A REVIEW OF CASE LAW RELATING TO LIABILITY FOR SKIDDING ACCIDENTS

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One of the greatest problems facing highway departments is slippery pavements in nonfreezing, wet weather. Because of increased legal duties imposed on public entities, highway departments find themselves exposed to liability for accidents that result from what used to be considered purely weather-related causes. Immunities are being weakened, engineering decisions are subject to review, and personal responsibilities are being imposed. A program of skid testing is imperative for early detection of low skid resistance areas. The use of mandatory minimum skid numbers is warned against because of possible adverse legal implications. Grooving, as well as other methods, has proven to be a solution to problems of low skid resistance. Generally, a public entity is not liable for a highway made slippery by rain alone; however, public entities may be held liable for hazardous low skid resistance conditions that result from their own actions or inactions (worn pavements; defectively designed, slippery PCC pavements; unplanted eroding cut-slopes; improperly applied seal coats; and clogged drains and drainage ditches that cause ponding). They also may be found liable when conditions are purely weather created and the hazard is such that the public entity has a duty to remove it entirely or ameliorate it by the use of warning signs. The reasonableness of the public entity's actions generally will be the deciding factor on whether liability will ensue.

•ONE of the most salient legal considerations of skid-resistant qualities of road surfaces is the potential liability arising from an automobile accident caused by the surface of the pavement. Although some accidents may be caused by low skid resistance pavement under dry conditions, the majority of slippery-pavement-related accidents occur during inclement weather. Of course, when snow and ice are on the pavement, it is inevitable that accidents will ensue. These accidents, however, are less related to the skid resistance of the pavement than to the efficiency of highway crews in ameliorating the conditions by means of sand or chemicals. It is primarily under nonfreezing, wet weather conditions that the skid resistance of the pavement surface may be a deciding factor in determining whether a potential accident occurs. Because of this and because public entities now must provide up-to-date skid-resistant highways, many lawsuits are being initiated as a result of what used to be considered purely weather-caused accidents.

As the duty of public entities is enlarged, cases have increasingly involved close questions of fact for the jury. Because of the appellate courts' abhorrence of invading the fact-determining process of the jury, the number of reported decisions does not really reflect the increase in litigation in trial courts. Therefore, I have included cases of personal experience within the California Department of Transportation that were decided or settled at the trial level along with reported decisions to give a better feel of how trial courts and juries are responding to conditions that give rise to accidents and to the potential liability of public entities.

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SOVEREIGN IMMUNITY

The classical doctrine of "rex non potest pecarre"[1] or "sovereign immunity" was a natural extension of medieval rule by divine right. Obviously, a king who received his power directly from God could not commit tortious acts. Sovereign immunity, which evolved from this archaic justification, remains with us today. To be sure, the present rationale for the perpetuation of a concept that appears to some as outdated[2] lies in contemporary notions of public policy, the necessity of a state's ability to govern, the exercise of police power, and fiscal solvency. For these reasons it is still a general rule that, unless a state has given its consent by way of a constitutional or statutory provision, a state exercising governmental functions,[3] as distinguished from proprietary functions,[4] cannot be made to respond to damages in tort. However, in keeping with the modern trend of courts, providing a remedy to injured parties, several states have enacted statutes that allow a state to be sued in tort under prescribed conditions.[5]

California's experience with sovereign immunity illustrates the present trend of extending liability where possible. In 1961 the California Supreme Court concluded in Muskopf v. Corning Hospital District that "... the rule of governmental immunity from tort liability... must be discarded as mistaken and unjust."[6] After a 2-year moratorium on tort actions against the state, the legislature in 1963 passed the comprehensive California Tort Claims Act.[7] The Act reinstated sovereign immunity except that under certain statutory conditions the state could be sued in tort.[8] One such statu-

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[1] "The King Can Do No Wrong", 2 Rolle 304.

[2] Muskopf v. Corning Hospital District, 55 Cal.2d 211, 11 Cal. Rptr. 89; Taylor v. New Jersey Highway Authority, 22 N.J. 454, 126 A.2d 313.

[3] Turner v. Superior Court in and for Pima County, 3 Ariz. App. 414, 415 P.2d 129; Faber v. State, 143 Colo. 240, 353 P.2d 609; Cournoyer v. Dayton, 20 Conn. Supp. 48, 122 A.2d 30; Hubbard v. State, 163 N.W.2d 904 (Iowa); Daniels v. Kansas Highway Patrol, 206 Kan. 710, 482 P.2d 46; V.T.C. Lines, Inc. v. City of Harlan, 313 S.W.2d 573 (Kentucky); Vujnovich v. State Through Department of Public Works, 184 So.2d 618 (La.); Sullivan v. Com., 335 Mass. 619, 142 N.E.2d 347; McCree and Co. v. State, 253 Minn. 295, 91 N.W.2d 713; City of Three Forks v. State Highway Commission, 156 Mont. 392, 480 P.2d 826; Opinion of the Justices, 101 N.H. 546, 134 A.2d 279; Schuschel v. Volpe, 84 N.J. Super. 391, 202 A.2d 218; Livingston v. Regents of New Mexico College of Agriculture and Mechanics Arts, 64 N.M. 306, 328 P.2d 78; Bellows v. State, 37 A.D.2d 342, 325 N.Y.S.2d 225; Wrape v. North Carolina State Highway Commission, 263 N.C. 499, 139 S.E.2d 570; Rector v. State, 495 P.2d 826 (Okla.); Moseley v. South Carolina Highway Department, 236 S.C. 499, 115 S.E.2d 172; State v. Clements, Civ. App., 319 S.W.2d 450 (Tex.); Emery v. State, 26 Utah2d 1, 483 P.2d 1296; Kellam v. School Board of City of Norfolk, 202 Va. 252, 117 S.E.2d 96; Creelman v. Svenning, 67 Wash.2d 882, 410 P.2d 606; Forseth v. Sweet, 38 Wis.2d 676, 158 N.W.2d 370.

[4] Smith v. State, 93 Idaho 795, 473 P.2d 937; Carroll v. Kittle, 203 Kan. 841, 457 P.2d 21; Youngstown Mines Corp. v. Prout, 266 Minn. 450, 124 N.W.2d 328; Stadler v. Curtis Gas, Inc., 182 Neb.6, 151 N.W.2d 915; Tiernan v. Missouri New York World's Fair Commission, 48 Misc.2d 376 264 N.Y.S.2d 834; McKenna v. State, 207 Misc. 1008, 141 N.Y.S.2d 809.

[5] Alaska Stat. § 44.80.010 et seq. (Michie Co. 1967); Cal. Gov. Code § 810 (West 1966); Colo. Rev. Stat. § 130-10-1 et seq. (Bradford-Robinson 1963); Conn. Gen. Stat. Ann. § 134-144 (West Additional Supp. 1974); Code of Ga. Ann. § 95-1710 (Harrison Co. 1972); Hawaii Rev. Stat. § 662-1 et seq. (1968); Iowa Code Ann. § 25 A.1 et seq. (West Additional Supp. 1974); Kansas Stat. Ann. § 46-901 (1973), § 68-419 (1972); Ky. Rev. Stat. § 44.070 et seq. (Bobbs-Merrill 1971); La. Rev. Stat. Ann. § 13.5101 et seq. (West 1968); Me. Rev. Stat. Ann. 23 § 457, 23 § 1451, 23 § 3651 (West 1964); Ann. Laws of Mass. ch. 81, § 18 (Michie Co. 1971), ch. 84, § 15 (Michie Co. 1967); Mich. Stat. Ann. § 5.1806 et seq. (Callaghan and Co. Additional Supp. 1974); Nev. Rev. Stat. § 41.031 et seq. (1973); N.Y. Ct. Cl. Act § 8 et seq. (McKinney 1963); Gen. Stat. of N.C. § 143-291 et seq. (Michie Co. 1974); Ore. Rev. Stat. § 30.260 et seq. (1973); Code of Laws of S.C. § 33-229 et seq. (Michie Co. Additional Supp. 1974); Tenn. Code Ann. § 9-801 et seq. (Bobbs-Merrill Additional Supp. 1974); Vernon's Civ. Stat. of Tex. Ann. art. 6252-19 et seq. (Additional Supp. 1974); Utah Code Ann. § 63-30-8 et seq. (Allen Smith Co. Additional Supp. 1973); Vt. Stat. Ann. 19 § 931 et seq. (Equity Publishing Co. Additional Supp. 1974); Rev. Code of Wash. Ann. § 4.92.010 et seq. (Bancroft Whitney-West Additional Supp. 1974).

[6] 55 Cal.2d 211, 213; 11 Cal. Rptr. 89, 90.

[7] Cal. Gov. Code § 810 et seq.

[8] Cal. Gov. Code § 815.

tory condition and a primary basis of liability is for a dangerous condition of public property.[9] The legislature also enacted several immunities that provide exceptions to the statutory basis of liability.[10]

Until recently 1 of the most frequently used defenses that protected public entities from liability for a dangerous condition was "design immunity."[11] Neither a public entity nor its employees are liable for injury caused by the design of construction on public property when that design has been approved in advance by the legislative body of the public entity or by some other body or employee exercising discretionary authority to give such approval. Moreover, when a design is prepared in conformity with standards previously so approved, the public entity is similarly immune. Thus, when a plaintiff alleges a dangerous condition on the highway, the public entity is immune if it can show that the design that caused the condition had been approved by expert highway engineers exercising their discretionary authority.

On January 3, 1972, in Baldwin v. State,[12] the California Supreme Court emasculated the design immunity statute. It held that the design immunity created by California Government Code § 830.6 does not survive when the design, although reasonably approved in advance as being safe, proves in actual operation under changed physical conditions to be dangerous and causes injury. In another case, the court went further to hold that design immunity does not immunize a public entity for its concurrent negligence in failing to warn of a dangerous condition of public property,[13] nor does it apply when a different use than that that was contemplated rather than changed physical conditions makes the public property dangerous.[14] The net result is that juries can, in California, second-guess engineers on their discretionary decisions even though the decisions might have been reasonable at the time they were made.

These same engineers, along with administrators, directors, and highway personnel down to the person with a shovel, are finding themselves subject to exposure to personal liability. Although the cloak of sovereign immunity may protect these people, that cloak, as illustrated, is tattered and full of holes.

The crux of any determination of personal liability is whether the decision or act involves a discretionary function or a ministerial function. Discretionary functions generally require a nondelegable exercise of reason in deciding whether an act will be done and the means with which it will be accomplished.[15] Ministerial functions occur when there is no question of whether the act will be done, and the means of accomplishment are directed, not discretionary.

Thus, it seems obvious that, in addition to the liability that the public will incur, a maintenance worker who fails to sand a highway after being directed to do so will incur personal liability if any accident occurs as a result of that failure. What is not so obvious is the situation where an administrator directs maintenance personnel to sand when necessary to keep the highway safe or to sand only when the temperature drops to 30 F for at least 4 hours. The first directive tends to delegate the discretionary decision of when to sand to the person in the field, thereby enabling application of a possible immunity for discretionary acts. The second directive removes discretion from maintenance personnel, but, because of the obvious potential creation of dangerous untended icy conditions on the highways, the administrator may nevertheless be liable despite the discretionary nature of his or her directive.

The courts have been wrestling with these problems and the dividing line is unclear.[16]

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[9] Cal. Gov. Code § 835.

[10] Cal. Gov. Code § 830.2-830.8.

[11] Cal. Gov. Code § 830.6.

[12] 6 Cal.3d 424.

[13] Cameron v. State of California, 7 Cal.3d 318.

[14] Davis v. Cordova Recreation and Park District, 24 Cal. Ct. App.3d 789.

[15] Smith v. Cooper, 475 P.2d 78 (Ore.).

[16] Dalehite v. U.S., 346 U.S. 15, 73 Super. Ct. 956; Johnson v. State of California, 69 C.2d 782, 447 P.2d 352 (Cal.); County of Sacramento v. Superior Court, 8 C.3d 479 (Cal.); Sisley v. U.S., 202 F.Supp. 273 (D. Alaska).

But, an unmistakable caveat to engineers and administrators who may be called upon to justify their decisions at some later date is presented.

SKID RESISTANCE

With this in mind, let us turn to the slippery road problem. A study in West Virginia determined that the average rate of wet pavement accidents was 2.2 times the rate of dry pavement accidents, and the upper range was 85 times the dry pavement rate (90, p. 210). Where the wet pavement rate was 85 times the dry pavement rate, the accident cost per vehicle-mile was 50 times the average. On West Virginia Interstate highways, 40 percent of all accidents are wet pavement accidents.

The problem, however, is not limited to West Virginia; its effects are nationwide. In a study conducted by the Highway Research Board in 1969, the problem of slippery pavements was of major concern to 46 percent of the states and of moderate concern to 50 percent. Only 2 states felt it was of minor importance (15, p. 15). In July 1971, the study was updated and showed that only 33 percent of the states considered slippery pavements to be of major concern, and 54 percent considered the problem to be of moderate concern. Six states felt the problem was minor (30, Appendix A). This shows that, although slippery pavements are still a major problem, the picture is improving.

Generally, a wet pavement accident occurs when the coefficient of friction between the pavement and the tires on a motor vehicle is insufficient, manifesting itself in a loss of traction control. The critical factor in such an accident is the contact area of the tire with the wet pavement. This area can be divided into 3 parts. The first is the forward contact area where the tire first meets the pavement and is actually floating on a film of water. This film thickness progressively decreases from forward to back as the individual tread elements traverse the surface and attempt to squeeze out the water between the rubber and the pavement. The second is the transition or draping area. Here, the tire elements penetrate the water film and begin to drape over the greater asperities of the surface of the pavement and make contact with the lesser asperities. The third part is the dry contact portion where tractive effort is developed (7, pp. 2-3).

If the tire does not have sufficient time to squeeze enough water from the pavement asperities to come in contact with the tire, then the entire length is in the condition of forward contact area and the tire actually is floating on a film of water, or hydroplaning. Reduction of this area of squeezing and initial water film penetration is influenced by water viscosity, speed of the vehicle, tire inflation pressure, geometry and depth of tire tread, wind, initial water film thickness, and pavement surface texture. The area of the transition zone depends on both pavement surface texture and dynamic rubber properties. It is, of course, the responsibility of the highway engineer to provide pavements with the surface texture necessary to reduce the areas of squeezing and initial water film penetration, thereby providing good skid resistance.

To diagnose low skid resistance areas, highway departments must undertake some program of skid testing. California has developed its own portable field skid tester that operates on the principle of spinning a rubber-tired wheel while it is off the ground, lowering it to the pavement, and noting the distance it travels against the resistance of a spring before it stops. The device is attached to the rear of a truck that is stationary during the test (89, pp. 40-48). Pennsylvania State University has developed a hand-carried device using a rubber "shoe" that slides along the pavement as the operator pushes the tester. The frictional resistance experienced by the shoe is converted to hydraulic pressure and displayed on a gauge (91). A laboratory tester that also can be used in the field has been developed by the British Transport and Road Research Laboratory. It consists of a pendulum to which a spring-loaded rubber shoe is attached. When the pendulum drops, the shoe is made to slide over the surface to be tested. The attenuation of the rebound serves as a measurement of the friction (92).

The most widely used method of skid resistance is the locked-wheel method. According to ASTM Method E 274, a test tire is installed on the wheel or wheels of a 1- or 2-wheel trailer. For measurement, the trailer is towed at a speed of 40 mph over dry pavement and water is applied in front of the test wheel. The test wheel is locked

by a brake. After the wheel has been sliding along the pavement for a certain distance to permit the temperature in the contact patch to stabilize, the force that the friction of the tire contact patch produces, or the resulting torque on the test wheel, is measured and recorded for a specific length of time. The result is reported as a skid number (SN) (30, p. 14).

There are countless methods of measuring skid resistance, the reliability of which vary. It is difficult, if not impossible, to correlate all of them. What is important is to develop a standard for the type of tester that is being used so that relative skid resistance measurements can be used to diagnose potentially troublesome locations.

The Federal Highway Administration has been actively encouraging states to have programs to improve areas of low skid resistance (94, 95, 96, 97, 98). To this end many states have started accumulating statewide skid resistance inventories. In addition, some have called for the establishment of a minimum SN (48, 55). Although this may be desirable from an engineering standpoint in terms of a guideline for scheduling remedial action, it would nevertheless have very serious legal implications as a possible legal standard of care. For example, if a minimum SN of 35 were adopted, and a given stretch of highway had a lower SN but a good accident history, the failure of the public entity to comply with the minimum standard could be used against it in court to prove that the highway is dangerous. This SN is for maintenance purposes only, not for design. Many states already have minimum design SNs specified in their construction contracts. Typically the contract calls for spot testing of the highway to determine compliance with these contract provisions before the highway is ever opened to traffic. The SN itself, rather than the actual safety history of the highway, becomes the criterion.

It is conceded by even the most adamant supporters of the establishment of minimum SNs that many states do not have the funds or manpower, even with federal aid, to bring all their highways up to par immediately. In the interim, these same states would face a further drain on their treasury in the form of judgments to plaintiffs who are able to convince juries that the minimum SN is a legal standard of care, and that noncompliance with it establishes a prima facie dangerous condition of the highway. Determining whether a highway is dangerous is not simple. It cannot be said arbitrarily that a location with a SN of 34 is dangerous and that one with a SN of 36 is not.

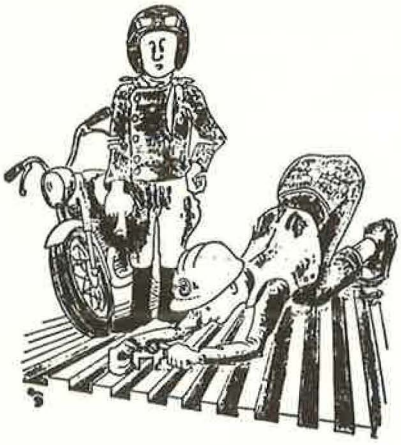
Locations of low skid resistance can be caused at the outset by defective design and construction or through time by deterioration. The circumstances in the former situation arose in the past at a time when highways were designed for a smooth surface to give riding comfort. More recently, the design defect is more one of construction in which the contractor fails to follow the skid resistance specifications in the contract. Pavement deterioration, on the other hand, usually occurs through wear (loss of material), polishing (smoothing of surface microtexture), or changes in the pavement surface structure (binder migration and movement of aggregate particles).

Generally, improvement of low skid resistance locations can be achieved by modifying existing pavement or by applying a new surface. Both approaches are simply means to roughen pavements to increase skid resistance.

Although acid etching and heater planing have been used with varying degrees of success on concrete and bituminous pavements respectively, grooving has proved to be, in most cases, the best solution to the problem of wet weather accidents.

Water runoff is facilitated and the pavement surface is roughened by grooves cut into the pavement with a diamond saw disk. The result is a significant decrease in accidents due to hydroplaning, wet weather skidding, and skidding on horizontal curves (8, 22). The grooves may run longitudinally, transversely, or diagonally. Longitudinal cuts help tracking on curves and transverse cuts, although they are more expensive, are better on straight sections, and facilitate drainage. Diagonal cuts are not widely used because they may cause a vehicle to drift in the direction of the cuts. The cut of the grooves themselves may be V-shaped or rectangular and may vary in depth from 0.062 to ¼ in., in width from ⅛ to ¼ in., and in spacing from ½ to 1 in. Tests in California have shown that a longitudinal, rectangular pattern that is ⅛ in. deep, 0.095 in. wide, and that has ¾-in. spacing is most acceptable to all types of vehicles. A greater width of the grooves may cause motorcycles and light cars to track—a phenomenon resembling being caught in streetcar tracks (1, 88) (Fig. 1). Overall, however, tests of motorcycle

Figure 1. Grooves that are too wide may cause motorcycles to track.



ridability on different types of pavement grooving have not produced any particular pattern that could be considered hazardous (70).

Sometimes, because of the degree of deterioration of the existing pavement, it is necessary to apply a new surface. This can be done by either the plant-mix method or by applying a seal coat in the field. The plant-mix method, which uses maximum polish-resistant aggregate of ⅜ or ½ in., provides greater uniformity and thus greater dependability in resurfacing. The direct application of a seal coat in the field, although a widely used method, has inherent potential problems of incorrect bituminous mixture, aggregate proportion, and improper curing, which cause binder migration (bleeding) and loss of aggregate material. Defective applications of seal coats have been a contributing factor in many wet weather accidents.

As is reflected by the emphasis of this discussion, highway skid resistance and what public entities do to improve it bear a direct relationship to the occurrance of wet weather accidents. Without accidents there would be no need to worry about what courts and juries are doing about liability; however, because utopia is far away, it becomes necessary to examine what happens when such accidents do occur, at least as they relate to the liability of public entities.

PUBLIC ENTITY LIABILITY

Given the common knowledge that highways are more slippery when wet than when dry, the general rule is that liability cannot be based on the fact that a highway is slippery from rain alone—there must be some defect, obstruction, or reason within the control of the public entity to hold it liable. Nor can negligence be inferred from the fact that a car skidded or that an accident happened.[17]

Thus, in Gambino v. State[18] the trial court found that the state had caused a skidding accident by constructing a vertical and horizontal curve in a manner not normally encountered, by failing to properly ditch the road, by not properly angling the grooving pattern on the pavement, and by failing to place a speed restriction sign. In its reversal the appellate court stated that all the alleged negligence on the part of the state simply did not contribute to the accident. The state was not an insurer; it had a duty to construct and maintain its highways in a reasonably safe condition in accordance with the terrain encountered and traffic conditions reasonably perceived. But, even so, a certain risk was unavoidable. Sudden storms are a part of nature; roads cannot always be straight and level; and curves with descending grades are always potentially dangerous. A highway may be said to be reasonably safe when people who exercise ordinary care can and do travel over it safely.

In Walker v. County of Coconino[19] a much broader base of liability was stated[20]:

> If a roadway should suddenly and without fault of the governmental body, come by any means into a condition dangerous to travel, the governmental body is liable for damages occasioned thereby if the governmental body fails to act in a reasonably prudent manner under the circumstances.

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[17] Eckerlin v. State, 184 N.Y.S.2d 778; Wesley v. State, 272 App. Div. 990, 72 N.Y.S.2d 772; Lahr v. Tirrill, 274 N.Y. 112, 8 N.E.2d 298; Galbraith v. Bush, 267 N.Y. 230, 196 N.E. 36.

[18] 28 A.D.2d 629, 280 N.Y.S.2d 91.

[19] 473 P.2d 472.

[20] Id., at page 475.

Although the Walker case involves ice on the road, the principle stated is specifically extended to any danger whether it be rain, ice, snow, or whatever.[21] The key is the reasonableness of the action or failure to act after the condition manifests itself. Whether there was fault on the part of the public entity in creating the condition goes to the issue of notice of the condition and the reasonableness in remedying it.

Whenever a public entity, either through an independent contractor or through its own employees, constructs or maintains a highway defectively, it is almost certain that liability will ensue for any accidents occasioned thereby. Thus, in a classic case, Veit v. State,[22] the public entity was held liable for injuries arising out of an accident caused by a slippery highway. Approximately 1 month before the accident the highway had been resurfaced with a chip seal. Shortly after completion it became apparent that the emulsion had migrated to the surface and aggregate was being thrown off to the side of the road by the wheels of automobiles and trucks. On 3 occasions the highway department had applied more aggregate to the area; each time the stones were brushed to the sides of the road by traffic. Although signs had been ordered, no SLIPPERY WHEN WET signs to warn of the condition had been placed at the scene. Numerous complaints had been referred to the assistant district highway engineer before the accident. On the day of the accident the plaintiffs were driving at 30 mph in a light rain when, for no apparent reason, the car skidded out of control causing injury.

The court held that ordinarily the state would not be liable for conditions due solely to weather. But, when the state in the resurfacing of a highway creates a dangerous condition and has ample notice of that condition, it is the state's duty to at least advise the public of that condition by erecting warning signs and applying such materials as would remedy the condition.[23]

The California Department of Transportation encountered a similarly caused slippery condition that resulted in a lawsuit. The state had notice of the problem area, but this information was not known by the plaintiffs. During a light rain on a straight stretch of highway a semitrailer hit the slippery area, jackknifed out of control, crossed the centerline, and collided with a fence on the opposite side of the highway. No one was hurt. Ten minutes later a second semitrailer hit the same slippery area, jackknifed, and collided with plaintiffs coming from the opposite direction. Within days after the accident the area was disked to increase the skid resistance; however, this did not solve the problem. The old asphalt had to be burned off and a new chip seal put down.

Had the plaintiffs' attorney been diligent, the state's notice of dangerous condition would have been discovered, and liability would have been virtually automatic. As it turned out, the insurance company for the codefendant truck driver put up $65,000.00 and the state only contributed $5,000.00.

Freeport Transport, Inc. v. Commonwealth of Kentucky, Department of Highways,[24] presents a case in which it appears that the highway department should have left well enough alone. For 9 years there had been no accidents on a particular sharp curve; then a spot patching job was undertaken after which 7 accidents occurred over an 8-month period; the last one gave rise to the lawsuit. The problem was that the surface material used in the patching project began to flake off and exposed the primer coat so that the surface became very slippery when wet. A majority of the court felt that 7 accidents in an 8-month period were sufficient constructive notice to the state that a dangerous condition existed at that location and that the plaintiff was entitled to damages. Two dissenting judges believed there was not evidence that the prior accidents occurred under similar conditions. They voiced the state's position[25]:

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[21] Compare Shaw v. State, 56 Misc.2d 857, 290 N.Y.S.2d 602.

[22] 78 N.Y.S.2d 336.

[23] Id., at page 339, see also Spence v. State, 165 N.Y.S.2d 896; Carthay v. County of Ulster, 168 N.Y.S.2d 715; Citron v. County of Nassau, 48 Misc.2d 928, 268 N.Y.S.2d 909; but compare Coffey v. State, 193 Misc. 1060, 86 N.Y.S.2d 172; 276 App. Div. 1049, affirmed 96 N.Y.S.2d 303; 276 App. Div. 1049, 96 N.Y.S.2d 304; reargument and appeal denied, 277 App. Div. 831, 97 N.Y.S.2d 918.

[24] 408 S.W.2d 193.

[25] Id., at page 195.

> The majority opinion is the most unrealistic decision this court has reached. The effect of the holding is that it has made the duty of the Department of Highways to keep under constant inspection, wet weather or dry, every mile of the many thousands of miles in this state. This includes toll, interstate, federal, primary, secondary, and rural highways. When it rains how often must the Department inspect for slick spots the road up Chicken Gizzard Ridge and over to Possum Trot?

In another wet weather case involving a construction defect, California contributed to what was at the time the largest out-of-court settlement on record.[26] The case received nationwide attention (93). The action arose from an accident that occurred when a vehicle driven by the plaintiff, a 19-year-old college student, hit a slippery area on a freeway, lost control, and plunged down an embankment. Plaintiff's injuries rendered him a quadriplegic.

The highway was brand new; it had been opened to traffic less than 3 weeks before. During the first month of operation approximately 40 similar accidents had occurred in the same general location. Within 3 days after the accident, highway department engineers tested the road surface for skid resistance. It was discovered that the coefficient of friction was well below the minimum specified in the construction contract (0.25) and below what was considered safe. In addition, witnesses observed an oil film on the road caused by seepage from the asphalt shoulders and the expansion dividers in the PCC pavement. Two days after the accident maintenance employees sanded the area to solve the oil problem. Water also was observed draining across the highway in a wide swath. And, because of the number of cars involved in other accidents that had to be pulled out of the median strip, an accumulation of mud also was on the highway. Thus, the liability picture was rather bleak.

As far as damages went, future medical expenses and lost earning capacity were in excess of $1,500,000.00. This did not even take into account damages for pain and suffering. The state ended up contributing $375,000.00 of a $750,000.00 settlement package with the contractor. Although the amount was startling, it was probably much less than a jury verdict would have awarded. The case was a costly lesson for state inspectors and engineers in new construction.

Another California case that was settled in a trial involved a skidding accident that resulted in quadriplegia.[27] The plaintiff alleged an inadequate coefficient of friction of the pavement itself, the presence of mud on the highway, improper drainage that caused hydroplaning, inadequate superelevation, and lack of a median barrier. The accident history showed more accidents than normal for comparable roadways. Plaintiff also contended that had the highway been grooved the increased skid resistance would have prevented the accident. State engineers agreed with this contention. The highway in question was 20 years old, which illustrates the need for highway departments to continually seek out such locations to alleviate problems of low skid resistance. In this case, simply grooving the highway in the area of the accident would have substantially lowered the risk of having a skidding accident.

Another problem that concerns maintenance more than design is oil accumulation on the pavement. Liability is increasing in this area. In an older case, Sheen v. State Highway Commission,[28] a highway had a large accumulation of spilled oil that was dripped and tracked by the trucks of a nearby oil refinery. The condition had existed for a month before plaintiffs' skidding accident. The court held that there were not sufficient facts to show that the highway itself was defective, which thereby relieved the state from liability. In a later case, Stern v. State,[29] in which the highway had been resurfaced a year earlier, the plaintiff skidded on a slick highway in a heavy rain. There was testimony that the slippery condition was caused by oil leaking from cars backed up because of traffic congestion. The highway was usually slippery for a con-

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[26] Shipley v. State, Contra Costa County Super. Ct. 97198.

[27] Walton v. State, Santa Barbara County Super. Ct. 80988.

[28] 173 Kan. 491, 249 P.2d 934.

[29] 224 N.Y.S.2d 126.

siderable time until the oil film was washed away. This, of course, is a condition that is prevalent on most highways when it first rains. Nevertheless, this court held that the state was negligent in maintaining the highway in a dangerous condition and in failing to warn the traveling public, until the condition was corrected, that the road was abnormally slippery when wet.[30]

Sometimes it is asserted that the public entity commits an act that, although intended to be beneficial, causes the highway to become more slippery. This happened in California in Catarino v. State,[31] a case in which highway department crews had sprayed the pavement on a bridge with a salt solution to prevent ice from forming. The bridge was posted with signs warning that the bridge was slippery when wet or frosty. The spraying was done at noon; 4 hours later at the time of the accident, the bridge still appeared wet. Investigating officers testified that the bridge was so slippery they had to hang on to the bridge railings to keep from falling down. The plaintiff contended that the spraying caused the pavement to be abnormally slick and was the cause of the accident. The state's witnesses testified that the spraying was not a causative factor and that their actions were reasonable. As it turned out, state maintenance crews were on their way to sand the bridge when the accident occurred. By a poll of 9 to 3 the jury returned a verdict in favor of the state of California; the reasonableness of the state's action was the determinative factor.

Skid resistance is always significantly lessened when water accumulates on the highway either because of faulty drainage design or improper maintenance. In Hampton v. State Highway Commission,[32] it was contended that inadequate design allowed a $2\frac{1}{2}$-in. accumulation of water for 850 ft on a high-speed freeway, which caused plaintiff's car to hydroplane and go out of control. The state's argument was that because hydroplaning could occur with as little water as $\frac{3}{10}$ in. the defective accumulation of $2\frac{1}{2}$ in. was not the proximate cause of the accident. The state Supreme Court did not agree, holding inter alia that, where the highway was too flat and had too few drains that were designed to be frequently clogged, the highway was in a dangerous condition when water accumulated in the traveled portion of the road whenever there was a rain of any consequence.[33]

A similar hydroplaning accident occurred in Smith v. Commonwealth of Kentucky, Department of Highways,[34] where water 2 in. deep was flowing across a highway. The evidence showed that this condition was attributable to the failure of maintenance crews to clean clogged drainage ditches beside the highway. This dangerous condition, coupled with the failure to warn of it, was sufficient to hold the state liable.[35]

In Brown v. Commonwealth of Kentucky, Department of Highways,[36] maintenance crews were in the process of cleaning drainage ditches when plaintiff's vehicle skidded on a muddy section of highway. The mud was deposited on the road during the cleaning operation. The court held that the plaintiff had been warned of the hazardous condition by the state's flagmen and signs, thereby relieving the state from liability. Had the state not provided warnings, the decision would have, no doubt, been otherwise.[37]

A similar California case, Musil v. State,[38] resulted in a hung jury. The plaintiff's vehicle skidded out of control when it hit a muddy spot on a mountain highway. The mud had been tracked on the highway by state maintenance crews in the process of cleaning up a mud slide. No warning signs or barriers advised motorists of the condition. As

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[30] Id., at page 132.

[31] Stanislaus County Super. Ct. 97169.

[32] 209 Kan. 565, 498 P.2d 236, rehearing denied July 19, 1972.

[33] See also Grady County, Georgia v. Dickerson (C.A.5 Ga.) 257 F.2d 369, cert. denied 358 U.S. 909, 3L. ed. 2d 230, 79 S.Ct 237; Bench v. State, 32 C.A.2d 342, Cal. Rptr. (1973) (regardless of design state may be held liable for failure to warn of accumulation of water in a curve constituting a dangerous condition).

[34] 468 S.W.2d 790.

[35] See also Leader v. South Carolina Highway Department, 244 S.C. 195, 136 S.E.2d 262.

[36] 397 S.W.2d 163.

[37] I.e., Cable v. Marinette County, Wisconsin, 117 N.W.2d 605; J. M. Dellinger, Inc. v. McMillon, 461 S.W.2d 471 (rehearing denied by Ct. Civ. App. of Texas on December 30, 1970).

[38] Stanislaus County Super. Ct. 116813.

a result of the accident, plaintiff was rendered quadriplegic. After several days of deliberation the jury was hopelessly deadlocked at 6 in favor of the plaintiff and 6 in favor of the state. A mistrial was then declared. Because the state felt that it had presented its best case and the plaintiff did not particularly wish to incur the added expenses of retrying the case, although he was prepared to, the case settled at $150,000.00. From these facts, if the case had been retried, a plaintiff's verdict of over ½ million dollars could easily have resulted.[39]

CONCLUSION

As the foregoing discussion illustrates, most cases of potential liability of public entities are determined on the facts of the particular case in a gray area where hard and fast legal rules are difficult to formulate. Public entities may be held liable for hazardous low skid resistance conditions that result from their own actions or inactions, such as worn pavements; defectively designed, slippery PCC pavement; unplanted, eroding cut-slopes; improperly applied seal coats; and clogged drains and drainage ditches that cause ponding. They may also be found liable when conditions are purely weather created and the hazard is such that the public entity has a duty to remove it entirely or ameliorate it by putting up warning signs. The reasonableness of the public entity's actions will generally be the deciding factor on whether liability will ensue.

Thus, all states must have effective and high-priority programs to improve areas of low skid resistance. The money spent for such programs will, in the final analysis, save public agencies millions of dollars as well as lives. It is now more important than ever to create a safe environment for highway users. The courts have laid the responsibility at our doorstep; it is up to us to use the knowledge gained over the past several decades to meet it.

REFERENCES

1. Apostolos, J. Pavement Grooves vs. Motorcycles. Random Samples, California Dept. of Transportation, Sept.-Oct. 1973, pp. 2-6.
2. Adam, V. A Look at Open Mixes to Improve Skid Resistance. Public Works, July 1971, pp. 48-51.
3. Aquaplaning and High-Speed Wet Grip. Serial No. 1190, Nov. 1964, 9 pp.
4. Baca, G. S. Legal Aspects of Skid-Resistant Surfaces—A California Viewpoint. Proc. FHWA Conf. Skid Resistance Surface Courses, April 1972, 7 pp.
5. Baca, G. S., and Gowan, B. C. Legal Liability of Local Government for Negligence in Construction and Maintenance on Public Rights of Way. California Dept. of Transportation, 1972, 8 pp.
6. Baldwin, D. M. Assembly and Use of Accident Data. Highway Research Record 376, 1971, pp. 14-17.
7. Beaton, J. L. Skidding on Highways, Preventive and Curative Measures. Civil Engineering, ASCE, 1970.
8. Beaton, J. L., Zube, E., and Skog, J. Reduction of Accidents by Pavement Grooving. HRB Spec. Rept. 101, 1969, pp. 110-125.
9. Brach, R. M. Friction and the Mechanics of Skidding Automobiles. Highway Research Record 376, 1971, pp. 99-106.
10. Brewer, R. A. Epoxy-Asphalt Open-Graded Pavement as a Skid-Resistant Treatment on the San Francisco-Oakland Bay Bridge. HRB Spec. Rept. 116, 1971, pp. 42-47.

[39] See also Kenyon v. State, 21 A.D.2d 851, 250 N.Y.S.2d 1007 [accumulation of dirt on highway (brought by construction trucks), which became slippery when it rained]; Welch v. Amalgamated Sugar Company (D. Idaho, S.D.) 154 F.Supp. 3 (accumulation of mud on highway dropped from trucks entering highway from defendant's property); City of Houston v. Hagman, 347 S.W.2d 355 (city held liable for dangerous condition of street covered with mud caused by rain eroding a dirt embankment; city knew of condition for some time and did nothing to correct it or warn of it).

11. Burnett, W. C., Gibson, J. L., Kearney, E. J., and Balmer, G. G. Skid Resistance of Bituminous Surfaces. Highway Research Record 236, 1968, pp. 49-60.
12. Campbell, M. E., and Titus, R. E. Spotting Skid-Prone Sites on West Virginia Highways. Highway Research Record 376, 1971, pp. 85-96.
13. Carr, C. I. Contribution of the Rubber Compound to the Wet Skid Resistance of Tires. Highway Research Record 214, 1968, pp. 1-6.
14. Colley, B. E., Christensen, A. P., and Knowlen, W. J. Factors Affecting Skid Resistance and Safety of Concrete Pavements. HRB Spec. Rept. 101, 1969, pp. 80-99.
15. An Inventory of Existing Practices and Solutions to Slippery Pavements—1969. Committee on Surface Properties—Vehicle Interaction, Highway Research Circular 106, Feb. 1970, 21 pp.
16. Campbell, M. E. The Wet-Pavement Accident Problems: Breaking Through. Traffic Quarterly, Vol. 25, No. 2, April 1971, pp. 209-214.
17. Cross, M. L. Liability of State, Municipality, or Public Agency for Vehicle Accident Occurring Because of Accumulation of Water on Street or Highway. ALR 2d, Vol. 61, pp. 425-440.
18. Dahir, S. H. M., and Mullen, W. G. Factors Influencing Aggregate Skid-Resistance Properties. Highway Research Record 376, 1971, pp. 136-148.
19. Daughaday, H., and Balmer, G. G. A Theoretical Analysis of Hydroplaning Phenomena. Highway Research Record 311, 1970, pp. 1-10.
20. Determining Pavement Skid Resistance Requirements at Intersections and Braking Sites. NCHRP Research Results Digest 50, Nov. 1973, 12 pp.
21. Domandl, H., and Meyer, W. E. Measuring Tire Friction Under Slip With the Penn State Road Friction Tester. Highway Research Record 214, 1968, pp. 34-41.
22. Farnsworth, E. E. Continuing Studies of Pavement Grooving in California. HRB Spec. Rept. 116, 1971, pp. 134-137.
23. Gallaway, B. M., Rose, G. G., Shiller, R. E., Jr., Kao, T. Y., and Hutchinson, J. W. The Relative Effects of Several Factors Affecting Rainwater Depths on Pavement Surfaces. Highway Research Record 396, 1972, pp. 59-71.
24. Glennon, J. C. The Frictional Requirements of Passing Vehicles. Highway Research Record 396, 1972, pp. 22-32.
25. Goodwin, W. A. Pre-Evaluation of Pavement Materials for Skid Resistance—A Review of U.S. Techniques. HRB Spec. Rept. 101, 1969, pp. 69-79.
26. Goodwin, W. A. Safety Inspection of the Highway and the Vehicle. Highway Research Record 376, 1971, pp. 21-28.
27. Hankins, K. D. The Degree of Influence of Certain Factors Pertaining to the Vehicle and the Pavement on Traffic Accidents Under Wet Conditions. Texas Highway Department, Departmental Res. Rept. 133-3F, Sept. 1970, 57 pp.
28. Hankins, K. D., Morgan, R. B., Ashkar, B., and Tutt, P. R. Influence of Vehicle and Pavement Factors on Wet-Pavement Accidents. Highway Research Record 376, 1971, pp. 66-84.
29. Harris, A. J. Road Surface Texture and the Slipperiness of Wet Roads. Highway Research Record 214, 1968, pp. 18-23.
30. Skid Resistance. NCHRP Synthesis of Highway Practice Rept. 14, 1972, 70 pp.
31. Hilgers, H. F. Slick When Wet. Texas Highways, Vol. 10, No. 1, Jan. 1963, pp. 9-11.
32. Horne, W. B. Tire Hydroplaning and Its Effects on Tire Traction. Highway Research Record 214, 1968, pp. 24-33.
33. Howard, G. Beat the Water Wedge. Autocar, Jan. 1964, 3 pp.
34. Humphreys, J. B., and Moore, A. B. High-Speed Skid Testing at University of Tennessee. Highway Research Record 376, 1971, p. 38.
35. Ivey, D. L., Keese, C. J., Neill, A. H., Jr., and Brenner, C. Interaction of Vehicle and Road Surface. Highway Research Record 376, 1971, pp. 40-53.
36. Kearney, E. J., McAlpin, G. W., and Burnett, W. C. Development of Specifications for Skid-Resistant Asphalt Concrete. Highway Research Record 396, 1972, pp. 12-20.
37. Keen, H. M. Design for Safety. Highway Research Record 214, 1968, pp. 7-12.

38. Kubie, W. L., Gast., L. E., and Cowan, J. C. Preliminary Report on Skid Resistance of Linseed Oil-Coated Concrete. Highway Research Record 214, 1968, pp. 42-49.
39. Kummer, H. W., and Meyer, W. E. Tentative Skid-Resistance Requirements for Main Rural Highways. NCHRP Rept. 37, 1967, 87 pp.
40. Liability for Damage or Injury by Skidding Motor Vehicle. ALR, Vol. 58, pp. 264-287.
41. Liability for Damage or Injury by Skidding Motor Vehicle. ALR, Vol. 113, pp. 1002-1055.
42. Locked-Wheel Pavement Skid Tester Correlation and Calibration Techniques. NCHRP Research Results Digest 49, Sept. 1973, 5 pp.
43. MacKenzie, A. J. Spray Grip Anti-Skid Surfacing Materials. Highway Research Record 376, pp. 61-62.
44. Mahone, D. C., and Runkle, S. N. Pavement Friction Needs. Highway Research Record 396, 1972, pp. 1-11.
45. Mahone, D. C., and Shaffer, R. K. Corrective Programs for Improving Skid Resistance. Highway Research Record 376, 1971, pp. 54-58.
46. Marsh, B. W. Summary of Workshop on Anti-Skid Program Management. Highway Research Record 376, 1971, pp. 5-6.
47. Martinez, J. E., Lewis, J. N., and Stoker, A. J. A Study of Variables Associated With Wheel Spin-Down and Hydroplaning. Highway Research Record 396, 1972, pp. 33-44.
48. McCullough, B. F., and Hankins, K. D. Skid Resistance Guidelines for Surface Improvements on Texas Highways. Highway Research Record 131, 1966, pp. 204-217.
49. McCullough, F. Field Evaluation of the Saw Cut Method. Texas Highways, Vol. 10, No. 1, Jan. 1963, pp. 11-12.
50. Meyer, W. E. Friction and Slipperiness. Highway Research Record 214, 1968, pp. 13-17.
51. Meyer, W. E., and Kummer, H. W. Pavement Friction and Temperature Effects. HRB Spec. Rept. 101, 1969, pp. 47-55.
52. Millard, R. S. Anti-Skid Measurement. Highway Research Record 376, 1971, pp. 59-60.
53. Mills, J. A., III. A Skid Resistant Study in Four Western States. HRB Spec. Rept. 101, 1969, pp. 3-17.
54. Moore, D. F. Prediction of Skid-Resistance Gradient and Drainage Characteristics for Pavements. Highway Research Record 131, 1966, pp. 181-203.
55. Moore, D. F. Recommendations for International Minimum Skid-Resistant Standard for Pavements. HRB Spec. Rept. 101, 1969, pp. 35-38.
56. Moore, D. F. The Logical Design of Optimum Skid-Resistant Surfaces. HRB Spec. Rept. 101, 1969, pp. 39-46.
57. Mortimer, T. P., and Ludema, K. C. The Effects of Salts on Road Drying Rates, Tire Friction, and Invisible Wetness. Highway Research Record 396, 1972, pp. 45-58.
58. Moyer, R. A. History of Anti-Skid Program Management in the United States. Highway Research Record 376, 1971, pp. 1-4.
59. Mullen, W. G., Dahir, S. H. M., and Barnes, B. D. Two Laboratory Methods for Evaluating Skid-Resistance Properties of Aggregates. Highway Research Record 376, 1971, pp. 123-135.
60. Nixon, J. F. Status of Skid Management Program in Texas. Highway Research Record 376, 1971, p. 65.
61. Oliver, D. C. A Synthesis of Case Law Jurisprudence Relating to Wet-Weather Highway Conditions. Highway Research Record 376, 1971, pp. 29-38.
62. Oliver, D. C. The Law of Liability as it Relates to Low Skid Resistant Roadways. Proc. FHWA Conf. Skid Resistance Surface Courses, April 1972, 15 pp.
63. Peebles. Legal Aspects of Skid-Resistance Measuring. Proc. FHWA Conf. Skid Resistance Surface Courses, April 1972, 12 pp.

64. Quinn, B. E., Engja, H., and Zable, J. L. Using a Modified Bureau of Public Roads Roughometer to Measure Pavement Roughness Spectra. Highway Research Record 311, 1970, pp. 26-35.
65. Ricker, E. R. Use of Accident Data to Identify Wet-Pavement Locations in Pennsylvania. Highway Research Record 376, 1971, pp. 17-20.
66. Rizenbergs, R. L., and Ward, H. A. Skid Testing With an Automobile. Highway Research Record 189, 1967, pp. 115-136.
67. Rogers, R. V. Municipal, School, and State Tort Liability. American Jurisprudence, 2nd Ed., Vol. 57, pp. 1-271.
68. Sandvig, L. D., MacGregor, L. M., Shaffer, R. K., Martin, J. P., and Minnick, J. Development and Results of a Skid Research and Road Inventory Program in Pennsylvania. HRB Spec. Rept. 101, 1969, pp. 18-34.
69. Schonfeld, R. Photo-Interpretation of Skid Resistance. Highway Research Record 311, 1970, pp. 11-25.
70. Sherman, G. B. Effect of Pavement Grooving on Motorcycle Ridability. California Department of Transportation, Highway Research Rept. M&R 633126-6, Nov. 1969, 28 pp.
71. Sherman, G. B. Grooving Patterns Studies in California. Highway Research Record 376, 1971, pp. 63-64.
72. Sherman, G. B. Skid Tester Correlation Study. California Department of Transportation, Highway Research Rept. M&R 633126-7, Oct. 1971, 43 pp.
73. Sherman, G. B., Matthews, J. A., and Page, B. G. Statewide Skid Resistance Inventory. California Department of Transportation, March 1973, 78 pp.
74. Sherman, H. W. Investigation of Injury-Producing Automobile Accidents at the Highway Research Institute. Highway Research Record 376, 1971, p. 37.
75. Smith, H. A. Locked-Wheel Pavement Skid Tester Correlation and Calibration Techniques and Requirements for Wear-Resistant and Skid-Resistant Highway Pavement Surfaces. AASHO, 1972, 17 pp.
76. Spellman, D. L. Texturing of Concrete Pavement. HRB Spec. Rept. 101, 1969, pp. 100-103.
77. Spellman, D. L., Woodstrom, J. H., Bailey, S. N., and Spring, R. J. Effect of Broom Texture on Motorcycle Ridability. California Department of Transportation, Highway Research Rept. CA-HY-MR 3126-8-72-32, Aug. 1972, 21 pp.
78. Spickelmire, L. S. Construction of Nonskid Pavement Surfaces. HRB Spec. Rept. 101, 1969, pp. 104-109.
79. States. Corpus Juris Secundum, Vol. 81, pp. 850-1348.
80. Stiffler, A. K. Relation Between Wear and Physical Properties of Road Stones. HRB Spec. Rept. 101, 1969, pp. 56-68.
81. Tyres and Skidding. Autocar, Jan. 1959, pp. 6-7.
82. Multidisciplinary Accident Investigation Summaries. U.S. Dept. of Transportation, NHTSA Rept. DOT HS 601, Vol. 4, No. 9, 326 pp.
83. Van Alstyne, A. California Government Tort Liability. California Continuing Education of the Bar, 1964.
84. Van Alstyne, A. California Government Tort Liability Supplement. California Continuing Education of the Bar, 1969.
85. Weller, D. E., and Maynard, D. P. The Influence of Materials and Mix Design on the Skid Resistance Value and Texture Depth of Concrete. RRL Rept. LR334, 1970, 42 pp.
86. Weller, D. E., and Maynard, D. P. The Use of an Accelerated Water Machine to Examine the Skidding Resistance of Concrete Surfaces. RRL Rept. LR333, 1970, 40 pp.
87. Whitehurst, E. A. Problems Associated With Anti-Skid Program Management. Highway Research Record 376, 1971, pp. 7-13.
88. Zube, E. Coefficient of Friction of Various Grooving Patterns on PCC Pavement. California Department of Transportation, Highway Research Rept. M&R 633126, June 1968, 21 pp.
89. Zube, E., and Skog, J. Skid Resistance of Screenings for Seal Coats. Highway Research Record 236, pp. 29-48.

90. Campbell, M. E. The Wet-Pavement Accident Problem: Breaking Through. Traffic Quarterly, Vol. 25, No. 2, April 1971, p. 210.
91. Kummer, H. W., and Meyer, W. E. The Penn State Road Friction Tester as Adapted to Routine Measurement of Pavement Skid Resistance. Highway Research Record 28, 1963, pp. 1-31.
92. Giles, C. G., et al. Development and Performance of the Portable Skid Resistance Tester. ASTM Spec. Tech. Publ. 326, pp. 50-74.
93. Jinx Strip. Newsweek, Sept. 25, 1967.
94. Pavement Skid Resistance. FHWA, Circular Memorandum, April 21, 1967.
95. Construction of Pavement Surfacing to Provide Safer Coefficient of Skid Resistance. FHWA, Instruction Memorandum 21-3-68, April 29, 1968.
96. Plant Mix Seal Coats. FHWA, Circular Memorandum, May 13, 1968.
97. Highway Safety Improvement Program. FHWA, Policy and Procedure Memorandum 21-16, May 3, 1972.
98. Skid Accident Reduction Program. FHWA, Instruction Memorandum 21-2-73, July 19, 1973.