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*Relation of the Bureau of Public Roads to the Automotive Industry*

## Relation of the Bureau of Public Roads to the Automotive Industry

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Roads are the tracks of the motor vehicle - as necessary to its utilization as rails to the steam locomotive and its train. Naturally, therefore, the relationship that has developed between manufacturers of automotive vehicles and builders of roads has been a very close one.

When the motor vehicle was much younger, the relations of its builders and the makers of its tracks were not as harmonious as they have since become, disturbed as they were by the question whether to build the roads to fit the loads as the vehicle manufacturers demanded, or trim the loads to save the roads as the road builders insisted.

Fortunately for the development of highway transportation there was early recognition by the two groups of their mutual responsibilities to promote that development on lines of economy, out of which there grew the close relationship that now exists - a relationship that is based upon a common willingness to submit their joint problems to the test of economic and physical law and abide by the result.

The Bureau of Public Roads, as the agency of the Department of Agriculture charged with the administration of the program of Federal aid road construction, has been thrown into the most intimate relationship with the makers of motor vehicles. Jointly

with the 48 State highway departments, in the last 14 years, it has supervised the construction of 90,000 miles of the country's most important interstate and intercounty highways at a total cost of more than two billion dollars. Mile for mile these are the roads most heavily used by motor vehicles of all roads in the country. It is but natural, therefore, that the motor vehicle manufacturers should manifest a special interest in their construction, and that there should thus be formed numerous contacts with the Federal and State agencies that have their supervision in hand.

Obviously, it is no more possible for highway engineers to design a road surface without a knowledge of the number and weight of the vehicles that will use it than it is for the railroad engineers to decide upon the weight of rail that will be used in their tracks without knowing the size of locomotives that will be operated over them. The problem of the engineers, of both schools, is indefinite and incapable of solution until the traffic factor is known with reasonable accuracy.

To the railroad engineers this traffic factor presents no difficulties. The traffic is under the complete control of their companies; and the number of trains and weight of the largest equipment to be operated over a given section of track can be predicted with exactness.

The highway engineer has no such complete control over the use of his product; but he must, nevertheless, find some means of

forecasting that use with reasonable accuracy. To foresee the volume of traffic that will flow he must depend upon the guidance of such data as he may obtain by means of traffic surveys and the study of the principles and trends of automotive transportation; and the adequacy of the roads he constructs rests upon his ability to read and interpret these data.

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In/the weight of the largest vehicle to be accommodated, he has the legal restrictions as a guide, but in these there is no fixity. They are subject to change by legislatures in response to popular demand and the needs of industry. So, even as to the weight of vehicles, the highway engineer must anticipate probable changes.

In order that engineers might have at their disposal the basic facts essential to these various forecasts and decisions it has been necessary to undertake a great deal of research and investigation, and in this work the Bureau of Public Roads has long occupied a central position in which it has been required to maintain close cooperative relationship with vehicle manufacturers on the one hand and the highway building agencies of the States on the other.

As a result of this work, the primary purpose of which has been to develop a rational basis of highway design, the Bureau has uncovered facts of the utmost importance to the automotive industry, and which have been utilized to the advantage of the industry and the business of highway transportation.

One of the most important contributions to the efficiency and economy of highway transportation is the development of

pneumatic tires for the larger classes of vehicles and the already virtually complete displacement of the solid rubber tire.

In the design of roads the vehicular factor in which the designer is interested is not the gross weight of the vehicles to be carried, or the dead load of the vehicles at rest transmitted through their wheels, but rather the impact with which the wheels of moving vehicles strike the road surface after being projected slightly into the air on contact with a surface irregularity.

Ten years ago very little was known of the intensity of such impact forces, and, as a better understanding of them was essential, the Bureau of Public Roads set about a study of them. How little knowledge existed is indicated by the fact that there was not even a dependable apparatus with which to measure forces of this character, so the Bureau had first to invent and manufacture the measuring apparatus.

It was not long before it was found that the impacts delivered by wheels equipped with solid rubber tires might be several times as great as those delivered by wheels carrying the same load but equipped with pneumatic tires. Moreover the speed at which a given intensity of solid-rubber-tire impact was reached was found to be much less than that at which the same intensity of blow would be delivered by a pneumatic tire.

Here was information that was equally useful to the road builder and the vehicle manufacturer, because the same impact that injures the road also in its reciprocal effect destroys the vehicle.

It was information that struck the knell of the solid rubber tire; and the process of abandonment has been even more rapid than we hoped for. The result is not only that the cost of highways capable of carrying the heaviest loads is greatly lowered, and the probability of road damage reduced, but vehicular operating costs are also decreased and practicable speeds raised - all of which tends to reduce the cost of transportation.

In the later investigations of motor truck impact the Bureau has had the direct cooperation of the Society of Automotive Engineers and the Rubber Manufacturers Association.

Of similar usefulness to the automotive industry as well as benefit to the public were the results of the Bureau's tests which proved the advantages of multiple axles for trucks and buses. These tests have shown that the demand which a given load makes upon the road surface depends upon the number of wheels on which it is carried and its distribution to the wheels. They have shown that a load carried on a vehicle with two rear axles requires for its support a road surface only half as strong as if it were carried on only one rear axle, assuming the same percentage of the load to be distributed to the front axle in each case.

These findings are the basis upon which the multiple axle vehicle is being developed - another improvement which, carried to its practicable limits of application, will also produce material savings in transportation.

Of the other services rendered to the automotive industry - too numerous to mention individually, and all of them the reciprocal results of activities designed for the public benefit - one only might be mentioned, as of outstanding value. It is the contribution which the Bureau has made to the definition of the economic field of automotive transportation. Made up of numerous detailed findings in the course of the traffic surveys which it has directed in a number of States, this service of the Bureau is of the broadest interest to the automotive industry as well as the public at large.