition, the research was designed to examine the effect of other variables such as day of week, weather conditions and supervision of road crossings, on the behaviour of children as pedestrians.

1.8 Significance of the Study

An aspect of primary health care is the use of health promotion strategies to prevent diseases, control communicable diseases, influence the quality of one's lifestyle and promote safety. In addition to promoting a healthy environment, health education addresses behavioural changes which need to be adopted if the health status of a community is to improve. In 1988, FORS developed the educational package *Out and About*. The package is aimed at teaching children a broad range of safe road safety techniques including pedestrian, vehicular and bicycle safety knowledge, skills and behaviour. Safe pedestrian behaviour includes: taking care when walking along a footpath or crossing a road, entering and exiting a vehicle; not playing in areas close to pedestrians or vehicular traffic; and obeying traffic signs. Manuals, audiovisual aids, posters and activity work books formed the basis of the *Out and About* educational package. This education program was made available to interested educational bodies throughout Australia. The RSCNT was one of the groups who utilised this program.

At the time of undertaking this research, no major evaluation of the program had been undertaken by the RSCNT. In light of the lack of research on the effectiveness of the education program, this study was considered to be timely and appropriate.

This study which specifically examines the pedestrian behaviour of children as they travelled to and from Darwin Primary Schools was conducted between 1993 and 1995.

1.9 Summary

Statements of key research issues relevant to this study have been presented in this chapter. The major issue has been described as unintentional injury and its relationship to road safety. It has been posited that an aspect of health promotion, education, is perceived to be necessary to encourage communities and individuals to have control over and improve their health. To that end, the FORS education package *Out and About* has been used in this study. This

package has been used in primary schools by the RSCNT in Darwin. The following chapter will describe the literature which informed this study.

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

Child pedestrian safety from the perspective of the effect of a specific road safety education program on child pedestrian behaviour, in particular road crossing activity, is discussed in this chapter. Therefore, this literature review is selective rather than all-encompassing. Specifically, the literature review will pay attention to: Piaget's theory of cognitive development; children's physical, cognitive and behavioural capabilities and limitations as pedestrians; adult pedestrians as role models; adults' expectations of children as pedestrians; task analysis of child road crossing behaviour; and an overview of road safety education programs and their effectiveness on children's behaviour. This literature review does not claim to be comprehensive in relation to the diversity of road safety education programs. However, it will present an overview of the more influential studies which guide the overall design of the study. Discussion of the education program *Out and About* can be found in Chapter 3.

2.2 Piaget's Theory of Cognitive Development

The development of children's road safety education programs should not be undertaken in isolation (Organization for Economic Co-operation and Development (OECD) 1986; Elliott 1985; Molen 1983; Molen 1981; Sandels 1968). One of the major factors influencing the development of such programs is an understanding of child development. This is considered to be essential if each aspect of the program is to be relevant to the target group. Piaget's theory of cognitive development is one of the theoretical frameworks commonly underpinning road safety education programs (Elliott 1985; Molen 1983; Sandels 1968).

To aid understanding, Piaget's theory is presented as separate components whereas in reality the transition between stages is gradual, continuous and interrelated. It is also recognised that children have individual developmental differences, so the ages specified are presented as guidelines. In Piaget's theory, development is divided into four periods of knowledge acquisition. Each stage is affected by the child's overall physical development, experience and social interaction.

The following summation of Piaget's theory is based on information presented by Smart and Smart (1977). The following is a brief description of the stages of child development.

- The sensori-motor period is from birth to two years of age. This period is characterised by: reflex activities present from birth in children; development of habits, for example

grasping objects and putting them in the mouth; searching for vanishing objects; imitation; and selecting and grouping objects, for example, building a tower using coloured blocks. During this period the child is unable to distinguish between itself and the outside world.

- The pre-operational period addresses the ages from two to seven years. In this period the child starts to develop the ability to integrate actions, situations and symbols within the immediate environment to solve problems. The child tends to think in terms of the present, but can reflect on missing objects and people, for example, 'Daddy at work'. Features of this developmental period are that children tend to focus on one thing at a time, have difficulty generalising, are impulsive and have a short concentration span.

- The concrete operational period occurs when the child is aged between seven and eleven years. During this period, the child is starting to develop logical reasoning and causal thinking patterns. The child is now able to understand, classify, order and apply relationship between events, actions and/or symbols associated with a specific situation or problem, for example, fruit can be classified according to size, shape, taste, texture and colour. In this period, memory is better organised and more efficient. The child is developing an ability to anticipate what will happen in the future. Frequently children in this age group confuse hypotheses with facts. Egocentric behaviour is a feature of this period of development.

- The formal operations period addresses the ages eleven to fifteen years. In this period, children acquire the ability to organise information and reflect on all aspects of a situation. Logic can be used in complex ways so that problem solving skills and abstract thought processes are refined. Children in this age group are able to conceptualise and solve visual-spatial problems, for example distance between approaching vehicles.

Critics of Piaget's theory of development argue that children may move into the different periods of development earlier than that stated by Piaget (Solso 1991). It would appear that these critics do not challenge the concepts outlined by Piaget. Therefore, his theory is considered to provide a reasonable framework for children's road safety education programs.

Programs for children under seven years of age should be structured so that one simple task is presented at a time, for example the footpath is the safest place to walk, or the road is for vehicles. As children in this age group are unable to integrate different concepts, it would be inappropriate to try and teach them to assess the distance between themselves and an approaching vehicle.

Developers of education programs for children in the 7-11 year age group should address the fact that at this stage of development children tend to learn by rote without comprehending

any involved concepts. Children in this stage of development could be taught basic concepts, such as the meaning of the sequence of traffic light colours. Causal relationships could be incorporated into the education program, for example, it is unsafe to cross the road between parked vehicles because neither the child nor the driver of an approaching vehicle can see each other.

Finally, the formal operation period is when the child is able to grasp and apply the principles of logical and causal thinking, differentiate between the right and left side of the body and assess the distance and speed of an approaching vehicle. Therefore, from the age of 11 years onwards, children should be able to understand and apply the complex principles associated with safe pedestrian behaviour.

2.3 Children's Capabilities and Limitations as Pedestrians

In addition to Piaget's theoretical framework of child development, it is necessary for curriculum developers to have an understanding of children's capabilities and limitations as pedestrians. Knowledge of children's physical and cognitive ability was perceived to be an important aspect of curriculum design (Solso 1991; Elliott 1985; Molen 1983; OECD 1983; Molen 1981; Molen *et al.* 1981; Sandels 1968).

2.3.1 Children's Capabilities and Limitations: Physical Development

Children's physical characteristics can have an influence on their ability to be safe pedestrians. They have visual limitations due to their height, thus increasing the potential to incur injury. Because of their short stature they have difficulty seeing over the bonnets or roofs of parked vehicles, hedges, fences or other objects near the road. They must tilt their heads to see traffic signs which are usually erected above the height of the average adult (Moses 1989; OECD 1983; Ross & Seefeldt 1978).

Children do not attain their highest visual development until approximately sixteen years of age (Moses 1989:921). A study to identify the differences between children's and adults' range of peripheral vision to a limit of 90 degrees was conducted by Sandels and her colleagues. The sample consisted of forty subjects: ten adults of each sex, aged between 20-40 years; and ten children of each sex, aged between 5 years 11 months and 7 years and 4 months. None of the subjects had known visual defects. Due to time and financial constraints, testing was confined to each subject's right eye. It was found that children's peripheral vision was more restricted than that of adults resulting in them perceiving '...approaching vehicles from an angle more slowly than would adults...'(Sandels, 1968:76). It was concluded that even though children stop at a kerbside and appear to be searching for

oncoming traffic, it can not be assumed that they have assessed the situation as would an adult.

Concern was also expressed about children's restricted vision if they cross the road between parked vehicles. In Groningen, the percentage of accidents involving children who crossed the road near parked cars was '... as high as 80% for children up to 5 years of age, versus 50% for 6-12 year old children.' (Molen 1983:35).

Concern was expressed about children's ability to hear and discriminate sound direction. A comparative study was undertaken for the purpose of determining if there was a variation between adults and six year old children in perceiving the direction from which a sound originates (Sandels 1968). Prior to conducting the study, audiometric tests confirmed that none of the subjects had hearing anomalies. The research design required subjects to sit in the centre of a circle of hidden loud speakers. The speakers were arranged in a similar position to that of the hands on the face of a clock. The distance between the subjects and the loud speakers was 1.5 metres. A tape recording was made of the sound a car makes as it approaches, passes and drives away from a road crossing. This sound was presented in a pre-determined random order for 3 seconds with a pause of 5 seconds between sounds thus giving the subject time to respond to the sound. The sound was presented 8 times from each speaker, making a total of 96 sound presentations. At the end of each sound being presented, subjects were required to indicate the direction from which the sound came. So that the subjects' level of concentration was not impeded, a short pause was taken after the first 48 sounds had been presented.

The study showed that there was a significant difference between adults' and children's ability to determine the direction from which a sound came. Adults had a high degree of accuracy in perceiving sound from all directions, whereas children were frequently incorrect. Children's responses were more accurate for sounds from speakers positioned at 11, 12, 1 and 6 o'clock on the clock face. Adults' best responses to sound directions were at the 3,4,8 and 9 o'clock hand positions (Sandels 1968:84). This was an important finding when one considers the position of oncoming traffic in relation to a person crossing the road. When a person is about to cross a road, the optimum direction for hearing traffic approaching on the right or left-hand side is at 3 and 9 o'clock. Considering children's poorest hearing responses were at 3 and 9 o'clock, this would put them more at risk for being unable to accurately detect the sound of oncoming traffic when they were about to cross the road.

In supporting these findings, it was noted that the appreciation of sound varied with age and gender:

> The lowest sensitivity to sounds was found amongst 5 year olds. The sensitivity then increased with age and reached its peak at 12 years of age,

> whereafter it decreased again at 13 and 14 years of age. Girls on average had a more sensitive hearing than boys (Eagles *et al.* (1970) in Sandels 1968 87).

Moses (1989:921) provided the following warning with regard to children's hearing ability:

> ...Children may appear to look about them correctly and watch out for traffic situations, but in fact, they are looking at entirely different objects, and in a corresponding way, they may also be listening to sounds other than the relevant traffic sounds.

These findings indicate that young children do have difficulty hearing traffic sounds and this would be further aggravated if the density of traffic was high.

2.3.2 Children's Capabilities and Limitations: Cognitive Development

Levels of understanding are also a feature of development across the lifespan. Cognitive development is a cumulative process and involves a number of factors including concentration span, memory, comprehension, mental representations, abstract thinking and decision making. All of these factors contribute to a child's ability to function safely as a pedestrian and ability to understand and actively participate in road safety education programs.

Children under the age of five years of age are unable to attend to more than one thing at time (Elliott 1985; Ross & Seefeldt 1978). It was confirmed by Moses (1989:922-923) that children under the age of six years of age have a short concentration span. Furthermore, young children are easily distracted especially if something seems more appealing or important to them at the time, for example retrieving a brightly coloured object off the road instead of looking to see if it was safe to do so, or talking to a friend instead of looking for potential pedestrian hazards (Molen 1983; Ross & Seefeldt 1978). Children's memory capacity and storage is slower and less than that of adults (Elliott 1985; OECD 1983). Based on this information, it is necessary that education programs designed for young children contain one concept at a time and the learning session be for a short duration.

Children have difficulty in firstly perceiving the presence and position of moving vehicles, secondly judging speed of vehicles and distance between moving vehicles, and thirdly differentiating between the right and left sides of the body (Malek *et al.* 1990; Elliott 1985; Molen 1983; OECD 1983; Sandels 1968). The concept of speed estimation was further explored by OECD (1983:37), who stated that children below the age of 5 years consider speed not in time but rather as '... fast, not so fast, slow...'. Realistically, this ordinal concept of speed may further disadvantage young children in traffic situations.

An unexpected finding, namely children's difficulty in differentiating between their right and left side, was an outcome of a study conducted by Sandels (1968). A scaled down model depicting a residential area with different types of housing, road systems, vehicles, dolls and cars was used in conjunction with a questionnaire to test crossing behaviour knowledge of children aged between 4 and 12 years (Sandels 1968). It was found that many children had difficulty understanding the concepts of right and left and lacked an insight into why they should look in specified directions to monitor traffic (Sandels 1968:68).

Another aspect of children's cognitive ability concerned traffic signs and traffic terminology. Examination of this cognitive ability was pursued by Sandels (1968). Children aged between 4 and 8 years of age were the subjects in the research associated with traffic signs relevant to drivers, cyclists and pedestrians. It was found that 4 year old children virtually had no knowledge of traffic signs. The correct response rate gradually improved with age. Children frequently misinterpreted the meaning of the *Children Crossing* sign. A common interpretation of the sign was that children should run across the road at that site so that '... no cars will knock them down' (Sandels 1968:95).

Research pertaining to traffic terminology involved children 6^{+} to 10^{+} years. It was noted that children's understanding of traffic terms and expressions increased with age (Sandels 1968). Boys were found to be have a greater awareness of traffic signs and traffic terms than girls.

2.3.3 Children's Capabilities and Limitations : Behavioural Factors

Behavioural factors which contribute to children's vulnerability as pedestrians include the tempo associated with crossing the road, their impetuosity, and their failure to search for traffic. Children's pace when crossing the road has been the subject of research (Gardner, Rowley, Bowen, Hayman & Fyfield 1986; Elliott 1985). It has been argued that it is not running across the road which contributes to children's risk of road injury, rather it is because they forget to observe for approaching traffic before and whilst crossing a road.

Immaturity was found to be responsible for children's impetuous and unpredictable behaviour and their ability to be easily distracted (Malek *et al.* 1990; Elliott 1985; OECD 1983; Ross & Seefeldt 1978). These factors were perceived to contribute to children's unreliability as pedestrians (Malek *et al.* 1990; Elliott 1985; Jarvis (1983) cited in Aylward & O'Connor 1987). This view was endorsed by Vinje (1981), who reported that children's impulsiveness was a contributing factor to their failure to search for oncoming traffic (Vinje (1981) cited in (Malek *et al.* 1990:305). Children's failure to search for traffic before or whilst crossing the road was found to be a common feature associated with child pedestrian injuries. In a review of factors associated with child pedestrian injury, Older and Grayson (1974) found that 39% of the children had not searched for oncoming vehicles prior to crossing the road, and 60%

had not seen the vehicle which hit them (Older & Grayson (1974) cited in Malek *et al.* 1990:305). Darting out and dashing are two features of children's road crossing behaviour. In relation to pedestrian activity, darting out is the term used when a person suddenly appears, whereas dashing is when a person moves quickly. Both of these actions are considered to be associated with children's immaturity (Malek *et al.* 1990; Pitt *et al.* 1990; Elliott 1985; Preusser & Blomberg 1984; Molen 1983; OECD 1983; Molen 1981; Molen *et al.* 1981; Ross & Seefeldt 1978).

An analysis of the causes and severity of child pedestrian injuries in the United States of America (USA) was undertaken by Pitt *et al.*(1990). Data for their study was collected between 1977 and 1980. Their study indicated that the commonest type of accident was associated with darting out activities (39%), followed by what they referred to as intersection dash (20.8%) (Pitt *et al.* 1990:550-554). These findings are comparable to those from Synder and Knoblauch's (1971) research on pedestrian accidents in the USA (Malek *et al.* 1990). An analysis of motor vehicle injuries revealed that 40% of motor vehicle accidents were associated with pedestrian mid block darts and dashes and that 71% of the cases involved children under the age of nine years (Preusser & Blomberg 1984:49).

2.3.4 Children's Capabilities and Limitations: Other Factors

Analysis of pedestrian injuries indicated that some other factors contribute to children's behaviour: child's gender and age group; traffic density; and time injury occurred. Analysis of national accident statistics of a number of its member countries was conducted by the OECD in 1983. It was concluded that the rate of injury for male primary school children was about twice that of females in the same age group (Rivara & Mueller 1987; OECD 1983). This rate increased with the child's age through to adolescence when it nearly doubled (Rivara & Mueller 1987:18).

Age was also a factor related to childhood pedestrian injuries. Moses (1989:20) indicated that psychologically children cannot operate in the same way as adults until they are about ten years of age. In the USA, childhood injuries '...cause more deaths than all other causes combined ...' Rivara and Mueller (1987:14). Child pedestrians in the age group 5-9 years were perceived to be most at risk of incurring injuries (Routledge, Repetto-Wright & Howarth 1974). It was predicted that over the ensuing 15 years, child pedestrians aged 5-9 years were 2.6 times more likely to die from motor vehicle injuries than all other causes combined (Budnick & Chaiken (1985) cited in Rivara & Mueller 1987:14). In Australia, similar pedestrian injury statistics for this age group were recorded (Elliott 1985:21). It was specifically stated that children between the age of 6-7 years were twice as likely to sustain a pedestrian injury as any other age group (Fortenberry & Brown 1982:316).

Whilst undertaking a study to observe children's pedestrian behaviour, Molen (1983) perceived that traffic density was a contributing factor. Observations of pedestrian behaviour were undertaken when traffic density was low, moderate and high. Low density of traffic was defined as less than 1 car per minute and high density was more than 2 cars per minute (Molen 1983:107). It was found that when traffic density was high, children were '... cautious when crossing the road ...' (Molen 1983:153).

Another characteristic of child pedestrian injuries was the time that they occurred. The most common time for child pedestrian accidents was after school between 3 and 6 p.m. (Pitt *et al.* 1990:551). Most injuries occurred on week days after school hours and the number of injuries was highest on Fridays (Fortenberry & Brown 1982:316).

2.4 Adult and Child Pedestrians

A literature review showed that adults were generally poor role models for child pedestrians and adults allowed young children to function independently in traffic. Various studies have been conducted to determine the influence adults had on child pedestrian behaviour (Molen 1983; Molen *et al. 1983*; Sandels 1968). Based on numerous observation sessions of child and adult pedestrians, it was concluded that parents often provide bad examples for their children (Sandels 1968). It was noted that parents regularly omitted to stop prior to crossing the road, crossed when traffic was approaching, crossed the road at an angle and frequently did not cross within the pedestrian crossing.

A study of unaccompanied adult pedestrians was undertaken by Molen (1983). In the absence of traffic or when the density of traffic was low, adults' compliance to stopping at the kerbside was poor. In addition, when traffic density was low, it was observed that adults rated poorly with regard to monitoring traffic. The conclusion was reached that adults' road crossing behaviour did not emulate what was taught to children in road safety programs (Molen 1983:173). A follow-up study was undertaken to observe the behaviour of adult and child pedestrians after they had both been exposed to a road safety education program. In this study it was found that there was an improvement in two road crossing elements: stopping at the kerbside and head movements to observe approaching traffic. As a result of this study, it was concluded that '...adults set good examples compared to the behaviour of their charges, but that their performance is far from ideal. ...'(Molen 1983:193).

A further study, namely one which involved observations of adults and children before and after delivery of a road safety education program was conducted. The purpose of the study undertaken was to assess the influence adults had on children's pedestrian behaviour (Molen *et al.* 1983). Prior to the education program, it was observed that adults' behaviour as pedestrians and as reinforcers of safe pedestrian behaviour when they accompanied children

was less than satisfactory. It was revealed that whilst holding a child's hand, an adult did not take the opportunity to instruct the child on the need to monitor traffic. Post-education observations revealed that adults became better role models and tended to give more instruction to their children (Molen *et al.* 1983:165-166).

Adults were also criticised for allowing young children to cope independently in traffic. It was recorded that 69% of five year old children under five travelled to school by themselves (Rothengatter (1984) in Aylward & O'Connor 1987:50). These results were similar to Arnberg's (1979) findings that between 39-62% five year olds travelled alone (Aylward & O'Connor 1987:50). Based on Piaget's theory of cognitive development, children of this age are immature and are at risk of injury. With children so young travelling to school alone, it was advocated that child pedestrian education commence at an early age, using '...normal traffic conditions supplemented with audio visual presentations. ...' (Rothengatter (1984) in Aylward & O'Connor 1987:50).

2.5 Analysis of Child Road Crossing Tasks

The intention of undertaking an analysis of children's road crossing tasks is to provide guidance for the objectives and content of education programs. Such analysis has been widely undertaken by researchers interested in child safety (Malek *et al.* 1990; Molen 1984; Preusser & Blomberg 1984; Molen 1981; Molen *et al.* 1981). There was general agreement amongst these authors as to the optimal framework on which to base the activity: child factors including personal and behavioural; traffic factors including driver and vehicle; plus social, environmental, legal and political factors. None of these factors should be taken in isolation but as an integrated process.

Irrespective of the framework used, the task analysis process must take into account the elements involved in the activity, detailed information on what is involved in each element, and the abilities required to complete the activity. The need to give consideration to the tasks being undertaken by different groups of people is recognised by Molen (1984). In relation to road crossing behaviour, examples of such groups are: people of varying ages; people with different levels of competence; children crossing alone or while accompanied; and children with physical and intellectual disabilities (Molen 1984:131).

A comprehensive analysis of pedestrian tasks has been documented (Molen 1981). The first activity was an examination of the behaviours associated with pedestrian tasks. This resulted in the development of a list of 26 main tasks for a range of pedestrian activities. Details of the tasks were then described addressing observable behaviours and psychological processes necessary for the task performance. The author acknowledged that the detailed task analysis

of pedestrian behaviour which he compiled was ideal for novices but could be modified for more skilled pedestrians.

A feature of this study is child pedestrian road crossing behaviour. The tasks associated with this activity have been described by many authors (Malek *et al.* 1990; Rivara & Mueller 1987; Gardner *et al.* 1986; OECD 1986; Molen 1984; Preusser & Blomberg 1984; Molen 1983; Molen *et al.* 1983; OECD 1983; Molen 1981; Molen *et al.* 1981; Sandels 1968). A synopsis of the salient behaviours associated with road crossing include:

- walking at a normal tempo;
- looking for an appropriate place to cross the road;
- stopping at the kerb or the outside edge of a parked vehicle;
- searching for approaching traffic, (the order for looking is dependent on which side of the road vehicles are approaching the pedestrian, for example look right-left-right);
- waiting until approaching traffic has passed;
- repeating the searching task until it is considered safe to cross the road, for example no approaching traffic or traffic considered to be a safe distance away from the crossing site;
- crossing the road at right angles to the kerbside; and
- monitoring for approaching traffic whilst crossing.

When crossing at an intersection, the process is the same plus the added need to look behind when searching for and monitoring traffic.

Based on the previously stated road crossing behaviour, specific educational objectives can be formulated. Aims of these educational objectives are: the promotion of safe road crossing behaviour through increased knowledge, positive attitude to, and skill in road crossing behaviour; and a reduction in the number of injuries to pedestrians.

2.6 Road Safety Education Programs

This research was concerned with the effect of one education program, namely *Out and About* on child pedestrian behaviour. As it is intended to discuss the *Out and About* program in the next chapter, a resume of the general features of road safety education programs will be presented in this literature review.

Numerous pedestrian education packages have been developed. These packages have been designed for children between the ages of 4 and 16 years; parents; teachers; drivers; and community members. Content of packages have included: use of animated characters; learning aids including videos, posters, stickers and workbooks; and evaluation methods (FORS 1988a; FORS 1988b; Gardner *et al.* 1986; Molen 1984; Preusser & Blomberg 1984; Molen 1983; Fortenberry, & Brown 1982; Sandels 1968). These programs are predominantly designed to incorporate educational strategies including: verbal instruction; demonstration of skills; skill development through guided practice; feedback; and observation and reward.

Design of education programs which target primary school children should be suitable for their level of development and contain language that is simple, clear, concise and age appropriate. Whilst endorsing this type of program design and content, Molen *et al.* (1983:156) also advocated that education sessions be of 10 to 15 minutes' duration with four sessions allocated for each task. It was also recommended that each child's pedestrian behaviour be assessed at the end of the four sessions. This structure and implementation of road safety education programs was supported by Elliott (1985:172).

There appears to be general consensus that road safety education programs should be incorporated into school syllabi. Where classroom teachers are responsible for the delivery of the education program that in-service programs be provided for these staff members (Ampofo-Boateng & Thomson 1991; Malek *et al.* 1990; Marsh & Hyde 1990; Rivara & Mueller 1987; Gardner *et al.* 1986; OECD 1986; Elliott 1985; Molen 1984; Preusser & Blomberg 1984; Molen 1983; Molen *et al.* 1983; OECD 1983; Maisey 1982; Molen *et al.* 1981; Molen 1981).

The effectiveness of road safety education programs requires evaluation studies to be carried out before and after children have received the education program. Evaluation should reflect the program's educational objectives and be undertaken in each domain. This can be achieved by assessing knowledge, attitudes and behaviour in relation to pedestrian activities. Observation of children's pedestrian behaviour should be performed unobtrusively and in real traffic situations (Penna 1994; Marsh & Hyde 1990; OECD 1986; Bowen 1985; Elliott 1985; Molen 1983; Molen *et al.* 1983; Molen *et al.* 1981; Molen 1981; Sandels 1968).

A study undertaken in Victoria, Australia during 1994 has some similarities with the research under discussion, namely assessment of children's road crossing behaviour. A review was conducted of the effectiveness of the road safety education program *Streets Ahead* (SA) (Penna 1994). Children aged eight to ten years from nineteen Melbourne schools participated in the study. Nine schools were each in the control and experimental groups with one school in the pilot study. There was variation between schools in time allocated to the teaching of

SA. On average the program was taught over a four week period with the intensity of teaching being between one and six hours per week (Penna 1994:63).

The study assessed children's road safety behaviour, knowledge and attitude. A written test was used to evaluate children's pedestrian knowledge and attitude. This test was administered to class groups. Children's road crossing behaviour was unobtrusively observed using a video camera. Observation sessions were recorded near uncontrolled flagged road crossing sites in the mornings, prior to the school day commencing. The rationale for restricting the observation sessions to the mornings was that more children could be observed over a longer time frame. Filming occurred for at least three mornings before and after the children in the experimental group had been exposed to the road safety education program.

The data collection instrument used to record children's road crossing behaviours was divided into three stages: pre-kerb zone; kerb zone and road crossing. Behavioural elements were evaluated at three levels of performance: well, reasonably or poorly done. It was also noted if a child was alone or accompanied whilst crossing the road (Penna 1994:32).

The study found that as a result of the SA program there had been an improvement in children's road safety attitude (7%) and knowledge (13%) (Penna 1994:67). It was concluded that '... the teaching of SA has had little, if any impact on children's average road crossing behaviour at uncontrolled crossings' (Penna 1994:52). It was stated that: 'There was much evidence of incorrect and potentially unsafe behaviours at the crossing sites in this study' (Penna 1994:69).

The effectiveness of road safety education programs has been assessed overseas and within Australia. Findings have varied and include comments such as '...pedestrian skills training programmes ... none of those currently taught in New Zealand have been shown to reduce injury rates.'(Roberts, Norton & Hassall 1992:53); '...discouraging ...' (Morris (1972) in Ampofo-Boateng & Thomson 1991:487); '... substantially improve knowledge ...this often does not translate into improved behaviour ...' (Malek *et al.* 1990:306); '... after the parent component was added ... there were significant increases at all ages in the proportion of children looking before crossing ...' (Rivara & Mueller 1987:773); '... looking behaviour improved substantially ...' (Preusser & Blomberg 1984:52); and '... some improvement ...' (Maisey 1982:10).

Although there has been limited success in the effectiveness of the road safety education programs, when children are left to function independently as pedestrians, there is still a need to ensure they have the knowledge and skills to safely and capably undertake these tasks.

2.7 Summary

The literature suggests that road safety education programs should be based on a theoretical framework. A framework commonly recommended for such education programs is Piaget's Theory of Cognitive Development. Prior to designing a road safety education program it is necessary to consider a number of factors, such as: children's physical, cognitive and behavioural capabilities and limitation and analysis of road crossing tasks. Education programs should include objectives designed to increase the level of students skill, knowledge, attitude and behavioural outcomes as a result of the program. A range of strategies including: verbal explanation; demonstration; positive feedback; and guided practice, should be utilised when teaching children road safety knowledge and skills. No program should be implemented unless evaluation mechanisms are clearly specified. It has been argued that road safety education programs should be a compulsory component of the school curriculum.

CHAPTER 3

3. *OUT AND ABOUT* EDUCATION PROGRAM

The purpose of this research was to examine child pedestrian behaviour, in particular road crossing activities, before and after exposure to the road safety education program *Out and About*. Therefore, it is appropriate that a summary of the development, design, implementation and evaluation of the program is presented in this chapter. This researcher's assessment of the education program is limited to the second versions of the packages designed for pre and primary school children. Information is also drawn from an earlier evaluation of the primary school package (Rush & Castor 1989,1988).

According to Castor and Rush (1988:1-2), the *Out and About* education package for primary school children was developed for FORS in 1984-1985. The first version of the package was distributed in 1986. Following the evaluation of the package by Axia Marketing and Social Research, a modified second version was distributed in 1987 with a reprint in 1988. The second version included two children's workbooks, one for 6-7 and another for 8-9 year olds (Marsh & Hyde 1990:26). In 1988, a video was developed for incorporation into the learning package (Marsh & Hyde 1990).

A separate education package for pre-school children, aged 4-5 years, was developed and trialed in 1987. This program was structured along the lines of the primary school package. Based on recommendations from the trial, the second version of this package was compiled and distributed in 1988. Both the pre and primary school packages were distributed free of charge.

Aims of the program are described as: '... to alert children to the dangers they face as road users, and to encourage them to learn and practise safe road behaviour' (FORS 1988a:4). Dependent on the child's age, the programs are designed to teach children a broad range of road safety techniques including pedestrian, vehicular and bicycle knowledge, skills and behaviours.

Both the pre and primary school packages utilise symbolic Australian animal characters including: *Hairy Nosed Wombat, Koala, Marsupial Mouse, Yellow Bellied Glider Possum; Platypus* and *Bilby*, to depict and reinforce teaching strategies. The content of both learning packages is similar in that they both contain a teacher's guide/handbook, parents' guides, children's workbook and various posters and stickers.

At the commencement of the teacher's booklet general information is presented. This includes an overview of the program structure, the use of the animated animals referred to as 'the team', overall aims of the program, information on how to use the package; and

recommended strategies to assess children's knowledge, attitude, skills and behaviours based on specific objectives. Suggested teaching methods include: integrating the program with other curriculum subjects; utilising classroom instruction and outdoor practical activities; having children practice road safety skills in real traffic situations under adult supervision; and involving parents in the teaching process. Teachers are reminded of children's limitations as pedestrians, bicycle riders and vehicle occupants. The teacher's guide provides a cross reference to related activities in the children's workbook.

The programs are divided into four major sections pertaining to road safety: seatbelts, roads, footpaths and playing. Specific topics addressed in the pre-school package are:

- need for and correct use of seatbelt, harness or child restraint when travelling in a car;
- that roads are designed to be used by traffic and are dangerous places for children, especially if they are not supervised by an adult;
- what to do if an item is on the road;
- that safe places to play are at school, home and in parks;
- that unsafe places to play are on or near roads, car parks and driveways; and
- why footpaths are the safest place to walk and the need to be alert for hazards when walking on a footpath (FORS 1988b).

As stated earlier in this chapter the primary school package is divided into level one and two. In the package, colour is used to separate the two levels: apricot for level one and green for level two. The following information on the content of the primary school curriculum is taken directly from the booklet.

Level one topics are:

- walking to and from school;
- crossing the road at a marked crossing and where there is no marked crossing;
- playing safely;
- in the car; and
- in the country.

Level two topics are:

- walking safely;
- crossing the road;
- playing safely;
- using public transport;
- riding your bike; and
- responsible behaviour.

Pre-school children are not taught road crossing behaviour. This skill is taught to primary school children in level one of the program and reinforced in level two. As road crossing behaviour is a focal point of this research, the concepts and procedures taught to the children are presented below:

1 Stop at the kerb.
2 Look to the right, towards the traffic in the lane that is closest to you. Listen for traffic.
3 Look the other way, to the left.
4 Look to the right again. Keep listening.
5 When there is no traffic, walk quickly, straight across the road.
6 As you cross, keep looking and listening for traffic (FORS 1988b:11,25).

The parents' guide reminds them that a children's immaturity and lack of understanding contributes to their vulnerability in traffic. Salient road safety information is provided. Suggestions are made as to how parents can assist in the education program either at school, home or in traffic situations.

The *Out and About* education package has a colourful appearance. Colour is used to advantage especially to highlight specific areas of the program. The language used to convey information is clear, concise, comprehensive and easily understood. Material used to augment the program is professionally developed taking cognizance of the age and level of development of the children for whom it is designed. This is especially so with regard to the workbooks, posters, stickers and video.

FORS commissioned Rush and Castor (1988) to evaluate the *Out and About* education package. The review involved a survey of Australian primary school teachers to determine how they used the road safety education program in their classes. One hundred and forty five teachers were involved in the study. The study found that although the material had been used with all primary school class levels, the main areas of usage were for classes 1, 2 and 3. The Children's book was the most used item, followed by the Teacher's Guide with the Parent's Guide being the least used item in the education package. Teachers perceived the

use of animated animals as a positive aspect of the program. Children were interested in the animals and as a result appeared to comprehend the safety concepts they were promoting.

Material in the education package was predominantly used on a weekly basis. This would seem to conform with the time allocation recommended for a children's road safety education to be effective (Molen *et al.* 1983). The most common area where teaching occurred was in the classroom. Classroom teaching included utilising activities presented in the Children's workbook, specific and general discussions on road safety, use of the video and poster activities. Approximately half the teachers utilised the outdoor and bicycle activities as outlined in the *Out and About* program. The most commonly used outdoor activities included walks, practising road crossing including watching for traffic and looking at traffic lights, general bicycle safety and helmet usage. Overall, the teachers felt that the material required minimal modification (Castor & Rush 1988). Furthermore, teachers were happy with the program (Rush & Castor 1989:30-31).

It was found that 69% of the teachers would not change the way they used the program including allocation of time to the various activities (Rush & Castor 1989:30-31). The authors also reported that 30% of the teachers would decrease the time on indoor activities so that they could increase the time allocated to outdoor activities.

In summation, the road safety education package *Out and About* contains material for use by teachers, parents and children. The program aims to make children safe and responsible when in traffic situations. It is designed to be used with preschool and primary school aged children.

CHAPTER 4

4. METHODOLOGY

Details of the methodology undertaken in the study form the basis of this chapter. An overview of unobtrusive structured field observation is presented. The following aspects are outlined in the chapter: a brief outline of the pilot study; resultant design and methodology of the main study; process involved in identifying and negotiating for schools to participate in the study; format used for analysing the data; procedures undertaken to gain approval to engage in the research; and limitations of the study

4.1Overview of the Study

The precipitating factor which prompted this study was that no major study had been undertaken to ascertain if the road safety education program *Out and About* had effected the pedestrian behaviour of Darwin primary school children. After conducting an education program at specific schools, the Darwin Field Officer, RSCNT had undertaken ongoing evaluation of children's road safety knowledge. This evaluation process varied with the age of children who participated in the program. Children in the 5-7 year age group were mainly asked to draw or colour-in particular pictures, for example the use of green, orange and red to indicate the sequence of traffic lights, or children standing at the kerbside waiting to cross the road. Children aged 8-10 and 11-13 years of age completed a questionnaire which addressed general principles of road safety including: pedestrian safety; elements of road crossing behaviour; potentially hazardous traffic situations, for example crossing the road between parked vehicles; bicycle safety; use of helmets when cycling; and safe places to play and cycle. The timing of this evaluation depended on classroom teachers being prepared to incorporate it into the school activities. As this was a voluntary exercise, some schools did not complete the evaluation activity. The Field Officer indicated that approximately half the schools returned the evaluation forms within a month of the education program being conducted. Overall, he was satisfied with the responses received from the children. The Field Officer stated that most of his time was allocated to teaching, consequently, he was unable to undertake a final evaluation of the program. The following research questions were independently discussed with the Executive Officer and Field Officer RSCNT to ensure that they adequately analysed children's pedestrian behaviour in relation to the *Out and About* program.

4.2 Research Questions

In investigating the effect the *Out and About* road safety education program had on the pedestrian behaviour of Darwin primary school children, the following questions provided the main focus for the research:

- What types of behaviour are associated with children as pedestrians? For example, walking, running, playing, talking, alighting from a private or public vehicle and/or crossing a road.
- Does the child's behaviour vary if accompanied by others or alone?
- Immediately prior to and when crossing a road, does the child pedestrian behaviour differ in children walking alone than with those whose hand is held by another person?
- To what extent does the child's behaviour vary with age? That is, does age affect safe pedestrian behaviour, for example, is the pedestrian behaviour of children in the 5-7 year age group different to that of children in the 8-10 or 11-13 year old age groups. Similarly, is the pedestrian behaviour of children in the 8-10 year age group different to that of children in the 5-7 and 11-13 year old age groups?
- Does child pedestrian behaviour vary at different times of the day or with climatic changes?
- What are the similarities and differences between the pedestrian behaviour of children who have been exposed to the road safety education program *Out and About* and those who have not?
- With children who have been exposed to the road safety education program *Out and About*, what changes are observed in their pedestrian behaviours over the three observation rounds, that is, one approximately one week before the education program, and a further two within a five week period after exposure to the education program?

The above questions enabled the description of child pedestrian behaviour, the analysis of the effect of the *Out and About* program and determination of the effect demographic variables had on child pedestrian behaviour.

4.3 Research Design : Overview

Prior to discussing the research design, notation must be made that it should be assumed that any child approaching primary school age could have been introduced to the basic road safety concepts by parents, carers or through the media. Such education could be through direct

teaching or by children mentally absorbing pedestrian action of others. This form of instruction was an extraneous variable and a situation which although not stated, would have been noted by researchers who had previously undertaken evaluation of road safety education programs (Penna 1994; Molen 1983; Sandels 1968). This extraneous variable was not measured in the study, but was minimised by including a pre-test in the design.

The research was exploratory, descriptive, correlational and quasi-experimental in design. That is, it provided an in-depth exploration of child pedestrian behaviour and associated subject and demographic variables. The study consisted of the observer standing in a fixed position and using a video camera to observe primary school children's pedestrian behaviour. Observation sessions were conducted before and after children in the experimental group had been exposed to the *Out and About* road safety education program. Data collection involved unobtrusive observation of children in real traffic situations. Filming was undertaken adjacent to, opposite to or within the boundary of participating schools. When close to the school boundary, to facilitate unobtrusive observation, the researcher was positioned adjacent to a tree or other structure, for example, telephone booth. Whilst utilising the zoom lens feature of the video camera to film children at the maximum distance, although unseen by the children being videoed, the researcher was visible to children who were in close proximity to the camera. The study consisted of two groups: control and experimental, that is, subjects who had and had not been exposed to the *Out and About* program. It was not possible to randomise the subjects; therefore the design was quasi-experimental. This was due to the nature of the study situation, that is, the researcher had no control over participating schools or allocation of schools to control and experimental groups. The use of control schools would enable comparisons to be drawn between control and experimental subjects. It was expected that the pedestrian behaviour of children in the control group would be relatively constant over each of the three rounds. This stable behaviour was anticipated because the children in the control group had not been exposed to the formal education program. The same procedures would be used for both the control and experimental groups, that is, data would be collected unobtrusively, and involve three distinct rounds. The schools in the study were reasonably representative of all primary schools located in the greater Darwin area.

The remainder of this chapter provides the reader with an insight into structured field observation, information about the teaching of *Out and About*, a brief outline of local traffic control mechanisms and legislation concerning *Children's Crossings*, schools and subjects involved in the study.

4.3.1 Structured Field Observation

A research technique used to obtain such information is referred to as structured field observation. This form of observation is a method of data collection where the observer observes and records events and analyses them according to pre-determined categories. This method of data collection is very appropriate when the researcher is investigating specific behaviours, environmental features, objects, activities or actions (Roberts & Burke 1989). Observations are recorded in a natural setting with the researcher being as unobtrusive as possible. Using this method of data collection, the researcher can record additional descriptive comments about the area, for example, demographic features, day of week, time, weather conditions and specific events that occur. Structured field observation can be covert or overt. Covert refers to situations where subjects are unaware of the researcher's presence. Overt observation occurs when subjects are aware that the research is being conducted and the researcher is recording observations.

The advantages of unobtrusive structured field observation include: gaining a realistic perspective of group dynamics and behaviour, identifying unpredictable events and behaviours (Sapsford & Abbott 1992; Roberts & Burke 1989). The major disadvantage of unobtrusive structured field observation as a research technique is that it takes a long time to gather the relevant information, thus is labour intensive.

In this study, education administrators, school staff, parents and the police were aware of the research. Whilst collecting data, the researcher was prepared to explain the research to those who enquired.

4.3.2 Unobtrusive Research Utilising Video Recordings

Videotaping is perceived to enhance data recording and to clarify any uncertainties which may occur during the observation period. Malin (pers. comm., 1994), Lecturer, Faculty of Education, N T University, outlined the advantages of unobtrusive observation using videotaping as: the ability to be selective with regard to what to record; preservation of the original sequence and duration of actions and opportunity to be systematic and focussed when analysing the footage. A fully automatic camera with zoom lens facilities enables filming to be undertaken at some distance from the subject, thus making the observation truly unobtrusive (Malin (pers. comm., 1994; Kellehear 1993). A camera which has an inbuilt microphone enables relevant information to be recorded at the time of the observation, for example, specific details about the observation site can be noted (Malin pers. comm., 1994).

Videotaping provides a visual record of the research and preserves the activity under observation (Marshall & Rossman 1989). This form of data collection enables the researcher to revisit footage and re-examine sequences by reversing, replaying and/or pausing the tape so

that data can be confirmed or more details recorded. Data analysis of the content can also be undertaken at a convenient time. This is particularly important if the researcher is tired: then the analysis session can be scheduled for another time, thus avoiding the potential for error. The material can be re-examined to confirm analytical interpretation of events and the behaviour of those observed. This enables a much more complex level of analysis to be undertaken compared to a live observation session where a paper and pencil type recording system is used to record data. Moreover, the film can be copied, thus ensuring that there is a backup record of the observation session. However, filming using a video camera can give rise to public curiosity. This and the cost of the equipment, including tapes, are perceived to be the main disadvantages of using videotaping for research purposes (Kellehear 1993).

Videotaping subjects' behaviour makes it possible for the researcher to copy and edit segments of the footage. These edited video segments can be used by another person to identify to which age group a subject should be assigned.

Unobtrusive field observation is a method used to ensure that subject's normal environment is maintained (Brink & Wood 1988). Although this type of observational research is time consuming, steps taken to enhance the quality of the technique included use of the video camera. When unobtrusively observing children's pedestrian behaviour, it was noted that within minutes of being aware that their behaviour was being observed, children quickly resumed their normal pedestrian behaviour (Molen 1983).

A method of data collection is *programmed sampling*, which is defined as:

> ... filming according to a predetermined plan - deciding in advance what, where, and when to film (Marshall & Rossman 1989:86)

This method is specifically useful when data is observed to determine if the subject's behavioural patterns change, especially before and after exposure to a particular education program, such as pedestrian safety. Major advantages of unobtrusively videotaping specific behaviours are that actions can be clearly defined and coded, and material can be reviewed on numerous occasions.

4.3.3 Teaching of the *Out and About* Program to Darwin Children

After reviewing the *Out and About* program, the researcher decided that to gain an increased understanding of the way it was taught, it would be necessary to spend some time with the Darwin Field Officer RSCNT. Increased understanding of the program would facilitate the design of the study.

In the latter part of 1993 through to mid 1994, the researcher accompanied the Field Officer whilst he provided road safety education to children enrolled at a number of Darwin Primary Schools. These education sessions were held either at the respective primary school or at the RSCNT Parap Road Safety Centre.

Discussions with the Executive Officer and Darwin Field Officer RSCNT ascertained that the School Road Safety pedestrian education program was designed to incorporate cognitive and behavioural learning strategies. An example of such a learning strategy is crossing a road at a marked crossing site. In addition, children were required to identify the purpose of traffic lights; indicate the meaning of the light sequence; identify potentially hazardous situations, for example a stationary bus; look for approaching traffic and to continue monitoring for oncoming traffic until safely across the road. The Field Officer used normal everyday language appropriate to the age of the children he was instructing. To emphasise or reinforce a specific point, he also incorporated current events into his teaching, for example press cuttings or photographs of recent child traffic accidents. One example that was used was the death of a young child who without looking dashed out in front of a stopped bus into the path of an oncoming vehicle.

The learning program was designed to promote the storage of information into children's long-term memory. The Field Officer believed that one way in which this could be achieved was through the provision of visual imagery and an active learning environment for the children. Using the lights as an example, the learning techniques used by the Field Officer can be illustrated as follows. Initially the children were asked to verbally identify and repeat the meaning of the colour sequence of the traffic lights. Correct responses were reinforced by a number of techniques including praise, giving the child(ren) road safety education stickers or posters. The showing of a video where a symbolic animal character or media personality reiterated a particular road safety behaviour. Another strategy used to reinforce information was to ask the children to draw a picture of themselves wearing a brightly coloured outfit and standing at the kerbside looking for traffic or colour-in a picture of a set of traffic lights.

Through negotiation with the relevant school authority, children were invited to attend the RSCNT external simulated street environment centre at suburban Parap. This was to enable the children to practice road crossing techniques and bicycle safety. Rehearsal of this psychomotor skill aids the encoding of information and transforms it from short to long term memory. What is learned through such a reinforcement process is available for future recall and use by the individual (Gagne 1985). The content of the teaching sessions utilised material from the *Out and About* program. The time sessions varied with the age of the children and what was being taught. As stated in (sub-section 1.4), classroom teaching sessions tended to be for about 30 minutes per group. On average, outdoor sessions, either at

the school or at the Centre were for approximately 60 minutes for most of the children. These outdoor sessions were mainly focussed on safe bicycle behaviour.

At the time of the research, the aim of the RSCNT education program was to improve child pedestrian safety knowledge, attitudes and behaviours with resulting reduction in unintentional injuries. Although the principles of the road safety education program remained the same, presentation and content varied for different age groups. The Field Officer specified the age groups as early childhood (5-7 years of age), middle primary (8-10 years of age) and upper primary (11-13 years of age). These age groups were incorporated into the research design.

4.3.4 Identification of Participating Schools

The Field Officer provided the researcher with the names of schools which had participated in the School Road Safety Education Program in the first half of 1994. This was to ensure that these schools were excluded from the study. In addition, it was one mechanism by which the researcher could minimise the likelihood of children participating in the study having been exposed to the road safety education program prior to the research being undertaken. Once these schools had been excluded, there were eighteen primary schools in the greater Darwin area identified as meeting the research criteria. The three Superintendents who oversaw all of the Darwin Primary Schools were advised of the research. They were advised that the researcher would be approaching Principals of these eighteen schools regarding the research and seek permission to discuss aspects of the research with teachers and School Council members. Two School Principals did not respond to the researcher's approach, even though messages were left with a member of each school's administrative staff on three occasions. In consultation with the researcher's supervisor, it was decided that for the research to be viable, it would be necessary to have a minimum of ten schools participating in the research. A total of sixteen schools agreed to participate in the study.

Once teaching staff indicated support for the research, arrangements were made for the research to be discussed with members of the School Council. Permission to undertake the research was sought from each School Council either by the researcher or through the School Principal.

If the school did not intend to participate in the road safety education program in the second half of the year then permission was sought from the School Council for the researcher to use that school as a Control Group. Schools which choose to participate in the education program were asked to act as a Experimental Group.

Teaching Staff and School Council members of the sixteen schools approached endorsed the research and agreed to participate in the study. The study involved a total of sixteen schools. The control group consisted of six schools which had a total student population of two thousand four hundred and sixty six, that is a group average of four hundred and eleven children. Ten schools formed the experimental group. This group had a total population of three thousand five hundred and fifty students, with an overall average of three hundred and fifty five students. Tables 4.1 and 4.2 outline the pseudonyms allocated to each participating school, control or experimental status of the school and approximate student population of each one.

Table 4.1 Participating schools in the control group with allocated pseudonyms, presented in descending order of total student population.

Pseudonym of Schools in the Control Group Student	Approximate Student Population
Pandanus	592
Livistonia	518
Calytrix	438
Cycus	417
Grevillea	405
Leucaena	096

It was estimated that there were seven thousand, two hundred and fifty five children aged five to fourteen years of age residing in the suburban areas where this study was conducted (Australian Bureau of Statistics 1995). Children in this study were between five and thirteen years of age. Approximately six thousand children attended schools participating in this study. Based on this data, schools participating in the study would be representative of students attending primary schools located in the greater Darwin area.

Table 4.2 Participating schools in the experimental group with allocated pseudonyms, presented in descending order of total student population.

Pseudonym of Schools in the Experimental Group	**Approximate Student Population**
Banksia	514
Hibbertia	506
Heliotropium	492
Melaleuca	402
Adansonia	367
Ficus	271
Gronophyllum	266
Ipomoea	260
Acacia	257
Eucalyptus	215

As it was intended to unobtrusively obtain the data, the study could be regarded as representative of child pedestrian behaviour in real traffic and conditions at road crossings. This would then be a satisfactory method of assessing the effectiveness of the *Out and About* program in relation to children's road crossing behaviour.

4.4 Characteristics of the Study Sites

The frontage of all schools participating in the research was on at least one arterial road. For the purpose of the study, an arterial road was specified as being a main road but not a highway. Roads adjacent to the schools were designed to accommodate through-route traffic. Two-way traffic traversed the roads outside all the schools involved in the study. One road adjacent to *Hibbertia* school had a central traffic island which separated the two-way traffic.

None of the observation sites had intersection traffic lights, signalised cross walks or pedestrian overpasses. Zebra striped street markings were not used to designate any of the

road crossing sites. All designed *Children's Crossings* were bounded by marked white lines and were in close proximity to schools involved in the study. *Children's Crossings* are distinguished by the use of orange coloured flags, erected on red and white kerbside posts. These crossings were operational during specific hours on school days. Details of *Children's Crossings* and other traffic control mechanisms including speed control devices, and supervised road crossings are presented later in this chapter.

Street parking bays were angled outside *Ipomoea* school, that is parking was at a 45^0 angle with the front of the vehicle usually being next to the kerb. As well as parallel parking being available outside all the other schools, *Hibbertia* and *Pandanus* schools also had angled street parking areas. Each school had a car park facility. The opportunity to unobtrusively observe children's pedestrian behaviour in the car park areas was restricted due to the layout of the parking bays.

A feature of suburbs in the greater Darwin area is the number of parks and outdoor recreational facilities in the residential areas. With the exception of *Cycus* and *Ipomoea*, there were parks and playing fields adjacent to schools in the study.

Constants used at each school in the study for the observations rounds were time of the day and positioning of the video camera. These strategies were used in an attempt to maintain consistency during the observation sessions.

4.4.1 Traffic Control Mechanisms

The safety of young children as they journey to and from school is of concern to a number of Darwin agencies: N T Government through the N T Police; Departments' of Transport and Works, and Education; Darwin City Council; Palmerston Town Council; RSCNT; community residents; and members of Primary School Councils. These agencies are aware that the phenomenon of pedestrian injuries is a complex one which require a number of intervention strategies to reduce the risk of trauma to young children. In addition to education programs other preventive measures include traffic legislation, speed control devices and supervised road crossings.

5.4.1.1 Legislation

The N T Traffic Regulations (1988) of the Traffic Act, specifies that a *Children's Crossing* is a special form of crossing situated near schools (RSCNT 1991:3). These crossings are operational only when the flags signifying *Children Crossing* are in place. They are predominantly located away from an intersection, that is, mid-block. Consequently, the

kerbside concrete is not always adjusted to footpath level (mountable kerb). This may create access difficulties for example, children wheeling a bicycle or an adult pushing a pram.

Requirements placed on drivers in relation to operation of *Children's Crossings* are:

> (1) A driver approaching a children's crossing shall drive at such speed as to be able, where necessary, to stop before reaching that crossing.
> (2) A driver shall stop before reaching a children's crossing and shall not cross over or allow any part of the vehicle being driven to enter on that crossing, where-
> (a) a person is, or is apparently about to enter, on the crossing; or
> (b) a Stop banner sign is displayed facing the driver.
> (c) a driver shall not overtake a vehicle which has -
> (a) reduced speed; or
> (b) stopped,
> at a children's crossing (RSCNT 1991:3-4).

It is stated in the N T *Traffic Code Book* (RSCNT undated:34) that it is illegal to park '... within eighteen metres of the approach side and nine metres of the departure side of a Children's Crossing.'

School zone speed restrictions are another form of legislation designed to reduce pedestrian injury. At the time of the research a school zone speed restriction of forty kilometres per hour was operational outside thirteen of the participating schools. A thirty kilometres per hour speed restriction was set outside *Gronophyllum* school. No school zone speed limit was in operation outside *Calytrix* and *Heliotropium* schools. The normal speed limit for this area was in force, namely, sixty kilometre per hour. The time period during which speed restrictions applied varied for the schools in the study. The time variations were as follows:

7:30	-	9:15 a m	and	2:00 p m	4:30 p m
7:30	-	8:30 a m	and	11:00 a m	3:00 p m
7:30	-	8:30 a m	and	2:00 p m	3:30 p m

This variation in times was brought to the attention of the Executive Officer RSCNT and plans were made to have the times standardised following the data collection phase of this study.

Residents in one suburb were very concerned about traffic speeding through residential areas and had successfully lobbied the Darwin City Council to trial a local traffic area speed restriction of fifty kilometres per hour throughout the suburb. Two schools, *Leucaena* and *Livistonia* were situated in this suburb.

5.4.1.2 Supervised Crossings

Children's Crossings were monitored outside *Banksia, Gronophyllum* and *Livistonia* schools. The *Children's Crossing* immediately outside *Leucaena* school was not supervised. This school was located adjacent to a school which had two supervised crossings. It was anticipated that some children attending *Leucaena* school would utilise the supervised crossings.

The Assistant Principal at *Banksia* school advised the researcher that if the pedestrian and vehicular traffic reached a specific level, School Councils could apply to the N T Department of Education for funds to employ a supervisor for the *Children's Crossing*. Visually, the level of vehicular traffic appeared to be very high outside each of the schools where the crossings were supervised. If a *Children's Crossing* site is supervised, the school can arrange for the RSCNT to provide onsite education to the crossing supervisor (RSCNT 1991).

The RSCNT recommends that at a supervised crossing, the supervisor have the children assemble on the footpath near the kerbside. When there is a lull in the flow of traffic, the supervisor walks out to the middle of the road, faces the way the main volume is approaching, and holds the Stop banner high so that it is visible to oncoming traffic. When the traffic has stopped, the supervisor signals for the children to cross the road. When all the children have crossed the road, the supervisor then returns to the kerbside to await the arrival of more children (RSCNT 1991). This grouping of children so that they cross the road together and the control of traffic so that the flow is not continually interrupted can be called a *platoon system.*

5.4.1.3 Speed Control Devices

The Darwin City Council has utilised local area traffic management (LATM) devices near some schools. These devices are designed to reduce vehicular speed and to improve pedestrian safety in local streets. Types of local area traffic management devices near schools associated with this study included humps, roundabouts and narrowing sections of the road. LATM devices were near *Adansonia, Eucalyptus, Gronophyllum* and *Melaleuca* schools.

4.5 Characteristics of the Research Sample

As stated earlier in this chapter, the *Out and About* primary school education program was used by the Field Officer, RSCNT. This program is designed for children between 5-13 years of age. The Field Officer structured the curriculum so that it was suitable for three age groups: 5-7, 8-10 and 11-13 years. Therefore, children involved in this study were divided into these age groups.

With a total potential student population of 6016, the researcher consulted with the Field Officer to estimate the research sample size. It was estimated that the sample size would be approximately 2000 children who should be evenly distributed by gender. In fact, the study comprised 3198 observations (n=3198). Between seasons there was a slight variation in the number of observations recorded: 1713 during the *wet* and 1485 during the *dry*. As the data collection phase was to extend over a six month period, it was anticipated that more children would travel by vehicle to and from school during the *wet* season. There was not expected to be any meaningful difference in the number of children observed in each age group. It was foreseen that the number of children observed in the control and experimental groups would be comparable. It was anticipated that of the observed children in the study, adults would accompany more of the children aged 5-7 years.

4.6 Variables

Components of the features chosen for the evaluation of child pedestrian behaviour were clustered into subject demographic, context environmental, school demographic and extraneous variables. Included in subject demographic variables were: age group, gender, colour of clothing, activity at commencement of observation, if child was accompanied or unaccompanied and if his/her hand was held whilst crossing the road. It was anticipated that the number of children accompanied by an adult would be less with older children, that is children in the 8-10 and 11-13 year age groups.

Context environmental variables addressed the setting and timing of data collection, time of the year, climatic and seasonal situation, amount of passing traffic in the child's vicinity, traffic regulations, road crossing behaviours and if the designated crossing was supervised or unsupervised.

The northern part of the N T of Australia has two distinct climatic seasons commonly known as the *dry* and *wet*. The *dry* season extends from May to September and during this period the weather is predominantly fine and sunny (Fernon 1993). Features of the *wet* season, which occurs between October and April, are high humidity levels, intermittent monsoonal rains and thunderstorms (Fernon 1993). The data collection phase of this study traversed the wet and dry seasons. Therefore, the season of the year was considered to be a variable which could affect child pedestrian behaviour.

Traffic density used in this study was: more than two vehicles per minute to be classified as heavy and less than one per minute as light (Molen 1983:107). When viewing the video footage to analyse subjects' pedestrian behaviour, the researcher noted if vehicles were moving or temporarily stopped, for example at a crosswalk area or bus stop. Where traffic was observed, the density was noted.

School demographic variables included the school population and code allocated by the researcher. The position a vehicle parked in relation to a school was perceived to be an extraneous variable. A vehicle could be parked at the kerbside adjacent to or opposite the school. A driver who parks a vehicle at the kerbside opposite to the school forces a child passenger to cross the road to get to or from the school. It was also thought that where child passengers sat prior to exiting or after entering a vehicle, in particular on the roadside side of the vehicle, would also be an extraneous variable.

Road crossing behaviour comprises outcome variables that have been clustered together. They include: stopping at kerbside; observing for oncoming traffic; head movement(s) when observing traffic; parked vehicles obstructing child's view; crossing within designated area; crossing between parked vehicles; monitoring traffic whilst crossing road; crossing road at an angle; and pace whilst crossing road.

Under normal circumstances, the process to detect presence of traffic involves looking and listening. Listening was unable to be detected using unobtrusive observation techniques. As a result, listening has not been incorporated into the elements associated with kerbside drill and monitoring traffic when crossing the road. Head movements are no guarantee that children are searching for approaching traffic (Molen 1983; Sandels 1968). However, head movements may be indicative that children are attempting to behave in a safe manner, so it was incorporated as a variable in this study. A criteria of head rotation of at least 45^0 from the midline was set when determining if children turned their head when standing at the kerb prior to crossing the road or whilst crossing the road.

4.7 Data Collection

As previously stated, the method used to collect data in this study was unobtrusive structured field observation, using a ten magnification zoom lens video camera. Several procedures were used to collect the data. The process included undertaking a pilot study to visually note children's road safety behaviour, a follow-up observation session observing children's pedestrian behaviour using video equipment, learning to use the video equipment efficiently, and scheduling for collection of data for the main study.

4.7.1 Observation of Child Road Safety Behaviour : Pilot Study

In August and September 1993, the researcher carried out a preliminary study to observe the road safety behaviour of school children. The methodology included sitting in a car and standing on the verge at various points outside two Darwin primary schools and observing the actions of children as they travelled to and from the respective schools.

The schools chosen for the pilot study were suggested by a N T Department of Education School Superintendent. When recommending the schools for observation, it was stated that they were generally representative of Darwin Primary Schools. One school had a student population of between 250-450, whilst there were more than 450 students attending the second school. To avoid any possible misinterpretation of the researcher's motives, the Assistant Principal of each school and a member of the Community Relations section of the N T Police was advised of the observation sessions.

The pilot study consisted of nine observation sessions: five morning sessions were conducted to coincide with children arriving at the schools; and four were undertaken in the afternoons at the end of the school day. The morning observation sessions began twenty minutes prior to school commencing. Each afternoon observation session lasted for approximately twenty minutes. With a secondary school located within a comfortable walking distance of both primary schools it was difficult to identify older children by age group. The weather was fine and sunny for each of the observational sessions and therefore it was not seen as a variable that would influence pedestrian behaviour in the main study.

During these sessions there was no restriction in relation to observing children's behaviours or activities, for example children as pedestrians or cyclists. In the main, the preliminary study showed that there was great variation in the road safety behaviour of children as they travelled to and from school. Examples of observed pedestrian behaviour included children: looking and not looking for hazards such as driveways, uneven ground, oncoming or reversing traffic; crossing the road at designated crossings and non-designated sites; reading or talking with another person whilst walking; and getting out of a vehicle on the left-hand side, that is kerbside, compared to the right-hand side, that is traffic side. Behaviours observed in relation to child cyclists included the wearing and non-wearing of helmets; looking and not looking for hazards when riding on the footpath, cyclepath or road; and talking and waving whilst riding.

The pilot study confirmed that there were many aspects of child road safety which could be addressed in the main study. However, to ensure that the research was manageable and to focus on specific behaviours, it was decided to restrict the main study to one aspect of road safety, namely pedestrian ethology. Pedestrian ethology involves the study of pedestrians' behaviour in relation to their normal environment (Molen 1983). Part of this normal environment includes the alighting and/or boarding private and public vehicular transport.

Other findings of the pilot study related to difficulties in distinguishing between upper level primary and secondary school children, and the arrival of some children at school earlier than the commencement of observation sessions. A further difficulty was encountered when a large amount of detail was missed in the observation sessions.

The pilot study led to the research focus being confined to observing the pedestrian behaviour of primary school children. Following informal discussion with some teachers, it was decided that observation periods should commence 30 minutes prior to the beginning of the school day. Based on the pilot study findings, an instrument was designed to aid collection of demographic and environmental data pertaining to child pedestrians. A copy of the data collection instrument is presented in Appendix A.

4.7.2 Data Collection Using Videotaping

As a result of the pilot study, it became obvious to the researcher that the method used to collect data had to be improved. Arrangements were made to discuss alternative data collection options with Dr Merridy Malin, Lecturer, Faculty of Education, Northern Territory University. Given that videotaping is deemed to be an unobtrusive form of data collection (Drummond & Ozanne-Smith 1991:11), a decision was made to use a video camera to tape child pedestrian behaviour.

After consultation with Malin (pers. comm., 1994), the following criteria for videotaping were formulated:

- tapes were to be labelled with the pseudonym assigned to the school and the date of filming;
- each tape was to be copied so that there would be a backup of the original data;

and

- a record was to be kept of each school, including the pseudonym assigned to the school, population size, if control or experimental group and date videotaping was undertaken.

4.7.3 Learning to use the Video Equipment

FORS provided the researcher with a grant which covered the cost of the video equipment required for the research. Equipment purchased included a *Panasonic NV-A1A* 10 power zoom lens, auto-focus VHS-C, that is Video Home System using Compressed Tape, Movie Camera with inbuilt microphone, heavy duty back up battery pack, *Optex* carry bag, *Mars* heavy duty VT-67 tripod and a supply of compressed and full VHS tapes.

Initially the researcher had basic skills in the use of videotaping and related activities. After the equipment was purchased, the researcher further refined these skills by practising using the video equipment in a variety of settings, backing-up video tapes and compiling edited film footage in what the researcher termed *cameo shots*. This term was used by the researcher to

describe the compilation of short video tape segments of child pedestrians from the original footage.

4.7.4 Follow-up Observation Session

Arrangements were made with the principal of a school which had been involved in the road safety education program earlier in the year, to undertake video filming outside the school on the 18-19 July 1994. This activity proved invaluable to the researcher in that video filming skills were honed. In particular, with the camera mounted on a tripod, it was possible to point the camera in one direction and by using peripheral vision, that is, catching sight of movements at the side, the tripod extension arm could be gradually moved so that the camera lens was slowly rotated. This method further enhanced the unobtrusive observation activity. To the naked eye it would appear that the researcher was looking in a particular direction whilst in effect with the camera pointed in another direction, the behaviour of a child could be followed, often for a prolonged period of time. This technique helped the researcher to identify and discretely capture actual child pedestrian behaviours.

Videotaping of child pedestrian activities using a ten-magnification zoom lens enabled filming to commence when the child was up to two hundred and twenty nine metres away from the researcher. At this distance children's dress features and general behaviour were visible. When the children were one hundred and eight metres from the researcher, facial features were clearly distinguishable. Filming using the zoom lens meant that the child was unaware when filming of pedestrian behaviours was initially undertaken. Close-up footage of the child was recorded so that material could be edited from this section of the footage to compile the cameo shot.

Initially, when videotaping, the researcher endeavoured to capture everything on the video film and this resulted in a conglomerate of pedestrian activities which were difficult to analyse. Therefore, the researcher decided to follow one child or a group of children at a time from a distance to a close-up point. This had the advantage of recording actual behaviours and utilising close-up footage of the subjects for the cameo shots. Thus, by positioning the video camera in a strategic position, the researcher captured typical child pedestrian behaviours. It is interesting to note that initially when children were aware that they were being filmed that some skylarking occurred. However, within a very short time, student interest in the researcher diminished. This phenomenon was also experienced in the main study.

Another advantage of undertaking these additional practice observation sessions was that of having an independent person comment on the quality of edited footage of the cameo shots. It was recommended that instead of the cameo shots lasting 3-5 seconds that where possible

they be extended to 10-20 seconds duration, with a few seconds of black tape leading into the next shot. It was also suggested that a numbering system be incorporated into the edited footage.

4.7.5 Schedule for Data Collection

The study incorporated a time-series design to measure children's pedestrian behaviour. Each participating school was surveyed on three occasions. Sequencing of the observation sessions was at least one week prior to and one week after each school, at which subjects in the experimental group had participated in the Road Safety Education program. Follow-up observations were done within a five-week period after the conclusion of the education program. The five-week time frame was chosen firstly to identify if children transferred the information into long-term memory and secondly to fit the second half of the school year which had been allocated for data collection. Observation sessions were undertaken over a similar time frame at the schools which formed the control group.

Half a year was considered by the Field Officer to be the maximum period the researcher would have for data collection. This would ensure that the schools that were to be assigned to the control group would not be deprived of access to the road safety education program for more than six months.

If children were to encode and store the road safety education concepts into long-term memory and be able to recall information when required, the researcher believed that such an activity would be manifested within such a time frame. Furthermore, if children in the experimental group consistently manifested positive pedestrian behaviour during the third observation round, it was more likely to be the result of the education program rather than developmental and maturational experiences.

In consultation with the Principal or nominated contact person from each school, a decision was made as to the number of filming schedules required for each observation round. Two schools were located in the middle of a block and there was only one road in close proximity. It was recommended that filming should be restricted to one morning and afternoon for each round for these schools. The remaining schools were surrounded by more than one road. The personnel at these schools recommended that each observation round consist of two morning and afternoon filming sessions. A timetable was developed to undertake videoing of the children arriving and departing from schools involved in the research. Timetabling arrangements ensured that filming was undertaken prior to children in the experimental group being exposed to the road safety education program and post education observation sessions were scheduled for one week after the children had completed the education program, with the third observation session being within five weeks of the completion of the road safety

education program. The timetable was given to the Principal or nominated contact person of each participating school for endorsement. The final schedule data collection in the main study is presented in Appendix B.

4.7.6 Data Collection in the Main Study

Data for the main study was collected between July and December 1994. In consultation with a senior school staff member specific observation sites were selected at each school. Single and multiple positioning locations were utilised. These positions were defined as:

> *Single positioning* is staying put for a period of time so as to gain a greater familiarity with one station. *Multiple positioning* means moving around the setting to observe in different locations (Wilson 1985:380).

Once a site was decided upon, it was recorded to enable the same location to be used in follow-up videotaping sessions. This technique was utilised in an attempt to capture on video tape the same children on subsequent observation sessions and to maintain consistency throughout the study.

The sample consisted of three thousand, one hundred and ninety eight observations (n=3198). Nearly twice as many children were observed in the mornings (66%) as the afternoons (34%).

4.7.7 Additional Information

In this study the researcher intended to focus specifically on children's pedestrian behaviour and analyse these actions based on what is taught in the road safety education program *Out and About*. However, additional observations noted by the researcher during the study will be presented in the results section.

4.8 Preparation for Data Analysis

As the road safety curriculum is tailored to specific age groups, it seemed appropriate to the researcher to identify child pedestrians by specific age group categories. On the advice of Malin (pers. Comm., 1994) it was decided to edit the main footage and assemble short cameo shots of subjects on a separate video tape. Individual cameo shots were restricted in length but were to be of sufficient footage to ensure that the age group of each child could be noted by relevant school personnel.

4.8.1 Editing of Video Footage

The purpose of editing the original video footage was to assemble short segments which showed each research subject. Subjects' age groups could then be indicated by an individual

or group of people from the school which the child attended. Any comments made by the researcher at the time of observation were edited out. The new footage consisted of a series of silent cameo shots. No positive or negative behaviours were included in this footage, thus ensuring that each child's actions remained confidential to the researcher.

Editing, using a *Panasonic AG 750* editing system, was undertaken by the researcher in the Educational Technology Centre at the NT University. The editing system comprised two video decks, television monitors, and an editing controller. A *For A VTW 400* video typewriter was also used to label and number segments. The method involved in editing for cameo shots was as follows: The original VHS tape was inserted into the source deck and a blank tape loaded into the recording deck. A thirty minute control track was laid down on the blank tape. This process enables video segments to be inserted onto the tape, using designated in and out points, thus ensuring a more stable end product.

After putting down thirty seconds of black at the start of the tape, the number assigned to the school and round number was put onto the tape using the video typewriter. This was followed by five to ten seconds of black then the number 1, to signify that the first cameo shot was to follow.

The next stage of the process was to view the original footage and select the section which was to be copied onto the receiving tape. Using the edit controller, an input point was set and an outpoint set for approximately twenty seconds later. Using the editing controller, the selected footage was then edited onto the receiving tape. This was followed by ten seconds of black. The next number was recorded, followed by the subsequent cameo shot. This process was repeated until all cameo shots had been copied onto the new tape. The editing process was a very time consuming segment of the research process.

During the editing process the advantage of having a ten-magnification zoom lens video camera came to the fore. Considerable length of footage of children's pedestrian behaviour could be obtained unobtrusively. Cameo shots consisted of a reasonable picture of the child(ren), thus making the task of identifying the child by age group easier for the nominated school representative(s).

4.8.2 Data Processing

Schools were requested to indicate the age group category of each child depicted in the cameo shot. To facilitate the process, an *Age Identification Sheet* was developed. At the top of the form was a key which indicated the age groups relevant to the study, a number allocated to the school and observation round number. Coded age groups used in the study were: A=5-7 years, B=8-10 years and C=11-13 years. The body of the form enabled recording

of the following information: cameo number and a brief description of each child which included gender and clothing worn. Where appropriate, other identifying information about the child was included, for example, colours of back pack, position in group and headgear worn. The video tape which contained cameo shots of child pedestrians, an age group identification sheet and covering letter were hand delivered to each school after each round of videotaping had been completed. When advised, by a member of the school staff, the researcher collected the completed identification material.

Two video cassette recorders and two television monitors were used to facilitate the data coding process. A video cassette and television monitor were utilised to play the video tape which contained the edited cameo shots whilst the other was employed to view the full video footage. Once the child was viewed on the edited footage, the researcher then watched the full video footage and recorded the child's pedestrian behaviour on the data collection instrument. Use of nominal data was a design feature of the data collection instrument. Therefore, it was relatively easy for the researcher to allocate the numerical value to a specific variable. The researcher was able to review video footage to confirm interpretation of events and behaviours observed.

Events were viewed repeatedly, each time focusing on a different environmental factor or aspect of the child's pedestrian behaviour, for example, body posture, activity and direction of gaze at the commencement of the observation session. In addition, footage was able to be *frozen* and then re-played so that the child's behaviour was observed in discrete segments. Video tape footage could be replayed as many times as needed until the researcher was satisfied that pedestrian behaviour had been correctly coded. This repetitive analysis activity was a critical factor in ensuring that child pedestrian behaviour was accurately recorded.

4.8.3 Data Entry

A data file was created using *SPSS/PC+ Version 5.0 Data Entry II* statistical package for the research. Variable names were determined. Labels and values were assigned to these variables and missing values.

Once all original footage had been reviewed and subjects' pedestrian behaviour and other variables noted, nominal data was coded and entered into an *IBM* (International Business Machine) compatible computer. In an attempt to minimise entry errors, data was entered twice to verify correctness of entry.

4.9 Data Analysis

The data typology was nominal or categorical thus facilitating classification; for example, child's gender, age group or activity at time of observation. Descriptive statistics were used to obtain meaningful information about the data. These statistics included frequency, arithmetic mean (mean) scores, standard deviation and percentages for each variable. Frequency refers to how often the score or event occurs. The arithmetic mean is obtained by adding all the scores together and then dividing the total by the number of scores. The standard deviation provides a measure of the spread of scores in relation to the arithmetic mean. Percentage refers to the score rate proportional to a hundred. Descriptive quantitative data enabled incidences to be enumerated and cross tabulated. Factorial and cluster analysis were used to identify differences and similarities amongst research findings, for example: age group, accompanied or unaccompanied and elements of road crossing behaviour. Comparisons between control and experimental groups road crossing behaviour were made. Where relevant, a summary of the data was depicted in tabular and graphic forms.

Darwin primary school children's pedestrian behaviour was evaluated relative to the *Out and About* road safety education program. This process was undertaken to determine the effectiveness of the program.

4.10 Ethical Procedures

The study was designed to obtain aggregated data rather than individual data. Subjects were coded by number and assigned to one of three age groups, namely 5-7, 8-10 and 11-13 years; this was to ensure that their anonymity and confidentiality was maintained.

As the research in this study crossed a number of different boundaries, ethical clearances were obtained from three different sources. Authorisation to engage in the research under the auspices of the RSCNT was sought and received (Appendix C). Permission to undertake the research, gain access to data, and an ethical clearance were sought from the N T University. A copy of the research approval and ethics clearance is in Appendix D. In light of the participants in the study being primary school children, consent to proceed with the study was sought and received from the N T Department of Education (Appendix E).

In addition to ethical clearances, special care was taken to safeguard the rights of children. Herd (pers. comm.,1994), a Senior Lecturer in Law at the N T University, stated that with the exception of areas where there is public constraint, for example law courts and art galleries, there is no common law restricting photographing or video filming in a public place such as a street, footpath or park. Permission to undertake the research was sought from teaching staff at all schools involved in the study. Staff were advised that children would be coded by age group, thus ensuring their anonymity and confidentiality. Staff were assured that no child

would be identified by name. On receipt of approval, School Councils were approached either by the researcher or the School Principal to inform them of the proposed research and reassure members that the confidentiality of the school and subject's would be maintained at all times. By negotiation between the school administration and the researcher, the school was to identify if it was to be a control or experimental group in the study.

It was suggested by a Department of Education Adviser that the researcher should ask for information about the research to be included in school newsletters, as this was the most appropriate method of informing parents or caregivers of the research. As no adverse response was received following the dissemination of this information in school newsletters, it was considered that parents and caregivers also endorsed the research.

Access to original research data was restricted to the researcher and academic supervisor. Each school was coded by a number which was marked on the outer side of each video tape. Storage of all original video tape footage was locked in a cupboard within the School of Health Science, at the N T University. For the duration of data analysis, when not in use, back up video tapes and data collection instrument forms were stored in a locked cupboard at the researcher's home.

As a further means of ensuring school confidentiality, pseudonyms were assigned to each school. The pseudonyms used in the research were given in Table 4.1 and 4.2.

Arrangements were made to provide each participating school with a copy of the research findings of stage one of the research.

4.11 Limitations of the Study

Limitations of the study were identified as:

- only children of primary school age would be included in the study;
- the study would only address the effect the road safety education program *Out and About* had on child pedestrian behaviour;
- no child would be specifically designated as being a participant in the research. Although this may restrict the number of times the same child would be observed over the three rounds of the research, it was perceived that if children were designated by the use of some symbol it may have a *Hawthorne effect* on their pedestrian behaviour. That is, children would be apt to change their pedestrian behaviour and behave differently because they were aware of being observed (Ausubel & Robinson 1969). Consequently, they might

consciously exhibit either excellent or inappropriate pedestrian behaviours during the observational period undertaken at the school;

- that there would be no matching of subjects observed in the first and subsequent rounds;

and

- analysis was restricted to pedestrian behaviours captured on video tape.

Primary school aged children are likely to have already been introduced to basic road safety concepts through a variety of sources including parents, carers, previous education programs, and the media. As this would be an unknown variable for all children, it was not considered to be a specific study limitation.

4.13 Summary

The research methodology utilised in this study was observation utilising videotaping to unobtrusively record the pedestrian behaviour of primary school children. Sixteen Darwin primary schools participated in the research; six formed the control group and the remaining ten were in the experimental group. As the road safety curriculum is tailored to specific age groups, the same age groupings were adopted for the study.

On the advice of Malin (pers. comm., 1994), it was decided to copy the original video footage as a backup tape and also to compile new tape footage using edited shots of child pedestrians. These short sequences were termed *Cameo Shots*. Cameo shots were silent and only of sufficient duration to aid relevant school personnel to identify the age group to which each child should be assigned.

Pedestrian behaviours were coded and entered into an *IBM* compatible computer and analysed using *SPSS/PC+ Version 5.0 Data Entry II* statistical package. Comparisons were made between what pedestrian behaviours were taught in the *Out and About* road safety education program and the children's pedestrian behaviour depicted on film. The purpose of this was to determine what effect the education program had on children's pedestrian behaviour.

CHAPTER 5

5. RESULTS

This chapter focuses on the results of the research observation sessions on primary school children's pedestrian behaviour and analysis of the data. Initially, subject demographic, context environmental, school demographic and extraneous variable results are presented. As this is phase one of a larger study, the main point of interest centres on children's road crossing behaviour in relation to the safety education program *Out and About*. During the data collection phase the researcher noted other factors which may influence child pedestrian behaviour. This information will be presented in this chapter.

5.1 Characteristics of the Study

Basically, this section is concerned with the overall study results for the control and experimental groups with regard to demographic, environmental and extraneous variables and specific data on children's road crossing behaviour.

5.1.1 Subject Demographic Variables

The study comprised observations of three thousand, one hundred and ninety eight child subjects (n=3198), 41% in the control group and 59% in the experimental group. Nearly equal numbers of the subjects were observed each round, that is 32%, 36% and 32%.

6.1.1.1 Age Group

The 8-10 year age group (43%) were the largest group in the study, compared to the 5-7 year age group (30%) and 11-13 age group (27%). This would account for the finding that nearly twice as many subjects in the 8-10 year age group were noted observing for traffic compared to subjects in the other two age groups. These percentages were evenly divided by gender for each age group. The percentage of subjects' by age group, observed each round, was consistent as outlined in Table 5.1.

Table 5.1 Number of subjects observed each round by age group.

Age group	Round 1		Round 2		Round 3		Totals	
	n	%	n	%	n	%	n	%
5-7 years	304	30	364	32	302	29	970	30
8-10 years	444	43	467	41	466	45	1377	43
11-13 years	280	27	306	27	265	26	851	27
Column Totals	**1028 (32%)**		**1137 (36%)**		**1033 (32%)**		**3198 (100%)**	

6.1.1.2 Gender

The gender balance in the overall study was almost equal with 48% male subjects and 52% females. These percentages were constant by round and with the control and experimental groups.

6.1.1.3 Colour of Clothing

Light coloured clothing was worn by 52% of the subjects, 42% wore a mixture of light and dark coloured clothes and 6% wore dark coloured clothing. By round and age group there was no discernible difference in the colouring of clothes worn by male or female subjects. All the schools involved in the study had a specified student uniform. These uniforms tended to be either light in colour or a mixture of light and dark colours. Most subjects wore their school uniform although this was not compulsory.

6.1.1.4 Activity at Time of Observation

The activity of subjects at the time of initial observation varied. However, the most common activities were walking (41%), alighting from a vehicle (23%) and walking and talking (22%). Percentages for all other observed activities were four percent or less per activity. Minor activities included: standing (4%); running (1%); walking while talking and eating (1%); walking while wheeling a bicycle (1%); eating while walking (1%); and walking and playing (1%). Activities which scored less than one percent included: reading while walking;

sitting; skipping; playing; talking; eating; drinking while walking; skating; and bouncing a ball while walking. These distributions were similar for control and experimental groups. Irrespective of the child's activity at the time of observation, 66% (mean) appeared to be frequently looking for hazards. Overall there was no variation between rounds, but the experimental group appeared to be looking for hazards more frequently (mean 71%) than the subjects in the control group (mean 61%).

Subjects were observed: on the roadside (47%), of which, approximately two-thirds were on the footpath and one-third on the verge; crossing a road (36%); in the school grounds (9%); in a park or vacant block (6%); and in a car park (2%). These percentages related to the activity subjects in the control and experimental groups were doing when first observed. Some subjects were observed undertaking more than one pedestrian activity, for example, alighting from vehicle and crossing road. Although 3198 subjects were observed, this study represents 5113 pedestrian activities.

6.1.1.5 Accompanied

Sixty percent of the subjects were accompanied by an adult or at least one other child. Approximately one-third of those accompanied were in each age group. The number of subjects accompanied in the control and experimental groups was 62% and 61% respectively. At the initial time of observation of those accompanied, about a third (36%) were walking and talking, and nearly a quarter were walking (28%) and did not appear to be interacting with the person who was next to them, whilst 23% were alighting from vehicles at the same time as someone else. More details on the effect another person had on the pedestrian behaviour of subjects is presented in the sub-section on Road Crossing Behaviour (see section 5.2). It will be demonstrated that subjects' compliance to some of the road crossing behaviour elements deteriorates when they are accompanied.

6.1.1.6 Hand Held

Over the three observation rounds, only 6% of the subjects had their hand held when initially observed. Two-thirds of these (65%) were in the 5-7 year age group, three quarters (77%) of whom had their hand held by an adult. These findings were the same for the control and experimental groups, by gender, age group and round. During the dry season, there was a slight increase (4%), of subjects who had their hand held than in the wet season. Children who did not have their hand held were considered to be responsible for their own pedestrian behaviour.

Over the three rounds the majority of subjects (57%) were observed crossing the road. Only a few (7%) had their hand held whilst undertaking the task. One-third of these were in the

control group and two-thirds were in the experimental group. The sample size was very small for each group by round. Therefore, no statistical conclusion can be drawn from this variable in relation to its influence on road safety behaviour.

5.1.2 Contextual Environmental Variables

The contextual environmental variables presented in this section will also address any effect climatic changes had on other variables, for example observing for hazards and crossing the road at a designated crossing site.

6.1.2.1 Time of Day Observed

Nearly twice as many subjects were observed in the mornings (66%) as the afternoons (34%). It was noted that children tended to arrive at school over a much longer period of time in the morning, whereas, once the school day ended, children quickly dispersed from the school precinct, thus limiting the number of observations possible.

6.1.2.2 Day of Week Observed

The number of subjects observed varied by the day of the week. This may have been because two public holidays were observed during the observational period, one on a Monday and the other on a Friday. The highest proportion of observations occurred on a Tuesday (24%) and the lowest on a Monday (17%).

6.1.2.3 Seasonal Factors

More subjects were observed in the wet season (54%) than the dry season (46%). There was an increase in the number of subjects, by age group, observed during the wet season: 12% (8-10 years); 4% (11-13 years); and 2% aged 5-7 years. Between the two seasons there was some variation in subjects' activity when first observed. In the dry season 7% more subjects were observed walking to school. In the wet season, 9% more subjects were observed alighting from a vehicle, of whom half were in the 5-7 year age group and approximately a quarter were in each of the other age groups. As stated in the Methodology Chapter, sudden onset of rain is a feature of a tropical wet season. To prevent their children from becoming wet, it would appear that more adults drive children to school in the wet season.

There was a slight increase in the number of subjects who appeared to observe for and monitor traffic when crossing a road in the wet season (78%) compared to the dry season (67%). Similar results were obtained for the control and experimental groups and by round. In the wet season subjects from all age groups appeared to observe more actively for hazards (mean = 13%). Another feature which was noted in the wet season was an increase in the

number of subjects who crossed the road at the designated crossing site. This change in pedestrian behaviour was observed over each round: 23%, 25% and 16% respectively. Based on an examination of the data, weather conditions appear to be the main reason responsible for this change.

6.1.2.4 Climatic Conditions

It would appear that adults pre-empted weather conditions. In the mornings during the wet season there was an increase in the number of subjects who travelled to school in a vehicle, even when it was predominantly fine and sunny. Less than one percent of the observations were undertaken in humid conditions or when it was raining. Therefore, in this study, variation in climatic conditions did not have any effect on subjects' pedestrian behaviour.

6.1.2.5 Traffic Density

When observing subjects, the level of passing and approaching traffic within the observation area was also noted. Traffic density was recorded on 1393 occasions, and 65% of the traffic was classified as being heavy, that is, more than two vehicles per minute. This level of traffic density was consistent for each round. A small variation in the traffic density was noted for each season: wet (45%) and dry (55%) Cars including utilities and station wagons represented the most frequent type of moving vehicles observed (93%).

6.1.2.6 Supervision of Road Crossings

Of the subjects observed in this study, 58% crossed a road. Four-fifths of these crossings occurred mid-block, that is, between intersections. Midblock is where *Children's Crossings* are usually sited. A quarter of the crossings took place at a supervised site. Nearly half of these (47%) were observed at *Banksia* school, one-third (36%) were observed at *Livistonia* and one-fifth (17%) were observed at *Gronophyllum*. Particulars of subjects' pedestrian behaviour when crossing the road at a supervised crossing are presented in the sub-section 5.2 on Road Crossing Behaviour.

5.1.3 School Demographic Factors

As stated in the Methodology Chapter, sixteen primary schools were involved in the study. Ten of these formed the experimental group and six formed the control group. Of the total number of subjects in the study (n=3198), 59% were in the experimental group and 41% were in the control group. At some schools there was a variation in the number of subjects observed per round. The variables which affected the observation sessions related to specific classes being absent from the school, for example when the numbers are lower for *Adansonia*

and *Calytrix* schools, their senior students were at school camps. Another factor that caused variation in observation numbers was after-school activities, for example, football training at *Grevillea*. Round three was undertaken at *Leucaena*, *Melaleuca* and *Pandanus* a fortnight prior to school ending for the year. The researcher was advised by school personnel that some students were already on holiday. Student attendance at some schools in November was reduced due to an outbreak of measles (Northern Territory News 1994:6). The researcher was unable to identify the schools affected by the measles outbreak. It is possible that the incidence of this disease affected the number of subjects observed in this study. Details of the number and percentage of subjects observed per round at each of the participating schools are presented in Table 5.2.

Table 5.2 Number of subjects observed per round at each participating school.

School		Round 1		Round 2		Round 3	
Pseudonym	**Category**	**n**	**%**	**n**	**%**	**n**	**%**
Acacia	Experimental	39	4	34	3	36	4
Adansonia	Experimental	39	4	78	7	65	6
Banksia	Experimental	62	6	87	8	65	6
Calytrix	Control	90	9	114	10	96	9
Cycus	Control	73	7	75	7	67	6
Eucalyptus	Experimental	36	3	35	3	34	3
Ficus	Experimental	49	5	70	6	72	7
Grevillea	Control	58	6	76	7	60	6
Gronophyllum	Experimental	47	4	40	4	58	6
Heliotropium	Experimental	94	9	110	10	120	12
Hibbertia	Experimental	89	9	72	6	63	6
Ipomoea	Experimental	45	4	37	3	37	4
Leucaena	Control	36	3	40	4	24	2
Livistonia	Control	95	9	79	7	73	7
Melaleuca	Experimental	88	9	101	9	86	8
Pandanus	Control	88	9	89	8	77	8
TOTAL		1028 (32%)		1137 (36%)		1033 (32%)	

NB Percentages have been rounded to the nearest full number, therefore the final percentage may have a slight rounding error.

5.1.4 Extraneous Variables

Children are unlikely to have any control over two extraneous variables specified in this study. One is where vehicles are parked to enable children to alight or enter, the other is the vehicle exit or entry point used by children.

6.1.4.1 Travelled In A Vehicle

Just under a third (31%) of the subjects travelled in a vehicle and therefore alighted or entered it. Vehicular types in which children travelled were: car (67%), 4 wheel drive (10%), van (9%), utility (7%) and bus (7%). Approximately one third of the subjects travelled in a vehicle for each round of the study: round 1 (36%), round 2 (33%) and round 3 (31%). Half again as many subjects travelled in a vehicle in the wet season (61%) as in the dry season (39%). As stated earlier, unexpected tropical showers in the wet season may influence the method by which children travel to and from school by vehicle. The largest number of subjects by age group who travelled in a vehicle was the 8-10 year old (43%), followed by 5-7 year old (32%) and 11-13 year old (25%).

6.1.4.2 Alighting From Or Entering Vehicles

Of the subjects who travelled in a vehicle, approximately three-quarters (77%) of them alighted from a vehicle in the mornings and a quarter (23%) entered a vehicle in the afternoons. Of all these subjects, approximately two-thirds (64%) of them alighted from or entered a vehicle parked kerbside, adjacent to the school. In nearly a third (29%) of these cases, the vehicle was parked by the kerbside opposite the school. Only 7% of the subjects who travelled to or from school were observed entering or exiting a vehicle in the school car park. On most observations sessions, the researcher was not in a position to have a clear vision of the school car park. About a third of the subjects alighting from or entering a vehicle were observed each round. The number of subjects observed varied between groups: 42% in the control group and 67% in the experimental group alighted from a vehicle; and 33% in the control group and 58% in the experimental group entered a vehicle.

The *Out and About* education program advocates that children enter and leave a vehicle on the side closest to the kerbside. Other entry or exit points have the potential to put the child at risk of being involved in a traffic accident. Therefore, the position a subject entered or left a vehicle was also recorded. Just over four-fifths (85%) of the subjects exited or entered a vehicle on the kerbside. The percentage of children who leave a vehicle on the street side and

to a lesser extent the rear was a cause of concern because they were more at risk of being hit by approaching traffic.

5.2 Road Crossing Behaviour

Ideally the sequence of pedestrian behaviour prior to crossing a road can be summarised as: stopping at kerbside; searching for and detecting traffic; evaluating the degree of safety; and deciding on the course of action. If it is deemed safe to cross the road, then while walking straight across the road, the pedestrian observes to the right and left for approaching traffic. The descriptive results presented earlier in this chapter do not provide any analysis of the subjects' degree of safety or compliance to the *Out and About* education program. As indicated earlier, to facilitate the analytical process, independent variables have been clustered together and are described as Road Crossing Behaviour.

The elements of subject's road crossing behaviour specifically analysed with code number assigned to them were:

- refrains from crossing between parked vehicles (101);
- crossed within designated area (102);
- view of approaching traffic not obstructed by vehicle parked on left (103);
- view of approaching traffic not obstructed by vehicle parked on right (104);
- stopped at kerbside prior to crossing the road (105);
- appeared to monitor traffic by moving head to the right-left-right, prior to crossing the road (106);
- appeared to monitor traffic whilst crossing the road (107);
- crossed the road at walking pace (108);

and

- crossed the road at a right angle to the kerbside, that is, straight (109).

In this section results relating to each of these elements are provided. They will show that the road safety education program is not having an effect on subjects behaviour in relation to: stopping at the kerbside; head movements to observe traffic prior to crossing the road; and monitoring for traffic whilst crossing the road.

Analysing this activity as outlined in the *Out and About* education program, it was found that for subjects in both the control and experimental groups there was a high compliance (99-79%) to six of the road crossing behavioural elements: refrained from crossing between parked vehicles; view of approaching traffic not obstructed by vehicle parked on subject's left; view of approaching traffic not obstructed by vehicle parked on subject's right; walked whilst crossing road; crossed road at a right angle to kerbside; and crossed within a designated crossing area. This high compliance rate was stable between the three rounds.

For subjects in the control group there was a slight improvement in compliance between rounds 1 and 2 with a further slight improvement between rounds 2 and 3 for the elements: refrained from crossing between parked cars; view of approaching traffic not obstructed by vehicle parked on subject's left; view of approaching traffic not obstructed by vehicle parked on subject's right; and walked when crossing the road (see Table 5.3). There was a slight improvement between rounds 1 and 2 with a slight regression between rounds 2 and 3 in the elements: crossed between designated area and crossed at right angle to the kerb, that is straight.

Compliance rate for subjects in the experimental group were similar to subjects in the control group for the elements: refrained from crossing between parked cars; view of approaching traffic not obstructed by vehicle parked on subject's left; and view of approaching traffic not obstructed by vehicle parked on subject's right. For subjects in the experimental group there was a slight regression in compliance rate between rounds 2 and 3 for the elements: crossed within designated area; walked when crossing the road; and crossed at right angle to the kerb. Between round 1 and 3 there was a slight regression in the elements: stopped at kerb prior to crossing the road; observed for approaching traffic prior to crossing; and monitored traffic whilst crossing the road.

Subjects in the control and experimental groups had a high compliance rate to six road crossing behavioural elements: refrained from crossing between parked cars; crossed road at a designated site; view of approaching traffic not obstructed by vehicle parked on subject's left; view of approaching traffic not obstructed by vehicle parked on subject's right; walked when crossing road; and crossed road at right angle to kerb. This rate remained high when other factors were considered, for example, traffic density, accompanied or unaccompanied, gender, age group etcetera. As the compliance rate to these behavioural elements was high for both the control and experimental groups, that is, subjects who had not and subjects who had been exposed to the road safety education program, the behaviours cannot be directly attributed to the road safety education program *Out and About*. Therefore, these behavioural elements will not be discussed any further in this section of the paper.

The three elements in which both groups scored poorly are critical areas of road crossing behaviour: stopping at kerbside; observing for approaching traffic prior to crossing; and monitoring traffic whilst crossing. For the control group there was a slight fluctuation in compliance level with these elements between the three rounds, with a slight improvement in each element by round three. For the experimental group, it is interesting to note that the two elements which had the lowest compliance rates were: head movement when observing for approaching traffic, and monitoring of traffic whilst crossing the road. This was also evidenced for both groups between rounds one and two and one and three. The next element with the lowest compliance rate was: stopping at the kerbside prior to crossing the road. For this element, a compliance rate of 55% occurred in round two falling to 52% in round three. The means and standard deviations of the group of nine behavioural road crossing elements for the control and experimental groups are depicted in Table 5.3. The maximum mean score was 1.00, that is, everyone observed complied with the activity.

Table 5.3 Road crossing behavioural elements: means and standard deviations for control and experimental groups.

Element Code & description Group	**Round 1** Mean	Std Dev.	**Round 2** Mean	Std Dev.	**Round 3** Mean	Std Dev.
101 "Refrained from crossing between parked vehicles"						
Control	.99	.08	99	.08	1.00	.00
Experimental	98	.13	.99	.08	1.00	.05
102 "Crossed in designated area"						
Control	.83	.38	.84	.37	.83	.37
Experimental	.78	.41	.82	.39	.77	.42
103 "View not obstructed by vehicle parked on left"						
Control	.98	.13	.99	.1	.99	.11
Experimental	.97	.17	.98	.12	.98	.13
104 "View not obstructed by vehicle parked on right"						
Control	.99	.08	.99	.10	1.00	.00
Experimental	.97	.16	.99	.11	1.00	.06
105 "stopped at kerb"						
Control	.49	.50	.45	50	.52	.50
Experimental	.54	.50	.55	.50	.52	.50
106 "Head movement"						
Control	.16	.37	.38	.49	.39	.49
Experimental	.23	.42	.19	.40	.21	.40
107 "Monitor traffic while crossing"						
Control	.12	.32	.28	.45	.30	.46
Experimental	.26	.44	.19	.40	.22	41
108 "Walked when crossing"						
Control	.85	.35	.92	.28	.95	.21
Experimental	.88	.33	.90	.29	.89	.31
109 "Crossed straight"						
Control	.86	.35	.89	.31	.85	.36
Experimental	.79	.41	82	.39	.78	.41

5.2.1 Road Crossing Behaviour and Age Group

Within the control and experimental groups, age did not substantially affect subjects' level of compliance to the three critical road crossing behavioural elements. Overall, there was a slight upward and downward movement in the compliance rate over the three rounds. The element stopping at the kerbside (63%) was complied with by experimental subjects aged 5-7 years, in round two. Control subjects aged 5-7 years had the lowest level of compliance (7%) for the element monitoring traffic whilst crossing the road.

5.2.2 Gender Influence on Road Crossing Behaviour

Both males and females in the control and experimental groups behaved poorly in the critical road crossing elements being discussed. In all groups a relatively low level of compliance was evident in monitoring traffic whilst crossing the road (11-27%). This lack of observation increases children's risk of traffic related injury.

5.2.3 Road Crossing Behaviour Whilst Accompanied

Of the total number of subjects in the study (n=3198), 62% were accompanied by an adult or at least one other child. Subjects in both groups had a low compliance rate to the elements: head movements to observe traffic prior to crossing the road and monitoring traffic whilst crossing the road, irrespective if they were accompanied or unaccompanied. Overall, half of the subjects who were accompanied by other children stopped at the kerbside prior to crossing the road. This percentage increased slightly when subjects were accompanied by adults (58%).

On average, there were slightly more unaccompanied children in the experimental group (50%) stopping at the kerbside than for those unaccompanied children in the control group (44%). The means of the percentage compliance rate for children who were accompanied and unaccompanied when crossing the road is presented in Table 5.4.

Table 5.4 Mean percentage compliance rate for critical road crossing behavioural elements when accompanied: Control and Experimental Group

Element code and description	**Compliance rate mean % of rounds 1,2 &3**			
Group	Unaccompanied	Accompanied by adult	Accompanied by children	**Overall Mean (%)**
105 "Stopped at kerb"				
Control	44	56	48	52
Experimental	50	60	53	
106 "Head movement"				
Control	23	9	18	18
Experimental	25	7	23	
107 "Monitor traffic while crossing"				
Control	18	9	12	17
Experimental	32	16	16	

5.2.4 Traffic Density Influence on Subjects Road Crossing Behaviour

Analysis of the three rounds showed that when traffic density was heavy, nearly two-thirds (63%) of subjects in the experimental group stopped at the kerbside prior to crossing the road compared to just over half of those in the control group (57%). Although the same trend occurred when the traffic density was lighter, the compliance rate was less: experimental group (48%) and control group (43%).

5.2.5 Road Crossing Behaviour in Relation to Crossing Site

Approximately three-fifths of the subjects crossed the road. The number of subjects who crossed at an intersection was less than one percent. As this sample size was so small, no statistical conclusions can be made from this variable in relation to its influence on child pedestrian behaviour. The majority of crossings were made mid-block (82%). Subjects in the control and experimental groups had a low compliance rate to the elements: observing for and monitoring traffic. The overall mean percentage for these elements was 23%. Subjects crossing at an intersection or T Junction when searching for approaching traffic omitted to observe behind them to see if any vehicles were approaching from this direction. Slightly more than half (56%) of the subjects stopped at the kerbside prior to crossing the road.

5.2.6 Road Crossing Behaviour at Supervised Crossings

When a *Children's Crossing* site was supervised, approximately two-thirds (68%) of the subjects stopped at the kerbside prior to crossing the road. Children waited at the kerbside until the crossing supervisor beckoned them indicating that it was safe to cross the road. At supervised crossings children tend to cross in a group, thus supporting the concept that a *platoon* system of crossing occurs at these sites. When the crossing was unsupervised, less than half (45%) of the subjects stopped at the kerbside. Similar rates of compliance for this element were also evidenced in the control (44%) and experimental (47%) groups.

Compliance to traffic observation before and whilst crossing the road was worst at supervised crossings for the groups: all subjects (10%), control (9%), and experimental (10%). When the crossing site was unsupervised subjects' compliance rate to these two elements was also poor for the groups: all subjects (19%), control (18%), and experimental (19%).

The percentages of subjects who complied to the three elements: stopped at kerbside prior to crossing the road; searching for traffic prior to crossing the road; and monitored traffic whilst crossing road, are recorded in Tables 5.5 and 5.6. Although subjects in the experimental group performed slightly better in these elements than subjects in the control group, the level of compliance is poor and potentially dangerous. Another feature is that at unsupervised crossings, experimental subjects' behaviour showed a slight regression between rounds one and three in the elements: stopped at kerbside and searching for traffic prior to crossing the road. behaviours

Table 5.5. Percentage of subjects who complied to the critical road crossing at unsupervised crossing sites.

Element Code & description Group	**Round 1** **%**	**Round 2** **%**	**Round 3** **%**	**Summary all rounds** **%**
105 'Stopped at kerb'				
All Subjects	44	47	45	**45**
Control	40	44	48	**44**
Experimental	48	50	43	**47**
106 'Head movement'				
All Subjects	18	15	21	**18**
Control	17	15	26	**19**
Experimental	18	14	15	**16**
107 'Monitor traffic while crossing'				
All Subjects	18	19	20	**19**
Control	13	21	14	**16**
Experimental	23	17	25	**22**

Table 5.6 Percentage of subjects who complied to the critical road crossing behaviours at supervised crossings.

Element Code & description Group	**Round 1** **%**	**Round 2** **%**	**Round 3** **%**	**Summary all rounds** **%**
105 'Stopped at kerb'				
All Subjects	68	65	70	**68**
Control	75	57	65	**66**
Experimental	62	70	73	**68**
106 'Head movement'				
All Subjects	12	9	6	**9**
Control	15	13	7	**12**
Experimental	8	6	5	**6**
107 'Monitor traffic while crossing'				
All Subjects	18	9	6	**11**
Control	8	6	5	**6**
Experimental	20	11	8	**13**

5.2.7 Participating Schools

No discernible trends could be detected on an individual school basis. Overall results were comparable for subjects at all schools on all the road crossing behavioural elements. As no distinguishable differences could be detected in the pedestrian behaviour of all subjects, it indicates that the *Out and About* road safety education program has had little, if any, effect on primary school children's pedestrian behaviour. The data also suggests that poor compliance to the critical road crossing behavioural elements is a norm for all subjects.

5.3 Additional Information

Although the research was designed to determine the effectiveness of the *Out and About* road safety education program on primary school children's pedestrian behaviour, the researcher observed events which impinges on these actions. As these observations may be acted upon by appropriate agencies or be the subject of future research, they are presented in the results section of this study. The following points are not presented in order of priority and for convenience have been combined into four categories: variation in children's and adults' road

safety behaviours, exemplary and inappropriate adult behaviours, school initiated actions, and traffic factors.

5.3.1 Variations in Children's and Adults' Road Safety Behaviours

Whilst filming at one school the researcher observed that a small group of older children, approximately 8-13 years of age, confronted a particular traffic hazard when proceeding to and from school. This hazard is created by the design of the road and environs relative to the school frontage. A curved road fronts this school and continues for some distance beyond each end of the school frontage. The school is situated facing the inside curve of the road and the designated *Children's Crossing* is sited central to the school frontage. The approach to the school from one direction is over a very wide storm water drain with the road raised approximately two metres above the drain. For descriptive purposes this raised section is termed a *bridge*. A footpath is provided over the bridge on the school side of the road. The opposite side of the bridge has only the kerb and approximately half a metre of grassed surface and a steel fence before the drop to the drain. Persons using this narrow ledge to cross the bridge are confined to walk between the fence and closely passing traffic.

It was noted that this particular group of children consistently used an alternative route to travel to school. Their route was to cross the curved section of the road approaching the bridge. This enabled the children to cross the bridge by the footpath on the school side of the road or to use the other footpath which was at a right angle to the bridge and traversed parkland. The researcher was concerned at the need for the children to cross a curved road with no pedestrian safety measures in force. This information was passed onto the school principal at the conclusion of the third observation round.

The researcher noted that there is a lack of mountable kerbing at a number of the *Children Crossing* sites outside schools participating in the study. It was observed that when adults were escorting a child to school and had a younger child in a stroller they had difficulty in negotiating the kerbside. The researcher also observed that some adults who were escorting a child to school whilst wheeling another child in a stroller, used a driveway site instead of the *Children's Crossing* when crossing the road. By using driveways these adults were not exhibiting good role model behaviour for younger children. The researcher was concerned that when travelling to school independently, a child may be conditioned to cross at the driveway instead of at the designated crossing site. The researcher raised the issue with the Chief Engineer, Darwin City Council who although sympathetic to the situation stated that to his knowledge the Council did not intend to change the kerbside at these crossings. The rationale given was that the kerbside acts as a deterrent for cyclists to speed across the crossing instead of walking bicycles across the road.

At the schools where vehicles were parked at an angle, it appeared that some drivers had difficulty being certain that there were no small children at risk behind or at the back of the vehicle. This was because these drivers tended to be hesitant reversing their vehicle, often stopping and starting. On some occasions when this occurred, the researcher observed small children walking between vehicles. These children were either about to enter a vehicle adjacent to the one reversing, or cross the road.

At another school, a group of children jay walked when crossing the road at a T Junction and used a car park driveway to gain access to the school. It would appear that these children had adopted this behaviour to avoid a section of the verge that had deteriorated into a dust hole. By walking up the driveway these children were at risk of being hit by a car. The researcher discussed this matter with Darwin City Council's Chief Engineer. On the afternoon of the last observation session at this particular school, it was noted that Council employees were in the process of constructing a path across the verge to join with an existing school footpath.

5.3.2 Exemplary and Inappropriate Adult Behaviour

It was not the intention to record the behaviour of adults whilst undertaking this study. However, the behaviour of two adults is worthy of comment. The adult who accompanied a child in the 5-7 year age group, consistently appeared to reinforce the kerbside drill routine with the young child. The video camera could not record sound at zoom distances, so the researcher was unable to record the conversation between the adult and child. The following procedure was evidenced on each filming round at the particular school. At the kerbside, the adult stood a little behind the child so that his view was not obscured, after looking to the right-left-right if there was no traffic the child spoke to the adult, who nodded her head. The child walked ahead of the adult when crossing the road. He conscientiously appeared to be monitoring the traffic whilst crossing the road. Once on the footpath, as the adult and child walked together, it appeared that she was informing him that he had satisfactorily undertaken the road crossing task as she nodded and smiled at the child. This behaviour was an excellent example of how an adult can reinforce the kerbside drill as recommended by road safety authorities.

Whilst undertaking the pilot study a young child was observed alighting from a vehicle which was parked at kerbside closest to the school. The child proceeded to walk towards the entrance to the school grounds. The driver drove forward slightly, did a U turn and started to drive back in the direction in which she had come. The vehicle stopped. The driver called out to gain the child's attention, and then threw an object out through the car window in the direction of the child. The article landed on the road. Without observing for traffic, the young girl ran onto the road to retrieve the object, returning to the footpath with her head

turned towards the driver of the vehicle, she smiled and waved her hand. At no time during this incident did the child appear to observe for any traffic. As it happened, there was no oncoming traffic but the initial action of the adult had diverted the child's attention from performing safely as a pedestrian. This behaviour was an excellent example of how an adult can put a child pedestrian at risk of being injured by an oncoming vehicle. Especially as the child's attention was on retrieving the object and not ensuring that no traffic was approaching prior to going out onto the road.

5.3.3 School Initiated Factors

The researcher became aware of actions that had been initiated at the local level by three schools. These actions were designed to promote the safety of children as pedestrians. One school is situated adjacent to a busy roadway. At this school the council has endorsed a policy that if a child is observed riding a bicycle instead of walking across a designated crossing, then in consultation with the child's parents, the bicycle is confiscated for 24 hours. This action is an attempt to stop the children from riding along the footpath/cycle track straight onto the road and possibly into the path of oncoming traffic. A staff member advised the researcher that initially a few children objected to the policy. There is now general acceptance of the policy and it is rarely infringed.

There is limited parking for vehicles at the school previously discussed. At the time of the data being collected, the school principal was having preliminary discussions with members of the school council and the Darwin City Council about the feasibility of a designated 'one way drop off zone' being made adjacent to the school.

A bus stop is situated in front of another school. Staff at this school have developed a voluntary roster system whereby in the afternoons children are supervised as they wait for and enter the bus.

The school council and staff at another school have designated that the footpath in front of the school for an area of approximately 138 metres is a 'non-bicycle riding zone'. The zone is designated by white lines painted on the footpath. When a child who is riding a bicycle approaches the line, s/he is required to dismount and walk the bicycle to the designated cycle storage areas. This action was initiated because the staff found that after school many of the children were talking while walking and did not detect an approaching bicycle. Either the pedestrian or the cyclist had to take evasive action, often unsuccessfully. Teachers are rostered to reinforce this policy. Throughout the observation periods this policy was strictly adhered to by the teachers and accepted by the students as it was a rarity to see a child riding a bicycle within the restricted zone.

5.3.4 Traffic Factors

Double yellow lines indicating 'no parking', were painted parallel to the kerb, 10 metres either side of the *Children's Crossing* sites. Throughout the research it was noted that outside four schools, some drivers had disregarded these signs. Parking within these areas disadvantages children as it has the potential to obstruct their view when observing for approaching traffic.

Although speed restrictions applied outside fourteen of the sixteen schools participating in the study, it was observed that many drivers do not conform to the speed limits. This was evidenced by the number of drivers who applied the car brakes when they saw the video camera. The sight of red brake lights was a regular feature observed by the researcher. This observation reinforced the concerns of some school principals and adults that the speed limits are often disregarded by drivers. At the same time, these concerned people realised the impracticality of total enforcement by the relevant authorities.

5.4 Summary

The main study was undertaken in 1994 and involved sixteen primary schools in the greater Darwin area and comprised a large number of observations of child subjects (n=3198). Children from six schools formed the control group and the experimental group were from ten schools. Nearly equal observation numbers were recorded in each round. More children were in the 8-10 year old age group, followed by the 5-7 year age group with the least number and in the 11-13 year age group. Almost an equal number of male and female subjects were observed. Most of the subjects wore either light coloured clothing or a mixture of light and dark coloured clothes.

When initially observed most of the subjects were: walking, alighting from a vehicle, and talking while walking. Percentages for all other activities were less than four percent per activity. When first observed most of the subjects were on the footpath or verge. More than half of the subjects were accompanied by an adult or at least one other child.

Approximately two-thirds of the subjects were observed in the mornings and a third in the afternoons. The greatest number of observations occurred on a Tuesday and the least on a Monday. More subjects were observed in the wet season than the dry season. During the dry season slightly more subjects were observed walking to school. In the mornings during the wet season only a few more subjects were observed alighting from a vehicle. There was a slight increase in the number of subjects who appeared to observe for and monitor traffic when crossing a road in the wet season compared to the dry season.

Traffic density was recorded on 1393 occasions and approximately two-thirds was classified as heavy, that is, more than two vehicles per minute. Cars, including utilities and station wagons, represented the most common type of moving vehicles observed.

Approximately one-third of the subjects travelled to or from school in a vehicle. Nearly equal numbers of subjects travelled in a vehicle each round. The main type of vehicle in which subjects predominantly travelled to or from school were cars. Of the subjects who travelled in a vehicle, over two-thirds alighted from a vehicle in the mornings and slightly less than a quarter entered a vehicle in the afternoons.

Slightly more than half of the subjects crossed a road. The majority of crossings were made mid-block. Of the children who crossed the road, just over a quarter did so at a supervised crossing site. The elements of subject's road crossing behaviour observed were:

- refrained from crossing between parked vehicles;
- crossed within designated area;
- view of approaching traffic not obstructed by vehicle parked on left;
- view of approaching traffic not obstructed by vehicle parked on right;
- stopped at kerbside prior to the crossing road;
- appeared to monitor traffic by moving head to the right-left-right, prior to crossing the road;
- appeared to monitor traffic whilst crossing the road;
- crossed the road at walking pace;

and

- crossed the road at a right angle to the kerbside, that is, straight.

In this study, gender and school did not influence the subjects road crossing behaviour. Subjects in the control and experimental groups performed poorly on the behavioural elements: stopping at kerbside; head movements to observe traffic prior to crossing the road; and monitoring for traffic whilst crossing the road. These elements were considered to be the most crucial for pedestrian safety. For the other six behavioural elements there was a high compliance rate for all subjects.

Half of the subjects stopped at the kerbside prior to crossing the road. At supervised crossings or when accompanied, subjects compliance rate to the other two crucial elements: observing for traffic before and whilst crossing the road was less than when they were by themselves or the crossing was unsupervised. When accompanied, the overall compliance percentage rate for these two elements was poor. At supervised crossings very few subjects observed for traffic before crossing and monitored for traffic whilst crossing a road.

There was an expectation that subjects in the experimental group would have a higher compliance rate to the behavioural elements in round two than in round one. There was a very slight improvement in the compliance rate between rounds for seven of the elements. Between rounds one and two, fewer subjects in the experimental group complied to the elements: observed for traffic before and whilst crossing the road. For subjects in the experimental group the compliance rates for the three crucial road crossing behaviours: stopped at kerbside prior to crossing the road; head movements to observe traffic prior to crossing the road; and monitoring traffic whilst crossing the road, was lower in round three than in round one. For subjects in the control group compliance to these three elements improved between rounds one and two and two and three.

The findings suggest that the *Out and About* program had minimal if any effect on the road crossing behaviour of Darwin primary school children. Furthermore, it would appear that primary school children generally disregard the critical safety elements of pedestrian road crossing behaviour.

An unplanned input to the study was some observations made by the researcher in relation to the behaviour of a number of drivers, adults and children; and being advised of school initiated activities to promote child pedestrian safety.

CHAPTER 6

6. DISCUSSION

The main purpose of the study was to determine the effect of the *Out and About* education program on the pedestrian behaviour of Darwin primary school children. This chapter has two main components: interpretation of the results using an epidemiological framework; and limitations of the results for general application. The interpretation of the results will guide the recommendations which emanate from the research. These recommendations will be presented in the next chapter.

6.1 Interpretation of Result

The epidemiological framework used to interpret the results in this study is made up of three parts: the host, agent and environment. Host details included subjects' age, gender, physical and psychological development; if their hand was held; alone or accompanied; and if they belonged to the control or experimental group. The agent component of the framework involved the children's road safety education program, adults as role models, supervisors at *Children's Crossing* sites, and specific school initiations. Environmental contextual influences were drivers, traffic density, related traffic regulations and control mechanisms, seasonal factors and topographical features.

6.1.1 Host Details

An important feature of this study was the relative sameness in behaviour of subjects within the control and experimental groups. Therefore, the comments made in this sub-section relate to all subjects irrespective of group. Regardless of subjects' age or gender, they all complied well to six of the road crossing behavioural elements but had low compliance rates to: stopping at kerbside; observing for traffic prior to crossing the road; and monitoring traffic whilst crossing the road. Taking cognizance of children's physical and psychological development, why did the subjects perform so well in some elements and poorly in others? Possible reasons include: *Children's Crossing* sites are strategically placed adjacent to schools, so these were the optimum areas for children to cross the road. The position the researcher occupied when collecting the data was in close proximity to the schools. This may have resulted in non-observation of children who crossed the road some distance away from the school. Most drivers conformed to the traffic regulation regarding not parking within 10 metres either side of the crossing site. Thus, subjects were not forced to cross between parked vehicles, nor had vehicles parked on either or both sides of the crossing site obstructing the subject's view. Most of the designated crossing sites provided subjects with direct access to the school grounds. This was because some of the schools did not have

perimeter fencing or the crossing was in line with a school access path. It is likely that the positioning of the crossing encouraged subjects to cross the road at right angles to the kerb. Excluding subjects who were alighting from a vehicle when first observed, more than two-thirds of the other subjects were walking. More than four-fifths (87%) of the subjects continued at the same walking pace whilst crossing the road as when approaching the crossing site.

Children's cognitive development is likely to be the main contributing factor as to why so few subjects complied to the crucial road crossing behavioural elements. According to Piaget, it is in the formal operations period of development that children acquire the ability to organise information and reflect on all aspects of a situation (Smart & Smart 1977). This is when they are usually between the ages of eleven to fifteen years. Based on this theory, children under eleven years of age have not learnt to internalise safe road crossing behaviours. Lack of internalising such activities may result in the children omitting to practice safe road crossing behaviours when unaccompanied. This study found that subjects aged 5-7 years in both the control and experimental groups had the lowest level of compliance for the element: monitoring traffic whilst crossing the road. This finding upholds the view that because of their level of physical and cognitive development, young child pedestrians are more vulnerable to being hit by an approaching vehicle (Rivara & Mueller 1987; Elliot 1985; Fortenberry & Brown 1982; Routledge *et al.* 1974).

This study found both males and females in the control and experimental groups behaved poorly in the critical road crossing elements: stopped at kerbside prior to crossing the road; searched for traffic prior to crossing the road; and monitored traffic whilst crossing the road. These findings do not support the view that male primary school children are more likely than female primary school children to incur pedestrian injuries (Rivara & Mueller 1987; Molen 1983; OECD 1983).

Irrespective of whether the crossing was supervised or unsupervised, the teaching of the *Out and About* program had no influence on children's road crossing behaviour in the three critical elements: stopped at kerbside prior to crossing the road; monitoring traffic before crossing the road; and observing for traffic whilst crossing the road. This was because the pre-test and post-test findings for these elements were the same, and there was a lack of difference in the behaviour of subjects in the control and experimental groups. The findings in relation to children's pedestrian behaviour at unsupervised road crossings are similar to those of Victorian school children before and after the education program *Streets Ahead* (Penna 1994). It is recommended that research efforts should be directed towards identifying why there was such a low compliance rate to the road crossing elements: stopping at kerbside; observing and monitoring for traffic prior to and whilst crossing the road.

This study also found that children are less safety conscious at supervised road crossings or when they are with others because they devolve responsibility to others for searching for and observing traffic prior to and while crossing the road. When with another person or with a group of people, it is not unusual for an individual to conform to group activities. This social influence on decision making is referred to as *diffusion of responsibility* (Latane & Darley 1970). It is as a result of diffusing responsibility for an action to others, that a child's level of independent rational thought is diminished (Latane & Darley 1970).

It should be noted that when looking to detect for approaching traffic either prior to or whilst crossing the road, children are taught to look right-left-right. It is recommended that consideration be given to changing these tasks to include looking behind. Where children cross at an intersection or T Junction, it is important that they be aware of any traffic which may be approaching them from behind.

6.1.2 Agent Factors

Within this study, education was a major issue. At the time of the study, the main road safety education program used by the Darwin Field Officer, RSCNT, was the *Out and About* program. This one person was primarily responsible for the education program within primary schools in the greater Darwin area. Even though the road safety education program conducted by the RSCNT was not a compulsory component of the school curriculum, the rate of participation by schools was high. Consequently, the amount of time that this one person could allocate to teaching the subject in each class at individual schools was restricted. This was often only one session on pedestrian safety and another on bicycle safety. On average, classroom teaching sessions were for 30 minutes and the duration of outdoor sessions was approximately 60 minutes. The outdoor sessions mainly focussed on safe bicycle behaviour. This intensity and duration of teaching sessions was not as recommended by safety experts who advocated that they be of 10-15 minute duration with four sessions allocated for each task (Molen *et al.* 1983).

When teaching, the Field Officer used: language which was appropriate to the age of the children he was instructing; a variety of teaching strategies; local happenings to illustrate the sessions; and rewards for the children who correctly responded to questions or activities.

In stating the limitations placed on the Field Officer, it must be noted that he appeared to use all the time available to him to teach road safety education to as many school children as possible. However, because of the time constraints placed on him, the Field Officer was unable to teach the *Out and About* program in the format as recommended (Molen *et al.* 1983). Therefore, it would be inappropriate to attribute the pedestrian behaviour of subjects in this study to any aspect of the *Out and About* program. Consequently, to facilitate future

evaluation of the program, it is recommended that the road safety education program *Out and About*, as presented to Darwin primary school children, be expanded to ensure that the time and methods used to teach the program incorporate an appropriate behavioural modification format.

It is recommended that changes be made to the road safety education program offered by RSCNT to Darwin primary schools. The program should be a compulsory topic in the school syllabi and involve more than one pedestrian and bicycle education session. Consideration should be given to utilising the following four stage format espoused by (Molen *et al.* 1983:155,156):

> a 'modelling' stage where the educator provides theoretical information at a level appropriate for the child's age and correctly demonstrates the task;
>
> a joint practice session where the child explains to the teacher what pedestrian behaviour is being undertaken and the steps which are being practised, and is given positive feedback by the teacher when correct pedestrian behaviours are performed;
>
> while observed, the child is given an opportunity to practice the task alone and receive feedback;
>
> and
>
> unobtrusively observing the child undertake the pedestrian task and giving appropriate feedback.

Regular follow-up teaching sessions should be incorporated into the program. The first two of these follow-up sessions would be at fortnightly intervals with another two sessions a month apart. This would enable the information to be reinforced and any additional instruction be given to the children. This teaching method is commensurate with successful behaviour modification programs (Biggs & Telfer 1987).

The outdoor learning environment for the early demonstration and practice sessions must be carefully chosen. This is to ensure that it appears natural to the children while at the same time being safe. This could be achieved if arrangements were made with the relevant authorities to temporarily make available a section of public road or vehicular driveway area within the school grounds for the purpose of demonstrating and supervising children's road crossing behaviour. Arrangements could then be made for parents to drive and/or park vehicles in strategic places within the area. Once children had demonstrated safe pedestrian behaviours then they could be observed practising crossing a road in real traffic situations.

In the event that the RSCNT does not have the funds to employ more teaching staff to implement the revised program format alternative strategies should be considered. One option would be for the RSCNT in conjunction with the N T Education Department and

School Councils to identify a number of schools to be involved in a pilot study which would extend over two terms. Dependent on the school population, and class sizes, it would be feasible for one teacher to be allocated to four or five schools. At each school, within each class, two groups of children would participate in the study. Children would be assigned to either a control or experimental group. Subjects in the experimental groups would be exposed to the intensive teaching of the *Out and About* program. Unobtrusive observation of children's pedestrian behaviour would be undertaken before and after completion of the education program. By restricting the schools and groups in the pilot study, it is highly likely that many of the subjects would be observed at each observation session. The second option would be for the intensive education program to be taught by school teachers. It would be essential for the teachers responsible for the program to undergo an appropriate in-service program.

Children's road safety is a societal issue and no education program should be done in isolation by a specialist road safety authority or education department. Other groups who could be involved in the program include Darwin City Council, Palmerston Town Council, Department of Transport and Works, Community Policing, Health Promotion organisations, and specific organisations, for example Child Accident Prevention Foundation of Australia (Kidsafe), Youth and Children's Services, Australian Red Cross etcetera. Child pedestrian safety may be incorporated into the charter of one or more service groups. If this was so, then they could also contribute to the safety education of children.

Parents have a special involvement in children's road safety education. One role parents play is the way in which they act as an example for their own and other people's children. As pedestrians and/or vehicle drivers, parents are role models. To satisfactorily fulfill this role, parents should become actively involved in the formal education program. It is recognised that in many families, adult members are in paid employment or have other commitments which make it difficult for them to participate in the program during school hours. However, this should not stop them reinforcing correct pedestrian behaviours at every opportunity and supporting teaching staff by participating in children's allocated after school activities, for example assisting, with the completion of workbooks. The *Out and About* education program incorporates a 'Parent's Guide' booklet. A copy of this booklet should be in every child's home so that adults can readily refer to the road safety concepts and information which is being taught to children. It is recommended that strategies be developed and implemented which promote the vital role parents play in the promotion of child pedestrian safety.

The findings of the study indicate that supervisors of *Children Crossing* sites do not reinforce road safety behaviours in the three elements demonstrated as critical to safe pedestrian road crossing. Although it may appear that stopping at the kerbside is enforced, it is suggested that

this action is undertaken by the supervisor more to facilitate traffic flow by using the *platoon system* rather than for the purpose of permitting the children to check for oncoming traffic. The RSCNT provides a voluntary education program for supervisors' at *Children's Crossing* sites. *Guidelines on Children's Crossings*, issued by RSCNT, focus on the design, legislation and operational aspects of these crossings and not educational strategies which supervisors could use to teach children salient road crossing behaviours at the same time as fulfilling their duty as a crossing supervisor (RSCNT 1991). Like parents, supervisors at road crossing sites can play an important part in children's road safety education. When waiting with children gathered at the kerbside, the supervisor can go through the kerbside drill. This would reinforce the tasks associated with detecting oncoming traffic. When children are crossing the road, the supervisor can remind them to monitor for approaching vehicles. Rote learning does not accelerate the formal operational stage of a child's cognitive development. However, it promotes the coding of information for later recall. As pedestrians, older children can then draw upon the information to make decisions on the correct pedestrian behaviour they should adopt. It is recommended that the RSCNT broaden the education program for supervisors of road crossings to include teaching them the basic pedestrian road crossing education behavioural elements: observing and monitoring for traffic prior to and while crossing the road. The purpose of this education program would be to encourage them to emphasise to children the critical road crossing behavioural elements.

In 1992/3 the researcher investigated the causes of childhood deaths in the greater Darwin region, due to unintentional injury, during the years 1983-1988. One aspect of this research involved deaths which involved motor vehicles (n=11) (unpublished). Of the eleven children who died, one was a child who was hit by a reversing vehicle. The driver of this vehicle did not see the child in the car side or rear vision mirrors. As it was observed that some drivers are hesitant when reversing a vehicle from an angle parking site outside primary schools, it is recommended that research be undertaken to determine if angle parking of vehicles outside primary schools is an appropriate safety practice.

When pushing strollers or prams adults should not have to use a nearby driveway for easy entry to the road as an alternative to coping with the drop from the kerb at a *Children's Crossing* site. The reason given to the researcher by the Darwin City Council Chief Engineer, (sub-section 5.3.1), as to why the kerb at these crossings is not sloped down to road level, does not appear to be rational. A feature of Darwin and Palmerston is that in many areas pedestrians and cyclists legally share the same pathway. Pathways at intersections are depressed to road level so that there is ease of access for people pushing strollers or riding bicycles. This double standard should not be allowed to continue. If adults are to be encouraged to be good role models for children, then when pushing another child in a stroller

or pram, whilst escorting a child to or after school, they should have easy access to *Children Crossing* sites.

Children should not have to access a designated *Children's Crossing* over a storm water bridge which has no footpath on that particular side of the road (sub-section 5.3.1). The researcher cannot put a price on injuries incurred or the death of a child who may be hit by a vehicle whilst crossing at a bend in a road at an non-designated crossing site.

The Chief Engineer, Darwin City Council is to be commended for acting so promptly on the extension of the pathway from the boundary of a particular school to the kerbside. This action has provided children with a safe access to the school grounds, thereby eliminating the need for them to jay walk.

Teaching staff and school councils readily agreed to participate in the study. To the researcher this indicated that people in responsible positions within the education system were positively committed to improving child safety.

Pedestrian safety initiatives implemented at a number of schools are to be commended. As outlined in the Results Chapter (5), the researcher was unexpectedly given information about the positive initiatives which have been introduced at these schools. It is likely that child pedestrian safety initiatives that have been developed and adopted at some schools may be appropriate for implementation at other schools.

6.1.3 Environmental Factors

Most drivers adhered to the 'no parking' zones either side of *Children Crossing* sites, however, exceptions were observed outside four schools. It is unrealistic to expect traffic authorities to constantly monitor this traffic infringement. Therefore, alternative strategies should be contemplated to enforce this legislation. One option would be a media campaign which focussed on why this legislation is in place. Information regarding the limitations children have because of their immaturity could be highlighted, this could include:

- visual restrictions, in particular their peripheral vision;
- inability to discriminate between the right and left side of their body;
- difficulty in gauging the gap between vehicles;

and

- ability to determine the approximate speed at which a vehicle is travelling.

Information about child pedestrians' capabilities and limitations could also be utilised to provide drivers with an understanding of why speed restrictions are in place in the vicinity of schools. During the data collection phase of this study, many drivers did not conform to the speed limits which were in operation around the schools. Two possible reasons that drivers do not comply with this traffic legislation were outlined in the Results Chapter (5). One was that the times when school zone speed restrictions were operational varied between Darwin primary schools. The signs for these speed restrictions are on the verge adjacent to the kerbside and may be difficult for a passing driver to read the times at which the restrictions apply. To simplify the system, there should be standardisation of the times these restrictions are operational. The researcher approached the Executive Officer RSCNT regarding this matter and since completion of the data collection phase of this study, the times have been standardised.

Another possible reason that drivers do not comply to speed restrictions near schools is that the speed limit is not standardised. Speed limits outside schools involved in the study varied between 30 and 60 kilometres per hour. Speed limits outside all Darwin primary schools should be uniform. It may be necessary to have strategies in place which deter drivers from speeding outside schools. These strategies could include: the use of surveillance speed cameras; speed control devices, such as, narrowing of the road either side of a *Children's Crossing* site; and media campaigns highlighting attributes of child behaviour, for example, their impetuosity and inability to concentrate for any sustained period of time.

Concern is expressed for the safety of subjects in the control and experimental groups as there was a poor compliance rate for the elements: observing for traffic prior to crossing the road; and monitoring traffic whilst crossing the road. Irrespective of the traffic density, less than one-quarter of the subjects observed for traffic either prior to or whilst crossing the road. These findings do not support the view that when traffic density is high, children are more attentive to observing and monitoring traffic when crossing the road (Molen 1983:153).

6.2 Limitation of the Study Results

The previously stated limitations of the study are presented in the Methodology Chapter (sub-section 4.10). An unanticipated limitation was the non-intensive teaching of the education program *Out and About* to children in the experimental group. At the time of undertaking the study, the researcher had not internalised the fact that the Darwin Field Officer did not have enough time to allocate more than one teaching session per group on pedestrian behaviour. As stated in Chapter 3, children's road safety education programs such as *Out and About*, should involve intensive and regular theoretical and practical teaching sessions. Therefore,

subjects' poor compliance rate to the three critical road crossing behaviours cannot be attributed to the *Out and About* program.

6.3 Summary

An epidemiological framework has been used to analyse the findings of this study. The host details addressed subjects age, gender, immaturity, and whether they were alone or had their hand held when crossing a road. Agent factors discussed included: the teaching of the *Out and About* road safety education program; adults as role models; the contribution supervisors at *Children's Crossings* could make to the road safety education program; pedestrian safety initiatives adopted by some schools; and the additional road safety behaviours the researcher observed whilst undertaking the study. Environmental factors which were addressed included drivers' infringement of some N T Traffic Act regulations and possible reasons why the legislation is breached.

CHAPTER 7

7. RECOMMENDATIONS

7.1 Synopsis of Research Background

This study focussed on the relationship between children, learning and the pedestrian safety education program offered in Darwin primary schools by the Road Safety Council of the Northern Territory (RSCNT). The *Out and About* program was used to teach children safe pedestrian behaviours. The purpose of the research was to examine the effect the road safety education had on the behaviour of child pedestrians as they travelled to and from Darwin primary school.

The data collection phase of the study was undertaken in 1994. Six schools, which were not involved in the road safety education program in 1994, were allocated to the control group. Ten schools, which participated in the education program in 1994, formed the experimental group. The study incorporated a time-series design to measure children's pedestrian behaviour. Each participating school was surveyed on three occasions. Sequencing of the observation sessions was at least one week before and one week after the road safety education program had been presented to the experimental group. Follow-up observations were done within a five-week period after the conclusion of the education program. The same observation format was adopted for the control group.

Data collection involved unobtrusive observation of the subjects in real traffic situations. A ten-power magnification zoom lens auto-focus video camera was used to collect the data. The main video tape footage was edited and sound free, short *cameo shots* of subjects were assembled on a separate video tape. School personnel then viewed the cameo shots and coded the subjects as belonging to one of three age groups: 5-7 years, 8-10 years, and 11-13 years. These age groups were used by the Darwin Field Officer, RSCNT when teaching the road safety education program.

The sample consisted of three thousand, one hundred and ninety eight observations (n=3198). Nearly twice as many children were observed in the mornings (66%) as the afternoons (34%). Data was analysed using the framework: subject demographic, contextual environmental, school demographic and extraneous variables. For analytical purposes, related data was clustered together to form a Road Crossing Behavioural Category. It was found that subjects in both groups had a high compliance to six of the road crossing behavioural elements. There was poor compliance to the elements: stopping at kerbside; observing for traffic prior to crossing the road; and monitoring traffic whilst crossing the road. These results indicated that

as taught, the road safety program *Out and About*, did not have any observable effect on the behaviour of child pedestrians.

7.2 Recommendations

This subsection provides brief qualifying information justifying the fourteen recommendations. The recommendations pertain to: the teaching of pedestrian road safety; research; changes to road and kerbside design; traffic matters; public education; and the wider dissemination of information.

7.2.1 Teaching of the *Out and About* Program to Children

Recommendation 1

The road safety education program *Out and About*, as presented to Darwin primary school children, should be expanded to incorporate appropriate behavioural modification format and techniques.

A typical behavioural modification program consists of: providing verbal information about the skill to be learnt, including rationale; instructor demonstrating the skill; participants practising the skill in a simulated or real environment; praising and/or rewarding positive behaviours; and explaining why some behaviours are inappropriate. Terminology should be suitable for the learner(s) and easy to understand. To be successful, teaching sessions should be of a short duration and repeated frequently (Molen *et al.* 1983). If a child's pedestrian behaviour is to be changed, then the relevant education program should utilise appropriate behavioural modification format and techniques.

The time available for teaching the *Out and About* program was inadequate. This was because the RSCNT could only provide one person to teach at all primary schools in the greater Darwin area.

7.2.2 Road Safety Education in Darwin Primary Schools

Recommendation 2

Road safety programs, as offered by the Road Safety Council of the Northern Territory, to primary schools in the Darwin area are made a compulsory subject within the school syllabi.

Children's road safety education is a societal issue and should not be left solely to one or two groups, such as an education authority or specialist road safety organisation. However, if children are to learn the concepts of safe pedestrian behaviour and to have them regularly

reiterated and reinforced, then road safety education should be incorporated into the education system. This is especially important for primary school children, as their cognitive development is incomplete and they have not acquired the ability to organise and reflect on the interrelationship of different situations. There is a general consensus that road safety education programs should be incorporated into school syllabi (Ampofo-Boateng & Thomson 1991; Malek *et al.* 1990; Marsh & Hyde 1990; Rivara & Mueller 1987; Gardner *et al.* 1986; OECD 1986; Elliott 1985; Molen 1984; Preusser & Blomberg 1984; Molen 1983; Molen *et al.* 1983; OECD 1983; Maisey 1982; Molen *et al.* 1981; Molen 1981). At the time that this study was undertaken the children's road safety education program conducted by the RSCNT was not a compulsory component of the school syllabi.

7.2.3 Traffic Observance at Intersections and T Junctions

Recommendation 3

Kerbside drill be broadened to include teaching children to look behind prior to and whilst crossing the road at an intersection or T Junction.

The road safety education program teaches children to look right-left-right when observing for and monitoring traffic. This sequence of actions is taught to ensure that children learn to fully appraise the traffic situation and finally check that there are no approaching vehicles on their right-hand side before they cross the road. In this study, although only 18% of the subjects crossed the road at an intersection or T Junction, the researcher noted that it was a rarity for children to observe if there was any moving traffic approaching from behind. This omission creates a potential problem if the driver of such a vehicle is intending to turn in the direction of the child.

7.2.4 Primary School Teachers' Road Safety Education In-service

Recommendation 4

In collaboration with the Road Safety Council of the Northern Territory, in-service programs are designed and conducted for selected teachers who would teach the road safety curriculum within Darwin primary schools.

If the road safety education program is made a compulsory topic within the school syllabus, it may be necessary for school teachers to be involved in the education program. To assist them in teaching the road safety program, it would be necessary for suitable in-service programs to be made available to these teachers.

7.2.5 Parents' Involvement in Children's Pedestrian Safety

Recommendation 5

Strategies are developed and implemented which promote the vital role parents play in the promotion of child pedestrian safety.

Any measures aimed at promoting the safe pedestrian behaviour of children cannot be undertaken in isolation. Parents are the primary teachers and role models for children. Covertly and overtly they teach their children the norms of society. This may be by: explaining a situation, event, or action to a child(ren); reinforcing information and skills which children have learnt at school; and through their own actions. When parents were actively involved in road safety education programs, then it was demonstrated that more children comply with safe road crossing tasks (Molen 1983; Sandels 1968). Parental involvement in the road safety education program may take one of many forms. Examples of how parents can promote safe pedestrian behaviours include: assisting with the teaching of behavioural skills at school or after school activities; and being good role models for the children especially when crossing a road or driving a vehicle. These contributions and positive parental attitudes should be recognised and encouraged.

7.2.6 Expansion of *Children's Crossing* Supervisors' Education and Role

Recommendation 6

The Road Safety Council of the Northern Territory *Children's Crossing* supervisor's education program to include teaching children critical road crossing behaviours.

The study found that children crossing the road at a supervised crossing gave little or no attention to the need to search for and monitor traffic prior to and whilst crossing the road. At a supervised crossing, more subjects (68%) stopped at the kerbside prior to crossing the road than subjects who crossed at an unsupervised site (44%). The researcher believes this was due to the action of the crossing supervisor controlling the flow of traffic. However, subjects' level of compliance to observing for traffic was poor due to them devolving this responsibility to the supervisor. Supervisors could be involved in the teaching of these crucial elements of road crossing behaviour to children. The reinforcement of these skills by supervisors at *Children's Crossing*, encourages children to practice the tasks in real traffic conditions. It is more likely that these learnt skills would be applied when children are required to function independently in traffic, especially when crossing a road at an unsupervised site.

7.2.7 Non-Compliance to Critical Road Crossing Behavioural Elements

Recommendation 7

Research efforts should be directed towards identifying why there was such a low compliance rate to the road crossing elements: stopping at kerbside; observing and monitoring for traffic prior to and whilst crossing the road.

Factors which contribute to child pedestrian injury are children: failing to detect approaching traffic; and darting and dashing out onto the road (Roberts *et al.* 1992; Malek *et al.* 1990; Pitt *et al.* 1990; Elliott 1985; Preusser & Blomberg 1984; OECD 1983; Molen *et al.* 1981; Molen 1981; Ross & Seefeldt 1978). This study found that when crossing the road at an unsupervised site: 44% of the subjects stopped at the kerbside; 47% observed for the presence of traffic prior to crossing the road; and 45% monitored traffic while crossing the road. These behavioural elements have been shown to be essential behavioural components of road crossing and are incorporated into pedestrian education programs including *Out and About*. The road safety program *Out and About*, developed in 1986, has been used widely throughout Australia to teach children road safety education (Castor & Rush 1988). It is of concern to the researcher that in this study so many subjects did not adhere to the recommended road crossing behavioural elements.

7.2.9 Reversing from Angle Parking Outside Schools

Recommendation 8

Research should be undertaken to determine if angle parking of vehicles outside primary schools is an appropriate and safe practice.

The researcher was concerned about vehicles reversing from an angle park outside some of the schools participating in the study. It is possible that the drivers had difficulty seeing if there were small children behind or adjacent to the vehicle.

7.2.10 Modification of Kerbs at *Children's Crossings*

Recommendation 9

Kerbs at *Children's Crossings* are modified to road level thus facilitating ease of access for the users.

The researcher became aware of a problem which arises when adults are escorting a child to school whilst wheeling a younger child in a stroller. The problem occurs when these adults arrive at a designed *Children's Crossing* site which is not sloped from the footpath height to

the road level. It appeared that they had difficulty negotiating a stroller from the kerbside onto the road. It was observed that some adults have adopted an alternative strategy to facilitate access to the road, namely to use a driveway. If adults are to be encouraged to act as good role models for children, then kerbsides at *Children's Crossing* sites should be sloped from the footpath height to the road level. This would facilitate ease of access to the crossing site for adults who are wheeling a younger child in a stroller whilst accompanying another child to school.

7.2.11 Potential Pedestrian Hazard Caused by Road Design

Recommendation 10

Design changes are made to the section of road or bridge to provide safe road crossing conditions for children living in the area.

In order to cross at the designated *Children's Crossing*, children living in an area on the opposite side of the road to one school, need to use a narrow verge adjacent to the kerb when crossing a storm drain bridge. As an alternative to using the *Children's Crossing*, it was observed that some children crossed at a curved section of road. It would appear that these children considered this to be a safer option than crossing the bridge where there was no footpath. The researcher will advise the RSCNT of the actual location of this road section so that the information can be passed on to the appropriate authority.

7.2.13 Standardisation of School Zone Speed Limits

Recommendation 11

Speed limits outside all schools in the greater Darwin area are standardised.

At the time when data was collected for this study, there was variation in the speed limits in force outside individual schools. This speed variation could cause confusion for drivers, especially if their journey involved them traversing streets adjacent to more than one primary school.

7.2.14 Infringement of Traffic Regulations

Recommendation 12

Develop and implement appropriate strategies designed to discourage drivers from speeding in the vicinity of primary schools and illegally parking near *Children's Crossings.*

When collecting data, the researcher observed numerous vehicles passing through marked School Crossings at speeds estimated to be well above the set speed limit for that area. The researcher's perception that drivers were travelling at speeds higher than permitted was reinforced by the number of brake lights she observed when the driver of the vehicle became aware that someone was recording the event on a video camera. These speeding infringements occurred when the *Children's Crossing* flags were in place to indicate speed restrictions were in force.

Although it was not a common occurrence, the researcher observed drivers outside four schools parking on double yellow lines within ten metres either side of a *Children's Crossing*. These parking restrictions have been put in place so that child pedestrians have a clear view of approaching traffic when they are assessing if it is safe to cross a road.

7.2.15 Schools' Pedestrian Safety Initiatives

Recommendation 13

Positive pedestrian initiatives developed and implemented by some Darwin primary schools should be disseminated to other schools and the Road Safety Council of the Northern Territory, for their information and if appropriate, adoption.

Every school is unique and in trying to maintain and promote a safe pedestrian environment, problems may arise. Whilst undertaking this study, the researcher became aware of some pedestrian safety initiatives individual schools had implemented. Other schools may have similar child pedestrian safety problems.

7.2.16 Publicity Regarding Children's Limitations as Pedestrians

Recommendation 14

Media campaigns should focus on the physical and cognitive limitations which confront child pedestrians.

Children do not have the physical skills or the cognitive ability to function as a pedestrian in the same way as an adult. Research has shown that children have not developed the same level of problem solving skills as adults. Their stature, hearing and visual limitations, lack of memory and concentration span and impetuosity increases their risk of pedestrian injury. Community members should be advised of what capabilities child pedestrians have and the limitations which impinge on their ability to function safely in traffic situations.

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9. APPENDICES

Appendix A

9.1 Data Collection Instrument

Data Collection Instrument

(Not Applicable values either 8 or 88)

(Missing Values either 9,99,999, 9999 or 99999)

Subject Number(ID)(0000) _____

Subject Observed Previously

(Repeatid : Round number then ID number) _____

Date(000000) _____

Subject Age Group

(Agegroup: 1=5-7 years, 2=8-10 years, 3=11-13 years) _____

School Code (Schcode : 01=Acacia, 02=Adonsonia, 03=Banksia,
04=Calytrix, 05=Cycus, 06=Eucalyptus, 07=Ficus, 08=Grevillea,
09=Gronophyllum, 10=Heliotropium, 11=Hibbertia, 12=Ipomoea,
13=Leucaena, 14=Livistonia, 15=Melaleuca, 16=Pandanus,
17=Polycarpia, 18=Sesbania) _____

School Population (Schpop :1< 350, 2 > 350) _____

Site Observations Recorded (Sitecode : 1= By crosswalk,
2=By Carpark, 3=By Shop, 4=Adjacent Park, 5=Roadside,
6=Vacant block) _____

Observation Round (Round: 1,2,3) _____

Group Type (Group : 1=Control, 2=Subject) _____

Time (Time 1 = am, 2 = pm) _____

Day of Week (Day : 1=Monday, 2=Tuesday, 3=Wednesday,
4=Thursday, 5=Friday) _____

Season of Year (Season: 1 = Wet, 2 = Dry) _____

Climatic Conditions (Climate: 1=Sunny, 2=Humid, 3=Overcast
4=Build-up, 5=Raining, 6=Thunderstorms) _____

Observation Environment in relation to observed subject
(Obsenvir : 01=Left Residential, 02=Right Residential
03=Left & Right Residential, 04=Front Residential
05=Rear Residential, 06=Left Park, 07=Right Park,
08=Left & Right Park, 09=Front Park, 10=Rear Park, 11=Left Shop
12=Right Shop, 13=Left & Right Shop, 14=Front Shop,
15=Rear Shop, 16=Left Road, 17=Right Road, 18=Left & Right Road,
19=Front Road, 20=Rear Road, 21=Left School, 22=Right School,
23=Left & Right School, 24=Front School, 25=Rear School,
26=Left Carpark, 27=Right Carpark, 28=Left & Right Carpark,
29=Front Carpark, 30=Rear Carpark, 31=Vacant block) _____

Relationship of School to Observer
(Schposit : 1= Front, 2=Back, 3=Left, 4=Right) _____

Relationship of School to Road
(Schsit : 1=Corner, 2=Mid Block, 3=Full Block) _____

Road Type within Observation Area
(Roadtype : 1=Arterial, 2=Sub-Arterial, 3=Local,
8=Not applicable) _____

Number of Road Entries Within Observation Area
(Entries : 1=1 only, 2=2, 3=more than 2, 4=None) _____

Types of Traffic Observed Near Child (Traffic : 1=Car
2=Truck, 3=Bus, 4=Motor Cycle, 5=Push Bike, 6=Mixed,
7=None, 8=Not Applicable) _____

Amount of Traffic (Amountra : 1=Heavy, 2=Moderate, 3=Light,
4=None, 8=Not Applicable) _____

Designated Street Crossing (Crossing : 1=Yes, 2=No) _____

Crossing Controlled by Traffic Light Device
(Xtrafdev : 1=Yes, 2=No, 8=Not Applicable) _____

Crossing Supervised (Xsuper : 1=Yes, 2=No,8=Not Applicable) _____

Sex of Subject (Sex : 1=Male, 2=Female) _____

Colour of Subject's Clothing
(Clothing : 1=Light, 2=Dark, 3=Mixed) _____

Subject Accompanied (Company : 1=No, 2=Adult, 3=Child,
4=Kids, 5=Adult &child, 6=Adult & kids) _____

Subject's Hand Held (Hand : 1=Adult Yes, 2=Child Yes, 3=No) _____

Child's Activity at Time of Observation (Activity : 01=Walking,
02=Running, 03=Skipping, 04=Playing, 05=Reading, 06=Talking,
07=Chasing/retrieving object on road, 08=Eating, 09=Drinking,
10=Walking & wheeling bicycle, 11=Walking & drinking,
12=Walking & eating, 13=Walking & bouncing ball,14=Walking & talking,
15=Walking & playing, 16=Walking & reading, 17=Sitting,
18=Alighting from vehicle,19=Walking, talking & eating, 20=Standing,
21=Bending over, 22=Cycling, 23=Skating, 88=Not Applicable _____

Subject Appears to be Looking for Hazards(Hazlook:1=Yes,
2=No, 3=Intermittently) _____

Area Where Subject is Observed (Precinct : 1=Footpath, 2=Verge,
3=Road, 4=Park, 5=School ground, 6=Outside shop, 7=Driveway
8=Vacant block) _____

Did Subject Cross Road (Xroad : 1=Yes, 2=No) _____

Road Entry Site Where Subject Crosses
(RoadX : 1=Intersection, 2=Mid-block, 3=T Junction,
8=Not Applicable) _____

Subject Stopped At Kerbside Prior To Crossing Road
(Kerbstop : 1=Yes, 2=No, 3=Unsighted, 8=Not Applicable) _____

Parked Vehicle(s) On Left Of Subject, Obstructing View
(Parkvehl : 1=Yes, 2=No, 3=Unsighted, 8=Not Applicable) _____

Parked Vehicle(s) On Right Of Subject, Obstructing View
(Parkvenr : 1=Yes, 2=No, 3=Unsighted, 8=Not Applicable) _____

Subject Crossed Between Parked Vehicles
(Xparkveh : 1=Yes, 2=No, 3=Unsighted, 8=Not Applicable) _____

Subject Appears to Observe Traffic
(Seektraf : 1=Yes, 2=No, 3=Unsighted, 8=Not Applicable) _____

Subject's Head Movement(s) If Observing Traffic
(Headmove : 01=Right Only, 02=Left Only, 03=Right & Left,
04=Left & Right, 05=Right, Left, Right,
06=Left, Right, Left, 07=None, 08=Unsighted,
88=Not applicable) _____

Subject Used Traffic Control Device
(Trafdev : 1=Yes, 2=No, 8=Not Applicable) _____

Subject Appeared To Monitor Traffic Whilst Crossing
(Trafmonx : 1=Yes, 2=No, 3=Initially only,
4=Towards completion of crossing, 5=Intermittently,
6=Unsighted, 8=Not Applicable) _____

Subject's Pace Whilst Crossing Road
(PaceX : 1=Walked, 2=Ran, 3=Walked & ran, 4=Skipped,
5=Cycled, 6=Unsighted, 7=Skating, 8=Not Applicable) _____

Subject Crossed Within Designated Area
(Xdesarea : 1=Yes, 2=No, 8=Not Applicable) _____

Angle Subject Crossed Road
(Angiex : 1=Straight, 2=Angled, 8=Not Applicable) _____

Subject's Activity Post Crossing Road
(PostX : 01=Continued Walking, 02=Walking Looking Ahead,
03=Walking Not Looking, 04=Walking & Waving,
05=Running, 06=Skipping, 07=Cycling, 08=Running & walking,
09=Walking in gutter, 10=Playing, 11=Running & waving,
12=Sitting, 13=Stopped, 14= Walking & reading,
15=Walking & talking, 16=Walking & bouncing ball,
17=Skating, 88=Not Applicable) _____

Did Subject Travel in Vehicle (Travehl : 1=Yes, 2=No) _____

Subject Alighted From Vehicle
(Outveh : 01=Left Front, 02=Right Front 03=Left Rear,
04=Right Rear, 05=Right Side, 06=Left Side, 07=Back,
08=Not Sighted, 88=Not Applicable) _____

Subject Entered Vehicle

(Inveh :01=Left Front, 02=Right Front, 03=Left Rear,
04=Right Rear, 05=Right Side, 06=Left Side, 07=Back,
08=Not Sighted, 88=Not Applicable) _____

Type Of Vehicle Subject Alighted From

(Vehtype : 1=Car, 2=Van, 3=Utility, 4=Bus, 5=Motor Cycle
6=Not Sighted, 7=4 Wheel Drive, 8=Not Applicable) _____

Did Subject Cross Road After Alighting From Vehicle

(PostvehX : 1=Yes, 2=No, 8=Not Applicable) _____

Type of Vehicle Subject Entered (Vehtypin : 1=Car, 2=Van,
3=Utility, 4=Bus, 5=Motor Cycle, 6= Not Sighted,
7=4 Wheel Drive, 8=Not Applicable) _____

Position Of Stopped Vehicle When Subject Alighted

(Vehstout : 1=Car Park, 2=Roadside Closest Side To School,
3=Roadside Furtherest Side To School, 8=Not Applicable) _____

Subject Moved To Kerbside After Alighting From Vehicle

(Movekerb : 1=Yes, 2=No, 3=Unsighted, 8=Not Applicable) _____

Subject's Activity After Alighting From Vehicle

(Subact : 01=Walking, 02=Running, 03=Skipping, 04=Playing,
05=Reading, 06=Talking, 07=Chasing/retrieving object on road,
08=Eating, 09=Drinking, 10=Walking & wheeling bicycle
11=Walking & drinking, 12=Walking & eating,
13=Walking & bouncing ball, 14 Walking & talking,
15=Walking & playing, 16=Walking & reading, 17=Sitting,
18= Walking & waving, 19=Standing & grooming,
20= Standing & adjusting back pack or similar,
21=Retrieving object from back of vehicle, 22=Standing waiting,
23=Walking & adjusting back pack, 88=Not Applicable)

_____

Position of Stopped Vehicle When Subject Entered

(Vehstin : 1=Car Park, 2=Roadside Closest Side To School,
3=Roadside Furtherest Side From School, 8=Not Applicable) _____

Comment 1 _____

_____

Appendix B

9.2 Schedule for Data Collection

Appendix B

Schedule for Data Collection

School Pseudonym	Round 1	Round 2	Round 3
Acacia	26/27:07:94	02/03:08:94	01/02:09:94
Adansonia	28/29:07:94	16/17:08:94	05/06:09:94
Banksia	04/05:08:94	22/23:08:94	19/20:09:94
Calytrix	08/09:08:94	24/25:08:94	15/16:09:94
Cycus	10/11:08:94	26/29:08:94	29/30:09:94
Eucalyptus	12/15:08:94	07/08:09:94	14/17:10:94
Ficus	18/19:08:94	27/28:09:94	27/28:10:94
Grevillea	30/31:08:94	23/26:09:94	09/10:11:94
Gronophyllum	09:09:94	24:10:94	11:11:94
Heliotropium	13/14:09:94	10/11:10:94	23/24:11:94
Hibbertia	21/22:09:94	18/19:10:94	25/28:11:94
Ipomoea	12:10:94	03:11:94	07:12:94
Leucaena	20/21:10:94	21/22:11:94	08/09:12:94
Livistonia	20/21:10:94	21/22:11:94	08/09:12:94
Melaleuca	01/02:11:94	29/30:11:94	05/06:12:94
Pandanus	25/26:10:94	07/08:11:94	01/02:12:9

Appendix C

9.3 Road Safety Council of the Northern Territory Authorisation to Conduct Research

ROAD SAFETY COUNCIL OF THE NORTHERN TERRITORY

Mrs Cecilia Batterham
PO Box 42945
CASUARINA NT 0811

Dear Cecilia

This is to advise you that the Council met on 14 September and discussed your proposal to evaluate child pedestrian behaviour before and after receiving road safety education.

Your research proposal has been approved by the Council. It is noted that you will be working in conjunction with the Executive Officer, Research Officer and the Darwin Field Officer of the Road Safety Council.

Yours sincerely

ALEX RAE
Executive Officer

14 September 1993

05/10/93

RSC/RAE/000956/ZEE

Head office
GPO Box 1176 Darwin NT 0801
Tel: (089) 82 7533 Fax: (089) 82 7077

Alice Springs
PO Box 1260 Alice Springs NT 0871
Tel: (089) 51 5354 Fax: (089) 51 5791

Appendix D

9.4Northern Territory University Ethics Clearance

NORTHERN TERRITORY UNIVERSITY
PO BOX 40146 CASUARINA, NT AUSTRALIA, 0811
TELEPHONE: (089) 46 6666 • FACSIMILE: (089) 27 0612
TELEX: DACOL AA85235

HUMAN ETHICS COMMITTEE REPORT

PROJECT APPROVAL CODE: 10/93/16

NEW PROPOSAL

PROJECT TITLE: The Behaviour of Child Pedestrians Travelling to and from Darwin Primary Schools

CHIEF INVESTIGATOR(S): Ms Cecilia Batterham

The abovementioned project has been considered by the Human Ethics Committee of the Northern Territory.

The Committee is satisfied that the proposed experiments involved in this project conform with the general principles set out in the current National Health and Medical Research Council regulations on experimentation, and with the policy of the Northern Territory University.

Expiry date: **10 November 1994**

APPROVED

Chair, NTU Human Ethics Committee

Date: 29.11.93

30/11/93

Appendix E

9.5Northern Territory Department of Education Authorisation to Conduct Research

NORTHERN TERRITORY
DEPARTMENT OF
EDUCATION

Curriculum and Assessment

GPO Box 4821 Darwin NT 0801
Telephone: (089) 89 5511
Facsimile: (089) 89 7378

Our Reference: 93/999
93.cf0872

Ms Cecilia Batterham
PO Box 42945
CASUARINA NT 0811

Dear Cecilia

Thank you for your application to conduct research involving NT schools.

I am pleased to inform you that subject to your complying with the conditions stated below, the Department has approved your application to carry out the following study:

'Behaviour of Child Pedestrians Travelling to and from Darwin Primary Schools'.

I note from your proposal that you intend to videotape a number of students travelling to and from Darwin primary schools. In this regard, I need to receive a written statement from you that the confidentiality of participants is protected.

The guidelines which we share with the NT University in relation to videotaping for research purposes are as follows:

> 'No names of actual schools or people are to be used. Pseudonyms or codes must be used in field notes, audio or videotapes, etc. The tapes are then only to be viewed by agreed upon audiences, and this is agreed upon and specified within a written contract. If any tapes are to be used for any other purpose, prior consent must be given by the teacher or persons videotaped'.

Your written statement should confirm that the above guidelines will be followed. Please note that you will also need to approach each of the schools concerned to obtain permission to carry out the study and to make any necessary arrangements for observation and videotaping.

Regards and best wishes

Cliff Fowler

CLIFF FOWLER
Chief Assessor

24 December 1993

copy to: Superintendents, Darwin Primary Schools

24/01/94