EVOLUTION OF RISK MANAGEMENT IN A STATE HIGHWAY AGENCY

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INTRODUCTION

Historically, the doctrine of sovereign immunity provided a formidable legal defense to tort actions brought against state governmental agencies. However, in recent years, changing public attitudes on highway safety, social justice, and litigation in general, coupled with numerous legal challenges to the doctrine, have eroded the protection sovereign immunity once provided. While prior to 1960 only a handful of states did not enjoy full immunity from torts, today statutes in only a handful of states provide for full immunity.

With these changes has come a swelling tide of tort actions against governmental agencies. State highway or transportation departments have been frequent targets, in part because of the broad exposure created by a public highway system. The level of tort activity directed against these departments has reached a point where tort liability payments have become a major financial concern; ways of reducing the number of tort actions and their financial impact should be priority items for the states.

Transportation safety and legal experts are recommending risk management as the logical, necessary and effective approach for departments of transportation to use in dealing with their emerging tort liability problems. (1) (2) (3) In a broader context, risk management should be a component of comprehensive highway safety programs. The purpose of this paper is to describe the evolution of Pennsylvania's risk management process. This process is believed to be in a mature phase of development relative to most other states. By describing the initiatives undertaken, identifying the problems encountered, and recommending courses of action, this article should provide useful insight for risk management processes as they evolve in other states.

Risk management is defined as a planned approach to protect an organization's resources from the risk of accidental loss or damage -- either from natural or man-made occurrences -- performed in a manner that enables management to achieve the organization's overall goals and objectives.

There are five commonly recognized steps in a normative model of the risk management process. These steps are listed and briefly described in Table 1.

TORT LIABILITY IN PENNSYLVANIA

The Commonwealth of Pennsylvania is one of the states that modified its tort liability statutes in the late 1970s and is now facing a rapidly escalating and financially significant liability problem. Prior to 1978, Commonwealth agencies, officials (appointed or elected), and employees enjoyed sovereign and official immunity. However, on July 14, 1978, the Supreme Court of Pennsylvania, in the case of Mayle v. Commonwealth, struck down sovereign immunity as a legal defense for the Commonwealth.

On September 28, 1978, the General Assembly passed Act 152, the Tort Claims Sovereign Immunity Act, reaffirming sovereign and official immunity for Commonwealth agencies, officials, and employees acting within the scope of their duties, but providing for limited waivers of immunity in eight areas. Table 2 lists four of the areas that directly affect the Pennsylvania Department of Transportation (PennDOT).

Act 152 permits recovery of damages for past and future loss of earnings and earning capacity, pain and suffering, medical and dental expenses, loss of consortium, and property losses, except that the latter cannot be recovered in the case of damages caused by potholes. As the law now stands, recoverable damages are limited to $250,000 per individual and $1 million per incident.

Although Act 152 was passed in September 1978, it suspended all trial or pretrial procedures on actions against the Commonwealth until July 1, 1979. As of June 10, 1988, approximately 58,700 actions were filed against Commonwealth agencies; approximately 46,200 of these actions, or 79 percent, involved PennDOT.

Although slightly more than one-half of the actions filed against PennDOT are disposed of without payment, the monetary cost for settlement payments on the remaining actions has been substantial, totalling nearly $100 million between July 1, 1979 and June 30, 1988. Had this money been available for maintenance, approximately one million signs could have been replaced, 62,900 miles of road surface treated, or 314 miles of road resurfaced.

Just as alarming as total PennDOT settlements has been the rapid growth in both annual settlements and the potential payments associated with tort actions that remain open in various stages of the litigation process. Figure 1 shows that with few exceptions settlement payments have increased significantly each year. Similarly, Figure 2 shows consistent annual jumps of $20 to $40 million in potential settlements associated with pending tort actions.

PENNDOT'S REVITALIZATION (4)

To gain a proper perspective on how and why PennDOT's risk management process evolved into its present form, it is necessary to examine briefly the state of the agency in the late 1970s and the major thrusts of the changes made in the 1980s. When Act 152 became law in 1978, PennDOT was an agency beset with near terminal problems in every facet of its operations. Years of financing multi-hundred million dollar new construction programs with state bond issues left the agency with an enormous debt service that eventually ground the construction program to a halt in the late 1970s. The magnitude, productivity, and quality of the maintenance program were abysmal; coupled with the accelerating level of stress on the highway system from increased truck travel, the result was a rapidly deteriorating highway system.

In addition, there were deep-seated organizational and administrative problems. Foremost was the tradition of filling hundreds of key management positions on the basis of political rather than professional qualifications. Political patronage was most fervently practiced in the county maintenance unit where approximately 70 percent of the agency's employees worked.

When a new administration took office in 1979, it immediately gave top priority to the organizational, administrative, and programmatic problems in maintenance. Improved maintenance productivity was the prime objective. Initial efforts focused on appointing professionally qualified county maintenance managers and assistants. Work force hiring standards and training were upgraded while maintenance foremen received supervisory education to improve management skills. Management set productivity goals in 13 key maintenance areas, developed monitoring systems for tracking progress, and held managers accountable for performance.

The results of these efforts were vast productivity increases and improving road conditions. For example, between 1979 and 1984, various surface treatment procedures were up between 33 percent and 58 percent, shoulder cutting was up 25 percent, and pipe replacement was up 34 percent. The estimaged number of potholes per mile was reduced from 5.2 in 1979 to 1.8 in 1984.

Once the fundamentals of professional highway management were in place and significantly improved productivity levels attained. PennDOT's top management reoriented its focus from overt emphasis on productivity to concern with quality performance and the development of the organization's capacity to manage itself. Emphasis was given to management development programs and to the development of state-of-the-art management systems. In turn, program management responsibility and authority were dispersed to the district engineering offices and county maintenance units. Quality circle and similar employee involvement programs were established. In short, during the mid-1980s PennDOT's top management approach to productivity improvement was:

> to promote the idea of participative management and then to encourage lower level managers to develop or adopt whatever techniques seem best suited to their particular units. (4, p. 91)

The large-scale problems facing PennDOT and the fundamental nature of the changes that needed to be made within the agency during the early and mid-1980s limited the attention and resources that could be given to a budding tort liability problem. Consequently, as discussed later in this paper, PennDOT's risk management process was slow to develop in the early 1980s. Nevertheless, the top priority given to reforming and significantly upgrading the maintenance program will have a far-reaching and prolonged impact on PennDOT's liability exposure. The emphasis on maintaining and even improving maintenance productivity will continue into the foreseeable future, for within the agency it is generally believed that such a course will be most effective in minimizing the level of highway tort activity over the long term.

The revisions made in policies, organization, management systems, and resources during the early and mid-1980s formed an agency that has become significantly more capale of responding to liability problems and provided the kind of framework within which a risk management process could evolve and function to mitigate the future number of tort actions. The next two sections of this paper discuss the initiation of risk managmenet within PennDOT and the maturing of the process in the 1980s.

RISK MANAGEMENT RESPONSE -- EARLY YEARS

As mentioned, the Mayle v. Commonwealth decision signaled the need for fundamental changes in the Commonwealth's approach to tort liability. The legislature initiated these changes by creating the eight areas of waived liability in Act 152. The legislature also assigned responsibility for minimizing tort liability associated with the Commonwealth's 44,000 mile highway system to three agencies: PennDOT, Department of General Services, and the Office of the Attorney General. PennDOT has the lead role as the agency responsible for design, construction, and management of the highway system.

The other two agencies engage in support roles. Within the Department of General Services, Act 152 created the Bureau of Risk and Insurance Management (BRIM) to function, in essence, as the Commonwealth's insurance agency. Placed with the Office of the Attorney General are the responsibility and authority to defend all Commonwealth agencies, officials, and employees in litigated tort actions. A separate Torts Litigation Unit was established within the office to carry out this responsibility.

Initiation of Risk Management In PennDOT

PennDOT's initial risk management efforts focused on identifying the types of dangerous conditions most significant to its tort liability experience and put into place guidelines designed to reduce the number of future torts arising from maintenance operations related to these conditions. Nonetheless, it soon became clear that more definitive risk management action was needed. Risk assessments of selected county maintenance units found significant shortcomings in the degree to which the guidelines were being implemented. The circumstances were somewhat alarming; the guidelines, designed to lessen liability payments, were probably increasing liability exposure in those counties where operations continued to be inconsistent with the guidelines.

Further inquiry with county, district, and central office maintenance personnel sought reasons for the widespread failure to implement the guidelines. Questioning initially centered on the content of the guidelines. However, responses indicated that the problem had less to do with guideline content than it did with a management system that failed to assign responsibility, grant authority, or fix accountability for risk management objectives. Although the most significant risks had been identified and risk management priorities set via the guidelines, objectives were not going to be realized unless the management process was strengthened.

STRENGTHENING THE RISK MANAGEMENT PROCESS

The manner in which the guidelines were developed and distributed combined with weaknesses in the risk management organizational structure and staffing and a lack of performance evaluation for risk management accounted for the principal management shortcomings. (5) To rectify the situation, PennDOT made several management changes; these are summarized in Table 3.

As these organization and performance evaluation changes were implemented, the risk management process began to move into a new phase of development. The process was further advanced with top management's change in priority for risk management.

Higher Priority For Risk Management

In 1986, the State Secretary of Transportation formed a high-level Risk Management Task Force and charged it with responsibility for developing a risk management action plan to deal with the most critical liability issues. The task force's findings and recommendations have subsequently formed the basis for PennDOT's risk management strategy.

The task force declared that the growth of tort actions and associated settlement payments compelled PennDOT not only to identify and monitor the types of highway elements that have generated the largest number of actions, but also to direct an appropriate level of manpower and funding to the correction of deficiencies with high tort potential. Unless a more aggressive approach to risk management in all activities (planning, design, construction and maintenance) were taken, PennDOT would continue to react to tort problems rather than preventing their occurrence. In defining "appropriate", the task force found that:

- The tort liability issue should not be considered separate from other highway obligations.

- The shifting of funds from existing programs, projects, and services for correction of tort problems must be weighed carefully in terms of costs and benefits.

- The cost to correct and maintain all highway deficiencies in the categories that generate the greatest number of actions is well beyond the funding capability of PennDOT. To forego a major portion of the construction and restoration program would be neither practical nor advisable.

- Tort actions will be made and judgments rendered against PennDOT even if the highway system can be improved to meet all reasonable standards.

The task force concluded that there is no "quick fix" to tort liability problems; a long-term perspective is necessary to achieving the most effective solutions. Two long-term goals were recommended: (6)

1. Foster an awareness by all employees of the risk potential associated with their actions.

2. Establish an environment that encourages a balance between productivity goals and risk management objectives.

The remaining portions of this paper discuss PennDOT's current risk management process, which is geared to achieving these long-term goals.

Risk Management Staffing and Responsibilities

The responsibility for coordinating PennDOT's risk management efforts on a department-wide basis rests with the Risk Management Division within the Center for Highway Safety, a bureau-level unit within Safety Administration. The creation and staffing of the division with a full time risk management engineer represented another noteworthy risk management

step taken by top management in 1986. The division's mission is both preventive and defensive, as evidenced by the major responsibilities of the risk management engineer. Further explanation of these responsibilities is contained in subsequent sections on risk identification, evaluation, and treatment.

- o Identify policies, procedures, and/or activities which have resulted in a significant number of tort actions or high payouts (risk identification and evaluation) and recommended strategies to correct the identified problems (risk treatment).

- o Increase employee awareness of tort liability and the actions that can reduce exposure.

- o Coordinate the collection, analysis, interpretation, and application of engineering data in the preparation and presentation of the defense of major (high exposure) and precedence setting tort actions.

Although the Risk Management Division provides direction and support for the risk management process, it does not have responsibility for daily management of the process. That responsibility falls to the district engineering and county maintenance offices.

Explicit risk management responsibilities of the district engineering offices include coordinating with BRIM and the Office of the Attorney General on the collection of required facts and expert engineering opinions, the scheduling of court appearances by PennDOT employees, assistance to county maintenance managers in the development of effective risk management intitatives, and verification that county maintenance managers are providing the direction and leadership needed to reduce the number of future tort actions.

Most districts assign these responsibilities to three individuals. Tort coordinators generally spend 75 to 100 percent of their time coordinating information collection and scheduling for defense of existing tort actions and assisting development of risk management initiatives. The coordinators generally report to maintenance program engineers who assist part-time with developing risk management initiatives. The maintenance program engineers are one or two management levels below the assistant district engineer for maintenance, who is directly responsible for monitoring county maintenance manager performance, including risk management.

Although they do not have risk management titles, the individuals most crucial to an effective risk management process are the county maintenance managers and their assistants. These managers are responsible for implementation of the maintenance program and for daily management of the county maintenance units. PennDOT's upper

management gives top priority to appointment of qualified individuals to the county management positions and devotes considerable resources to developing managers' professional skills, including extensive risk management training.

The county maintenance manager's job is very demanding; they must continually make difficult maintenance resource allocation and scheduling decisions for many varied types of maintenance activities. These decisions must be made in an environment that is constantly changing due to variations in a wide range of elements, from factors internal to the agency, such as manpower and equipment availability, to external matters, such as weather conditions and traffic accidents. Furthermore, the county maintenance managers are responsible for a highly visible function. Their positions are one of the critical interfaces between the agency and the general public; demands that must be addressed come not only from within the organization but directly from the public as well.

Although the county maintenance managers are aware of the general magnitude and location of principal maintenance deficiencies, including the types of problems often associated with tort actions, they do not have, and reasonably cannot expect to have, sufficient resources to address all the problems. Indeed, for the foreseeable future, maintenance needs will significantly outweigh available resources. Consequently, decisions about what to repair and when usually involve weighing many factors, including tort liability concerns, and making significant trade-offs.

One of the trade-offs involving risk management is the determination of a suitable balance between productivity objectives, which should mitigate the tort liability problem in the long run, and risk management objectives that call for relatively immediate correction of dangerous conditions. As previously mentioned, the conflict between productivity and risk management objectives arises in part because dangerous conditions are generally not predictable and tend to be scattered geographically. The interruption of regularly scheduled maintenance activities to address isolated dangerous conditions can significantly impair productivity. Yet routine maintenance, especially activities such as shoulder work, scheduled on efficient, multiyear geograhic cycles may not address specific problem locations for several years.

There are no tailor-made formulas for making these tradeoff decisions. While guidelines, advice, and training can be given, PennDOT must ultimately rely upon the judgement of its maintenance managers to make professional decisions daily. This is one primary reason why well-qualified managers are needed to head the county maintenance units and why continuous managerial development is emphasized.

RISK IDENTIFICATION AND EVALUATION

Risk identification and evaluation is accomplished through explicit risk management staff activities, such as tort actions analyses and risk assessments performed by the risk management engineer, as well as by routine maintenance, traffic operations, and safety activities performed in the district and county offices.

Tort Actions Analyses

A computer data base maintained by BRIM allows the risk management engineer to analyze frequency distributions and trends on settled tort actions for items such as the types of highway elements associated with the actions, settlement payments, county and district locations, and whether or not fatalities were involved. The results of these analyses (exemplified in Tables 4 and 5) are a primary source of information used to focus agency attention on those types of highway elements associated with high settlement payments or a high proportion of fatalities. Although the number of highway element categories used to classify tort actions exceeds 100, nine of the categories account for nearly 60 percent of total settlements. The Risk Management Division makes recommendations at least annually to districts and counties to strengthen activities associated with risk types of elements. Each district and county also receives a quarterly summary of tort action settlements classified by highway elements for their respective jurisdication.

The analysis of trends in the tort data also provides a degree of effectiveness evaluation. For example, in the initial years following modification of sovereign immunity, potholes were associated with a high number of tort actions and settlement payments. However, since about mid-1982, PennDOT has directed considerable effort and funds to improving roadway surfaces and the number and cost of pothole actions have been dramatically reduced.

The risk management engineer also regularly reviews settlement memorandums on recently settled tort actions. A settlement memorandum is a document prepared by BRIM or the Torts Litigation Unit for any legal action on which a Commonwealth payment, whether court-ordered or negotiated, is made. It summarizes the facts of the case, assesses the degree of Commonwealth liability, and outlines the rationale for offering settlement or for pursuing the action to judgment.

The settlement memorandum reviews are used primarily to identify policy or procedural deviation patterns associated with particular types of high risk highway elements. This is also the principal purpose of the county risk assessments. In many cases, the types of high risk elements identified from the tort actions data base are symptoms of more fundamental problems that exist in such matters as the manner in which an operation is performed, record keeping,

scheduling of work activity, or interpretation of guidelines and recommendations. The risk assessments attempt to uncover these more fundamental causes of tort actions. For example, in the early 1980s, tort actions arising from intersection incidents, where a stop sign had been knocked down or stolen before the incident, were a major liability problem. A high percentage of these incidents involved fatalities and high settlement payments. Risk assessments found serious shortcomings in notification procedures, repair response times, and provisions for temporary traffic control. Emphasis was placed on improvement of these activities. In recent years very few actions have involved missing or down stop signs.

Field Office Risk Identification and Evaluation

While the tort actions analyses and risk assessments identify various types of high-risk highway elements on a systemwide basis, risk identification and evaluation in the county and district offices tends to have a more site-specific orientation. The courts have consistently found transportation agencies negligent for failing to correct highway deficiencies if it can be shown that the deficiency existed for an unreasonable length of time prior to the incident.

Pennsylvania utilizes three primary means of identifying maintenance related deficiencies: (1) STAMPP surveys, (2) road maintenance surveys, and (3) citizen complaints.

STAMPP Surveys. The Systematic Technique to Analyze and Manage Pennsylvania Pavement (STAMPP) was originally implemented in 1983 as a means of identifying candidate pavement sections for maintenance and rehabilitation programs. College students are employed during the summer months to conduct an annual survey of each mile of state highway. During this survey, the condition of the pavement, shoulders, drainage facilities, and roadside features (including guiderail) are observed and recorded. These data are then analyzed using STAMPP decision support software to determine county maintenance needs and establish funding levels.

In aggregate, STAMPP data provide an overall status of the state highway system. In addition, the data can be accessed to provide specific information for selected highway segments. For example, all highway segments with a greater than 4-inch shoulder dropoff in each of the past 3 years, or all highway segments on the primary commercial network with nonfunctional guiderail and treatments, can be identified by using STAMPP.

However, the fact that STAMPP data are updated only once per year limits their use as a means of identifying site-specific problems.

As an example, consider a highway segment with a 7-inch shoulder dropoff that is surveyed in the summer of 1987. STAMPP will list that condition or the segment until the following survey is conducted in the summer of 1988, even if the actual condition is corrected prior to that time. STAMPP data, however, do provide an excellent means of identifying highway segments with recurring problems and those with outdated or substandard elements such as nonfunctional guiderail.

Road Maintenance Surveys. Each county maintenance manager and assistant county maintenance manager is required, as a routine matter, to observe and record road condition data as they travel the roadway sections under their jurisdiction. Any observed condition that warrants corrective and preventive maintenance action is noted on a preprinted form (M-681) and then entered into the Maintenance and Operations Resource Information System (MORIS) planning file. The information stored in the planning file is reviewed each week and serves as the basis for preparing the following week's work schedule. Corrections to high-risk deficiencies as noted by the county or assistant county manager are incorporated into the work schedule at the possible expense of other preplanned activities.

Citizen Complaints. All complaints received by PennDOT are considered important sources of information relating to the serviceability and safety of the highway network. Complaints related to winter operations and potholes are routinely recorded in a radio log or the pothole hotline log, respectively. Corrective action on winter operations-related complaints is normally initiated during the work shift in which the complaint is received.

Pothole hotline complaints and all other complaints (telephone or written) are recorded on an M-206 Complaint Record and then reviewed by the maintenance manager for assignment of priority and for assignment to the appropriate individual for investigation, follow-up, or corrective action. Upon completion of the work needed to satisfy the complaint, a report showing the action taken, date completed, and individuals performing the work is recorded on the back of the M-206.

Other Risk Identifiction and Evaluation Activities

One of the traditional means of identifying highway system risks in Pennsylvania has been through procedures used to identify high accident locations for highway safety programming purposes. As in most states, highway safety in general, and the reduction of injury and fatal accidents in particular, has long been one of PennDOT's primary objectives. Accident data base systems are used to find highway segments and intersections with high accident histories. These locations

are evaluated and priorities are set for programming on the basis of criteria such as the number and type of remediable accidents, severity of injuries, the importance of the project within the community or area it serves, and benefit/cost ratio.

PennDOT's 3R betterment program is another important component in PennDOT's overall highway safety effort. Each project included in the betterment program is evaluated from a safety standpoint and safety enhancements are included as needed. Typically, guiderails, shoulders, superelevation, and drainage features are brought up to current standards in conjunction with the placement of a new roadway surface. Approximately 350 miles of state highways receive safety enhancements in this manner annually.

In addition, each construction contract is reviewed by a district safety review committee prior to completion of final design. This process ensures the proper applicaton and inclusion of current safety hardware and design features in each project.

Risk Treatments

Results from risk identification and evaluation procedures have consistently indicated that most tort actions against PennDOT are associated with alleged failure to perform functions which are either included in normal operating procedures or are part of planned/programmed efforts. Therefore, the emphasis in developing risk treatments has been directed toward strengthening the existing activities that have the greatest potential for reducing future risk rather than generating new programs. In particular, PennDOT's efforts to improve maintenance productivity and quality, to upgrade elements to current standards in conjunction with the 3R betterment program, and to continue and expand on its highway safety program are viewed as the most positive steps that can be taken to limit future tort actions.

Risk treatment recommendations developed by the risk management engineer are subjected to a review and revision process that includes the affected central office bureaus and divisions (primarily maintenance and traffic engineering/operations), the district engineering offices, and the top management of PennDOT, including the Secretary of Transportation. In general, risk treatments have been directed toward specific types of high-risk elements. For example, more emphasis has been given to eliminating shoulder dropoffs, nonfunctioning guiderail, slippery pavements, icy spots, and inconsistencies between posted speed limit signs and curve warning speed advisory plates due to the historically high tort settlements associated with these types of elements.

Other risk treatments have been aimed at improving management support systems used to identify and monitor specific types of deficiencies. For example, due in part to the high settlement payments made on tort actions involving signing deficiencies, PennDOT is moving toward the development and implementation of a statewide sign inventory system to aid in the identification and correction of missing or incorrect signs. Presently, signing deficiencies, such as damaged, missing, obsolete, or nonreflective signs, are identified by assistant county maintenance managers during routine driving inspections. Commonwealth attorneys have noted that assistant county maintenance managers who were not familiar with the signing that should be in place on the highway system often failed to discover that a sign was missing if there were no indications that it had once been there. This suggests the need for a statewide inventory of signing, which when coupled with regular signing inspections will provide a useful tool for counteracting liability risk due to signing deficiencies.

Research to improve PennDOT policies or procedures constitutes another type of management support system risk treatment. Recently the absolute number of relative percentage of tort actions involving slippery pavements have been increasing. These increases have brought attention to PennDOT procedcures for identifying slippery pavement locations and to policies regarding the timing and type of corrections applied. These procedures and policies, developed in the early 1970s, may be outdated due to subsequent research on pavement skid resistance and surface treatment. Consequently, PennDOT is presently sponsoring two slippery-pavement-related research efforts. One will improve the identification and programming of wet weather problem locations by developing a new means for classifying pavement sections according to their potential for wet weather accidents. The second will evaluate construction methods and surface treatment and overlay mix designs to find means of maintaining skid resistance for longer periods of time.

The first of the two research efforts illustrates the kind of procedural changes that are sometimes necessitated by liability concerns. PennDOT's present slippery pavement identification technique broadly classified pavement sections based upon skid number and past wet weather accident history. However, this technique does not indicate which sections have the highest potential for wet weather accidents. This potential is a function of actors such as traffic volumes, vehicle type mix, geometry, pavement wet time, and seasonal skid resistance variation. These factors are considered in programming slippery pavement corrections and account, in part, for why some pavement sections identified as slippery are not corrected in what the courts may consider a reasonable period of time. However, the increase to PennDOT's liability exposure caused by such sections is so significant that a change in the means for identifying and programming slippery

pavement projects is warranted. The new system will bring the accident potential factors forward from programming into the slippery pavement classification process by formally incorporating them in a wet pavement index. PennDOT is sponsoring research to develop the index, which will be used to rank order pavement sections based upon their potential for wet weather accidents. It is believed that this new system will lessen PennDOT's liability exposure and be more easily understood and defended in tort actions.

Education and training to increase employee awareness and understanding of tort liability and risk management is yet another type of management support system risk treatment and may be the most important of all risk treatments. For the risk management process to be effective, employees must be aware of the legal implications of their actions or inactions and should be sensitive to the relationship between their performance and the safety of the higway system. Education and training should also clarify personal liability concerns, making it clear that if employees act in a reasonable manner consistent with agency policies and procedures there will be no personal liability exposure.

Within PennDOT, formalized education and training programs are the principal means of increasing employee awareness and understanding of tort liability and risk management. The responsibility for developing these programs lies with the risk management engineer. The majority of training to date has been directed toward developing a general understanding of tort liability and risk management principles. All PennDOT personnel have completed or are currently receiving tort awareness training and training to aid maintenance forces in the identification of high risk deficiencies. Future training will be focused on specific tort problems, such as collection of perishable data at accident sites, complaint handling, and record keeping.

The principal mediums for the training programs are seminars, workshops, and videotapes. The last of these are more effective when supplemented by a risk management trainer for the initial showing. Copies of the videos are made available in the district and county offices for future reference and refresher training.

The county risk assessment is also one of the means used to enhance employee awareness of tort liability by keeping county personnel aware of the changes in tort exposure that occur over time and by reviewing appropriate risk management treatments for operations associated with a high number of tort actions. The field visits of the risk management engineer provide a person-to-person contact that is more effective than periodic memorandums or telephone calls. The learning process is not just unidirectional: the risk management engineer gains much information on operating practices that is useful for sharing with

other counties, monitoring the progress of risk management initiatives, or modifying risk management policies or procedures.

The risk treatments discussed thus far have loss prevention objectives. The principal loss reduction acitivity is the risk management engineer's development and coordination of input to the defense of major tort actions where settlemnt costs are expected to exceed $100,000. Approximately 50 such actions are settled each year, but the risk management engineer is able to be fully involved in only 2 or 3 of these cases while being partially involved in approximately 25 more. Full involvement includes extensive meetings and discussions with the trial team (Commonwealth attorney, expert witnesses, and fact witnesses), review of expert reports (plaintiff and defense), collection of data, and attendance at trial.

Risk Management Control and Performance Evaluation

As indicated earlier, monitoring and control for risk management improved once management responsibilities were clarified and performance measures were incorporated into management performance evaluation systems. The principal responsibility for risk management monitoring and control lies with the district engineering and county maintenance offices. Risk management performance measures have been incorporated into the performance evaluation of managers in both the county and district offices, including the district engineer. Most of these measures are process-oriented.

SUMMARY AND CONCLUSIONS

Table 6 displays the characteristics of the PennDOT risk management process as it has evolved and matured. During the first few years following the modification of sovereign immunity, the scope, magnitude, and key characteristics of the new environment created by tort liability were determined. A general understanding of the kinds of highway elements and functional activities associated with tort actions was attained and activities important to a good risk management effort were identified. Some initial risk treatments, such as the risk management guidelines for field maintenance forces, were developed and implemented.

This initial stage was also a period for assessing manpower and resources commitment needs for risk management. Several fundamental problems in the management system hindered effectiveness of risk treatments and the overall risk management process. Through the period there was no full-time staff assigned to the function; risk management was an add-on, part-time responsibility for a few individuals. Top

management gave little explicit emphasis or consideration to risk management due, in part, to the overall dire state of the agency. Responsibility for risk management was not clearly established. Key activities, such as the complaint handling process and maintenance record keeping, were haphazard and incomplete. Although tort actions were being processed, a data base on high-risk highway elements was not being developed for risk management. There was little tort awareness or risk management training, and numerous legal actions were related to policy or procedure violations. Few maintenance improvements were being made in the name of risk management unless the condition demanded an emergency response, such as a knocked-down stop sign.

Once top management was able to give higher priority to risk management, a more formalized and effective process began to evolve (stage 2 in Table 6). Attention was given to mitigating some of the organizational problems that beset the risk management effort in stage 1. Top management established risk management goals and objectives and committed personnal at the central and district office levels full-time to risk management. Risk management responsibilities, lines of authority, and accountablility measures were developed.

In addition to administrative matters, support systems and programmatic thrusts were improved or given greater emphasis for risk management. For example, a data base on settled tort actions was developed and used with more frequent risk assessments to focus risk treatment resources. Consultants were hired to improve complaint handling systems, to revise the wording of policies and manuals, and perhaps most important of all, to develop tort awareness training programs for employees. Few tort actions arising in stage 2 are related to policy and procedure violations.

Few risk treatments developed in stage 2 involve new programs or activities. Rather, the risk management process in this period has been oriented to increasing tort awareness and to modifying the emphasis on productivity objectives when there are serious risk management considerations. As a result, maintenance forces are more responsive to correction of high risk deficiencies in stage 2. Given two types of deficiencies, first consideration is now given to the type that has tended to be associated with tort actions.

Presently, PennDOT's risk management process is in transition between stages 2 and 3. The latter is an overall more aggressive and sophisticated approach than the former. In stage 3, even greater emphasis is placed on identifying and treating the most fundamental causes of tort actions, causes that often relate to the management system and performance. Risk management responsibilities and activities reach more levels of the organization, become routine, and are institutionalized. More meaningful accountability measures are developed

and used to judge performance. Risk management becomes a component in all training programs. More sophisticated support systems are developed in this stage, such as an information system that integrates accident, road system condition, maintenance activity, complaint handling, and tort actions data. Also characterizing this stage are decision support systems that assist county maintenance managers in weighing the trade-offs between productivity and risk management objects in the course of deciding upon the appropriate response to isolated dangerous conditions.

While traditional risk management activities become routine in stage 3, new activities aimed at more aggressively defending the transportation agency in tort actions are undertaken. For example, procedures are developed and employees are trained to collect perishable data at accident sites with high tort potential and in-depth investigations are conducted at high profile accident locations. A higher percentage of the risk management engineer's time is spent working with legal staff to develop strategies in defense of major tort actions. More cases are pursued to judgement where the liability of the transportation agency is questionable. Even though in some cases this stragegy may result in higher payments than if a settlement were negotiated, the strategy should discourage frivolous actions and result in lower total settlement payments in the long run.

In conclusion, some of the key elements in the development of a mature and effective risk management process include:

- Individuals with good management skills in decision-making field positions.
- Extensive tort sensitivity and risk management training, particularly for field managers.
- Top management support and general direction for risk management efforts.
- Top management clarification of the relationship between risk management objectives and programmatic objectives of the agency.
- Strong management systems that explicitly assign responsibility, grant authority, and establish accountability for risk management performance.
- Sufficient support systems for items such as record keeping, complaint handling, and tort actions analysis.

- A good public image to help mitigate the number of frivolous tort actions.
- A tort actions data base integrated with other highway information system data bases maintained by the agency.
- Aggressive defense of the transportation agency in tort actions where agency negligence is minimal.
- Consideration of risk management practices in other states.

To be most effective, risk management should become a way of thinking within the transportation agency. It should not be viewed or practiced as a separate program. Instead, it should be integrated into the philosophy of the agency and the everyday attitude of all agency employees as they work to achieve the agency's programmatic objectives. As such, risk management becomes the business of all employees, not just the responsibility of individuals with risk management titles.

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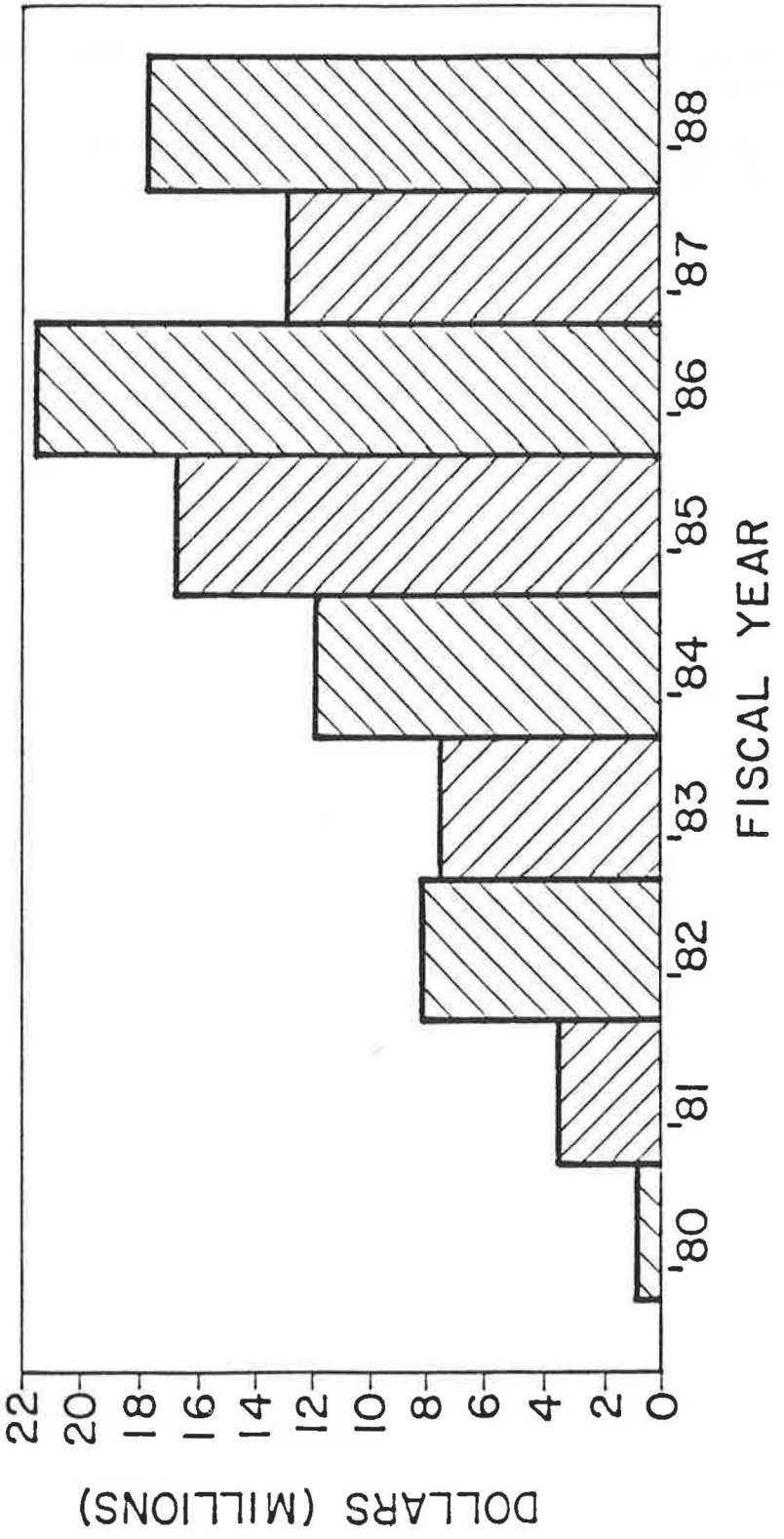
LIST OF FIGURES

Figure 1.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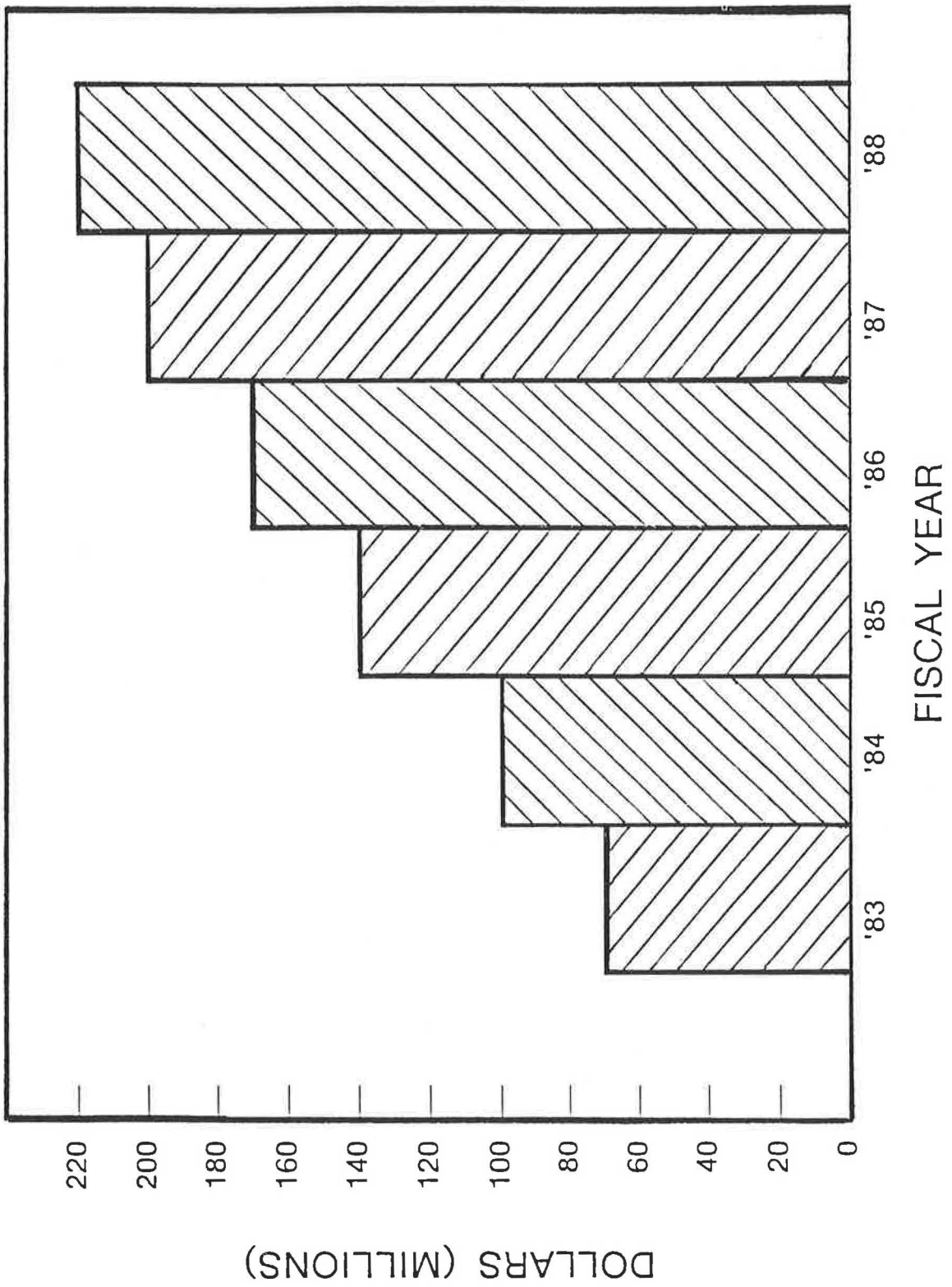
FISCAL YEAR

Figure 2.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DOLLARS (MILLIONS)
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FISCAL YEAR

Table 1. Normative Model of the Risk Management Process

Process Steps	Description/Comments
1. Determination of objectives	The key role in the process for top management. At times, the appropriate risk management action will conflict with or inhibit the undertaking of other program activities. For these situations, top management needs to provide general but clear direction to assist lower level managers in making suitable tradeoff decisions.
2. Identification of risks	The systematic and continuous identification of exposures to accidental losses as soon as or before they emerge. For systemwide analysis, two of the most popular methods are tort actions analysis and risk assessments. The former examines past tort incidents for pertinent characteristics, such as the types of physical highway elements associated with liability losses. The latter identifies and seeks relationships between policies, procedures, and practices and the identified elements. Highway inventories and inspections are methods used to identify risk exposures at specific sites.
3. Risk evaluation	A qualitative or quantitative assessment of the relative significance of each type of risk exposure. Measurement is usually made along two dimensions, the frequency and the severity of the potential loss.
4. Development and selection of risk treatments	The determination of the most cost-effective of effective risk management tool for treating risk exposures. Two complementary approaches are risk control and risk financing. The former alters the exposures in such a way as to reduce the expected loss or to make the annual loss more predictable. Examples range from directly allocating more resources for correction of physical elements, to improving employee training programs and performance evaluation systems. Risk financing either transfers the risk by using external funds to pay for liability losses, such as by purchasing insurance, or retains the risk by using internal funds to cover losses, i.e. self-insurance.
5. Implementation, management control, evaluation and review	Traditional managerial tasks. The prospect for achieving risk management objectives is considerably enhanced when responsibilities are clearly assigned, individuals are held accountable for performance, and the effectiveness of risk treatments are regularly evaluated.

Table 2. Areas of liability created by the Pennsylvania Tort Claims Sovereign Immunity Act and relevant to the Pennsylvania Department of Transportation.

Area of Waived Liability	Description
• Vehicle liability	Damages caused by the operation of any motor vehicle owned by the Commonwealth.
• Care, custody, or control of personal property	Damages caused by the care, custody, or control of personal property in the possession of Commonwealth agencies.
• Commonwealth real estate, highways, and sidewalks	Damages caused by a dangerous condition of highways, sidewalks, and real estate under the jurisdiction of Commonwealth agencies, except as limited in the next section.
• Potholes and other dangerous conditions	Damages, other than property damages, caused by potholes or other similar conditions created by natural elements. The claimant must prove that the dangerous condition created a reasonably foreseeable risk of the kind of damage incurred and that PennDOT was given written notice of the condition in sufficient time prior to the accident to protect against the dangerous condition.

Table 3. Actions taken to strengthen the risk management process.

Action	Explanation of Action
• The risk management guidelines for maintenance were converted to a more formal, long-standing policy document.	The document used to issue the guidelines was originally interpreted as a lower priority, short-term policy statement.
• District engineering offices that have supervisory responsibility and authority for county maintenance offices located within each district, were explicitly assigned responsibility for ensuring that the guidelines are followed.	When the guidelines were originally issued, the district offices were not explicitly assigned responsibility for ensuring implementation. This created a management control gap, as the central office did not have the resources to provide routine risk management control over county maintenance operations.
• The district engineering offices' risk management role was expanded to include assistance to each county maintenance office in the development of an effective risk management.	The district role had been limited to coordinating the collection and flow of information on existing torts in each district. This generally did not include activities explicitly designed to decrease the number of future tort actions.
• Measures related to risk management objectives were incorporated into the county maintenance office accreditation process and into the performance evaluation review of each county maintenance and assistant maintenance manager.	At the time the risk management guidelines for maintenance were originally issued, there were no measures on tort liability performance in PennDOT management evaluation systems. The measures in those systems compared performance against management objectives that were principally oriented toward improving productivity. However, productivity objectives may conflict with tort liability objectives in certain circumstances because dangerous conditions are generally not predictable and tend to be located in isolated sites; their correction often has an adverse effect on scheduled routine maintenance function productivity.

Table 4. Distribution of settlement payments among contributing highway elements (July 1979 through June 1988).[a,b]

Contributing Highway Element	Settlement Payments (millions)	Percent of Total Settlements
Work zone control	$ 6.71	7.0
Guiderail	6.56	6.9
Potholes	6.51	6.8
Signing	6.02	6.3
Median barrier	5.48	5.7
Shoulder dropoff	5.22	5.5
Appurtenance design	5.07	5.3
Icy patch	4.27	4.5
Slippery pavement	3.26	3.4
All other elements	$ 46.58	48.7
Total all elements	$ 95.70	100.0

[a]Includes payments on tort actions pending at the time the Tort Claims Sovereign Immunity Act became law (July 1, 1979).

[b]Based on data compiled as of June 1988.

Table 5. Percent of tort action settlements by contributing highway element and fiscal years (based on date of incident).

Contributing Highway Element	1979 to 1983[a]	1983 and 1984	1985 and 1986
Work zone control	10.7	3.4	1.0
Guiderail	5.0	10.2	12.5
Potholes	9.2	2.4	0.8
Signing	6.8	5.4	8.6
Median barrier	7.6	3.3	4.7
Shoulder dropoff	6.2	5.6	6.7
Appurtenance design	4.3	4.8	3.8
Icy patch	5.9	4.8	2.1
Slippery pavement	2.4	12.7	11.7
All other elements	41.9	47.4	48.1

[a]Includes payments on tort actions pending at the time the Tort Claims Sovereign Immunity Act became law (July 1, 1979).

Table 6. Characteristics of various stages in the development and maturing of a risk management process.

Stage 1: Learning Phase

1. Little explicit consideration or emphasis given to risk management by top management.
2. Maintenance activities solely productivity oriented.
3. No staff assigned full-time to risk management.
4. Risk management responsibilities not explicitly assigned; no measures by which to rate risk management performance.
5. Complaint handling process not formalized; complaints addressed on a sporadic, inconsistent basis.
6. Record keeping incomplete.
7. Highway elements and other relevant information associated with tort actions reviewed but not routinely compiled into data base for monitoring.
8. Numerous tort actions related to policy/procedure violations.
9. Little tort awareness or risk management training.

Stage 2: Development Phase

1. Risk management goals and objectives established.
2. Full-time risk management personnel assigned at central and district offices.
3. Risk management responsibilities clearly established; performance measures developed.
3. Tort actions classified by contributing highway elements and placed into a data base for analysis.
4. Risk assessments used to identify problems in policies, procedures, or guidelines.
5. Policies and manuals reviewed/modified to reduce risk potential.
6. Complaint handling system formalized and response times established.
7. Tort awareness training given to all employees.
8. Maintenance forces more responsive to complaints and correction of high-risk deficiencies.
9. Few tort actions related to policy/procedure violations.

Table 6. Characteristics of various stages in the development and maturing of a risk management process (continued).

Stage 3: Proactive Phase

1. Risk management component included in all employee training programs.
2. Employees at all levels in the organization implicitly accept risk management responsibilities.
3. Risk identification, evaluation, and treatment focuses more on processes and procedures.
4. Integrated information system for risk management developed.
5. Perishable data collected at accident sites with tort potential.
6. Indepth accident investigation at selected high-profile accident locations.
7. More emphasis on aggressive defense of selected tort actions.