

A HIGHWAY VIEWPOINT ON THE SIZE AND WEIGHT OF MOTOR BUSES

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I appreciate the privilege you have given me to discuss at this opening session of your convention some matters of common concern to you as operators of motor buses and to highway officials as builders of the roads and streets over which your vehicles are operated.

You, and the highway officials for whom I speak have essentially a single purpose - to supply the facilities and the means of a safe and efficient highway transportation service. Neither vehicle operators nor road builders alone can accomplish that purpose. The two groups constitute essentially complementary agencies. They must work together, or neither will work to best effect.

It is appropriate, therefore; indeed it is essential, that they take frequent counsel together; and such counsel is especially desirable at this time when each - vehicle operators and road builders alike - after an interlude of war, are planning what we all hope will be a long period of fruitful development in peace.

Revolutionary change is possible neither in the roads nor the vehicles. You are presently equipped with many vehicles which I am sure you will wish to continue in service over the period of their useful lives. You are doubtless planning now the new and better vehicles with which you will replace the present equipment when, and as such replacement becomes economically feasible.

Highway officials are the custodians of a similar present equipment of roads and streets, and they, like you, recognize the necessity of continuing their equipment in service over the period of its reasonable economic life. Like you, also, they are now giving thought to the new and better highways, which in due time they will build in replacement of existing obsolete sections of the highway system.

In each case there are limits of financing ability which will determine the rate at which the replacement can occur.

If, then, we can agree that the future task and problems of motor bus operators and road builders are broadly similar, you will concede, I hope, that your tasks and your problems are in some respects simpler - less complex - than the tasks and the problems of the road builders.

You are concerned with the operation of one class of vehicles only. The roads which are the concern of highway officials must accommodate your vehicles and additionally, vehicles of distinctly different classes, of widely different character.

Your vehicles are relatively few. The total of all vehicles which highway officials must endeavor to serve is many times greater.

You can confine your attention to the efficient rendering of one kind of transportation service - the common carriage of persons for hire. Road builders must attempt to meet your needs and additionally the needs of owners and operators of freight vehicles, both private and for hire, and of a very much larger number of private passenger car owners. The desires and claims of these other road users are not in all respects identical with your desires, and the road builders must pay respectful attention to the reasonable desires and claims of all users of the highways.

The roads over which you operate constitute only a portion, a relatively small portion, of the entire system of streets and highways for which highway officials as a group must acknowledge a responsibility.

The financing of your equipment and operation is largely within your own control and amenable with some certainty to the demonstration of a prospective reasonable balance of income and outlay. The financial endowment of highway officials is subject to uncertainties of public fund appropriation, and is governed in its investment and expenditure by laws which modify and restrict the apportioning authority of administrative officials.

Highway officials are generally keenly aware of this relative complexity of their task and problems, and of the legal restrictions imposed upon their administrative discretion and financial decisions; and your recognition of these conditions of their thought and action will help to create a cordial atmosphere for the discussion of common concerns.

It was in such an atmosphere of cordial and reciprocal respect, I am happy to say, that I met with your representatives recently in discussion of proposals for the limitation of vehicle size and weight under consideration by the Highway Transport Committee of the American Association of State Highway Officials.

Since these discussions occurred, the Committee has made its report and the limits it proposed have been adopted by majority vote of the State membership as a policy of the Association. It is of those

recommended limits, now supported by the organized State highway officials of the country, that I wish to speak briefly today, particularly as they may affect your own operations.

The recommendations relate to the height, width and length of vehicles, to axle loads and weights to be carried on groups of axles of various spacings and to the speed of vehicles.

For the height of vehicles the limit recommended is $12\frac{1}{2}$ feet; for the maximum width of all classes of vehicles, 96 inches.

For the length of single trucks a maximum length of 35 feet inclusive of front and rear bumpers is recommended. For busses the greatest length recommended, also inclusive of front and rear bumpers, is 40 feet, and it is provided that a bus in excess of 35 feet in overall length shall have not less than three axles.

The recommended overall length for tractor-semitrailer combinations is 50 feet, and for other combinations, consisting of not more than two units the overall length limit is placed at 60 feet.

A point on which the highway officials are nearly unanimous is that axle loads should be limited to 18,000 pounds; and they define axle load as the total load transmitted to the road surface by all wheels whose centers may be included between two parallel, transverse, vertical planes 40 inches apart, extending across the full width of the vehicle.

In addition to this limit upon the load to be carried on one axle, the recommendation also includes a table of the maximum weights to be delivered to the road surface by groups of axles comprised within various longitudinal distances from 4 to 57 feet. For axles spaced at least 4 feet and less than 8 feet apart, the limits given in the table are uniformly 32,000 pounds. Two axles spaced 8 feet apart are allowed a total weight of 32,610 pounds; and above the 8-foot spacing the table shows increasing total weights for distances between the extreme axles of any group rising by one-foot intervals. The heaviest weight shown in the table, corresponding to a distance of 57 feet between extreme axles, is 73,280 pounds. For any number of axles included within a longitudinal distance of 25 feet the maximum weight allowed is 48,350 pounds; for a 30-foot spacing of extreme axles it is 52,650 pounds; and for a 35-foot spacing, 56,800 pounds.

The permissible maximum speed for trucks is recommended as 45 miles per hour. For passenger vehicles - including busses - no fixed speed limit is recommended; it is proposed instead that such vehicles may be operated at such speeds as shall be consistent at all times with safety and the proper use of the roads.

Obviously there are some particulars of these recommendations that do not affect the normal operations of members of this Association. In respect to those particulars in which you may find your operation affected, I assume that there are some among you who may not agree with the limits proposed. For those so minded I should like to outline briefly the reasons which led our committee to its decisions.

The 12 $\frac{1}{2}$ -foot limit of height may be dismissed, I assume, as generally acceptable. Whatever may be its effect upon the design and operation of trucks, it apparently will not affect any normal operation of busses; and, indeed, it is not seriously objectionable to most operators of trucks.

The speed recommendation gives well deserved recognition to the outstanding record of safety in bus operation generally, and also may be assumed as acceptable to your membership.

The group-axle weight limits likewise appear to be without restrictive effect on normal bus operation, and elicit, I assume, no serious objection among you.

The area of probable disagreement is thus narrowed to questions of width, length, and axle load; and within this area I know, from friendly discussion with your representatives, there is some disappointment with the limits proposed.

Let me, then, try to make clear to you the considerations which brought us to these disappointing decisions. And, first, permit me to define the basic causes of the highway officials' interest in the establishment of maximum limits of vehicle size, weight, and speed.

They are:

1. To establish some of the fundamental prerequisites of highway design. Obviously, the designer of a new highway or bridge must have a definite knowledge of the maximum loads his structure will be required to support and the maximum dimensions and speeds of vehicles. The loads assumed determine the strength of the structure. The assumed vehicular dimensions and speeds determine the necessary width and height clearances and alinement - in general, all those elements of design comprised in what is called the geometry of the road or bridge.
2. To establish a sound relationship between the dimensions and weights of vehicles in present operation and the strengths and capacities of existing highways. Whatever criteria may be assumed for the design of new highways or bridges, great mileages of roads and thousands of bridges previously constructed now exist and must be preserved in reasonable usage over an economically defensible life span. Highway engineers can estimate with approximate accuracy the strength of these existing roads and bridges, and recognize an obligation to protect them against usage which would overtax either their strength or capacity.

3. To promote efficiency in the interstate operation of motor vehicles. Highway officials of the several States recognize the desirability of eliminating so far as practicable the barriers to interstate commerce inherent in a multiplicity of State regulation. They believe the elimination of such barriers by joint action of the States to be far preferable to alternative action by the Federal government; and they deem it their duty to advise their respective States upon appropriate action within the field of their official responsibilities.
4. To promote the safety of highway transportation. That a maladjustment of the size, weight and speed of vehicles to the dimensions, strengths, and geometry of existing roads and bridges is fraught with elements of hazard is regarded by highway officials as axiomatic. They seek by proposal of maximum vehicular limits to promote and preserve a safe road-vehicle adjustment.

Now, keeping in mind these basic grounds of the highway officials' interest, let us examine the reasons for the specific decisions on width, length, and axle load of vehicles, with particular reference to the limits applicable to motor busses.

First, width:

The Highway Transport Committee gave careful and sympathetic consideration to the needs, ably presented by your representatives and other eminently qualified automotive engineers and vehicle operators, for a limit of width greater than 96 inches. The need for greater width of the body of busses and at the axle level of trucks was accepted as genuine and urgent.

We could not, however, blink the fact that a very large proportion of the existing mileage of most heavily traveled main highways - on the average about 50 percent of such mileage - exists today with two-lane surfaces less than 20 feet wide, and of the mileage so classified almost the total is 18 feet wide or less. This is the present condition - not of relatively unimportant roads, but of large parts of the most important routes - of the very routes traveled by your busses.

Highway officials generally recognize this condition as seriously defective. Unquestionably, it will be corrected as rapidly as possible by the widening of existing surfaces and the construction of new pavements of substantially greater width.

Until, by such corrective measures, the proportion of mileage under 20 feet in width can be substantially reduced, the Committee felt that it should recommend no change in the 96-inch width limit

now almost universal in the laws of the States. However, its recommendation of the continuance of that limit was qualified by an advisory note, reading as follows:

"It is recognized that certain conditions inherent in the design of vehicles suggest the desirability of 102 inches as a standard of maximum width. The existence of numerous bridges and a large mileage of highways too narrow for the safe accommodation of vehicles of such width precludes the present adoption of the higher standard of width. The State highway departments and Public Roads Administration are urged to give consideration to the desirability of eventual provision for the accommodation of vehicles 102 inches in width in planning the reconstruction of Federal-aid and State highways."

Thus, while insisting upon the necessity of adhering for the present to the 96-inch width limit, as a measure of protection for existing highways, the Committee recommended in positive terms the design of new and reconstructed main highways with width sufficient to accommodate vehicles 102-inches wide. The latter recommendation has actually the same weight and importance as the former, though, because it is addressed by the Association to its own members, it appears as an advisory note attached to the body of the statement intended in other respects as advice to the public and legislative and law enforcement branches of government.

Turning now to the length recommendation:

The Highway Transport Committee was persuaded by evidence of need presented by your representatives to propose the limit of 40 feet for busses as single vehicles. It accepted the greater length as desirable despite some misgivings that such a proposal might be regarded as inconsistent with the recommendation of a 35-foot maximum length for single trucks, to which it felt bound to adhere. The Committee was convinced that allowance of the greater length for busses would conduce to both the safety and the convenience and comfort of motor bus travel; and the Association membership, voting by States, endorsed the purpose and the proposal in somewhat surprising strength.

The qualification attached to the proposal that vehicles in excess of 35-foot length should have three axles was determined upon in this manner:

It was known, and acknowledged by your representatives, that 2-axle, 35-foot busses in present operation develop axle loads which reach, and in many cases slightly exceed 18,000 pounds. Because of this accepted fact, your representatives had urged the desirability of increase in the presently prevailing axle-load limit of 18,000 to 20,000 pounds. Our Committee, on grounds which I shall later present, deemed it essential to adhere to 18,000 pounds as the maximum limit of axle load. In the presence of such a limit it reasoned that the proposed greater length allowance would probably be usable only by the addition of a third axle. Its conclusion to that effect was influenced not only by the evidence of numerous weighings of modern 35-foot busses

in use, but also by the expressed desire of your representatives for a 20,000-pound limit, as a necessity of the feasible design of future vehicles. If the third axle were added there could be no doubt that the longer vehicles would conform easily to the 18,000-pound axle-load limit. The probability that they would, in fact, impose upon road surfaces concentrations of load substantially below the limit would be particularly acceptable to highway officials, keenly aware of the slenderness of the margin of strength available in even the stronger of existing surfaces for support of loads at the 18,000-pound maximum. So the 3-axle qualification was regarded as assurance that the benefits of safety and comfort that the longer busses would afford your passengers, and - shall I say, the possible revenue advantages which you as operators would enjoy - would not be overbalanced by possible highway distress. On these grounds the qualification was advanced, and on the same grounds, it was effective in the obtainment of a substantial majority support for the 40-foot length limit. Without the qualification, it is my judgment that the proposed increase in length would have found far less favor, and possibly failed of adoption.

And, now, on the matter of the axle-load limit per se:

In what I have just said I have indicated the great importance which highway officials attach to a firm adherence to 18,000 pounds as a maximum. There is none of the recommendations on which the opinion of these men who have the responsibility for designing and maintaining the major highways of the country is more united. The proposal of a limit so much as a thousand pounds heavier would have enlisted in its support no more than a corporal's guard of the voting State membership of the Association. The reason is the almost unanimous conviction of the engineers who must shoulder final responsibility that the least encouragement of axle loading at and above 18,000 pounds, the least increase of the present frequency of application of such loads will result in great damage and an indefensible shortening of the useful life of a large part of the major highway system. The conviction is forced by a great body of practical experience. It is amply supported by specific physical tests and mechanical theory.

The 18,000-pound limit is essential for the preservation of almost the totality of existing surfaces. The normal life expectancy of the large aggregate mileage of these existing surfaces, if axle loads be kept within this limit, runs on the average between 10 and 20 years into the future. The design of new and reconstructed surfaces to withstand heavier load concentration will entail certain increase of road expenditure that there is no demonstrated certainty of offsetting by reduction of vehicle operating costs. Moreover, the devotion of a substantial part of the always limited highway funds available to such surface strengthening will subtract by just so much from the funds available for elimination of far more serious faults of the highway system. By all these reasons highway officials are persuaded not only that there should be no present increase of the prevailing 18,000-pound axle-load limit, but also that it is inadvisable in new highway design to anticipate eventual provision for the operation of vehicles imposing heavier load concentration.

As you will observe, we are led to these conclusions largely by economic considerations based upon what we believe to be sound evidence. We are as eager as you are to realize all possible gains in the overall efficiency and economy of highway transportation; and if we are wrong in our economic deductions, I believe you will find us ready to accept and act upon clear demonstration of our error.

To the end that our present recommendations may be subjected to a constructive review in the light of the experience and knowledge of vehicle operators and manufacturers, the Highway Officials Association has authorized our Committee to join with a committee representative of the National Highway Users Conference in a factual study of their operating effects. At our suggestion the Highway Research Board, a division of the National Research Council, has also established a committee to undertake and direct specific fact-finding investigations.

If there is demonstrable error in the recent recommendations, I believe you will agree it should be uncovered by the studies expected of these two committees, in both of which highway and automotive engineers and vehicle operators will join their best endeavors in friendly cooperation. The recommendations, as they now stand, suggest a revision of laws and highway construction policies greatly to the advantage of your operations, and as the Chairman of the Committee that drafted them I feel that I may ask for them your sympathetic consideration and, consistent with your interests as you see them, the fullest possible measure of your support.