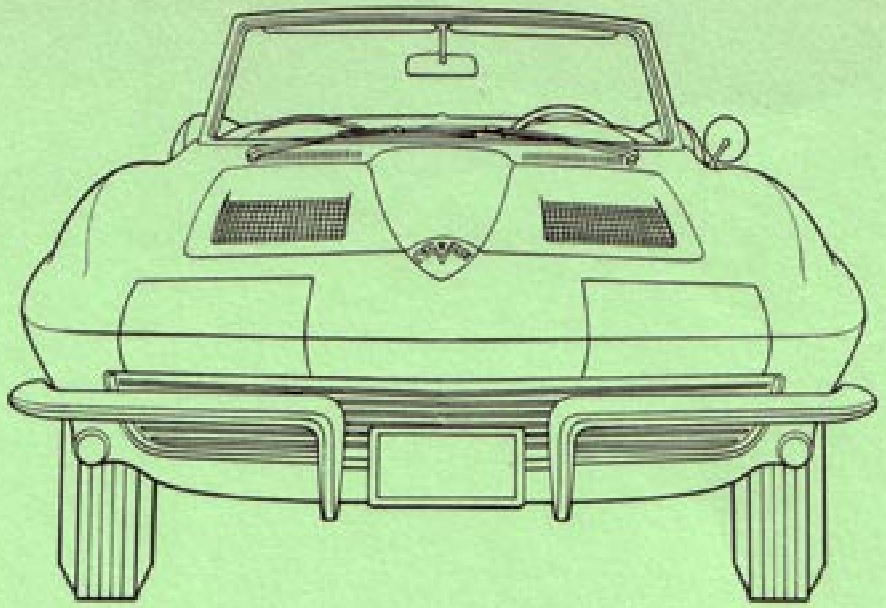

CORVETTE NEWS SUPPLEMENT

to Volume 6, Number 3

THE 1963 CORVETTE STING RAY BY CHEVROLET

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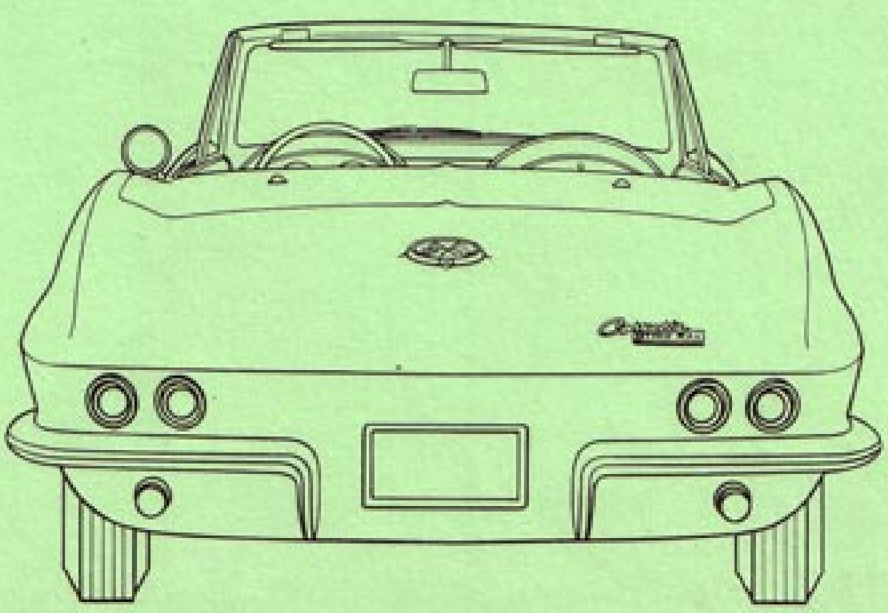
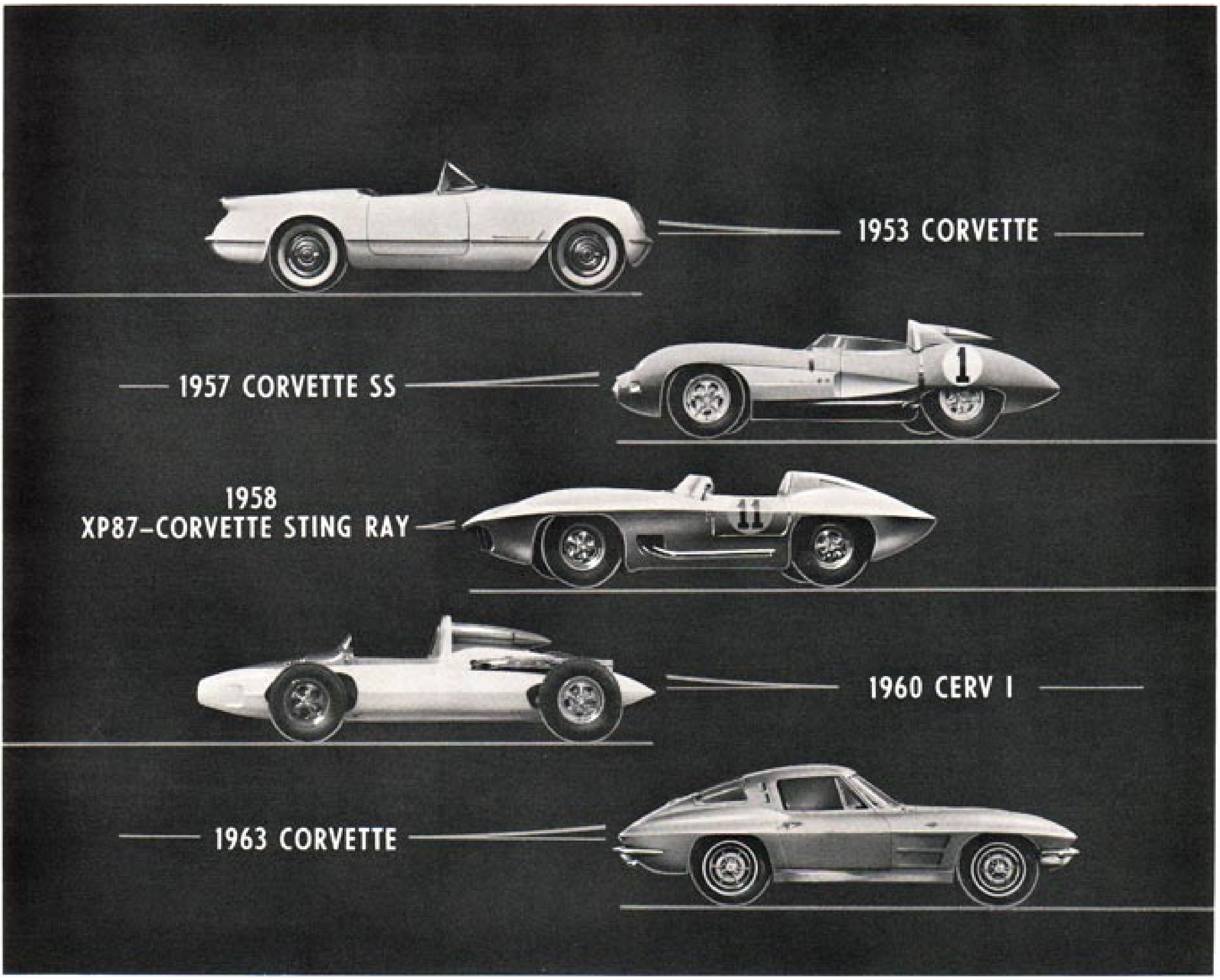
As presented to the 1963 SAE INTERNATIONAL CONGRESS AND EXPOSITION OF AUTOMOTIVE ENGINEERS, Cobo Hall, Detroit, Mich., January 14-18, 1963





CONCEPT

SYNTHESIZING THE CONCEPT

The Chevrolet Corvette was introduced in the fall of 1953. The first cars were moderately powered, had a conventional chassis and somewhat cumbersome weather protection, and were equipped with an automatic transmission.

In the decade that has followed the Corvette has emerged as a true sports car with a 250 to 360 horsepower engine availability spread, a chassis that is at home on the street or in competition, and a synchronized 4-speed manual transmission in three quarters of the Corvettes purchased in recent years.

In the last few years Corvette demand has exceeded supply; so from the standpoint of popularity an entirely new vehicle was not necessary. Nevertheless, we felt that the original design no longer represented our best engineering so plans for a change were initiated in 1959.

In the meantime we had accumulated considerable experience with special vehicles. In 1957 the Corvette SS was designed with a DeDion rear suspension and a weight to power ratio of 5.8 lb/hp.

The experimental XP87 Corvette Sting Ray of 1958 was styled by William L. Mitchell, GM vice-president in charge of styling. Built on a Corvette SS chassis, this vehicle introduced body features that would be adopted in the 1963 Sting Ray. The CERV I of 1960 had an independent rear suspension and a weight to power ratio of 4.2 lb/hp, and this was subsequently improved to 3.9 lb/hp. So we knew that we could design a future Corvette with vastly improved performance, handling stability, and ride comfort.

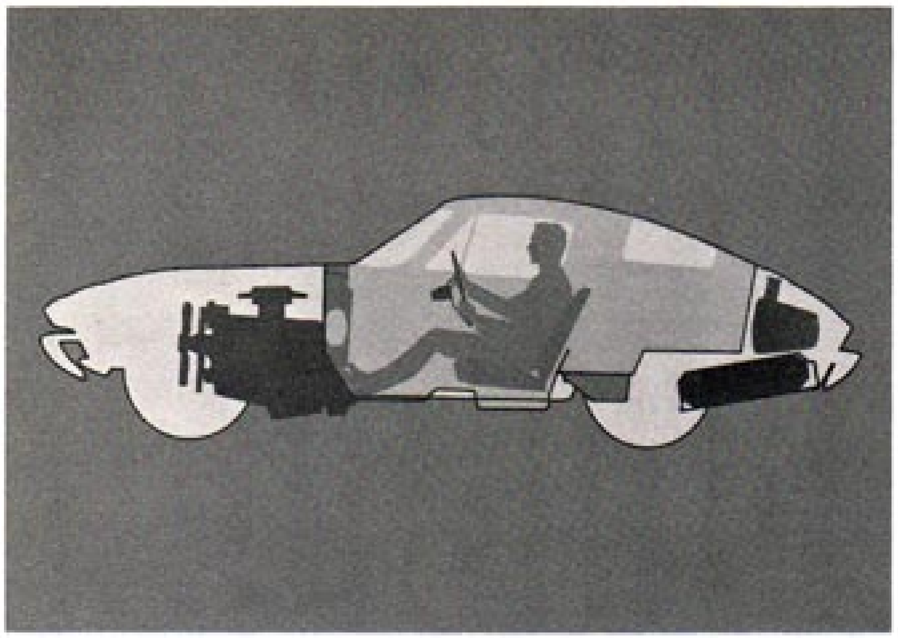


Figure 1. Body space apportionment.

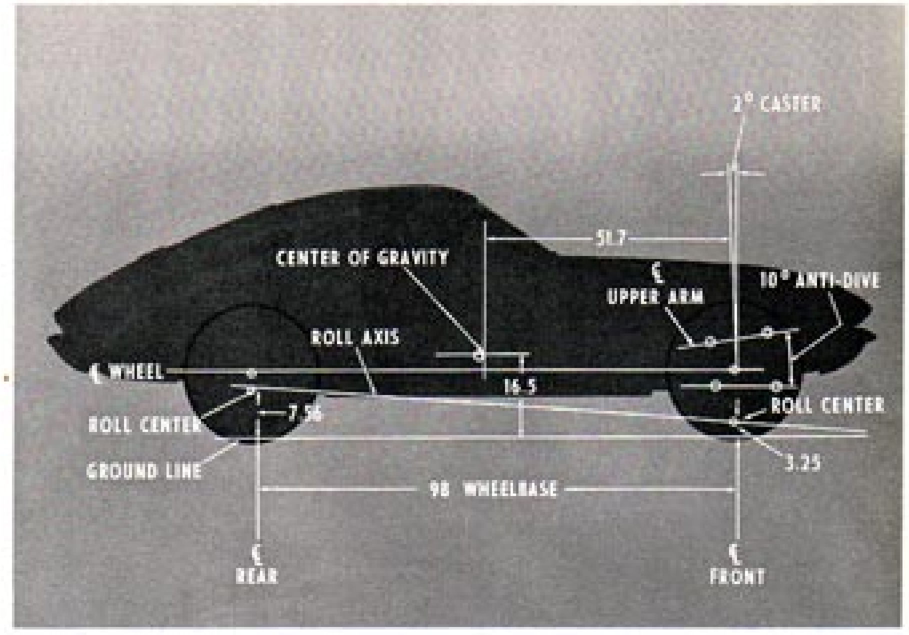


Figure 2. Suspension geometry.

Shortening of the wheelbase on the 1963 Corvette by 4 inches placed the vehicle's major components and center of gravity in a more rearward position than in 1962.

We synthesized all that had been learned, separated essentials from incidentals, and went about the search for the means to render the desired mechanical functions economically feasible.

A cardinal attribute of a successful product is its ability to offer full value for the money. Broadly speaking, automobile value is represented by transportation utility, driving pleasure, and pride of ownership.

Transportation utility of a 2-passenger automobile is curtailed, and so it follows that a car of this type has to excel on the other counts. With this in mind the broad specification for the 1963 Corvette was established:

> A vehicle that will provide luxurious transportation for two and an exceptionally high level of performance, stability, and safety, with a high emotional appeal.

That this was a tall order became clear with the realization that a vehicle of such characteristics could not be achieved by merely rearranging passenger car components already available. Yet designing elaborate new components for a low volume vehicle, such as the Corvette, posed an ominous threat to costs. Any intentions of introducing engineering frills had to be discarded in favor of a firm concept target - maximum improvement for minimum expenditure.

SPACE AND MASS ENGINEERING

Chevrolet's most efficient engine in terms of power per pound and power per cubic inch of displacement is the 327 cu. in. Corvette engine. Therefore, this engine was carried over for 1963 in the traditional front engine with transmission and rear drive design. This component arrangement combined shortest wheelbase with lowest cost, because all engine - transmission combinations were carry-over and did not entail an increase in cost.

Important factors ruled out alternate designs:

> A rear engine of the weight of the 327 would have had to go ahead of the rear axle and this would have increased the wheelbase and introduced a costly power train.
>
> A front engine and rear transaxle combination would not have produced perceivable improvement, but would have meant a significant cost increase.

A frame-mounted differential design, which would remove the effects of transverse torque on the wheels and improve the sprung to unsprung weight ratio, together with an independent rear suspension were essential to realization of the optimum in ride and handling characteristics. This high cost design was unanimously regarded as necessary to attainment of the desired results, and the engineering problem was narrowed to achievement of the desired function at the lowest cost.

Getting good handling and performance in a car is simplified if vehicle masses are so disposed that the suspension and steering improve the effect of mass disposition rather than compensate for basic inequities. It is desirable for vehicles with a high power to weight ratio to have a weight distribution in the range of 47% front - 53% rear to 40% front - 60% rear. This distribution assists traction and braking and reduces steering effort.

To achieve a distribution in this range, the passenger compartment was placed as far back as possible and the engine centerline was offset one inch to the right, taking advantage of the fact that passenger foot room requirements are less than those of the driver. This offset also reduced the width of the driveshaft tunnel, because the crankshaft and offset rear axle pinion were now on the same centerline. The engine and transmission were placed as low as compatible with safe ground clearance, and as far back as possible without reducing footroom comfort (Fig. 1). The spare tire was moved to a compartment accessible from the outside and the fuel tank set above the spare tire. Luggage storage space was increased by using the area behind the seats in the new closed body design instead of a trunk as in former models. As a result of these various changes, the new design weight distribution is 47% front and 53% rear, compared to 51% front and 49% rear on the 1962 Corvette. The height of C.G. above the ground is 16.5 inches versus 19.8 inches on the previous model (Fig. 2).

The new wheelbase of 98 inches, four inches shorter than the previous Corvette, was accomplished with occupant comfort being enhanced rather than impaired (Fig. 3). A track of nominally 56 inches front and 57 inches rear was chosen, which was a reduction of one inch in front and two inches in the rear as compared to the former dimensions.

The task of attaining a good ride and handling combination is lessened as the C.G. is lowered. Therefore, the ground clearance line was set at five inches and all major masses were placed as close to this line as possible. The frame and underbody went on the groundline, and the occupants were placed within the frame rather than on top of it as before.

Lowering the C.G. caused some problems. For instance, the exhaust system and frame were occupying the same space. This problem was solved by routing the exhaust pipes through special passages in the frame without loss of torsional rigidity or beaming strength of the frame members.

Large volume, regular passenger car parts were used for the front suspension and brakes. The resultant increase in brake size was most welcome to keep pace with improved performance. Rearrangement of passenger car front suspension components made possible the attainment of desired wheel motion geometry without having to use special parts.

An important factor in Chevrolet's ability to offer the 1963 Corvette at the same price as its predecessor is the cost reduction derived from usage of current front suspension passenger car parts in place of the limited production parts of the previous Corvette.

The new Corvette retains its successful plastic body with separate frame design. The original decision made in the early Fifties to use a fiberglass body was based on good economics. Production of an estimated number of units was set as the break even point between plastics and steel, with steel becoming more economical as production increases. Even though the new design is expected to surpass the estimated production mark by a wide margin, as have other Corvettes in the past, the excellent durability characteristics of fiberglass, continuing customer satisfaction and high resale value prompted the decision to stay with fiberglass with the new Corvette.

Although the responsibilities of the engineering and styling groups in an organization are strictly divided, concern with the future product leads to meetings of the minds between the two, and engenders some cross-fertilization of ideas.

The final design compromise produced a body that is both aerodynamically sound and aesthetically pleasing, thus appealing to both the performance-conscious and styling-conscious individual.

	1962	1963	
		CONV.	SPORT CPE.
LENGTH	176.7	175.3	
WIDTH	70.4	69.6	
HEIGHT	52.9	49.8	
WHEELBASE	102.0	98.0	
TREAD, FRONT	57.0	56.3	
TREAD, REAR	59.0	57.0	
OVERHANG, FRONT	31.8	32.0	
OVERHANG, REAR	42.9	45.3	
APPROACH ANGLE	21° 18'	26° 39'	
DEPARTURE ANGLE	21° 10'	17° 21'	
GROUND CLEARANCE (MIN.)	6.7	5.0	
HEAD ROOM	35.8	38.1	37.0
ENTRANCE ROOM	30.8	29.8	31.0
LUGGAGE SPACE (CU.FT.)	5.2	8.4	10.5

Figure 3. Dimensions, 1962 and 1963 Corvette.

The 1963 Corvette showed a moderate weight reduction compared to previous models. However, it must be realized that several additions were made to the vehicle. For instance: the exhaust system has thicker walls for durability; the new retractable headlights are heavier than the former conventional design; the new 20 gallon tank is heavier than the old 16 gallon tank; the 1963 brakes are bigger and body reinforcement added weight to the new Corvette design. Torsional stiffness of 1963 convertible is 10% above its 1962 counterpart, and the sport coupe is 90% stiffer than the 1962 convertible. Considering that we added quality, durability, and stiffness and saved some weight, we felt satisfied.

SUSPENSION FUNDAMENTALS

The broad objective of the new vehicle suspension design was the acquisition of the best possible balance of handling and ride and maximum tire adhesion. In the conventional ball-joint front suspension, which has understeer characteristics, the roll center was raised from near the ground to an uncommon height of 3.25 inches above the ground by lowering the inner pivots of the upper control arms. This causes considerable camber change during vertical movement of the wheels (Fig. 4). The advantages of this arrangement are higher resistance to roll for a given ride rate, and lower increase of positive camber; that is, lower loss of cornering power. The changes in lateral forces associated with changes in camber during vertical motion of the wheel are compensated for by appropriate toe changes during the same motion.

Such an arrangement is more sensitive to correct wheel alignment and under unfavorable conditions more wheel fight prone than a conventional arrangement, but improvement in ride and handling and steering response were deemed to be well worth the extra care.

As stated previously, the main objectives of the new independent rear suspension were the removal of the negative effect of transverse torque, an increase of the sprung to unsprung weight ratio and a concomitant improvement of ride. From the multitude of possible arrangements which would achieve the desired results, we arrived at the one which gave us complete freedom in the choice of wheel motions and accomplished the desired function with a minimum number of parts.

It can also be seen in Figure 4 that the rear roll center is 7.56 inches, being lower than the rear roll center in 1962. The vertical motion of the rear wheel is influenced more by camber change than in the front.

A solid rear axle design creates a transverse torque in the manner depicted schematically in Fig. 5. A load transfer between the wheels occurs in a conventional rear axle design that can negatively affect handling characteristics. As indicated, in the first gear maximum torque period the static weight load of 750 pounds per wheel changes to 583 pounds in the right wheel, and in the left wheel to 917 pounds. If we decrease the weight to power ratio this load

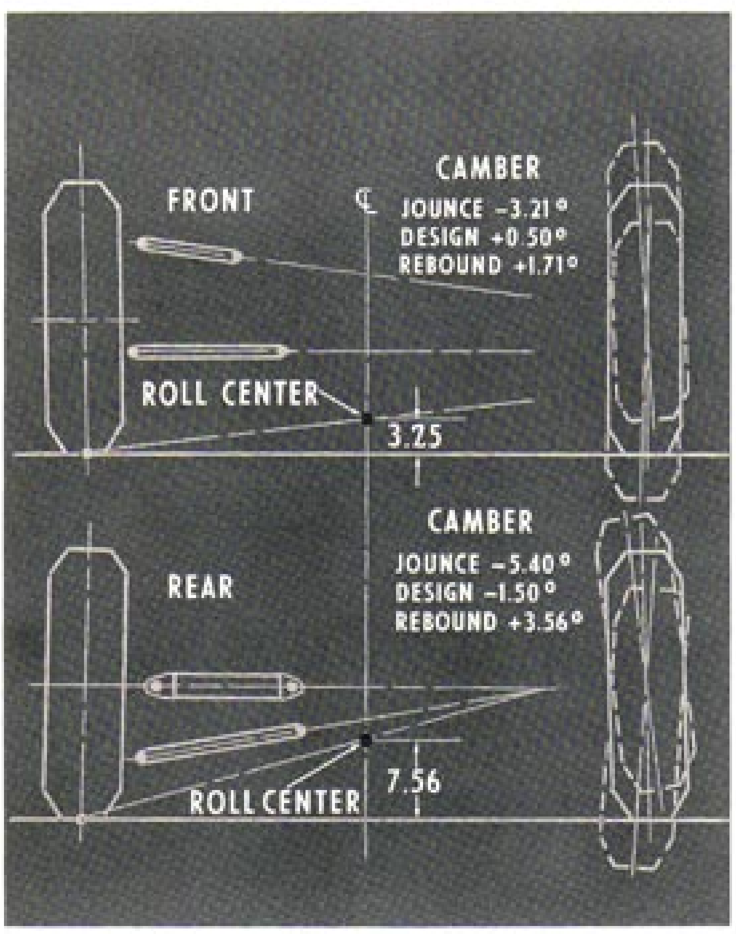


Figure 4. Camber change with vertical movement.

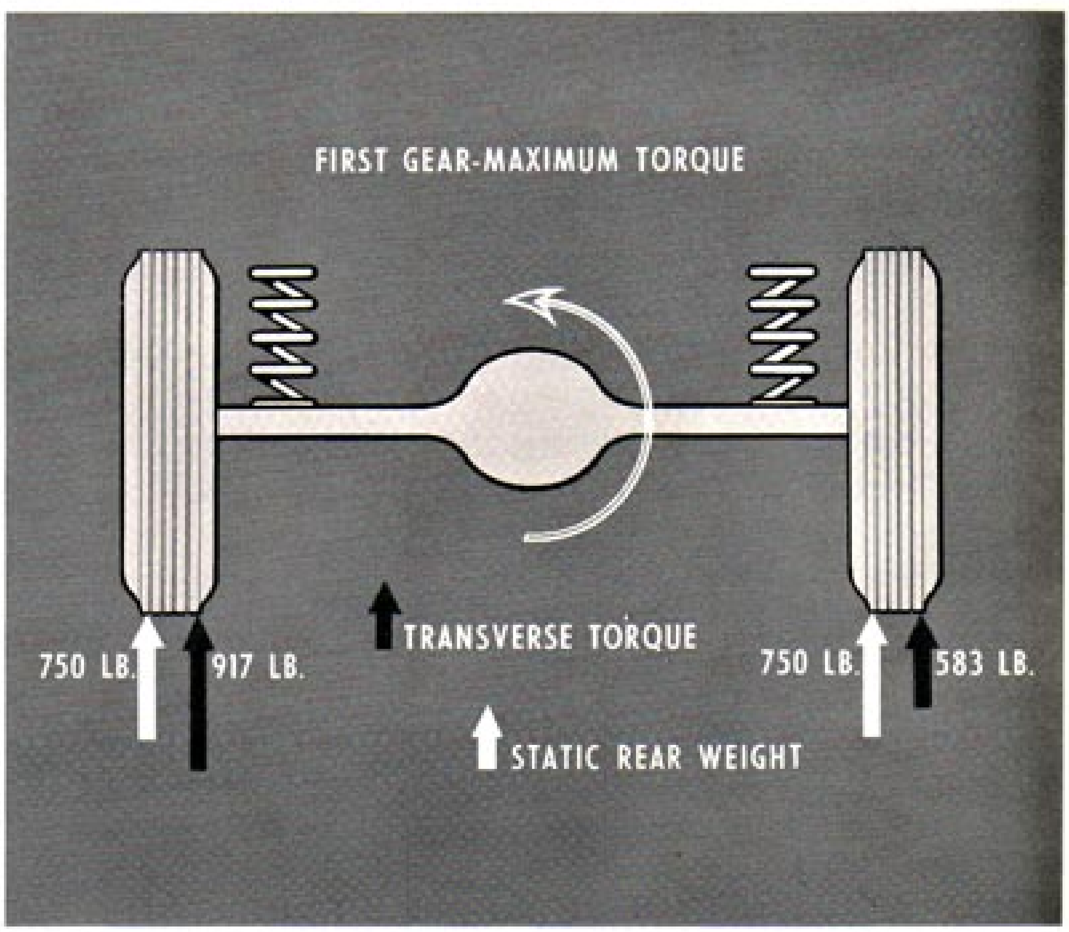


Figure 5. Transverse torque of conventional axle.

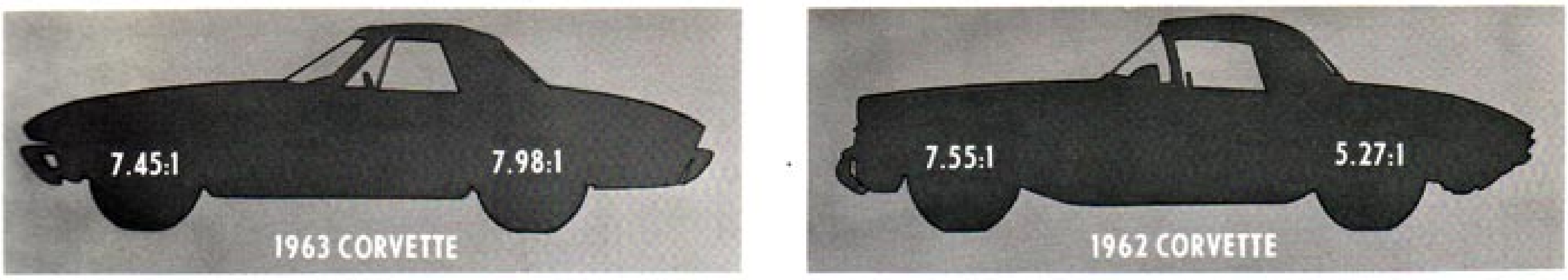


Figure 6. Sprung weight ratios.

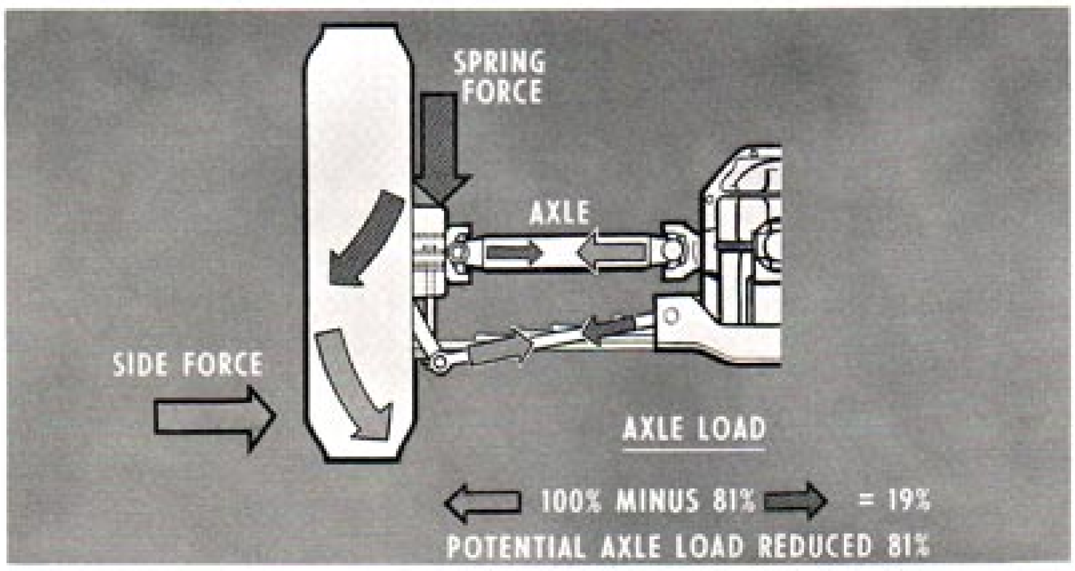


Figure 7. Load on rear axle shaft under side force.

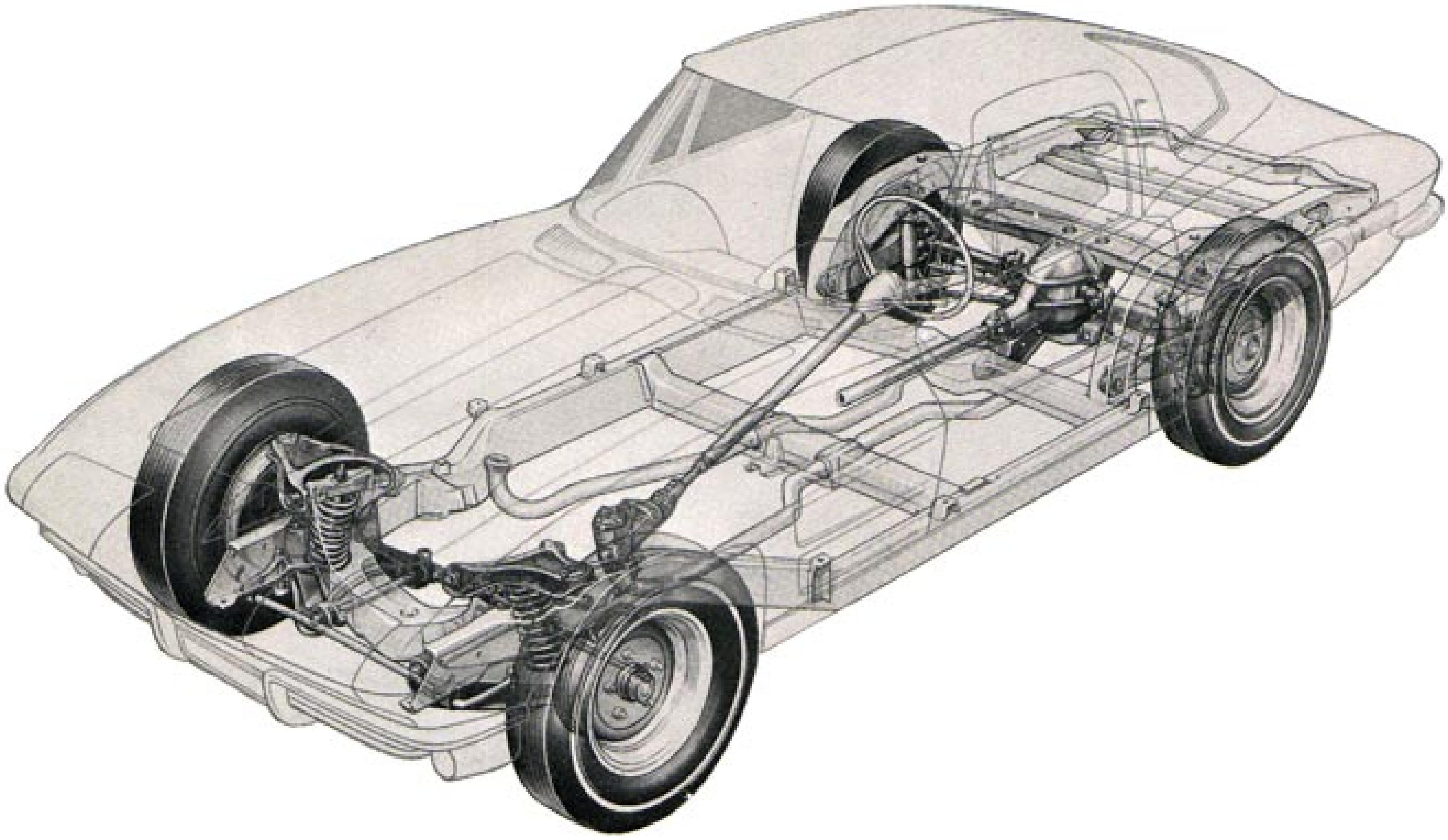
transfer will play an increasingly important part.

With a conventional differential on a straightaway acceleration, no excessive ill effect occurs. However, transverse torque may break traction in one tire causing a slight fish-tailing reaction. A more pronounced effect would occur during a left hand turn, where centrifugal force would accentuate it. The weight shift during a right hand turn could reduce the torque moment to zero. Naturally the less torque load transfer the better the traction and vehicle stability. The Corvette independent rear suspension and frame-fixed differential virtually eliminates transverse torque. The benefit of better tire adhesion is accrued because axle tramp is not possible with only one wheel being disturbed at a time, and the entire sprung mass serves as a base for the suspension spring to keep the wheel in contact with the ground.

Comfort, the second reason for a fixed differential design, has been improved by an increase in the sprung to unsprung weight ratio. Figure 6 shows the decided sprung weight increase in the rear of the '63 Corvette. This means a reduction in the magnitude of an impact passing through the rear suspension to occupants. This is an important advantage in a sports car such as the Corvette, because the driver sits closer to the rear axle than he would in a regular car.

The use of an axle shaft as a control arm eliminates the necessity of sliding splines. This is not only a lower cost solution, but is a functionally better one, since no lock-up of splines, with a consequent suspension members fight, can occur. The cornering loads in the drive shaft are kept low by the choice of attachment points of the control rod and suspension spring. The schematic drawing in Figure 7 represents one side of the suspension and shows the forces that occur and what happens to them. Side forces turn in the bottom of the wheel placing the lower torque rod in compression and the axle receives a tension load. The weight of the vehicle imposes a spring force that tends to turn the bottom of the wheel outward. This causes an opposite loading in both members which partially cancels side force. The result is a considerable reduction in the potential axle load.

To summarize, the design objectives that brought about the new Corvette concept were fundamental. They called for an appealing body design that would also reduce frontal area and lower aerodynamic drag. The design objectives also made imperative the integration of vehicle safety, comfort, handling, performance and a stabilized price tag - all in an American sports car that would bring more pleasure to the process of driving. The details of how these objectives were accomplished are presented in the following two sections of this paper, on the body and chassis.



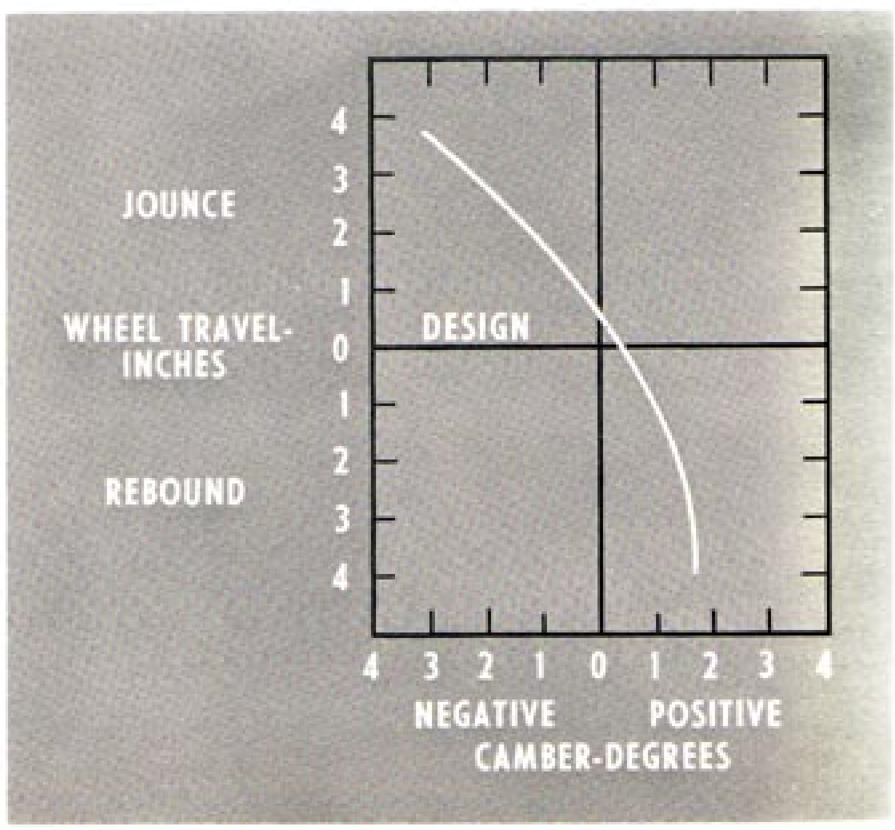
CHASSIS

The ride and handling qualities of this new Corvette are excellent.

Because of the nearly equal weight distribution on the front and rear wheels, it was possible to obtain a balanced ride by adjusting front and rear spring rates without any adverse effect to the handling. Consequently, the shock absorbers were valved for wheel damping only, without having to compromise for ride balance. This gave the vehicle an uncompromisingly flat, controlled ride. Another significant contribution to the ride was the reduction of the unsprung weight - 11 pounds on the front suspension and 89 pounds on the rear suspension - without increasing the overall vehicle weight. This reduction in unsprung weight was obtained by using a ball joint front suspension and a radically new independent rear suspension.

A great deal of attention was paid to isolation, both from the road and from the power train. Front suspension upper and lower control arm inner pivots have rubber bushings to act as an effective barrier to road noise and to reduce front impact feel. At the rear, rubber is used at eight locations at the suspension links. It is also used at both ends of the shock absorbers at either end of the rear spring link and between the spring leaves. The nose of the differential carrier is attached to the frame through large rubber pucks on both the compression and rebound side. The complete rear suspension including the differential carrier, is attached to the differential carrier cross-member, which in turn, is bolted

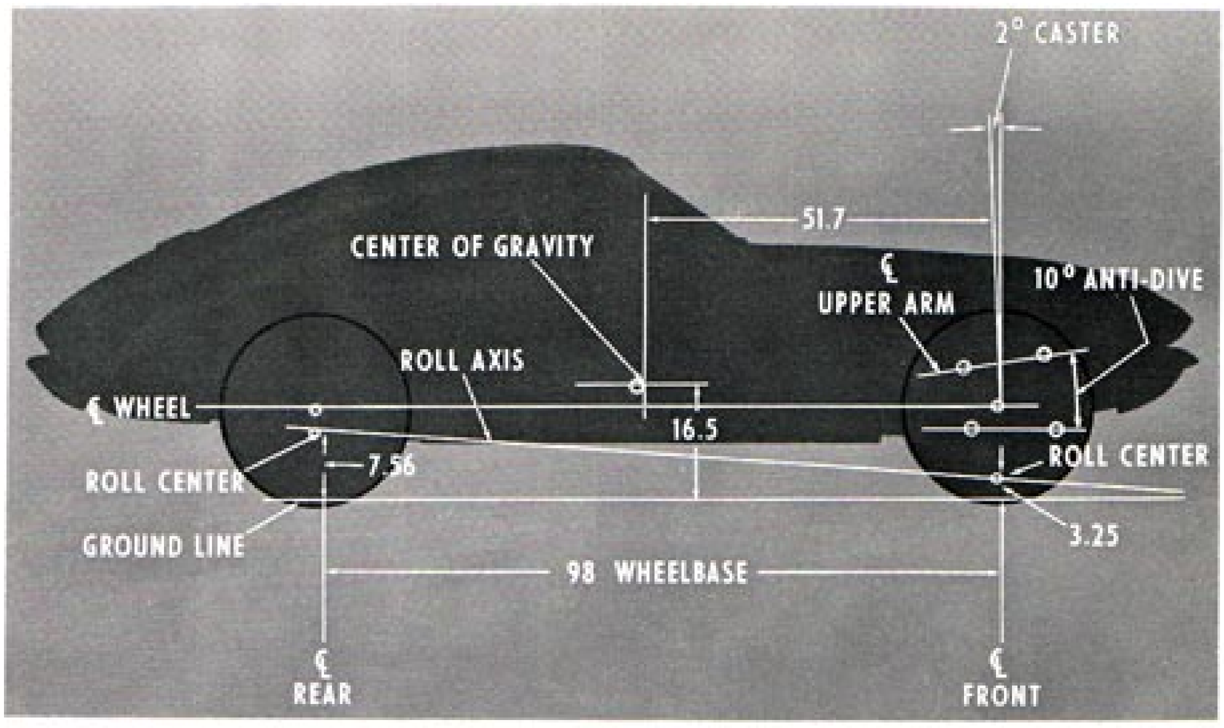
FRONT WHEEL GEOMETRY CURVES



to the frame through huge rubber isolation mounts.

This careful attention to detail produced a smooth riding, quiet automobile without any sacrifice to the handling.

There are many definitions of what a sports car is. But on one point all agree - a sports car must have superior handling. Good handling characteristics cannot be "tacked-on" by the suspension engineer, but must be considered in the basic package design.

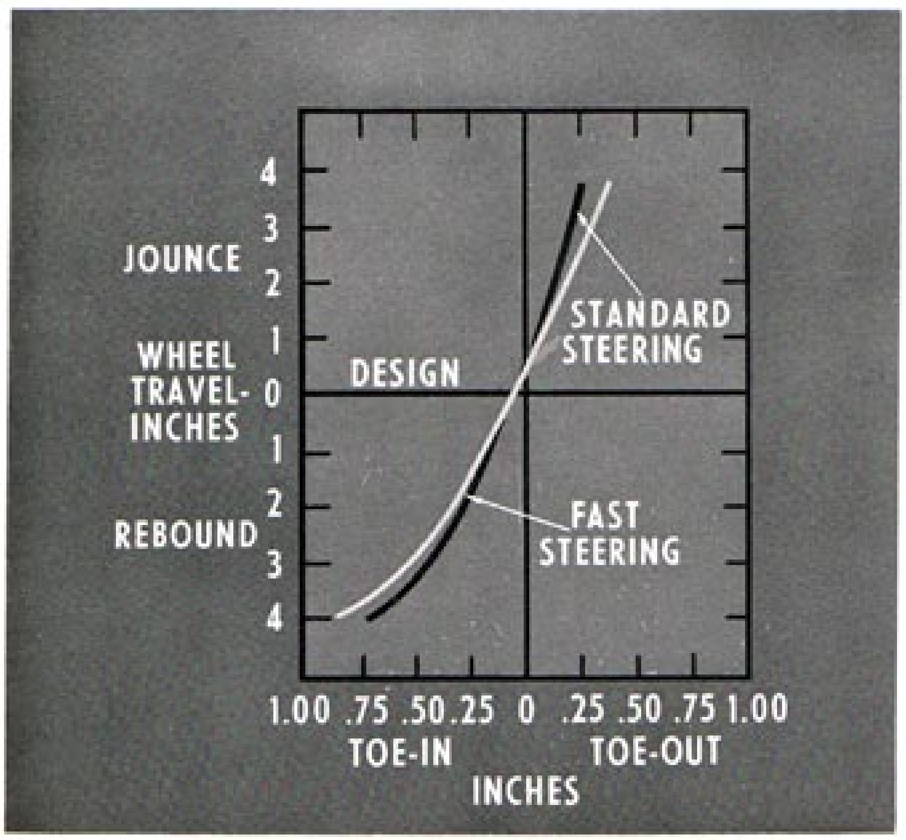


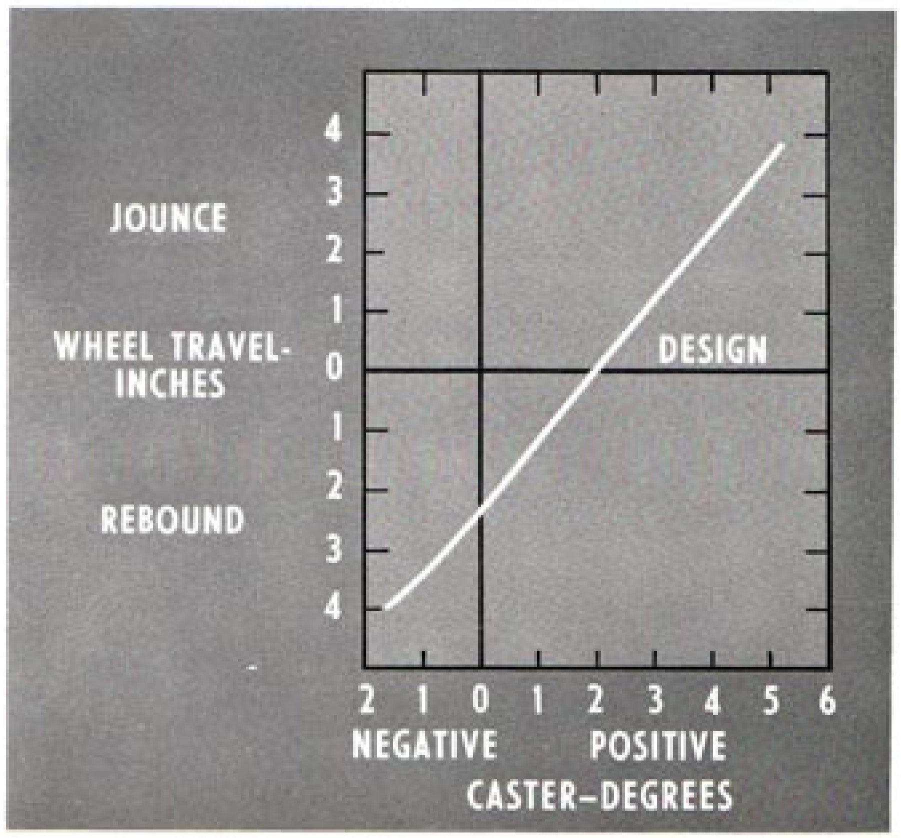
The C.G. was lowered to 16.5" through a lower silhouette, obtained by frame design and a frame-mounted differential carrier. The front suspension roll center was raised to 3.25" and the rear suspension roll center was lowered to 7.56". The result was a roll couple reduced 18.5 % over 1962. In other words, with equivalent ride rates the 1963 Corvette would roll 18.5% less at the same speed through a given corner. The actual static ride rates/wheel are 93 lb/in. front, and 125 lb/in. rear. The roll rates are 420 lb.ft./degree front, and 325 lb.ft./degree rear.

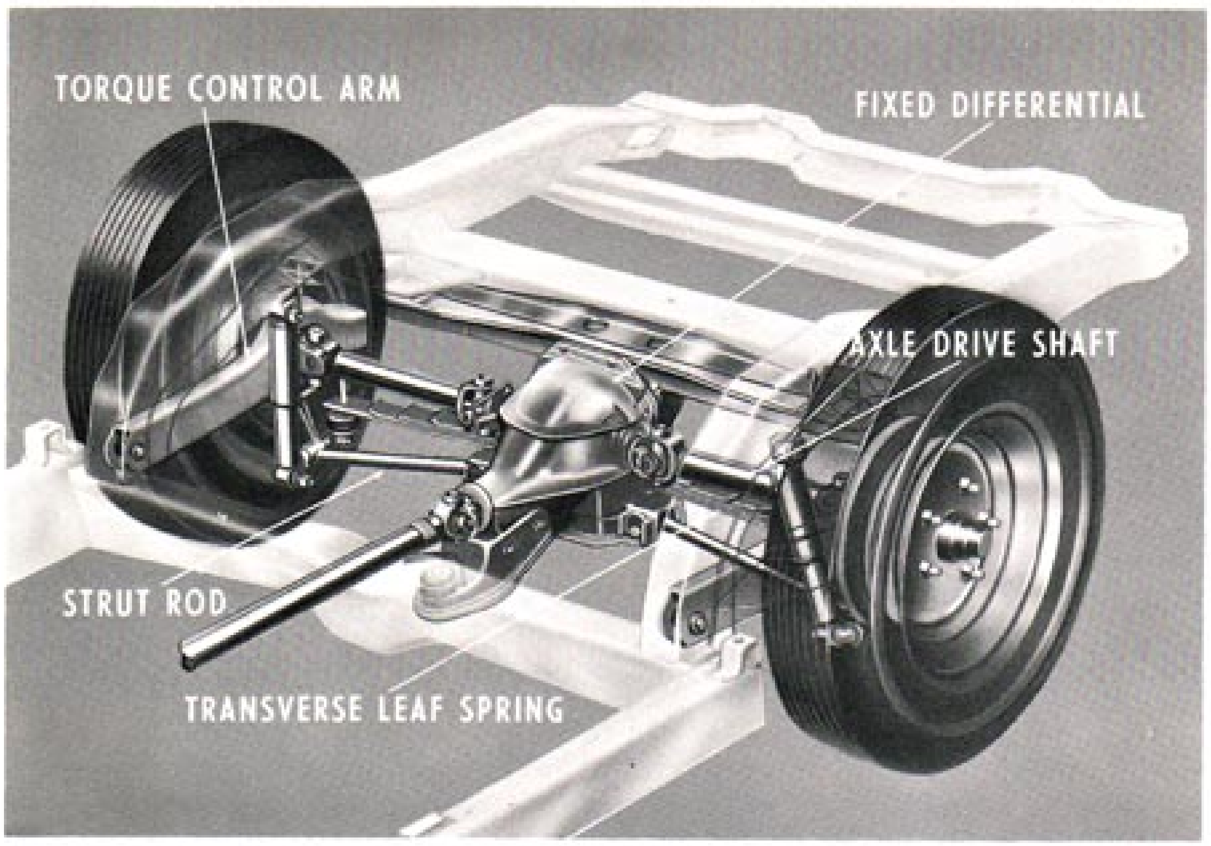
The front suspension camber curve is a deviation from the conventional passenger car, with strong negative camber as the wheel goes into jounce. This negative camber causes the wheel to lean out more at the bottom in a curve, greatly increasing tire adhesion.

The rear suspension features independent wheel movement, a fixed differential, articulating axles and a single transverse multi-leaf spring. In order to provide the desired handling characteristics, the rear wheels must move parallel to each other, without appreciably affecting either camber or tread. This was accomplished by a modified short and long arm link system using the axle shaft as the upper link and a solid strut rod as the lower link. All accelerating and braking forces are carried by the torque control arms which are bolted rigidly to the rear wheel spindles and carry the load directly to the frame at the forward part of the rear kickup.

The net result was a vehicle that rides comfortably, has a low noise level and nearly neutral steer. Torque steer and wheel tramp are eliminated. Roll is negligible. The driver is well aware before either the front or rear end breaks loose and an easy correction of the wheel puts him back on course.







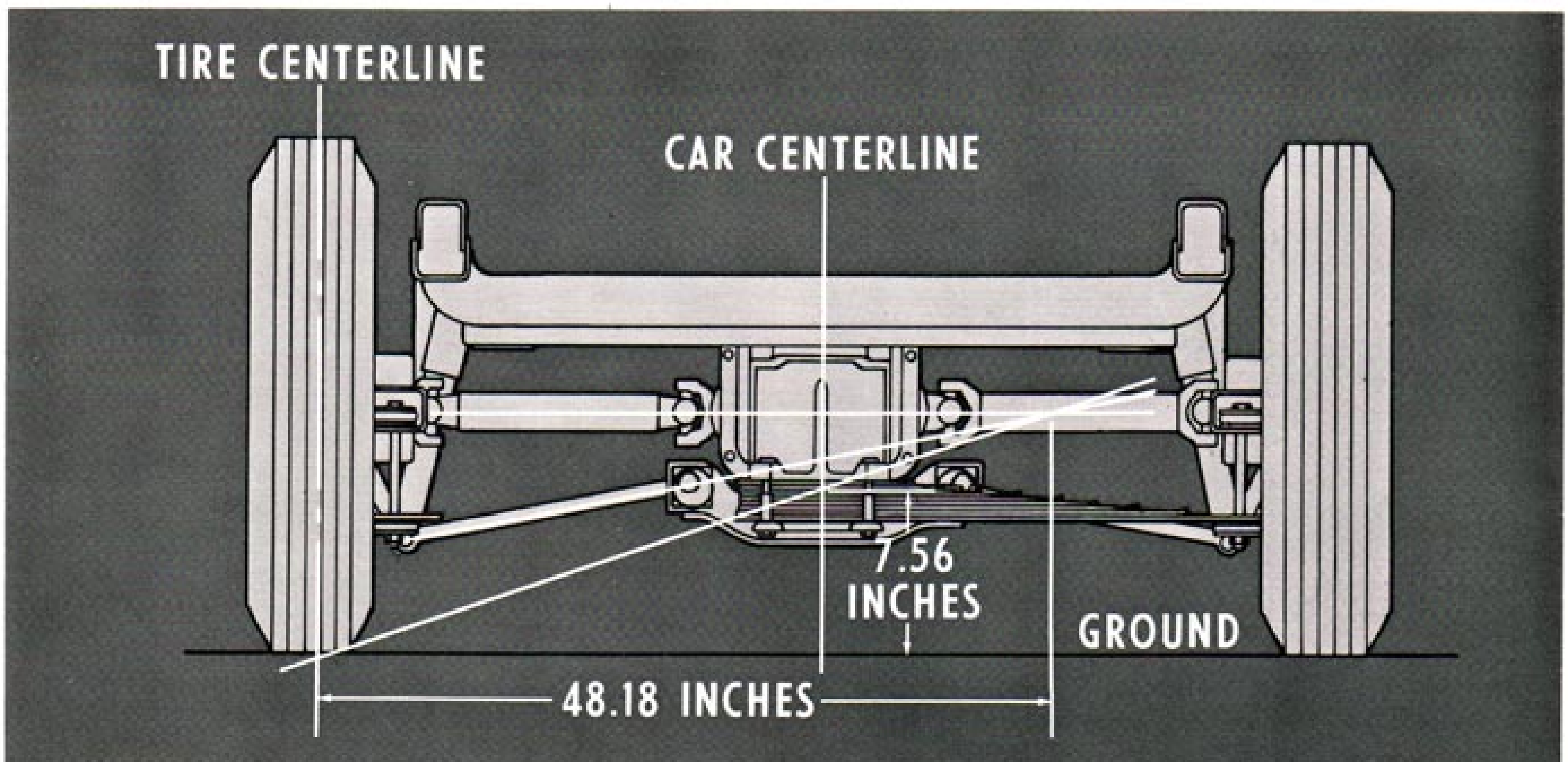
REAR SUSPENSION

The rear suspension is a full independent type. In order to achieve the high order of ride and handling that this vehicle demanded, there was never any question of continuing with a solid rear axle. Rear unsprung weight had to be cut to a minimum, which meant bolting the differential carrier to the frame, giving the further advantage of a rigid driveline, permitting a still lower over-all height.

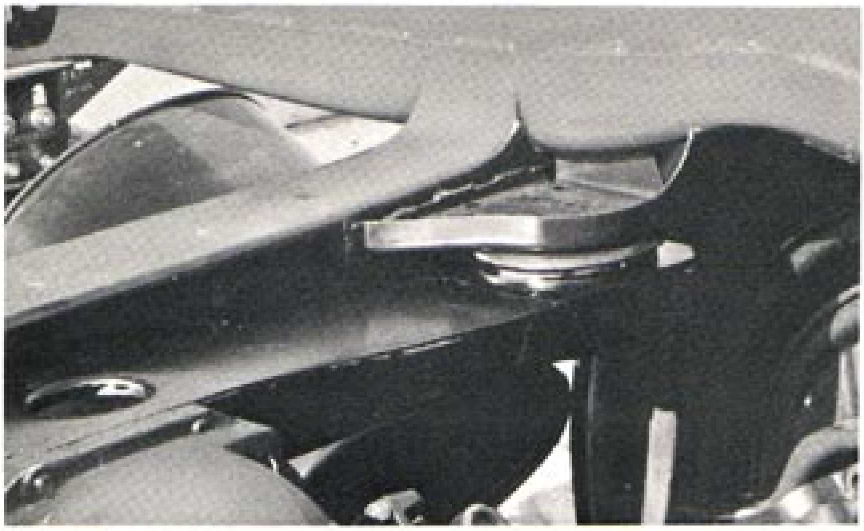
Since this vehicle was to have sports car handling, a link design was chosen. Using upper and lower links, the rear wheel camber may be set for optimum handling merely by relocating the pivot points of the links. Due to space considerations, each axle shaft serves the dual purpose of a driving member and the upper link, the shaft pivoting at the inboard and outboard universal joints. The lower link is a strut rod which connects at its inboard end to a bracket bolted to the differential carrier housing and at its outboard end to the strut support.

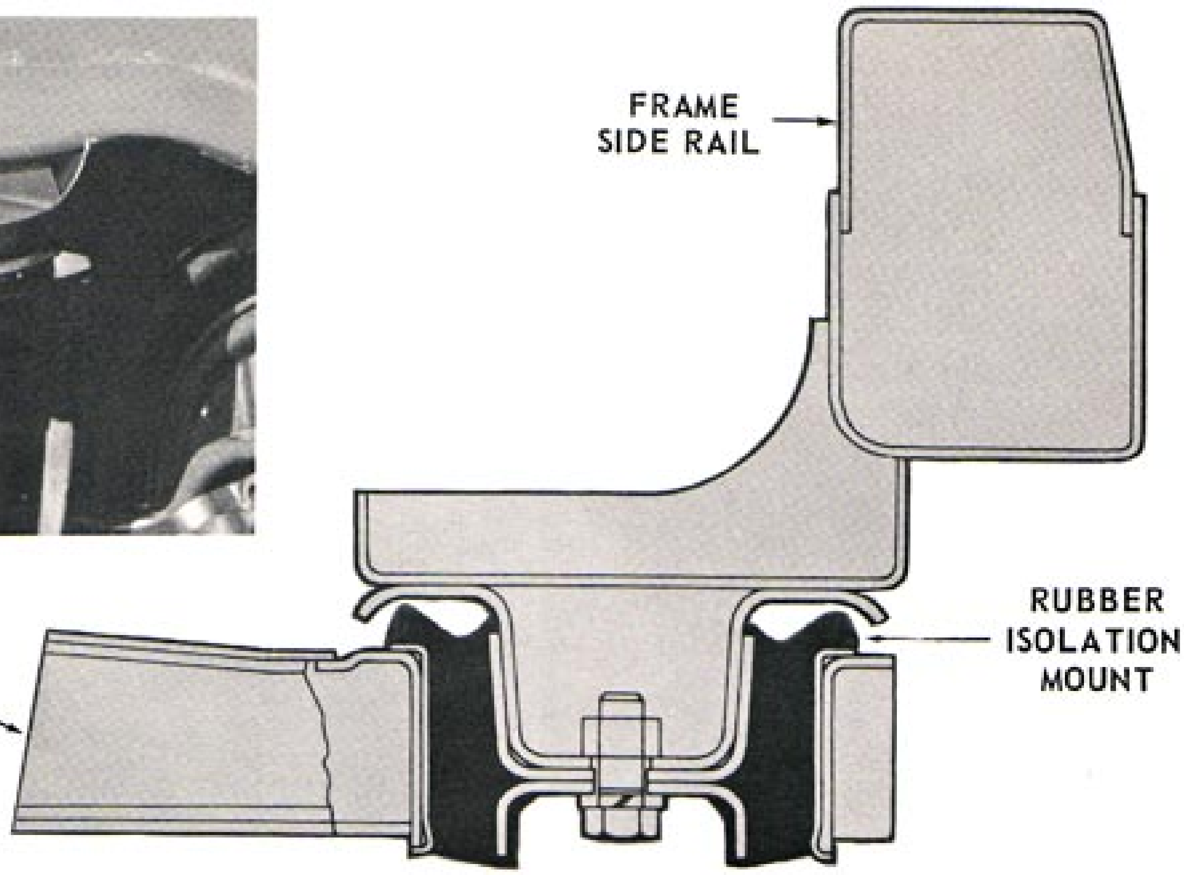
All braking and accelerating forces are transmitted to the frame by means of a torque control arm which bolts solidly to the spindle support. The spring is set transversely, mounted at its center to the differential carrier housing. The outer ends of the spring are attached to the torque control arm which extends to the rear of the spindle support. A link bolt between the arm and the spring connect the two. The shock absorbers are freon filled to reduce aeration, and attached to the frame by a bracket and to the legs of the strut support, using the strut rod bolt as the lower attachment.

The rear wheel spindle transmits the drive from the axle drive shaft to the wheels. Two tapered roller bearings support the spindle.



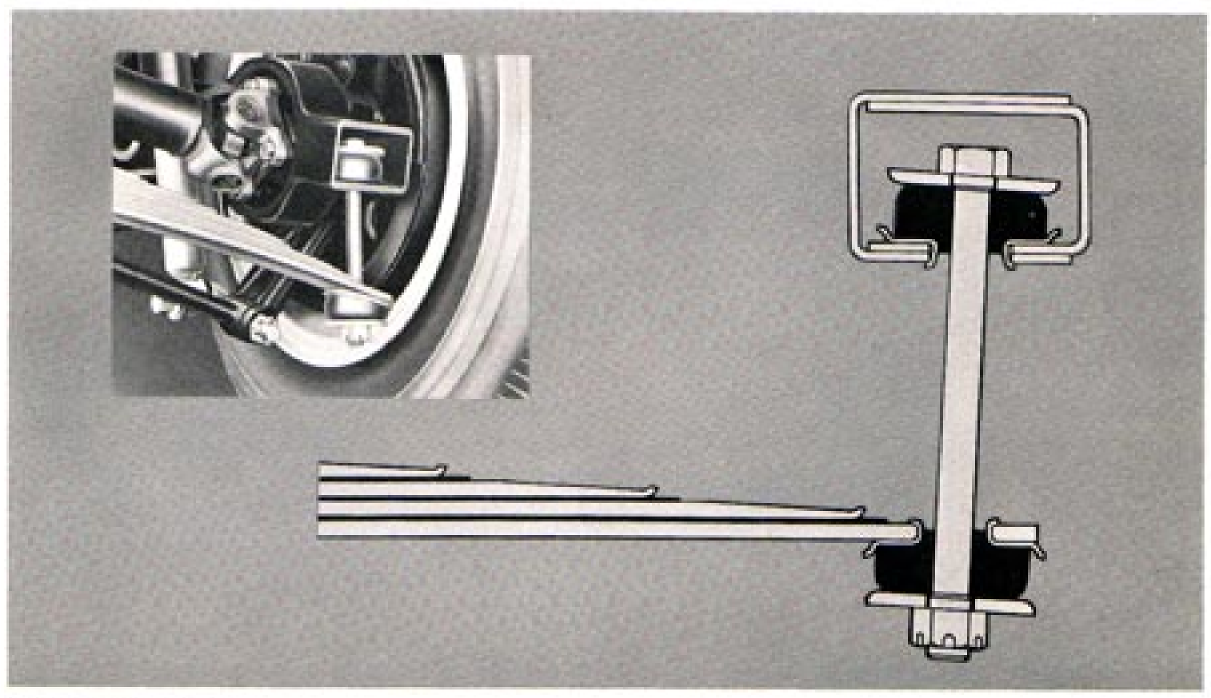
Rear Suspension Roll Center





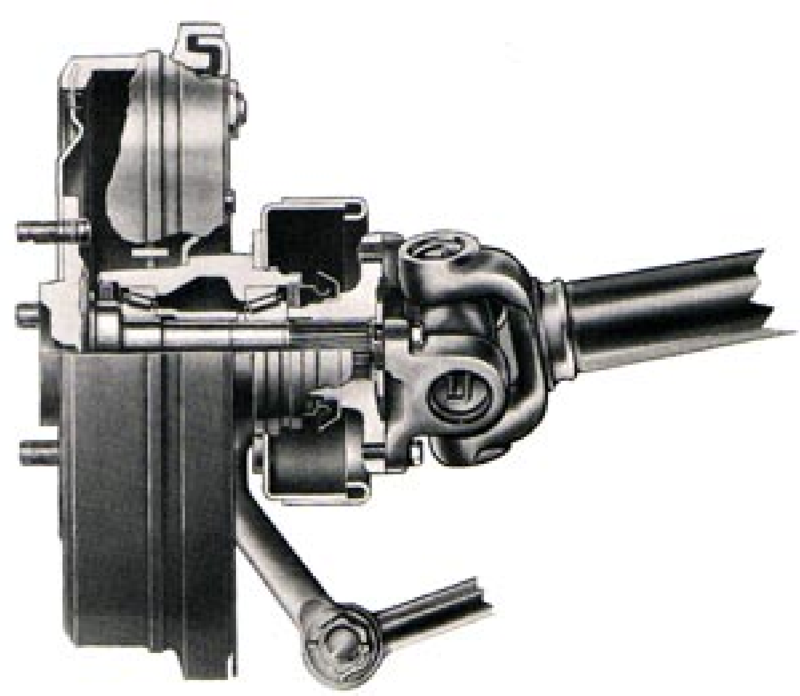
Differential Crossmember Mounting

A great deal of attention has been paid to isolate the passenger compartment from both road and mechanical noises. The differential, which has the rear spring and strut rods attached directly to it, is rigidly bolted to a crossmember. This crossmember, in turn, is attached to the frame by large, cup-shaped rubber isolation mounts. Under normal vehicle weight, the mounts are acting in shear. Under extreme impacts, the top rubber tip contacts the frame bracket and the rubber is in compression. Further isolation is obtained by preloaded bushings at both ends of the strut rods and at the front pivot of the torque control arm.



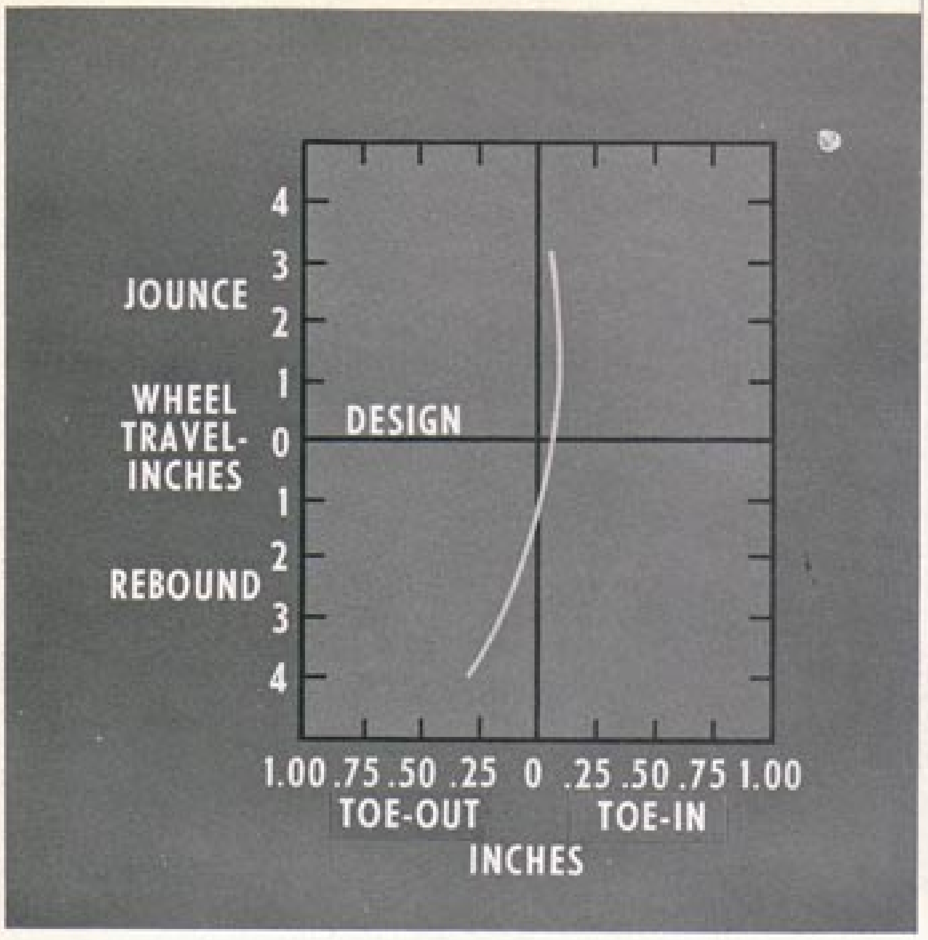
Spring Mounting

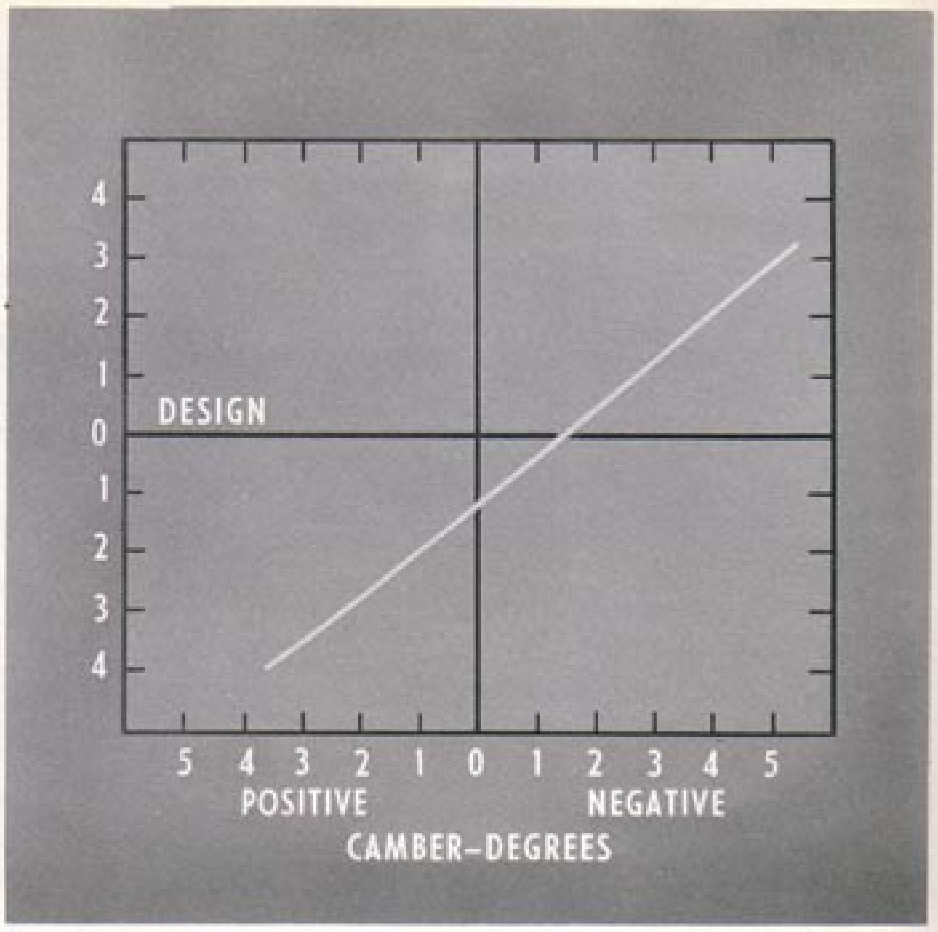
Full-length polyethylene liners separate seven of the nine leaves of the rear spring. Two large rubber pads are used at either end of the torque control arm to spring link bolt.



Rear Wheel Bearing Cross-Section

Short, forged steel spindles directly support rear weight and transmit driving torque from axle drive shafts to wheels. Each spindle is supported by two widely spaced tapered roller bearings housed in a cast nodular iron spindle support. The outer end of the strut attaches to a forked extension cast integrally with the spindle support.

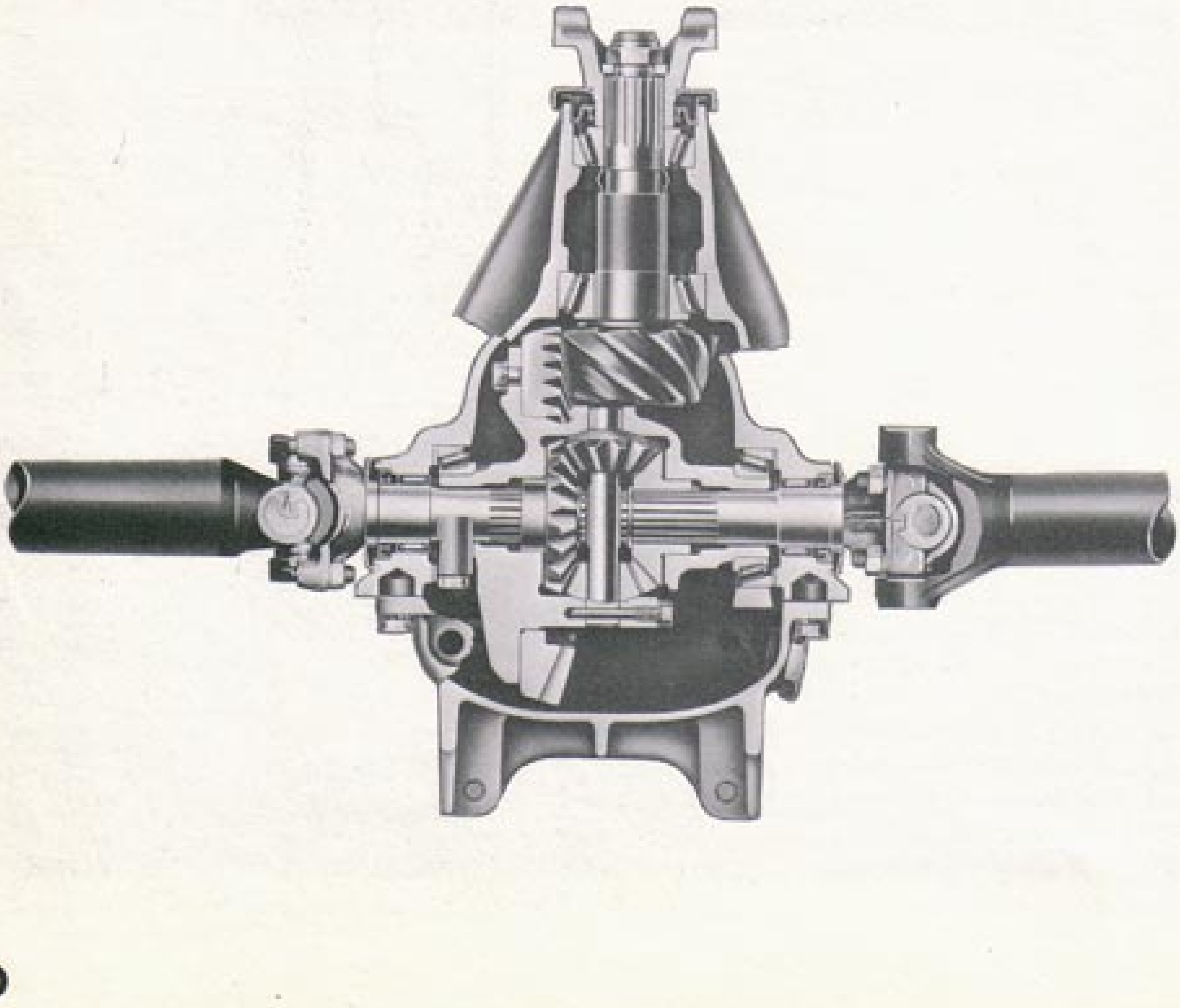




Rear suspension geometry is set by a combination of shims and cams. Wheel camber is set by moving the inner pivots of the rear strut rods laterally by means of a cam welded to the inner pivot bolts. Wheel toe-in is adjusted at the front of the torque control arm by a shim pack between the frame rear side rail and the control arm.

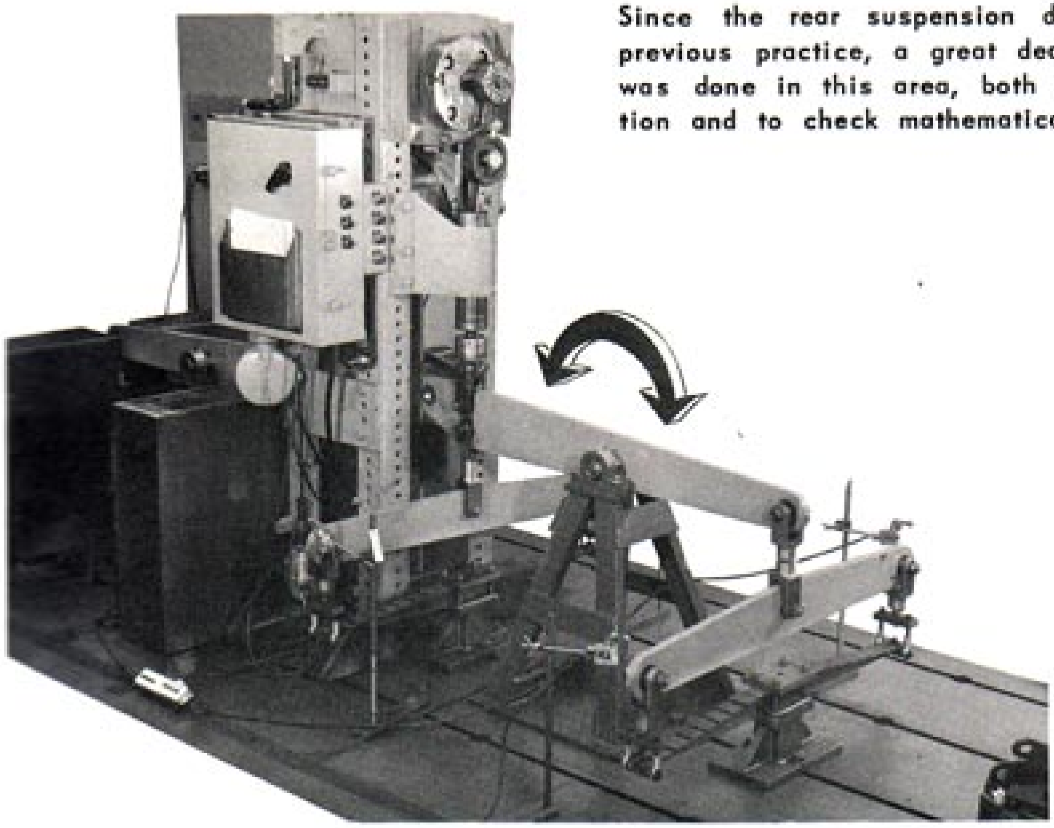
A heavy duty rear suspension is optional as part of a special performance package. These rear suspension pieces consist of a higher rate rear spring and larger diameter recalibrated shock absorbers. The chart below compares the standard with the Heavy-Duty option:

	STD	H.D.
Spring Rate	162 #/in	305 #/in
Shock Abs	1 in	1-3/8 in



Rear Axle

The fixed differential bolts solidly to the supporting crossmember through a cast iron cover. Internal components are conventionally arranged with the case and carrier made of nodular iron. Suspension thrust in one direction is taken by snap rings located on the splined end of the short integral yoke and drive shafts. Thrust in the opposite direction is through the yoke unit to the differential pinion shaft.



Since the rear suspension design was so different from previous practice, a great deal of development and testing was done in this area, both to obtain background information and to check mathematical theories.

Rear Spring Stroking Fatigue Test

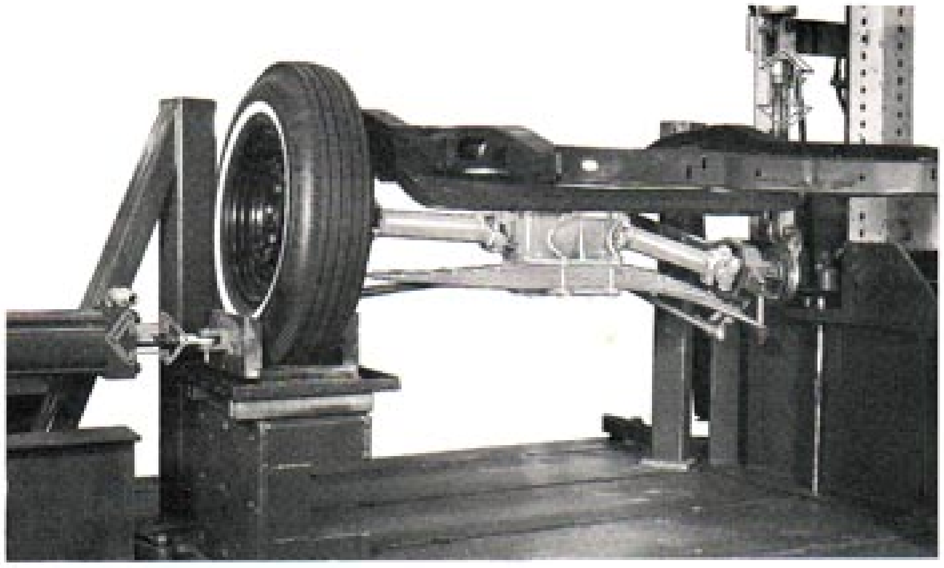
Unlike conventional leaf springs, the rear springs receive no accelerating or braking forces. Therefore, no established laboratory baseline was available. The success of our spring design would have to be based on Proving Ground vehicle testing.

Preliminary tests were based on the guess that the required Belgian block life expectancy could be met by a rear spring design with one-half the cycle life of conventionally loaded rear springs. Subsequent stroking and road tests, on five-leaf, seven-leaf, and finally the shot-peened nine-leaf spring assemblies all tended to validate the original estimate. The production design which exceeded the predicted cycle life requirement ran the full Belgian block schedule without failure.

Rear Suspension Stroking Test

In addition to component part testing, the complete rear suspension was laboratory tested as a unit mounted through its normal frame attachments. The right rear wheel was stroked vertically through its full geometry. Simultaneously a one "g" cornering force was applied and released to the left rear tire at ground level. This rear wheel was placed 2.4" into jounce to simulate the roll at this cornering force. The vertical stroking and cornering force patterns were purposely not in phase so that the cornering loads were applied through full ride travel.

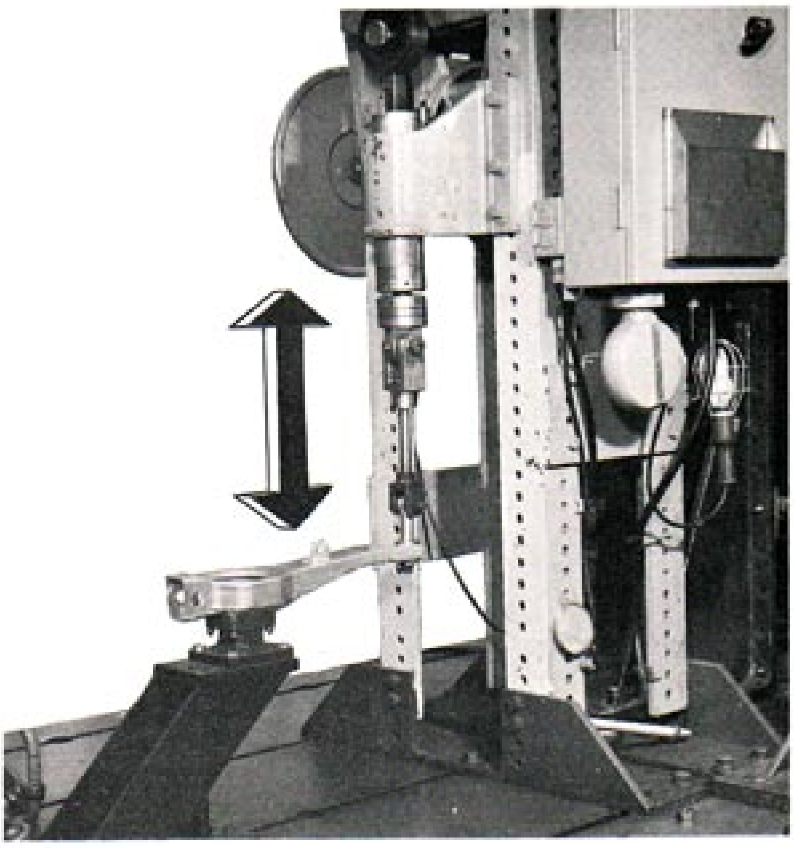
Final results of this test in fully exceeding base line requirements helped "prove" the complete design on accelerated basis.

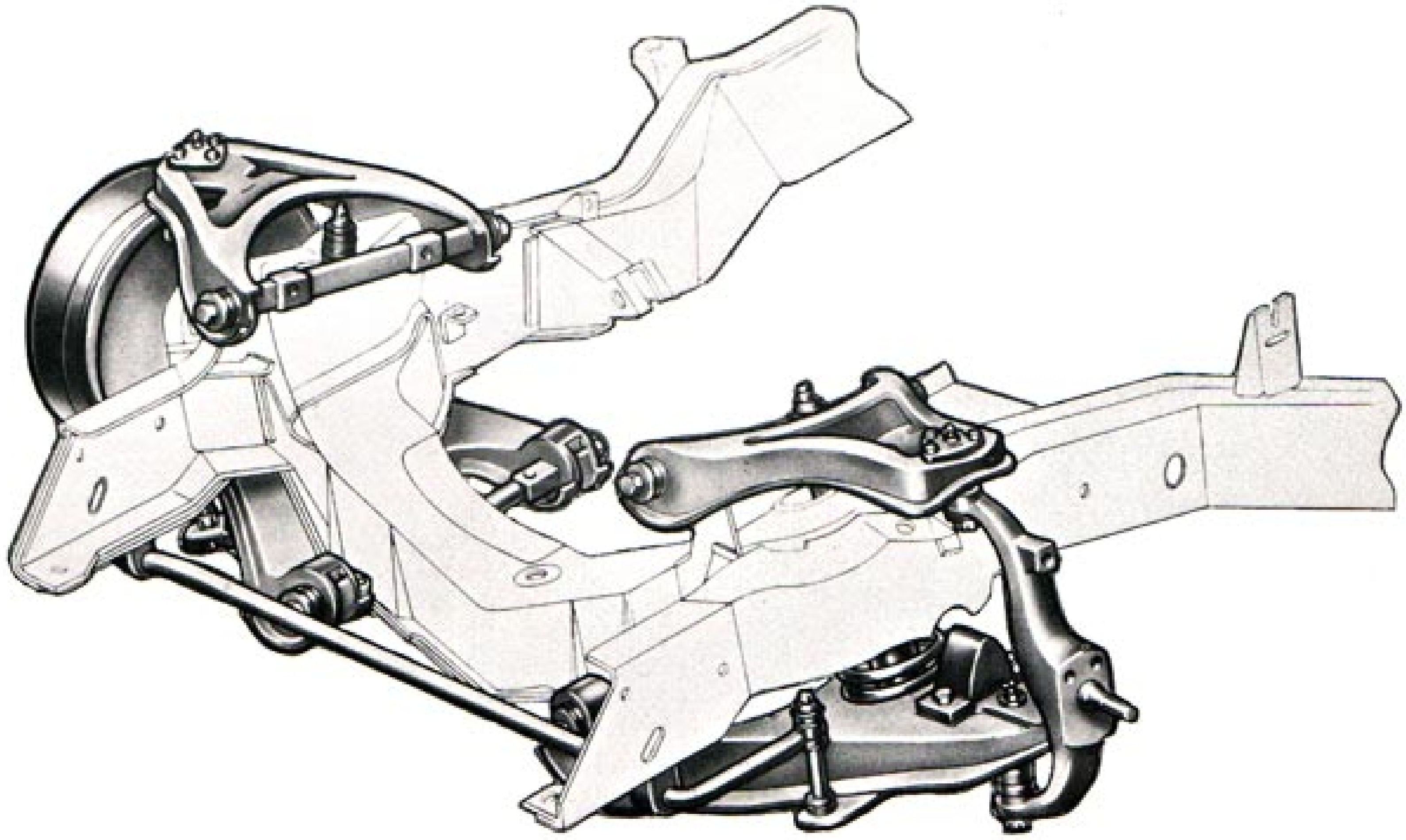


Torque Control Arm Fatigue Test

Clearance requirements with the tire and shock absorber gave the torque control arm an unusual shape in the plan view. Cross-sections of the arm were calculated to give satisfactory yield strength; however, early fatigue failures were experienced on the Belgian blocks, and duplicated on a brake reaction stroking test. To accelerate the development program, the fixture shown was designed to apply braking and accelerating loads directly to the test piece by means of a laboratory stroker.

This provided a means for accelerated testing of various proposed fixes such as reinforcements and changes in welding patterns. Finally, the width of the arm assembly was increased, and the spindle support plate extended forward. This latest version increased the cycle life tenfold on laboratory test and subsequently passed all Proving Ground road tests.





FRONT SUSPENSION

The front suspension is a complete departure from that of the previous Corvette. The reverse Elliott kingpin arrangement has been replaced by a spherical ball joint design, basically the same as that used on the passenger car. The ball joints allow anti-dive to be built-in, and simplify the lubrication requirements. Possibly the most noticeable improvement the ball studs impart is the reduced friction to the system, which reduces the steering effort considerably, giving light precise control.

To deyelop a high-performance limited production vehicle to market competitively with a normal family sedan takes either ingenuity or a performance compromising approach. The ingenuity approach was applied by using many of the passenger car front suspension components. Upper control arms, hubs, steering knuckles and wheel bearings are standard production.

The Corvette steering linkage is placed behind the front wheel centerline (opposite to the passenger car). The desired roll center is obtained by lowering the rear inner pivot of the upper control arm.

Coil springs and shock absorbers are mounted concentrically on a seat formed in the lower control arm. The upper ends are housed in towers formed in the frame front crossmember. They are inclined inboard at the top to aid vehicle stability and to minimize spring distortion, thereby giving a more constant spring rate. The shock absorbers used incorporate anti-oil aeration provisions under extreme operating conditions.

A conventional stabilizer bar is used to keep roll to a minimum. Supported by the frame, the bar is connected to the lower control arms by standard passenger car links, brackets and grommets.

Since many passenger car components are used, the interchangeability factor is quite apparent. It also reduces the number of lubrication points from sixteen to four. Through the use of Teflon lined ball joints, positive boot seals and high quality grease in the joint assemblies, the interval between chassis lubrications is extended from 1000 to 6000 miles, or every six months under normal driving conditions.

A heavy-duty front suspension is optional or part of a special performance package. These front suspension pieces consist of higher rate front springs, larger diameter shock absorbers and a heavier stabilizer bar.

The chart below compares the standard with the Heavy-Duty option.

	STD	H.D.
Spring Rate	260 #/in	550 #/in
Stab Bar	.75 in dia	.94 in dia
Shock Abs	Recalibrated for H.D.	

A completely new, fast and precise steering system contributes significantly to the excellent maneuverability of the 1963 Corvette.

Located to the rear of the front wheels, symmetrical relay type linkage and recirculating ball steering gears are used. Included among the many features are: faster, more precise steering with reduced effort; built-in, easy conversion from basic to faster steering; an adjustable safety dished steering wheel; and 6000 mile lubrication. For the first time since the Corvette introduction, power steering will be available as optional equipment.

Precise and positive steering control through all attitudes of suspension jounce and rebound is provided by a careful match of the new steering system with the suspension design. A relay rod runs laterally across the vehicle rearward of the front wheels. The left end of the rod connects to the pitman arm. A rubber bushed, permanently sealed idler arm supports the opposite end. During steering maneuvers, the pitman arm and the idler lever carry the transverse link in a "parallelogram" action.

A new hydraulic damping device is used in the linkage system for road isolation. Located between the frame on the left and the relay rod near the right tie rod inner end, the damper functions much like a road wheel's hydraulic shock absorber. Energy absorption, by a piston moving in an oil filled cylinder, controls vibrations that would otherwise be transmitted to the steering wheel.

Extended interval lubrication is incorporated in the steering system. Five points require lubrication on a 6000 mile, normal driving basis. These are the four tie rod ends and the pitman arm-to-relay rod connection. All other pivots and attaching points are permanently sealed units, and require no periodic service attention.

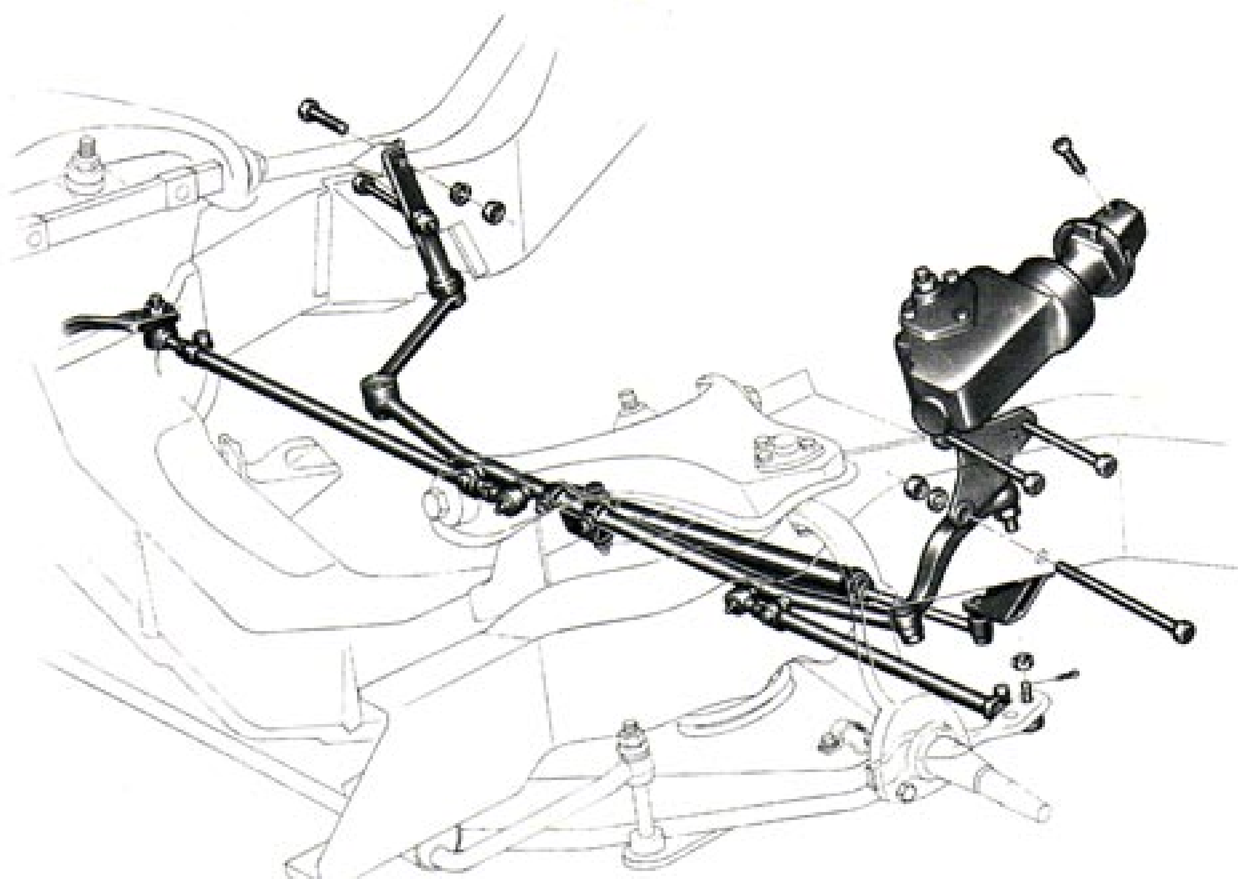
All 1963 Corvettes are equipped with basic and fast steering provisions. No extra parts are necessary to switch from one to the other; a relatively simple service operation is all that is required.

To provide for the basic and fast steering ratios, two holes are placed in each steering arm for the attachment of the tie rod ball studs. Located in line at the rear of the arm, the tapered holes receive the tie rod ball studs according to the need for basic or fast steering. The rearmost position is used for the standard manual steering, which has an improved over-all ratio of 19.6:1. Fast steering is provided by the forward steering arm location, the over-all ratio being 17.0:1.

A low friction, recirculating ball steering gear is used in the Corvette for the first time, with construction much like the gear used in Chevrolet passenger cars. The gear ratio is 16:1. The steering gear is connected to the steering shaft through a flexible coupling.

Another new feature for 1963 is the adjustable steering wheel. The wheel and the column move axially as a unit for a total travel of 3 inches.

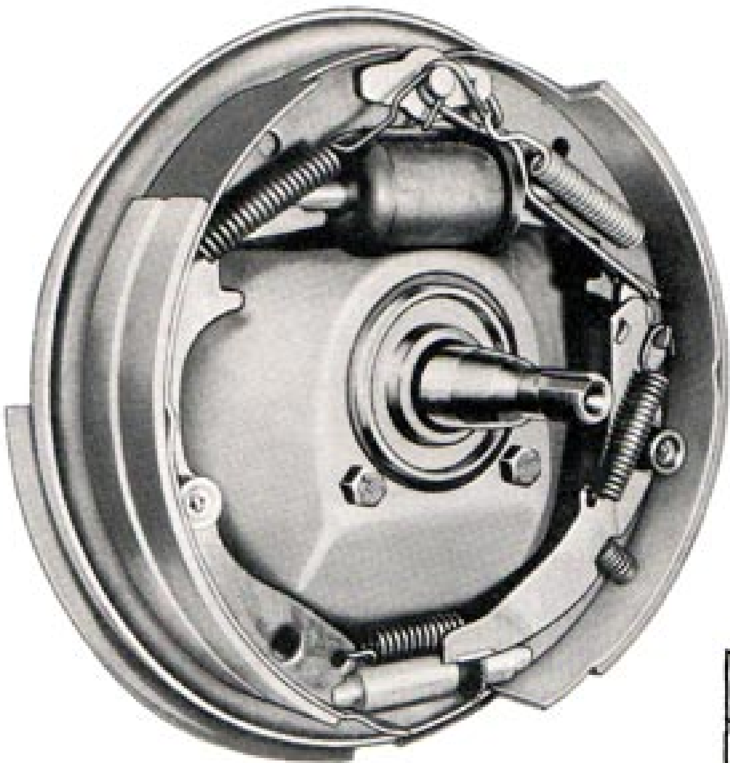
Corvette power steering is the hydraulic assist or booster type, similar to the units used on the regular passenger car. The amount of assist is proportional to the force necessary to turn the front wheels, up to approximately 80 percent of the required effort. The faster steering linkage position is used for vehicles equipped with this option.



Steering Linkage

New, larger brakes of proven duo-servo design give Corvette still another element of excellent driving control. Patterned after the passenger car design and incorporating a self-adjusting feature, the new brakes are most effective with the full independent suspension. A very favorable vehicle weight to lining ratio insures effective long life. Advantages which stem from the Corvette weight distribution and low center of gravity include an effective weight transfer forward during braking, giving good effort distribution.

Brake diameter remains 11 inches, but lining widths have been increased. Front linings are 2.75 inches wide while the rear linings are 2.00 inches, increases of 0.75 and 0.25 inch respectively over 1962. Effective lining area is nearly 186 square inches, an increase of approximately 18 percent. This gives the Corvette an excellent weight to lining area ratio of less than 18 pounds per square inch at design load.



Standard Self-Adjusting Brakes

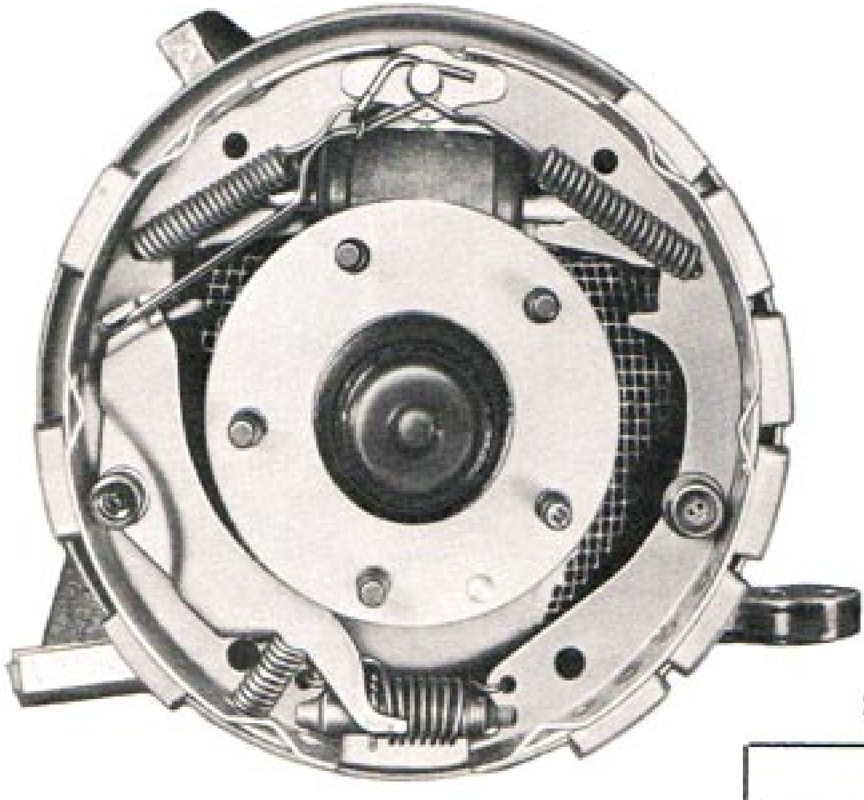
DRUM AREA SQUARE INCHES

	FRONT	REAR
1962	84	73
1963	116	84

Brakes are self-adjusting, eliminating need for periodic manual compensation for lining wear. Built into the brake at each wheel, the adjuster operates automatically on reverse stops as adjustment is needed, without attention from the driver.

The unit is a five part articulating mechanism, mounted on the secondary shoe. One end is connected through a heavy wire link to the anchor pin, while a pawl lever contacts the star wheel of the adjusting screw at the lower end. On reverse stops, the secondary shoe moves outward and rotates slightly forward, until the primary shoe contacts the anchor pin. If the movement is sufficiently large, the self-adjuster is actuated. Dictated by the need for lining adjustment, the pawl lever turns the star wheel, spreading shoes apart in the normal manner. Ratcheting action returns the mechanism when brakes are released.

Vacuum power assist and metallic sintered iron linings are available optionally for service beyond normal use.



Forward Adjusting Heavy-Duty Metallic Brakes

DRUM AREA SQUARE INCHES

	FRONT	REAR
1962	172	120
1963	193	140

An extra heavy-duty brake system is included as a part of the special performance package option. The system consists of larger-than-standard finned drums, special metallic linings, dual circuit master cylinder, and special cooling provisions. Severe service cooling requirements are met by integrally cast fins on the drum perimeters, internal fans, holes in the heavier-than-standard webs, and front air scoops. In contrast to the standard brakes, the self-adjusting mechanism is located on the primary shoe of each brake. Here, it operates on forward braking when required to provide adjustment during competitive events. The dual circuit master cylinder features separate hydraulic circuits for the front and rear brakes. A vacuum powered assist is a part of this system.

FRAME

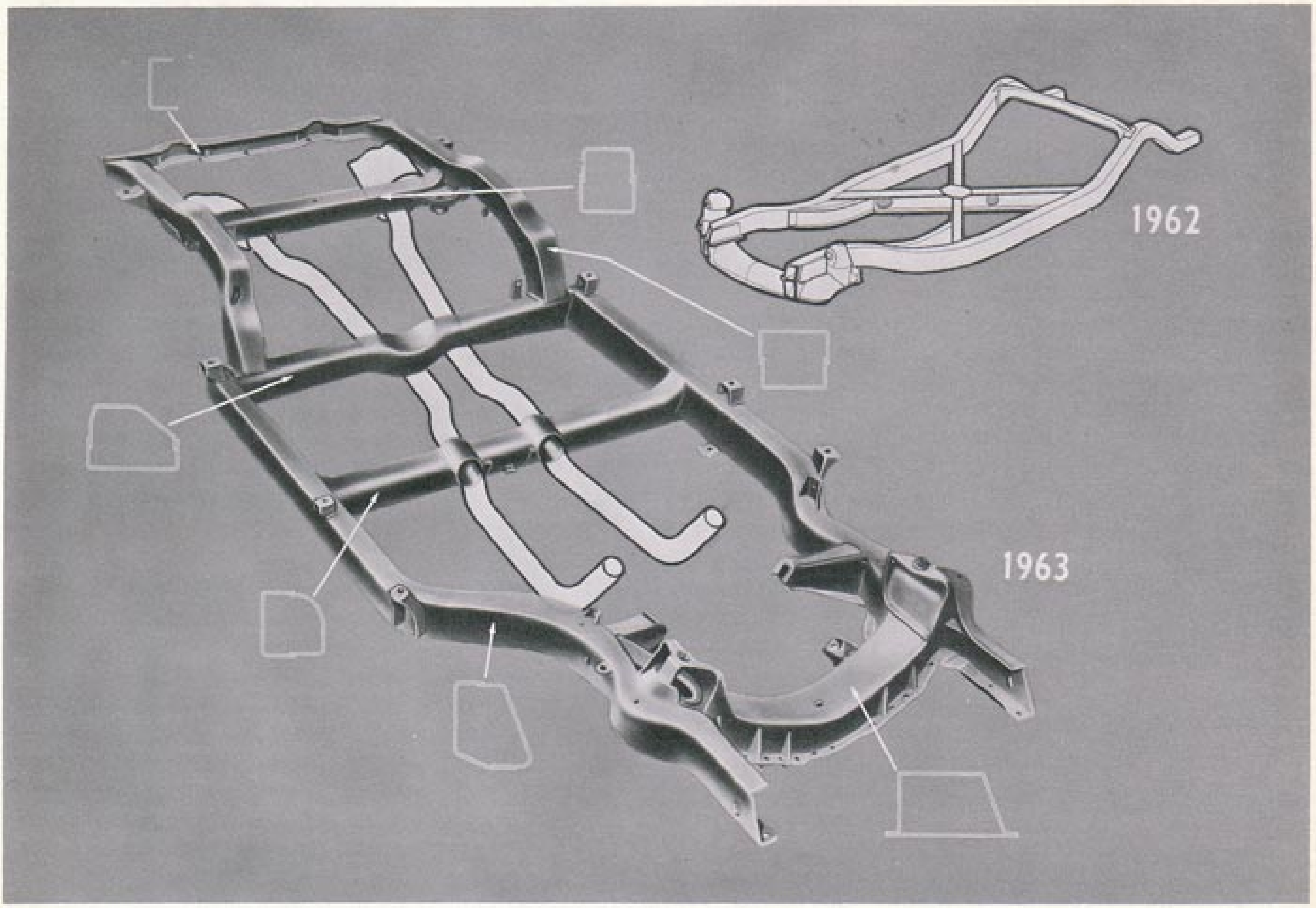
The Corvette frame is a ladder type of all welded steel construction. Its basic elements are front and rear side rails and five crossmembers.

The forward side rails are placed at the outer extremities of the body. Locating these rails on the perimeter of the body sides permitted the seats to be placed between the structural members rather than over them. This resulted in a lower silhouette and center of gravity.

The front side rails sweep in at the cowl in one continuous piece for front wheel clearance. The rear side rails are offset inboard of the rear wheels proceeding straight back to the rear crossmember. Five welded-in crossmembers provide torsional rigidity. All members except the rear crossmember and the front side rails forward of the front crossmember are closed for maximum stability with minimum weight.

A single continuous stamping, the outer side rail, forms the main structural element from the rear kick-up offset forward. An inner side rail runs continuously from the rear offset to the front crossmember forming a trapezoidal shaped section with the outer rail. At its forward end, the inner rail is splayed inward and welded to the front crossmember to stabilize the front structure.

Front "horns" of the outer side rail are stabilized and reinforced by a nesting "U" channel. The



Frame Construction

rear of the "U" channel splays inboard and is welded to the front wall of the front crossmember.

The front crossmember assembly is a closed hat-section welded to the side rails. In the previous model this was a separate unit bolted to the frame at assembly with the front suspension attached.

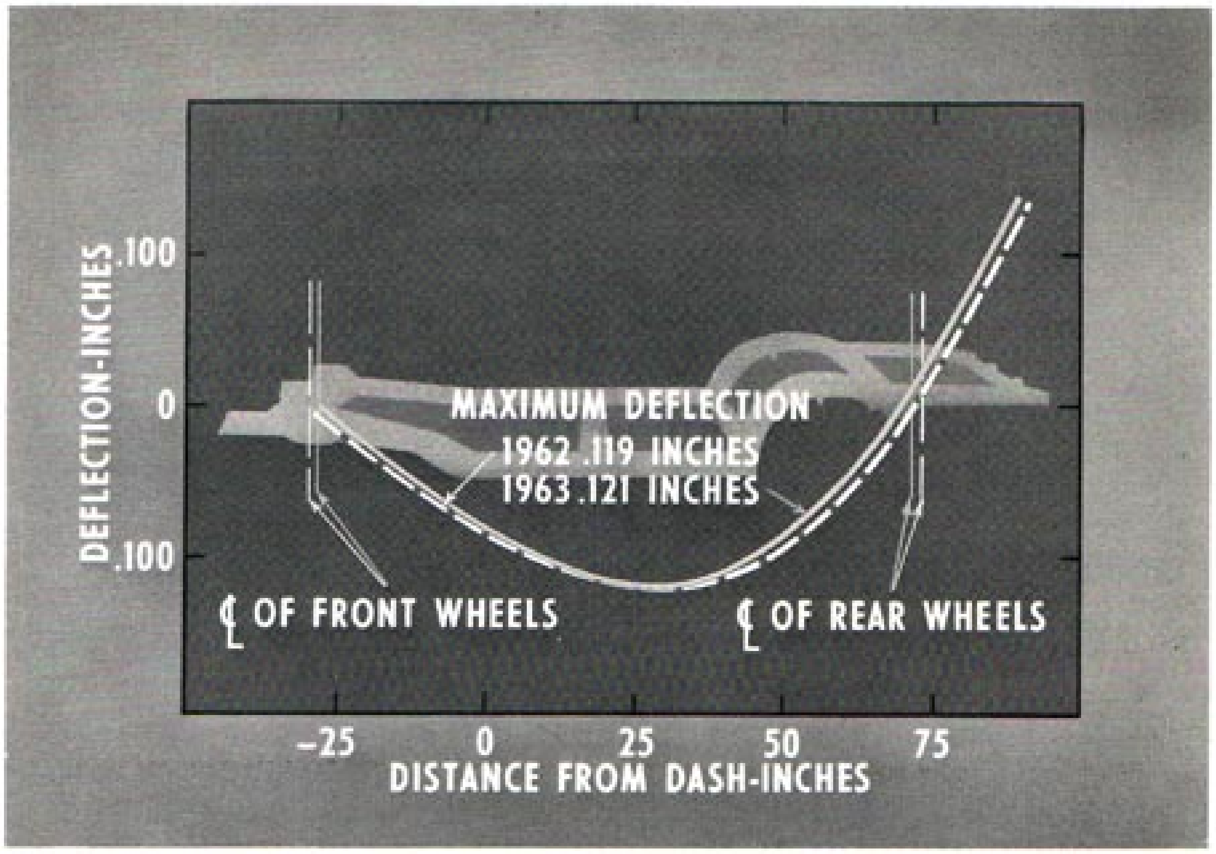
Contributing to overall frame rigidity is a transmission crossmember running under the passenger compartment just below the leading edge of the seats. To maintain adequate ground clearance, it was necessary to route the exhaust system through this welded-in crossmember in such a manner that rigidity was not impaired. This made for a more complicated assembly to satisfy strength and clearance requirements.

A rear hip bar of box section construction makes a rigid connection between the main platform and the rear side rails. The center of this bar is dropped for propeller shaft clearance.

One of the base vehicle requirements was the elimination of the conventional deck lid with the luggage to be stowed through the passenger compartment. To provide maximum luggage space, the rear compartment floor was lowered - limited only by the top of the differential carrier housing. The rear side rails were spread apart as far as possible limited by the rear wheel clearance requirement. This made the attachment of the differential frame crossmember somewhat complicated to obtain adequate rigidity.

A simple "C" section crossmember ties the rear of the frame together.

The net result of the new frame gave virtually equal weight to that of the 1962 unit. Bending deflection, using a load of 1500 pounds at the seat "A" point, results in the deflection curves shown.



Frame Beaming Stiffness 1963 vs. 1962

Torsional rigidity is extremely important to a performance vehicle. In this new frame, torsional rigidity has been increased nearly 50 percent over the previous model as shown.

The final production frame differed very little from the early pretest units. A "first effort" paper design was made, and from it the many and various parameters affecting beaming and torsional rigidity were determined. From the many variables involved, a computer program was set up and an analysis of the design approach made. With this information, a more concrete design evolved. By a process of elimination, the contribution of each structural element was found. Metal gages and cross sectional shapes were similarly analyzed. From this bulk of information, pretest frames were built and tested.

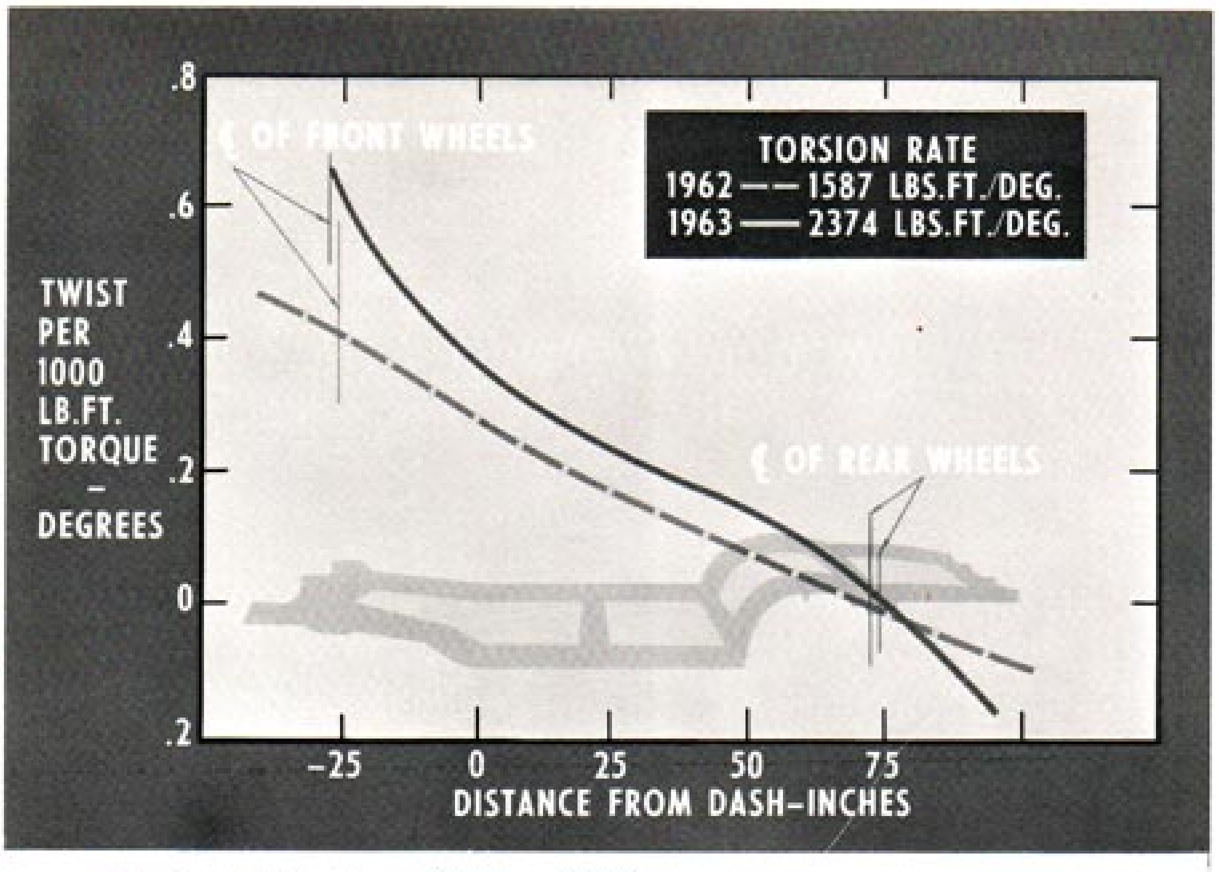
From a stringent test sequence, nearly all of the initial design factors were confirmed. However, the testing program did bring to light a torsional deficiency in the area of the forward side rail "S" curve. When twisted, this area of transition match-boxed. This tendency for the section to be unstable was corrected simply by the addition of an internal bulkhead.

In the course of the frame development, the point arose that if stiff was good, stiffer was better. Consequently, a frame was built with torsional stiffness considerably greater than the production design. Evaluation of a vehicle equipped with the stiffer frame proved the ride to be unacceptable. This approach was quickly abandoned.

FUEL AND EXHAUST

It was desired to increase the capacity of the standard fuel tank for greater cruising range and at the same time locate it in such a manner as to provide the maximum luggage space.

Spare tire and fuel tank positions are reversed with the tank in the former tire area, and the tire secured below the tank in a pro-



Frame Torsional Rigidity 1963 vs. 1962

tected enclosure. The tank is fully protected on the top and sides by body panels. The spare tire "pocket" protects it from below. A large diameter fuel filler door is centrally located in the rear deck panel.

A 20-gallon tank, increased from 16.4 gallons, evolved and is located at the extreme rear of the vehicle. The tank is filled through the opening in the fixed deck panel. The filler neck and opening size have been increased from 2-1/8 inches to 3 inches permitting rapid refueling. The large opening and the short filler neck literally allow full fuel flow from the gas pump directly into the tank without blowback.

The dual exhaust system is completely revised to conform with the new chassis and underbody configuration. Two-inch diameter exhaust pipes and muffler inlet tubes are used for all base 250 horsepower engines, and for the optional 300 horsepower engine when used with Powerglide. A larger 2-1/2 inch exhaust system is used for the 300 horsepower engine when used in combination with Synchromesh transmission, and also for both high-performance engines with special camshafts.

Mufflers are mounted behind the rear axle, making longer exhaust pipes necessary. New elliptically shaped mufflers are 6-1/4 inches shorter than previous mufflers, but have nine percent greater volume. Bright metal tail pipes extend through circular openings in the lower rear body panel.

Muffler corrosion resistance has been improved to give the exhaust system extended life. Left side mufflers are completely aluminized, inside and out. Right side (cold side) mufflers are composed of stainless steel heads, shell, baffle numbers one and four, and a portion of the outlet tube called the outlet louver tube; remaining parts are aluminized.

An optional competition fuel tank is available on the Aerocoupe only which increases the capacity from 20 to 36 gallons. This tank is of fiber glass construction and is mounted forward of the rear axle on top of the underbody. A filler neck extension connects the larger gas tank to the standard fuel tank door.

POWERPLANTS

The Corvette engines and transmissions are highly refined units. Four 327 cu. in. V-8 engines range in horsepower from 250 to 360 and are used in combination with three different transmissions. The 283 cu. in. Fuel Injection V-8 achieved 1.0 H.P./cu.in. in 1957. The engine has since been bored and stroked to 327 cubic inches to provide 1.1 H.P./cu. in. This vehicle has also provided the impetus for the fully synchronized four-speed manually shifted transmission introduced in 1957. The regular passenger car line has benefitted from these power train developments. Many of the same basic units are used in the much higher volume regular passenger car.

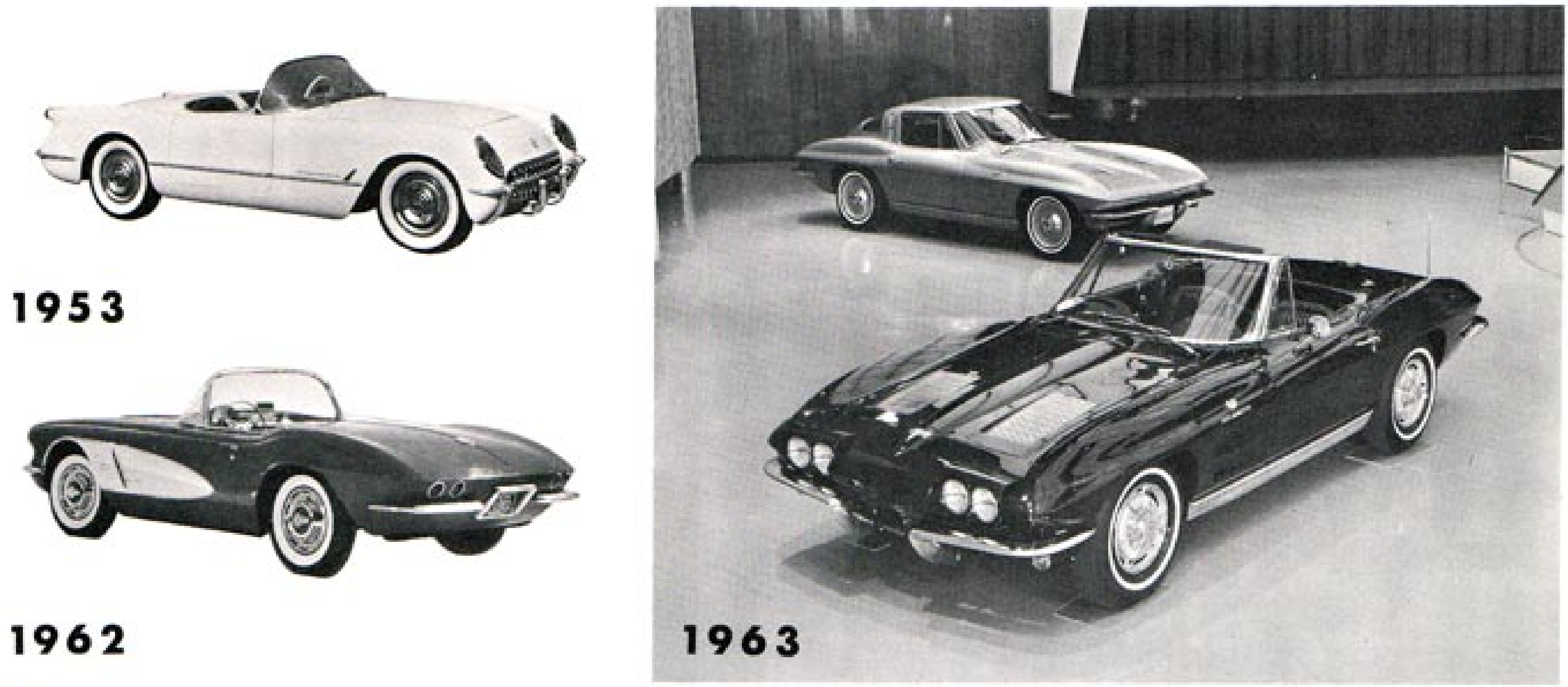
WHEELS AND TIRES

The 6.70 x 15 tires are used as in previous years. They are mounted on 15 x 5.5 K welded steel wheels. This rim is 1/2 inch wider than in 1962 to provide more tire stability.

Available as an option are permanent molded aluminum wheels. The wheel size remains 15 inches, but the rim width has been increased to 6 inches. To permit ease of installation on the standard vehicle, a malleable iron adaptor is bolted to the wheel lugs. This adaptor contains the wheel pilot, locking device and locking nut threads. The wheel is placed over the adaptor and secured by the locking nut, providing a simple and effective wheel knockoff design.

The standard tires for the 6 inch wheels are also 6.70 x 15.

Room has been provided at the front for 6.50/6.70 x 15 racing tires. At the rear, 8.00/8.20 racing tires may be used on the Aerocoupe only, when equipped with the 36-gallon gas tank.



1953

1962

1963

Figure 1.

BODY

The new Corvette represents the first complete redesign of the Corvette body since the first cars were produced in Flint in the Fall of 1953. The original version was a two-door, two-seat convertible with removable side windows and a folding soft top.

During the years from 1953 to 1962 the Corvette body was changed in many ways. A new top and windshield was introduced in 1956. The removable hardtop made its appearance in that year also.

The instrument panel and front end were changed radically in 1958 and the rear end in 1961. The 1962 car was quite a different machine from the 1953 - and yet some of the original 1953 tools - notably the underbody were still in use making the 1962 parts.

Obviously, the job before us in producing the completely new 1963 Corvette body was much less challenging than the original '53 model. We knew what material would be used, who the possible sources were, and we had the advice of people who were experienced in assembling plastic bodies. All we needed was a new concept.

For a sports car, the Corvette always seemed a little big. This was especially noticeable when it was running in competition. Significant reductions are made in overall height and length. The wheelbase is decreased four inches and adjustments made in overhangs front and rear to compensate for this move.

Another shortcoming of the Corvette, some of us thought, was the entry and exit room. Shown in Figure 4 is a 1962 Corvette with the dog leg pillar intruding on the entrance room, and the 1963 model with more entry room available.

A convertible body style in 1963 was a must, and the successful removable hardtop was, of course, a required accessory for this car. Beyond this was the desire for

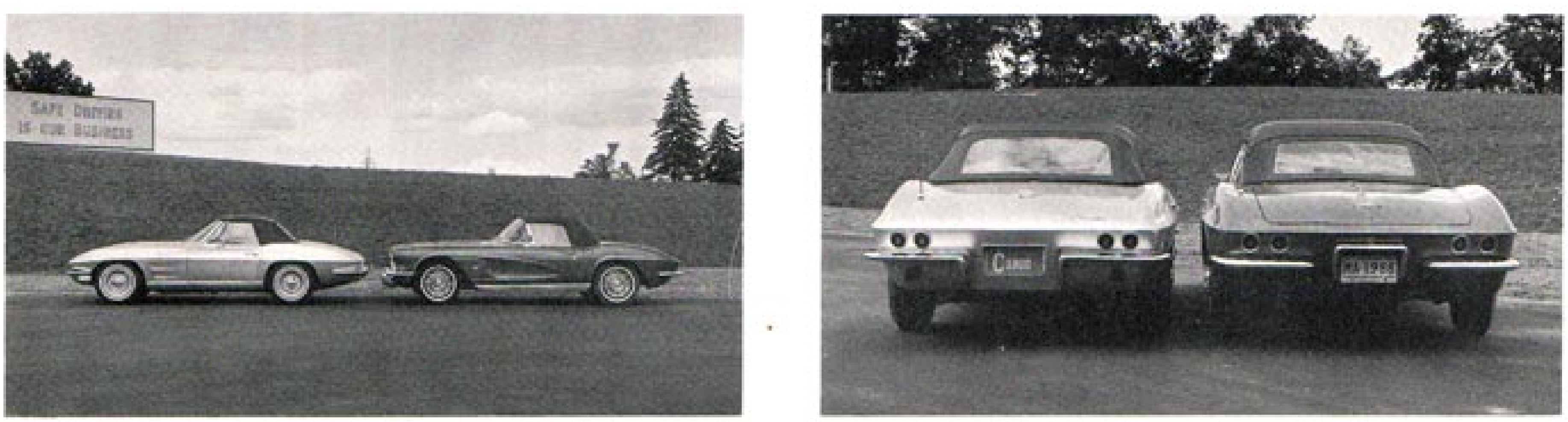


Figure 2. Decreases in overall length, width and height contribute to the small silhouette appearance. The passenger compartment of the 1963 Corvette is moved rearward and the wheelbase shortened.

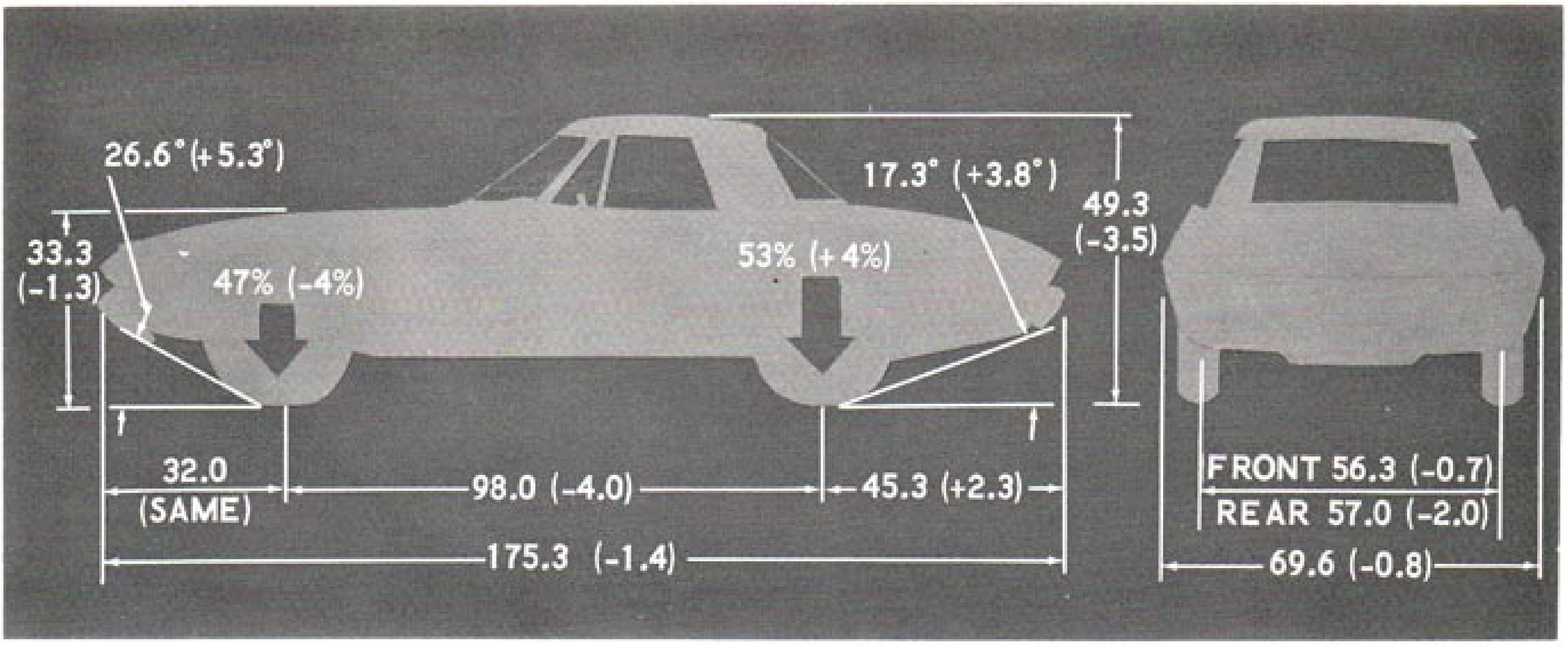


Figure 3. Dimensional comparison of 1962 and 1963 Corvettes with removable tops.

another body style, a smooth back coupe called Gran Turismo in Europe. This style was becoming popular overseas, and it looked like a natural for a competition car. For these reasons, a smooth back coupe was proposed and accepted as a part of this program.

The styling people had a problem. They knew this car had to be new, modern, and different from the old car; and yet it must be instantly recognizable as a Corvette.

The Corvette identity that has developed and the hard won endorsement by the sports minded crowd has given the present Corvette an image that we did not want to destroy. It is obvious that we should not bring out a car that had lost identity with its family. I think the styling people did a fine job in this respect.

As the styling took shape, the space engineering began. Various configurations of gas tank, spare wheel, and stowage space were examined. The front of the car and the passenger area were pretty well dictated by the power plant and transmission, but the rear end arrangement could have been done in several ways. One factor was the Coupe rear deck lid cut lines. It seemed that no matter how these lines were designed, they took away from the desired, sharp, clean lines of the Coupe roof.

The Coupe model weighed heavily in our space arrangements because we wanted to have this smooth, flat spacious area in the back of the Coupe. Filler neck location and capacity of the gas tank was still another item that steered the design toward the final arrangement that went into production.

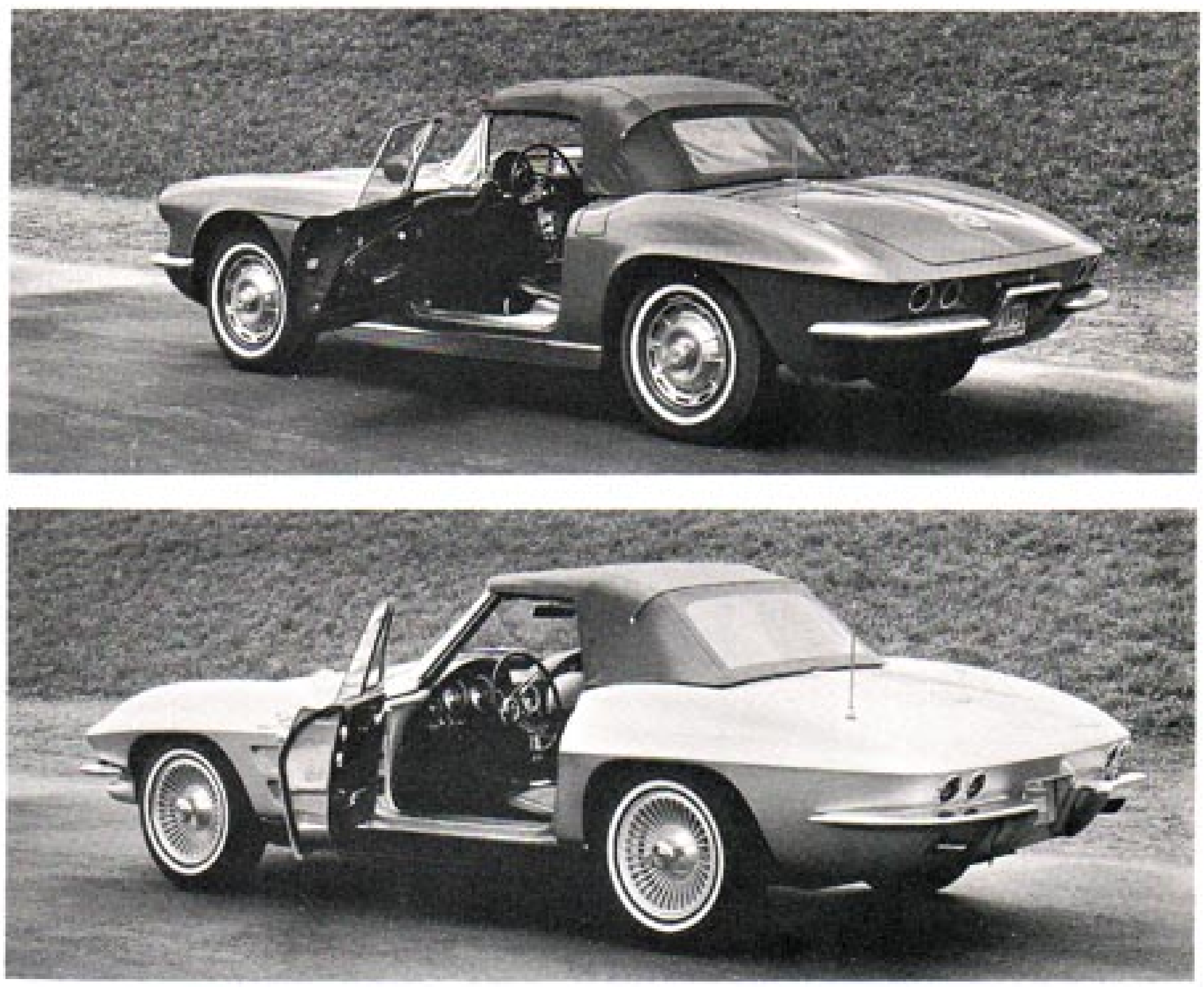
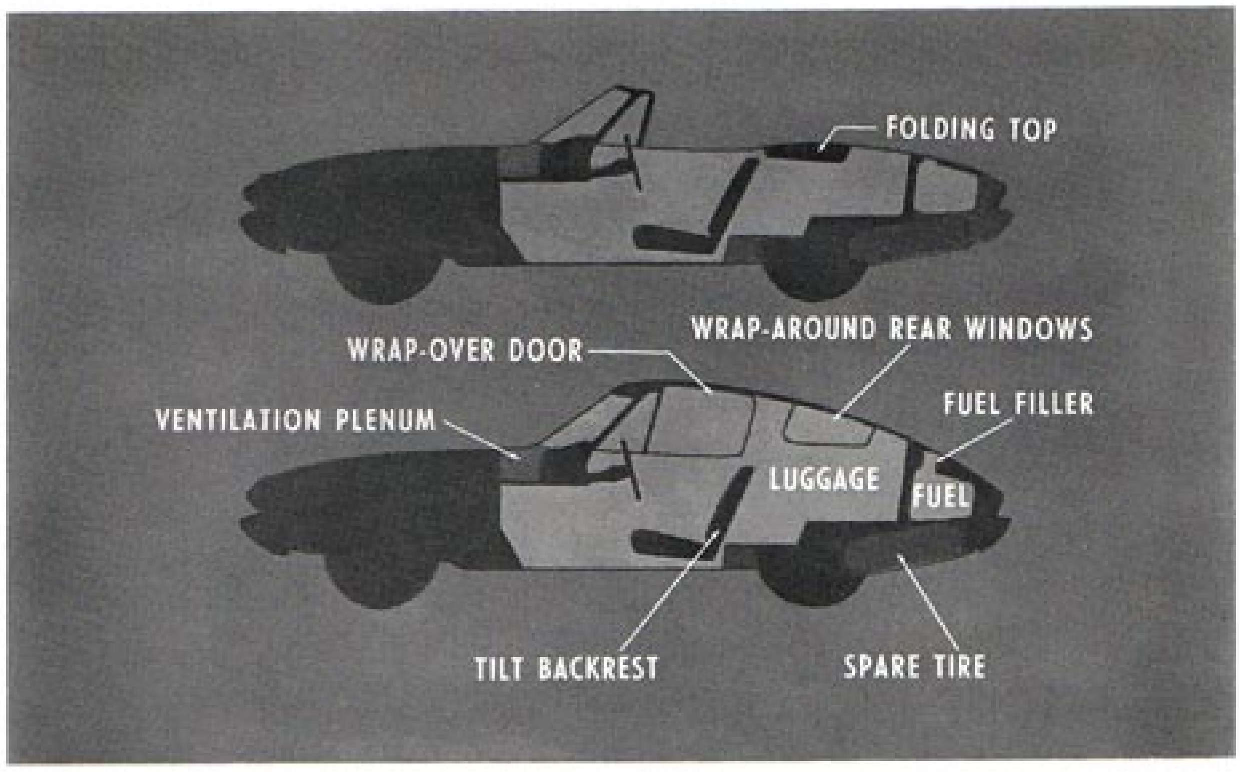


Figure 4. Improved passenger and driver entry and exit are obtained with simplification of windshield and hinge pillar construction.

Figure 5. Below the removable floor panel are two depressed areas, one on each side of the tunnel. The left hand space is utilized for tool stowage.



The final configuration put the gas tank at the extreme rear with an easy to reach large diameter filler neck. The deck lid was eliminated to solve the problem of the lines cutting up the Coupe rear end. The tire was stowed in a plastic enclosure below the gas tank accessible from the rear under the body. This permitted a space with a low floor behind the seats to be used for luggage on both styles. The seats were designed with folding backs to permit access to this space. The luggage space was almost doubled on the Coupe and increased 60 percent on the convertible style over the 1962 design with a conventional rear trunk arrangement. There never has been a question of the desirability of continuing with molded fiberglass for this particular car. When a completely new program was initiated, we found that the advantages which led to the use of plastic in 1953 held true for the 1963 design.

It is true that the so-called cross-over point of the material versus steel will vary from piece to piece, the more complicated pieces having a much higher crossover volume.

In order to learn the true cross-over volume of this car in plastic versus steel, it would have been necessary to design the car both ways and carry out a complete study. However, there is one feature of plastic that has always been advantageous; and this is the low cost tooling. This permits fairly complicated changes from year to year without a tremendous investment in tools and equipment.

The original material specification on the molded fiberglass body panels has worked out quite well. The last change recorded on this drawing is dated April 21, 1957. While we do not pretend that this is the final state of the art, we do feel that we have reached a plateau on specifications where we can produce a good plastic body panel. We have over the years, found that the most practical design from a

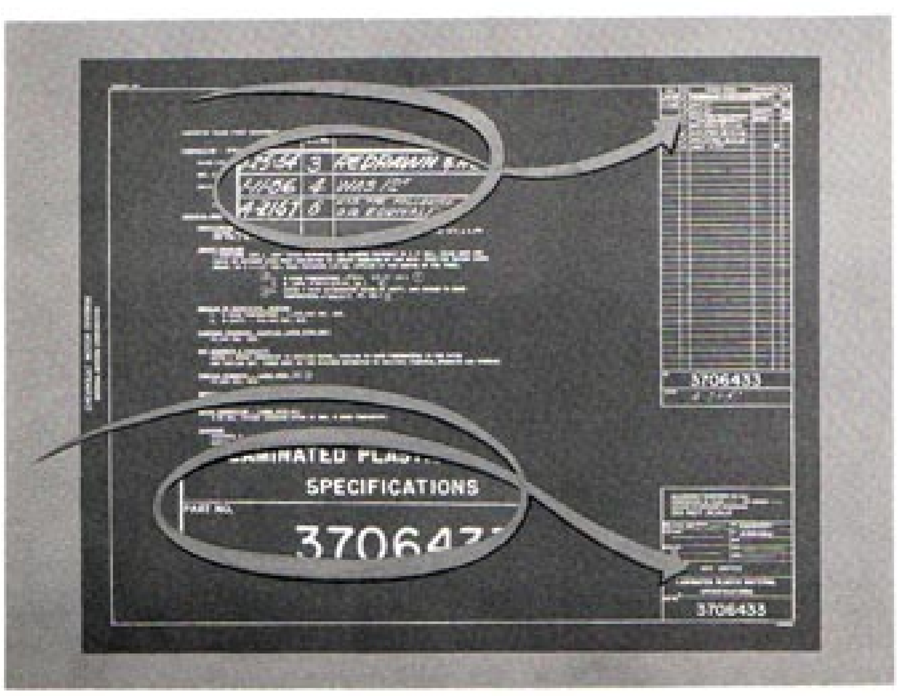


Figure 6. Laminated plastic specification.

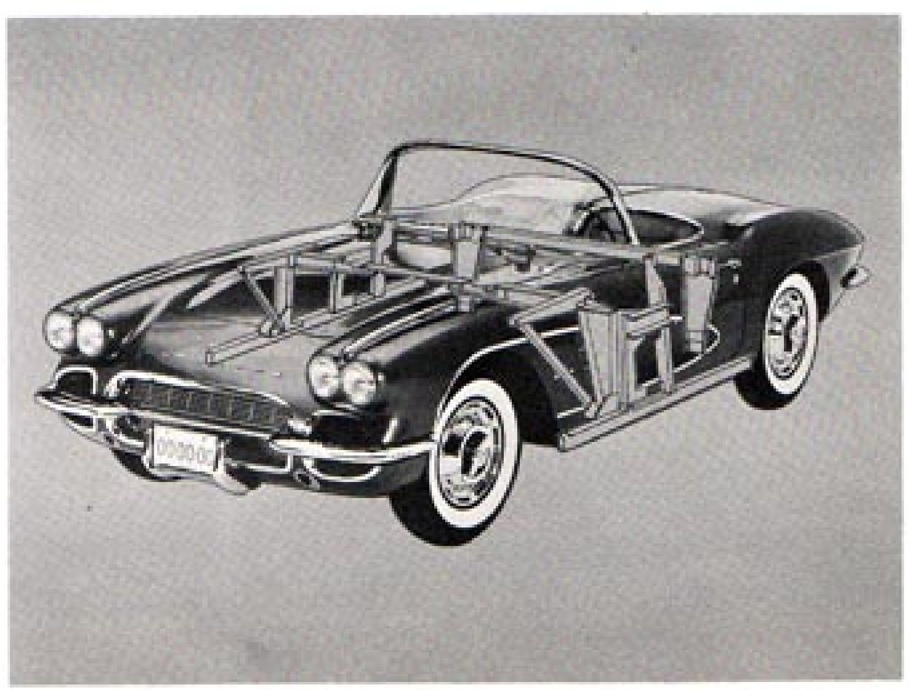


Figure 7. Steel body reinforcements (1962).

Coupe

cost and weight standpoint is to gain stiffness with metal structure using the plastic as a skin. We gradually added stiffeners in the Corvette as the years went by and eventually ended up with the package shown in Figure 7.

In the 1963 program the design process was reversed. A steel framework was to be the foundation on which we would build. As this structure took shape, it became known as the bird cage.

It is obvious that the Coupe structure does look a little like a bird cage since it is a complete framework with upper rails tying in the windshield and lock pillar areas.

The convertible structure is the same, except that the upper rails are missing; and the lock pillars are gusseted into the rear cross rail for stiffness as illustrated above. These structures back up the plastic panels and provide

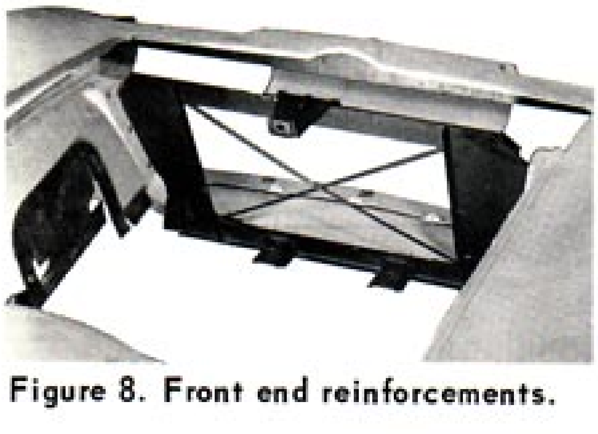


Figure 8. Front end reinforcements.

firm attachments for the door hinges at the front and the locks at the rear. The windshield framing is an integral part of this structure.

The folding top with its steel framework is bolted to the steel at the lock pillar and latches into the windshield framework at the front.

The removable hardtop is essentially a plastic structure, but it too bolts at the rear and latches to the windshield, adding some stiffness when installed.

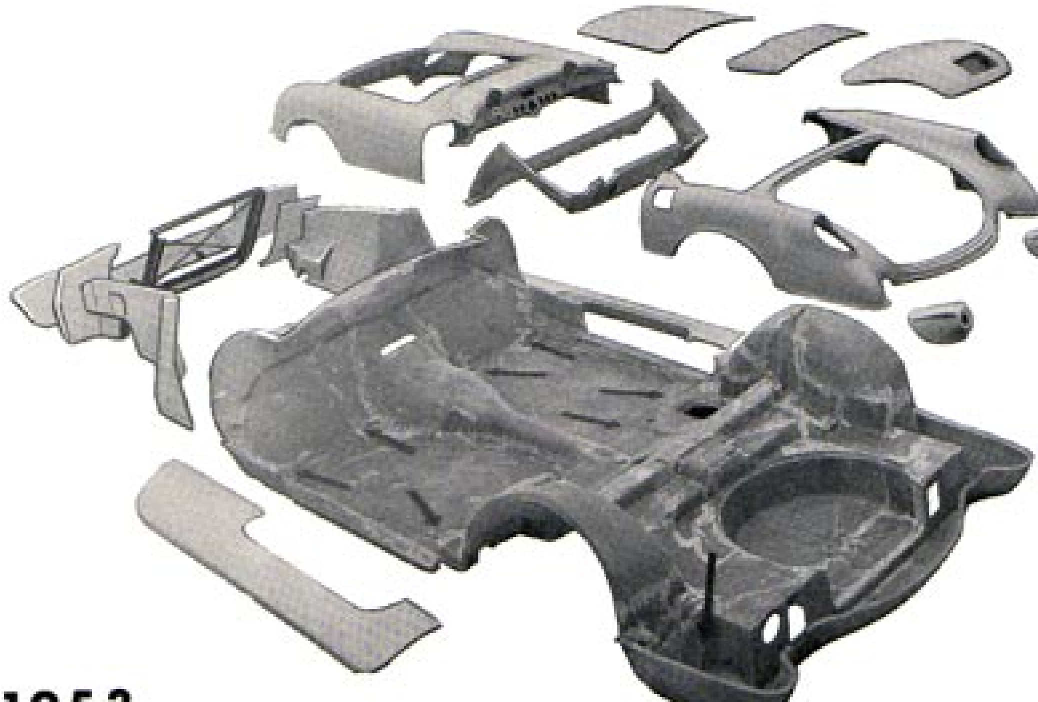
The steel parts in the 1962 body weighed 48 pounds. In the 1963 body, they weigh 82 pounds. To this steel structure are attached the plastic parts that make up the additional structure and the skin of the body and front end. The means of attachment in most cases is by riveting the plastic parts to the metal. In places where rivets could not be exposed, a bonding strip was riveted to the steel and final skin was then bonded to this.

The plastic nose section of the car is essentially a bonded plastic structure very much like the 1962 model. It is reinforced in the front end by a radiator support and a reinforcement in the head lamp area.

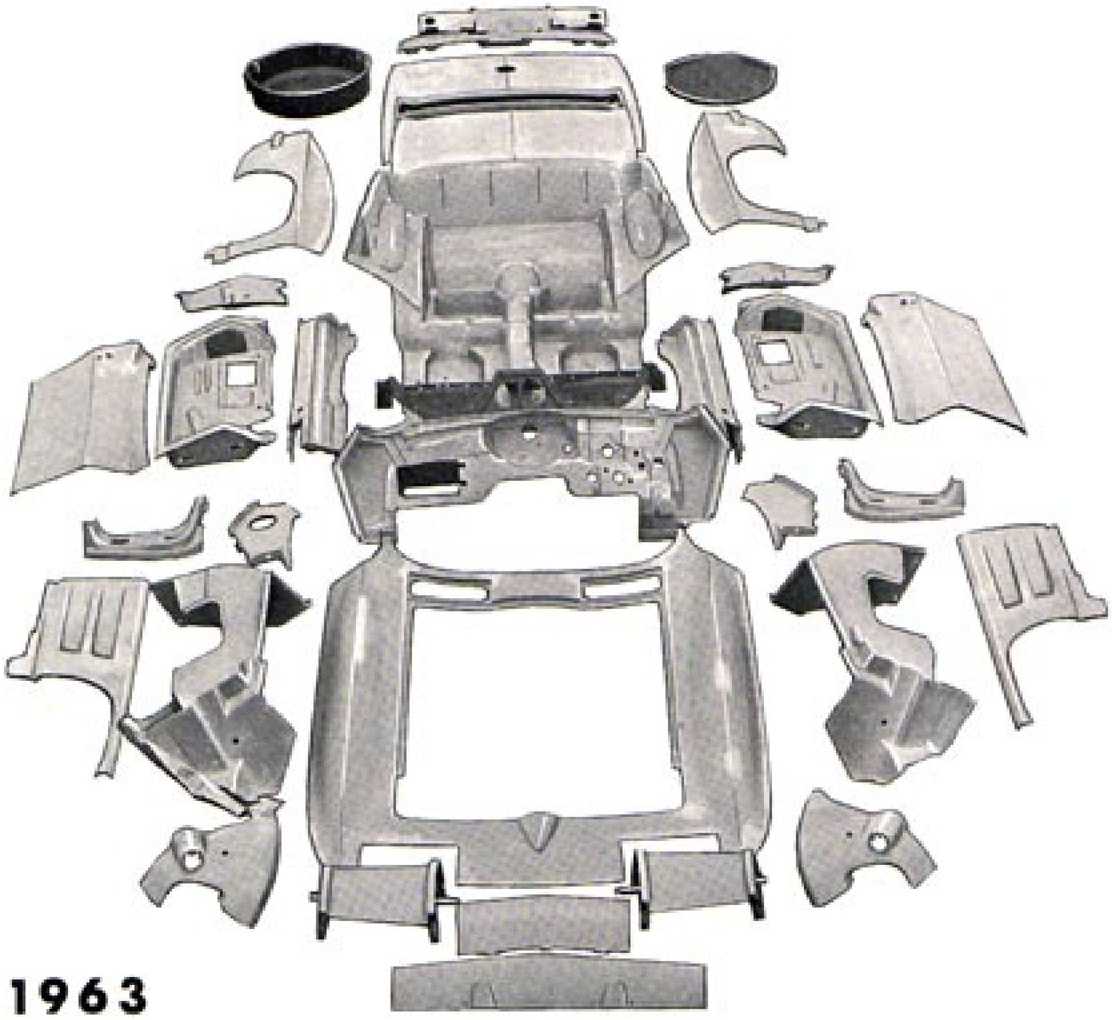
Convertible-open

Convertible-folding top

Convertible-removable top



1953



1963

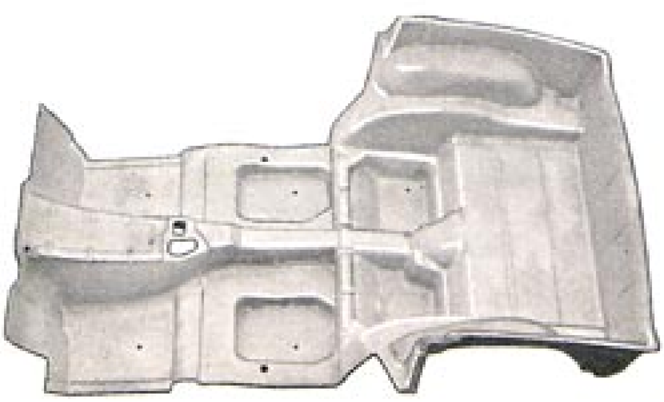


Figure 9. Body construction, in general, is the same for 1963 Corvette models as it was in 1953 with the underbody forming the base for the build-up of remaining body panels. Doors for coupe models are the same as for the convertible with the addition of upper frames for side glass.

The plastic parts comparison is shown pretty well by the panel layouts of 1953 and 1963 convertible pieces (Figure 9). The top layout is the 1953 original concept. In later years we spread out and added more pieces, but generally the construction was similar. The 1953 plastic parts weighed 357 pounds.

The 1963 convertible plastic parts weighed 300 pounds, so we have traded some plastic weight for the additional steel that we put into the car for added rigidity. The total body weight ready to drop on the chassis was 411 pounds in 1953, 405 pounds in 1962, and 397 pounds in 1963.

The doors on this car were an engineering program in themselves. This is a long door, and extreme body shape put a severe restriction on hinge spread. The Coupe door had the added problem of a large size upper that cut up into the roof. These are very large doors on very small hinge spans.

The door in the roof idea is not new. It has been kicking around for years as a means to improve entry and exit. High volume cars steered clear of it because of cost and fabrication problems, but the Corvette Coupe being very low had much to gain by this approach, so we went ahead. Figure 11 illustrates the narrow hinge span, the big door, and to some extent the amount of steel we put into this hinge to be sure that we had an adequate design.

The doors are essentially plastic structures but are backed up with steel reinforcements, particularly in the hinge area. The window glass is solid tempered and curved slightly in two directions. There is no window frame on the convertible. A C.V. window occupies space made available by the new windshield shape. The door lock is essentially the same lock as regular passenger car with all

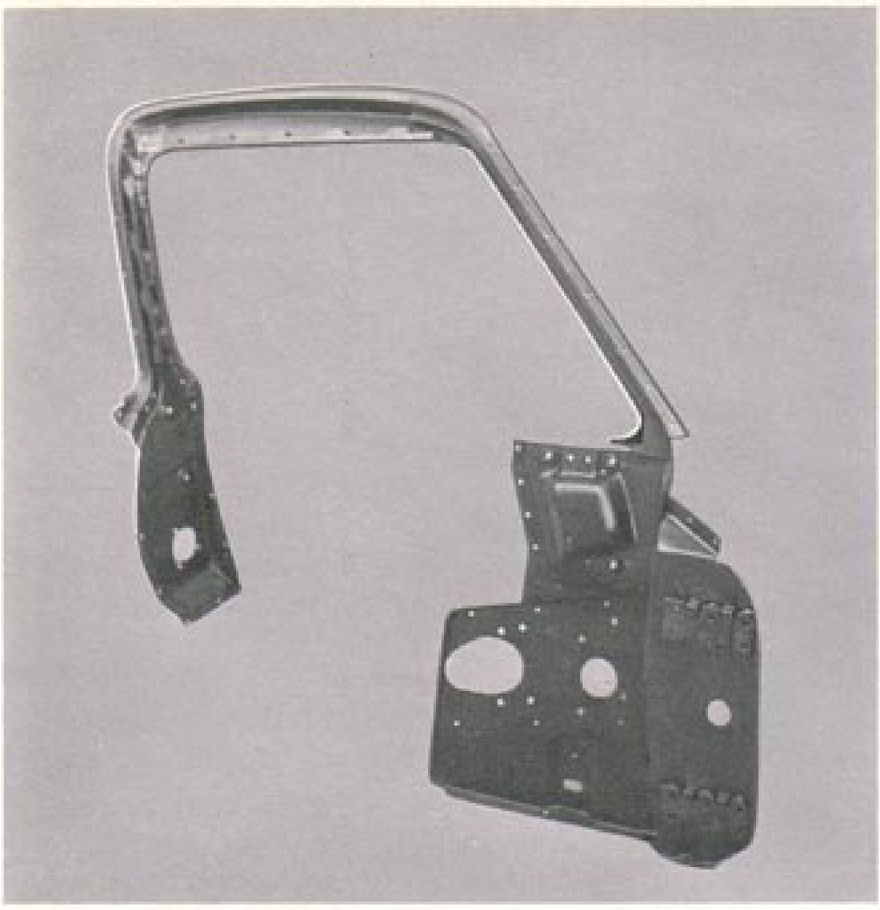


Figure 10. Door steel reinforcement.

Figure 11. Coupe "wrap-over" door.

GM features. The convertible is somewhat the same except, of course, that the upper door frame is omitted.

The underbody is again a one-piece molded unit extending from the dash panel rearward. One difference from previous models is that this underbody ends just ahead of the gas tank. The upper body continues to the rear. A rear partition panel closes off the body compartment ahead of the gas tank. The underbody is common to both models.

Body mounts are located in four places on each side of the body. Number 1 is just ahead of the hinge pillar, and Number 2 just aft of the hinge pillar to provide a good anchor for the hinge, Number 3 anchors the base of the lock pillar at the front of the rear wheel opening and is the last bolt on the underbody proper. Number 4 is at the extreme rear of the underbody and ties down the body upper structure to the frame. The first three are bolted through the steel body rail which forms the bottom of the bird cage.

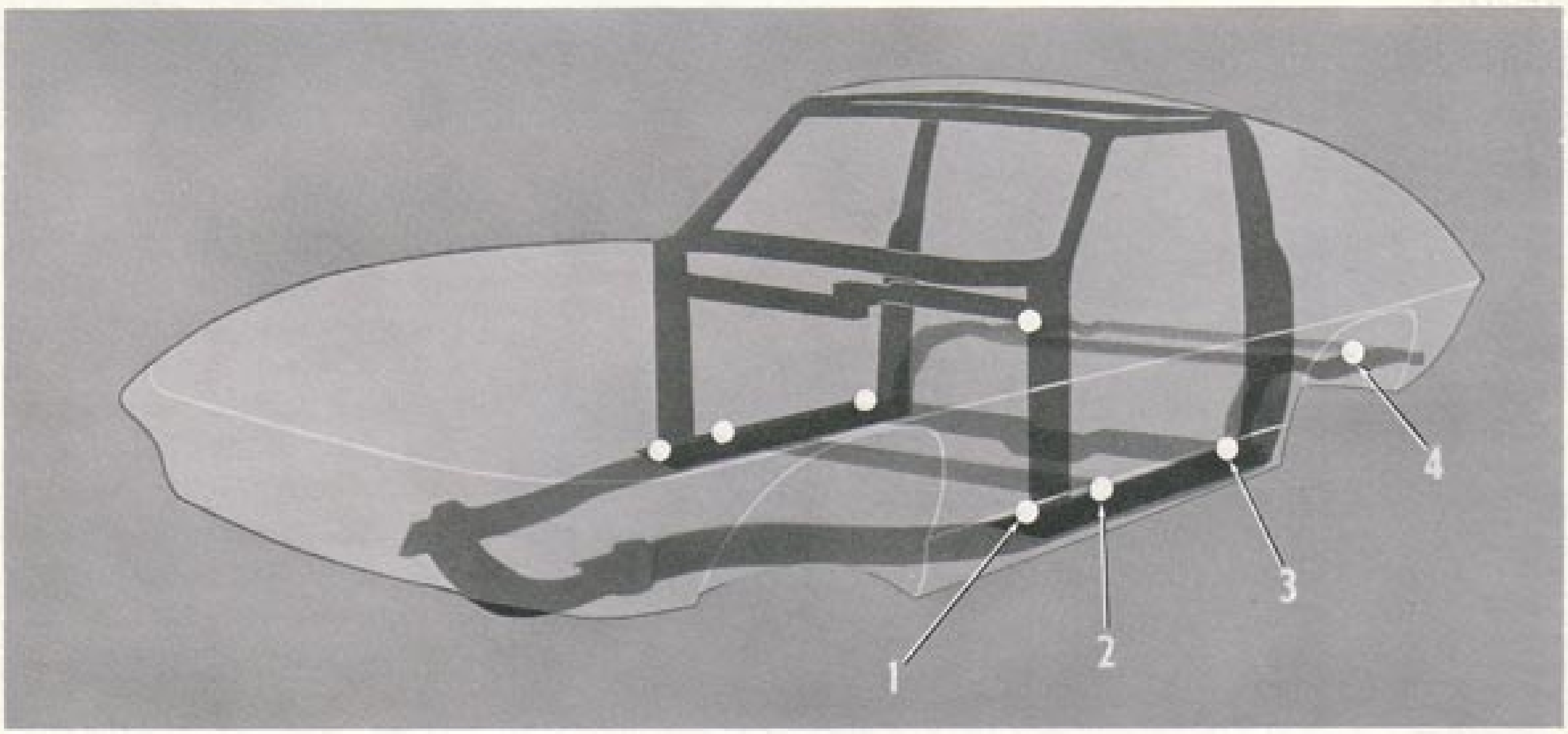
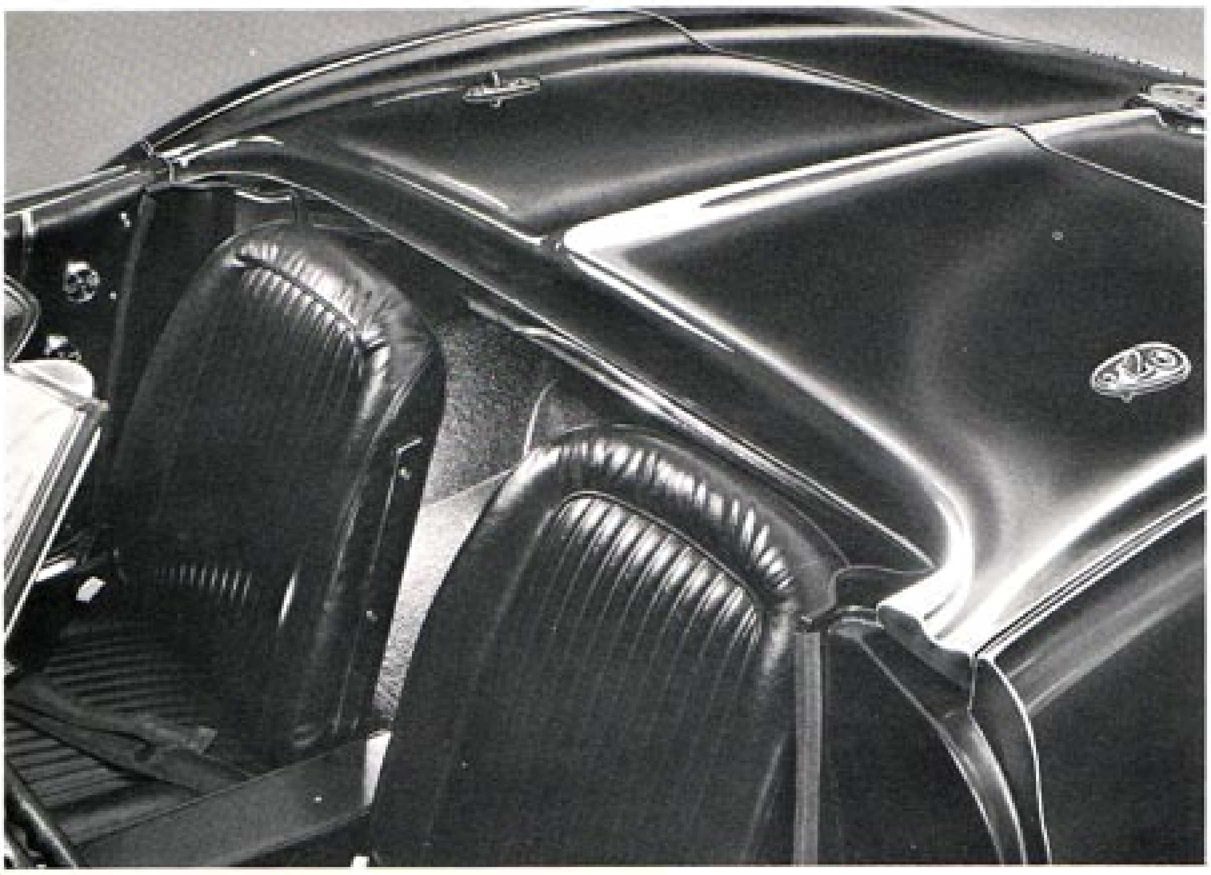
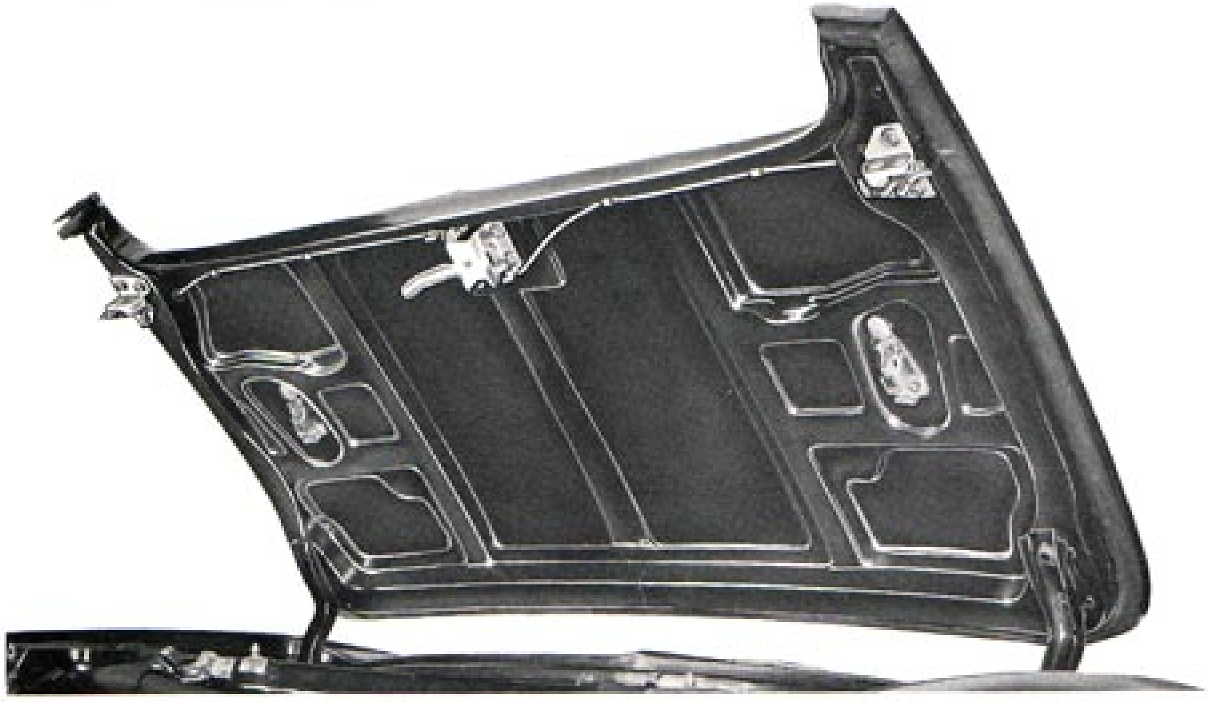
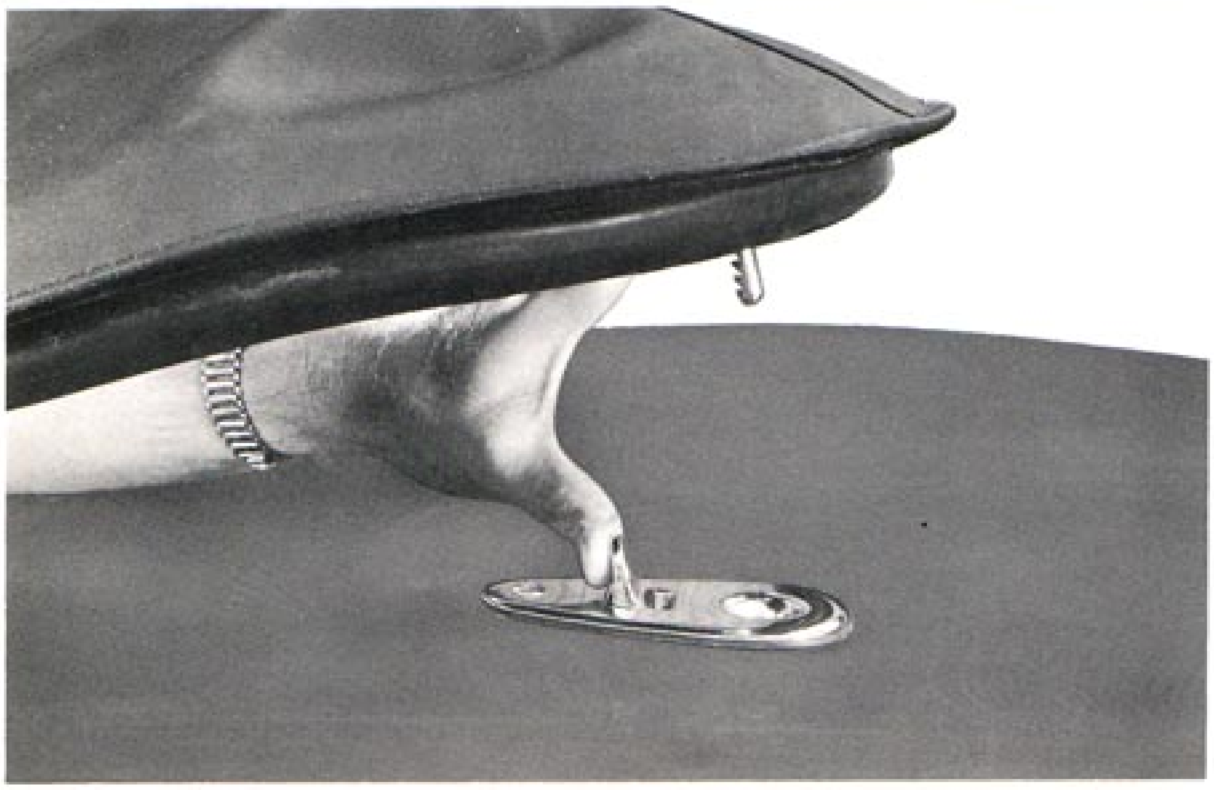


Figure 12. Body mounting points.







The folding top is just about like any other Corvette folding top, and is still stowed under the cover as on previous Corvettes. In 1963 the center post between the seats is gone to allow access to the luggage space, and the folding top lid bridges across with latches on each side.

The folding top latches are a simple cam type operated by cables from a single release in the center of the lid. The folding top header is retained by latches similar to the 1962 design.

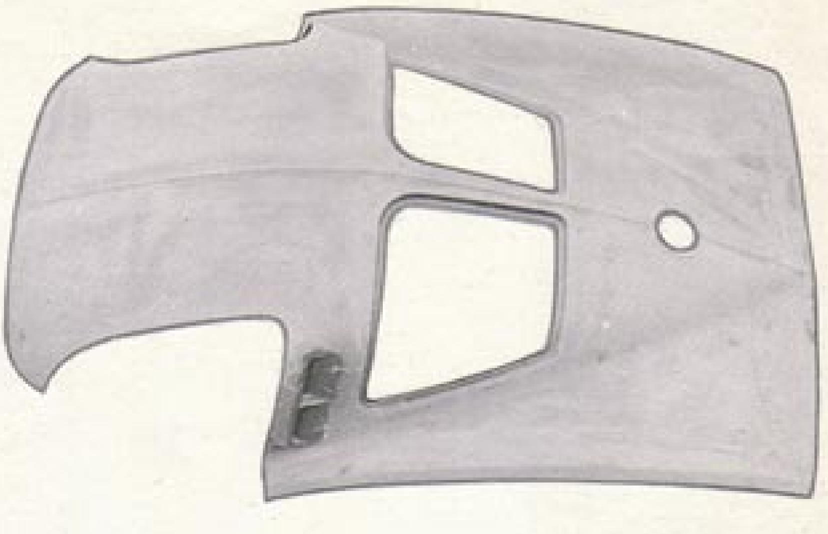
The retention of the rear bow is new for 1963. The over-center clamp and hook is replaced with a guide pin that is retained by a sliding latch under the lid.

The removable top side rails and roof panels are bonded plastic parts. Metal is used at the header rail and along the bottom edge of the backlight. Attachment at the front employs the same latches used on the convertible. Attachment at the rear is by bolts concealed under the rear bow seal and is accessible by reaching under the folding top compartment lid.

The Coupe roof panel is a large, one-piece plastic part bonded to the metal bird cage header and roof bow. In the rear, the roof is joined directly to the plastic parts which form the rear of the body. The roof panel carries two tempered glass back lights. A plastic inner panel is bonded to the roof at this point to help support the back light.

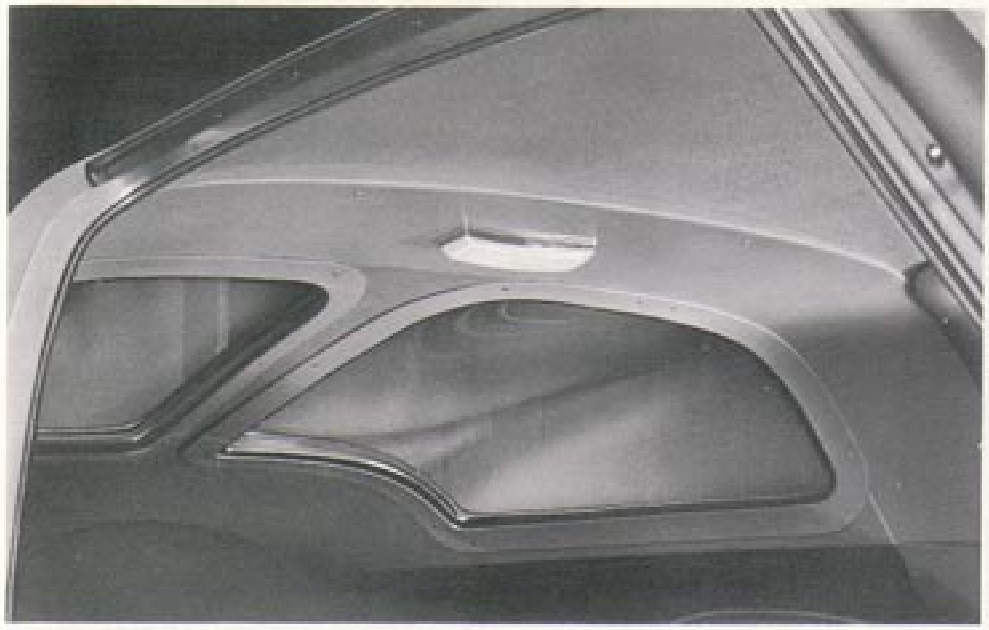
A thin plastic decorative piece - we call it the halo panel - goes in to conceal the metal roof bow in the rear area. The removable hardtop and the Coupe roof are trimmed out with a headlining and moldings to finish off the inside.

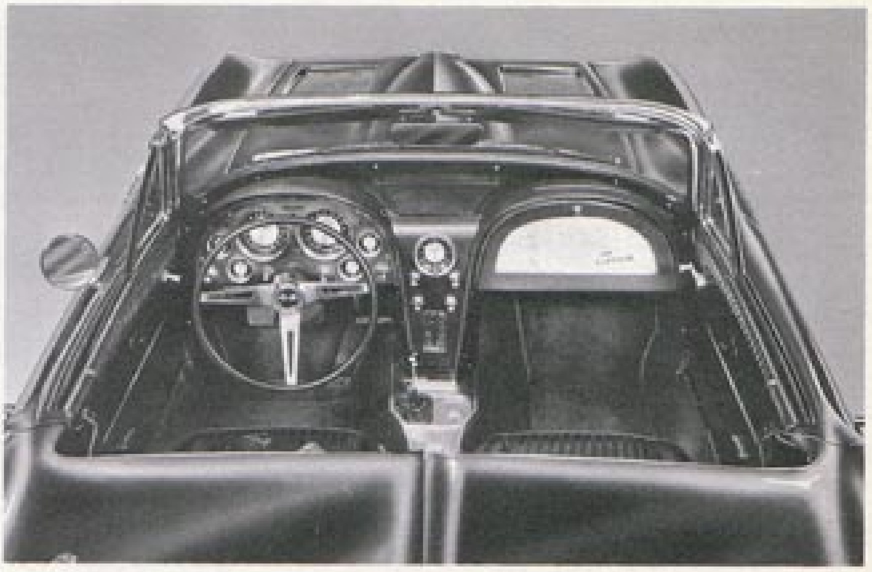
The seats are individual bucket type using a combination tube and



stamping framework, formed wire springs, and polyurethane padding. The base tube in the seat is also the top half of the seat adjuster. Both seats are adjustable, the adjuster handle being located at the right hand front corner of the seat. Both adjusters also have vertical adjustment features which permit a bolt type adjustment to the seat position desired by the owner.

This seat adjustment complements the steering wheel adjustment. The steering wheel can be moved up and down along the steering column angle by adjusting clamping bolts at the instrument panel and ahead of the dash panel. This gives the owner an opportunity to select the combination which suits him and lock it up in this position. The seats are, of course, equipped with seat belts which anchor through the floor and tie to the chassis frame.





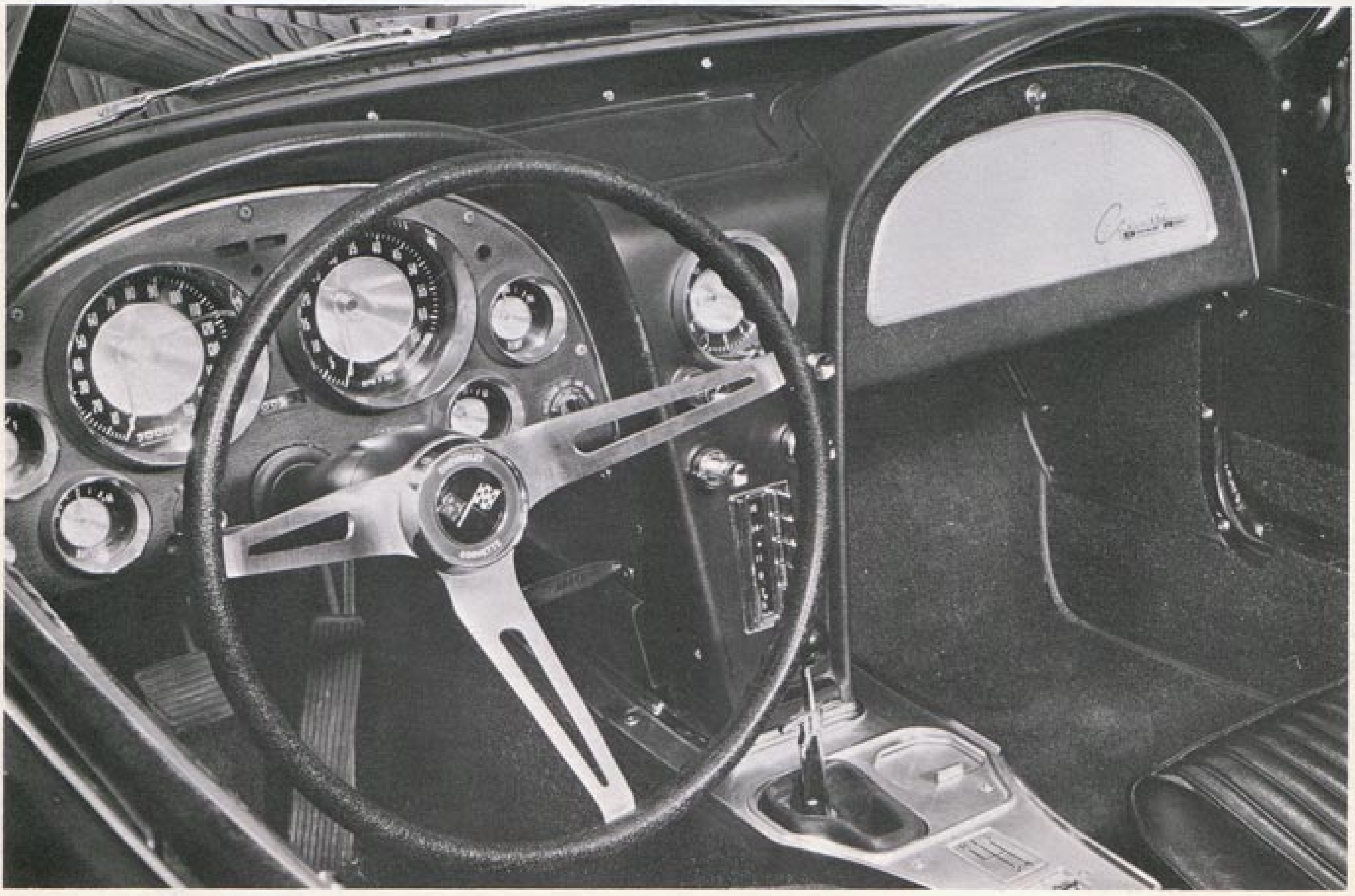
The instrument panel is a plastic piece including the center console area that sits down on the underbody tunnel. Two padded visors over instrument cluster and glove box door are attached to the top of the basic instrument panel. The instrument cluster unit and the glove box are assembled from the front to complete the major assembly. Pictured above is the plastic part of the instrument panel which is molded with a vinyl skin to give a leather covered appearance.

In the instrument cluster, the large aircraft type dials, trip odometers, gages instead of indicator lights were all added very much as the result of our contact with Corvette fans.

Control placement, pedal locations, and general roominess in the cockpit has improved over the 1962 Corvette and we believe is better than many of the foreign cars of this type.

The glove box is conventional A cardboard liner forms the box. The door outer is molded of acrylic plastic and contains all of the decorative design features.

The center console area carries a clock, the radio, and the heater controls. The heater is a full



fresh air type replacing the recirculating heater used on previous models. Fresh air is taken from a plenum air intake system and reaches the cockpit area through inlets in the cowl kick panels. Vent controls are located under the instrument panel on each side of the steering wheel.

A feature worth mentioning is the head lamp arrangement. The dual head lamps are mounted on rotating sections of the nose panel. When not in use, the head lamps are concealed by the smooth line of the nose.

A switch on the left side of the instrument cluster rotates the lamps to up position when required. The normal push pull switch turns lamps on or off.

The head lamp arrangement, like the side doors, involved a lot of engineering to arrive at the final design.

We designed and built five different types of mechanism to control the lamps. These ranged from a simple manual rod and cable design up through a complicated electronic Rube - Goldberg that handled all motion with a single switch. We finally settled on a two motor electrical system that required two switches to operate but has no little dogs running on tread mills.

Each head lamp door has its own electric motor, actually an adaptation of a C.V. window motor. The activating circuit is independent of the light circuit for simplicity. A red warning light goes on when the head lamps are on with the doors closed, to eliminate the possibility of this pilot error. This system was designed and tested with head lamp aiming and positive positioning as primary considerations. Testing has proved the system to be durable, dependable, accurate, and safe.

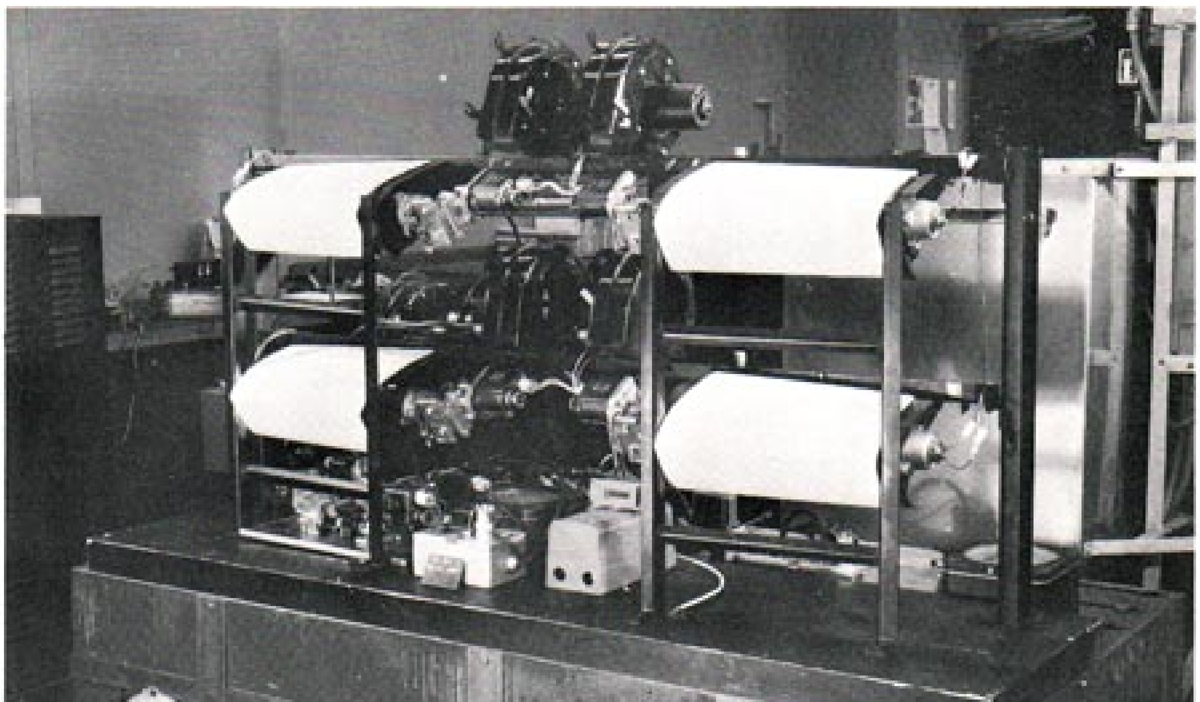
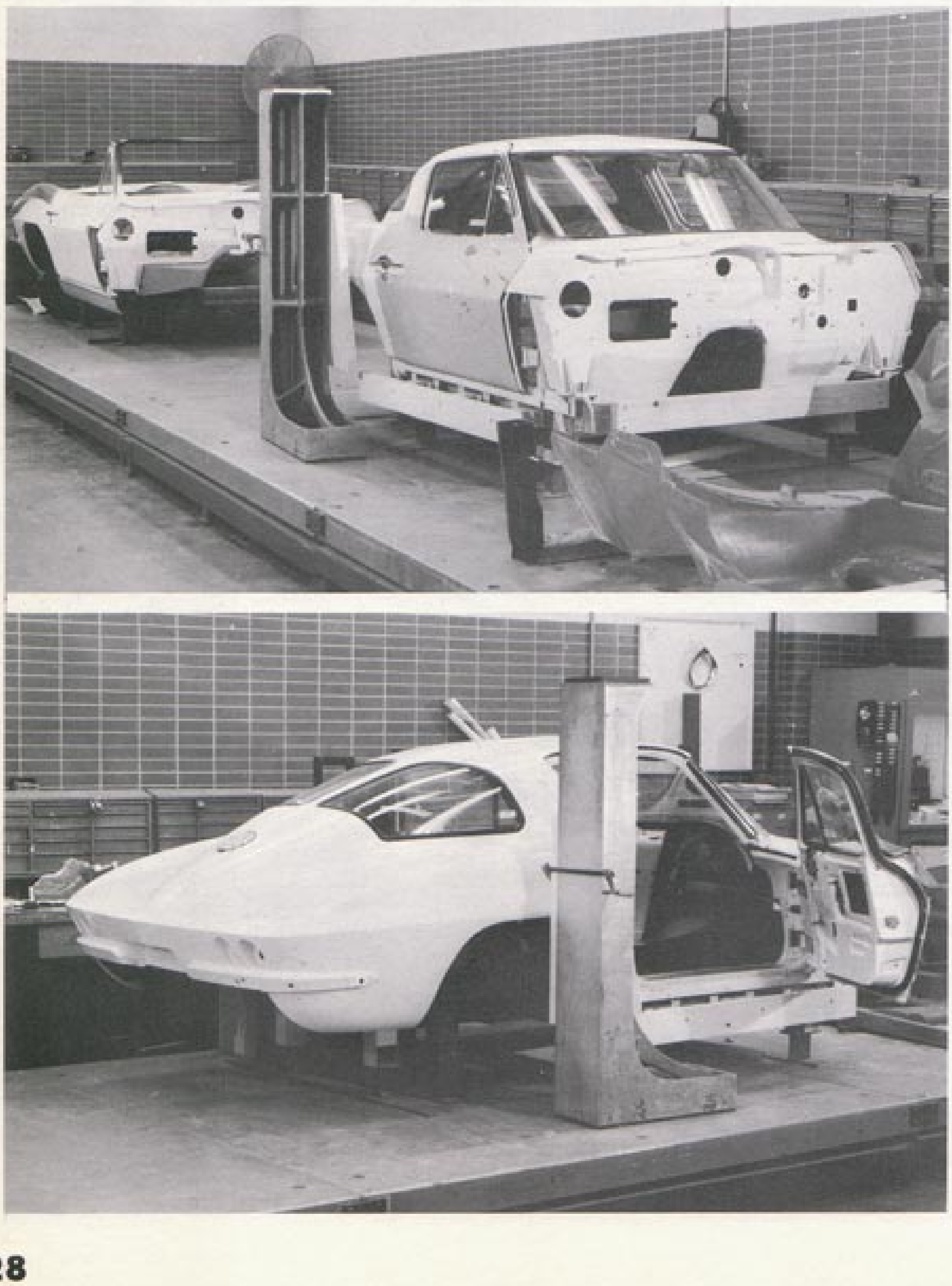


Figure 13. Rotating headlamp test fixture.

Figure 14. Extruded closed cell rubber door seal.

Figure 15. Spare wheel provision.



The sealing of the body should be mentioned here because it was a problem on the first Corvette and one which received a lot of attention in subsequent models. The seals on the 1963 Corvette are mostly large sectioned, closed cell rubber extrusions with molded rubber parts filling in here and there.

The Coupe door again received extra attention on this point. Not only is a large gutter provided at the primary seal, but a secondary seal and door bumper is provided along the top edge of the door to float most of the water away from the critical area. Of course, sealing the deck lid on this job was literally no problem at all. Windshield and back light sealing is accomplished with conventional rubber channels.

Figure 16. Plastic body bucks maintained pace with the developmental program and were made to print in every detail. As the program changed the bucks were updated to present the latest design configuration. Constantly in use as a check on design, the bucks served to try out fixes, new ideas, and fits of parts. During later stages of development, the bucks were used for various body tests.

Bumpers are similar to those used on past model Corvettes and are tied back into the frame members with steel back bars. The grille is a simple part using extruded aluminum horizontal bars joined with vertical ties. The hood, hood hinge, hood lock, and hood hold open are similar to the 1962.

The spare wheel is mounted below the gas tank. Access is from outside the car at the rear. To make it easy to get at the spare, a carrier is provided. This carrier drops down at the rear permitting the wheel to slide in or out. The carrier is hung from the chassis on three long bolts. The single bolt at the rear can be unlatched from a guide slot to permit dropping the carrier. A lock is provided in this bolt as a protection against theft.

The wheel in the stowed position is protected from mud and ice by a plastic cover which fits over it completely. The upper cover is a bathtub permanently fastened to the chassis. The lower cover is also the tray on which the wheel slides in and out.

Chevrolet has always believed in thorough test work, and this program was no exception. Three complete prototype cars were built, two convertibles and a Coupe.

In addition to the prototype cars, complete Coupe and convertible bodies were built and mounted on surface plates as permanent test and development bucks. These bucks were continuously in use as a check on design and most important, as a body on which to try out fixes, new ideas, or just the fit of various parts without tying up the running cars which were undergoing road tests at the Proving Grounds. These bucks served faithfully as a running check on design, guinea pigs for all sorts of tryouts, and finally as test fixtures for door slam and other tests of this type.

Figure 17. Complete vehicles were tested on the chassis rolls to determine the dynamic characteristics of the body and frame combination. Important areas such as body mount locations, sympathetic panel vibration, door pillar and dash panel "matchboxing" were investigated.

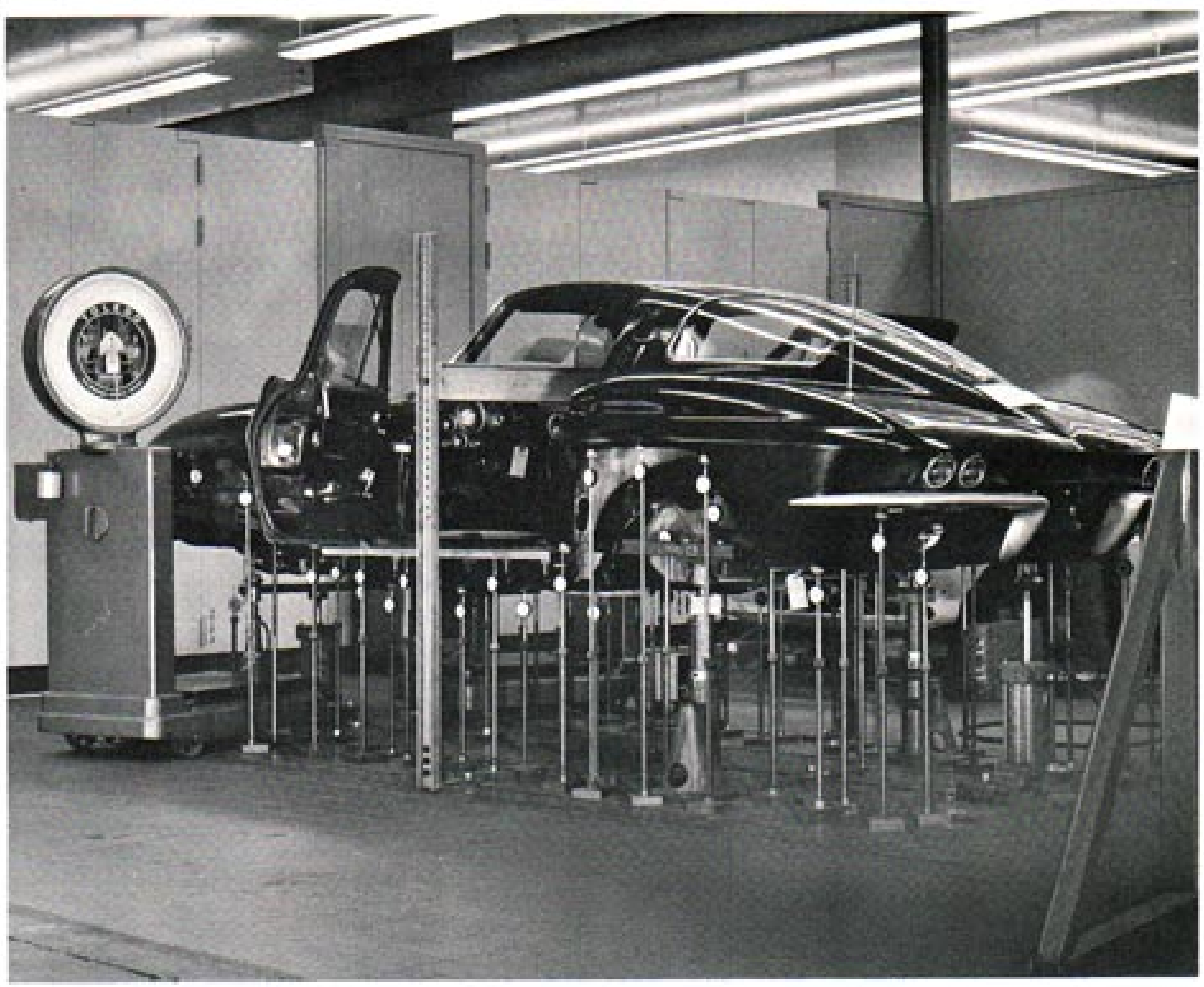


Figure 18. Torsional stiffness and beaming strength were checked in the Structures Laboratory and the results of these tests were compared to previous models and designs in the structural analysis of both body styles.

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