1939

SCHOOL BUS STANDARDS

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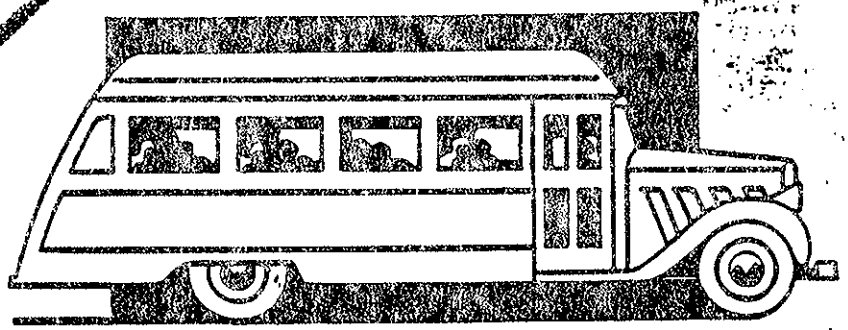

DEVELOPED AND APPROVED BY A CONFERENCE OF REPRESENTATIVES OF THE FORTY-EIGHT STATES

020534

MODERN SCHOOL SERIES

Frank W. Cyr, *Consulting Editor*

The Color of This Cover is National School Bus Chrome,
Adopted by the Conference for All School Buses
in the United States

(For Federal Specifications of the United States Bureau of Standards
write United States Bureau of Standards, Washington, D. C.)

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MINIMUM STANDARDS
for
SCHOOL BUSES

Developed and Approved by

REPRESENTATIVES OF THE FORTY-EIGHT STATE EDUCATION DEPARTMENTS

In Conference, April 10-16, 1939
Teachers College, Columbia University

Assisted by

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INTERNATIONAL TEXTBOOK COMPANY
Scranton, Pa.

1939

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FOREWORD

Pupil transportation, a necessary adjunct to the school system especially in rural areas, is a function created by state law and to a large extent is a state responsibility. For that reason the National Council of Chief State School Officers accepts the responsibility for setting up cooperative relations to formulate national uniform minimum standards of school bus construction. Accordingly, the conference of official representatives of the forty-eight state departments of education was convened for the purpose of formulating and agreeing upon a statement of uniform minimum standards. This publication presents the findings of that conference.

A large majority of the states by the authority of state law developed standards for school bus construction and operation which they thought were conducive to safety and economy. It now seems, however, that variations in construction standards are not resulting in economy because they hamper production of buses for a national market and compel the construction of buses as custom made jobs without materially adding to safety. It was therefore necessary that the state representatives discharge their responsibility for setting up uniform standards through cooperative action.

The National Council of Chief State School Officers is under special obligation to Frank W. Cyr and M. C. S. Noble, Jr., for giving us the benefits of their findings in the National Survey of Pupil Transportation and for organizing and conducting the conference of state representatives; and to Frederick H. Dutcher for acting as technical advisor to the conference; and to the General Education Board for the grant of funds with which to finance the conference. The full cooperation of the engineers of the automotive industry in providing technical advice is recognized.

It is our hope that the standards proposed will result in greater *safety* and *economy* in school bus construction throughout the nation.

H. E. HENDRIX, *President*
National Council of Chief State School Officers, and
State Superintendent of Public Instruction of Arizona

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Part I

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Minnesota	T. C. Engum, Director of Ungraded Elementary Schools
Mississippi	J. M. Bryant, Assistant Superintendent of Education

* Unless thus indicated, individuals represent state departments of education.

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	Louis Kaser, Superintendent Burlington County Schools
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	*B. P. Bretz, State Motor Police
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Wyoming	Miss Irene Carson, Assistant Superintendent of Public Instruction
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Part II

BACKGROUND OF THE NATIONAL CONFERENCE ON SCHOOL BUS STANDARDS

Importance of Pupil Transportation

The safe and economical transportation of nearly 4,000,000 children to and from school every day of the school year is a matter of first importance to millions of parents and thousands of school board members in all parts of the nation. In 1938, 86,099 school buses were in operation. The total number of school buses purchased from manufacturers annually is in excess of 10,000. At an estimated cost of $2,000 per bus the annual investment in school transportation facilities is about $20,000,000. These statistics indicate the extent of this important service. It is a problem of increasing importance, as indicated by the fact that from 1926 to 1938 the number of school buses increased 132%.

It would be practically impossible to make adequate consolidations of rural schools if it were not for the feasibility of pupil transportation. It is generally recognized that the need for future consolidation of schools will almost inevitably lead to expansion in pupil transportation systems.

The cost of pupil transportation may be considered as an addition to the ordinary cost of a satisfactory school program and in that sense it can be considered as a deduction from the total funds that might be available for superior school plant facilities and instructional programs. In view of this situation it is highly desirable that all possible economies consistent with pupil safety be attained and practiced in the construction and operation of school buses.

The National Survey of Pupil Transportation

On December 1, 1937, Teachers College, Columbia University, with the aid of a grant from the General Education Board, initiated the National Survey of Pupil Transportation for the purposes: (1) of determining the

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present status of pupil transportation in the United States and (2) of developing constructive recommendations covering all phases of this problem.

The report of the National Survey of Pupil Transportation presented: (1) listing by States of existing statutory provisions, rules and regulations governing school bus construction and equipment; (2) suggested minimum school bus standards developed in light of the findings of the Survey.

Need for Uniform Standards

Through the survey it was found that the majority of states had already established uniform standards, that each year the number of states adopting standards was increasing and that after once having adopted standards no state had attempted to administer pupil transportation without them. It was quite evident, however, that in many cases standards have been set up by more or less hit-and-miss methods. In states that have not adopted uniform standards, various local school authorities have followed haphazard methods of setting specifications for the purchase of school buses. On the other hand, some states have utilized such scientific information as is available and the advice of competent engineers as a basis for setting up their standards.

One of the most evident facts concerning standards for school bus construction is the lack of agreement among the several states. The conflicting standards that exist among the states, and in some instances within a single state, have not only been productive of confusion but have also made the cost of school buses unnecessarily high without always increasing pupil safety. This excessive cost has occurred because the differences in standards among the states have forced manufacturers to approximate custom-built jobs, thereby making it impossible for the schools to benefit by such economies as would result if national uniform minimum standards were adopted by the states.

As the result of visits to state departments of education and rural schools in approximately thirty states, it was found that a general demand for uniform minimum standards existed. Subsequent conferences with manufacturers also indicated their willingness to cooperate in such a program.

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The National Council of Chief State School Officers

After considering the tentative report of the National Survey of Pupil Transportation, H. E. Hendrix, President of the National Council of Chief State School Officers, invited Frank W. Cyr, under whose general supervision the survey was being conducted, and M. C. S. Noble, Jr., director of the survey, to attend the meeting of the Council in Cleveland on February 28, 1939, and to present definite recommendations governing school bus construction and equipment.

On the basis of these recommendations, the Council agreed that there exists a definite need for cooperative action in the development of minimum standards and unanimously favored a conference composed of representatives of the forty-eight states, of both chassis and bus body manufacturers' engineers, and other interested agencies for this purpose. In accordance with this decision, the conference was called and the necessary arrangements made.

In the meantime, during the 1939 Annual Convention of the American Association of School Administrators, three preliminary meetings were held in which the suggested standards were thoroughly discussed by representatives of State Education Departments and engineers in the automotive industry in preparation for the National Conference.

THE NATIONAL CONFERENCE ON SCHOOL BUS STANDARDS

Procedures

The conference first agreed upon certain statements as to the characteristics of acceptable school bus standards. The first of these statements was accepted as a guiding principle in terms of which all standards should be interpreted and measured. Then each of the standards proposed in the tentative list was used as a basis for discussion. The following characteristics of an acceptable standard were agreed upon.

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Characteristics of Acceptable Standards

At the first session of the conference it was felt that before uniform standards for school bus construction could be set up, it would be necessary to consider the question: What is a desirable school bus standard? Accordingly, the following series of statements were agreed upon as guides and points of reference during the conference:

State regulations governing school bus construction should be set up to insure *safe* and *economical* vehicles.

a. *Safety* means the safe conduct of pupils to and from school. It includes the time the pupil is on the bus, and the time consumed in entering or leaving the bus. It refers to both major and minor accidents and the prevention of accidents. It also refers to the health of the pupils as affected by bus construction.

b. *Economy* means the construction, procurement, operation and maintenance of school buses at the lowest possible cost of pupil transportation consistent with safety.

1. The primary function of uniform state regulations is to specify the *result desired* in terms of safety and economy. The methods of achieving the result desired must be defined insofar as this is necessary in order to make enforceable regulations.

2. Uniform state regulations should:
   a. Provide minimum standards, and
   b. Specify exact spacial dimensions insofar as this will further efficient volume production.

3. Uniform state regulations should:
   a. Eliminate the procurement of unsafe buses, and
   b. Eliminate conflicting standards among states since such conflicts increase the costs of production.

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4. States may make adaptations to the minimum uniform standards insofar as this will permit desirable adaptation to local needs; provided, these adaptations:

   a. Do not conflict with uniform standards, or

   b. Otherwise unduly increase the cost of production.

5. Uniform state standards should provide limits within which sound construction is possible, thus permitting the degree of flexibility which is necessary to accommodate the various manufacturers. The designing of safe buses in accordance with state requirements is a responsibility of the manufacturers.

6. Uniform state standards should permit the widest possible opportunity for the development and use of such new inventions and improvements as is consistent with the formulation of enforceable regulations.

7. Uniform state regulations should be subject to annual review, and revision when necessary, through cooperation of state departments of education.

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USING THE STANDARDS

In order to put the national uniform minimum standards for school bus construction into operation, each of the legislatures should confer upon the state department of education the general obligation of setting up statewide rules and regulations governing the school bus chassis, bodies, and equipment. In no instances, should detailed bus specifications be written into the state law.

* * *

The standards for school bus construction in this report must be officially adopted by a state to become legally effective within it.

* * *

The standards for school bus construction in this report are intended to apply only to new equipment purchased after their adoption. No state should make them apply to equipment previously purchased without careful consideration of the economic effects of such retroactive action.

* * *

These standards are intended to apply only to vehicles designed to carry more than twenty pupils. Special adaptations must be made to govern the construction of smaller vehicles.

* * *

These standards are not intended to apply to buses which transport pupils to school but, which are also used primarily as public carriers.

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Items added over the years & appearing in 1980 report (not mentioned in this 1939 report):
Air Cleaner
Horn
Oil Filter
Shock Absorbers
Transmission
Turning Radius
Undercoating

Part III

STANDARDS FOR SCHOOL BUS CHASSIS

1. *Axle.*—The axle specifications shall be as follows:

   a. *Front axle:* Shall have a gross weight rating at the ground according to the chassis manufacturer's rating, equal to or exceeding that portion of the total load which is supported by the front axle. The chassis manufacturer's rating shall be furnished by the chassis manufacturer to all state departments of education.

   b. *Rear Axle:* Shall be of full-floating type and have a gross weight rating at the ground according to the chassis manufacturer's rating, equal to or exceeding that portion of the total load which is supported by the rear axle. The chassis manufacturer's rating shall be furnished by the chassis manufacturer to the state departments of education.

Now in Body section

2. *Battery.*—Storage battery, as established by the manufacturer's rating, shall be of sufficient capacity to care for starting, lighting, signal devices, heater and other electrical equipment. No bus shall be equipped with a battery of less than 120 ampere-hours measured at a twenty-hour rate. Battery shall be mounted outside body shell.

3. *Brakes.*—Four wheel brakes, adequate at all times to control the bus when fully loaded, shall be provided.

   a. *Foot or service brake:* Shall be capable of stopping the complete unit (i.e., wet chassis weight *plus* body weight *plus* driver's weight, without pupils) from the initial brake application within 22 feet when driven at a speed of 20 miles per hour over a dry level road having approximately .6 coefficient of friction and whose surface is free from loose materials. This stopping ability to be determined by test with an approved decelerometer

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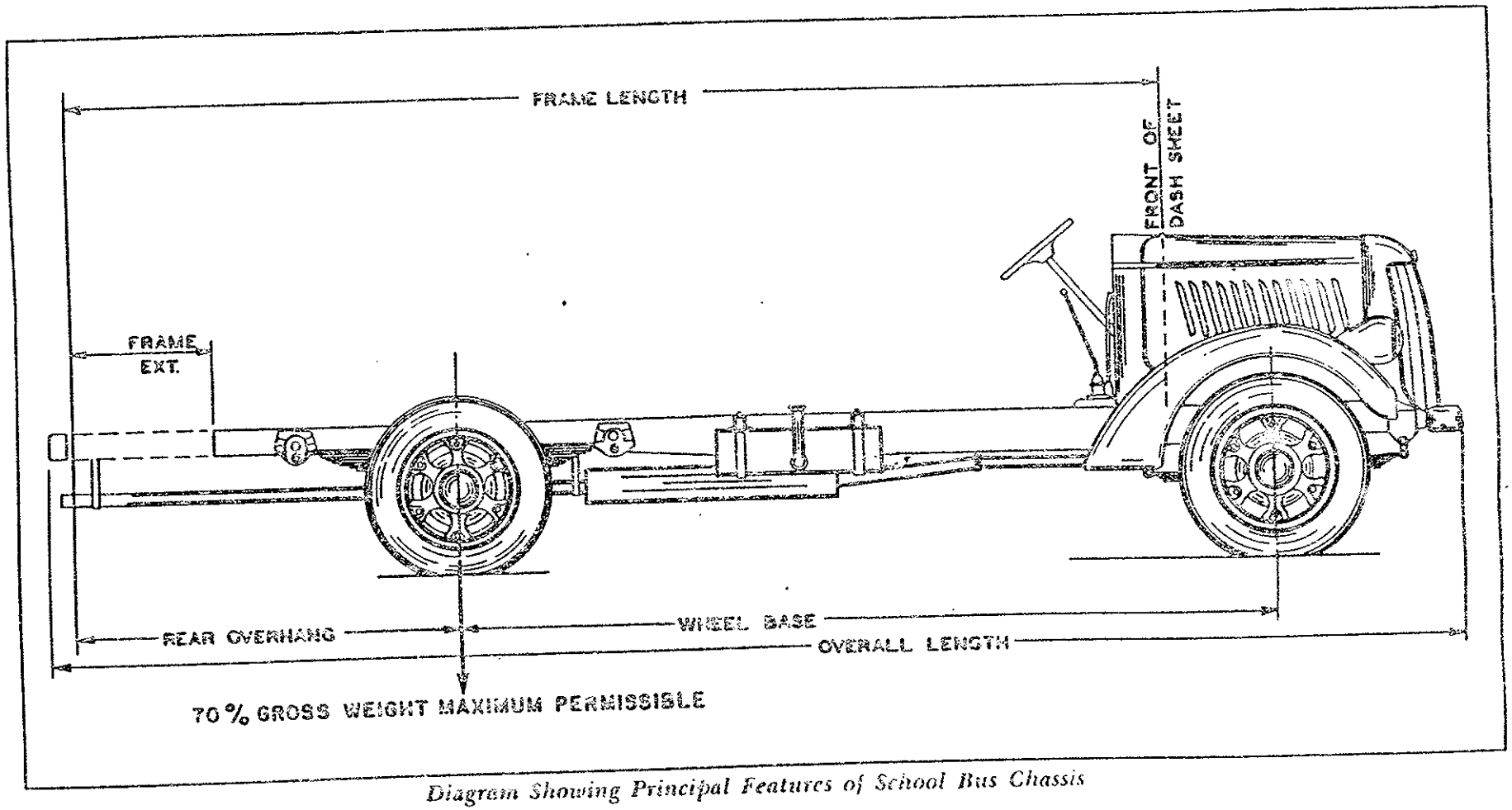

Diagram Showing Principal Features of School Bus Chassis

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or other instrument which indicates brake effectiveness in units that are convertible into rate of deceleration.

b. *Hand or emergency brake:* Shall be of the hand lever type and shall be manually operated. It shall be provided in addition to the service brake, or shall be an entirely separate mechanical operating mechanism to be connected at least to the rear service brake shoes. It shall be capable of stopping the complete unit (i.e., wet chassis weight *plus* body weight *plus* driver's weight, without pupils) from the initial brake application within 50 feet when driven at a speed of 20 miles per hour over a dry level road having approximately .6 coefficient of friction and whose surface is free from loose materials. This stopping ability to be determined by test with an approved decelerometer or other instrument which indicates brake effectiveness in units that are convertible into rate of deceleration.

c. In the event that a school bus shall be equipped with air or vacuum actuated power or assistor type brakes or a hydraulic booster:

(1) Any such installation must be made by an authorized representative of chassis or brake manufacturer and must be in conformance with the recommendation of that manufacturer.

(2) Hydraulic line pressure may not exceed recommendation of chassis manufacturer.

(3) Every vacuum booster or air system must be equipped with a reserve tank of not less than 1,000 cubic inches capacity.

1980 front in chassis sec. rear in Body sec.

4. *Bumpers.*—Bumpers shall be installed on the front and on the rear of the bus and shall be directly attached to the chassis frame. They must be of sufficient strength to permit the pushing of a vehicle of equal gross loaded weight or of being pushed by a vehicle, without permanent distortion to bumper, chassis frame or body. The rear bumper shall be so designed as to make the "hitching of rides" or obtaining of a toe hold impossible.

Diagra. . Showing Principal Features of School Bus Chassis

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5. *Exhaust Pipe.*—Exhaust pipe shall extend beyond the external rear of the body of the bus at the point of projection, but not beyond the bumper. Exhaust pipe shall be entirely outside body. It shall be of sufficient size and length and shall be installed by the chassis manufacturer.

6. *Frame.*—The frame specifications shall be as follows:

a. Each frame side member should be of one piece construction. If the frame side members are extended such extension shall be designed and furnished by the chassis manufacturer with his guarantee and the installation shall be made by either the chassis or the body manufacturer and guaranteed by the company making the installation. Extensions of frame lengths are permissible only when such alterations are behind the rear hanger of the rear spring.

b. No additional holes not provided in the original chassis frame shall be permitted in the top flanges of the frame side rails. There shall be no welding to the frame side rails except by the chassis manufacturer.

7. *Gasoline Tank.*—Gasoline tank shall be of not less than 18 gallons capacity and shall be mounted directly on the chassis frame on the outside and to the right side. However, if there is insufficient space available on the right side of short wheelbase chassis, the tank may be placed on the left side. The tank shall not extend in height above the side member of the chassis, or in width beyond the outer edge of the body, or in depth below the regular running board location. The tank shall be constructed of not less than 18 gage terne plate or equivalent. Filler, vent, and drain openings shall be outside the bus body. The filler shall not project beyond body panels. There shall be flexible gasoline- and oil-proof connections at both ends of the gasoline feed line.

8. *Generator.*—The generator shall have not less than 25 amperes maximum output, shall be voltage and current controlled and shall be capable of delivering 25 amperes from a speed of 25 miles per hour or more.

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9. *Governor.*—Governor, driven from the propeller shaft may be supplied on school buses. The installation shall be such as to prevent tampering and adjustment by the driver.

10. *Guards.*—

a. Emergency brake drum if located on the drive shaft shall be protected by an adequate metal shield mounted above such brake drum. The drive shaft shall be equipped with a protective guard to prevent whipping through floor or dropping to ground, if broken.

b. All closures between the bus body and the engine compartment shall be fitted with gas-tight gaskets and pedal openings shall be closed by bellows type gas-tight boots.

11. *Overall Length.*—The maximum overall length of the bus shall not exceed 33 feet.

12. *Passenger Load.*—The gross weight of the vehicle when fully loaded (i.e., wet load *plus* driver's weight *plus* weight of maximum pupil load) shall not exceed the maximum carrying capacity of the vehicle as established by the manufacturer's rating. These ratings shall be furnished by the manufacturer to all state departments of education.

13. *Power or Grade Ability.*—Bus must be so geared and powered as to be capable of surmounting a 3 per cent grade at 20 miles per hour with full load on continuous pull.

For the purpose of computing the performance ability of a vehicle, the following formula shall be used:

$$\left(\frac{T \times 12 \times R \times E}{LTR \times GW} - 0.015\right) \times 100 = \text{the maximum grade in per cent which vehicle will surmount at 20 miles per hour.}$$

T = Net torque from certified power curve of manufacturer corresponding to engine revolutions per minute at 20 miles per hour.

12 = Constant to reduce pounds-feet to pounds-inches.

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R = Total reduction (axle ratio × transmission ratio used).
E = Efficiency (0.9).
GW = Maximum gross weight of wet chassis, body and payload. (To compute payload, allow 100 pounds for each pupil.)
LTR = Loaded tire radius (From specifications of tire manufacturer).
0.015 = Pounds of rolling resistance per pound of gross vehicle weight.

Note: In case refinements of this formula or a substitute formula are developed and approved by the Society of Automotive Engineers, the newly approved recommendation of the society shall automatically become a substitute for this specification.

14. *Speedometer.*—A speedometer shall be located at a convenient place on the instrument board of each bus and be in good working order.

15. *Steering gear.*—Steering gear shall be approved by the manufacturer and designed to assure safe and accurate performance when the vehicle is carrying the maximum gross load at 35 miles per hour. No changes shall be made in the steering apparatus which are not approved by the chassis manufacturer.

16. *Tires.*—The tire specifications shall be as follows:

a. The following tire sizes, based upon the recommendation of the Tire and Rim Association, shall be required. In order to allow for a reasonable tolerance, the total weight imposed on any tire shall not be greater than 10 per cent more than the following ratings.

Tire Sizes	Load Capacity Per Tire	Gross Load Limits For Six Tires
6.00—20	1400	8400
6.50—20	1700	10200
7.00—20	1950	11700
7.50—20	2200	13200
8.25—20	2650	15900
9.00—20	3250	19500

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b. Dual rear tires shall be provided if the wheelbase is 154 inches or more, or if the chassis has a manufacturer's rating of one and one-half tons or more. Spare tire, if required, shall be mounted to the rear end of the chassis frame on a suitable support, or by suitable attachment to the inside of the body to the left of the driver with the tire resting in a depression in the floor.

17. *Weight Distribution.*—As uniform tires are required, perfect weight distribution is one-third gross vehicle weight on front axle and two-thirds gross vehicle weight on rear axle measured at the ground. Therefore, no school bus shall have more than 70 per cent gross vehicle weight on the rear axle measured at the ground.

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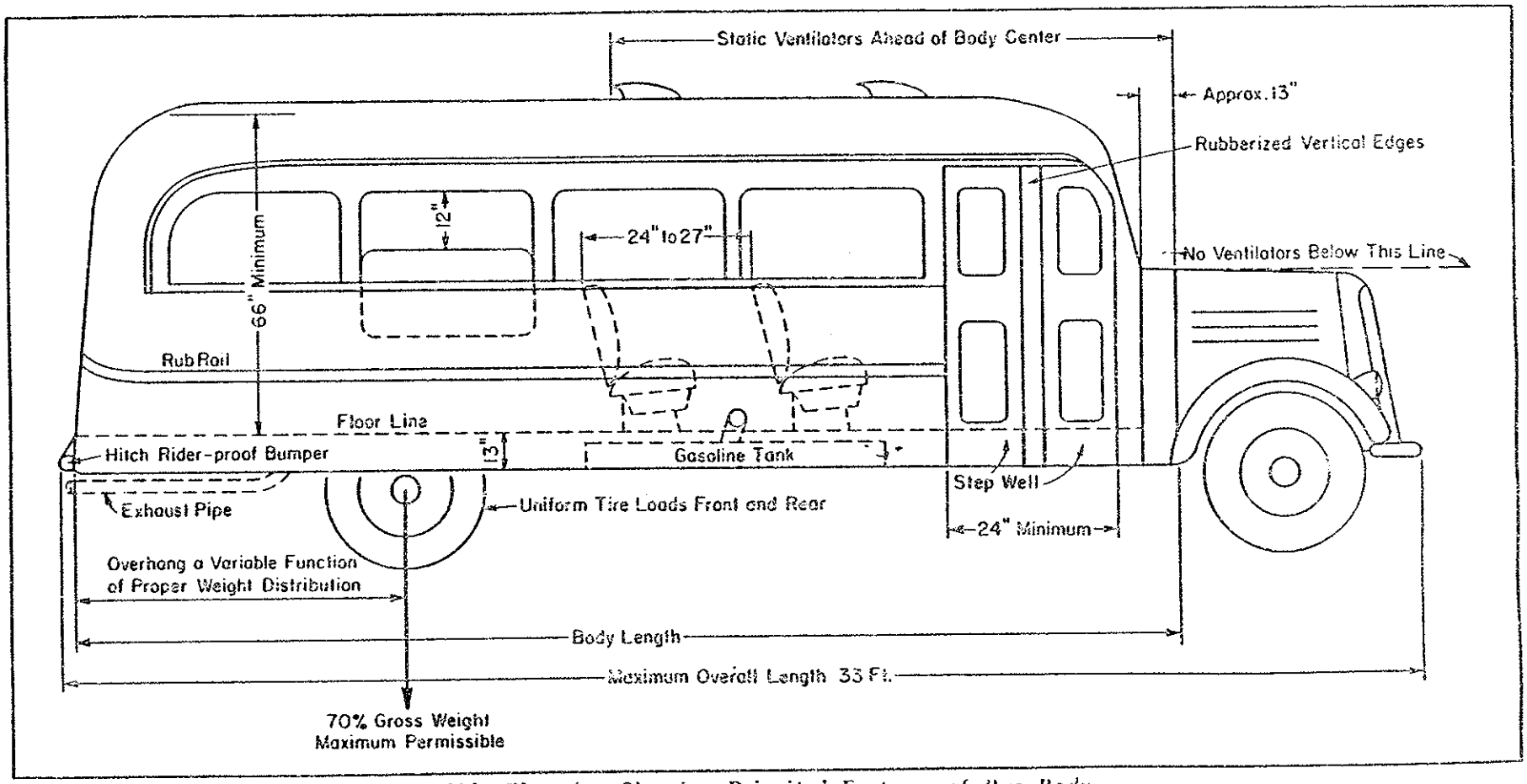

Side Elevation Showing Principal Features of Bus Body

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Items added over years & appearing in 1980 report (not mentioned in this 1939 report):
Sanders
Seat Belt for Driver
Stirrup Steps
Stop Signal Arm
Sun Shield
Undercoating
Windshield Washers

Part IV

STANDARDS FOR SCHOOL BUS BODIES

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1. *Aisles.*—The minimum clearance of all aisles, including the aisle leading to the emergency door shall be 12 inches.

2. *Body Sizes.*—The following standards shall govern the sizes of school bus bodies:

   a. The purchase of bus bodies shall be limited to the following lengths. However, adoption of these lengths shall impose no restrictions as to type of seating arrangement.

Basic Pupil Load	Range of Body Lengths
24	170"–185"
30	180"–210"
36	215"–230"
42	245"–265"
48	255"–285"
54	290"–315"

Note: These sizes are based upon 27-inch spacings between rows of forward facing seats, an outside width of 96 inches, a center aisle width of 12 inches, and an average rump width of 13 inches. These lengths are measured from the front of the chassis dash to the inside rear of the body at the floor line.

3. *Ceiling.*—Ceiling shall be free of all projections likely to cause injury to pupils. This standard is not intended in any way to require the use of an inner lining beneath the roof bows.

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4. *Construction.*—Construction shall be all-steel construction *or* construction of other metal with at least

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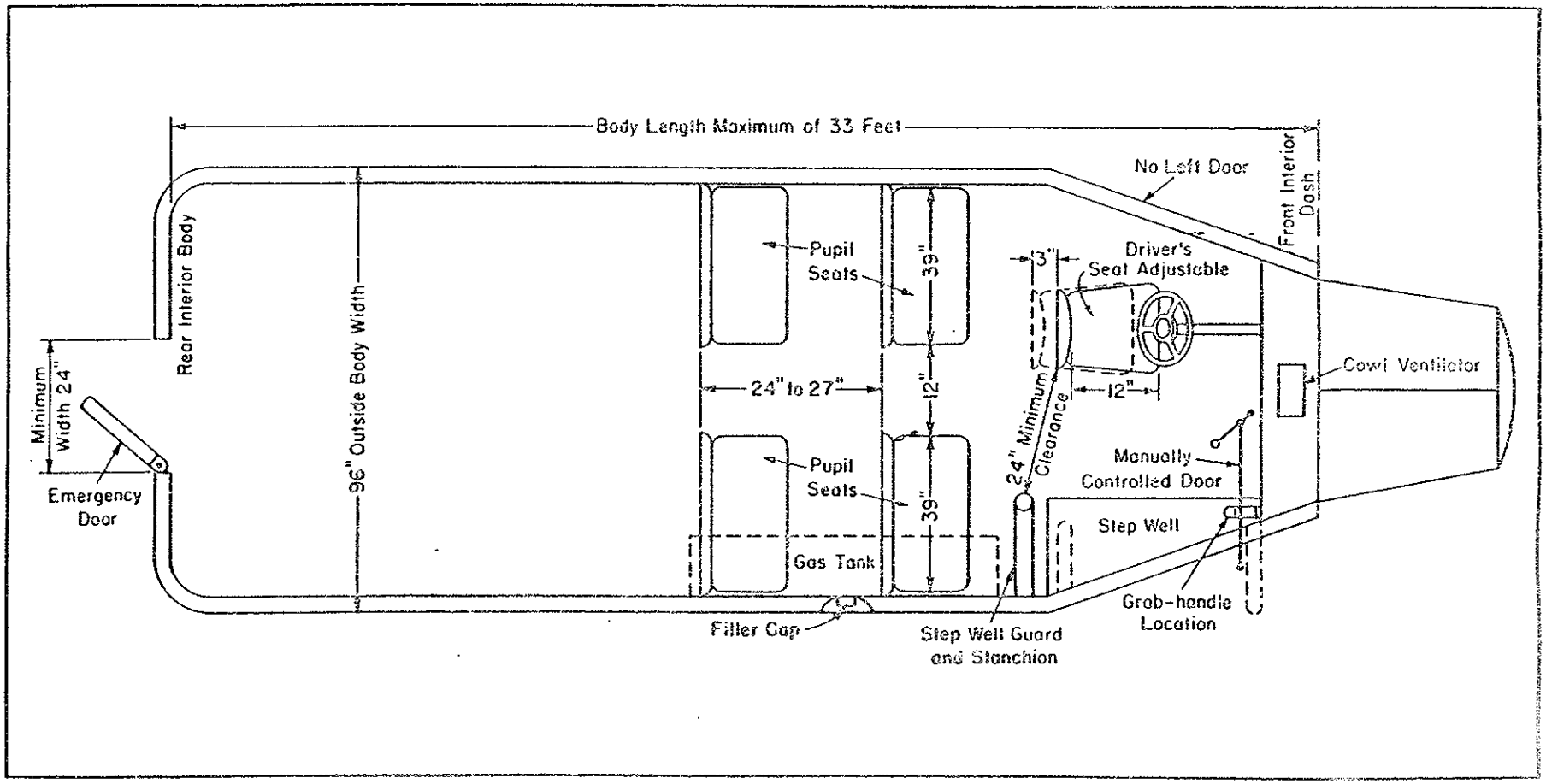
State Legislation Showing Principal Features of Bus Body



Plan View Showing Principal Features of Bus Body

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a strength equivalent to all-steel construction, as certified by the bus body manufacturer. This standard is not intended to limit in any way the proper use of insulating and sound-deadening materials.

5. *Doors.*—The following specifications shall apply to doors:

a. Service Door:

(1) Shall be manually operated and of the hand lever type, under the control of the driver and so designed as to prevent accidental opening when leaned against.

(2) Shall be located on right side near the front of the bus. At least two-thirds of its opening width shall be ahead of a point opposite the back of driver's seat.

(3) Shall have a minimum horizontal clearance opening of 24 inches.

(4) Shall be of folding type. If one leaf opens in and the other out, the front leaf shall open outward.

(5) Lower panels as well as upper panels shall be of safety glass to permit driver to see children who are waiting to enter bus, and the ground where children step off.

(6) Vertical closing edges of door shall be equipped with rubber or rubberized materials to protect children's fingers.

(7) There shall be no door at the left of the driver.

(8) A stanchion shall be required at the rear of the entrance step well from roof to floor. Placement shall not restrict passageway to less than 24 inches.

(9) A safety bar shall be installed from the stanchion and wall at a height of approximately 30 inches to prevent children in front seat from being thrown into step well in case of sudden stop.

b. Emergency Door:

(1) Shall be located in center of rear of bus.

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(2) Shall have a minimum horizontal clearance of 24 inches, a minimum vertical height of 48 inches and be marked "Emergency Door" on both the inside and outside.

(3) Shall be equipped with a fastening device which may be quickly released, but is designed to offer protection against accidental release. Control from driver's seat shall not be permitted. Provision for opening from the outside shall consist of either a square hole in which a screw driver or other object may be inserted, or a device of such design as to prevent "Hitching" but that will permit opening when necessary.

(4) Shall be hinged on the right side of the body, shall open outward and shall be designed to open from both inside and outside of the bus.

(5) There shall be no steps leading to the emergency door.

(6) Glass used in the emergency door shall be safety glass.

6. *Fire Extinguishers.*—Each bus shall be equipped with a fire extinguisher of a type and size approved by the laboratories of the National Board of Fire Underwriters.

7. *First Aid Kit.*—Each bus shall carry a first aid kit approved by the proper state authority and the driver shall be instructed in its use. The kit shall be kept fully equipped and in good condition.

8. *Floor.*—Floor shall be of metal and so constructed that exhaust gases can not enter the bus. A fire-resistant non-slipping surface may be applied to the metal floor. All closures between the bus body and the engine compartment shall be fitted with gas-tight gaskets and pedal openings shall be closed by bellows-type gas-tight boots.

9. *Identification.*—For purposes of identification school bus bodies:

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a. Including hood, cowl and roof, shall be painted a uniform color, *National School Bus Chrome*, according to the United States Bureau of Standards specifications with the exception of fenders and trim.

b. Fenders and trim shall be black.

c. Shall bear the words, SCHOOL BUS, in black letters at least four inches high on both the front and rear of the body.

10. *Inside Height.*—The minimum inside body height shall be 66 inches measured at the longitudinal center line.

11. *Lights.*—Each bus shall be equipped with headlights, tail light, stop light or lights, step well light, clearance lights, interior lights and extra light bulbs and fuses; also such other marker lights, reflectors or directional signal lights as may be required by state law.

12. *Mounting.*—The mounting of body shall be as follows:

a. Body manufacturers, when installing body on frame, shall insert between the body and the frame a spacer at every point of contact between the body and frame, of such form that shearing stresses shall not be put upon rivet heads.

b. The rear end of the chassis frame shall be flush with the rear end of the bus body.

13. *Overhang.*—Body shall be mounted so that not more than 70 per cent of the gross vehicle weight shall be on the rear axle, measured at the ground.

14. *Posts.*—The front corner posts shall be so designed and placed as to afford minimum obstruction to the driver's vision of the road. The strength of all posts and the roof shall be such as to support the entire weight of the loaded vehicle if overturned.

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15. *Rear Vision.*—

a. A non-glare interior rear-view mirror large enough (at least 4" × 15") to afford a good view of the road to the rear, as well as of the pupils, shall be required.

b. An exterior non-glare rear-view mirror shall be provided and located to the left of the driver. The exterior rear-view mirror shall not extend beyond the maximum width of 96 inches, and shall not be less than 6 inches in diameter or 4" × 6" if rectangular.

16. *Rub-Rail.*—The body shall be protected by an applied or pressed-in rub-rail, located at the seat line or between the floor and seat lines.

17. *Seats.*—The seating arrangements shall be as follows:

a. Thirteen inches shall be the allowable average rump width in determining the seating capacity of the bus.

b. All seats shall be securely fastened with bolts or rivets to that part or parts of the school bus which support them; no bus shall be equipped with jump seats or portable seats.

c. No seat on the right side of the bus shall be placed ahead of the forwardmost pupil seat on the left side of the bus.

d. Seat back centers on forward-facing seats shall be within the range of from 24 to 27 inches, both inclusive.

e. There shall be painted on the inside of the bus body directly over the windshield to the right of the driver the maximum seating capacity of the bus. The size of letters and figures shall be such as to permit them to be read by passengers.

f. All seats shall be covered with suitable padding materials.

g. The minimum distance between the steering wheel and the back rest of the driver's seat shall be 12 inches. The driver's seat shall have a fore and aft adjustment of not less than 3 inches, and shall be strongly attached.

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18. *Speedometer.*—Speedometer shall be located at a convenient place on the instrument board of each bus and be in good working order.

19. *Steps.*—The following regulations shall apply to the construction and design of bus steps at the service door:

a. The riser of the upper step shall be not less than 13 inches and not more than 15 inches. When more than two steps are used, the upper two steps may have a riser of less than 13 inches, but these risers must be of equal height.

b. The steps shall be enclosed to prevent the accumulation of ice and snow.

c. Steps shall not protrude beyond the side body line.

d. A grab handle of not less than 10 inches in length shall be provided inside doorway and to the right upon entering, to assist pupils in getting on and off the bus.

20. *Tools.*—Bus shall have a tool compartment and carry such tools as may be necessary to make minor emergency repairs while the bus is enroute.

21. *Ventilators.*—Body shall be equipped with a suitable, controlled ventilating system of sufficient capacity to maintain the proper quantity of air under operating conditions without the opening of windows except in extremely warm weather. No intake ventilators in the front bus corner below the top of the engine hood line shall be used. No static exhaust roof ventilators may be installed to the rear of the center of the body.

22. *Wheel Clearance.*—The body shall clear the wheels sufficiently to allow for load and chains.

23. *Width.*—Ninety-six inches shall be the standard outside width of school bus bodies. However, where existing conditions make necessary the use of narrower bodies, widths less than 96" are acceptable.

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24. *Windshield and Windows.*—All glass in windshield, windows and doors shall be of safety glass approved by the laboratories of National Board of Fire Underwriters; such glass to be of sufficient quality to prevent distortion of view in any direction. The windshield shall be slanted to prevent glare and large enough to permit the driver to see the road clearly. All full side windows must open and lower vertically and must provide an unobstructed opening of at least 12 inches. A guard or thickness of safety glass must be provided which will prevent pupils from extending heads or arms out of windows.

25. *Windshield Wipers.*—Bus shall be equipped with suitable and adequate double windshield wiper, vacuum or power driven, capable of manual operation in emergencies, so arranged as to clean the windshield, both in front of the driver and on the right side of the windshield, thus clearing a sufficient area to allow a reasonable driving vision.

26. *Wiring.*—

a. The wiring shall be arranged in at least five regular circuits as follows: (1) Dome lights, (2) step, clearance and marker lights, (3) starting, (4) ignition, (5) head, tail, stop and dash lights.

b. Where desired there shall be two auxiliary circuits as follows: (1) Direction lights, (2) heater, defroster, etc.

c. Each circuit, except starter and ignition, shall be separately fused.

d. All wires shall be insulated and protected by a covering of fibrous loom (or equivalent) which will protect them from external damage and which will eliminate dangers from short circuits.

e. Wires shall be fastened securely to body and/or chassis. All joints shall be soldered.

Note: In each state the state agency which is authorized to formulate rules, regulations and/or standards governing school bus construction shall determine whether skid chains, defrosters and heaters shall be required; also, to designate the section or sections

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of the state in which these requirements shall be enforced. Wherever such items shall be required by said state agency, the following regulations shall be in force:

1. Skid Chains: Bus shall carry a set of chains.
2. Defrosters: Bus shall be equipped with a defrosting device.
3. Heaters: The heater shall be of the hot water or other type, approved by the laboratories of National Board of Fire Underwriters. It shall be capable of heating the bus under normal winter temperatures.

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Part V

EXPLANATORY NOTES

Example of Grade Ability Calculation

Following is the mathematical procedure by which the trained engineer determines whether or not the performance of a given motor vehicle can meet required performance specifications:

Torque	= T = 184*	
Total Ratio	= R = 10.17	(Rear axle ratio of 6.16 × transmission ratio of 1.658)
Mechanical Efficiency	= E = 0.9	
Gross Vehicle Weight	= GW = 15,100	(Chassis, 6,400; Body, 4,400; 43 pupils @ 100, 4300)
Loaded Tire Radius	= LTR = 17.7	(8.25–20)

Substituting in formula:

$$\left(\frac{184 \times 12 \times 10.17 \times 0.9}{17.7 \times 15{,}100} - 0.015\right) \times 100 = 5.06\% \text{ grade.}$$

The grade ability required by the school bus regulation is 3% at twenty miles per hour, which is equal to a climb of 3 ft. in 100 ft. of horizontal travel.

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* T=Torque at engine speed equivalent to 20 mile per hour road speed. In order to read the T value from the chassis manufacturer's torque curve, it is first necessary to determine the engine speed (r.p.m.) equivalent to 20 miles per hour road speed.

The mathematical formula follows:

$$\text{Engine Speed (r.p.m.)} = \frac{\text{m.p.h.} \times R \times 336}{2 \times LTR}$$

When
m.p.h. = miles per hour.
R = total gear reduction
336 = Constant value resulting from cancellation
2×LTR = Loaded Tire diameter equivalent.

Example:

$$\text{r.p.m.} = \frac{\text{m.p.h.} \times R \times 336}{2 \times LTR} = \frac{20 \times 10.17 \times 336}{2 \times 17.7} = 1920$$

By reference to the torque curve, at the 1920 r.p.m. engine speed calculated above, we find 184 lb.-ft. torque.

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It will be noted from the above calculation that this school bus could climb a 6.06% grade which provides a nice margin of safety.

National School Bus Chrome

National School Bus Chrome was adopted by the conference as the uniform color for all school buses throughout the United States. The first consideration in adopting a uniform color was to provide the safety which will accrue when, throughout the United States a school bus is recognized by its color. The second consideration was economy since manufacturers are forced to make additional charge for special colors.

Engineers of the United States Bureau of Standards prepared the samples and provided technical advice upon which the choice was made. The United States Bureau of Standards, Washington, D. C., has prepared Federal Specifications. This color can be legally used in most states at once as few states have exact specifications and the majority of the present regulations are a general requirement for orange or yellow.

The panels on the front cover of this report represent the range of shades included within the Federal Specifications for National School Bus Chrome.

The Enactment of Proper Statutory Provision

The function of legislative statutes should be to authorize the State Education Department or some other state agency to make necessary regulations governing school bus construction and equipment. Such regulations should not be incorporated in the statute itself. States in which proper statutory provisions do not exist should give careful consideration to the following statements:

1. The large number of pupils being transported is adequate evidence of the need for state regulations governing the construction and equipment of school buses. State regulations for school buses constitute the best assurance that pupils will be transported in safety and with reasonable economy.
2. Both educational theory and the experience of a majority of the states indicates that the state department of education is the agency best qualified to establish such regulations.

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3. The responsibility of the state department of education to establish rules and regulations governing school bus construction and school bus equipment should be fixed through a single statutory provision which confers broad powers upon the department.

   Following are two examples of desirable types of laws which are reproduced as suggestions to states desiring to enact an effective statute:

   (A) *California:* "The State Board of Education shall have the power to adopt reasonable regulations relating to the construction, design, operation, equipment and color of school buses. No regulation relating to the construction, design or color of school buses shall apply to buses purchased prior to the effective date of this section, except that any school bus repainted after the effective date of this section shall, regardless of the date when purchased, be painted to conform to all the regulations relating to the color of school buses."

   (B) *Pennsylvania:* "All vehicles hereafter purchased or placed in use for the transportation of pupils, whether owned or hired by the school district, shall conform to standards prescribed by the State Council of Education. Such standards, when promulgated by the State Council of Education, may be revised not oftener than once each year, and whenever new requirements are made, they shall be published at least six months before they shall become effective, and shall apply only to vehicles thereafter purchased or put in use."

4. State departments of education in those states which have not already placed upon some state department the responsibility of setting up state rules and regulations for school buses should use the first opportunity to request their legislatures to place this responsibility upon the state department of education.

Manufacturer's Uniform Reporting Forms

Waste, inefficiency and confusion result from differences in the types of reports which the various states require from manufacturers. To overcome this situation the conference authorized a committee to prepare

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a set of uniform report forms which manufacturers can use in reporting to all states the information required in the enforcement of the uniform bus standards. When this committee has developed acceptable forms, they will be made available for use by all of the states.

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Part VI

REPORT OF COMMITTEE ON SELECTION OF SCHOOL BUS DRIVERS

It is the opinion of this committee that, in the last analysis, the safety and efficiency of pupil transportation service will depend largely upon the manner in which the school bus is operated and, therefore, the selection and training of drivers is a matter of prime importance. No school bus is safe in the hands of a driver who is physically or emotionally unfit or who fails to observe sound driving practice. The school bus driver should be selected with as great care as teachers and in accordance with defensible standards. Although the major responsibility for selecting and training drivers rests upon local school authorities, general standards, rules and regulations should be promulgated by the responsible state agency to guide local school boards in exercising this important function. In recognition of the need for more rigid regulations, the committee submits the following recommendations:

I *Selection of School Bus Drivers*

No person shall be permitted to operate a school bus without a permit or certificate of eligibility issued by the responsible state agency. The applicant for such a permit or certificate shall present satisfactory evidence of his qualifications to the issuing agency as follows:

1. *Physical Fitness:* The driver shall be in good physical and mental health, be able-bodied, free from communicable disease, strong enough physically to handle the bus with ease, and shall have normal use of both hands, both feet, both eyes and both ears. As evidence of his physical fitness and mental alertness, he shall submit annually to a physical examination by a reputable physician designated by the local school authorities and shall present the physician's certificate of physical fitness to the agency which issues the driver's permit or certificate of eligibility.

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TEST FOR DRIVING ON PRESCRIBED COURSE

*Name*_____

*Checked by*_____

*Date*_____ *Test number*_____

*Previous score*_____ *Period number*_____

*Time begin*_____ *end*_____

*Total in minutes*_____

*Mileage begin*_____ *end*_____

*Previous total*_____ *Total*_____

Checking:		
Seat adjustment	1	
Mirror	1	
Starting Motor:		
Did not depress clutch	2	
Did not check gear lever	2	
Forgot to turn on ignition	1	
Starter: Not long enough	1	
Too long	1	
Raced motor	10	
Did not feed gas	1	
Wrong order	1	
STARTING CAR:		
Use of clutch:		
Released too quickly	3	
Released too slowly	1	
Improperly depressed	1	
Use of accelerator:		
Applied too suddenly	2	
Too much gas at start	2	
Too little gas at start	1	
Hold down between shifts	2	
Use of gears:		
Low gear—went too far	1	
Not far enough	1	
Too fast	2	
Too slow	1	

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Second— went too far	1
Not far enough	1
Too fast	2
Too slow	1
Started with hand brake on	2
Feeds gas in spurts	2
Stalled motor	2
Clashed gears	1
Selected wrong gear	2
Unsteady on steering	2
Eyes down when shifting	2
STOPPING CAR:	
Stopped in wrong position	2
Too hard on brake	2
Forgot to use clutch	1
Too soon with clutch	2
Late with clutch	1
ATTITUDES:	
Nervous	1
Hesitant	1
Easily distracted	2
Over-confident	3
Not alert	3
Discourteous	3
DRIVING IN TRAFFIC:	
Failed to look for other cars	5
Drives too fast	5
Drives too slowly	2
Ran through stop sign	10
Ran through red light	10
Tried to beat light	10
Went through on amber	2
Starts up on amber	4
Passes in wrong place	10
Cuts in too soon after passing	10
Drives too far to left	10
Drives too far to right	2
Too close to car in front	10
Drives off roadway	3
Brakes too suddenly	5
Inconsiderate of pedestrians	8
Blocks pedestrian lane	4
Inconsiderate of motorists	4

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Cuts corner on right turn	4			
Cuts corner on left turn	8			
Too wide on right turn	4			
Too wide on left turn	4			
Improper steering	4			
Too fast at intersections	10			
Slouches when driving	1			
Rides clutch	5			
Tried to start out of gear	1			
PARKING:				
Too far from curb	2			
Did not set hand brake	1			
Too slow getting in	1			
Poor judgment of direction	1			
Poor judgment of distance	3			
Bumped other car	3			
STARTING ON HILL:				
Rolls back	2			
Too light on hand brake	1			
Improper timing of clutch and brake release	1			
Stalled motor	2			
Not enough gas	1			
Too much gas	1			
Too slow, holds up traffic	2			
Jerks passengers	1			
SIGNALLING:				
No signal for left turn	10			
No signal for right turn	10			
No signal for stop	10			
If no signal, failed to look	10			
Signal inadequate	8			
Bumped curb	5			

(A Score of *60 or above* is necessary to qualify)

2. *Age:* Every school bus driver shall be at least 18 years of age and, if over 60 years of age, shall pass a thorough physical examination semi-annually.

3. *Driving Ability:* Every school bus driver shall successfully pass a special school bus drivers' examination conducted by the agency responsible for issuing drivers licenses. Such examination shall include (a) an oral and/or written test to determine the applicant's knowledge of the motor vehicle laws and the rules and regu-

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lations governing the transportation of school children, and (b) a practical road-test to determine the applicant's driving habits. (The preceding check sheet is recommended as a means of evaluating driving habits.)

4. *Experience:* The applicant shall present evidence of at least two years of 10,000 miles of driving experience without personal blame for a major accident. The driver should have had experience in operating motor vehicles larger than an ordinary passenger automobile.

5. *Character:* No person shall be employed as a school bus driver who has been convicted of any of the following offenses as a result of driving a motor vehicle: (a) manslaughter, (b) driving while under the influence of intoxicating liquor or habit-forming drugs, (c) failure to stop, disclose identity and render assistance when involved in an accident.

6. *Credentials:* The applicant shall present to the examiner at the time of examination his certificate of physical fitness, the registration card for the vehicle in which the test is to be taken, and a valid chauffeur's or driver's license, if required by state law.

II *Knowledge of Job Responsibilities*

1. *Maintenance:* Every school bus driver shall give evidence of a knowledge of bus maintenance and demonstrate his ability to inspect the vehicle which he operates. The driver should possess sufficient mechanical ability to make all ordinary repairs and adjustments and to keep the motor in good working condition. (The accompanying check sheet is recommended in evaluating the applicant's knowledge of and ability in making necessary inspections.)

A specific plan of preventive maintenance should be established and administered by the driver. Such a plan should definitely locate responsibility for making inspections and repairs. It should be the driver's responsibility to check the mechanical condition of the vehicle, as indicated by the maintenance schedule, make such repairs and adjustments as come within his ability, and report the need for other repairs and replacements to the person authorized to do the work.

A series of preventive maintenance charts now in use in the State of New York are available and can be

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UNITED STATES INDIAN SERVICE
MOTOR VEHICLE INSPECTION REPORT

SUBMIT WEEKLY

Phoenix Indian School, Phoenix, Arizona

Make_____ Chassis_____

Type_____ Year_____ Body_____

Date_____ 193__

Vehicle License U. S. I. S. No._____

Speedometer Reading_____ Miles

	Yes	No	Remarks
Anti-freeze in radiator checked			
Battery water checked			
Bus, Car, Truck, Cleaned			
Distributor points cleaned and checked 5000 miles			
Fuel Pump Diaphragm renewed 10,000 miles			
Generator charging			
Greased			
Headlight lenses cleaned			
Headlight reflectors cleaned			
Oil checked			
Radiator cleaned—Inside and Outside			
Spark Plugs checked 10,000 miles			
Windows broken			
Windshield broken			
Exhaust extends to rear			
Governor on carburetor			
Rear vision obstructed			
Safety door obstructed			
Windows shatter proof			
Tools: Crank			
Crescent Wrench			
Hammer			
Jack			
Pliers			
Pump			
Screwdriver			
Tire and Wheel Wrench			
Equipment: Accident Report Card			
Chains			
Fire Extinguisher			
First Aid Kit			
Flags (3 red)			
Flares (3 red)			
Fuses, light, spare			
Shovel			
Tire, spare			
Tow Chain			
Tube, extra, spare			

GENERAL CONDITION OF VEHICLE

Excellent	Good	Fair	Poor	Dangerous

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UNITED STATES INDIAN SERVICE
MOTOR VEHICLE INSPECTION REPORT
SUBMIT WEEKLY
Phoenix Indian School, Phoenix, Arizona

Make_____ Chassis_____
Type_____ Year_____ Body_____
Date_____ 193____
Vehicle License U. S. I. S. No._____
Speedometer Reading_____ Miles

	OK	Not OK	Remarks
Axles, Spring, Shackles			
Braking effort			
Brake equalization			
Brake Hand, hold on 7% Grade			
Brake Pedal 1½" clearance			
Brake Mechanism			
Clutch pedal 1" min.			
Horn			
License, condition, position			
Carbon Monoxide			
Gasoline Waste			
Excessive Smoke			
Driver's Seat			
Bumpers, Brackets			
Doors, Latches			
Fenders, Running Board			
Floor Covering			
Locking Devices			
Muffler and Exhaust System			
Mirror			
Reflector			
Steering Wheel 3" Maximum			
Tires, Condition			
Windshield Glass			
Windshield Wiper			
Wiring			
Lights, Clearance			
Lights, Parking			
Lights, Stop			
Lights, Tail			
Lights, Reflectors			
Headlights, Switch			
Headlights, Bright			
Headlights, Dim			
Headlights, Output, left			
Headlights, Output, right			
Headlights, Focus, right			
Headlights, Focus, left			
Headlights, Ver. Aim, right			
Headlights, Ver. Aim, left			
Headlights, Hor. Aim, right			
Headlights, Hor. Aim, left			
Wheel Alignment			

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obtained from the State Department of Education as an example of a desirable program of bus maintenance.

2. *First Aid:* Every driver shall give evidence of a knowledge of first aid treatment. School authorities should provide for regular instruction in rendering first aid treatment by competent instructors.

3. *Reports:* The driver shall be competent to keep such records and to make such reports as may be required by the school authorities.

4. *Reliability:* The driver shall present evidence that he is thoroughly reliable and of good moral character.

5. *Safe Transit Practices:* The driver shall give satisfactory evidence of a knowledge of commonly accepted safety precautions and driving regulations.

6. *Relationships:* The driver shall satisfy the agency which issues the driver's permit or certificate that he is thoroughly familiar with his relationships with parents, pupils, teachers and other school authorities.

III *Training of School Bus Drivers*

Since pupil transportation is a legitimate phase of the educational program, it becomes the responsibility of the school authorities to provide adequate facilities whereby school bus drivers can be trained. However, school authorities have been extremely slow to recognize the need for a program of driver education and to provide the necessary facilities therefor. Before an adequate program of driver education can be organized and administered, instructors must be secured, methods and materials of instruction must be determined, classroom and training ground facilities must be provided and the means and methods of financing the project must be devised.

It is not the purpose of this report to recommend the procedure to be followed in setting up a suitable program of driver education but rather to emphasize the urgent need which exists in this field and to urge state, county and local authorities to take prompt action in formulating a coordinated plan whereby school bus drivers may be trained.

In the absence of appropriate techniques of driver education and until a suitable program of training can

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be developed, it is recommended that the school authorities secure the cooperation of existing agencies in offering such training. This program might well be organized as a phase of adult education or the emergency education program of Works Progress Administration, and might utilize such agencies as the State Motor Patrol, Safety organizations, automobile clubs, Red Cross, vocational and industrial education departments, etc.

State and county school officials should supplement such training with bulletins, group conferences, practical demonstrations, field trips, records and reports, and case studies. These materials might well cover such topics as, rules and regulations, state laws, driver examination, bus maintenance, bus equipment, factors influencing the cost of transportation, safety factors, efficient routing and related topics.

It should be emphasized, however, that an adequate supply of competent school bus drivers awaits the development of state-wide programs of driver education which should be organized and administered around the major objectives of safety, efficiency and economy in pupil transportation.

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RESOLUTION OF THE NATIONAL CONFERENCE ON SCHOOL BUS STANDARDS

Representatives of the forty-eight states and the United States Indian Service express appreciation of the wisdom of the National Council of Chief State School Officers in recognizing the magnitude of the problems involved in providing safe and economical transportation for three million children now being transported to school in the United States.

We believe that the minimum standards for school buses approved by this conference guarantee an increased measure of safety and economy in the transportation of school children, and that these objectives have been achieved with greater efficiency through cooperative effort than could have been attained by the states acting separately. In view of the urgent need for further assistance and study, we request the National Council of Chief State School Officers to assume the sponsorship of future conferences. We recommend that the State Departments of Education of the several states give these matters immediate consideration and proceed with the administration of the uniform standards adopted.

We wish to take this means of expressing our appreciation to:

Dr. Frank W. Cyr, Dr. M. C. S. Noble, Jr., and Professor Frederick H. Dutcher, for thorough investigation prior to the conference and invaluable contribution to its deliberations.

Dr. Howard A. Dawson, Director of Rural School Service of the National Education Association, for cooperation.

Dr. H. F. Alves, Senior Specialist in State School Administration of the United States Office of Education for counsel.

Dr. E. F. Hickson and Dr. K. S. Gibson of the United States Bureau of Standards for technical advice.

Particularly the State Departments for the services of staff members concerned with pupil transportation, the manufacturers of school bus bodies, chassis and equipment for the services of their technical representatives, the General Education Board of the Rockefeller Foundation for the grant of funds necessary to meet the expenses of the conference, and

Teachers College, Columbia University, for so generously acting as host to the members of the conference.

Unanimously adopted by National Conference on School Bus Standards, Teachers College, Columbia University, April 16, 1939.

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