

Risk Management Analysis: Highway Maintenance Operations

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ABSTRACT

Tort liability is a growing concern to transportation agencies. Pennsylvania lost sovereign immunity in 1978 and to date has experienced a considerable number of claims for damages due to alleged negligence. An analysis of the claims indicates that approximately 75 percent or more relate to maintenance operations. In-depth discussion of specific cases between attorneys defending the Pennsylvania Department of Transportation and its engineers yielded a number of strategies relating to maintenance operations that can reduce exposure to future suits. Those elements specifically addressed include complaint recording and processing, sign deficiencies, low shoulders, icy spots, potholes, and guide rail repair.

The relationships of tort liability to maintenance operations and, more importantly, means of reducing exposure to future tort actions are considered in this paper.

During the summer of 1978 the Commonwealth of Pennsylvania lost its sovereign immunity and therefore became liable for acts of negligence relating known highway deficiencies to the cause of accident damages. The Bureau of Risk and Insurance Management of the Department of General Services for the Commonwealth maintains a current history and profile of all tort liability claims and legal suits that are filed against all Commonwealth agencies and departments. A recent loss-data analysis that they performed revealed that from the inception of the torts program in 1978 until July 12, 1983, more than 14,357 claims have been filed against the Pennsylvania Department of Transportation (PennDOT) pertaining to the state highways and motor fleet accidents of which 11,807 claims are in prelitigation and 2,550 legal suits are in litigation.

Even though approximately 50 percent of these claims and suits have been denied or closed without settlement to date, total settlements have exceeded \$20 million, and the projected incurred loss for the remaining 50 percent of open or partially open claims and legal suits exceeds \$61 million. In summary, PennDOT has incurred an estimated tort loss in excess of \$81 million to July 1983. The potential loss of revenue associated with these and future claims makes it imperative to better understand relationships between alleged highway deficiencies and claims.

BACKGROUND

In Pennsylvania, all claims against the Commonwealth are channeled through the Bureau of Risk and Insurance Management for claims handling, data processing, and fiscal and administrative control. Tort

liability claims and suits are processed as follows. Professional claims evaluators working in the claims division represent the Commonwealth in the settlement of tort claims, and the tort suits are defended by the torts litigation section of the attorney general's office.

By reviewing the prelitigation and litigation loss-data analysis, an overview of potential problems and loss trends associated with geographical locations in the state was obtained. In addition, information included in the settlement process was carefully analyzed for selected settlements exceeding \$50,000 to pinpoint priority problems and proximate contributing factors.

To better understand the potential problems that PennDOT was facing, each of the some 25 attorneys defending the department was interviewed in depth to gain insight on specific suits. The criteria used to identify specific suits for discussion purposes were as follows:

1. An act of omission or commission by the department that grossly affected its liability,
2. High probability of reoccurrence at other times or places,
3. Probability of a solution,
4. Probability of future major suits against the department.

Surprisingly, well over 75 percent of all suits identified involved maintenance operations. The remaining categories included design defects, contract construction work, and third-party legal agreements. Highway conditions associated with maintenance operations most predominantly mentioned included low shoulders, isolated icy spots, deficient signing, deficient or poorly maintained guide rail, and potholes.

Efforts were concentrated on understanding the relationship between highway maintenance operations and tort liability. In Pennsylvania, county maintenance organizations are made up of a county maintenance manager, usually 3 to 5 assistant county managers, and 10 to 15 foremen who supervise the work crews. They are responsible for maintenance operations on all state highways within the county. In-depth interviews were conducted with county maintenance managers and assistants. PennDOT has a comprehensive maintenance manual that serves as a framework for performing specific types of functions, efficiencies, productivity, crew size, equipment needs, and so on.

County maintenance managers in five selected counties were interviewed to gain insight on the planning, determining of priority, and conducting of maintenance operations, particularly as related to general types of deficiencies associated with tort liability that the attorney general's office identified.

Specific types of information gathered are outlined as follows:

1. Written complaints
 - a. How are written complaints handled?
 - b. Who receives them in the county?

- c. Are they reviewed in the field by this individual? If not, by whom?
 - d. What has been the shortest and longest time to field check a complaint? What determines the time?
 - e. What is the method of record keeping?
 - f. Has a maximum time been established? Is there a method of determining priority for review of complaints?
 - g. How is the decision whether to do something about a complaint made?
 - h. Who decides not to do anything about a complaint?
 - i. Who decides to do something?
 - j. What factors are considered in making the decision?
 - k. Who decides when work is to be done?
 - l. Who determines that a complaint is a true emergency?
 - m. How is this decision made for potholes, for shoulder drop-offs, for other emergencies?
2. Telephone complaints
- a. Who takes telephone complaints?
 - b. Are the complaints recorded? What is the method of record keeping?
 - c. Who reviews the complaints and when?
 - d. Who decides not to do something about a complaint?
 - e. Who decides when to do something about it?
 - f. How is this done?
3. All complaints: establishing priorities
- a. Is there a procedure for identifying critical hazards recorded through complaints? If so, how does it work?
 - b. How do pothole complaints fit into it?
 - c. How do guide rail complaints fit into it?
 - d. How do shoulder drop-off complaints fit into it?
4. Emergency calls during nonworking hours
- a. How is the department notified?
 - b. Who is notified?
 - c. Who determines whether it is an emergency?
 - d. How is the determination made?
 - e. How are knocked-down stop signs handled?
 - f. How are serious potholes handled? Is a crew ever sent out in the middle of the night, during off hours, on holidays, and so on?
 - g. Is a contract used to place flashing barricades?
 - h. How are shoulder drop-offs handled? Are flashing barricades used?
 - i. How are icy patches handled? Are they handled the same night? How is the decision made whether to handle such situations at once?
5. Knocked-down guide rails
- a. How is the department informed of knocked-down guide rails?
 - b. Are records kept of such guide rails? Where are the records?
 - c. How are priorities established?
 - d. What is the normal time to have guide rail repaired?
 - e. Is guide rail repair performed by contract or department forces? How much of each is done?
 - f. What is the size of the guide rail contract? Is this a restraint? Is the contract confined to a certain number of routes?
 - g. How is the work fed to the contractor? At what rate? How is the rate determined?
 - h. How are roads not covered in the contract repaired?
- i. What is the inventory of available guide rail materials?
 - j. How is the type of guide rail replacement determined? Who does this?
 - k. Is the guide rail foreman familiar with guide rail standards, type, height of end section?
 - l. Are weak posts and guide rail systems replaced?
 - m. Are end treatments replaced?
 - n. Is there quality control; does the assistant county manager check work from a technical standpoint, that is, proper height, blockouts, end treatment?
 - o. What is the process for scheduling work?
 - p. How do complaints enter into it?
 - q. How do emergencies enter into it?
6. Emergencies
- a. Are there any written policies on how to respond to emergencies? Is there a definition of an emergency during off hours, on weekends, or on holidays?
 - b. Are there any policies on how complaints are to be reviewed, analyzed, and worked into the schedule?
7. Signs
- a. Is there a process to replace knocked-down stop signs during nonworking hours?
 - b. Is there a sign inventory under way in the county?
 - c. Are any sign requests generated from assistant or county managers?
 - d. What about knocked-down signs not covered by the traffic unit work order? Who does the repair work and how?
 - e. How many signs does the sign foreman have work orders for? What length of time will it take to complete all sign work orders?

An analysis of tort information obtained from PennDOT's attorneys in conjunction with operational data from the maintenance managers permitted an assessment of current practices. Results of the assessment yielded a set of recommended guidelines and practices to reduce exposure to future tort liability associated with maintenance operations. Such guidelines and practices can be categorized as follows:

1. Emergencies (during working hours and outside of working hours),
2. Record-keeping process for notification of hazards,
3. Low shoulders,
4. Icy spots and snow removal,
5. Sign deficiencies,
6. Work zones,
7. Guide rail repair,
8. Potholes, and
9. General.

A discussion of practices to reduce exposure to tort liability in each category follows.

EMERGENCIES

The basic types of emergency conditions encountered are knocked-down stop signs and icy spots. (PennDOT does not maintain traffic signals.) Less-frequent emergencies include major potholes, slides, and significant pooling of water on the roadway. Some key steps that can be taken to reduce exposure during or outside of working hours are as follows.

Outside of working hours, a communication system should be established such that police agencies can

immediately contact responsible individuals having sufficient authority to react to the emergency. A mechanism or process should be established such that crews or individuals can quickly assemble and respond to emergency situations during normal weekday nonworking hours and on weekends.

During nonworking hours or working hours, the individual responsible for accepting notification during nonworking hours should have sufficient authority to determine whether the condition constitutes an emergency or can be corrected during normal working hours. Although many types of conditions can be easily defined as emergencies (e.g., knocked-down stop signs or icy spots), other conditions require dialogue with the police agency or individual notifying the maintenance organization to assess the magnitude and severity of the condition specified. The decision to respond during nonworking hours should be based on degree of hazard and potential for severe accident occurrence within a short period of time.

When an emergency condition exists, the police agency should be requested to control traffic at the site until the work crew arrives. The name of the responsible individual in the police agency to whom the request is made should be documented along with the time of the request.

NOTIFICATION OF HAZARDS

All complaints and notification of hazards, whether written or by telephone, should be documented, preferably on a standard notification form. The form should identify not only the name, address, and phone number of the complaint but also the time the complaint was received, the person receiving the complaint, and the time that the complaint was acted on along with the action taken.

Quality control should be performed by middle management to ensure that the form is completed properly, that all complaints are being recorded, and that the forms are filed in a logical, easily retrievable method.

In some instances, because of other higher-priority work, complaints cannot be corrected for an unusually long time, longer than what would be considered a reasonable period of time under normal circumstances. When this occurs, the document that records the notification of complaint should specify what higher-priority work needed to be accomplished before correction of the complaint. Complaints or notification of hazards in which correction responsibility is with another agency (municipality, contractor) should be documented as well as the time that the responsible agency was notified and the name of the individual in the agency who receives the notification.

LOW SHOULDERS

Low shoulders at isolated locations, such as at the bottom of a steep grade or the inside of a sharp curve, sometimes pose a serious recurring problem due to rapid degradation. A solution in such instances is to provide an all-weather paved surface capable of withstanding occasional loads.

When a major shoulder drop-off exists (4 in. or more in depth) and cannot be corrected within a reasonable period of time, flashing barricades or Low Shoulder warning signs should be placed at spot locations as soon as possible. Low Shoulder signs should be placed for extensive sections of low-volume highways that cannot be fixed for a reasonable period of time.

A low shoulder poses a higher potential for accidents during winter months because of the higher probability that vehicles will leave the pavement when it is covered with snow or ice. It is also more difficult to repair such spots during winter months. Consequently, emphasis should be placed on shoulder operations in the fall to minimize the low-shoulder occurrences during winter months. Shoulder construction in conjunction with pavement overlay work should be coordinated so that the exposure time for a shoulder drop created by an overlay is minimized.

ICY SPOTS AND SNOW REMOVAL

Specific locations ice up frequently during winter operations. Excess water on the roadway may be caused by poor or blocked drainage, springs, broken water mains, runoff from driveways or land adjacent to the right-of-way, proximity to a large body of water, and many other reasons. A program can be generated to identify sites that ice up frequently, the probable causes determined, and the appropriate remedial action taken. This should occur during non-winter months.

For those locations that ice up frequently due to an illegal driveway or runoff from an adjacent parcel of land, the property owner should be informed in writing that the illegal driveway or runoff is causing water problems in the pavement. In some cases it may be desirable to provide the municipality with a copy of the letter and to ask to be informed when a problem occurs. If the property owner fails to take corrective action within a reasonable period of time, the agency's legal counsel should be contacted to pursue appropriate legal action. It may be advisable to inform the property owner that should an accident occur before corrective action has been taken and a claim is filed against the agency, the agency will join the property owner in the suit.

For those recurring icy spots that cannot be corrected, a Watch for Ice sign should be erected.

For some conditions, except during snowstorms, some agencies utilize night patrols during nonworking hours (winter months only). The following provisions are recommended for these patrols:

1. Each piece of equipment used on the patrol should have two-way radio communications with the agency so that if the agency is notified by telephone of a dangerous icy condition, the agency radio operator can immediately notify one of the patrol for appropriate response.
2. Each agency should prepare a list of known icy spots that cannot be corrected until spring. This listing, updated by middle management, should form the backbone of the patrol's work. The list should be provided to the patrols so that a schedule of work can be developed.
3. Either the radio operator or the equipment operator should record the notification time of an icy spot and the time at which it is corrected. Many times suits allege a considerable length of time between notification and correction. The police agency responsible for the highway should be requested to furnish protection and traffic control until the agency's crew arrives.
4. The number of workers on night patrol should not be fixed nor should the patrol function only on week nights. If there are known icy spots that have a probability of occurring on weekend nights, it is desirable to have a mechanism for responding in approximately the same amount of time as would be expected on a weekday night. Also, after a heavy snow, even after the pavements have been plowed, there may

be an increased frequency of icy spots at certain locations because the daytime temperature is above freezing and causes runoff, which freezes on the pavement at night. When such a condition is occurring or anticipated to occur, the number of patrols should be increased to that estimated to be necessary to reach the bulk of the icy spots within a reasonable period of time.

5. The patrol should be in effect during the period in which freezing may be expected to occur at night. This may be slightly longer than the standard period of winter operations. The patrol should also be aware of potential freezing conditions adjacent to bodies of water and shaded sections of highway, particularly in late fall and early spring when there is no snowfall.

When long structures are plowed, hardened snow on the portion of the structure between the edge of pavement and the parapet should be removed within a reasonable period of time to prevent vehicles from going over the parapet.

With minor modifications, the foregoing procedures can also be applied to locations that frequently flood.

SIGN DEFICIENCIES

A method to identify and correct sign deficiencies in a logical, routine manner is highly desirable. Deficiencies include cases in which a sign is knocked down, missing, obsolete, not in compliance with existing regulations, and of poor reflectivity. They should be corrected within a reasonable period of time.

Stop signs that have been knocked down should be treated as an emergency condition and replaced within a short time during working or nonworking hours. In some cases a temporary stop sign (mounted on a tire rim or similar base) can be used until a sign crew can place a permanent sign. When notified of a damaged stop sign, the police should be requested to remain and control the intersection until the agency's employee or crew arrives and replaces the sign.

During spring and summer, foliage can significantly reduce or eliminate the visibility of a sign. It is desirable for the agency to have a process to identify sites where this may occur and take preventive action. This is especially critical for stop signs, warning signs, and important directional signs. Brush cutting may be scheduled during inclement weather.

WORK ZONES

A contractor should not be permitted to modify the traffic control plan without the written approval of the agency. Before using a given route or combination of routes as a detour, they should be thoroughly inspected to ensure that (a) all traffic control devices are in conformance with established regulations and (b) other deficiencies such as low shoulders and potentially hazardous potholes, which are magnified when higher volumes of unfamiliar motorists use the facility, are corrected. This is particularly true when a low-volume route will be used as a detour and a substantial portion of the motorists can be expected to be unfamiliar with it.

The construction contract should contain a clause that indemnifies the agency in the event that a suit is initiated. It may be desirable to extend the clause so that the agency is also indemnified for acts of negligence pertaining to the contract on the

part of its employees. Utility companies, municipalities, and other public agencies that perform work with agency rights-of-way should agree by contract, agreement, or permit to save the agency harmless from any claims associated with the work performed. It may be desirable to extend the clause so that the agency is also indemnified for acts of negligence pertaining to the work on the part of its employees.

GUIDE RAIL REPAIR

A process should be established to repair accident-damaged guide rail within a reasonable time in order to minimize the possibility that a vehicle may collide with the damaged section. Emergency-type repairs (within a very short time period) are advisable if there exists substantial potential that a second serious accident will occur before the guide rail can be repaired on a routine basis. Some factors influencing the potential include length of guide rail completely damaged (approximately 50 ft or more) and a volume and speed of the facility, history of guide-rail accidents, or location where the embankment is extremely steep or high so that penetration would almost certainly result in a serious accident. Existing accident-damaged blunt ends of guide rail should be replaced with a standard buried-end treatment.

Managers should keep abreast of the standards and criteria for each type of guide rail used. Quality control of guide-rail repair from a technical standpoint should be performed (i.e., connections to parapets, end treatments, height of guide rail, proper post, and adequate deflection area).

POTHOLES

In the spring when pothole occurrences are at a maximum level, the major emphasis is usually on the higher-volume arterials. The maintenance strategy employed should be sufficiently flexible to react to potholes on lower-volume routes if those potholes are potentially more hazardous.

A process should be established so that major potholes judged to have substantial potential for causing an accident within a short time should be treated as emergencies. As such, flashing barricades or actual repair during standard nonworking hours should be considered probable solutions to the problem.

GENERAL

Funds necessary to defend tort claims against an agency are normally budgeted annually, entirely separately from the budget used for maintenance. Maintenance personnel should be aware that, given no increase in revenue, the more funds that are necessary to pay tort claims, the less funds there are for maintenance operations.

To increase awareness of the relationship between tort claims and maintenance operations, maintenance personnel should be trained in reducing the potential for claims against the agency. In addition, sanitized case summaries (those in which the names, dates, and anything specific to the location have been removed) and court verdicts should be made available to maintenance personnel so that specific relationships between maintenance operations and the laws on torts can be apparent.

Dependent on specific law, in many cases claims against the agency are not filed for several months or even years after the accident has occurred and

the case may not be tried until several years after the accident. Some of the perishable conditions such as the specific pavement, shoulder, and sign conditions may be quite different at the time the claim is filed or tried compared with when the accident occurred. In such cases the plaintiff's attorney may have considerably more knowledge of the highway conditions than the agency's attorney. In those accidents in which there is likelihood that a claim may be filed against the agency, it may be beneficial to obtain highway condition information, usually photographs, shortly after the accident occurs.

Manuals and regulations should be reassessed periodically to determine whether the criteria and requirements specified reflect the actual capabilities and priorities of the agency in addition to the latest acceptable standards and techniques available. Violating a nonpriority requirement specified in an out-of-date manual may put the agency's attorney at a disadvantage.

SUMMARY

In summary, it is important that maintenance functions and tort liability relations undergo close scrutiny. Generated from these analyses are means by which future tort claims may be reduced. It is imperative, however, that an agency not lose sight of its primary maintenance goals. As such the measures implemented to reduce tort liability should complement the agency's ability to obtain established maintenance goals rather than force the agency to make a choice between goals and tort liability.

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Abridgment

Sign Maintenance Management

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ABSTRACT

Sign maintenance management requires a systematic approach beginning with an inventory of traffic control devices that is updated with work orders. The initial inventory procedure can be accomplished either manually or by photologging followed by data entry in a computer file. The data base is required for management of maintenance procedures, materials purchase, inventory control, forecasting, and budget planning. A benefit of an ongoing inventory is the accurate identification of such problems as theft, vandalism, installation deficiency, and durability. Suggestions for correcting such chronic sign maintenance problems as weathering failure, accident damage, vandalism, theft, defacement, and gunshot damage are made. Refurbishment of sign faces in the field may be possible in a number of such situations. A maintenance system is required for cost justification and control and is a useful adjunct in the defense of tort liability.

The essential needs of route guidance, intersection control, vehicle guidance, and safety are most economically met by conventional traffic control signs. Maintenance of such essential traffic control devices reliably and in satisfactory condition is aided by a systematic approach that includes record keeping and such field activities as inspection, evaluation, and replacement.

INVENTORY

With proper records, the age of sign installations can be traced, and exact numbers of signs by type are known; information is available that is helpful in planning and budgeting as well as in tort liability. In their review of tort liability case law, Eck and Malaeb (1) found a pattern that claims for deficient construction signs and traffic control devices had the highest dollar award per claim. They recommended inspection, record keeping, and warning systems. This review will address these activities.

Proper planning requires the collection of information from the field, and this invariably involves an inventory of devices. Field data can be collected either manually or with photologging equipment. Automated pictorial logging is often more economical than the manual process and offers numerous other advantages. Videotaping is a relatively new method used to collect data and is also satisfactory.

Each technique has its advantages and disadvantages. Manual techniques (Table 1, Figure 1) are most appropriate for low-volume roads and where labor may be readily available for such work. The multipurpose form in Figure 1 employs a keysort needle for sorting and collating. The Utah form is designed for field use with later data entry in a computer file. The advantages of the manual method of collecting data are that it requires no special equipment or skills. The disadvantage is that it is expensive and time consuming for routes with a normal amount of traffic. In addition, it is difficult to check the accuracy of the information once it has been collected. Other field trips may be required for verification.

The objective is to be able to reconstruct in some detail a description and location of devices