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REPORT TO THE SUBCOMMITTEE ON  
INVESTIGATIONS AND OVERSIGHT  
COMMITTEE ON PUBLIC WORKS  
HOUSE OF REPRESENTATIVES

72-016724

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Problems In Implementing The  
Highway Safety Improvement Program

B-164497(3)

Federal Highway Administration  
Department of Transportation

BY THE COMPTROLLER GENERAL  
OF THE UNITED STATES

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096553

MAY 26, 1972



COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

B-164497(3)

Dear Mr. Chairman:

This is our report on problems in implementing the highway safety improvement program of the Federal Highway Administration, Department of Transportation, which you requested by letter dated March 3, 1972.

The limited progress made since inception of this program in 1964, when viewed in light of the deaths and injuries associated with highway hazards, raises a question as to whether the Department of Transportation has taken all feasible action to implement a high-priority program to identify and correct hazardous highway locations. Varying degrees of State compliance with the Federal Highway Administration's program guidance have produced a fragmented approach to the problem. An opportunity exists to materially improve the Nation's traffic safety record if the Government will provide stronger leadership toward program implementation.

We believe that setting aside a specific part of highway trust funds to be used annually for the correction of hazardous highway locations would promote greater efforts by the States to improve highway safety and would give the safety improvement program the status of a major national program in line with the growing congressional, departmental, and public concern over the large number of fatalities, injuries, and accidents that occur annually on the Nation's highways.

The Department is obtaining legal clarification concerning the Secretary of Transportation's authority to administratively set aside funds for the highway safety improvement program. We believe, however, that legislative action specifically setting aside a part of highway trust funds to ensure an appropriate level of accomplishment would provide a more effective program incentive.

We have obtained written comments on the contents of this report from the Department of Transportation. Written comments have not been obtained from the States in which our review was performed.

B-164497(3)

We shall not distribute copies of the report until your agreement has been obtained or public announcement has been made by you concerning the contents of the report.

Sincerely yours,



Comptroller General  
of the United States

*Cit* <sup>R</sup>The Honorable James C. Wright, Jr.  
Chairman, Subcommittee on Investigations  
and Oversight  
Committee on Public Works  
House of Representatives

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III Photographs showing examples of hazardous highway features, accidents involving these types of hazardous features, and improved treatment of the highway features

ABBREVIATIONS

FHWA Federal Highway Administration  
GAO General Accounting Office

COMPTROLLER GENERAL'S  
REPORT TO THE SUBCOMMITTEE ON  
INVESTIGATIONS AND OVERSIGHT  
COMMITTEE ON PUBLIC WORKS  
HOUSE OF REPRESENTATIVES

PROBLEMS IN IMPLEMENTING THE  
HIGHWAY SAFETY IMPROVEMENT  
PROGRAM

1 Federal Highway Administration <sup>63</sup>  
2 Department of Transportation <sup>29</sup>  
✓ B-164497(3)

## D I G E S T

### WHY THE REVIEW WAS MADE

Because of the large number of traffic deaths--54,800 in 1970--the General Accounting Office (GAO) reviewed the highway safety improvement program established to identify and correct hazards on Federal-aid highways. Such hazards contribute to a significant number of accidents and fatalities each year. (See p. 7.)

The review was performed in six States--Colorado, Illinois, Missouri, Montana, Oregon, and Utah.

#### Background

The program started in 1964 when the President expressed concern over the large number of highway fatalities and said that there was an urgent need for a program to improve highway safety. The President also said that special attention should be given to the correction of hazards on highways having large numbers of accidents.

The program is being carried out under the Federal-aid highway program which is administered by the Federal Highway Administration, Department of Transportation.

Fixed roadside objects--wall-like bridge abutments, unyielding signposts, rigid light poles, concrete footings, and spearlike guardrails--are among the more easily identified and correctable types of highway hazards. Such hazards have been called booby traps and have been responsible for killing and maiming thousands of motorists each year. (See photos, pp. 35 to 43.)

### FINDINGS AND CONCLUSIONS

Eight years after inception, the highway safety improvement program has yet to become a fully implemented major national program.

Varying degrees of State compliance with the Highway Administration's program guidance have produced a fragmented approach to reducing highway accidents and fatalities through identification and correction of hazardous highway locations. GAO believes that this happened because Highway Administration guidance to States largely has been advisory, rather than mandatory, and because quantified goals have not been established for the program. (See pp. 13 to 19.)

An opportunity exists to materially improve the Nation's traffic safety record if the Government will provide stronger program leadership.

The six States were all doing some type of work to correct highway hazards. GAO believes, however, that the highway safety improvement program is dependent upon

- routinely setting aside and using funds specifically to eliminate highway hazards,
- identifying hazardous locations on the basis of actual accident experience, and
- correcting hazards in accordance with priorities based on potential for accident reduction in relation to the cost of the correction.

#### Reservation of funds

The Highway Administration has not reserved Federal-aid highway funds specifically for highway safety programs. GAO noted that the States had spent a small part of their Federal-aid highway funds to eliminate highway hazards. Of the total Federal-aid funds available to the six States during the 7 years ended December 31, 1970, only 3 percent were spent for that purpose. (See pp. 15 and 20.)

The six States had not routinely set aside and used a designated part of their Federal-aid funds to correct hazardous locations. For calendar year 1971 one of the six States did commit \$10 million of its highway funds specifically for highway safety improvement projects. About \$5.5 million actually was used for this purpose. The remaining funds were used for other highway work, and the highway safety improvement projects for which the money was to have been used were deferred until the following year. (See p. 21.)

## Identification of highway hazards

Meaningful inventories of hazardous locations, as described below, are needed to provide the Highway Administration and the States with a basis for determining (1) the magnitude of the overall highway hazard problem in the States, (2) the total estimated cost of correcting the hazards, and (3) the order and pace at which safety improvement work should be done to timely and significantly reduce highway accidents, deaths, and injuries. (See p. 22.)

Each of the six States had developed a system which, in part, met Highway Administration criteria for a systematic highway safety improvement program. For example, all six States were preparing summaries showing highway accidents by location. None of these States, however, had a comprehensive inventory of correctable hazardous locations that was updated systematically and used routinely for developing and carrying out safety improvement projects. (See p. 23.)

## Assignment of priorities for correction of highway hazards

Because enough money to do all necessary safety improvement work seldom is available, States need to establish priorities for identified projects so that those having the greatest accident reduction potential for each dollar spent are undertaken first.

Three of the six States were not ranking possible safety improvement projects on a State-wide basis in terms of the highest potential benefit at the lowest relative cost. The other three States had developed priority listings for their safety improvement projects but were not scheduling and carrying out their safety work fully on that basis. (See p. 25.)

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Under the conditions described above, neither the Highway Administration nor the States have reasonable assurance that the safety improvement projects--selected on a case-by-case basis by the States and approved by the Highway Administration--represent the most worthwhile use of safety improvement funds.

## AGENCY ACTIONS AND UNRESOLVED ISSUES

Officials of the Office of the Secretary, Department of Transportation, and the Highway Administration agreed generally with GAO's analysis of the progress and status of the safety improvement program. (See p. 28.)

Highway Administration officials stated that greater recognition should be given to other safety-related work being carried out by the States, such as work to upgrade the safety of the Interstate System and other high-speed highways in accordance with the recommendations of the American Association of State Highway Officials (referred to as yellow-book work).

GAO recognizes that yellow-book work promotes highway safety. This report comments on such work to the extent that it was identified by the six States.

Yellow-book work on existing highways, however, is directed primarily toward correcting generally recognized types of hazards (for example, replacement of fixed signs with breakaway signs over a section of the Interstate System), rather than toward correction of identified hazardous locations. Except for major safety improvement projects at specific locations, yellow-book work on the Interstate System, unlike other safety improvement work, does not have to be based on accident data analysis.

Highway Administration officials stated also that many safety-related highway projects had been financed wholly with State funds. They provided GAO with data showing that the States had reported that wholly State-funded projects classified as safety related had averaged about \$125 million annually during the 7 years ended September 1971.

A Highway Administration analysis of the reported information showed that not all the projects included would meet the requirements of the safety improvement program. Also, the procedures followed by the States for identifying and correcting hazardous locations reduces assurance that the safety-related projects being financed wholly by the States represent the most worthwhile use of the funds involved.

Since GAO considers the reservation of funds to be important for an effective program, GAO also discussed the feasibility of the Secretary's administratively reserving a part of available trust funds specifically for projects under the safety improvement program. Highway

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Administration officials pointed out that generally, in the past, reservations of funds for specific highway-related programs had been based on legislative authorization. Accordingly they planned to obtain legal clarification on this matter. (See p. 29.)

GAO believes that legislative action specifically setting aside a part of highway trust funds to ensure an appropriate level of accomplishment would provide a more effective program incentive.

MATTERS FOR CONSIDERATION BY THE SUBCOMMITTEE

The Subcommittee may wish to consider the need for legislative action to establish a viable Federal highway safety improvement program. Determinations by the States and the Department of Transportation as to the magnitude of the overall highway hazard problem in the States could provide the Subcommittee with a basis for determining an appropriate level of funding for the program.

## CHAPTER 1

### INTRODUCTION

An announced intention of the Department of Transportation is to make the Nation's highways as safe as possible. Federal and State highway experts and independent organizations concerned with highway safety generally agree that the Nation's highways have design defects and roadside features which are hazardous to the safety of the motoring public and which are contributing to a significant number of highway accidents and fatalities each year. The identification and correction of such hazards has been the primary purpose of the highway safety improvement program administered by the Office of Traffic Operations in the Federal Highway Administration (FHWA), Department of Transportation.

This program was initiated in 1964 when the President expressed his concern over the large number of fatalities occurring annually on the Nation's highways and designated FHWA as the focal point for an accelerated attack on traffic accidents and fatalities. The President stated that there was an obvious and urgent need for a program to improve highway safety rapidly and significantly and that special attention should be given to hazards on highways having high accident experience.

In implementing the highway safety improvement program, FHWA stated that it was well known that certain locations or short sections of highway had accident rates substantially above the average and that such locations where large numbers of accidents occurred logically were prime targets for accident prevention efforts by highway and traffic engineers.

We reviewed FHWA's highway safety improvement program in six States--Colorado, Illinois, Missouri, Montana, Oregon, and Utah. The purpose of the review was to determine the progress made to establish an effective program for the identification and correction of hazardous highway locations on Federal-aid highways.

FHWA's safety improvement program is carried out under the Federal-aid highway program which provides Federal-aid highway trust funds to the States to cover about 90 percent of the cost of constructing interstate highways and about 50 percent of the cost of constructing primary, secondary, and urban highways. Individual highway safety projects are initiated by the State highway departments and are submitted to FHWA for approval for Federal cost sharing under the same general procedure used for regular highway construction projects.

Although the Federal-aid highway system in calendar year 1970 constituted about 890,000 miles, or about 24 percent, of the more than 3.7 million miles of streets and highways in the Nation, the system accounted for

--71 percent of the 54,800 traffic deaths,

--51 percent of the more than 2.7 million injuries resulting from traffic accidents, and

--66 percent of the more than one trillion miles traveled.

CHAPTER 2HIGHWAY HAZARDS AND THE BENEFITSTO BE DERIVED FROM THEIR REMOVALHIGHWAY HAZARDS

Three factors--the highway, the driver, and the vehicle--have an effect on highway safety. The National Safety Council--a public service organization which furnishes leadership in the safety movement--annually publishes reports which show that highway-related factors have been primary or contributing causes of accidents resulting in about 36 percent of the traffic deaths during the 7 years ended December 1970.

Fixed roadside objects constitute one of the more easily identified types of highway hazards that are susceptible to correction. According to the Insurance Institute for Highway Safety--an independent nonprofit organization dedicated to reducing deaths, injuries, and property damage resulting from accidents on the Nation's highways--roadside hazards, such as wall-like bridge abutments, unyielding signposts, rigid light poles, concrete footings, and spear-like guardrails, are highway booby traps and are responsible for killing and maiming thousands of motorists each year. The Institute characterized the resulting human and property waste as needless and avoidable. (See photos, app. III.)

In hearings on roadside hazards in May 1967 before the Special Subcommittee on the Federal-aid Highway Program, House Committee on Public Works, one of the Subcommittee members made the following statement.

"Regardless of the reasons why a driver may leave the paved portion of a high-speed highway, roadside areas should be sufficiently clear of obstructions to give him an opportunity to regain control of his car. He and his passengers should be given a reasonable chance of survival and not be faced with the death penalty for a comparatively minor error."

A special Vermont study of roadside hazards in the State, published in September 1970, showed that roadside hazards were involved in about a third of the State's highway fatalities in 1969. The study pointed out that such hazards involved placement, design, and materials that ignored simple rules of

energy absorption and thereby resulted in accidents which produced serious injuries or deaths.

In addition to advocating the removal, relocation, and/or redesign of fixed roadside objects, FHWA has identified the following types of projects as being safety oriented.

1. Installing and modifying median barriers, guardrails, and roadside delineation markers.
2. Resurfacing highways to provide greater skid resistance.
3. Installing special signs, lighting, and markings.
4. Widening narrow traffic lanes.
5. Providing stable shoulders of adequate widths.
6. Flattening side slopes.
7. Reconstructing highways to increase sight distances on curves.
8. Widening narrow bridges or other structures.
9. Installing protective devices at railroad crossings.
10. Reconstructing intersections to incorporate safety features.

#### BENEFITS FROM REMOVING HIGHWAY HAZARDS

FHWA compared accident data 1 year before and 1 year after safety projects were completed at 446 hazardous locations throughout the United States. The comparison showed that, for the 446 locations (1) fatalities had been reduced 25 percent, from 75 to 56, (2) personal injuries had been reduced 24 percent, from 4,091 to 3,101, and (3) total accidents had been reduced 20 percent, from 6,432 to 5,177.

Oregon prepared a study of the benefits and costs of highway safety improvement work done in the State for a 9-year period ended June 1969, which, in part, compared the accident history during 1 year before and during 1 year after 1,264 safety improvement projects were completed. The State calculated that the following net benefits were derived from these projects.

	<u>Number of accidents by type</u>			<u>Total</u>	
	<u>Property damage</u>	<u>Injury</u>	<u>Fatal</u>	<u>Number of accidents</u>	<u>Accident costs (millions)</u>
Before	4,715	4,825	146	9,686	\$19.9
After	<u>3,626</u>	<u>3,347</u>	<u>91</u>	<u>7,064</u>	<u>13.5</u>
Net reduction	<u>1,089</u>	<u>1,478</u>	<u>55</u>	<u>2,622</u>	<u>\$ 6.4</u>

Oregon estimated the dollar benefits by applying to the number of accidents reduced the National Safety Council's estimates of accident costs of \$41,700 for each fatal accident, \$2,500 for each injury accident, and \$380 for each property damage accident. The Council computed these amounts on the basis of estimated costs of wages lost, medical expenses, insurance costs, and property damages associated with each type of accident.

Oregon estimated that the annual benefits of \$6.4 million would be realized in each of the 10 years following the improvements, for a total benefit of \$64 million. Comparing the total benefit of \$64 million with the total project costs of \$26.2 million resulted in a benefit-cost ratio of 2.4 to 1.

California has done extensive work evaluating the benefits achieved from its safety improvement effort. On the basis of before-and-after studies for 381 safety projects, the State found that

- fatal accidents had decreased 31 percent,
- injury accidents had decreased 8 percent, and
- property-damage accidents had decreased 14 percent.

In July 1970 FHWA made a special analytical study dealing with the costs and effectiveness of major Federal-aid highway programs that included analyses of the relative safety benefits provided by these programs. Although FHWA cautioned that scarcity of data hampered the study, especially in the determination of benefits, it pointed out that a number of observations and conclusions could be drawn from the study results.

According to the study, 4.78 lives could be saved and 86.96 injuries could be avoided for each \$1 million spent for highway safety improvement work. In comparison, the study showed that, for each \$1 million spent for regular

highway construction work on the Interstate System, 0.77 of a life could be saved and 19.33 injuries could be avoided; for \$1 million worth of construction work on Federal-aid primary, secondary, and urban roads, 1.10 lives could be saved and 35.85 injuries could be avoided.

The cost effectiveness of the highway safety improvement work, in terms of lives saved, was shown to be about five times greater than that of regular highway construction work. In terms of injuries avoided, it was more than three times greater.

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The continuing incidence of deaths and injuries resulting from avoidable encounters between motorists and hazards on the Nation's highways raises a question as to the adequacy of the efforts being made to alleviate the highway hazard problem. As shown in the following table, the ratio of highway-related fatalities to total traffic fatalities has changed very little during the 7-year period ended December 1970.

<u>Calendar year</u>	<u>Total traffic fatalities</u>	<u>Highway-related fatalities</u>	<u>Percent of highway-related fatalities to total fatalities</u>
1964	47,700	16,700	35
1965	49,000	17,100	35
1966	53,000	18,800	35
1967	53,100	19,300	36
1968	55,200	20,400	37
1969	56,400	20,200	36
1970	<u>54,800</u>	<u>18,650</u>	34
Total	<u>369,200</u>	<u>131,150</u>	36

## CHAPTER 3

### ATTEMPTS TO DEVELOP AN EFFECTIVE AND VOLUNTARY NATIONAL SAFETY IMPROVEMENT PROGRAM FOR FEDERAL-AID HIGHWAYS

Eight years after its inception in 1964, the highway safety improvement program has yet to achieve the status of a fully implemented major national program. Varying degrees of State compliance with FHWA's program guidance have produced a fragmented approach to reducing highway-related accidents, injuries, and deaths on Federal-aid highways. This fragmented approach has resulted, we believe, because FHWA's guidance to States largely has been suggestive and because quantified goals have not been established for the program.

An opportunity exists to materially improve the Nation's traffic safety record if the Government will provide stronger program leadership by (1) reserving Federal-aid highway funds specifically to correct hazardous highway locations and (2) requiring the States to use these funds in a systematic program effort.

#### ESTABLISHMENT OF THE SAFETY IMPROVEMENT PROGRAM IN 1964

In directing FHWA in 1964 to immediately undertake an accelerated attack on traffic accidents, the President urged that State and local governments be encouraged and assisted to develop priority safety programs that would give special attention to hazards on highways having large numbers of accidents. In April 1964 in response to the President's direction, the Secretary of Commerce<sup>1</sup> and the Federal Highway Administrator urged the Governors and the State highway departments to immediately undertake priority programs for the elimination of highway hazards.

FHWA since has issued a number of program guidance memorandums containing its views and suggestions regarding the implementation of highway safety improvement projects. The most important was a policy and procedures

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<sup>1</sup>Effective April 1967 the Federal Highway Administration (Bureau of Public Roads) was transferred from the Department of Commerce to the newly formed Department of Transportation.

memorandum issued in August 1965, which represented the major guidance provided for the program by FHWA. The memorandum, as amended, discusses the purpose of the program and FHWA's policy regarding it, provides listings of improvements to illustrate appropriate types of safety projects (see p. 10), and emphasizes the importance of systematically identifying, by accident data analysis and inventorying, hazardous highway locations and of scheduling safety improvement work on the basis of assigned priorities.

The program excluded the Interstate System until January 1966 when FHWA modified its policy. In February 1967 the American Association of State Highway Officials completed a study of the safety characteristics of the Interstate System and other highway systems and issued its report entitled "Highway Design and Operational Practices Related to Highway Safety."

This report, commonly referred to as the yellow book, identified various types of roadside features generally considered hazardous and recommended an intensive program to remove such hazards from existing streets and highways and to engineer new highways with safety as a major criterion. FHWA endorsed the yellow book and urged the States to adopt the recommendations as soon as possible.

For yellow-book work on the Interstate System not involving major reconstruction, FHWA waived its policy that highway hazards be identified on the basis of accident data analysis. Consequently, except for such major projects, yellow-book work on the Interstate System essentially involves a general safety upgrading of stretches of roadway without the need for an analysis of the accident histories of specific highway locations.

#### PROGRAM GUIDANCE

Although FHWA, on occasion, has discussed the need for States to increase their level of effort under the program, it has not established quantified program goals. Instead FHWA has allowed each of the States to set its own level of effort to eliminate highway hazards.

At the inception of the program, the Federal Highway Administrator directed FHWA field engineers to encourage State highway departments to program a "substantial" part of their Federal-aid highway funds (for primary and secondary roads) for the elimination of highway hazards at locations where large numbers of accidents occur. The Administrator, however, did not define what was considered to be substantial but merely pointed out that assigning a greater portion of

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available funds to eliminating such hazards, at the expense of deferring some part of other highway construction, could provide sizable and immediate benefits to the public through the reduction of highway accidents.

About 1-1/2 years after the start of the program, the FHWA Chief Engineer informed all field offices that the States' progress in programming safety improvement projects had been spotty and that in some instances a marked increase in the use of Federal-aid highway funds for safety improvement work might be necessary--even exceeding, in some cases, 25 percent of the State's Federal-aid highway apportionment.

According to information contained in FHWA reports, about \$664 million, or 2.1 percent of the approximately \$31 billion in Federal-aid funds expended for highway construction work during the first 7 years of the highway safety improvement program has been devoted to highway improvement projects classified as safety oriented. Similar data for the six States included in our review follows.

### Federal-aid funds spent during the 7 years ended December 31, 1970

<u>State</u>	<u>Total</u>	<u>For highway safety improvement</u>	
		<u>Amount</u>	<u>Percent</u>
	----- (millions) -----		
Colorado	\$ 417	\$ 12.2	2.9
Illinois	1,423	60.3	4.2
Missouri	774	22.6	2.9
Montana	405	8.2	2.0
Oregon	480	9.1	1.9
Utah	407	6.8	1.7
Total	<u>\$3,906</u>	<u>\$119.2</u>	3.0

FHWA's memorandum on highway safety improvement, issued in August 1965, urged the States to inventory the most hazardous locations on the Federal-aid primary and secondary highway systems and to improve most, if not all, of these locations within 4 years. Accident records, road inventory data, field inspections, complaints, and the personal knowledge of highway department employees and the police were stated to be acceptable sources for developing the inventory of highway hazards.

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FHWA cautioned, however, that it did not intend for the States to designate as safety improvement projects regular Federal-aid highway projects for construction, reconstruction, or relocation of highways merely because a reduction in accident hazards could be anticipated, particularly when these projects would have been programmed in any case.

In response to FHWA's memorandum, all six of the States included in our review prepared inventories of what they considered to be hazardous highway locations. According to officials of the respective State highway departments:

1. Colorado, Illinois, Oregon, and Utah based their inventories on past-year accident data coupled with the personal knowledge and engineering judgment of highway department employees.
2. Montana based its inventory largely on engineering judgments applied to suggestions solicited from highway department employees, the police, State and county officials, and the general public.
3. Missouri compiled its inventory largely by selecting from its regular programmed construction projects those projects or parts of projects which had accident concentrations or which involved such features as bridges, curves, or other aspects which could be classified as safety projects on the basis of engineering judgment.

On November 18, 1965, the FHWA Chief Engineer issued a memorandum to the FHWA field offices concerning the progress made by the States in programming highway improvements. The Chief Engineer stated that, unless the funds devoted by the States for safety improvement work clearly were sufficient to correct, during each year through 1969, approximately one fourth of the hazardous locations on the inventories, approval of regular Federal-aid highway construction projects would be deferred until adequate provision had been made for safety improvement projects.

The Highway Safety Act of 1966 (23 U.S.C. 401) provided additional emphasis to the general need to improve highway safety. The act provided for coordinated programs to be developed by the States in accordance with standards to be promulgated by the Secretary of Transportation in various safety-related areas.

In its report on the Highway Safety Act of 1966, the House Committee on Public Works noted that FHWA already was conducting a safety improvement program and commented that

the program not only should be continued but also should be expanded. The Committee also stated that FHWA should substantially increase its supervision over the types of projects approved to ensure that the program serves its intended purpose. The Committee pointed out that most of the projects approved by FHWA under the program showed no backup accident data to justify the projects.

One of the standards issued by the Secretary of Transportation in 1967 provides for the identification and surveillance of highway locations where large numbers of accidents occur and for the elimination or reduction of hazards at the identified locations.

The standard gives recognition to FHWA's highway safety improvement program--which covers only Federal-aid highways--and states that programs also should be established for roads and streets not on the Federal-aid highway system. Generally the standard includes the same basic elements for an effective program as those included in FHWA's memorandums on its highway safety improvement program for Federal-aid highways. The standard provides for

- accurately identifying accident locations,
- compiling an inventory of locations where large numbers of accidents occur, locations where accidents are increasing sharply, and design and operating features associated with frequent or severe accidents,
- establishing priorities and taking steps to reduce accidents through the elimination or reduction of hazardous locations identified,
- evaluating the effectiveness of the improvements made, and
- maintaining a continuing systematic program for identifying and correcting road hazards.

Despite the various actions and instructions by FHWA, the safety improvement program did not become fully operational in the six States included in our review. The status of the program in these States by the end of the 3d year of the 4-year program established by FHWA in August 1965 is shown below.

	Total		Completed or under contract			
	Number of projects in inventory	Estimated cost (millions)	Number of projects	Percent of projects	Estimated cost (millions)	Percent of total cost
Colorado	136	\$24.6	42	31	\$ 6.6	27
Illinois	407	86.1	260	64	42.6	49
Missouri	286	95.5	214	75	62.7	66
Montana	296	7.8	57	19	3.4	44
Oregon	155	28.0	106	68	12.8	46
Utah	208	2.9	35	17	0.2	7

The extent to which Missouri's reported progress, as shown in the table, actually represented program-related improvements is questionable because, contrary to FHWA guidelines, the State had developed its inventory from projects included in its regular highway construction program.

FHWA did not carry through on its plan to achieve substantial completion of the inventoried safety improvement projects within 4 years. In March 1969 FHWA revised its policy and urged the States to maintain a continuing safety improvement program. This revised policy did not include standards against which to measure State progress.

In the summer of 1970, FHWA requested the American Association of State Highway Officials to study the existing program and to work with FHWA to launch a major specially funded program, should funds be specifically made available for it. At that time the House Committee on Public Works was considering authorizing \$200 million a year, for 2 years, for highway safety improvements.

The Association's Select Committee on Traffic Safety held a special meeting in November 1970 to discuss the problem. Minutes of the meeting indicate that there was little agreement on the direction a specially funded program should take, even though the existing program had been in effect for almost 7 years. The Executive Director, FHWA, in commenting on the meeting, stated:

"Some of the States represented at the meeting insisted that they could go into their accident records files, pull out sections that had high accident experience, determine the reason for the bad accident record, and quickly formulate programs of projects on the basis of such information. It is my personal observation that there are very few places where this can be done."

In November 1970 the House approved an authorization of \$200 million, for each of 2 years, for safety improvement projects. This authorization, however, was deleted by Senate and House conferees from the Federal-Aid Highway Act of 1970.

In April 1971 FHWA advised the States that the Congress had indicated a strong continuing interest in a highway safety improvement program and urged the States to set aside 10 percent of their annual primary and secondary highway trust fund authorizations for projects to eliminate or reduce safety hazards on Federal-aid highways other than interstate highways. Program requirements were relaxed considerably in an attempt to expedite highway safety improvement projects.

The suggestion that 10 percent be set aside was rescinded in October 1971 when FHWA announced a new emergency highway safety and unemployment program. Originally FHWA set aside \$700 million for this program to be made available for the remainder of fiscal year 1972 without specific State-by-State distribution. In December FHWA made additional funds available for the program.

An FHWA program memorandum stated that the work to be done under this program should consist of (1) projects to stimulate jobs in areas of high unemployment and (2) projects addressed to the safety improvement of existing highways and to the elimination of existing hazards. The memorandum stressed that, in the safety area, rail-highway grade-crossing projects should be given highest priority. Also included in the program were projects eligible under the highway safety improvement program discussed in this report; projects eligible under the traffic operations program to increase capacity and safety; and other types of projects, such as major reconstruction, that could not be justified on the basis of safety alone but could be justified on the basis of overall need.

As of December 31, 1971, about \$967 million had been obligated under FHWA's emergency highway safety and unemployment program, including \$785 million for projects to stimulate jobs in high-unemployment areas, \$91 million for safety-related projects in high-unemployment areas, and \$91 million for highway safety projects.

CHAPTER 4NEED FOR A SYSTEMATIC PROGRAM APPROACH  
TO THE PROBLEM OF HIGHWAY HAZARDS

All six States included in our review were doing some type of work to correct highway hazards. Some of this work consisted of upgrading the safety of the Interstate System and other high-speed highways, as provided in the American Association of State Highway Officials' yellow book. Some work involved wholly State-funded safety projects, including those carried out by State road maintenance forces. In addition, all but one of the six States were programming Federal-aid highway projects specifically to correct hazardous locations involved in highway accidents. Overall, however, the States were not routinely reserving and using Federal-aid highway funds to further a systematic program to correct identified hazardous locations on Federal-aid highways.

We believe that the operation of an effective program for the systematic elimination or correction of hazardous locations on the Federal-aid highway system requires full implementation of three basic procedures.

1. Routine reservation and use of funds specifically to eliminate highway hazards.
2. Identification of hazardous locations on the basis of actual accident experience.
3. Correction of hazards in accordance with priorities established among identified projects on the basis of the potential for accident reduction in relation to the cost of the correction.

RESERVATION OF FUNDS

FHWA has not reserved Federal-aid highway funds specifically for highway safety projects. We noted that the six States included in our review had devoted a relatively small part of their Federal-aid highway funds to eliminating highway hazards under the safety improvement program. Although an FHWA study showed that, in terms of lives saved and injuries avoided, the benefits to be derived from the removal of highway hazards were much greater than those obtainable from regular highway construction work, only 3 percent of the total Federal-aid highway funds available to the six

States during the 7 years ended December 31, 1970, were spent for projects under the highway safety improvement program. (See p. 12.)

These six States had not routinely set aside and used a designated part of their Federal-aid highway funds to correct hazardous highway locations under FHWA's highway safety improvement program.

For calendar year 1971 Illinois did commit \$10 million specifically to correct hazardous highway locations under the safety improvement program. About \$5.5 million actually was used for this purpose. The remaining funds were used for other highway construction work, and the highway safety improvement projects for which the funds were to have been used were deferred until the following year. Illinois also performed yellow-book work in 1971, but a State highway official advised us that the amount of funds spent for this type of work was not readily available because it was being accomplished along with regular construction work. Illinois Federal-aid funds for fiscal year 1971 amounted to about \$261 million.

Utah had included 22 Federal-aid safety improvement projects, estimated to cost \$2.6 million, in its fiscal year 1971 budget. Of these 22 projects, nine were in process or completed during that year, one was dropped, and 12--estimated to cost about \$1.3 million--were deferred and were planned for inclusion in the next year's budget. The cost of the nine projects (\$1.3 million) represents about 2 percent of Utah's Federal-aid highway funds of about \$63 million for that year. The State also performed yellow-book work amounting to about \$0.8 million during fiscal year 1971.

In Colorado a listing of proposed safety projects estimated to cost more than \$22 million was prepared as of June 1970. For the most part these projects were not included in the highway budget for funding in fiscal year 1971 or 1972; consequently most of them had not been undertaken as of December 1971.

Colorado completed three Federal-aid safety improvement projects, totaling about \$703,000, in fiscal year 1971. These projects had not been included in the June 1970 listing. The State also was performing yellow-book work. A State highway official advised us that the amount of funds devoted to this work could not be estimated because it was being accomplished along with regular construction work. Colorado's Federal-aid funds for fiscal year 1971 amounted to about \$80 million.

Highway officials in Oregon and Montana informed us that, on the basis of engineering judgment, funds were diverted from regular construction work to safety work whenever the situation justified such a diversion. In fiscal year 1971 Oregon undertook projects costing about \$7.8 million to generally upgrade the safety of its interstate highways, compared with Federal-aid funds of about \$94 million. In Montana, safety improvement projects costing an estimated \$0.6 million were undertaken in fiscal year 1971 and about \$0.8 million was spent on yellow-book work during the year. The State's Federal highway funds for that year totaled about \$71 million.

Between January 1970 and November 1971, the month we completed our review, Missouri had programmed no Federal-aid safety projects for the sole purpose of correcting identified hazardous locations on its highways and did not plan to do so. State highway officials explained that their goal was to continue the State's regular Federal-aid highway construction program and to provide a network of highways which would serve the movement of people and goods with flexibility, mobility, comfort, convenience, safety and aesthetics and which would create a system yielding an optimum return on investment.

The officials informed us that safety was only one of the factors considered in selecting projects to be included in the State's regular highway construction program. In fiscal year 1971, the State did perform \$6.8 million worth of yellow-book work to upgrade its interstate highways, which represented about 6.8 percent of the \$100 million of the Federal-aid highway funds the State received in fiscal year 1971.

#### IDENTIFICATION OF HAZARDOUS LOCATIONS

Meaningful inventories of hazardous locations are needed to provide FHWA and the States with a basis for determining (1) the magnitude of the overall highway hazard problem in the States in terms of the amount and type of improvements needed, (2) the total estimated cost of such improvements, and (3) the order and pace at which safety improvement work should proceed to have a timely and significant impact on highway accidents, deaths, and injuries.

Three ingredients which FHWA considers necessary for a system to develop a continuing comprehensive listing (inventory) of hazardous highway locations are: (1) an accurate referencing system for identifying the specific spots on a roadway where accidents have occurred, (2) a traffic records system that will enable identification of causative factors of highway

collisions, and (3) a procedure for identifying and reporting hazardous highway elements and locations on the basis of accident data analysis.

Each of the six States covered in our review had developed systems which, in part, met FHWA's criteria for a systematic highway safety improvement program. For example, all six States were preparing summaries showing highway accidents by location. None of these States, however, had a comprehensive inventory of correctable hazardous locations which was systematically updated and routinely used for developing and carrying out highway safety improvement projects.

#### Field referencing

Utah, Colorado, and Missouri had complete field reference systems covering their Federal-aid highway system. The field referencing systems in the other three States were at various stages of completion. Although field referencing on the interstate and primary systems essentially was completed, it was completed for only about 6,300 (22 percent) of the total of 29,100 miles of secondary highways in these States. Oregon was planning some action to reference some of the 4,800 miles (57 percent) of secondary roads in the State that were not referenced. Montana and Illinois had no firm plans for completing referencing of their secondary routes.

#### Traffic records system

All six States were compiling accident data from individual accident reports which were prepared by either police accident investigators and/or the motorists involved in the accidents. The extent of accident reporting varied considerably. Although accident reports generally were received for accidents on State highways investigated by State police, reports on accidents investigated by some municipalities and county jurisdictions were not being submitted to the States for compilation. It appeared, for example, that data on about one half of the accidents in Missouri was not being entered into the highway department's traffic accident records system.

The accident report forms used by the six States contained various degrees of information on the specific highway features associated with accidents. We believe that the reports' usefulness as a basis for identifying highway hazards would be greatly enhanced if they were standardized to provide for more specific information on highway features associated with traffic accidents.

All six States prepared summaries of accident data at least annually. Colorado, Missouri, Illinois, and Utah had developed listings showing accident data by location for the most recent year; Montana had summarized data for the most recent 3 years but had not included secondary highways; and Oregon had summarized data for the most recent 5 years.

### Accident data analysis

Colorado, Missouri, Illinois, and Utah had established various procedures for analyzing their accident data to isolate hazardous highway locations. These procedures included associating the rate or number of accidents with specific locations where clusters of accidents had occurred. In Oregon a consulting firm had developed a computer-oriented accident analysis system for the State, but the system had not been put into operation at the time of our review. Montana was applying a statistical procedure to accident data for some sections of highway but did not consider the result to be useful for identifying hazardous locations.

At the time of our review, Illinois, Utah, and Colorado were using their accident data systems to identify and list some hazardous locations that could be considered for inclusion in their highway programs. The safety improvement projects carried out by these States, however, were not always selected from such listings.

In Utah, only 10 of the 22 Federal-aid safety improvement projects programmed for fiscal year 1971 were identified by the State through accident analysis; the remaining projects were selected by State officials on the basis of personal knowledge and engineering judgment.

Of the 31 projects completed or scheduled in Illinois during calendar year 1971, 26 were selected from a listing of hazardous locations identified through accident analysis and five were selected by State highway officials on the basis of their judgment of need.

Although Colorado had developed a listing of proposed safety projects based on accident analysis, none of the three safety projects completed in fiscal year 1971 were selected from this listing. Instead, the projects were selected on the basis of State, county, or city officials' personal knowledge of roadway conditions.

In Missouri highway officials told us that they used the results of their accident data analysis as one element of input for their regular highway construction program. In Oregon highway district engineers used their judgment in

selecting hazardous highway locations to be corrected from accident data summaries furnished to them. Both of these States reported that, except for yellow-book work on their Interstate Systems, they had not completed any specific highway safety projects with Federal-aid funds during fiscal year 1971.

Hazardous highway locations in Montana were being identified primarily on the basis of complaints of unsafe conditions received from various sources. An FHWA evaluation of Montana's safety program in January 1971 concluded that the State did not have a comprehensive system, at that time, to isolate highway hazards through accident analysis. State highway officials informed us that they planned to establish better procedures for identifying hazardous highway locations.

The incompleteness of accident data and the failure of the six States to systematically develop comprehensive inventories of correctable hazardous locations routinely used for developing and carrying out safety projects can lead to situations where relatively hazardous locations may not be identified for consideration in programming annual safety improvement work.

For example, in Colorado we reviewed accident reports on all fatal accidents involving a roadside object, or possibly resulting from a road defect, for a 2-1/2-year period ended June 30, 1970, and identified 240 different locations where fatal accidents of this type had occurred. More than one fatal accident had occurred at some of these locations. State officials advised us that they were not aware of many of these hazardous locations because, under their current system of analyzing only the most recent year's accident data, the locations had not been identified.

According to a Department of Transportation report prepared in February 1971, none of the States had implemented fully the Department's standard on identification and surveillance of highway accident locations, which had been issued pursuant to the requirements of the Highway Safety Act of 1966.

ASSIGNMENT OF PRIORITIES FOR  
CORRECTION OF HIGHWAY HAZARDS

Because sufficient resources seldom are available to do all necessary safety improvement work, States need to follow a reasonable and uniform method of establishing priorities among identified safety projects so that those having the greatest accident reduction potential for each dollar spent will be undertaken first.

Of the six States covered in our review, Oregon, Montana, and Missouri were not ranking proposed safety improvement work on a State-wide basis in terms of the highest potential benefit for the lowest relative cost. Utah, Illinois, and Colorado had developed State-wide priority listings for their safety improvement projects but were not scheduling and carrying out their safety improvement work fully on that basis.

When a State has not developed systematically an inventory of hazardous locations, identified highway features at these locations in need of correction, and established priorities demonstrating which improvements would provide the greatest benefits, neither the State nor FHWA has reasonable assurance that the various safety improvement projects, selected on a case-by-case basis by the State and approved by FHWA, represent the most worthwhile use of safety improvement funds.

To illustrate, Colorado determined that two bridges should be improved in the interest of safety. The bridges, including approaches, were reconstructed in September 1969 at a total cost of about \$616,000. One of the structures served less than 200 vehicles a day; the other served 2,700 vehicles a day. During the 3-year period preceding reconstruction, a total of eight accidents had occurred at both locations, including two injury accidents and six property damage accidents.

At the same time a 3-1/2-mile stretch of hazardous road containing a number of dangerous curves that could have been improved at an estimated cost of about \$700,000 remained uncorrected. This road served 2,700 vehicles a day. During the 3-year period, 38 accidents occurred on this road section including one fatal accident, 32 injury accidents, and five property damage accidents.

A somewhat different situation exists in Missouri which informed us that it was not programming the correction of specific hazardous locations under a safety improvement program but was considering known highway hazards as one factor in deciding which major highway construction projects to undertake. Under these circumstances the elimination of highway hazards can be delayed for long periods or can be deferred indefinitely.

We noted one hazardous highway location in Missouri which had been known to the highway department since 1965 but which was not scheduled for correction until 1974--the date when the road was planned for complete reconstruction.

In the 3-1/2-year period from January 1968 to June 1971, five persons were killed and 15 persons were injured in 19 separate traffic accidents at this location.

## CHAPTER 5

### COMMENTS BY THE

#### DEPARTMENT OF TRANSPORTATION

We discussed the contents of this report with designated officials of the Office of the Secretary and FHWA. These officials generally agreed with our analysis of the progress and status of the safety improvement program.

FHWA officials stated that they believed that greater recognition should be given to other safety-related work which was being carried out by the States, including (1) yellow-book work to upgrade the safety of the Interstate System and other high-speed highways in accordance with the recommendations of the American Association of State Highway Officials and (2) wholly State-financed safety-related projects.

FHWA and the States are not required to maintain records showing the full scope of the yellow-book work being performed; however, this report does comment on such work to the extent that it was identified by the six States included in our review. We recognize that yellow-book work promotes highway safety. We note, however, that the basis for such work generally varies from the basis on which projects are determined under the safety improvement program.

Yellow-book work on existing highways primarily is directed toward the correction of generally recognized types of hazards (for example, replacement of fixed signs with breakaway signs over a section of the system) rather than toward the correction of identified hazardous locations. Except for work on major safety improvement projects at specific locations, yellow-book work on the Interstate System, unlike other safety improvement work, does not have to be based on accident data analysis.

FHWA officials stated also that many safety-related highway projects had been financed wholly with State funds. They provided us with data showing that the States had reported that wholly State-funded projects, classified as safety related, had averaged \$125 million annually during the 7 years ended September 1971. FHWA's analysis of the reported information showed that a number of the projects included would not meet the requirements of the safety improvement program.

Also, as discussed in this report, the procedures followed by the States for identifying and correcting hazardous locations reduces assurance that the safety-related

projects being financed wholly by the States represent the most worthwhile use of the funds involved.

Because we consider the development of an effective safety improvement program to be dependent upon the reservation of funds for the program, we also discussed the feasibility of the Secretary's administratively reserving a part of available highway trust funds specifically for projects under the safety improvement program. FHWA officials pointed out that generally, in the past, reservations of funds for specific highway-related programs had been based on legislative authorization. Therefore they planned to obtain legal clarification on this matter.

CHAPTER 6CONCLUSIONS AND MATTERS FOR CONSIDERATIONBY THE SUBCOMMITTEECONCLUSIONS

The limited progress made to date under FHWA's voluntary safety improvement program, when viewed in the light of deaths and injuries associated with highway hazards, raises a question as to whether the Department has taken all feasible action to implement a high-priority program to deal with the problem of highway hazards.

Data developed by FHWA and various independent highway safety-related organizations demonstrate that a major effort to eliminate highway hazards could contribute materially to the Department's announced intention to make the Nation's highways as safe as possible. We believe that an opportunity exists to improve materially the Nation's traffic safety record if the Department will provide stronger leadership toward the implementation of the highway safety improvement program for Federal-aid highways.

We believe that setting aside a specific part of highway trust funds to be used annually for the elimination or correction of hazardous highway locations would promote greater efforts by the States to improve highway safety and would give the correction of hazardous highway locations the status of a major national program in line with the growing congressional, departmental, and public concern over the large number of fatalities, injuries, and accidents that occur annually on our highways.

FHWA's experience with the Emergency Highway Safety and Unemployment Program which was announced in October 1971 demonstrates, in our opinion, the impetus that can be given to a special highway program by the specific reservation of funds. The response of the States in this case resulted in the obligation of about \$967 million in less than 3 months, primarily to finance projects to stimulate jobs in high-unemployment areas.

The Department is obtaining legal clarification concerning the Secretary's authority to administratively reserve funds for the highway safety improvement program. We believe however, that legislative action specifically setting aside a part of highway trust funds to ensure an appropriate level

of accomplishment would provide a more effective program incentive.

Under the procedures now being followed by the States, neither FHWA nor the States have reasonable assurance that the limited funds that are being directed toward safety improvement projects are being spent for improvements which offer the greatest potential for reducing injuries and deaths.

The degree of success of an effective highway safety improvement program is dependent on the States' developing comprehensive inventories of correctable highway hazards systematically updated through accident analysis and routinely used for developing and carrying out projects to correct the hazards in accordance with assigned priorities that would provide the greatest benefits for each dollar spent. FHWA's program guidelines, if effectively implemented, could provide reasonable assurance that funds are being used in a systematic manner for highway safety improvement.

MATTERS FOR CONSIDERATION  
BY THE SUBCOMMITTEE

In view of the problems encountered in implementing a voluntary national highway safety improvement program to reduce traffic accidents and deaths caused by hazardous highway features, the Subcommittee may wish to consider the need for legislative action to establish a viable Federal safety improvement program. Determinations by the States and the Department of the magnitude of the overall highway hazard problem in the States in terms of

- the amount and type of improvements needed;
- the total estimated cost of such improvements;  
and
- the order and pace at which safety improvement work should proceed to have a timely and significant impact on highway accidents, deaths, and injuries

could provide the Subcommittee with a basis on which to determine the level of funding at which the program should be carried out.

... AVAILABLE

CHAPTER 7

SCOPE OF REVIEW

Our review was conducted at the Washington, D.C., headquarters of FHWA; the State highway offices responsible for implementing the safety improvement program in the States of Colorado, Illinois, Missouri, Montana, Oregon and Utah; and the FHWA regional and division offices having jurisdiction over these States.

We reviewed pertinent legislation, FHWA policies and procedures, and FHWA and State records pertaining to the safety improvement program. We also interviewed FHWA and State officials.

Our review included an examination into the systems and procedures established by the selected States to accomplish the program purpose of identifying and correcting specific highway locations and/or elements identified as hazardous. As part of this examination, we looked into the efforts being made by the States to select and program individual projects for correction of highway hazards. We also visited the sites of highway hazards and selected safety projects in each of the six States included in our review.



ASSISTANT SECRETARY  
FOR ADMINISTRATION

OFFICE OF THE SECRETARY OF TRANSPORTATION  
WASHINGTON, D.C. 20590

March 21, 1972

BEST DOCUMENT AVAILABLE

Mr. Richard W. Kelley  
Assistant Director, Civil Division  
United States General Accounting Office  
Washington, D.C. 20548

Dear Mr. Kelley:

We have reviewed the draft report relative to problems encountered in implementing the highway safety improvement program and, in general, we take no issue with the findings contained therein.

The report raised the question of setting aside a specific portion of trust fund monies for the implementation of this program. This point was discussed in some detail at a meeting on Monday, March 13, attended by representatives of GAO, OST and FHWA, particularly as to whether or not the Secretary now has the authority to take such action. It was agreed that we would obtain a legal opinion on this matter from our General Counsel. As soon as this opinion is received, you will be further advised.

Thank you for the opportunity to comment on your report.

Sincerely,

A handwritten signature in cursive script, reading 'William S. Heffelfinger'.

William S. Heffelfinger

# APPENDIX II

NINETY-SECOND CONGRESS

JAMES C. WRIGHT, JR., TEX., CHAIRMAN

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## Congress of the United States House of Representatives

SUBCOMMITTEE ON  
INVESTIGATIONS AND OVERSIGHT  
OF THE  
COMMITTEE ON PUBLIC WORKS  
Washington, D.C. 20515

B-576 RAYBURN HOUSE OFFICE BUILDING  
TELEPHONE: ARCA CODE 202, 225-3274

March 3, 1972

Honorable Elmer B. Staats  
Comptroller General of the United States  
General Accounting Office  
Washington, D.C. 20548

SECRET  
CONFIDENTIAL

Dear Elmer:

The Subcommittee on Investigations and Oversight is planning to commence public hearings on certain highway safety subjects on April 11, 1972.

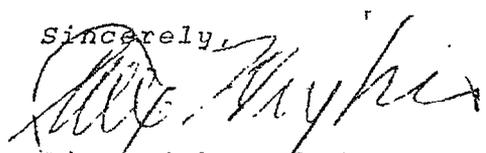
Included among these subjects is the manner in which the Federal Highway Administration is carrying out its safety improvement projects program. We understand that your staff assigned to the Federal Highway Administration is presently performing work in this area. I consider it extremely important that the information you have gathered on this program be available in time for our hearings.

Therefore, I would deeply appreciate it if a report, incorporating the then available information, be made available to us by mid-April. I would further appreciate it if you and your aides would appear before this Subcommittee, at an appropriate time, to give us the benefit of this knowledge. We will later inform you of the date and location.

Your representatives may contact Mr. George Kopecky to work out the detailed arrangements.

Thank you for your cooperation and assistance in this matter

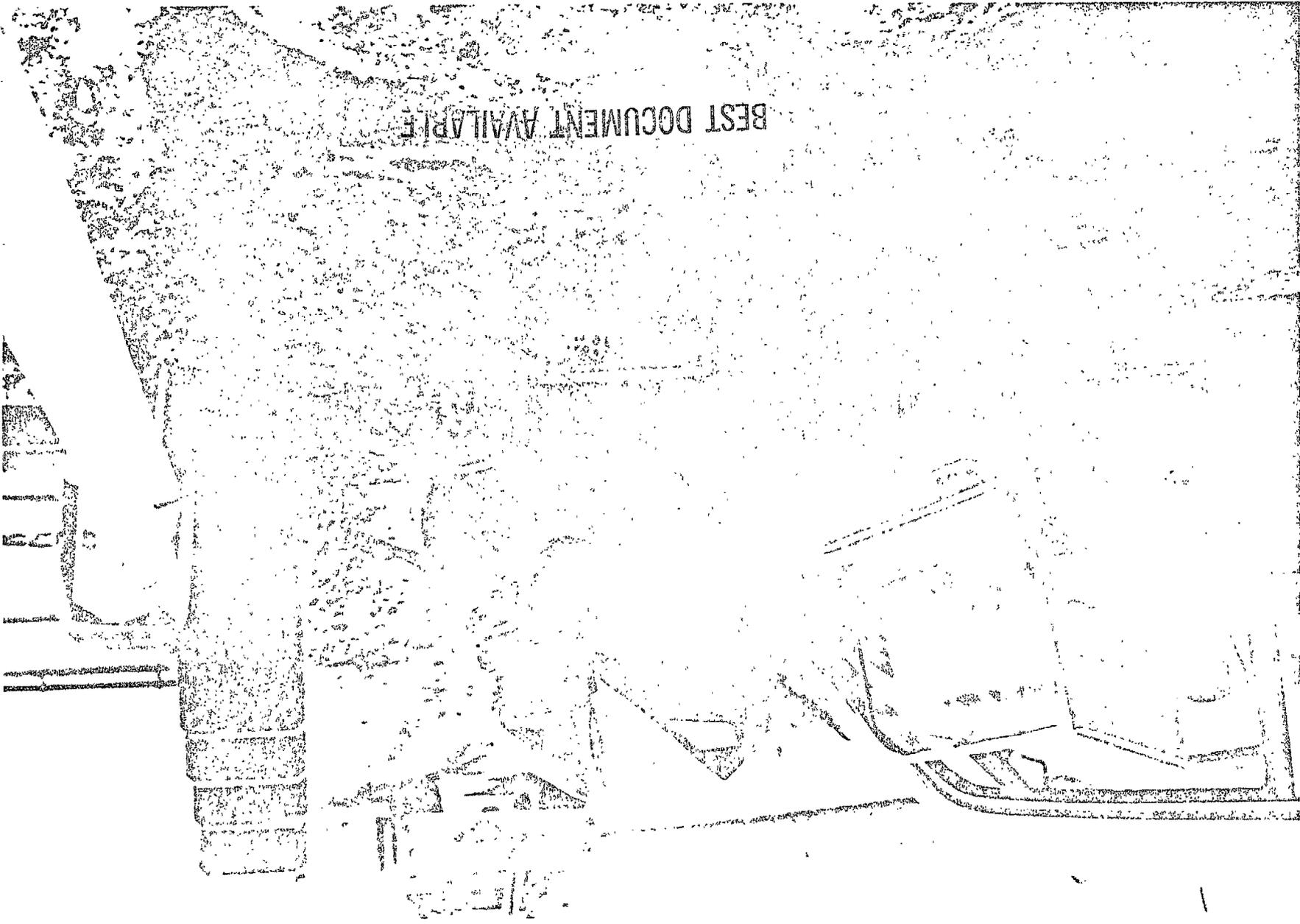
Sincerely,

  
Jim Wright, Chairman  
Subcommittee on Investigations  
and Oversight



HAZARDOUS TRANSITION OF GUARDRAIL AND BRIDGE PARAPET.  
SOURCE: INSURANCE INSTITUTE FOR HIGHWAY SAFETY

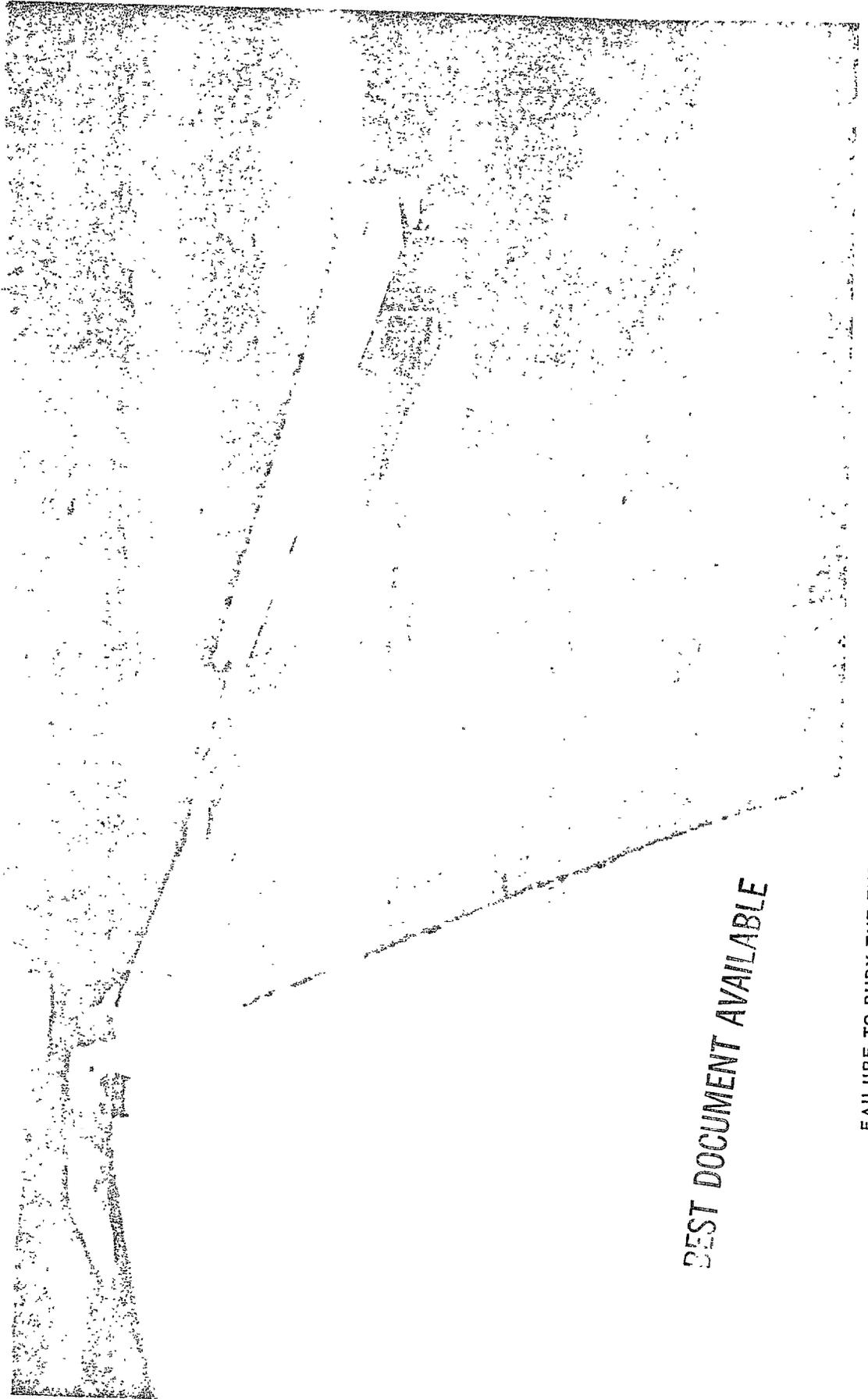
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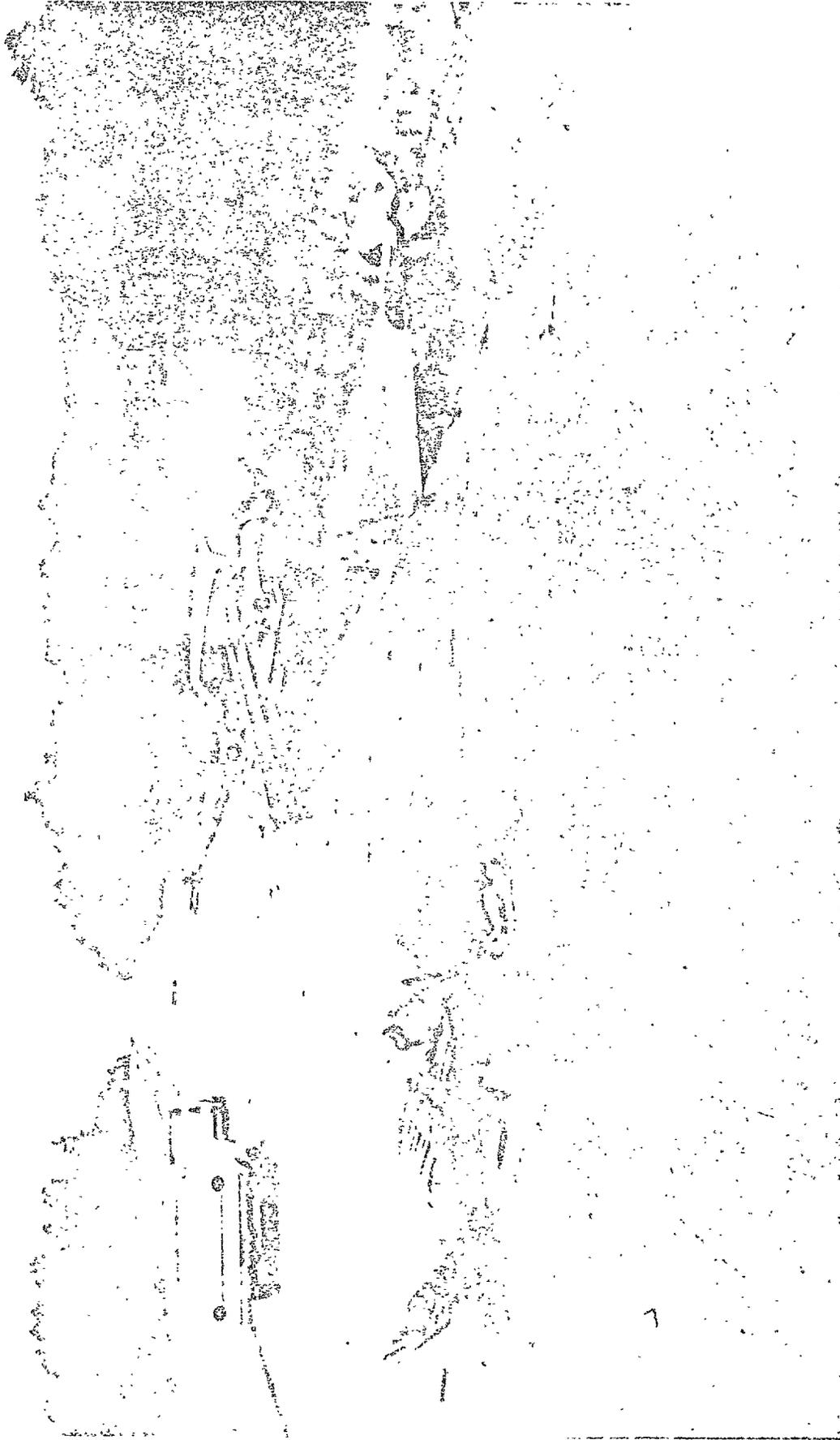
EXAMPLE OF IMPROVED TREATMENT. GUARDRAIL CARRIED COMPLETELY ACROSS BRIDGE.  
SOURCE: INSURANCE INSTITUTE FOR HIGHWAY SAFETY.

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FAILURE TO BURY THE END OF GUARDRAILS IS A COMMON GUARDRAIL HAZARD.  
SOURCE: FEDERATION OF INSURANCE COUNSEL



AN EXAMPLE OF VEHICLE'S HITTING UNBURIED END OF GUARDRAIL.  
SOURCE: FEDERATION OF INSURANCE COUNSEL

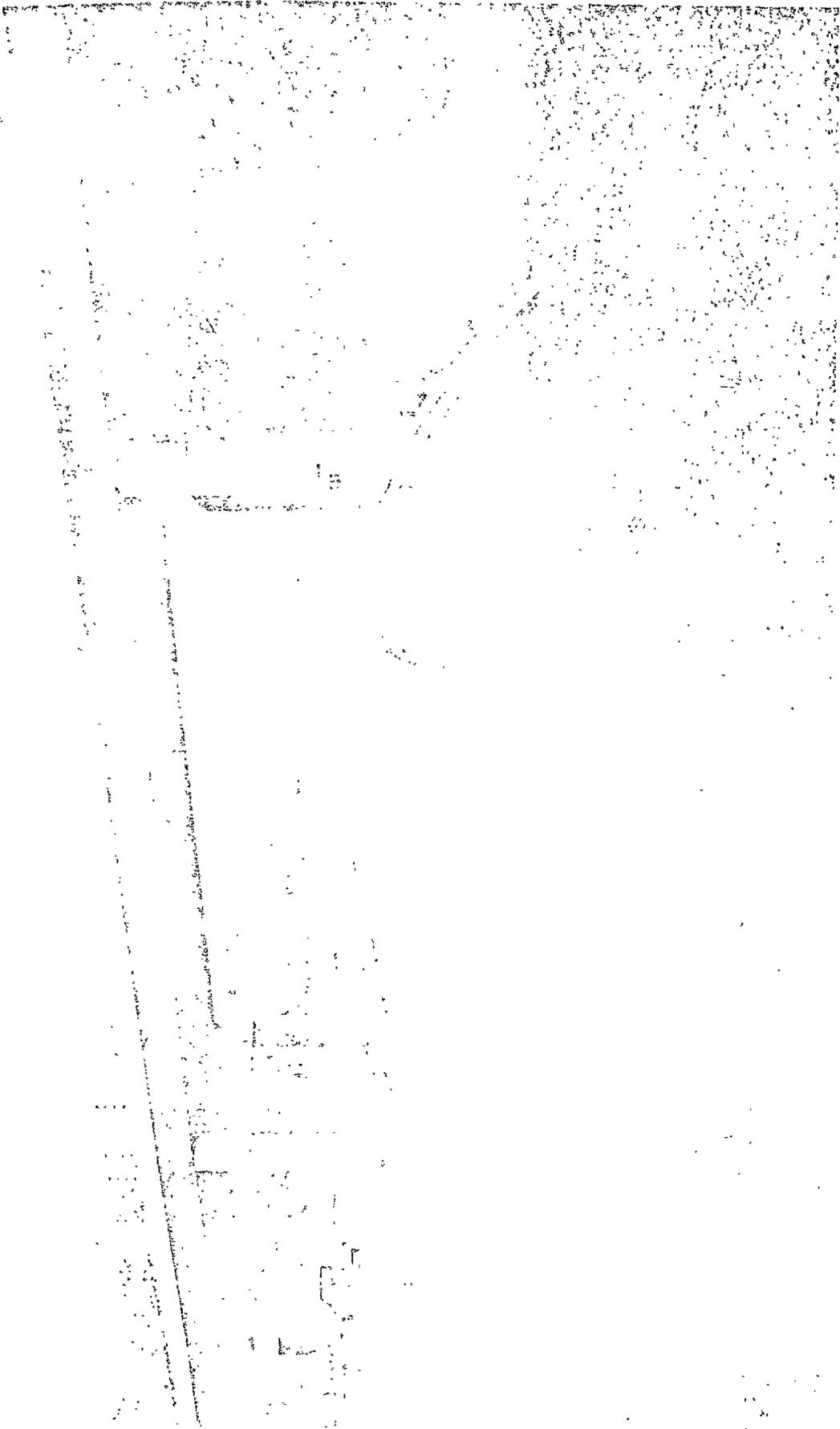
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APPENDIX III



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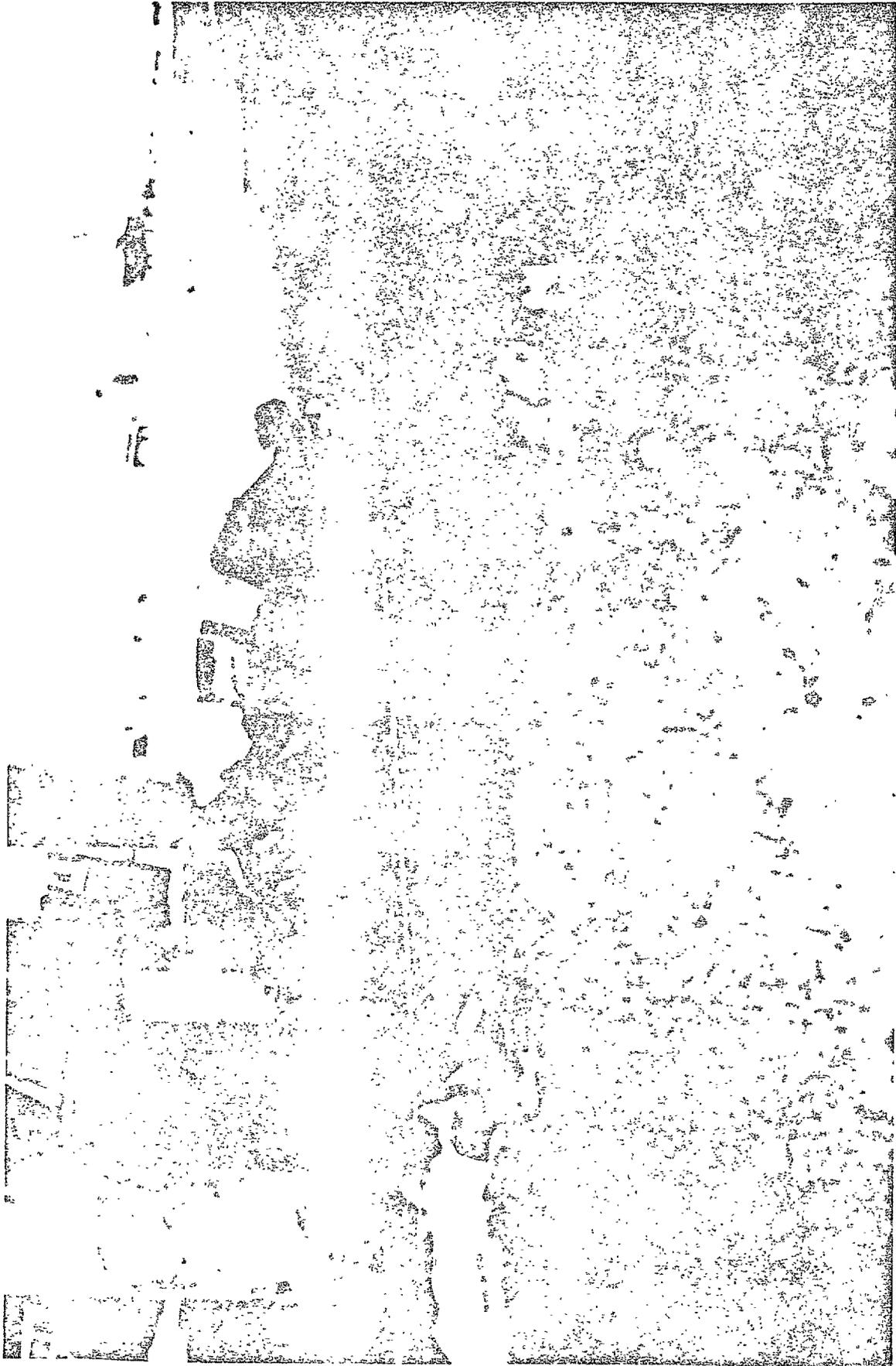
EXAMPLE OF IMPROVED TREATMENT--END OF GUARDRAIL BURIED.  
SOURCE: INSURANCE INSTITUTE FOR HIGHWAY SAFETY



UNPROTECTED BRIDGE PIERS IN MEDIAN.  
 SOURCE: INSURANCE INSTITUTE FOR HIGHWAY SAFETY

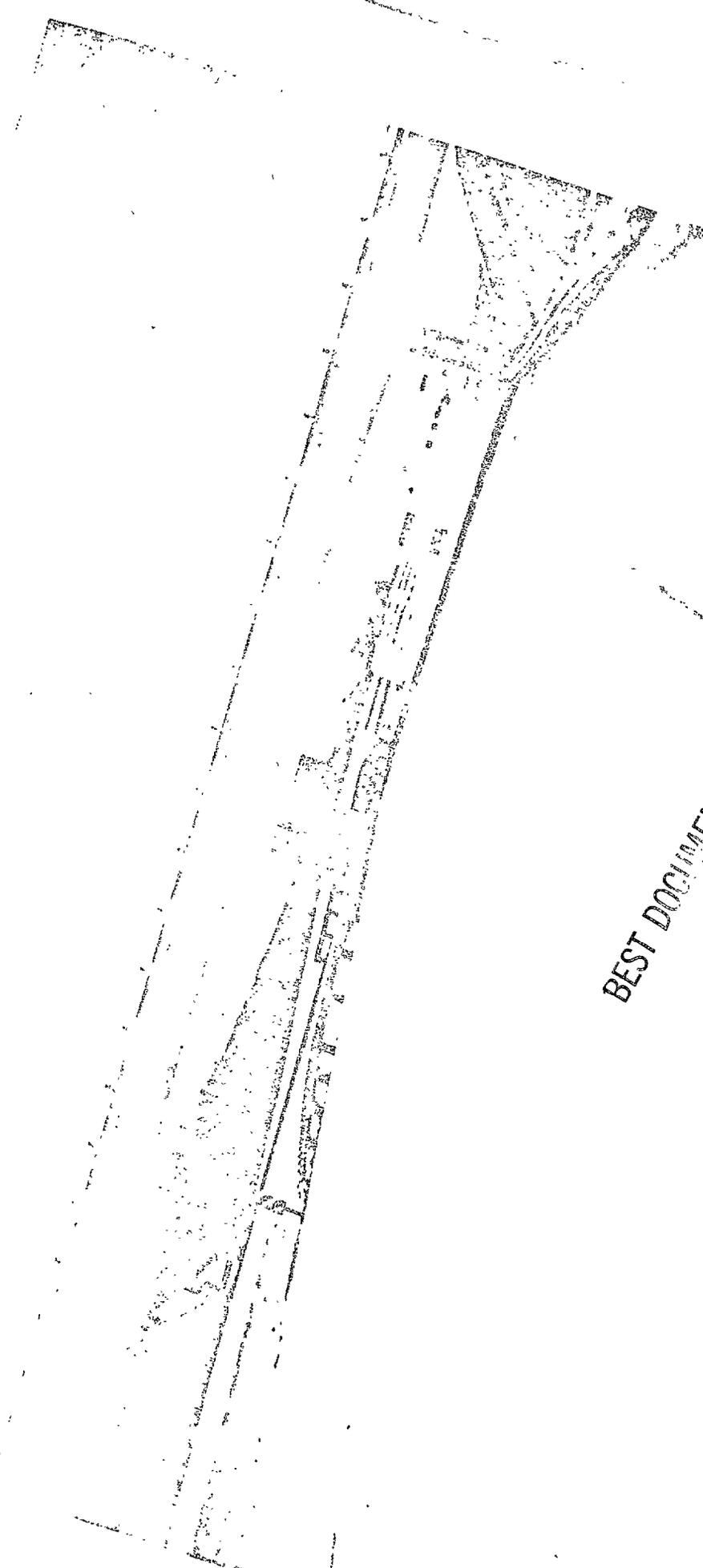
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APPENDIX III



EXAMPLE OF VEHICLE'S HITTING UNPROTECTED BRIDGE PIERS.  
SOURCE: FEDERAL HIGHWAY ADMINISTRATION

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EXAMPLE OF IMPROVED PROTECTION FROM BRIDGE PIERS.  
SOURCE: FEDERAL HIGHWAY ADMINISTRATION