

Who shall use the Highways
and How.

WHO

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Who Shall Use The Highways and How

THE introduction of any new commodity or service which changes existing conditions, always creates antagonism and often intensely bitter opposition from those selfishly interested.

There are many ways of illustrating this situation which affects the social and economic life of our people, but for the purpose of this discussion we will confine ourselves to one item—that of transportation—to prove the conclusion indicated in our preliminary statement.

This Nation began with water transportation as virtually the only means of communication; hence rivers and lakes were the determining elements in the location of towns and colonial industrial developments. Roads were few, poorly constructed, and always impassable many months in the year, in the area then called the United States. The vehicles for travel were so uncomfortable that people and products were sent by boat whenever possible. Where there was no water transportation, canals were projected and often constructed, for no one had yet visioned the "iron horse."

**Changing Methods
of Transportation
Bring Opposition
from Rivals**

When he did come, snorting down a short mileage of track, ship builders and canal promoters became vocal. But progress would not be delayed and the Nation, states, and even local communities loaded down railroad projectors with bounties of an almost unlimited character.

Then the internal combustion engine appeared on highways, which by this time, had been improved in a very limited mileage by the use of first plank, then crushed rock, cement and bitumen. Then the railroad man, who had a wicked smile when the canal promoter and shipbuilders cursed him every time he joyfully rang his bell, lived to see the "average man" become his own engineer on the highway, able to make his own time table and drive his car far back into the country where even the sound of the locomotive whistle could not be heard.

Water transportation is so limited in area in this country and speed has become such an important factor, that transportation by water is no longer a serious competitor of the railroad. However, independent, individual transportation over the highway,

**Business Must
Adjust Itself to
Changed Condi-
tions**

with the constantly increased improved mileage which it may utilize, has become such an important factor in the every day life of our people that other means of transportation cannot curtail or destroy. Co-ordination may be necessary and advisable, but "the greatest good to the greater number" idea still prevails and business must adjust itself to this situation.

The cradle wielder gave way to the producer of the reaper and the binder. Wagon and buggy makers became good automobile mechanics. The spinet and reed organ, from the attic, looked down on the grand piano installed in many a home. Victrolas were the last word until the radio came. *Every business thus had to adjust itself to changed conditions, and that without thought of coming whimperingly to the Federal or State governments for "protection." Transportation, as a business, is no exception.*

Railroads Attack Mass Highway Transportation

**Railroads Oppose
Proper Highway
Construction**

After several years of determined opposition to any form of taxation for highway improvements, the railroad officials seem to have given up the idea that they can retard these improvements when constructed for the individual automobile, although they realize that the automobile now transports many people who heretofore used train service only. They propose now to concentrate their fire on the road builders, who, they say, are building super-highways for the heavy trucks and busses—mass methods of transport—at a great unnecessary cost to the general public, including the railroad stockholders.

**This Shows that
Even the Rail-
roads Use the
Highways**



Railroads went into the hands of receivers before they had any visible competition in highway transportation.

Roads Must be Economically and Scientifically Built

People were on the highways with automobiles by the thousands when most of the highways were "byways" and the use of those "byways" destroyed the effective use of the automobile in one season. State Highway Departments sprang up over night. The Federal Government, after several years of study by a Congressional Committee, decided the Congress was responsible for a portion of the necessary expenditures for highways and among other reasons given, declared that the National Defense demanded it. This meant roads and bridges must be so constructed that they will maintain vehicles needed to transport materials of what-so-ever kind in time of such emergencies. General Douglas MacArthur, Chief of Staff and Acting Secretary of War, on July 25, 1933, in approving the recommendations of the American Association of State Highway Officials, said: "Proper provision would not be made for the National Defense if our major highways were designed for vehicles of smaller dimensions and weights."

Federal Government Admits Need of Scientifically Built Roads

All this has meant traffic surveys to determine quality of construction needed in each locality, research of road materials to determine the most durable kind, establishment of road systems in and between the States using the most direct source of communication, proper design of road bed and drainage, erection of uniform safety devices and directional signs in all the States and a coordinated plan made into law to control the size, weight and speed of vehicles on the highway. These have been some of the tasks devolving upon the State Highway Departments and the Federal Bureau of Roads without any prospect of personal dividends or railroad president salaries; but to bring dividends to all those who use the highways through reduced transportation costs and an ever widening possible use of their cars by constantly increasing the mileage of improved highways.

State Highway Department's Big Job

The 24,000,000 owners of highway vehicles have demanded this service and their investment and desires warrant it.

Who Shall Use the Highways?

For several years the State Highway Departments and the Bureau of Public Roads, through their coordinated organization, well known as the American Association of State Highway Officials, have given intensive study to the subject of control of the use of the highways through regulation of the size, weight and speed of vehicles used on the highways. They have made definite recommendations along this line and a number of State legisla-

**Passenger and
School Busses are
Necessary Parts
of Rural Life**



tures have given their hearty approval by law. Various organizations interested in this control have added their approval. But now along come the railroad officials again with accusations on their lips, mixed with the curl of contempt for the *scientific* methods used by the Highway Officials in arriving at their conclusions. Desiring to befuddle the public mind, they declare that this recommendation simply means added taxation and unnecessary expenditures for a favored few, who are the rivals of the railroads, for the mass transportation of people and products.

It might be well to quote directly from one of their prominent spokesmen:

**Railroad Spokes-
men's Misleading
Statements**

"If the recommendations of the State Highway Officials are ever adopted, not only railroad taxes, but also taxes of every other tax payer will be increased just to build super-highways for the accommodation of a comparatively few big, heavy, commercial vehicles * * * they (the railroads) are unwilling to endorse the recommendations * * * because their taxes would be increased, their expense for grade crossing elimination would be increased and their expense for the maintenance of highway bridges over their tracks would be increased. * * * As the size and weight of motor vehicles are the determining factors in the type of highways that must be built and as a very large part of the highway expense is now being paid from general taxes,

this question involves the burden the taxpayers must carry for the benefit of highway transportation. * * * The State Highway Officials recommend a maximum over all length of 35 feet for single vehicles and 45 feet for combinations of not more than two vehicles. Such a regulation would increase the over all length of motor vehicles in many of the States. * * * They recommend a formula for limiting gross weights whereby the gross weight allowed would be equal to the distance between the first and last axle of the vehicle or combination of vehicles plus 40 times a coefficient to be determined by the individual States (although the State Highway Officials recommend that the coefficient should not be less than 700). No layman and few engineers can understand either the formula or the reason for it unless it is to make our highway problem more complicated and more difficult to regulate."

Facts Concerning Regulation of Length and Weight

The recommended limits of the Association accord with those now in force in 17 States, and in 15 States the present regulation for length of vehicle is 33 feet. The 45-foot combination vehicle length recommended is less than that now prescribed in 24 States, and exceeds present limits in only 9 States.

With regard to the recommended axle-loaded limits of 16,000 pounds per high-pressure pneumatic, solid and cushion-tired wheels, and 18,000 pounds on low-pressure tires, the fact is that there are only three States in which the maximum axle load allowed on pneumatic-tired wheels is less than 16,000 pounds. The rule recommended by the State Highway Officials is the present rule in 11 States, and 34 States permit heavier loads. The 11 States that limit axle loads on pneumatic tires to the 16,000 pounds recommended by the Highway Officials, form the largest group in agreement on any one axle load limit. The next largest group compose 10 States which fix the axle limit at 18,000 pounds. Four States prescribe limits between 16,000 and 18,000 pounds; six are above 18,000 pounds; and 24 States have no limit. These are the facts of present State legislation and clearly show that the recommended law is not a new thing, neither is it detrimental to either the rights of the taxpayer or the road user, and certainly *is not substantially an increase in the weights allowed in practically every State.*

Real Facts Concerning Traffic Control

The Much Discussed "Formula"

The much discussed and maligned "formula" for limiting gross weights, *is intended for the protection of bridges and is not*

needed for road surfaces. It may be difficult for anyone lacking technical training to understand such a statement. The average man has very little conception of the mechanics of bridges, and has never "stopped to think" of the different manner in which loads affect a bridge *spanning space* and a road surface, that is *at all points supported* by mother earth.

Wheel Loads
Should Govern

He would not be an average man if, after one look at a large truck, he did not *know* that it must be more destructive to the road surface than a smaller vehicle. He *sees* the vehicle as a single load. He does not appreciate that the road surface feels it, not as a single load, but as four or six or eight loads, according to the number of the wheels, each load but a fraction of the total weight of the vehicle and all together no more troublesome to the road surface than one alone, if they are applied as much as 40 inches apart.

He has not been told in terms that are intelligible to him that the reason this is so is that the road surface can get rid of its responsibility for each wheel load by merely passing it directly downward to the brown old earth whose good gigantic smile is untroubled by any number of such burdens, if the road surface will just spread them out a bit. Not sensing these things, and never having had them explained to him, being, moreover, warned by his instinct to look warily upon large and heavy objects that move, the average man is predisposed to the belief that the larger the vehicle the greater the damage, *ipso facto*; in which belief he is confirmed by the reiterated suggestion of a steady propaganda emanating from railroad sources. And so, he is not prepared to accept *the truth*; that, *so far as road surfaces are concerned, the limitation of axle or wheel loads gives full protection, let gross loads be what they may.*

Gross Loads and Bridges

Proper Control of
Loads on Bridges

Still less is he prepared to understand the essential relation of length and weight in determining the effect of vehicles upon bridges. On a bridge he sees only what is above the pavement, and that pavement the same, perhaps, that has covered the road at the approach to the bridge. He has no adequate conception of the way in which the load of a vehicle on a truss bridge is transmitted by the stringers to the floor beams and by the floor beams to the trusses and by these back to the abutments and piers and by them to the ground. He has not been told that if the distance between the extreme axles of a vehicle or combination of vehicles is greater than the distance between the floor beams of the bridge, the entire weight of the vehicle or combination can never come at one time upon any set of stringers. He has not been told that a given load causes higher stresses in the floor beams and trusses

if it is concentrated in a short length than if it is extended over a greater length. On the bridge, as on the road, he views the whole matter very simply. What is the weight? Is it five tons? That's pretty heavy. Is it 10 tons? That's a plenty. Is it 20 tons? That's too much. It does not occur to him, and never will, if those who would limit the farmer's truck to the weight of one hog can prevent it—that the three weights may have exactly the same effect upon the bridge if each is distributed over an appropriate length, increasing with the weight. *In short, what this "average man" needs to know is that for the protection of bridges we should prevent large loads on short vehicles, and not simply prevent large loads.*

Wheel Loads vs. Gross Loads

Those who would eliminate any competition in transportation by prohibiting even properly adjusted regulations in the weights of vehicles on the highway, declare that it will take hundreds of millions of dollars to build the present system up to the standard to meet the requirements of this Association's recommendations, basing their statement on the *false premise that the gross weights that would be permitted could not be borne by existing highways.*

Highway stresses are ruled by *wheel loads* and not by *gross loads*. Those who really seek the protection of the highways should help to impress that fact indelibly upon the minds of legislators and law enforcement officers. For, it so happens, that



**Properly
Equipped Trucks
Transport the
Necessities of
Life Without
Injury to
Pavement**

Wheel Loads and
Not Gross Loads
Control and Are
Easily Enforced

the wheel load is not only the more critical factor but is also the more easily determinable factor. To measure gross loads, stationary platform scales are a practical necessity; and, unless they are placed and actually operated on at least all important roads, the gross load limitation, whatever it may be, will be a virtual dead letter. The wheel load limitation is, on the other hand, easily enforceable by officers, equipped with small, portable scales who, appearing suddenly, first on one road, then on another, may plant their telltale instrument by the roadside and require any driver to run his heaviest wheel on it, and so, quickly and practically, detect the law violators. And of this at least there can be no question: That for the protection of the roads an enforced wheel load limitation is immeasurably better than an unenforceable gross load limitation.

It has been shown in this article that the wheel loads proposed by the Highway Officials exceed those now legally prescribed in only three States. This fact alone should allay any reasonable fear that adoption of the Association's weight suggestions would loose upon the highways a destroying caravan of excessively heavy vehicles.

Only Small Road Mileage Traveled by Heaviest Vehicles

Heavy Vehicles
Traverse Main
Roads New Jersey
Survey Shows

If any doubt remains, it should be possible somehow to demonstrate the proposition that to Highway Officials appears axiomatic: That the mileage of highways that must be fitted with surfaces designed to support the maximum permissible wheel load, forms a very small proportion of the total mileage of highways. Here are two illustrations showing the limitation of travel by the heaviest vehicles.

In the traffic survey of State highways and principal county roads, conducted in 1932 in New Jersey, by the Bureau of Public Roads and the New Jersey State Highway Commission, observations at a group of stations at which traffic was heaviest showed a daily average of 12,213 vehicles passing, of which 10,832 were passenger cars and 1,381 were trucks. Of the trucks observed at these stations 17.8 percent were classified as heavy, including capacities of five tons and more. At another group of stations at which the observed traffic was lightest the total traffic averaged 2,295 vehicles daily, of which 2,024 were passenger cars and 271 were trucks; and of the trucks only 12.1 percent were of five tons capacity or larger. The indication is that the percentage of heavy trucks decreases as the total traffic drops in density. At both of these groups of stations, traffic is much heavier than that served by a large majority of the roads of the



**Vehicles With
Solid Tires
Should be
Eliminated
from the
Highway**

country. On roads that would be classed as of light traffic there is strong indication that the percentage of heavy to total trucks would be considerably lower than the 12.1 percent recorded in New Jersey for traffic averaging more than 2,000 vehicles daily.

The traffic survey in Michigan in 1931 showed that the 7,691 miles constituting the State highway system carried an average daily traffic of 1,444 vehicles; the 17,175 miles constituting the county system an average of 190 vehicles; and the 60,214 miles of township road (the remainder of the rural mileage) carried an average of only 22 daily vehicles. On 43,265 miles; which is 88.5 percent of the total mileage of rural roads in the State, the average daily traffic of all kinds was 50 vehicles or less. If all of these roads carried 50 daily vehicles (as a matter of fact 38,000 miles carried only 25 and less), and trucks of five tons capacity and larger constituted as great a percentage of the total traffic on these roads of extremely light traffic as on the New Jersey roads averaging more than 2,000 vehicles per day, there would be on these 53,000 miles less than one five-ton truck daily loaded or unloaded. Obviously there is in Michigan a mileage, at least 88 percent of the total rural road mileage, the improvement of which can not conceivably be influenced by the fact that the existing axle load limit is 18,000 pounds for pneumatic-tired vehicles. A similar situation would certainly be revealed in every State, if the facts were available.

**Michigan
Statistics**

It can be said, therefore, that all available facts strongly in-

**Recommended
Wheel Load Does
Not Demand Ex-
cessive Mileage of
Improved
Highways**

dicating that if the Association's wheel load recommendations were adopted there would be no need in any State to design more than a small percentage of the total mileage of highways to support the heaviest loads permitted. The roads that would need to be designed for support of the maximum wheel load are, in the main, already included in the State highway systems. Since only three States now prescribe axle loads less than the Association's recommendations and 34 States now permit heavier loads, adoption of the recommendations might reduce expenditures for improvement of the roads subjected to a significant number of maximum loads; it would not increase it; and since any roads, the design of which might be affected, are in all probability included already in the State highway systems, *support of which is provided to the extent of about 80 percent by motor vehicle taxes*, there would appear to be no need, in any event, to fear an appreciable increase in railroad taxes.

**Motor Vehicle
Taxes Pay the
Bill—not Railroad
Taxes**

**Points to be
Remembered**

Summary

1. All business must adjust itself to meet changed conditions without expecting governmental protection, and methods of transportation are no exception.
2. All highways are open for travel and transportation of products.
3. Curtailment of the use of the highways cannot be limited in order to compel people to use some other transportation facility.

**The Length of
This Truck
Shows the
Need for Our
Proposed
Regulations**



4. Roads must be economically and scientifically built and the State and Federal Governments are determined that this shall be done.

5. Mass transportation over the highways should be regulated, which is being done in most States, but this regulation should be uniform.

6. The recommendation of the American Association of State Highway Officials as to the regulation of trucks and busses on the highways limits the axle load to less than that now permitted in almost all the States.

7. This proposed regulation is deemed the least that should be allowed to meet the requirements for our National Defense.

8. The roads used by heavy vehicles are already on the State Systems and no additional sources for taxes for construction of these roads are needed.

9. Highway stresses are ruled by wheel loads and not gross loads.

10. The "formula" recommended is for the purpose of determining the effect of vehicles on bridges and not on roads.

11. Rural highways on the State Systems are financed, over 80 percent, by motor license fees and the gasoline tax, hence the cry about necessary additional property tax in order to make highway improvements, is unwarranted.

Gross Weight, Dimensions and Speed for Vehicles

Recommended for Adoption

It is the opinion of the Association of State Highway Officials that the adoption of a uniform standard to govern gross weight, dimensions, and speeds for motor vehicles operating on the highways is a fundamental necessity for the following reasons: Needed Uniform
Regulations

- (a) To establish one of the fundamental prerequisites of highway design.
- (b) To promote efficiency in the interstate operation of the motor vehicle.
- (c) To secure safety in highway operation.
- (d) To remove from the highways undesirable equipment and operations.
- (e) To stabilize on a definite basis the many relationships between the highway and the motor vehicle.

These conclusions have been reached after many years of consideration on the part of the Highway Transport Committee of the Association, supplemented by painstaking research by a number of the State Highway Departments and the Bureau of Public Roads.

The Association therefore makes the following recommendations to the proper State authorities having control of traffic on the highways:

(1) *Width*

Width of Vehicle No vehicle shall exceed a total outside width, including any load thereon, of 8 feet, except vehicles now in operation which, by reason of the substitution of pneumatic tires for other types of tires, exceed the above limit.

(2) *Height*

Height No vehicle unladen or with load shall exceed a height of 12 feet 6 inches.

(3) *Length*

Length

(a) No vehicle shall exceed a length of 35 feet extreme overall dimension, inclusive of front and rear bumpers.

(b) Combinations of vehicles shall consist of not more than two units, and, when so combined, shall not exceed a total length of 45 feet.

(c) The truck tractor and semi-trailer shall be construed to be one vehicle for the purpose of determining lengths.

(d) For occasional movements of materials or objects of dimensions which exceed the limits herein provided, a special permit shall be required.

(4) *Speed*

Speed Control

(a) Minimum speed. No motor vehicle shall be unnecessarily driven at such a slow speed as to impede or block the normal and reasonable movement of traffic, except when reduced speed is necessary for safe operation or when a vehicle or a combination of vehicles is necessarily, or in compliance with law, proceeding at reduced speed.

(b) Maximum speed. No bus or truck shall be operated at a speed greater than 45 miles per hour. Passenger automobiles may be operated at such speeds as shall be consistent at all times with safety and the proper use of the roads.

(c) Vehicles equipped with solid rubber or cushion tires shall be operated at a speed not in excess of 10 miles per hour.

(5) Axle Load

(a) The wheels of all vehicles, including trailers, except those operated at 10 miles per hour or less, shall be equipped with pneumatic tires. Axle or
Wheel Load

(b) No wheel equipped with high pressure, pneumatic, solid rubber or cushion tires shall carry a load in excess of 8,000 pounds, or any axle load in excess of 16,000 pounds.

Research indicates that low-pressure pneumatic tires can carry 9,000 pounds per wheel without increasing pavement slab stresses.

An axle load shall be defined as the total load on all wheels whose centers may be included between two parallel transverse vertical planes 40 inches apart.

(c) These limitations are recommended for all main rural and intercity roads, but should not be construed as inhibiting heavier axle loads in metropolitan areas if any State desires.

(d) These weight specifications for wheel and axle loads may be restricted by the State Highway Department for a reasonable period where road subgrades are materially weakened from thaw-



The Wheel Load, Being the Gauge of Road Damage. This Simple Method of Testing an Overloaded Truck Simplifies the Work of the Traffic Police

ing after deep frost, or from a continued saturated condition of the soil.

(6) *Gross Weights*

Gross
Weights

Subject to the limitation imposed by the recommended axle loads, no vehicle shall be operated whose total gross weight, with load, exceeds that given by the formula $W=c(L+40)$ where:
 W =total gross weight, with load, in pounds;

c =a coefficient to be determined by the individual States;

L =the distance between the first and last axles of a vehicle or combination of vehicles, in feet.

A value of 700 is recommended for "c" as the lowest which should be imposed, but this should not be construed as inhibiting greater values.

NOTE: This gross weight recommendation is particularly applicable to bridges, since axle loads and length limitations are determinative in their practical application.

