The Relationship of SCDOT Damage Claims and Lawsuits to Roadway Engineering Safety Issues

Final Report

CLEMSON UNIVERSITY

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SCDOT Research Problem Statement:

SCDOT processes approximately 1000 claims per year and is engaged in 100 lawsuits per year. These claims and lawsuits most often are filed as a result of the claimant believing something about our highway system is flawed and this caused them harm for which they are seeking damages. Much time, effort and resources are spent by SCDOT employees and legal staff, the Insurance Reserve Fund, private attorneys on contract to represent the SCDOT, independent engineering experts and employees from other state agencies researching, processing and defending these claims and lawsuits. This is an effort that could otherwise be spent on proactive measures that would increase the safety for the motoring public. Another very important concern is the very real possibility that a legitimate claim or lawsuit could have been prevented if some method of analysis concerning these past actions would lead to the reduction of road defects over which a claim could be filed or lawsuit brought against SCDOT.

Another issue is that there is often a lengthy lapse of time between the time of an incident/crash and the filing of a damage claim or lawsuit. During such periods, changes in roadway conditions may occur due to improvements, deterioration, or other factors. It then becomes challenging for the defending SCDOT team to investigate the case properly because the roadway conditions from the time of the incident no longer exist. It would be beneficial if SCDOT could immediately identify crashes that are likely to result in claims and lawsuits, so a data collection team can record relevant data after such an incident. This will allow them to better defend a case later, if the incident results in a claim or lawsuit.

Through an analysis of SCDOT's claims and lawsuits, it is possible to discern a pattern or gain information about the frequency and types of claims and lawsuits, and the corresponding crash or incident that gave rise to them. The desired result is to provide

SCDOT with a proactive approach for eliminating or ameliorating the types of highway conditions that are alleged by plaintiffs to contribute to causes of crashes or incidents. Through such an approach, future lawsuits and claims can be reduced. Studying patterns of previous cases found in favor of the plaintiff may also help to build stronger defense cases for the DOT or provide direction for changes in legislation to stop potentially frivolous cases.

This research dealt with managing risks of claims and lawsuits filed against SCDOT. It is important to identify proactive safety related mitigation measures that can potentially minimize SCDOT's claim and lawsuit risks. In addition, process and policy enhancements have to be made in order improve the claims and lawsuit handling process.

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Executive Summary

Tort liability is of concern to public agencies, especially transportation agencies, because money spent defending tort claims and lawsuits and compensating victims is money that is not able to be spent improving the safety of the state highway system. Consequently, it is of importance how state transportation agencies manage risk relating to claims and lawsuits filed against them for crashes on their highway systems. The South Carolina Department of Transportation (SCDOT) processes approximately 1000 such damage claims per year and is engaged in about 100 lawsuits per year. Of the 3000 closed claims analyzed in this project covering the last 3 years, the total payout to settle the 990 or 33% of claims that were paid was $524,706. During the same period of time, SCDOT paid $9,893,507 to resolve 164 or 55% of lawsuits (shown in Figure 1).

The payout amounts do not include expenses related to researching, processing and defending against damage claims and lawsuits by SCDOT employees and legal staff. Nor does it include expenses associated with Insurance Reserve Fund employees, private attorneys on contract to represent SCDOT, independent engineering experts and employees from other state agencies. These individuals expend significant effort on each claim and lawsuit, which further detracts from day-to-day management and operation of the statewide transportation infrastructure. It is estimated that SCDOT processing costs $440.30/claim and thus, over $1.3 million have been expended by the SCDOT in labor for the handling of damage claims over the last 3 years – nearly three times the amount spent on payouts. While the SCDOT has been successful keeping claim payouts low, our report recommends several strategies be implemented that would reduce the indirect costs incurred through the handling of the claims. In addition, claim payouts could be further reduced through the implementation of standard procedures across the state that would reduce current handling and decision inconsistencies regarding claims.

It is estimated that it costs SCDOT $569,290 for its staff to assist the IRF and its attorneys in handling approximately 300 lawsuits over the same 3 year period, or $1,916.80/lawsuit. This does not include the costs that the IRF incurs from outside counsel, expert witnesses, etc. While the Insurance Reserve Fund manages lawsuits brought against SCDOT, it is in the best interest of the SCDOT to remain involved throughout this process to ensure the most favorable outcome for long-term SCDOT risk management goals.

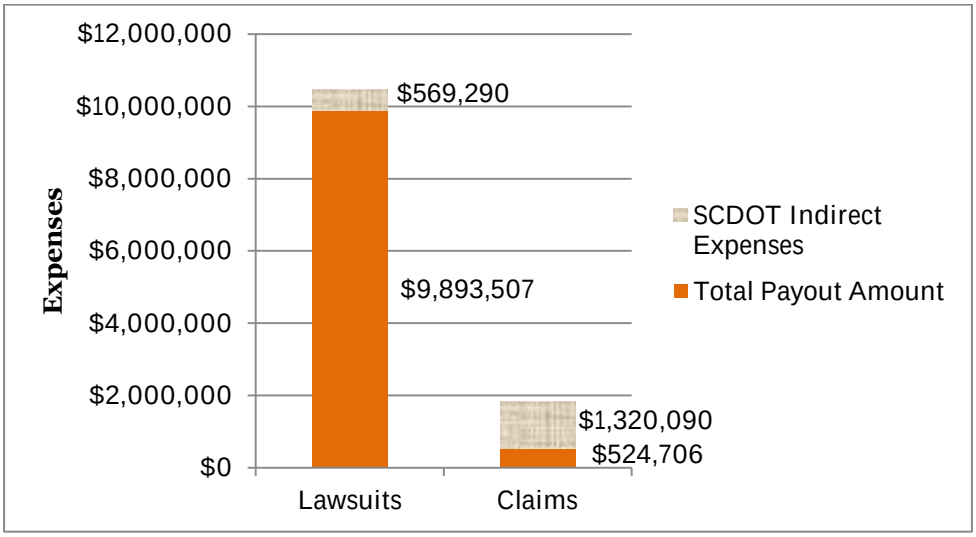

Figure 1 Total Payout Amount and Indirect SCDOT Expenses for Claims and Lawsuits (2007-2010)

Claims and lawsuits are often the result of claimants' perception of alleged defects on the roadway. The public is better served by the agency being proactive, rather than reactive, in addressing the conditions that give rise to litigation. An excellent opportunity exists, in managing the risk of future claims and lawsuits, with an analysis of these types of past events and improving roadway elements that lead to or may be perceived to be a contributing factor to a crash that resulted in litigation. Therefore, it is critical that the SCDOT address this issue to protect itself from these claims and lawsuits, while also improving conditions on roadways that may contribute to these legal challenges and safety issues.

Through an analysis of SCDOT's claims and lawsuits, one might be able to discern a pattern or at least gain some information, about the frequency and type of claim or lawsuit and the corresponding crash or other incident that gave rise to the claim or lawsuit. The desired result would be that if SCDOT were able to take a proactive approach to eliminating or ameliorating the types of highway conditions that are alleged by plaintiffs to contribute to the cause of the crash or incident, then future claims and lawsuits could be reduced.

Study Objectives

The objectives of this study include:

- Analyze factors associated with claims and lawsuits that are important for risk identification and management;

- Identify methods to respond to claims and lawsuits in a consistent manner statewide and prevent claims and lawsuits by identifying and reducing the perceived and real hazards that generate them; and,

- Identify proactive measures, such as reducing risk factors, and reactive measures that include handling claims and lawsuits and amounts paid to claimants to increase the effectiveness of the risk management system.

Methods

To meet the objectives of the project, the research team proposed several research tasks and subtasks as follows:

1. Explore and analyze tort liability systems
    a. Review SCDOT tort claims and lawsuits business processes
    b. Conduct surveys and interviews with other state DOTs
    c. Review literature related to tort risk management
2. Collect and analyze SCDOT data related to claims and lawsuits
3. Develop models relating claims and lawsuits to risk factors
    d. Conduct Regression Tree analysis
    e. Conduct spatial data analysis
4. Develop risk profiles using fault trees
5. Develop a risk management support system and an implementation plan.

A multitude of tools (i.e., spatial analysis, detailed statistics, nationwide surveys, SCDOT employee interviews, regression trees, and fault trees, etc.) were employed to achieve these tasks. Figure 2 shows how these tools were incorporated in carrying out the major research tasks and resulting products.

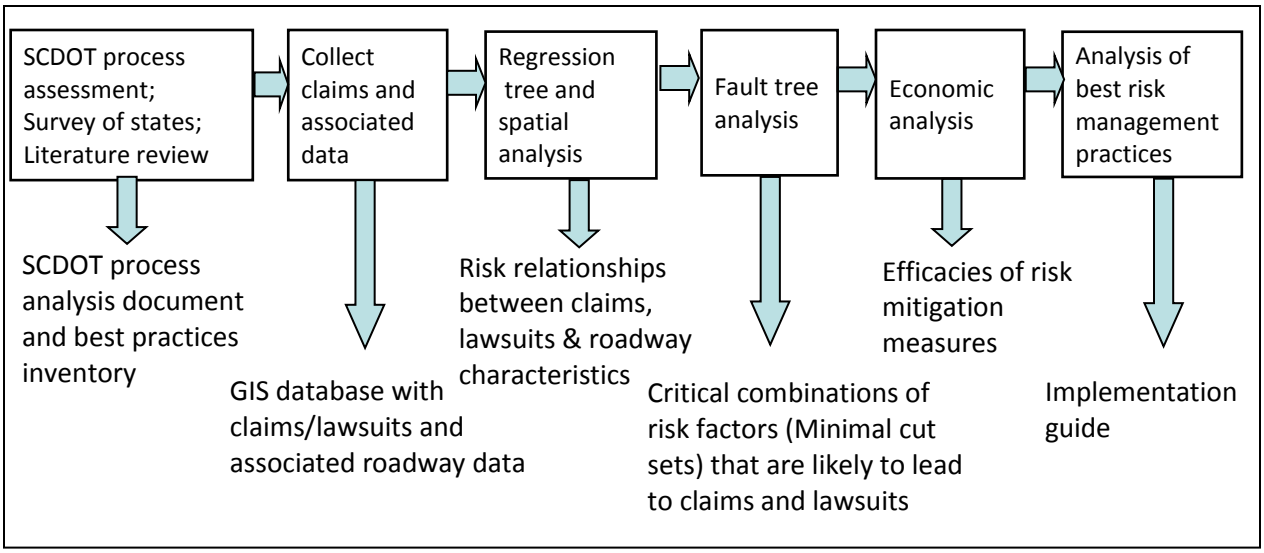

Figure 2 Flow Chart of Research Tasks and Outcomes

Results

While the initial expectation for the project was to focus on engineering countermeasures that could be implemented to reduce frequency and extent of damage claims and lawsuits, many of the analytical tools utilized in this study revealed issues related to:

- Need for standard operating procedures for processing, handling, investigating, and making recommendations on whether or not to pay or deny claims;
- Inconsistencies in handling of claims across districts and counties in the state;
- Redundant data entry and excessive record handling at the county and legal services office;
- Limited ability to track claims and lawsuits received by the DOT during the handling process;
- Insufficient data capture, which does not allow for proper identification of the location of claims or matching of claims to crash records or for informed decisions on claims; and
- Absence of performance measures and associated processes to evaluate the SCDOT risk management program on a regular basis.

Each of these issues will be briefly documented in the following sections. In addition, a section on the top 10 causal factors of lawsuits and claims based on frequency, total payout, and average payout are also included along with suggested countermeasures.

Need for standard operating procedures

Initial project meetings with legal office staff indicated that there was little in the way of documented standard operating procedures for processing, investigating, and making recommendations to approve or deny claims. Recommendations are developed in the county offices where claims originate and pass through the district engineer's office before ending up in the Office of Legal Services where they are finalized. Currently, there is no standard procedure or form for investigating and documenting claims other than the form that the claimant completes. There is no documented statewide policy regarding which claims should or should not be paid and why, or that outlines how to determine whether or not the state may be liable. The literature review revealed that this is not the norm. The majority of reporting states have standard operating procedures, tracking, and evaluation procedures.

Inconsistencies in handling of claims across districts in the state

The research team manually extracted several data fields from the hard copy claim files (over 2400 files) kept at the SCDOT Office of Legal Services in order to obtain all relevant data. While extracting this data

the team observed inconsistencies, in handling the claims and making recommendations on them, between counties and districts. This pattern was later confirmed during an analysis of damage claims using regression tree techniques, when researchers found that in almost all completed analyses, there were significant differences in the payment and denial of claims by type, depending on the district in which the claim was received. These differences were also found when statistics were gathered based on districts as shown in Table 1. In many cases, the Chester and Charleston districts stood out from other districts in the state. These two districts have some of the highest percentage of claims paid, however, average payouts are lower than other districts. Additionally, there were significant differences in the types of claims received by different districts. For example, Orangeburg had the majority of claims and payouts related to paint splatter. Orangeburg is the only district that maintains its entire pavement marking operations in-house, while other districts use contractors. In any future benefit cost analysis, the additional costs related to damage claims should be considered when making the decision to keep these operations in-house.

The lack of standard operating procedures and decision support at the county level appears to be the predominant factor in these handling and process variations. The lack of written procedures for these process tasks result in variations in procedures across the state, which often leads to incomplete and ineffective claims and lawsuit data. In addition, these variations ultimately lead to inconsistent payment and denial of claims, since data from the county level is heavily utilized in the final decision. When looking at descriptive statistics, the Richland District has the lowest percentage of paid claims of all other districts. The research investigations indicated that this was the most proactive district and the only one to have well documented procedures. The well documented Richland procedures were adopted as the basis from which the research recommendations were made.

Table 1 Number of Claims, % Paid, and Average Payout Amount by District (3000 Claims From 2007-2010)

District code	District Name	# Claims	% of Claims Paid	Total Amount Paid		Average Amount Paid	
				Without indirect costs	With indirect costs	Without indirect costs	With indirect costs
1	Columbia	893	24%	$129,869	$523,057	$601	$2,410.40
2	Greenwood	167	42%	$48,575	$122,105	$692	$1,744.36
3	Greenville	439	28%	$64,876	$258,168	$523	$2,082.00
4	Chester	396	41%	$55,136	$229,495	$342	$1,390.88
5	Florence	294	38%	$53,350	$182,798	$480	$1,646.83
6	Charleston	542	42%	$83,209	$321,852	$361	$1,393.30
7	Orangeburg	269	34%	$88,592	$207,033	$968	$2,226.16
	Total	**3000**		**$523,607**	**$1,844,507**		

Redundant data entry

Given that the current process is primarily paper driven, there is quite a bit of redundant data entry and filing associated with individual claims across the state. Several issues with the current handling system were identified during this research, which suggest the need for an enterprise data system:

- The Office of Legal Services already utilizes an electronic database, Risk Management Information System (RMIS). This requires a legal office employee to transfer data from the

hardcopy recommendation letters developed in the county office and claims form. These are redundant tasks.

- Redundant hard copy files are often kept at the county level, as well as the legal office. Copies of the recommendation letter and claim form, as well as additional papers are copied and filed at both the county and legal office.
- Some counties (Richland) already use a self-developed electronic spreadsheet to track claims in-house. These data are also used to develop the recommendation letter, which is then sent to the legal office where data is entered into the RMIS.
- Tracking claims between the various offices and employees involved in the process is very difficult. Before a claim reaches the legal office it can only be found by tracking the actual hard copy file, which can be sitting on a desk, awaiting a signature. In addition, this can require claimants to call multiple offices to determine the status of a claim. This gives the claimants a "runaround" feeling, which is a poor customer service feature.
- A copy of the claims form and recommendation letter is the main form of data sharing throughout the process. This can limit data sharing and capture of important variables found during field investigations.
- Time requirements exist for offices to handle claims and time is wasted with hard-copy files traveling from office to office.

The legal staff could better serve SCDOT by minimizing their handling of claims, and instead, ensuring that standard operating procedures have been followed.

Limited ability to track claims and lawsuits

With the current system, there is virtually no way to track how many active claims have been received by any level within the DOT, because the claims are not entered into RMIS until they reach the legal office. In many cases, county offices are contacted with status requests on active claims, and if the claim has been forwarded to the district or legal offices, no information is available. This is because only the legal office has access to RMIS and thus, the claimant must be referred to the Office of Legal Services. This practice undoubtedly has a negative impact on customer service.

In terms of lawsuits, the legal office is usually the first to be informed and most lawsuits are entered directly into the RMIS database. However, the lawsuits are immediately turned over to the IRF, and only limited information is returned intermittently. An important linkage is missing here and that is the link between the entity whose activities give rise to litigation and the entity that handles and pays for the litigation. The IRF provides little input to SCDOT on how to avoid similar future litigation and SCDOT has no mechanism in place to ensure that the manner in which the litigation was handled does not encourage future litigation. Even if ultimate control over the resolution of a lawsuit rests with the IRF, SCDOT needs to be consulted prior to that resolution in order to ensure that its risk management goals are being achieved.

Insufficient data capture

One of the most basic analysis tasks is that of identifying claims locations using a geographic information system to search for spatial patterns. Such a task requires information regarding county, route, milepost, and GPS coordinates. While location data can sometimes be difficult to obtain based on initial information provided by the claimant, it is essential to an effective risk management program. If SCDOT cannot, with some level of certainty, identify where the damage or injury occurred on the network, it is impossible to make a determination of liability, much less identify and implement improvement measures.

Originally, the RMIS database was queried for the most recent 300 closed lawsuits and 3000 damage claims prior to May 2010. However, not all lawsuits and claims were spatially located. Due to limited location data available in the electronic database and paper files, only 1159 (~39%) damage claims were successfully located spatially. The lawsuit data contained only a handful of cases with readily available location data and thus no spatial analyses were run for lawsuits. The lack of location data must be resolved in any future enhancements to the tort liability process. In addition, the amount of time expended to obtain location data from paper files would make it impractical to repeat these tasks on a regular basis for implementation of a successful risk management program.

Researchers attempted to match the approximately 15% of claims that were reported to Law enforcement with crash data in an effort to gain extensive and professional details on the incidents leading to claims. However, several issues with data prevented the team from achieving a significant number of matches. The name of the claimant is recorded in the claims data, while the name of the driver is recorded in the crash database, which prevented a significant number of matches due to drivers not being owners. Incident dates that matched up rarely included other matching data fields, which was a similar result when matching by license plate number was performed. Including a data field on the claim forms for crash report numbers would make this matching much more effective, giving the SCDOT an improved and reliable idea of the incident that occurred, which led to a claim.

Absence of performance measures and evaluation processes

Currently, there are no objectives, performance measures, or targets established for risk management at SCDOT. To maintain an effective risk management system, the agency should continually assess performance against a set of agreed upon measures. This will require that additional data be maintained, that implementation of standard procedures is followed, and likely the creation of new cost codes added to allow for accounting of expenditures (labor and otherwise) related to handling tort claims and lawsuits.

Most expensive and frequent causes of lawsuits and claims

Through the development of detailed statistics of the claims and lawsuit data, the most expensive and frequent causes of lawsuits and claims were identified along with other trends and patterns which are covered extensively in the “Descriptive Statistics” section of the final report. Tables 2 and 3 show the top ten causal factors based on frequency, total settlement amount, and average payout for claims and lawsuits. Table 4 shows the definitions of the causal factors listed in Tables 2 and 3.

Table 2 Top 10 Causal Factors Based on Frequency, Total Settlement Amount, and Average Payout for Claims (2007 to 2010)

Frequency	Total settlement amount	Average payout
Pothole damage	Pothole damage	Tree fell on
Debris from road	Debris DOT Mower/landscape	Tree in road
Debris DOT Mower/landscape	Debris from road	Trip/Fall Mh-Cb-Di-Grate
Paint Splatter	Paint Splatter	Road surface irregularity
Mh-Cb-Di-Grate	Mowing	Mh-Cb-Di-Grate
Mowing	Mh-Cb-Di-Grate	Hwy traffic sign post
Debris DOT Truck	Debris DOT Truck	Debris from road
Low shoulder/Elevation difference	Low shoulder/Elevation difference	Construction/Paving
Trip/Fall uneven surface	Trip/Fall uneven surface	Drainage Structure
Pothole- edge/shoulder	Tree in road	Trip/Fall uneven surface

Table 3 Top 10 Causal Factors Based on Frequency, Total Settlement Amount and Average Payout for Lawsuits (2007 to 2010)

Frequency	Total settlement amount	Average amount
Trip/Fall uneven surface	Water on road surface	Tree limb obstructing road
Water on road surface	Deer	Improper signage/No signage
Trip/fall Mh-Cb-Di-Grate	Improper traffic control devices	Deer
Obstructed sight distance	Fail to yield ROW	Missing sign
Fail to yield ROW	Low shoulder/Elevation difference	Open hole/Manhole
Pothole Damage	Pothole Damage	Improper traffic control devices
Low shoulder/Elevation difference	Tree limb obstructing road	Work Zone Maint Equip
DOT/Contract Vehicle	Improper design/Intersection design	Water on road surface
Tree in road	Improper signage/No signage	RR crossing
Improper design/Intersection design	Missing sign	Low shoulder/Elevation difference

Table 4 Causal Factor Definitions

Causal Factor Definitions
Construction/Paving-Property damage due to construction or paving work
Debris DOT Mower/landscape-Vehicle damage due to thrown object from mower
Debris from road-Vehicle damage due to road debris
Debris DOT Truck-Vehicle damage due to debris falling from DOT truck
Deer-Vehicle damage due to collision with or swerving to avoid a deer
DOT/Contract vehicle-Vehicle collision with DOT or contract vehicle
Drainage Structure-Property damage due to inadequate or clogged drainage structure (flooding)
Fail to yield ROW-Vehicle collision due to a failure to yield ROW
Hwy traffic sign post-Vehicle damage due to hitting a traffic sign post
Improper intersection design-Vehicle collision due to improper intersection design
Improper signage/No signage-Vehicle collision due to improper or no signage
Improper traffic control devices-Vehicle collision due to improper traffic control device
Low shoulder/Elevation difference-Vehicle damage due to low shoulder or elevation diff at EOP
Missing sign-Vehicle collision due to missing sign
Mh-Cb-Di-Grate-Vehicle damaged due to broken or raised manhole, catch basin or drop inlet
Mowing-Property damage (other than vehicle) due to mowing
Obstructed sight distance-Vehicle collision due to due obstructed sight distance
Open hole/Manhole-Vehicle damage due to collision with an open hole or open manhole
Paint Splatter-Vehicle damaged due to wet paint on road
Pothole damage-Vehicle damaged due to potholes
Pothole: edge/shoulder-Vehicle damage due to pothole near EOP or due to a broken EOP
Road surface irregularity-Vehicle damage due to a road surface irregularity (other than pothole)
RR crossing-Vehicle damage due to RR crossing or vehicle collision with train
Tree in road-Vehicle damage and/or personal injury due to a fallen tree in the road
Tree fell on car-Vehicle damage and/or personal injury due to a tree falling onto a vehicle in roadway
Tree limb obstructing road-Vehicle damage or injury due to collision with limb hanging in or on road
Trip/Fall uneven surface-Personal Injury from a trip or fall due to an uneven surface
Trip/Fall Mh-Cb-Di-Grate-Personal injury from a trip or fall due to a manhole, catch basin, or drop inlet
Work Zone Maintenance Equip-Vehicle collision with work zone equipment (mostly temporary signs)

Recommendations

The following list represents the prioritized recommendations for changes to policies, practices, and training identified as a result of the completed research tasks.

1. Establish SCDOT Tort Liability/Risk Management Committee
   With 46 counties, 7 districts, and several headquarter divisions and offices, it is difficult for SCDOT to get its arms around the myriad of tort liability and risk management issues that arise on a daily basis. An approach that has been successful in other states, and is proposed here, is for SCDOT to establish a Statewide Tort Liability and Risk Management Committee. The committee would be comprised of representatives from the Office of Legal Services, Traffic Engineering, Construction and Maintenance. The committee's charge would be to meet quarterly, and more often if needed, in order to identify and address statewide tort liability and risk management issues and trends, and to recommend and later update statewide policies.

These may run the gamut of claims handling and investigations, maintenance policies and reporting procedures, traffic operations documentation, review of contracted services, and implementing lessons learned from litigation results. Ensuring that appropriate solutions are implemented in a uniform manner throughout the state will enhance the effectiveness of the Department's risk management program. Figure 3 shows the role the committee would have in the continuous review of the claims handling process.

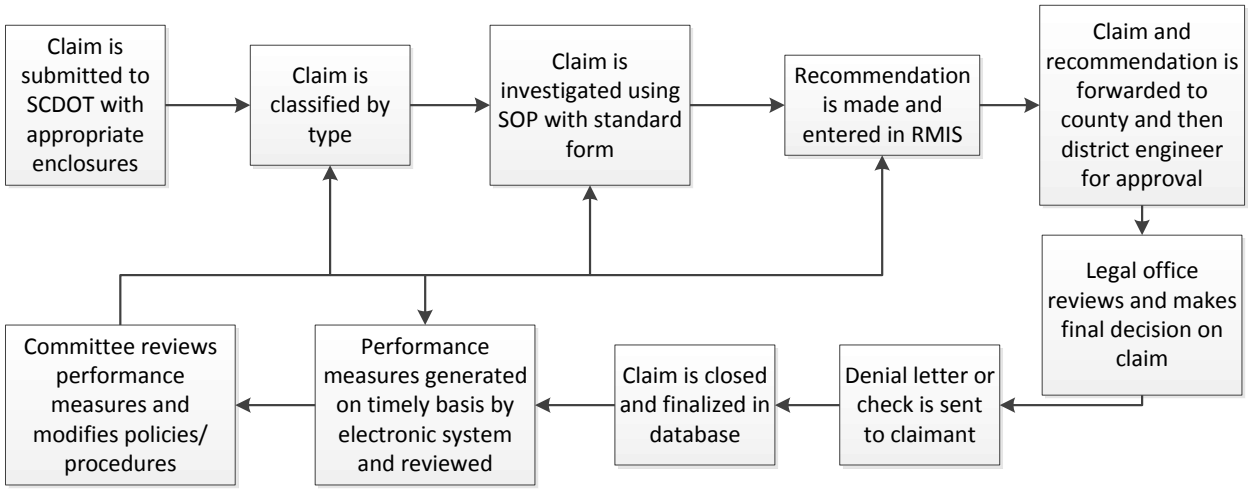

Figure 3 Reviewable Steps In the Claims Handling Process

There are several issues (detailed in the "Claims Avoidance Strategies" section of the final report) that this committee will initially dedicate a significant amount of time to, including:

a. Establish standard operating procedures (SOPs) for all steps in the process (See Figures 4 and 5 on the following pages). Notes and references in the flowcharts can be found in the "Uniform Statewide Claims Handling Procedure" section of the final report.
b. Identify all personnel responsible for carrying out SOPs at all levels of the agency. All SCDOT employees who have significant responsibility for handling damage claims and lawsuits should be identified and trained accordingly. Maintenance of an organizational chart with personnel identified will ensure that the job responsibilities are continually maintained. This chart should be reviewed at quarterly meetings to ensure that it is up to date.
c. Establish performance measures and targets for the tort management system as a whole that can be reviewed and used to refine the system. These performance measures can also be used to evaluate districts, as well as the system as a whole.
d. Conduct quarterly meetings to review performance reports and make necessary changes or adjustments to procedures, policies, and practices. As the risk management system matures, it is expected that changes in payments and denials will occur and priorities will shift requiring a continuous feedback loop for continual improvement (See Figure 3 above).

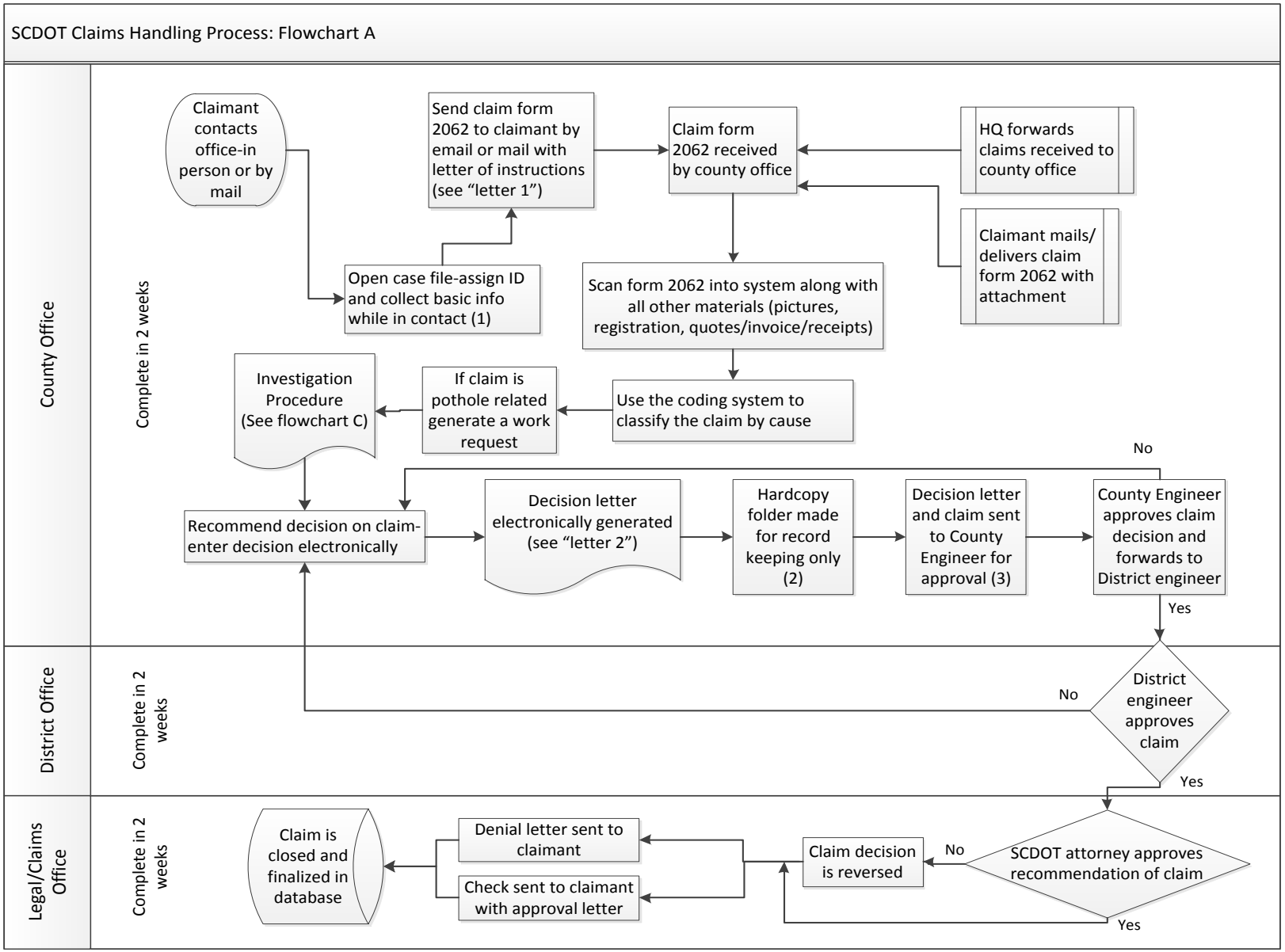

Figure 4 Proposed Claims Handling Process

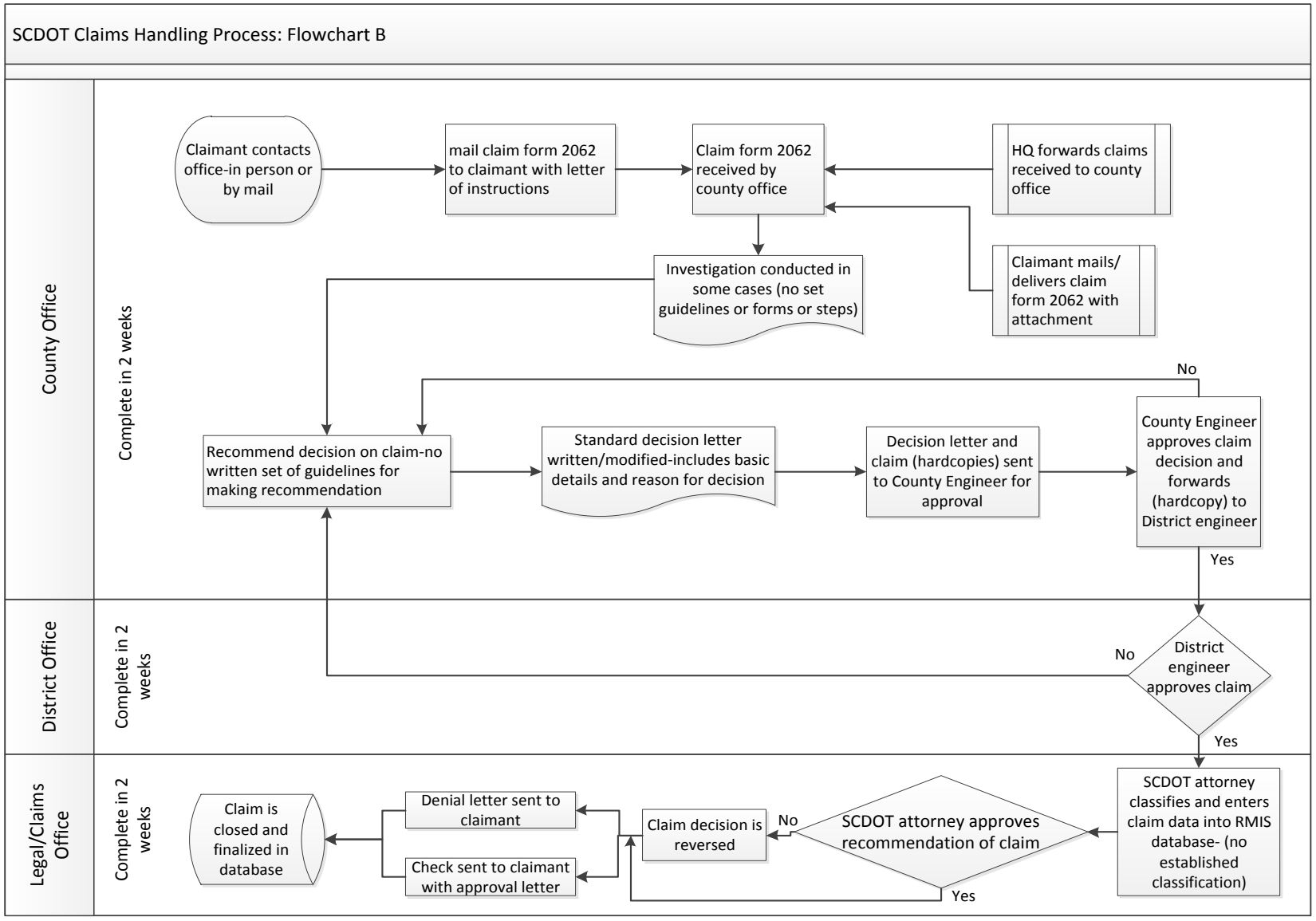

Figure 5 Current Claims Handling Process

2. Implement Enhanced RMIS Enterprise-wide
   The "Process Enhancements" section of the final report details the recommendations and benefits of a system-wide electronic database. Among the benefits are: reduction in redundant paper work, efficient data sharing, effective claims tracking, opportunity to incorporate decision support systems, and the potential to improve data completeness and accuracy. Reports such as NCHRP "Development and Evaluation of a National Data-Management System for Highway Tort Claims" contain detailed technical information about establishing a database system.

3. Conduct Training on SOP and RMIS
   Training the county level employees responsible for handling claims would be very effective at improving the quality of claims data and consistency of claims procedures and recommendations. In addition, this training could serve as an introduction and explanation of the statewide process that is outlined in the previous section or the use of one of the decision support systems.

   Relevant topics for this training include:

   a. Process overview and relevant responsibilities in process
   b. Demonstrations of field data collection techniques expected in the investigations
   c. Instructions and demonstrations on the use of equipment needed in the investigations (GPS specifically)
   d. Instructions on data entry-format and accuracy
   e. Explanations of the use of specific data fields in the claims handling process
   f. Explanation of the claims process as a whole and the importance of the handling at the county level
   g. Instructions and explanations on making claim recommendations
   h. Instructions and expectations of employee-claimant interactions
   i. Explanation of relevant legal terms and implications
   j. Review of lawsuits and claims where SCDOT practices were beneficial or detrimental to outcomes

4. Establish Quarterly Meetings with IRF Representatives, Retained Counsel, and SCDOT Counsel
   Since all decision-making with regard to litigation rests with the IRF and its retained outside counsel, at the very least, there should be quarterly meetings to address recent and ongoing litigation. SCDOT counsel can then report to the SCDOT Tort Liability and Risk Management Committee about trends and strategies in order for the SCDOT to be more accountable for the continually increasing $5 million annual premium paid to the IRF.

   The IRF practice of retaining private law firms in the counties where the litigation is venued is no doubt a good practice from the standpoint of ensuring that local representation is familiar with the judges and the jury pool. However, with 46 counties and the larger counties using multiple law firms, it is difficult to envision that over 50 law firms will produce a uniform litigation strategy that works in the best interest of SCDOT. The resources devoted to each case by the law firm will vary, not necessarily based upon the nature of the case itself, but more likely on the importance or priority that the individual attorney places upon it. That importance or priority is likely to be based upon the attorney's caseload, support staff, and experience in handling SCDOT cases. There is no assurance that skilled expert witnesses are being used

throughout the state. It is unknown as to how much communication is shared among the various law firms on the best strategies to employ in defending a single client, SCDOT.

Because of this apparent lack of communication, collaboration, and consultation, SCDOT has little or no authority over the conduct and resolution of lawsuits handled by the IRF. Lawsuits are possibly being settled for "convenience", "nuisance value", or "litigation costs", resulting in plaintiffs receiving a settlement with minimal investment or effort, thereby encouraging others to sue SCDOT, with an eye on an easy payment. At the very least, such settlements should not be made unless it is clear that plaintiffs have incurred greater costs and attorney time and effort, such that they are not made whole. In addition, some cases simply should not be settled where there is no liability on the part of SCDOT, even if the costs of proceeding to trial may exceed the settlement. There must be a deterrent to the filing of meritless lawsuits against SCDOT. If plaintiffs' attorneys know that they are either going to lose money when they sue SCDOT or they will face daunting costs to pursue protracted litigation, they will be less likely to bring an action where the chances of success are marginal.

Regular meetings between representatives of the IRF, its retained outside counsel and SCDOT attorneys could facilitate implementation of policies and procedures that enhance the risk management interests of SCDOT. Even if ultimate control over the resolution of a lawsuit rests with the IRF, SCDOT needs to be consulted prior to that resolution in order to ensure that its risk management goals are being achieved.

In addition to regular status memoranda that detail and analyze the posture of the lawsuit at various milestones, SCDOT needs to receive a copy of the Request for Settlement memorandum or Request for Payment memorandum (in the case of a judgment) from the private counsel representing SCDOT to the IRF.

5. Implement Countermeasures to Reduce Claims and Lawsuits
   Suggested countermeasures for all of the causal factors found in Tables 2 and 3 are listed in Table 5 in order to cover the most frequent and costly causes of claims and lawsuits. Since many of these claims and lawsuits are paid by SCDOT due to a lack of prior knowledge of alleged conditions, more frequent inspection and subsequent maintenance is a general recommendation that could reduce the number of locations that might result in a claim or lawsuit. The countermeasures listed in Table 5 are the most common as reported in several resources including in the following publications; the HSM[1], the CMF[2] Clearing House, and NCHRP report 500 series. All references for the countermeasures in Table 5 are listed in Table 6.

[1] Highway Safety Manual, First Edition, Volume 3
[2] Crash Modification Factor

Table 5 Recommended Countermeasures Based On the Top Ten Causal Factors of Claims and Lawsuits

Causal Factor	Recommended Countermeasures
Type 1 (Collision with non-fixed object)	
Deer	• Reduce Speed Limit (1) • Implement Roadside Vegetation Management (2) • Construct Fences/barriers/overpasses/underpasses/at-grade separation (3)
Debris DOT Mower /landscape	• Clear the area of debris before mowing • Use a more restrictive safety guard or debris cover on mower • Maintain mowers as necessary (e.g. sharpen blades)
Debris from road	• Implement more frequent inspection and subsequent maintenance for interstates and secondary roads
Debris DOT Truck	• Educate DOT truck drivers on how to properly secure loads in all types of trucks.
DOT/Contract vehicle	• Educate professional truck drivers about the hazards associated with work zones and other construction-related activities (4) • Provide truck drivers with defensive driving education.
Fail to yield ROW **(Vehicles mostly failed to stop at stop sign)**	• Make sure the stop signs and warning signs are within appropriate sight distance of a driver and inform the driver of how many approaches are required to stop (5) • Implement more frequent inspection of stop signs and warning signs and subsequent maintenance
Improper design/ Intersection design	• Check design plans regarding horizontal curvature, vertical curvature, speed, traffic control devices, etc. (6) • Install additional signs to inform drivers of conditions on the road / intersections (7)
Obstructed sight distance (e.g. vegetation)	• Implement more frequent inspection of sign and sight distance visibility and subsequent maintenance (8) • Implement Roadside Vegetation Management (2)
Paint Splatter	• Improve “wet paint” signs indicating road painting is underway. (9) • Implement more restrictive warnings or barriers of wet paint. • Provide information for motorists through VMS, Internet and radio stations.
Tree in road	• Implement more frequent inspection of roads and subsequent inspections of ROWs • Increase removal of potentially “hazardous” trees near roadway
Tree fell on car	• Implement more frequent road side inspections for trees that are dead, have insufficient root structure, etc. and subsequent maintenance (10)
Water on road surface	• Install signs to alert drivers of areas where water can collect on the road (11) • Conduct Inspections for proper longitudinal and transverse slopes (12) • Conduct milling and micro surfacing (13)
Type 2 (Collision with fixed object)	
Hwy traffic sign post	• Revise sign post removal procedures and inspect sites to ensure “stubs” are not left • Delineate / Shield the sign post as a fixed object (14)
Improper traffic control devices	• Implement more frequent inspection and subsequent maintenance • Check design plans to ensure they conform to Manual on Uniform Traffic Control Devices (MUTCD) requirements (6)

Table 5 (continued)

Causal Factor	Recommended Countermeasures
Improper signage/ No signage	• **Install stop sign, warning sign, etc (15)** • **Upgrade pavement markings, add signage (16)**
Low shoulder/ Elevation difference	• Implement shoulder improvement (17) • Install safety edge (18) • Install rumble strips (19) • Add 2-feet paved shoulder (20)
Missing sign	• Implement more frequent inspection of stop signs, warning signs, etc. and subsequent maintenance
Mh-Cb-Di-Grate	• Implement more frequent inspection for broken or off-grade Manhole covers, Drop inlets, Catch basins and drainage structures (21)
Pothole Damage	• Increase the frequency of current inspection regarding different roadway classifications. Decrease repair times of reported potholes.
Pothole-edge/shoulder	• Increase the frequency of current inspections regarding different roadway classifications
RR crossing	• Inspect pavement surface of the railroad crossing (22) • Improve at grade active warning system (23) • Inspect trees and other vegetation that can obscure driver's visibility (10)
Road surface irregularity	• Repair identified pavement areas and along the curbs (22)
Type 4 (Pedestrian Injury)	
Trip/Fall uneven surface	• Repair cracks, potholes, uneven sidewalks, and broken steps. • Delineate conditions that cannot be repaired (14) • Urge property owners to report sidewalks in need of repair to the city manager or director of public services.
Trip/fall Mh-Cb-Di-Grate	• Implement more frequent inspection for broken or off grade manhole covers, drop inlets, catch basins and drainage structures and subsequence maintenance
Type 5 (Property damage that occurs off road)	
Construction/Paving	• Educate DOT employees on how to avoid cutting cables, and be more cautious during installing mail boxes, paving, road work, and construction activities (24)
Drainage Structure	• Implement more frequent inspection of storm drains, ditches, culverts, etc. for debris, clogging or obstruction.(21) • Educate employees on how to avoid cutting cables while digging up and installing storm drains, culverts, catch basins, etc. (24)
Mowing	• Delineate above ground utilities (14) • Educate mower operators on how to avoid cutting cables, and to steer clear of fire hydrants, water meter boxes, mail boxes, signs and property fences (10)

Table 6 References for Recommended Countermeasures In Table 5

Reference Number	Source
(1)	**www.deercrash.com,** toolbox **Clearing House:**- Decreasing posted speed limit, CMF=0.86, Park et.al. 2010; - Advisory speed sign, CMF=0.87, Elvik, R. and Vaa, T., 2004 **HSM**, Install advisory speed sign, CMF= 0.87
(2)	**www.deercrash.com**
(3)	**www.deercrash.com**
(4)	**(NCHRP 17-18(3),** Work Zones, Exhibit I-3
(5)	**NCHRP 17-18(3),**Un signalized intersections, Exhibit I-3, Strategy 17.1 C1 **Clearing house & HSM** (Table 14-4): Conversion of stop-controlled intersection into roundabout **Clearing house & HSM** (Table 14-7): Conversion of stop-controlled to signal **Clearing house & HSM** (Table 14-5): Converting a minor road stop control into an all-way stop control **HSM**: - Provide stop ahead pavement marking, CMF=0.69 - Provide flashing beacons at stop-controlled intersections CMF=0.95
(6)	**HSM**, Volume 3, Chapter 14-Intersection; **NCHRP 17-18(3)**, Signalized intersection, Exhibit I-3 & Un signalized Intersection, Exhibit I-3; **Clearing House**, intersection geometry and traffic control categories **NCHRP17-18(3)**, Horizontal Curve, Exhibit I-1 & **HSM**, (Table 13-27) **HSM** (Table 13-28) & (13-30), & **Clearing House**, vertical and horizontal alignment **Clearing House**, Improve visibility of signal head, CMF=0.93, Sayed et. al. 2007
(7)	**Clearing House**, Install combination of chevron signs, warning signs and/or sequential flashing bacons, CMF=0.61, Montella, 2009
(8)	**NCHRP 17-18(3),**Un signalized intersections, Exhibit I-3, Strategy 17.1 C1 **Clearing house**, Increase triangle sight distance, CMF=0.52, Elvik, R. & Vaa, T. 2004
(9)	**Clearing house**:- Install advance warning signs, CMF=0.65, Polannis ,1999 - Provide advisory speed sign, CMF=0.87, Elvik R. & Vaa T, 2004
(10)	**NCHRP 17-18(3),** Trees in "hazardous" location, Exhibit I-4
(11)	**Clearing house**:-Install advance warning signs (positive guidance) CMF=0.65, Polannis ,1999 - Provide advisory speed sign, CMF=0.87, Elvik R. & Vaa T, 2004
(12)	**HSM** (Table 13-27) & **Clearinghouse**, Improve super elevation
(13)	**Clearing House:**- Refinish pavement with micro surfacing treatment, CMF=0.63, Erwin & Taghe 2008 - Resurface pavement CMF=0.95, Abdel Aty et al. 2009
(14)	Install post mounted delineators: **NCHRP 17-18(3)**, Utility Poles, Exhibit I-2; **HSM,** CMF=1.04**; Clearing House,** CMF=1.04, Elvik R. & Vaa T. 2004
(15)	**Clearing House**:- Intersection traffic control group - Install stop sign on both minor approaches of an unsignalized intersection, CMF= 0.78, Haleem & Abdel Aty, 2010 - Install sign to conform to MUTCD, CMF=0.85, Elvik. R. & Vaa. T. 2004 **NCHRP 17-18(3)**, Un signalized intersection, Exhibit I-3

Table 6 (continued)

Reference Number	Source
(16)	**MUTCD** & **Clearing House**, Roadway delineation category
(17)	**Clearing House**: stabilize shoulder, CMF= 0.75, Gan et al. 2005; **NCHRP** 17-18(3), Run-Off road collisions, Exhibit I-1
(18)	**FHWA-HRT-11-024**, March 2011,CMF=0.90
(19)	**NCHRP 17-18(3)**, Run-Off road collisions, Exhibit I-1; **Clearing House**, CMF=0.78, Sayed et al., 2010; **HSM**, Table (13-44)& Table (13-45)
(20)	**Clearing House**, shoulder treatment category; **HSM**, Table (13-7) & Table (13-8)
(21)	**Clearing House**, Improve drainage patterns, CMF=0.68, Gan et.al, 2005
(22)	**Clearing House**, Resurface Pavement, CMF=0.95, Abdel Aty et al. 2009
(23)	**Clearing House**, Installing gates at crossing with signs, CMF=0.05, Park, Y.-J. and Saccomanno, F.F., 2005
(24)	**NCHRP 17-18(3)**, Work Zones, Exhibit I-3

The Relationship of SCDOT Damage Claims and Lawsuits to Roadway Engineering Safety Issues

Final Report

Introduction

Tort liability depends largely upon federal and state law. Most states once had sovereign immunity that protected the government, its employees and its agencies from tort liability. However, sovereign immunity was looked upon with disfavor because it allowed negligent conduct to go unaddressed and victims to be uncompensated. As a result, most state governments lost sovereign immunity through court decisions or acts of the legislature. Civil wrongs by government agencies, known as torts, are the legal responsibility of public agencies to the victim(s) of those civil wrongs. Of those states that have lost sovereign immunity, 40 have placed limits or caps on the amounts that a court or jury can award, with award ranges limited to between $50,000 to over $1 million. Because courts and juries determine award amounts per person or occurrence, the limits differ in each case.

Tort liability is of concern to public agencies, especially transportation agencies, because money spent defending tort lawsuits and compensating crash victims is money that is not available to be spent improving the safety of the state highway system. Consequently, it is of importance how state transportation agencies manage risk relating to claims and lawsuits filed against them for crashes on their highway systems. The South Carolina Department of Transportation (SCDOT) processes approximately 1000 such claims per year and is engaged in about 100 lawsuits per year. Of the 3000 claims filed over the last 3 years, the total payout to settle the 990 that were paid was $524,706 while SCDOT has paid $9,893,507 to resolve 164 lawsuits for the same period of time. These payout amounts do not include expenses related to researching, processing and defending against damage claims and lawsuits by SCDOT employees and legal staff. Nor does it include expenses associated with Insurance Reserve Fund employees, private attorneys on contract to represent SCDOT, independent engineering experts and employees from other state agencies. These individuals expend significant effort on each claim and lawsuit which further detracts from day-to-day management and operation of the statewide transportation infrastructure. Therefore, it is critical that the SCDOT address this issue to protect itself from these claims and lawsuits while also improving conditions on roadways that may contribute to these legal challenges.

Claims and lawsuits are often the result of claimants' perception of alleged defects on the roadway. The public is better served by the agency being proactive, rather than reactive, in addressing the conditions that give rise to litigation. An excellent opportunity exists in managing the risk of future claims and lawsuits by analyzing these types of past events and improving roadway elements that could potentially benefit from improvement or may be perceived to be a contributing factor to a crash that resulted in litigation.

Through an analysis of SCDOT's claims and lawsuits, it is possible to discern a pattern or gain information about the frequency and types of claims and lawsuits, and the corresponding crash or incident that gave rise to them. The desired result is to provide SCDOT with a proactive approach for eliminating or ameliorating the types of highway conditions that are alleged by plaintiffs to contribute to causes of crashes or incidents. Through such an approach, future lawsuits and claims can be reduced.
Studying patterns of previous cases found in favor of the plaintiff may also help to build stronger defense cases for the SCDOT or provide direction for changes in legislation to stop potentially frivolous cases.

Study Objectives

The objectives of this study include:

- Analyze factors associated with claims and lawsuits that are important for risk identification and management,

- Identify methods to respond to claims and lawsuits in a consistent manner statewide and prevent claims and lawsuits by identifying and reducing the perceived and real hazards that generate them; and,

- Identify proactive measures, such as reducing risk factors, and reactive measures that include handling claims and lawsuits and amounts paid to claimants to increase the effectiveness of the risk management system.

Literature Review

What is tort liability?

"The common law goal of tort law is to efficiently deter wrongdoers and fully compensate unjustly injured victims" (McQuillan, et al., 2010). A tort is a civil wrong committed by one individual that results in physical harm and/or property damage to another person (McQuillan, et al., 2010).

Essentially, tort law has four major objectives. "First, it seeks to compensate victims for injuries suffered by the culpable action or inaction of others. Second, it seeks to shift the cost of such injuries to the person or persons who are legally responsible for inflicting them. Third, it seeks to discourage injurious, careless, and risky behavior in the future. Fourth, it seeks to vindicate legal rights and interests that have been compromised, diminished, or emasculated" (LawBrain, 2011).

Tort Liability and Government Agencies

Sovereign Immunity

Historically, the doctrine of sovereign immunity prevented governmental liability from tort actions that were brought against state governmental agencies without their consent. Between the mid-1960s and late 1970s, changing public attitudes, in addition to legal challenges to the doctrine, reduced its protection in many states.

The rationale for sovereign immunity—also called governmental tort immunity—was to prevent monetary judgments against the government, as these judgments would have to be paid with taxpayers' dollars. The American law of sovereign immunity has been generally based on a misconception of English common law that says "*the king could do no wrong*"[3]. (E.M, Borchard. 1925; Louis L., Jaffe. 1963). The concept of sovereign immunity was brought to the United States as early as 1812 in the case of *Mower vs. the Inhabitants of Leichester* when a defective bridge caused damage to one of Ephraim Mower's horses in Massachusetts (Turner, et al., 1987).

In South Carolina, sovereign immunity began in 1820 after William Young's wagon and horses were damaged due to a deficient bridge over Wilson's creek[4]. A divided Constitutional Court of South Carolina, citing *Russell v. The Men of Devon*[5], stated that they were not responsible in a private action for the neglect of a duty[6].

Over the next 165 years, sovereign immunity was eroded until it ended in 1985 with the enactment of the South Carolina tort Claims Act. (C.T., Goolsby, et al., 2003).

[3] See Ricco*, Developments in Tort Liability of the Federal Government Under The Federal Tort ClaimsAct,* 1987 Annual Survey of Amer. Law 619, 619

[4] *Young v. Commissioners of the Roads*, 11 S.C.L. (2 Nott & McC.) 537 (1820)

[5] 2 Term Pep.667,100 Eng.Rep.359 (1788)

[6] Id. at 537; *see also Treasurers v. Cleary*, 37 S.C.L. (3 Rich) 372 (1832) (" The constitution reserve to the Legislature the exclusive power of disposing of the revenue, nor will a suit lie against the State by an individual, so that there is no means by which one having even the most righteous claims upon the State can come at them except through this channel.")

Partial Immunity and No Immunity

The trend toward governmental accountability led many state legislatures to enact statutes to define liability for state governmental entities and their employees for their actions.

Federal Tort Claims Act

The Federal Tort Claims Act (FTCA[7]), enacted by the United States Congress in 1948, for the first time, gave American citizens the right to sue the federal government. The FTCA permitted private parties to sue the United States in a federal court for injuries caused by the negligence of any federal employee acting within the scope of his employment. The FTCA constitutes a limited waiver of sovereign immunity. There are three major exceptions in FTCA under which the United States may not be held liable: 1) the Feres doctrine, which restricts military personnel from receiving payments for injuries sustained during service; 2) the discretionary function exception, which does not hold the United States liable for acts or omissions of its employees that involve policy decisions; and 3) the intentional tort exception, which immunizes United States for assault and battery, among some other intentional torts, unless they are conducted by federal law enforcement or investigative officials (Cohen, H. et al., 2009).
The most important exception to federal government liability is the "discretionary function".[8] It provides that the federal government shall be held immune from[9]:

"Any claim based on an act or omission of an employee of the Government, exercising due care, in the execution of a statute or regulation, whether or not such statute or regulation be valid, or based upon the exercise or performance or the failure to exercise or perform a discretionary function or duty on the part of a federal agency or an employee of the Government, whether or not the discretion involved be abused."

The discretionary function exception insulates governmental entities and employees from liability for planning or policy level decisions. At least 26 states have also enacted some form of discretionary immunity (Craig, Jon L. 2002; Best, A., Barnes, D.W., 2007).

Tort Claims Acts

State tort claims acts, many of which are modeled after the Federal Tort Claims Act, authorize tort claims and lawsuits against the states (Thomas, 1992). These acts provide either a general waiver of immunity with certain exceptions for immunity or reinstitute sovereign immunity with exceptions for liability.

Similar to federal law, common provisions in state tort claims acts include procedures for giving pre-action notice of a tort claim against the state, a limitations period for filing a notice of claim or action in court, permission for state entities to purchase liability insurance or self-insure, and clarification of the personal tort liability of government officers and employees (Craig, Jon L. 2002).

In South Carolina, a general waiver state, the Tort Claims Act includes 31 exceptions[10] to the waiver of immunity which can be roughly classified under four general categories:

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[7] (June 25, 1948, ch. 646, Title IV, 62 Stat. 982, "28 U.S.C. Pt.VI Ch.171" and 28 U.S.C. § 1346(b))
[8] (28 U.S.C. §2680 [a] and [h])
[9] (28 U.S.C. §2680[a])
[10] S.C. CODE ANN. § 15-78-60 (Supp.1991).

1. Losses resulting from legislative and judicial acts or omissions
2. Losses resulting from the exercise of discretionary activity or the performance of or failure to perform discretionary acts
3. Losses resulting from specified acts, as enumerated
4. Losses resulting from the design of highways or absence, condition, or malfunction of any sign, signal, warning device, illumination device, guardrail, or median barrier, unless the governmental entity fails to take action within a reasonable time after the notice.

At least 29 states have provided immunity from suits regarding punitive or exemplary damages. California, Kansas, Maryland, Mississippi, New Jersey, New Mexico, South Carolina and Wyoming have also established that the state is immune from liability for interest prior to judgment (Craig, J. L. 2002; Morton, H. 2007).

At least 33 states have enacted a statutory maximum, or a "cap," on the amount that may be recovered regarding claims brought against the state. In Florida, Nebraska and North Dakota, tort claims that go beyond the statutory limit are paid through direct legislative appropriation; while in the state of Maryland, the treasurer is in charge of paying all or part of the damages that exceed the statutory limit from the State Insurance Trust Fund (Craig, J. L. 2002; Morton, H. 2007). Statutory caps vary due to their type and scope. Usually, a cap is provided on a recovery for each plaintiff and also a cap on damages per cause of action or per occurrence. Caps on damages currently range from a low of $50,000 per cause of action in Nevada to a high of $1.6 million per individual in Oregon and $5 million per occurrence in Indiana[11] (Morton, H. 2007; Report of California performance review GG37, 2010).

Highway Defect Statutes

A highway defect statute is another specific way of waiving the sovereign immunity of state transportation departments. This approach focuses on the potential liability of a DOT, whereas a general waiver of sovereign immunity exposes a state to tort liability on any theory. For example, the highway defect statute established in Connecticut[12] states: "Any person injured in person or property through the neglect or default of the state or any of its employees by means of any defective highway, bridge, or sidewalk which it is the duty of the commissioner of transportation to keep in repair…may bring a civil action[13]."

[11] Ind. Code §34-13-3-4, Oregon On-Line Survey(2010)

[12] Connecticut's statute is still in force, but Kansas, a former highway defect statute state, has enacted a Tort Claims Act, K.S.A. § 75-6101, an "open ended" tort claims act making liability the rule and immunity the exception. Rollins v. Dep't of Transp. 238 Kan. 453, 711 P. 2d 1330 (1985).

[13] CONN. GEN. STAT. tit. 13a, § 144. Cases involving highways decided under this section include Ormsby v. Frankel, 54 Conn. App. 98, 734 A.2d 575 (1999) (issue of constructive notice was question of fact for the jury), *cert. granted in part* 250 Conn. 926, 738 A.2d 658; Warkentin v. Burns, 223 Conn. 14, 610 A.2d 1287 (1992) (90-day notice of claim provision was unambiguous); and Hall v. Burns, 213 Conn. 446, 569 A.2d 10 (1990) (workload of transportation department relevant to issue of whether a defect existed in the highway).

Magnitude of Tort Claims

Direct Costs Associated with Payouts

After states began to lose sovereign immunity, many states and highway departments began to experience the increasingly large financial burden of tort liability actions. In response to this new burden, several states began to study their past experiences with tort claims and lawsuits to determine ways to address the problems that arise from exposure to tort liability.

In the three-year period between fiscal years 1979 and 1982, states paid in excess of $84,000,000 to settle highway tort claims (Gittings, 1987). By 1991, AASHTO estimated the annual state payments made in settlement amounts for highway related tort claims, were between $135 million and $345 million. The range on such estimates was necessarily broad, for there was not a reporting system for highway tort claims to which all or even a large majority of states regularly responded (Kerchensky et. al., 2003).

In 1990, Turner et al. conducted a follow-up status report of tort liability among state highway agencies (Turner et al., 1990). Over time, the number of states responding to the surveys dropped from 90% to less than 50%. When considering the 9 states that completed all 5 of the AASHTO surveys, the tort liability trend shows that the number of claims has increased from about 1,000 to 10,137 over the 14 year period in these states. The author also estimated that the number of claims which had been filed against transportation agencies increased from about 2,000 to about 27,000 in the United States during the same period, representing a growth factor of 20 percent per year. In 1995, Turner and Blaschke estimated that state highway agencies paid out in settlements and judgments $200 to $300 million to defend 33,000 to 35,000 claims (Turner and Blaschke, 1995).

In 1990, Turner et al. also collected data on the number and dollar amount of pending claims. According to their data, an estimated 15,000 to 18,500 pending claims in the United States were reported over a ten year period from 1978 to 1987. The dollar amounts associated with these pending claims were estimated to be somewhere between $8 and $10 billion in 1987. The states have also paid out a large amount of money for settlements and judgments of these claims. The report declared that in fiscal year 1987, the amount of money paid out by the states was between $125 and $150 million.

The following are detailed accounts from several states on the magnitude and direction of payouts.

- Michigan DOT reported annual payouts of $1.4 million and $29.2 million for the years 1978 and 1987 respectively (Datta et al., 1991). In 1978, when the road commission in Michigan was faced with $72 million pending lawsuits, they established a risk management program (Bair et al., 1980).
- In Pennsylvania, sovereign immunity was overturned in 1978. The Pennsylvania DOT decided to study its experience with tort claims in order to develop a risk management program. The study established that from 1979 to 1988, Pennsylvania paid out almost $100,000,000 for tort claims, and during the same period, yearly totals doubled every 2 years (Gittings, 1989).
- In Iowa, where the code of Iowa was amended in 1967 to permit claims and suits against counties for tort damages, 99 counties of Iowa paid $52 million during 1973 to 1978 and more than $30 million was pending (Carstens, 1981).
- In Kentucky, however, a study that analyzed 29 years of tort claims from 1981 to 2009, showed that the number of claims per year and the dollar amount associated with these claims has not grown much since sovereign immunity was lost. While the number of claims has fluctuated over the years, the largest number of claims for a three year period was from 2003 to 2005. The

study reported the annual average number of claims and payout were 530 and $4.3 million respectively for the time period of 1981-2009 (Agen, 2010).

- A study of Indiana's tort liability system reported that the total settlement amount of common claims was approximately $80,000, which is only 4% of the total $2 million paid for all claims in the year 2001. Between 1999 and 2001, the number of paid claims increased from 307 to 396, which corresponds to a 25% increase in the number of claims during that specific period of time (Giraud et al., December 2003).

Indirect Costs Associated with Payouts

Tort actions create a financial burden on state agencies not just from the payouts they incur, but also from the indirect costs associated with handling all of the claims. These costs are incurred whether the tort action is frivolous, denied, or paid. A study of Indiana's tort liability picture showed that although the four most frequent types of tort claims accounted for approximately half of all claims, the direct costs of these claims were just a small percentage of the total payouts, while these same claims accounted for a large percentage of the indirect costs (Giraud et al., December 2003). Based upon the status report of tort liability among state highway agencies, states spent approximately $30 million in addition to settlements while processing tort actions in the court of claims (Turner et al., 1990).

Effects of Excessive Tort Costs

At $180 billion in annual costs, the United States has the most expensive tort system in the world. While an efficient tort system can ultimately provide numerous incentives, a poorly designed tort system can generate large costs that must be burdened by someone. Typically, these excessive costs are paid for through a "tort tax." In other words, both individuals and firms will have to take on the economic burden of excessive tort costs through increases in product prices and decreases in individual wages, returns on investment, and innovation. In fact, the current tort cost in the United States is estimated to be $650 per person, with an overwhelming 80% of these costs being lost to pay for excessive settlements and indirect costs (Council of Economic Advisers, 2002).

Factors Affecting DOT Claims

Although there is no type of claim that is dominant across the states, several studies conducted in different states have shown common factors leading to tort actions. Issues related to pavement conditions and traffic control devices were found to be the most common causes of tort claims and lawsuits in 4 states and Oakland county (Turner et al., 1990; Bair et al., 1980; Gittings, 1989; Carstens, 1981; Agen, 2010; Giraud, et al., December 2003). Pavement condition issues included potholes, shoulders, fixed objects adjacent to the roadway, paint and maintenance. Issues related to traffic control devices were mostly due to the absence of stop or warning signs. A Pennsylvania study also identified a significant relationship between injury severity and contributing factors, as well as a high correlation between injury severity and settlement amounts (Gittings, 1991).

Studies have not only looked at the past when it comes to highway tort liability issues. One paper addresses the expected changes in tort liability due to the increased role of technology in transportation systems. Sophisticated new technology in transportation will be a great benefit to the highway user. When glitches occur, however, transportation agencies will find themselves with greater exposure to tort liability for failing to meet the increased expectations of the travelling public.(Smith et al., 2000). In addition, concerns with the large number of tort actions are not just centered around the safety of the roadways and the financial burden on state agencies. A paper by Turner and Blaschke discussed the potential negative effect tort liability concerns can have on engineers' innovation (Turner and Blaschke, 1995).

Tort liability causes and solutions have proven to be complex matters, and solutions may not be as apparent as one might think. For example, failure to meet design standards for roadways might appear to be an obvious cause for tort claims, but robust documentation of design exceptions has proven to be effective. In Indiana, Malyshkina and Mannering's study of the locations where previously granted design exceptions are present showed there was no significant increase in accident severity or frequency (Malyshkina and Mannering, 2010). In Kentucky, a similar project showed that an analysis of previously granted design exceptions did not show an increase in crash rates (Agen et al., 2002). Another example comes from a study on tort reform, which is an obvious response to increasing tort liability. However, Lee, Brown, and Schmidt showed that 33 states modified joint and several liability laws between 1985 and 1990, and yet, little evidence was found in court records of a decrease in tort claims due to these reforms (Lee et al., 1994).

Defense Strategies for DOTs

This section discusses some possible defense strategies that transportation departments may apply in tort actions brought against them.

Economic Defense

Financial feasibility, inadequate funds and the need to allocate scarce resources, based upon a well-reasoned system of priorities, can explain a transportation agency's inability to keep every piece of its highway system in a state-of-the-art condition. Most of the time, transportation departments are not held liable in cases where they had to spend "their limited funds [on] those highway projects they believe are most urgently needed."[14]

It appears that the absence of necessary funds may be a suitable defense brought by the agency to avoid liability. However, evidence is always required to defend its allocations and its discretionary decisions. The state must offer proof that the "challenged conduct or omission was a thoughtful, premeditated, and deliberated policy decision made by consciously balancing risks and benefits. This proof may come in the form of meeting minutes, testimony by the decision makers regarding the process involved, or other documents showing that the governmental entity made an affirmative policy decision."[15]

Although making decisions regarding the allocation of resources, including funds, personnel or equipment, are generally discretionary functions that are immune from judicial inquiry, the economic defense is not always successful in tort actions. Public authorities may be accused of not taking into consideration less expensive alternatives that may have prevented the accident.

Contractual Indemnity

Contractual indemnity is another kind of protection from tort liability that a transportation department may provide in a contract to employ against third party claims. In transportation construction contracts, the contractor may be required to indemnify the transportation department. A typical indemnity clause provides that:

[14] 65 N.Y. JUR. 2D Highways, Streets, and Bridges § 407, at 217–18.

[15] Serviss v. Department of Natural Resources, 711 N.E.2d 95, 98 (Ind. Ct. App. 1999) (citations omitted; case involved a sledding accident).

"[t]he Contractor shall indemnify and save harmless the [Transportation] Department, its officers and employees, from all suits, actions, or claims of any character brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; …or because of any act or omission, neglect, or misconduct of the Contractor[.]"[16]

Although contractual indemnity may permit the transportation department to protect itself from liability, it is not a successful defense for cases in which the claims arise out of the transportation department's own negligence.

Insurance

One of the principal issues in regard to insurance coverage is whether the limitations on a transportation department's consent to be sued in tort could be affected by the purchase of insurance. There is authority that purchasing liability insurance brings accountability for the state.[17]

The state statute may or may not waive the immunity or the immunity waiver may be limited.[18] Essentially, purchasing liability insurance by transportation departments may have different effects among the states.

Contributory Negligence and Comparative Negligence

Accidents are a daily occurrence, and the first question that is typically asked is "who is at fault in the accident?" The principal defenses to tort liability are comparative negligence and contributory negligence.

Contributory negligence holds that a person who carelessly harms another individual cannot be held liable if the injured person contributed to the accident in any way. The contributory negligence defense was established in English laws as early as 1809[19] and was applied to American law in *Brown v. Kendall.*[20] As of 2008, only four states (Alabama, Maryland, North Carolina, and Virginia) and the District of Columbia still recognized the traditional form of contributory defense. The other 54 states utilized the comparative negligence defense (Kaplan, 2008).

[16] Vankirk v. Green Constr. Co., 195 W. Va. 714, 466 S.E.2d 782, 786, n.2 (1995), *cert. denied,* 518 U.S. 1028 (1996).

[17] HARPER & JAMES, THE LAW OF TORTS § 29.4; Wright v. State, 189 N.W.2d 675, 680 (N.D. 1971), *overruled* in Bulman v. Hulstrand Constr. Co., 521 N.W.2d 632, 636 (1994). In *Wright*, the court held that it "was within the discretion of the State Highway Department to determine whether a policy of insurance against liability should be purchased, who should be covered, and the extent of the coverage.... [T]he purchase of the policy was not a waiver of the immunity of the State from suit...." In *Bulman*, the North Dakota Supreme Court abolished the State's sovereign immunity from tort liability but noted that its "decision should not be interpreted as imposing tort liability on the State for the exercise of discretionary acts in its official capacity, including legislative, judicial, quasi-legislative, and quasi- judicial functions." Bulman, 521 N.W.2d at 640. Abrogation was prospective so that the legislature could implement a plan for liability insurance or self-insurance. Whether liability insurance itself was a waiver does not appear to have an issue in *Bulman*.

[18] Henry v. Okla. Turnpike Auth., 478 P.2d 898, 901 (Okla.1970) (The "said statute requires only a limited insurance liability to be purchased.... This statute did not authorize a full and complete waiver [of sovereign immunity of the Turnpike Authority] and we so hold.").

[19] Butterfield v. Forrester, **103** Eng. Rep. **926** (K.B. 1809).

[20] **60** Mass. (6 Cush.) **292,** 296 (1850).

Jurisdictions following a comparative negligence system typically apportion the damages using one of the four approaches (Low and Smith 1992): "pure" comparative negligence, "modified" comparative negligence which is described in two variants of 51% rule and 50% rule, and the "slight-gross" rule.

Under pure comparative negligence, which is the most flexible approach, a plaintiff's recovery would be reduced based on his/her contribution to the injury. For example, if he/she is 80% liable for an accident, 20% of his/her damages could be recovered from the other party.

The modified approach, which is the most common amongst the states, allows plaintiffs to recover if the injured party is not more than 50% or 51% at fault for the injury, considering the combined negligence of both parties. South Carolina follows a system using the modified comparative negligence, the 51% rule. [21]

The last approach, which is used only in South Dakota and Nebraska, sustains the recovery bar of contributory negligence unless the plaintiff can prove his/her negligence was slight in comparison with the negligence of the defendant.

Risk Management

While the number of tort actions against states and their corresponding costs can be overwhelming, numerous strategies and approaches exist to help states reduce liability, better manage actions, and prevent future claims. These strategies fall under risk management, which aim "to minimize costs and expenditures related to insurance and claims of all types" (Lewis, 1994). Each agency develops its own strategies for the purpose of implementing a risk management program. For example, a key aspect of risk management in the State of Alabama was reported to be the accident surveillance and roadway defect collision investigation program (Bair et al., 1980; Turner and Colson, 1988).

Demetsky (1993) conducted a study regarding assessment of risk management procedures in state departments and found that 21 out of 38 responding states had some form of risk management program for transportation. Except for Missouri and Alabama, however, most other states did not have a procedural manual. The same survey reported that 23 of the states evaluated their risk management program, but the criteria for evaluation varied (Demetsky, 1993).

In 2003, another survey by Giraud et al. revealed that current highway tort liability risk management programs had not changed much over the previous 10 years. All 13 responding states reported having risk management procedures in their agencies, and 10 of them reported that their risk management program had the potential to reduce the number of claims. All responding states declared that they evaluated their risk management program, but only 3 of them had clearly established objectives regarding their process (Giraud et al., December 2003).

[21] Nelson v. Concrete Supply Co., 303 S.C. 243, 244, 399 S.E.2d 783, 784 (1991).

The details of programs for a few states follow:

- In Pennsylvania during the early 1980's, the Pennsylvania DOT implemented an effective risk management effort, which addressed managerial, administration, support, and training changes to allow employees and the department to have more control of the department's liability exposure. Due to this program, a strong relationship between highway maintenance personnel and state and local police had a major impact on tort liability prevention. Thus, effective risk management loss control resulted from the timely sharing of information between DOT and police on serious injury or fatality incidents associated with "dangerous" highway conditions (Gittings, and Jacobs 1989).
- In 1989, Michigan developed a comprehensive risk management program to target specific improvements to minimize the number of crashes, associated tort claims and fiscal losses. This program included three identifiable processes of risk identification, resource allocation and risk management evaluation. Their program also addressed four major elements of crash reduction, loss reduction, defect surveillance, and public relations. The tools used to implement this program included: the use of a risk management user guide by local government policy makers, a training program for local agency supervisory staff, and a follow-up assistance in implementing risk management principles (Datta et al., 1991).
- In 1991, a study for the Virginia DOT identified areas for risk management improvement and associated methods for investigation. The study recommended establishing additional cooperation between VDOT and state agencies, developing training procedures, and informing employees of their work responsibilities and job descriptions. It also aimed to accomplish risk management objectives by creating a comprehensive system for inventory, maintenance and documentation (Thackston and Black, 1991).

In 2003, research was conducted to develop a highway tort liability risk management system for the Indiana Department of Transportation. This study developed a framework for a risk management program that addressed two different approaches: pre-emptive ("before-the-fact") and palliative ("after-the-fact"). The former is aimed at minimizing the occurrence of tort liability incidents, while the latter is focused on minimizing the consequences of an accident and also provide feedback to the pre-emptive approach. Several levels of risk management were defined based on corresponding staff including: Database Specialist, Claims Analyst, and Risk Manager. The study suggested that 'Strengthening links between the attorney general's office and INDOT' and 'Incremental development of the risk management program' could be beneficial in implementing a decision support system (Giraud et al., 2003).

Methods

To meet the goals of this research project, the research team proposed several research tasks and subtasks as follows:

1. Explore and analyze tort liability systems
    f. Review SCDOT tort claims and lawsuits business processes
    g. Conduct Surveys and interviews with other state DOTs
    h. Review literature related to tort risk management
2. Collect and process SCDOT data related to claims and lawsuits
3. Develop models relating claims and lawsuits to risk factors
    i. Regression tree analysis
    j. Spatial data analysis
4. Develop risk profiles of different highway categories using fault trees
5. Develop risk management support system and implementation plan.

A multitude of tools (i.e., spatial analysis, online surveys, regression trees, and fault trees, etc.) were employed to achieve these tasks. Table 1 summarizes the tools along with a brief description of their function. Figure 1 shows how these tools were incorporated in carrying out the major research tasks. The following sections discuss methods used for each of the research tasks and subtasks in more detail.

Table 1 Research Tools

Tool	Function
Process Assessment	Conducted interviews with multiple offices/people within the DOT to determine business process requirements for dealing with damage claims and lawsuits.
On-Line Surveys/Telephone Interviews	Prepared and deployed an on-line survey on issues related to tort liabilities and roadway safety engineering. Follow up telephone interviews with selected DOTs were also conducted.
GIS Database Development	Developed a GIS database with three years of geo-coded claims data along with corresponding roadway and traffic details.
Regression Tree Analysis	Developed relationships between risk factors and claims/lawsuits from previous cases.
Fault-Tree-Based Risk Profiling	Developed prioritized list of risk factors and relationship between countermeasures and changes in risk probabilities.
Economic Analysis and Trade-off Analysis	The benefit-cost and cost analysis to demonstrate the efficacies of various tort risk related countermeasures.

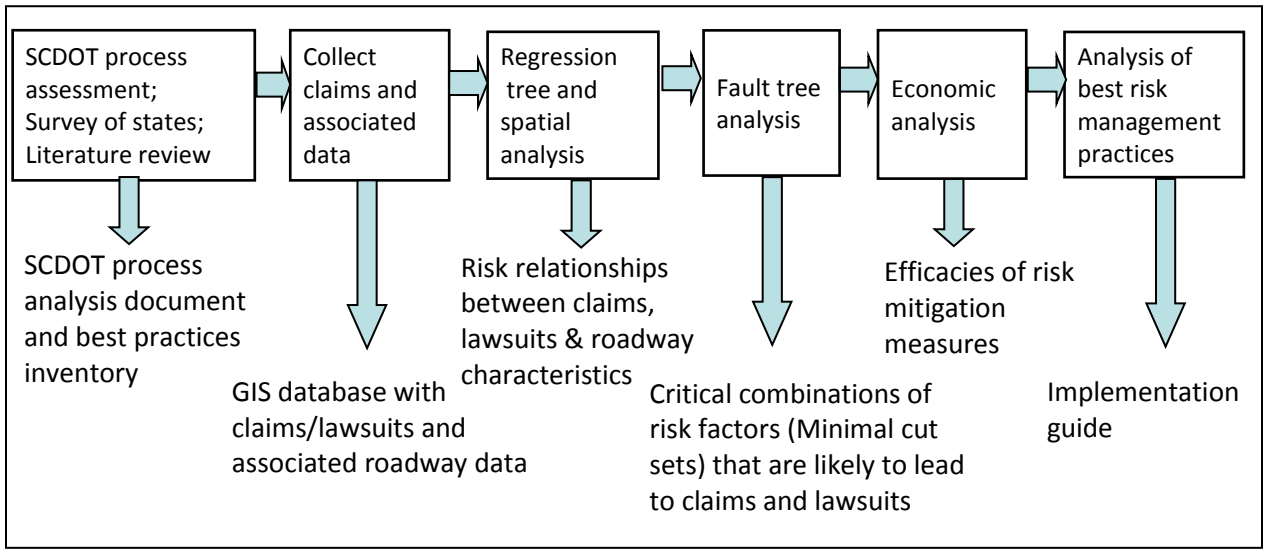


Figure 1 Flow of Research Tasks and Outcomes

Task 1 Exploratory Analysis of Tort Liability Systems

This task was broken into three components: 1) a review of the damage claim form and lawsuit processes within the South Carolina Department of Transportation (SCDOT); 2) the development and deployment of an on-line survey and follow-up telephone interviews with the legal and engineering departments of state DOTs; and 3) a review of existing literature on tort risk management. Only the process analysis and survey are documented in this section. The literature review was conducted using standard formal searches of TRIS and other related databases using the Clemson University Library system. The resulting literature review was presented in the initial portion of this report as background material.

SCDOT Tort Claims Business Process

Given that SCDOT does not currently have a comprehensive claims and lawsuits process document, it was imperative to determine what potential sources of information exist, in what format they exist, and the level of detail included in the source documents. Additional details on the current methods used for processing claims were also of interest. Because claims originate in the County Engineering Offices, the research team began the research project by interviewing Amanda Taylor in the Office of Legal Services and Tony Magwood in the Richland County Maintenance Office to determine the steps taken to receive, review, and respond to individual damage claims and lawsuits. In addition to interviewing Tony Magwood in the Richland Office, our researchers also spent a day in the office and the field observing an engineer conducting site investigations for claims and processing paperwork. This task allowed the research team to become intimately familiar with the current business process requirements and any logistical issues that exist in the current system. The results of this process analysis were invaluable for the development of recommendations for future risk management enhancements.

Surveys and Interviews with Other State DOTs

In August of 2003, the National Cooperative Highway Research Program published findings from a study assessing the feasibility of developing a national data management system for highway tort claims. The study covered three main areas: The research team focused efforts on three specific tasks: a set of core data elements; process assessments from five key state tort claims information systems; and construction of a model data management system. Building on this information, the Clemson research

team developed a survey based partially on those that had been conducted earlier with the addition of some questions of particular interest to SCDOT. The survey document can be found in its entirety in Appendix A.

The purpose of the survey was to determine outcomes of state DOTs' tort data management, and to identify any potential decision support systems that have been developed as a result of having the data system in place. The questionnaire consisted of the following four sections:

1. Tort legislation
2. Insurance Information
3. Tort Action Procedures
4. Risk Management Program

Each section began with general questions, followed by specific questions seeking quantitative and detailed responses to capture an in-depth view of each category and the related practices. For instance, the risk management program section started by asking if the state currently implemented a program and specific questions then followed.

The survey structure and many of the questions were based on the survey previously used by FHWA's Joint Transportation Research Program (Indiana DOT and Purdue University). The survey kept a log of all responses for each question, which was saved and could be accessed by the authors online for review. The survey ended with a request for state agencies to provide any detailed data available on the state's claims, lawsuits, risk management programs and processes that might be useful and was not requested previously in the survey. Several states returned detailed data packages on tort issues and the risk management process in their state. In order to encourage disclosure of sensitive information and data, each responder was assured anonymity and that no responses would be linked to a particular state.

The survey was deployed on a prominent survey engine website and emails were sent to the research offices of each of the state departments of transportation. After a series of reminder emails, the response rate did not meet initial expectations, and the research team made personal contact with individuals in the legal offices in several states to encourage them to participate which doubled our initial response. In some cases, the research team also conducted follow-up interviews to retrieve documentation and clarification on items of interest.

Task 2 Collect and process SCDOT data related to claims and lawsuits

After the process assessment described in Task 1, the research team identified several sources of data needed to complete this project successfully. The first and most important data source was information from the electronic claims database maintained by the SCDOT Office of Legal Services. Other related data such as crash history, roadway characteristics, and traffic volumes were also sought as input for statistical analyses and model development. The following sections describe each of the data sources in detail.

Legal System Data (Claims, Lawsuits, Investigations)

The SCDOT Office of Legal Services personnel manually enter tort claims and lawsuits data into an extensive electronic database consisting of over 30 fields of information relating to the tort actions. Most entries are obtained from information submitted on the damage claim form and investigation information received from the County Engineering office. Additional data elements regarding claims or lawsuits that are processed by the Insurance Reserve Fund on behalf of SCDOT are also added. These include information such as the final decision, settlement amounts, close date, etc. This system is only

populated once a claim reaches the legal department in Columbia either as a direct filing, or after going through the county and district offices. Thus, there is no tracking system or database that is used statewide by the Department for handling damage claims and lawsuits.

It is possible to conduct queries on the claims database. For example, SCDOT information technology staff queried the database for the 300 most recently closed lawsuits, and 3000 recently closed damage claim files for use in this project. It was important to have closed files so that the disposition and any settlement amounts associated with the claim would be known. From the available fields of information for each tort action, the research team selected only the fields useful for the study for export into a single worksheet sent to the team by SCDOT for both lawsuits and claims. The most important data fields included (See all data fields in Appendix B – Legal Database Fields Obtained):

- Date of incident
- Location of Incident
- Vehicle Tag
- Route Type
- Road name/number
- Mile point
- GPS coordinates
- Cause of incident
- Remarks-details on the incident and cause
- Decision-Whether the action was paid, denied, or settled.
- Claim amount-amount claimed in tort action
- Settled amount-amount paid to claimant

To build upon the existing electronic database and fill in incomplete and unclear entries, the research team reviewed the paper files of the claims and lawsuits which contained additional information from the tort process which was not included on the initial claims form submitted by the claimant. Some of the most important missing pieces of information in the electronic file were sufficient details on the location of the incident. While typically available in the paper documentation received from the district, these were not consistently entered into the electronic database. Additionally, several other pieces of data were also retrieved from paper files:

- GPS coordinates
- Nearest intersecting road
- Any nearby landmarks claimant listed
- Any nearby addresses claimant listed
- Full road numbers-(eg. S-40-2922 replaced with 2922)
- IRF number
- IRF expenses
- Make & model of vehicle
- Additional details on the incident in the “remarks” section
- Mile point if not already entered

A project specific worksheet for lawsuits and claims was created from the initial database query and additional data received from the paper files were input using Excel.

Approximately 1,000 damage claims are received by SCDOT each year. To obtain a significant sample for analysis, researchers chose the 3,000 most recently closed damage claims. The claims represent the sample closed during the period between January 28th, 2007 and April 19th, 2010. The vast majority (50%) of the claims represent damages incurred from potholes. Complete descriptive statistics for the sample are provided in the results section. These statistics were created from a reclassification of the claims data which will be described in the following section. Upon further inspection, the database had a number of typical data entry issues, such as formatting of particular data elements such as route number. The same route number might be listed as "2999" or "40-2999" or "S-40-2999" in different entries. Another common data issue with route name was due to multiple names on certain roads. For example, "Calhoun Memorial Highway" might be used or "US 76" or "US 123" or "SC 28" or "Tiger Boulevard". In analyzing these data elements, one would have to reformat all to be the same otherwise, they would be analyzed separately. This is one of the tasks completed during the review of the hard copy files of the claims and lawsuits. GPS coordinates and/or mile points were also extracted from hard copy files when available, but they also varied widely in formats. The coordinate format varied mostly by county and included: degree minutes seconds, decimal degrees, and even state plane coordinates which all varied widely in accuracy due to the recording of a significant number of digits, which could range in the decimal degrees format from 5 to 8 digits. Drop down menus and input format masks are easy fixes for these issues, but they don't fix previously entered data – these would have to be fixed manually. Also, a standard investigation procedure, which could include a specific and consistent GPS coordinate format and accuracy would also provide for much more effective data.

Initial lawsuit data was obtained for 300 of the most recently closed lawsuits. 297 of the lawsuits were suitable for analysis. This data was used as a sample representing approximately 3 years of lawsuits on average. However, the incident dates on the lawsuits range from February 1997 to August 2008. Due to the timeframe allowed for filing lawsuits, and the lengthy court process, many of the closed lawsuits were much older than the damage claims received for a similar 3-year period. To gain sufficient data on the cause of the lawsuits, as well as the resolution of the lawsuit, researchers had to review the hard copy files of the lawsuits in the legal department office. The hard copy files provided additional details of the incidents through investigations, discovery, and other evidence used in the lawsuit. This data was important for the research project in order for the lawsuit to be appropriately classified by causal factor. Classifying the lawsuits based on causal factor required more judgment and more details because most lawsuits involve multiple allegations against SCDOT with regard to the incident. In addition, investigations and other evidence in the lawsuit could be used to clarify the cause. Additional information was collected from these hard copy files, such as specific location data obtained from copies of accident reports (often included in lawsuit files but rarely ever in claims).

Due to the age range of the lawsuits, and the available in-house storage area, many of the hard copy files for the lawsuits in the initial sample were in long-term storage (Only hard copy files for 39 lawsuits on the list of 297 could be found in the legal office). In addition, crash report standards and thus the data available on the lawsuits underwent significant procedural changes, as well as recording formats, during the time frame that our lawsuit sample represented. This made data collection on lawsuits with incidents prior to 2003 impractical. Therefore, in order to gain an adequate sample of lawsuits with sufficient details, an updated list of recently closed lawsuits was obtained from the IRF. This list allowed the research team to find additional lawsuits that were closed, recent and still filed in the legal office. This resulted in an additional 93 lawsuits, for a total of 132, being reviewed, whose details could provide an adequate depiction of the incident, as well as the resolution and its details.

Matching Claims Data and Crash Data

One of the initial tasks planned for the claims data was to match the claims that stemmed from incidents involving vehicles to entries in the crash database. Approximately 15% of the claims stemmed from a vehicle crash where it was reported to law enforcement and therefore it was assumed a report was created and filed in the crash database. It was believed that matching the two databases would allow for a much better depiction of the incident due to law enforcement's detailed and professional view of the incident compared to the claimant's description which is submitted with the claim. This would allow for a much more informed decision on the claims and would allow for an accurate cause of the incident to be identified which would strengthen the data used in the analyses later in the project.

This task began by importing both databases into Microsoft Access which was easily done since the claims data was provided in an excel file and the crash data was received in a .txt file format. With both databases in Access, matching could easily be conducted. Unfortunately, the crash report number was not a data field in the claims database and therefore, claims could not be matched directly with crash reports.

Matching was first attempted using the last name field. Using the last name to match surprisingly did not provide many successful matches. This was due partly to the difference between the last name data fields-the last name in the claims data had to be the owner of the vehicle (only the owner of the vehicle can make a claim) while the last name in the crash file was the driver-which could have been the owner or someone else.

Matching by date was the next attempt however; it resulted in averages of several claims per day. Further narrowing down the matches by time was also attempted however; unless the times were exactly the same a match could not be made. This could be explained by the fact that the claimant did not record the exact time of the incident or that the crash reports reflect the time that the incident was reported.

The last attempt at matching claims with crashes was made using license tag numbers. This was the most successful attempt and resulted in roughly 50-70 matches for each year. One issue identified was that the format of the license plate data was not consistent-a significant number of entries in the claims file included a space between the number and letter characters in the license plate sequences. This resulted in missed matches but this was addressed because the data in the claims file could be separated and then re-combined without spaces. Once the 50-70 matches were made they could be manually checked to confirm other details were consistent before a definite match was made. Unfortunately, once details such as date, time, make and model, last name and cause were checked, approximately 10 or less matches could be identified as definite matches.

Location Data

One of the most important data items needed for tort actions is the specific location of the incident that precipitated the action. The incident location is a key component in defining spatial patterns that may lead to quick resolution of serious roadway environment issues. Because the damage claims form only requests information on the route and nearest intersection, the process of locating the incident site is left up to the county engineers. In many cases, automated geocoding based on intersection can produce a poor success rate due to many factors, such as misspelled or the use of alternative road names (e.g. highway number versus roadway name), as well as incorrectly identified roadway prefix or type. In addition, the relative density of intersections will also affect the accuracy of the position data. In locations where there is a tight roadway network grid, the location will be fairly accurate. However,

in more remote rural areas where there may be miles between intersecting roads, the accuracy of the location will be greatly degraded.

The claims form includes multiple data fields for inputting the location of the alleged accident. Data fields on the damage claim form include a description of the location, such as the road name and nearby intersecting street, closest town, and county. From the engineer's site visit, additional information such as the route number, mile point, and the latitude and longitude coordinates of the incident location may also be available. The engineer might also review the location if he/she finds it to be different than what was specified on the claims form. However, for a multitude of reasons (mostly related to the tort handling process), sufficient incident location for many of the claims and lawsuits was not recorded in the legal database. These reasons include:

- Lack of adequate information provided by the claimant on the claims form (e.g., For wet paint in the road, the claimant may not know actual location of incident).
- GPS coordinates were not specified to an accurate value during the investigation (e.g., 4 decimals is approximately a few hundred feet of error, 5 decimals is less than 100 feet of error).
- The road number was not included in the investigation.
- The location data included in the recommendation letter from the county employee who investigated the incident was not entered into the database by the legal department (note – not all fields in the claims database are populated for all claims).
- Inability of the county employee conducting the incident investigation to identify the incident location
    - Due to lack of adequate information by the claimant on the claims form.
    - Inability of county employee to understand the defect or other critical detail of incident due to claimants incorrect, false or lack of proper terminology used.
    - Incident location has been altered (e.g., defect was repaired etc.).

The location data for the incidents leading to claims and lawsuits is vital in order to match the incidents with roadway characteristic data, which will be critical to the regression tree analysis as described in the following section.

Roadway Characteristics Data

If proper location data is obtained, the incident can be geo-coded in the SCDOT GIS and information about the roadway at that site can be obtained from the Roadway Information Management System. Roadway characteristics are important in the process of developing models to relate tort risk to associated factors, such as pavement edge height differences in areas with no paved shoulders. To accurately locate a site, specific location data are required. There are two methods for location – either using latitude and longitude or county-route-mile point. For latitude and longitude, the coordinates should be in decimal degrees with a minimum of 5 decimal places, however 6 is preferred. The county-route-mile point seems pretty straight forward, but often, the formatting of this combination may be wrong or the mile point may be out of range which prohibits the GIS from locating the incident site.

The claims database initially contained mile point data for 334 claims out of 3,000. In addition, location data was pulled from the paper files for 1126 more claims. Of these, 1024 had county-route-mile point only, 102 had latitude and longitude only, and 462 had both. For lawsuits, the legal database only contained route numbers for 112 lawsuits and no mile points or GPS coordinates at all. In addition, location data was pulled from the paper files for 43 more lawsuits. Of the lawsuits with location data, 7 had county-route-mile point only, 32 had latitude and longitude only, and 4 had both. Due to the

limited location data available for lawsuits, no models were able to be developed with roadway characteristics.

The damage claims location data was provided to the SCDOT GIS office for geocoding to the state roadway map. Due to the limited accuracy of the latitude and longitude data, none of the sites with latitude and longitude only were able to be geocoded. The locations of most of the points fell more than 200' from the roadway prohibiting the snap to route feature to work properly which prevented the GPS location from being accurately identified along the route. The county-route-mile point was more successful with 1159 out of 1272 sites being geocoded. Once the exact location was obtained in the GIS, data from the roadway characteristics file was queried based on location. Because the research team was not sure what roadway characteristics, if any, would be related to tort risk actions, a laundry-list of items was requested from the SCDOT (see Table 2). The data items marked with (*) were returned to us for use in modeling.

Table 2 Roadway Characteristics Items Requested

Number of lanes *	Barrier Type
Lane Width*	Median Type*
Road Width	Median Width
Shoulder Width	Access Control*
Shoulder Type	Right of Way
AADT*	Traffic count type and year
Speed Limit	Side Walk (Right and Left)
Functional Classification*	Truck Route*
Horizontal Curve parameters (Lc,T,R,Δ)	Area Type
Vertical Curve Parameters (L,….)	Operation

Reclassification of causal codes for claims and lawsuits

The research team spent a considerable amount of time looking into the coding used for classifying tort claims and lawsuits because a number of inconsistencies were found when using the current coding to generate regression trees. For instance, South Carolina Claim ID 153625 is coded as an 'Accident' with remarks indicating property damage when contractor's mower hit claimant's fence. Similar types of events with damage to fence lines from mowers or other construction or maintenance equipment can be found coded in the claims database as 'DOT Equipment' and 'Work Crew'. Essentially, there is no one common identifier for this type of incident. Thus, when using a classification type regression tree analysis approach, the results would be impaired because the same type of incident can be found in multiple classifications. Currently, claims and lawsuits are classified into a single causal category such as pothole, water on road, thrown object-mower, tree, accident, signal, etc (detailed in Table 3).

Table 3 Current Tort Action Classification

Accident	Driveway	Paint	Tar
Bridge	Erosion	Pavement	Thrown object-mower
Cable barrier	Fell	Pothole	Thrown object-other
Concrete	Ice	Railroad	Thrown object-truck
Construction	Intersection	Resurfacing	Tree
Cut Utility	Low shoulder/Drop off	Road hazard	Trip/Fall
Dip/Bump	Median	Sidewalk	Vehicle
DOT equipment	Metal	Sign	Water on road
DOT Truck	Mh-Cb-Di-Grate	Signal	Work crew
DOT Vehicle	No warning	Steel	
Drainage	Other	Tar	

However, these can and should be grouped to have more predictive power. For example, motor vehicle crash events could be separated from property damage and personal injury events before coding contributing factors. Water on the road and obstructed views are actually contributing factors that almost always lead up to a motor vehicle crash, whereas trees falling on property such as fences or a broken window caused by rock thrown from mower stem from natural man-made causes and do not precipitate a crash. A more logical classification structure would be multi-level, allow multiple contributing factors to be identified and may have root levels defined as crashes, natural hazards, maintenance operations, etc. The root level crash could have sub-levels of contributing factors such as water on road, obstructed view, low shoulder, animal, missing sign, etc.

Therefore, the research team with assistance from the technical oversight committee reclassified claims and lawsuits to create more homogeneous groups regarding causal factors (see table 4). The outcome of this activity provided more useful data for regression tree analysis, as well as spatial and statistical analysis. The new classification shown in Figure 2, classifies claims and lawsuits in a hierarchical structure. The first split indicates whether the incident is a collision or non-collision. The second indicates the type of collision (Collision with a Fixed Object or Not a Fixed Object) or non-collision (Damage to Vehicle, Pedestrian, or Property). The third and fourth levels are descriptive events and associated codes, such as trip or fall on uneven surface (code 70), or hit driveway entrance bump/dip (code 119). The classification scheme is described in more detail in the paragraphs to follow.

Many of the lawsuits involved multiple vehicle crashes. However, the SCDOT is not concerned with whether the causal factor led to a single or multiple vehicle crash-they are interested in identifying the causal factor that led to the lawsuit and therefore these lawsuits will be classified using the same causal factors as the single vehicle crashes.

Collision or Non-Collision (C or NC)

For the first indicator “Collision or Non-Collision”, all vehicle to vehicle incidents are coded as collisions. If there is a single vehicle incident with injuries, those too are coded as collisions. If the claimants vehicle was in operation and they hit anything from a pothole to another vehicle or if they were driving and were hit by debris from DOT truck, it would be considered a collision. However, if it is a DOT truck that is in operation, and they hit something on claimant's property this is considered non-collision property damage only (from the claimant’s view point).

Type

For the second indicator, the type of collision or non-collision is being captured. 'Type 1' is coded as collision with not fixed object, 'type 2' is collision with fixed object, 'type 3' is non-collision-vehicle damage, 'type 4' is non-collision-pedestrian damage and 'type 5' is non-collision-property damage. For collisions, the claimant's vehicle either struck a fixed object or not a fixed object. For non-collisions, the type code indicates whether damage was incurred to a vehicle, pedestrian, or property. Non-collisions involving vehicles would be property damage only (e.g., damage caused by SHEP worker, etc.). Pedestrian non-collision events are typically trip and fall events caused by uneven surfaces, drainage grates, or other debris. Property damage under non-collision is typically caused by road surface work, shoulder/ditches, utility work, mowing, limb management, etc and involves property other than a vehicle being damaged such as building damages, erosion or flooding damage, or utility damage.

Event / Code

The third and fourth indicators, 'Cause Code' and 'Event', tell us about the most severe aspect of damage. These codes are dependent on the first two codes. Guardrail, bridge overhead structure, sign post, deer or other animal, motor vehicle in transit, DOT vehicle in transit, debris, etc. are examples of different events.

Table 4 gives an example of claims reclassification. As it is shown in this table, five columns have been added to the current claim database. The first column classifies the incident or event as Collision or Non-Collision. The second column shows the type of collision or non-collision from 1 to 5. The third and fourth column describes harmful events associated to the claims. The fifth column indicates whether the event occurred during active construction or maintenance. While this is somewhat subjective (claims are coded as construction maintenance activity if it was indicated in the claim), it could be an important tool for identifying the types of incidents occurring in active construction or maintenance sites that the workers could be trained to look out for on the job. If the workers are aware of these incidents, it is more likely that they will be more proactive in preventing them in the future. A truck en-route to job is to be considered active Construction or maintenance. As well, damages occurring in a construction area or during active mowing operations would also be active.

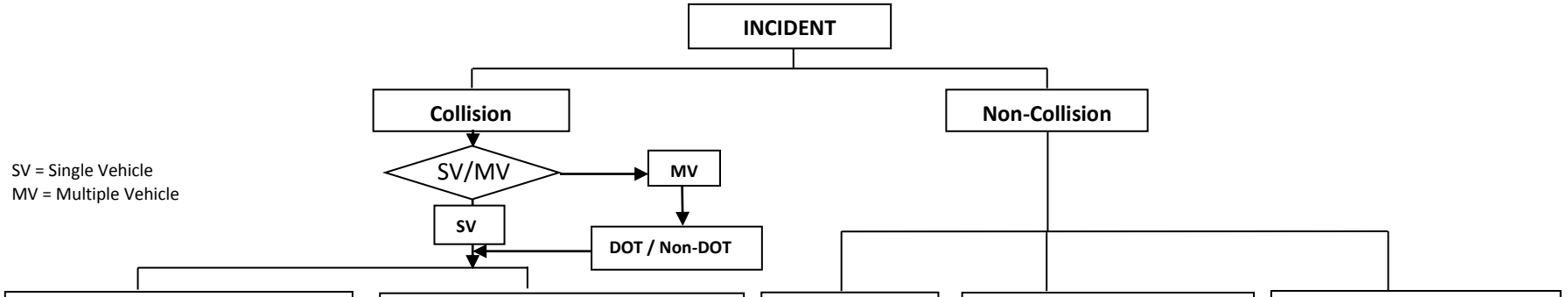
This same coding will also be used in the development of the decision support tool. For instance, if someone indicates that their fence was damaged by a mower crew, the decision support tool would allow the district engineer to select the proper coding and the tool would then indicate what the most likely outcome would be and would also indicate a standard procedure to follow for this type of incident. For this incident, it would be important to check to make sure there was a mower in the area at the time of incident. If so, was it a DOT vehicle or contract vehicle – if DOT, a recommendation to the legal office to pay would be in order; however, if a contract mower caused the damage, DOT would pay and then dock the contractor payment. So there would be a number of steps involved in making sure the claim is handled properly.

Table 4 Changes Due to Reclassification

BZ613 fx 5

A	V	AK	BY	BZ	CA	CB	CC
SClaimID	Cause	Remarks	C or NC	Type	Cause Code	Event	Const/Maint
154859	Thrown Obj	A dump truck in front of claimant hit several potholes throwing a rock into claimant's sideview mir	C	1	115	Debris-DOT Truck	Y
153192	Other	PD when a claimant struck a deer in the hwy	C	1	20	Deer	N
152293	No Warning	PD when DOT forces re-dug a filled in ditch at the end of claimants illegal driveway and claimant	C	2	46	Ditch	Y
152665	Dot Vehicle	PD when a DOT vehicle struck a bollard knocking it loose	NC	5	1000	DOT Vehicle	Y
153207	Other	DOT crew was turning around on the claimant's property, apparently backed into the corner of his	NC	5	1000	DOT Vehicle	Y
151609	Cut Utility	PD-DOT cut claimant's 100 pair cab;e while replacing drain line.	NC	5	306	Drainage Pipe	Y
151687	Cut Utility	PD when DOT forces was placing pipe and cut claimant's pair cable.	NC	5	306	Drainage Pipe	Y
152228	Work Crew	PD when DOT forces was installing a new drainage pipe when crews hit water line. 6/13/08 - disc	NC	5	306	Drainage Pipe	Y
151695	Road Hazar	PD when claimant's vehicle was damaged after coming out of a parking lot and turning onto highv	C	2	119	Driveway Entrance Bump/Dip	N
151882	Cut Utility	PD-DOT cut claimant's 100 pair cable while digging trench out of driveway.	NC	5	501	Driveways	Y
155029	Low Should	PD Claimant was turning into her driveway when she states she ran off the side and damaged the	NC	5	501	Driveways	N
151600	Other	PD when claimant struck a utility cut partially covered by a steel plate in the roadway.	C	2	99	Failed Utility Cut	N
152039	Other	PD when claimant ran over a utility cut in the roadway.	C	2	99	Failed Utility Cut	N
151754	Cut Utility	PD-DOT cut claimant's 100 pair cable while replacing guardrail.	NC	5	610	Guardrails	Y
152656	Cut Utility	PD when DOT forces were replacing guardrail and damaged cable	NC	5	610	Guardrails	Y
152520	Road Hazar	PD when claimant ran across sign post	C	2	52	HWY traffic sign post	N
151827	Work Crew	PD when DOT forces were trimming trees on side of road when an object was thrown and broke cl	NC	5	405	Limb Mngt	Y
152596	Work Crew	PD when work crew was trimming limbs and threw a limb and broke claimant's vehicle windshield	NC	5	405	Limb Mngt	Y
153293	Other	While taking down some dead trees, SCDOT employees fell one on two park benches belonging to	NC	5	405	Limb Mngt	Y
151764	Other	PD when claimant's vehicle fell down into a hole or groove when claimant too much off the should	C	2	101	Low Shoulder/Drop-off	N
151820	Low Should	PD when claimant's daughter ran across a drop off.	C	2	101	Low Shoulder/Drop-off	N
151824	Low Should	PD when claimant hit a low shoulder.	C	2	101	Low Shoulder/Drop-off	N
151869	Low Should	PD when claimant hit a low shoulder on edge of roadway.	C	2	101	Low Shoulder/Drop-off	N

Sheet1 richland



Not Fixed (1)

Animal
- Deer (20)
- Animal – not deer (21)

Road Surface
- Water on Road Surface (122)
- Paint Splatter (16)
- Asphalt/Tar (107)

Tree
- Tree in Road (18)
- Tree Limb Obstructing Road (113)
- Tree Fell on Car (114)

Debris
- Debris from Road (102)
- Debris -DOT Truck (115)
- Debris -DOT Mower/Landscape (112)
- Work Zone Maint Equip (29)
- Metal Plate (103)
- Other (125)
- Obstructed Sight Distance- e.g. Vegetation (221)
- Improper Design/Intersection Design (224)
- Failed to yield ROW (227)
- Too Fast for Condition (228)

Fixed (2)

Bridge
- Bridge Overhead Structure(40)
- Bridge Pier/Abutment (42)
- Bridge Rail (43)
- Bridge End (44)

Barrier
- Raised Median (134)
- Cable Barrier (135)

Roadside Design Feature
- Culvert (44)
- Curb (45)
- Ditch (46)

Post/Pole/Support
- Hwy Traffic Sign Post (52)
- Utility Pole (61)
- Overhead Sign Support (57)
- Improper Signage/No Signage (225)
- Missing Sign (226)
- Improper Traffic Control Device (229)

Road Surface
- Road Surface Irregularity (133)
- Pothole Damage (17)
- Pothole-edge/shoulder(18)
- Open Hole/Manhole (132)
- Bump/Dip (19)
- Driveway Entrance Bump/Dip (119)
- Surface Protrusion (rebar/other) (116)
- Mh-Cb-Di-Grate (100)
- Failed Utility Cut (99)
- Low Shoulder/Drop-off (101)
- Ran-off-road hit fixed object on roadside(09)
- Tree on roadside (60)
- Other (68)
- Rail Road Crossing (69)
- Embankment (47)

Vehicle (3)
- SHEP Worker (108)

Pedestrian (4)

Trip/Fall
- Trip/Fall Uneven Surface (70)
- Trip/Fall Mh-Cb-Di-Grate (71)
- Trip/Fall on Debris (72)
- ADA ramp (73)
- Water on Sidewalk (74)
- Other (75)

Property (5)

Bridge
- Bridge Construction (800)

Drainage/Ditches/Driveways
- Drainage Structure (305)
- Drainage Pipe (306)
- Shoulder/Ditches (203)
- Driveways (501)

Road Surface work
- Construction/Paving (204)
- Surface Repair (102)

Vegetation Mngt
- Limb Mngt (405)
- Tree Removal (408)
- Mowing (401)
- Signs (603)
- Guard Rails (610)
- DOT Vehicle (1000)
- Utility Work (1001)
- Other (1002)

Figure 2 Proposed Classification System

Task 3 Develop models relating claims and lawsuits to risk factors

Spatial data analysis

For the initial analysis, data from Richland County was obtained from SCDOT. Roadway data and spatial location of claims in Richland County were imported into ArcGIS and inspected for spatial patterns. The approach was later extended to the entire state. In total, there were 297 lawsuits and 3000 claims analyzed in order to represent 3 years of data. Not all lawsuits and claims were used in the spatial analysis due to data unavailability. 1,159 claims were spatially located and were used for further spatial analysis.

The causal factors within each claim type were reclassified to obtain generalized causal codes for easier representation and better understanding of the spatial patterns. Tables 5-8 give the initial cause codes and their corresponding reclassification codes by claim type.

Table 5 Data Recoding for Claim Type 1 - Collision with Non-Fixed Object

Initial cause code	Reclassified cause code
Animal	Animal-Not Deer
Asphalt	Asphalt/Tar
Debris	Debris -DOT Mower/Landscape
Debris	Debris from road
Debris	Debris-DOT Truck
Animal	Deer
WZ/DOT	DOT/Contract Vehicle
Metal	Metal Plate
Tree	Tree Fell on Car
Tree	Tree in Road
Tree	Tree Limb Obstructing Road
Water	Water on Road Surface
WZ/DOT	Work Zone Maint Equip

Table 6 Data Recoding for Claim Type 2 - Collision with Fixed Object

Initial cause code	Reclassified cause code
Bridge	Bridge end
Bridge	Bridge Overhead Structure
Pothole	Bump/Dip
Curb	Curb
Bump/Dip	Driveway Entrance Bump/Dip
Utility Cut	Failed Utility Cut
Post/Pole	HWY traffic sign post
Shoulder	Low Shoulder/Drop-off
Mh-Cb-Di-Grate	Mh-Cb-Di-Grate
Mh-Cb-Di-Grate	Open Hole/Manhole
Post/Pole	Overhead sign support
Pothole	Pothole - edge/shoulder
Pothole	Pothole Damage
Other	Rail Road Crossing
Other	Ran-off-road hit fixed object on roadside
Surface	Road Surface Irregularity
Surface	Surface Protrusion (rebar/other)

Table 7 Data Recoding for Claim Type 4 – Non-Collision (Pedestrian)

Initial cause code	Reclassified cause code
Trip/Fall Mh-Cb-Di-Grate	Trip/Fall Mh-Cb-Di-Grate
Trip/Fall Uneven Surface	Trip/Fall Uneven Surface
Water on Sidewalk	Water on Sidewalk

Table 8 Data Recoding for Claim Type 5 – Non-Collision (Property)

Initial cause code	Reclassified cause code
Other	Surface Repairs
Shoulder	Shoulder/Ditches
Other	Construction/Paving
Drainage	Drainage Structures
Drainage	Drainage Pipe
Mowing	Mowing
Veg Mgmt	Limb Mgmt
Veg Mgmt	Tree Removal
Other	Driveways
Other	Signs
Other	Bridge Construction
Other	DOT Vehicle
Other	Other

Several thematic maps were generated based on the reclassified cause codes using Arc GIS to identify specific patterns that are otherwise not obviously visible. The findings from the spatial analysis are discussed in the results section.

Regression tree analysis

A number of regression techniques have been used over the years to model incident/crash data. Early accident models were developed using multiple linear regression models, which have numerous faults and limitations (Lerman and Gonzales, 1980). In an attempt to overcome some of the limitations, researchers began using Poisson regression models, which more accurately model events that are random and independent in nature. However, Poisson regression assumes that the variance is equal to the mean of the dependent variable. When violated, this restriction invalidates the t-tests. Another modeling technique, NB regression allows the variance to be greater than the mean and has been widely used in recent accident models. However, NB regression still requires the functional form of the model to be specified in advance. It is also significantly influenced by outliers, does not handle discrete variables with more than two levels, and is adversely affected by multi-colinearity among independent variables (Hadi A.S., 1992; Mohamedshah et al, 1993; Karlaftis and Tarko, 1998). In these models, it is possible for the multi-colinearity to increase the variability of the independent variable coefficient estimates, resulting in lower t-statistics and coefficients that are either not significant or counterintuitive (Karlaftis et al, 2003).

For this research to identify risk factors associated to claims and lawsuits, different regression techniques are used that recognize the aforementioned problems and account for them in the analysis framework. The method is referred to as HTBR or hierarchical tree-based regression. It is a tree-structured non-parametric methodology. The regression tree model takes a set of data and develops partitions within the data after identifying natural splits. The top parent node splits into two child nodes. Each child node can again split into zero, one, two or more child nodes. The splits are decided by seeking answers to two questions:

1) Which of the independent variables obtain the maximum reduction in the variability of the response variable (Karlaftis and Golias, 2002)?

2) Which value of the selected independent variable results in the maximum reduction in variability of the response variable (Karlaftis and Golias, 2002)?

The HTBR method splits nodes until one of the stopping rules is triggered. The following rules are used to determine if the nodes will no longer continue to be split:

- The maximum tree depth (length/levels) has been reached.
- No more splits can be made, because all terminal nodes meet one or more of the following conditions:
  - There is no significant predictor variable left to split the node.
  - The number of cases in the terminal node is less than the minimum number of cases for parent nodes.
  - If the node were split, the number of cases in one or more child nodes would be less than the minimum number of cases for child nodes.

Advantages of categorical regression tree analysis over many other methods are as follows:

- Outcomes of tree-based models are relatively simple for a non-statistician to interpret, which is a useful characteristic for a safety analysis to practitioners and engineers.
- It is well-suited to include a relatively large number of independent variables and to identify complex interactions among these variables.
- The model is based on incident frequencies; so it does not require any assumptions on the distributions of the model parameters.
- The HTBR model effectively handles outliers by isolating those parameters.
- Tree-based models can handle multi-colinearity among variables much better than ordinary least squares (OLS) regression.
- Many statistical packages, such as Classification and Regression Tree (CART), and SYSTAT (TREES) are available to conduct tree-based regression. Additionally, it is can be easily implemented in popular commercially available software packages, such as SAS, SPSS and PASW. The PASW statistics (formerly SPSS statistics) Software package with Classification and Regression Tree Algorithm (CART) is used for the purpose of this study.
- Most importantly, HTBR can yield predictions of dependent variables by incorporating splitting rules into a series of 'if then' statements.

In this project, the tree-based regression models have been developed for both damage claims and lawsuits. To increase the prediction capability for the dependent variable, roadway data elements were retrieved for a portion of the claims database in which location of the incident was known. Unfortunately, due to lack of availability of location data in the lawsuit database, no roadway data could be obtained with regards to lawsuits. Dependent variables considered in these models include: final decision regarding pay or deny a claim or lawsuit; causal or contributing factors for claims and lawsuits; and classification of claims and lawsuits (type 1 to type 5). Predictive variables for claims with location data are shown in Table 9.

Table 9 Predictive Variables for Claims with Available Location Data

Variable Name	Description	Database		
		Legal	RIMS	Traffic
County*	County's name where the claim is filed	✓		
District*	District's name where the claim is filed	✓		
Route type*	Interstate, US route, SC route, Secondary road	✓		
Functional class	Urban arterial, Rural arterial, Urban collector, etc.		✓	
AADT	Average Annual Daily Traffic (vehicle/day)		✓	✓
Claim amount*	Amount reported by legal office	✓		
Settlement amount*	Payout amount reported by legal office	✓		
Number of lanes	Total number of lanes for both direction		✓	
Lane width	Width of traffic lane		✓	
Month*	Month when the claim is filed	✓		
Median type	Not divided, Divided-concrete median, Divided physical barrier, etc.		✓	
Shoulder width	Width of shoulder		✓	
Reported to Law	Whether the incident is reported to law	✓		

The objective of conducting HTBR is to identify and categorize risks among independent variables that help to predict the dependent variables within the prediction models. Only the variables marked with (*) were available for development of regression trees for claims or lawsuits without location data.

Unfortunately, many of the types of claims submitted to SCDOT, are too few in number to allow HTBR to run. For this research, parent nodes had to contain 30 cases and child nodes 15 cases. Thus, at least 30 claims had to be available for the dependent variables.

Task 4 Develop risk profiles of different highway categories using fault trees

After extensive review of damage claims and lawsuits during the data collection process and multiple discussions and meetings with SCDOT officials to understand all levels of the tort claims process, an adequate understanding of the various events that lead to tort actions against the SCDOT was achieved. This understanding was critical in order to develop a comprehensive fault tree that accurately represented the events and their relationships that lead to tort actions. The fault-trees developed provide the opportunity to analyze the interaction between different basic events that lead to a tort action being filed. The fault tree modeling hierarchy numerically describes factors causing tort actions through the concept of Boolean-algebra (AND, OR) to analyze how underlying events contribute to the likelihood of a particular claim or lawsuit taking place. FaultTree+ V11.2 software by Isograph (2005) was used to build the fault tree, calculate the top level probability, identify minimum cut sets, run the Monte Carlo simulation, as well as quantify and rank the minimum cut sets. The methods outlined in the Fault Tree Handbook (Vesely et. al., 1981) for fault tree construction were implemented when building the trees in the software.

Claims

The top level event of the claims fault tree was identified as a claim filed against the department. Since one of the goals of the project is to identify “perceived” defects in the roadway by users, in addition to safety related conditions, this top level event needed to include claims that were not caused by an actual defect, notwithstanding the perception of one by the claimant. In addition, many of the claims were denied due to the department having no prior notice despite the cause of the claim being an alleged defect. If paid claims were only considered in the development of the fault tree, many of these defects and their resulting claims would not have been considered. In addition, the indirect costs of claims and the volume of claims make the inclusion of all claims filed against the department an effective method.

To continue building the fault tree from the top level event, in the standard top down construction approach, the various types of claims were considered that represent the next and immediate cause of a claim. The relationship between each event is characterized by an “or” gate or “and” gate. A damage claim is filed when property damage or personal injury occurs due to the alleged negligence of the SCDOT. Based on the claims database only 100 of the 3000 claims involved personal injury and therefore personal injury claims were not separated from property damage claims in the fault tree. However, events that led to “trip and fall” claims were uniquely personal injury claims and makeup an individual branch in the tree that only represents injury claims. Outside of the “trip and fall” related events, over 89% of claims were related to vehicular property damage. The other property damage claims were mostly related to building, utility, and property (landscape) damage. The second level of the fault tree represents these divisions through branches for damage due to landscape work, damage due to flooding, vehicle damage, damage due to tree crew and personal injury due to trip or fall as seen in Figure 20 found in the Results Section.

At the third level of the fault tree, several branches became limited by the extent of knowledge of the events, the availability of data on the events, or the scope of the project. For example, the probability of a claim being filed against the DOT if an event happened could be identified for several claim types where data was available from sources such as the crash database. However, knowledge as to *why* motorists chose to file a claim is unavailable and exceeded the scope of the project so the branch ended.

Undeveloped events were used to represent events that could be broken down further, but due to the scope of the research and additional data required to devise probabilities at lower levels, the branches were not continued. For example, "inadequate or inappropriate or no evasive action taken" is represented as an undeveloped event since it could be broken down much further at lower levels, however, since this project is not concerned with driving behavior, but rather the existence of defects and their relationship with claims, the branch of the tree was not continued.

Events in each branch continued to be broken down until one of the following limiting conditions were reached: 1) Further knowledge of the event was unavailable (e.g., debris fell from unknown vehicle). 2) Further breakdown was outside the scope of the project (e.g., inadequate, improper, or no evasive action taken). 3) Data to quantify the lower level events was not available and thus would not be useful in the next step in the analysis (e.g., tree crew made an error while removing a tree). Once each branch resulted in one of the 3 conditions being met, the fault tree was completed.

Once the tree was developed in the software, the minimum cut sets were identified which represent the minimum combination of events that lead to a claim being filed. These cut sets can be identified by the fault tree software. Based on a multitude of data including the state crash database, claims database, maintenance records, request logs, and expert opinions, probabilities were identified for the basic events that make up the fault tree. The assumption made for these probabilities are outlined in a section at the end of the "Fault Tree" section of the Results. With these probabilities, the probability that each minimum cut set could lead to a claim was calculated through the use of Boolean-algebra and the fault tree software. The probability for each minimum cut set was used to rank the sets in order to identify the riskiest combinations of events that would lead to a claim against the SCDOT. These rankings of combinations of events allow for the SCDOT to conduct risk prioritization and identify the effect countermeasures could have on the probability of a claim being filed against the SCDOT.

To account for variability in the basic event probabilities, a log-triangular distribution was assumed. Using the 3 years of data for claims and crashes, the basic event probabilities were estimated for each year and the average and standard deviation of the three probabilities were then used to develop the log-triangular distribution for each basic event. The Fault Tree software required the distribution to be described using the mean and the error factor based on the equation (Isograph, 2010):

$$EF = e^{1.285*\sigma}$$

Where EF=the error factor
σ = standard deviation

With the distributions for each basic event input to the software, it was possible for the software to run simulations to solve the fault tree for the top level event probability (a claim being filed) using the Monte Carlo method. The Monte Carlo method takes a random value from each basic event probability distribution and solves the fault tree to calculate the probability of the top level event. This simulation was repeated 1000 times in the software which resulted in a distribution of the top level event

probability. The distributions represent the inherent uncertainty in the probabilities as opposed to the implementation of fixed, single value probabilities.

Devising probabilities of basic events required a number of data types due to the wide range of events that could lead to a claim against the SCDOT. Since most of the types of claims only consisted of a few cases from the 3-year database, they were not included in the fault tree. Claim types that consisted of more than 6 claims over the 3 years were targeted to be included in the fault tree development. This resulted in approximately 95% of the claims in the database being represented in the fault trees. Being able to break the claims types down into basic events in the fault tree, as well as calculate probabilities for these basic events, was also a factor in the decision to incorporate the claim type into the fault tree. For example, although multiple claim types were identified that related to surface defects from the claim database, the crash database used a generalized identification of surface defects as contributing factors, which did not allow for a breakdown of these events in the fault tree. A list of the basic events included in the claims fault tree and details on the data used and assumptions made in the calculation of each probability are listed at the end of "Fault Tree" section of the Results.

Lawsuits

For the analysis of the lawsuits, a similar approach to the claims was taken in regards to the construction of the fault tree. The top level event for the tree was chosen to be a lawsuit filed against the DOT. This is important because the project goals include reducing the number of lawsuits filed, as well as identifying "perceived" defects in the roadway by the motorists. The types of lawsuits represented in the fault tree are based on common allegations made against the DOT. Including all events in the fault tree that represent every lawsuit would be beyond the scope of the project, and would not be effective in identifying relevant events that could be mitigated in order to reduce incidents and lawsuits. Unlike the claims, where common types were easily identified and represented 95% of the total, the diversity of the lawsuits types resulted in the fault tree developed only representing approximately 75% of total lawsuits.

Similar to claims, lawsuits stem from incidents of property damage and personal injury; however, unlike claims, lawsuits have a higher ratio of personal injury incidents compared to claims. Property damage only lawsuits make up approximately 22% of the total compared to 89% of claims. Due to the diversity of the lawsuit types, problems were encountered when the probabilities for the basic events were calculated. The diversity of the claims and the assumptions that would have to be made to calculate the probabilities created a large amount of uncertainty. Therefore, another method from that used for claims was used to represent lawsuits in the fault tree and calculate the basic events probabilities.

This method is simpler than the method used for the claims as it depends upon the assumption that if a basic event occurs a claim is filed. This is represented by a fault tree that is constructed using "or" gates only. To calculate the probabilities of these basic events (BE), the following equation was used:

$$P(BE) = \frac{\#\ of\ lawsuits\ that\ represent\ BE}{Total\ \#\ of\ lawsuits}\ X\ \frac{\#\ lawsuits\ related\ to\ vehicle\ accidents}{total\ \#\ of\ vehicle\ accidents}$$

The # of lawsuits that represent BE is the set of lawsuits from the 3 year data that are identified by their causal factor to match the BE. For example, for the "Tree in the Road" BE the number of lawsuits that stemmed from the causal factor associated with trees in the road was used.

The total # of lawsuits is the number of lawsuits from the 3 year data.

The # of lawsuits related to vehicle accidents is the number lawsuits identified by causal factors related to a vehicle accident.

The total # of vehicle accidents is the number identified over the 3 year period of the lawsuit data.

This equation simplified:

$$BE = Probability\ of\ the\ lawsuit\ type\ X\ Probability\ a\ lawsuit\ is\ filed\ due\ to\ an\ accident$$

This equation was used to calculate the probability of the basic events of the lawsuit fault tree.

Minimum cut sets of lawsuits were identified through the use of the software in order to identify the smallest combination of events that lead to a lawsuit. Identifying these events allows them to be targeted for counter measures, in order to reduce the number of lawsuits filed against the department. However, since the lawsuit fault tree is made up of only "or" gates, each basic event will represent a minimum cut set because only one event needs to occur. Because of this, the cut sets were ranked based on the probability of the basic events since the probability of the top level event is the sum of the probability of the basic events. Therefore, eliminating the probability of a basic event will reduce the probability of the top level event equal to the basic event's probability. This still allows the SCDOT to prioritize risk however; it does not provide an order of events that must occur for a lawsuit to be filed. This limits the number of countermeasures that can be implemented for each cut set because only the basic event can be targeted with countermeasures to reduce the probability of a lawsuit.

Results

Current South Carolina Tort Procedures

The extensive review of the SCDOT business process allowed the research team to understand and outline the current claims handling process which is discussed in this section.

A claim begins the process when a claimant files the claim form with the SCDOT at the maintenance office in the county where the incident occurred. These claims can be submitted personally or mailed in and must include two estimates for the damage (if damage is being claimed) or a paid invoice. The claimant must be the registered owner of the vehicle and a copy of the vehicle's registration must be included. In addition the claims form must be notarized as an affidavit.

Once the maintenance office receives the claim, a county employee is to conduct a site visit for investigation where GPS coordinates of the accident are to be recorded and in some cases, photos are taken for documentation. The county engineer then makes a recommendation on the claim, to deny or pay, and forwards the claim and recommendation on to the district engineer. The district engineer will then review the claim and recommendation before making his/her own recommendation and forwarding the claim to the SCDOT claims staff. At the claims department a DOT attorney will review the claim, call for an investigation by one of the SCDOT's two investigators if needed and make a final decision, which is then mailed to the claimant. The information from the claims form is entered into the electronic database by an employee once the claims reaches the Office of Legal Services and the data is based on the information filed by the claimant. In the Office of Legal Services, attorneys rely heavily on the engineer's recommendations which make the county's role very important in the process. The claimant can appeal the decision, which calls for an investigation by one of the Office of Legal Service's investigators, regardless of whether an investigation was conducted at the county level at the initiation of the claim or not. If the claimant is still not satisfied with the decision, the claim can be taken to court. After investigating the tort claims and lawsuit process, Figure 3 and Figure 4 were developed to show the steps taken to file, review, and close a tort claim or lawsuit in South Carolina.

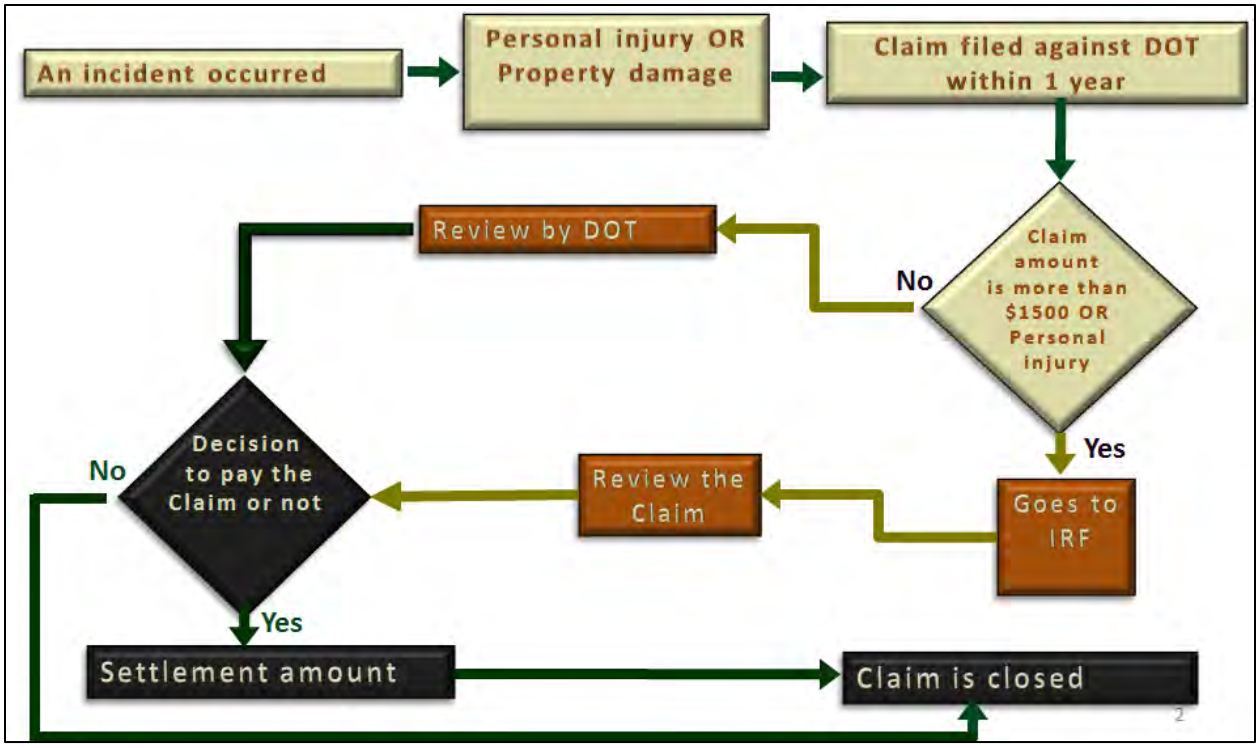


Figure 3 Claims Handling Process

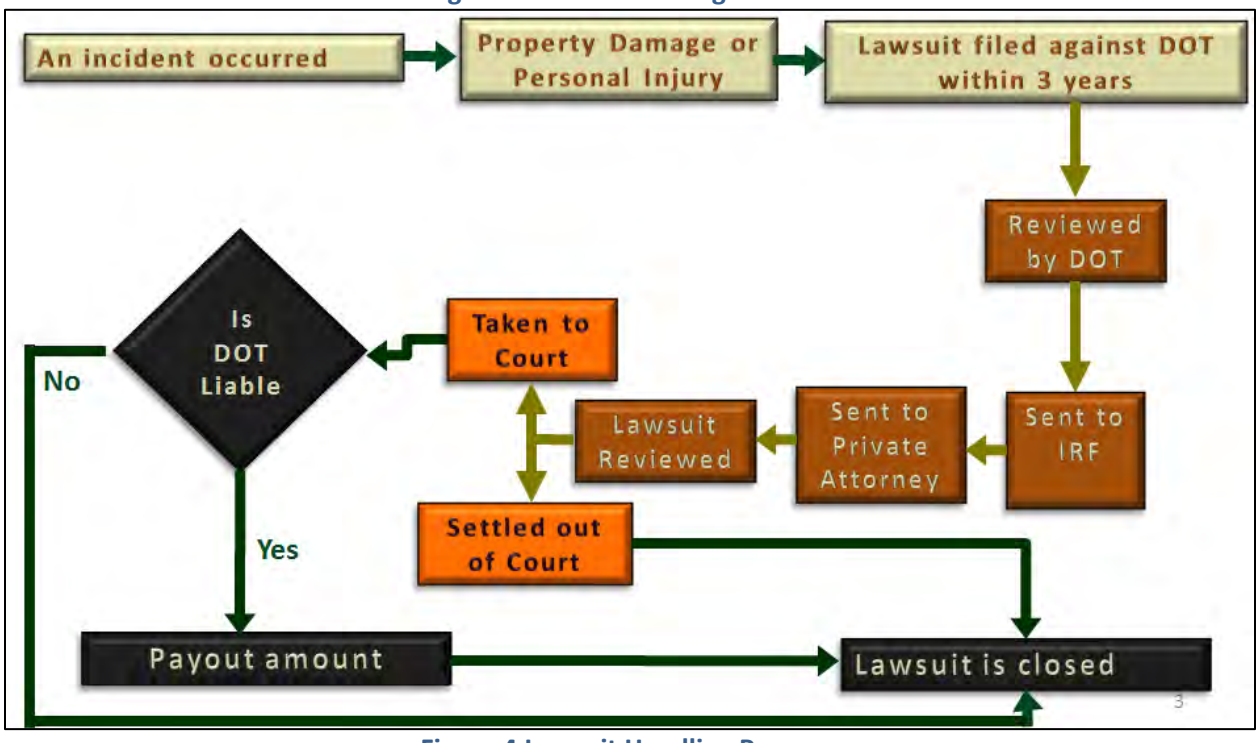


Figure 4 Lawsuit Handling Process

Lawsuits can be filed from two approaches: a claim is denied, then appealed and the claimant is still not satisfied with the outcome and files a lawsuit or a lawsuit can be filed directly against the department. Once a lawsuit is filed its path through the SCDOT is shown in Figure 4. Lawsuits are sent to the Insurance Reserve Fund and are then subbed-out to be handled by private attorneys located near the

place of the incident. Once the private attorneys take the lawsuit, updates are given to the SCDOT and a final submission is returned outlining the end result of the lawsuit. Updates include the attorney's current assessment of the lawsuit including important details of the incident, the probability of losing the lawsuit and the estimated value of a loss. The final submission includes the settlement amount, the reasoning behind the settlement, and an evaluation type response where the attorney discusses positive aspects of the SCDOT regarding the lawsuit as well as negative aspects which are followed by recommendations for improvements.

Survey of States

The initial blind call only returned 8 responses, so directed requests were sent to an additional 29 states. A total of 20 states responded and 18 completed the survey in its entirety. Figure 5 shows the first set of responses in addition to the states that responded to the survey after it was sent for the second time. It demonstrates that the responding states represent most regions in the country in order that issues such as snow and ice are appropriately represented.

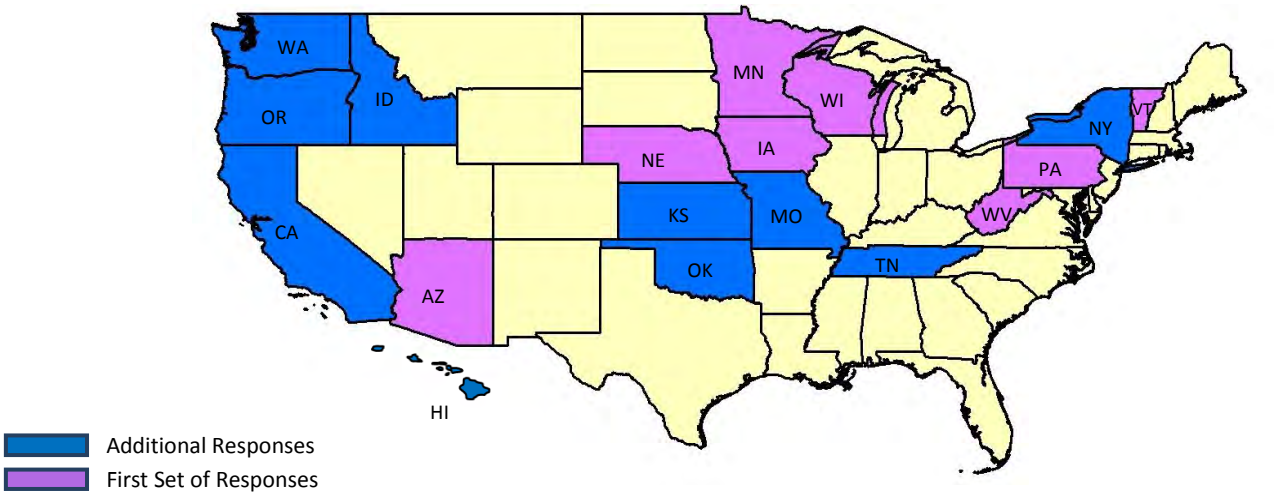


Figure 5 State Survey Responses

States reported detailed information on claims system outcomes. The following section presents the states' responses to each of the four categories in which the survey was divided.

Tort Legislation

The survey began by asking what type of immunity states held against liability for highway related torts. 76% of the states responding reported "partial" immunity as their defensive system against tort claims and lawsuits, while 4.5% reported "full" immunity and 9.1% reported no immunity.

Award limits or caps are one form of tort reform that states enact to keep annual expenses relatively consistent and to protect against large payouts. 56% of responding states stated damage award limits or caps of $250k to $1.6 million per person and $1 million to $3.2 million per occurrence of an incident, while the results of the survey also indicated 5.6% of responding states have no limits on the amount of damage awards. Figure 6 and Figure 7 show the number of responding states based on award limit/cap per person and occurrence.

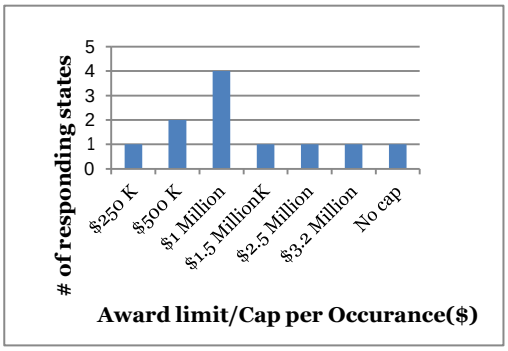


Figure 6 Number of Responding States Based On Cap Per Occurrence

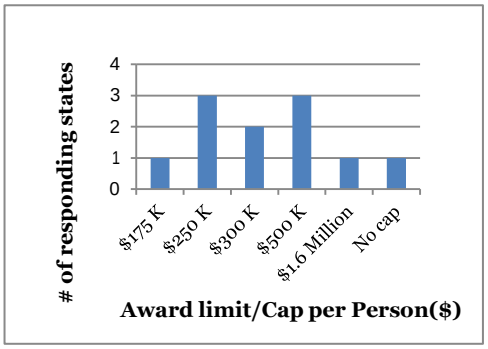


Figure 7 Number of Responding States Based On Cap Per Person

The South Carolina Department of Transportation (SCDOT) benefits from a cap on damages of $300,000 per person and $600,000 per occurrence on tort liability arising out of its activities. Responding states reported a statute of limitations from 4 months to 5 years for lawsuits and 4 months to no limit for claims. Figure 8 and Figure 9 detail the responses of states with regard to statute of limitations.

In South Carolina, a claimant has one year from the date of the incident to file a damage claim. With regard to lawsuits, if a plaintiff did not first file a damage claim, he has two years from the date of the incident to file a lawsuit but, if a plaintiff did first file a damage claim, he has three years from the date of the incident to file a lawsuit.

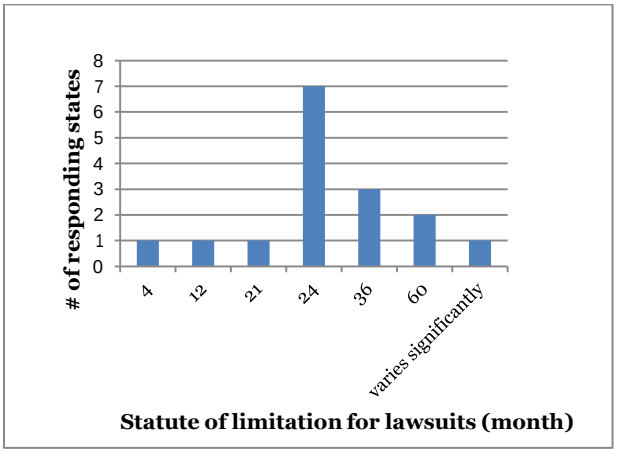


Figure 8 Number of Responding States Based On Statute of Limitations for Claims

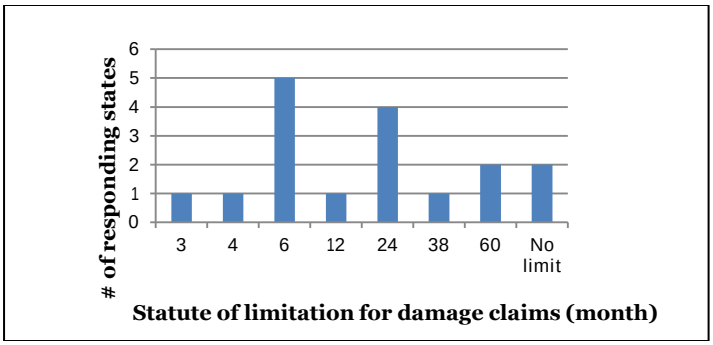


Figure 9 Number of Responding States Based on Statute of Limitations for Lawsuits

The time required to resolve claims and lawsuits proved to vary widely among states. The resolution time for lawsuits ranged from 12 months to several years, while the resolution time for claims ranged from 1 month to 18 months. Lawsuits generally demanded more time for resolution than claims, except for one state in which there was no difference. The shorter time required for claims is most likely due to the fact that claims can typically be handled within the department.

Insurance Information

With the loss of sovereign immunity, many states acquired insurance. It did not take long, however, with rising tort costs, for states to lose coverage and become self-insured. The survey reported that 35.3% of the responding agencies hold some type of liability insurance for highway tort actions. When tort actions are settled, 50% of responding agencies pay for these settlements out of the DOT's budget while the remaining half used funds from other state departments. Other state departments where funds are used to pay claims include one state's Central Agency of Administration and another's Department of Administration (State Risk management).

In South Carolina, the Insurance Reserve Fund (IRF) is a Division of the South Carolina State Budget and Control Board, and reports to the five-member board through the Office of the Executive Director. The Budget and Control Board is authorized and required to provide insurance to governmental entities by a number of statutes including section 15-78-10 through 15-78-150 of the South Carolina Governmental Tort Claims Act that gives IRF authority to provide liability insurance.

Tort Action Procedures

The initial question for this section was whether or not states have a documented procedure such as a flow chart or business process that describes their tort claims administration. Surprisingly 64.7 percent of responding states did *not* have some form of documentation for this important process. Most of the states that did have the process or administration documented cited a state statute or tort codes describing the process. The initial concern with this response is that there is no practical reference for employees to use to understand the important handling of tort actions. Communicating with employees the role of tort liability within the department has proven to be an important method of decreasing tort liability exposure. The lack of a document explaining the department's critical procedures can be a fundamental deficiency. South Carolina does not have a statewide documented process. However, Richland County, SC has a complete documented procedure with regard to claims and lawsuits which could be the basis for the statewide process.

To better understand states' handling of tort actions, they were asked about different methods available for submitting claims and lawsuits. The results showed that fax and mail are the most commonly available methods, while submittals in person and on-line forms ranked second. The call-in method is

the least popular method among the responding states. This can be an interesting issue, since access and convenience of claims filing could have an effect on the number of claims filed against a state. South Carolina accepts mail and in-person deliveries.

When asked about claims investigations, 47 percent of states responded that a standard form or documented procedure was used for investigating, as contrasted with South Carolina, which does not have a statewide standard form and procedure for investigations. The results of the survey also showed that 64.7 percent of responding states conduct analyses to relate claims or lawsuits to roadway safety or crash data. Most of the agencies that conduct analyses do it on a case by case basis, but routinely on high accident areas. They conduct a thorough analysis on the contributing circumstances in collisions and lessons learned after the resolution of a tort litigation case. South Carolina does not regularly conduct analyses to relate tort actions to safety issues. Having a documented and standard investigation procedure is important for states to maintain consistent and thorough investigations. Conducting analyses is important as well, because it helps states identify regularly occurring causes and sites that could benefit from an improvement and thereby, reduce risk. In addition, it allows a state to be proactive, rather than reactive.

Responses revealed that 59 percent of responding DOTs maintain a database of claims and lawsuits while the rest of the agencies do not. Of the DOTs who maintain a database, 30 percent scan text documents into it, while 40 percent still prefer keeping paper files and the remaining states use a combination of both. Currently in South Carolina, claims and lawsuits are maintained through paper files and electronic database. Records of claims and lawsuits can be a valuable tool for agencies and can be used for evaluations, identifying trends, and reducing tort actions.

Risk management program

The last section of the survey covered risk management programs and 41% of respondents indicated that they do not have a specific highway tort liability risk management program. Less than half of the states that do have a risk management program in place have clearly established objectives and 67 percent of them evaluate their programs based on the total number of accidents and the total number or total cost of all claims and lawsuits filed or paid. Establishing a risk management program is a common tool in addressing tort liability issues. These programs can cover a wide range of issues related to tort liability and are typically tailored to a state's needs. Setting objectives and evaluating programs over time ensures that it is meeting its intended purpose and being effective.

Some examples of risk management programs reported include a Loss Prevention Department that trains maintenance employees about possible exposure to liability and has setup a reporting procedure for citizens and employees to report safety concerns. The department has investigators on staff to review accident scenes and a safety audit is conducted every year on the ten locations with the highest crash frequency. Another state has established a risk management program that aims to reduce exposure to risk, which can have many similarities to programs focused on tort liability.

A successful risk management program in one of the responding states, has conducted monthly tort awareness training for numerous specific functional groups including maintenance, design, construction and traffic. One state has also participated in reviewing revisions to all policy and procedure manuals, as well as their construction specifications and insurance requirements. This state implemented a "lessons learned" program in order to reduce the risk of future claims or lawsuits. The "lessons learned" and recommended remedial measures are investigated and evaluated for possible implementation by district and headquarters staff. The state DOT's legal division also produces a statewide publication, in

which real cases are used to highlight tort issues and improve staff tort awareness. Another state that has claimed to be successful in managing the risk associated with claims, divided its process into three steps: risk identification, risk mitigation and claims management.

Agencies were also asked about alternative methods used, besides safety improvement programs, to identify locations that may potentially benefit from improvement. While all the DOTs reported citizen complaints and accident investigations as two of the most used techniques, 78 percent of them indicated that reviewing past tort claims is also a method of identification. An important and common question related to tort liability is: how are safety projects prioritized once locations that could benefit from improvement are identified? This is important because a state can find itself highly exposed without a credible procedure to use for its defense, if an accident occurs at one of the identified sites before improvements are made. While a majority of responding states reported established ranking priorities as the most common procedure to follow, some states declared available budget, B/C analysis and accident severity and accident rate as their procedure to determine the priorities among competing locations that may potentially benefit from a safety investigation or improvement

Identifying roadside elements that may lead to a tort claim are also important practices, because these elements may create a potential exposure for states. Therefore, DOTs were asked about a decision support system used to determine which roadside elements are most likely to lead to a tort claim, however, only 23% of the responding states indicated the use of a decision support system in identifying roadside elements that may potentially benefit from a safety investigation or improvement.

Descriptive Statistics

Claims

All of the following descriptive statistics refer to the 3000 most recently closed claims as of May 2010. Table 10 compares claim statistics for each district across the state. Columbia has a significantly large number of claims but a significantly lower percentage of claims paid, which is most likely due to their rigorous claims handling process. Major differences between the average amounts paid per claim are shown, with Orangeburg and Columbia representing the high end and Chester and Charleston representing the low end.

Table 10 Number of Claims, % Paid, and Average Payout Amount by District (3000 Claims From 2007-2010)

District code	District name	# Claims	% of Claims Paid	Total Amount Paid		Average Amount Paid	
				Without processing fee	With processing fee	Without processing fee	With processing fee
1	Columbia	893	24%	$129,869	$523,057	$601	$2,410.40
2	Greenwood	167	42%	$48,575	$122,105	$692	$1,744.36
3	Greenville	439	28%	$64,876	$258,168	$523	$2,082.00
4	Chester	396	41%	$55,136	$229,495	$342	$1,390.88
5	Florence	294	38%	$53,350	$182,798	$480	$1,646.83
6	Charleston	542	42%	$83,209	$321,852	$361	$1,393.30
7	Orangeburg	269	34%	$88,592	$207,033	$968	$2,226.16
	Total	**3000**		**$523,607**	**$1,844,507**		

Table 11 shows the top 10 causes of claims, with number of claims and percent paid for each district. Pothole-related claims in Charleston and Chester have a significantly higher pay percentage than the other districts. Columbia has the highest number of claims and the lowest percentage of paid claims for debris from the road compared to other districts. The percentage of mowing claims that are paid are high across the board, but Orangeburg pays almost 93% which is the highest payout rate for any of the top 10 claim types for any district. In addition, Orangeburg has the largest number of paint splatter claims by far over other districts. Columbia has a high number of man-hole, catch basin, drainage inlet, grate claims yet few are paid.

Table 11 # Claims (% Paid) by District for Top 10 Causes (2007-2010)

	District 1 Columbia		**District 2 Greenwood**		**District 3 Greenville**		**District 4 Chester**		**District 5 Florence**		**District 6 Charleston**		**District 7 Orangeburg**	
Cause Code	Total #	Pay %	Total #	Pay %	Total #	Pay %	Total #	Pay %	Total #	Pay %	Total #	Pay %	Total #	Pay %
Pothole Damage	426	24%	36	13%	232	32%	234	43%	133	28%	341	45%	95	25%
Debris from road	70	5%	11	9%	42	9%	30	23%	15	13%	46	21%	15	13%
Debris -DOT Mower/Landscape	52	73%	35	85%	11	81%	31	83%	32	81%	17	76%	28	92%
Paint Splatter	29	20%	25	24%	1	0%	4	25%	4	75%	7	0%	53	43%
Mh-Cb-Di-Grate	66	3%	2	0%	11	9%	6	33%	9	22%	7	28%	5	20%
Mowing	10	50%	12	83%	12	50%	13	61%	9	88%	9	55%	7	28%
Debris-DOT Truck	19	31%	10	80%	8	87%	9	66%	10	70%	8	37%	8	25%
Low Shoulder/Drop-off	23	56%	0	N/A	12	8%	4	0%	10	30%	12	66%	5	0%
Trip/Fall Uneven Surface	10	10%	2	0%	10	10%	7	14%	14	42%	2	50%	3	33%
Pothole - edge/shoulder	17	47%	2	50%	7	0%	1	0%	4	75%	11	36%	0	N/A

Table 12 shows that potholes represent the smallest average payout compared to other claim types. Tree in the road and trip/fall on drainage structures have the largest average payout, most likely due to their typically resulting in personal injury. There is a large difference between the average payout of the trip/fall uneven surface and trip/fall Mh-Cb-Di-Grate claims, even though the % of claims paid is nearly identical. Tree in the road and debris from the road claims have a significantly lower % of paid claims than the other types, most likely due to DOT's lack of prior notice of the alleged hazards. Indirect cost associated to claims has not been considered in total settlements and average payout per claims.

Table 12 Economic Details of Claims for Top 10 Causes (2007-2010)

Cause	Total Settlements	% Total Settlement Amount	# Claims Paid	% Claims Paid	Average Claim Pay Out
Pothole Damage	$168,101	32%	504	34%	$334
Debris -DOT Mower/Landscape	$76,604	15%	168	82%	$456
Other	$42,583	8%	13	39%	$3,276
Mowing (property damage)	$33,698	6%	44	60%	$766
Paint Splatter	$21,177	4%	39	32%	$543
Construction/Paving	$16,260	3%	7	32%	$2,323
Asphalt/Tar	$16,213	3%	21	72%	$772
Trip/Fall Uneven Surface	$15,261	3%	11	23%	$1,387
Trip/Fall Mh-Cb-Di-Grate	$14,861	3%	4	24%	$3,715
Tree in Road	$14,750	3%	4	10%	$3,688
Debris-DOT Truck	$13,616	3%	39	54%	$349
Debris from road	$11,778	2%	30	13%	$393

Figure 10 shows the large variation in the percentage of claims paid by the cause of the claim. Natural events such as trees falling on cars or in the road are rarely paid. This is largely due to the lack of prior notice. However, debris from mower has a significantly higher payout, due to the fact that claims are forwarded to contractor mowers who perform a majority of the ROW mowing.

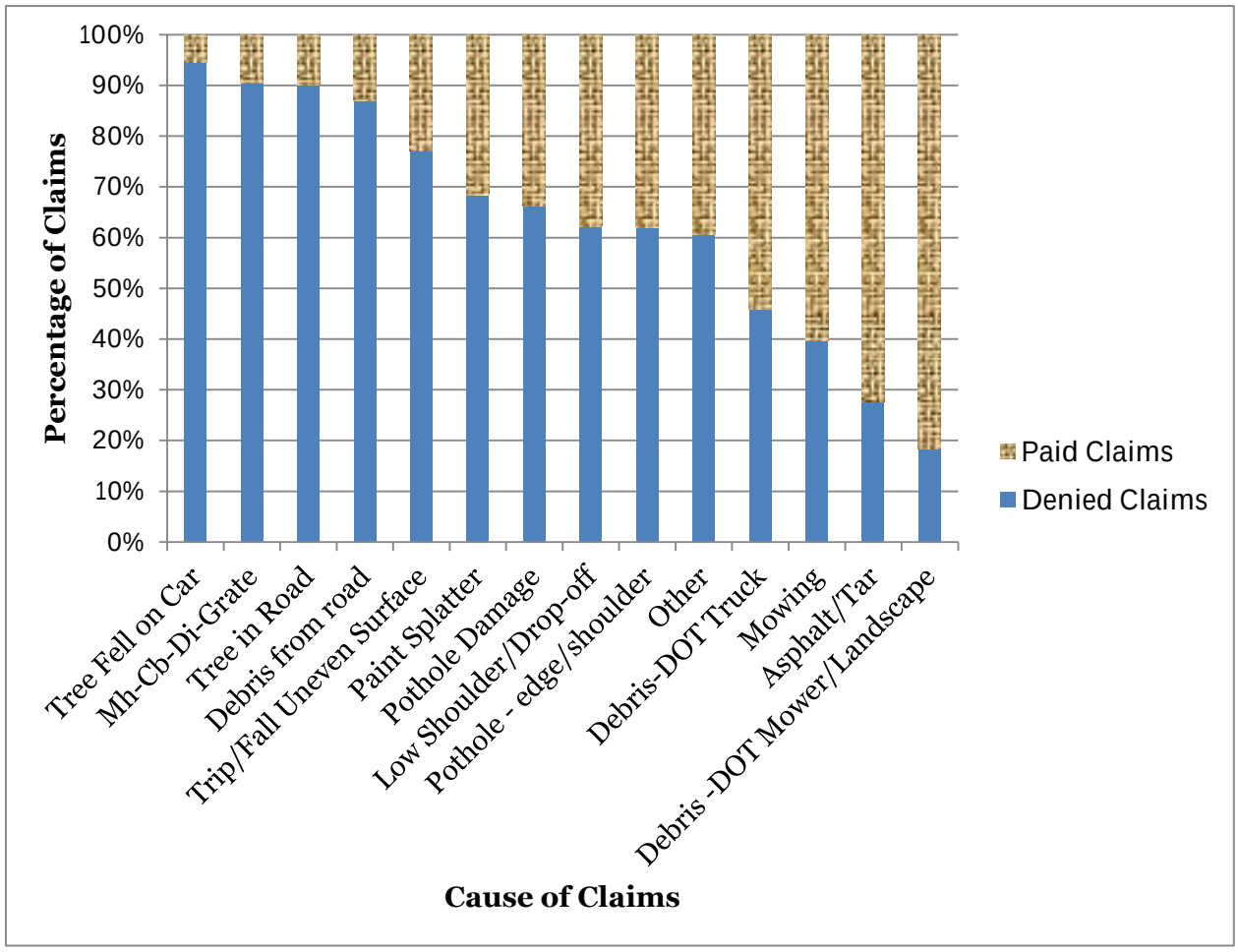


Figure 10: Percentage of Paid and Denied Claims Based on Most Common Causes Which Represent 85% of 3000 Claims from 2007-2010

Figure 11 shows the comparison of the number of claims by type and the percentage of the total each type represents. It is easily seen that the pothole claims make up approximately 50% of claims, with debris from the road and mowers making up the next most common causes. All the charts and tables represented in this section are associated to the top 85% of the total claims. Appendix F shows the total list of claims in details.

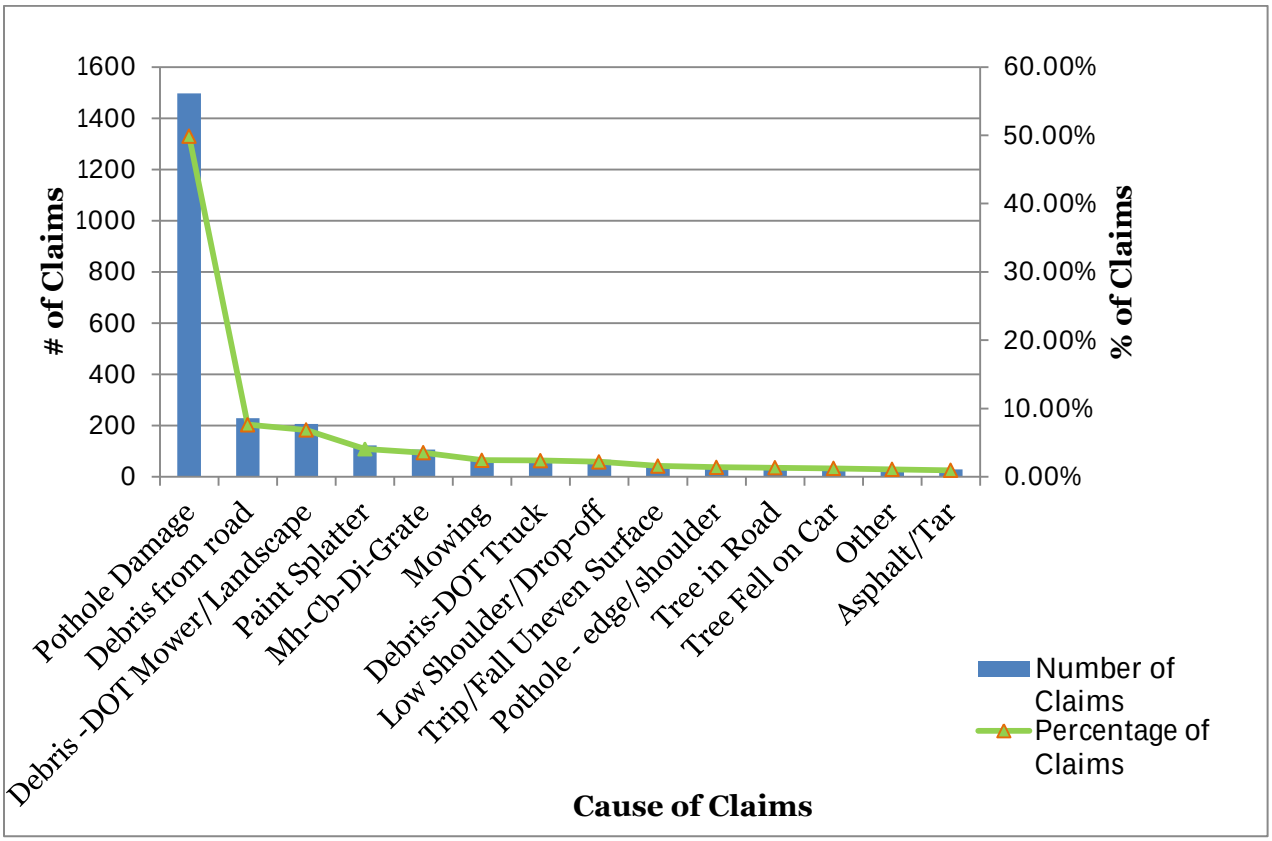


Figure 11 Number of Claims and Percentage of Total Claims Based on Most Common Causes Which Represent 85% of 3000 Claims from 2007-2010

Lawsuits

All of the following descriptive statistics refer to the 297 most recently closed lawsuits as of May 2010.

Table 13 shows the comparison of lawsuits across districts. Despite Columbia's significantly higher number of claims, it actually received fewer lawsuits than Charleston. Florence received more lawsuits than Greenville. It also had the lowest percentage of lawsuits with a payout and the lowest average amount paid after Charleston. Greenville had the second lowest percentage of lawsuits with a payout; however, it also had the highest average amount paid. Columbia had the highest total amount paid compared to the other districts.

Table 13 Number of Lawsuits, % Paid, and Average Payment by District (297 Most Recently Closed Lawsuits as of May 2010)

District code	District name	# Lawsuits	% of Lawsuits Paid	Total Payout		Average Payout	
				Without processing fee	With processing fee	Without processing fee	With processing fee
1	Columbia	56	57%	$2,113,992	$2,221,332	$66,062	$69,417
2	Greenwood	26	65%	$1,515,924	$1,565,761	$89,172	$92,104
3	Greenville	42	45%	$1,690,417	$1,770,922	$88,969	$93,206
4	Chester	36	56%	$1,324,700	$1,393,705	$66,235	$69,685
5	Florence	47	38%	$729,300	$819,390	$40,517	$45,522
6	Charleston	60	60%	$1,374,216	$1,489,224	$38,173	$41,367
7	Orangeburg	30	67%	$1,144,959	$1,202,463	$57,248	$60,123
	Total	**297**		**$9,893,507**	**$10,462,797**		

Figure 12 shows the variation in the percentage of lawsuits denied based on type which varies from over 90% to 0%. Rail Road (RR) crossing and DOT/Contract vehicle related lawsuits had over 80% and 90% respectively denied, which is due to the limited liability of the DOT at RR crossings. However, SCDOT has 3rd party auto insurance which covers payouts for DOT registered vehicles. Although 100% of improper design/intersection design, shoulder/ditches, and tree fell on car lawsuits are paid, there are only a few (6 to 7 each) of these type of lawsuits filed against SCDOT in this period.

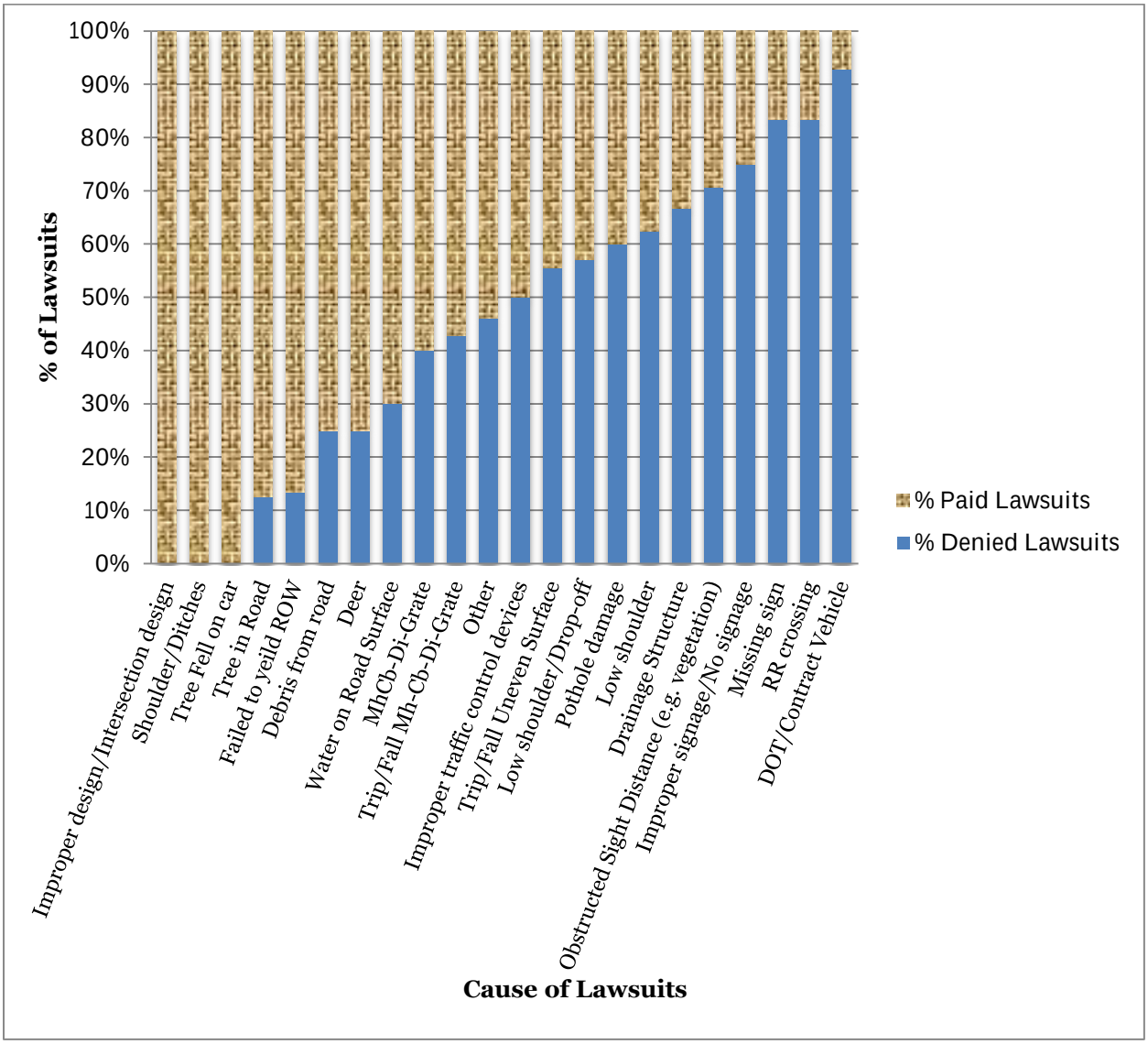


Figure 12: Percentage of Paid and Denied Lawsuits Based on Most Common Causes which Represent 85% of the 297 Most Recently Closed Lawsuits as of May 2010

Table 14 compares lawsuit payouts based on lawsuit cause. By far, the largest settlements are related to water on road surface. These totaled over $1.3 million regarding settlement amount. Although there are a few improper signage/no signage lawsuits filed against DOT, these lawsuits led to the largest average payout. Tree fell on car and shoulder/ditch related lawsuits had 100% payouts; however, tree fell on car represented the second lowest average payout. Mh-Cb-Di-Grate related lawsuits had by far the lowest average payout of $467.

Table 14 Economic Details of Lawsuits Based on Most Common Causes which Represent 85% of the 297 Most Recently Closed Lawsuits as of May 2010

Cause	Settlement Amount	# of Lawsuits	# Paid Lawsuits	% Paid Lawsuits	Average Payout
Water on Road Surface	$1,356,427	20	14	70%	$96,888
Other	$1,068,033	39	21	54%	$50,859
Deer	$870,000	4	3	75%	$290,000
Improper traffic control devices	$727,250	6	3	50%	$242,417
Failed to yield ROW	$512,906	15	13	87%	$39,454
Low shoulder/Drop-off	$478,000	15	6	40%	$79,667
Pothole damage	$415,354	15	6	40%	$69,226
Improper design/Intersection design	$389,000	7	7	100%	$55,571
Improper signage/No signage	$325,000	4	1	25%	$325,000
Missing sign	$250,000	6	1	17%	$250,000
Tree in Road	$238,250	8	7	88%	$34,036
Trip/Fall Mh-Cb-Di-Grate	$203,700	21	12	57%	$16,975
Trip/Fall Uneven Surface	$185,583	27	12	44%	$15,465
Obstructed Sight Distance (e.g. vegetation)	$97,000	17	5	29%	$19,400
Debris from road	$47,000	4	3	75%	$15,667
Shoulder/Ditches	$46,352	6	6	100%	$7,725
Drainage Structure	$36,000	6	2	33%	$18,000
RR crossing	$31,000	6	1	17%	$31,000
DOT/Contract Vehicle	$23,000	14	1	7%	$23,000
Tree Fell on car	$6,432	6	6	100%	$1,072
Mh-Cb-Di-Grate	$1,400	5	3	60%	$467

Figure 13 shows the number of lawsuits and the percentage of the total for each reported cause. Trip/Fall Uneven Surface lawsuits, second only to "Other" lawsuits, constitute by far the largest number of lawsuits and represents approximately 28% of the total. Trip/Fall Mh-Cb-Di-Grate lawsuits are the next most common lawsuits and represent approximately 20% of the total number of lawsuits. All the descriptive statistics represented in this section are associated to 85% of lawsuits. Appendix G shows the total list of lawsuits in detail.

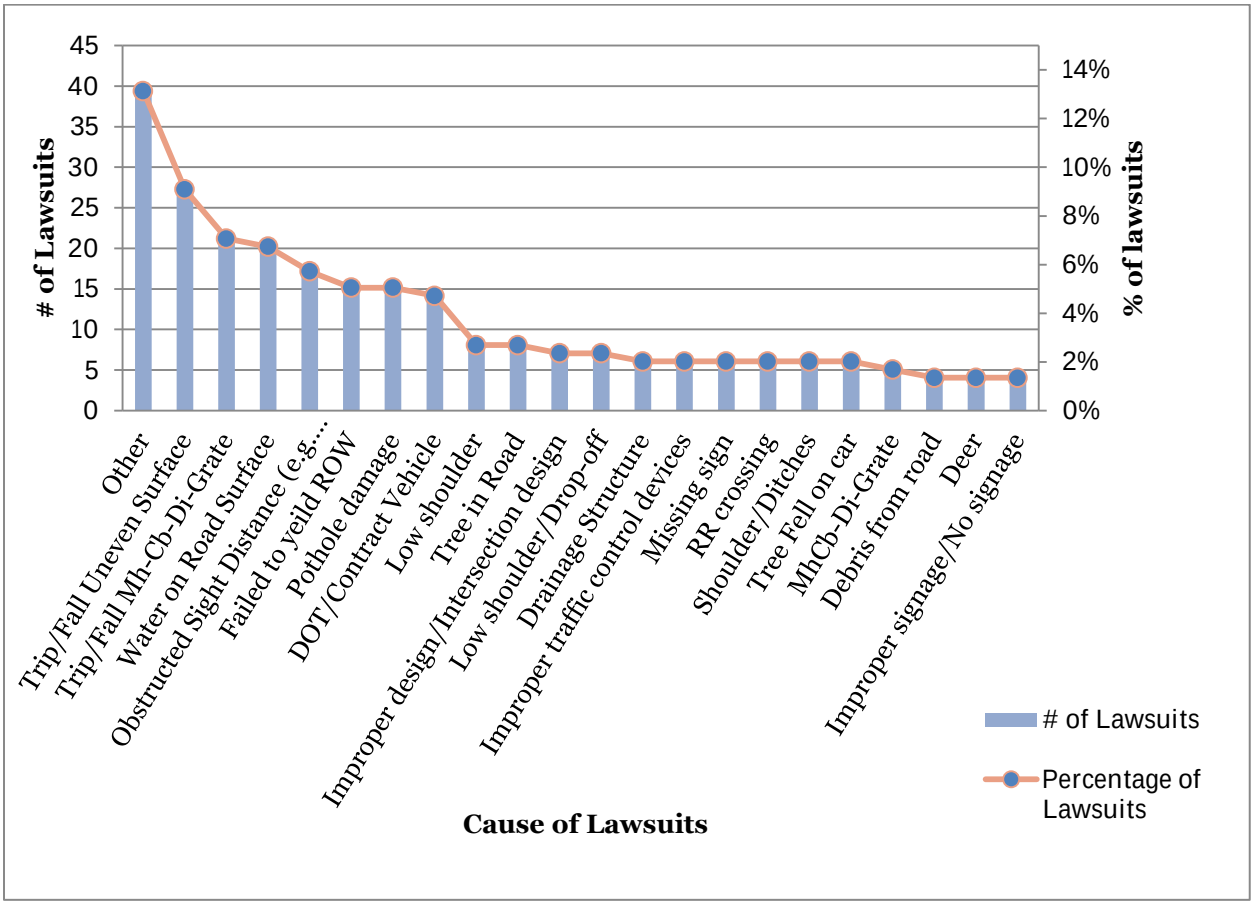


Figure 13 Number of Lawsuits and Percentage of Total Lawsuits Based on Most Common Causes Which Represent 85% of the 297 Most Recently Closed Lawsuits as of May 2010

Regression Tree Analysis

The regression trees applied here use hierarchical tree-based regression (HTBR) - a tree-structured non-parametric methodology. The objective of conducting HTBR is to identify and categorize risks among independent variables that help to predict the dependent variables within the prediction models. As described in the Methods section, the regression tree model takes a set of data and develops partitions within the data after identifying natural splits. The top node splits into two child nodes. Each child node can again split into zero or more child nodes. The splits are made based on the answer to the following questions:

1) Which of the independent variables obtain the maximum reduction in the variability of the response variable (Karlaftis and Golias, 2002)?

2) Which value of the selected independent variable results in the maximum reduction in variability of the response variable (Karlaftis and Golias, 2002)?

In each level, the child nodes would be considered the parent nodes for the next level. The tree will stop splitting if the number of cases in one or more child nodes is less than the minimum required number of cases for the parent node for the next level. In this study, the minimum number of parent nodes and child nodes has been considered to be 30 and 15 cases, respectively. Because the data distributions will not perfectly split at natural breaks of 30 and 15 cases, it is likely that 75-125 cases or more would be required to have more than one split.

Table 15 and Table 16 shows sample sizes for various breakdowns on the damage claims data. Given the sample size requirements, and uneven distribution of cases among subcategories within the five types of claims, the highlighted samples were the only ones expected to produce useful regression trees. However, given additional years of data, more cases would be added to each category, and the likelihood of achieving the required sample sizes would increase.

In this project, the tree-based regression models have been developed for both damage claims and lawsuits. To increase the prediction capability for the dependent variable with more descriptive elements, roadway data elements were retrieved for a portion of the claims database in which location of the incident was known and roadway characteristics could be linked spatially. Unfortunately, due to a lack of availability of location data in the lawsuit database, no roadway characteristics data could be obtained with regards to lawsuits. Dependent variables considered in these models include: final decision regarding whether to pay or deny a claim/lawsuit; causal/contributing factors for claims and lawsuits; and classification of claims and lawsuits (type 1 to type 5). Predictive variables for claims include district, route type/functional class, AADT, claim amount, settlement amount, number of lanes, lane width, month, median type, and shoulder width.

Table 15 Claims Data Sample Sizes For Various Categories (Only Factors That Result In The Highest 85% Of Claims Are Included)

Claims

Category	Total Sample	Total % Paid	Total % Denied	Sample with location data	Total % Paid	Total % Denied
All Claims	**3001**	33%	67%	**1159**	34%	66%
Type 1 - Collision with not fixed object	**821**	40%	60%	**315**	39%	61%
1 Subcat…(Debris from road)	**228**	14%	86%	99	13%	87%
2 Subcat…(Debris_DOT mower/ landscape)	**206**	82%	18%	75	81%	19%
3 Subcat…(Paint splatter)	123	32%	68%	50	28%	72%
4 Subcat…(Debris_DOT Truck)	72	54%	46%	21	52%	48%
5 Subcat…(Tree in road)	40	10%	90%	12	8.3%	91.7%
6 Subcat…(Tree fell on car)	37	5%	95%	6	0%	100%
7 Subcat…(Asphalt/Tar)	29	72%	28%	16	88%	12%
Type 2 – Collision with fixed object	**1859**	31%	69%	**764**	31%	69%
1 Subcat…(Pothole)	**1493**	34%	66%	**595**	34%	66%
2 Subcat…(Mh-Cb-Di-Grate)	106	9.4%	90.6%	55	5.4%	94.6%
3 Subcat…(Low shoulder/Elevation difference)	66	38%	62%	31	50%	50%
4 Subcat…(Pothole-edge/Shoulder)	42	38%	62%	20	40%	60%
Type 3 – Non Collision_Vehicle Damage	3	67%	33%	0	0%	0%
Type 4 – Non Collision_Pedestrian Injury	70	21%	79%	20	30%	70%
1 Subcat…(Trip/Fall uneven surface)	48	23%	77%	13	46%	54%
Type 5 – Non Collision_Property Damage	**248**	38%	62%	60	42%	58%
1 Subcat…(Mowing-Property Damage)	73	61%	39%	20	55%	45%

Table 16 Lawsuits Data Sample Sizes For Various Categories (Only Factors That Result In Highest 85% Of Claims Are Included)

Lawsuits						
Category	**Total Sample**	**Total % Paid**	**Total % Denied**	**Sample with location data**	**Total % Paid**	**Total % Denied**
All Lawsuits	**298**	55%	45%	0	0	0
Type 1 - Collision with Not fixed	**155**	57%	43%	0	0	0
1 Subcat…(Multi vehicle_Non DOT)	89	60%	40%	0	0	0
2 Subcat…(Water on road surface)	20	70%	30%	0	0	0
3 Subcat…(DOT vehicle)	14	10%	90%	0	0	0
4 Subcat…(Water on road surface)	20	70%	30%	0	0	0
5 Subcat…(DOT/Contract Vehicle)	14	7%	93%	0	0	0
6 Subcat…(Tree in road)	8	88%	12%	0	0	0
7 Subcat…(Tree fell on car)	6	100%	0%	0	0	0
Type 2 – Collision with fixed	60	50%	50%	0	0	0
1 Subcat…(Pothole)	13	38%	62%	0	0	0
2 Subcat…(Low shoulder)	8	38%	62%	0	0	0
3 Subcat…(Railroad Crossing)	6	17%	83%	0	0	0
4 Subcat…(Mh-Cb-Di-Grate)	5	60%	40%	0	0	0
Type 3 – Non Collision_Vehicle	0	0%	0%	0	0	0
Type 4 – Non Collision_Pedestrian	59	53%	47%	0	0	0
1 Subcat…(Trip/Fall uneven surface)	27	44%	66%	0	0	0
2 Subcat…(Trip/Fall Mh-CB-Di-Grate)	21	57%	43%	0	0	0
Type 5 – Non Collision_Property	23	56%	44%	0	0	0
1 Subcat…(Drainage Structure)	6	33%	67%	0	0	0
2 Subcat…(Shoulder/Ditches)	6	100%	0%	0	0	0
3 Subcat…(Construction/Paving)	5	60%	40%	0	0	0

In numerous categories such as ‘paint splatter’, ‘debris-DOT truck’, ‘tree in road’ etc., where the sample size is small (125 cases or less), tree-based regression typically stopped after the first split. There were simply not enough cases to satisfy the minimum required number for parent and child nodes. As a result, the tree would stop after splitting in the first level. Figure 14 and Figure 15 show examples of truncated trees after the first split.

However, the number of pothole claims was high enough to develop trees in order to gain some insight. Considering lawsuits, the research team could not obtain any roadway data due to the unavailability of location data in the lawsuit database. So, the trees produced for lawsuits are essentially based only on the independent variables available in the lawsuit database, without considering roadway data elements as independent variables.

Debris-DOT truck

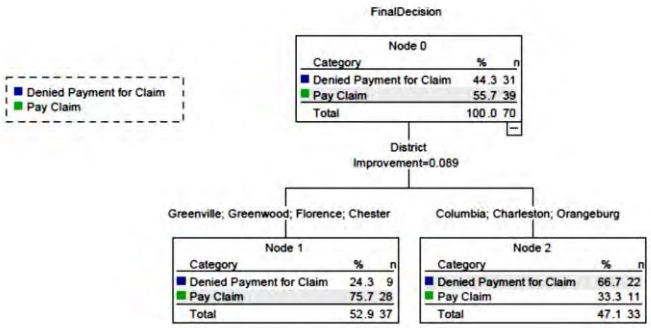


Figure 14 Predictability of Debris from DOT Truck Claim Payment or Denial

Shoulder Elevation Difference

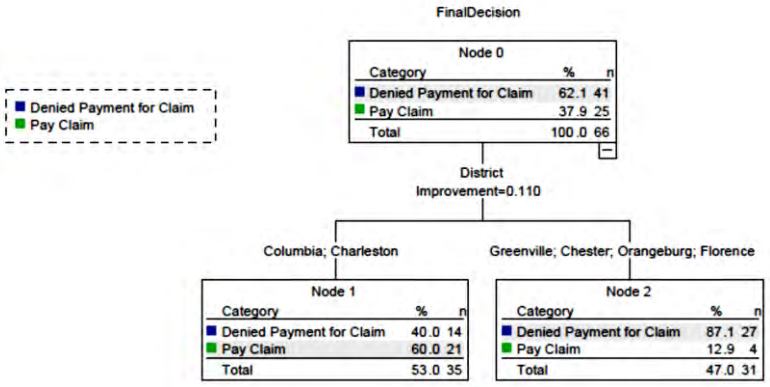


Figure 15 Predictability of Shoulder Elevation Difference Payment or Denial

One of the most interesting findings observed from the development of numerous regression trees was the significant difference in payout and denial patterns for various claims categories by district. Nearly every single category that had enough cases to split at least once, split on the predictor variable 'District'. For instance, in Figure 14 the tree is predicting whether a Type 1- Debris from DOT truck claim will be paid or denied. The predictor variable that explains the most variation in this tree is 'District'. The districts of Columbia, Charleston, and Orangeburg deny 66.7% of claims, as opposed to Greenville, Greenwood, Florence, and Chester which deny 24.3% of these claims.

The exception to the trend of District being the most significant variable is associated with the paint splatter tree model in Figure 16. In this case, the most significant variable is route type. The majority (92.1%) of claims on Interstate, US Route, and SC Route are not paid, whereas there is a 42.4% chance of payment if the claim occurred on a Secondary route.

Paint Splatter

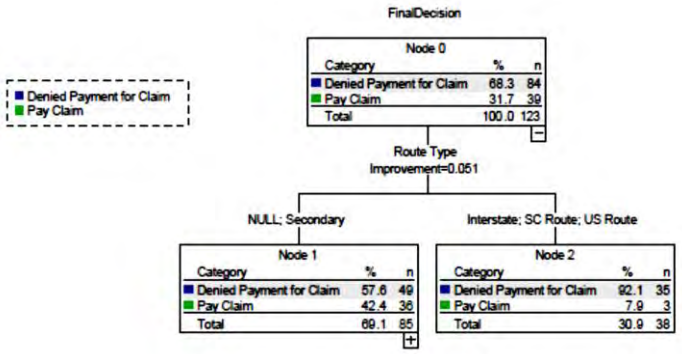


Figure 16 Predictability of Paint Splatter Claim Payment or Denial

The more predictor variables and the larger samples of cases, the more complicated the tree structures become. In Figure 17, a large tree has been trimmed to show one specific limb ending at Node 20. Node 20 represents 2.4% of total cases. Within node 20, 93.4% of cases are found to be Type 1 claims. Reading back on the limb to the trunk of the tree, Type 1 claims are highly likely in the districts of Columbia and Chester, if the incident occurs on an interstate, within a larger group of districts including Florence, Columbia, Greenville, Charleston, and Chester, in the 8 months from April through November.

These models would be most helpful for lawsuits if enough cases existed with proper location data and linked roadway characteristics beyond those used here. Imagine that you could predict that a lawsuit is 90% likely given that an incident/crash occurred in one of 2 particular counties on an interstate roadway in the spring or summer months. If this were true, it would be possible to determine which cases absolutely should be investigated immediately and data prepared for defense.

Figure 18 shows a fully developed HTBR model for predicting payment or denial of pothole claims when location data and roadway characteristics are available. As potholes are associated with wear and tear on pavement and other external factors, it is expected that AADT and functional classification would be possible predictor variables – which is indeed the case. As with most other tree development using this data, District was the most significant explanatory variable. Charleston and Chester are shown to be more likely to pay claims related to potholes with 46% paid. However in the other five districts, roughly 75% of the pothole claims are likely to be denied.

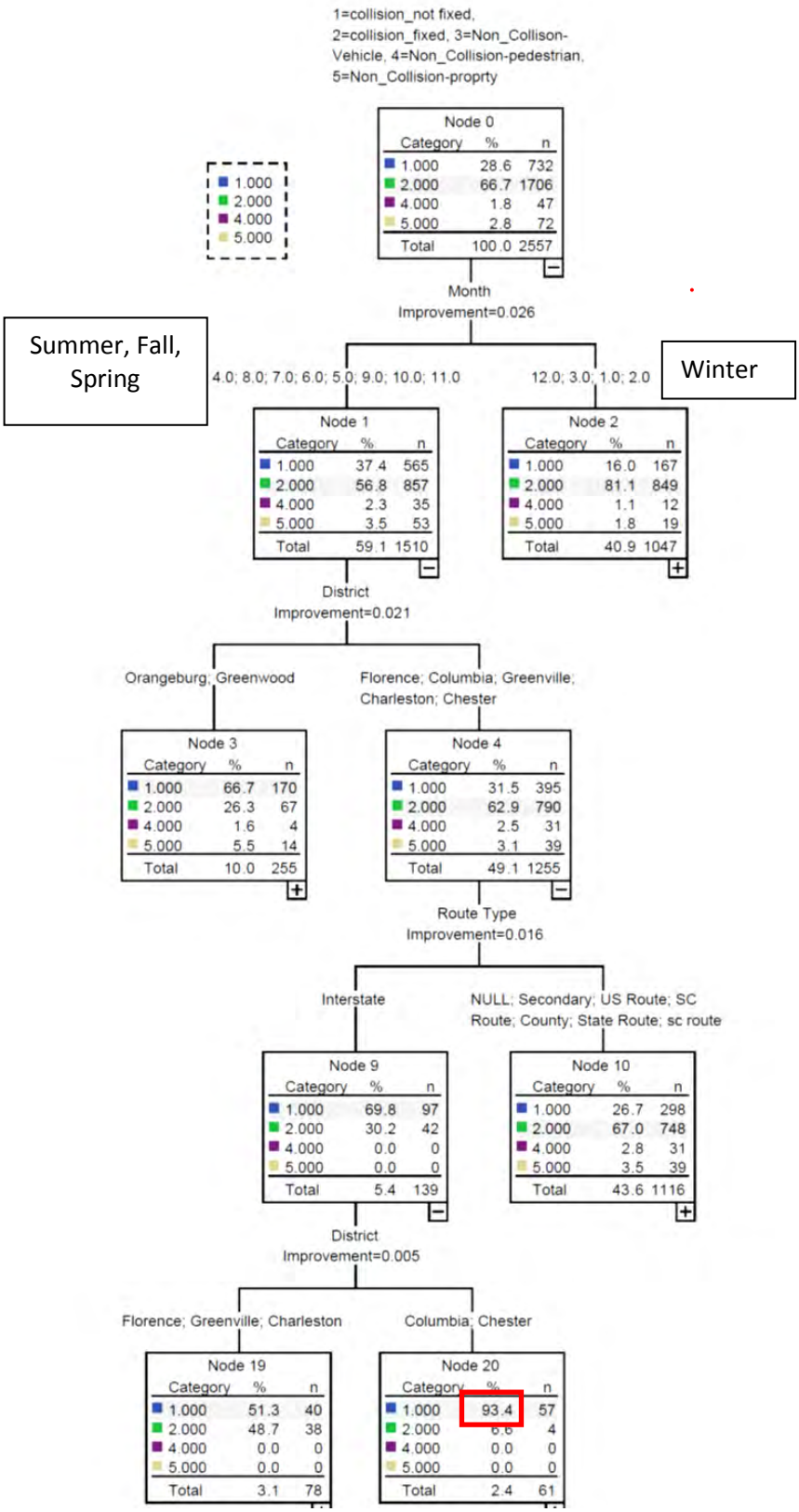


Figure 17 Example From Trimmed Tree Predicting Type of Claim

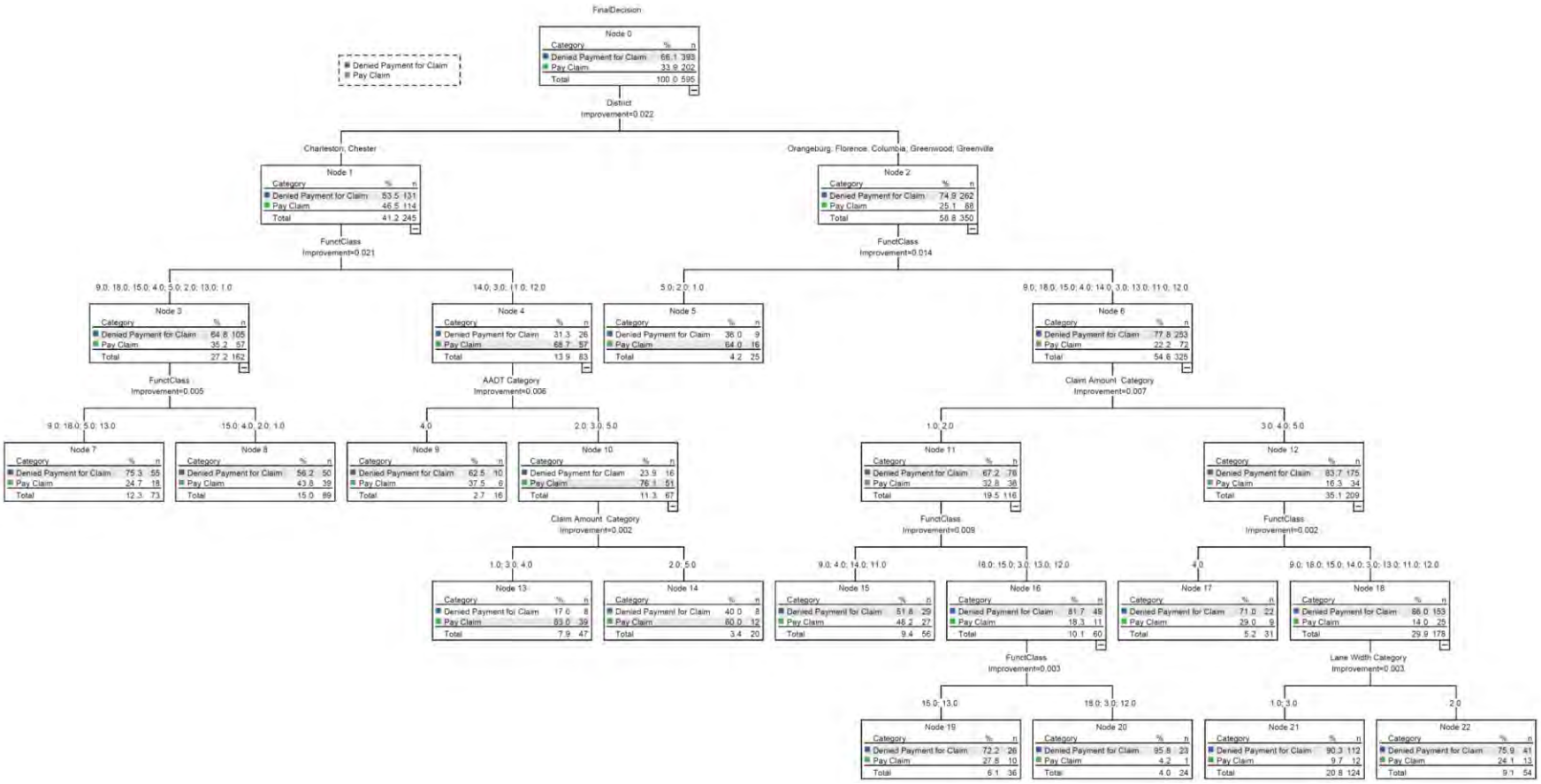
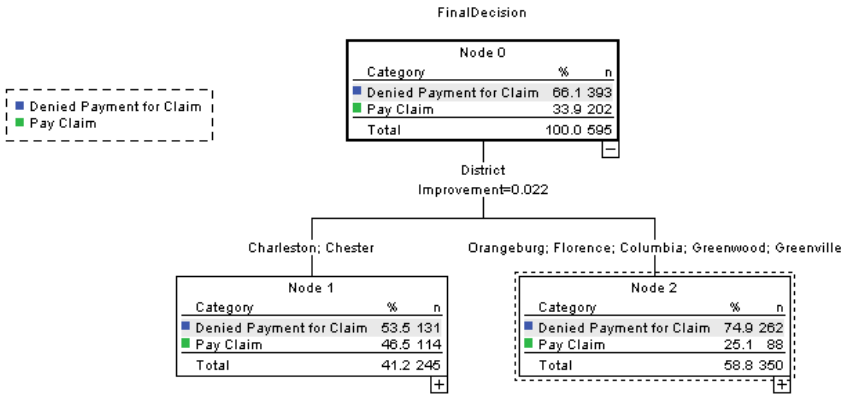
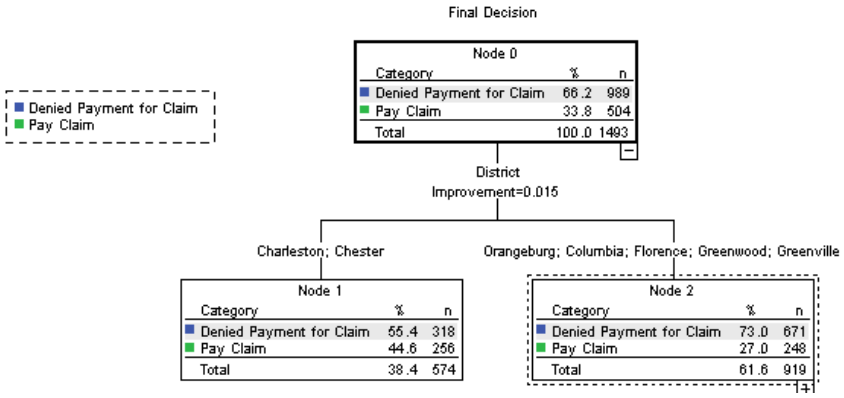


Figure 18 Full HTBR Model Predicting Denial or Payment of a Pothole Claim Using Only Data With Location Information/Roadway Characteristics

Since only a portion of the claims have location data and corresponding roadway characteristics data, the research team decided to check and make sure that the smaller sample of data did not contain a bias. If it can be shown the smaller sample does not contain a bias and is representative of the full data set, the relationships identified in the sample can be assumed to hold true for the whole data set. Figure 19a and Figure 19b show roughly the same splits for the whole data set and the smaller sample with more data. To further verify that the relationship truly exists; the research team looked at payout amounts for the two sets of districts. Again, the relationships are almost identical. *Thus, the location bias does not seem to hold true for potholes so the relationships identified in Figure 18, created using the smaller data sample with locations, can assume to hold true for the full data set.*



a) Pothole claims with location data



b) Pothole claims using whole data set

Figure 19 First Split For HTBR Models Predicting Payment Of Pothole Claims

Table 17 Pothole Claims With Location Data

District	$Total payout for 3 years	$ Annual payout	$Average payout/ claim
Charleston, Chester	35,426.87	11,808.96	316.30
Columbia, Florence, Orangeburg, Greenwood, Greenville	35,742.26	11,914.09	388.50

Table 18 Pothole Claims Whole Data

District	$Total payout for 3 years	$ Annual payout	$Average payout / claim
Charleston, Chester	77,929.12	25.976.37	316.78
Columbia, Florence, Orangeburg, Greenwood, Greenville	90,172.27	30,057.42	374.16

Fault Tree Analysis

The research team has developed fault trees to represent the events that lead to a tort action against the SCDOT. These trees are used to identify the riskiest combination of events that will lead to a tort action. These ranked combinations can assist SCDOT to identify and mitigate these events in an effort to improve the safety of the roadway while at the same time reducing the number and impact of tort actions filed against the department. The results of the fault tree development are outlined in this section along with the ranked minimal cut sets based on probability.

Fault trees

The fault trees for claims are shown in Figures 20 and 21. The fault trees represent the events that lead to the claim types that make up 95% of all claims. The top event is a claim filed against the department. On the second level, personal injury claims are represented in the trip/fall branch while property damage is represented by branches for vehicle damage, utility damage, damaged caused by flooding, and damage caused by landscape work. The claim tree is broken down into 29 basic events, and 4 undeveloped events on 7 levels.

The fault trees for the lawsuits are shown in Figures 22-25 and represent a significantly different tree compared to claims. This is mostly due to the fact that the types of claims represented in the claims fault tree did not include multiple vehicle incidents which make up a large percentage of lawsuits. The type of lawsuits represented in the fault tree makes up approximately 75% of all the lawsuits. The top level event is a lawsuit filed against the department, which is then broken down to flooding damage, trip and fall injuries, and vehicle damage at the second level and is shown in Figure 22. The intermediate event, vehicle damage, is broken down further into 3 branches which are shown individually in Figures 23-25. The lawsuit tree results in 3 main branches consisting of 6 levels which are broken down to a total of 31 basic events.

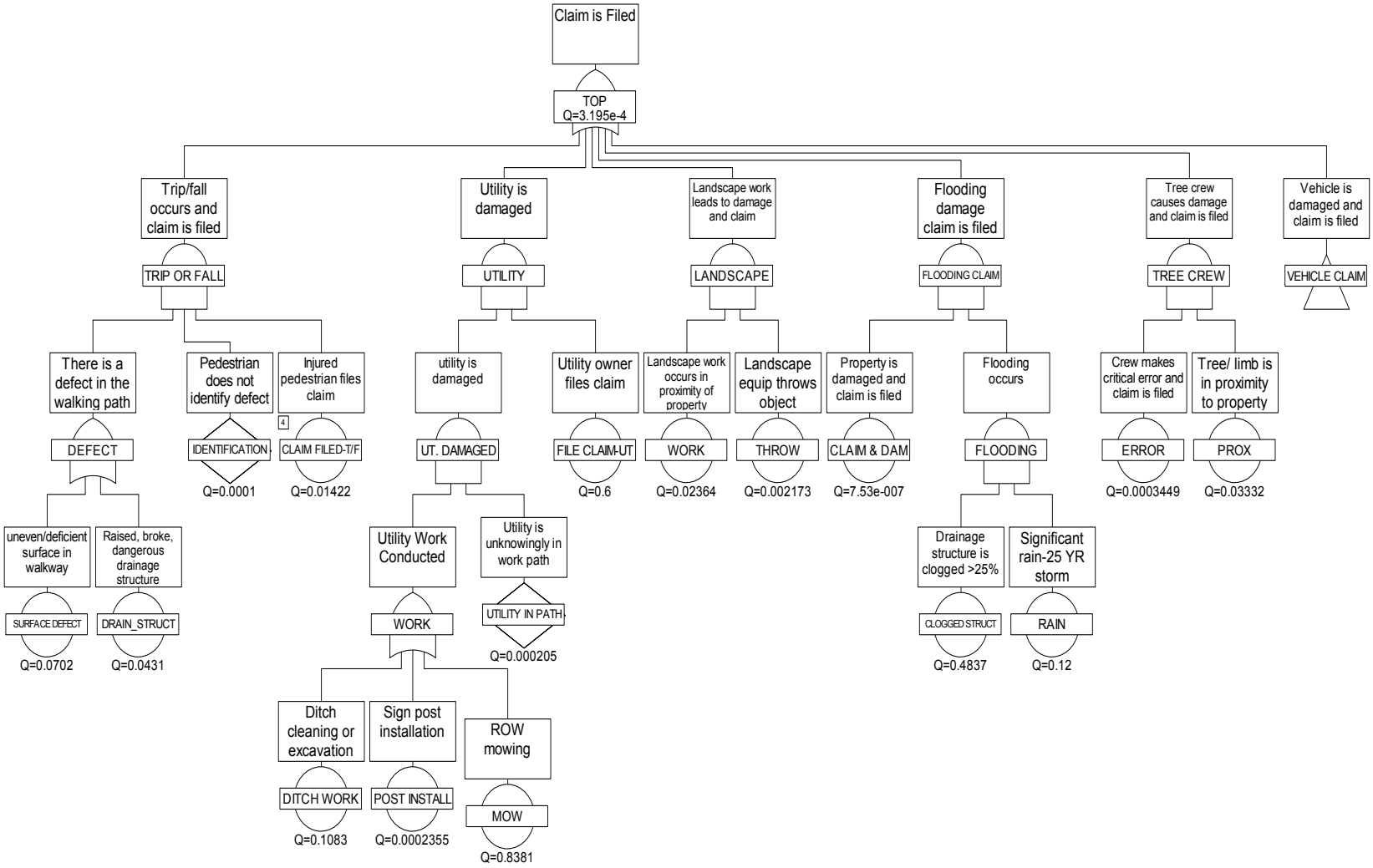


Figure 20 Fault Tree for Claims

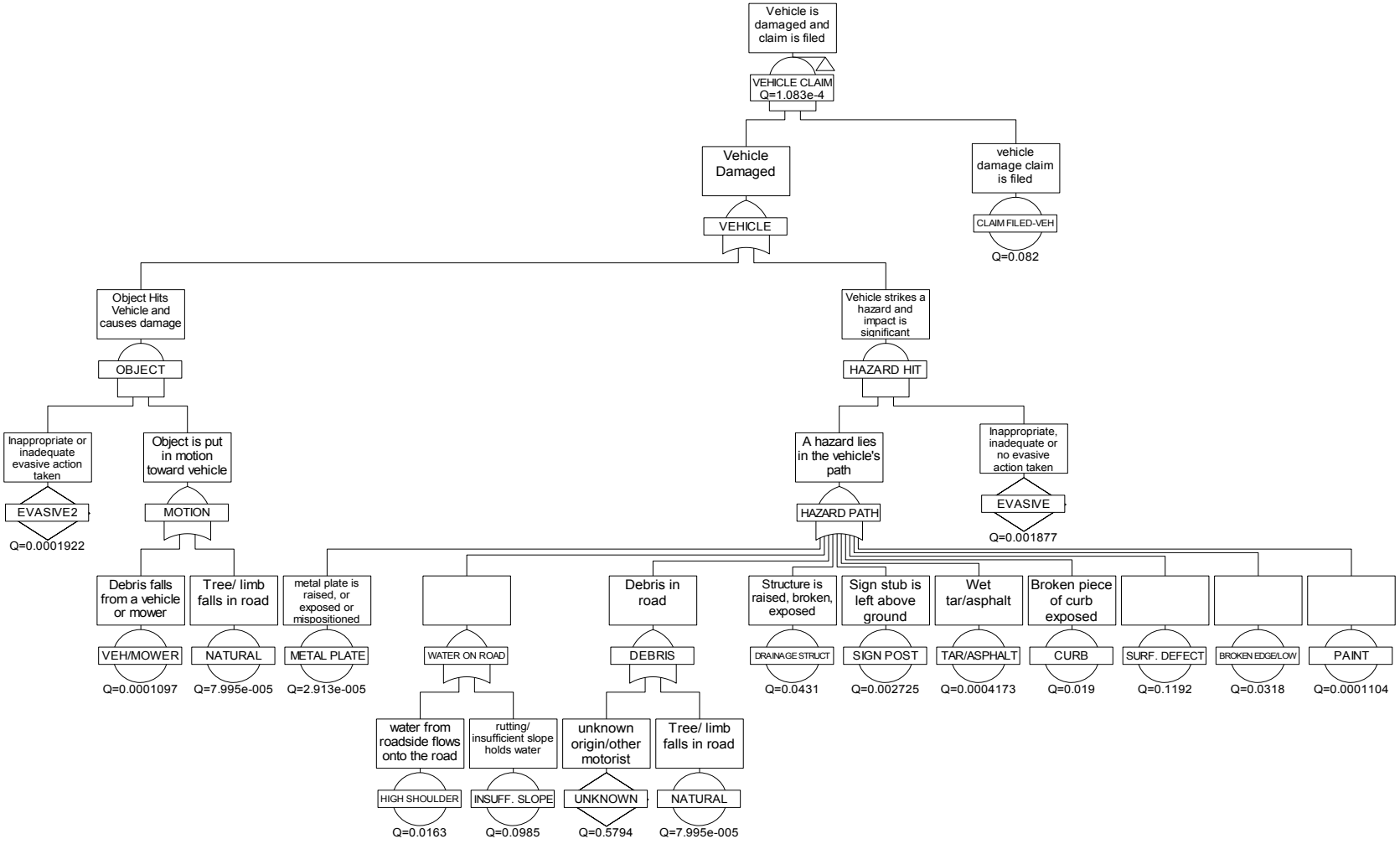


Figure 21 Fault Tree for Claims Cont. (Vehicle Branch)

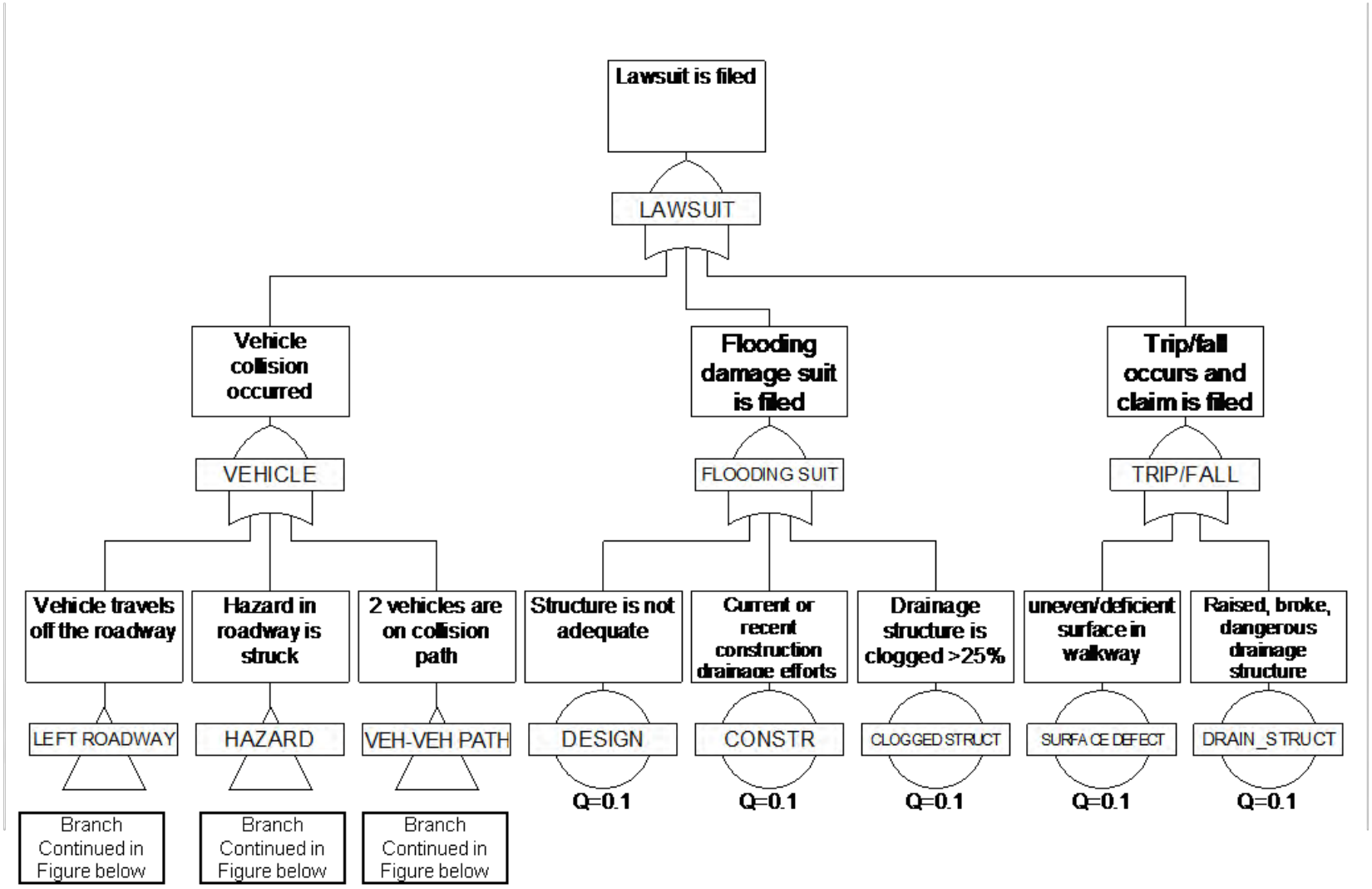


Figure 22 Top Levels of Lawsuit Fault Tree

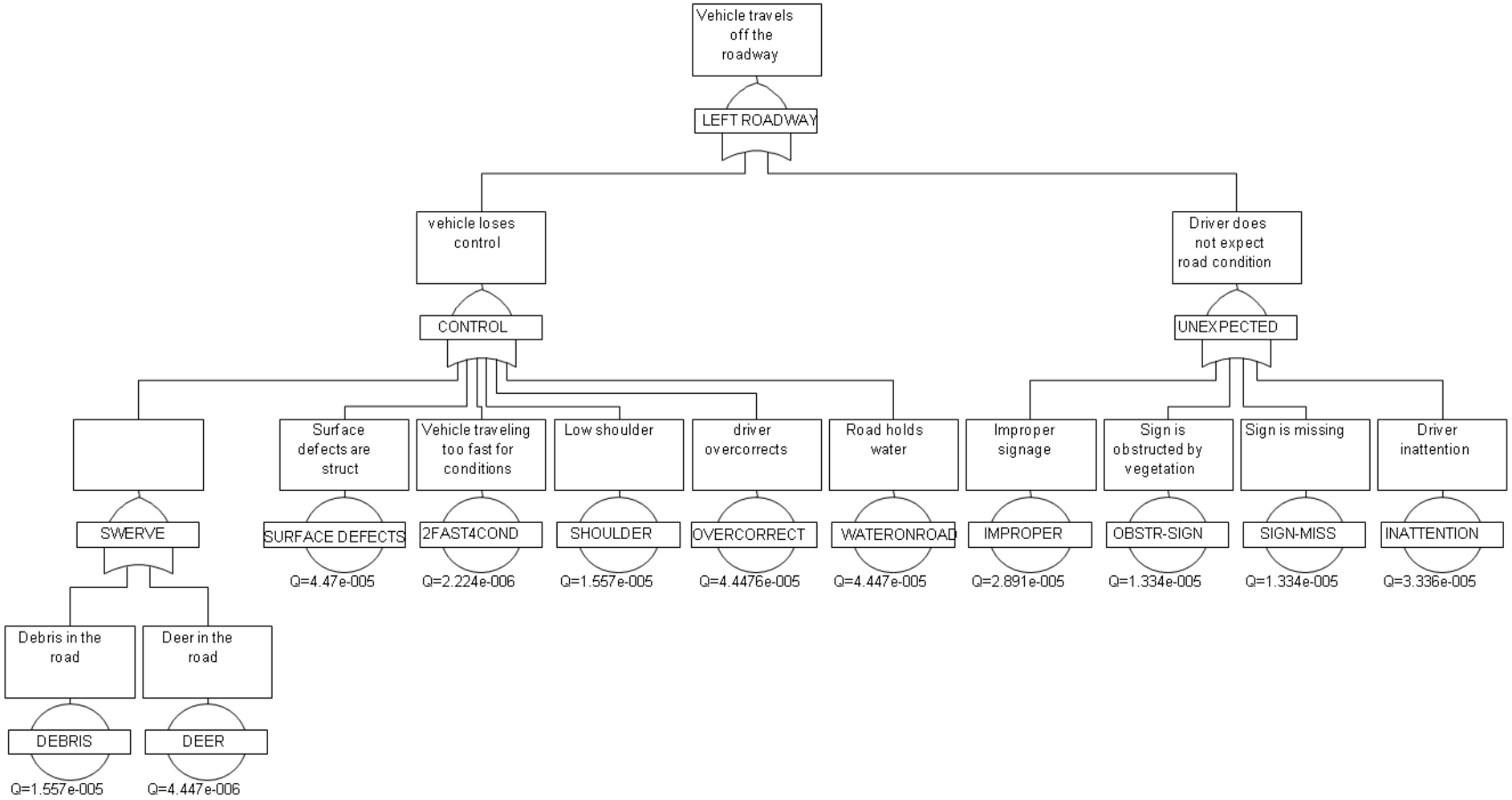


Figure 23 Expanded Branch of Lawsuit Fault Tree

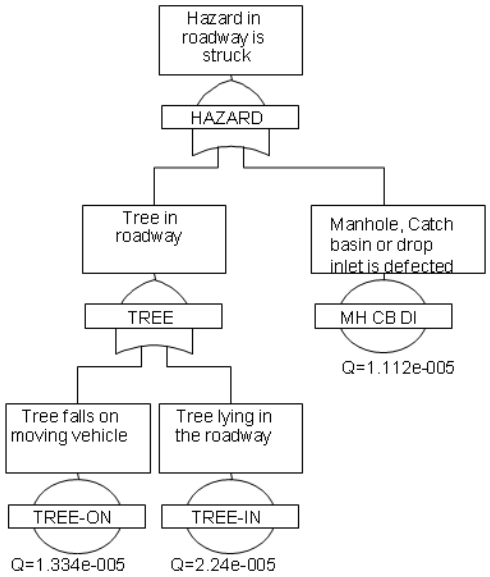


Figure 24 Expanded Branch of Lawsuit Fault Tree

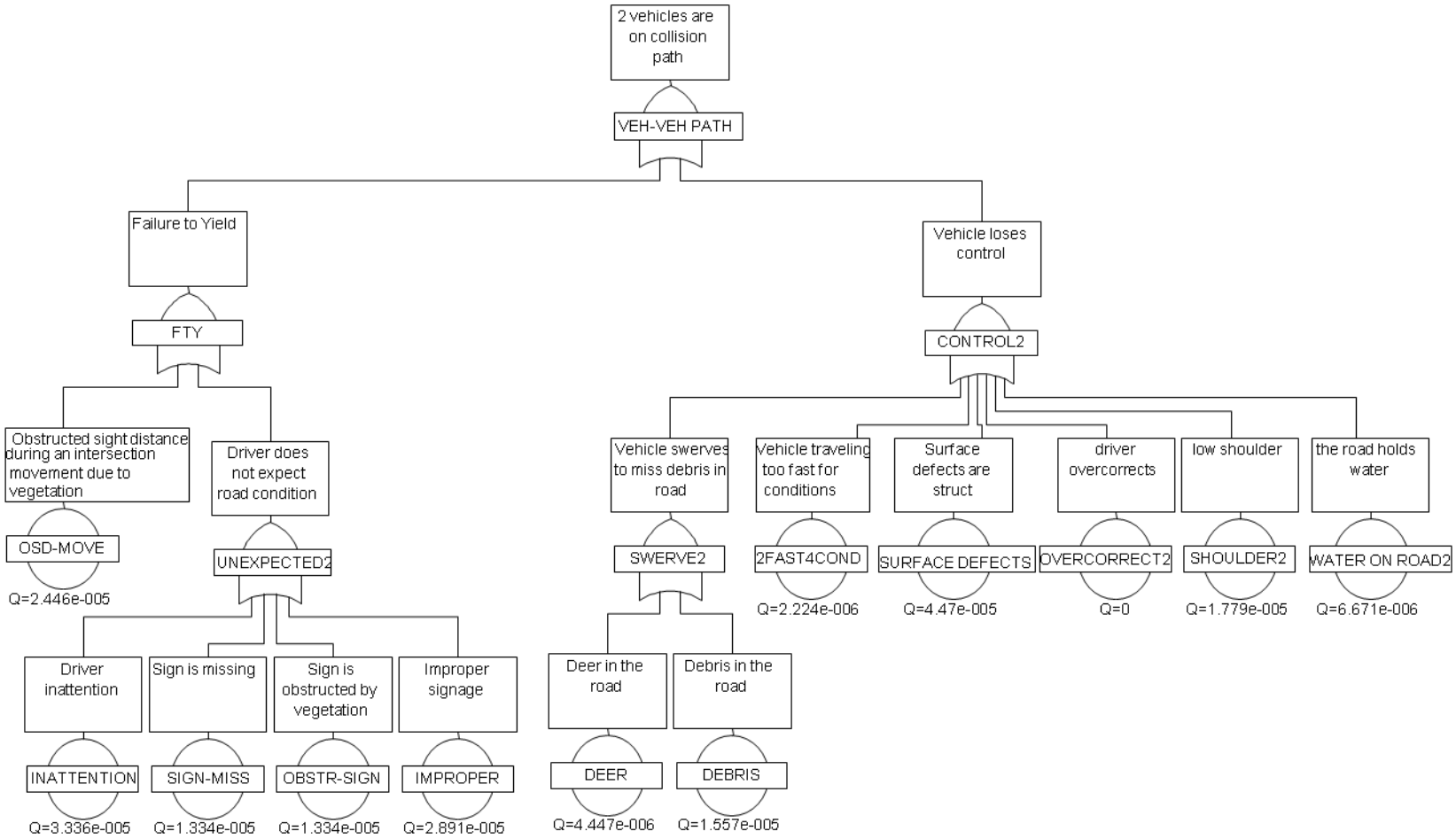


Figure 25 Expanded Branch of Lawsuit Fault Tree

Ranked Risk Factors-Claims

The minimum cut sets were identified as the minimum combination of events that lead to a claim being filed. The minimum cut sets identified from the claims fault tree consist of 2 basic events while all the other cut sets are made up of 3 basic events. Since only 2 minimum cut sets are identified from the fault tree, the top 10 most probable cut sets are identified and ranked in order of probability to provide a more comprehensive ranked list. The cut sets are ranked by their probabilities in Table 19 and detailed in Figures 26 through 35. The cut sets identified with an asterisk (*) in the table are the minimum cut sets. These cut sets allow for basic events to be identified and targeted with countermeasures to reduce the probabilities of their occurrence, in order to reduce the probability a claim is filed. The probabilities of the cut sets in Table 19 represents the potential reduction in the probability of a claim being filed, if a countermeasure or multiple countermeasures are used to reduce or eliminate the probability of one of the basic events that make up the cut set. The most probable cut sets are outlined in Table 19 with further descriptions of the events and countermeasures.

Table 19 Ranked Combinations of Events That Lead To a Claim

Rank	Basic Events That Make Up Cut Set	Cut Sets	Probability	Countermeasure
1	ROW mowing, Utility is unknowingly in work path, utility company files a claim	Utility damage by mower	1.03E-04	Delineate above ground utilities
2	Debris of unknown origin in the road, inappropriate/ improper or no evasive action, vehicle owner files a claim	Vehicle damage from unknown road debris	8.92E-05	Frequent inspection and efforts to increase debris reports and response
3*	Landscape work in proximity to susceptible property, equipment throws debris	Landscaping work damages property*	5.14E-05	Greater care of operation or use of equipment with more control near property
4	Surface defect in the road, inappropriate/ improper or no evasive action, vehicle owner files a claim	Vehicle damage due to surface defect	1.84E-05	Increased maintenance efforts for surface repairs and improved response to maintenance requests
5	Rutting or insufficient slope holds water, inappropriate/improper or no evasive action, vehicle owner files a claim	Vehicle damage due to water on road with insufficient slope	1.52E-05	Resurface road segment, milling surface level
6	Ditch work, utility is unknowingly in work path, utility company files a claim	Utility damage due to ditch work	1.33E-05	Locate utilities before ditch work, ensure utilities are buried at proper depth
7*	Tree removal in proximity to susceptible property, crew error	Tree crew damages property*	1.15E-05	More precautions or greater care during tree removal

Table 19 (continued)

Rank	Basic Events That Make Up Cut Set	Cut Sets	Probability	Countermeasure
8	Vehicle damage due to broken or raised mh, cb, di, inappropriate/improper or no evasive action taken	Vehicle damage due to raised or broken mh, cb, di	6.63E-06	Increase inspections of structures, improve response to maintenance requests
9	Broken edge/low shoulder, inappropriate/improper or no evasive action, vehicle owner files claim	Vehicle damage due to broken edge and low shoulder	4.85E-06	Increase road edge maintenance, improve response to maintenance requests
10	Broken curb, inappropriate/improper or no evasive action, vehicle owner files claim	Vehicle damage due to broken curb	2.92E-06	Delineate vulnerable curbs, increase inspections and maintenance of damaged curbs

In order to account for the variability in the probabilities, distributions were used to describe the basic events as well as the top level event. The 1000 simulations run using the Monte Carlo method produced a probability distribution for the top level event. Based on the distribution, the 90% confidence interval for the mean probability of the top level event was ($3.057x10^{-4}$, $3.365x10^{-4}$).

Figure 26 shows the most probable cut set, “utility damage due to mowing”. An effective counter measure to reduce claims could be delineating these utility pedestals with posts, so that mowers to see them when mowing in tall grass. This counter measure targets the basic event “utility is unknowingly in work path”. This cut set has a high probability of leading to a claim, most likely due to the amount of mowing conducted in the area of these utility pedestals - the right of way. In addition, tall grass can easily hide these green colored pedestals from view. The event “utility owner files a claim” is included in the tree to represent the probability that a utility owner files a claim against the DOT if damage occurs. An expert opinion from the state maintenance office identified this probability, which can vary depending on the owner of the utility.

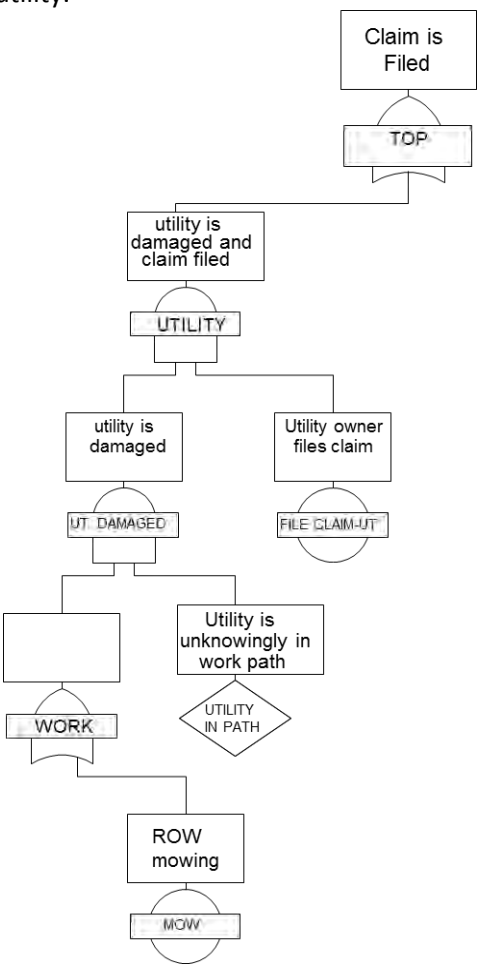


Figure 26 Cut Set "Utility Damaged by Mower"

Figure 27 shows the cut set "vehicle damage due to debris in road". This cut set shows identifying an effective countermeasure for one of the basic events that lead to this type of claim is difficult since the debris is from an unknown origin. However, the use of a countermeasure for the basic event, "debris in the road", could be implemented in order to reduce this probability. Countermeasures such as increased patrols or efforts to encourage or increase reports of debris could be effective.

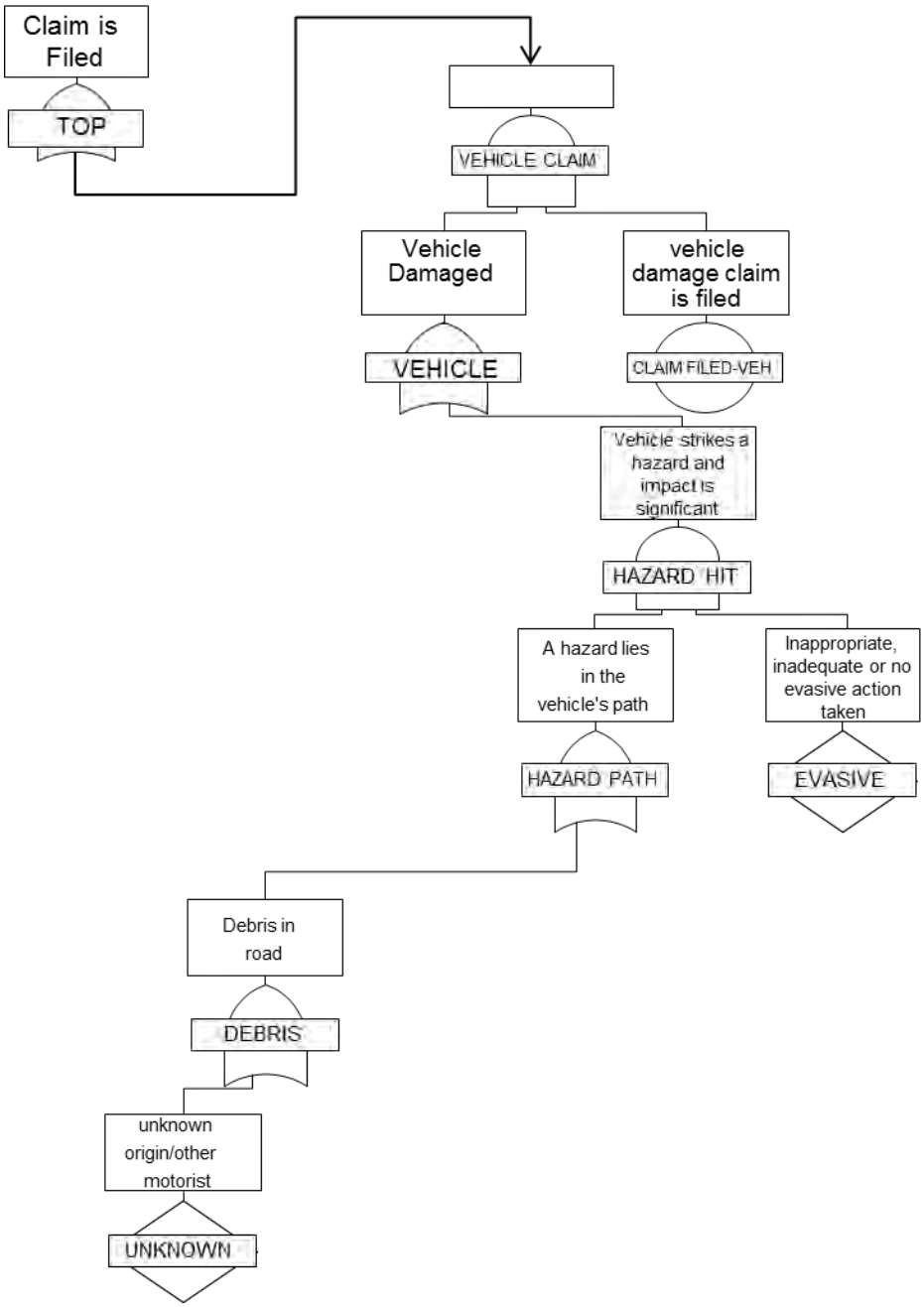


Figure 27 Cut Set "Vehicle Damage Due to Debris In Road"

Figure 28 shows the minimal cut set "Landscaping work which causes damage to property" which is the second most probable combination of events that lead to a claim being filed. Since landscape work must be conducted near susceptible property in order to properly maintain the ROW, a countermeasure should be identified by the maintenance crews, which would target the basic event "landscape equipment throws object". This countermeasure could include using equipment with more control near property susceptible to damage or could include modifying current equipment to reduce the number objects or distance objects are thrown. These events have a high probability of leading to a claim, mostly due to the large amount of work conducted in rights of way.

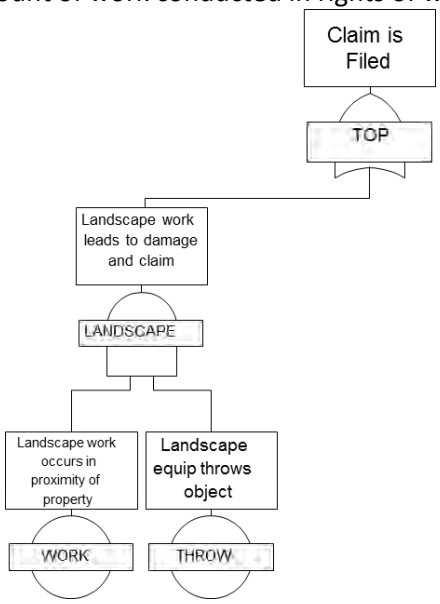


Figure 28 Cut Set "Landscape Work Damages Property"

Figure 29 shows the cut set for "vehicle damage due to a surface defect". This cut set is the most represented in the claims database and the fault tree analysis shows the cut set to be one of the most probable as well. Increased surface maintenance through increased inspections and improved responses to maintenance requests are two countermeasures that could be implemented to reduce the probability of this cut set.

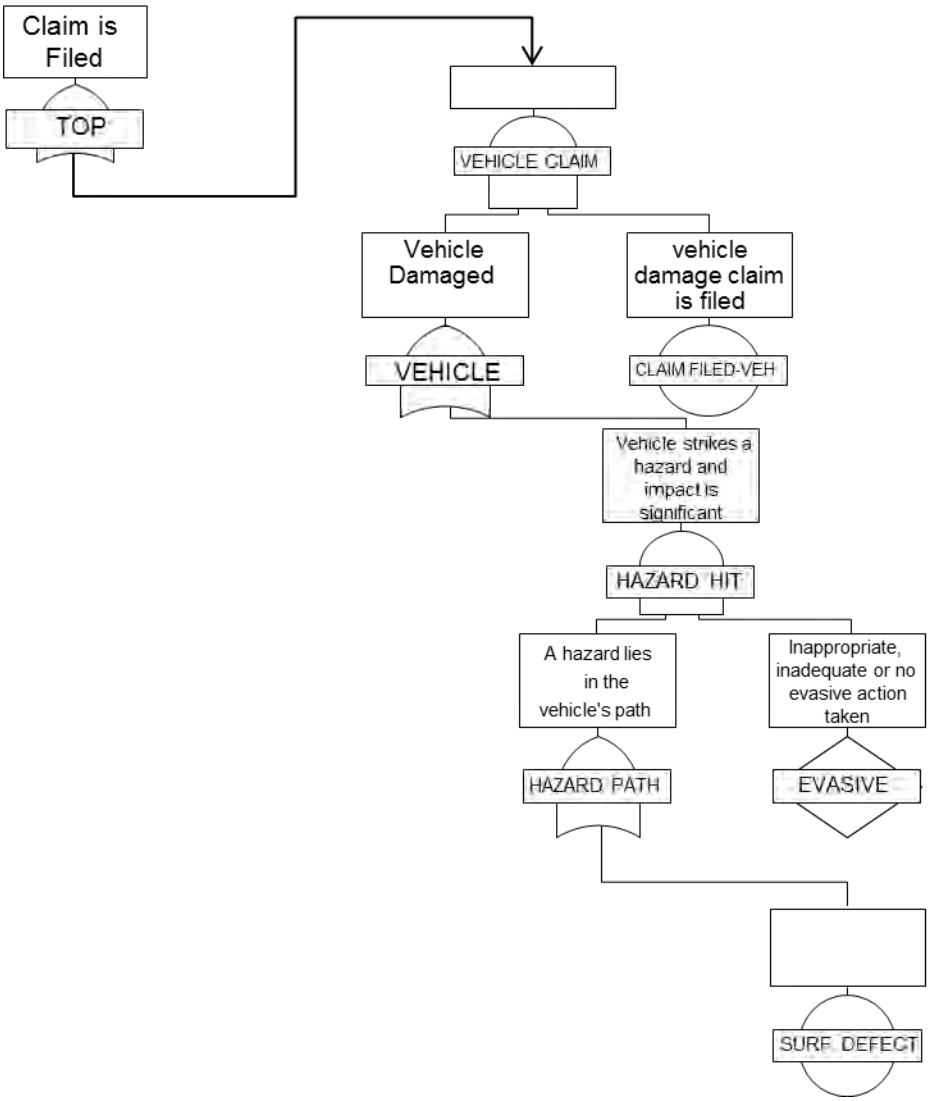


Figure 29 Cut Set for "Vehicle Damage Due To Surface Defects"

Figure 30 shows the cut set for "vehicle damage due to water on the road with insufficient slope". This cut set results in vehicles losing control due to standing water on the road. Countermeasures to reduce this cut set could target the "rutting" event by resurfacing these roadway segments or if the situation allows for it, milling the road level. In order to reduce the probability of the "no evasive action" event, warning signs could be placed near these sections to warn motorists to slow their speed and reduce losing control.

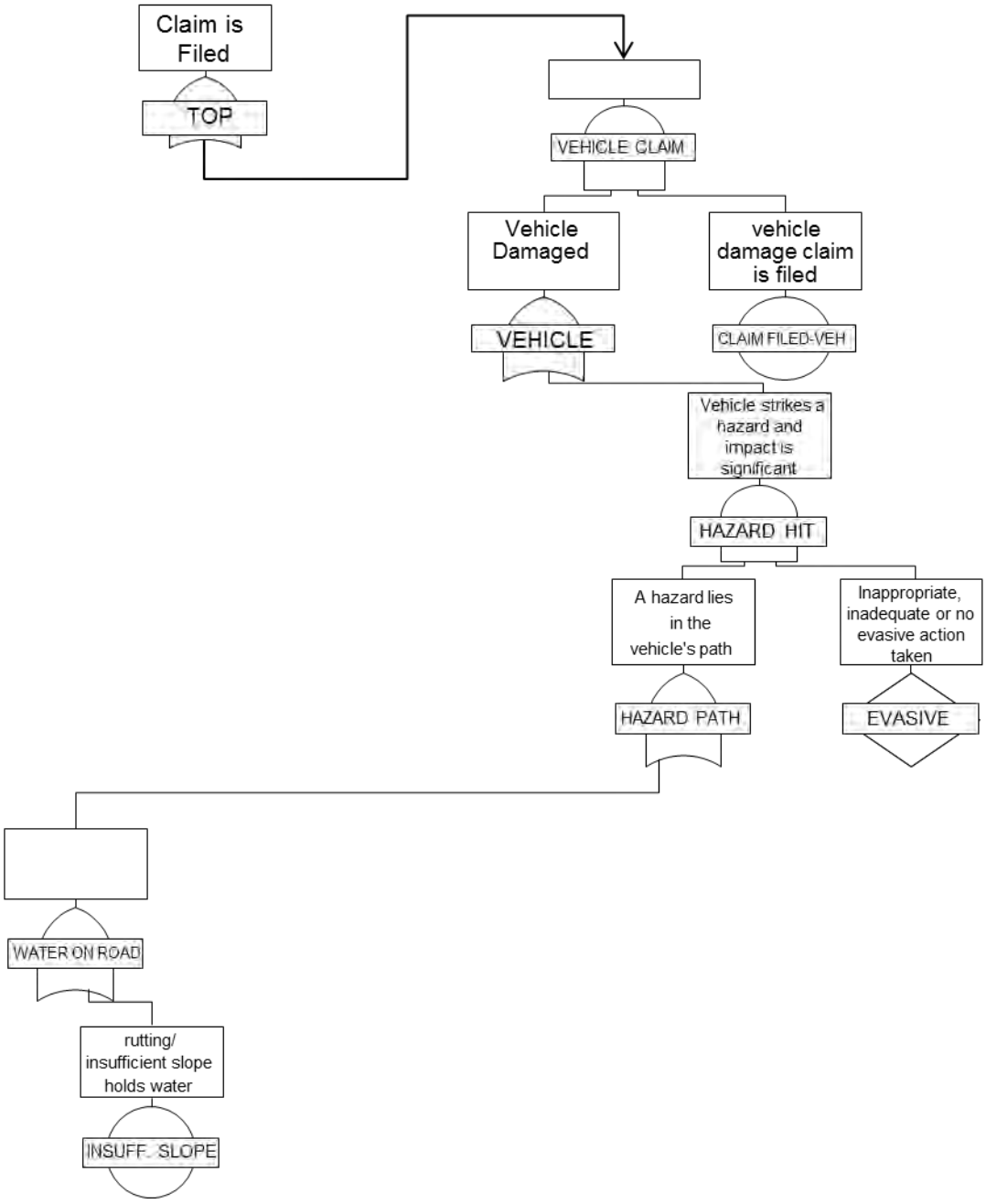


Figure 30 Cut Set for "Vehicle Damage Due To Water on The Road With Insufficient Slope"

Figure 31 shows the cut set "utility damage due to ditch work". An effective countermeasure would need to target the basic event, "utility is unknowingly in work path", by identifying these utilities that are located near future ditch work. Currently, utilities are not required to be identified before ditch work, such as cleaning, is conducted, since utilities are to be buried a safe distance below ditch bottoms.

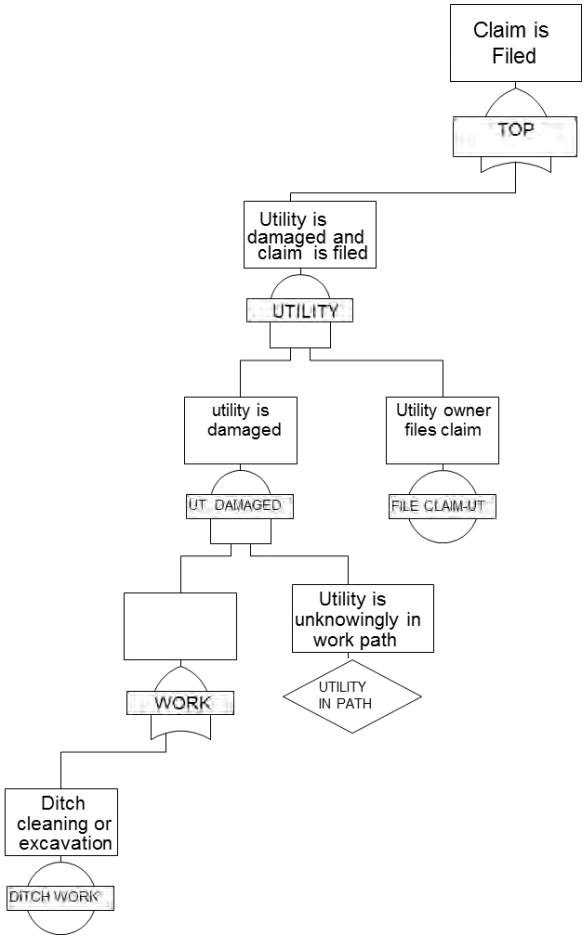


Figure 31 Cut Set "Utility Damaged Due to Ditch Work"

Figure 32 shows the minimal cut set “tree crew damages property”. This cut set shows the basic event, “crew error”, should be targeted to reduce these types of claims, since tree work will continue to need to be done in order to properly maintain ROW. Modifying procedures to increase safety or providing training to reduce these types of errors could be effective countermeasures.

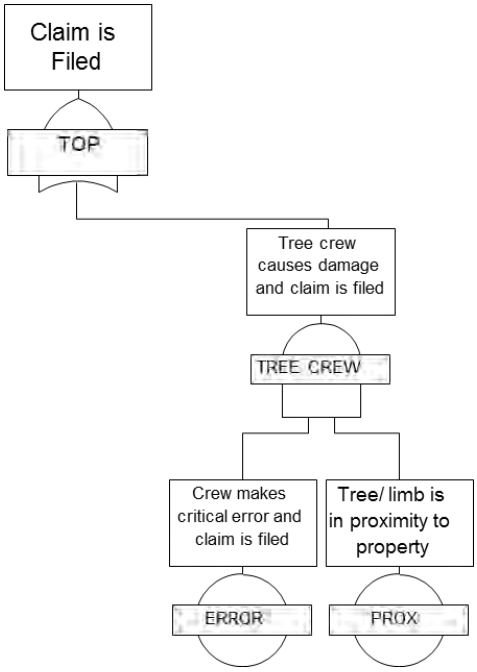


Figure 32 Cut Set “Tree Crew Damages Property”

Figure 33 shows cut set "vehicle damage due to raised or broken mh, cb, or di". Countermeasures to reduce the probability of this cut set include increasing inspections and maintenance of these drainage structures or improving responses to maintenance requests regarding these structures.

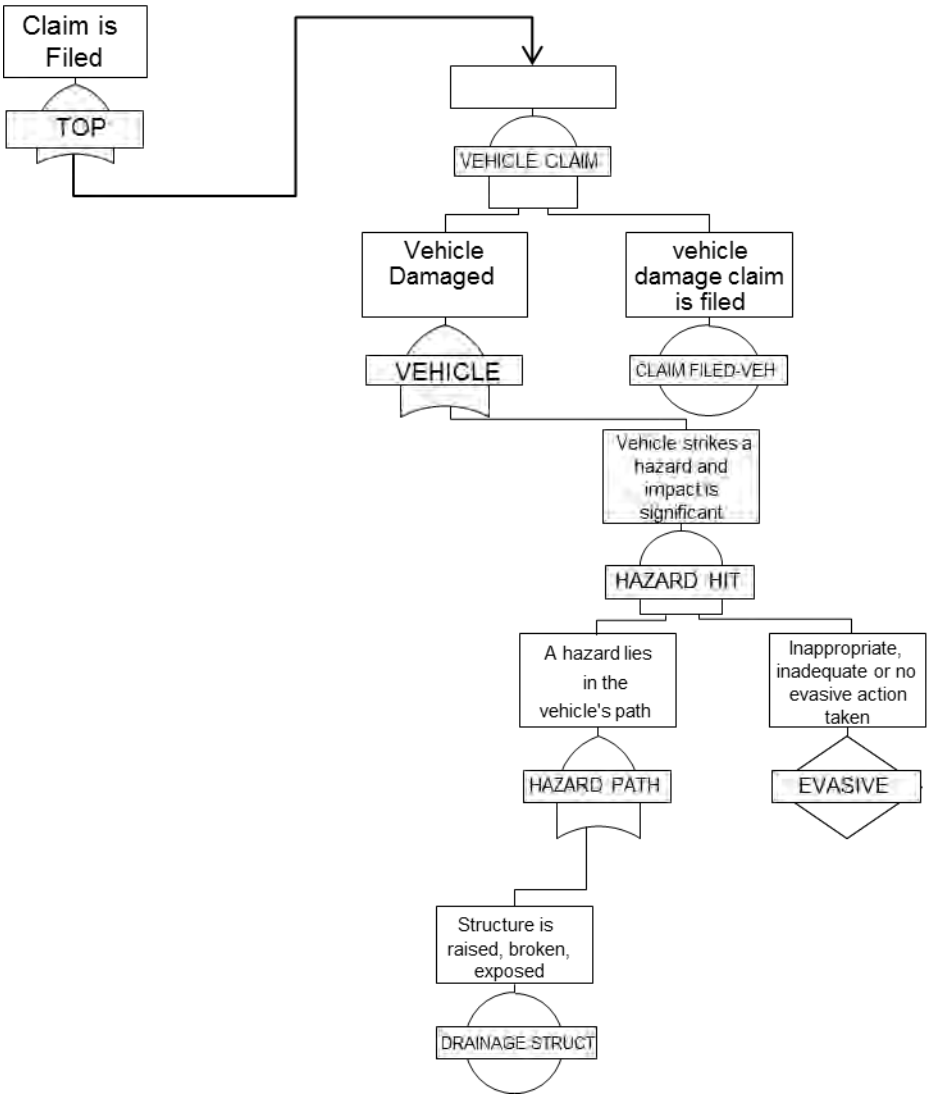


Figure 33 Cut Set "Vehicle Damage Due to Raised or Broken MH, CB, DI"

Figure 34 shows cut set "vehicle damage due to broken edge or low shoulder". This cut set occurs when vehicles strike an exposed edge of the roadway that has been broken or is uneven. Countermeasures to reduce the probability of this cut set should reduce the occurrence of broken edges through increased maintenance inspections and efforts.

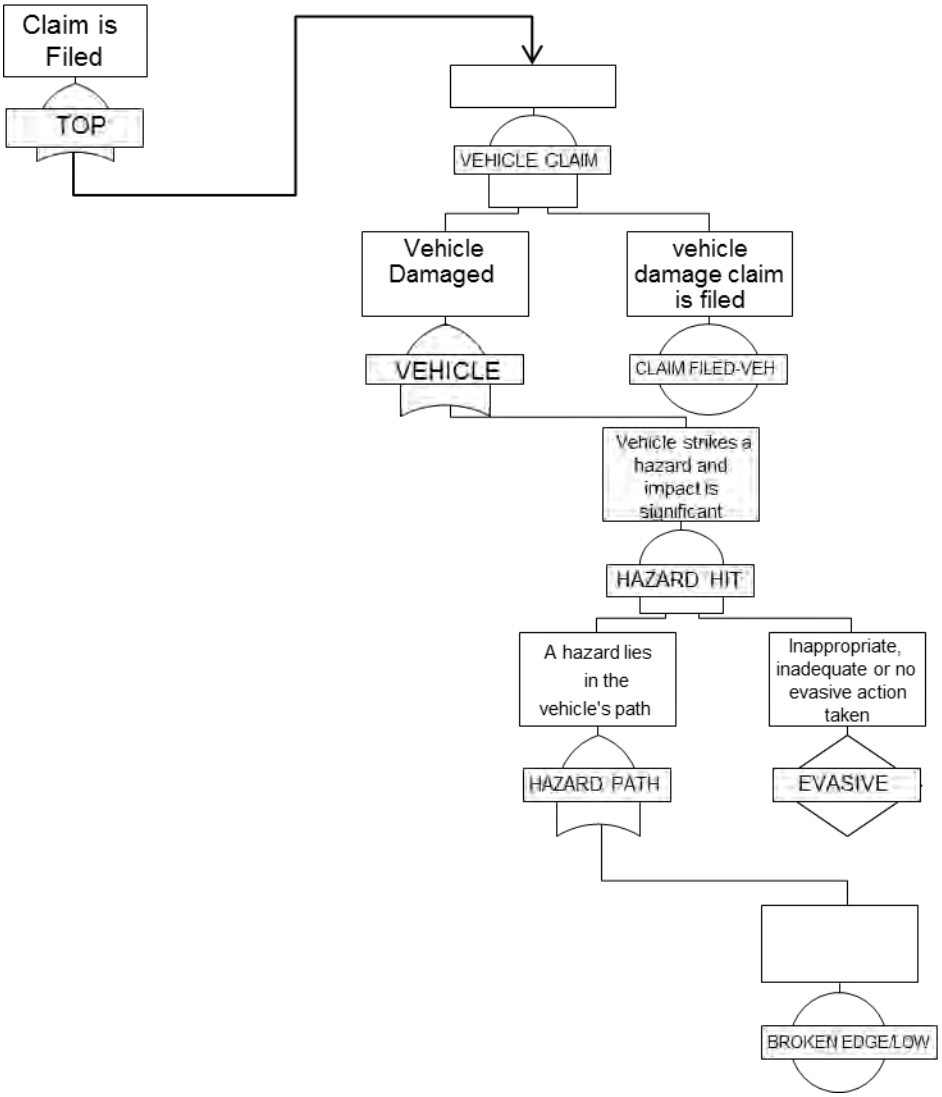


Figure 34 Cut Set "Vehicle Damage Due To Broken Edge or Low Shoulder"

Figure 35 shows cut set "Vehicle damage due to broken curb". This cut set occurs when vehicles strike a broken piece of curb and shows two countermeasures can be implemented to reduce the probability of its occurrence. Increased maintenance and inspections of curbs is one approach that would reduce the probability of the basic event "curb". Another approach is delineating curbs that are frequently struck by vehicles in order to reduce the probability of the basic event "no evasive action".

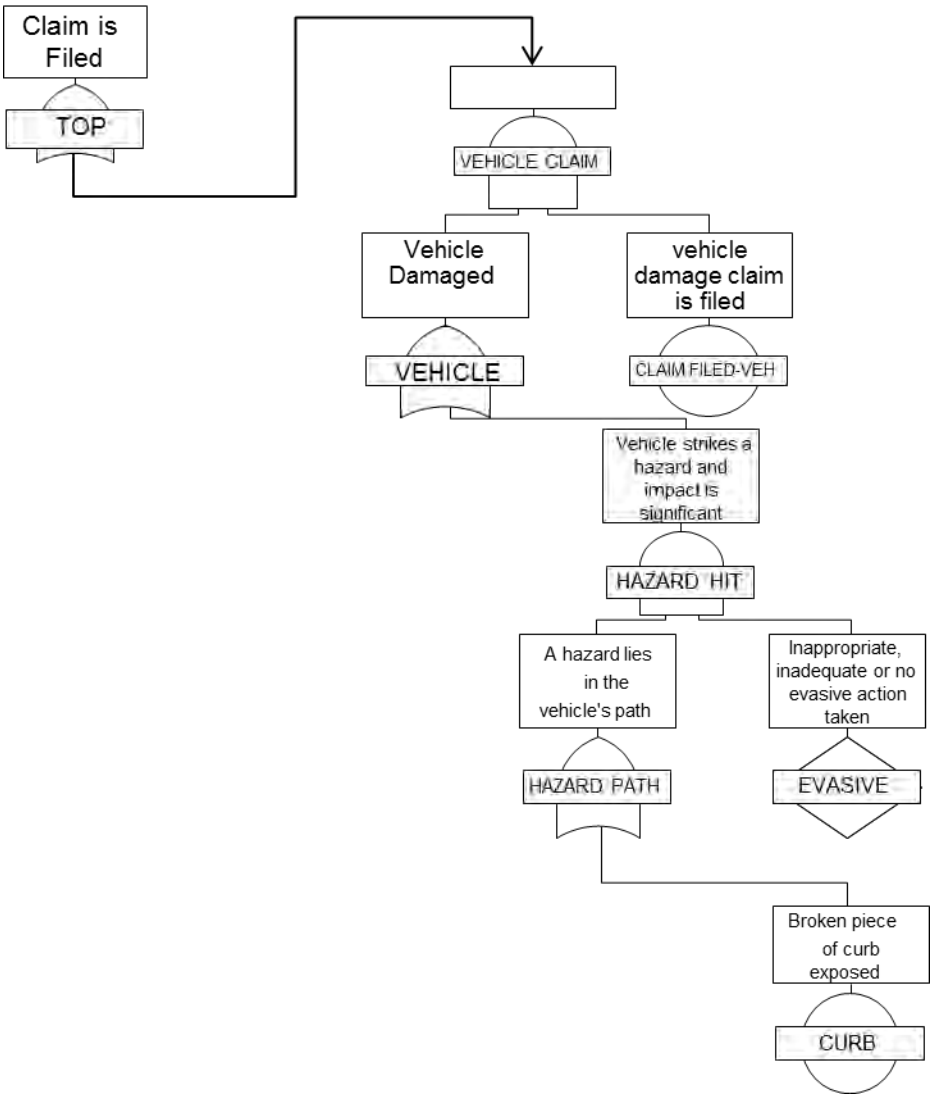


Figure 35 Cut Set "Vehicle Damage Due To Broken Curb"

The remaining cut sets from the claims Fault Tree are detailed in Appendix C.

Risk Factors - Lawsuits

The lawsuit fault tree provided 27 minimal cut sets. Due to the larger number and diverse types of events that lead to a lawsuit, the probabilities for the basic events in the lawsuit fault tree could not be calculated with an acceptable reliability following the same procedure as the claims fault tree. Therefore, a simpler method was used to identify the probability of the basic events which also led to the development of a simpler fault tree which is made up of only "Or" gates and thus leaves each basic event as a minimum cut set. We were only able to calculate the probabilities of the vehicle related basic events which gave 22 of the 27 probabilities. However, the 20 most probable minimal cut sets were ranked and are shown in Table 20.

Table 20 Cut Sets for Lawsuits

Min Cut Set	Probability
Off road- surface defect	4.447E-05
Off Road- water	4.447E-05
Failure to Yield- inattention	3.336E-05
Failure to Yield- improper	2.891E-05
Failure to Yield- OSD	2.446E-05
Tree in road	2.224E-05
Lose Control Shoulder	1.779E-05
Off road- shoulder	1.557E-05
Off road- debris	1.557E-05
Failure to Yield- missing	1.334E-05
Failure to Yield- Obstructed sign	1.334E-05
Tree on road	1.334E-05
mh cd di	1.112E-05
Lose Control too fast for conditions	6.671E-06
Lose Control Water	6.671E-06
Lose Control Surface Defect	4.447E-06
Lose Control Deer	4.447E-06
Off road- overcorrect	4.447E-06
Off road- deer	4.447E-06
Off Road- too fast	2.224E-06

As explained in the "Fault Tree" section of the Methods, the probability of cut sets were calculated and ranked in order to prioritize the risk of a lawsuit. Table 20 shows the top 20 most probable cut sets and their respective probabilities. This ranking shows that surface defects that lead to off the road crashes are the most probable sequence of events that will most likely lead to a lawsuit. The second most probable order of events that leads to a lawsuit is the "water on the road" cut set. These cut sets and the others that make up the 6 most probable are shown in Figures 36 and 37, and allow the SCDOT to prioritize the risks and choose the most effective countermeasures that will reduce the probability of a lawsuit.

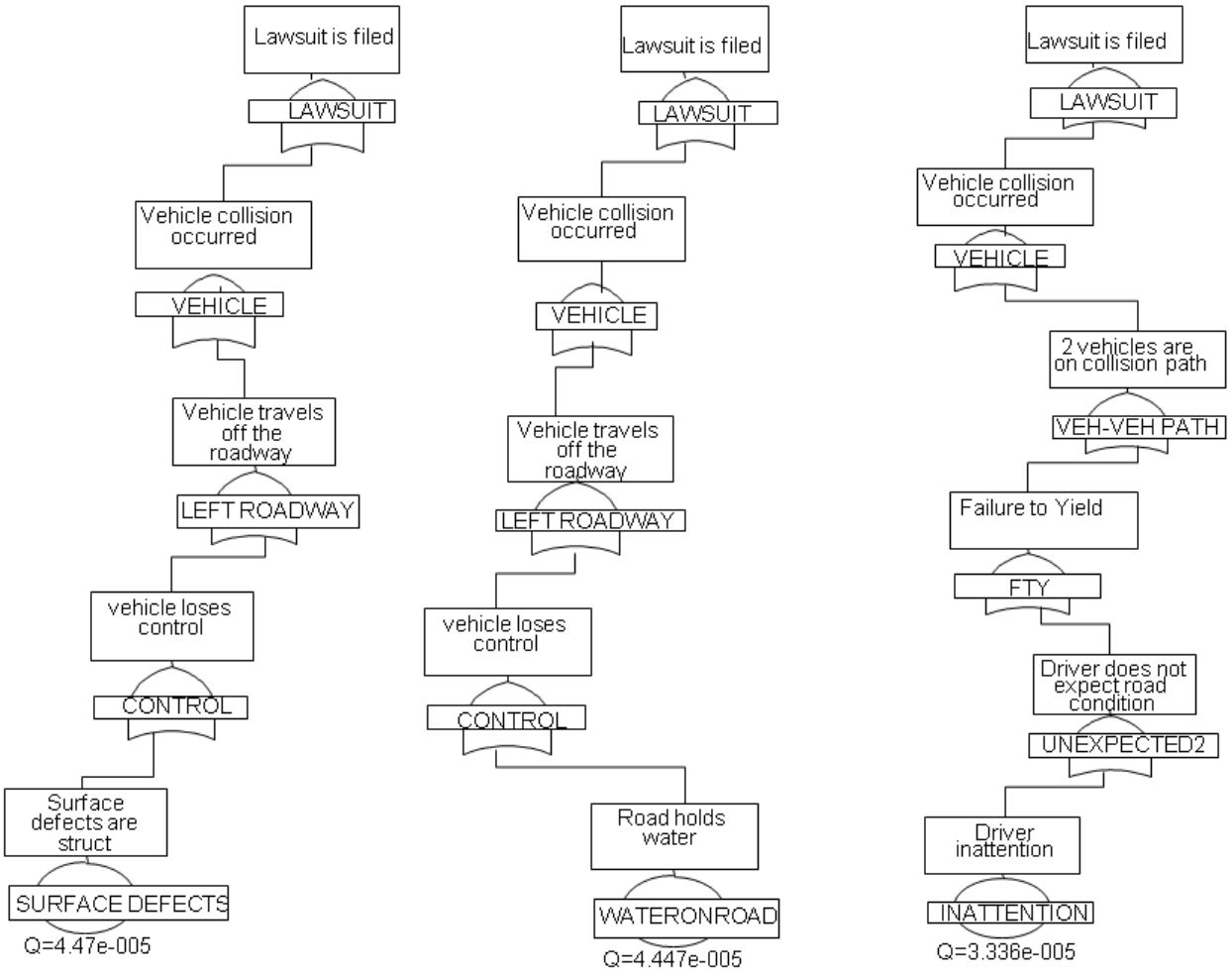


Figure 36 Three Most Probable Minimum Cut Sets

The minimum cut set for "water on the road" shown in Figure 36 could be used to show the SCDOT that more detailed data should be collected to determine the most common cause of water on the road. Breaking the basic event down further through further research would allow the SCDOT to determine if rutting or high shoulders are the most typical causes of water on the road and thus implement countermeasures accordingly. This level of detailed data is not currently collected for claims and lawsuits however, the probability of this cut set shows that collecting this information in order to identify a more specific countermeasure for water on the road would be effective.

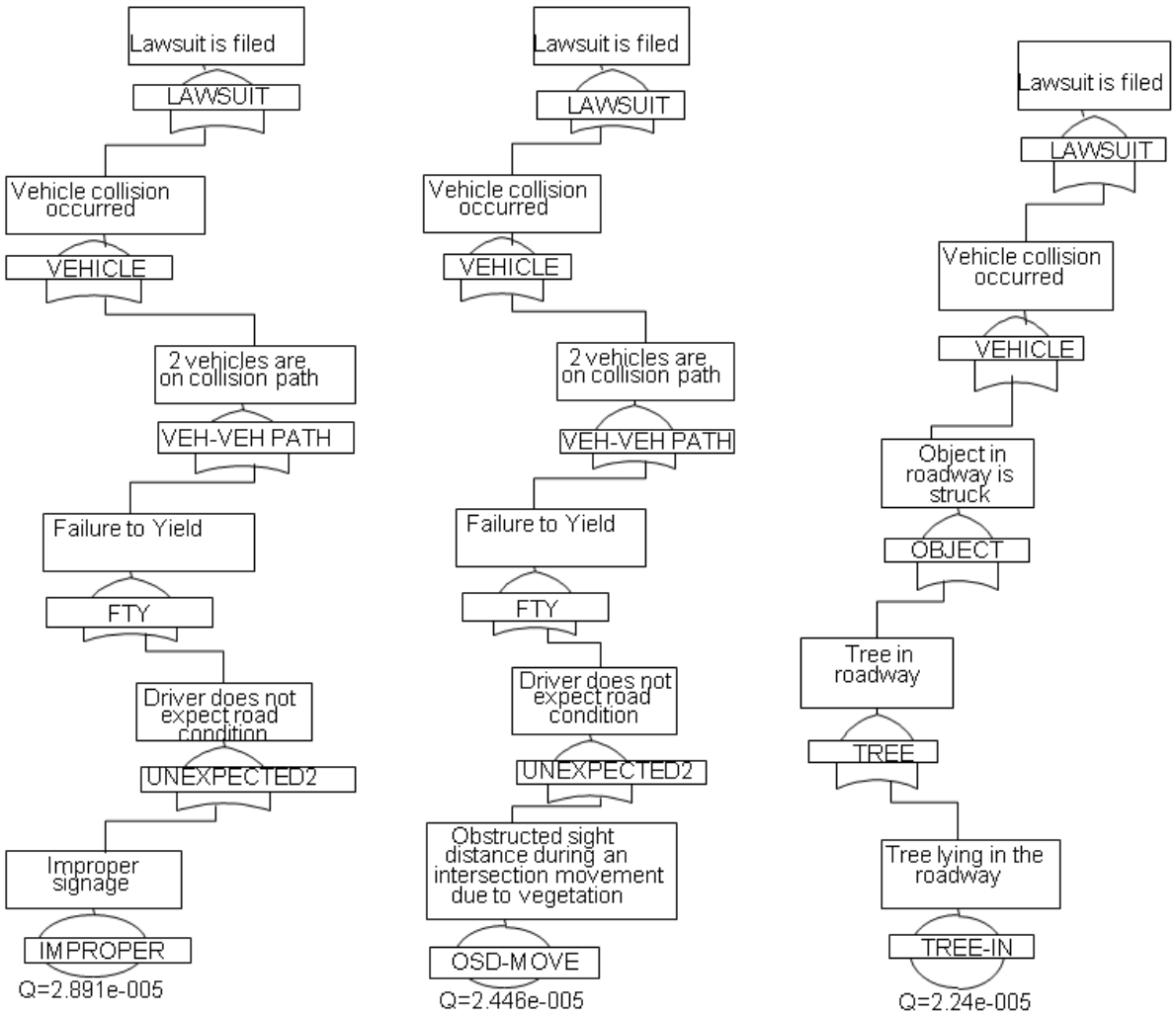


Figure 37 4th, 5th, and 6th Most Probable Minimum Cut Sets

Figure 37 show the 4th, 5th, and 6th most probable minimum cut sets. The minimum cut set for "improper signage" shows that improper signage and trees in the roadway are 2 of the most probable series of events that lead to a lawsuit. The "improper signage" cut set shows that improving signage at intersections or incorporating warnings through efforts such as pavement markings could be an effective countermeasure for reducing lawsuits.

Basic Event Probability Assumptions for Claims Fault Tree:

MAP -Maintenance Assessment Program
50% of property damage only vehicle collisions go unreported-NHTSA

Utility Damage Probabilities: (Basic events are in bold)

Utility owner files claim: Expert opinion.

ROW mowing: Miles of ROW mowed from maintenance records (assumed 57% of mowing was contracted). Assume average 25' of EOP mowed on both shoulders to get centerline miles of road mowed.

Utility in work path: Amount of ditch cleaning, new signs installed-maintenance records. Assume 1 pedestal on average per mile of mowed shoulder.

Post Install: Maintenance records.

Ditch work: Assume average segment of roadway has 2 ditches. Ditch work-maintenance records.

Trip/fall Probabilities:

Claim is filed: Assume 1500 elderly (45+) pedestrians injured each year in SC-NHTSA.

Identification: Assume 1/500 pedestrians would not identify 2" vertical displacement in sidewalk. Assume probability of traversing a 2" vertical displacement without notice of it is ~0 based on peer reviewed study.

Drain structure: Assume 10% of catch basins are in potential pedestrian walk paths and 4.31% are broken-MAP report

Surface defect: 7.02% of sidewalks have defect-MAP report.

Landscape Work Leads to Property Damage:

Work: One fourth of secondary road shoulders and one half of primary road shoulders have property susceptible to damage within 100' of ROW work.

Throw: Assume routine ROW vegetation work with mower is conducted 7 months out of the year - maintenance vegetation manual. Assume .5 of thrown object damages are reported as claims.

Flooding Damage:

Structure clogged: 48% of drainage structures (driveway, cross line, and miscellaneous drainage structures) clogged-MAP report.

Rain: Assume 25 year storm needed to cause flood damage

Property damaged and claim is filed: Assume amount property damaged claimed is amount caused by SCDOT structures

Tree Crew Causes Property Damage:

Crew error: Number of trees removed-MAP report

Work is in proximity of property susceptible to damage: Property within 100' of tree removal is susceptible. Number of trees removed-MAP report.

Vehicle Damage:

The crash database was used extensively for the following events, in order to estimate the number of vehicles that hit certain "defects" but did not file claims. Queries in the crash database were made using the "causal factor" and "sequence of events" data fields. Expert opinions include the state and assistant state maintenance engineers.

Claim is filed: 50% of property damaged vehicles are reported to crash database.

Evasive action for object: Statewide VMT from FHWA, # of vehicles that hit objects from claim and crash database

Evasive action for object hits vehicle: Statewide VMT from FHWA, # of vehicles that were hit by debris from claim and crash database.

Tree/limb falls in roadway: 98% of fallen trees removed in maintenance record fell in roadway and were a in the roadway for 2 hours
Metal plate: Assume there are 100, 1 lane mile road segments with a metal plate being used at any given time on SCDOT system.
Insufficient slope: Assume .5 of road segments with PQI of poor have conditions that would lead to water being held on road-MAP report and expert opinion.
High shoulder: Assume can lead to water on road.
Veh/mower throws objects: Assume mowing operations take place 7 months of year.
Unknown debris in roadway: Assumed 1% of debris on roadside was a hazard in the roadway for a significant amount of time - debris # from MAP report
Tree/limb falls in road: 98% of fallen trees removed - MAP report.
Drainage structure defect: Broken catch basins - MAP reports.
Sign post stub: Assume 1/5 temporary posts are left with a stub above the ground which represents a hazard within 10' along shoulder
Tar asphalt: Assume related operations (chip sealing) take place 40 weeks out of the year.
Broken curb: Map report.
Surface defect: Road segments that need pothole and patching - MAP report.
Broken edge: Assume 50% of segments with low shoulder have hazardous broken edge.
Paint: Assume paint operations take place 40 weeks a year and assume average of 4 lf of pavement markings are place for every lf of road centerline.

Spatial Data Analysis

As discussed in the methods section, ArcGIS was used to run several analyses on spatially located claims. Thematic maps based on the type of claim, claim amounts, and settlement amounts were generated and reviewed for spatial trends that may not be observable in descriptive statistics and other non-spatial analyses.

Originally, the legal database was queried for the most recent 300 closed lawsuits and 3000 damage claims prior to May 2010. However, not all lawsuits and claims were spatially located. Due to limited location data available in the electronic database and paper files, only 1159 damage claims were successfully located spatially. The lawsuit data contained only a handful of cases with readily available location data and thus no spatial analyses were run for lawsuits. The lack of location data must be resolved in any future enhancements to the tort liability process. The effectiveness of this and other analysis methods were significantly reduced. In addition, the amount of time expended to obtain location data from paper files would make it impractical to repeat these tasks on a regular basis for implementation of a successful risk management program.

In addition to the overall lack of location data for claims and lawsuits, the accuracy of the data that does exist could be much improved. For example, when reviewing the geocoded locations of the claims, the research team noted that most were located at intersections or within 10 to 20 yards of an intersection. Few claims were located in the midblock segment portions of the roadway network. After spending a day with one of the Richland County claim investigators, the reason for this was evident. The current route mile point log has mile point information for intersections and midblock locations would have to be estimated using measuring wheel or odometer. Further, the claim asks for the information to the closest intersection. The intention of this is to enable the public to provide a route and intersection, then the claim investigator would need to provide a more thorough location using county-route-mile point or GPS coordinates. However, most of the investigators are tagging the location to one side or the other of the closest intersection. Figure 38 shows an example of this phenomenon.

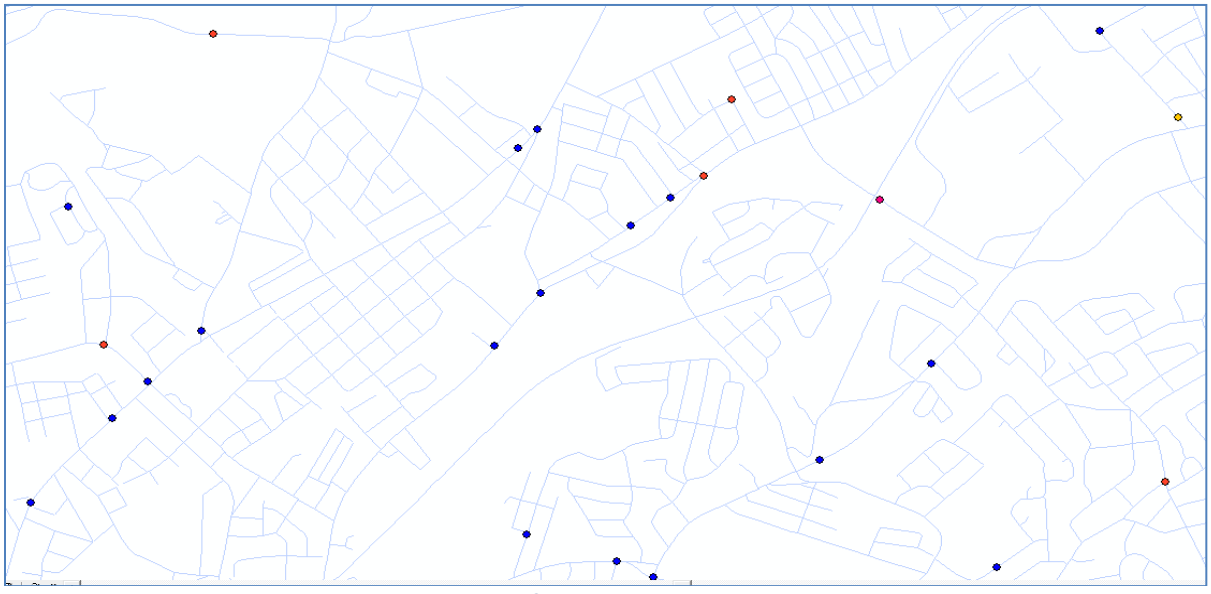


Figure 38 The Majority of Claims Are Located At Intersections

Because such a limited sample did have location data (less than 40% of the total claims), researchers tested for underlying biases in spatial data availability using a Microsoft Excel-based chi square

probability test. The chi-square tests were conducted on distributions of data – either proportion by type of claim, or proportion by district. Both tests were run to test whether the proportions of samples with and without location data are similar. If so, then the lack of location data is randomly distributed and affects all types of claims and all districts equally, and the sample of claims with locations would be considered representative of the whole data set. However, if the proportions are significantly different and one or more types or districts have fewer claims with locations, then the outcome could be biased. The first test checked to make sure the proportion of claims by type were similar for all claims versus claims which had been spatially located. The following are the null hypotheses:

- Null hypothesis (H_O): There is no difference in the distribution of claims by type between claims with location data and all claims
- Alternate hypothesis (H_A): There is a difference in the distribution of claims by type between claims with location data and total claims

Test result: At a 5% confidence interval, there is significant evidence to conclude that there is no difference in distribution of claims by type between claims that are spatially located and total claims. In other words, it is determined that the claims with location data when divided by their type are representative of the entire database.

Table 21 Excel Based Chi Square Probability Test To Test for Biases In Spatial Data Availability of Claims By Type

	Classification by type				
	1	**2**	**3**	**4**	**5**
% of Claims located spatially	27.18	65.92	0.00	1.73	5.18
% of Total claims	27.36	61.95	0.10	2.33	8.26
Chi test probability	**0.7967**				

The test results, shown in Table 21, indicate that at a 5% confidence interval, there is significant evidence (~80% probability) to conclude that there is no difference in distribution of claims by type between claims that are spatially located and total claims. In other words, it was determined that the spatially located data by claim type is representative of the entire database.

A similar test was conducted to see if there were any underlying biases based on region within the state. As there are fewer claims within each county, the research team consolidated the claims based on districts to check for existing biases in spatially located data. The following are the null hypotheses:

- Null hypothesis (H_O): There is no difference in the distribution of claims by district between claims that are spatially located and total claims
- Alternate hypothesis (H_A): There is a difference in the distribution of claims by district between claims that are spatially located and total claims

The test results indicate that at a 5% confidence interval, there is significant evidence to conclude that there is a difference in the distribution of claims by district between claims that are spatially located and total claims. In other words, it is determined that the spatially located data is *not* representative of the entire database by district. Table gives the differences between the percent of spatially located claims and total claims by district. Columbia, Greenwood, Florence, and Orangeburg districts are well represented by the spatially located claims. That is, their number of spatially located claims is within +/- 6% of their total percentage of claims. The differences highlighted in yellow show that Charleston is over

represented while Greenville and Chester are underrepresented. The spatial distribution of claims by district is presented in Figure 39. Note that the districts in the upstate (Greenville, Chester, and Greenwood) are sparsely represented. Only 78 claims out of 1,001 claims in these districts had location information.

Table 22 Distribution of Spatially Located Claims and Total Claims By District

District code	District name	Claims located spatially	% located	total claims	% total	% difference
1	Columbia	382	32.96	893	29.77	3.19
2	Greenwood	40	3.45	167	5.57	(2.12)*
3	Greenville	22	1.90	438	14.60	(12.70) *
4	Chester	16	1.38	396	13.20	(11.82) *
5	Florence	176	15.19	294	9.80	5.39
6	Charleston	360	31.06	542	18.07	12.99
7	Orangeburg	163	14.06	269	8.97	5.10

* percent of spatially located claims is less than the percent of total claims

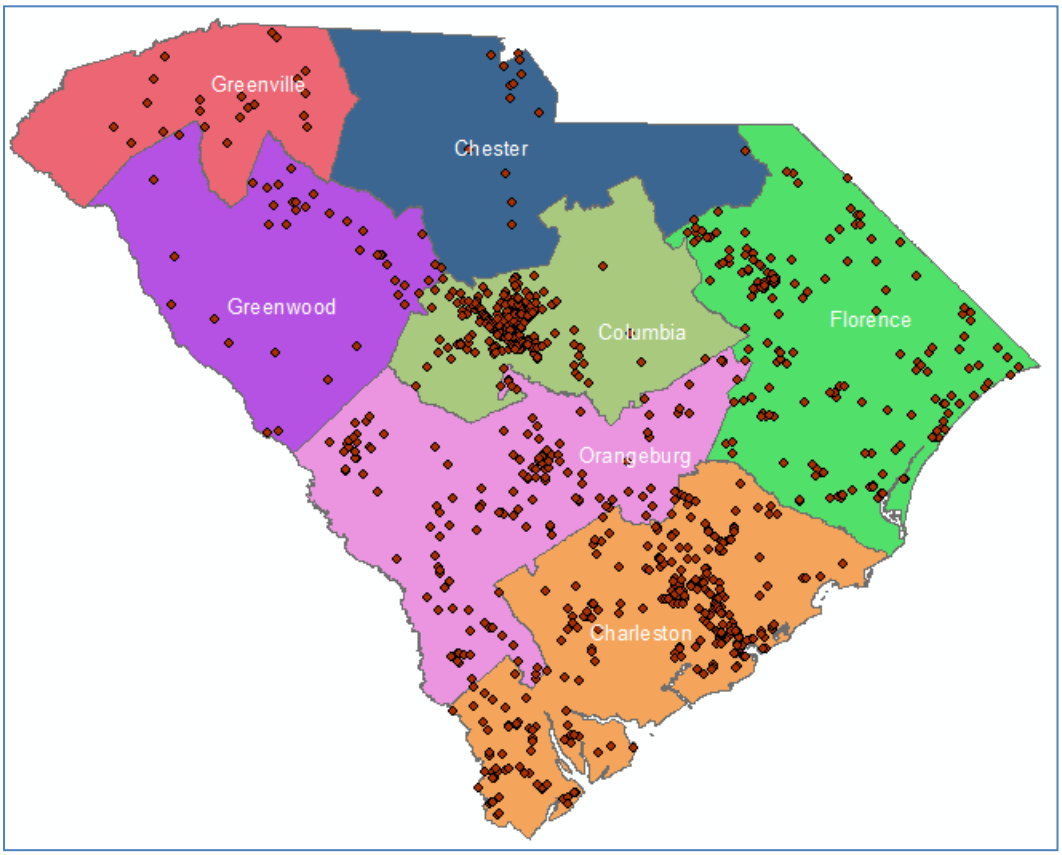


Figure 39: Location of Claims By District

From the above discussion, it is evident that there could be potential biases in the spatial data analyses. More claims were spatially located in the Charleston district than the state average and this overrepresentation is reflected in thematic maps. However, overrepresentation should not affect the ability to discern spatial patterns, while underrepresentation in spatial analysis could most likely lead to

undiagnosed patterns that really do exist. Unfortunately, nothing could be done to address this bias rather than to either include more data (which is not available at this point) or to generate and use a subset of the available data to reflect the actual percentages of total claims. A smaller sample size might not be representative of the true spatial trends and therefore, this bias is not addressed in this project.
All of the spatially located claims were classified by type based on the reclassification scheme. Each type is presented in the next several graphics with detailed insets as necessary. Table 23 gives the description of each claim type along with the number of claims located in each category.

Table 23 Descriptive Statistics of Spatially Located Claims By Type

Claim type	Description	# of claims
Type 1	Claims due to collision with a non-fixed object	315
Type 2	Claims due to collision with a fixed object	764
Type 3	Non-collision vehicle related claims	0
Type 4	Non-collision pedestrian related claims	20
Type 5	Non-collision property related claims	60

As noted earlier, the majority of the claims are due to collision with either fixed or non-fixed objects. There are no non-collision vehicle related claims, and very few non-collision pedestrian and property related claims in the spatial data set. Figure 40 spatially portrays all claims by type.

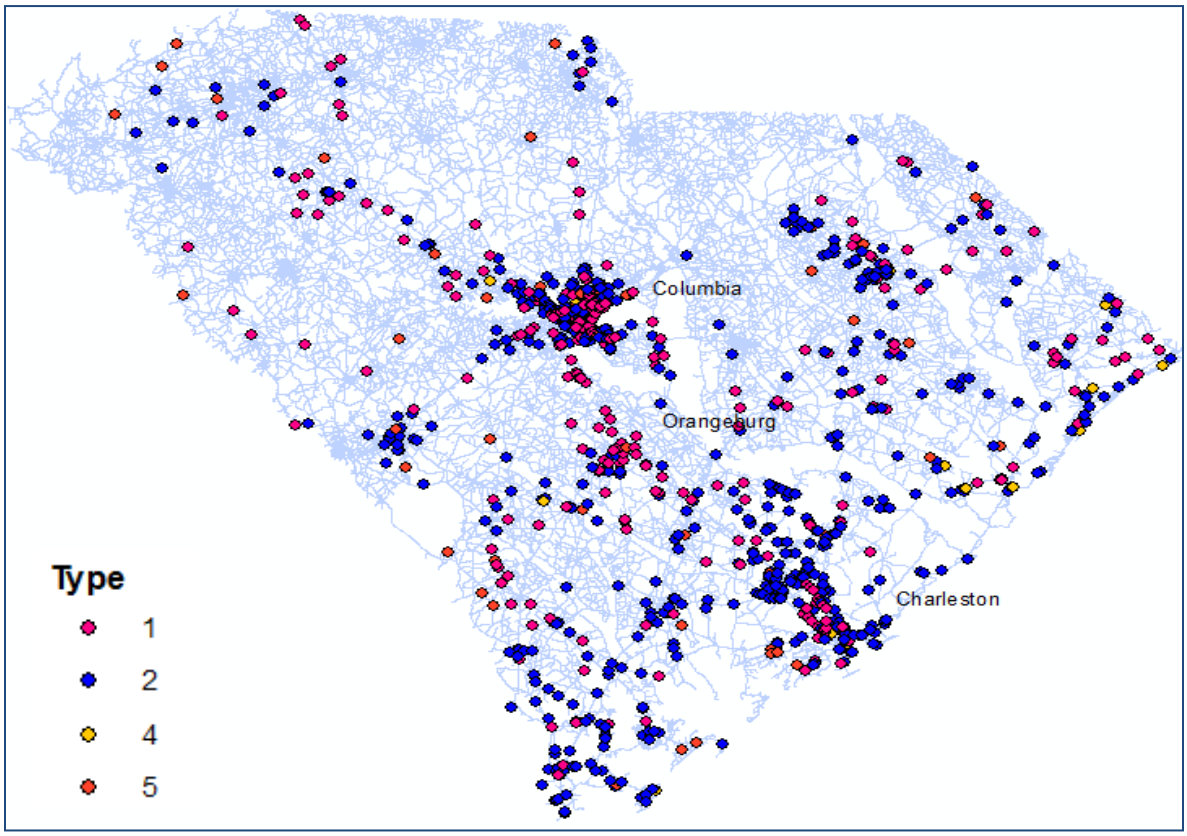


Figure 40: Claims in SC By Claim Type

Analyzing claims by claim amount, there were more claims with smaller claim amounts. And more of these claims were concentrated in highly populated areas including Columbia, Orangeburg, and Charleston. Figure 41 identifies claims by claim amount.

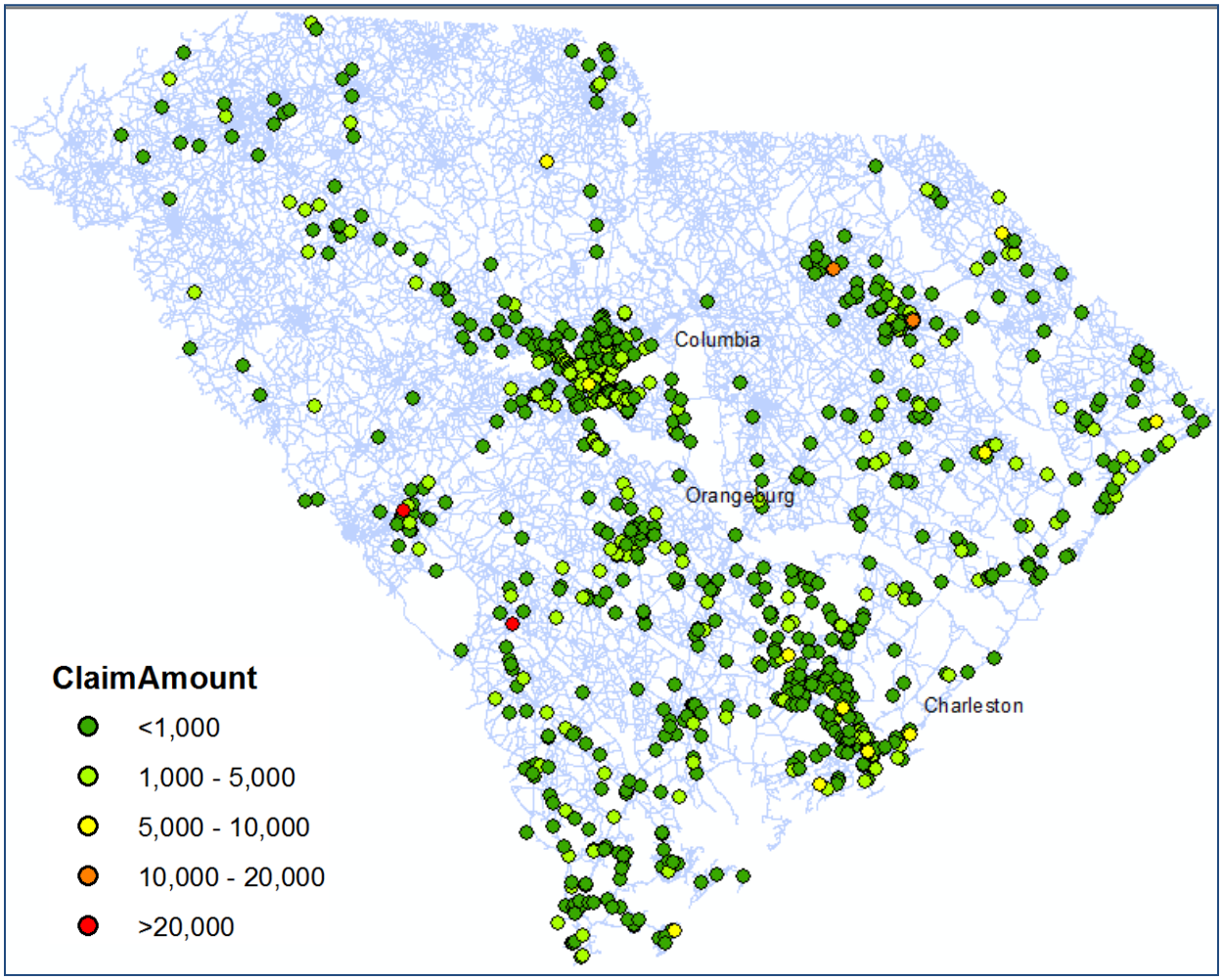


Figure 41: Claims By Claim Amount

Of the 1159 claims that were being analyzed, SCDOT denied payment for 792 claims, which is over two-third of the claims in this sample. This is consistent with the full 3-year sample. These unpaid claims were found to be concentrated in highly populated areas. Even though most of the claims are not paid, the average settlement amount for paid claims was $457 which is considerably less when compared to the average claim amount of $802 requested by the claimant. Figure 42 identifies all unpaid claims in the state.

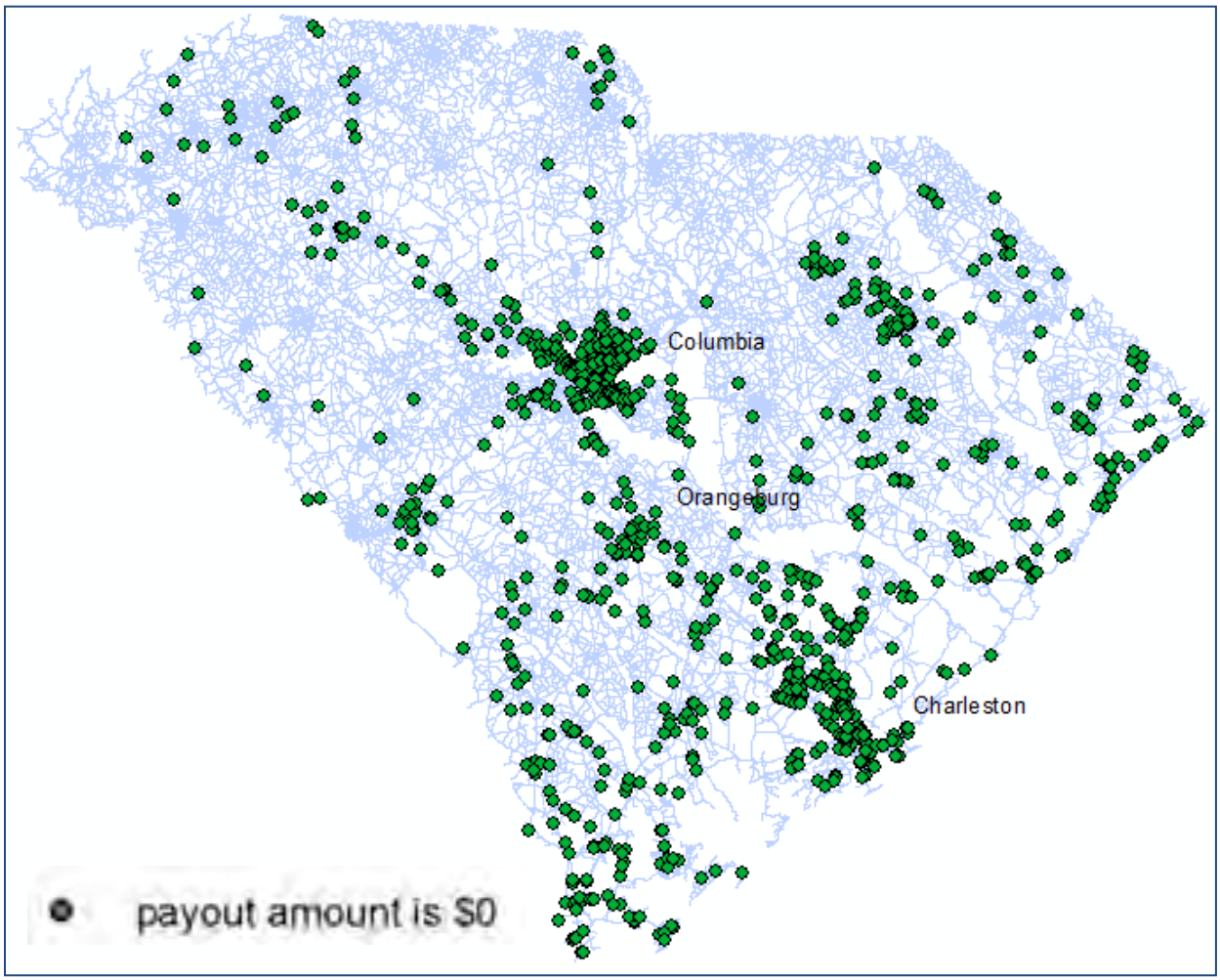


Figure 42: Unpaid Claims

Spatial analysis of the paid claims resulted in slightly different results. Paid claims were scattered across the state with relatively more paid claims in the Columbia and Charleston regions. The Columbia region had higher payout claims compared to any other region in the state. Figure 43 shows the paid claims by settlement amount.

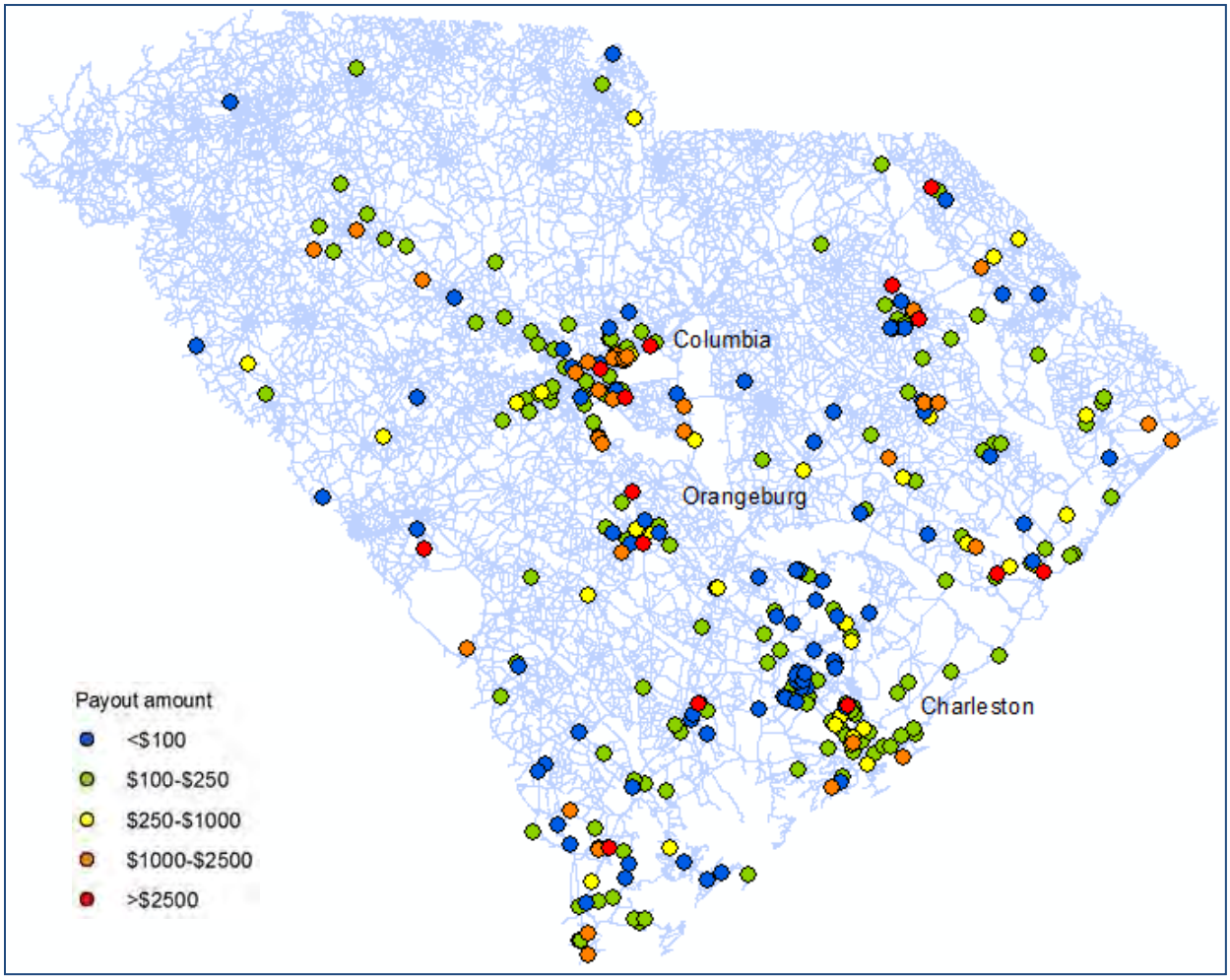


Figure 43: Paid Claims

Over 50% of spatially located claims (615 out of 1159) were pothole related. A majority of the pothole related claims were from the Columbia and Charleston regions with a considerable number of them in the south eastern part of the state. Figure 44 gives the location of all pothole related claims in South Carolina with a separate coding for those claims related to potholes on the edge of the shoulder.

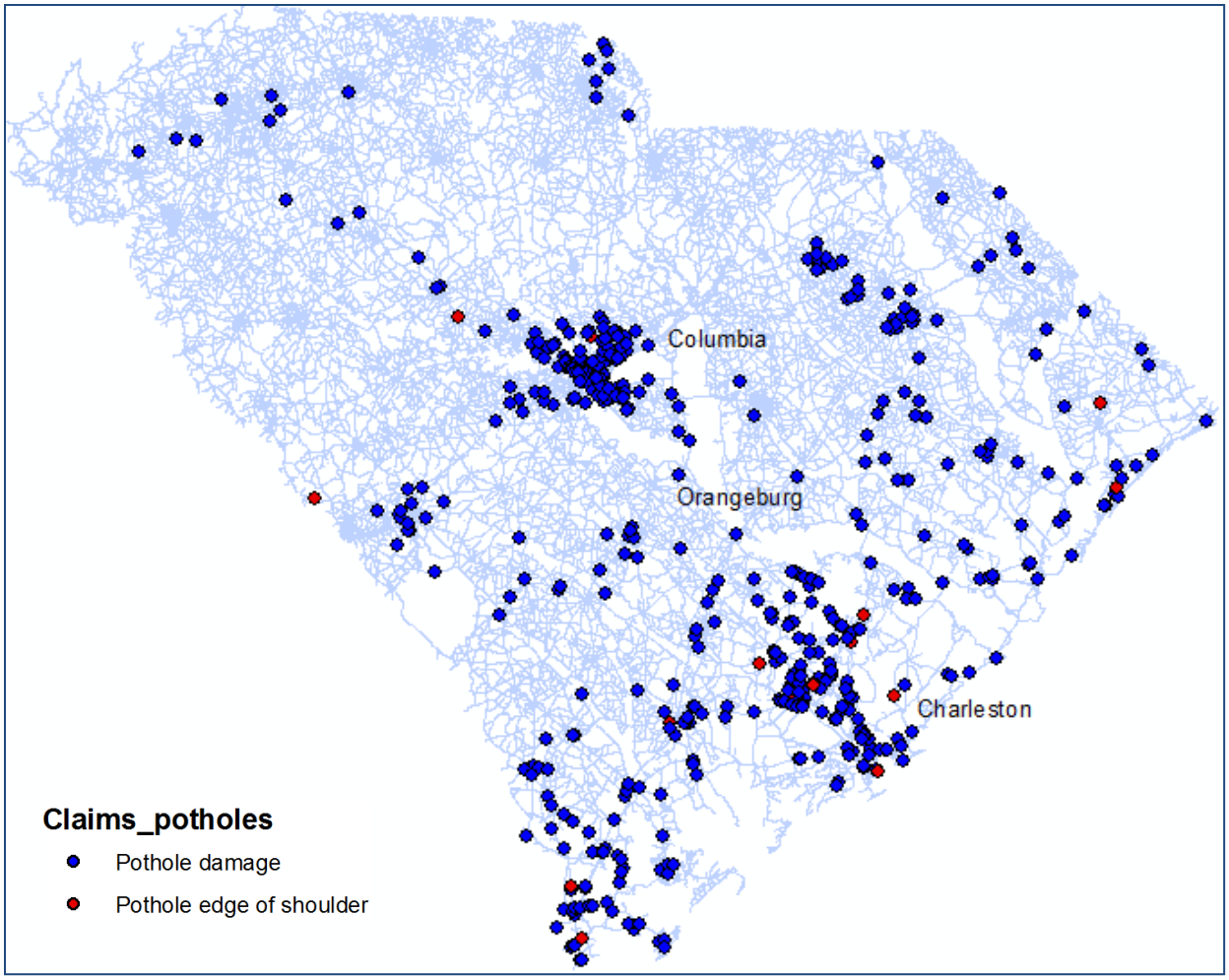


Figure 44: Pothole Related Claims

Claims that were classified as type 1 – claims due to collision with a non-fixed object were grouped as per Figure 2 to reduce the complexity of the colors in the legend. The resulting spatial representation is shown in Figure 45. Debris and paint were found to be the two most frequent reasons for filing claims. The Orangeburg region had the maximum number of paint splatter related claims. Debris was an issue in both Columbia and Charleston regions particularly along I-26 and I-77 corridors (See Figure 46). Using the spatial relationships shown here, SCDOT could likely reduce debris related claims by targeting debris clean-up on roadways with frequent debris claims. In addition, Orangeburg is shown to be overrepresented in paint splatter claims (this was also noted in the descriptive statistics). Thus marking operations in Orangeburg should probably be reviewed. Also, substantial number of tree and asphalt related claims were scattered across the state.

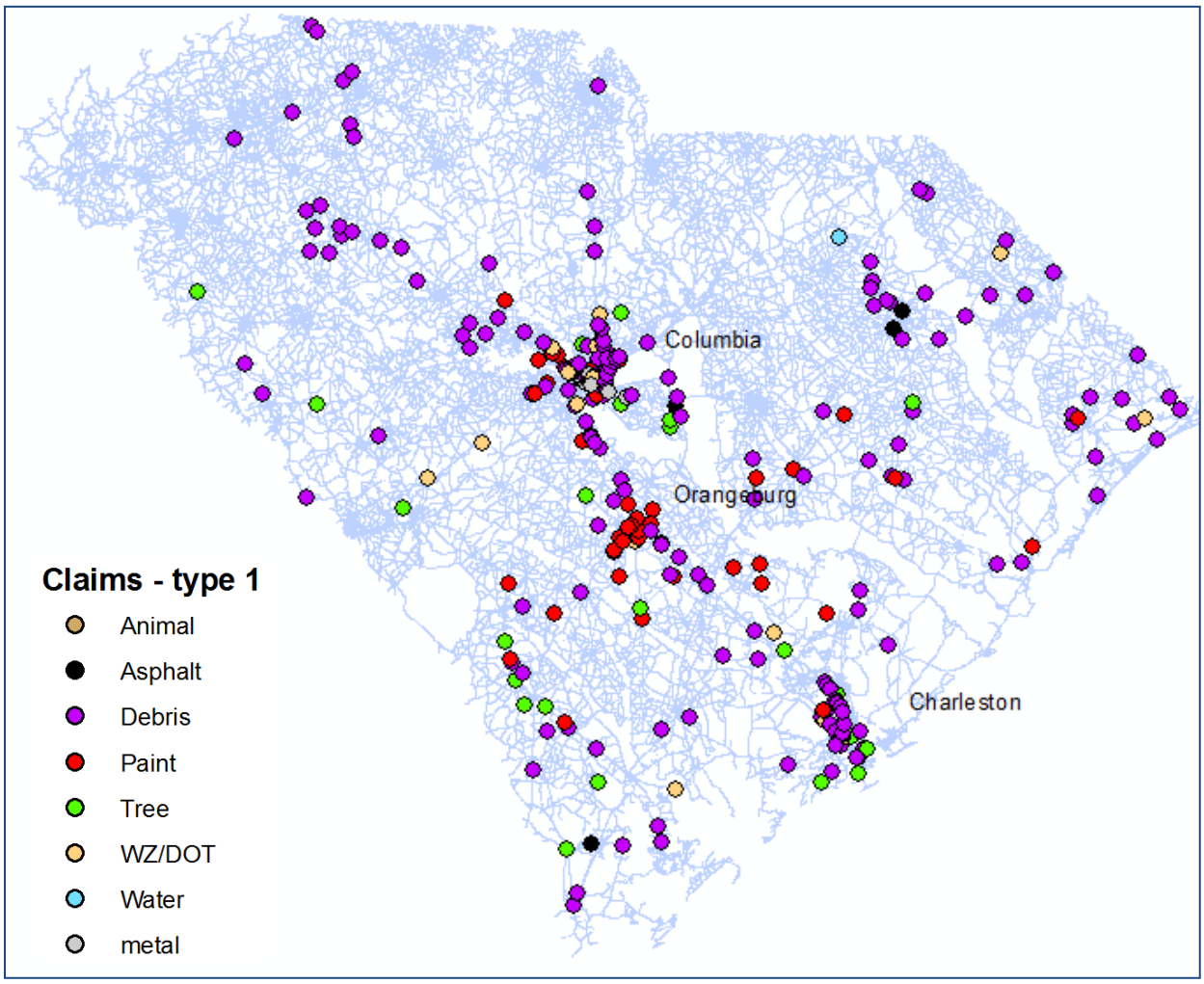


Figure 45: Claims Classified As Type 1 - Claims Due To Collision With a Non-Fixed Object

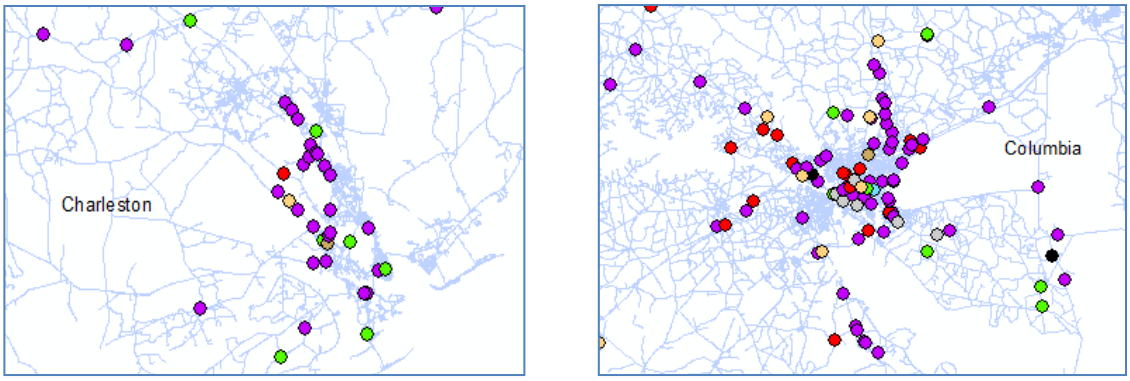


Figure 46: Linear Patterns of Debris Claims in Columbia and Charleston

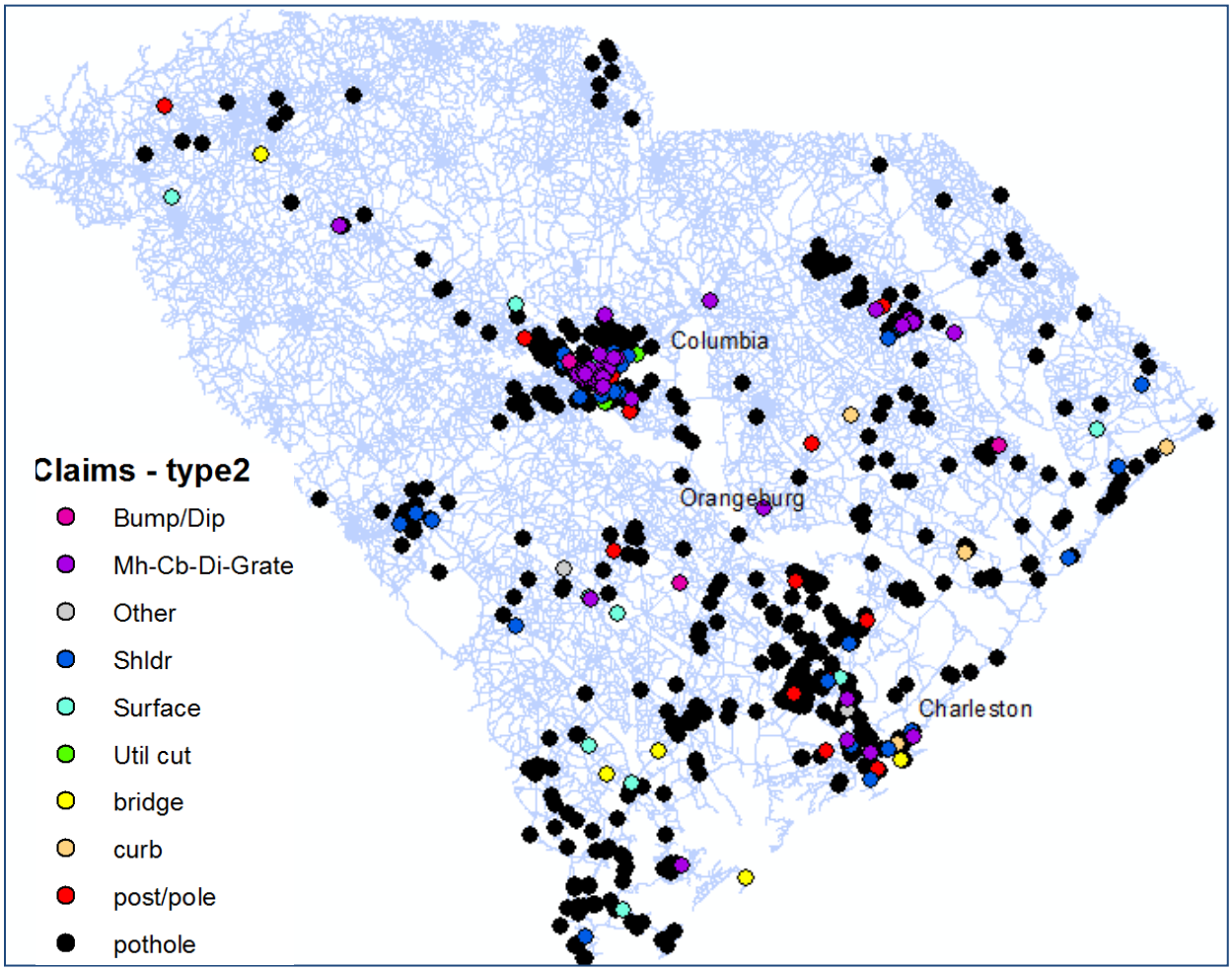


Figure 47: Claims Identified As Type 2- Claims Due To Collision with a Fixed Object

Claims that were identified as type 2 – claims due to collision with a fixed object were grouped as per Figure 2 and are shown in Figure 47. A majority of type 2 claims were pothole related. Fewer numbers of type 2 claims were associated with interstates. This is likely due to increased maintenance inspections and larger roadside clear zones on higher classification facilities. The majority of type 2 claims were located in the urban areas of Columbia and Charleston. Second to pothole related claims, claims due to mh-cb-di-grate and shoulders were more frequent. Shoulder related claims were distributed across the entire southeastern region of the state while claims due to mh-cb-di-grate were more concentrated in the Columbia area as shown in Figure 48.

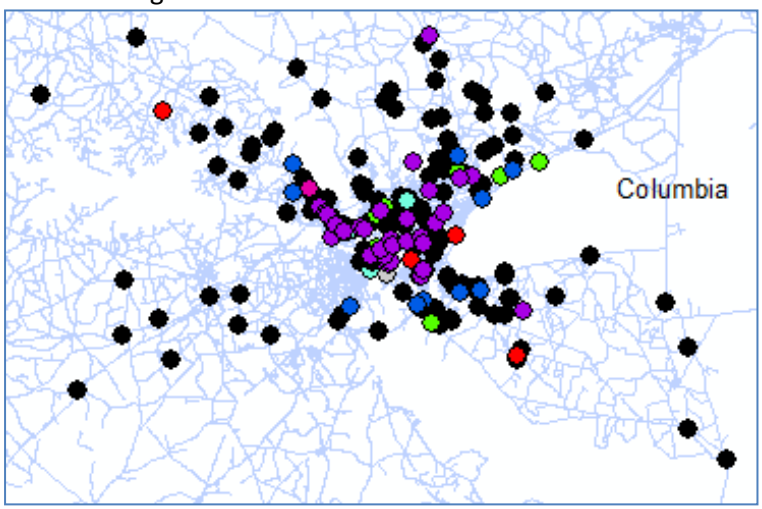


Figure 48: Type 2 Mh-CB-Di-Grate Claims In Columbia

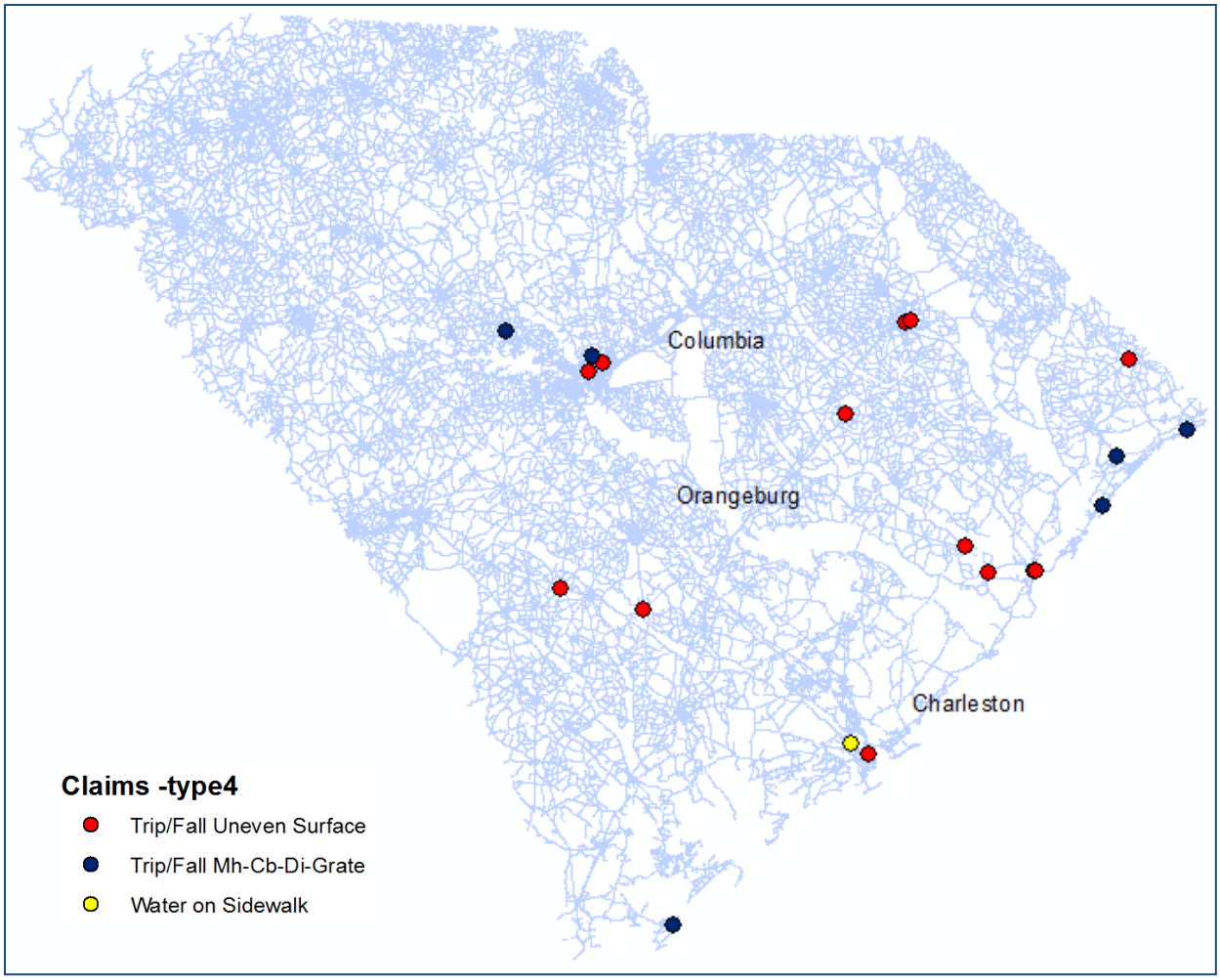


Figure 49: Claims Identified As Type 4- Non-Collision Pedestrian Related Claims

Due to the limited sample size of type 4 and 5 claims, not much in the way of patterns were identified. Type 4 claims were pedestrian related non-collision claims and are shown in Figure 49. They were very few in number (20 claims) with no clear spatial pattern. Claims due to uneven surface were more predominant in this category. Figure 49 spatially identifies these claims.

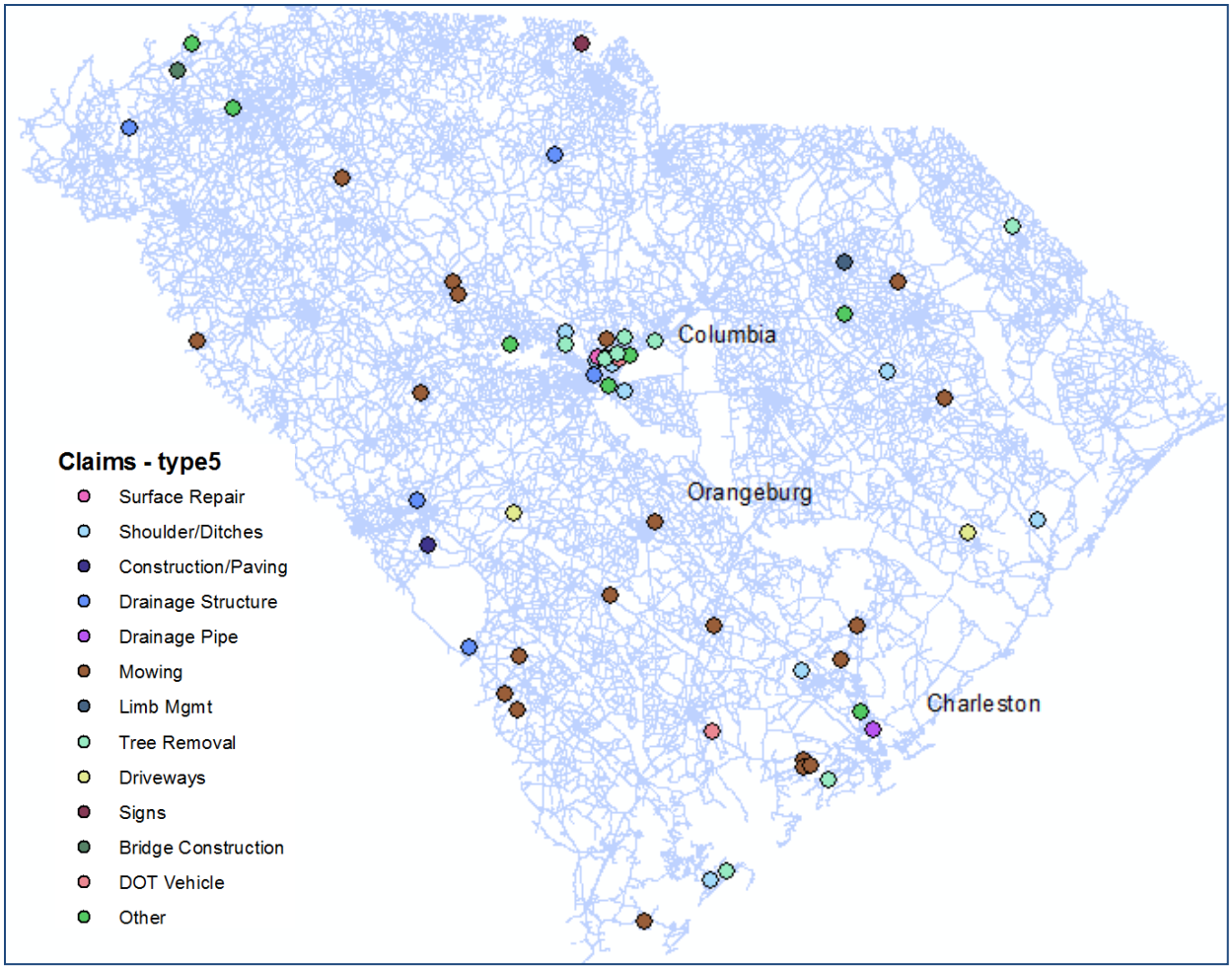


Figure 50: Claims Identified As Type 5- Non-Collision Property Related Claims

Claims that were identified as type 5 – non-collision property related claims were grouped as per Figure 2 and are shown in Figure 50. Type 5 claims were scattered across the state with a substantial number of claims concentrated in the Columbia region. The Columbia region had claims relating to shoulder, surface, and tree. Mowing related claims were also frequent but were scattered across the state with no underlying pattern.

Cost of Tort Liability

The following sections present both benefit-cost analysis and cost-analysis related to tort claims and lawsuits. The benefit cost analysis section includes countermeasures related to potholes and shoulder elevation difference claims/lawsuits. The cost analysis section includes causal factors for which benefit-cost values could not be estimated due to the lack of data or the nature of the recommended countermeasures which made it too difficult to relate incremental costs to incremental benefits. These causal factors are mainly related to maintenance and inspection schedules.

Benefit-Cost Analysis

To evaluate the effectiveness of safety improvements for the traveling public, departments of transportation (DOTs) nationwide have routinely conducted benefit cost analyses to determine if implementation of safety measures would provide enough benefit to at least equal the cost of the highway improvement. The benefit cost analysis provides information on the amount of return for every

dollar spent. These analyses are also beneficial to DOT's by allowing them to set priorities for road safety countermeasures, which will in turn reduce the risk of tort liability resulting from alleged roadway defects.

Like DOTs in the other 49 states, the safety of the traveling public is an important objective of the South Carolina Department of Transportation. This section presents a benefit cost analysis for different safety improvement measures that have the potential to reduce tort liability for the SCDOT. These measures are related to corresponding countermeasures for different causal factors associated with claims and lawsuits. For this analysis, the administrative cost components associated with claims and lawsuits, including field review and investigation, data entry, preparation and mailing letters, and review of documentation, were estimated by the SCDOT Office of Legal Services. After a review of records, the average administrative cost was calculated to be $440.30 per claim and $1,916.8 per lawsuit, including county, district and state level expenses. To calculate the annual administrative cost, these amounts were multiplied by the total number of claims and lawsuits filed against SCDOT respectively. This cost was considered regardless of whether or not the claims and lawsuits were either paid or denied because all required processing. The annual average payout amount per claim or lawsuit was calculated for paid claims and lawsuits only. Unfortunately, the research team had no information on costs associated with IRF labor, rather only the settlement or payout amounts for approved damages or injuries. Total IRF costs as well as settlement/payout amounts should be captured in a future system to allow for a full accounting of associated tort costs. Figure 51 illustrates a comparison between claims and lawsuits with regard to total settlement amount and processing costs. Although the total settlement amount of lawsuits for three years is much higher than claims, the processing cost of claims for the same period is twice as much as the total processing costs associated with lawsuits.

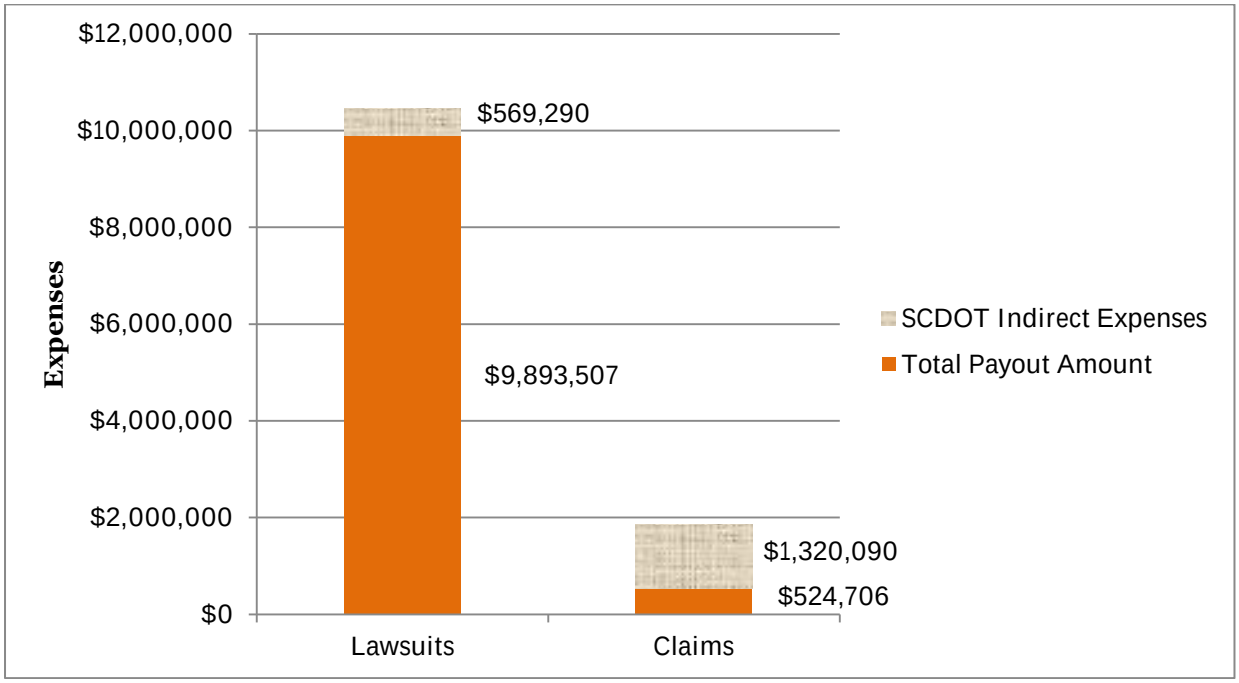


Figure 51 Total Payout Amount and Indirect Costs For Claims and Lawsuits

In order to incorporate reduction in accident costs into the analysis, Crash Modification Factors (CMF) were selected from the following sources: the Highway Safety Manual, National Cooperative Highway

Research Program (NCHRP) research result digest 299, Kentucky Transportation Center research report KTC_96_13 and the CMF Clearinghouse web site maintained by the Federal Highway Administration. The following section lists a summary of benefit cost analyses of countermeasures for different causal factors that minimize the risk of claims and lawsuits against SCDOT.

Causal Factor: Pothole

The following assumptions and data were used in estimating a benefit cost ratio for pothole patching:

- Crash data were collected from the crash database during the 2007-09 period using contributing factor code 34 from the SC crash database: rut, holes and bumps.
- The recommended countermeasure considered for potholes involves doubling the number of current inspections annually for different functional classes. It was assumed that cost increases will only be incurred from additional inspections. Patching costs will remain unaffected by the increase in the number of inspections per year, since the recommended inspection schedule will be applicable to the same number of potholes, compared to the current schedule.
- According to data provided by the SCDOT maintenance office, the current regular inspection schedule for maintenance crews for different roadway functional classes is as follows:
  Interstates are inspected monthly, primary routes are inspected once every six months, and secondary roads are inspected once per year. It is assumed that if the frequency of inspection is doubled annually, the number of pothole related claims/lawsuits and crashes will decrease by 50%.

Table 24 Number and Cost of Pothole Related Crashes by Severity Level 2007-2009

Injury scale*	Year	Number of injuries, fatalities & PDOs		
	2011[1]	2007	2008	2009
K	$6,079,365	1	0	1
A	$421,363	4	0	2
B	$83,853	7	1	9
C	$44,023	9	3	3
0	$4,193	13	23	28
Total		34	27	43
Total crash cost per year		$8,802,504.00	$312,361.00	$7,926,241.00
Total # of crashes per year		17	19	22
Average cost per crash		$517,794.35	$16,440.05	$360,283.68
3 year average cost/crash		**$298,172.70**		

*Injury Scale: K=fatality, A=Incapacitating Injury, B=Non-Incapacitating Injury, C=Possible Injury, O=No Injury

Table 25 B/C Ratio for Pothole Patching

Pothole Patching	Benefit								Total Cost ($)	Benefit-Cost Ratio
	number of related crashes/ year	CMF			Benefit from Crash reduction/ year ($)	Payout/ Year ($)	Administrative Cost /year ($)	Total Benefit ($)		
		FHWA	KTC	Selected						
Secondary roads	7.33	0.95[2]	0.75[3]	0.75	273,200.74	110,396.4	56,543.86	440,141	45,388.20	**10**
Primary roads	9.30	0.95[2]	0.75[3]	0.75	346,624.95	26,272.8	36,082.46	408,980.21	22,403.83	**18**
Interstate	2.67	0.95[2]	0.75[3]	0.75	99,514.91	6,087.6	8,360.57	113,963.08	5,055.60	**23**

In Table 25 above, a distribution of route category has been considered to calculate the average number of crashes and the number of claims. Benefits from crash reduction were obtained by multiplying CRF=(1-CMF) by number of crashes per year. The average administrative cost is considered to be $440.30 per claim and average payout is $334 per claim.

[1] FHWA Publication No. FHWA-HRT-10-063, July 2010. National average Inflation Rate from 1999 to 2011= 2.38
[2] FHWA Clearing house, all types of crashes resulting in either serious injuries or fatalities; Roadway type: Not specified (reference: Abdel-Aty et al., 2009)
[3] KTC, All types of roads, and crashes & injuries on these roads, 1996

The benefit-cost ratios describe the amount of return for every dollar spent by SCDOT. The benefit-cost ratio on the interstate is higher (23) than primary (18) and secondary roads (10), which might be related to a reduction in the number of relatively severe incidents on interstates compared to primary and secondary roads.

Causal Factor: Low shoulder/Elevation difference

The following assumptions and data were used in estimating a benefit cost ratio for low shoulder and are outlined in Table 26-Table 28:

- Crash data have been collected during the 2007-09 period using contributing factor code 6: shoulders.
- Two different countermeasures have been recommended:
  - Shoulder improvement (primary and secondary roads)
  - Safety edge
- According to the SCDOT maintenance office, the statewide average cost for regarding/repairing the roadside shoulder is $0.26 per linear foot. The service life of regarding/repairing is assumed to be three years.
- According to the SCDOT maintenance assessment program, 3.79% of primary roads and 2.95% of secondary roads have low shoulder conditions which is assumed in this analysis. However, there was no record of percentage of interstates with low shoulders. Therefore, the interstates are excluded from this analysis.
- The average payout related to this causal factor is $346 per claim.

Table 26 Number and Cost of Low Shoulder Related Crashes By Severity Level 2007-2009

Injury scale	Year	Number of injuries, fatalities & PDOs		
	2011[1]	2007	2008	2009
K	$6,079,365	0	0	2
A	$421,363	2	0	0
B	$83,853	5	3	1
C	$44,023	3	1	0
0	$4,193	12	9	16
Total		22	13	19
Total crash cost per year		$1,444,376	$333,319	$12,309,671
Total # of crashes per year		15	12	9
Average cost per crash		$96,291.73	$27,776.58	$1,367,741.22
3 year average cost/ crash		$497,269.84		

Table 27 Low Shoulder Improvement Benefits

Benefit										
Countermeasures	Cost of crashes/mile of low shoulder/year	CMF				Selected CMF	Crash reduction benefit/ mile of low shoulder/ year	Administrative cost/mile of low shoulder /year	Average payout /mile of low shoulder / year	Total benefits /mile of low shoulder/year
		NCHRP	FHWA Clearing house	KTC	HSM					
Shoulder Improvement (primary)	$4,907.65	-	0.75[2]	0.75	-	0.75	$8,588.39	$7.76	$6.06	**$8,602.21**
Shoulder Improvement (secondary)	$2,698.3	-	0.75[2]	0.75	-	0.75	$3,170.50	$6.39	$5.02	**$3,181.91**
Safety edge (primary)	$4,907.65	0.943[3]				0.943	$1,958.15	$7.76	$6.06	**$1,971.97**
Safety edge (secondary)	$2,698.3	0.943[3]				0.943	$722.87	$6.39	$5.02	**$734.28**

Table 28 Low Shoulder Benefit-Cost Ratio

Cost		Benefit-Cost Ratio
Recommended Countermeasure	Cost/mile of low shoulder/ year	
Shoulder improvement on each side of the primary road	$458	**18**
Shoulder improvement on each side of the secondary road	$458	**6**
Safety edge for each side of the primary road[3]	$38.3-$153.2	**13-51**
Safety edge for each side of the secondary road[3]	$38.3-$153.2	**5-19**

Shoulder improvement is the most common treatment for eliminating low shoulder/elevation differences on different functional classes of roadway. The cost-benefit analysis in Table 28 show that every dollar spent on primary and secondary roads would save between 13 to 51 and 5 to 19 dollars, respectively in terms of administrative, pay out and crash cost, depending on the cost of recommended countermeasures, which ranges from $38.3 to $153.2.

Cost Analysis

The following section contains discussions on economic costs and possible countermeasures for different reported causal factors of claims and lawsuits for which a benefit cost analysis could not be calculated due to lack of required data. For these causal factors, current costs and low cost countermeasures are provided that are likely to reduce the risk of claims and lawsuits arising from these reported causes.

In this section, total settlement amount and average payout per claim and lawsuits are presented for different causal factors. As shown in Figure 52, the total settlement amount for pothole claims are twice as much as the total settlement amount for other causal factors due to the high number of pothole claims filed against SCDOT. However, Figure 53 shows that average payout per tree fell on car is highest among all other causal factors in terms of average payout per claim.

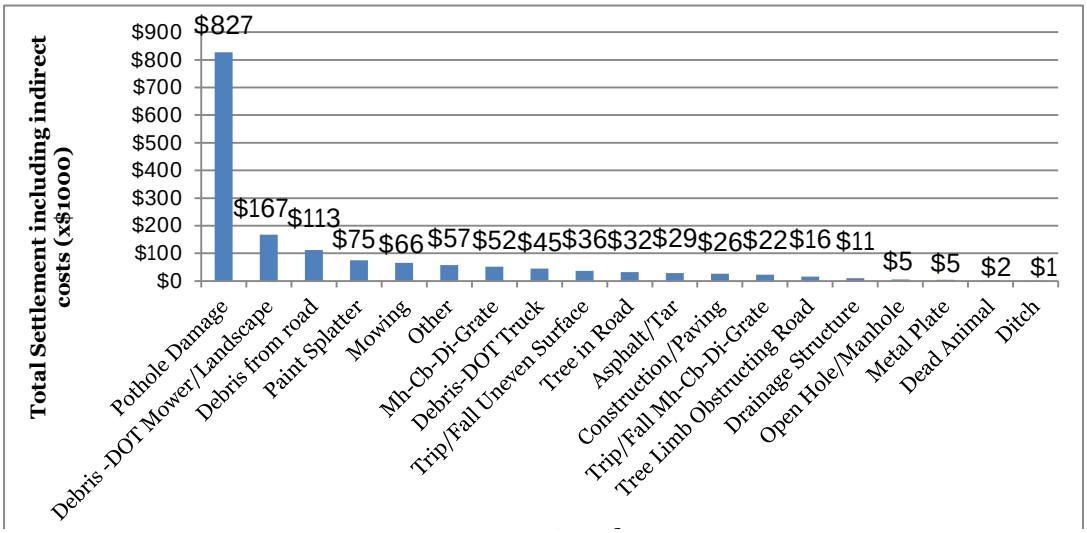


Figure 52 Total Settlement Amount For Claims (2007-2010) Based On Causal Factors

[1] FHWA Publication No. FHWA-HRT-10-063, July 2010. National average Inflation Rate from 1999 to 2011= 2.38

[2] Not rated _All types and severity of crashes _ Roadway type is not specified

[3] FHWA-HRT-11-024, March 2011, chapter 5 & 6

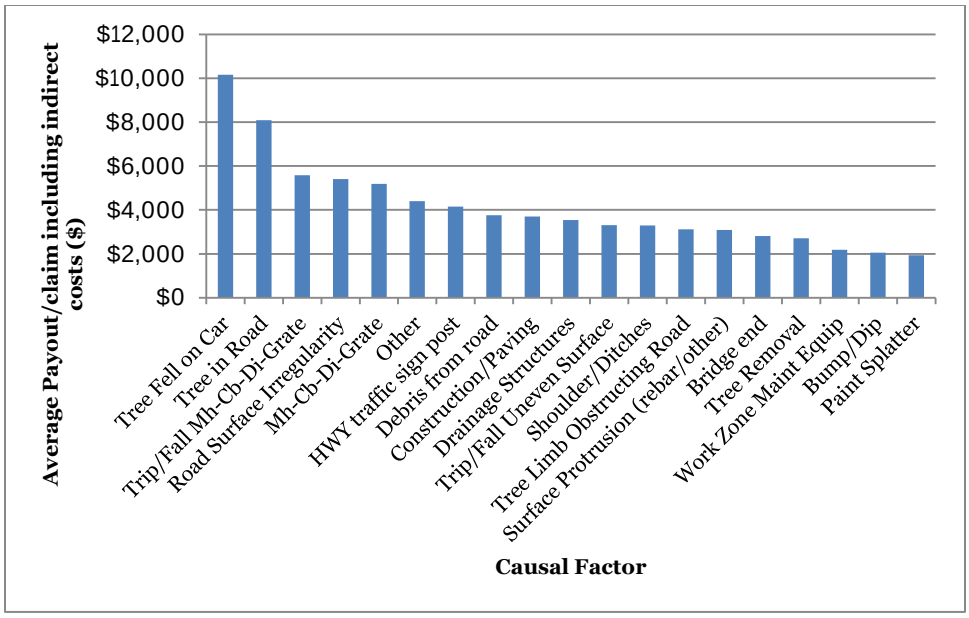


Figure 53 Average Payout Per Claim (2007-2010) Based On Causal Factor

Figure 54 and Figure 55 represent the total and average payout amount for lawsuits based on causal factors. Water on road surface lawsuits have resulted in the highest total payout compared to other causal factors while tree limb obstructing road and improper signage/no signage have the highest average payout among all other lawsuits.

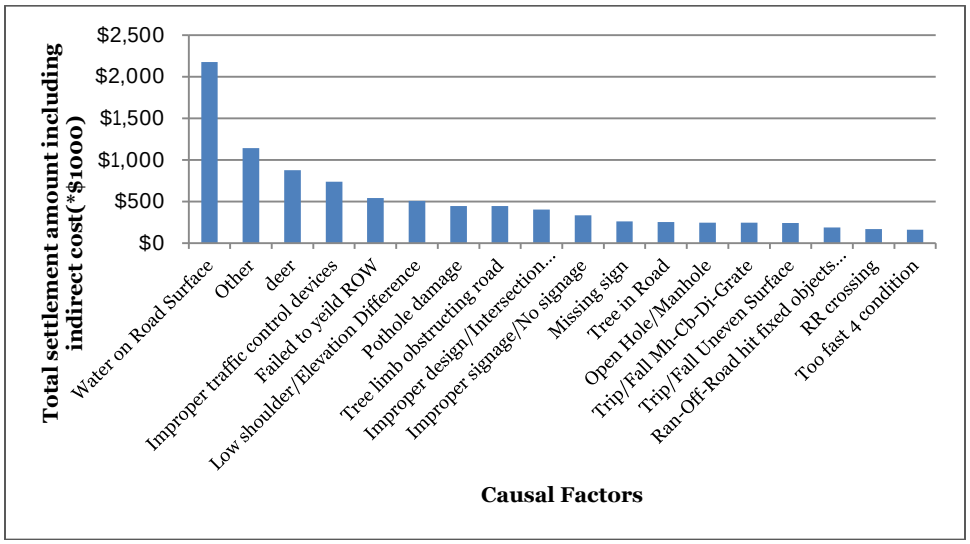


Figure 54 Total Payout Amount for Lawsuits (2007-2010) Based Causal Factors

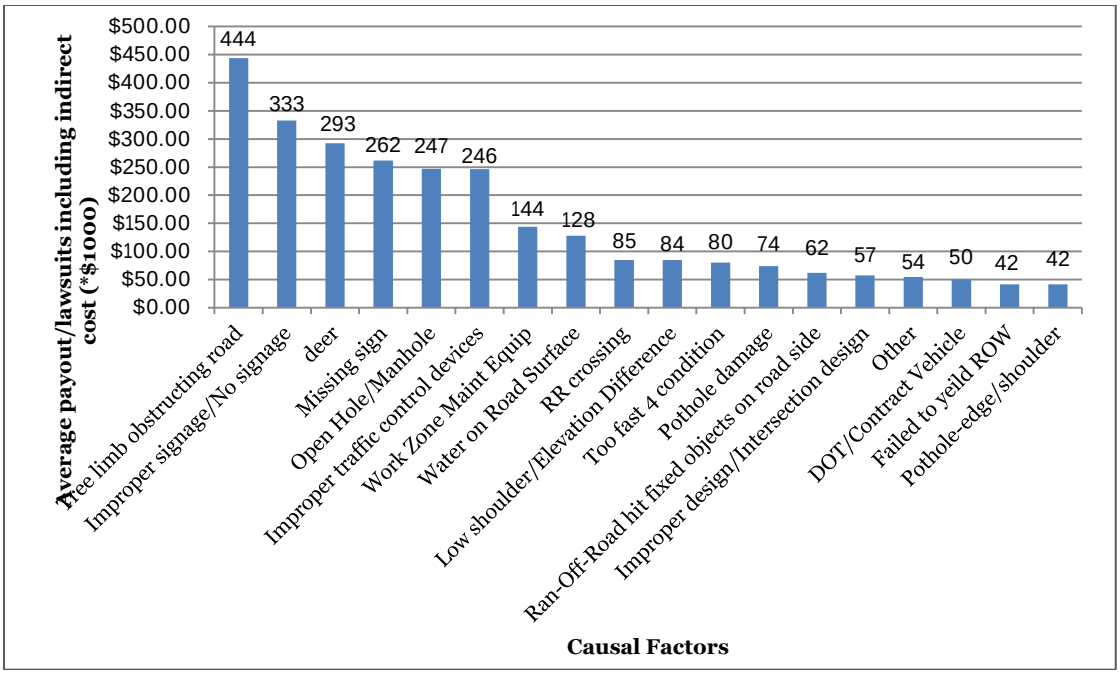


Figure 55 Average Payout Per Lawsuit (2007-2010) Based On Causal Factors

Tables 29 and Table 30 summarize the 10 most common causal factors of claims and lawsuits based on frequency, total settlement amount, and average payout. Indirect expenses associated to claims and lawsuits have been considered in the following tables. Table 31 shows the definitions of all the causal factors listed in Tables 29 and 30.

Table 29 Most Common Causal Factors for Claims (2007 to 2010)

10 most common sorted based on:		
Frequency	**Total settlement amount**	**Average payout**
Pothole damage	Pothole damage	Tree fell on car
Debris from road	Debris DOT Mower/landscape	Tree in road
Debris DOT Mower/landscape	Debris from road	Trip/Fall Mh-Cb-Di-Grate
Paint Splatter	Paint Splatter	Road surface irregularity
Mh-Cb-Di-Grate	Mowing	Mh-Cb-Di-Grate
Mowing	Mh-Cb-Di-Grate	Hwy traffic sign post
Debris DOT Truck	Debris DOT Truck	Debris from road
Low shoulder/Elevation difference	Low shoulder/Elevation difference	Construction/Paving
Trip/Fall uneven surface	Trip/Fall uneven surface	Drainage Structure
Pothole- edge/shoulder	Tree in road	Trip/Fall uneven surface

Table 30 Most Common Causal Factors for Lawsuits Through 2007-2010

10 most common sorted based on:		
Frequency	**Total settlement amount**	**Average amount**
Trip/Fall uneven surface	Water on road surface	Tree limb obstructing road
Water on road surface	Deer	Improper signage/No signage
Trip/fall Mh-Cb-Di-Grate	Improper traffic control devices	Deer
Obstructed sight distance (eg. vegetation)	Fail to yield ROW	Missing sign
Fail to yield ROW	Low shoulder/Elevation difference	Open hole/Manhole
Pothole Damage	Pothole Damage	Improper traffic control devices
Low shoulder/Elevation difference	Tree limb obstructing road	Work Zone Maint Equip
DOT/Contract Vehicle	Improper design/Intersection design	Water on road surface
Tree in road	Improper signage/No signage	RR crossing
Improper design/Intersection design	Missing sign	Low shoulder/Elevation difference

Table 31 Causal Factor Definitions

Causal Factor Definitions
Construction/Paving-Property damage due to construction or paving work
Debris DOT Mower/landscape-Vehicle damage due to thrown object from mower
Debris from road-Vehicle damage due to road debris
Debris DOT Truck-Vehicle damage due to debris falling from DOT truck
Deer-Vehicle damage due to collision with or swerving to avoid a deer
DOT/Contract vehicle-Vehicle collision with DOT or contract vehicle
Drainage Structure-Property damage due to inadequate or clogged drainage structure (flooding)
Fail to yield ROW-Vehicle collision due to a failure to yield ROW
Hwy traffic sign post-Vehicle damage due to hitting a traffic sign post
Improper intersection design-Vehicle collision due to improper intersection design
Improper signage/No signage-Vehicle collision due to improper or no signage
Improper traffic control devices-Vehicle collision due to improper traffic control device
Low shoulder/Elevation difference-Vehicle damage due to low shoulder or elevation diff at EOP
Missing sign-Vehicle collision due to missing sign
Mh-Cb-Di-Grate-Vehicle damaged due to broken or raised manhole, catch basin or drop inlet
Mowing-Property damage (other than vehicle) due to mowing
Obstructed sight distance-Vehicle collision due to due obstructed sight distance
Open hole/Manhole-Vehicle damage due to collision with an open hole or open manhole
Paint Splatter-Vehicle damaged due to wet paint on road
Pothole damage-Vehicle damaged due to potholes
Pothole: edge/shoulder-Vehicle damage due to pothole near EOP or due to a broken EOP
Road surface irregularity-Vehicle damage due to a road surface irregularity (other than pothole)
RR crossing-Vehicle damage due to RR crossing or vehicle collision with train
Tree in road-Vehicle damage and/or personal injury due to a fallen tree in the road
Tree fell on car-Vehicle damage and/or personal injury due to a tree falling onto a vehicle in roadway
Tree limb obstructing road-Vehicle damage or injury due to collision with limb hanging in or on road
Trip/Fall uneven surface-Personal Injury from a trip or fall due to an uneven surface

Table 31 (continued)

Causal Factor Definitions
Trip/Fall Mh-Cb-Di-Grate-Personal injury from a trip or fall due to a manhole, catchbasin, or drop inlet
Work Zone Maintenance Equip-Vehicle collision with work zone equipment (mostly temporary signs)

Identify Potential Countermeasures:

As it was mentioned before, this section include countermeasures for different reported causal factors of claims and lawsuits for which a benefit cost analysis could not be calculated due to a lack of required data. A large portion of these causal factors were due to a lack of appropriate maintenance activities. These include debris from road, clogged or inadequate drainage structure, broken or off-grade Mh-Cb-Di-Grate, trees in roadways, tree limbs obstructing roadways, obstructed sight distance due to vegetation, and missing signs.

Currently, SCDOT maintenance crews conduct regular inspections on a schedule that varies by roadway functional class as follows: Interstates are inspected monthly, primary routes are inspected once every six months, and secondary roads are inspected once per year.

Since many of these claims and lawsuits are paid by SCDOT due to lack of *a priori* knowledge of such issues, more frequent inspection and subsequent maintenance may reduce the number of locations that might result in a claim or lawsuit due to maintenance related causal factors. Though it is difficult to provide precise metrics on the exact number of claims or lawsuits reduced from such increased maintenance activities, more frequent inspections could reduce the number of claims and lawsuits related to maintenance activities.

The research team has provided a list of potential countermeasures associated to most common causal factors of claims/lawsuits, as illustrated in Table 32. Different resources have been considered to develop these countermeasures including HSM (Highway Safety Manual, first edition, volume 3), the CMF (Crash Modification Factor) Clearing House, and NCHRP report 500 series. HSM provides the best available research-based CMFs, which can be used as a useful tool to evaluate the safety effect of implemented treatments. While the HSM provides only the best available research-based CMFs, the CMF Clearinghouse is a comprehensive listing of available CMFs associated to different countermeasures. Besides HSM and the CMF Clearinghouse, NCHRP Project 17-18(3) has developed guides to assist state and local agencies in reducing injuries and fatalities. In order to identify potential countermeasures, the research team has studied each claim/lawsuit with regard to causal factors while using the above mentioned resources to come up with a list of countermeasures that can be used to avoid or lessen the impact of potential claims and lawsuits.

Table 32 Recommended Countermeasures Based on the Top 10 Causal Factors of Claims and Lawsuits

Causal Factor	**Recommended Countermeasures** (References in parentheses)
Type 1 (Collision with non-fixed object)	
Deer	• Speed Limit Reduction (1) • Intercept feeding (2) • Roadside Vegetation Management (3) • Fences/barriers/overpasses/underpasses/at-grade separation (4)
Debris DOT Mower /landscape	• Clear the area of debris before mowing • Use a more restrictive safety guard or debris cover on mower • Maintain mowers as necessary (e.g. sharpen blades)
Debris from road	• More frequent inspection and subsequent maintenance for interstates and secondary roads
Debris DOT Truck	• Educate DOT truck drivers on how to properly secure loads in all types of trucks.
DOT/Contract vehicle	• Educate professional truck drivers about the hazards associated with work zones and other construction-related activities (5) • Provide truck drivers with defensive driving education.
Fail to yield ROW **(Vehicles mostly failed to stop at stop sign)**	• Make sure the stop signs and warning signs are within appropriate sight distance of a driver and inform the driver of how many approaches are required to stop (6) • More frequent inspection of stop signs and warning signs and subsequent maintenance
Improper design/ Intersection design	• Checking design plans regarding horizontal curvature, vertical curvature, speed, traffic control devices, etc. (7) • Putting additional signs to inform drivers of conditions on the road / intersections (8)
Obstructed sight distance (e.g. vegetation)	• More frequent inspection of sign and sight distance visibility and subsequent maintenance (9) • Vegetation management plan
Paint Splatter	• Improve “wet paint” signs indicating road painting is underway. (10) • Implement more restrictive warnings or barriers of wet paint. • Provide information for motorists through VMS, Internet and radio stations.
Tree in road	• More frequent inspection of roads and subsequent inspections of ROWs • Increased removal of potentially “hazardous” trees near roadway
Tree fell on car	• More frequent road side inspections for trees that are dead, have insufficient root structure, etc. and subsequent maintenance (11)
Water on road surface	• Installing signs to alert drivers of areas where water can collect on the road (12) • Inspections for proper longitudinal and transverse slopes (13) • Milling and Micro surfacing (14)

Table 32 (continued)

Causal Factor	**Recommended Countermeasures** (References in parentheses)
Type 2 (Collision with fixed object)	
Hwy traffic sign post	• Revise sign post removal procedures and inspect to ensure "stubs" are not left • Delineate / Shield the sign post as a fixed object (15)
Improper traffic control devices	• More frequent inspection and subsequent maintenance • Check design plans to ensure they conform to MUTCD requirements (7)
Improper signage/ No signage	• Install stop sign, warning sign, etc (16) • Upgrade pavement markings, add signage (17)
Low shoulder/ Elevation difference	• Shoulder improvement (18) • Install safety edge (19) • Install rumble strips (20) • Add 2-feet paved shoulder (21)
Missing sign	• More frequent inspection of signs
Mh-Cb-Di-Grate	• More frequent inspection for broken or off-grade Manhole covers, Drop inlets, Catch basins and drainage structures (22)
Pothole Damage	• Increasing the frequency of current inspection regarding different roadway classifications. Decrease repair times of reported potholes.
Pothole-edge/shoulder	• Increase the frequency of inspections for different roadway classifications
RR crossing	• Inspection of conditions on the surface of the railroad crossing (23) • Improve at grade active warning system (24) • Inspection of vegetation that can obscure driver's visibility (11)
Road surface irregularity	• Repair identified pavement areas and along the curbs (23)
Type 4 (Pedestrian Injury)	
Trip/Fall uneven surface	• Repair cracks, potholes, uneven sidewalks, and broken steps. • Delineate conditions that cannot be repaired (15) • Urge property owners to report sidewalks in need of repair to the city manager or director of public services.
Trip/fall Mh-Cb-Di-Grate	• More frequent inspection for broken or off grade manhole covers, drop inlets, catch basins and drainage structures
Type 5 (Property damage that occurs off road)	
Construction/Paving	• Educate DOT employees on how to avoid cutting cables, and be more cautious during installing mail boxes, paving, road work, and construction activities (25)
Drainage Structure	• More frequent inspection of structures for debris, clogging or obstruction. (22) • Educate employees on how to avoid cutting cables while digging up and installing storm drains, culverts, catch basins, etc. (25)
Mowing	• Delineate above ground utilities (15) • Educate mower operators on how to avoid cutting cables, and to steer clear of fire hydrants, water meter boxes, mail boxes, signs and property fences (11)

Table 33 References for Recommended Countermeasures Listed In Table 32

Reference Number	Source
(1)	**www.deercrash.com,** toolbox **Clearing House:**- Decreasing posted speed limit, CMF=0.86, Park et.al. 2010; - Advisory speed sign, CMF=0.87, Elvik, R. and Vaa, T., 2004 **HSM**, Install advisory speed sign, CMF= 0.87
(2)	**www.deercrash.com**
(3)	**www.deercrash.com**
(4)	**www.deercrash.com**
(5)	**(NCHRP 17-18(3),** Work Zones, Exhibit I-3
(6)	**NCHRP 17-18(3),**Un signalized intersections, Exhibit I-3, Strategy 17.1 C1 **Clearing house & HSM** (Table 14-4): Conversion of stop-controlled intersection into roundabout **Clearing house & HSM** (Table 14-7): Conversion of stop-controlled to signal **Clearing house & HSM** (Table 14-5): Converting a minor road stop control into an all-way stop control **HSM**: - Provide stop ahead pavement marking, CMF=0.69 - Provide flashing beacons at stop-controlled intersections CMF=0.95
(7)	**HSM**, Volume 3, Chapter 14-Intersection; **NCHRP 17-18(3)**, Signalized intersection, Exhibit I-3 & Un signalized Intersection, Exhibit I-3; **Clearing House**, intersection geometry and traffic control categories **NCHRP17-18(3)**, Horizontal Curve, Exhibit I-1 & **HSM**, (Table 13-27) **HSM** (Table 13-28) & (13-30), & **Clearing House**, vertical and horizontal alignment **Clearing House**, Improve visibility of signal head, CMF=0.93, Sayed et. al. 2007
(8)	**Clearing House**, Install combination of chevron signs, warning signs and/or sequential flashing bacons, CMF=0.61, Montella, 2009
(9)	**NCHRP 17-18(3),**Un signalized intersections, Exhibit I-3, Strategy 17.1 C1 **Clearing house**, Increase triangle sight distance, CMF=0.52, Elvik, R. & Vaa, T. 2004
(10)	**Clearing house**:- Install advance warning signs, CMF=0.65, Polannis ,1999 - Provide advisory speed sign, CMF=0.87, Elvik R. & Vaa T, 2004
(11)	**NCHRP 17-18(3),** Trees in "hazardous" location, Exhibit I-4
(12)	**Clearing house**:-Install advance warning signs (positive guidance) CMF=0.65, Polannis ,1999 - Provide advisory speed sign, CMF=0.87, Elvik R. & Vaa T, 2004
(13)	**HSM** (Table 13-27) & **Clearinghouse**, Improve super elevation
(14)	**Clearing House:**- Refinish pavement with micro surfacing treatment, CMF=0.63, Erwin & Taghe 2008 - Resurface pavement CMF=0.95, Abdel Aty et al. 2009
(15)	Install post mounted delineators: **NCHRP 17-18(3)**, Utility Poles, Exhibit I-2; **HSM,** CMF=1.04**; Clearing House,** CMF=1.04, Elvik R. & Vaa T. 2004
(16)	**Clearing House**:- Intersection traffic control group - Install stop sign on both minor approaches of an un signalized intersection, CMF= 0.78, Haleem & Abdel Aty, 2010 - Install sign to conform to MUTCD, CMF=0.85, Elvik. R. & Vaa. T. 2004 **NCHRP 17-18(3)**, Un signalized intersection, Exhibit I-3

Table 33 (continued)

Reference Number	Source
(17)	**MUTCD** & **Clearing House**, Roadway delineation category
(18)	**Clearing House**: stabilize shoulder, CMF= 0.75, Gan et al. 2005; **NCHRP** 17-18(3), Run-Off road collisions, Exhibit I-1
(19)	**FHWA-HRT-11-024**, March 2011,CMF=0.90
(20)	**NCHRP 17-18(3)**, Run-Off road collisions, Exhibit I-1; **Clearing House**, CMF=0.78, Sayed et al., 2010; **HSM**, Table (13-44)& Table (13-45)
(21)	**Clearing House**, shoulder treatment category; **HSM**, Table (13-7) & Table (13-8)
(22)	**Clearing House**, Improve drainage patterns, CMF=0.68, Gan et.al, 2005
(23)	**Clearing House**, Resurface Pavement, CMF=0.95, Abdel Aty et al. 2009
(24)	**Clearing House**, Installing gates at crossing with signs, CMF=0.05, Park, Y.-J. and Saccomanno, F.F., 2005
(25)	**NCHRP 17-18(3)**, Work Zones, Exhibit I-3

Policy Enhancements

It is critical that SCDOT operate and maintain a robust risk management program, because claims and lawsuits drain precious dollars away from activities and projects that could otherwise be used to improve South Carolina's state highway system. The Highway Safety Improvement Program, principally focused in traffic operations, already includes aggressive strategies to reduce the number of crashes on the highway system that give rise to claims and lawsuits. Reducing risk, however, as part of SCDOT's overall mission, should be a major focus throughout all levels and functional areas of the organization. The Department should instill a philosophy to continuously improve its risk management activities to increase their effectiveness. Departmental management needs to set an example and ensure that risk management considerations are included in all decision-making. Training should be provided to all levels of the organization so that employees can improve on protecting the Department from losses incurred as a result of tort liability.

Risk management typically has two components:

1. Steps that are taken to minimize the potential exposure to tort liability and to avoid claims and lawsuits, and
2. Steps that are taken once a claim or lawsuit has begun that are designed to reduce the amounts paid to resolve the litigation.

Each component must be considered critical if SCDOT is to reduce the total dollars redirected to tort litigation from improvements to the state highway system. Essential to the success of a risk management program is SCDOT's ability to exercise control over both components. Based upon the research team's analysis of other states' risk management programs and the information provided by SCDOT, there are some strategies that SCDOT may wish to consider in order to enhance its risk management practices.

Claims Avoidance Strategies

Integration of the Office of Legal Services into Decision-making

While SCDOT management undoubtedly already consults the Chief Counsel and her staff on a multitude on issues that appear to have some legal implications, it can prove beneficial to have even more involvement. There are issues that will present themselves to management that may have a mix of policy and legal implications. It is not unusual for decision-makers to use tort liability implications as an excuse to avoid making what is really a policy decision. While it is not the normal role for SCDOT attorneys to make policy, they can assist in separating the policy issues from the legal ones. The policy decision-maker then can make an informed decision, taking into consideration the legal implications.

Professional legal training impresses clear analytical thinking, consideration of unintended consequences, and identification of issues not readily apparent to the layperson. Integration of SCDOT attorneys into decision-making can ensure that potential tort liability and risk management considerations are taken fully and appropriately into account. Departmental divisions should routinely work closely with SCDOT attorneys in order that they can provide in-house advice and counsel to all functional units. The SCDOT attorneys should not be avoided and only consulted after a problem arises. They should be an integral part of the process at the outset.

Office of Legal Services Review of Policies, Procedures and Manuals

SCDOT management needs to work closely with the Office of Legal Services when developing policies, procedures and in-house manuals.

These documents must be clearly worded, unambiguous and free from language that gives rise to potential tort liability implications. SCDOT's policies, procedures and manuals should not be replete with standards and warrants and levels of performance that are unattainable with limited tax dollars, thereby allowing potential for misuse by claimants, who assert that such procedures establish a legal standard of care.

Such documents set forth SCDOT's own expectations of its employees. When employees fall short of those expectations, they, by definition, have failed to meet the Department's own standard of care. That is the benchmark by which a judge or jury will measure the conduct of the Department and whether it has met its duty to the travelling public.

Therefore, SCDOT's policies, procedures and manuals should provide for the exercise of discretion and professional engineering judgment. The introduction should so state explicitly and further, that the particular manual, for example, is not intended nor does it establish a legal standard of care.

SCDOT's Vegetation Guidelines is an example of a manual that can be improved by such a review. Its Engineering Directive Memorandum sets a standard that SCDOT will meet the wants and desires of the local community, with some qualifications, "whenever possible". The use of the term "whenever possible", even when qualified, raises an unrealistic threshold. The term "whenever practicable" is a preferred term to express this benchmark. The guidelines themselves are replete with the user "shall" do this or the user "shall" do that. Simple instructions are expressed as a mandate. Since the guidelines "integrate . . . government statutes and regulations", deviation from them could be deemed to be a violation of a mandatory duty, possibly giving rise to liability. The guidelines also contain surplusage when, for example, in an effort to apparently impress upon the user the safety implications of mowing, they state that mowing is important to maintain clear zones and to allow for errant vehicle recovery. While these concerns may have some validity, expressing them in this way further exacerbates the

mandatory nature of the "guidelines" by SCDOT's explicit admission that a "violation" of their provisions will have serious safety consequences for the travelling public. While SCDOT is not normally liable for the acts of its independent contractors, the roadway is nevertheless owned and controlled by SCDOT, which is ultimately responsible to the travelling public.

The Office of Legal Services can ensure that the proper balance is struck between providing guidance to SCDOT's employees and avoiding mandatory rules, standards and warrants that entail potential tort liability implications.

Prior review of draft documents by the Office of Legal Services can also ensure that wording, terms and language in documents that have tort implications are avoided. This is often called "bite me" language or "words with baggage." They have a common, lay meaning but also have taken on a life of their own in litigation. Examples are "hazardous", "of concern", "trap", "deficiency", "black spots", "higher risk facilities", "dangerous", "safety problem", etc. Most of these terms can be avoided by simply expressing the thought in factual, neutral terms, without characterizing it further. Also stating that a particular site "can benefit from a safety improvement" without characterizing it as currently "hazardous", conveys the requisite information.

Maintenance manuals often contain language and concepts that raise tort liability implications. A common example is the guidance provided to maintenance workers on pulling shoulders. A manual will layout the dangers of "drop offs" and how they cause vehicles to go out of control. Because of this, employees are urged to pull the shoulder when a "drop off" exceeds 1 ½ inches, for example. This flies in the face of ample research that demonstrates that "drop offs" play no role in vehicle control until they exceed 3 to 4 inches, maybe more. It is only then that "scuffing" may occur on the inside of the tire and provide resistance to remounting the travelled way. The whole discussion acts as an admission by the department that "drop offs" are dangerous and if those in excess of 1½ inches are not eliminated, the department has not met its duty to the travelling public.

A maintenance manual that has been reviewed by attorneys will usually express the need for pulling shoulders in engineering terms, rather than safety terms. Shoulders provide lateral support to the travelled way. Failure to pull shoulders when the difference in elevation between the shoulder and the travelled way reaches a point when it is no longer providing that lateral support will cause the edge of the travelled way to ravel and break off. This causes increased maintenance effort and cost, and should be prevented from occurring. By using terms like "elevation difference" the highly charged term "drop off" is avoided and there is no superfluous discussion of "loss of vehicle control".

In short, the Department's policies, procedures and manuals should fulfill their purpose in assisting and guiding SCDOT employees and should not be able to be used as weapons against them in tort litigation.

Office of Legal Services Review of Legislation

The Office of Legal Services should be charged with reviewing all pending legislation that may have legal implications for the Department. The review should include a recommended position of support, neutral or oppose, that can then be passed up the Executive Branch, as appropriate.

South Carolina's Tort Claims Act and general tort law is quite favorable to SCDOT, compared to other states. As a result, the Office of Legal Services should act as a watchdog for legislation proposed by the plaintiffs' bar that would undermine the current legal climate. Some states, such as Pennsylvania (no liability for potholes caused by natural elements) and Michigan (the shoulder is not designed for

vehicular travel and thus DOT has no duty to public for its use), have specific exceptions to liability to cover certain conditions of the highway. To the extent that SCDOT is experiencing a large number of claims arising out a particular highway condition and a legislative proposal might enhance SCDOT's legal defenses to tort liability, the Office of Legal Services can be an effective vehicle for proposing and drafting that legislation.

A Statewide Tort Liability and Risk Management Committee

With 46 counties, 7 districts, and several headquarter divisions and offices, it is difficult for SCDOT to get its arms around the myriad of tort liability and risk management issues that arise on a daily basis. An approach that has been successful in other states, and is proposed here, is for SCDOT to establish a Statewide Tort Liability and Risk Management Committee. The committee would be comprised of representatives from the Office of Legal Services, Traffic Engineering, Construction and Maintenance. The committee's charge would be to meet quarterly, and more often if needed, in order to identify and address statewide tort liability and risk management issues and trends, and to recommend statewide policies. These may run the gamut of claims handling and investigations, maintenance policies and reporting procedures, traffic operations documentation, review of contracted services, and implementing lessons learned from litigation results. Ensuring that appropriate solutions are implemented in a uniform manner throughout the state will enhance the effectiveness of the Department's risk management program.

Figure 56 demonstrates the committee's role in the review of the claims handling process. It is important for the committee to continue to improve upon the proposed process in order to adjust to the changes that should become apparent once the new process is implemented. In order to monitor the changes in the process and handling of claims, performance measures need to be developed based on their expectations of the process as a whole. This will allow the committee to understand the effects their previous changes have made on the system and allow them to adjust accordingly. The major steps in the process that would benefit from continued review are: the classification system, the investigation and SOP procedures, the basis for recommendations on claims, and the performance measures.

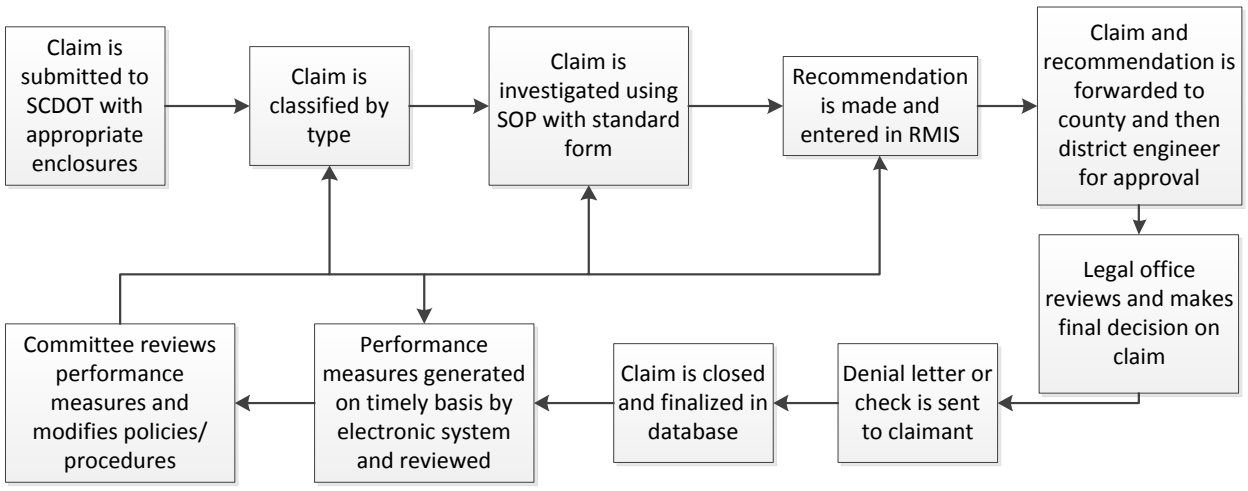


Figure 56 Reviewable Claim Processing Steps

Claims/Lawsuit Handling and Cost Mitigation Strategies

Early Identification of SCDOT Employee Witnesses

As part of the initial investigation, potential SCDOT employee witnesses should be identified. These are people most knowledgeable about the various aspects of the claim and the functional areas impacted. They will be able to assist SCDOT attorneys and later, Insurance Reserve Fund (IRF) retained attorneys, in understanding the issues of the case, as they relate to particular functional areas of the Department. They can begin to prepare for their role in the litigation in assisting in the production of documents, responding to interrogatories and requests for admission. They may also be potential witnesses, both lay and expert.

Effective Witness Preparation

Having identified the involved SCDOT employees who may be witnesses, it is imperative that they be prepared for their critical role. The material included in SCDOT's Effective Witness Training needs to be focused on these employees and made relevant to the context of the litigation. Particular attention is required for those employees who may become in-house expert witnesses.

In addition to working with in-house expert witnesses, there may be the need to develop a cadre of outside expert witnesses who can be retained under contract as the need arises. Perhaps, in coordination with the IRF, a list of experts in various fields (e.g. traffic engineering, accident reconstruction, etc.), who have had successful experience and results in testifying on behalf of SCDOT, can be developed. These are experts who will testify in their areas of expertise in a consistent manner statewide, and not be subject to impeachment from one county to another or one case to another, because of discrepancies in their testimony. The credibility of these witnesses is critical to the credibility of SCDOT's defense.

Ensure that SCDOT Is Involved in Litigation Decision-making with IRF

SCDOT reports that its current 2011 premium to the Insurance Reserve Fund (IRF) is approximately $5.5 million and that it varies from year-to-year based upon claims experience. All decision-making with regard to litigation rests with the IRF and its retained outside counsel.

SCDOT reports that the IRF usually retains one law firm in each of the counties in South Carolina, sometimes two or three in the larger counties (Charleston, Columbia, Greenville/Spartanburg). SCDOT reports that outside counsel use limited law and motion practice to dismiss lawsuits, e.g. asserting the statute of limitations as a bar to the action. It rarely uses cost effective, dispositive motions, such as motions for summary judgment or adjudication based upon discretionary immunity, weather immunity, design immunity, lack of notice, etc. These motions can often result in an early dismissal of plaintiff's action. While eschewing law and motion may appear to reduce the overall costs of litigation in some cases, the wholesale rejection of a rigorous law and motion practice surrenders an important weapon in SCDOT's arsenal and a potential deterrent to future litigation.

SCDOT revealed that the Office of Legal Services is provided status memoranda on litigation from IRF's attorneys only intermittently. Occasionally, it sees a memorandum summarizing the outcome of the litigation. The Office of Legal Services submits a request for "lessons learned" to the outside counsel and sometimes it is completed and returned. There does not appear to be an established protocol for SCDOT review of detailed settlement/judgment memoranda. It does not approve settlements. There is no requirement for including recommended remedial measures nor is there a protocol for either analysis of same or implementation.

This situation appears to be an artifact of the manner in which tort liability litigation against SCDOT is funded in South Carolina – by the use of a quasi insurance policy administered by a sister agency. Nevertheless, an important linkage is missing here and that is the link between the entity whose activities give rise to litigation and the entity that handles and pays for the litigation. The IRF provides little input to SCDOT on how to avoid similar future litigation and SCDOT has no mechanism in place to ensure that the manner in which the litigation was handled does not encourage future litigation.

1. At the very least, there should be quarterly meetings with representatives from the IRF, its retained outside counsel and SCDOT counsel to address these issues. SCDOT counsel can then report to the SCDOT Tort Liability and Risk Management Committee (*supra*).

The IRF practice of retaining private law firms in the counties where the litigation is venued is no doubt a good practice from the standpoint of ensuring that local representation is familiar with the judges and the jury pool. However, with 46 counties and the larger counties using multiple law firms, it is difficult to envision that over 50 law firms will produce a uniform litigation strategy that works in the best interest of SCDOT. The resources devoted to each case will vary, not necessarily based upon the nature of the case itself, but more likely on the importance or priority that the individual attorney places upon it. That importance or priority is likely to be based upon the attorney's caseload, support staff, and experience in handling SCDOT cases. There is no assurance that skilled expert witnesses are being used throughout the state. It is unknown as to how much communication is shared among the various law firms on the best strategies to employ in defending a single client, SCDOT.

2. Again, quarterly meetings with representatives from the IRF, its retained outside counsel and SCDOT counsel should be initiated to address these issues.

Because of this lack of communication, collaboration, and consultation, SCDOT has little or no authority over the conduct and resolution of lawsuits handled by the IRF. Lawsuits are possibly being settled for "convenience", "nuisance value", or litigation costs" resulting in plaintiffs receiving a settlement with minimal investment or effort, thereby encouraging others to sue SCDOT, with an eye on an easy payment. At the very least, such settlements should not be made unless it is clear that plaintiffs have incurred greater costs and attorney time and effort such that they are not made whole. In addition, some cases simply should not be settled where there is no liability on the part of SCDOT, even if the costs of proceeding to trial may exceed the settlement. There must be a deterrent to the filing of meritless lawsuits against SCDOT. If plaintiffs' attorneys know that they are either going to lose money when they sue SCDOT or they will face daunting costs to pursue protracted litigation, they will be less likely to bring an action where the chances of success are marginal.

3. Regular meetings between representatives of the IRF, its retained outside counsel and SCDOT attorneys could facilitate implementation of policies and procedures that enhance the risk management interests of SCDOT.

Even if ultimate control over the resolution of a lawsuit rests with the IRF, SCDOT needs to be consulted prior to that resolution in order to ensure that its risk management goals are being achieved.

4. In addition to regular status memoranda that detail and analyze the posture of the lawsuit at various milestones, SCDOT needs to receive a copy of the Request for Settlement Memorandum or Request for Payment memorandum (in the case of a judgment) from the private counsel representing SCDOT to the IRF.

That memorandum should contain a description of the incident giving rise to the lawsuit, the incident site, the plaintiffs and any codefendants, plaintiffs' contentions, SCDOT's contentions and defenses, an evaluation of liability and damages as to each plaintiff, codefendant's contribution, the lawsuit's procedural history (including settlement negotiations), and the attorney's recommendation for resolution. In addition, the memo must contain a discussion of the need, if any, for any remedial measures on the part of SCDOT. This allows SCDOT to analyze and implement measures that will avoid future litigation. (See sample memo in Appendix D.)

5. If, for policy reasons, SCDOT objects to the settlement, a consultation procedure must follow between the IRF and SCDOT to address those objections.

Follow up on Recommended Remedial Measures

Recommended remedial measures provide SCDOT with the most reliable lessons learned from the litigation and how to avoid such litigation in the future. It allows the Department to take steps to avoid repeating its mistakes of the past.

With the inclusion of "Recommended Remedial Measures" in the detailed Request for Settlement Memorandum or Request for Payment provided by the IRF and its retained attorneys, SCDOT needs to establish a procedure to handle them. The Office of Legal Services should send them under attorney-client confidentiality to the District Administrator in whose district the lawsuit arose, who in turn can refer them to the appropriate person in the district and/or the county who can best respond. The recommendations should be investigated, analyzed, evaluated, and a report prepared under attorney-client confidentiality. The report should either set forth steps being taken to implement the recommendation or explain in detail why no such steps are being taken (e.g. because of funding, policy or engineering reasons). The report back to the Office of Legal Services should be signed by the District Administrator and completed within 30 days. If the issue is of statewide concern, the matter should be referred to the appropriate Deputy Secretary for consideration of statewide action.

Process Enhancements

This section discusses process enhancements related to SCDOT's tort liability risk management.

Workflow Changes

One of the largest issues with the current SCDOT claims handling process is the lack of documented, detailed procedures of the process, ranging from the county level to the legal office. These undocumented procedures include:

- Instructions/suggestions on making a decision whether to deny or pay a claim (e.g., Questions that should be asked during the decision)
- Investigation procedures and other data collection (HMMS records etc.) at the county level
- Data entry guidelines (e.g., GPS coordinate format and level of accuracy)
- Overall claims process (For employee at each level to understand role in process)
- Investigations by the legal office investigators

The lack of written procedures for these process tasks results in variation in procedures across the state which often leads to incomplete and ineffective claims and lawsuit data. In addition, these variations ultimately lead to inconsistent paying and denial of claims, since data from the county level is heavily utilized in the final decision. The research team suggests the adoption of uniform statewide claims handling procedures discussed in the following section.

In addition to a uniform statewide handling procedure the research team has identified a need for an electronic database that could be utilized by each level in the claim handling process. Currently, the Office of Legal Services uses the Risk Management Information System (RMIS) to log and store lawsuit and claims data. This is an ideal system that could be expanded to allow access at the county level. Several issues with the current handling system were identified during this research, which suggests the need for such a system:

- The legal office already utilizes an electronic system, RMIS. This requires a legal office employee to transfer data from the recommendation letters developed in the county office and claims form which are redundant tasks.
- Redundant hard copy files are often kept at the county level as well as the legal office.
- Some counties (Richland) already use a self-developed electronic spreadsheet to track claims in-house.
- Claims tracking between the various offices/employees involved in the process are very difficult. Before a claim reaches the legal office it can only be found by tracking the actual hard copy file, which can be sitting on a desk, awaiting a signature. In addition, this can require claimants to call multiple offices to find the status of a claim.
- A copy of the claims form and recommendation letter is the main form of data sharing-this can limited data sharing.
- Time requirements exist for offices to handle claims-time is wasted with files traveling from office to office.

The development of an electronic database or the expansion of the Office of Legal Services' current (RMIS) could provide the following benefits:

- More efficient data sharing
- Reduction of redundant data transfers (i.e., to paper claim form to recommendation letter to electronic database)
- Electronic data entry for all counties
- This can solve other issues like consistency, accuracy and completeness of data
- Claims tracking from all levels of the process
- Automatic generation of standard forms (i.e., a recommendation letter)

In addition to these benefits an electronic database could easily allow for the incorporation of a decision support system at various stages in the claims handling process such as the county level investigation, claim recommendation and claim classification. These potential decision support systems are outlined in a following section, "Decision Support System Framework". The combination of the implementation of a standard claims handling procedure and an electronic database with an incorporated decision support system could greatly improve the efficiency and effectiveness of the claims handling process.

A Uniform Statewide Claims Handling Procedure

Once an incident has occurred or a claim has been filed, SCDOT must immediately marshal its forces to defend and resolve the matter. Incidents that occur, which are recognized as likely to give rise to a claim, should be investigated promptly. Early investigation, recordation of the site, identification of witnesses and preservation of evidence will prove invaluable when these potential claims become claims.

SCDOT Departmental Directive 21A was issued in 2007 to establish departmental policy regarding damage claims. It sets for general guidelines on how to handle damage claims once they are filed against the Department.

SCDOT reports that its 46 county offices handle claims in a substantially similar fashion but they have not promulgated written detailed uniform claims handling procedures. The exception is Richland County, which has published a detailed and comprehensive claims handling procedures. (See Appendix E). Richland County apparently recognizes the importance of these initial actions and the fact that they are instrumental to the conduct of SCDOT's defense. In addition, the Columbia District, which includes Richland County, also has by far the lowest percentage of paid claims. This could partly be due to the strict approach implemented through a well-defined procedure of which each employee is familiar.

SCDOT needs to adopt, and adapt as appropriate, Richland County's Damage Claim Procedure as its Uniform Claim Handling Procedure statewide. Concomitant with this recommendation is the necessity of providing the counties with the resources and equipment to carry out those procedures. The Office of Legal Services can continue to play an important role in training the people handling claims. This process supports the consensus that the initial investigation is the foundation upon which the defense of SCDOT will rest.

Important procedures that are included in the Richland County process:

- Sending claims involving active construction projects to the construction office
    - Allows for up-to-date knowledge of details of site at time of incident as well as forwarding to contractor responsible, if applicable
- Sending a detailed letter with instructions for filling out the damage claim to claimant, if claim is called in
- Immediately submitting a work request if hazard or defect is or might be present at time claim is received
- Informing claimant of responsible party and the contact information applicable
- Keeping track of communications with claimant
- The use of beeper logs, radio logs, and quarterly inspections when determining prior notice
- Specific lengths of time to search in records when determining prior/constructive notice
- Standard recommendation form template to ensure all information is included
- Checking permits for utility cuts near incident location (including emergency permits)
- List of contacts for common 3rd parties responsible for claims and who claimants can be referred to
- Detailed flow charts outlining the handling process at the county level
    - These charts have sufficient detail to guide a person unfamiliar with the process through the steps needed to handle the claim

The flow charts developed by Richland County are specifically the type of resource that the research team suggests should be introduced statewide in order to improve consistency among claims handling. These two flow charts are shown in Appendix E. Additional procedures and details that need to be added to the process in order to improve consistency at the critical decision points at the county level include the investigation and recommendation. These two procedures would best be addressed by the

development of a decision support system to walk employees through the decision process. The Decision Support System section talks about this in more detail.

Figures 57, 58, and 59 are flowcharts that outline the current and proposed claims handling process, as well as a recommended investigation process which should be reviewed and refined by SCDOT before adoption. Figure 57 assumes the implementation of the enterprise-wide electronic database system discussed in the previous section. When compared to the current process, the proposed flowchart shows the proposed improvements in the system. One of the major improvements in the process is moving the data entry task from the legal office to the county level. This change will provide the legal office more time to increase its involvement with the handling of lawsuits which is proposed in the "lawsuit handling" section. Other major changes in the process include the implementation of a documented classification system, the use of an investigation procedure, and the implementation of an enterprise-wide electronic database.

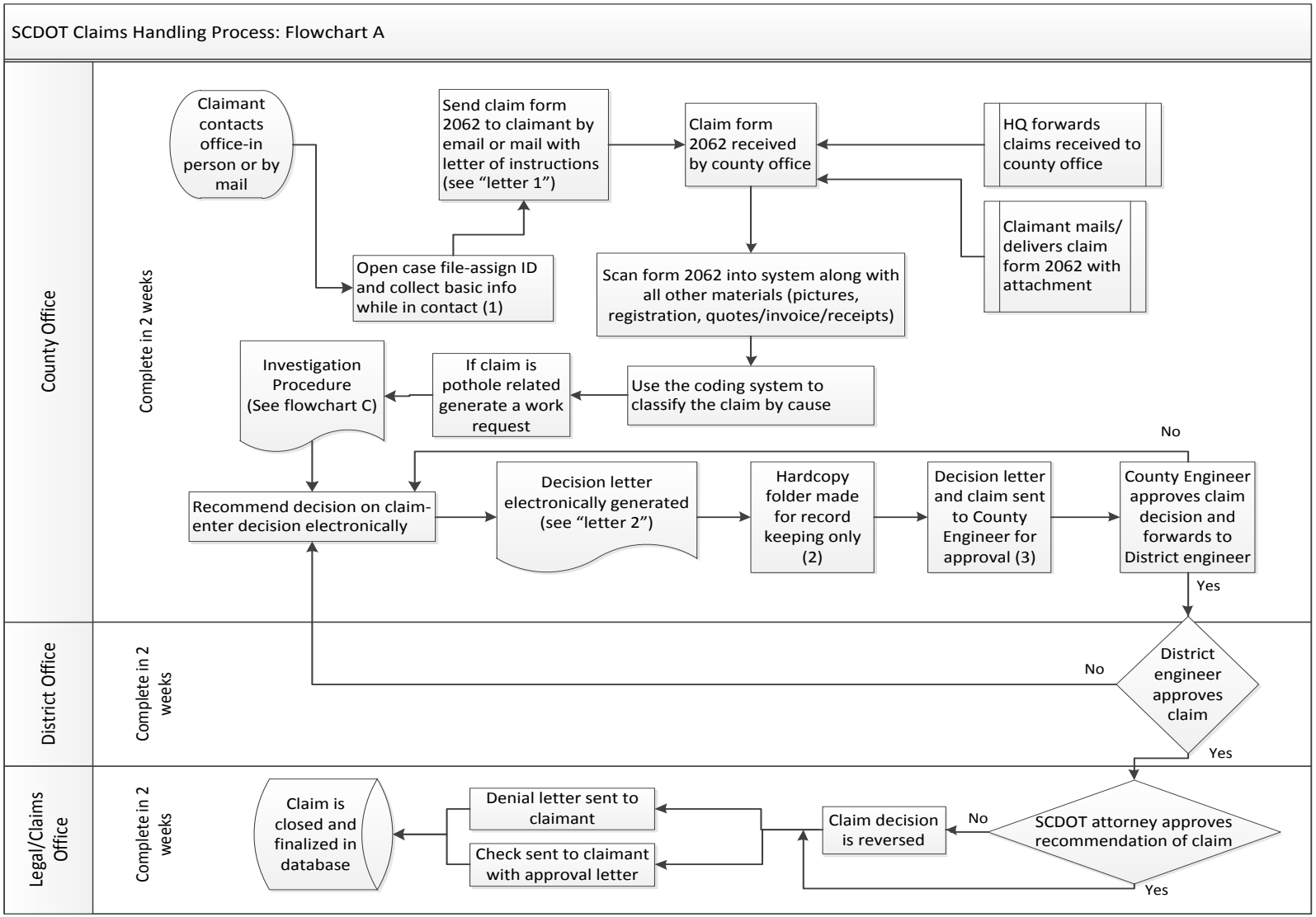


Figure 57 Proposed Claim Handling Process

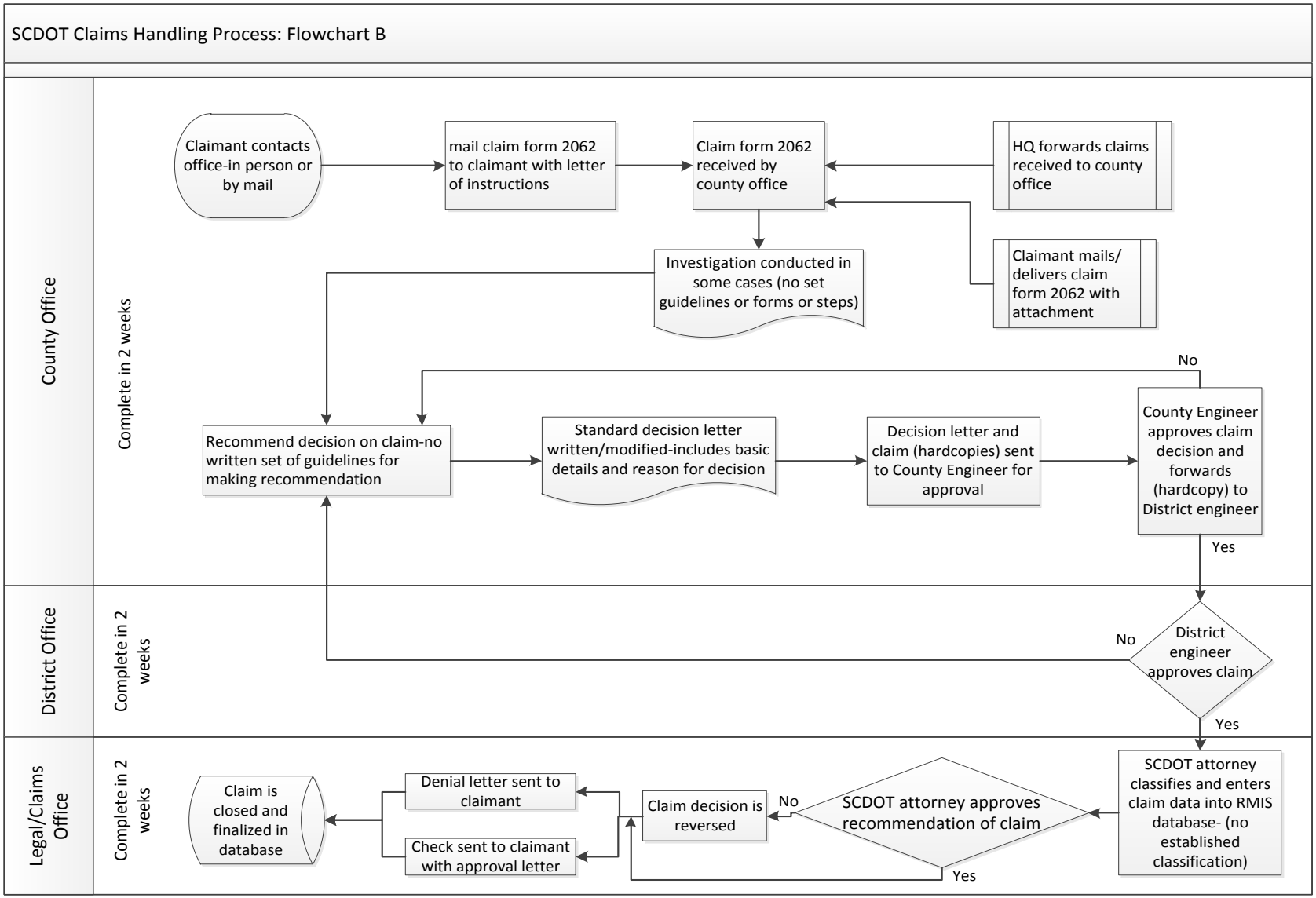


Figure 58 Current Claims Handling Process

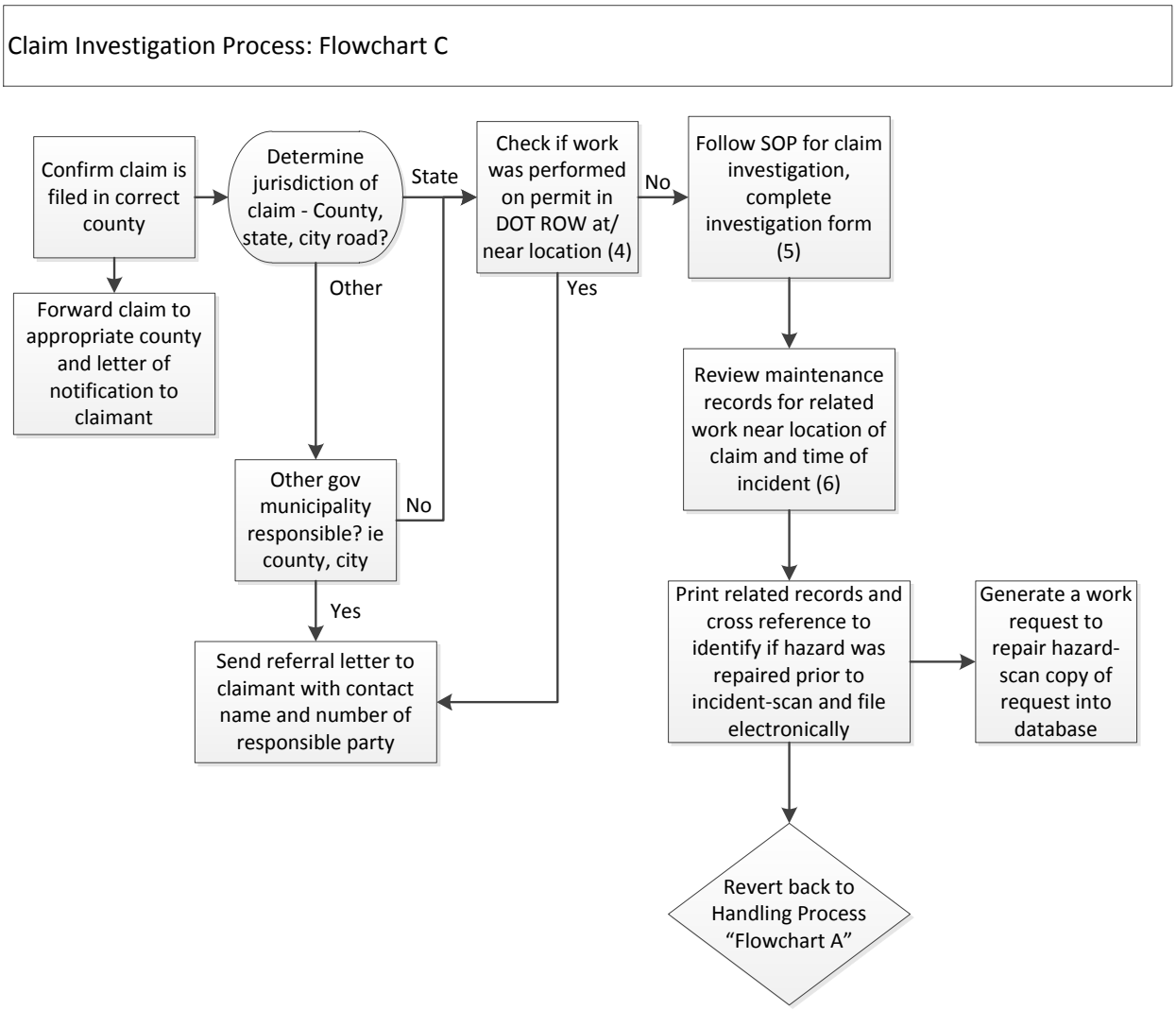


Figure 59 Proposed Investigation Process

Figure 59 outlines the proposed investigation process. This is a critical process at the county level where much of the data needed to make a decision on a claim is verified or collected. In addition, other data is collected and verified at this step which can be used by the SCDOT to identify trends and patterns in claims. The critical data at this step include the location of the incident leading to a claim and claim cause/defect type. These data are critical because locating the incident that led to the claim is required in order to conduct an investigation where the actual cause/defect is identified.

Other important steps in this process include identifying and forwarding claims related to other responsible parties such as contractors or other municipalities as well as reviewing and documenting maintenance work and requests that could be related to the claim. Both of these steps are critical to determining the state's liability for a claim.

Flow chart notes

The numbered notes correspond with the numbers in the flowcharts above. The referenced "letters" in the flowcharts can be found in Appendix E.

(1) Make sure to collect basic information
    a. Classify problem-attempt to distinguish between hazards like broken shoulder vs pothole
    b. Name, phone #, and preference for contact-mail vs email
    c. Location-ask for landmarks, businesses, addresses, bridges, guardrails, signs etc.
        i. Make sure to get direction and position in lane or distance off road etc.
    d. Details-ask if the hazard has been repaired yet, size of hazard

(2) SCDOT should decide where the most appropriate place for the hard copy files to be kept should be-the county office or the claims office in HQ. Both have advantages-keeping in the county office would only require the transfer of electronic data out of the offices, however, keeping hardcopies in the claims office would be a more centralized location.

(3) This step can consist of an email or notification to the county maintenance engineer that electronic approval needs to be made on prepared claims (electronic signatures would be appropriate).

(4) This step will involve checking encroachment permits for work done in the area that could relate to a hazard (ie-a pothole might constitute checking for utility cuts). A time period of say 5 years could be used. If it is believed the work lead to the hazard the claim should be forwarded to the proper entity responsible.

(5) Maintenance records for work requests and work conducted in the area of the hazard should be checked for the previous year.

(6) The SOP (standard operating procedure) for each type of claim should be developed by the SCDOT as a way to provide specific steps for investigators to follow that are tailored to the specific type of claim. These specific steps will attempt to help investigators filter through the typical details submitted by claimants and identify the actual defect versus the perceived defect (if applicable) by the claimant. These guidelines should help investigators identify and locate the actual defect as well as collect data such as pictures. A standard investigation form should be developed as well (Could be based off of "investigation form" in the appendix from Richland county) in order to encourage uniform and consistent data collection.

    For example, guidelines for pictures could state:
    - Take in a way that shows the defect's location in the travel lane or ROW.
    - Distances off the EOP should be documented if appropriate as should the severity of hazard (ie depth, area of pothole).
    - Other objects or details that might be appropriate should also be documented (ie hubcaps or other signs of damage).

General Process Notes:

- Automatic reminders could be used to notify the proper employee of reminders of claims in order to keep up with deadlines. For example, if a claim is awaiting approval and has sat idle for a week, a reminder could be sent automatically.
- Communication logs/history should be kept for each claim in order to document all contact made with claimants through phone, email, or mail. This function should be accessible at the county

A claim is initiated with a standard SCDOT claim form #2062 (in Appendix E) that is filled out by the claimant. This is the single input of data from the original source, unless a claim is reported by phone and details are recorded by a county employee. Based on an extensive review by researchers of over 2500 submitted forms, the following common issues regarding its completion by claimants have been observed:

- "Place of incident" and "Route/road where incident occurred" is not easily distinguishable by claimant. They include various data types in this section which can be conflicting or repetitive.
- In rural areas, the "nearest intersecting road" is not usually filled in.
- "Place of incident" is not specific enough to ask the claimant for the nearest address or landmark, which in rural areas can be the only way to identify the location.
- "In or near town" often results in claimants choosing "in" or "near" instead of entering a name of a town or city.
- "reported to law enforcement agency" does not ask for a report or incident #.

These issues relate mostly to locating the incident which is vital for the state to be able to accurately make a decision on the claim. Locating the claim allows the investigator to determine what, if any, the true defect is (e.g. broken edge vs. pothole). It allows the county to know if a defect still exists and if the county was previously aware of the defect. It also allows for an effective record of defects for the future. Due to the importance of properly locating a claim, the following suggestions are made as revisions for data entries on the claims form as a way to obtain more accurate and effective data from the claimant:

- Road(s) name (both roads if intersection)
- If not an intersection, the nearest intersecting road
- Distance and direction to the nearest intersecting road
- Closest landmark (business or home address-if in rural area any other distinguishable landmark: fire hydrant, bridge name or water body it crosses, guardrail, etc)
- Direction of travel: N, S, E, or W if possible, or direction toward town or city (i.e. Hwy 378 toward Lexington).

Another integral part of a statewide claims handling process is the use of a detailed, consistent, and descriptive classification system for claims and lawsuits. A new classification system is outlined in the Methods section under Task 2 of this report. Use of this system is also demonstrated in a decision support system framework in the following section. This classification system could be implemented with the current handling process or incorporated in an electronic database as well. It also could be implemented at the county level or in the Office of Legal Services.

Lawsuit Handling Process

The current lawsuit handling process is outlined in Figure 60. As described in the section "Ensure SCDOT is involved in litigation decision making" under "Policy Enhancements" the current handling process needs to include SCDOT having an increased role in the handling of lawsuits by the private attorneys that are hired by the IRF. This change could provide SCDOT considerable benefits and the cost benefits can be highlighted in Figure 51. This figure shows the relatively small indirect costs of lawsuits compared to the total settlement amounts. Increasing the indirect costs by increased involvement by the SCDOT might increase the total cost of lawsuits by a small percentage however, the potential reduction in the settlement amount could be very large.

The proposed lawsuit handling process shown in Figure 61 could be possible by implementing the claims handling process which includes moving much of the current data entry from the legal office to the county offices. This move would provide the legal offices more time to become involved in the proposed handling of the lawsuits. Figure 61 outlines the proposed handling process which shows the increased involvement by the SCDOT in the handling of the lawsuits by the private attorneys as well as the IRF.

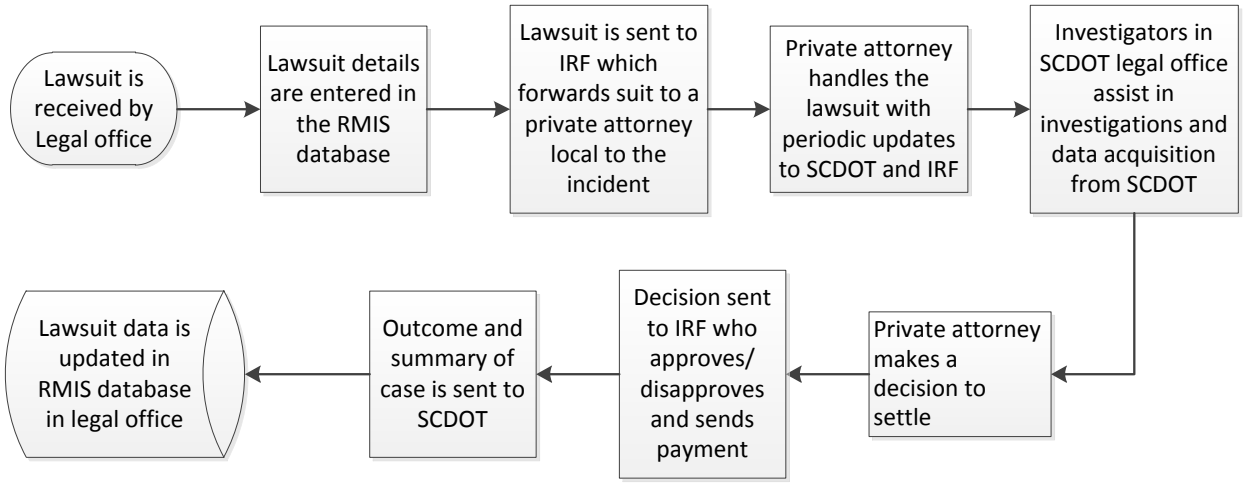


Figure 60 Current Lawsuit Handling Process

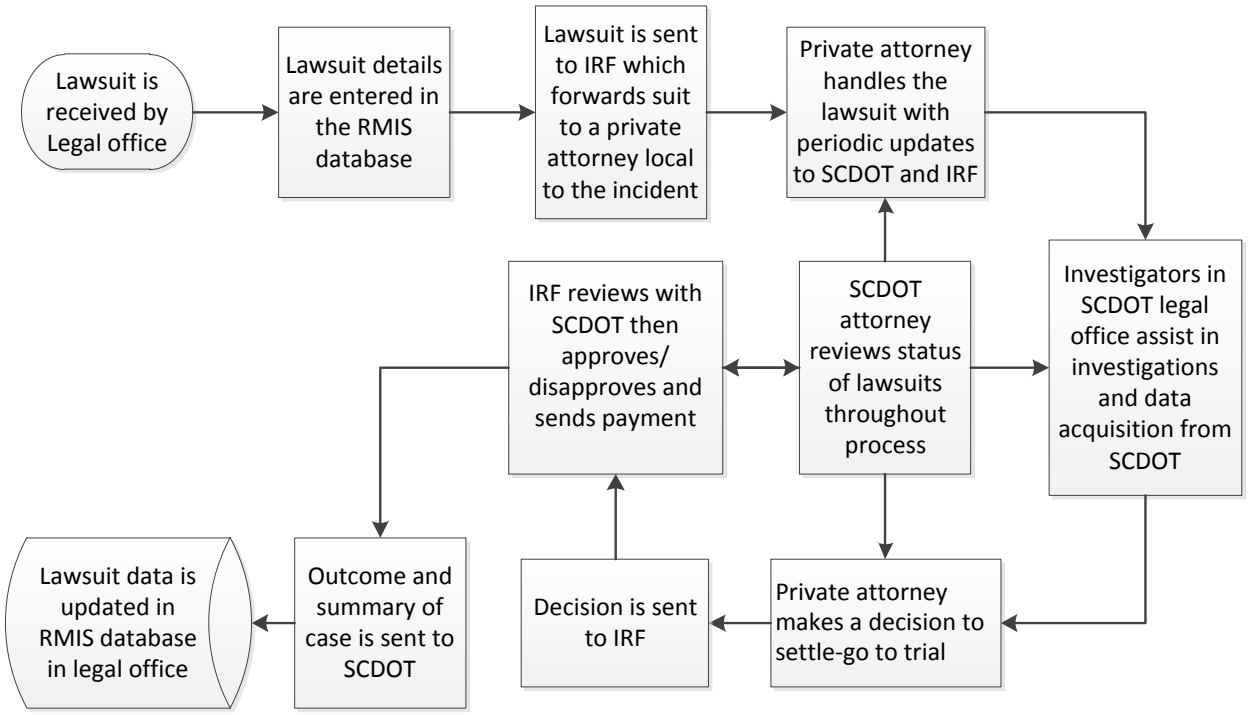


Figure 61 Proposed Lawsuit Handling Process

Decision Support System Framework

Along with a uniform handling process, decision support systems will greatly improve the consistency of decisions made by various employees and offices, which has proven to be a major issue with the current system. Decision support systems could be implemented at the following steps in the claims handling process:

- Initial claim investigations at the county level
  - In order to help the employee identify the alleged defect or cause of the incident
  - In order to help the employee to identify the actual location
- Claim recommendation at the county level
  - To ensure the claims are consistently being approved/denied on the same and appropriate grounds. The legal office's significant weighting of these recommendations in the final decision makes this decision critical.
- Claim classification in the Office of Legal Services
  - So that data and identification of claims will be useful and effective

These three procedures are critical to the process and final outcome of a claim. Consistency amongst employees and claims is the key benefit of this system. In addition, these decision support systems could easily be integrated into an electronic database, which would be automatically implemented by the user during the data entry for investigative data, classification, and writing of a recommendation letter. The electronic system could easily prompt the user with questions to guide him/her through the decision process.

A decision support system for the claims investigation would require the investigator to answer a series of questions. The series of questions would change as they progress and would depend on the answers to the previous questions. These questions require the investigator to consider all options when attempting to identify the incident location and true cause of an alleged incident (e.g., was the pothole really a failed utility cut?).

One example of a series of relevant questions in regards to finding the location of a pothole:

Did the claimant cite a pothole as the cause?

A-Yes

Does the incident description include any words or phrases that might be used in regard to the right side of the travel lane or edge of pavement? (i.e., side of the road, edge of road, near the white line, etc.)

A-Yes

Begin looking for signs of a broken edge of pavement in the same location.

A-No

Is a bridge or overpass within .25 mile of location?

A-Yes

Check for a sunken bridge end.

This example shows how an investigation can be guided based on a series of simple questions that can greatly improve the thought process and improve the accuracy of the final decision for all employees in

various counties. Below is an example of a series of questions that could be used in a decision support system for the recommendation on the decision of the claim from the county employee.

Is the incident site owned or controlled by SCDOT?
If “No”, deny. If “Yes”, continue.

Did SCDOT have either actual or constructive notice?
If “No”, deny. If “Yes”, continue.

Is a third party responsible for the injury?
If “Yes”, deny. If “No”, continue.

Does the alleged hazard solely arise out of the design of the highway and be subject to Design Immunity?
If “Yes”, deny. If “No”, continue.

Did the injury occur in a construction zone where SCDOT is protected by an indemnity bond?
If “Yes”, deny. If “No”, continue.

These questions demonstrate how the system would ensure recommendations on claims from various counties are all made based on the same criteria and with the same judgment. Below is a completed decision support system for the new classification structure detailed in the Methods section under Task 2.

Finally, a claims classification support system for the Office of Legal Services, reflecting the new classification structure, detailed in the Methods section under Task 2, would ensure that data and identification of claims are useful and effective. This example shows how data input can be guided, based on a series of simple questions and answers so that uniformity and completeness requirements are satisfied.

What is being claimed?
Property Damage
What is damaged?
A vehicle
Was the object that caused the damage fixed? (Alleged road defects are considered to be fixed - other vehicles are not fixed) If a SHEP worker caused the damage-go to Type 3.

Yes-go to Type 2
Identify the categories in bold the object would relate the most to and choose a bulleted listing that best describes the incident. Record the number which will be used to identify the cause.
No-go to Type 1
Identify the category in bold the object would relate the most to and choose a bulleted listing that best describes the incident. Record the number which will be used to identify the cause. If multiple vehicles are involved use

code “22” and then go to the subcode list and choose a bulleted listing that best represents the incident. If the claim does not relate to one of the categories in bold check the bottom of the column and use “other”.

Property other than vehicle

Go to Type 5

What activity was being performed that allegedly caused this property damage?

Identify the category in bold that most closely relates to the activity and choose a bulleted listing that best describes the incident. Record the number which will be used to identify the cause. If the categories in bold do not represent the activity check the bottom of the column for miscellaneous type listings.

Personal Injury

Was the person in a vehicle when the injury occurred?

Yes-Go to Collision

Was the object the vehicle hit which resulted in the incident that caused the injury, fixed or not fixed? (Alleged road defects are considered to be fixed - other vehicles are not fixed)

Yes-go to Type 2

Identify the category in bold the object would relate the most to and choose a bulleted listing that best describes the incident. Record the number which will be used to identify the cause.

No-go to Type 1

Identify the category in bold the object would relate the most to and choose a bulleted listing that best describes the incident. Record the number which will be used to identify the cause. If the claim does not relate to one of the categories in bold check the bottom of the column and use “other”

No-Go to “Non-Collision” Type 4 “Pedestrian”

Choose from the bulleted list the classification that most closely represents the incident and if none exist use “other”.

Training Recommendations

The following section discusses different training recommendations related to minimizing the risk associated with SCDOT’s tort liability.

County Claims Handling Employee Training

Training the county level employees responsible with handling claims would be very effective at improving the quality of claims data and consistency of claims procedures and recommendations. In addition, this training could serve as an introduction and explanation of the statewide process that is outlined in the previous section or the use of one of the decision support systems.

Relevant topics for this training include:

- Demonstrations of field data collection techniques expected in the investigations
- Instructions and demonstrations on the use of equipment needed in the investigations (GPS specifically)
- Instructions on data entry-format and accuracy
- Explanations of the use of specific data fields in the claims handling process
- Explanation of the claims process as a whole and the importance of the handling at the county level
- Instructions and explanations on making claim recommendations
- Instructions and expectations of employee-claimant interactions
- Explanation of relevant legal terms and implications

SCDOT Employee Tort Liability Awareness Training

An integral component of a risk management program is regular tort liability awareness and risk management training for management, traffic operations, maintenance, construction, design and other functional areas. This training regimen instills a culture in SCDOT of the importance of the consideration of the legal ramifications of each person's decisions.

The training should emphasize that SCDOT's attorneys are too often relegated to the "shovel patrol" at the end of a parade, cleaning up other people's mess. It is better to have the people at the front of the parade avoid making the mess in the first place. That is the purpose of a sound risk management program.

A typical training class should touch on the following topics:

1. Explain the role of the Office of Legal Services in the Department's operations.
2. Describe the role of the Office of Legal Services with regard to tort liability claims and lawsuits.
3. Explain the role of the Insurance Reserve Fund (IRF) and its retained attorneys with regard to lawsuits.
4. Lay out the magnitude of tort claims and litigation against SCDOT, including number of claims and lawsuits, and the amounts paid out each year.
5. Briefly set forth the legal bases for SCDOT liability under the Tort Claims Act.
6. Identify the defenses and immunities afforded SCDOT and explain how they operate to bar claims.
7. Inform them of the effect of contributory and comparative negligence in barring, in whole or in part, plaintiffs' claims.
8. Explain the law of joint and several liability and how the "deep pocket" practice works against SCDOT.
9. Inform them of the protection that Title 23 of the United States Code, Section 409, provides in protecting from disclosure in litigation specified documents relating to the Highway Safety Improvement Program so they cannot be used against the Department.
10. Based upon the functional responsibility of your audience, point out the areas that give rise to exposure to tort liability. Then explain how to ameliorate such liability.
    a. For example, the trainees in the class for maintenance class ought to aware of the potential liability arising from low shoulders, dirty signs with reduced retro reflectivity, downed delineators, damaged or missing guardrail, potholes, and signs obscured by shrubbery and trees.
    b. Among the issues that the traffic operations class should be aware of include improper signage, faulty signal timing, and compliance with the MUTCD.

c. Construction needs to know that it must be concerned with both safety on the job and safety for the travelling public. This includes complete construction signage and the documentation to establish what signs were in place at the time of a crash.
d. The design engineers need to be aware of the need to fully document their design decisions, including any design exceptions. Most importantly, they need to have a records retention system that allows that documentation to be accessible years later when litigation ensues. Without it, design immunity, which operates as a bar to liability, cannot be established and design decisions cannot be justified as reasonable.
e. Post-accident improvements have to be carefully considered. Explain how to balance the need to preserve the scene and not make "knee-jerk" non-engineering supported changes, and at the same time, initiate those improvements that are justified by sound engineering discretion and judgment.
f. Finally, management needs to have an overall understanding of all these issues in order to effectively steer the Department on a course that enhances risk management.

In addition to providing tort liability awareness training to its employees, SCDOT needs to ensure that it is reinforced by refresher classes. Tort awareness should be a periodic topic of meetings at the county, district and headquarters levels. It especially should be a topic included in safety tailgate meetings of maintenance crews, since they are the ones most directly in a position to identify and ameliorate risks to the travelling public.

SCDOT Employee Effective Witness Training

The Pennsylvania Department of Transportation has had a robust risk management program for over twenty years. An integral part of that program is PennDOT's instructions to its employees who become witnesses in lawsuits. Some of those concepts are included in this strategy and adapted for inclusion by SCDOT in proposed effective witness training.

SCDOT's employees will invariable be involved in any litigation against the Department. They are usually among the first people at the scene of a major collision. They may have had some responsibility for the maintenance of the site, the design of an improvement or an engineering evaluation of its traffic operations. As a result, the Department must be proactive in instructing its employees on how to be an effective witness for SCDOT. This includes general guidelines on demeanor and comportment, as well as more specific instruction on what the Department expects of its employees when they become a witness in litigation. Employees should have a basic understanding of the litigation process and the difference between testifying at a deposition and testifying in court.

It must be explained to employees that a deposition is an informal court proceeding. It involves the questioning of an employee conducted in the presence of a court reporter. The reporter makes a typed record of the questions that counsel poses to the employee and the responses that the employee makes to those questions. The lawyer for the employee witness is present and may object to questions when necessary. The questions asked may encompass broader issues than those that may be asked at trial and the responses may be used in court for any purpose; primarily to impeach the witness's credibility. The opposing attorney who asks the questions will sometimes appear very friendly, but it must always be remembered that he or she is representing a party adverse to SCDOT.

Employees need to understand that most depositions are "discovery" proceedings. That means that the opposing counsel is permitted to ask a broad range of questions to determine the extent of the deponent's knowledge about the case. Some of these questions and corresponding answers would

not be permitted in a court of law under the rules of evidence. However, the courts allow "discovery" in these depositions to develop or uncover evidence that may be used at trial, and for that reason, employees should not be surprised if counsel does not object to questions that may seem be out of line. Counsel will make objections during the deposition to questions on subjects that are not proper for the deposition and will have the opportunity during trial to object to any portion of the deposition, requesting it be excluded from the testimony at trial.

Testifying at trial differs in that it inevitably follows the taking of a deposition. The deponent will have already given testimony under oath and will have had his "story" pinned down. The witness will generally need to stick to his or her prior testimony. In court, the attorney representing SCDOT will have the opportunity to question the employee witness to more fully develop facts favorable to its case and present new information that may shed a different and more positive light on prior testimony. Moreover, the employee witness should be on the same page as the SCDOT attorney so that he/she can provide the full and complete testimony that is being sought.

Employee witnesses need to be provided a list of pointers, which could include the following:

1. *Tell the truth* - This is more than a maxim; it is a rule of self preservation. Always assume that the examining counsel knows what he/she is doing and can sense when a witness is playing fast and loose with the truth. The consequences for the witness can be severe.
2. *Think before you speak* - Allow several seconds to elapse before you begin to answer each question. This allows counsel to formulate objections; it further allows you to think through your answer.
3. *Speak up*- Give an audible answer and don't mumble.
4. *Answer only the question asked* - The examiner is entitled to an answer to the question that has been asked, but only to that question.
5. *Do not volunteer information* - As a witness, you are not there to educate the examiner.
6. *Do not answer a question that you do not understand* - It is up to the examiner to frame intelligible questions; if he/she cannot, do not help. Do not explain to the examiner that the question is incomprehensible because he/she has misunderstood words of art in your business, trade, or science. Do not help the examiner by saying "Do you mean X?" or "Do you mean Y?" If you do, you will be asked both of those questions.
7. *Do not guess*-The questioner is entitled to your best estimate, not a guess. Beware of time and distance questions that would require you to guess. Don't fall into the trap.
8. *Never speculate* - If you do not know or cannot recall something, say so. This rule becomes more important and more difficult to follow when the examiner is scoring points or making it appear to you that only an idiot does not know the answer to the question. This device is frequently used by lawyers. Don't fall into the trap.
9. *Don't look for help with your answer*- Your attorney can't answer for you. If you don't understand the question, say so. If you can't remember, say so. If you don't know, say so.
10. *Keep your answers factual* –Don't exaggerate or color your answer with your opinion.
11. *You only know what you have seen or heard* - Questions are often phrased "do you know…?" A question in a deposition may legitimately ask what you know and question whether you may have information bearing on a particular subject; but remember, the questions is trying to elicit what you actually perceived, not scuttlebutt.
12. *Be as specific or as vague as your memory allows, but stick to your actual recollection* - If you are asked when something occurred and you remember that it occurred on January 15, state, "on

January 15." If you cannot recall the exact date, state the approximate date only if that is your *actual recollection.*

13. *Do not explain your thought processes*. - If your answer to a question depends on your recollection of facts not called for by the question, do not refer to these other facts. In other words, if you are asked when a conversation with Jones occurred, and you recall that it had to be in December because you met Smith after Jones and that was in January, do not explain this thought process to the examiner – simply answer "in December".
14. *In testifying about conversations make it clear whether you are paraphrasing or quoting directly*.
15. *In answering questions calling for a complicated series of events or extensive conversations, summarize where possible* - The examiner, if he/she is doing his/her job properly, will ask for all the details. It is always possible however, that the examiner will accept your summary: so much the better.
16. *Never characterize your own testimony* - Do not use words and phrases such as "In all candor", "honestly", "I'm doing as best I can".
17. *Avoid the use of "never" and "always*" - These two words have a way of coming back to haunt you.
18. *Do not testify as to what other people know unless you are asked about it specifically* - Do not volunteer the names of colleagues or co-workers who may know the answer to the question or be able to supply additional information on the subject. If you do, the examiner will most likely depose them at a later date.
19. *Do not testify as to your state of mind unless you are specifically asked about it* - If the question is: "Did you read that document?" the answer is "Yes" and not, "Yes and I believe every word of it".
20. *If information is in a document, which is used at the deposition, ask to review the document before responding to any questions about it* – Even if you have a photographic memory and have a mental picture of the document, you should always take advantage of the opportunity to refresh your memory about it.
21. *If information is in a document, which is <u>not</u> used at the deposition, answer the question only if you can recall the answer* - If you cannot answer the question without looking at the document, which is not present at the deposition, you may simply answer the question by stating that you do not recall. If you can answer the question, do so. After a witness states that he/she does not recall a fact which the examiner believes he/she should have knowledge of, the examiner may ask if there is a document which can refresh his/her memory.
22. *Do not let the examiner put words in your mouth* - Do not accept his/her assumptions or his/her characterization of time, distance, personalities, or events. You should rephrase the question into a sentence, using your own words.
23. *Do not answer a multiple-part question unless you are certain that you have all the parts in your mind* - If it is too complex to be clearly structured in your mind, it is too complex and ambiguous to be answered.
24. *Pay particular attention to the introductory clauses preceding the main question* - Leading questions, that is, questions that suggest answers, are often preceded by statements which are either half-true or contain facts which you do not know to be true. Do not have the examiner put you in a position of adopting half-truths or unknown facts on which he/she can then base further questions. Listen to the entire question and don't fall into the trap of being "led down the garden path."
25. *Use all recesses to follow counsel to a place where you can confer in private* – This allows you to clear up any misunderstandings and receive advice from counsel.

26. *If you are caught in an inconsistency, do not panic* - What will happen next depends upon what questions are asked of you. State, if asked, what your present recollection is. State the reason for the inconsistency only if you are asked. Clarification and rehabilitation are done by your counsel later in the deposition or at trial.
27. *If you are finished with an answer and the answer is complete and truthful, remain silent* - Do not expand on it. Do not add to your answer because the examiner looks at you expectantly. Don't be tempted to fill the silence and fall into the trap of expanding your answer. If the examiner asks you if that is all you recollect, say "yes" if that is the case.
28. *Do not agree to supply any information or documents requested by the examiner* - If he/she refers to documents or information, the request is made to your counsel. Counsel will either answer the request or take the request under advisement.
29. *If there is an objection, stop talking and listen to the objection very carefully* - You may learn something! If your attorney instructs you not to answer, follow those instructions.
30. *Never express anger or argue with the examiner* - If a deposition becomes unpleasant, handling that is your counsel's role. In all cases, you must remain calm, courteous and confident.
31. *Do not expect to testify without the other side scoring points* - If the other side appears to you to be asking questions that call for answers that do not help your case, accept the fact that every lawsuit has two sides and sit back and take your punishment. Avoid the temptation to guess, be evasive, expand on your answer where the expansion is not called for, or, even worse, prevaricate.
32. *Avoid any attempts at jokes or levity* - If you make jokes or wisecracks, you will be hauled over the coals for not taking your solemn oath seriously. It's ok for the lawyers and judges, but not for you. Pomposity is an occupational disease of the legal profession.
33. *Avoid absolutely any ethnic slurs or references which could be considered derogatory or even the mildest obscenity* - For example, don't refer to females over 18 as "girls".
34. *There is no such thing as "off the record".* - If you have any conversation with anybody in the deposition room (with the exception of your attorney), be prepared for questions about that conversation.
35. *If the examiner appears totally confused about your business and its technical aspects, do not attempt to educate* –Let him/her fumble around – no matter how frustrating it may be to you. Simply answer the questions posed.
36. *If you do not remember something, say so* - You may then be asked if a statement or document refreshes your recollection. If it does, say so. If it does not, the answer remains that you do not remember. You may be asked whether there exists a document which may help you refresh your recollection.
37. *If you are asked about a document used at a deposition, read it completely before testifying* - Do not let anyone rush you but take whatever time is required. Do not make any comments what so ever about the document except to answer to the question that elicits your testimony.
38. *If you are hit with a flash of insight or recollection while testifying and this has not been previously discussed with counsel, keep this to yourself, if possible, until you have had an opportunity to go over it with counsel*- You never want to surprise your counsel in front of the other side.

Once an employee is identified as a potential witness in litigation against SCDOT, an intense refresher of the effective witness training outlined above in the context of the particular case will need to be conducted.

Highway Patrol Training

It is important that SCDOT maintain a close working relationship with the Highway Patrol. Not only is this relationship critical to providing effective and expeditious incident management and response, it can also provide a positive impact on the Department's risk management program. Thorough crash investigations and complete reporting are necessary to the defense of claims and lawsuits that arise out of those crashes. Likewise, sensitivity to potential tort liability issues can reduce the incidence of surplusage in crash reports that may invite a claim or lawsuit.

Training for the South Carolina Highway Patrol, particularly the new cadets as part of their training classes, should include the following topics:

1. A discussion of the Highway Safety Improvement Program as it relates to the Highway Patrol.
2. An explanation of the significance of the Patrol's role in the State's safety program.
3. Instruction on how the Department makes safety decisions and choices for highway improvements and maintenance functions based on collision reports.
4. Provide an understanding of the legal principles involved in highway litigation and Highway Patrol's role as part of that process as a first responder and reporter and potentially, as a witness later in the process.
5. Explain how complete, accurate and factual collision reports are critical.
6. Cadets should be taught the importance of GPS locations, proper photographs of the highway that clearly show conditions at the time of the crash, and complete measurements. Examples of both good and bad practices should be provided.
7. Develop and explain a procedure to notify the Department of potential problems on the state highway system, without putting the information in crash reports, thereby assisting the Department in identifying and ameliorating potential tort liability and enhancing risk management.
8. Cadets will gain an appreciation of the mutual safety goals of the Department and the Highway Patrol

This kind of training, presented to cadets at the beginning of their careers, can promote a sense of partnership between the Highway Patrol and SCDOT in providing for the safety of the travelling public. It can avoid the "us versus them" attitudes that can too often impair an effective, positive relationship.

Conclusions

For any DOT, the risk management process is diverse, which ranges from managing risks of construction projects and contractors to SCDOT employee management and resource allocation. This research, which encompassed a subset of the overall risk management process, dealt with managing risks of claims and lawsuits. Several tools were utilized in the conduct of this research to develop risk management recommendations for SCDOT (See Summary Table 34). These recommendations were specific to the following areas: policy enhancements, process enhancements, economical and effective safety related mitigation measures and training needs.

Initially, the project involved collecting basic data on the current SCDOT tort handling procedures at all levels of the process and identifying current trends in the claims and lawsuits through descriptive statistics. These data and the descriptive statistics brought to light issues with claim and lawsuit data management as well as handling procedures. The primary issue was an inconsistent and inadequately defined process for investigations, handling, classification and decisions on claims at the county level where claims and lawsuits initiate. These issues ultimately create a statistically significant variation in the final outcome of claims based on DOT district, which is identified in the results of the regression tree analysis. These results from the descriptive statistics and confirmed by the regression analysis provide evidence that policy and process enhancements should be addressed, which are included in the results of the implementation plan.

In addition, consistently inadequate location data from multiple stages in the process were observed to be a major issue with claims and lawsuit handling. Several of the issues with the location data were then confirmed in the results of the spatial analysis. The lack of location data including potential accuracy and bias by districts also led to limited samples of claims and lawsuits that could be linked to roadway characteristics data.

Risk factors identified in the regression analysis were not able to be incorporated into the fault tree analysis due to the limited types of roadway characteristic data available related to road related conditions. Countermeasures identified in the results of the fault tree analysis can be implemented by incorporating them into new or revised maintenance procedures. Suggested countermeasures such as identifying above ground and buried utilities before mowing, ditch work, and post installations would be effective in reducing the probability of claims. Increasing sidewalk repairs or delineating defects in sidewalks would also be effective in reducing claims.

Policy enhancement recommendations related to claims avoidance strategies include integration of the Office of Legal Services into Departmental decision-making, Office of Legal Services review of policies, procedures and manuals, Office of Legal Services review of legislation, and a statewide tort liability and risk management committee. Policy enhancements related to claims and lawsuits handling and cost mitigation strategies include early identification of SCDOT employee witnesses, effective witness preparation and ensuring that SCDOT is involved in litigation decision-making with the Insurance Reserve Fund that is currently responsible for many critical decisions regarding the management of SCDOT related lawsuits.

Table 34 Summary of Results and Relationships

Task	Products Detailed in the Respective Results Section	How to Utilize Results
State Survey	Insight into other state's risk management strategies and legal standing regarding claims and lawsuits filed against Transportation Departments.	Identify risk management strategies that could be applicable or effective in SC.
Descriptive Statistics	Extensive comparison of the number, location, and economic statistics of current claims and lawsuit by cause type.	Identify variation or patterns in data that can lead to the identification of process or policy issues to be addressed in the implementation plan.
Spatial Analysis	Spatial representation of claims and lawsuits by cause/classification, settlement decision, settlement amount, and claim amount.	Identify spatial variation or patterns in data which can lead to the identification of localized process or policy issues to be addressed in the implementation plan.
Regression Tree	Statistically significant patterns and splits in the claims and lawsuit data based on many characteristics.	Determine relationship between risk factors and claims/lawsuits based on historical data.
Fault Tree	Identification of the smallest combination of events that lead to a claim or lawsuit. Ranking of these combinations by probability that they will lead to claim in order to find the potential effect of countermeasures.	Prioritize available resources to implement countermeasures according to the most critical combinations of causal factors related to claims and lawsuits.
Benefit Cost Analysis	Identification of selected countermeasure's economic value.	Consider the suggested effective and economical countermeasures for reducing claims and lawsuits.
Implementation Plan	Process and policy changes to improve the risk management of claims and lawsuits. Recommendations to improve the efficiency and effectiveness of the claims handling process.	Consider the suggested policy and process changes in order to strengthen risk management.

Process enhancement recommendations include a uniform claims handling procedure at all levels, changes in forms related to the claims process and a proposed electronic central database which could be accomplished through expansion of the current Risk Management Information System (RMIS). The handling procedure provides a detailed process for the county level engineers where claims are initially received, and a majority of the critical information regarding the incident and claim are investigated and reported. The proposed database would be capable of tracking and monitoring claims and lawsuits as well as improving the efficiency, effectiveness and resource sharing among the various levels of

management and departments. This system would be able to tie the various levels of management and departments involved in the process together through a single point and greatly improve some of the current system's largest flaws: data collection, management, consistency, and sharing, which were identified in the project analyses to create a significant variation in the outcomes of claims.

Based upon results generated in this research through various tasks, which include descriptive statistics, regression tree analysis, fault-tree analysis and benefit cost analysis, proactive safety related mitigation measures have been proposed to minimize claim and lawsuit risks. In addition, several major process and policy recommendations have been made in order to standardize and improve the claims and lawsuit handling process as well as improve the risk management efforts of the SCDOT.

Future Research and Next Steps

It is recommended that SCDOT develop a tort awareness training course to deliver to its employees at all levels. In addition, a training course on the related topic is recommended for development and delivery to the State Highway Patrol in order to promote a more symbiotic relationship. Outlines of these training courses have been provided in the policy enhancement section of this report. Training or briefings for SCDOT employees at the county level responsible for handling claims and lawsuits should also be conducted to ensure the proper implementation of the proposed statewide county level procedures.

An electronic database, outlined in the process enhancements section of this report, is recommended for development in order to provide a more effective, and efficient claims handling process. The SCDOT should modify and revise the database outline provided for specific functions of the various departments involved in claims handling and management. It is also recommended that the research results presented in this report be incorporated in SCDOT's decision support system related to tort liability management.

SCDOT currently deploys a significant number of cameras on its highways and the number is likely to increase in the future to increase coverage of additional roadways. Future research should evaluate how these surveillance videos and other automated data collection systems can be utilized in tort liability risk management. In addition, because of the expected widespread use of vehicle "black box" data, future research should evaluate how this data will impact SCDOT's tort liability risk management.

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Appendix A: Survey Sent to States

Exploratory Analysis of Tort Liability Systems

After most states lost their sovereign immunity, tort liability has become of concern to public agencies, especially transportation agencies, because money spent defending tort lawsuits is not available for improving the safety of the state highway system. Consequently, how state transportation agencies manage risks against claims and lawsuits that may be filed against them, is of great importance.

Therefore, SCDOT has partnered with Clemson University researchers to conduct a study on "The Relationship of SCDOT Damage Claims and Lawsuits to Roadway Engineering Safety Issues" to identify sources of claims and lawsuits, while also defining potential system improvements that may reduce these legal challenges and positively affect public safety and mobility.

Clemson University has prepared the following questionnaire as an exploratory analysis of existing tort liability systems to determine outcomes of tort data management, and to identify any potential decision support systems that have been developed as a result of having the data system in place. We believe that information received from this questionnaire, will provide useful input to our analysis. So, please take your time and answer the questions as completely as possible. The results of the study will be shared with all participating parties. However, individual state's responses will not be distributed or published.

If you have any question or would like to mention some additional information, please do not hesitate to call or email the following project contacts:

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(864-656-3313)

Dr.Jennifer Ogle
ogle@clemson.edu
(864-656-0883)

THANK YOU IN ADVANCE FOR YOUR ASSISTANCE AND YOUR RESPONSE BY FEB 22,2010 WOULD BE GREATLY APPRECIATED

CONTACT INFORMATION

1. Would you please provide your contact information.

Name:
Company:
Address:
Address 2:
City/Town:
State:
ZIP/Postal Code:
Country:
Email Address:
Phone Number:

2. Would you like to include an additional contact person?

3. Please provide alternative contact information.

Name:
Company:
Address:
Address 2:
City/Town:
State:
ZIP/Postal Code:
Country:
Email Address:
Phone Number:

TORT LEGISLATION

1. What kind of immunity does your state have against highway-related tort claims and lawsuits?

- ◯ Full
- ◯ Partial
- ◯ No immunity

if partial, please describe

2. What type of award limits, immunities, or impacts on liability exist in your state? Please select all that apply.

- ☐ Joint and several liability
- ☐ Design Immunity
- ☐ Other (non-design) discretionary immunity
- ☐ Economic or budgetary defense
- ☐ Collateral source of payments
- ☐ Non-economic damage awards permitted
- ☐ Punitive damage award permitted
- ☐ Contributory negligence standard
- ☐ Comparative negligence standard
- ☐ Legislative approval required on each litigation settlement
- ☐ Limit or cap on dollar amount of damage award

If limit or cap exists in your state please indicate ceiling per injured person and ceiling per occurrence or incident

3. What is the statute of limitations in your state?

For filing lawsuits (in months)

For filing damage claims (in months)

4. What is the typical time required to resolve a :

Lawsuit (in months)

Damage claim (in months)

5. Does your state have a policy in place to handle claims for non-standard equipment (e.g. after market wheel rims) on vehicles which can be far more costly than standard equipment?

◯ Yes

◯ No

If yes, please describe or attach file

INSURANCE INFORMATION (section - 1)

1. Does your state maintain liability insurance on highway tort actions?

- ◯ Yes
- ◯ No

2. Please select the type of liability insurance available for highway tort actions in your state.(select all that apply)

- ☐ Blanket tort policy
- ☐ Coverage for automobile laibility
- ☐ Coverage for construction equipment operation
- ☐ **Coverage for maintenance equipment operation**
- ☐ Other

If other, please describe

INSURANCE INFORMATION (section - 2)

1. How do you determine the amount of funds that need to be set aside for paying future claims.

2- Does your agency pay a premium to an insurance fund for coverage?

- ◯ Yes
- ◯ No
- ◯ Other

3. From which agency's budget are expenses paid for tort claims?

- ◯ General budget/special funds administered by the state Attorney General
- ◯ Funds administered by the state DOT
- ◯ Other

If other, please describe briefly

TORT CLAIMS/LAWSUITS DATA (section - 1)

1. Do you have a documented procedure (such as a flow chart or business process) that describes your tort claim administration?

- ◯ Yes
- ◯ No

If yes, please describe or attach file

2. What methods are available for submitting damage claims?(please check all that apply)

- ☐ Online form
- ☐ Fax
- ☐ Call-in
- ☐ In-person
- ☐ Other

If other, please explain

3. Do you have a standard form/procedure for conducting claim investigations?

- ◯ Yes
- ◯ No

If yes, please describe or attach file

4. Do you maintain documentation on or otherwise track DOT labor hours associated with claims handling, tort litigation, etc?

- ◯ Yes
- ◯ No

5- Does your agency conduct analysis to relate a claim or lawsuit to roadway safety causes or crash data?

- ◯ Yes, explain.....
- ◯ No

6. Does your state maintain a database of claims and lawsuits?

- ◯ Yes
- ◯ No

TORT CLAIMS/LAWSUITS DATA (section - 2)

1. Are claims entered into a central database immediately when they are received.

- ◯ Yes
- ◯ No

If no, please explain the process

2. Are text documents scanned and maintained within the electronic database instead of Just kept in a paper file?

- ◯ Yes
- ◯ No
- ◯ Both

3. Which of the following pieces of information are included in the database of claims? (Please check all that apply)

- [ ] amage claim or lawsuit(type)
- [ ] Date of accident
- [ ] Date of claim
- [ ] Status of claim
- [ ] Contact information
- [ ] Requested amount-injury
- [ ] Amount-property damage
- [ ] Type of accident
- [ ] Reported to police
- [ ] Specific location-route/milepoint or postmile or GPS coordinates
- [ ] Paid or denied/resolution/judgment
- [ ] Amount paid/settlement value
- [ ] Attorney information
- [ ] Other
- [ ] Recommendations for payments or denial
- [ ] witnesses
- [ ] Denial letter sent to
- [ ] Check sent to claimant
- [ ] Identification related to state reserved fund

If other, please explain

4. How does your state determine the location giving rise to the claims? Is this location geocoded? How much time do you spend looking for claim sites if original description is inadequate?

5. Can you query the number of claims by causal category (ie., pothole, shoulder, pavement, traffic control devices, fixed objects ...) to determine leading causes of lawsuits in your state?

- Yes
- No

6. For the most recent complete year (ie., the statute of limitations has passed) of tort claims AND lawsuits, please provide the following data (if available).Please note that individual state's responses will not be distributed or published.

Year	
Number of damage claims paid with total amount	
Number of damage claim denied with total amount requested	
Number of lawsuits disposed by settlement with total amount	
Number of lawsuits disposed of with a court judgment with total amount	
Number of lawsuits disposed of without an award with total amount	
Number of lawsuits pending	

7. What outcomes/policies have resulted from your tort data management system? Have you implemented any widely successful treatments/countermeasures?

RISK MANAGEMENT PROGRAM (section - 1)

1. Has your state established a risk management program to address issues such as highway tort liability?

- ◯ Yes
- ◯ No

If no, please briefly describe how you manage highway -related tort liability risks.

RISK MANAGEMENT PROGRAM (section - 2)

1. Please describe the organizational set-up and/or process of the risk management program.

2. Do you have staff in your agency specifically assigned to management of highway tort liability risks?

- ◯ Yes
- ◯ No

If yes, please provide a brief description of their duties.

3. Does your agency have clearly established objectives for highway tort risk management?

- ◯ Yes
- ◯ No

If yes, please list them below or kindly forward any document that has such a list of objectives.

4. Which alternative methods, besides highway safety improvement program, do you use to identify locations, that may potentially benefit from Improvement? Please select all that apply.

- ☐ Citizen complaints
- ☐ Accident investigation
- ☐ Special design and maintenance procedure
- ☐ Central traffic operations center
- ☐ Review of past tort claims
- ☐ Other

If other, please specify

5. Do you have a decision support system that aids in determining which roadside elements are most likely to lead to tort claims, so that these elements can be proactively addressed by the agency?

Yes No If yes please specify.....

6. What measures are taken after you identify a location, that may potentially benefit from a safety investigation? (either through Highway safety improvement program or alternative methods)

7. How do you determine the priorities among competing locations that may potentially benefit from a safety investigation or improvement, under highway safety program or risk management program? (e.g., use of a mathematical formula or index, subjective approach, established ranking priorities)

8. Does your state have an established uniform statewide maintenance policy whereby for example a pothole of certain size/depth must be repaired in a specific time frame from notification? Please describe or attach file. Yes No If yes, please specify

9. Do you have a time limit within which an identified hazardous location should be improved?

◯ yes

◯ No

If yes, how long (in days) do your agency's maintenance crews generally take to address a reported location?

10. Does your state provide training/workshop/seminar programs through which you advise employees in your DOT about risk management practices or highway tort claim liability?

◯ Yes

◯ No

If yes, please provide your state's contact person for risk management or tort liability training activities or programs.

11. Do you have any special risk management strategies that were not discussed in the above questions but merit mentioning?

Yes No If yes, Please explain

12. Do you regularly evaluate the results and the performance of your risk management program?

- ◯ Yes
- ◯ No

13. What criteria are used to measure the efficiency of the risk management program? (check all that apply)

- ☐ Number(or rate) of accidents
- ☐ Total number of all claims filed or paid
- ☐ Total cost of all claims filed or paid
- ☐ The program is not evaluated
- ☐ Other

If other, please specify.

14. Have you conducted any cost-benefit study (or other effectiveness study) for the risk management program or its outcome? Yes No , If yes please explain

15. Do you think your risk management program has helped in reducing tort liability costs in your DOT?

- ◯ Yes
- ◯ No

If yes, to what extent

Appendix B: Legal Database Fields Obtained

Date of incident and Time of incident
Location-road name
County Code
County name
District name
Vehicle Tag
Vehicle State Code
Reported_LE-Yes, No
Cause Code
Cause
Othe cause code
Tort or Defect
Damage of Injury Code-Damage, Injury, Both
Road type-(Interstate, US, SC, secondary)
Route-number
Begin MP-milepoint
End MP-milepoint
Begin XCoord
End X Coord
Beg Y Coord
End Y Coord
Utility Indicator
Utility Name
Remarks-detail incident and cause
TypeCode-Claim or Lawsuit
ContractCode
ContractNumber
F2062 date-data on claims form indicating when it was filled out
Claim office date-when the claims/legal office received the claim
Field date-when it was investigated
Date to designee
Date to procurement
Date to construction
Date to accounting
Date to IRF
Date to adjuster
Date to legal
Appeal date-date when claimant submitted appeal
Appeal Close date-date when appeal of claim was closed
Claim Close date-date claim is closed
Lawsuit open date-date when claim became lawsuit
Lawsuit closed date-
Final Decision-Pay or denied
Closed- Yes or No
Claim amount-total amount claimed on claims form

Injury amount-amount for personal injury
Property amount-amount claimed for property damage
Settle amount-amount paid to claimant
Company claimant
Claimant name-Last, First middle initial
Claimant city-city of claimant's residence
Claimant state code-state of claimant's residence
Claimant zip-zipcode of claimant residence
Claim Img Path
Date created-date and time entry in legal database was created
User created-username of employee that created entry
Date updated-date and time entry was last updated
User updated-username of employee that last updated entry
Time stamp

Appendix C: Fault Tree Analysis Cut Sets

Cut sets of Claims (not included in Fault tree section of report)

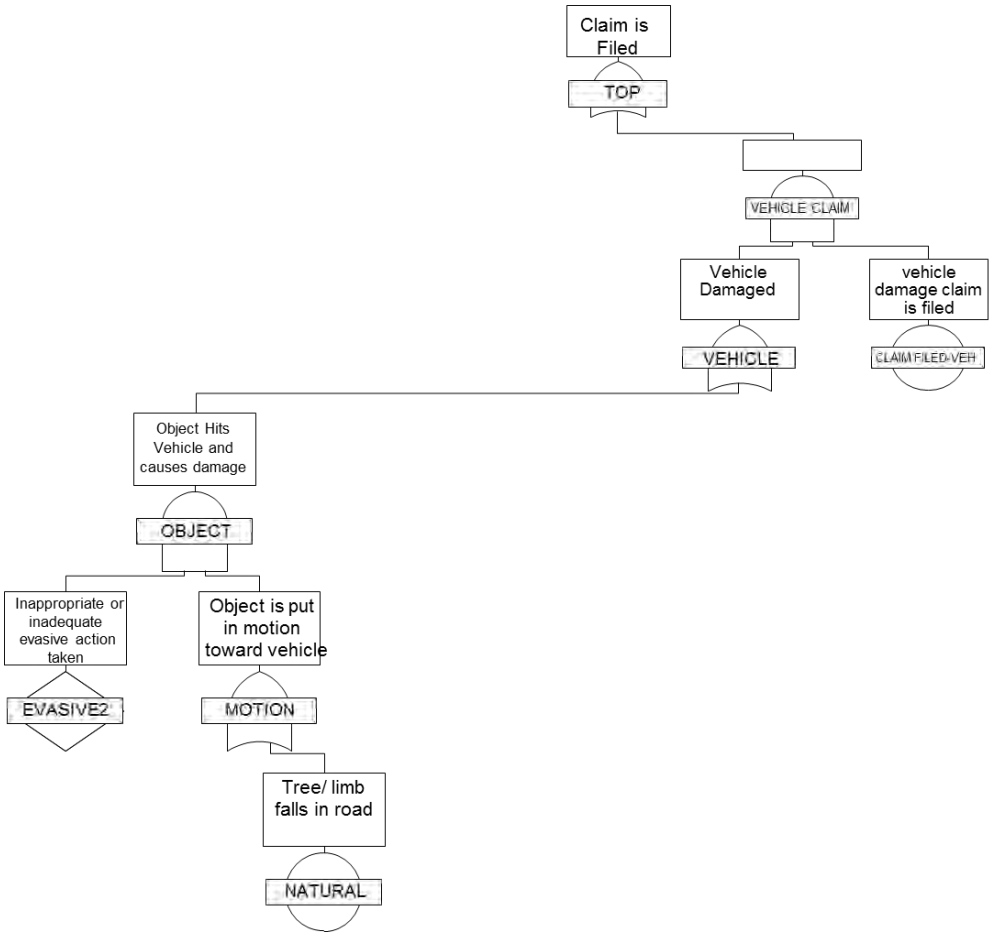


Figure 1 Tree/limb falls in road and hit vehicle

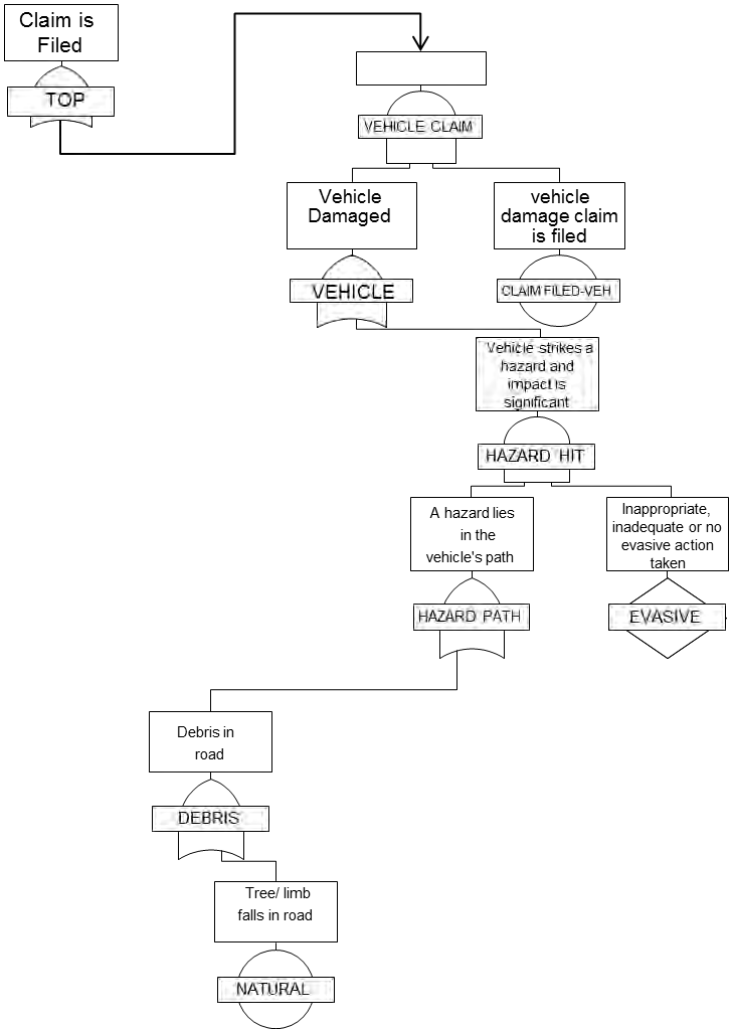


Figure 2 Vehicle hits Tree/limb that fell in road

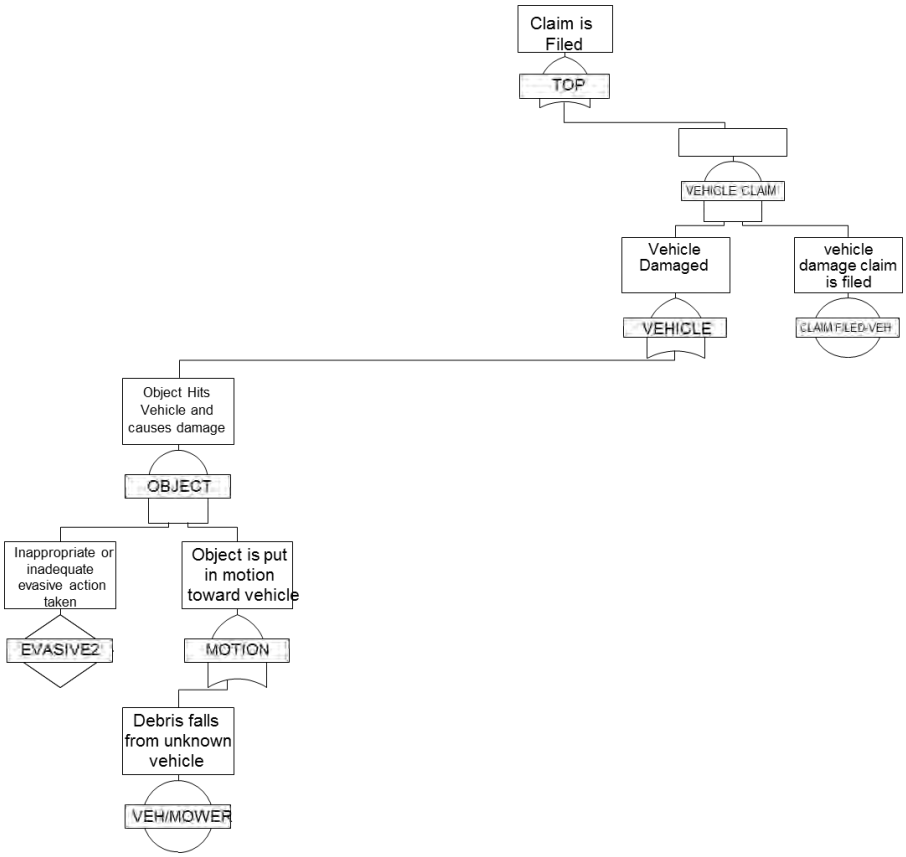


Figure 3 Vehicle damage due to debris thrown at vehicle

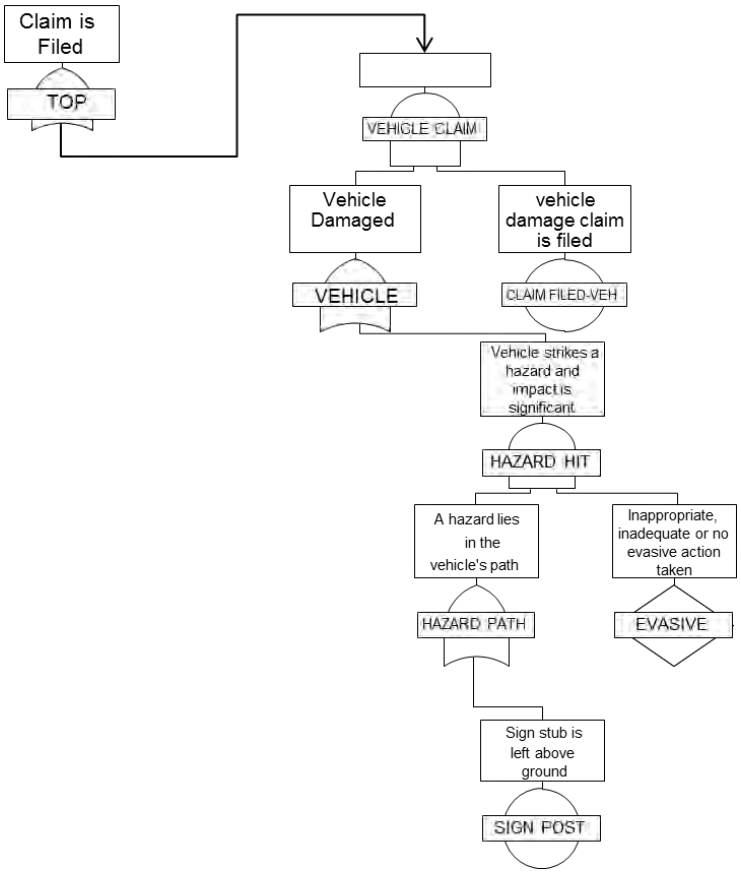


Figure 4 Vehicle hits sign stub

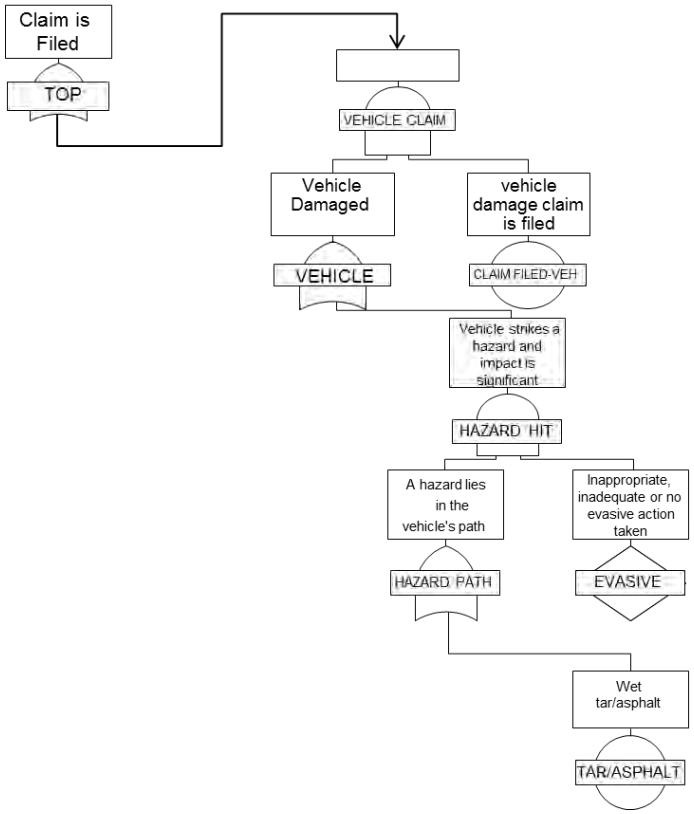


Figure 5 Vehicle Strikes wet tar/asphalt

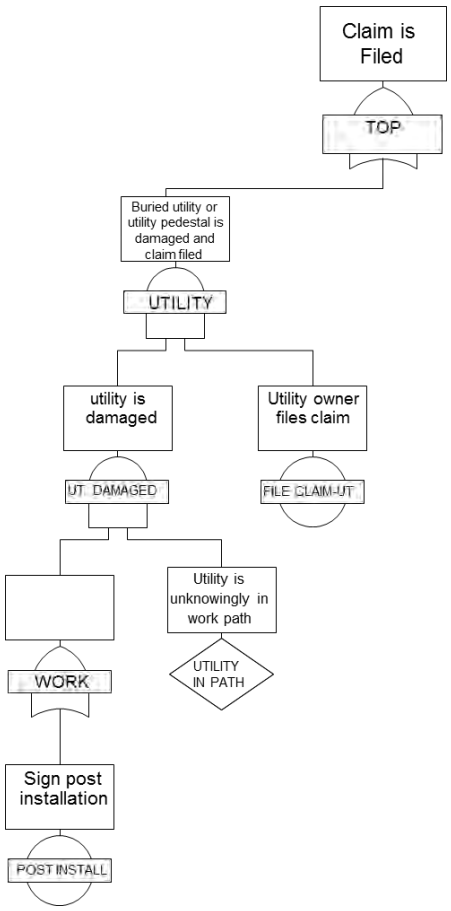


Figure 6 Cut Set Utility Damage Due to Post or Sign Install

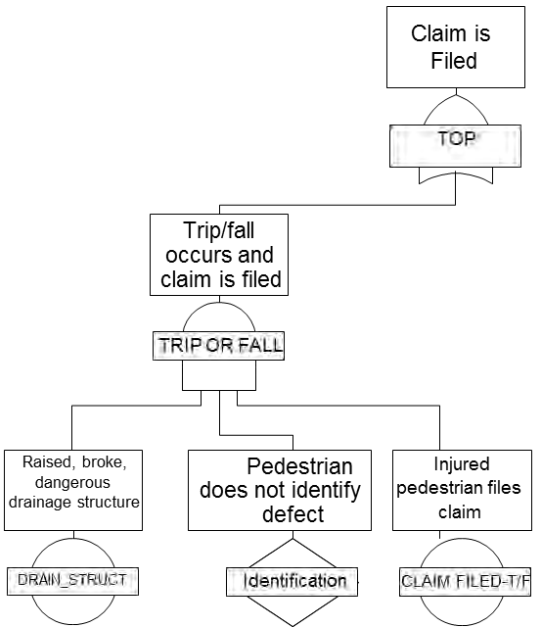


Figure 7 Cut Set “Trip/Fall Due to Drainage Structure”

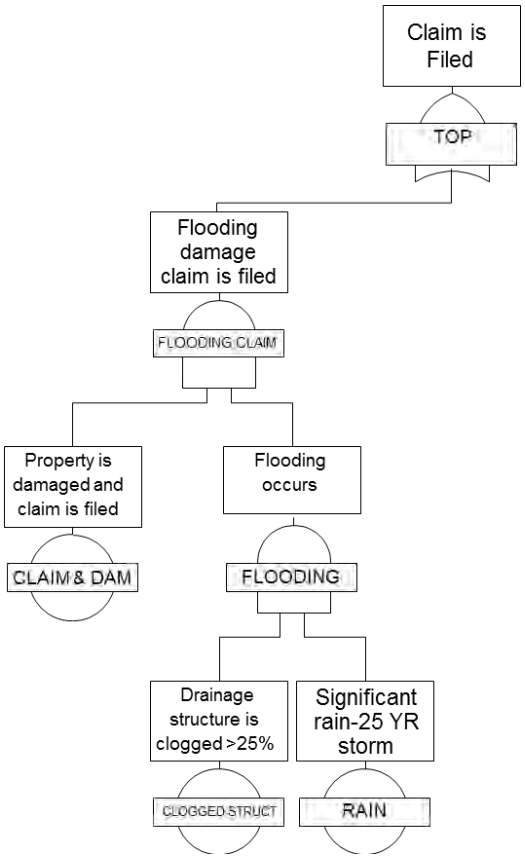


Figure 8 Cut Set “Property Damage Due to Flooding”

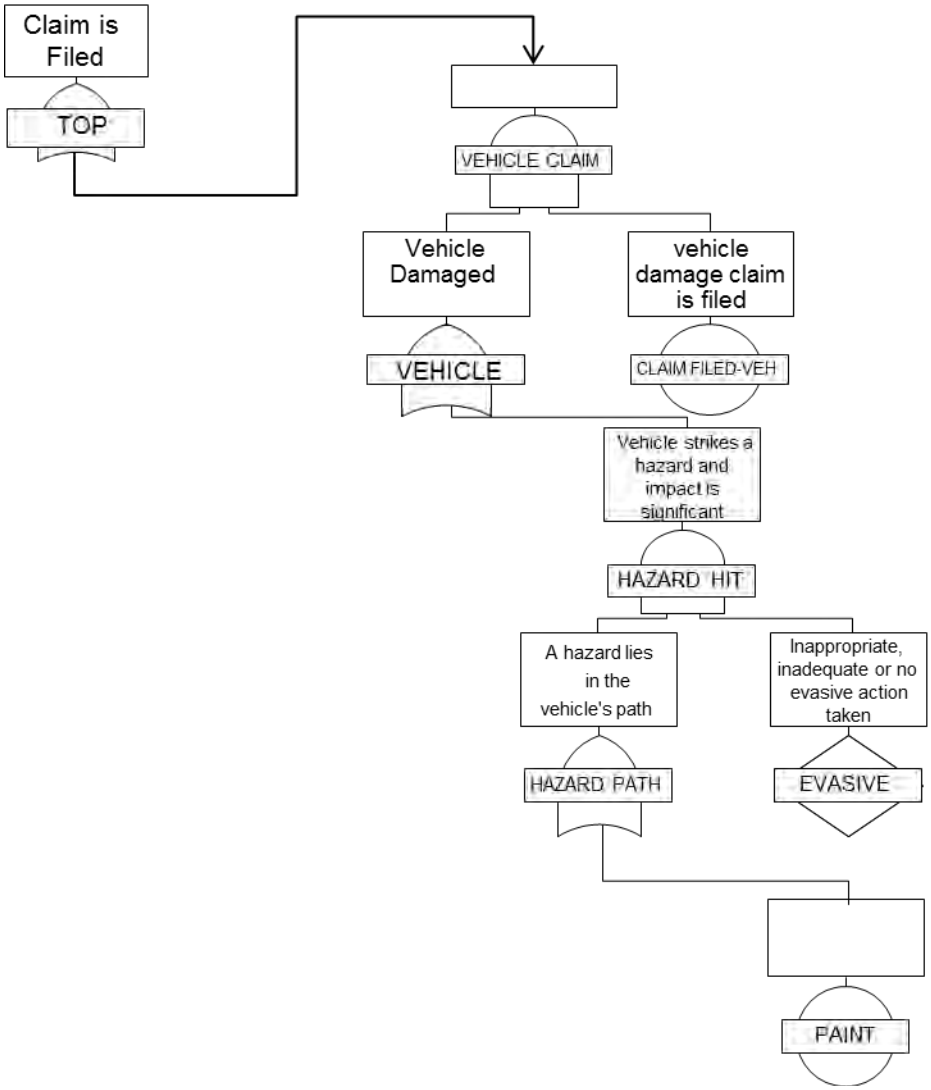


Figure 9 Vehicle strikes paint

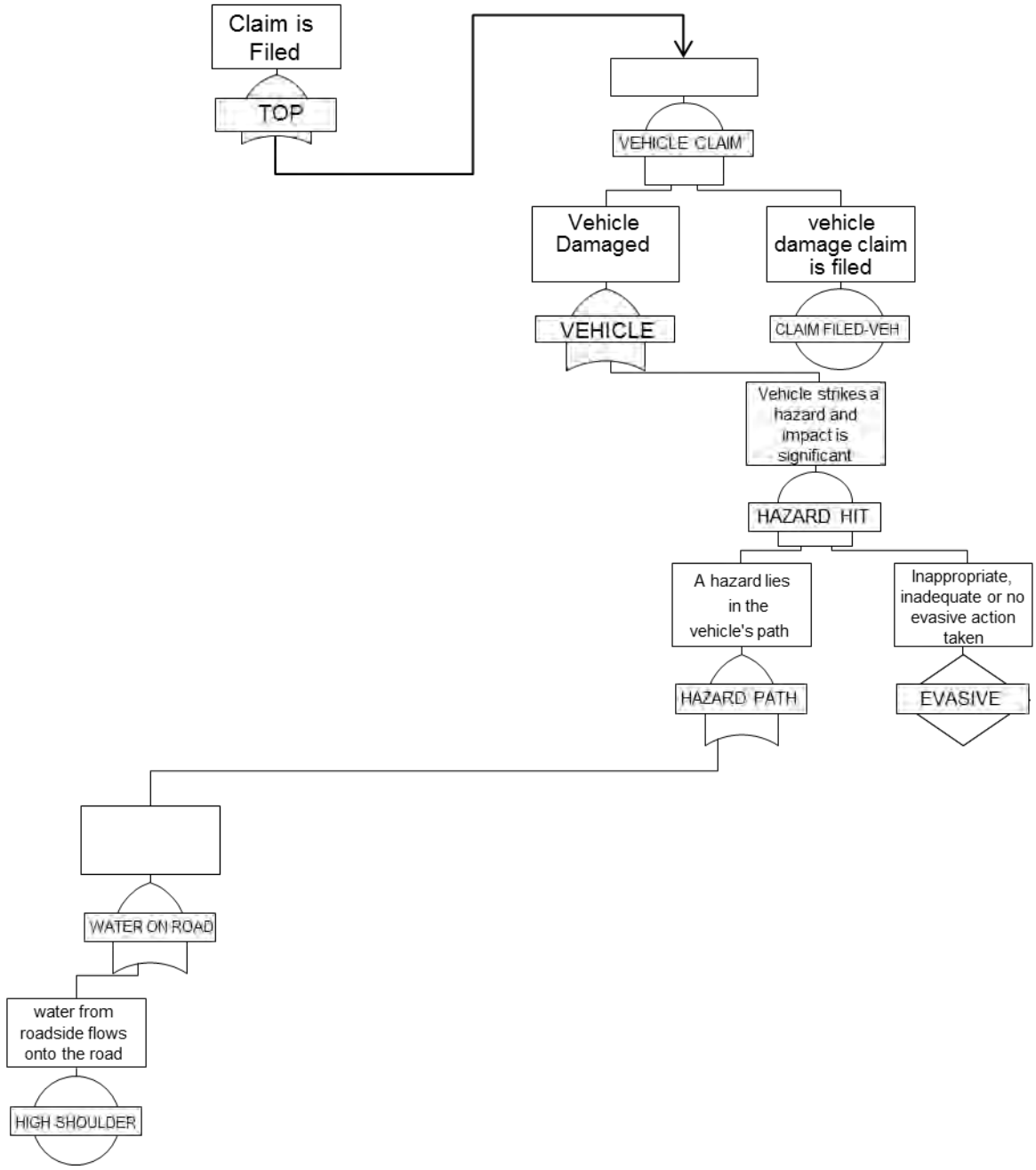


Figure 10 Vehicle hits water on road due to high shoulder

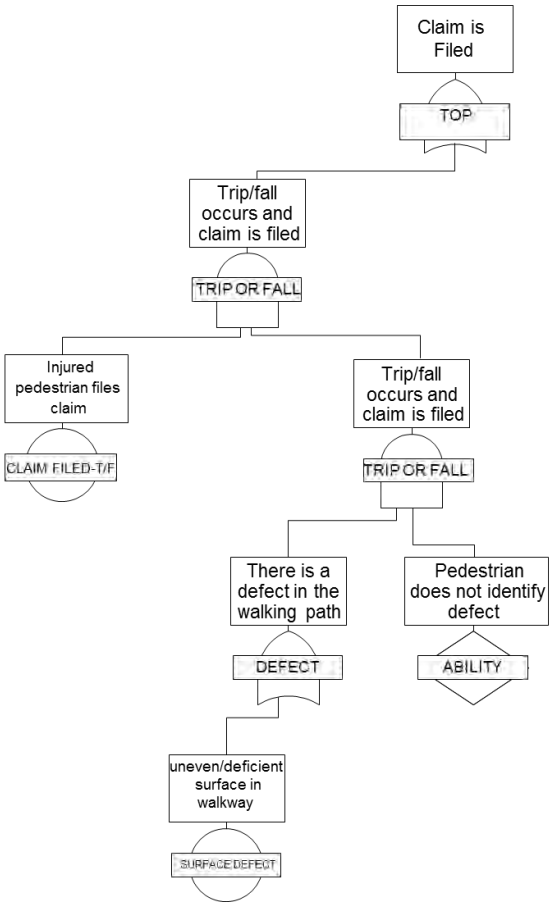


Figure 11 Cut Set “Trip or Fall Due to Surface Defect on Sidewalk”

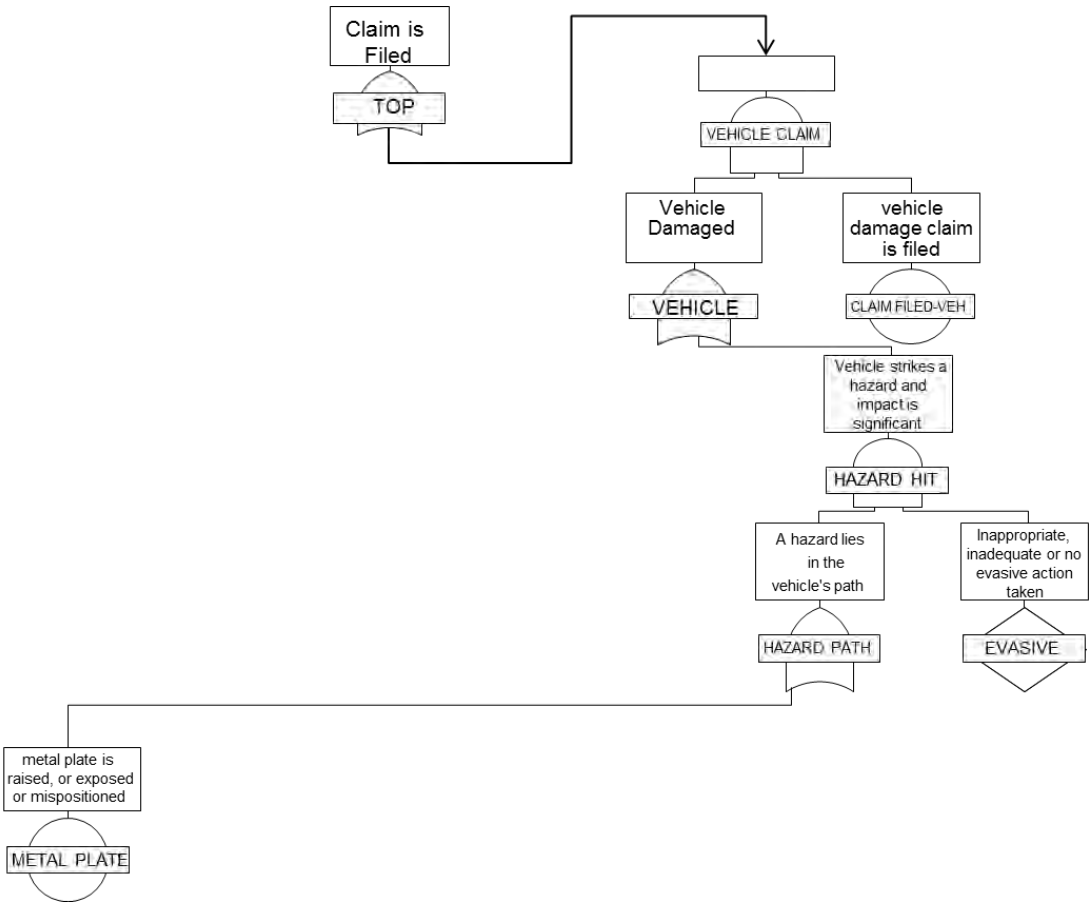


Figure 12 Vehicle hits metal plate

Appendix D: Sample Settlement Memo

SAMPLE MEMORANDUM

To: _____
Chief Counsel

Date: X

File: (Entire Charging Numbers)

From: SENDER'S NAME
Sender's Title
Sender's Law Firm

Subject: Case Name (Include First and Last Name of Plaintiff; use et al. if applicable)
County, Court and Case Number

REQUEST FOR (SETTLEMENT OR JUDGMENT)

CONFIDENTIAL ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

INTRODUCTION

A brief statement of the bases of the suit, i.e., "Plaintiff Doe sues for wrongful death and Plaintiff Roe sues for personal injury alleging dangerous condition of public property." Include the name of plaintiff's attorney, i.e., Plaintiff Doe is represented by Joe Smith, Attorney at Law; Plaintiff Roe is represented by John Jones, Attorney at Law. Do not include addresses. Use complete sentences throughout the memo.

INCIDENT

Describe how it allegedly occurred. Include the date of incident. Only use titles when describing Department employees (do not give names).

INCIDENT SITE

Briefly describe the scene or situation.

DESCRIPTION OF PLAINTIFF(S) (should be singular OR plural)

Include personal description (age, employment, physical or athletic activities, etc.), interrelationships, and the connection to the incident (passenger, driver, observer, etc.)

CODEFENDANT(S) (should be singular OR plural)

Identity, description and roles.

PLAINTIFF(S)' CONTENTIONS (should be singular OR plural)

Why they think we are liable.

STATE'S CONTENTIONS

Defenses we assert.

EVALUATION

A. Liability

Clearly describe why the Department's potential liability justifies settlement.

B. Damages

Economic and noneconomic damages must be outlined separately for each individual.

CODEFENDANT(S)' CONTRIBUTION (should be singular OR plural)

Including none, if applicable, and the basis for such contribution.

PROCEDURAL HISTORY

Describe where the case sits, i.e., ready for trial, ready for settlement conference, preparation for one of these, or discovery stage. Include a sentence which states the date the case was resolved.

Describe the method of settlement, i.e., arbitrator's award, stipulated judgment, settlement agreement, etc. Refer to the supporting documents you are attaching (releases, dismissals, arbitrator's award, judgment, memorandum of costs, or whatever). Include a sentence which states the Release is attached.

Motion for Summary Judgment—Include a statement to the effect that either a motion for summary judgment was made and denied (in whole or in part) or that it was not made and, if so, state the reasons for not filing the motion.

If one or more plaintiffs are minors, you must submit a minor's compromise.

Attach a Payee Data Record, pursuant to IRS Statute effective January 1, 1998, signed by plaintiff's attorney. State: "An executed Payee Data Record is attached." You must include a Payee Data Record for plaintiff(s)' **(singular OR plural)** attorney and any insurance or annuity companies receiving payment. You do not need Payee Data Records for plaintiffs in tort cases.

State the amount originally sought, e.g., that amount contained in the Statement of Damages. If a Judgment is involved, also state the amount of the final demand.

A settlement/judgment memo should be submitted no later than 10 days following a judgment or tentative agreement as to settlement. Memoranda submitted after 10 days will require a written explanation, as part of the memoranda, as to why it took longer than 10 days.

Should an expedite be requested, please include an explanation why (i.e., structured settlement with a date the funding will expire).

RECIPIENT(S) OF PAYMENT (singular OR plural)

Describe your payee, i.e., [plaintiff] "John Doe and his/her attorney, Joe Schmoe." This phrasing should be EXACTLY THE SAME as what you have typed on the Settlement/Judgment Check Request form under "PAYEES." Please be as brief as possible.

If interest is being paid, please indicate as follows: $_____ plus interest at seven percent from (date) until paid both in the memorandum and on the check request.

If a payee is other than a named plaintiff, identify the payee in this paragraph as to the reason the payment is being made to that individual, i.e., "XYZ Annuity Company for purchase of a structured settlement annuity;" "Sam Jones, prior attorney exercising attorney fees lien," etc. If an annuity company is involved, please request 60 days instead of the normal 30 days for funding the annuity. Provide pay data record(s) as well as the rate quote(s) for all annuity companies.

CONCLUSION

Your recommendation for payment and the reasons therefore.

REMEDIAL PROCEDURES

Describe here any matters necessary to prevent recurrence.

_____
ASSIGNED ATTORNEY
Title

Appendix E: Richland County Claim Handling Process and Forms

Claims data entry fields for suggested state wide process

Data fields are divided into sections by who is responsible for them (county employee or legal/claims office)

Data fields in italics are vital and should be a priority-if contact is made with a claimant these fields should be verified or inquired about if not filled out initially.

County employee

Claim number-unique and only id number assigned by county when claim is first received. This number will start with the first two digits being the year it is received by the office and the third and fourth digit will be the county code. Four additional digits could be used to further identify the claim.

IRF number-id number the IRF gives the claim went sent to them

Date of incident-day month year (DD/MM/YYYY)

Time of incident- 24 hr time

Road type-(Interstate, US, SC, secondary)

Road number

Milepoint

Latitude coordinate

Longitude coordinate-degrees minute seconds format (seconds to 2 decimal places: tenths, hundredths: ##° ##' ##".##)

Road(s) name (both roads if intersection)

If not an intersection, the nearest intersecting road

Distance and direction to the nearest intersecting road

Closest landmark (business or home address-if in rural area any other distinguishable landmark: fire hydrant, bridge name or water body it crosses, guardrail, etc)

Direction of travel-N, S, E, or W if possible or direction toward town or city. (ie Hwy 378 toward Lexington)

City, town, municipality incident occurred in

County code incident occurred in

District code incident occurred in

Vehicle Tag #

Make and model of vehicle

State vehicle is registered

Was incident reported to Law enforcement?

If so, what LE was it reported to and what is the report #?

Was other vehicle involved?

Owner name

Vehicle tag #

Make and model

Collision or non-collision

Type of cause (from new classification: 1-5)

Event-number next to cause in classification table

Subcode-if applicable under "non-DOT vehicle"

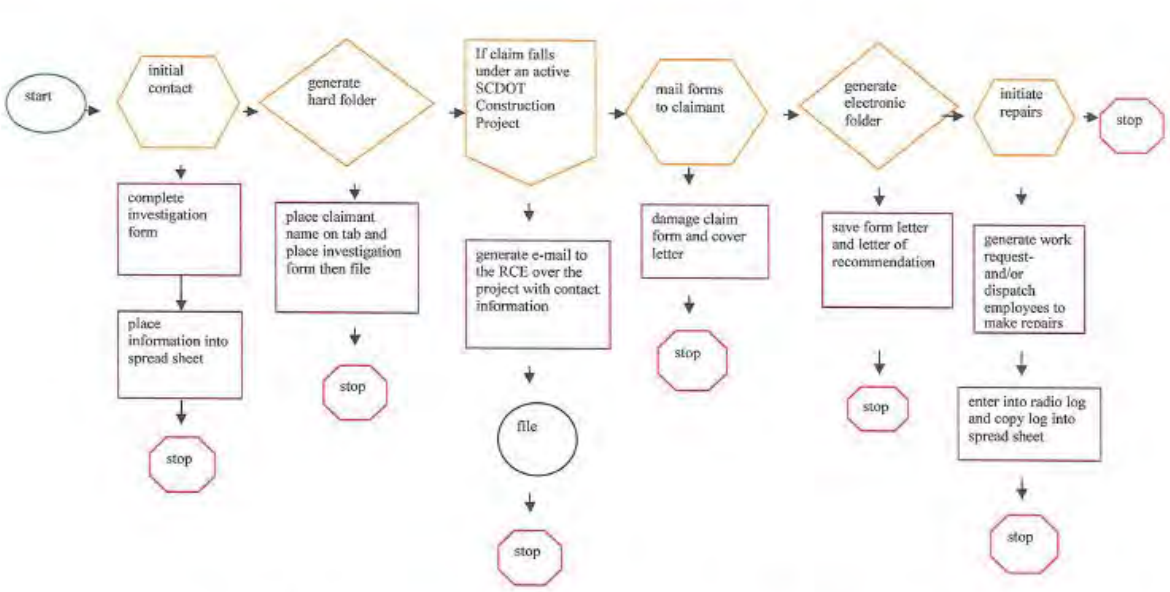
Cause name-

Is incident construction related? Y/N

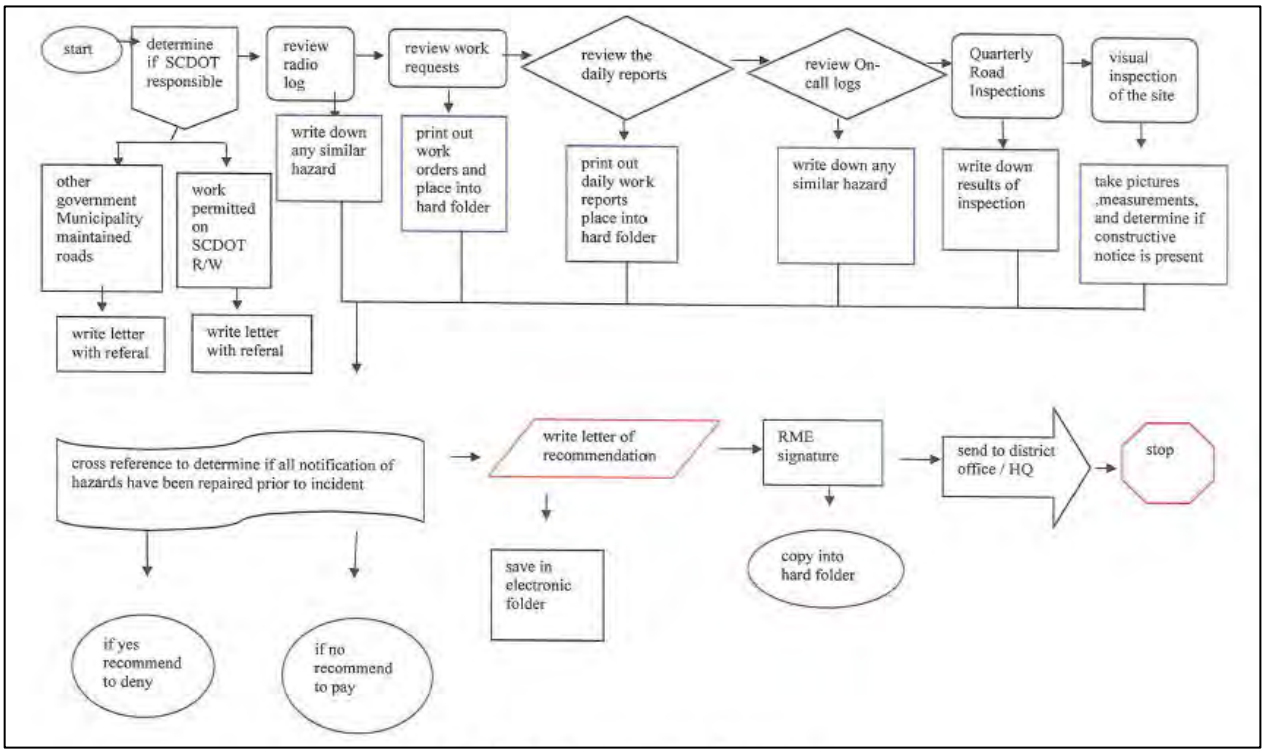
Damage or injury

Description/remarks of claim/hazard: (as much detail is possible)

No prior or constructive notice?
If there was a defect, when was a crew dispatched to repair it?
F2062 date-date on claim form submitted by claimant
County date-date county received claim
Claim amount-how much was claim for
Injury amount-how much of the claim was for injury
Property amount-how much of the claim was for property
Company (that is claimant)
First name of claimant
Middle initial of claimant
Last name of claimant
Claimant city
Claimant state
Claimant address-
Claimant zip code
Claimant's insurance company
Policy number
Insurance Agent name
Insurance Agent number
District Office
District date-date district received claim
Legal/claims office
Legal office date- date legal office received claim
Date to IRF-date claim sent to IRF
Date decision letter sent to claimant
Appeal date-date appeal is made
Date appeal closed
Claim closed date
Lawsuit open date
Lawsuit closed date
Decision-Pay, Denied, settled
Closed-is the claim closed
Settlement amount-how much was paid
IRF expenses incurred
Last updated-date entry was last updated



Current Richland County Process-Initial Contact to Mailing of Damage Claim Form



Current Richland County Investigation Procedure

Current SC Claim Form 2062

Form 2062
Rev. 11/2005

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DAMAGE CLAIM FORM

INSTRUCTIONS: Please type or print, except where signature is indicated. If this claim is being submitted for damage to a registered vehicle, the owner(s) of the vehicle must be the claimant(s). In addition to the Claim Form, two repair estimates or a paid invoice must be submitted to substantiate the amount being claimed. In the case of personal injury, or non-vehicular claims, documentation of losses will be required. All applicable blanks on this form must be completed. Claimant(s) signature(s) must be properly notarized.

Claimant(s)			Federal Employer Identification Number	
Contact person (If claimant is a company or other organization)			Social Security Number	eMail Address
Address (Street, Apartment Number, PO Box)			City / State / Zip	
(_____)_____-_____ Home Phone	(_____)_____-_____ Work Phone	(_____)_____-_____ Cell Phone	Damaged Vehicle: Make _____ Model _____	Tag Number & State
Insurance Company(s)		Policy Number(s)	Agent(s) _____ Phone(s) (_____)_____-_____	
Date of Incident	Time of Incident AM or PM	$ Amount Claimed for Personal Injury	$ Amount Claimed for Property Damage	

Place of Incident _____

Route/Road where Incident Occurred _____ Nearest Intersecting Route/Road _____

In or Near Town	County	Reported to law enforcement agency? If so, which one?

Description of incident, including cause and type of damage or injury (and all parties involved):

Witness(es) to Incident (Name, Address, Phone Number)

AFFIDAVIT

COUNTY OF_____ STATE OF_____

Personally appeared before me_____ (Claimant(s) Name) **, who, upon oath, says that the above claim is true and just, and that he/she has not received compensation from other sources for damages claimed.**

Sworn to before me this_____ day of _____ , 20 _____ .

Notary Public for _____ (State)

Printed name of notary

My commission expires _____

Printed name(s) of claimant(s)

Signature(s) of claimant(s)

Date

DO NOT WRITE BELOW THIS LINE. FOR SCDOT USE ONLY.

Other parties involved _____

Claim Number	Date Received at SCDOT	SCDOT Representative	Approved / Disapproved	Amount $ / Date	

"Letter 1" Referenced in Figure 56: The claim instructions letter

Re: Damage Claim

Dear Mr. /Mrs. XXX:

Please accept our apologies for your trouble. Enclosed is a copy of the SCDOT Damage Claim Form (#2062). If you wish to file a claim against the South Carolina Department of Transportation, please complete this form and return to the following address.

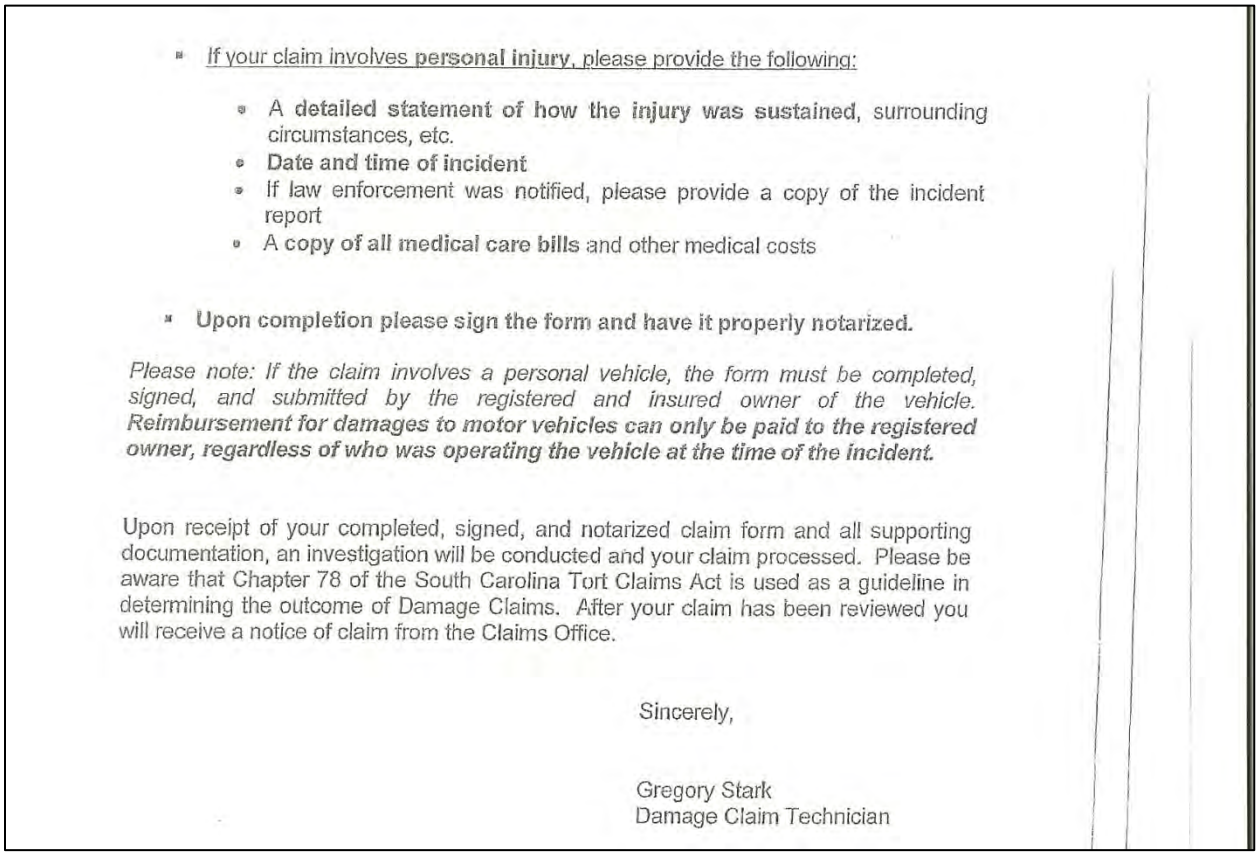
South Carolina Department of Transportation
RICHLAND MAINTENANCE
7201 FAIRFIELD ROAD
COLUMBIA SC 29203

To ensure that we are able to process your claim as quickly as possible, please be sure to satisfy all requirements and include all necessary information.

Please submit the Damage Claim form and additional documents according to the following guidelines:

- **Complete all portions of the Damage Claim form.** An incomplete form will severely delay the processing of your damage claim.
- If your claim involves **damage to your personal vehicle and/or property,** please provide the following:
  - **Road name and number** along with **nearest intersection, mile marker, and/or house number** (and any other helpful landmarks) and the **direction you were traveling (vehicle related incident)**
  - A **detailed statement of how the damage was sustained**, surrounding circumstances, etc.
  - **Date and time of incident**
  - If law enforcement was notified, please provide a copy of the incident report
  - **If repairs have been made, please provide paid invoices/receipts** for work. **If repairs have not yet been made, please provide at least two (2) repair estimates** to substantiate the amount of your claim. These estimates must be on business letterhead or in the form of a statement from the company/repair shop providing the estimate. In the event that your claim involves a windshield, rear window, or side windows, estimates must be provided by an auto glass shop.
  - **Vehicle registration card and proof of insurance (vehicle related incident)**
  - A **minimum of two (2) photos of the damage** involved in this claim

"Letter 1" (continued) Referenced in Figure 56: The claim instructions letter



- If your claim involves **personal injury**, please provide the following:
  - A **detailed statement of how the injury was sustained**, surrounding circumstances, etc.
  - **Date and time of incident**
  - If law enforcement was notified, please provide a copy of the incident report
  - A **copy of all medical care bills** and other medical costs

- **Upon completion please sign the form and have it properly notarized.**

Please note: If the claim involves a personal vehicle, the form must be completed, signed, and submitted by the registered and insured owner of the vehicle. ***Reimbursement for damages to motor vehicles can only be paid to the registered owner, regardless of who was operating the vehicle at the time of the incident.***

Upon receipt of your completed, signed, and notarized claim form and all supporting documentation, an investigation will be conducted and your claim processed. Please be aware that Chapter 78 of the South Carolina Tort Claims Act is used as a guideline in determining the outcome of Damage Claims. After your claim has been reviewed you will receive a notice of claim from the Claims Office.

Sincerely,

Gregory Stark
Damage Claim Technician

Standard Recommendation Letter Developed at County Office "Letter 2" in Figure 56

TO: M. Thad Brunson, District Engineering Administrator

FROM: A. Tony Magwood, Richland Maintenance

RE: Damage Claim for John Smith (Received Month 00, 2010)

DATE:

Enclosed is the completed Damage Claim form and supporting information as submitted by Mr. John Smith for damages incurred to his/her (Year, Make, and Model).

Mr. Smith stated that the incident occurred at approximately 0:00 am/pm on Month 00, 2010, while traveling North/South/East/West on Main Street (S-xx-xxxx) near mile point 0.00 GPS coordinate XXXXXXXXX.

Mr. Smith stated that (description of incident as provided by complainant) damaging (tire, wheel/rim, etc).

Repairs have/have not been made to the vehicle. Enclosed is the receipt for repairs completed./Enclosed are two (2) estimates as submitted by Mr. Smith. The lesser estimate is in the amount of $0000.00.

This claim was investigated by Gregory Stark and it has been determined that the SCDOT did/did not have prior notice of (description of deficiency) at this location. Work order # 00000 was generated on Month 00, 2010 to have the (deficiency) repaired to have the area repaired with (method). The work order was completed on Month 00, 2010.

I am recommending that this claim be paid/be denied.

A. Tony Magwood
Resident Maintenance Engineer

I agree/disagree with the above report and recommend that this claim be approved/denied.

M. Thad Brunson
District Engineering Administrator

Appendix F: Comprehensive list of claims through 2007-2010

Cause Code	total # of claims	# paid	% paid	Total Settlements	Total settlement with indirect cost estimated
Pothole Damage	1497	504	33.7%	$168,101	$827,230
Debris from road	229	30	13.1%	$11,778	$112,607
Debris -DOT Mower/Landscape	206	168	81.6%	$76,604	$167,306
Paint Splatter	123	39	31.7%	$21,177	$75,334
Mh-Cb-Di-Grate	106	10	9.4%	$5,175	$51,846
Mowing	73	44	60.3%	$33,698	$65,840
Debris-DOT Truck	72	39	54.2%	$13,616	$45,317
Low Shoulder/Drop-off	66	25	37.9%	$9,147	$38,207
Trip/Fall Uneven Surface	48	11	22.9%	$15,261	$36,395
Pothole - edge/shoulder	42	16	38.1%	$5,743	$24,236
Tree in Road	40	4	10.0%	$14,750	$32,362
Tree Fell on Car	37	2	5.4%	$4,018	$20,309
Other	33	13	39.4%	$42,583	$57,113
Asphalt/Tar	29	21	72.4%	$16,213	$28,981
Tree Limb Obstructing Road	28	5	17.9%	$3,285	$15,614
Shoulder/Ditches	24	6	25.0%	$9,219	$19,786
Tree Removal	24	8	33.3%	$11,073	$21,640
Work Zone Maint Equip	23	7	30.4%	$5,125	$15,252
Construction/Paving	22	7	31.8%	$16,260	$25,947
Drainage Pipe	20	0	0.0%	$0	$8,806
Bump/Dip	19	5	26.3%	$1,900	$10,266
Drainage Structures	18	3	16.7%	$2,674	$10,599
Failed Utility Cut	18	0	0.0%	$0	$7,925
HWY traffic sign post	18	2	11.1%	$367	$8,292
Road Surface Irregularity	17	3	17.6%	$8,713	$16,198
Trip/Fall Mh-Cb-Di-Grate	17	4	23.5%	$14,861	$22,347
Surface Protrusion (rebar/other)	13	2	15.4%	$457	$6,181
Curb	12	0	0.0%	$0	$5,284
DOT/Contract Vehicle	11	6	54.5%	$5,027	$9,870
Metal Plate	11	0	0.0%	$0	$4,843
Open Hole/Manhole	11	3	27.3%	$572	$5,415
Driveway Entrance Bump/Dip	8	2	25.0%	$337	$3,860
Limb Mngt	8	6	75.0%	$2,398	$5,920
DOT Vehicle	7	7	100.0%	$1,445	$4,527
Signs	6	0	0.0%	$0	$2,642
Bridge Construction	5	0	0.0%	$0	$2,202
Bridge end	5	1	20.0%	$612	$2,813

(List Continued)

Cause Code	total # of claims	# paid	% paid	Total Settlements	Total settlement with indirect cost estimated
Bridge Overhead Structure	5	2	40.0%	$1,549	$3,750
Overhead sign support	5	0	0.0%	$0	$2,202
Driveways	4	2	50.0%	$380	$2,141
Guardrails	4	0	0.0%	$0	$1,761
Rail Road Crossing	4	1	25.0%	$0	$1,761
Utility Work	4	0	0.0%	$0	$1,761
Water on Road Surface	4	0	0.0%	$0	$1,761
Raised Median	3	0	0.0%	$0	$1,321
SHEP Worker	3	2	66.7%	$182	$1,503
Trip/Fall on Debris	3	0	0.0%	$0	$1,321
Animal-Not Deer	2	0	0.0%	$0	$881
Deer	2	0	0.0%	$0	$881
Ditch	2	0	0.0%	$0	$881
Non_DOT Vehicle	2	0	0.0%	$0	$881
Ran-off-road hit fixed object on roadside	2	1	50.0%	$405	$1,286
Surface Repairs	2	0	0.0%	$0	$881
Water on Sidewalk	2	0	0.0%	$0	$881
Bridge pier/ Abutment	2	0	0.0%	$0	$880
Utility Pole	2	0	0.0%	$0	$880
Total	**3003**	**1011**		**$524,706**	**$1,846,927**

Appendix G: Comprehensive list of lawsuits through 2007-2010

Cause Code	total # of Lawsuits	# paid	% paid	Total Settlements	Total settlement with indirect cost estimated
Other	39	21	54%	$1,068,033	$1,142,789
Trip/Fall Uneven Surface	28	13	46%	$187,383	$241,054
Water on Road Surface	23	17	74%	$2,131,427	$2,175,513
Trip/Fall Mh-Cb-Di-Grate	21	12	57%	$203,700	$243,953
Obstructed Sight Distance (e.g. vegetation)	17	5	29%	$97,000	$129,586
Failed to yeild ROW	15	13	87%	$512,906	$541,658
Pothole damage	15	6	40%	$415,354	$444,106
Low shoulder/Elevation Difference	15	6	40%	$478,000	$506,752
DOT/Contract Vehicle	14	1	7%	$23,000	$49,835
Tree in Road	8	7	88%	$238,250	$253,584
Improper design/Intersection design	7	7	100%	$389,000	$402,418
RR crossing	7	2	29%	$156,000	$169,418
Drainage Structure	6	2	33%	$36,000	$47,501
Improper traffic control devices	6	3	50%	$727,250	$738,751
Missing sign	6	1	17%	$250,000	$261,501
Shoulder/Ditches	6	6	100%	$46,352	$57,853
Tree Fell on car	6	6	100%	$6,432	$17,933
Mh-Cb-Di-Grate	5	3	60%	$1,400	$10,984
Debris from road	4	3	75%	$47,000	$54,667
Deer	4	3	75%	$870,000	$877,667
Improper signage/No signage	4	1	25%	$325,000	$332,667
Construction/Paving	3	2	67%	$4,000	$9,750
Ran-Off-Road hit fixed objects on road side	3	3	100%	$180,000	$185,750
Too fast 4 condition	3	2	67%	$155,000	$160,750
Pothole-edge/shoulder	3	2	67%	$77,500	$83,251
Trip/Fall on Debris	3	2	67%	$14,750	$20,501
Bump/Dip	2	1	50%	$15,000	$18,834
Culvert	2	0	0%	$0	$3,834
Debris-DOT Mower/landscape	2	1	50%	$750	$4,584
Drainage pipe	2	1	50%	$10,250	$14,084
Road surface Irregularity	2	1	50%	$0	$3,834
Tree limb obstructing road	2	1	50%	$440,000	$443,834
Work Zone Maint Equip	2	1	50%	$140,000	$143,834
Asphalt/Tar	1	1	100%	$0	$1,917
Cable Barrier	1	0	0%	$0	$1,917
Debris- DOT truck	1	0	0%	$0	$1,917

(List Continued)

Cause Code	total # of Lawsuits	# paid	% paid	Total Settlements	Total settlement with indirect cost estimated
Ditch	1	0	0%	$0	$1,917
Embankment	1	1	100%	$320,000	$321,917
Equipment	1	1	100%	$25,000	$26,917
Hwy Traffic Sign Post	1	1	100%	$10,000	$11,917
Open Hole/Manhole	1	1	100%	$245,000	$246,917
Paint Splatter	1	0	0%	$0	$1,917
Raised median	1	1	100%	$35,000	$36,917
Water on sidewalk	1	1	100%	$11,769	$13,686
Total	**296**	**162**		**$9,893,507**	**$10,460,880**