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Abstract

This Summary report briefly describes the design phase of a study to evaluate the safety effectiveness of certain minor traffic engineering and road safety projects undertaken in Australia.

A review was made of sources of data available on accidents, traffic flows and minor traffic engineering improvements for road safety implemented in the States of Australia. It was concluded that the major data constraint relates to accident data and that South Australia and Western Australia are presently the only States with data bases in an immediately suitable form for the proposed evaluation.

A methodology was developed and recommended for the evaluation phase, based on the principles of the before-and-after study. Care was given to resolution of problems arising from changes in site exposure and changes in secular trends of accidents.

A trial analysis was conducted for some intersection signalisation projects undertaken in Adelaide in 1975/76. The feasibility of the proposed methodology was demonstrated and some preliminary results established concerning the safety effectiveness of these projects.

NOTE:

This report is to facilitate discussion on the methodology proposed to evaluate MITERS-type projects and its distribution has been limited to the people/organizations directly involved. The views expressed are those of the author(s) and do not necessarily represent those of the Commonwealth Government.

The Office of Road Safety publishes two series of reports resulting from internal research and external research, that is, research conducted on behalf of the Office. Internal research reports are identified by OR while external reports are identified by CR.

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- SUMMARY -

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STUDY DESIGN

FOR

EVALUATION OF THE EFFECTIVENESS OF MITERS-TYPE PROJECTS

..

prepared for

OFFICE OF ROAD SAFETY

DEPARTMENT OF TRANSPORT

by

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of

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## PREFACE

This Summary and its companion Technical Report<sup>1</sup> describe a study design for an evaluation of the safety effectiveness of minor traffic engineering and road safety projects undertaken in Australia. **These projects** are of the type which would be eligible for Commonwealth funding under the terms of the MITERS (minor improvements for traffic engineering and road safety) program. **This program is a discrete part of the Roads Grants Act 1974 and the State Grants (Roads) Act 1977** which together have provided funds for the States for expenditure on road projects for the six year period 1974/75 to 1979/80 inclusive.

In the investigations for this study design, a review was made firstly of sources of data available on accidents, traffic flows, and projects implemented in the States of Australia. It was concluded that the major data constraint relates to the methods of recording accident data and that South Australia and Western Australia are presently the only States with data bases in an immediately suitable form for the proposed evaluation. Other States, particularly New South Wales and Victoria, have adequate records of accidents but these are stored in such a way that it is difficult to gain access to details of accidents at a large number of sites, which would be necessary in the evaluation.

A methodology was then developed and recommended for the evaluation, based on the principles of the before-and-after study. **Care was given** to resolution of problems arising from:

- . changes in site exposure;
- . changes in secular trends of accidents;
- . **seasonal factors not covered in changes in site exposure.**

Lastly, a trial analysis was conducted for intersection signalization projects undertaken in Adelaide in 1975/76. **The feasibility of the proposed methodology was demonstrated and preliminary results established**

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<sup>1</sup> Report No. CR 8 (October 1979) '*Study Design for the Evaluation of the Effectiveness of MITERS-type Projects: Technical Report*' prepared by G.L. Teale, A.S. MacLean, N.F. Clark, P.G. Gipps, Nicholas Clark and

concerning the safety effectiveness of these projects.

It is recommended that the evaluation should proceed, using data from South Australia and Western Australia, but that one of the two larger States, should, if possible, be included if improvements can be made to its methods of coding the location of accidents.

STUDY DESIGN

FOR

EVALUATION OF THE EFFECTIVENESS OF MITERS-TYPE PROJECTS

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# 1 INTRODUCTION

This report presents a summary of the findings of an investigation for a study design for the evaluation of the road safety effectiveness of MITERS-type projects.

In the investigation, MITERS-type projects were defined as those projects which would qualify for Commonwealth funding in the MITERS program. The acronym MITERS comes from minor improvements for traffic engineering and road safety. The MITERS program is a discrete part of the *Roads Grants Act 1974* and the *States Grants (Roads) Act 1977* which together have provided funds to the States for expenditure on minor projects for the six year period 1974/75 to 1979/80 inclusive.

It is now well established that the analysis of the effectiveness of road accident counter-measures is by no means a simple task. The purpose of this summary is to facilitate an easy appreciation of the main issues which, in turn, are described and analysed in terms of relevant statistical and mathematical principles, in the technical report<sup>1</sup>.

The most significant problem is the variability in accident numbers at any location due entirely to random chance, but other problems such as changes over time in the type of accidents reported, changes in traffic flows when one year is compared with the other, all present a challenge to which advanced statistical theory must be applied before inferences can be drawn of the effectiveness of accident counter-measures. A report on these problems was prepared for the Office of Road Safety in 1974<sup>2</sup>.

The technical report of this study is a document which can be easily comprehended only by those who have had recent experience in the statistical and operational problems of analysis of accident counter-measures. It presents a review of the possible methods of analysis and suggests an approach to an evaluation which has been shown to provide

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<sup>1</sup> CR 8 Technical Report *Study Design for the Evaluation of the Effectiveness of MITERS-type projects: op cit.*

<sup>2</sup> Maclean A.S., Richardson A.J., Ogden K.W., Taylor M.A.P. and Clark N.F. *Evaluation of the effectiveness of traffic accident counter-measures* prepared for Road Safety Research Section Department of Transport:

useful results with data provided by South Australia.

This summary has been prepared to provide an overview of the technical report for those who have a need to appreciate the nature of the suggested methodology without necessarily being concerned at the details of how the evaluation will be undertaken. It also provides a useful introduction to the technical report, by briefly describing its structure and contents.

The evaluation itself is needed so that decisions may be made of the value of MITERS-type projects relative to other road accident counter-measures and in this way assess whether adequate funds are being provided for works of this type relative to other measures for reducing accident numbers. It is also desirable to provide information on which types of MITERS projects are most effective in reducing accidents, and in what circumstances one type of project should be preferred to another.

Typical MITERS projects are described in the Notes on Administration of the States Grants (Roads) Act 1977 issued by the Department of Transport as:

- (a) traffic signals;
- (b) road signs and pavement marking;
- (c) speed control systems;
- (d) elimination of intersections on arterial roads, modification of multiple-street intersections, provision of median strips or new or modified traffic islands and roundabouts;
- (e) pedestrian crossings (including flood lighting) and the provision of pedestrian safety zones;
- (f) localised improvements to street lighting, or new lighting at isolated locations;
- (g) bus stopping bays for safety reasons;

- (i) use of slip-base and frangible street lighting poles and sign supports at locations with high accident records;
- (j) relocation or protection of roadside objects at hazardous locations;
- (k) protection devices at railway crossings;
- (l) the adjustment to super-elevation on curves, and improvement of visibility on crests or curves; and
- (m) provision of guardrails on embankments, curves and bridge approaches.

## 2 STUDY AIMS

The aims of the study design were:

- . to assess the feasibility of evaluating the safety effectiveness of MITERS-type projects;  
  
if the feasibility could be established, to examine alternative techniques for assessing project effectiveness and recommend a methodology for an evaluation study;
- . to draw up a work program for an evaluation study.

### 3 . SUMMARY OF STUDY DESIGN

The technical report has three main chapters:

#### Chapter 2: Data requirements and availability

A review and discussion of the sources of data on accidents, traffic flows, and projects implemented in the States of Australia.

#### Chapter 3: Methods for evaluating effectiveness of MITERS-type projects

A brief review of alternative procedures for assessing the effectiveness of road safety projects, followed by the development and presentation of statistical methods proposed for the evaluation phase of the study. The chapter is divided into two parts: a discussion followed by an annex with details of statistical and mathematical principles.

#### Chapter 4: Trial analysis

A demonstration, using South Australian data, of the statistical methods proposed in Chapter 3. The feasibility of the methodology is demonstrated, and some preliminary results are shown of the safety effectiveness of recent traffic-signal installations in Adelaide.

The discussion and conclusions presented in these chapters are summarised in the next section:

## 4 STUDY DESIGN INVESTIGATION

### 1. Data requirements and availability

Data requirements for the evaluation of the effectiveness of MITERS-type projects fall into three main classes:

accident data

exposure data

project data

#### Accident Data

In the main report investigations are described which show that two States currently have accident data immediately available in a form suitable for the proposed methodology. These are South Australia and Western Australia. In both these States, the accident data base allows computer sorting by location of accident. This means that accident data relevant to a particular project, or group of projects, can be automatically assembled for any location of interest.

The location coding systems of South Australia and Western Australia are very similar. A unique code which identifies each section of road and each intersection is associated with each accident record. The location coding system in Victoria, however, would make that State's data difficult to use for evaluation.

New South Wales data is suitable for the evaluation, but substantial manual sorting and checking of data would be necessary, at considerable expense. A further difficulty with the New South Wales data is that in rural areas, it is often not possible to identify the actual location of an accident reported by a policeman or member of the public. An example is quoted in the main report in which the actual locations of 20% of reported accidents could not be determined. The inclusion of New South Wales in the evaluation would be desirable because that State undertakes a program of MITERS projects as a part of a comprehensive traffic facilities program. There is, therefore, scope for including in the evaluation MITERS-type projects which are

Whilst the New South Wales and Victorian accident data bases could be used for the evaluation, because of the lower rate of recording of property damage accidents, they are considered to be less suitable than the South Australian and Western Australian data bases. This is not a major barrier and the larger size of the road network in those States, and the consequent numbers of accidents suggests that one at least should be further considered.

All States in Australia have regulations which require some but not all traffic accidents to be reported to police. For example, in Tasmania, an accident not involving personal injury is not required to be reported. In New South Wales, accidents where aggregate property damage is less than \$300 are not required to be reported. Reporting criteria are summarized in Table 1.

In every State, it is likely that the compliance of drivers with reporting requirements will not be complete. A driver's ability to estimate the cost of aggregate property damage or to ascertain whether personal injury, as legally defined, has been incurred is suspect.

It is expected that property damage only accidents will be seriously underrepresented in the data bases. If this underrepresentation is consistent with respect to time, geographical location and type of accident, an evaluation can be made of certain MITERS-type projects within both South Australia and Western Australia. Comparisons of project performance between States will be possible generally only in terms of casualty accident data.

Adequate accident data is available in the data bases in South Australia from January 1972 and in Western Australia from January 1976.

TABLE 1

RECENT LEGAL REQUIREMENTS FOR ROAD TRAFFIC REPORTING IN  
AUSTRALIAN STATES

State	Road Traffic Accidents Required to be Reported to Police
New South Wales	(a) All accidents involving personal injury.  (b) All accidents where aggregate property damage exceeds \$300. (\$50 prior to July 1977)
Victoria	(a) All accidents involving personal injury.  (b) All accidents where there is property damage or an animal is injured and the owner or owner's representative is not present. (since 1970)
Queensland	(a) All accidents involving personal injury.  (b) All accidents where aggregate property damage exceeds \$1,000. (\$300 prior to October 1978; \$100 prior to January 1976)
South Australia	(a) All accidents involving personal injury and/or injury to an animal.  (b) All accidents where aggregate property damage exceeds \$100. (\$50 prior to 1975)
Western Australia	(a) All accidents involving personal injury.  (b) All accidents where aggregate property damage exceeds \$100, or where property damage level is in dispute, or where all interested parties are not present. (Since 1969: increase in prescribed amount under consideration).
Tasmania	(a) All accidents involving personal injury.

### Exposure Data

Exposure to accidents may be measured by traffic flow data. This data is available over the same period as the accident data in South Australia and Western Australia. However, at most sites of MITERS projects in both States, flow data is collected only every two years. Hence, the calculation of year by year exposure indices requires trends to be assumed. In South Australia the counting network is quite extensive and in nearly all cases exposure indices can be calculated for specific sites. In Western Australia the network is not as extensive and in some cases only an index for an area can be obtained. However, given the short period for which the accident data is available, adjustment for exposure should not often be critical. The information is currently available only from manual files and so extraction will proceed after identification of sites for study.

The generally accepted approach to calculating average exposure indices using Average Annual Daily Traffic (AADT) is discussed in the main report. It is pointed out that in fact there are inaccuracies in this approach. However, as only AADT flows are available in any State, except at a very few locations, this inaccuracy must be accepted and it is not expected to be significant, although it will cause problems in interpretation.

There is sufficient traffic flow data available in South Australia for the comparison of accident rates in before and after studies. In Western Australia, some local trends in traffic flows will have to be assumed for comparison of accident rates. The likely errors introduced, however, will be small compared with the variability of the accident numbers.

### Project Data

Submissions made by the States to the Commonwealth for funding of MITERS projects include information on:

- . type of project
- . estimated costs
- . location of project

Information required in the evaluation which is not available from this source includes:

- . special features of projects
- dates of commencement and completion

Information may also be required relating to road engineering or traffic management work carried out near the location of particular MITERS-type projects.

Therefore, while the States' submissions show the location and type of projects undertaken under the MITERS program (except in the case of bulk Category A projects where locations of individual projects are not specified), there is additional information which must be obtained from road and traffic authorities.

Submissions from the States to the Commonwealth for approval of MITERS projects were assessed in terms of the numbers of accidents claimed to be susceptible to improvement following implementation of nominated projects. There were 15 out of 26 types of project in South Australia, and 7 out of 22 types of project in Western Australia for which the numbers of accidents are large enough to indicate that statistical evaluation is feasible<sup>1</sup>. These project types are shown in Table 2. 11 of the 18 types of improvement deal with treatment of a single intersection, while the total number of projects which deal with treatment of a single intersection is 508 out of a total of 819.

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<sup>1</sup> This point is discussed further in Section 3.2

TABLE 2

PROJECT TYPES IN SOUTH AUSTRALIA AND WESTERN AUSTRALIA FOR WHICH  
NUMBERS OF ACCIDENTS INDICATE STATISTICAL EVALUATION IS FEASIBLE

Project Type	Number of Projects	State
1. Conversion of Intersection to "T"	70	S.A.
2. Median barrier/closure	17	S.A.
3. New or upgraded street lighting	43	S.A.
4. Safety bars	91	S.A.
5. Modify intersection signals	40	S.A.
6. Modify intersection channelisation	2	S.A.
7. Modify intersection signals and channelisation	5	S.A./W.A.
8. New intersection signals	47	S.A./W.A.
9. New intersection channelisation	95	S.A./W.A.
10. New intersection signals and channelisation	11	S.A./W.A.
11. Eliminate intersection	4	S.A.
12. Roundabout	52	S.A.
13. New pedestrian signals	25	S.A.
14. Area traffic management	1	S.A.
15. Priority route scheme	102	S.A.
16. Pedestrian refuge/median/island	32	W.A.
17. GIVE WAY signs	27	W.A.
18. STOP sign	155	W.A.

## 2. Recommended Method for Evaluating Effectiveness

Basic Test: The proposed methodology is based on the before-and-after technique. This technique is commonly used in the evaluation of road safety measures. It is recommended for three main reasons:

it is conceptually simple and widely understood;

it is the most economical technique in terms of data requirements;

it is ideally suited to the analyses of MITERS projects which are implemented either completely or not at all.

Because, in most cases, the number of accidents each year at a particular site is not high, any procedure designed to test for a change in the accident experience after implementation of a project at that site (compared with the incidence before) will not in general be very powerful. That is, there will be only a small chance that the statistical test will indicate a change to have occurred when a change has, in fact, occurred. For this reason, it will be necessary to combine results from several sites where the same type of MITERS improvement has been carried out.

The methodology proposed is based, therefore, on comparing the number of accidents in each of the before and after periods at a group of sites at which a particular type of MITERS project has been implemented.

Modifications are discussed in the main report. The basic test works as follows:

Suppose there is a group of sites numbered from 1 to  $m$  at each of which a particular type of MITERS project has been implemented. For site  $i$ , let:

$p_i$  be the ratio of accidents expected in the after period to accidents in the combined before-and-after periods if no change in accident incidence occurs. (If there is no change in exposure indices or other factors,  $p_i$  is the ratio of the length of the after period to the length of the total period);

$N_i$  be the total number of accidents observed in before and after periods;

$n_i$  be the observed number of accidents in the after period.

The test will determine if the number of accidents expected in the after period, compared with the number observed in the after period, indicates that the projects have generated a real improvement in safety (a real reduction in accident occurrence) at the group of sites. That is testing whether:

$\sum n_i$  is statistically significantly smaller than  $\sum N_i p_i$ .

In the main report, it is shown how to determine a critical value  $\delta(\alpha)$  for various significance levels, such that if

$\sum n_i$  is smaller than  $[\sum N_i p_i - \delta(\alpha)]$

it may be concluded that implementation of the type of project under test has been associated with a real improvement in safety at the group of sites. That is,  $\delta(\alpha)$  is the minimum number by which the total number of accidents observed in the after period at the group of sites must be less in order to indicate that the projects have improved safety at a given significance level.

The quantity  $\alpha$  represents the chance that the conclusion drawn is wrong. That is, if we conclude that the project has improved safety, there is a  $100\alpha\%$  probability that the indicated improvement was due to chance alone, and that the project type has not in fact led to any improvement in safety. The value assigned to  $\delta(\alpha)$  therefore, depends on the value chosen for  $\alpha$ . The latter will

typically be of the order of 0.05 or 0.10, indicating respectively a 5% and 10% probability that an indicated improvement could be explained by chance.

The statistical power of the test was examined. This represents the probability that the test will indicate an improvement in safety to have occurred given that one has, in fact, occurred. In the technical report it is shown that for most situations of interest, the power will be sufficiently high.

### Selection of Project Types for Evaluation

In the technical report, it is shown that the project types suitable for evaluation will be those for which the total, over all sites, of accidents observed in before-and-after periods is greater than a certain number. In many cases, it will be sufficient to have the total number of accidents in the before-and-after periods for a project type ( $\sum N_i$ ) equal to about 100. Application of this criterion yields the selection of project types shown in Table 2, already described.

### Stratification

In conducting the evaluation, the following types of questions will also have to be addressed:

- Do different types of project alter the nature and severity of accident types occurring?
- Do different versions or categories of the one type of project differ in their safety effectiveness?
- Do different types of projects differ in their safety effectiveness?
- Do differences in sites influence the effectiveness of the same type of project?
- Do projects differ in their effectiveness according

There are two test procedures proposed in the main report to answer these questions. Preference for one of the procedures over the other, in each case depends entirely on the numbers of accidents observed. If these numbers are sufficiently large, then a contingency table may be constructed, and a Chi-square statistic calculated to test for differences between groups of projects. The contingency table is set out as follows:

Let

$N_i$  be the total number<sup>1</sup> of accidents observed in the before-and-after periods for project group  $i$ .

$n_i$  be the number<sup>1</sup> of accidents observed in the after period for project group  $i$ .

When a group has the same before and the same after periods, the contingency table is then:

	Before	After	Total both periods
Group 1	$N_1 - n_1$	$n_1$	$N_1$
Group 2	$N_2 - n_2$	$n_2$	$N_2$
..	..	..	..
..	..	..	..
..	..	..	..
..	..	..	..
..	..	..	..
Group $m$	$N_m - n_m$	$n_m$	$N_m$
Total all groups	$m$ $\sum_1 (N_i - n_i)$	$m$ $\sum_1 n_i$	$m$ $\sum_1 M_i$

<sup>1</sup>after adjustment for changes in exposure etc.

When not all the before-and-after periods coincide, the above table must be modified. The value of the Chi-square is compared with the value it should take under the hypothesis that there is no difference between groups. If it is too large, it is concluded that group differences do exist.

Note that the groups of projects may be defined in any way at all. For example, the grouping may be by project type, by type of site, by year of implementation, or even by project cost. The only requirement is that the total observed number of accidents for each group is large enough that the distribution of the test statistic may be regarded as Chi-square. A good rule of thumb is that the number of accidents observed for each group in each period is greater than  $10^1$ .

If this requirement is not satisfied, it is necessary to use an alternative test procedure as follows:

Let

$\lambda_{b_i}$  be the true accident frequency<sup>2</sup> for group  $i$  in the before period;

$\lambda_{a_i}$  be the true accident frequency<sup>2</sup> for group  $i$  in the after period;

$\kappa_i$  be the ratio  $\lambda_{a_i}/\lambda_{b_i}$ .

The test is to determine whether  $\kappa_i$  is the same for all groups.

The procedure proposed (explained in detail in the main report) is firstly to calculate a single estimate of the  $\kappa_i$  under the hypothesis that they are all the same. This estimate is then compared with estimates of each of the  $\kappa_i$ , made under the hypothesis that they are not

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<sup>1</sup> Otherwise the distribution of the number of accidents will be heavily skewed in violation of the assumptions invoked in contingency table tests.

<sup>2</sup> After adjustment for exposure.

all the same. Under the first hypothesis the sum of the squared differences between the two (adjusted for the variance of the estimates of the  $\kappa_i$ ), is distributed as a Chi-square variable. If this sum is too large in comparison with the value it should take under the first hypothesis, this is rejected. That is, it is concluded that the  $\kappa_i$  are not all the same and that group differences do exist.

### Severity and Type

To test the effect of MITERS-type projects on the occurrence of accidents of different type or severity, a contingency table approach similar to that described immediately above is proposed. In this case, the groups become classes representing accident severity or type categories.

If the numbers of accidents of each class are too small, the alternative approach described earlier may be adopted, with the groups again becoming classes representing accident severity or type categories.

### Cost Effectiveness

The final aspect of the proposed evaluation procedure requires an assessment of the cost effectiveness of different project types. It is recommended that cost effectiveness be expressed in terms of the average change in annual accident frequency per dollar expenditure on projects. This approach, described in the main report will allow ranking of project types according to their cost effectiveness exhibited to date only.

The recommended approach may be visualised as follows :

Suppose the reduction in accident frequency for each class of MITERS project is plotted against the value in current dollars of the cost of implementation of each class. The cost effectiveness of the class is then given by the slope of the line joining this point to the origin. To test whether all classes of projects are equally cost-effective, the scatter about a regression line through the origin fitted to the plotted points may be examined. If it is concluded that

the different classes of projects are not equally cost-effective, pair-wise comparisons may be carried out in order to determine the ranking of cost effectiveness.

The test is validly applied whatever the type or severity of accident included in the calculation of accident frequency. A limitation is, however, that it may lead to different conclusions depending on the severity of accidents used in determining the effectiveness.

Illustration of the proposed procedures for assessing and comparing the cost effectiveness of different classes of projects has not been made in the main report.

### 3. Trial Analysis

To illustrate some of the methods described in Section 2, it was decided to conduct a trial analysis for one project type using data available from one State. The South Australia accident data base was chosen as the only one suitable at the time for the purpose. Projects examined in the trial analysis comprised nine traffic light installations at intersections in metropolitan Adelaide. The projects were divided into two groups: Group A where new traffic lights only were installed and Group B, where new traffic lights were installed together with modification of channelization. All sites from the 1975/76 program within metropolitan Adelaide which fell into either of these two categories were included. These categories were not subdivided further by such criteria as the type of phasing used. One of the aims of the trial was to see if further subdivisions were justified on statistical grounds.

The principal problem for the trial analysis was the determination of the precise implementation date of individual projects. This information can be obtained from State Road Authorities, but a substantial manual check of records would be involved. It was instead ascertained that projects were undertaken and completed during the financial year, 1975/76.

Before making a final choice of the years to be used for before-and-after periods, a brief examination was made of the reliability of the data base, in terms of the statistical characteristics of the accident data. The main conclusion was that data for 1973 appeared to be unsatisfactory, and consequently the years for before-and-after periods were chosen as 1974 and 1977 respectively.

All of the statistical procedures described in the previous section were used in the trial, with the exception of those proposed for assessing and comparing the cost effectiveness of different classes of projects.

The trial successfully showed that the proposed statistical procedures are both appropriate and workable and therefore suitable for use in the evaluation study. Specific conclusions from the trial analysis were :

- (i) the particular signalization projects analyses were as a whole, effective in reducing both overall accident numbers and accident rates;
- (ii) projects not involving channelisation were equally as effective as those involving channelization in reducing both overall accident numbers and accident rates;
- (iii) for projects not involving channelization, the effectiveness in reducing both accident numbers and accident rates varied significantly according to the site of installation;
- (iv) both types of signal projects caused a significant decrease in the number of right-angle accidents, but not in the number of rear-end accidents;
- (v) projects not involving channelization caused a significant increase in the number of rear-end accidents;
- (vi) both types of project were equally effective in reducing both property-damage-only and injury-plus-fatal accident numbers.

## 5 EVALUATION STUDY WORK PROGRAM

The study design is suitable for evaluation of many of the MITERS-type projects in South Australia and Western Australia. Should the evaluation phase proceed in accordance with the study design proposed, it is suggested that the following tasks would need to be undertaken over approximately one man year. Reference may be made to the technical report for details of procedures proposed.

The tasks to be undertaken are as follows :

### 1. ASSEMBLE PROJECT DATA (16 WEEKS)

1.1 Select Projects (½ week) : Projects to be included in the evaluation will be determined from the set of projects so far implemented under the MITERS program. The set of projects for which numbers of accidents indicate statistical evaluation to be feasible includes (see Table 2) :

- . conversion of intersection to 'T'
- . median barrier
- . new street lighting
- . upgraded street lighting
- . safety bars
- . modification of intersection signals
- . modification of intersection channelization
- . modification of intersection signals and channelization
- . new intersection signals
- . new intersection channelization
- . new intersection signals and channelization
- . eliminate intersection
- . roundabout
- . pedestrian signals
- . area traffic management
- . priority route scheme
- . pedestrian refuge
- . median island
- . GIVE WAY sign
- . STOP sign

This set may have to be modified following determination, from accident data bases, of actual accident records for each project type. This is part of Task 3 below.

1.2 Code MITERS project locations (4 weeks) : From State records locations of implemented projects will be identified and coded into a computer file, together with keys describing the project type applicable. The location code used will be that maintained by the State for its own purposes.

1.3 Code MITERS project implementation data (3½ weeks) : Actual dates of commencement and completion of construction will have to be obtained from State Road Authorities, and coded together with the information of Task 1.3.

1.4 Obtain other technical information (4 weeks) : To assist in the later stratification of project types, technical information relating, for example, to phasing arrangements for signal projects will have to be determined by consultation with State Road Authorities and coded together with the information of Tasks 1.2, 1.3.

1.5 Obtain cost information (4 weeks) : For each individual project, capital and operating (maintenance) costs will have to be obtained from State Road Authorities.

At the completion of this task there will be available a comprehensive data file of implemented MITERS projects able to be sorted by :

- . location
- . project type
- . implementation dates
- . technical differences
- . capital and operating costs

## 2. ASSEMBLE TRAFFIC FLOW INFORMATION (4 WEEKS)

Traffic flow information for each site included in the MITERS project data file will be extracted from State Road Authorities' records in the form of AADT by year. This information will be coded into a separate file (if not already done so by State Road Authority), cross-referenced against project file locations.

## 3. ASSEMBLE ACCIDENT DATA (11 WEEKS)

3.1 Obtain accident data files (2 weeks) : These will be obtained from States as follows :

- . for South Australia: from January 1972 onwards
- . for Western Australia: from January 1976 onwards

3.2 Load and sort accident data files (2 weeks)

3.3 Check consistency of accident data (4 weeks) : These will be made of the accident data files to detect inconsistencies. Identified problems will be examined and appropriate action taken.

3.4 Compare engineering information (3 weeks) : Accident data files for each State already contain a certain amount of engineering information for the location of each accident. This will, for MITERS project locations, be compared with the data file assembled in Task 1.1 and discrepancies determined and rectified.

## 4. ESTABLISH CONTROL DATA FOR SECULAR TRENDS (5 WEEKS)

4.1 Select control groups (3 weeks) : There are three major reasons for using a control :

- (i) to take account of under-reporting of accidents;
- (ii) to take account of secular changes in accident severity;
- (iii) to take account of secular changes in the overall incidence of accidents.

It will be necessary to select, for each type of project, a control group which can adequately reflect at least the latter two requirements. In the case of the first requirement, it is expected that the effect of under-reporting will be more or less constant over the years, and therefore in relative terms of little significance in determining the impact of projects on accident occurrence.

The selection of a control group for each project type will be made in terms of :

- . geographical area (e.g. urban or rural)
- . location type (e.g. intersection or mid-block)
- . accident type (e.g. right angle or rear end)
- . accident severity (e.g. injury or property-damage-only).

4.2 Calculate control factors (2 weeks) : This will involve use of the accident data bases to obtain accident records for the selected control groups. Year to year control factors will be calculated.

## 5. EVALUATION (13 WEEKS)

5.1 Test effectiveness within States (6 weeks) : This will be carried using the methods described in the main report (Chapter 3).

5.2 Test cost effectiveness within States (4 weeks) : This will be carried out using the methods described in the main report (Chapter 3).

5.3 Compare project performance between States (3 weeks) : Whilst inter-State comparisons will generally be difficult, some projects will be sufficiently similar to enable this using casualty accident data.

## 6. REPORT (6 WEEKS)

A concise yet fully informative report will be prepared to show, for MITERS project :

- . the safety effectiveness and cost effectiveness of each project type
- . the overall impact on road safety of the MITERS program in South Australia and Western Australia

Particular attention will be given too showing :

which project types were most safety effective and under which conditions

which project types were most cost effective and under which conditions

- . which project types were not sufficiently effective to justify expenditure and under which conditions

in what circumstances were specific project types of differential effectiveness between South Australia and Western Australia, and

- . the implications for the evaluation results of using alternative measures of exposure to traffic accidents.