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Abstract <p>The Virginia Department of Transportation (VDOT) faces a growing tort liability problem. Under the Virginia Tort Claims Act, VDOT is liable for up to \$75,000 for negligent or wrongful acts or omissions committed by its employees within the scope of their employment. VDOT must also pay judgments rendered against its employees as individuals for acts of negligence committed within the scope of their employment. In many cases, sovereign immunity will protect VDOT employees from tort claims. However, courts are increasingly willing to find state employees liable for negligent acts or omissions.</p> <p>To control future liability exposure, VDOT must develop a program to reduce the risk of tort liability. A comprehensive risk management system would attack the problem at three points. First, by making the roadways safer, the number of claims would be held to a minimum. Second, by improving VDOT's ability to defend tort claims, the number of claims paid and amounts awarded would be held to a minimum. Finally, by quickly settling claims that VDOT will inevitably lose and by setting aside money to pay such claims, a risk management program would assure that VDOT is prepared for unavoidable tort liability.</p> <p>This report documents the findings of the initial phase of VDOT's effort to develop a comprehensive risk management system. The purpose of this phase was to assess VDOT's exposure to tort liability and to describe existing efforts for controlling risk. In subsequent phases, the findings discussed herein will be used to design and implement improvements in VDOT's existing risk management efforts.</p> <p>VDOT's risk-causing activities include the design, construction, and maintenance of roadways. Claims alleging negligent maintenance are the most frequently filed, but only 13 percent of these claims are paid. The low success rate of these claimants indicates that VDOT is effectively responding to roadway defects even though there are currently no formalized procedures for ensuring an effective response.</p> <p>VDOT obtains information about roadway defects from many sources. However, there are no uniform policies for collecting such information or for agency-wide distribution of the important information produced by these various sources. VDOT attempts to transfer some risks to contractors and consultants through indemnity and insurance agreements. Risks that cannot be prevented or transferred are assumed through self-insurance.</p>				

FINAL REPORT

ASSESSMENT OF TORT LIABILITY RISK MANAGEMENT
IN THE VIRGINIA DEPARTMENT OF TRANSPORTATION

by

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(The opinions, findings, and conclusions expressed in this report are those of the authors and not necessarily those of the sponsoring agencies.)

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INTRODUCTION

The Virginia Department of Transportation (VDOT) is facing a problem common to many state agencies throughout the nation. The problem is that VDOT pays more money each year to compensate for damages caused by the careless, or negligent, actions and inactions of its employees. When VDOT must compensate for such damage, it is said to be "liable in tort." Tort is defined as a civil wrong or injury.

There is always a risk that VDOT will be subjected to tort liability. Recent legal developments have increased that risk. To combat this growing problem, VDOT must begin now to develop a comprehensive program to control, or manage, the risk of tort liability. A comprehensive tort liability risk management program will accomplish three objectives. First, by making the roadways under VDOT's jurisdiction safer, the number of claims brought against VDOT will be held to a minimum. Second, by establishing procedures that effectively demonstrate VDOT's performance of its duty, VDOT can reduce the amount of compensation paid when claims are brought. Finally, by effectively preparing for and settling claims that must be paid, there will be no surprise claims that exceed VDOT's ability to pay.

Before VDOT can implement a comprehensive tort liability risk management program, its exposure to tort liability must be assessed, and its existing system for controlling tort liability must be documented. This report describes the assessment and documentation. The first section discusses the legal environment in terms of the applicable statutes, cases, and legal trends that affect VDOT's tort liability. The second section is an analysis of claims that have been filed against VDOT and its employees. The third section introduces the concept of risk management as a method of controlling exposure to tort liability. The fourth section discusses VDOT's

efforts to make its activities less likely to result in tort liability. The fifth section discusses VDOT's efforts to transfer the risk of tort liability to contractors and consultants. The sixth section explains the processes by which VDOT prepares for tort liability that cannot be prevented or transferred. The final sections summarize the findings and conclusions.

LEGAL BACKGROUND

VDOT faces a growing tort liability problem. In the past five years, VDOT's liability to tort claimants has been held to just over \$500,000, but the volume of tort claims is expanding dramatically(1). Without regard to the growth in the number of tort claims, if the proportion of claims paid and the ratio of claim dollars sought to claim dollars awarded remain constant, tort liability will cost VDOT an additional \$1 million by June 1990.

This section discusses the legal avenues through which tort claimants make VDOT pay for their injuries: actions against VDOT under the Tort Claims Act, and actions against individual VDOT employees. This section also discusses legal trends that threaten to increase VDOT's liability exposure.

Liability of VDOT

Prior to the Tort Claims Act, the state could not be held liable for the actions of its employees. The doctrine of sovereign immunity, firmly rooted in American common law, prevented anyone from suing the state(2). Sovereign immunity means that the state cannot be sued, except by its permission. Sayers v. Bullar, 180 Va. 222, 225, 22 S.E.2d 9, 10 (1942).

The doctrine apparently had its start in the English case of Russell v. Men of Devon, 100 Eng. Rep. 359 (1788). The arguments offered in support of sovereign immunity are: it protects the public treasury; it ensures that officials are not fearful of carrying out their public duties; it ensures that citizens will be willing to take public jobs; it prevents citizens from improperly influencing the conduct of government; and it provides for the smooth operation of government. Messina v. Burden, 228 Va. 301, 308; 321 S.E.2d 657, 660 (1984).

The arguments in support of sovereign immunity have been widely criticized. The doctrine was discredited by the inconsistent and irrational manner in which courts granted or denied immunity. By the early 1980s, most

states had enacted statutes partially or completely waiving immunity(3). Virginia joined those states in 1981 with the enactment of Code of Virginia, Sections 8.01-195.1 to 195.8, the Virginia Tort Claims Act. The text of Sections 8.01-195.1-3 is reproduced in Appendix A.

The Tort Claims Act allows plaintiffs to sue the state and hold it liable for injuries caused by the negligent or wrongful act or omission of any state employee while acting within the scope of his or her employment. The state can be liable only if a private person would be liable. The amount recoverable for claims accruing prior to July 1, 1988, is limited to \$25,000. For claims accruing on or after July 1, 1988, a plaintiff may recover up to \$75,000. The language of the Act raises two crucial issues: when is an employee acting within the scope of his or her employment, and when would a private person be liable.

Scope of Employment

An employee acts within the scope of his or her employment if his or her act is either directed by the employer or a natural incident to the business, is performed with the intent to further the employer's interest, and did not arise wholly from some external or personal motive on the part of the employee. Kensington Assoc. v. West, 234 Va. 430, 432, 362 S.E.2d 900, 901 (1987).

Elements of a Negligence Claim

To hold the state liable for an employee's negligent act or omission, a plaintiff must show the same elements of negligence that would be required if the plaintiff were suing a private person. The plaintiff must show that the employee owed a duty of care to the plaintiff; the employee breached that duty; the plaintiff suffered an injury; the employee's breach was a proximate cause of the plaintiff's injury; and the plaintiff was not contributorily negligent(4). Specifically, to hold VDOT liable for a roadway defect, the plaintiff must prove that the defect was a dangerous result of a VDOT employee's breach of care; the defect caused the plaintiff's injury; and VDOT had constructive or actual knowledge of the defect.

Liability of VDOT Employees

The state insures its employees against tort liability for acts of simple negligence committed within the scope of employment. The state's insurance covers compensatory but not punitive damages. Thus, if a state employee is held liable for damages to compensate for loss resulting from an

act of simple negligence, the state must pay the judgment(5). Simple negligence is a loosely defined term meaning anything other than gross negligence. Gross negligence is defined as an act performed so carelessly as to show a complete neglect of another's safety. Frazier v. City of Norfolk, 234 Va. 388, 393, 362 S.E.2d 688, 691 (1987). The General Services Department's Risk Management Division does not rigidly adhere to legal definitions of terms such as gross negligence and scope of employment. Thus, the state may actually pay a claim against an employee that involves activity indicating a complete disregard of safety or that was not a natural incident to the work at hand. For the state to refuse to pay a claim clearly involving negligence, the employee's conduct must be willful and wanton and must demonstrate a complete lack of judgment without any extenuating circumstances(6).

The plaintiff must show the same elements of negligence as in a suit against the state, but there is no statutory limit on the amount recoverable in a suit against individual state employees. Whereas a suit against the state under the Tort Claims Act is limited to \$25,000 or \$75,000, a suit against an employee might recover millions of dollars. Regardless of the amount, the state would have to pay if the employee's act fit the criterion set forth above.

However, in order to hold a state employee liable, the plaintiff must show that sovereign immunity does not bar the suit. The four-factor test developed in James v. Jane, 221 Va. 43, 267 S.E.2d 108 (1980), continues to determine if state employees are entitled to immunity for acts of simple negligence. The four factors are

1. whether the act complained of involved the use of discretion
2. the nature of the function performed by the employee
3. the extent of the state's interest and involvement in the function
4. the degree of control and direction exercised by the state over the employee.

Courts make the determination of immunity by considering the four factors on a case-by-case basis. The case where an employee will most likely be protected by sovereign immunity is one in which the employee while exercising independent judgment performs a public function in which the state has a significant interest and exercises a great degree of control.

Discretionary/Ministerial Acts

Sovereign immunity is more likely to protect an employee if he or she

performs a discretionary act than if he or she performs a ministerial one. Discretionary acts involve the exercise of independent judgment in choosing from a range of alternatives. Ministerial acts, on the other hand, are performed "in a prescribed manner, in obedience to the mandate of legal authority, without regard to, or the exercise of, [one's] own judgment upon the propriety of the act being done." Dovel v. Bertrum, 184 Va. 19, 22, 34 S.E.2d 369, 370 (1945).

Virginia courts have held the following activities to be discretionary: selecting and adopting a plan for the construction of public streets, Freeman v. City of Norfolk, 221 Va. 57, 266 S.E.2d 885 (1980); failure to install traffic control devices, Hinchey v. Ogden, 226 Va. 234, 307 S.E.2d 891 (1983); maintenance of a manhole cover, Messina v. Burden, 228 Va. 301, 321 S.E.2d 657 (1984); and design and construction of a culvert, Bowers v. Commonwealth, 225 Va. 245, 302 S.E.2d 511 (1983).

Ministerial act cases can be divided into two categories. The first involves situations where a clear, generally accepted standard is available. In these cases, there is no need for the employee to exercise independent discretion. The other category involves situations where the appropriate action is so obvious that no standard is necessary. Actions that have been considered ministerial in other states include the following: adhering to clear lane-marking standards, Rogers v. State, 51 Ha. 293, 459 P.2d 378 (1969); and warning motorists of a 12-inch drop-off at a lane resurfacing project, Stanley v. State, 197 N.W.2d 599 (1972). These cases bear out the general rule that maintenance activities at the operational level are ministerial, whereas maintenance activities at the planning level are discretionary(7). Maintenance activities at the planning level involve choices of which work to do. Maintenance activities at the operational level involve the quality of the work done.

Governmental/Proprietary Functions

Sovereign immunity is more likely to protect an employee functioning in a governmental rather than a proprietary capacity. A distinguishing feature of governmental functions is that "the purpose of protecting the general public health and safety" is involved. Trans, Inc. v. Falls Church, 219 Va. 1004, 254 S.E.2d 62 (1979).

Virginia courts have held the following functions to be governmental: maintenance of traffic signals, Id. at 1006, 254 S.E.2d at 64; street cleaning, Fenon v. City of Norfolk, 203 Va. 551, 125 S.E.2d 808 (1962); bus operation, Tunnel District v. Beecher, 202 Va. 452, 117 S.E.2d 685 (1961); and construction and maintenance of public highways, Hinchey v. Ogden, 226 Va. at 238, 307 S.E.2d at 893.

State Interest

Sovereign immunity is more likely to protect an employee when there is such a compelling state interest in the employee's function as to justify a denial of the right to assert a claim against the employee. James v. Jane, 221 Va. at 54, 282, S.E.2d at 870. In Messina v. Burden, the court found that the state's interest in the maintenance of a manhole cover was so compelling as to entitle the employee to the protection of sovereign immunity. Messina, 228 Va. at 314, 321 S.E.2d at 664.

State Control

Sovereign immunity is more likely to protect an employee who is subject to a significant degree of state direction and control than one who possesses complete autonomy. Virginia courts have found the following activities to be subject to a significant degree of state control: maintenance of a manhole cover, Id. at 313, 321 S.E.2d at 664; and design and construction of a culvert, Bowers v. Commonwealth, 225 Va. at 253, 302 S.E.2d at 515. In Bowers, the court noted that the Culpeper resident engineer was a subordinate employee of the Virginia Department of Highways and Transportation. Id. at 253, 302 S.E.2d at 515.

Legal Trends

Two recent trends have the potential to affect VDOT's liability exposure. One is the courts' tendency to characterize fewer state employee activities as discretionary. The other is the recent increase in the monetary damage ceiling set by the Tort Claims Act.

Whether an act is discretionary or ministerial is an important consideration in deciding whether sovereign immunity will bar a suit against an employee. Although the discretionary/ministerial distinction has protected many state employees in the past, the law in this area is rapidly changing. Activities the courts once regarded as discretionary are being recharacterized as ministerial and subject to review. See, e.g., State v. Watson, 7 Ariz. App. 81, 436 P.2d 175 (1968) (failure to follow the Manual on Uniform Traffic Control Devices [MUTCD]). Atkinson v. County of Oneida, 77 A.D.2d 257, 432 N.Y.S.2d 970 (1980) (failure to review and update a traffic control plan). VDOT can anticipate an increased liability exposure for decisions formerly considered discretionary. Plaintiffs will continue to refine the arguments in support of their claims. The development of improved and precise standards will allow plaintiffs to characterize more activities as ministerial. The Virginia Work Area Protection Manual (February 1988) is an example of the well-organized and detailed standards that exist for many activities involving relatively high levels of risk(8).

Another important trend is the effort to raise the recovery limit set by the Tort Claims Act. This effort stems from a belief that the state is not paying enough in damage awards to tort claimants. The recovery limit was recently raised from \$25,000 to \$75,000 for claims based on activities occurring on or after July 1, 1988. This increase will result in more total damages being paid by VDOT because the possibility of larger recoveries will attract more plaintiffs.

CATEGORIES OF LIABILITY EXPOSURE

This section analyzes VDOT's exposure to tort liability as reflected in the claims filed against it. The claims are discussed in terms of the various types of risk. VDOT's responses to those risks are discussed in later sections. The purpose of the discussion is to identify common themes and to highlight the risk categories that pose a serious liability problem for VDOT.

Between July 1987 and December 1987, 304 claims under \$1,000 were filed against VDOT. Of these, 154 were paid; 114 of the claims involved equipment operations. Of claims involving equipment operations, 84 involved mowers; 74 of the claims involving mowers were paid. Thus, 48 percent of claims paying under \$1,000 involved mowing operations. The total amount paid for claims under \$1,000 between July 1987 and December 1987 was \$36,485.97(9).

A list of all claims over \$1,000 filed against VDOT from April 4, 1983, through June 30, 1988, is contained in Appendix B(1). For the purposes of this analysis, the claims were categorized according to risk type. The data in Table 1 provide a summary of the claims for each category.

The claims are categorized as follows:

- o Maintenance: Claimant alleges that VDOT was negligent in allowing the roads to deteriorate into a hazardous condition and that VDOT's negligence caused the injury.
- o General hazard: Claimant alleges that the injury was caused by some defect in the design and/or construction of the roadway and that VDOT had a duty to correct the defect. This category also includes claims that join allegations of negligent design and/or construction with allegations of negligent maintenance.
- o Work zone: These claims involve hazards associated with motorist safety in maintenance or construction zones. This category is

Table 1

Claims over \$1,000 Filed Against VDOT
April 4, 1983-June 30, 1988*

TYPE	CLAIMS DENIED			CLAIMS PENDING			CLAIMS PAID		
	No.	\$ Amt.	Avg. Amt.	No.	\$ Amt.	Avg. Amt.	No.	\$ Amt.	Avg. Amt.
Maintenance	81	6,738,462	83,191	37	6,050,764	163,534	12	51,862	4,322
General hazard	46	18,934,454	411,618	35	19,942,147	569,775	6	296,200	49,367
Work zone	10	216,651	21,665	12	7,417,533	618,128	7	11,178 [∞]	1,597
Operations	16	2,071,336	129,458	15	665,877	44,392	30	133,893	4,463
Miscellaneous	11	581,159	52,833	3	826,115	275,371	11	30,772	2,797

*See Appendix B for a detailed description of claims.

Claims in the general hazard category allege negligence in any of the following: design, construction, design and construction, design and maintenance, construction and maintenance, or design, construction, and maintenance. Of general hazard claims that have been closed, 11 percent were paid. Paid claimants in this category received 18 percent of the amount of their original claim.

General Hazard Claims

Although VDOT does not have a duty to bring all hazardous design conditions up to current standards, it clearly has a duty to maintain the road system so that it does not deteriorate into an unsafe condition. The data in Table 2 summarize maintenance claims according to the type of defect alleged. The two central issues in these claims are whether VDOT had notice of the defect; and once notice was received, whether VDOT responded in a reasonable manner to correct the hazard, or at least provided warning of it until a repair could be accomplished. Notice of and response to defects are discussed in the next section.

Maintenance claims are the most frequently filed type of claim. Of maintenance claims that have been closed, 13 percent were paid. Paid claimants in this category received 31 percent of the amount of their original claim. The term maintenance in this context is used in the narrow sense of roadway preservation or prevention of roadway deterioration. Common usage of the phrase "failure to maintain a safe roadway" often refers to situations that may be more accurately described as design problems. Design-oriented claims are described below as a subcategory of general hazards claims.

Maintenance Claims

- o Miscellaneous: This category includes claims that do not fit any other category.
- o Operations: These claims include injuries caused by VDOT employees while operating equipment in activities such as mowing, blasting, or ferry operations. Operations claims also include injuries unrelated to motorist safety that occur in work zones.
- o Limited to claims of improper traffic control, unsafe shoulders, and other hazards to motorists.

Maintenance Claims over \$1,000 Filed Against VDOT
 April 4, 1983-June 30, 1988

Table 2

TYPE	CLAIMS DENIED	CLAIMS PENDING	CLAIMS PAID
Loose gravel	6	1	1
Other debris in the road	10	7	1
Slick pavement	5	0	1
Ice/snow	9	2	3
Sign missing or obscured	5	6	0
Signal malfunction	8	1	1
Defective surface	2	1	0
Pothole	4	1	0
Flooding from clogged storm drain	7	2	0
Defective repair	4	1	0
Hazardous sidewalk	7	6	0
Standing water, dip or bump	4	3	0
Low shoulder	5	4	0
Other	4	4	4

Most of these claims fail because VDOT does not have a clearly defined duty to remove all existing hazardous conditions. It is by no means clear that VDOT has a duty to improve every highway that might be considered unsafe by today's standards or that has become unsafe because of changing conditions. The decision whether to improve an existing situation will generally be protected as discretionary. However, VDOT's defense for discretionary acts might not apply if the claimant can show that the condition has become manifestly dangerous.

The number of general hazard claims by risk type is indicated in Table 3.

Table 3

General Hazard Claims over \$1,000 Filed Against VDOT
April 4, 1983-June 30, 1988

TYPE	CLAIMS DENIED	CLAIMS PENDING	CLAIMS PAID
Defective traffic control	11	6	1
Dangerous intersection	8	2	1
Missing guardrail	1	3	1
Other	26	24	3

These claims are similar to maintenance claims in that the claimant alleges that a road defect existed and VDOT had a duty to correct it. General hazard claims differ from maintenance claims in that various divisions within VDOT are likely to be included as defendants. Maintenance claims generally involve residency personnel or traffic signal maintenance personnel at the district level, whereas general hazard claims may involve any VDOT personnel who make decisions affecting the roadway. Another difference is the means by which VDOT is expected to have notice of the defect. With maintenance claims, unsafe conditions may be identified through complaints from citizens, police, and VDOT employees. With general hazard claims, VDOT is expected to monitor the safety of the road system. VDOT personnel, especially in the residences, should be familiar with the areas in their jurisdiction that have a bad reputation for unsafe conditions. The primary means used to determine whether an existing

condition has become so hazardous that corrective action is warranted in detail through traffic records. The traffic records system is discussed in detail below.

Design Claims

VDOT is generally immune from liability for design decisions. Claimants have filed seven design claims, but none has been paid. The law in this area, however, is rapidly evolving. VDOT cannot expect blanket protection from design claims in the future. VDOT may be vulnerable in areas where clear design standards are available. For example, in the area of traffic control devices, a plaintiff could argue that a clear design standard such as the Manual on Uniform Traffic Control Devices(8) precludes the exercise of discretion.

Work Zone Claims

Work zone claims involve hazards to the motoring public in maintenance and construction zones and are usually associated with improper traffic control, uneven road surface conditions, or obstructions that block drivers' vision. Of work zone claims that have been closed, 41 percent were paid. Paid claimants in this category received 12 percent of the amount of their original claim.

Work zone claims differ from maintenance and general hazard claims in that work zone hazards arise while the work is underway. As of June 30, 1988, VDOT had paid six claims in excess of \$1,000 for injuries caused by work zone hazards. Five of these claims involved motor grader collisions. Claimants' low success rate in other work zone cases indicates that VDOT is complying with the standards established by the Virginia Work Area Protection Manual(10) and the Maintenance Division Policy Manual(10). The manuals provide clear, easily understood standards for traffic control around work zones.

Operations Claims

Operations claims involve allegations that VDOT personnel did not exercise due care while engaged in potentially hazardous activities such as moving, blasting, and ferry operations. This category also includes claims for injuries that occur in work zones but do not involve motorist safety. Of operations claims that have been closed, 65 percent were paid the highest claimant success rate. However, paid claimants in this category

received only 8 percent of the amount of their original claim. VDOT has standards for performing many of the tasks involved in these cases, but courts use a common sense, case-by-case evaluation to fix standards of care in operations claims.

Miscellaneous Claims

The miscellaneous category includes all claims that do not fit any other category. Of miscellaneous claims that have been closed, 50 percent were paid. Paid claimants in this category received 20 percent of the amount of their original claim. Miscellaneous claims often involve allegations of willful misconduct, such as using specifications that unfairly discriminate against certain suppliers, or employee harassment. The total number of miscellaneous claims and the dollar amounts awarded are low.

PRINCIPLES OF RISK MANAGEMENT

Risk management has been used in many industries to help reduce instances of loss and to control better the severity of any losses that might occur. VDOT can use risk management principles to reduce the loss caused by tort liability. This section introduces the general concepts behind risk management and describes the programs of other transportation departments to demonstrate the application of risk management techniques.

General Concepts

A risk management program should contain five basic steps:

1. Identifying the risks involves classifying the important sources of loss with which the program must deal.
2. Measuring the risks involves quantifying the magnitude of loss and the frequency with which that might occur.
3. Determining a method of controlling the risks involves choosing from a variety of risk management techniques, including avoidance, prevention, assumption, and transfer.

- 4. Implementing the method involves organizing and staffing the risk management function, formulating policies and objectives, and establishing specific projects and guidelines to meet risk management goals.
- 5. Monitoring the results involves ensuring that employees follow risk management guidelines and keeping records with which to evaluate the program's effectiveness(11).

Risk management programs usually involve the exercise of discretion in an environment of uncertainty. Risk management may be characterized as an ongoing data collection and analysis system to monitor operations and identify problem locations, select appropriate countermeasures, rank needs in order of priority, schedule improvements, and evaluate project and program effectiveness(12). Selecting appropriate countermeasures is one of the most important activities in the risk management program. The techniques appropriate for an agency will depend on the types of risks it faces and the magnitude of those risks(11).

Various techniques are available to control identified risks. Risk avoidance means refusing to engage in the risk-causing activity. Risk prevention means making the risk-causing activity safer. Risk transfer means shifting the risk to a contractor or insurance agency. Risk assumption means meeting losses from the agency's own financial resources, also known as self-insurance(11).

Regardless of risk type, two essential ingredients of an effective program are the commitment of management and follow-through at all levels. An effective risk management program must also include the following: a sense of agency commitment, effective claims management, accurate resource allocation, adequate personnel training, informed engineering decisions, and a means of promoting employee accountability and responsibility. Such a system minimizes risk by transmitting information about apparent and potential hazards to the parties responsible and holding them accountable for results(13).

The primary goal of a tort liability risk management program for a transportation agency is to reduce the number of injuries to persons and property caused by the actions or omissions of agency employees. The secondary goal of a tort liability risk management program is to reduce the amount of money paid to persons injured by the actions or omissions of agency employees. The achievement of the primary goal will help to achieve the secondary goal because a safer transportation system will lead to fewer lawsuits.

A tort liability risk management program benefits several activities, including planning and programming; design, construction, and maintenance; traffic engineering management; transportation of hazardous materials; and

training. The result is a safer transportation system and a minimized number of lawsuits. In addition, employees benefit from a risk management system because it reduces their risk of personal injury and liability.

Examples of Risk Management Programs

Several state and county highway departments have had problems controlling the number of lawsuits filed against them in recent years. On the state level, claims concerning the following have been most prevalent: pavement/shoulder defects, traffic control devices, work zones, geometrics, and traffic barriers(14). As a result, some departments have instituted programs modeled on the principles of risk management. Two jurisdictions that have initiated risk management procedures are discussed in this section: Oakland County, Michigan, and the Commonwealth of Pennsylvania.

The Board of County Road Commissioners for Oakland County, Michigan, has incorporated a risk management program as part of its highway safety management system. In order to emphasize the program's importance, the road commission initiated the "Safety First" program, which involved top management in highlighting the importance of safety in the department. After this program was underway, the department was reorganized to create functional offices and responsibilities to support safety enhancement. The new risk management organization included: an Executive Committee, a Program Coordinator, a Risk Management Coordinating Committee, a Safety Supervisor, a Risk and Insurance Analyst, and a Claims Technician. The new risk management approach included both risk identification and the four alternative elements in risk treatment (assumption, transfer, prevention, and avoidance). Projects implemented as part of the risk management program include a guardrail obstacle improvement program, an intensified winter maintenance program, and a shoulder paving program(15).

The Pennsylvania Department of Transportation (PennDOT) used risk management principles in reacting to the increasing number of lawsuits filed against the state resulting from highway incidents. The two principal objectives of the Liability Subcommittee of the State Transportation Advisory Committee were to assess the future outlook for tort claims and to evaluate the propriety and effectiveness of legislative or administrative changes to reduce the magnitude of claims. It was crucial for PennDOT to know the types of highway defects that accounted for the majority of tort claims or lawsuits in order to diminish the number of these tort actions. Survey results indicated that maintenance operations accounted for 75 percent of claims (shoulder drop-offs, isolated icy spots, deficient signing, inadequate or poorly maintained guardrails, and potholes). In addition, there was concern over how well management directives on tort liability were being implemented.

The Advisory Committee gave recommendations for improvements in five major areas: management control for tort liability prevention, risk management staffing in the department's central office, tort liability sample results, department and state/local police relationships, and serious tort incidents with a high degree of driver error.

The Advisory Committee made several recommendations. It proposed that at least one individual in the central office function as a full-time risk management official. The committee also suggested the development of guidelines to improve work zone safety. Increased awareness of the major causes of tort claims was necessary. The committee emphasized the importance of adequate maintenance records and follow-up procedures. PennDOT had to determine a cost-effective method for recording and maintaining the data necessary for a periodic analysis of tort claims. PennDOT's relationship with other agencies had to be defined. Finally, the committee recommended that the legislature amend the state code to minimize PennDOT's portion of joint and several liability claim awards(16).

RISK PREVENTION

VDOT presently engages in several activities aimed at preventing risks. Risk prevention means making the risk-causing activity safer. For VDOT, the risk-causing activity is the design, construction, and maintenance of roadways. Making that activity safer involves finding out about roadway defects and correcting or preventing them. This section discusses VDOT's risk prevention activities in terms of sources of information about roadway defects, response to notice of defects, and prevention of defects through standards for design and work safety.

Sources of Information About Defects

VDOT cannot afford to hope that roadway defects will go away or that courts will find that VDOT is not liable for defects of which it had no actual knowledge. VDOT must go on the offensive, aggressively seeking out roadway defects and quickly correcting them. To reduce the risk of tort liability, VDOT must obtain all information relevant to roadway defects and make that information available to those who can use it to correct the defects. This subsection discusses VDOT's current sources of information about roadway defects.

For the purpose of tort liability, "notice" refers to either actual notice or constructive notice. VDOT can be charged with constructive notice if the claimant can show that the defect existed for such a long time that

VDOT was negligent in not discovering it. Constructive notice can also be shown through prior incidents, reputation, or any other way the claimant can convince a jury that VDOT should have known about the hazard(17).

Constructive notice imposes a duty to discover hazards, although the exact scope of this duty is unclear. VDOT is not expected to know the current condition of the entire road system. On the other hand, some hazards should be anticipated without VDOT requiring actual notice. For example, a resident engineer should be on notice that a particular road floods during periods of heavy rain and should take appropriate precautions. VDOT may also be charged with constructive notice if a hazardous condition is the result of a lack of routine maintenance of such devices as traffic signals.

The Office of the Attorney General (OAG) has noted that there could be a liability problem if a defect arises in one VDOT district and other districts are not informed. Once VDOT employees are notified about a defect anywhere in the state, a plaintiff could argue that the entire department should be held with constructive notice of the defective condition. If the courts were to reach such a conclusion, the knowledge requirement of the negligence suit would be satisfied(18).

Cases where the claimant demonstrates actual notice are much clearer. VDOT has actual notice when a VDOT employee, in the course of his or her employment, discovers a hazardous condition or when someone from outside the VDOT provides notice. VDOT obtains notice of roadway defects from several sources.

Claims Information

In addition to the detailed files kept for each claim, VDOT's Claims Manager keeps a cumulative record of all claims filed against VDOT seeking over \$1,000(1). Figure 1 shows a typical page from this record. The OAG also prepares a quarterly report of pending claims for the Commissioner of VDOT(19).

This information might be very useful in notifying employees in the various residences of the types of defects of which they should beware. However, VDOT does not have a formal mechanism for disseminating claims information to its various functional and geographical divisions. Only those persons directly involved in an incident are in the information loop. For example, the resident engineer in Wytheville may not learn from the claims experience of his counterpart in Leesburg unless the incident is so serious that it is widely publicized.

OUTSTANDING CLAIMS AGAINST THE DEPARTMENT
REPORT COVERS PERIOD APRIL 4, 1983 TO SEPTEMBER 30, 1987

CASE NUMBER	DISTRICT/ RESIDENCY	AMOUNT OF SUIT	ESTIMATED CLAIM OR ADD'L COST	STATUS	AMOUNT PAID	DESCRIPTION
A70-848	NV/Fairfax			NON-SUIT		Original claim \$3,000.00.
	Case was non-suit against Dept.					Claimant tripped on cracked sidewalk causing personal injury. Original suit \$100,000.00.
A70-881	NV/Fairfax	\$450,000.00				Claimant injured in auto accident. Alleging department failed to maintain overpass in a safe condition.
A70-891	LY/Appomattox			DENIED		Claimant was a passenger in car that lost control due to ice on road. Suffered serious injuries. Original claim \$5,000.00.
	Denied by Attorney General's Office					
A71-025	NV/Manassas	\$100,000.00				Two vehicles collided at intersection. Claimant injured and alleging an unsafe intersection.
A71-062	NV/Fairfax			DENIED		Lost control of car, hit another car head on killing one. Claimant alleging improper maintenance of road. Original claim \$25,000.
	Denied by Attorney General's Office					
A71-107	BR/Lebanon			DISMISSED		Inmate alleges employee dumped him out of front end loader bucket injuring his back. Original suit \$1,500,000.00.
	Dismissed by Federal Court.					
A71-113	BR/Lebanon			DISMISSED		Inmate alleges cruel and unusual punishment requiring him to work in inclement weather, and be transported in a "dog house" in back of dump truck. Original suit \$75,000.00.
	Dismissed by Federal Court.					
A71-115	LY/Appomattox			CLOSED		Possible contamination of well from leaking fuel storage on Department Headquarters Lot. Original estimated claim \$4,000.00.
	Closed, no claim made.					
A71-125	BR/Lebanon	\$75,000.00				Tractor with sweeper broom created a cloud of dust causing a two car accident. Claimant alleged employee negligent, resulting in her injuries.
A71-200	BR/Lebanon	\$50,000.00				Excavation damaged building causing company to move.
A71-233	NV/Fairfax			PAID	\$1,849.40	Scaffolding that was leased for bridge repair by the Department was damaged or destroyed by flash flood. Original claim \$1,849.40.
	Claim paid by the Dept., not covered by insurance.					
A71-257	RI/Sandston			DENIED		Truck driver claims he hit a deep depression on I-64 causing head to strike the roof of truck resulting in serious injuries. Original claim \$10,000.00.
	Denied by Attorney General's Office.					

FIGURE 1. TYPICAL PAGE FROM VDOT CLAIMS MANAGER'S
CUMULATIVE CLAIMS SUMMARY

Traffic Records

Traffic records can be an effective tool in a risk management program. Good traffic records are useful in the planning of road improvements and in identifying potentially dangerous locations. Traffic records also serve an educational function by allowing VDOT personnel to study accident trends and characteristics in the state.

At the present time, VDOT does not have a comprehensive data management system for these records. Rather, the Central Office's Traffic Engineering Division keeps the records by using separate software packages. An effort is underway to integrate the records into a comprehensive package known as the Highway and Traffic Records Information System (HTRIS). HTRIS will offer distinct advantages over the current system because it will solve the compatibility problems that currently exist among the various programs now in use. However, the development of HTRIS is expected to take several years(20).

Crash data are particularly relevant to VDOT's risk management effort. The primary use of crash data is to identify dangerous locations. The Traffic Engineering Division compiles crash data from police reports filed with the Department of Motor Vehicles. The police reports are not open to the public. Data from the reports are used to create annual and monthly summaries for use by the districts. The summaries include statistical analyses of the data, which are intended to identify locations where the crash rate is higher than would be expected for the traffic volume at that location. The district engineers use this information to plan safety improvements. Reports generated by the Traffic Engineering Division are public information. An annual crash data report is compiled for public use. However, these annual reports do not include the results of statistical analyses performed by the traffic engineers(21).

The study of accident characteristics plays a vital role in identifying roadway defects. For example, an analysis of the effect of wet pavement on the accident rate at a particular location may indicate a defective pavement surface. VDOT's existing record system captures many accident characteristics such as weather conditions, time of day, and the like. Reports on accident characteristics are generated upon request, but there is no formal, ongoing effort to study the characteristics of all accidents. Rather, certain accident sites are investigated in connection with projects such as VDOT's Wet Skid Accident Reduction Program and the installation of recessed pavement markers to help identify lane markings(22).

One traffic engineer has expressed concern that accident characteristics are not completely described in the police reports. For example, when a police officer investigates an accident in a work zone, he or she may not identify it as a work zone accident because other factors such as intoxicated drivers were involved. Since the officer approaches the

accident from a different perspective than a traffic engineer would, the crash data may not accurately reflect the significance of work zone hazards(23).

Risk management requires a comprehensive inventory of the state's highways. An inventory system would be particularly helpful for scheduling the routine maintenance of traffic control devices, such as signs, signals, and markings. Several such inventory systems are currently in use or are being developed at the district level. When implemented, HTRIS will coordinate these activities, making the information readily available to all districts and divisions(24).

State and Local Police

State and local police play an important role in notifying VDOT of hazardous conditions. Since monitoring highway safety is a primary police function, the police are in a position to identify many hazardous conditions. Police officers involved with initial crash investigation lend valuable assistance in determining the causes of many accidents. The police often arrive first at the scene of accidents or other hazardous locations.

Crash Investigation Team

The Virginia Crash Investigation Team (Team) is a multidisciplinary group responsible for determining the circumstances and probable causes of selected transportation system crashes and mishaps. Formed in 1971 by the (then) Highway Safety Division, the Team currently operates as part of the Department of Motor Vehicles, Transportation Safety Administration. The Team is composed of a traffic engineer, a Virginia state trooper, and a graduate psychology student, with specialized advisory assistance from medical, engineering, and other personnel when needed(25).

The Team performs in-depth investigations of 25 to 30 crashes each year. Serious crashes are selected for investigation from the State Police Daily Activity Report. Most of the crashes investigated by the Team involve fatalities.

The Team analyzes an accident in terms of its components: the mechanical condition of the automobile(s), the mental and physical state of the driver(s), and the condition of the roadway. The Team looks for contributing factors to the crash, details of crash events, and data on postcrash developments. Information is drawn from the crash site inspection, the examination of vehicles, interviews with drivers and witnesses, and other techniques. The result of the investigation is an objective appraisal of the human, mechanical, and environmental factors

contributing to the crash. The Team's goal is to assist in the understanding and prevention of such tragedies.

Each year, the Team reports on about half of the crashes it investigates. Team reports make no references to specific persons or places but include pictures of the crash sites and vehicles involved. Reports narrate the crashes, provide conclusions, and give recommendations for preventive measures. However, the recommendations are not mandatory, and there is no formal follow-up procedure to determine whether there has been compliance with the recommendations. Some VDOT employees have commented that Team reports are too rare to be useful and that many reports give the same recommendations.

The Team distributes 500 to 550 copies of each report to federal, state, and local government personnel involved with highway safety. Federal agencies receiving the reports include the U.S. Department of Transportation and the Transportation Research Board of the National Research Council. State agencies in Virginia that receive Team reports include VDOT, State Police, Department of Education, Department of Health, and Department of Motor Vehicles (Transportation Safety Administration and Public Information Office). The Team also sends reports to local police departments and transportation safety commissions, which serve as the primary conduits of information from the Team to the public. Within VDOT, Team reports are sent to the Commissioner, Director of Operations, Traffic Engineering Division, Transportation Research Council, district engineers, and district traffic engineers.

The reports are used for engineering improvements, roadway environmental improvements, public education, operator and personnel training, emergency services, vehicle inspection standards, legislation, enforcement systems, and the identification of problems associated with drugs and alcohol(26).

Because the Team investigates only serious crashes, often involving multiple fatalities, many of those crashes investigated have the potential to result in civil litigation against the state. Although the reports do not include references to specific people or places, the small number of investigations, seriousness of the incidents, and detail of the reports often make it possible to identify the crashes involved. Accordingly, plaintiffs' attorneys seek to obtain information from the Team by two methods: discovery of the Team's reports under the rules of civil procedure, and testimony at trial by Team members as expert witnesses on the causes and circumstances of a crash.

Team reports and documents may be discovered and used as evidence by accident victims pressing personal injury claims under the Virginia Tort Claims Act. Section 8.01-402 of the Code of Virginia grants an evidentiary privilege to the Team for information concerning any statements made to Team

members during an investigation. However, the privilege does not apply where the state is a defendant since the purpose of the privilege is to ensure candid statements by witnesses rather than to protect the state from tort liability. At the federal level, the same argument was used to defeat the evidentiary privilege of the National Transportation Safety Board for cases in which the federal government was a defendant.

Testimony by Team members as expert witnesses is admissible as evidence subject to the ruling in Thorpe v. Commonwealth, 223 Va. 609, 292 S.E.2d 323 (1982) (extended to civil actions in Mary Washington Hospital, Inc. v. Gibson, 228 Va. 95, 319 S.E.2d 741 [1984]). In Thorpe, the court held that experiments on which an expert bases his or her opinion must be performed under conditions substantially similar to the conditions of the accident. Thus, if an accident investigated by a Team member involved "too many missing variables to permit the expert to give his opinion," Id. at 614, 292 S.E.2d at 326, that member would not be allowed to testify on the accident's probable cause(27).

The discoverability and admissibility of Team investigation evidence raise a serious dilemma regarding the Team's usefulness for risk management purposes. On the one hand, the discovery by the Team of the cause of a crash presents the opportunity to remedy the situation and reduce the state's liability risk by preventing similar crashes. On the other hand, Team material could be very damaging to the state's litigation posture if it served to put the state on notice of a defect that should have been corrected or indicated that the state was otherwise at fault in the design, construction, or maintenance of the roadway.

In terms of risk management, two real problems arise in connection with the Team. The first is how to further the Team's discovery of crash causes and increase dissemination of that information without increasing the risk that the information will be used against the state in litigation. Second, if Team information may be used against the state in litigation, the state must use the information to identify legitimate claims and settle them before money is spent on trials that the state would inevitably lose.

VDOT Accident Investigation

Until July 30, 1987, VDOT investigated the site of every fatal crash and completed a TE-13/AG-7 Report (see Appendix C) on the crash. Field engineers still investigate fatal crashes listed on the State Police Daily Activity Report. However, the investigators no longer complete a report on the crash. Instead, if they feel that the crash poses a threat of liability for VDOT or that the roadway contributed to the crash, they notify the OAG. The field engineers must (1) collect and keep on file any data needed to document the roadway conditions, and (2) take corrective action.

A review in conjunction with the OAG indicated that the TE-13/AG-7 Report was not required and that elimination of the associated paperwork would streamline the process. However, various VDOT personnel indicated that the TE-13/AG-7 Reports were very useful. The reports facilitated the identification and correction of specific hazardous locations and were educational in a more general sense. Some VDOT employees were of the opinion that if the investigations were performed by employees who were not directly affected by the incident, the reports would have been more candid(21).

Highway Helpline

Recently, the Commissioner identified a need for a system of citizen input that was positive, quick, and responsive to help identify defects in the highway system. As a result, the Highway Helpline (Helpline) was initiated as a means of demonstrating responsiveness to citizens' concerns and as a method for early detection of highway problems. The 800 number (1-800-367-ROAD) serves as a direct link to VDOT.

The Helpline operates between the hours of 8 a.m. and 5 p.m., Monday through Friday. When citizens call the Helpline during business hours, they speak with a VDOT representative on one of three lines available for use. If the call is made outside business hours, a recording informs the caller of the Helpline's hours and instructs the caller to contact the State Police if he or she has an emergency. The information from the conversation is documented on a form that includes the name and address of the caller, the location of the defect or problem, and how the caller learned about the Helpline. Subsequently, the caller is mailed a letter of thanks from the VDOT for taking the time to assist in the correction of potentially hazardous situations.

After the information is recorded on the Helpline's standard form, the document is telefaxed to the appropriate residency with instructions that the residency personnel contact the caller as soon as possible to elicit more specific information and to demonstrate that "VDOT is on the job." In the Helpline office, the form is filed as pending until a response on the matter is received from the residency. If a response is not received in two weeks, Helpline personnel call the residency to inquire on the status of the work. When the work is completed, the matter is closed in the Helpline office, and the report is placed in the completed file.

The Helpline averages approximately 950 calls per month (not including the increase in calls on snow days). Many of the calls in the spring concern potholes. The calls in the winter are usually made by people concerned about road conditions. However, the Helpline receives many calls inquiring about information that the Helpline does not provide. Citizens apparently believe that the Helpline caters to any inquiries about highway

travel. Many have asked to be "routed" to various locations, to have their cars jump-started, for a weather forecast, and for an evaluation of restaurants in West Virginia.

Another problem is that in some situations a citizen might desire to call the residency directly; however, since the Helpline number is more accessible, it is the first number called. It should also be noted that the completed file of information stored in the Helpline office is never used. VDOT may benefit by analyzing the type of calls, the locations of the defects, and the frequency of calls(28).

Routine Maintenance

Some district engineers have implemented systems for planning and documenting the routine maintenance of traffic control devices. These systems can provide good records for legal defense purposes as well as improve the overall maintenance of the traffic control devices. The system used in the Culpeper District is a good example of a comprehensive traffic signal maintenance system. The system provides for the documentation of any reports of problems and the response to those reports. Routine maintenance of each signal is also scheduled and documented. Reports of defective signals have decreased drastically since the scheduled maintenance system was implemented, although part of the decrease may be attributed to technological improvements in traffic control equipment(29).

Expected Value Analysis

The Federal Highway Administration has developed a systematic, scientific method of identifying potentially hazardous roadway locations. The method is called "expected value analysis" and involves collecting, categorizing, and analyzing roadway data in terms of a variety of factors. VDOT is currently in the process of implementing a system of expected value analysis. The system is expected to be working by early 1989.

The system will collect data on various locations from all districts. The data will then be categorized by traffic volume and type of intersection: signalized or unsignalized, controlled or uncontrolled, and divided or undivided. The categories will then be analyzed in terms of a range of factors, such as weather conditions, day of week, etc. For each factor and type of location, the system will identify a maximum accident rate. For locations with an accident rate higher than that set by the expected value analysis, the system will list countermeasures.

District personnel will then be notified of problem locations for which they should be on the lookout. When a problem location is identified, personnel in the field will determine a cost/benefit ratio for

appropriate countermeasures. If the cost/benefit ratio is less than 1, the countermeasures will be funded by the federal government's Highway Safety Improvement Program.

There is no plan to enforce response by district personnel to notification of problem locations. Rather, the Traffic Engineering Division will informally monitor the districts and encourage them to document the reasons particular locations are left alone. The Traffic Engineering Division expects to update the data on one third of the state each year(24).

Expected value analysis will improve on the present "critical rate" analysis because expected value analysis takes into account all factors relevant to a crash. Critical rate analysis takes into account only the total number of crashes. Expected value analysis is systematic and will be used consistently statewide. Thus, expected value analysis will leave less to traffic engineers' independent judgment. Independent judgment can often lead to inconsistent results and is hard to defend in court. Moreover, fewer activities involving independent judgment are being characterized as discretionary and immune from suit(30).

VDOT can no longer rely on sovereign immunity to protect engineering decisions. Therefore, a consistent, defensible alternative to independent judgment should be developed for engineering decisions in high-risk areas. Since expected value analysis not only identifies high-risk areas but also is consistent and can be easily presented in court, it may provide a suitable alternative.

Response to Notice of Defects

At the present time, no uniform policy exists for handling complaints from either inside or outside VDOT. The methods of receiving and responding to these calls are generally the prerogative of resident engineers.

Typically, when a call is received by a resident engineer's office, the person receiving the call will decide which section within the office should respond to the call, and a written or oral message will be given to the appropriate person for corrective action. Generally, no record of the call will be kept, and there is no follow-up mechanism to ensure that the situation has been rectified. The system relies on the trust that VDOT personnel have in fellow employees to handle problems in a conscientious manner(10).

Accurate record keeping is essential for establishing a defense in court. Although most residencies do not have a system for logging complaint calls, the actual maintenance activities are thoroughly documented at the

Area Headquarters. These records show the time, location, and exact nature of each maintenance task(6).

Fairfax is one of the residencies that have implemented a system for logging all complaint calls and for following-up to ensure that each complaint is resolved. The Fairfax Residency's follow-up mechanism consists of a form that is completed by Area Headquarters personnel and returned to the resident engineer's office when a complaint is resolved. The system has not been in service long enough to allow the determination of whether the response to complaints has improved. The Fairfax resident engineer anticipates that a side benefit of the system will be a complete historical record of maintenance tasks that can be used for planning purposes(31).

The relatively low number of successful maintenance claims against VDOT indicates that the present system works well in fulfilling the primary goal of risk management: to increase safety by minimizing roadway defects. The system is perhaps less than ideal in meeting the secondary risk management goal of improving VDOT's legal position in defending itself from lawsuits. For this purpose, an ideal system would have well-established procedures for responding to road hazards and would provide for complete documentation so that VDOT could demonstrate that its response was reasonable.

Although a comprehensive documentation system would be ideal in terms of defending against lawsuits, it is not clear that such a system would work well in practice. Interviews with residency personnel did not indicate a strong need for such a system, and there was an indication that attempts to formalize the system could meet with resistance from maintenance personnel. One situation where a thorough record-keeping system seems to work well is in connection with items that require routine maintenance, such as traffic control devices. It is clear that if any record-keeping system is implemented, it must be comprehensive and used properly. If a record-keeping system appears to be haphazard, it will not have credibility in court. It is important to note that the OAG can use the documentation to show that VDOT did not have notice. Proving lack of notice in this manner is more difficult for VDOT than it is for a plaintiff to show notice. Also, a system that records complaints without providing for positive follow-up would seem to benefit plaintiffs in tort actions(32).

There is no formalized procedure for ensuring that VDOT personnel respond to notice of roadway defects in a reasonable manner. Again, the existing system relies on the judgment and conscientiousness of individual employees(29). The Maintenance Division Policy Manual(10) sets out priorities in general terms, but in practice, maintenance personnel in the field decide how and when to respond to a particular hazard. Most of these decisions are made by area superintendents on the basis of available equipment and staffing and in light of other, more serious problems that may exist at the time. Resident engineers expressed doubts that improvements could be made by the formalizing of the priority-setting process. Such a

system would be unable to account for all the relevant factors without relying on the judgment of area superintendents(33).

Another issue related to the reasonableness and speed of VDOT's response is whether the repair or warning provided was done properly. There have been five claims alleging defective repair, none of which was successful. In order to prevail on such a claim, the plaintiff must show that the repair did not comply with the standards outlined in the Maintenance Division Policy Manual(10) or that those standards were grossly inadequate.

Preventing Defective Conditions

VDOT prevents many defects through design criteria and the monitoring of employee work safety. While notice of and response to defects provide the primary means of preventing maintenance claims and many general hazard claims, the keys to preventing design claims are ensuring that design standards are consistent with the state of the art and documenting the reasons for deviations from the standard.

The existing design review system addresses both of these concerns, although there is no foolproof method to ensure that designers thoroughly document every deviation. VDOT's Road Design Manual (34) and Road and Bridge Standards (35) provide a comprehensive set of design criteria. The criteria are frequently updated to stay abreast of industry standards. The updates are achieved through periodic revisions and interim Instructional and Informational Memoranda (IIM). Although the standards are comprehensive, they cannot cover every situation. The General Notes on page 701.00 of the Road and Bridge Standards (35) make it clear that engineering judgment is the key element in roadway design. The notes are instructive as to the types of engineering judgments that go into a design. The following is an example:

Roadway designs shall be formulated utilizing geometric elements that are conducive to safety. [The] tables [contained herein indicate] preferred and in some instances the minimum elements to be utilized. The application of these values contained in the table must be made in conjunction with sound evaluation of these facts and engineering judgement to effect the proper solution. The economic, environmental and social factors involved in highway design shall also be considered.

Where it is impractical or not economical to obtain the minimum design as shown in these tables permission shall be secured from the state location and design engineer for recommended changes in design.

On federal [sic] funded projects all decreases from minimum standards shown herein shall be agreed upon in writing with the Federal Highway Administration.

The geometric standards were obtained from the AASHTO Policy on Geometric Design of Highways and Streets which indicated a design speed range for each functional classification. The standards reflect the design speed at the high end of the speed range and in most instances is coupled to a terrain classification. However, the terrain classification is just one of several factors involved in determining the design speed of a highway(35).

Often, compliance with the design standards is prohibitively expensive because of terrain, right of way, and other restrictions. In such cases, the designer must document the reasons for deviation from the standards. Generally, justification involves balancing competing concerns. The trade-off is between either construction costs and motorist convenience or construction costs and motorist safety. Although the extent of a designer's immunity from liability for the consequences of such design decisions is not clear, the balancing of competing factors is obviously a serious matter(36).

In some situations VDOT has a specific procedure for striking this balance. The IIM reproduced in Appendix D is an example of such a procedure. This IIM provides a method for quantifying the trade-off between guardrails and clear zones on roadsides and is based on the cost per mile for a given level of safety. In other situations encountered by designers, the trade-off will require more judgment on the part of the designer because standardized methods cannot account for every contingency. VDOT's best protection in these situations is a thorough design review and documentation process as specified in the Road Design Manual(34).

VDOT attempts to prevent claims associated with work zones and equipment operations by establishing safety standards and monitoring compliance with those standards. Examples of these standards are the Virginia Work Area Protection Manual(8), the Maintenance Division Policy Manual(10), and traffic safety plans.

Traffic safety plans for construction projects are included in the construction plans. Traffic engineers are responsible for ensuring that the designs comply with applicable standards. To ensure compliance with the design standards, four units within VDOT have responsibility for the oversight of work zone safety: resident engineers' offices, Employee Safety and Health, Management Services, and district engineers. The inspectors from the resident engineers' offices have primary responsibility for work zone safety.

The Office of Employee Safety and Health has regional safety officers stationed in a number of locations throughout the state. VDOT has increased its staff of regional safety officers to assist in inspection of work zones. The safety officers are primarily concerned with monitoring employee safety. In doing so, they indirectly monitor motorist safety. The two functions are inseparable: if conditions around a work zone are unsafe for employees, they are unsafe for motorists as well(37).

Quality assurance personnel from the Management Services Division are responsible for monitoring the performance of contractors to ensure compliance with contract documents, including compliance with the traffic control specifications. VDOT is expanding its Quality Assurance Program and increasing its staff to conduct on-site reviews of several hundred projects. A major focus will be on adherence to work zone safety principles(20).

Management Services Division inspectors use a comprehensive checklist that includes all aspects of contract compliance. If the inspector notes an unsafe condition, he or she will notify the resident inspector or someone else who can take appropriate corrective action.

District personnel are only indirectly involved in monitoring work zone safety. During the course of their oversight of construction projects, district engineers or their subordinates will note unsafe conditions and take steps to ensure that the problems are resolved(37).

RISK TRANSFER

One method VDOT presently uses to help limit its tort liability exposure is transferring risk to other parties. VDOT's risk transfer efforts consist of indemnity agreements and insurance.

Indemnity Agreements

Indemnity, or "hold harmless," agreements are found in contracts VDOT enters into with construction contractors and design consultants. In construction contracts, indemnity agreements are found in the text of the contract and in various provisions of the Road and Bridge Specifications(38). The Specifications are included by reference in every construction contract. Section 107.13 of the Specifications provides that contractors shall indemnify and save harmless the state and its employees from suits brought due to any act or omission, neglect, or misconduct on the contractor's part. In other words, the contractor agrees to be the sole party responsible for its own negligence. Similar provisions are found in

contracts with design consultants, but VDOT contracts for only 16 percent of its design needs.

The result of these indemnity agreements is that VDOT is exempt from third party lawsuits brought by people injured by the negligence of a contractor or consultant. However, VDOT may be liable for damages caused by a faulty structure if the construction was done according to VDOT design specifications(39).

Insurance

VDOT also shifts risk to road contractors by requiring them to carry insurance. VDOT's construction specifications require road contractors to carry adequate liability insurance to cover any claims associated with their work. Bidders must submit certificates of insurance with their bids. VDOT generally does not receive a copy of the actual policy until some time after the certificate is received. VDOT functions as a client of road contractors' insurers. Policy coverage is firm-specific. However, inspection of these policies often reveals exclusions in the coverage that can substantially increase VDOT's liability exposure.

State-furnished "wrap-up" insurance has been suggested as a solution to the exclusions problem. Wrap-up insurance provides project-specific coverage for the state, contractor, subcontractor, and others involved in a construction project. The main advantages of such a policy are potential cost savings and an improved level of coverage. The cost savings are achieved through the lower rates offered to buyers of policies with large coverage limits. The umbrella coverage provided by wrap-up insurance also eliminates redundant services associated with having each subcontractor provide its own insurance. Wrap-up insurance provides improved service because there is only one policy to monitor and only one insurance company with which to deal in the event of a claim.

Road contractors tend to resist wrap-up insurance unless they are having trouble getting insurance themselves. The main complaints are that wrap-up insurance increases the complexity of the bidding process and disrupts ongoing relationships with current insurance carriers. Much of the savings potentially gained by the wrap-up policy is lost when road contractors need to keep their existing policies to insure other jobs not covered by the wrap-up policy.

Wrap-up insurance was considered and rejected in a 1987 study by VDOT's Office of Policy Analysis. Wrap-up insurance provides significant premium savings only for projects costing more than \$50 million. VDOT's six-year plan has 10 projects costing more than \$50 million, two of which are under

construction. Other states have considered combining several projects into one wrap-up policy but have decided against it for various reasons.

Another complaint voiced about state-furnished insurance is that it removes incentives for road contractors to be careful because they are not paying the insurance premiums. Although this may be a valid complaint, it is important to recognize that other incentives for care influence contractor behavior. These incentives include the desire to protect a firm's reputation and the need to adhere to safety regulations such as those promulgated by OSHA. Also, the increased insurance costs associated with careless firms might be passed to those firms through the procurement process(40).

Claimants often request VDOT's assistance in resolving claims against road contractors. VDOT has established procedures for handling such claims. Resident engineers investigate the claims to determine their validity. Copies of documents generated as a result of the investigations are sent to the OAG. If a claim is valid, VDOT will either withhold the amount from future payments until the claim is resolved or make the restoration and deduct the cost from future estimates(41).

RISK ASSUMPTION

VDOT assumes the portion of risk that it cannot prevent or transfer. VDOT prepares for potentially successful claims in two ways. First, VDOT has a many-tiered claims process that attempts to identify and settle legitimate claims. Second, VDOT sets aside money to pay successful claims in the state's tort liability self-insurance fund.

Claims Process

The procedures used in making claims against the state are written in the Claims Manual(42) published by VDOT. This portion of the report discusses the Claims Manual and describes the actual functions of the major parties: the OAG, the Claims Manager, and the General Services Department's Division of Risk Management.

Claims Manual Requirements

The preface to the VDOT Claims Manual(42) states that the manual was developed to provide VDOT employees with a useful reference and guidelines for the handling of workers' compensation, vehicle accidents, claims

against VDOT and requests for legal representation for employees. For the purpose of this report, the section of concern is entitled "Tort Liability Claims Against the Department." Claim filing and claim processing are discussed below. The principal players in the claims process are the OAG, VDOT's Claims Manager, and the Division of Risk Management. The duties and responsibilities of these three entities are set by Virginia state law and the Claims Manual.

Claims Process in Action

In order to develop an understanding of the claims process, an imaginary claim will be created and followed through the process. Assume that a VDOT act or omission was the alleged cause of a citizen's accident. The citizen decides to seek compensation from the VDOT for personal injuries and property damage. The citizen can initiate a claim by contacting the Claims Manager or the VDOT residency office where the accident occurred. The residency personnel send the information to the Claims Manager. The Claims Manager reviews the claim and makes his or her recommendation to the OAG to pay compensation or to deny the claim. If the OAG agrees that the claimant should be compensated, it requests a check from the General Services Department's Division of Risk Management.

If, however, the OAG does not have sufficient information to take a position on the claim, it will request additional information from the Claims Manager. The Claims Manager then contacts the residency of the accident's occurrence and asks that the resident engineer investigate the scene, examine the police reports, and send information to the Claims Manager stating VDOT's interpretation of the strength of its legal position. The Claims Manager subsequently transmits the crash investigation information to the OAG. When the OAG examines the claim and the information received, it determines whether to settle or deny.

If the OAG denies the claim, the claimant may then decide to file a suit against VDOT. Any suit against VDOT must be filed with the OAG's Division of Judicial Affairs. If the claimant is seeking a large compensation, the suit would probably have been filed in the initial stages, and the contact with the residency or Claims Manager would have been bypassed. The Judicial Affairs Division is separate from the OAG's Finance and Transportation Division, which does not litigate suits but serves as VDOT's general counsel. Each OAG division retains files of all claims that come through its office. The Judicial Affairs Division manages suits against all state agencies.

The Judicial Affairs Division may decide that VDOT should not fight the suit and that the suit should be settled. If so, compensation is paid, and the case is closed. However, if there is not enough information to make a decision to settle or the Judicial Affairs Division decides that the state

should fight the suit, the OAG goes through the same information-gathering process described for claims. If the OAG denies the suit, the claimant may desire to litigate, depending on the claimant's belief in the strength of his or her case. After examining the information from the residency, the plaintiff's lawyer may decide to drop the suit.

If the OAG's denial leads to litigation, any VDOT employee may be called to testify depending on the evidence that is needed in support of VDOT's position and on the VDOT employee's expertise and responsibilities.

If VDOT wins the suit and the plaintiff does not appeal, the issue is closed. However, when the OAG loses the suit, it requests funds from the Division of Risk Management to compensate the plaintiff. Regardless of the outcome, a copy of the final disposition of the case is sent to the Claims Manager, who in turn transmits the information to the district and resident engineers of the location in question. Finally, the information is recorded, and the case is closed. Each district uses the information for its own purposes(9).

Self-Insurance

The state insures itself and its employees against liability for torts committed on the job. Tort damage awards against VDOT are paid from a fund operated by the Risk Management Division of the General Services Department. The fund is created from contributions paid by all state agencies each year. For 1988-89, each agency pays \$30.60 per employee, regardless of the number of torts the agency commits. The contribution amount is based on forecasted needs for the coming year. All agencies pay the same amount, because it is difficult to predict each agency's proportional share of the state's total tort liability. As of June, 1988, the tort liability fund consisted of approximately \$7 million(5).

FINDINGS

This report documents the findings of the initial phase of VDOT's risk management project. The purpose of this phase was to assess VDOT's exposure to tort liability and to document VDOT's current approach to managing risks. In a subsequent phase, the findings discussed herein will be used to design an improved risk management system.

VDOT faces a growing tort liability problem. Presently, VDOT is liable for up to \$75,000 for negligent or wrongful actions/omissions committed by its employees within the scope of their employment. VDOT must also pay

judgments rendered against its employees as individuals for acts of negligence committed within the scope of employment. However, no judgment may be rendered against an employee if he or she is protected by sovereign immunity. Sovereign immunity will protect an employee if he or she uses discretion, acts in a governmental capacity, is subject to state control, and performs a function in which there is a significant state interest. When a VDOT employee is personally liable for such acts/omissions, there is no limit on the amount of damages VDOT may have to pay. Courts are increasingly willing to hold agencies like VDOT and their employees liable for negligent acts/omissions committed within the scope of employment. Improved standards and refined tactics are combining to increase VDOT's exposure to tort liability.

Claims against VDOT and its employees can be broken into five categories:

1. Maintenance claims are the most frequently filed, but only 13 percent are paid. The average payment is \$4,322.
2. Only 11 percent of general hazard claims are paid, but the average payment exceeds \$49,000. Decisions whether to improve existing locations are usually protected as discretionary. No design claim over \$1,000 has been paid, but deviations from improved standards may pose a threat in the future.
3. Seven work zone claims have been paid. The average payment is \$1,597.
4. Claimants are paid in 65 percent of operations claims. The average payment is \$4,463. VDOT has standards for performing the tasks most commonly associated with operations claims, but courts adopt their own standards of care in these cases. Operations claims account for 66 percent of claims paid under \$1,000.
5. Claimants are paid in 50 percent of miscellaneous claims but recover an average amount of only \$2,797. Miscellaneous claims often involve intentional torts.

Many industries and government agencies have used risk management concepts to reduce loss caused by tort liability. VDOT must also take steps to control the risk of tort liability. It has taken some steps already.

First, VDOT has attempted to make the design, construction, and maintenance of roadways safer and less likely to result in tort liability. VDOT's efforts in this area consist of finding out about roadway defects, responding to notice of defects, and preventing defects.

VDOT receives notice of roadway defects from several sources:

- o VDOT's Claims Manager keeps detailed records of claims information. However, the current system does not provide for agencywide dissemination of important information produced by the investigation and resolution of claims.
- o Traffic records are compiled by the Traffic Engineering Division, which sends summaries of crash data to the districts. However, there is no statewide effort to develop a comprehensive inventory of the state's highways. A comprehensive data management system for traffic records will take at least two years to develop.
- o State and local police provide first-impression hazard information.
- o Crash Investigation Team reports thoroughly describe 10 to 20 accidents per year but may be used against VDOT if they indicate VDOT is at fault.
- o VDOT field traffic engineers investigate some accidents, but there is no formal selection criteria.
- o The Highway Helpline provides a way for citizens to call defects to VDOT's attention. However, many callers do not understand the Helpline's purpose. The completed file of information is not used for analyzing the type and frequency of calls or the locations of defects.
- o Routine maintenance provides some districts with notice of defects and also provides good records for legal defense purposes. However, not all districts have implemented routine maintenance systems.
- o Expected value analysis identifies high-risk locations by comparing similar locations throughout the state. However, there is no plan to monitor the manner in which field personnel use the results of expected value analysis.

The choice of methods of responding to notice of defects are the prerogative of resident engineers. Some residencies have implemented systems for documenting all calls and following-up on the response. However, there is no formalized procedure for ensuring that VDOT personnel respond to notice of roadway defects in a reasonable manner. Personnel in the field set their own priorities.

VDOT prevents many defects through design and work safety standards. Design criteria are frequently updated to stay abreast of industry standards, but the best protection is a thorough design review and

documentation process as specified in the Road Design Manual(34). VDOT is expanding its effort to improve work zone safety.

Second, VDOT has attempted to transfer some tort liability to contractors and consultants. One method of risk transfer is the contractual indemnity agreement. However, even in the presence of an indemnity agreement, VDOT may be liable if a contractor builds according to faulty specifications furnished by VDOT. The other risk transfer method used by VDOT is the requirement that road contractors carry their own insurance. One problem with this method is that the road contractors' policies often contain many exclusions.

Finally, VDOT assumes the portion of risk that it cannot prevent or transfer. VDOT has established a tiered claims process that attempts to identify and settle legitimate claims and to deny illegitimate ones. The process is very successful at settling legitimate claims, but it might be expedited by eliminating redundant steps. VDOT also insures itself against tort liability by setting aside money in the state's tort liability fund. One problem with self-insurance is that the fund contains only \$7 million and must cover all claims against the entire state, and outstanding claims against VDOT alone total more than \$32 million.

CONCLUSION

In order to control tort liability, VDOT should coordinate and improve existing risk management efforts and make additional efforts where necessary. By establishing a comprehensive risk management program that addresses the problem areas identified herein, VDOT can (1) reduce the number of injuries attributed to the carelessness of its employees, (2) improve its ability to defend tort claims, and (3) better prepare for claims that must be paid.

REFERENCES

1. Virginia Department of Transportation. (1988, June). Outstanding Claims Against the Department. Richmond, Va.
2. Taylor, E. W. (1981). "A Re-examination of Sovereign Tort Immunity in Virginia." 15 University of Richmond Law Review 247.
3. Kuhlman, R. S. (1986). Killer Roads: From Crash to Verdict. Charlottesville, Va. The Michie Company.
4. Larson, D. F. (1987, September). Tort Liability and Risk Management. Cornell Local Roads Program. Report No. 87-4. Ithaca, N.Y.
5. Kaulfers, A. Jr., (1988). Personal correspondence. Virginia Department of Transportation, Division of Risk Management, Department of General Services.
6. Beall, J., Jr. (1988). Personal correspondence. Commonwealth of Virginia, Office of the Attorney General, Finance and Transportation Division.
7. Transportation Research Board. (1975, September). Personal Liability of State Highway Department Officers and Employees. Research Results Digest 79. Washington, D.C.: National Research Council.
8. Virginia Department of Transportation. (1988). The Virginia Supplement to the Manual on Uniform Traffic Control Devices. Richmond, Va.
9. Street, E., Claims Manager (1988). Personal correspondence. Virginia Department of Transportation, Administrative Services Division.
10. Virginia Department of Transportation. (1978). Maintenance Division Policy Manual. Richmond, Va.
11. Greene, M. R., and Serbein, O. N. (1978). Risk Management: Text and Cases. Reston, Va.: Reston Publishing Co.
12. Reed, G. L. (1985). "Transportation Liability and Risk Management." Effectiveness of Highway Safety Improvements. New York, N.Y.: The American Society of Civil Engineers, p. 92.
13. Weber, H. T. (1979, October). "Implementation of a Practical Risk Management Program." 26 Risk Management 10.

14. Anderson, R. W. (1984). "Risk Management and Governmental Tort Liability." Reprinted in Highway Hazards: Correction, Protection, and Liability. Springfield, Va.: TranSafety, pp. 2-7.
15. Bair, B. O., Foginini, W. J., and Grubba, J. L. (1979). "Highway Risk Management: A Case Study." Birmingham, MI: Oakland County Road Commission.
16. Gittings, G. L. (1985). "Experience and Response to Tort Liability in the Pennsylvania Department of Transportation." University Park, Pa.: The Pennsylvania Institute.
17. Piunik, S. I. (1986). Tort Liability. Action Guide Series. National Association of County Engineers, Miami Fl. pp. 6-1, 6-2.
18. Dixon, F. A. (1988). Personal correspondence. Commonwealth of Virginia Civil Litigation Section, Judicial Affairs Division, Office of the Attorney General.
19. Commonwealth of Virginia, Office of the Attorney General. (1988, April). Quarterly Report of Tort Claims Against the Department or Its Employees. Richmond, Va.
20. Virginia Department of Transportation, Traffic Engineering Division. (1987). Annual Report: Highway Safety Improvement Programs. Richmond, Va. pp. 36-37.
21. Small, F. F. (1988). Personnel correspondence. District Traffic Engineer. Virginia Department of Transportation.
22. Butner, J. L. (1988). Personal correspondence. Traffic Engineering Division, Virginia Department of Transportation.
23. Tackett, W. E. (1988). Personal correspondence. Traffic Engineering Division, Virginia Department of Transportation.
24. Ambler, M. E. (1988). Personal correspondence. Traffic Engineering Division, Virginia Department of Transportation.
25. Virginia Department of Transportation, Department of Motor Vehicles. Crash Investigation Team. (1988). Report No. 162. Richmond, Va.
26. McAllister, D. O., Manager (1988). Personal correspondence. Crash Investigation Team, Virginia Department of Motor Vehicles.
27. Sharkey, S. M. (1986). Disclosure and Use of Information Held Virginia Crash Investigation Team: Analysis and Recommendations.

Unpublished report. Charlottesville, Va.: Virginia Transportation Research Council.

28. South, L. J. (1988). Personal correspondence. Virginia Department of Transportation, Office of Public Affairs.
29. Roosevelt, D. S. (1988). Personal correspondence. Virginia Department of Transportation, Resident Engineer, Charlottesville Residency.
30. Bridewell, T. A. (1988). Personal correspondence. Virginia Department of Transportation, District Traffic Engineer, Richmond District.
31. Bailey, A. V. (1988). Personal correspondence. Virginia Department of Transportation, Resident Engineer, Fairfax Residency.
32. Messitt, P. R. (1988). Personal correspondence. Office of the Attorney General, Commonwealth of Virginia, Finance and Transportation Division.
33. Kanode, P. S., (1988). Personal correspondence. Virginia Department of Transportation, Resident Engineer, Manassas Residency.
34. Virginia Department of Transportation. (1988). Road Design Manual. Richmond, Va.
35. Virginia Department of Transportation. (1986, January). Road and Bridge Standards. Richmond, Va.
36. Mannell, R. A. (1987). Personal correspondence. Virginia Department of Transportation, Location and Design Division.
37. Varga, C. W. (1988). Personal correspondence. Virginia Department of Transportation, Employee Safety and Health.
38. Virginia Department of Transportation. (1988). Road and Bridge Specifications. Richmond, Va.
39. Mannell, R. A. (1988). Personal correspondence. Virginia Department of Transportation, Location and Design Division.
40. Virginia Department of Transportation, Office of Policy Analysis. (1987). Wrap Up Insurance. Richmond, Va.
41. Gee, C. F. (1988). Personal correspondence. Virginia Department of Transportation, Construction Division.
42. Virginia Department of Transportation, Administrative Services Division. (1988). Claims Manual. Richmond, Va.

APPENDIX A
VIRGINIA TORT CLAIMS ACT

Article 18.1 Code of Virginia
Torts Claims Against the Commonwealth of Virginia

Sec. 8.01-195.1. Short Title. - This article shall be known and may be cited as the "Virginia Tort Claims Act." (1981, c. 449.)

Sec. 8.01-195.2. Definitions. - As used in this article:

"Agency" means any department, institution, authority, instrumentality, board or other administrative agency of the government of the Commonwealth of Virginia or any transportation district created pursuant to Chapter 32 (sec. 15.1-1342 et seq.) of Title 15.1 and Chapter 630 of the 1964 Acts of Assembly; and

"Employee" means any officer, employee or agent of any agency, or any person acting on behalf of any agency in an official capacity, temporarily or permanently in the service of the Commonwealth or any transportation district thereof, whether with or without compensation; and

"School boards" as defined in subdivision 5 of sec. 22.1-1 are not state agencies nor are employees of school boards state employees.

"Transportation district" shall be limited to any transportation district or districts which have entered into an agreement in which the Northern Virginia Transportation District is a party with any firm or corporation as an agent to provide passenger rail services within such district or districts while such firm or corporation is performing in accordance with such agreement. (1981, c. 449; 1986, cc. 534, 584.)

Sec. 8.01-195.3. Commonwealth transportation district or locality liable for damages in certain cases. - Subject to the provisions of this article, the Commonwealth shall be liable for claims for money only accruing on or after July 1, 1982, and any transportation district shall be liable for claims for money only accruing on or after July 1, 1986, on account of damages to or loss of property or personal injury or death caused by negligent or wrongful act or omission of any employee while acting within the scope of his employment under circumstances where the Commonwealth or transportation district, if a private person, would be liable to the claimant for such damage, loss, injury or death. However, except to the extent that a transportation district contracts to do so pursuant to Sec. 15.1-1358, neither the Commonwealth nor transportation district, shall be liable for interest prior to judgment or for punitive damages. The amount recoverable by any claimant shall not exceed (i) \$25,000 for causes of action accruing prior to July 1, 1988, or \$75,000 for causes of action accruing on or after July 1, 1988, or (ii) the maximum limits of any liability or other tort, if such policy maintained to insure against such

negligence or other tort, if such policy is in force at the time of the act or omission complained of, whichever is greater, exclusive of interest and costs.

Notwithstanding any provision hereof, the individual immunity of judges, the Attorney General, Commonwealth's attorneys, and other public officers, their agents and employees from tort claims for damages is hereby preserved to the extent and degree that such persons presently are immunized. Any recovery based on the following claims are hereby excluded from the provisions of this article:

1. Any claim against the Commonwealth based upon an act or omission which occurred prior to July 1, 1982.
- 1a. Any claim against a transportation district based upon an act or omission which occurred prior to July 1, 1986.
2. Any claim based upon an act or omission of the General Assembly or district commission of any transportation district, or any member or staff thereof acting in his official capacity, or to the legislative function of any agency subject to the provisions of this article.
3. Any claim based upon an act or omission of any court of the Commonwealth, or any member thereof acting in his official capacity, or to the judicial functions of any agency subject to the provisions of this article.
4. Any claim based upon an act or omission of an officer, agent or employee of any agency of government in the execution of a lawful order of any court.
5. Any claim arising in connection with the assessment or collection of taxes.
6. Any claim arising out of the institution or prosecution of any judicial or administrative proceeding, even if without probable cause.

Nothing contained herein shall operate to reduce or limit the extent to which the Commonwealth or any transportation district, agency or employee was deemed liable for negligence as of July 1, 1982, nor shall any provision of this article be applicable to any county, city or town in the Commonwealth or be construed as to remove or in any way diminish the sovereign immunity of any county, city or town in the Commonwealth. (1981, c. 449; 1982, c. 397; 1986, c. 584; 1988, c. 884.)

APPENDIX B

SUMMARY OF CLAIMS OVER \$1,000 FILED AGAINST VDOT
APRIL, 1983 - SEPTEMBER, 1987

MAINTENANCE CLAIMS PENDING
APRIL 1983 - June 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A71-280	BR/ABINGDON	100000	ROCKS IN ROAD
A71-533	BR/LEBANON	100000	DEBRIS IN ROAD
A71-753	BR/WISE	50000	STEPPED INTO POTHOLE
A75-440	CU/LOUISA	100000	DUST
A76-496	CU/WARRENTON	100000	RAN OFF ROAD
A76-497	CU/WARRENTON	5000	RAN OFF ROAD
A77-184	FR/FREDERICKSBURG	100000	STANDING WATER
A76-624	FR/SALUDA	10000	IMPROPER DRAINAGE
A75-612	FR/WARSAW	3500	TREE FELL
A75-612	FR/WARSAW	3500	TREE FELL
A76-706	FR/WARSAW	50000	PED FELL INTO DITCH
A76-117	LY/CHATHAM	50000	LOOSE GRAVEL
A76-035	NV/FAIRFAX	2000000	UNEVEN SIDEWALK
A71-408	NV/FAIRFAX	350000	CROSS-WALK
A72-680	NV/FAIRFAX	400000	LOOSE GRAVEL
A72-958	NV/FAIRFAX	500000	SIDEWALK
A72-979	NV/FAIRFAX	25000	SIDEWALK
A74-059	NV/FAIRFAX	1585	STOP SIGN BEHIND NEW TREES
A77-434	NV/FAIRFAX	2765	TREE FELL
A77-089	NV/FAIRFAX	4000	TREE FELL
A74-475	NV/LEESBURG	30000	NEG INSTALL&MAINT OF STOP SIGN
A75-350	NV/LEESBURG	125000	LOW SHOULDER
A76-238	NV/MANASSAS	1000000	FAILURE TO REPLACE SIGN
A73-071	RI/CHESTERFIELD	850000	LOW SHOULDER
A77-112	RI/PETERSBURG	50000	SLIPPERY GRATING
A72-828	RI/SANDSTON	50000	MANHOLE
A75-288	SA/CHRISTIANSBURG	1000000	STANDING WATER
A76-853	SA/CHRISTIANSBURG	23987	PED STEPPED IN HOLE ON SHOULDER
A74-993	SA/HILLSVILLE	75000	BAD PATCHING JOB, LOOSE GRAVEL
A74-507	SA/MARTINSVILLE	30000	PROP DAMAGE FROM FLOOD
A71-405	SA/MARTINSVILLE	100000	MISSING STOP SIGN
A76-921	SA/ROCKY MOUNT	25000	HIGH WATER
A72-793	ST/LURAY	50000	LOW SHOULDER
A76-831	ST/LURAY	500000	ICE ON ROAD
A77-140	SU/NORFOLK	1427	POTHOLE
A76-237	SU/SUFFOLK	50000	WEEDS COVERED STOP SIGN
A75-939	SU/SUFFOLK	500000	SIGN OBSCURED BY WEEDS
A76-369	SU/SUFFOLK	50000	BOTH DRIVERS HAD GREEN

MAINTENANCE CLAIMS DENIED
APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A72-977	BR/JONESVILLE	25000	LOOSE GRAVEL
A74-560	BR/JONESVILLE	1029	TREE IN ROAD
A76-056	BR/LEBANON	3100	BLOCKED DRAINS, FLOOD
A74-544	BR/LEBANON	2331	TREE IN ROAD
A70-655	BR/LEBANON	6000	
A74-673	BR/TAZEWELL	10000	ICE (PED)
A75-819	BR/TAZEWELL	1170	BLOCK DRAINAGE FLOODED HOME
A69-860	BR/WISE	2004578	SLICK PAVEMENT
A69-976	BR/WISE	50000	ROCKS IN ROAD
A75-630	BR/WISE	3500	IMPROPER DRAINAGE
A73-621	CU/CHARLOTTESVILLE	2493	BOTH DRIVERS CLAIMED GREEN LGT
A76-611	CU/CHARLOTTESVILLE	3389	TRAFFIC LIGHT
A71-440	CU/CULPEPER	1000000	ICE
A74-992	CU/LOUISA	25000	SNOW
A72-678	FR/FREDRICKSBURG	30000	MALFUNCTIONING STOP LIGHT
A69-666	FR/FREDRICKSBURG	125000	MOTORCYCLE SLIPPED ON GRAVEL
A70-078	FR/FREDRICKSBURG	1000000	SLICK PAVEMENT
A73-489	FR/SALUDA	10000	MALFUNCTIONING SIGNAL
A73-900	FR/SALUDA	3835	MALFUNCTIONING SIGNAL
A70-741	FR/WARSAW	2000	PEDESTRIAN SLIPPED ON PAVEMENT
A70-891	LY/APPOMATTOX	5000	ICE
A70-619	LY/APPOMATTOX	100000	ICE
A75-670	LY/CHATHAM	1058	IMPROPER DRAINAGE
A72-222	LY/DILLWYN	60000	M'CYCLE HIT RECENT PATCH
A71-399	NV/FAIRFAX	4000	DRAINAGE DITCH, FLOODED HOME
A71-776	NV/FAIRFAX	800	ICE
A71-802	NV/FAIRFAX	75000	UNSAFE ROAD CONDITIONS
A70-454	NV/FAIRFAX	250000	STANDING WATER
A72-037	NV/FAIRFAX	1240	HIT METAL PLATE IN ROAD
A69-909	NV/FAIRFAX	100000	POTHOLE
A71-351	NV/FAIRFAX	4000	FELL INTO UNGUARDED MANHOLE
A70-848	NV/FAIRFAX	100000	UNSAFE SIDEWALK
A70-784	NV/FAIRFAX	15000	ICE
A72-985	NV/FAIRFAX	19000	POTHOLE
A73-228	NV/FAIRFAX	917	GROOVE PULLED CAR INTO POTHOLE
A73-259	NV/FAIRFAX	7000	LOW SHOULDER
A72-767	NV/FAIRFAX	20000	MALFUNCTIONING SIGNAL
A73-271	NV/FAIRFAX	20000	PED TRIPPED ON ROAD EDGE
A75-577	NV/FAIRFAX	1414	HIT KNOCKED-DOWN SIGNAL HEAD
A73-286	NV/FAIRFAX	100000	BRIDGE JOINTS. STAT OF LIMITAT
A74-753	NV/FAIRFAX	25000	DANGEROUS SIDEWALK
A73-403	NV/FAIRFAX	25000	FOLIAGE BLOCKED STOP SIGN
A73-069	NV/FAIRFAX	2527	TREE IN ROADWAY
A72-769	NV/FAIRFAX	15000	PEDESTRIAN STEPPED INTO HOLE
A75-441	NV/FAIRFAX	20000	DANGEROUS SIDEWALK
A73-402	NV/FAIRFAX	20000	MANHOLE

MAINTENANCE CLAIMS DENIED
APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A74-723	NV/FAIRFAX	24030	"SLIPPERY WHEN WET"
A75-714	NV/FAIRFAX	250000	EDGE OF ROAD CAVED IN
A73-404	NV/FAIRFAX	1302	FAILURE TO REPLACE STOP SIGN
A73-475	NV/FAIRFAX	2104	RAN INTO DRAINAGE DITCH
A73-490	NV/FAIRFAX	6000	SLICK ROAD
A74-083	NV/FAIRFAX	3820	BLOCKED ST DRAIN, HOME FLOODED
A72-397	NV/MANASSAS	25000	STOP SIGN HIDDEN BY TREES
A72-175	NV/MANASSAS	100000	SIGNAL MALFUNCTION
A71-673	RI/AMELIA	150000	FAILED TO REPLACE STOP SIGN
A71-378	RI/AMELIA	6000	
A74-652	RI/CHESTERFIELD	3231	BAD PATCHING
A72-232	RI/CHESTERFIELD	40000	BAD PATCH IN ROAD
A71-257	RI/SANDSTON	10000	DIP IN ROAD
A72-677	RI/SANDSTON	25000	FAILED TO MAINTAINING STOP SIGN
A71-371	SA/CHRISTIANSBURG	4000	FELL INTO UNGUARDED DRAINAGE
A74-308	SA/HILLSVILLE	25000	BAD PATCH
A71-893	SA/HILLSVILLE	150000	ROCKS IN I-77
A75-180	SA/ROCKYMOUNT	25000	RAN OFF ROAD
A73-059	SA/SALEM	51475	FLOOD CAUSE SLIDE, DAMAGED HOM
A72-989	SA/SALEM	15200	LOOSE GRAVEL
A69-788	ST/EDINBURG	2500	MOTORCYCLE SLIPPED ON GRAVEL
A74-172	ST/EDINBURG	1057	LOOSE GRAVEL
A72-597	ST/EDINBURG	75000	ICE
A76-195	ST/HARRISONBURG	1762	SALT APPLICATION
A76-211	ST/LURAY	5000	PED STEPPED IN HOLE
A70-351	SU/ACCOMAC	25000	SLICK PAVEMENT. STAT OF LIMITS
A75-178	SU/NORFOLK	25000	STRUCK OBJECT ON I64
A75-179	SU/NORFOLK	25000	STRUCK OBJECT ON I64
A76-485	SU/NORFOLK	810	RR TIE IN ROAD
A76-584	SU/SUFFOLK	2500	TRAFFIC LIGHT
A74-639	SU/SUFFOLK	5000	BUMP. TRUCK VIBES DAMAGED HOME
A70-556	SU/SUFFOLK	250000	BUMP
A73-880	SU/SUFFOLK	20000	DEFECTIVE ROAD SURFACE
A74-716	SU/WILLIAMSBURG	7290	VISION OBSTRUCTED BY VEGETATIO

MAINTENANCE CLAIMS PAID
 APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT PAID	REMARKS
A70-384	BR/LEBANON	5500	STOP LIGHT MALFUNCTION
A70-767	BR/WISE	2500	MANHOLE
A72-102	NV/FAIRFAX	3000	HIT SNOW COVERED MEDIAN
A73-701	NV/FAIRFAX	1245	GATE MALFUNCTION, EMP'EE NEG
A70-825	RI/CHESTERFIELD	250	ICE
A70-322	RI/CHESTERFIELD	250	ICE
A73-802	RI/SANDSTON	1159	DAMAGED LIGHT FIXTURE HIT CAR
A72-768	SA/BEDFORD	12000	LOOSE GRAVEL
A71-581	SU/TUNNEL & TOLL	2000	GREASE IN ROAD
A73-099	SU/TUNNEL & TOLL	476	HIT LOOSE DRAIN COVER
A73-100	SU/TUNNEL & TOLL	982	HIT LOOSE DRAIN COVER
A73-101	SU/TUNNEL & TOLL	22500	HIT LOOSE DRAIN COVER

GENERAL HAZARD CLAIMS DENIED
APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A72-814	BR/LEBANON	1869	HIT ANCHOR IN RUNAWAY RAMP
A73-528	CU/CHARLOTTESVILLE	1500	IMPROPER SIGN AT I-64 ENTRANCE
A71-264	CU/CHARLOTTESVILLE	2000	LOW SHOULDER
A73-227	CU/CULPEPER	75000	MAINT, MARKING
A71-292	CU/LOUISA	25000	DANGEROUS INTERSECTION
A72-717	FR/BOWLING GREEN	50000	NEG. ALIGNMENT AND BAD SIGNING
A70-676	FR/FREDRICKSBURG	25000	BAD SIGNING
A76-062	LY/CHATHAM	100000	DES, MAINT, CONSTR
A72-984	LY/HALIFAX	6000000	SIGN BLOCKED VIEW
A73-345	NV/FAIRFAX	50000	INSUFF TIME TO CROSS @ SIGNAL
A74-699	NV/FAIRFAX	1427	DES, OPER OF AUTO GATE ON I395
A75-319	NV/FAIRFAX	1500	LOW (NO?) SHOULDER
A75-161	NV/FAIRFAX	25000	SIGNING, TR CNTRL @ INTERSECTI
A74-141	NV/FAIRFAX	25000	POOR LANE MARKINGS
A71-906	NV/FAIRFAX	75000	
A71-940	NV/FAIRFAX	1160	HIT MEDIAN. BAD MARKING
A74-592	NV/FAIRFAX	5000	DES, CONSTR, MAINT
A72-049	NV/FAIRFAX	75000	BAD SCHOOL CROSSING & NO GUARD
A73-380	NV/FAIRFAX	3000	BAD SIGNING @ INTERSECTION
A71-062	NV/FAIRFAX	25000	LOST CONTROL. IMPROPER MAINT
A71-939	NV/FAIRFAX	100000	DESIGN
A73-376	NV/FAIRFAX	200000	IMPROPER G'RAIL INSTALLATION
A73-784	NV/FAIRFAX	25000	INTERSECTION NEEDS WARNING
A72-809	NV/FAIRFAX	3000	SOFT SHOULDER
A71-589	NV/FAIRFAX	100000	DANGEROUS HIWAY (DESIGN)
A76-708	NV/FAIRFAX	4000	INADEQUATE SHOULDER
A76-708	NV/FAIRFAX	75000	POLE TOO CLOSE TO ROAD
A70-601	NV/LEESBURG	25000	BAD SIGNING
A74-276	NV/LEESBURG	1087	FAILED TO SIGN DROPOFF BY ROAD
A73-141	NV/MANASSAS	2500000	IMPROPER INTERSECTION
A76-596	NV/MANASSAS	50000	SIGNING
A71-949	RI/AMELIA	50000	HIT CONCRETE DIVIDER (DESIGN)
A70-808	RI/ASHLAND	50000	UNSAFE INTERSECTION
A70-100	RI/CHESTERFIELD	505000	UNREGULATED INTERSECTION
A71-309	RI/SOUTH HILL	10000	LOST CONTROL ON CURVE
A71-367	ST/EDINBURG	200000	NO SIGN OR GUARD @ HOLE (PED)
A71-528	ST/EDINBURG	100000	SIGNING, G'RAIL, MARKINGS
A71-743	ST/LEXINGTON	50000	DES, CONSTR, MAINT
A72-983	ST/LEXINGTON	50000	DESIGN
A76-744	ST/LURAY	75000	POLR TOO CLOSE TO ROAD
A73-939	ST/STAUTON	75000	DES, CONSTR
A73-006	SU/FRANKLIN	3911	SOFT SHOULDER (NEW ROAD)
A74-392	SU/TUNNEL & TOLL	8000000	NO STOPPING AREA
A75-115	SU/WILLIAMSBURG	75000	CONSTR, MAINT
A75-114	SU/WILLIAMSBURG	75000	CONSTR, MAINT
A74-242	SU/WILLIAMSBURG	25000	DES, MAINT, CONSTR. INTERSECTION
A74-243	SU/WILLIAMSBURG	40000	DES, MAINT, CONSTR. INTERSECTION

GENERAL HAZARD CLAIMS PENDING AS OF
JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A75-816	BR/JONESVILLE	100000	DES, MAINT, CONSTR
A77-396	BR/LEBANON	7313	DRAIN DESIGN
A77-452	BR/LEBANON	40000	DES. DROVE OFF ROAD
A72-515	BR/LEBANON	350000	IMPROPER MAINT (?)
A74-864	BR/WISE	5000000	ROCK SLIDE
A72-403	BR/WYTHEVILLE	50000	FELL INTO DRAINAGE RAVINE
A71-771	CU/CHARLOTTESVILLE	100000	MISSING G'RAIL, PED FELL OFF
A76-303	CU/CULPEPER	299834	MAINT, CONSTR
A77-479	CU/WARRENTON	50000	BIRDGE DESIGN
A73-517	FR/BOWLING GREEN	25000	SIGNING
A71-573	FR/FREDERICKSBURG	20000	DESIGN, MAINT, CONSTR
A77-168	FR/FREDERICKSBURG	30000	SIGNING
A76-968	NV/FAIRFAX	100000	NO SIDEWALK
A74-624	NV/FAIRFAX	5000	FAULTY STORM DRAINAGE SYSTEM
A75-817	NV/FAIRFAX	50000	SIGING & DES, CONSTR, MAINT
A74-700	NV/FAIRFAX	50000	DES, CONSTR, MAINT
A72-987	NV/FAIRFAX	11200000	BRIDGE JOINTS
A70-881	NV/FAIRFAX	450000	UNSAFE OVERPASS
A77-499	NV/FAIRFAX	30000	DES AND CONSTR
A74-028	RI/ASHLAND	25000	DES, MAINT, CONSTR
A76-239	RI/PETERSBURG	50000	DES AND CONSTR. HIT MANHOLE
A76-240	RI/PETERSBURG	50000	DES AND CONSTR. HIT MANHOLE
A76-577	RI/SANDSTON	30000	TOILET BROKE LOOSE
A74-829	SA/HILLSVILLE	150000	SIGNING
A75-095	SA/HILLSVILLE	150000	SIGNING
A77-394	SA/HILLSVILLE	75000	DES, MAINT
A77-056	SA/SALEM	50000	DES, MAINT
A74-606	ST/EDINBURG	300000	DANGEROUS RR CROSSING
A75-576	ST/LEXINGTON	50000	FAIL TO WARN ABOUT ASPHYXIATIO
A75-367	ST/LEXINGTON	125000	LOST CONTROL. HIT BAD G'RAIL
A74-387	ST/STAUNTON	100000	NO SIGN OR GUARD AT HOLE
A74-386	ST/STAUNTON	100000	NO SIGN OR GUARD AT HOLE
A75-962	SU/FRANKLIN	200000	DANG. ENTRY TO PRIVATE BUSINES
A75-012	SU/NORFOLK	5000000	DES AND MAINT

GENERAL HAZARD PAID
APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT PAID	REMARKS
A69-536	FR/WARSAW	250000	RAN OFF BRIDGE
A70-394	LY/APPOMATTOX	5000	SIGNING
A72-406	NV/FAIRFAX	12500	ROADWAY WAS DANGEROUS
A72-407	NV/FAIRFAX	12500	ROADWAY WAS DANGEROUS
A71-025	NV/MANASSAS	1200	UNSAFE INTERSECTION
A70-597	SU/SUFFOLK	15000	NO G'RAIL

WORK ZONE CLAIMS DENIED
 APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A70-725	BR/JONESVILLE	25000	COLLI W/ EQPT. SIGNING FLAGGING
A71-611	LY/CHATHAM	15000	NEW PAVEMENT BLOCKED STORM DRAIN
A70-254	LY/DILLWYN	25000	
A74-223	NV/DISTRICT OFFICE	1736	VDOT WORK CREW WAVED DRIVER ON
A76-118	NV/FAIRFAX	25000	PORT BARRIERS BLOCKED VISION
A74-140	NV/FAIRFAX	7290	UNEVEN PAVEMENT
A73-384	NV/MANASSAS	50000	VDOT EQPT BLOCK ROAD W/O FLARE
A72-862	ST/LURAY	50000	COLLISION WITH VDOT GRADER
A76-033	SU/NORFOLK	15000	FLAGGING
A74/750	SU/WILLIAMSBURG	2625	FAILURE TO WARN OF HOLE IN ROAD

WORK ZONE CLAIMS PENDING AS OF
JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A73-640	BR/JONESVILLE	1003698	SIGNING
A73-270	BR/WISE	50000	IMPROPER SIGNING
A75-870	BR/WYTHEVILLE	3835	SIGNING
A75-116	CU/LOUISA	100000	DUST
A72-196	CU/LOUISA	35000	TRUCK FLAGGED ONTO SHOULDER
A74-811	FR/FREDRICKSBURG	25000	SIGNING
A74-810	FR/FREDRICKSBURG	25000	SIGNING
A74-809	FR/FREDRICKSBURG	50000	SIGNING
A74-614	LY/CHATHAM	25000	MUD LEFT ON ROAD
A71-887	NV/MANASSAS	1000000	LOW SHOULDER
A71-992	RI/ASHLAND	5000000	LOW SHOULDER
A77-500	ST/LEXINGTON	100000	SIGNING

WORK ZONE CLAIMS PAID
APRIL, 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT PAID	REMARKS
A76-883	BR/WISE	1085	MOTORGRADER COLLISION
A71-125	BR/LEBANON	1200	SWEEPER CREATED DUST HAZARD
A76-246	LY/APPOMATTOX	1680	MOTORGRADER COLLISION
A76-408	RI/AMELIA	1364	MOTORGRADER COLLISION
A76-674	RI/CHESTERFIELD	2151	MOTORGRADER COLLISION
A75-053	RI/CHESTERFIELD	796	GRADER BLADE HIT CAR
A76-911	ST/LEXINGTON	2902	MOTORGRADER COLLISION

OPERATIONS CLAIMS PENDING AS OF
APRIL, 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A76-486	BR/LEBANON	2000	CALVES KILLED, INJURED, SPRAYING
A74-923	BR/TAZEWELL	10602	SNOW PLOW COLLIDED WITH TRAIN
A71-942	CU/CHARLOTTESVILLE	25000	INMATE INJURED
A76-816	LY/AMHERST	200000	INMATE INJURED
A76-530	RI/PETERSBURG	50000	INMATE INJURED
A76-532	SA/DISTRICT OFFICE	1800	PAINT MARKED CAR
A76-225	SA/HILLSVILLE	3200	PROPERTY DAMAGE FROM BLASTING
A76-667	SA/MARTINSVILLE	25000	INMATE INJURED
A76-667	SA/MARTINSVILLE	250000	TRUCKER DELIVERING STONES HURT
A77-224	ST/HARRISONBURG	1050	PAINT SPRAYED ON VEHICLE
A77-225	ST/HARRISONBURG	1150	PAINT SPRAYED ON VEHICLE
A77-226	ST/HARRISONBURG	1075	PAINT SPRAYED ON VEHICLE
A72-522	SU/FRANKLIN	25000	MOWER COLLISION
A73-068	SU/NORFOLK	200000	K'OR EMPLOYEE INJURED

OPERATIONS CLAIMS DENIED
 APRIL 1983 - SEPTEMBER 1987
 (ONLY INCLUDES CLAIMS OVER \$1000)

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A70-575	BR/ABINGDON	25000	OPERATOR HAD SIEZURE, COLLIDED
A71-200	BR/LEBANON	50000	PROPERTY DAMAGE FROM EXCAUAT
A71-113	BR/LEBANON	75000	8TH AMENDMENT CLAIM BY INMATE
A71-107	BR/LEBANON	1500000	INMATE INJURED BY EQPT OPERATR
A71-941	CU/CHARLOTTESVILLE	25000	INMATE INJURED BY JACKHAMMER
A72-973	FR/SALUDA	2299	MOWER COLLISION
A70-022	LY/APPOMATTOX	75000	INMATE CUT BY CHAINSAW
A70-468	NV/FAIRFAX	1200	INSTALING HIWAY DEVICE HIT CAR
A69-658	NV/LEESBURG	1325	MOTOR GRADER DAMAGED DRIVEWAY
A72-679	RI/ASHLAND	40000	MOWER TOO CLOSE TO HIWAY
A71-464	RI/PETERSBURG	8000	STEPPED INTO HOLE LEFT BY VDOT
A75-871	RI/SANDSTON	50000	INMATE INJURED. CHAIN SAW
A74-375	ST/EDINBURG	15000	BLASTING
A73-070	SU/SUFFOLK	200000	K'OR EMPLOYEE INJURED
A76-194	SU/SUFFOLK	2499	DIRECTIONS ONTO SCALE
A75-716	SU/WAVERLY	1013	HIT FERRY BRIDGE. BAD DIRECTIO

OPERATIONS CLAIMS PAID
APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT PAID	REMARKS
A71-588	BR/LEBANON	24500	INMATE INJURED
A70-329	BR/LEBANON	0	PROPERTY DAMAGE FROM EXCUATION
A73-057	BR/LEBANON	5530	PROPERTY DAMAGE FROM BLASTING
A70-600	BR/LEBANON	3000	PROPERTY DAMAGE FROM BLASTING
A70-649	BR/LEBANON	2032	PROPERTY DAMAGE FROM BLASING
A70-710	BR/LEBANON	659	PROPERTY DAMAGE FROM BLASTING
A70-793	BR/LEBANON	12000	PROPERTY DAMAGE FROM GRADING
A77-217	BR/WISE	1756	FELLED TREE HIT HOME
A73-922	BR/WISE	3152	PROPERTY DAMAGE FROM BLASTING
A75-580	BR/WISE	1009	MUD BLOCKED DRAIN, FLOODED
A72-296	BR/WYTHEVILLE	750	MOWER COLLISION
A71-498	CU/LOUISA	3697	MOWER COLLISION
A71-439	CU/WARRENTON	3000	PROPERTY DAMAGE FROM BLASTING
A74-472	LY/AMHERST	4471	MOWER COLLISION
A75-954	LY/CHATHAM	1000	HORSE KILLED. ATE CHERRY LEAVES
A73-994	RI/CHESTERFIELD	1163	VDOT FORCES CUT C&P LINE
A73-774	RI/PETERSBURG	2165	SANDBLASTING, PLYWOOD HIT CAR
A76-272	SA/DISTRICT OFFICE	1625	PAINT MARKED CAR
A76-223	SA/DISTRICT OFFICE	1425	CAR COVERED WITH PAINT
A72-043	SA/SALEM	1000	FELLED TREE HIT CAR
A76-891	SA/SALEM	1045	FELLED TREE HIT CAR
A76-391	ST/EDINBURG	3200	HERBICIDE KILLED TOMATOES
A69-872	ST/STAUTON	5000	INMATE INJURED
A76-378	SU/SUFFOLK	12935	MOWER COLLISION
A71-716	SU/SUFFOLK	600	MOWER COLLISION
A74-912	SU/TUNNEL & TOLL	8000	NEG OPERATION OF DRAW SPAN
A74-913	SU/TUNNEL & TOLL	8000	NEG OPERATION OF DRAW SPAN
A76-131	SU/WAVERLY	1074	MOWER COLLISION
A74-545	SU/WAVERLY	1605	FERRY
A70-029	SU/WAVERLY	18500	FERRY

MISCELLANEOUS CLAIMS DENIED
 APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A72-738	FR/FREDRICKSBURG	28000	UNFAIR SPECS (PROCUREMENT)
A71-115	LY/APPOMATTOX	4000	CONTAMINATED WELL
A70-001	NV/FAIRFAX	25000	CHILD DROPPED MH COVER ON FOOT
A71-379	NV/FAIRFAX	7397	LOAD HIT BRIDGE, HAD PERMIT
A75-192	NV/FAIRFAX	1876	PRIV TRUCK DAMAGE BY VDOT EQPT
A76-143	NV/FAIRFAX	1530	SIGN FELL ON CAR
A69-616	RI/ASHLAND	500000	CONSPIRACY TO INJURE TRADE
A73-204	ST/STAUNTON	2500	PAINTERS LET COWS LICK PADS
A74-072	SU/SUFFOLK	4617	CAR BEING TOWED AWAY DAMAGED
A75-071	SU/WILLIAMSBURG	4825	DESTROYED SHRUBS DURING CONST
A75-475	SU/WILLIAMSBURG	1414	CUT C&P LINE NO CALL TO MSUTIL

MISCELLANEOUS CLAIMS PENDING AS OF
JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT CLAIMED	REMARKS
A74-766	CU/WARRENTON	25000	EXTENDED ROAD ACROSS CEMETARY
A77-241	LY/AMHERST	1115	TREES CUT ON PRIVATE PROPERTY
A73-451	SU/NORFOLK	8000000	EMPLOYEE ALLEGING HARASSMENT

MISCELLANEOUS CLAIMS PAID
 APRIL 1983 - JUNE 30, 1988

VDOT CASE NO.	DISTRICT/ RESIDENCY	AMOUNT PAID	REMARKS
A71-287	BR/LEBANON	500	CUT TREES ON PRIVATE PROPERTY
A72-886	BR/LEBANON	500	COW DIED
A76-268	CU/CHARLOTTESVILLE	1450	DEBRIS ON PROPERTY
A71-640	FR/FREDRICKSBURG	10123	CONTAMINATED WELL
A71-233	NV/FAIRFAX	1849	DAMAGE TO LEASED EQPT
A71-323	SA/ROCKY MOUNT	3250	CONTAMINATED WELL
A72-645	SA/SALEM	300	CUT TREES ON PRIVATE PROPERTY
A72-646	SA/SALEM	500	CUT TREES ON PRIVATE PROPERTY
A72-389	ST/EDINBURG	300	COW DIED
A71-660	ST/STAUTON	2000	CONTAMINATED SPRING
A70-755	SU/ELIZ R TUNNEL	10000	MISTREAT. OF PERSON IN CUSTODY

APPENDIX C
TYPICAL FATAL ACCIDENT REPORT

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HIGHWAYS

TO : Mr. J. P. Mills, Jr. Wise , Virginia
 FROM : H. J. Rhodes Jan. 5 , 1967
 SUBJECT : Fatal Traffic Accident Report

In accordance with previous instructions, I am submitting four copies of my report covering the fatal collision listed below:

PERSONS KILLED:

<u>Name</u>	<u>Address</u>	<u>Race</u>	<u>Sex</u>	<u>Age</u>	<u>Vehicle* Number</u>
Sarah Gardner	McClure, Va.	W	F	59	1
Stacy Wood, Jr.	Clinchco, Va.	W	M	22	1

Was victim a pedestrian? Yes ___ No X

VEHICLES INVOLVED:

<u>Make</u>	<u>Model</u>	<u>Year</u>	<u>Vehicle* Number</u>
Oldsmobile	2 Door Coupe	1959	1

Estimated speeds of vehicles: No. 1 25 No. 2 ___ No. 3 ___

NAME OF OPERATORS:

<u>Name</u>	<u>Address</u>	<u>Race</u>	<u>Sex</u>	<u>Age</u>	<u>Vehicle* Number</u>
Sarah Gardner	McClure, Va.	W	F	59	1

LOCATION OF ACCIDENT: Route 83 County or City Dickenson

0.1 Miles W. Clinchco 4500'
 Miles (N.E.S.W. to Nearest Town) Feet to Nearest Int., Bridge, etc.

TIME OF ACCIDENT: Date Dec. Day 23, 1966 Time 7:05 P. M.

Dawn ___ Daylight ___ Dusk ___ Darkness X

*Vehicle number will be the same as given on sketch on Page 6

WEATHER CONDITION: Clear _____ Cloudy _____ Rain _____ Snow Sleet _____

Fog _____ Mist _____ Hail _____ Other _____

SURFACE CONDITION: Dry _____ Wet _____ Snowy Icy _____ Muddy _____

Oily _____ Other _____

INDICATE DAMAGE DONE TO HIGHWAY PROPERTY None

Estimated Cost _____

GIVE BRIEF DESCRIPTION OF ACCIDENT

Vehicle #1 going east, apparently going at excessive speed and lost control of car in curve. The vehicle skidded over an embankment and landed on its top in the McClure River. The vehicle was completely submerged except for the wheels and the frame. The driver and passenger both drowned.

CONCLUSIONS AND RECOMMENDATIONS:

What factors relating to the driver, weather or vehicle do you feel may have contributed to the accident?

According to the investigating officer, the vehicle was traveling at 25 MPH. He feels that the safe speed for the location and the condition of the road would have been 15 MPH.

What factors relating to the physical aspects of the road over which the Department has control and responsibility may have influenced the accident?

Guard rail probably would have prevented the vehicle from going into the river.

As a result of this accident do you feel any remedial measures should be taken by the Department? Yes No If so, list the recommendations and estimated cost.

Install 300' of guard rail. Estimated cost - \$600.

If remedial measures are to be instituted by the Department indicate who will handle.

	<u>Estimated date of completion</u>
Residency <input checked="" type="checkbox"/>	<u>1-31-67</u>
District <input type="checkbox"/>	_____
Central Office <input type="checkbox"/>	_____

As a result of your investigation of the location (not necessarily this particular accident) do you have any suggestions as to the improvement of the safety of the motorists or pedestrians for the section? Yes No If so, indicate and give estimated cost _____

Have any remedial measures been taken at the location since the above accident occurred?

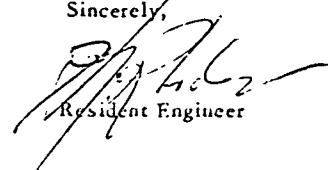
Yes No If so, indicate _____

Do you feel a further study of the accident location or general area should be made by the Traffic and Planning Division? Yes No

This accident was discussed with Investigating Officer J. T. Osborne of Clintwood on December 30, 1966

Date of inspection of accident location 12/30 Time of inspection _____ AM 4:30 PM

Investigation made by J. A. Robinson, Jr. Assistant Resident Engineer
Position

Sincerely,

Resident Engineer

FATAL TRAFFIC ACCIDENT CHECK LIST

I. Signs, Pavement Markings and Signals

A. Signs

1. Location

a. Are signs erected in accordance with the Virginia Manual of Uniform Traffic Control Devices? Yes

b. Is sight distance to sign adequate? Yes

2. Maintenance

a. Are signs in good condition? Yes

b. Is brush trimmed from around signs? Yes

3. Adequacy

a. Is signing adequate? Yes

b. Is signing in accordance with policy as set forth in the Virginia Manual? Yes

B. Pavement Markings

1. Existing Markings

a. Is pavement marked in accordance with the Virginia Manual of Uniform Traffic Control Devices? Yes

2. Maintenance

a. Are markings maintained in good condition? Yes

3. Adequacy

a. Is marking adequate? Yes

b. Is additional marking required? NO No

C. Traffic Signals N. A.

1. Location

a. Are signals located for maximum visibility to approaching traffic? _____

2. Maintenance

a. Were signals in operation? _____

b. Are all lamps in good condition? _____

3. Adequacy

a. Are additional signal heads required? _____

II. Condition of Pavement

a. Is superelevation on curves adequate? Yes

b. Is pavement rough? No

c. Does pavement have excessive crown? No

d. Is pavement slick and does it have a tendency to be slippery when wet? No

e. Is pavement width adequate for volume of traffic? Yes

INFORMATION NEEDED

I

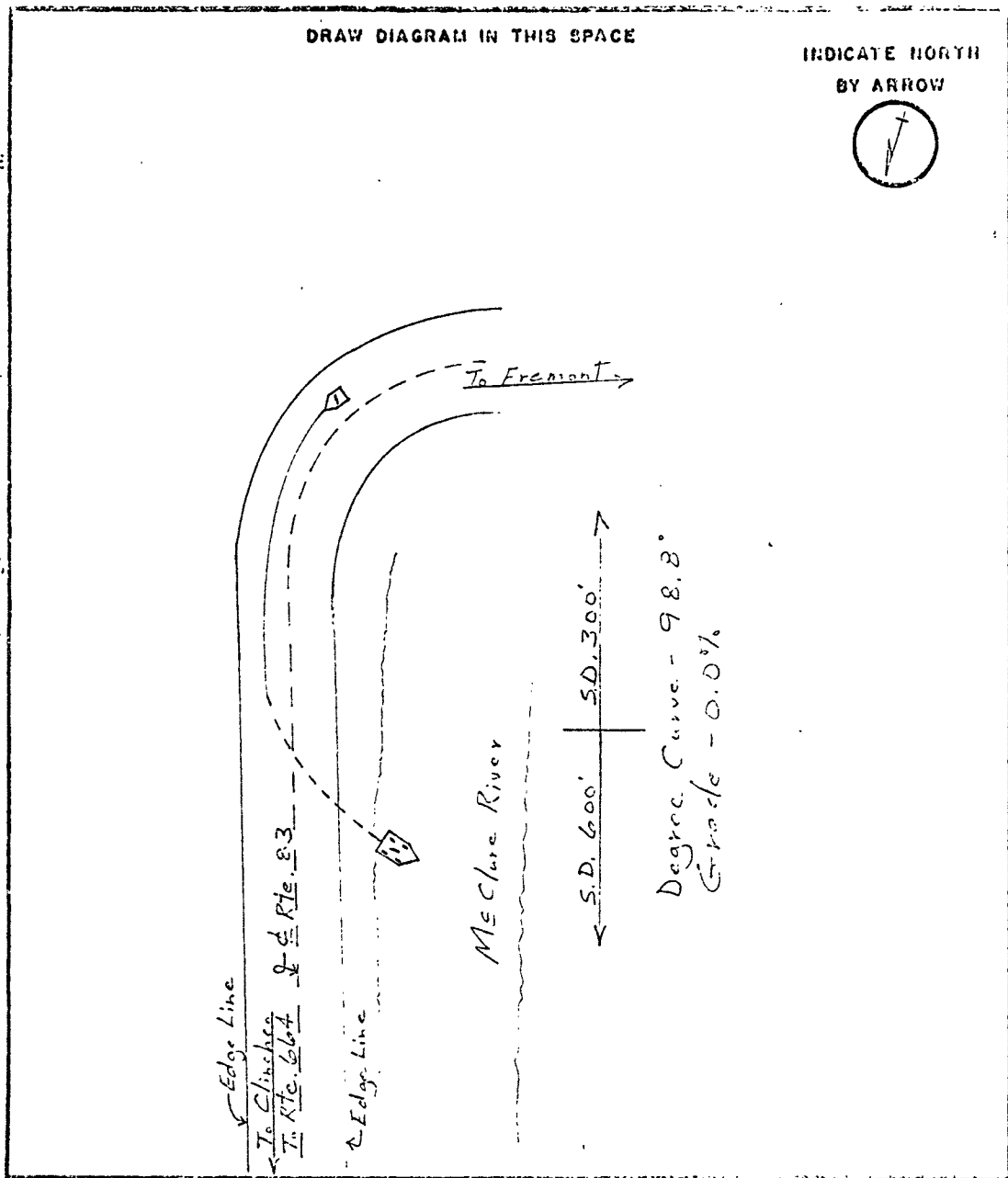
SHOW ON THE ACCIDENT DIAGRAM:

1. INDICATE LOCATION AND TYPE OF ALL PAYMENT MARKING
 2. SHOW SIGHT DISTANCES FROM BOTH DIRECTIONS
 3. SHOW PERCENT OF GRADE
 4. SHOW DEGREE OF CURVE
 5. NUMBER VEHICLE WITH NUMBER ON SHEET I
- 1
- 2
- (Solid line)
- (Dotted line)
7. INDICATE DISTANCE TO NEAREST INTERSECTION, BRIDGE OR BOUNDARY LINE.
 8. INDICATE THE NEAREST TOWN BY ARROW IN EACH DIRECTION OF TRAVEL.

I DIAGRAM OF FATAL ACCIDENT

DRAW DIAGRAM IN THIS SPACE

INDICATE NORTH BY ARROW



II

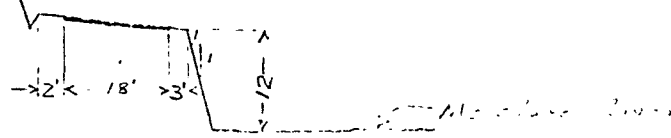
SHOW ON THE CROSS SECTION DIAGRAM:

1. TYPE AND WIDTHS OF ROADWAY FOR:
 - a SHOULDER
 - b PAVEMENT
 - c MEDIAN
2. SHOW SLOPE OF PAVEMENT AND SHOULDERS

II SKETCH CROSS SECTION OF ROAD WHERE FATAL ACCIDENT OCCURRED

DRAW CROSS SECTION IN THIS SPACE

1/2" / 1' Super elevation



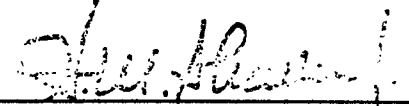
APPENDIX D

LOCATION AND DESIGN DIVISION
INSTRUCTIONAL AND INFORMATION MEMORANDUM
NO. LD86 (D) 104.5

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION

LOCATION & DESIGN DIVISION

INSTRUCTIONAL & INFORMATION MEMORANDUM

GENERAL SUBJECT: CLEAR ZONE AND TRAFFIC BARRIERS		NUMBER: LD-86 (D) 104.5
SPECIFIC SUBJECT: I GENERAL GUIDELINES		DATE: December 16, 1986
II RECOVERABLE AREA DETERMINATION		SUPERSEDES: LD-86 (D) 104.4
III DETERMINING CLEAR ZONE WIDTHS		
IV BARRIER INSTALLATION GUIDELINES		
CATEGORICAL INDEX SECTION(S): D, K	SIGNATURE: 	

Changes are shown in Bold Print.

This revision is to provide guidelines for a project cost-effective selection procedure to determine whether the project is to be designed with recoverable areas to provide the clear zones as indicated in the Geometric Design Standards or be designed without the recoverable areas. The design determination is to be made in the early stages of project development and the decision is to be documented in the project files.

I. GENERAL

These instructions provide clear zone width guidelines and barrier criteria that have been developed in accordance with the 1977 AASHTO Guide for Selecting, Locating and Designing Traffic Barriers and with reference to the new Road and Bridge Standards dated January 1, 1986.

Highways should be designed through judicious arrangement and balance of geometric features to preclude or minimize the need for guardrail or other traffic barriers. To provide for maximum roadside safety, a thorough study during the early stages of design is necessary to **determine if recoverable areas are to be provided in accordance with the guidelines covered herein** and to recognize and eliminate, where practical, those hazardous conditions which will require some type of traffic barrier.

Traffic Barriers should only be used where the result of striking the object or leaving the roadway would be more severe than the consequence of striking the barrier. Where guardrail needs are indicated by warrants, see 1977 AASHTO Guide, page 5, Section II-A, Warrants, the roadway should be examined to determine the feasibility of adjusting site features so that the barrier will not be required (i.e. Flattening a fill slope, removing a hazardous object, such as a drainage head wall, etc.). The initial cost to eliminate the guardrail may appear excessive, however, a barrier installation will require maintenance costs for many years and this fact should not be overlooked.

Guardrail should be included on the plans prior to the submission for field inspection on INTERSTATE, PRIMARY AND ARTERIAL projects without recoverable areas.

Guardrail should be included in the plans only at obvious locations such as bridges, large endwalls, etc., prior to the submission for field inspection on projects with "recoverable areas" and secondary projects.

II RECOVERABLE AREA DETERMINATION

GUIDELINES FOR A COST-EFFECTIVENESS SELECTION PROCEDURE FOR BARRIERS VS. RECOVERABLE AREAS

1. In the preliminary plan development process, an early analysis is required to determine the feasibility of providing the required recoverable areas to meet the clear zone requirements in accordance with the Geometric Design Standards for the project.

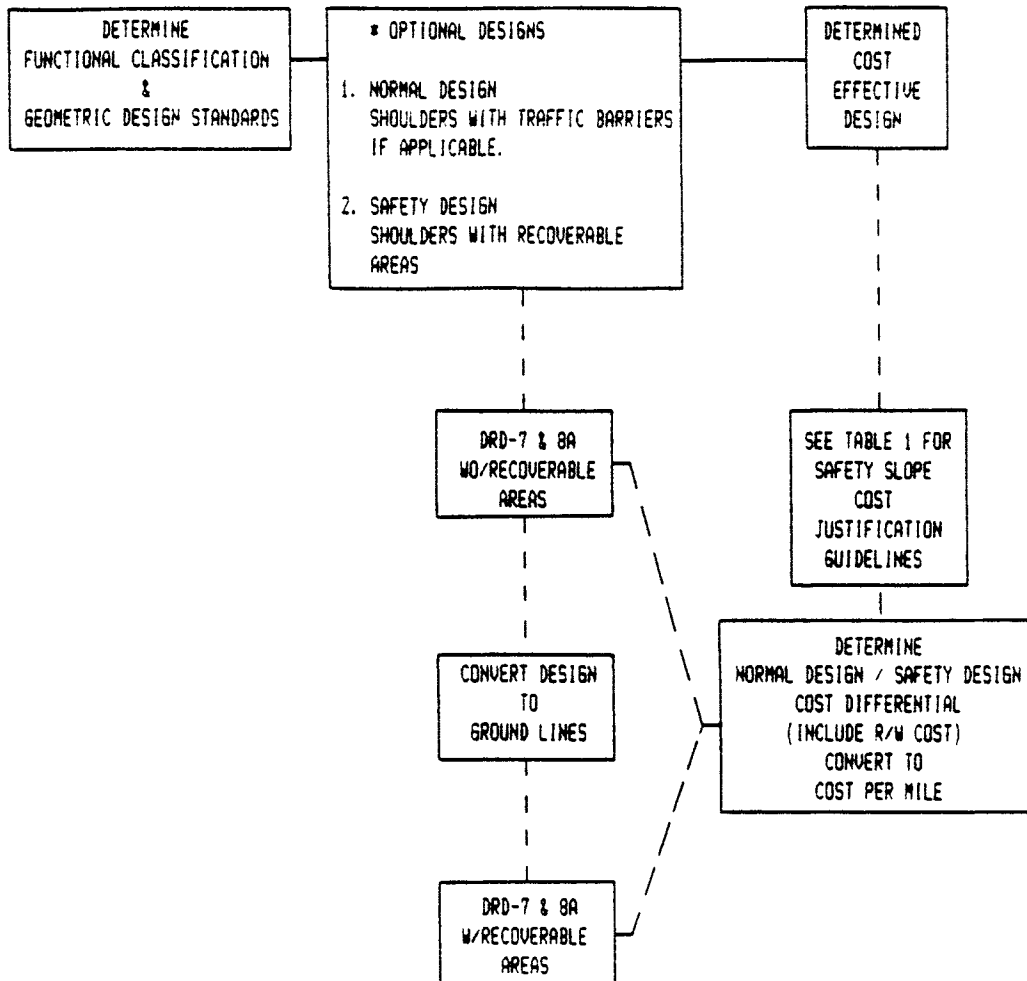
The main line clear zone requirements in the Geometric Design Standards for the specific functional classification of roadway are based on a recoverable 6:1 slope being provided. The clear zone (C_Z) requirements for other conditions and/or slopes are to be obtained from Figure No. 4.

After the project Functional Classification and the proper Geometric Design Standards have been determined an estimate of the additional construction and R/W cost to provide the desired clear zone is to be determined.

Prior to establishing the additional construction and R/W cost estimate the developed areas that would involve heavy R/W damages and/or relocations and the areas that involve environmental restrictions, such as park properties or historic areas, are to be noted. In areas where these conditions exist, horizontal and vertical alignment adjustments are to be made where possible to provide the desired recoverable areas and clear zones. In these situations alternate designs may also be the elimination of the ditches and/or median width reductions with possible incorporation of raised medians or median barriers to reduce required R/W.

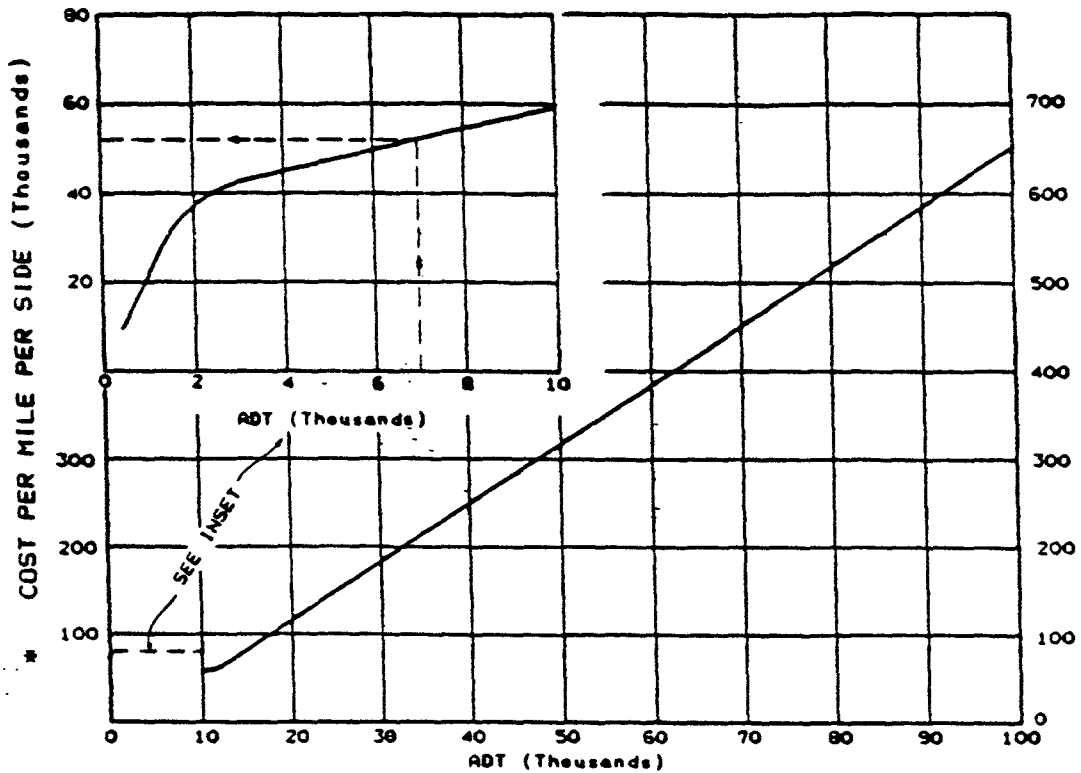
2. With an ever increasing awareness of mounting construction cost, a Cost Effectiveness Selection program was developed to provide a technique for comparing alternate solutions to problem locations. This evaluation is accomplished by comparing a recoverable area design to a do-nothing option (base case) and ranking them according to their cost effectiveness. Each design's total cost is computed based on its useful life. Included in this total cost are initial construction cost, maintenance cost, salvage value and accident cost. The accident cost includes vehicle damage and personal injury along with cost incurred by the Department.
3. The above procedure has been used to develop Guidelines For The Maximum Cost Per Mile Expenditure that is cost effective for safety improvements and Figure No. 2 (Sheet 4) provides values for Average Daily Traffic Volumes. The values, along with good engineering judgement, are to serve as an aid in determining the feasibility of providing the recoverable area and clear zones through the project.
4. The following aids are provided for the safety slope justification determination:
 1. Figure 1 - Cost Effective Selection Procedure
 2. Figure 2 - Safety Slope Cost Justification Guidelines

FIGURE NO. 1
COST EFFECTIVE SELECTION PROCEDURE



Note: Upon receipt of Normal Design and Safety Design earthwork quantities, a cursory review may indicate that the cost per mile per side for the earthwork alone far exceeds the Guidelines for Maximum Cost Per Mile Expenditure for Safety Slopes in Figure 2, thereby eliminating the need to determine the other additional cost such as drainage extensions, right of way, etc.

FIGURE NO. 2
SAFETY SLOPE COST JUSTIFICATION GUIDELINES



* ADDITIONAL R/W & CONST. COST ALLOWABLE TO OVERCOME ACCIDENT COST INCREASE

EXAMPLES OF COST PER SIDE EXPLANATION	
UNDIVIDED DESIGN ADT = 400	
SIDE	SIDE
\$9,400 PER MILE	\$9,400 PER MILE
DIVIDED DESIGN ADT = 7,000	
SIDE	SIDE
\$52,000 PER MILE	\$52,000 PER MILE

III DETERMINING CLEAR ZONE WIDTH

The following is a guide and should be supplemented with engineering judgement:

Clear zone (CZ) is defined as the roadside border area, starting at the edge of the traveled way (edge of pavement), available for safe use by errant vehicles. Previously, 30 ft. was considered to be the standard clear zone, but current guidelines, as shown in Figure No. 4, give values greater or less than 30 feet, depending on the roadside slopes, operating speed and traffic volume.

Any non-traversable hazards or fixed objects, including but not limited to those listed in Table 4, which are located within the clear zone as determined from Figure No. 4, should preferably be removed, relocated, or made yielding; or as a last resort shielded with a barrier.

Strict adherence to these recommended minimum clearances may not be practical in certain situations due to limited right of way width or other physical or economic constraints. This is especially true on urban streets with lower operating speeds and on local roadways with lower traffic volumes.

When adequate right of way is available, urban projects should be designed with shoulders in lieu of curbs (unless city ordinance requires otherwise) and they should have clear zone widths consistent with their operating speed, traffic volume and side slopes as noted in Figure No. 4.

When curbs are utilized on urban projects and desirable clear widths are not available, it is desirable to locate all necessary unyielding objects as close to the right of way line as possible. Other non-essential off-roadway obstacles such as trees should be removed from the roadside wherever feasible.

FIGURE NO. 3 - URBAN CLEAR ZONE WIDTH GUIDELINES

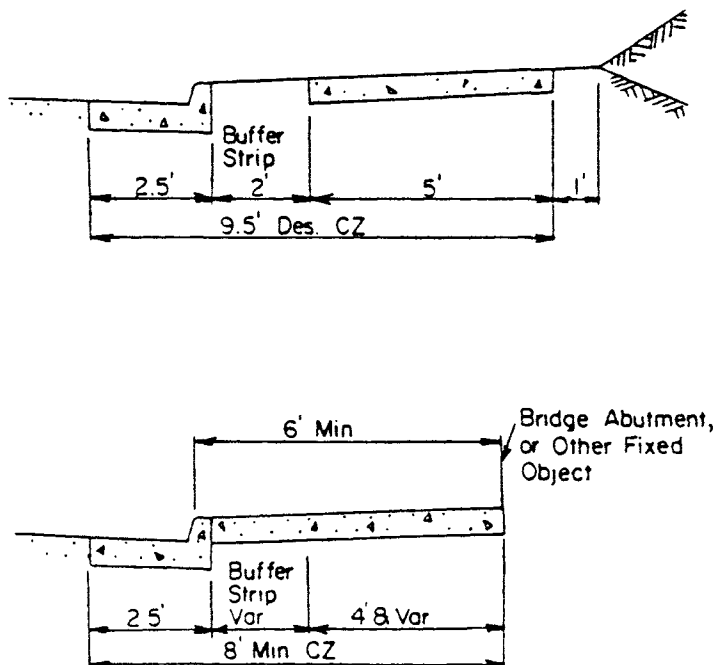
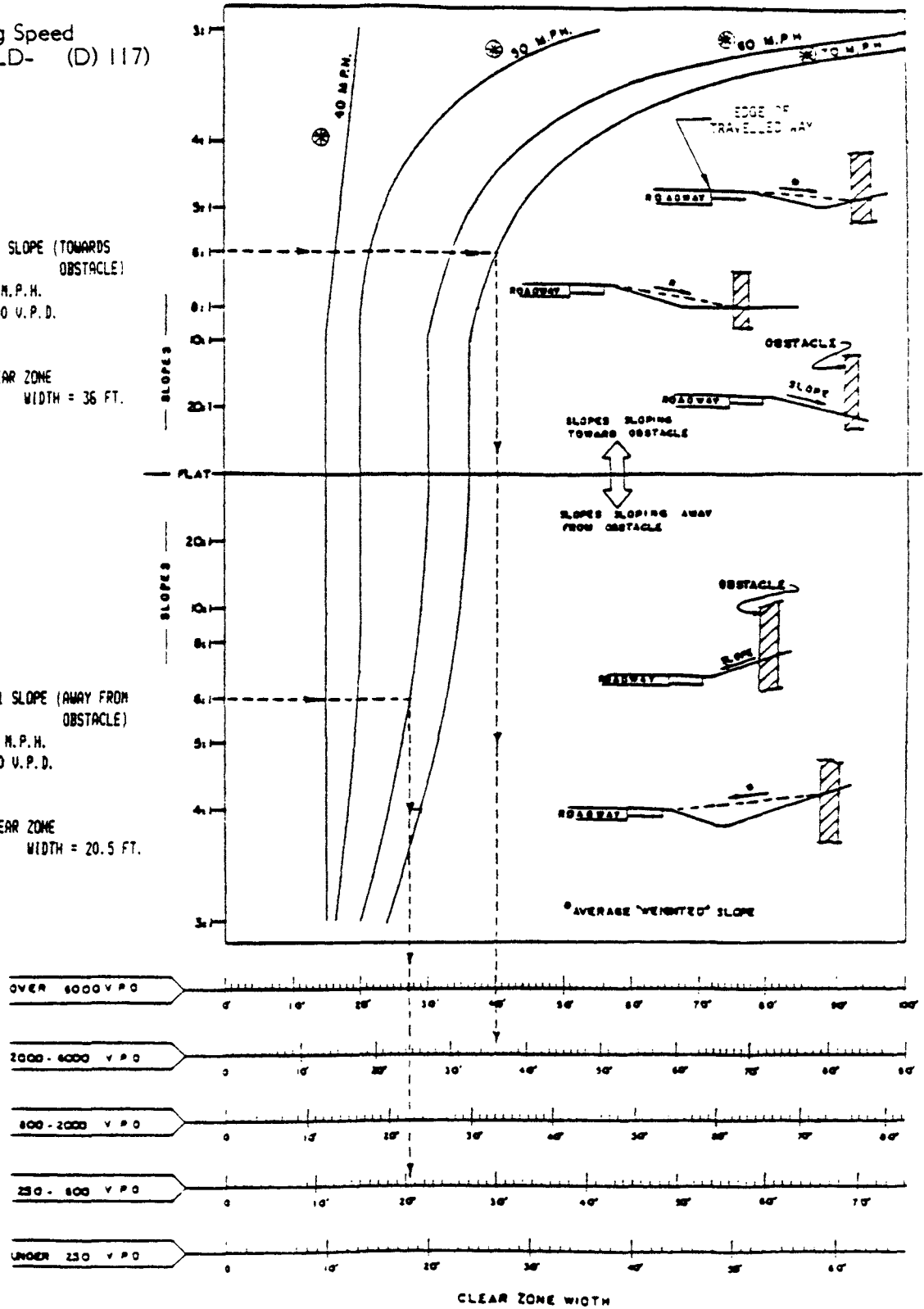


FIGURE NO. 4 - CLEAR ZONE WIDTH GUIDELINES

⊕ Operating Speed
(See IIM LD- (D) 117)

EXAMPLE #1:
6:1 SLOPE (TOWARDS
OBSTACLE)
70 M.P.H.
5000 V.P.D.
ANSWER:
CLEAR ZONE
WIDTH = 36 FT.

EXAMPLE #2:
6:1 SLOPE (AWAY FROM
OBSTACLE)
60 M.P.H.
750 V.P.D.
ANSWER:
CLEAR ZONE
WIDTH = 20.5 FT.



Source: The AASHTO Guide For Selecting, Locating, and Designing Traffic Barriers (1977). The Texas Transportation Institute Supplement to A Guide For Selecting, Designing and Locating Traffic Barriers (March 1980).

IV. BARRIER INSTALLATION GUIDELINES

GENERAL

When it has been determined that a barrier is required, a determination must be made as to the type of barrier that is to be used. The 1986 Road and Bridge Standards now provides information for four (4) types; a Strong Post System (St'd. GR-2; 2A); a Weak Post System (St'd. GR-8, 8A, 8B); Cable Guardrail (St'd. GR-3); and Concrete Barrier (St'd. MB-7A, 7B, 7C). Although the process is complicated by the number of variables and the lack of objective criteria, there are guidelines that can be used in making a barrier system selection. In general, the most desirable system is one that offers the lowest accident severity at the least cost, and is consistent with the given constraints. **The Standard GR-8 Weak Post System is the preferred treatment under most circumstances because it's characteristics, when struct, are superior to other guardrail systems.**

Page 56, Table III-D-1, of the 1977 AASHTO Guide for Selecting, Locating, and Designing Traffic Barriers, presents eight items which must be considered before a system selection is made. Although these items are not necessarily listed in order of importance, the deflection, strength, and safety requirements should never be compromised. The 1986 Road and Bridge Standards shows the dynamic deflection for each of the systems currently approved by the Department. (See Sheet 12 for barrier height, maximum dynamic deflection, minimum offset from hazardous object and post spacing.) Also, the standards provide transition designs for fixed object roadway obstructions and flared terminal wall connections. Terminal treatments are provided for installation of each system.

FILL HEIGHTS

The introduction of the barrier system selected due to embankment heights should be based on the following general criteria:

INTERSTATE- Fills over 7.5 feet.

Fills with "recoverable areas" - At obvious needs such as bridges, large endwalls, etc. and fills where recommended during field inspection.

PRIMARY AND ARTERIAL- Fills over 7.5 feet.

SECONDARY AND FRONTAGE ROADS - At obvious needs such as bridges, large endwalls, etc., and fills where recommended during field inspection.

When fill slopes are 3:1 or flatter, a barrier is not required unless there are hazardous obstacles within the clear zone limits.

FIXED OBJECTS

No fixed objects, regardless of their distances from the edge-of-pavement, will be allowed within the deflection zone of the guardrail system to assure that the barrier system will perform as designed. This will include overhead sign supports, walls, drainage structures, bridge piers, signal supports, **utility poles**, trees, etc. Additionally the deflection zone must be free of breakaway signs, signals and luminaire supports since their performance when struck by deflecting guardrail is unknown and untested.

When it is impractical to locate these obstacles outside of the deflection zone of a particular type of guardrail, it will be necessary to strengthen the guardrail to decrease its deflection (e.g., GR-8 = 8', GR-8B = 4.5-) or to use a different type of guardrail or barrier which has less deflection.

Table 3 (Barrier Systems) on Sheet 12 **specifies** the minimum offset requirements from "hazardous objects" for the different type barrier systems.

SHORT GAPS

Short gaps between barrier installations should be avoided. When the areas of concern are less than 200 feet apart, the barrier protection shall be made continuous. Be sure that barrier is recommended on all systems at ponds, or other bodies of water to prevent vehicles from running into the water which could possibly result in drownings.

TERMINALS

Guardrail terminals are to be provided for all installations regardless of "Functional Classification". The termini of guardrail must be designed and located so there are no exposed rail element ends on which a vehicle could be impaled. With Standard GR-2 the preferred treatment is to bury the end of the guardrail, using the Standard GR-6 end treatment, into a cut slope even if the guardrail must be extended a short distance to accomplish this. If the use of Standard GR-6 treatment is not practical, use the Standard GR-7, Breakaway Cable Terminal. When using the Standard GR-7 terminals on standard shoulders the flare is 4 feet as specified in the standard drawing. This is considered essential to proper performance for end-on impacts to eliminate the potential of spearing. In consideration of the 4 foot flare requirement to construct the terminal treatment, for either Standard GR-7 or GR-8, the shoulder in the terminal area must be widened sufficiently to accommodate the terminal. On bridge replacement projects and other projects (involving guardrail updates) on which existing shoulders are of insufficient width and for which there are no provisions for widening such shoulders, additional fill material is required to be placed to ensure that the flare can be correctly installed. Typical installation details are shown in Figure No. 5 and are to be included in the plans along with a tabulation of the applicable widths. (Projects with paved shoulders - Details are shown on Special Design Drawing No. 1380-A, Bituminous Paving Under Guardrail. Other situations - Details will be available from CADD.)

When this situation occurs for the GR-7 terminals on projects without normal grading operations, the following new pay item is to be used to cover the required embankment, benching and reseeding.

PAY ITEM	PAY UNIT	ITEM CODE
Guardrail Terminal Site Preparation	Each	13349

(A Special Provision Copied Note is available for use in contracts involving this pay item.)

New construction projects provide the necessary shoulder widening for the required guardrail and guardrail terminals, therefore, the above pay item is not applicable.

The use of GR-7 terminals on raised medians or behind curbs in urban areas, where consecutive driveways or other situations require numerous openings, should be studied thoroughly since it is impractical to use the GR-7 treatment. (See Road and Bridge Standards, Guardrail Installation Criteria, page 501.19, Installation At Entrance Or Other Required Openings). Where these terminals are used behind curbs the flare may be reduced from 4 feet to 2 feet. Where the guardrail is behind the sidewalk or sidewalk space, a 4 foot flare is to be used when sufficient right of way is available. The 4 foot

flare may be reduced or eliminated in this case only when sufficient right of way is not available and should be detailed on the plans.

On Standard GR-3 and GR-8 guardrail installations, a terminal is required at each end of the run for anchorage. (Exception - Standard GR-8 tied into Standard GR-2).

BRIDGES

When the proposed design calls for the utilization of an existing bridge having the older type parapet walls, or rails, a detail showing the "Recommended Method for Attaching Guardrail to Bridge Rails" is to be obtained from the Special Design Section for inclusion in plans. Prints of the existing bridge rail should accompany the request. The method of measurement and basis of payment is for "Special Design Guardrail Bridge Attachment, (B or Str. No.), Lump Sum" which price bid shall include all materials, labor, tools, equipment and incidentals necessary to complete the work connecting all segments of rail to one bridge.

When the use of guardrail on raised or depressed medians is being planned to shield bridge piers, the designer should also consider the use of a Special Design Impact Attenuator Bull Nose Barrier. This design has been used by the Minnesota Department of Transportation for several years with excellent performance. The design utilizes a 5 foot radius W-Beam guardrail and wooden breakaway posts, therefore, a 10 foot wide raised median would be the minimum. A similar design of the "Bull Nose Barrier" is shown on page 214 of the 1977 AASHTO Guide. (Pay Item - Bull Nose Barrier - Each - Computer Est. No. 13601.) Installation layout details will be furnished by the Special Design Section for each Bull Nose Barrier location for inclusion in the plans.

SECONDARY PROJECTS

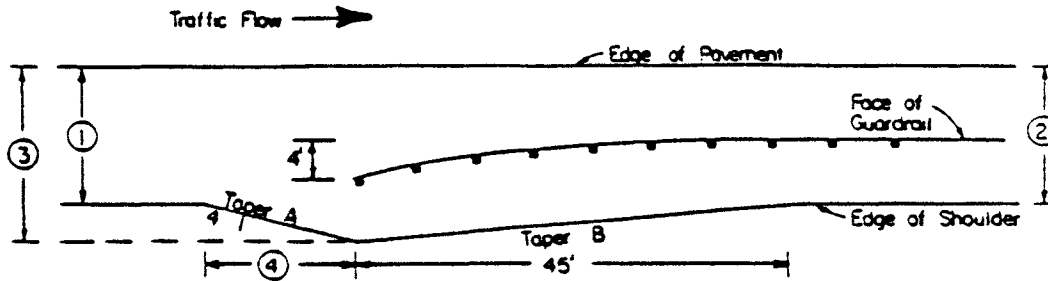
See Road and Bridge Standards GS-3 and GS-4 for additional widths to be added to the normal shoulders on secondary roads when guardrail is required.

CABLE GUARDRAIL (Std. GR-3)

Cable guardrail should normally be used only on Limited Access projects which provide "Recoverable Areas" exceeding 14 ft. in width. The introduction of cable rail due to height of fill should be 20 feet above the original ground. This is based on the hinge point between 6:1 slopes and 2:1 slopes. If the introduction of cable guardrail is in close vicinity to a cut section, it should be extended and terminated in the back slope of the cut ditch. (Use 15:1 transition for Design Speeds of 70 MPH or 13:1 transition for Design Speed of 60 MPH or less.)

FIGURE NO. 5 - GUARDRAIL TERMINAL INSTALLATION SITE PREPARATION REQUIREMENTS FOR GR-7

TYPICAL INSTALLATION



(See, also, Special Design Drawing No. 1380-A in IIM LD- (D) 150)

Table I
 *SHOULDER WIDTHS AND TAPER REQUIREMENTS

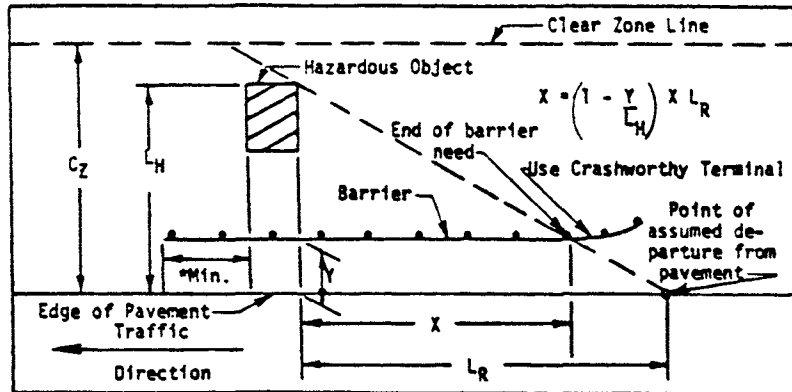
Normal Width ① Ft.	Additional Width Req'd. For G.R. Ft.	Normal Width For G.R. ② Ft.	Additional Width for Term. Flare Ft.	Width @ Terminal ③ Ft.	Taper A ④ Ft.
15	-	15	4	19	16
13	-	13	4	17	16
12	-	12	4	16	16
11	-	11	4	15	16
9	-	9	4	13	16
8	-	8	4	12	16
7	-	7	4	11	16
4	2	6	4	10	24
2	3	5	4	9	28

*Shoulder widths other than the widths listed may be encountered on bridge replacement projects and other projects (involving guardrail updates) on which existing shoulders are of insufficient width. When this occurs, the values for the Additional Width For Terminal Flare, Width @ Terminal and Taper A are to be adjusted accordingly.

DETERMINING LOCATION OF THE ENDS
OF GUARDRAIL

The following Figures and Tables have been adopted from the 1977 AASHTO Barrier Guide and will give a method to determine the location of the end of guardrail systems. (See Figures 6-7 and Tables 2-4.) Appropriate terminals shall be installed at this point.

Figure No. 6 - Barrier length of need determination
(Condition showing hazard right of traffic)



- X = Length of Need
- CZ = Clear Zone Width
- LH Max. = CZ
- LR = Runout length (See Table 2)
- * = 25' for GR-2
- 12.5' for GR-2A
- 25' plus a Type I Terminal for GR-8
- 1' for MB-7C

Table 2

Design Parameters for Roadside Barrier Layout

Design Traffic Volume (ADT)							
Operating Speed (mph)	Over 6000	2000-6000	800-2000	250-800	Under 250	Flare Rate	
	Runout Length L_R (ft)	Runout Length L_R (ft)	Runout Length L_R (ft)	Runout Length L_R (ft)	Runout Length L_R (ft)	GR-2 3&8	MB-7 A,B,&C
	70	480	440	400	360	330	15:1
60	400	360	330	300	270	13:1	17:1
50	320	290	260	240	210	11:1	14:1
40	240	220	200	180	160	9:1	11:1

SLOPES FOR APPROACH BARRIERS

As a general rule, a roadside barrier should not be placed on an embankment if the slope of the embankment is steeper than 10:1; however, in special cases, such as "barn roof" ("recoverable area") slopes, it is acceptable to place the barrier on slopes up to as steep as 6:1; however, when the barrier is used on 6:1 slopes, a 10 foot rounding should be included between the shoulder and slope. Where it is not feasible for the entire graded median in the area of the hazard to be on a 10:1 slope, an acceptable alternative is to provide the 10:1 slope between the edge of pavement and the approach barrier. (See Fig. 7)

Figure 7 Suggested Slopes For Approach Barriers

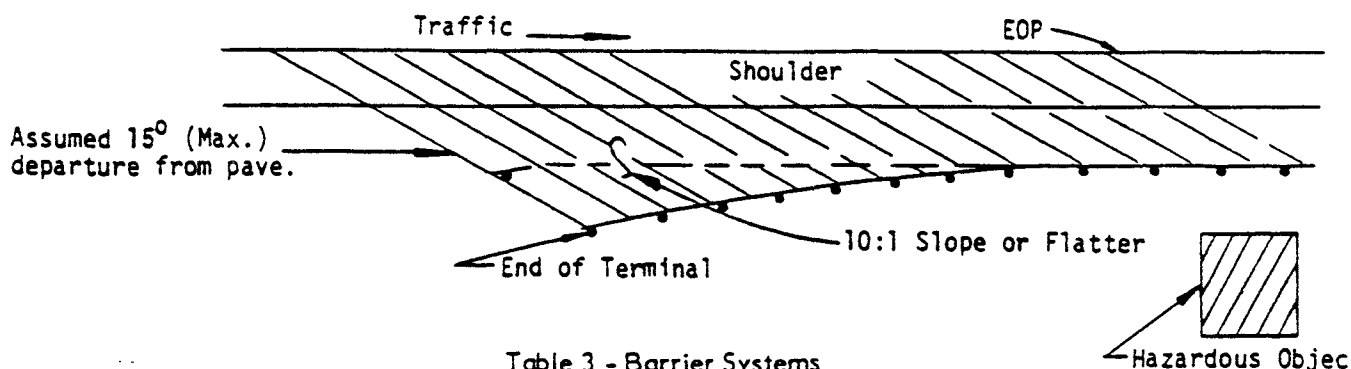


Table 3 - Barrier Systems

Type Designation	Barrier Height	Maximum Dynamic Deflection (a)	Minimum Offset (c)	Post Spacing
GR-2	27"	4.0 ft.	6.0 ft.	6'-3"
GR-2A	27"	(b) Less than 4.0 ft.	3.0 ft.	3'-1-1/2"
GR-3	30"	11.0 ft.	12.0 ft.	16'-0"
GR-8	30"	8.0 ft.	9.0 ft.	12'-6"
GR-8A	30"	6.0 ft.	7.0 ft.	6'-3"
GR-8B	30"	4.5 ft.	5.5 ft.	3'-1-1/2"
GR-8C	30"	5.0 ft.	6.0 ft.	4'-2"
MB-7A, B & C	32"	0.0 ft.	0.0 ft.	N/A

- (a) The deflection zone of all rail systems must be totally clear of any obstacles in order to assure that the rail will perform as tested.
- (b) No test data available.
- (c) Minimum offset from hazardous object.

DETERMINING WARRANTS FOR ROADSIDE BARRIERS

TABLE 4

<u>Fixed And Hazardous Objects Within The Clear Zone</u>	<u>Guardrail Required</u>	
	Yes	No
1. Sign Support (ground mounted):		
(a) Post of breakaway design		X
(b) Sign bridge supports	X	
(c) Metal shapes 2-1/2" dia. or greater, also piggyback posts with a total section greater than 4 lbs. per foot.	X	
(d) Concrete base and/or bolts extending 4 in. or more above ground.	X	
2. Lighting poles and supports of breakaway design		X
3. Bridge parapet ends, piers and abutments at underpasses	X	
4. Retaining walls and culvert headwalls	X	
5. Trees with diameter greater than 4 in.*	X	
6. Utility Poles	**	
7. Wood poles or posts with cross sectional areas greater than 25 square inches.	X	
8. Lighting poles for high mast lighting	X	
9. Rough rock cuts and large boulders	X	
10. Streams or permanent bodies of water more than 2 feet in depth	X	
*Every effort should be made to remove the tree rather than shield it with guardrail.		
**Guardrail will not normally be used to shield a line of utility poles. However, where guardrail is used in front of utility poles for other reasons, the choice of guardrail should be in accordance with the deflection shown in Table 3.		

