

the first rolling and planing, as the longer the time the less success in planing.

Our experience appears to show that fine material fed into the planer does not stick so well in cold weather, regardless of the weight of roller or amount of rolling.

The time which should elapse between spreading and rolling and planing will vary greatly as so many things affect the manipulation of the material. Some of these are: weather in general, temperature of the air and material and whether the rock asphalt is ground, steamed or hand broken. Our experience on the one small section of the north end seems to show that it is quite possible to get excellent results by planing and rolling until a smooth surface is obtained, without adding any extra material, providing the weather is warm enough.

It was very amusing at times to hear the theories advanced by people who never had any experience along similar lines of work; also, there was a wide variance between the theories of engineers, contractors and others with road building experience, and it was my observation that practically all theories were exploded in one way or another before the work was completed. However, we can look back and remember that with only one or two exceptions every method advanced by officials directly concerned and which appeared to have any merit whatever was tried out. We are also glad to know there is a record of the different operations and methods used, and as time goes on we may, by observation, be enabled to more intelligently determine just what are the proper methods to pursue in the construction of a road of this kind.

It is my belief that the methods used in this type of construction will of necessity vary greatly with the seasons, air temperature, etc., and in my opinion no iron-clad rules can be laid down as there will often be times when someone with authority on the job will have to use the proverbial "fool's judgment" in order to obtain the best results.

## RAILROAD-HIGHWAY CROSSING ACCIDENTS

---

By Thomas H. Carrow,  
Superintendent of Safety, The Pennsylvania Railroad Com-  
pany, Philadelphia, Penn.

---

Nearly everybody knows carelessness is the major cause of street and highway accidents. This knowledge comes through reports of accidents in the daily newspapers that indicate an utter lack of care on the part of a certain percentage

of automobile drivers. But there is another very important cause of highway accidents which is not so readily recognized by the casual observer, that is, failure on the part of drivers to understand and appreciate the death-dealing qualities of an improperly operated automobile and the precautions that must be taken under all circumstances to make driving safe.

This observation seems to be confirmed by the experience of thousands of people who have been in an accident for which they may or may not have been responsible. It is only after an accident or a near accident that many people wake up to the dangers that constantly arise in driving an automobile. Nothing less than an accident will make them think SAFETY. I have often seen drivers slow down and drive more carefully for a while after seeing a wreck on the roadside, indicating the necessity for a shock to make them realize excessive speed is dangerous.

The old saying that "knowledge is power" is only true when knowledge induces intelligent action. Most people have read or heard about all the hazards of automobile driving, but comparatively few people are sufficiently impressed with these hazards to take the precautions necessary to prevent accidents. Thinking is necessary for safety and until "thinking safety" becomes a habit and the exercise of necessary precautions becomes automatic there is no such thing as a safe driver and unless compelled to some drivers will not seriously think about safety.

### Obvious Dangers at Grade Crossings

With respect to railroad-highway crossing accidents even a child understands the necessity for slowing down before reaching the railroad tracks. Nobody questions the wisdom of looking in both directions before crossing. Listening for the whistle or the rumble of the locomotive would seem to be dictated by the instinct of self-preservation, if not by reason, and if one train has passed, looking to see if another train is coming in the opposite direction is such an obviously necessary precaution that one wonders how the human mind can fail to exercise it.

Yet it is the disregard of these simple common-sense precautions that causes nearly all railroad-highway crossing accidents. The result is about 2,500 deaths and 7,000 injuries at railroad-highway crossings in the United States yearly. To the same kind of thoughtlessness, carelessness, or recklessness may be attributed at least 25,000 deaths and 600,000 injuries on the streets and highways, to say nothing of a property damage that reaches the astounding figure of \$600,000,000.

What is the remedy for highway crossing accidents? The ideal is the elimination of all crossings, but with 234,000 cross-

ings in use and with the cost of elimination \$75,000 per crossing, elimination on a large scale is both economically and physically impossible. New crossings are being made faster than the old ones can be eliminated while the elimination of street and highway intersections, which would prevent many more accidents than the elimination of railroad-highway crossings, is simply unthinkable.

The only other remedy is to teach the thirty or forty million automobile drivers in this country to drive safely and back up this teaching with suitable laws and the enforcement of laws that will make it more desirable to be safe than reckless.

### **Failure to Stop, Look and Listen**

If anyone will take a thousand reports of railroad-highway grade crossing accidents and analyze them in detail he will become impressed with one fact that stands out more conspicuously than all the rest, and that is, nearly every one of the accidents could have and should have been prevented by the drivers of the automobiles observing common sense precautions. Stopping for a train to pass rarely consumes a minute and in a thousand-mile trip it would be necessary to stop but a very few times. Using proper care when approaching crossings and stopping when necessary would not cause the loss of an hour's time in a tour across the continent.

It takes a locomotive engineer several years to qualify for the job, yet in some respects there is just as much danger in careless or reckless driving of pleasure automobiles and motor trucks as careless or reckless driving of locomotives. A locomotive engineer is checked constantly, and if he displays a natural tendency to disregard safety he is taken out of service. But inefficient, careless, thoughtless and incompetent drivers of automobiles may continue to be a menace to the driving public as long as they have sufficient strength to step on the gas.

Automobile deaths have increased 283 per cent over a period of ten years, there being 23,000 deaths in 1926, against 6,000 ten years previous. "Should the ratio of increase continue in the future, 1936 will record the deaths of 65,000 persons due to motor vehicle crashes" says Mr. W. H. Cameron, Managing Director, National Safety Council. But the casualty record will not reach these proportions if Town, County, State and Federal officials and the public generally see to it that practical preventive measures are adopted including public safety education.

### **Lessons Taught by the Careful Crossing Campaign of 1927**

The railroads of the United States carried on a campaign to prevent accidents at railroad-highway crossings during the

summer months of 1927. This was the seventh campaign waged for this purpose since 1921. The results of these campaigns show the possibility of public safety education. I do not have the figures for the whole country but the results on the Pennsylvania Railroad, which operates in thirteen states, are significant.

During the four months, June to September of 1927, 106 persons were killed at crossings as a result of driving or walking in front of and into the side of trains. This number is three more than occurred in the same period of 1926, which may be considered an even break. However, a very much more encouraging showing was made with respect to injuries, the number having dropped from 182 in 1926 to 152 in 1927, and counting both killed and injured the reduction is 16%.

With a production of 3,530,000 automobiles in the United States in 1927, and a greater mileage per car and more particularly an unprecedented growth in the delightful pleasure of touring over the excellent roads throughout the United States, it may be considered phenomenal that any improvement whatever was made in the records.

One of the significant disclosures of every "Careful Crossing Campaign" since 1921 has been the results of checks made of reckless driving. Out of a half million cars observed, only 3 per cent were considered to have approached and driven over the railroad tracks in total disregard of their safety. This indicates that approximately 97% of the drivers of automobiles use a fair amount of care in approaching and driving over the railroad tracks, and it is safe to say that 90 per cent use all the care that is necessary.

Some of the reports disclose startling information as to the type of mind of the reckless 3 per cent. For example, as incredible as it may seem, 10 persons were killed during the first 9 months of 1927 on Pennsylvania Railroad tracks as a result of crawling under lowered crossing gates and walking in front of locomotives which are 15 feet high and 10 feet wide and which always ring the bell and do a certain amount of puffing when passing over the crossings.

As an indication of lack of knowledge of driving, it is interesting to notice that 15 persons were killed in 7 accidents as a result of automobiles stalling on the railroad tracks during the same period.

In September, 1927, the Pennsylvania Railroad had 613 crossings protected with red flashing light signals, which indicate that trains are coming. Since the railroad began to install these signals in 1923, we have records of 314 accidents at crossings where the signals were totally disregarded, a form of negligence similar to driving across a street intersection in the face of a stop signal.

A woman with a learner's permit for driver's license had her car stalled on the track after ignoring the crossing watchman's whistle to stop, with the result that five persons were killed.

In one case an automobile was driven through the crossing gates, the point of the gate puncturing the man's lung, resulting in death.

Notwithstanding the visibility of a train, 16 persons were killed during the 9 months period due to automobiles or teams being driven into the side of trains in 13 different accidents.

One accident almost assumed the nature of a disaster. A large six-wheel truck loaded with cement was struck when trying to beat a train across the crossing. The truck was thrown into the path of another train, derailing the engine and several Pullman cars.

The universal warning to the traveler on the highway is Stop, Look and Listen, but a deaf person cannot listen and for this reason two men thus afflicted walked in front of a moving train, having failed to look. Such accidents swell the total.

One of the victims of a crossing accident was a gentleman 78 years of age, his age being suggestive of incompetency, which is supported by the fact that he drove on to the track while the warning flashing lights were operating.

Two drivers ran around other machines already stopped waiting for the train to pass and drove into the side of another train.

### **How Railroads Prevent Train Accidents**

Many of the large railroads of the country have operated several successive years without a passenger being killed in a train accident. It has been more than a year and one-half since a passenger was killed in a train accident on the Pennsylvania Railroad, during which time two million trains were operated and about two hundred million passengers were carried.

What is the explanation of this comparative immunity from death while traveling on passenger trains? Simply this: The railroads have adopted a comprehensive set of operating rules; the employes are properly trained and examined on these rules and constant supervision and checks are provided to see that the rules are observed. On every division of every railroad there is at least one man assigned to make tests and observations to detect violations of rules and regulations in addition to the checks and observations made by supervisory officers.

For example, in one of the three Regions of the Pennsylvania Railroad in one month 184,911 tests and observations were made, which showed a 99.89% perfect performance and

for every one of the few violations of rules or regulations detected the employes found guilty were held just as responsible as if an accident had resulted, and penalties fitting the violations were imposed.

The methods employed to secure safe operation by the railroads in modified form are the only methods that will secure safety on the highways, and that is a system of checking on the observance of the rules of the road and the imposition of appropriate penalties for violations.

### Recommendation

It is therefore recommended that this Road School take such action as may be necessary to secure a state-wide check of automobile driving on all of the roads of the State of Indiana for a period of, say, three days, three times a year, to detect all forms of careless or reckless driving and violations of law or rules of the road. At least 500 checkers, either officers of the law or other persons selected for the purpose, should be assigned to do the checking.

It is also recommended that the results of these checks be tabulated on forms to be provided for the purpose, summarized and distributed throughout the Commonwealth.

In no other way will the people of Indiana or any other state become apprised of the extent of the danger of driving on the highways. In no other way will public officials become impressed with the necessity for taking remedial action.

The accident record is bad enough, as everyone knows, but the number of accidents that actually occur as compared with the number of dangerous practices indulged in by the drivers of automobiles that might cause accidents are really insignificant. It is more a matter of good luck than safe driving that fatal injuries on the streets and highways and at railroad-highway crossings do not run up to, say 50,000 instead of 28,000 a year.

*Let's Get After Not Only The Reckless Drivers But Also The Drivers Who Do Not Realize The Dangers Involved in Operating An Automobile.*

## SURVEYOR'S INSTRUMENTS AND EQUIPMENT

---

By William A. Ehrman,  
Howard County Surveyor, Kokomo, Indiana.

---

The first instrument we shall speak of as a part of the surveyor's equipment is the theodolite or transit. Originally the surveying instrument consisted of a long telescope