

National Conference on Street and Highway Safety

Report of the
**COMMITTEE ON THE MOTOR
VEHICLE**

Appointed by
The Secretary of Commerce

This report is one of eight issued for consideration in advance of the National Conference on Street and Highway Safety. The reports are: I Statistics; II Traffic Control; III Construction and Engineering; IV City Planning and Zoning; V Insurance; VI Education; VII The Motor Vehicle; VIII Public Relations

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CONTENTS

	PAGE
Introduction	7
Summary of conclusions	7
Controls	11
Brakes and braking	12
Steering gears and steering	13
Driver vision	13
Lights	14
Signals	16
Anti-skid and traction devices	16
Tires	16
Bumpers	16
Anti-theft locks	17
Speed governors	17
Inspection	18
Legislation and regulation	18

Conference on Street and Highway Safety

Report of Committee on the Motor Vehicle

*The Honorable Herbert Hoover, Chairman,
Conference on Street and Highway Safety,
Washington, D C*

SIR: The report of the Statistics Committee and other data available show that the vast majority of accidents are due to other than mechanical causes. Nevertheless opportunity exists for improvement in design and construction which will further reduce accidents due to these causes.

Many vehicles of safe design and construction are being operated in an unsafe condition due to lack of care on the part of the owners. Your committee believes that this can be corrected only by directing the attention of each vehicle owner and operator to his responsibility toward himself and toward other users of the highways.

Your committee in this report points out those features which it believes should, in the interest of safety, receive attention of manufacturers responsible for design and construction and of the great multitude of owners and operators responsible for maintaining their vehicles in safe operating condition, as well as the public authorities empowered to control the operation of motor vehicles.

Due to the great range of design covered by all types of motor vehicles, the committee has made recommendations which can be applied in a general way to vehicles of all types, with the understanding that in their application each vehicle must be considered by itself.

In some cases the committee felt able to make definite recommendations; in others it did not believe that the knowledge at present available would justify specific conclusions. Some questions of the latter type have a possible bearing on safety and for this reason they are discussed so as to bring out the present state of knowledge on the subject.

The committee's recommendations are as follows:

Controls

(a) The engine accelerator pedal should be located at a sufficient distance from the brake pedal to minimize the danger of applying the accelerator when intending to actuate the foot-brake.

(b) The brake-pedal should be so constructed as to minimize the

danger of the driver's foot slipping from it when he wishes to actuate the foot-brake

(c) In vehicles in which it is intended that the accelerator pedal and the brake pedal shall be operated by the same foot, the movement of the foot from the accelerator to the brake pedal should be as easy and direct as possible

Brakes and Braking

(a) Motor vehicles should be so designed as to permit braking with the engine on severe grades without injury to any of the mechanical parts

(b) Service brakes should be so constructed as to be capable of simple and safe adjustment by the operator throughout the life of the wearing parts

(c) Ratchets of hand brakes should be so designed and constructed as to have greater durability and certainty of operation, so that they may give efficient service throughout the life of the vehicle

(d) The design and construction of motor vehicles should be such that unintended lubrication shall not reach the braking surfaces

(e) Pending the adoption by constituted authorities of a code for standard braking ability, which is now in course of preparation, all motor vehicles except possibly motor cycles and heavy trucks should be capable of stopping from a speed of 20 miles per hour on a dry, smooth, hard surfaced road, free from any loose material, by means of the service brake alone in a distance of not more than 50 feet. Emergency brakes should be capable of the same performance as service brakes, but as an absolute minimum requirement they should be capable of holding the vehicle on any grade which it can ascend

Steering Gears

(a) The permissible lost motion or play in steering gears should be limited to about 15 degrees

(b) The alignment of front wheels as to caster, toe-in and other details should be designed and maintained as nearly as possible. On vehicles of ordinary design, the toe-in should never exceed five-eighths of an inch

Driver Vision

(a) Design of bodies and cabs should be carried out with due regard to the necessity of reducing to the minimum the shut-off area of driver vision

(b) The question of mirror design and location for purposes of rear view should be studied

(c) The use of all posters or other obstructions to vision on the front windows or on the windshield should be avoided

(d) Some device for cleaning the windshield from rain and snow, that can be conveniently operated by the driver should be available for use when windshields cannot be kept open or a clear vision secured by other means.

(e) The committee recommends that the portion of the windshield in front of the driver be made so as to permit of being readily opened by the driver should weather conditions require it, to permit of proper vision

Lights

(a) Present lighting regulations should be more rigidly enforced as a necessary beginning in arriving at any improved night-driving condition on the highways

(b) The study of proper road illumination, combined with the minimizing of undesirable glare should be given immediate further consideration with a view to determining whether it may not be possible to improve the regulations now in force

(c) Clear red should be used for tail lights and the rear aspect of parking lights, and its use should be prohibited for any other exterior light so located as possibly to be mistaken for a tail light or a parking light

(d) Clear yellow should be used for stop lights and a maximum permissible intensity of such stop lights should be established

(e) The use of colored lights on vehicles tending in any way to confuse the meaning of the customary safety lights should be prohibited

(f) The location of spot-lights should be limited to the right of the vertical center-line of the vehicle and the beam of the spot-light should never be directed to the left of the vertical center-line

Signals

(a) All motor vehicles should be equipped with adequate audible signals

(b) Vehicles, the design of which does not permit the driver to make the proper hand-driving signals, should be equipped with some simple form of mechanical signal to give the necessary indications

Anti-Skid and Traction Devices

The committees while recognizing the importance of maximum pos-

sible traction on all types of road surface in the interest of safety, due to effect of traction on both stopping and steering, is unable, however, to recommend definitely any particular type of construction or device

Tires

The use of badly worn or repaired tires, especially on the front wheels of a motor vehicle, should be avoided as a possible source of danger

Bumpers

(a) A study of the use of bumpers as a safety device should be undertaken in the near future. The facts available at the present time are not sufficient to justify an expression of opinion as to whether bumpers, as they are now usually designed and constructed, have any effect in reducing loss of life or personal injury

(b) When bumpers are used the height of the center line above the road surface should be standardized so far as conditions will permit

Bodies

The overall width of body and load of any motor vehicle should be limited to 96 inches

Loading

Loading beyond the rated capacity of any vehicle should be prohibited

Antitheft Locks

The committee is of the opinion that the use of antitheft locks has no definite relation to motor-vehicle safety except in so far as it may occasionally prevent joy-riding by irresponsible persons

Speed Governors

The committee is of the opinion that a speed governor of the type controlling engine speed alone is not a complete safety-device, but that a practical governor controlling the speed of the vehicle would be desirable

Inspection

(a) In the interest not only of safety but of economy of operation adequate and periodic inspection, adjustment and repair of motor vehicles is absolutely essential. To this end the committee recommends the preparation of a simple and practical inspection-chart and code, applicable to all makes of motor vehicles, giving particular attention to items affecting safety

(b) To promote its general acceptance, the committee recommends that this chart and code, when prepared, be issued by the Department of Commerce

(c) Public service commissions and other public bodies having control of common carriers operating motor vehicles should be urged to establish reports and methods of supervision to ensure adequate inspection and upkeep

Legislation and Regulation

(a) The committee recognizes and wishes to emphasize the importance in the interest of safety of uniformity in legislation in the various states with regard to the design, construction, operation and maintenance of vehicles

(b) Such legislation should deal only with the system of regulation leaving to the regulating authorities proper discretion as to specific details

(c) The enforcement of such regulations as may be established regarding design, construction, inspection and maintenance of motor vehicles should be entrusted only to men properly qualified by technical training and experience

For the Committee,
H. M. CRANE, *Chairman*.

Washington, D. C.
December 1, 1924

The following notes regarding the different recommendations given above are submitted by the Committee

Controls

A modern gasoline motor vehicle is largely controlled through three pedals, those for the clutch, the brake and the engine throttle or accelerator. There has come to be a considerable degree of standardization in regard to the general location of these pedals, but in a good many cases sufficient care has not been used in working out the exact layout so as to make it impossible to produce an unintended result in operation. In many vehicles the brake pedal and the accelerator pedal are so close to each other that it is only by considerable care that a combined operation of the two can be avoided. There is no adequate reason in design for any such crowding, and it should not be continued. The danger of an unintentional release of the service-brake by the slipping of the driver's foot is too evident to require extended comment.

In almost all gasoline motor vehicles, custom has standardized the operation of the clutch by the left foot, and the brake and accelerator by the right foot, the right foot thus being called upon either to accelerate or to decelerate the motion of the vehicle. In many cases, therefore, when a stop has to be made, the right foot must be moved from the accelerator pedal to the brake pedal to produce the desired result. It has been suggested that a different arrangement of pedals in which the left foot would operate the brake and the right foot would operate the clutch and accelerator might be desirable from this point of view. The committee believes, however, that in view of the practically complete standardization of the other arrangement, a recommendation to change would not be constructive at the present time. On the other hand, it is evidently important that the relative positions of the brake and the accelerator pedals be such that the right foot may be moved from one to the other as quickly and certainly as possible.

Brakes and Braking

In practically all gasoline motor-vehicles, the engine provides an almost unlimited braking ability if properly designed. It can produce a high degree of retardation by using the proper combination of gears in the gear-box and also, due to its facilities for cooling, can produce this retardation for any length of time desired. There are few if any motor vehicles built today that have sufficiently large braking surfaces to control without overheating on grades that are excessively severe either as to length or steepness, or both, which are occasionally met with in service. In view of the capabilities of the engine as a brake, it would not be economical or desirable to provide friction brakes of the ordinary type to take care of conditions that are only occasionally encountered. In braking with the engine it is generally believed to be desirable to continue the ignition but to close the throttle as tightly as possible. If the throttle is adjusted so that it can be closed to an idling speed of not over 400 revolutions per minute, a maximum of retardation can be obtained while still maintaining the vehicle under perfect control.

The committee's recommendation regarding the adjustment of service-brakes simply means that no shop work should be required except for the replacement of brake linings or brake drums at very infrequent intervals. During the period of operation between such replacements, the driver should be able to make the regular running adjustments easily and with certainty.

The committee believes that many drivers today operate cars with unserviceable brakes, due to bad adjustment or other causes, for the

reason that the adjustment is difficult and inconvenient. It is unfortunately the case that many cars have been produced in the past in which the hand-brake ratchets have been most unsatisfactory. The hand brake is generally used to hold the car in position when it is at rest, and it is obvious that unless it does so with a reasonable degree of reliability, a considerable element of danger may be introduced.

Plainly, if the brakes are designed to operate in a dry condition, every precaution should be taken to see that anything tending to lower the coefficient of friction should be prevented from reaching the braking surfaces. Cars have been built in the past in which the braking power would occasionally be completely lost after a short time due to oil getting on the brakes.

The question of the effect on safety of the ability to stop very quickly is at present a subject of vigorous discussion. Many vehicles of very moderate stopping ability are in daily use on the highways with a most excellent safety record. This is undoubtedly due to the fact that they are being driven with a full knowledge and consideration of their exact stopping ability. Some standard for brakes should be set up and the committee is convinced that everything possible should be done to increase our knowledge of braking possibilities and of their effect on safety. The American Engineering Standards Committee, which is the clearing house for standardization work of this kind, has authorized a sectional committee to prepare a safety code for braking. The sectional committee is now functioning and will undoubtedly be ready to report in the near future. In the meantime the committee submits the recommendation given under 2 (*e*) above.

Steering Gears and Steering

Excessive lost motion in steering gears is undoubtedly the cause of numerous accidents as it has a very direct bearing on the certainty of steering control. This is also true of the alignment of the front axle and wheels. If the caster in the steering knuckles is reversed sufficiently, in which case the top of the steering pivots is inclined forward instead of backward, there is a possibility of the vehicle getting out of control. This is also true if the relative position of the two front wheels is not correct with respect to each other, the toe-in never exceeding five-eighths of an inch. As a matter of fact, excessive tire wear will generally call attention to the violation of this recommendation.

Driver Vision

This is a matter of extreme importance that in the past has not been given the attention that it deserved. It applies both to passenger

cars and to many types of commercial vehicles. Practically all vehicles have been built so that the driver has a satisfactory view through an arc of about 70 degrees, or approximately 35 degrees on each side of the centerline of his vision. Furthermore, the angle has been much wider to the left on right-hand-drive vehicles and to the right on left-hand drive vehicles. Unfortunately an angle at about 45 degrees is the angle at which a vehicle approaching at right angles is usually first seen. There are many cars operating today in which vision at this point on one side or the other is completely shut off by heavy door pillars, windshield frames or side curtains. The driver always becomes partially unconscious of this blind spot and is surprised by the appearance of a pedestrian or vehicle so close that an accident cannot be avoided. There is no practical reason for allowing this condition to continue and stringent measures should be taken to remedy it. It is obvious that nothing should be placed on the front windows or windshield which will obstruct the driver's view and in this connection it should be thoroughly understood that a field of view of at least 180 degrees or 90 degrees on each side of the center-line of the vehicle is what should be aimed at. Windshield cleaners aid the cause of safety as they encourage the maintenance of good driver-vision under bad weather conditions. Attention should be called to the fact that many windshields are not kept sufficiently clean in service for safe night-driving. A very light layer of dirt or dust on a plate of glass is sufficient to reduce its power to transmit light by about 50 per cent. All windshields should be designed so that they can be opened to allow clear vision in case circumstances make it impossible to keep the windshield clean.

Lights

The question of proper road illumination for night driving has been a subject of attention for the last 25 years, due to the conflicting requirements of the driver behind the headlight and the driver meeting the headlight. It might be well to give an outline of the history of headlight regulation to clarify the committee's recommendation.

The first headlights of any real power on motor cars were of the acetylene type, and when first used were criticized very severely as producing glare. This was due to the fact that most other vehicles had either no lights at all or else very ineffective oil lamps. When the electric headlight was introduced as part of our automotive equipment, there came a time when the number of motor cars on the road was increasing with extreme rapidity and the combination created a very

unsatisfactory condition This was partly due to the early design of the electric headlight in which the most piercing beam possible was produced by the aid of a high-power bulb in connection with a parabolic reflector Conditions rapidly became intolerable with the large number of electrically lighted cars, and various types of regulation were undertaken in the early regulation the question of glare was treated as being of paramount importance and practically nothing was done to ensure that a safe driving light should also be obtained As a result, the Illuminating Engineering Society and the Society of Automotive Engineers took up the subject in a very serious manner, with the result that a certain form of light distribution was worked out as being the best compromise between absence of glare and the presence of sufficient light for safe driving This light distribution is obtained by the use of either special mirrors or lenses, or both, in connection with very definite adjustment of the headlights themselves These requirements have been put into force in a very considerable number of states during the past few years, either by legislation or regulation It is fair to say, however, that only one or two states have made a serious effort to enforce the regulations as laid down It is more and more apparent, however, as time goes on, that we have not yet reached an ideal solution of the problem In the first place, the recommended light-distribution is worked out on the basis of two vehicles approaching on a level road and without any considerable amount of spring action This is due to the necessity of keeping the piercing part of the light-beam as high as possible without actually shining in the eyes of the driver of an approaching vehicle The desired condition is badly upset on roads of a rough contour or even on roads of a rough variety which may cause a vehicle to pitch upon its springs The accurate working out of the desired light distribution requires a better lamp equipment than has been commercially furnished up-to-date and a certain degree of care and attention on the part of the owner Up-to-date the lamp equipment on the cheaper cars cannot be expected to permanently fulfill the requirements of this type of regulation

It is recognized by the committee that regulation of the headlight is a very difficult problem, due not only to the conflicting requirements as outlined above but also to the wide range of conditions under which motor cars are operated The regulations described above have been made legal in a very considerable number of states but so far have been enforced in only a few of these states Until there is complete enforcement over a period of time, it will be impossible to judge correctly the final desirability of these regulations

In recommending that red be used for tail lights and the rear aspect of parking lights, the committee is only supporting the present universal standard, both legal and otherwise in this country

Signals

There are many commercial vehicles, both buses and trucks, operating on the roads wherein the design of body or cab is such as to prevent the giving of intelligible hand signals by the driver to vehicles approaching from the rear. Some way of indicating the driver's intention to stop or turn, to vehicles approaching from the rear is important in promoting safe operation and it is believed that where for commercial reasons the body design prevents the usual method of giving these signals by hand, some mechanical arrangement should be provided

Anti-Skid and Traction Devices

There is no question that the stopping ability of any vehicle on the road, as well as its safe steering, is intimately connected with the friction of the tires on the road surface. When the surface of an ordinary improved highway is dry, conditions are excellent, but in wet weather conditions it may readily become unsafe unless the proper form of anti-skid equipment is used. Such anti-skid equipment may be in the form of special tire treads or of tire chains or of other special devices tending to produce the desired effect. The type of road and the existing weather conditions control the best forms of anti-skid device for the purpose; for instance, an improved road covered with frozen snow and ice might require one type of device, while a muddy clay road would require another. For this reason, the committee does not wish to make a definite recommendation, although it does emphasize the necessity of having the proper equipment for the weather and road surface existing at the time

Tires

The committee's recommendation regarding the use of badly worn or repaired tires, especially on the steering wheels of motor vehicles, relates entirely to vehicles that are driven at a fairly high rate of speed. As most passenger vehicles and many commercial vehicles are today commonly driven at such speeds, it was thought desirable to call attention to this possible source of danger

Bumpers

The bumper as developed up to date has been worked out almost entirely from the point of view of safeguarding the vehicle upon which

it is mounted, and in this respect has undoubtedly produced desirable results. It may also possibly conduce somewhat to the safety of passengers in the vehicle upon which it is used, but there are certainly no facts available to support this proposition definitely. On the other hand, from the point of view of danger to pedestrians, there is some reason to believe that the present type of passenger-car bumper, due to its height from the ground, may be a source of danger rather than of safety. The experience of street railway companies in relation to equipment of this kind was far from satisfactory. The committee believes that it is time that the bumper should be studied from the point of view of the safety of pedestrians as well as passengers, so as to realize any possible value that it may have in this direction.

Antitheft Locks

An antitheft lock is applied to a motor vehicle to prevent its operation by some unauthorized person. Due to the fact that a certain proportion of so-called stolen cars have been taken for joy-riding purposes and abandoned immediately afterwards, there is, of course, a probability that, used in this way, they may be dangerous because of the irresponsibility of the operators. A very popular form of antitheft lock produces its locking effect by preventing the operation of the steering gear. Some members of the committee felt that occasionally a car might be operated for a short distance with the steering gear inoperative, due to its being locked, and that this might introduce a factor of danger. There are many thousands of such locks in use today but there are certainly no figures available that prove that they are a source of danger. The committee cannot, therefore, state that they are not safe to use.

Speed Governors

There are many commercial vehicles today that are equipped with governors which definitely control the maximum engine speed. This is done primarily for reasons of economy, it having been definitely proved that over-speeding raises the cost of upkeep of all parts of a vehicle at a rate entirely out of proportion to any possible benefits obtained. Unfortunately, the engine-type governor cannot control the vehicle speed on down grades with vehicles of the present conventional design, in view of the ability of the driver to throw out the clutch and to allow the vehicle to run as fast as it will under the influence of gravity. Some drivers use this feature to obtain high average speed in rolling country and increase the danger of accident by doing so. It is for this reason

that the committee is inclined to prefer a type of governor controlling the vehicle speed under all conditions, if such a device is practically possible

Inspection

The committee recognizes the fact that a large majority of the motor vehicles in use on the highways are owned by individuals and driven by non-professional drivers. It is undoubtedly true that most of the owners and drivers have no mechanical knowledge or experience. There is, therefore, a continuing danger that vehicles may be operated that are so badly out of adjustment in certain respects as to constitute an actual hazard to both their occupants and to other users of the highways. The committee believes that nothing short of a campaign of education can be expected to improve this condition. This campaign should be aimed at encouraging frequent inspection of vehicles by technically competent persons and at encouraging the owners and drivers to become familiar with the rather simple parts having to do with safety of operation.

Fleet owners are really under very considerable economic pressure to keep the vehicles under their control in proper operating condition. When properly maintained, the vehicles perform their daily service in a much better manner, and, what is more important, they are less likely to cause accidents which are always costly to owners of this type. Unfortunately, there are always occasional owners who are so shortsighted as not to recognize the facts stated above and for this reason the matter should be brought firmly to the attention of all owners. In the case of common carriers, it is very simple to do this through the regularly constituted commissions or other regulatory bodies.

Legislation and Regulation

It would seem to be unnecessary to argue about the desirability of uniformity in motor-vehicle regulation throughout the country, in view of the fact that state and municipal boundary lines really mean nothing in highway traffic. Unfortunately, the history of legislation in this country and the present state of regulation indicate the necessity for keeping up a fight for uniformity until some real measure of uniformity shall be attained.

The committee's recommendation regarding the proper type of legislation is based on the idea that the writing of specific requirements and figures in the laws of states and municipalities is bound to result in a lack of flexibility which will inevitably cause delay in the attaining of

uniformity The committee also believes that for various reasons such regulations enacted into law are usually prepared too hurriedly to permit of their being the best obtainable; and mistakes are at the same time difficult to correct It would appear to be far better to have a competent regulatory authority appointed by law with power to make specific regulations within certain limitations

It is apparent that, as time progresses, a greater number of rules will be laid down covering the general design and construction of motor vehicles permitted on the highways Such rules are bound to be of a technical and engineering nature and it is the firm conviction of the committee that they cannot be properly applied by men who have not proper technical training and experience