once for all, simplify and rationalize our whole system of taxation and favorably affect both local road and state road resources. And it should allay whatever controversy exists among the proponents of the principal forms of transportation, and establish all of them on a sound, economic basis. Eventually it will lead, without doubt, to a greater degree of centralization of highway administration.

ELIMINATING DANGER HAZARDS ON OUR HIGHWAYS

By James D. Adams, Chairman, Indiana State Highway Commission, Indianapolis

Slightly more than a year ago, I spent my first afternoon at the Purdue Road School. On that occasion, I learned many things about highways, and, during the twelve months which have just passed, I have gathered some additional information.

Having spent most of the years of my adult life in the newspaper business in Columbia City on State Road No. 30, which is the second most heavily traveled east and west road across Indiana, I have had opportunity to see and take a small part in the development of highways in that section of the state. Ten years ago, the motor traffic was not nearly so hazardous and was not such a source of news stories as it has proved in later years. With the increasing speed of motor cars, the construction of faster traveling surfaces, and the abolishment of restrictions as to speed on our highways, traffic tragedies commenced to increase; and it has been my duty in an editorial capacity to recount many frightful tragedies which have occurred on our state roads.

Experience in that work and my contact with the highway department has brought me a vivid realization of the increase in our motor traffic accidents, until today we recognize motor tragedies as the greatest horror of modern times. When I was in school, I was taught that there are four great agencies to keep down increasing population—war, famine, pestilence, and flood—but today we must add to the head of this list the motor vehicle as an instrument of destruction.

A few days ago I noticed advertisements in the papers to the effect that some new motor cars have a cruising speed of 80 miles per hour, while others can develop 120 miles per hour. It might be interesting to know that when a car is going 60 miles per hour it covers 88 feet per second; at 100 miles per hour it covers practically 148 feet per second, while at 120 miles per hour it covers 176 feet per second. This is greater speed than that at which our forefathers could shoot a cannon ball during the Civil War.
While statistics are generally uninteresting, we must rely upon them in any discussion of our modern day motor travel. The question is frequently asked, "What could be worse than war?" The answer is, "Automobile accidents."

MOTOR VEHICLE FATALITIES IN U. S.

America has engaged in six major conflicts: namely, the Revolutionary War, the War of 1812, the Mexican War, the Civil War, the Spanish-American War, and the World War. The years of actual conflict cover fifteen and the total number of Americans who were killed and died of wounds is 300,000. But the total number of fatalities due to automobile accidents in the past fifteen years was 325,000, or 25,000 more then were killed in the six major wars in which this country has been engaged. At our present rate of increase, the next 15 years should show 450,000 killed. In the last 18 months, nine times as many people have been injured in automobile accidents as were wounded in the American Expeditionary Forces during the 18 months of our participation in the World War.

During 1932, more than 29,000 people were killed in automobile accidents or died of injuries. That averages one fatality throughout the United States every 18 minutes of the 365 days of that year. Last year proved even more fatal with the deaths mounting to 30,500, an increase of 31/2%, and the killings per minute increasing from one every 18 minutes to one every 17 minutes of the entire year. I have no available statistics showing the number injured in 1933, but in 1932 the number injured as compiled by the Travelers Insurance Company totaled over 904,000. While the number of automobiles licensed in the United States remained approximately the same, there was a shocking increase in the number of fatal accidents, giving reason to believe that the increasing speed of motor cars has a direct bearing on the increase in motor car accidents.

Statistics also disclose that fatalities are increasing in proportion to the number of accidents, indicating that the increased speed results in greater loss of life than in the accidents of former years, which occurred at a lower rate of speed.

The cost of property damage incident to the automobile accidents which occurred in 1932 is said to amount to between five and six times as much as all the gold mined in the world that same year.

INDIANA STATISTICS

In Indiana, we find that the total number of our citizens who have been killed in automobile accidents from 1920 up to the present time is in excess of 10,650. In 1933 there was an increase of accidents in the state of nearly 21/2% over those of 1932. Statistics compiled by the Travelers Insurance
Company show that approximately 31,000 persons were injured in automobile accidents last year in Indiana, and that there were approximately 26,000 automobile accidents. This averages over 71 accidents in the state per day during 1933. Compiling an estimate on the basis of available figures, the Travelers Insurance Company states that from 1920 to 1933, inclusive, more than 300,000 persons have been non-fatally injured in this state in automobile accidents. The number killed and injured, which is in excess of 31,000 in the past year, shows us that it is equivalent to a population exceeded by only a few cities in the state. If we were to take the combined list of injured and killed since 1920, we would find that it would be the equivalent of sending the population of South Bend to the hospital three times in a single year. It lacks but 40,000 of equaling the entire population of Indianapolis.

Insurance companies estimate that a human life is worth $30,000. Using that as a basis of an estimate, the economic loss in Indiana during 1933 from automobile fatalities would be in excess of $30,000,000. If to that we add the time lost by those injured in motor accidents, the total would mount in excess of $50,000,000. How small an amount we are spending to correct the causes of this destruction!

Statistics also bring home to the people of Indiana the fact that a much larger percentage of our population become the victims of the motor vehicle than in the remainder of the nation. For instance, the death rate per hundred thousand for the past five years has shown that Indiana has from 4 to 6.3% more than the average of the other states, indicating that there may be some primary causes responsible for this undesirable distinction year after year.

Our own traffic surveys of fatalities on state highways outside our cities and towns show that about 20% of such accidents result from leaving the highway and crashing into a deep ditch. For 1931 and 1932, the number killed as the result of vehicles crashing into ditches has exceeded all other individual causes. However, if we combine fatalities from bridges and culvert head walls, we find that they represent the largest number of fatalities in the state, exceeding the number who are killed as the result of striking the deep side ditches. A considerable percentage die from striking telephone poles, some from striking trees, and a fair percentage from all other causes, which would include collisions.

We are faced with more speedy automobile traffic. We must realize that with the return of prosperity there will be more vehicular traffic on our highways and the slower cars will be replaced by the more speedy ones. There is a conflict of opinion as to the effect that the repeal of prohibition laws will have, but in the light of these various questions we must
recognize that serious thought will have to be given to handling more motor vehicular traffic.

The T. P. A. Insurance Company reports that last year one out of each 37 policyholders was injured or killed in an automobile accident. The insurance companies have been sounding a note of alarm, but it has been difficult to awaken public opinion to the hazards which confront not only the reckless motorist but the careful motorist as well, who frequently falls the innocent victim of some inconsiderate driver.

There is some basis for careful consideration of our motor traffic when we compare it with the railroad transportation system. Railroad tracks are placed sixteen feet from center to center, while a box car is $10\frac{1}{2}$ feet wide, so that this gives a clearance of $5\frac{1}{2}$ feet between two box cars. On our eighteen-foot pavement, of which we have many thousand miles in Indiana, we have much less clearance. The average motor car is from 5-feet 2-inches to 5-feet 6-inches wide, so that when it is driven down the middle of one nine-foot traffic lane, a clearance of only 21 inches is provided on each side. If the car we are meeting is likewise traveling down the middle of its nine-foot lane, we have a total clearance of 42 inches as compared to 66 inches, or 2 feet less clearance than is required for two box cars which are traveling on a fixed roadway at probably a slower rate of speed. The average truck is eight feet wide, so that if it is traveling down the center of its nine-foot section, when it meets another truck of similar size, we have twelve inches of clearance. The marvel of the whole proceeding is that we have as few accidents as we do.

We have many signs on our Indiana highways, reading, “Do not Park on Traveled Road.” Yet, on that same highway, we find a shoulder of only 4 or 5 feet in width, so that it is necessary for the motorist to park at least partly on the pavement in emergencies.

That we may get a more vivid picture of Indiana fatalities, we have had a map prepared showing the record of deaths on Indiana State highways outside the cities and towns since 1929. Many miles of these roads have been taken into the system since the starting of these records, so that any way you consider them they are inaccurate and the toll is much greater than is shown here.

Our records show that more than $20\%$ of the fatalities which occur on Indiana highways result from vehicles running into deep ditches and $30\%$ are the result of striking bridges and culvert headwalls, making a total of more than $50\%$ of all fatalities. Therefore, we felt justified in launching upon an extensive program of widening shoulders, culverts, and bridges. While there has been much previous discussion of widening, nevertheless, opportunity did not present itself for entering upon this project in a big way until the acute unemployment stages were reached in the late summer months.
SUCCESS OF WIDENING PROGRAM

It was toward the closing days of September that our department started on its extensive program of widening. It seemed hopeless to attempt to acquire the necessary rights of way, but with determination and the co-operation of local communities, civic clubs, and particularly the press of Indiana, we were able to develop a public interest which has far exceeded anything that we had ever dreamed. Stressing first the need of giving our people employment and second the need of greater safety on our highways, we were able to get this huge widening project under way. As the shoulders were widened and farmers were able to see that no destruction or harm was visited upon their premises, they more heartily joined in the movement, and right-of-way is now being acquired with much greater ease than ever before. (Figs. 1 and 2.)

We likewise have found from the standpoint of the department that the wider right-of-ways are making our problems of handling snow much less difficult. In fact, the reports that came from the LaPorte and Fort Wayne districts on the occasion of a recent heavy snowfall were to the effect that the widening had been worth all it cost from the standpoint of maintenance alone.

We are also getting reports from all parts of the state of motorists who have met with an accident and have been compelled to leave the pavement. They write us that they have escaped serious accident, their machines were not broken up, and that no one had been hurt. They think such accidents might have resulted fatally under the old conditions.
We have campaigned for the wider shoulders and the wider right-of-ways for five reasons: first, employment for our needy people; second, added safety for the motorist; third, reduction in the cost of maintenance; fourth, the improved appearance of the roadway; and fifth, the resulting benefit to the farm adjacent to the improved roadway. During the three and a half months since the program started (up to January 1, 1934), nearly 400 miles of roadway have been widened and more than $1,690,000 has been paid in wages. By the use of more equipment, more miles could have been widened. Some of our unemployment surveys disclosed that 40% of the unemployed were boys between the ages of 18 and 23. While widening our roadways, we were at the same time reclaiming young men.

Up to the present time, we have not been able to embark upon a program of culvert widening on a large scale, but within the coming few weeks this will be undertaken in a big way. On hundreds of miles of our roadways, the culverts will be extended. Farmers are finding that, where the roadway has been widened, they are enabled to move their heavy machinery along the widened shoulders, thereby making it safer for them and for the motorist. We are convinced that the wider shoulders, wider right-of-ways, and wider bridges and culverts will reduce our motor accidents. We know that elimination of sharp curves, increasing the superelevation on curves, improving the visibility and giving a longer sight distance all will play important parts in reducing the motoring hazards.

Viewing the statistics of the past year of 30,500 killed from motor accidents and then breaking that down into units, we find that some fourteen thousand of those people were
pedestrians. That being the case, the wider roadway will permit at some future time the construction of a footpath along the highway where the pedestrian may walk with the assurance that his life is not jeopardized and the motorist will have a feeling of relief that he need not constantly be on the lookout for a pedestrian. (Figs. 3 and 4.)

Illinois voted a special bond issue of $18,000,000 for widening roadways on what they designate as the Indiana Plan, recognizing not only the employment factor, but the important safety factor as well.

Fig. 3. Road 6, Sec. B., Lake County, 1 mile east of junction with Road 30. Condition of road at this location before widening.

Fig. 4. Road 6, Sec. B., Lake County, 1 mile east of junction with Road 30. Condition of road at same location as Fig. 3 after widening.
BEAUTIFYING THE ROADSIDE

There is one other point which I wish to make in this connection and that is to refer to the experience of one other state which has come to my attention. Rhode Island has gone a long way toward the beautification of highway intersections. There was one intersection where 21 accidents had occurred in one year. In 1929 this intersection was beautified with numerous small plantings, and from that time until the present but one accident has occurred. There we have the instance of 21 accidents occurring in one year and one occurring in four years after beautification. No one is able to explain this. All we know is the result.

With her widened highways, Indiana may now embark upon a program of roadside improvement, sometimes called beautification, of our highways. Tourists in the old country come back impressed by the magnificent trees along the highways, but Indiana has done very little in this particular. In fact, little could be done until the roadways were widened, so that now we obtain as a by-product of our relief program and our safety program a program of roadside beautification.

As the years pass with increasing population and increases in motor traffic on our highways, we will need our wider right-of-ways for pavement widening, for safety, for beautifying, and for savings in maintenance costs.

It will be a fine thing for motorists in the future to see how beautiful Indiana's highways are with mile upon mile of majestic trees. I can think of nothing more beautiful than to travel beneath a canopy of elms stretching their branches across the roadway to afford a welcome relief from the rays of the sun on a hot summer's day. Smaller plantings will serve as a buffer to keep off the drifting snow.

This highway business is one of such major importance, being second only to agriculture in Indiana today, that it deserves our best study and best thought. The U. S. Department of Agriculture is authority for the claim that Indiana has invested in her roadways between $550,000,000 and $600,000,000 and that the Indiana State Highway Department has an investment in excess of $180,000,000; so we have full justification to meet on an occasion like this and discuss our problems of today and our plans of tomorrow.

I can think of no finer tribute than to have it said one hundred years from now that the Highway Department of Indiana in 1933 and 1934 looked to the future and anticipated our needs when they made wider roadways, when they planted trees along those roadways, and put a little of the arts and some of our finer sentiments into the hard economic designs which are so much a part of roadways.

I trust that when you men go back to your respective homes in various parts of the state, you will lend your support to the
wider roadways for the safety they provide, for the needed labor which results therefrom, and for the possibilities of beautification.

Perhaps when all other efforts have been exhausted, the answer to our problems of highway safety may be found in reduced speed of motor vehicles, in having a wider traveling area, in having footpaths along our roadways for the pedestrian, and in prevailing upon our self-restraint and common sense to drive with greater care.

TRANSPORTATION AND RESEARCH
By A. A. Potter, Dean of Engineering, Purdue University

Transportation—effective, safe, economic, and adequate transportation—is of greater concern to us than to any other nation in the world. Transportation is of major significance to this country in peace and in war; transportation affects us politically, socially, industrially, and from the standpoint of public defense. Great distances separate the political units of our government, and adequate transportation facilities must be had to insure its solidarity. The stability of our government could not have been maintained two hundred years ago. The locomotive and good roads have done more to keep the forty-eight states together than have special legislation or any other factors on record. The U. S. A. constitutes the largest area in the world wherein there exist free and unrestricted trade and commerce; our different states have no tariff barriers against each other, thus making efficient and economic transportation of definite importance from the standpoint of American industry. It must be also realized that our great natural resources and our superior production capacity have value only if we have adequate and cheap transportation systems to distribute goods and services. Transportation is also of great importance to us from the standpoint of national defense, as we have long frontiers and vast coast lines to be protected.

That Indiana has not been backward in its support of highway transportation is evidenced by the fact that this state has expended for road building alone, not counting Federal contributions, over three hundred million dollars since 1919, the disbursements of the State Highway Commission alone having totaled over $185,000,000 since 1919.

Thanks to your effective work, the roads of Indiana are a source of pride to all. We are certain that in rain or shine, winter or summer, our good roads will make motor vehicle transport safe and comfortable.