GUIDERAIL VISIBILITY NEEDS ANALYSIS

INTERIM REPORT

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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I. Introduction

of the first steps in the study of guiderail delineation was a determination of the benefits which could accrue to the public through this project. If the benefits resulting from guiderail delineation could not offset the cost of installation, no further study would be warranted.

Through use of a positive guidance approach, several benefits of guiderail delineation can be shown immediately. Essentially, the major effect of guiderail delineation would be to increase the visibility of the guiderail to the nighttime motorist. Guiderail delineation, however, could also have a secondary effect of providing additional information regarding roadway alignment to the driver which should result in safer travel. It is these two effects which are expected to account for the major benefits of delineating guiderail.

II. Positive Guidance Factors

purpose of guiderail is to protect the public from collision with roadside obstacles adjacent to the traveled way. However, by the very nature of its placement along the roadside, the guiderail is itself an obstacle. Delineation will provide two benefits in this regard. One, it will improve nighttime visibility with increased obstacle detectability enabling the driver to better avoid conflict or collision with the guiderail. Two, it could increase early obstacle recognition, thus, increasing the time available for the driver to recognize that an obstacle exists and to take steps to avoid it. According to FHWA's, "A User's Guide to Positive Guidance," increased hazard detectability and recognition leads to a reduction in both accidents and accident severity.

Guiderail delineation can also provide an additional benefit by providing a nighttime source of driver information regarding roadway alignment. This affords the driver with a better understanding of the course of the road ahead of him which, in turn, provides for a safer and more regular traffic flow. Perhaps

the most important aspect of roadway alignment delineation is that it serves to accentuate the difference between straight roadways and roadway changes, such as curves, reinforcing driver expectancy of the roadway ahead.

From a positive guidance standpoint, guiderail delineation can provide desirable and potentially significant benefits. In addition to positive guidance measures, the benefits of guiderail delineation might also be expressed in terms of a reduction in accidents and accident severity.

III. Accident Analysis

A. General Outline

A reduction in guiderail accidents, due to improved delineation, should result in a savings in costs incurred through vehicle damage and occupant injury, as well as in costs incurred to repair or replace the guiderail itself. An estimate of the needed reduction in accidents which would offset the costs of installation can be made by quantifying the above costs.

Total costs, due to guiderail accidents, can be broken down into two components: 1) accident costs, which are costs incurred by the vehicle and vehicle occupants, and 2) repair costs, which are costs incurred to repair or replace the guiderail.

A listing of guiderail accidents, along state highways, is compiled annually by the NJDOT. These guiderail accident statistics only include accidents where the first hit is on the guiderail. An accident where the initial hit is with another vehicle or object and which involves a subsequent hit on the guiderail is not classified as a guiderail accident. This accident classification method creates an artificially low figure for guiderail accidents. The actual number of reported guiderail accidents is higher than the classified figure. In addition, the guiderail accident statistics do not include unreported hits.

It might be argued that once a vehicle is involved in an accident with another vehicle or object, guiderail delineation is of no use. However, a driver, after hitting a vehicle or other object, may in fact be able to control his vehicle enough to avoid hitting the guiderail or at least take some action that would reduce the severity of impact with the guiderail. Also, by virtue of the driver's awareness of the existence of the guiderail in advance, the driver may proceed in a more cautious manner and avoid an accident entirely.

The amount of guiderail hits that were not first-hit accidents cannot be determined. Therefore, they are not used in this report to determine need, but only as a means of identifying a possible additional advantage of delineating guiderail.

Since guiderail delineation is not very effective during daylight conditions, only guiderail accidents, fatalities, and injuries which occurred during non-daylight conditions will be considered. By using the National Safety Council's suggested values for property damage accidents, injuries and fatalities, an estimated cost of guiderail accidents can be calculated.

Another component of the total costs due to guiderail accidents can be obtained from NJDOT's Maintenance Management System reports. The reports itemize total maintenance costs by maintenance task, which allows determination of the cost for repair and replacement of guiderails. The cost to the motorist from guiderail accidents added to the repair cost from accidents represents the total cost from guiderail accidents on state highways. By comparing this total cost to the cost of researching and installing delineation, an accident cost reduction to break even can be obtained.

B. Guiderail Accident Costs

From NJDOT's accident reports, a listing of all guiderail accidents on state highways for the years 1980, 1981, and 1982 was obtained. Guiderail delineation

was thought to have little or no effect on accidents, fatalities, and injuries occurring under daylight conditions. Therefore, accidents occurring under daylight conditions were eliminated from further consideration in this study. Also eliminated from consideration were accidents, fatalities, and injuries where the light conditions were unknown.

The cost estimates per accident, used for property damage accidents, fatalities, and injuries, are those provided by the National Safety Council for use in 1983. They are based on data accumulated by that agency in 1982.

Table 1 shows guiderail property damage accidents as well as fatalities and injuries attributed to guiderail accidents for 1980, 1981 and 1982. Table 2 shows accident costs attributable to these guiderail accidents for this same three year period.

TABLE 1

GUIDERAIL ACCIDENTS, FATALITIES AND INJURIES FOR NON-DAYLIGHT CONDITIONS ON STATE HIGHWAYS IN NEW JERSEY, 1980-1982

	1980	1981	1982	TOTAL
Property Damage Accidents	428	435	372	1,235
Fatalities	7	7	4	18
Injuries	380	417	405	1,202

TABLE 2

COSTS ATTRIBUTABLE TO GUIDERAIL ACCIDENTS 1980-1982

Property Damage:	1,235 x $ 1,090	per accident =	$ 1,346,150
Fatalities:	18 x $200,000	per accident =	3,600,000
Injuries:	1,202 x $ 8,000	per accident =	9,616,000
TOTAL			$ 14,562,150

C. Guiderail Repair Costs

Although accident costs represent the major component of total costs attributable to guiderail accidents, costs to repair or replace the guiderail also contribute a small but significant sum. The repair costs, which are shown in Table 3 were obtained from NJDOT's Maintenance Management System for the years 1980, 1981 and 1982.

TABLE 3

GUIDERAIL REPAIR COSTS ON STATE HIGHWAYS IN NEW JERSEY, 1980-1982

REPAIR COSTS*	
Paint Guiderail (Work Standard Code 145)	13,381
Repair Guiderail (Work Standard Code 146)	1,213,450
Straighten Guiderail (Work Standard Code 147)	22,774
Repair Broken Cable Terminal (Work Standard Code 148)	26,314
TOTAL	$1,275,919

Adding the accident costs and repair costs gives a total cost figure for the three-year period of $15,838,069.

D. Installation Costs

By comparing the total cost attributable to guiderail accidents against guiderail delineation installation costs, it is possible to calculate the needed decrease in total costs to offset the cost of installing delineation. Installation costs were estimated by calculating the cost to install one delineator, then, multiplying the cost by the number of delineators necessary to delineate all guiderails on all state maintained highways in New Jersey at the estimated spacing of 25 feet between delineators. Figure 1 shows the procedure used to estimate installation costs.

*Costs obtained from Maintenance Management System Report "MMGCOSWK-1, Cost Report by Work Standard Code" for the Years 1980, 1981 and 1982.

FIGURE 1

ESTIMATE OF INSTALLATION COSTS

CALCULATION OF COST PER DELINEATOR

EQUIPMENT COST FOR SAFETY OPERATIONS

Maintenance Truck @$3.00/hr. x 8 hrs. = $24

LABOR COST FOR SAFETY OPERATIONS AND INSTALLATION

1 Asst. Foreman @$8.70/hr.	=	$ 8.70/hr.
2 Maint. Man I @$5.88/hr.	=	11.76/hr.
1 Flagman @$5.88/hr.	=	5.88/hr.
		$26.34/hr.
+ Overhead (45%)		11.85/hr.
		$38.19/hr x 8 hrs. = $305.52

ESTIMATION OF DELINEATORS INSTALLED PER DAY

8.0 hr. work day
-1.0 hr. travel time
-1.5 hr. safety operations
-0.5 hr. coffee break

5.0 hr. for installation

2 minutes per delineator

$\frac{300 \text{ minutes}}{2 \text{ minutes}} = 150$

TOTAL INSTALLATION COSTS (PER DAY)

Equipment Cost	$ 24.00
Labor Cost	305.52
Purchase Price at $2 per Delineator	300.00
	$629.52

TOTAL COST PER INSTALLED DELINEATOR

$629.52/150 = $4.20 per delineator

II. STATE MAINTAINED HIGHWAY INSTALLATION COSTS

Total Guiderail Length = 5,348,589 ft.

Spacing of Delineators = 25 ft. spacing

# of Delineators Needed = 213,944

TOTAL INSTALLATION COST = 213,944 x $4.20 = $898,563

Delineator installation costs were calculated using mid-range 1982 salaries with five percent added to estimate 1983 salaries. Added to the installation cost of approximately $900,000 is another $90,000 which represents the cost of this research project. Unless further work is needed, the total cost of installing guiderail delineators is then estimated to be $990,000.

Comparison of the total installation cost with the total accident cost estimated previously shows that a reduction of 6.2 percent in accident costs, over only the first three years, is necessary to offset the cost of installing delineation on the five million feet of guiderail presently in place on all state highways in New Jersey.

E. Overall View

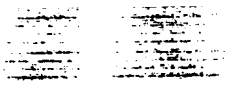
The 6.2 percent reduction in accident costs can equate to a decrease of five fatalities or 124 injuries over the three-year period of 1980-1982. A 6.2 percent reduction in accident costs should be attainable through some combination of reduced fatalities, injuries or property damage accidents.

It should be noted that the total installation costs calculated do not include delineation maintenance costs. However, during the present study, the cost of delineation maintenance will be looked into and findings will be presented in the final report.

It should also be noted that the total installation costs assume that all guiderails will be delineated. In reality, this may not be necessary. Therefore, as part of the present study, a method of prioritizing guiderail for delineation by location and adjacent roadway geometry should be considered.

IV. Conclusions and Recommendations

The primary purpose of this analysis was to make some preliminary determination of the benefits which would accrue to the public through delineation of guiderails. Using the positive guidance approach to this problem,



several benefits were immediately apparent. They included increased hazard detectability and recognition and improved roadway alignment information.

Positive guidance benefits should translate into a reduction in guiderail accidents and accident severity. Total costs for guiderail accidents during the three-year period analyzed (1980-1982) were estimated to be $15,838,069. Compared against this figure was an installation cost of $990,000. The breakeven point to offset installation costs was found to be a reduction of 6.2 percent in accident costs.

This breakeven point, as shown previously, seems easily obtainable and surpassable. The potential for providing major safety benefits to the public through guiderail delineation using a relatively small amount of funds is evident.

The results of this analysis warrant continuation of the guiderail delineation study.