

"file copy"

PERSONAL AND CONFIDENTIAL

General Technical Committee Meeting
Tuesday, April 19, 1966
Engineering Staff
General Motors Technical Center

BLOW-UP

Plaintiff's
EXHIBIT

EXHIBIT #46A

Shapiro v GM

**G.M. AUTOMOTIVE SAFETY TEST ENGINEERING
1969 DESIGN GOALS FOR SAFETY**

Page 1

The following design goals are intended to outline performance requirements which should be met by 1969 General Motors passenger vehicles. The design should prevent the vehicle occupants from being severely injured under the following impact conditions:

1. During a 30-mph barrier impact.
2. During a 40-mph impact in which one vehicle runs at 90° into the side of another vehicle moving at 40 mph.
3. During a 30-mph rear end collision without brakes applied.
4. During a ground level roll over from an initial speed of 70 mph, or a simulation of this condition.

III GLASS

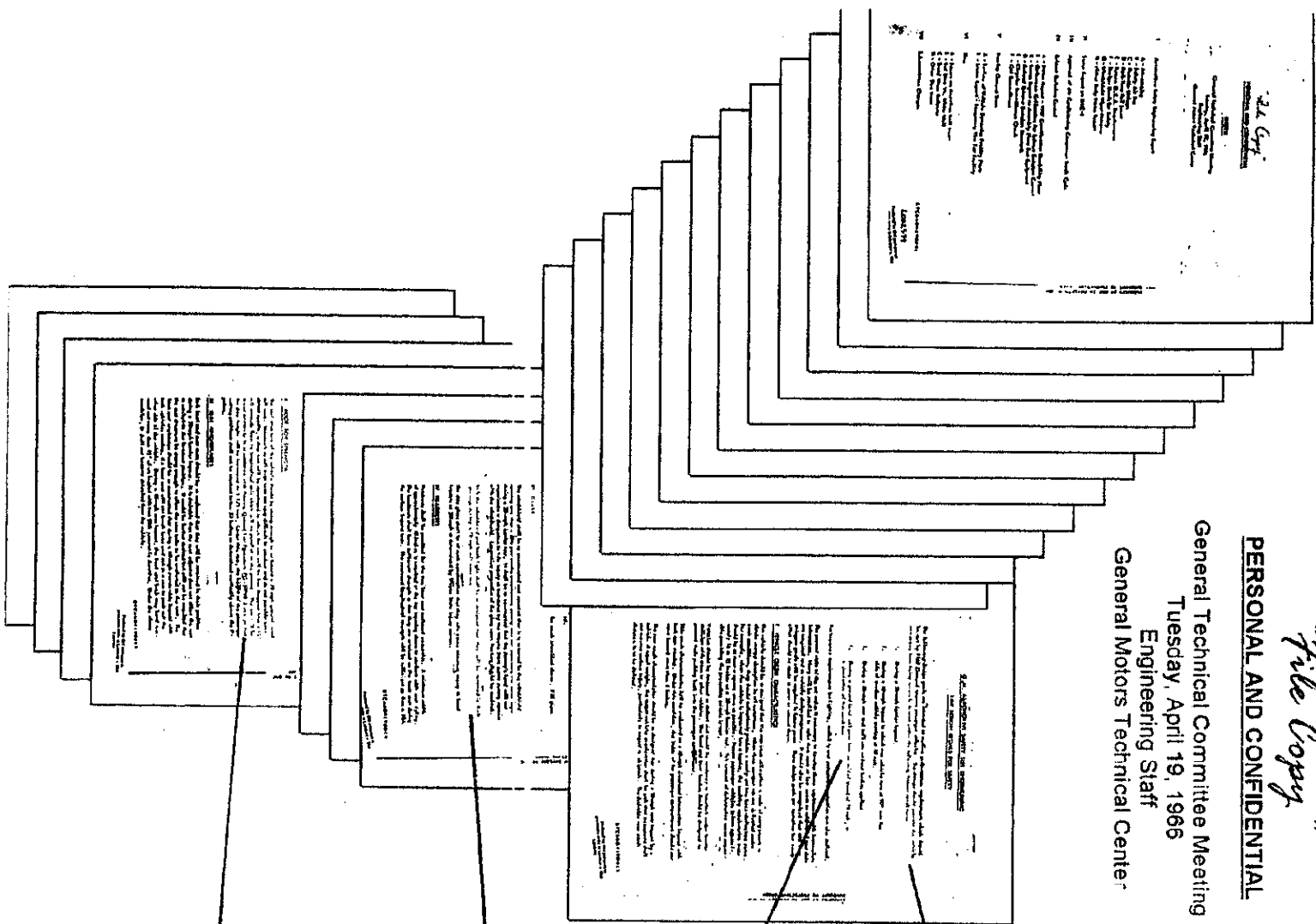
Page 2

Both the windshield and back light shall be so designed that they will be retained in their openings during a 70 mph roll over test.

X ROOF TOP STRENGTH

Page 5

The roof structure of the vehicle should be strong enough to withstand a 70-mph ground-level roll over. Inasmuch as roll over tests are very difficult to conduct and do not provide consistent results, a drop test will be developed in which the car will be free dropped from a 45° roll attitude from its longitudinal axis which will be parallel to the ground. The car will be tested primarily in accordance with Proving Ground Test Procedure PG-20960-2 except that the drop height will be increased to 5 1/2 feet.





General Motors Engineering Staff

General Motors Technical Center, Warren, Michigan 48090

Date: April 19, 1966
Subject: Design Goals for Safety
To: General Technical Committee

(Handwritten circled 'X')

Attached GM design goals for 1969 have been provided for the guidance of division and staff groups. Refinements are to be expected and comments will be appreciated. As indicated, the material was first distributed to General Motors groups on March 7.

Design goals for 1968 models are following the GSA proposed standards in detail. In addition, models that will carry over into 1969 should provide as many 1969 goals as possible. This will obviously avoid redesigning and retooling.

Louis C. Lundstrom jr
L. C. Lundstrom, Director
Automotive Safety Engineering

dg

attachment

- cc: J. M. Roche
- E. N. Cole
- E. D. Rollert
- H. G. Warner
- H. F. Barr
- GTC - Automotive Safety Subcommittee

Inter-Organization Letters Only

GTC660419.00000012

GTC660419.00000012

G.M. AUTOMOTIVE SAFETY TEST ENGINEERING

1969 DESIGN GOALS FOR SAFETY

The following design goals are intended to outline performance requirements which should be met by 1969 General Motors passenger vehicles. The design should prevent the vehicle occupants from being severely injured under the following impact conditions:

1. During a 30-mph barrier impact.
2. During a 40-mph impact in which one vehicle runs at 90° into the side of another vehicle moving at 40 mph.
3. During a 30-mph rear end collision without brakes applied.
4. During a ground level roll over from an initial speed of 70 mph, or a simulation of this condition.

Performance requirements for lighting, visibility and pedestrian protection are also defined.

The present state of the art makes it necessary to develop these requirements with incomplete information. Many will be modified to make them more or less severe as additional test data are acquired and as vehicle design progresses. It should also be recognized that still more stringent goals will be required in future years. These design goals are tentative but every effort should be made to meet or exceed them.

I VEHICLE CRUSH CHARACTERISTICS

The vehicle should be so designed that the maximum utilization is made of components to obtain energy absorption in all directions. When these components are deflected under crash conditions, they should collectively produce a nearly uniform force-deflection curve. For example, when the vehicle is impacted into a barrier, the resulting acceleration trace should be as near a square wave as possible. Present passenger vehicles deform approximately 18 to 25 inches on a 30-mph barrier test. This amount of deformation seems reasonable providing the preceding criteria is met.

Vehicles should be designed to deflect and avoid the tendency to interlock under frontal collision with trees or other vehicles. The hood and front fenders should be designed to prevent their pushing back into the passenger compartment.

Side crush characteristics will be evaluated on a 40-mph simulated intersection impact with both cars moving. Under this condition, the inside of the passenger compartment should not move inward more than 6 inches.

The rear crush characteristics should be so designed that during a 30-mph rear impact by a vehicle of equal weight, the target vehicle acceleration shall be such that occupants shall not receive serious injury, particularly in regard to whiplash. The desirable rear crush distance is to be defined.

GTC660419.00000013

GTC660419.00000013

percentile dummy during a simulated 10g rear impact will not have a rearward head deflection relative to his chest greater than 15°.

The rear surfaces and structure of the headrests shall conform to instrument panel impact specifications.

V INSTRUMENT PANEL

The general function of the instrument panel will be to provide a convenient location for all necessary controls and instruments while at the same time provide a safe target for passenger impact. This impact may be the head in the case of the belted passenger, or the torso in the case of the unbelted passenger. Vehicles should be designed to give maximum benefit to both belted and unbelted passengers. It is realized that the requirements of these two situations are not always compatible, however, every effort should be made to meet them. In order to properly accomplish its function, the instrument panel should have the following characteristics:

A. General

1. Should have no significant discontinuities, unyielding knobs, protruding trim, or other features that would produce head, eye, or facial trauma. Air conditioning outlets, ash trays, etc., are to be fail safe in any position.
2. Should not be constructed of any material that tends to shatter or splinter, producing sharp edges or load-concentrating areas.

B. Head Contact Area - Restrained & Unrestrained

1. Construction over the entire width of the panel shall be such that a 15 pound, 6.5-inch diameter sphere will be subjected to less than 80g deceleration from a speed of 30-mph. This will require a crush distance of 4.5 inches assuming a constant force collapse. Because of probable deviations from this ideal condition, 6 to 8 inches of crush distance should be provided.
2. The upper and forward surface should be covered with a glare-free, load distributing pad.

C. Lower Portion - Knee Contact Area

1. Construction over the entire width of the panel shall be such that a 40 pound, 3-inch diameter sphere will be subjected to less than 30g deceleration from a speed of 15 mph. This will require a crush distance of 3 inches assuming a constant force collapse. Because of probable deviations from this ideal case, 5 to 6 inches of crush distance should be provided.

VI INTERIOR PADDING

Interior padding must be provided on all objects that might produce injury if struck by the head. This includes door posts, headers, roof rails, sun visor mounts, front seat backs, light fixtures, roof, window openings. Since blows to these objects are likely to be glancing hits and since several inches of padding are usually impractical, the following generalization seems appropriate: Any interior surface likely to be struck by an occupant's head, except the instrument panel and front seat back, shall be covered with a minimum of 1/2-inch-thick effective load-distributing material. The primary purpose of this material is to distribute the load to a substantial area of the skull. This material should be of optimum density to accomplish its purpose.

Other items of interior hardware such as arm rests, window controls, door handles, door locking knobs, etc., must be designed so that they are either incapable of producing injury or are protected by adequate padding.

VII LIGHTING

All requirements of the following SAE Standard Procedures or their latest revisions shall be complied with:

Headlights	J-579	or modified for tumpike beam.
Tail Lights	J-585	
Brake Lamps	J-586	
Turn Signals	J-588	
Backup Lights	J-593a	

In addition, the following comments apply:

- A. Design considerations should be given to a reduction in the accumulation of ice, mud, and snow that obscure vehicle lights.
- B. Rear lights should not be continuous across the car as depth perception is reduced. The rear lights should be as close to the extremity of the car as practical and should be visible from the side of the car.
- C. Front turn indicators should be separated from the head lamps far enough to prevent them from being lost in the glare.
- D. Front and rear located side markers should define at least 80% of the length of the vehicle.
- E. Front and rear marker lights mounted on the roof are to be developed.

GTC660419.00000016

GTC660419.00000016

VIII LOCKS AND HINGES

Strength requirements for locks and hinges are made on the basis that each hinge individually should be as strong as the lock. The minimum design strength requirements are as follows: 5000 pounds longitudinal (into lock) with the additional requirement that the door latch shall be strong enough to contain a 1500-pound longitudinal load at the secondary location position. Transverse strength requirements are 2000 pounds outward with the additional requirement that the lock hold 1000 pounds outward in the secondary position. This requirement exceeds the suggested SAE J-339b recommended practice. Inertial requirement of parts should be so that a 30g acceleration in any direction will not unlatch the lock. Any deflection of the door panel should not actuate the latch mechanism.

IX PEDESTRIAN CONSIDERATIONS

The front of the vehicle must be designed to minimize injury to those pedestrians that it may strike. It should be designed to deflect pedestrians to the side rather than to the center of the car. It should present a relatively smooth face, particularly in the bumper, grille, and headlight areas. Headlight eyelids must be eliminated as must sharp vertical or horizontal edges.

Exterior ornamentation in the bumper area in front of the fender and in front of the hood should be so designed as to not present sharp points or sharp edges from either front or rear. Exterior moulding should be so designed as to eliminate sharp edges and points which can tear skin. There should be no ragged or raw edges on bumper bars, grille bars, or accessory equipment. All ornamentation, moulding, grille bars, bumper bars, etc., must have sufficient clearance to adjacent members and be of such contour as to not catch fingers and clothing. In essence, the front of the vehicle which is most likely to strike a walking pedestrian will be blunt.

X ROOF TOP STRENGTH

The roof structure of the vehicle should be strong enough to withstand a 70-mph ground-level roll over. Inasmuch as roll over tests are very difficult to conduct and do not provide consistent results, a drop test will be developed in which the car will be free dropped from a 45° roll attitude from its longitudinal axis which will be parallel to the ground. The car will be tested primarily in accordance with Proving Ground Test Procedure PG-20960-2 except that the drop height will be increased to 5-1/2 feet. Under this test, the height of the passenger seating positions shall not be crushed below 33 inches as determined vertically above the P-points.

XI SEAT ANCHORAGES

Both front and rear seats should be so anchored that they will be retained in their position during a 30-mph barrier impact. It is desirable that the seat adjuster does not allow the seat to ratchet to the foremost position. It would be further desired but will not be required that the seat structure be strong enough to allow the seat belts to be anchored to the seat. The front seat anchorage should be so constructed that during a 40-mph car-to-side impact with both vehicles moving, the front seat will not break loose and act as a ram to push out the other side of the vehicle. During a 40-mph rear impact, the front seat back may bend rearward not more than 45° when loaded with two 50th percentile dummies. Under the above condition, it shall not become detached from the vehicle.

The front seat back should act as a barrier to prevent unrestrained rear seat occupants from causing added injuries to the front seat occupants. On a 30-mph barrier impact test, the front seat back should provide an effective barrier for three rear passengers.

XII STEERING SYSTEM

The steering system will be of conventional steering wheel-column design. This steering system will be designed to provide the maximum amount of protection to the driver and the minimum hazard to all vehicle occupants. Auxiliary controls mounted on the column, such as gear selector, turn indicators, etc., shall be designed to minimize the possibility of injury to occupants. Consideration should be given to mounting all such controls on the left side of the column and to provide break-away or other non-injurious mounts. In addition, the column and wheel should have the following characteristics:

A. Column

1. Shall not penetrate the passenger compartment more than 1 inch during a 30-mph barrier impact.
2. Shall collapse axially at a load of 200 pounds for the first 1/4 inch; less than 50 pounds for the next 1/2 inch; and 1000 pounds for the next 9 inches.
3. The axially moving parts (including steering wheel) above the energy-absorbing section shall not weigh more than 18 pounds.

B. Wheel

1. Shall have a crushable pad protecting the hub.
 - (a) Having at least 30 square inches' area, preferably circular.
 - (b) Having a constant 1000 pounds crushing force for a distance of 3 inches.
2. The rim facing the driver shall present a nearly flat surface of not less than 3/4-inch width.
3. Any portion of the rim shall collapse with less than 200 pounds' force.

The requirements under A-2 above are indicated by a computer analysis of the E.A. steering column and are intended to optimize its performance.

GTC660419.00000018

GTC660419.00000018

GM CONFIDENTIAL

PRELIMINARY

SAFETY ITEM USAGE

1966 - 1968 GENERAL MOTORS PASSENGER CARS

SAFETY ITEM	GSA Std. No.		1966 Usage		1967 Usage		1968 Usage	
	1967	1968	Std.	Opt.	Std.	Opt.	Std.	Opt.
BODY - INTERIOR								
Seat Belt Anchorages (6-Pelvic)	515/1	515/1a	X	-	X	-	Xa	-
Seat Belts (2 Frt., 2 Rear, Pelvic)	None	None	S	-	S	-	S	-
Shoulder Belt Anchorages (2 Frt.)	515/1	515/1a	X	-	X	-	Xa	-
Shoulder Belt Anchorages (2 Rear)	None	515/1a	-	-	-	-	Xa	-
Shoulder Belts (2 Frt.)	None	None	-	S	-	S	-	S
Shoulder Belts (2 Rear)	None	None	-	-	-	-	-	S
Padded Instrument Panels	515/2	515/2a	X	-	X	-	Xa	-
Padded Sun Visors	515/2	515/2a	X	-	X	-	Xa	-
Energy-Absorbing Forward Compartment	None	515/2a	-	-	-	-	Xa	-
Recessed Instruments and Instrument Panel Controls	515/3	515/3a	X	-	X	-	Xa	-
Safety Door Hinges	515/5	515/5a	X	-	X	-	Xa	-
Safety Door Latches	515/5	515/5a	X	-	X	-	Xa	-
Safety Door Locks - Inside Frt. & Rear Free-Wheel n.	None	515/5a	Rr.	-	F&R	-	Xa	-
Seat Anchorages (Strength Requirements)	515/6	515/6a	X	-	X	-	Xa	-
Seatback Locks (Folding Seats)	None	515/6a	-	-	X	-	Xa	-
Glare Reduction - Instrument Panel Top	515/13	515/13a	X	-	X	-	Xa	-
Glare Reduction - Instrument and Controls	515/13	515/13a	X	-	X	-	Xa	-
Inside Rearview Mirror (Safety Mtg.)	None	515/17a	-	-	-	-	Xa	-
Inside Rearview Mirror (Shatterproof)	None	None	S	-	S	-	S	-
Recessed Window and Door Controls (Interior)	None	515/18	-	-	-	-	X	-
Ash Tray and Lighter Protection - Front and Rear	None	515/19	-	-	-	-	X	-
Armrest Protection - Front and Rear	None	515/20	-	-	-	-	X	-
Seatback Padding (Forward Facing Seats)	None	515/21	-	-	-	-	X	-
Headrests - Front Seats	None	515/22	-	X	-	X	-	X
Rear Window Defogger	None	515/24	-	X	-	X	-	X
Roll Bars (Open Light Trucks Only)	None	515/25	-	-	-	-	X	-
BODY - EXTERIOR								
Safety Glass (ASA Z 26.1)	515/8	515/8	X	-	X	-	X	-
Dual Speed Windshield Wipers and Washers	515/12	515/12a	X	-	X	-	Xa	-
Glare Reduction - Windshield Wipers	515/13	515/13a	X	-	X	-	Xa	-
Outside Left Hand Rearview Mirror	515/17	515/17a	X	-	X	-	Xa	-
CHASSIS - INTERIOR								
Energy-Absorbing Steering Control System	515/4	515/4a	X	-	X	-	Xa	-
Dual Master Cylinder Brake System	515/9	515/9a	-	-	X	-	Xa	-
Dual Master Cylinder Warning Light	519/9	515/9a	-	-	X	-	Xa	-
Standard Gearshift Quadrant	515/11	515/11	X	-	X	-	X	-
Fuel Tank and Filler Pipe Security	None	515/26	-	-	-	-	X	-
Speed-Warning Device	None	None	-	S	S	-	S	-
Fire-Resistant Wiring Harness	None	None	S	-	S	-	S	-
CHASSIS - EXTERIOR								
Four-Way Emergency Flasher	515/7	515/7	-	X	X	-	X	-
Standard Bumper Heights	515/10	515/10	X	-	X	-	X	-
Exhaust Emission Control	515/14	515/14a	-	Cal.	-	X	Xa	-
Tires and Safety Rims (T&RA Std.)	515/15	515/15	X	-	X	-	X	-
Backup Lights	515/16	515/16	X	-	X	-	X	-
Side Marker Lights	None	515/23	-	-	-	-	X	-
Corrosion-Resistant Brake Lines	None	None	S	-	S	-	S	-
Rayon Braid Brake Hose	None	None	S	-	S	-	S	-
NOTE: X Indicates standard or optional usage of item complying with original GSA Standard. Xa Indicates standard or optional usage of item complying with revised GSA Standard. S Indicates standard or optional usage of special safety item which is not required by GSA Standards.								

GTC660419.00000020

GTC660419.00000020