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SCHOOL TRIP SAFETY AND URBAN PLAY AREAS

Vol. IV A Review of Daylight Savings Time Related Student Pedestrian Problems and Countermeasures

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Final Report

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16. Abstract

The purpose of the School Trip Safety and Urban Play Areas research project was to develop guidelines for the protection of young pedestrians (5-14 yrs.) walking to and from school, entering and leaving school buses, and at neighborhood play. The other six volumes produced under this project are:

Volume I - Executive Summary
Volume II - Student and Driver Perception of School Trip Safety and Traffic Control Devices
Volume III - A Survey of the Characteristics of the Urban Play Street
Volume V - Guidelines for the Development of Safe Route Maps for the School Walking Trip
Volume VI - Guidelines for Planning School Bus Routing and Scheduling
Volume VII - Guidelines for the Creation and Operation of Urban Play Streets

This study of the impact of reduced light conditions (under winter Daylight Savings Time) on school trip safety was performed in two phases.

The first was the identification and categorization of increased school trip safety problems associated with DST and the countermeasures in use to mitigate these problems

The second phase involved a critique of these identified countermeasures by the survey sample in terms of their accident reduction potential, cost, user acceptance and implementation difficulties.

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Finally, we particularly wish to thank the Contract Manager, John Fegan, of the Federal Highway Administration for his continuing assistance and guidance.

SECTION I
INTRODUCTION

The overall objective of the present young pedestrian research study is to formulate guidelines for the protection of children walking to and from school, entering and leaving school busses, and at neighborhood play. With the implementation of year-round Daylight Savings Time (DST) on January 6, 1974, children in many areas of the continental United States were required for the first time to walk to school or to school busses under conditions of darkness or twilight. News reports of early morning school trip fatalities and accidents in Florida, Michigan, Ohio, Pennsylvania, Maryland, Virginia, and Illinois[1] strongly imply that winter DST increased the safety hazard for children going to school. The concerns of parents, school officials, and school bus drivers for the safety of school children traveling in pretwilight hours have been widely reported.[2] In some areas, measures were introduced in an effort to reduce potential early morning darkness hazard such as delayed school openings,[3] distribution of retroreflective materials to school children,[4] and use of flares on crosswalks.[5]

The purpose of this phase of the young pedestrian study is to address the implications these reduced light conditions have for school age pedestrian protection. One facet of the study was the identification and categorization of increased school trip safety problems associated with DST and the countermeasures in use to mitigate these problems. Additionally, the identified countermeasures were evaluated in terms of their accident reduction potential, cost, user acceptance, and implementation difficulties.

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[1]The Washington Post, 8 January 1974, page A10.
The Washington Post, 26 January 1974, page A6.
The Washington Post, 1 February 1974, page B1.
Time Magazine, 21 January 1974, page 20.

[2]The Washington Post, 8 January 1974, page A1.
The New York Times, 9 January 1974, page 16.
The New York Times, 18 January 1974, page 31.
Op. cit., Time Magazine, 21 January 1974.

[3]The New York Times, 15 January 1974, page 23.
The Montgomery Journal, 17 January 1974, page A6.
Op. cit., The Washington Post, 26 January 1974.

[4]Op. cit., Time Magazine, 21 January 1974.

[5]Ibid

SECTION II

LITERATURE REVIEW

There are very few written sources of information on the effects of year-round Daylight Savings Time. The written material that will be discussed was not available until after the data collection phase of the present study was initiated.

National Reports

The United States Department of Transportation published a preliminary report to Congress in June 1974 that is by far the most extensive study done on the effects of year-round Daylight Savings Time. The report includes findings on such topics as public acceptance, energy use analysis, motor-vehicle fatalities and accidents, and the area of school children safety. Included in the discussion of school children safety are school age fatality statistics for January and February 1973 and 1974. The reported January data were gathered by the National Safety Council and will be discussed later. National fatality statistics for February 1973 and 1974 appear in the report and are reproduced below.

Table I

Total Motor Vehicle Related Fatalities Involving Children of School Age (5 to 18) – February 1974 Vs. 1973

Time of Accident	Number of Fatalities		
	1974	1973	Change
12 p.m. 6 a.m.	9	3	+ 6
6 – 7 a.m.	5	2	+ 3
7 – 8 a.m.	18	8	+10
8 – 9 a.m.	8	4	+ 4
9 a.m. 5 p.m.	43	76	–33
5 – 6 p.m.	5	10	– 5
6 – 7 p.m.	8	17	– 9
7 – 8 p.m.	11	15	– 6
8 – 12 p.m.	20	22	– 2
Unknown	4	—	4

Source: The Year-Round Daylight Savings Time Study, U.S. Department of Transportation, June, 1974.

As Table I illustrates, there was an overall decrease of 26 school age fatalities reported for February 1974 versus 1973. There was a substantial increase, however, in fatalities occurring in the

6 AM to 9 AM period (14 fatalities to 31). During the time period 9 AM to 5 PM, which encompasses the daylight school trips, the number of school age fatalities was substantially reduced (76 fatalities to 43) from February 1973 to 1974.

The authors are cautious in drawing conclusions based on these statistics because of the unknown effects on accidents of lowered speed limits and reduced number of vehicle trips during that period. Interpretation is further complicated by the fact that approximately 47% of students in their sample were attending schools which delayed starting times up to an hour with the advent of DST. The authors do state, however, "that the available data indicate that the trend for decreased fatalities involving school children during the months of January and February 1974 versus 1973 is not present for the going-to-school hours of 6 to 9 AM."[1]

The National Safety Council conducted a survey of all 50 states and the District of Columbia to determine if there was any increase in the number of school child fatalities for January 1974 over 1973.[2] They received responses from 42 states and the District of Columbia which according to the report represented 75% of the population.

According to fatality figures reported by the Council, "school-age traffic deaths throughout the United States were down from 76 fatalities in January 1973 to 55 fatalities in January 1974."[3] This decrease in fatalities reported for January 1974 reflects school child traffic deaths during the 24-hour day. The National Safety Council concluded that there was no overall increase in school age traffic fatalities due to Daylight Savings Time. Data from this report, while not statistically significant, were in the same direction as those in the DOT report to Congress, i.e., a higher proportion of 6 AM to 9 AM fatalities for 1974.

One other nationwide survey on the effects of year-round Daylight Savings Time was conducted by Research and Forecasts, Inc. for Potters Industries, Inc. The survey queried Institute of Traffic Engineers (ITE) members on the "safety impact of continuing Winter Daylight Savings Time." The survey included questions on accident statistics for 1973 and 1974; however, these results were not included in their report. The researchers stated that "statistical evidence was unavailable in most states at the time of the survey, and, where it was available, other factors such as the fuel crisis and lower speed limits greatly influenced 1974 tallies." One finding reported from the 189 responses tabulated was that 50% of the respondents "said they would opt for, and encourage, Daylight Savings Time again this winter." The 37% of the sample not favoring its continuation felt there was no energy conservation with DST or felt DST "created an AM darkness hazard for school-age children."

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[1]U.S. Department of Transportation. *The Year-round Daylight Savings Time Study*. June 1974, pp. 5-4.

[2]Motor Vehicle Statistics Department. News Release. National Safety Council, Chicago, Ill., March, 1974.

[3]Ten states experienced overall increases in school-age pedestrian fatalities in January 1974. Florida showed the largest increase, five fatalities, while Illinois showed the second largest with four. Connecticut and North Carolina both showed increases of three fatalities. The other states reporting an increase (up one fatality) were: Nevada, Virginia, New Mexico, Wisconsin, Louisiana, and Pennsylvania.

State Level Reports

Although we did not request officials to conduct special surveys on the effects of year-round DST, personnel in many states voluntarily included reports and materials with their responses which had been distributed within their states or previously sent to the Department of Transportation. Nine states sent copies of the fatality figures available for the early months of 1973 and 1974. Two states, Virginia and West Virginia, included lists of school districts which had implemented school hour changes with the advent of Daylight Savings Time.

Respondents in Wood County, Wisconsin and in Delaware included descriptions of programs involving the distribution of retroreflective materials to school children.

Safety curricula and safety program descriptions were received from three states: Missouri, Florida, and Nebraska. These states had ongoing pedestrian safety programs in which, with the advent of Daylight Savings Time, special emphasis was given to safe walking and bicycling habits during darkness.

SECTION III

IDENTIFICATION OF PEDESTRIAN SAFETY PROBLEMS AND COUNTERMEASURES

Preliminary Survey

The preliminary survey was conducted to obtain factual information on the impact of Daylight Savings Time on school trip safety. A questionnaire was developed to ascertain, using a sample of individuals professionally involved in school trip planning, whether DST had an adverse effect on school trip safety. Additionally, information was sought on countermeasures used to mitigate safety problems associated with school age children traveling to school in early morning darkness.

Survey Data Collection Procedures

Procedures Used to Identify Local Personnel. To obtain the names of individuals knowledgeable about school trip safety problems on an operational level, several sources were used. The most intensive effort centered in obtaining candidate names and areas from state level officials in the 44 states implementing DST in January.

First, Governor's Representatives or their equivalents who were involved in traffic safety at the state level were contacted. Some 50 letters were sent out requesting information on the impact of DST upon areas within each state. During subsequent telephone contacts, the officials were queried as to specific areas in their states which experienced school trip problems associated with DST or areas which implemented any special measures or programs to counteract the effects of morning darkness. Specific inquiries were made about areas having been reported in the news media as experiencing problems or programs related to DST. All officials were asked about media messages, retroreflective materials issued to children or crossing personnel, special training, school hour changes, bussing problems, and school-child pedestrian accidents. Where problems and/or measures were indicated, every effort was made to obtain names of local personnel such as educators, police officials, traffic engineers and transportation safety workers in those jurisdictions. From approximately 125 telephone conversations, 212 local personnel were identified. All of these individuals were associated with the 26 jurisdictions (25 states and the District of Columbia) that expressed a concern about DST.

In several cases, these operational personnel served as a further source of knowledgeable contacts. Using the space provided on the questionnaire form (see Exhibit 1 for a copy of the survey), they suggested the names and addresses of 12 additional local level individuals dealing with school trip safety issues.

Exhibit 1

School Trip Safety Study

1. **Area of Responsibility:**

   Municipal ( ) County ( ) State ( ) Other (specify)_____

2. **Job Field:**

   Education ( ) Law Enforcement ( ) Traffic Engineering ( )

   Transportation Safety ( ) Other (specify)_____

3. **Job Title:** _____

4. In your opinion, did the institution of winter Daylight Savings Time (DST) on January 6, 1974 create a safety problem or create a potentially hazardous situation for school children on their trip to school in your area?

   YES ( ) NO ( )

5. If so, what critical incident (accident, near misses, complaint, personal observation, news media reports, etc.) occurred in your area that brought this problem to your attention? Pay particular attention to the first two months of DST (January 6 – February 28).

   Date of critical incident _____

   Description: _____

6. With the advent of DST, were any special precautions or measures taken in your area relative to children traveling to school in the early morning hours?

   YES ( ) NO ( )

   If so, a. What were the measures? _____

   b. Have these measures been effective in increasing the safety of the early morning school trip? On what evidence do you base your opinions? _____

PLEASE TURN OVER

Exhibit 1 (Continued)

School Trip Safety Study

7. Will you retain any of those measures next winter, assuming Daylight Savings Time remains in effect?

YES ( ) NO ( )

Which ones? _____

_____

_____

_____

8. In the first two months of DST, how many school-age pedestrian accidents occurred within your area during the early morning hours when children were traveling to school? How many occurred in the same period in 1973? (If you cannot determine the exact number, please check the box if your responses are estimates or approximations.)

	Jan 6 – Feb 28 1973	Jan 6 – Feb 28 1974	Estimated
No. of School-age pedestrian accidents	_____	_____	☐
No. of School-age pedestrian fatalities	_____	_____	☐

9. If the "energy crisis" continues, would you be in favor of continuing winter DST next year?

YES ( ) NO ( )

Please explain why: _____

_____

_____

_____

10. Please make additional comments here and list addresses of other local officials who have dealt with problems and/or special measures associated with children traveling to school in darkness.

_____

_____

_____

_____

11. Were students in your area issued retro-reflective materials to wear on their clothing?

_____

If you wish to receive a copy of the tabulated findings of this study when it is complete, fill in your name and mailing address.

Name: _____

Address: _____

_____

One other major source was used to identify areas experiencing school-child pedestrian problems associated with DST. A review of in-house pedestrian accident reports for January, February, and March 1974 was conducted and 54 officials in those areas where pretwilight school trip accidents occurred were added to the survey sample.

Before proceeding with a description of the survey sample and results of the survey, a few cautionary remarks concerning the survey procedure are in order. It has been noted that the local areas identified as experiencing special problems or measures due to DST were referred to us by state level officials. Using this procedure, it is possible that some potential candidate local areas were not investigated because they were unknown to the state officials or were inadvertently overlooked. The reader should also note that the results found from the survey are necessarily limited by the information actually reported on the survey form. Due in part to several months time lag between occurrence of problems, accidents, or special measures associated with DST, it is probable that all pertinent information was not reported. Nevertheless, the results obtained from the survey do seem to offer valuable insights as to the problems and programs associated with DST.

Characteristics of the Preliminary Survey Sample

A total of 278 questionnaires were sent out to knowledgeable individuals in areas identified as experiencing some effect on school trip safety due to DST. Questionnaire responses were received over a two-month period. A "reminder" letter was sent out at approximately the half-way point in the data collection effort. A total of 166 responses from 24 states and the District of Columbia were received, a return rate of 60%. (See Attachment I for a summary of responses from each state.)

Table II illustrates the characteristics of the sample by profession. As indicated in the table, the professionals in education are the most highly represented in the sample. It was felt that they would be most able to provide detailed information on the effects of DST and any related countermeasures.

Table II

Professional Characteristics of Survey Sample
(N = 166)

Profession	Number of Recipients	Percentage Responding	Percentage of Sample
Education	161	64	62
Law Enforcement	65	51	20
Traffic Engineering	40	52	13
Transportation Safety	5	80	2
Other	7	71	3

The great majority of respondents, 84%, indicated their area of professional responsibility was primarily on a local level, (e.g., city, county, school district).

Results of the Preliminary Survey

Identification of Pedestrian Safety Problems. Seventy-eight percent of the sample indicated they felt the institution of DST on January 6, 1974 created a safety problem or potentially hazardous situation for school children on their trip to school. When queried on what critical incidents occurred in their areas that brought this problem to their attention, 31% did not respond or reported there were no critical incidents. The 160 critical incidents and safety problems which were reported fell into the following categories:

Critical Incidents Related to DST	Number Reported	Percentage of Reported Incidents
Motorists' complaints (e.g., difficult to see children)	38	24
School-child pedestrian injuries	23	14
School-child pedestrian fatalities	22	14
Pedestrian/vehicle near-misses	18	11
Bussing difficulties (e.g., students on edge of roadway; mistaking trucks for buses)	17	11
Personal observation	16	10
Potential hazard	8	5
Other (e.g., molesting; weather conditions)	8	5
News report	7	4
Lack of sidewalks	3	2
Total	160	100

Respondents were asked to provide accident and fatality data for January through February 1973 and 1974 for school-age children during the early morning hours. They were requested to check the appropriate boxes if the figures given were estimates. Out of the sample of 166, 51 (31%) gave no response to this item. Another 45 respondents (27%) gave partial or estimated responses. The number of complete responses was 70 (42%). Looking at the complete response data only, there appears to be no appreciable differences in early morning school child accidents or fatalities reported during the first two months of 1973 and 1974. The absolute numbers are difficult to interpret due to possible duplication of data within the same geographical areas. Moreover, the sizes of jurisdications and types of geographical areas varied widely within the sample; a large percentage of the data were reported by a small percentage of respondents. Of those people who made complete responses, 65% reported there were no accidents or fatalities in their areas during January through February 1973 or 1974.

When asked if they would be in favor of continuing winter DST during 1974-1975 if the "energy crisis" continues, only 37% of the respondents favored year-round DST.

Identification of Countermeasures

A high percentage, 82%, of respondents indicated that special precautions or measures relative to children traveling to school in the early morning hours had been implemented in their areas. Some 256 of these measures were reported, 36% of them being school hour changes or news media campaigns. The countermeasures were grouped into the following categories (see Attachment II for a complete listing of countermeasures and geographical areas):

Improved Pedestrian Conspicuity

Augmented Safety Instructions or Recommendations

Improved Crossing Guard or Patrol Conspicuity

Improved Crossing Site Conspicuity

Implemented Bussing Modifications

Increased Police Activity

Made Crossing Personnel Assignments

Passed Legal Measures

Identified Hazardous Crossings

Accident Data Analysis

Another method used to identify school trip safety problems associated with DST was the analysis of 79 pretwilight school trip accidents. The procedures and results of the accident analysis are presented briefly here. The reader is referred to Attachment III of this volume for a more detailed description of the analysis.

Locating DST Darkness Related Accidents. The 79 accidents identified as school trip related and occurring before twilight* were obtained from three sources. First, we reviewed the available in-house pedestrian accident reports from six states for January, February, and March 1974. The accidents reviewed occurred in six states: California, Michigan, Missouri, North Carolina, Pennsylvania, and Texas. From some 470 accident reports, 35 were identified definitively as school trip related. Of those 35, 18 accidents occurred before twilight in January and February. These 18 accident reports provided very detailed information on the conditions and behaviors occurring at the time of the accidents.

*According to the U.S. Weather Bureau, Civil twilight (the condition wherein artificial light is not needed to see) begins when the sun is 6^{o} below horizon. This period corresponds to about 30 minutes before sunrise.

Another source of accident reports was from states which indicated they had experienced problems due to DST. The state of Florida provided 23 reports of fatalities occurring between 6 AM and 9 AM from January through April. Of those, 10 were school trip related, 4 of which occurred before twilight. Michigan sent reports of 61 school age pedestrian accidents occurring in the early morning hours of January. The majority of those, 49, occurred when children were on their way to school before twilight.

A third source of accident data was provided by survey respondents in the states of Nebraska and South Carolina who spontaneously included accident reports when returning their questionnaires. Six of these school trip accidents in South Carolina and two in Nebraska were determined to have occurred before twilight.

Accident Characteristics

A complete summary of Accident Characteristics is included in Attachment III. Those characteristics which appear to imply an increased school trip hazard associated with darkness will be presented here. For example, the highest percentage of accidents, 38%, occurred when road surfaces were snowy or icy (only 28% of the dark early morning school trip accidents occurred when road surfaces were dry). The great majority of these accidents occurred on two-lane undivided roads. (This roadway characteristic is not a function of the accidents being rural. More than half of them, 61% occurred in what were categorized as urban/suburban areas.) The percentage of accidents occurring at intersections, 34%, is somewhat lower than might be predicted for the school age pedestrian based on other accident data. A seemingly high percentage of these pedestrian accidents occurred when a school bus was physically present (9%). In many cases, the vehicle striking the child was the school bus.

Several characteristics of pedestrian behavior in these pretwilight accidents merit attention. First, the greatest number of accident involved pedestrians on their way to school before twilight were struck while *not* attempting to cross the roadway. About 9% of them were standing in or beside the roadway, while in another 25 cases (32%) the pedestrians were walking in or beside the roadway. Eighty percent of these young pedestrians were struck while walking *with* the traffic.

An interesting aspect of driver behavior is that in 23% of the cases, drivers made statements to the police that they did not see the pedestrian prior to the accident.

In order to determine if this percentage is higher than would be expected under daylight conditions, a comparison was made between drivers' statements in pretwilight and posttwilight school trip accidents. While driver's statements were reported on many police accident reports, they were reliably available only from the 35 in-house field investigations. These 35 applicable in-depth reports were examined for drivers' statements concerning pedestrian visibility (18 pretwilight and

17 posttwilight accidents). Nearly twice as many of the pretwilight accident involved drivers stated they did not see the pedestrian (39%) as the drivers who were involved in posttwilight accidents (21%). Although these differences are suggestive, they were not found to be statistically significant.

In-Depth Field Investigations

Because of the completeness of the 18 in-house field investigations, some results of their analysis not available for the total sample will be presented separately. Figures available from this data base indicate that nearly three out of four of the young pedestrians were wearing dark clothing at the time of the accident. The information on trip origin and destination reveals that four of the 18 accidents occurred within a school zone. Another ten of the young pedestrians were struck en route to or attempting to board a school bus (primarily rural). There was no sidewalk present at 15 of the 18 accident sites. Road markings were reported as limited or nonexistent. There were no edge markings on the roadway at 15 of the accident sites. In 4 of the cases, warning signs appeared in advance of the accident sites.

Potential Countermeasures

Several countermeasures to darkness related pedestrian hazard are suggested by the accident analysis. These potential countermeasures include the following:

Pedestrian Practices

- Walk or stand well off the roadway
- Walk *facing* oncoming traffic
- Wear light-reflecting articles

School Bus Procedures

- Crossings initiated only when bus stopped
- Crossings initiated by driver/monitor
- Redesign of routes to eliminate crossings
- Bus stop location changes

Roadway Conditions

- Warning signs for school bus stops (poor sight distance)
- Retroreflective school zone signing
- Center line and edge markings
- Improved shoulders
- Street lighting

The measures selected for evaluation in Phase II were those which were reported to be actually in use by one or more of the survey sample. These were *retroreflective materials for peds, bus stop location changes, signing changes* and *additional street lighting.* These rated measures are discussed in more detail in later sections.

SECTION IV

RATING PROCEDURES FOR THE IDENTIFIED COUNTERMEASURES

After identifying a set of countermeasures currently in use, a method was sought to evaluate the potential benefits and implementation difficulties associated with the various countermeasures. One suitable method within the scope of this project was to solicit opinions on selected countermeasures from the previously described knowledgeable sample. To this end, countermeasures were selected for rating, a questionnaire rating sheet was developed, and the opinions of a knowledgeable sample of individuals were solicited. These procedures are described in this section.

Survey Data Collection Procedures

Rating Sheet and Selection of Countermeasures. A questionnaire rating sheet was developed to obtain rankings on countermeasures identified in the preliminary survey.

From the thirty-five measures reported as being actually in use, fourteen countermeasures were selected for rating. Several criteria were used in the selection of these countermeasures. Items which were only reported from one source were not included except in combination with a more frequently reported measure. The most frequently reported countermeasures, other than delayed school openings, dealt with improving the conspicuity of young pedestrians during the school trip. These items were selected for the survey. Most of the other countermeasures chosen were traffic-control related (e.g., *additional crossing guards)* or involved structuring the school trip environment (e.g., *bussing previous walkers).* Measures which required extensive cooperation from the community for their implementation were not selected for rating (e.g., *delayed school openings, pedestrian ordinances,* or *news media safety campaigns).*

The rating sheet (see Exhibit 2) was designed to elicit opinions on the fourteen countermeasures on four dimensions: (1) the anticipated effectiveness of the countermeasure in terms of a reduction in predawn school trip accidents, (2) the acceptability of the cost involved in implementing the countermeasure, (3) the amount of difficulty anticipated with purchasing, distributing, and providing information for each measure, and (4) the amount of anticipated user compliance/acceptance. These four evaluative dimensions were selected as important for analysis of the countermeasures. They were suggested in part by the respondents in the preliminary survey. Naturally the respondents were most concerned about the accident reduction potential of the various countermeasures. The cost of the countermeasures was also reported as an important consideration in many areas and school districts. Several individuals also expressed a concern with the problems of purchasing, distributing, and educating users on countermeasures within their areas. (These factors were combined under the ease of implementation dimension.) And lastly, the extent to which the countermeasures would be accepted and used by the intended population suggested

the user compliance dimension. To obtain uniformity of ratings, the scale for each dimension was described with an explicit set of four statements corresponding to a scale from 1 to 4 (1 = highest rating). Additionally, brief descriptions of the fourteen countermeasures were included with the rating sheet (see Exhibit 3).

Survey Sample No. 2. The individuals requested to perform these ratings were designated as the second survey sample. The second survey sample was selected from those operational personnel identified from the preliminary survey as knowledgeable about school trip safety issues. Two criteria were used in choosing the individuals to rate the countermeasures. One, the individuals must have completed more than 50% of the preliminary survey questionnaire. Additionally, they must have indicated a desire to receive those questionnaire results. The total number of individuals selected to receive the rating sheets was 132.

Exhibit 2

Rating Sheet

Listed below are measures that you and other respondents to the first survey indicated they had implemented. Your opinion on the applicability of each of the measures in your area is of vital interest. (Refer to next page for descriptors of measures). It is important that you evaluate each measure. Use the bottom of the page for additional or explanatory remarks if you wish. Please rate each measure on a scale from 1 to 4 relative to the following criteria:

1. *Accident Reduction.* If used as recommended, how effective would the measure be in preventing predawn school trip accidents in your state?
2. *Cost of Implementation.* Rate the measure on acceptability of cost for your area.
3. *Ease of Implementation.* Rate how difficult it would be to purchase, distribute, and provide information on each measure within your area.
4. *Anticipated Compliance/Acceptance.* Rate the measure on the degree of user compliance or acceptance in your area.

RATING CRITERIA

ACCIDENT REDUCTION	COST OF IMPLEMENTATION	EASE OF IMPLEMENTATION	ANTICIPATED COMPLIANCE
1. Very effective, eliminates most of the pedestrian accidents.	1. Acceptable cost and low.	1. Very easy to implement.	1. Good compliance, no problems.
2. Effective, eliminates a large proportion of pedestrian accidents.	2. Acceptable cost and moderate.	2. Can be implemented with some problems.	2. Fair compliance, some problems.
3. Somewhat effective, eliminates a small proportion of pedestrian accidents.	3. Acceptable cost but high.	3. Presents considerable implementation problems, but can be done.	3. Poor compliance, considerable problems.
4. Not effective, would not reduce the number of pedestrian accidents.	4. Unacceptable cost, too high	4. Not feasible.	4. No substantial compliance.

PROPOSED MEASURE	Accident Reduction	Cost of Implementation	Ease of Implementation	Anticipated Compliance
Improved Pedestrian Conspicuity				
• Retro-reflective materials	____	____	____	____
• Flashlights	____	____	____	____
Improved Crossing Guard Conspicuity				
• Flashlights	____	____	____	____
• Special vests or jackets	____	____	____	____
• Reflective patrol flags	____	____	____	____
• Reflective body straps	____	____	____	____
Improved Crossing Conspicuity				
• Additional street lighting	____	____	____	____
• Use of flares	____	____	____	____
• Signing changes	____	____	____	____
Police Activity				
• Increased patrol activity	____	____	____	____
Crossing Personnel Assignments				
• Additional or reassigned crossing personnel	____	____	____	____
Bussing Modifications				
• Bussing previous walkers	____	____	____	____
• Bus stop location changes	____	____	____	____
• Additional bus lighting	____	____	____	____

Exhibit 3

Brief Descriptions of Reported Measures

I. Improve Pedestrian Conspicuity

The wearing of retroreflective materials (materials which reflect light from headlights back to the driver) or the carrying of flashlights to increase pedestrian visibility to motorists.

II. Improve Crossing Personnel Conspicuity

Flashlights

Use of hand-held flashlights to direct traffic and to make crossing personnel more visible. Many of these have red or amber wands (approximately $2-$3).

Retroreflective Safety Clothing

Retroreflective body straps or "Sam Brown" belts. Cost range is $3.25-$3.75.

Vests with alternating fluorescent orange and retroreflective stripes. Cost range is $2.85-$5.70.

Retroreflective patrol flags. Cost range is approximately $2-$4.

III. Improve Crossing Conspicuity.

Street Lighting

Placing street lights at those crossing which have an inadequate number or no street lights where children cross.

Flares

Placement of several emergency flares near crossings but away from crosswalks, or in the center of the crossing. Cost of flares is about $.25 each.

Signing

Replacing nonretroreflective school signs with retroreflective signing (from 15%-65% increase in cost).

Angling retroreflective signs toward the roadway is reported to make them visible from a greater distance.

IV. Police Activity

Increase of activity in school or school bus stop areas to enforce speed limits and for nontraffic related surveillance (e.g., for possible molesters).

V. Additional Crossing Personnel

Crossing guard reassignments or use of additional crossing personnel.

VI. Bussing Modifications

Bussing Previous Walkers

Bussing students who cross high speed or high volume roadways during hours of darkness even though they may live within the minimum distance to be bussed.

Bus Stops or Routes Changed

Bus stops relocated off busy roads or to more well lighted areas. Spacing between stops reduced to decrease riders' walking distances. Some routes altered so that riders are not required to cross to get to their stops.

Additional Lighting

Interior bus lights left on during trip to alert riders and motorists to presence of bus. Inexpensive ($2) lights added to front of old busses to light up the words SCHOOL BUS. Implemented as a measure to make busses distinguishable from a longer distance.

SECTION V

DATA ANALYSIS AND RESULTS

A total of 110 rating sheets were returned out of 132 for a response rate of 83 percent. Nine questionnaires had less than 50 percent of the requested 56 ratings complete and were eliminated from the data analysis. The number of rating sheets analyzed was 101, or 76.5 percent of the total mailed. Table III below presents a summary of the characteristics of the sample by profession (N=101).

Table III

Professional Characteristics of Survey Sample #2

Profession	Number of Recipients	Percentage Responding	Percentage of Sample
Education	80	74	58
Law Enforcement	30	80	24
Traffic Engineering	16	87	13
Transportation Safety	2	100	2
Other	4	75	3

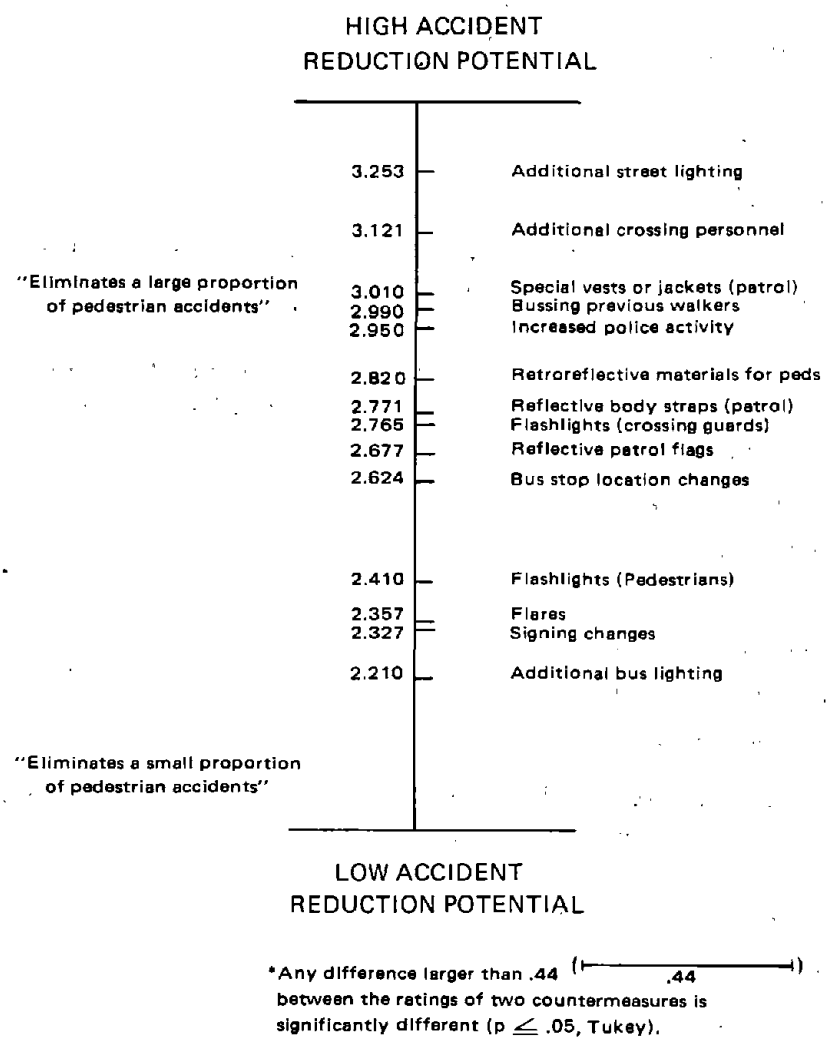
Mean ratings were obtained for each of the fourteen countermeasures on the four dimensions.* For purposes of this analysis the rating scale was reversed (all values were subtracted from 5) in order to have the higher ratings represented by larger numbers.

The mean ratings of each of the 14 countermeasures was computed on each of the four evaluative dimensions. Table IV displays the mean ratings of the countermeasures on their accident reduction potential. Additionally, this table and the following four tables present the rank order and relative distance between each of the countermeasures. The differences between the ratings of the countermeasures can be tested for significance by comparing these differences with the value given in the footnote. The value in the footnote was computed using the procedures developed by Tukey for controlling the overall α level. Since many paired comparisons (i.e., 91) between the 14 countermeasures are possible, we have chosen to use the Tukey procedure in order to assure that the probability of detecting a significant difference among these countermeasures by chance alone is at most five percent.

*See Attachment IV for a table of the Standard Deviations of the Ratings.

Table IV

Rated Accident Reduction Potential*



Looking at Table IV we find that *additional street lighting* was evaluated as having the highest accident reduction potential. Using the .44 value given in the footnote we can ascertain that *additional street lighting* was rated as being significantly more effective in accident reduction potential than all of the countermeasures falling below *retroreflective materials for peds*. The five countermeasures having the highest rated accident reduction potential were:

- *Additional street lighting*
- *Additional crossing personnel*
- *Special vests or jackets (patrol)*

- *Bussing previous walkers*
- *Increased police activities*

Judged least effective in reducing accidents were:

- *Flashlights (pedestrian)*
- *Flares*
- *Signing changes*
- *Additional bus lighting*

Rated accident reduction potential cut across the various countermeasure types, i.e., it was not confined to a particular kind of countermeasure category.

A second evaluative dimension of considerable importance is cost of implementation. Table V displays the relative acceptability of cost for the fourteen countermeasures. The five countermeasures having the highest rating on this dimension were:

- *Reflective body straps (patrol)*
- *Bus stop location changes*
- *Reflective patrol flags*
- *Flashlights (crossing guards)*
- *Special vests or jackets (patrol)*
- *Retroreflective materials for peds*

All of these countermeasures represent improved crossing personnel items except for *bus stop location changes* and *retroreflective materials for peds.*

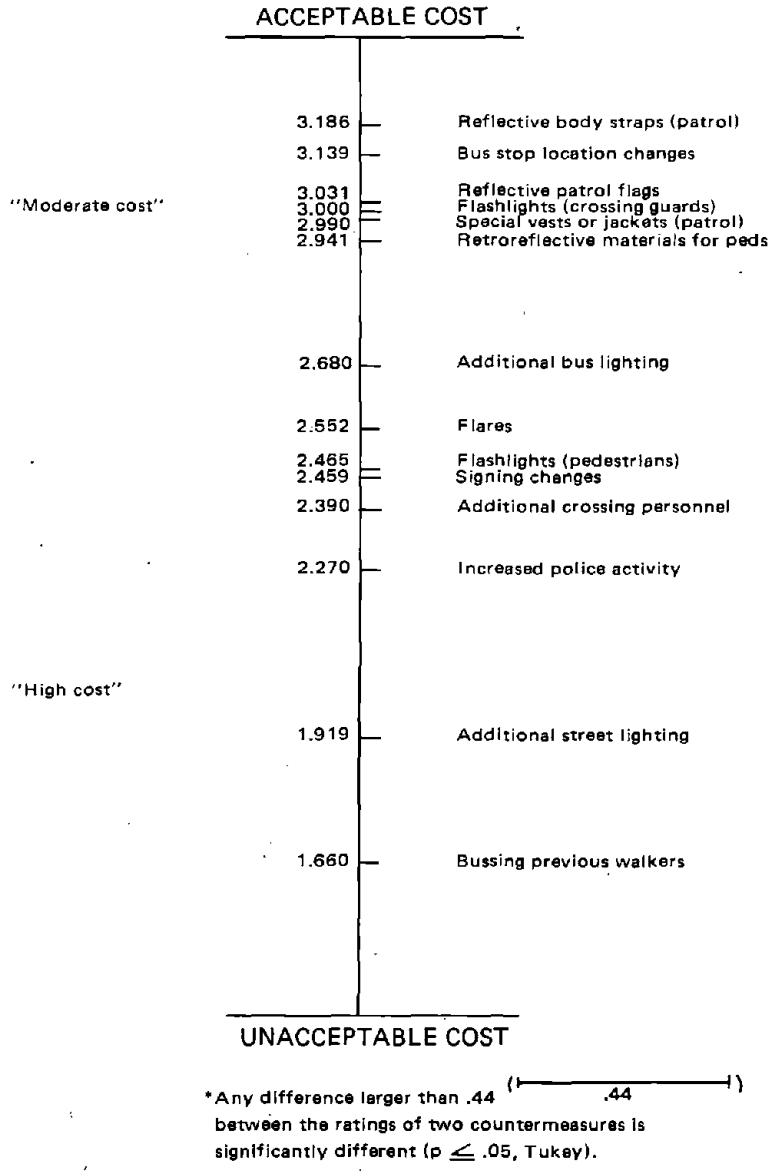
Those countermeasures rated low on acceptability of cost were:

- *Increased police activity*
- *Additional street lighting*
- *Bussing previous walkers*

The last countermeasure, *bussing previous walkers,* is rated significantly lower on acceptability of cost than every other countermeasure. This rating (1.660) is the lowest rating for any countermeasure on any dimension.

Table V

Rated Acceptability of Implementation Cost*

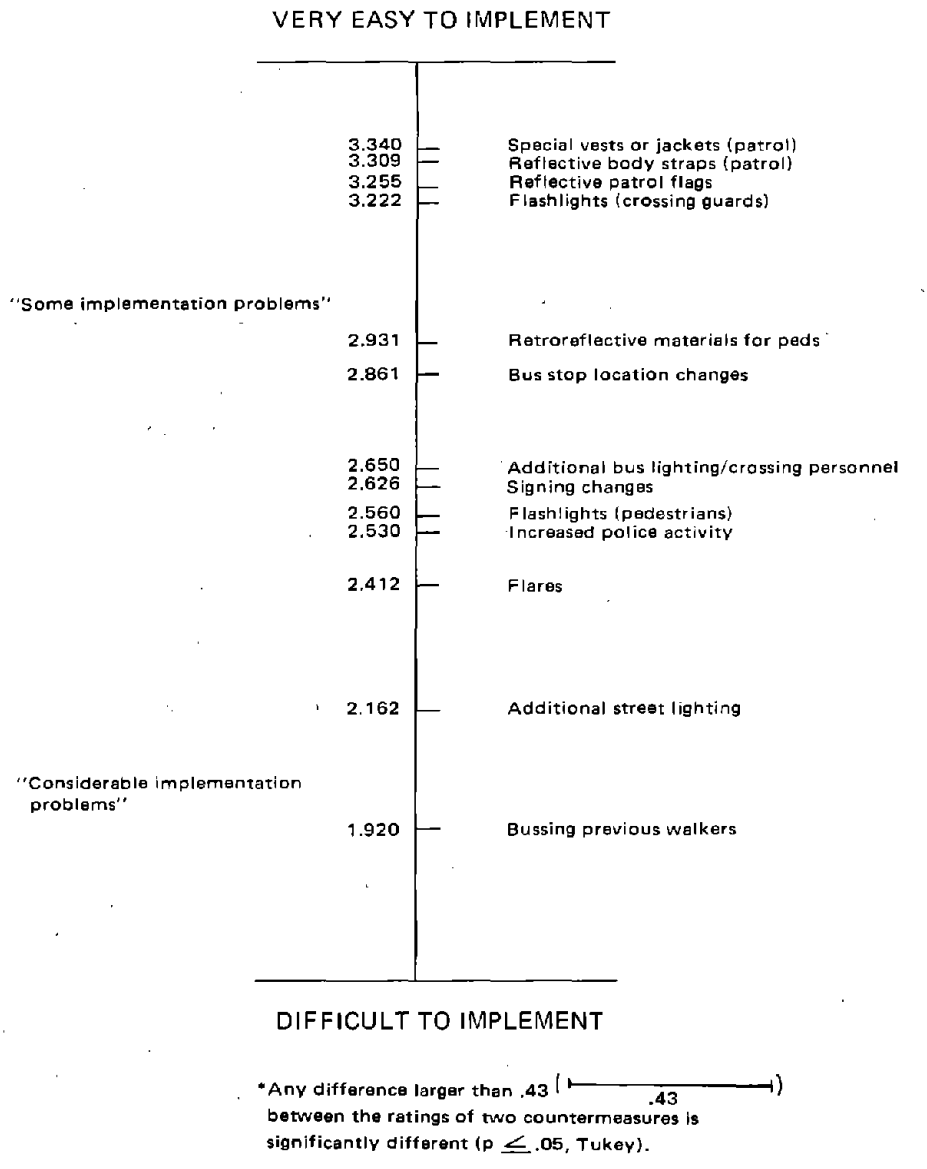


*Any difference larger than .44 between the ratings of two countermeasures is significantly different ($p \leq .05$, Tukey).

The ratings on another evaluative dimension, ease of implementation, are illustrated in Table VI. Four countermeasures were rated as much easier to implement than the others. All of these measures were items used to improve crossing personnel conspicuity:

- *Special vests or jackets (patrol)*
- *Reflective body straps (patrol)*
- *Reflective patrol flags*
- *Flashlights (crossing guards)*

Table VI
Rated Ease of Implementation*



*Any difference larger than .43 (⟷ .43) between the ratings of two countermeasures is significantly different ($p \leq .05$, Tukey).

Countermeasures rated as difficult to purchase, distribute and provide information on were :

- *Flares*
- *Additional street lighting*
- *Bussing previous walkers*

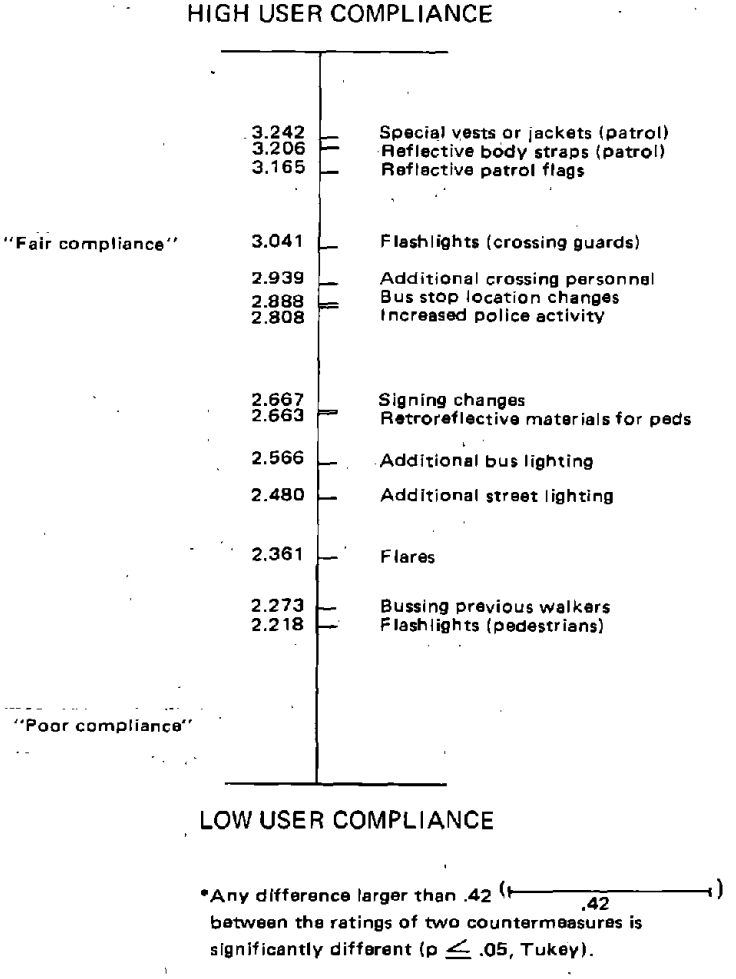
Within these three countermeasures rated low on the ease of implementation dimension, *bussing previous walkers* was rated as significantly more difficult to implement than the use of *flares*.

Table VII illustrates the ranking of the fourteen countermeasures on the fourth of the evaluative dimensions, anticipated user compliance. There is less difference in the ratings between the highest and lowest countermeasures on this dimension than on the other three (1:024). The countermeasures expected to receive the highest user compliance were again items of crossing personnel equipment:

- *Special vests or jackets (patrol)*
- *Reflective body straps (patrol)*
- *Reflective patrol flags*

Table VII

Rated Anticipated User Compliance*



*Any difference larger than .42 (⟷ .42) between the ratings of two countermeasures is significantly different ($p \leq .05$, Tukey).

Those receiving the lowest ratings were :

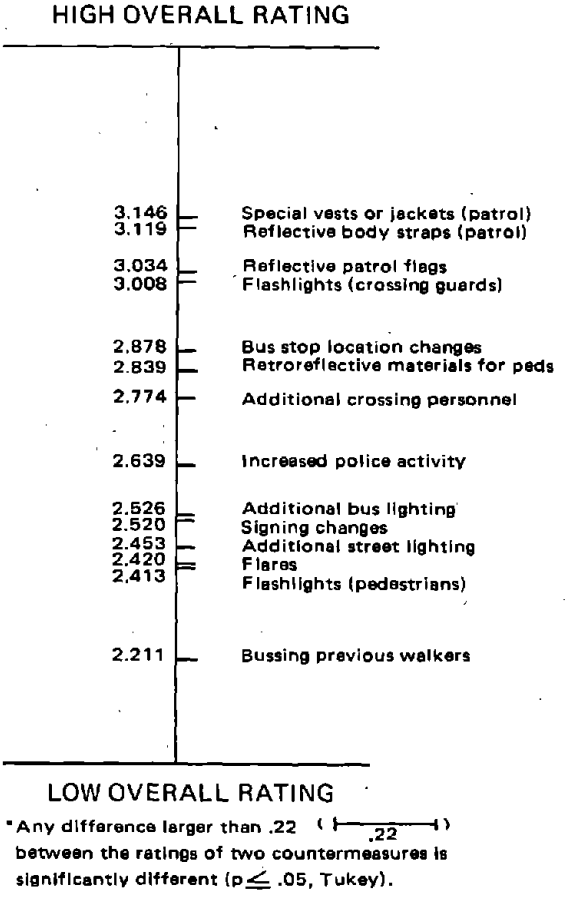
- *Flares*
- *Bussing previous walkers*
- *Flashlights (pedestrians)*

The lowest rated countermeasure, *flashlights (pedestrians),* was expected to receive slightly better than poor compliance.

Another way of comparing the countermeasures is by combining the four evaluative dimensions into one overall index as illustrated in Table VIII. We have defined an index which consists of the sum of the countermeasures' mean ratings on the four criteria divided by 4. This computational procedure gives equal weight to each evaluative dimension. The reader is cautioned that the derivation of the index is strictly arbitrary and that other weighting schemes would result in strikingly different results (e.g., considering accident reduction potential twice as important as cost). The resulting index value can range from 1 to 4 and is comparable to the scales found in Tables IV, V, VI and VII.

Table VIII

Combined Ratings on all Criteria*



*Any difference larger than .22 (⊢—.22—⊣) between the ratings of two countermeasures is significantly different ($p \leq .05$, Tukey).

Using the overall index, the four most highly rated countermeasures were all associated with increasing the conspicuity of crossing personnel. Figure 1 graphically displays the mean ratings of each of these countermeasures on the four individual evaluative dimensions. All four of these countermeasures were also the four countermeasures rated as most easy to implement. Only *special vest or jacket (patrol)* was among the five most highly rated countermeasures on the accident reduction potential dimension presented in Table IV.

The six intermediately preferred countermeasures displayed in Figure 2 show a much greater diversity of rating patterns than the four highly preferred countermeasures. The two most highly rated of this group of countermeasures on accident reduction, *additional crossing personnel* and *increased police activity*, were among the four lowest measures in cost of implementation. The countermeasures *additional bus lighting* and *signing changes* were rated lowest of all the fourteen measures in accident reduction, but were intermediately rated on the remaining three dimensions.

The four least preferred countermeasures are presented in Figure 3. As displayed on the graph, *additional street lighting* and *bussing previous walkers* were similarly rated across the four dimensions. Both measures were among the top four of the fourteen countermeasures in accident reduction potential, but were rated as the lowest two measures in cost of implementation. All four countermeasures in this group received the lowest of the ratings given for ease of implementation and anticipated compliance.

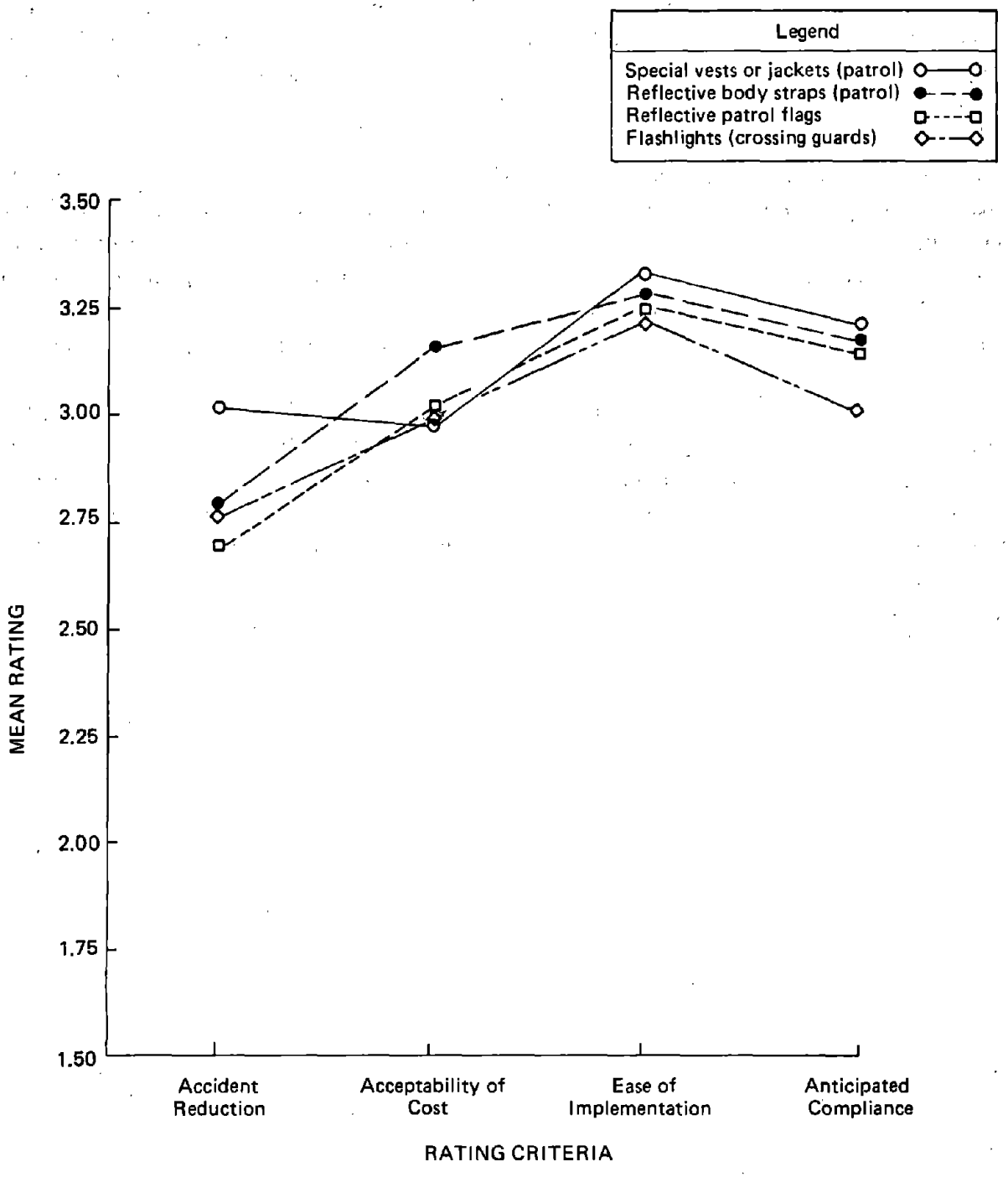


Figure 1. Mean Ratings of the Four Most Preferred Countermeasures.

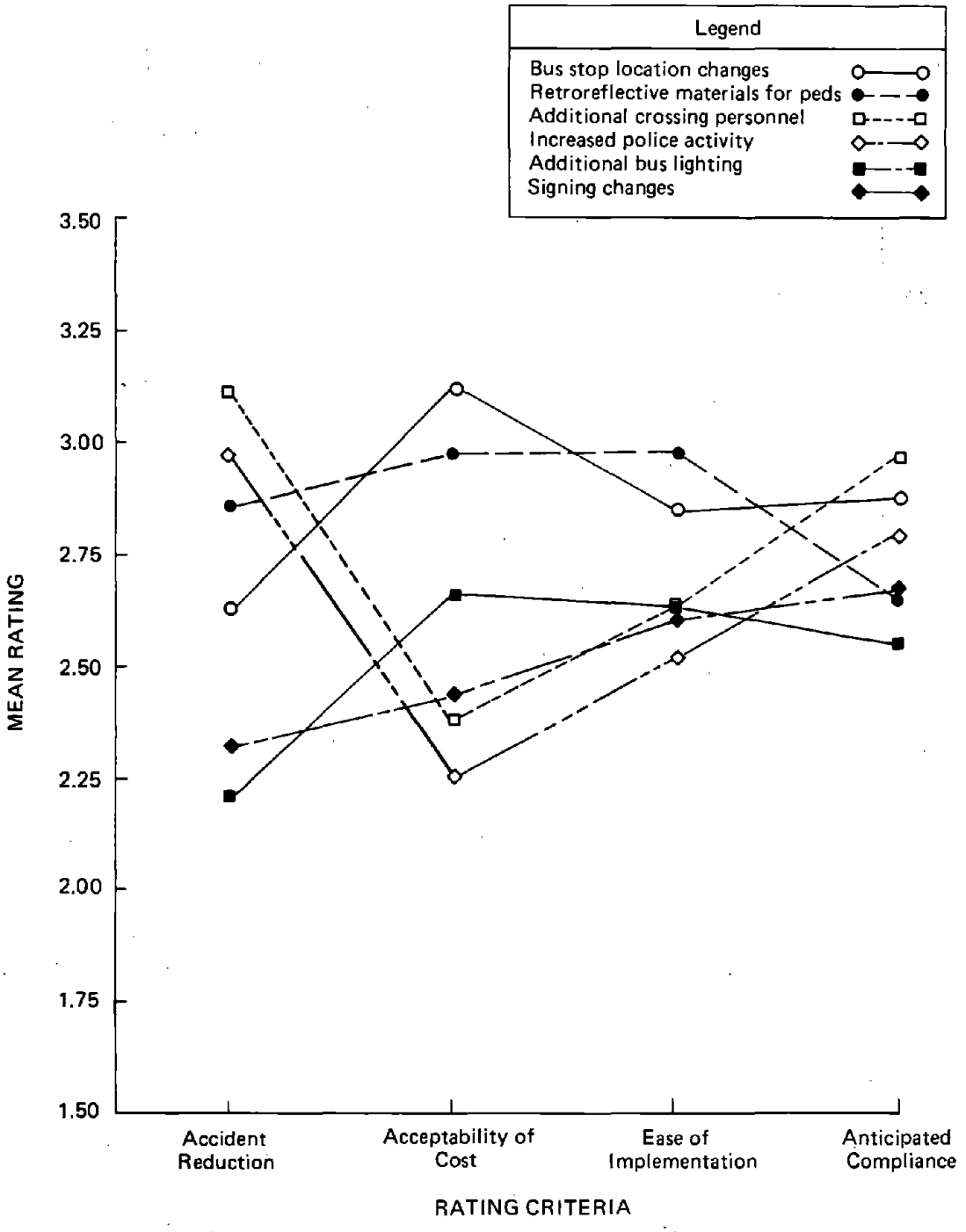


Figure 2. Mean Ratings of the Six Intermediately Preferred Countermeasures.

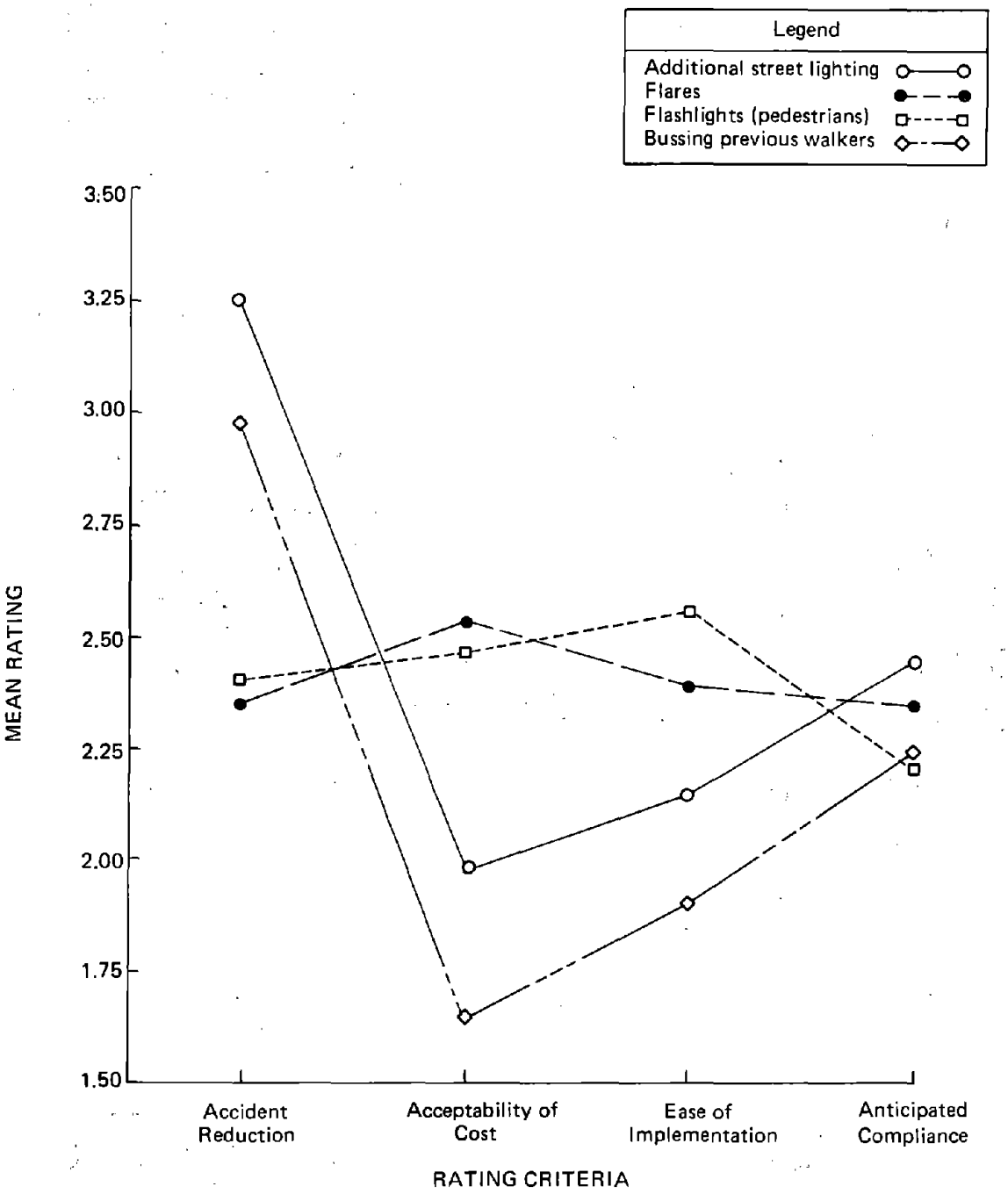


Figure 3. Mean Ratings of the Four Least Preferred Countermeasures.

SECTION VI

CRITIQUE OF THE COUNTERMEASURES

Methodological Considerations

In rating the countermeasures, four separate evaluative dimensions were used. These dimensions were: accident reduction, cost of implementation, ease of implementation, and anticipated user compliance or acceptance. From a methodological standpoint, it is interesting to note that these four dimensions are relatively independent and thus yield unique information about each countermeasure. An implication for research in the area would seem to be that useful information can be gathered on countermeasures on at least the four facets explored in this study and possibly others.

Critique of the Proposed Countermeasures

Results from the preliminary survey showed measures used to improve pedestrian conspicuity to be the most frequently reported of the proposed countermeasures. Within this countermeasure category *retroreflective materials for peds* was rated consistently higher on each of the four dimensions than *flashlights (pedestrians). Retroreflective materials* was among the intermediately preferred group of countermeasures on the overall scale, and *flashlights* fell into the least preferred group. There was a significant difference between their ratings on the overall scale as well as on the dimensions of implementation cost and user compliance. Both countermeasures received their highest relative positions on the ease of implementation dimension: *retroreflective materials*, 5th and *flashlights,* 9th. They were intermediately rated on accident reduction potential and cost of implementation. On the criteria of anticipated user compliance where the measures received their lowest ratings, *retroreflective materials* was placed in the 9th position and *flashlights (pedestrians)* was rated last.

The countermeasures used to improve crossing guard conspicuity were the next most frequently reported group of countermeasures in the preliminary survey. All four items in this category were found to be the countermeasures with the highest overall rating. There were no significant differences between the ratings of the items in this category on any dimension. The crossing guard items were rated highest on the ease of implementation criteria followed by anticipated user compliance and implementation costs. The lowest ratings for crossing guard equipment were received on the potential accident reduction dimension. (On which all of the countermeasures except *special vests or jackets* were intermediately preferred.)

The three devices grouped under the category of improved crossing conspicuity received very similar overall ratings (occupying 10th, 11th, and 12th positions). Within each dimension there were no significant differences between ratings for *flares* and *signing changes* but their rating profiles

were quite different from that of *additional street lighting* in the same category. Both of the former devices were rated low in accident reduction potential, and intermediate in cost and ease of implementation. *Signing changes* was anticipated to receive intermediate user compliance while compliance in the use of *flares* was felt to be potentially low. Also within this category the rating profile for *additional street lighting* is quite a different one. As the most highly rated measure on the accident reduction criteria, *additional street lighting* received significantly higher ratings than *flares* or *signing changes.* This situation is somewhat reversed for the implementation cost dimension, however, where *additional street lighting* was found to be significantly lower on the scale than these countermeasures. It is interesting to note that the sample rated street lighting significantly lower in ease of implementation than signing changes for school zones.

The next most frequently reported countermeasure category from the results of the preliminary survey was that of *increased police activity* (near the school zone). Because there was no difference between the ratings of this countermeasure and *additional crossing personnel* they will be discussed together. (*Additional crossing personnel* received higher ratings on all four evaluative dimensions, but the differences between the two measures did not approach significance.) Both countermeasures achieved their highest rating by the sample on accident reduction potential. The use of crossing personnel was felt to have a very high potential in reducing accidents while *police activity* was among the five most highly rated countermeasures for this dimension. For the user compliance and ease of implementation criteria the countermeasures were intermediately rated. Both received their lowest ratings on implementation cost where they were among the four lowest rated countermeasures. The overall ratings received for *additional crossing personnel* and *increased police activity* placed them 7th and 8th respectively on the overall rating scale.

The three countermeasures grouped in the Bussing Modifications Category, *bussing previous walkers, bus stop location changes,* and *additional bus lighting* were all rated significantly different from each other on the overall rating scale. Their relative positions in the combined ratings were: *bus stop location changes,* 5th; *additional bus lighting,* 9th; and *bussing previous walkers,* 14th. The rating profile of *bussing previous walkers* is quite dissimiliar from the other two measures in the Bussing Modifications Category. Although it received the lowest ratings of all the countermeasures on the cost acceptability and ease of implementation scales, as well as a very low rating on user compliance, it was rated among the top four measures in accident reduction potential. Conversely, *bus stop location changes* received its lowest rating in accident reduction potential (10th) and its highest rating in cost of implementation (2nd). The measure was intermediately rated on the ease of implementation and user acceptance dimensions. *Additional bus lighting* was intermediately rated on all criteria except accident reduction in which it was rated the lowest of the fourteen countermeasures.

In summary, the countermeasures rated highest in accident reduction potential, *additional street lighting* and *crossing personnel,* were also considered somewhat expensive to implement. The countermeasures grouped under crossing personnel equipment were all rated easy to implement, very acceptable in terms of cost and user compliance, but not as effective as other measures in accident reduction potential.

As has been previously mentioned in this report all the rating dimensions were given equal weight; none was considered to be more important than the others in arriving at each countermeasure's overall rating. In choosing which of the countermeasures to implement, the user should consider the particular circumstances within his jurisdiction. Many considerations, such as the amount of funds available, the number of bussed students, the difficulty of distributing materials, the type of roadways, and the existing accident hazards, all impact on the choice of suitable countermeasures.

Attachment I

Preliminary Survey Data Reported Within States

STATES	Number of Recipients	Number of Responses	Reported DST Problems	Reported DST Measures	Would Retain DST
Arkansas	4	4	4	4	2
California	9	4	2	1	3
Colorado	7	2	2	1	1
Delaware	37	19	14	17	9
Florida	37	19	18	19	6
Maryland	11	5	4	5	2
Michigan	18	7	7	7	1
Minnesota	14	5	5	5	1
Mississippi	4	1	1	1	0
Massachusetts	1	0			
Montana	1	1	1	1	0
Nebraska	9	7	6	7	1
Nevada	38	23	9	10	14
New Jersey	9	8	8	7	3
North Carolina	14	8	8	8	3
North Dakota	1	1	1	1	0
Ohio	11	7	6	7	2
Oregon	1	1	1	1	0
Pennsylvania	3	2	2	2	0
South Carolina	11	8	5	7	2
Texas	12	8	8	6	2
Virginia	11	11	7	8	3
Washington	6	4	4	4	4
Wisconsin	3	2	2	2	0
Wyoming	5	2	0	1	2
D.C.	1	1	1	1	0
Unkown		6	3	4	1
Totals	278	166	129	137	62

Attachment II
Summary of Reported School Trip Related Countermeasures

COUNTERMEASURES REPORTED	FREQUENCY	GEOGRAPHICAL AREAS
Improved Pedestrian Conspicuity		
● Retroreflective materials	32	All except CA, NV, MD, VA
● Flashlights	4	AR, FL, OH, VA
● Light colored clothing	9	AR, DE, MD, NB, NJ, NC, SC, VA
Augmented Safety Instructions or Recommendations		
● Safety recommendations to parents	18	DE, FL, MN, NV, NC, VA, OR
● Safety programs	13	CO, FL, MT, NV, NJ, WA, WI, VA
● Classroom instruction	12	CO, DE, FL, MD, MI, NV, NC, OH, SC, TX
● School patrol alerted	1	VA
Improved Crossing Guard or Patrol Conspicuity		
● Flashlights	8	CA, FL, NJ, NC, TX, WA
● Special vests or jackets	8	MD, NJ, NC, TX, WA
● Reflective patrol flags	4	MN, OH
● Reflective body straps	2	MD, OH
● Illuminated "stop" paddles	1	NJ
● Flourescent "stop" sign with flashers	1	NJ
● Retroreflective tape	1	WA
● Head lamps	1	TX
Improved Crossing Site Conspicuity		
● Additional street lighting	5	FL, NB, NC, OH, TX
● Use of flares	3	MD, VA, NJ
● Use of police cars	2	MD, NJ
● Lighted safety cones	2	TX
● Installation of better signing	1	NV
Implemented Bussing Modifications		
● Additional driver or rider training	4	MI, NC, SC, VA
● Bussing previous walkers	3	CA, OR, NV
● Bus stop location changes	2	FL, NV
● Changes in bus schedule	2	NC, SC
● Bus routes changed	1	MI
● Additional bus lighting	1	OH
● Use of interior lights	1	VA
Increased Police Activity		
● Increased patrol activity	10	MN, NB, NV, NJ, OH, WA
● Increased vigilance near schools	1	NB
● Bus stops patrolled	1	FL
Made Crossing Personnel Assignments		
● Additional crossing personnel	5	FL, NC, OH, TX, WA
● Crossing guard reassignments	1	DE
● Use of parents at intersections	1	WA
Passed Legal Measures		
● Pedestrian ordinance	1	MI
Identified Hazardous Crossings	1	MN
Total	163	

Attachment III

Results of the Accident Data Analysis

The 79 pedestrian accidents identified as school trip related and occurring before twilight* were obtained from three sources. First, the in-house pedestrian accident reports from six states for January, February, and March 1974 were reviewed. From some 470 accident reports, 35 were identified definitively as school trip related. Of those 35, 18 accidents occurred before twilight in January and February.

Another source of accident reports was from states which indicated they had experienced problems due to DST. The state of Florida provided 23 reports of fatalities occurring between 6 a.m. and 9 a.m. from January through April. Of those, ten were school trip related, four of which occurred before twilight. Michigan sent reports of 61 school age pedestrian accidents occurring in the early morning hours of January. The majority of those, 49, occurred when children were on their way to school before twilight.

A third source of accident data was provided by survey respondents in the states of Nebraska and South Carolina who spontaneously included accident reports when returning their questionnaires. Six of these school trip accidents in South Carolina and two in Nebraska were determined to have occurred before twilight.

Table III-1 below illustrates the number of reports from each state as well as the percentage of the total number of accident reports each state represents.

Table III-1

Summary of Accident Reports From Nine States

States	Number of Accident Reports	Percentage of Total
Michigan	56	71
South Carolina	6	8
Texas	5	6
Florida	4	5
California	3	4
Nebraska	2	2
Pennsylvania	1	1
Missouri	1	1
North Carolina	1	1

*According to the U.S. Weather Bureau, Civil twilight (the condition wherein artificial light is not needed to see) begins when the sun is 6^{0} below horizon. This period corresponds to about 30 minutes before sunrise.

Accident Characteristics

Table III-2 presents the characteristics which were coded for each accident and the percentages of accidents which fell within each characteristic category (e.g., 89% of the accidents coded occurred in the month of January). Several caveats dealing with interpretation of the accident analysis should be mentioned. Most of the accident reports were obtained from Michigan and may not be representative of *all* DST pedestrian accidents throughout the country. The figures for pedestrian injuries cannot be interpreted as a true sample of the accident involved population since for several contributing states only fatal accidents were available for analysis. For two categories of accident characteristics, a large percentage of accident reports do not contain applicable information. These categories are "color of pedestrian clothing" and "type of area" (i.e., residential, open country, school zone, etc.).

Table III-2

Summary Percentage of the Analyzed Pretwilight School Trip Accidents
N = 79

Descriptive Data	%
MONTH	
January	89
February	10
March	1
TIME OF DAY	
0600 – 0700	4
0701 – 0730	23
0731 – 0800	48
0801 – 0830	24
0831 – 0900	1
PED AGE	
04	2
05 – 09	15
10 – 14	56
15 – 18	25
64	1
PED SEX	
Male	62
Female	38
*PED INJURY	
Fatal	13
Serious	29
Moderate	39
Minor	19
**PED CLOTHING	
Dark	30
Medium	2
Light	5
Unknown	62
LIGHT CONDITIONS	
Dark	72
Dark, street lights	25
Predawn	2

Descriptive Data	%
WEATHER CONDITIONS	
Clear	71
Rain	9
Snow	9
Fog	8
Unknown	4
ROAD SURFACE CONDITIONS	
Dry	28
Wet	29
Snowy or icy	38
Unknown	4
LOCATION	
Urban/suburban	61
Rural	39
**TYPE OF AREA	
School area	13
Residential	24
Commercial	4
Open country	6
Unknown	54
TRAFFIC CONTROLS	
None	78
Traffic signal	14
Ped signal	5
Stop sign	5
Crossing guard	5
TRAFFIC LANES	
Two	80
Three	2
Four	11
Five	5
TYPE OF ROAD	
Undivided	94
Divided	6

*Only police reports on fatalities were available for some states.

**This information not available from the majority of police reports.

Table III-2 (Continued)

Summary Percentage of the Analyzed Pretwilight School Trip Accidents

N = 79

Descriptive Data	%
ALIGNMENT	
Straight	54
Intersection	23
T – intersection	11
Curve	10
Unknown	1
VISUAL OBSTRUCTION	
None	66
Rain/snow/fog	10
Vehicles/headlights	10
Cloudy windshield	5
Foliage/poles	2
Unknown	6
INTERSECTION	
Yes	34
No	63
Unknown	2
DRINKING	
Pedestrian	0
Driver	0

Descriptive Data	%
DRIVER ACTION	
Going straight	51
Turning right	4
Turning left	5
Passing	4
Backing	1
Starting	2
Passing school bus	2
Ran traffic light	6
Avoiding other peds	4
Attending oncoming vehicle	9
Wiping windshield	1
Ran onto shoulder	1
Slid into ped	2
hit/skip	6
did not see ped	23
PEDESTRIAN ACTION	
Walking beside roadway	19
Walking in roadway	13
Standing beside roadway	4
Standing in roadway	5
Crossing at intersection	16
Crossing not at intersection	13
Crossing to catch school bus	5
Attempting to board bus	1
Coming from behind parked bus	1
Slid into school bus	1
Walked/ran into path of vehicle	18
Ran from behind parked vehicle	1
Unknown	3

Attachment IV

Standard Deviations of the Countermeasure Ratings*

Countermeasure	Evaluative Dimension				
	Accident Reduction Potential	Acceptability of Cost	Ease of Implementation	Anticipated User Compliance	Combined Ratings
	sd	sd	sd	sd	sd
Special vests or jackets (patrol)	.810	.843	.839	.805	.838
Reflective body straps (patrol)	.872	.877	.878	.849	.893
Reflective patrol flags	.907	.925	.929	.881	.937
Flashlights (crossing guards)	.924	.985	.990	1.009	.991
Bus stop location changes	.984	.868	.856	.832	.906
Retroreflective materials for pedestrians	.684	.854	.812	.812	.801
Additional crossing personnel	.832	.859	.829	.802	.876
Increased police activity	.865	.882	.877	.907	.920
Additional bus lighting	1.052	1.057	1.081	1.147	1.101
Signing changes	.878	.871	.949	1.025	.943
Additional street lighting	.796	.720	.813	1.090	1.001
Flares	1.052	1.069	1.147	1.017	1.075
Flashlights (pedestrians)	.950	1.028	1.071	.908	.999
Bussing previous walkers	1.054	.738	.880	1.052	1.065
Average Standard Deviation	.904	.898	.925	.938	.953

*See Tables IV-VIII for Mean Ratings of the Countermeasures.