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.
In watching the Indiana road-building program during the past fourteen years, I have been wondering whether you who are responsible for the design, construction, and maintenance of highways and streets are making sufficient use of new science and are planning your future programs with a degree of certainty. This matter has been called most forcefully to my attention during recent weeks, when, in my capacity as a member of the National Science Advisory Board for the Railroads, it was necessary for me to appraise the methods used by industries, outside of transportation, to plan for the future. I found that the most successful industries of this country have been spending for research, even during the past four years of depression, one to four per cent of their income in order to keep ahead of practical applications. I found that the Bell Telephone Laboratories appropriated last year (1933) over $13,000,000 for research and development, of which over $8,500,000 were expended for fundamental scientific research in order to appraise the effect of new developments which come from the outside. The Aluminum Company of America has been devoting to research one to four per cent of its gross sales; the DuPont Company, one and one-half to four per cent of its net income. Apparently industries which have best weathered the depression have been foremost in research, since they consider research expenditures as the insurance their companies must take out in order that their products may continue to show improvement year by year.

What percentage of the twenty-five or more billion dollars which have been expended in this country during the past fourteen years for roads and streets, or of the three hundred fifty million or more dollars which have been used in road building in Indiana during the same period, has been utilized to develop better methods of road building by taking advantage of new science? What encouragement are you giving to the development of new types of roads and streets to take care of increased demands? What knowledge, accurate scientific knowledge, do the State Highway Department and other road building agencies of Indiana and of the nation have which they can use most effectively in their plans for the future, so that the funds available for road building may be employed most beneficially for the public? What new knowledge are you gathering about road construction which insures that you are basing your programs for the future upon facts and not merely upon opinions? Are your present methods of building roads sufficiently flexible to allow for traffic growth? Expenditures by progressive industrial enterprises are supported by facts secured through research. Is that true in road building? We have in this country not less than three million miles of roads, over three fourths of a million miles of which are improved. We have not reached the saturation point in road and street building, but what scientific knowledge have
you to guide construction in the future in order to make cer-
tain that you are building better roads year by year? What
guarantee are you giving the taxpayers that obsolescense on
your roads will not be excessive?

Your Purdue University has received from industry since
1925, or during the past eight years, $1,278,500 for engineer-
ing research of value to American industry. This does not
include the Purdue Research Foundation or agricultural re-
search. To name a few of the contributors to engineering re-
search: the railroads, $946,000; the Indiana limestone in-
terests, $23,000; the electric and gas public utilities, $168,000;
and television research, $101,000. How much has been ex-
pended by the state or by the nation during the same period,
since 1925, for highway research? Taking even the low figure
of one and one-half per cent on expenditures—and most
progressive industries spend three and one-half or four per
cent for research—more than five million dollars should have
been expended since 1925, or during the past eight years, by
Indiana for highway research. While I have no accurate
figures of such research expenditures, I am certain that it was
much less than one tenth. Can we expect true progress in
road building under such conditions?

It is true that no single improvement has done more in
recent years for the general good of the people of Indiana than
the improvements in our streets and highways, but what of the
future? Research for such an important undertaking as road
building is like insurance for you individually. You must sub-
stitute the certainty for the uncertainty by devoting more
money to highway research or you are bound to lose public
support.

It has been said that the research program of a company
is a guide to the investment value of its securities. One of
these days you will find that the taxpayer will demand ac-
ccurate research knowledge if he is to invest large sums in
improved roads and streets.

All reports indicate that this—the twentieth Road School—
has been most successful, and we at Purdue University are
greatly indebted to you for your cooperation. In particular,
I wish to take this occasion to express appreciation to the
State Highway Commission, to the County Surveyors' and
County Engineers' Association, to the County Road Super-
visors' Association, to the County Commissioners' Association,
and, last but not least, to the Highway Materials and Equip-
ment Association. Let us work together for a still better
Twenty-First Road School in January, 1935, and do not forget
that you must give greater consideration to scientific research
in connection with the road and street building programs of
the future. It is a question of research and facts or stag-
nation and failure. Which will you choose for the road building
program of Indiana?