313B

THE CORVAIR 95

CHEVROLET'S SPACE AGE PANEL TRUCK

BY

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CONCEPT AND GOALS

Obviously, the most important consideration in the development of any new product is that it meet the demands of the consumer. To closely study what was available, models of each European compact were purchased for intimate engineering investigation (Fig. 3). These vehicles were measured, disassembled, and reassembled. They were performance tested, durability tested, load efficiency tested, and in general, subjected to every other conceivable investigation. It was soon discovered that several of the imports had great load capability and reliability considering their overall size, weight and cost.

A comprehensive study was conducted to get the views of users in this country who were already operating the imports. In addition, Chevrolet engineering personnel visited Britain, Italy, Germany, France, and Switzerland where a larger variety of models and their uses could be observed. The owner's likes, dislikes, observations, and suggestions were recorded and forwarded to the home office for study.

An evaluation of these reports indicated that the cab forward

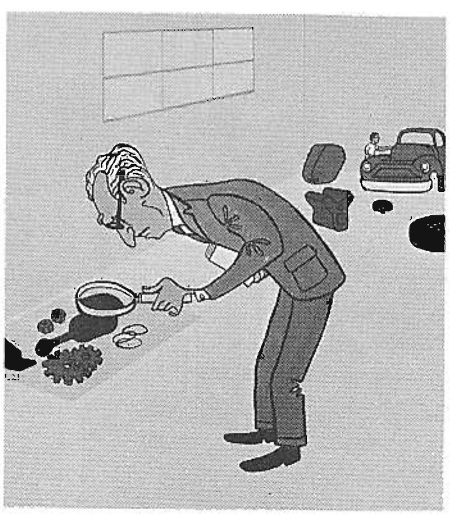


Figure 3

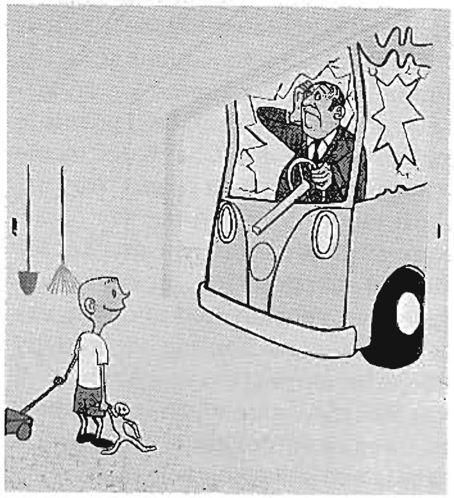


Figure 4

design, because it offered the largest load space-to-vehicle cube ratio, found the greatest acceptance. Another important advantage of this design was its adaptability to either passenger or cargo carrying service. However, one common objection was voiced: in most of the cab forward design and other vehicle types investigated, the engine generally obstructed the driver or load space, or both. It became immediately apparent that a cab forward design embodying the rear engine concept then under development at Chevrolet would easily satisfy these conditions.

The foreign test vehicles were also studied to eliminate any deficiencies and incorporate advantages into our models. One deficiency came to light in quite an abrupt manner when an engineer drove one of the imports home. Since it was raining, the driver attempted to garage the vehicle much to the distress of the garage door and the windshield and roof panel of the import (Fig. 4).

This experience immediately established one of our design objectives: the overall height must not exceed the minimum average garage door height since most of the passenger, and many of the pickup and panel models, might well be garaged. A survey sponsored by Chevrolet determined the average minimum garage door height in the United States to be 75 inches.

The investigations Chevrolet conducted dictated the following additional design objectives:

- Lowest possible platform height for easy side and rear loading and unloading, and for comfortable driver and passenger entry and exit.

- Maximum cargo accessibility through the use of doors at both sides and at the rear of the load compartment. In addition, the cargo area of the panel models should be accessible from the driver's seat with a minimum of obstruction.

- A nearly constant and equal weight distribution to provide maximum tire utilization, unloaded traction, and excellent ride and handling characteristics.

- Performance acceptable by U.S. standards with fuel economy to be maximum obtainable with such performance requirements. Both 3 and 4-speed manual transmissions and an automatic transmission must be available to cover a wide range of usages.

- Simple power plant and suspension assembly removal and replacement for ease of service with good access to filling station service items.

- Contemporary, functional styling to relieve vehicle of its boxy look with coachwork finished to U.S. standards.

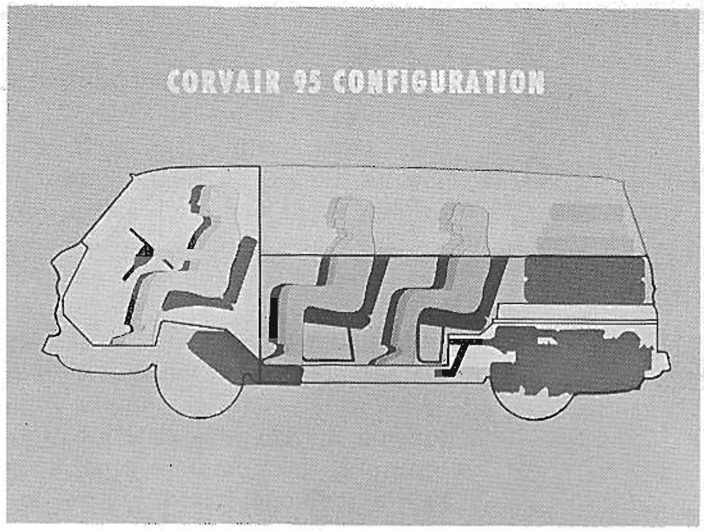


Figure 5

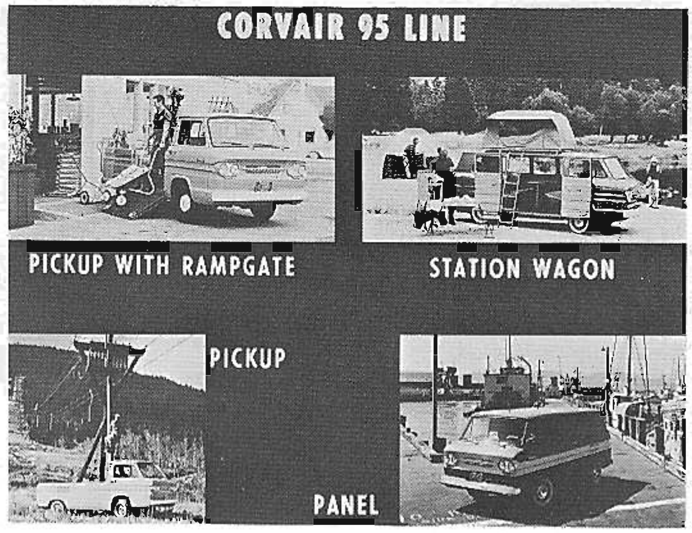


Figure 6

The rear mounted horizontally opposed six-cylinder engine, cab forward design, passenger compartment requirements, load space and platform height requirements, and such design objectives as the 75-inch maximum overall height for garage entry firmly established the new vehicle's configuration (Fig. 5). To keep a low K /ab ratio for best ride and handling characteristics, the wheelbase was made as long as possible within an established overall length. The rear wheels were set back as far as the rear mounted engine would permit and the front wheels were positioned as far ahead as driver entry would allow.

Chevrolet's new light-duty line (Fig. 6) consists of a panel, a station wagon, a pickup, and a pickup with rampgate. These models are built on a 95-inch wheelbase and are nominally rated at 1/2-ton. All models feature body-frame integral construction, which permits the elimination of a separate frame; truck-type chassis components with coil spring independent suspension, front and rear; relay-type steering linkage similar to that used in the conventional line; transaxle design with the standard 3-speed or optional 4-speed or Powerglide transmission; large, 11 x 2-inch brakes; a rear mounted, six-cylinder air-cooled engine, and a 4600 pound maximum GVW rating.

Probably the most controversial subject in truck design is styling and its effect on customer appeal. The stylists were given a real challenge. Make the truck attractive, but don't expect the engineer to retreat an inch at the expense of function or any of the design objectives. Attractive appearance was attained without sacrifices.

A description of how the concept and objectives just outlined were met in the actual design and production of these vehicles follows.

BODY

One of the paramount aims in the Corvair 95 design program was to provide a compact, lightweight, vehicle capable of carrying economically a 1600-1900 pound payload. Another important aim was to maintain relatively equal and constant weight distribution for good vehicle ride and handling. To meet these goals, a body having an integral frame and provisions for forward controls and a rear-mounted engine was selected. With this arrangement, the body could be proportioned to satisfy the requirements of compactness and large capacity, and with the driver forward and the engine at the rear, the requirement of relatively equal and constant weight distribution could be met. Lightweight, another requirement, is obtained through the body-frame integral construction which eliminates a great part of the weight of a separate frame.

The selection of body-frame integral construction also affords other important advantages: the entire body shell is made stronger and more rigid since the structural material is more efficiently utilized, and interior capacity is increased since the load compart-

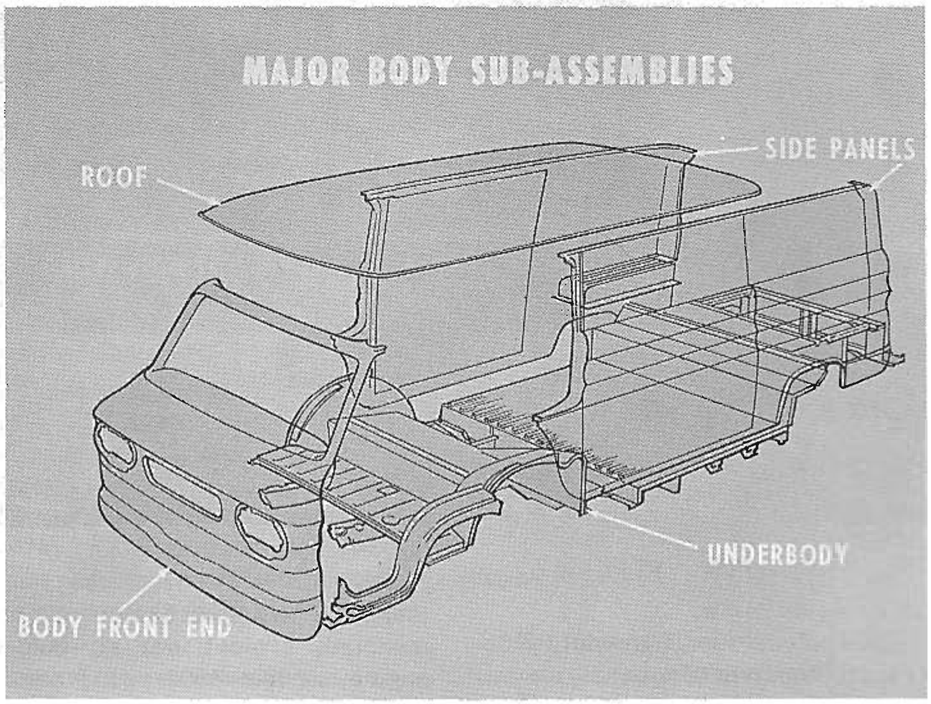


Figure 7

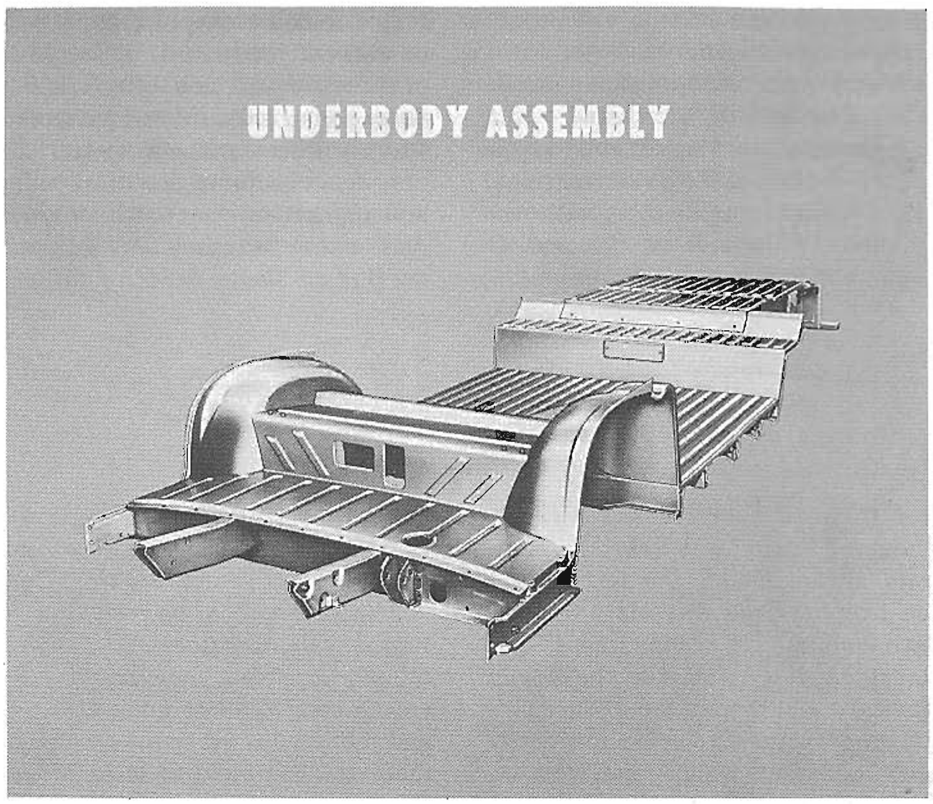


Figure 8

ment floor can be positioned closer to the ground.

Except for pickup models, the bodies are comprised (Fig. 7) of five basic sub-structures: the underbody, left and right hand side panels, front end, and roof panel. A rear cab structure is used on the pickups. These major assemblies are bolted and welded together with various other supporting members to form a complete body which has extremely high torsion and beaming strength. For example, the complete panel body has a torsional rigidity rate between the wheels of 7721 pound-feet per degree and a center beaming of .010 inch deflection per 1000 pounds. This compares with a torsional rate of 6976 pound-feet per degree and a center beaming rate of .016 inch deflection per 1000 pounds for a well-known import equipped with a similar body type.

The Underbody Assembly

The underbody assembly is shown in perspective in Figure 8. The forward end of the underbody, or driver compartment, is comprised of a slightly crowned floor panel and a seat riser flanked with wheelhouses.

The center area consists of a large longitudinally corrugated drop center load floor. This configuration affords several features which are basic to the overall Corvair 95 concept. With the incorporation of doors or ramps in the body side structures, convenient side loading at low heights is provided, supplementing that at the rear. Also, since the largest load area is at the center of the vehicle, weight distribution between the front and rear wheels remains relatively unchanged when the vehicle is loaded, permitting the design of components which

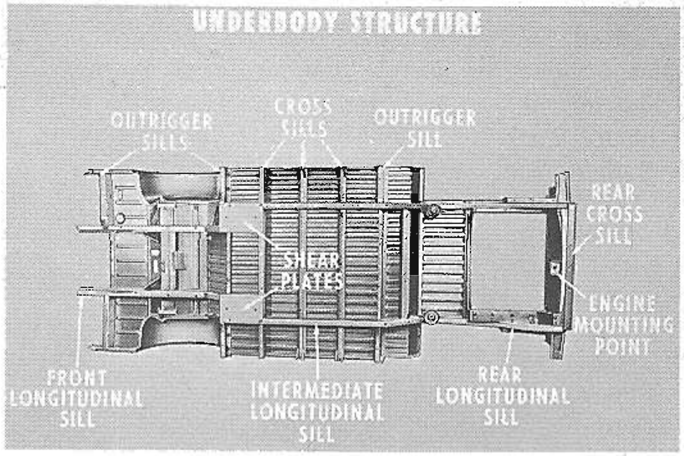


Figure 9

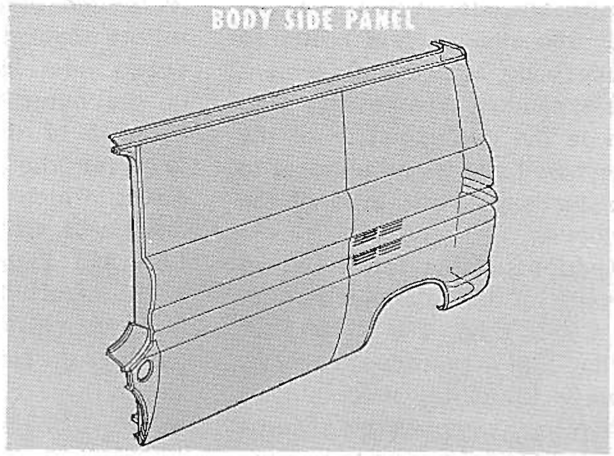


Figure 10

provide the best ride and handling characteristics.

The rear area is composed of a vertical wall and portions of the rear load floor. Provisions for mounting the power plant and rear suspension are also provided.

Torsional support is given the underbody structure (Fig. 9) with cross sills and outriggers of various section. Shear plates, welded to the full length underbody sills, are used to strengthen the underbody longitudinally.

For convenient vehicle jacking, left and right hand pads are provided on the foremost and rearmost outrigger sills. Provisions are also made on the sills for mounting chassis components. A total of seven mounting points are provided for the front and rear suspension, transaxle, and engine assemblies.

Side Assemblies

The right and left hand side panel assemblies (Fig. 10) extend from the front door lock pillar to the rear of body. They are formed with integral rear quarter panels. Included in the assemblies are rear wheelhouses and an engine air induction system.

Side panels are reinforced with full-length welded-in vertical strainers and pillars, and rigidity is enhanced with the styling configurations of the outer lower panels (Fig. 11). The left hand upper body side panel is held rigid with a horizontal strainer and rubber friction pad assembly. An identical, but shorter right hand assembly is used between the left hand side door hinge pillar and rearmost vertical strainer.

In the station wagon application, embossed inner panels are added to the left hand side panel, providing not only a finished interior appearance, but also contributing to the rigidity of the side panel structure. In addition, three glass windows are incorporated in the station wagon left hand side panel, two of the windows being of the roll-down type while the third, or rearmost, window is stationary. This is repeated on the right hand side, the two roll-down windows being part of the double side door structure.

In the areas where no side doors exist, the rocker sill is formed from inner and outer panels. Figure 12 shows a section through

Figure 11

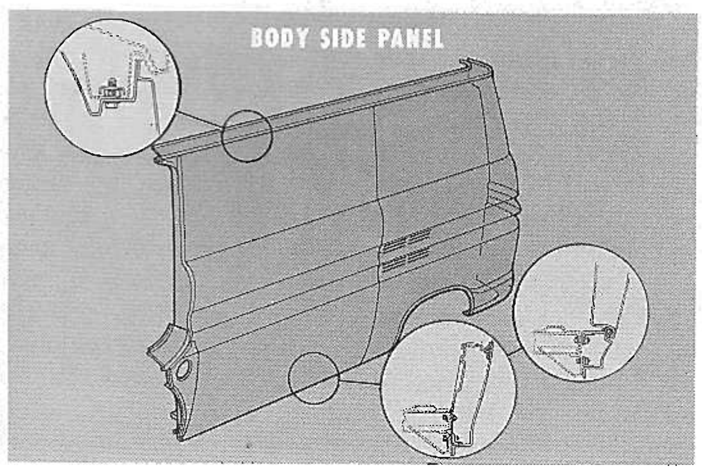


Figure 12

this sill and illustrates how the entire side assembly is bolted to the underbody. Note the placement of the expanding type sealer. Also shown is the configuration of the rocker panel and its attachment to the underbody in the area of the side doors.

A section is also formed along the length of the side assembly to form a roof rail. The method for attaching this structure to the roof assembly is shown in the inset. Incidentally, the doors are assembled as part of the side assembly.

Front Assembly

Common to all models, the front end structure (Fig. 13) consists of an inner panel, toeboard, hinge pillars, and instrument panel attached to an outer panel assembly surmounted by windshield pillars and a windshield header panel. All components are welded together to form a very sturdy structure which contributes greatly to overall body rigidity. The header and pillar construction is shown in the insets.

A plenum chamber for the intake of fresh air is incorporated in the front end structure. Air is admitted through an elongated, louvered inlet located at the center of the outer panel. The forward location of the inlet permits air to enter the plenum with a ram effect which causes rapid discharge of air through the outlets. Left and right hand outlet doors are controlled in the conventional manner with pull-type knobs located on the instrument panel lower lip at the far left and right hand sides. The entire assembly is bolted and welded to the front underbody.

Roof Assembly

With the side assemblies and front assembly fastened to the underbody, the roof assembly (Fig. 14) is added to complete the body structure. Because of its length and shallowness, extra-heavy gauge steel is used for the roof panel to prevent oil-canning. Added rigidity is afforded with six supporting roof bows which, before actual assembly of the roof panel, are slightly overcrowned so they butt tightly against the roof panel. Rubber friction pads are used between the roof bows and roof panel, and insulation from sound and temperature is afforded by cementing vinyl-coated trim pads to the roof panel.

A stamping shaped to form a roof rail and a drain gutter is welded to the outer panel. Weld and cage nuts inside the roof rail attach the roof to the rest of the body.

Integral with the roof panel in the areas over the front and rear doors are halo panels which when combined with similar panels integral with the body side panels and a bolt-on panel over the windshield give the effect of a continuous halo-type inner roof panel.

The pickup body (Fig. 15) is constructed in much the same manner except of course, the side assemblies terminate at the top of the pickup box and the roof assembly is necessarily small. The cab back is made up of an upper and a lower assembly.

Pickup box side assemblies are double-wall constructed in the lower section to protect outer panels from cargo damage. Incorporated in the side assemblies is the same engine air induction system as used for other models. The upper

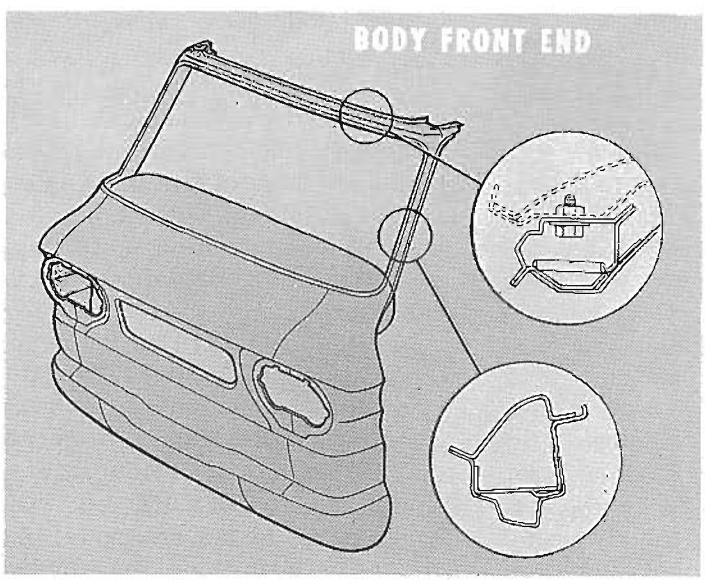


Figure 13

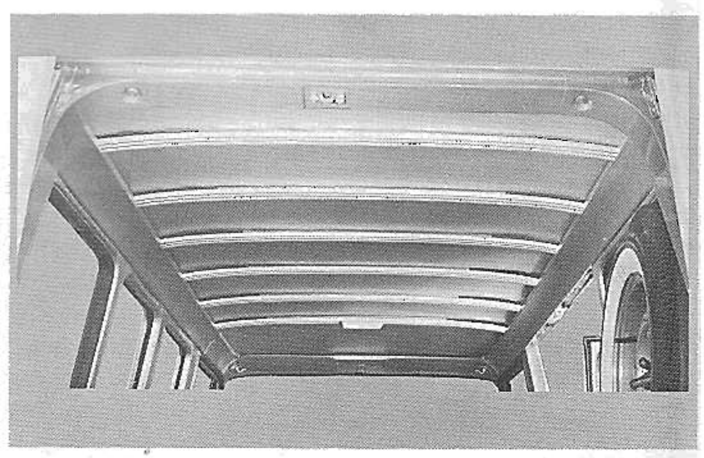
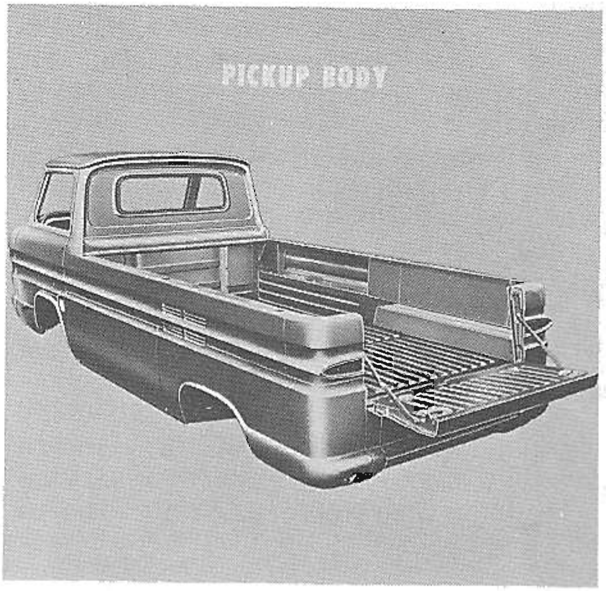


Figure 14 - Roof Panel



PICKUP BODY
WITH
RAMPGATE

PICKUP BODY

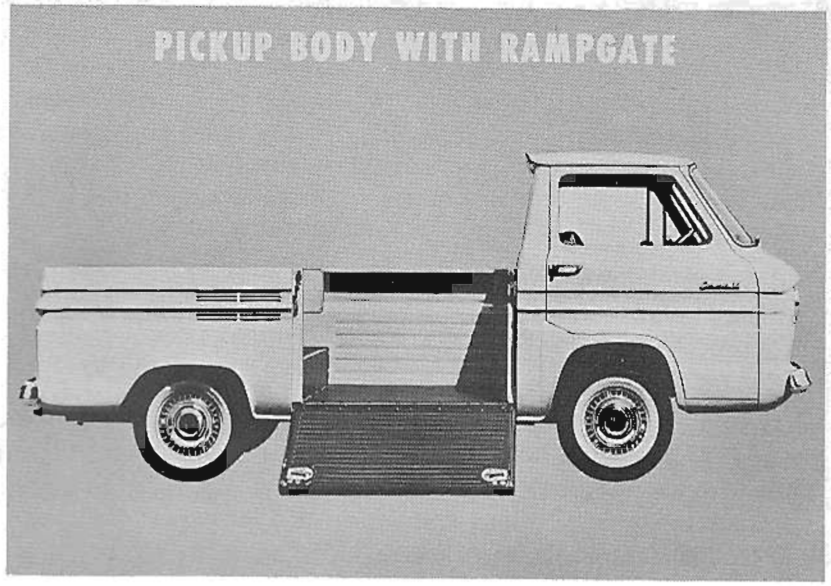


Figure 15

section of the outer side panels is held rigid with welded-on stake pockets, which also serve as vertical strainers. For added strength, the metal gauge of the pickup side panels is heavier than that used for other Corvair 95 models.

An inner and outer panel comprise the tailgate structure, the inner panel being ribbed longitudinally and the outer panel being configured for stiffness. The tailgate is hinged with two heavy-gauge strap-type hinges, and the tailgate is supported in the open position with two folding links. Slam-type bolt locks retain the gate in the closed position, and the locks are released with spring-loaded handles recessed in the inner panel at the upper left and right hand corners.

Double-rabbet construction of the tailgate pillars assures a grain-tight seal of the tailgate with the pickup box side panels. The grain-tight sealing feature is maintained even under side panel spread conditions with the use of protruding tangs on the tailgate which mate with slots in the gate pillars when the gate is closed.

A pickup model with a rampgate in the right hand side structure affords convenient, fast, and safe loading and unloading from the curb side. The sturdy rampgate, rated at 1000 pound capacity, is comprised of an inner and outer panel reinforced with internal transverse and longitudinal strainers. Full-width embossed ribbing is carried on the inner panel, contributing to the rigidity of the gate and assuring a good ramp surface when the gate is lowered. This ramp is particularly useful for wheeling large heavy objects, such as refrigerators, lawn mowers, welders, and tires, in and out.

The gate is hinged at the bottom with a full-width, concealed, piano hinge. Gate retention is through slam-type locks at the upper left and right hand corners of the inner panel. Both locks are operated with spring-loaded release handles recessed in the surface of the inner panel. The release handle assemblies are chrome-plated for appearance and durability. A safety catch pull handle mounted to the side panel right hand pillar must be released before the gate can be lowered.

A full-length, hard rubber bumper caps the top edge of the gate, providing protection to the outer panel when the gate is lowered. Inclination angle of the gate is approximately 22 degrees. The inner panel of the rampgate, like the body load floor, is finished with a scuff resistant epoxy-resin paint.

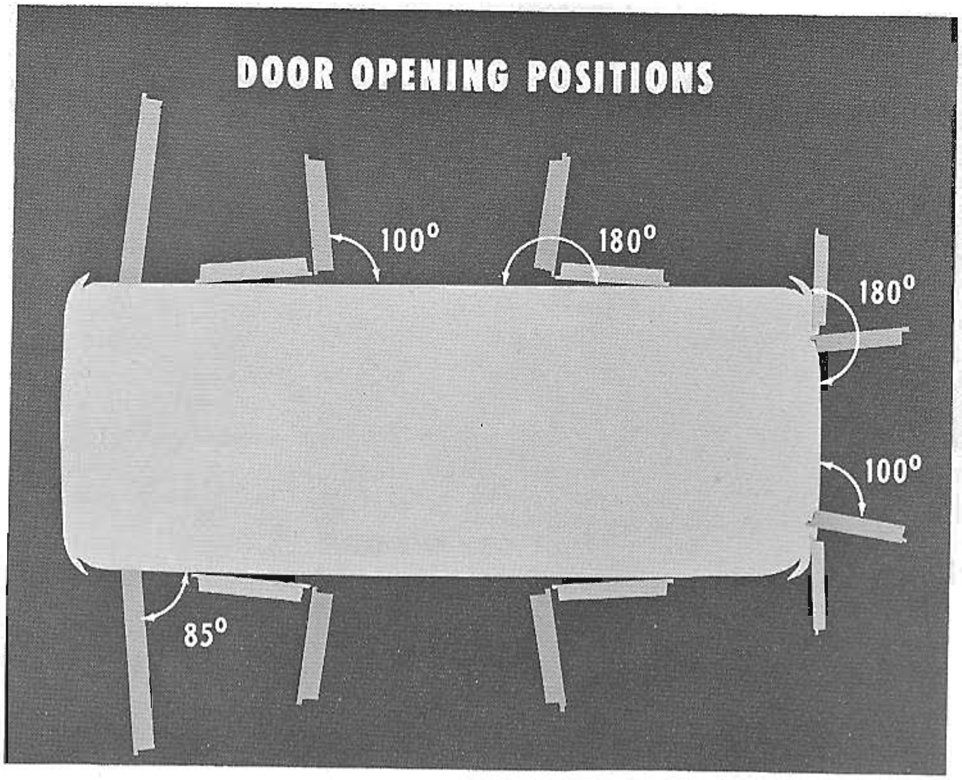


Figure 16

Doors

Outstanding accessibility to the driver and load compartment is featured (Fig. 16). All doors are conventionally constructed from a formed outer panel and a drawn inner panel and held together with a hemming flange around the periphery. Front doors are embossed and configured for stiffness, and are forward-hinged with butt-type hinges. As with regular truck models, the door check is separate from the hinges. Doors open a full 85 degrees for adequate entrance room.

Side and rear cargo doors are of the double side hinge type utilizing strap-type hinges. Rubber grommets around the hinge slots in the body pillars prevent entry of dust into the body interior. Two-position checks permit the doors to open at 100 and 180 degrees. In the 180 degree position, rubber bumpers on the body panels prevent interference of the doors with the body.

With the availability of the optional left hand side door, wide opening double doors at both the right and left hand side and at the rear permit easy loading of even the extra large items. Loading height, which is convenient all around, is less than 15 inches at the side doors.

The front doors on all body types have crank up windows as do the second and third windows in the station wagon.

Seats

Seat construction for Corvair 95 models is essentially the same as that for standard models in the regular truck line, with spring wire elements employed for cushions and coil springs for backrests. Urethane foam padding is used in the seat cushion. Standard seats are covered with woven cloth trim while custom coverings are of nylon-faced woven cloth. Vinyl is used for the seat facings, seat bolsters, and backrest rear faces.

A single driver's seat is provided for the panel model and a full-width front seat is available as a regular production option. All other models have the full-width front seat as regular production equipment. As with regular truck models, optimum front seat comfort is assured with smooth-operating seat adjusters and easily adjusted backrest. A retention device prevents Corvair 95 front seats from falling forward on sudden stops.

Rust Prevention

Anti-corrosion measures (Fig. 17) are necessarily more elaborate with body-frame integral construction; therefore, the entire underbody and all critical enclosed areas are meticulously coated with rust inhibiting materials to assure the absolute maximum in corrosion resistance. Drain holes are strategically located to draw-off excess water.

Initially, the underbody assembly is processed through a seven stage zinc phosphate washer where the metal is cleaned and phosphate coated for paint adhesion and rust resistance. Four additional distinct and different rust inhibiting materials are used, singly or in combination, for maximum protection: A weld through primer, zinc chromate primer, aluminum preservative coating, and undercoating.

The weld-through primer which is composed of 95 percent zinc pigment is applied to the following areas; the inside surfaces and flanges enclosed by shear plates, the outer surface of the shear plates, and the inside surface of the front outer rocker panel.

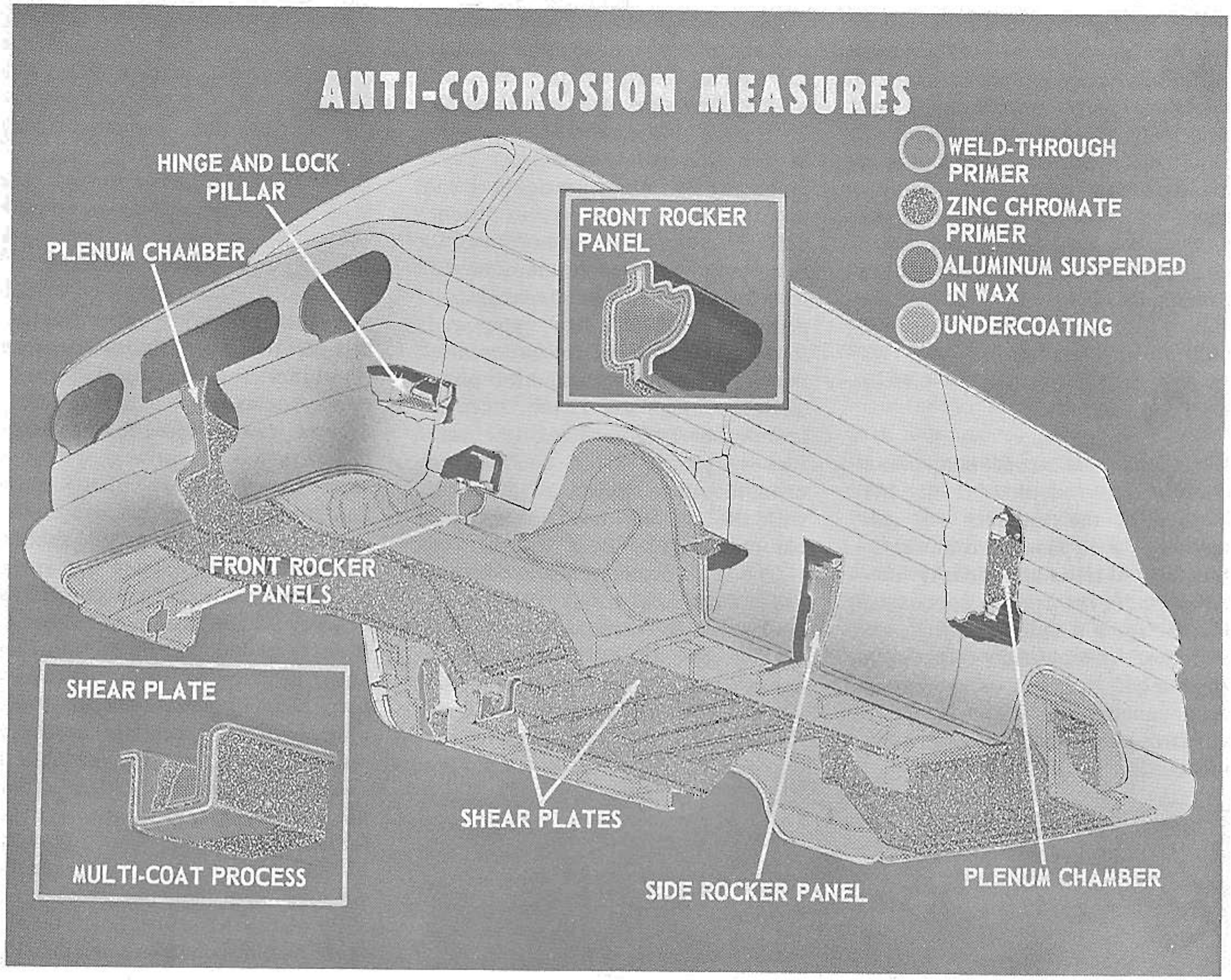


Figure 17

Zinc chromate primer is sprayed on the entire underside of the underbody including the inner and outer surfaces of the cross sills, the longitudinal frame sills and the underside of the dash and toe panel. The inner surface of the hinge and lock pillar, the inside of the front rocker panel, the plenum chambers and the inside of the body side rocker panels are also sprayed. This material has been selected for its corrosion and moisture penetration resistance properties.

An aluminum preservative, which consists of aluminum particles suspended in a wax base, serves to supplement the zinc chromate primer. The sections treated with this material are the areas enclosed by the shear plates, the front rocker panel, left hand body side rocker panel, the front door hinge pillar, and the front plenum chamber.

As a final rust preventative measure, undercoating is applied to the areas where wheel throw and sand abrasion are prevalent. These sections include the toe panel, wheelhouses, and the entire underbody area outboard of the longitudinal frame sills.

CHASSIS

The chassis features a fully independent suspension system for matchless ride and handling and truck-engineered components for load capacity and durability. A combination of passenger and load space requirements established a tread width of 58 inches at the rear, based on the maximum tire size of 7.00-14. The front tread was made identical to that of the rear to provide ideal front and rear wheel tracking.

Front Suspension

An independent front suspension system was adopted (Fig. 18). Studies of the imports and experiences with passenger and commercial vehicles had clearly indicated that the most successful designs from a ride, handling, and customer acceptance standpoint were equipped with independent front suspension. The inherent benefits of an independent front suspension are well known.

Early calculations had established that front suspension loading for the new light-duty vehicles would be greater than on the compact cars but lower than on the larger Chevrolet passenger car. Since our full sized station wagons and taxi-cabs had shown excellent reliability in severe service, it was decided to use as many of the heavier front suspension components as possible. The upper and lower control arms, the ball joints, the steering knuckle, and the pivot shaft bushings are taken directly from the large Chevrolet car. However, the front suspension crossmember which is integral with the frames on the passenger car could not be used.

The front crossmember, designed specifically for heavier duty applications, forms a rigid foundation for the front suspension assembly. It is a strong, one-piece hat section stamping with a welded-on bottom plate. Integral with the crossmember are the upper spring seats, shock absorber mounting towers, and upper control arm mounting brackets. A heavy bracket which serves to attach the suspension unit to the body is also included.

Upper and lower control arms are one-piece stampings formed with embossments and flanges for added strength. The arms are attached to the suspension crossmember through rubber-bushed, forged steel pivot shafts. A system of shims and attaching bolts at the upper control arm is utilized to set front wheel camber and caster.

At the outer extremities of the control arms, forged steel steering knuckles are supported by spherical joints. The upper spherical joint assembly is riveted to the control arms. Since this joint is lightly-loaded, a rubber loading ring is provided to compensate for bearing wear. The lower spherical joint carries the vehicle weight. Both joints are seated in concave bearing surfaces of durable, molded phenolic-impregnated fabric laminations.

The coil springs and shock absorbers are mounted concentrically and inclined toward the center of the vehicle. In this position, the springs and shock absorbers are more nearly tangent to the lower control arm arc of travel, with the result that spring distortion in suspension movement is minimized and the suspension deflection rate is more nearly constant.

A spindle movement of 7-1/2 inches from full jounce to full rebound is provided. Rubber bumpers cushion the extreme wheel motions. The coil spring is made of AISI 5160 steel and is stressed to 139,000 pounds per square inch at the metal stop. Ride and durability development established a

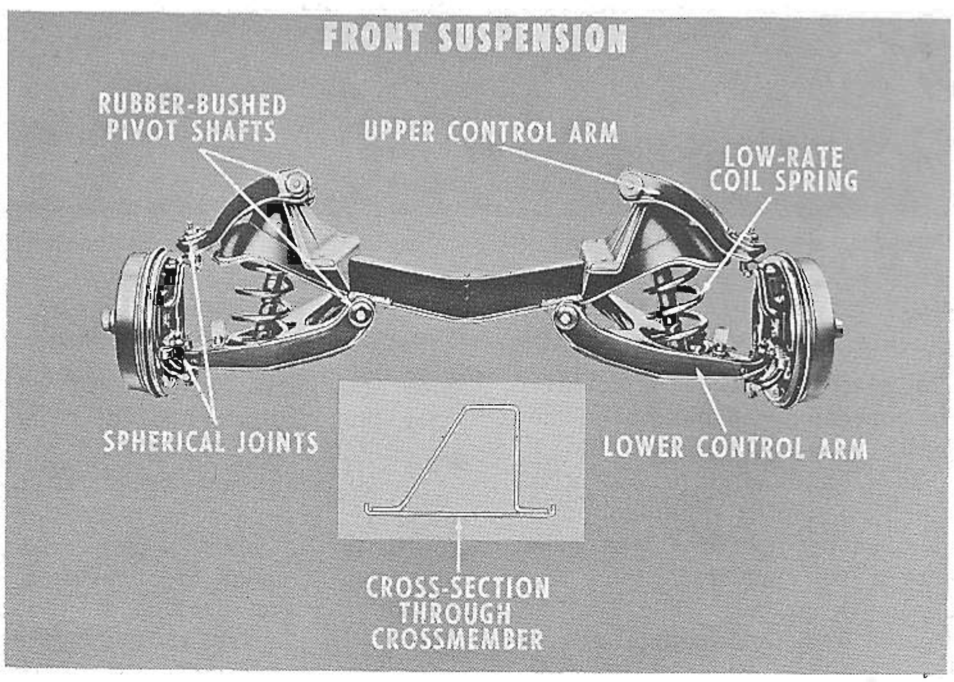


Figure 18

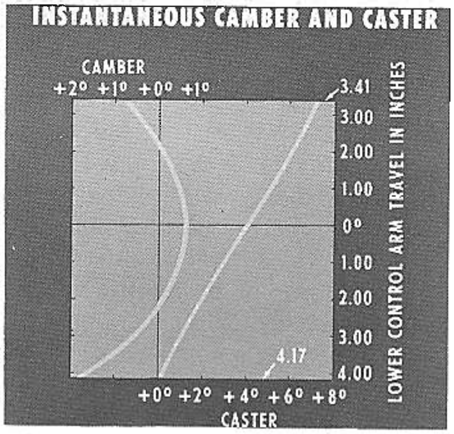


Figure 19

spring rate at the wheel of 175 pounds per inch.

The upper control arm is 9.88 inches long and the lower is 15.5 inches long with ball centers of 9.81 inches. The arms converge inward and intersect at about 274.1 inches. This creates a curve of instantaneous camber as shown in Figure 19. A curve of this shape provides minimum steering wheel fight.

The upper control arm pivot axis is positioned at a 10 degree angle to the lower control arm axis, providing 45 percent dive control upon braking. This creates an instantaneous caster curve as shown.

The curb caster setting is plus 2 degrees and the curb camber setting is 1/4 degree.

During the development of the front suspension, a stress analysis was made and corrections were introduced when the following criteria were not met:

- All components affected by bump loads must be stressed to 1/5 the yield of the material in question, based on the rated design load.

- All components affected by rebound loads must be stressed to 1/2 the yield of the material in question, based on the design load.

- All components affected by braking loads must be stressed to 1/2 the yield of the material in question, based on a vehicle loaded to 112-1/2 percent of the rated GVW making a panic stop with full weight transfer and tire coefficient of 1.0.

Steering System

A relay-type steering linkage, (Fig. 20) similar to that used on other light duty vehicles, provides fast, responsive action with low effort. Designed to be completely compatible with independent wheel suspension, the steering gear and linkage are placed forward of the centerline of the front wheels. A recirculating ball-type steering efficiency and dependability of this gear design is well established in the industry.

The steering gear and linkage system are rigidly attached to the longitudinal sills of the vehicle underbody. A forged relay rod is supported at the outer ends by an idler arm on one side and by a bell crank on the other. The support is accomplished by the use of nylon sleeved rubber insulated bushings mounted in the idler arm and bell crank. The bell crank pivots on a special tapered nylon bearing which is heavily spring loaded for self alignment and wear compensation. Adjustable tie rods, with spring loaded half ball joints at each end, extend from the relay rod to forged steering arms which are bolted to the steering knuckle.

The steering gear is of course mounted far forward and its pitman arm is connected to the bell crank by an adjustable drag link with ball joint ends similar to, but larger than, the tie rod ends.

With both tie rods adjustable, accurate toe-in settings can be made for proper steering geometry. The drag link which also is adjustable permits compensations

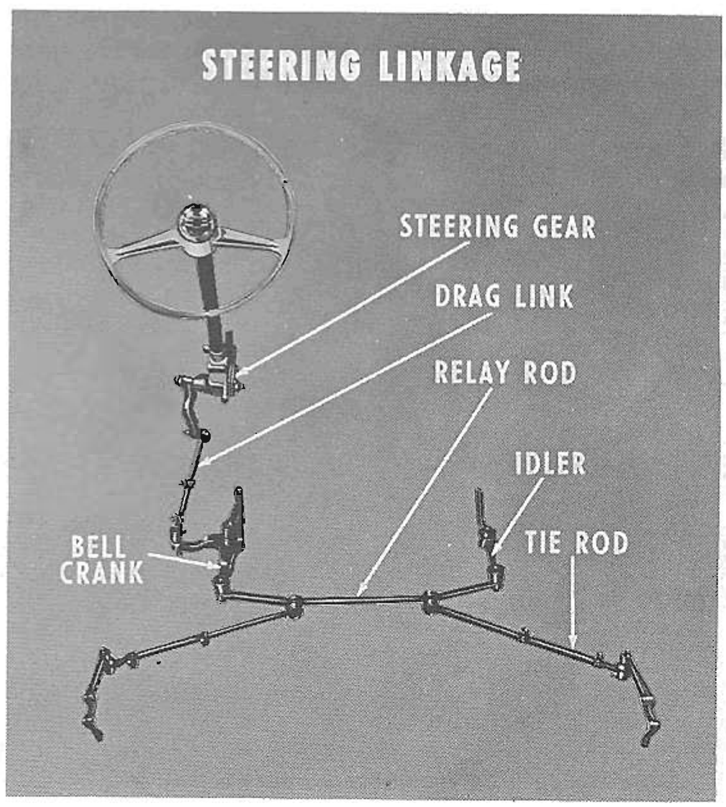


Figure 20

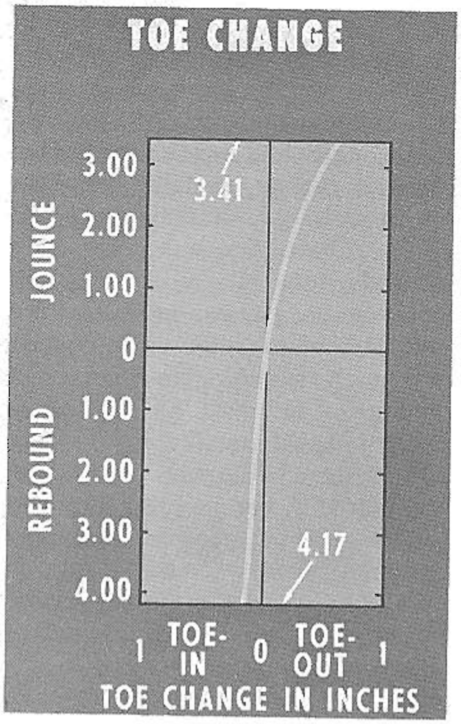


Figure 21

for body variations due to limit stack-up. In addition, this adjustment allows steering gear on-center positioning in the straight ahead direction.

Considerable development work determined the most favorable tie rod lengths and tie rod ball positions for best handling and least steering wheel fight. As a result the tie rods are about 10 percent longer than theoretical with the inner balls a little higher than correct. This produces a toe-in-to-vehicle height relationship as shown in Figure 21. This geometry produces about 4 percent roll understeer by causing the wheels to toe out and when forced upward by a bump.

Overall steering ratio is 23 to 1, providing easy manual steering and because of the light loads involved the need for power assists is eliminated.

Rear Suspension

The new light duty forward control models utilize the swing type independent rear suspension (Fig. 22). In a rear engine, rear drive vehicle, the drive axle is positioned in close relationship with the engine. This design practically dictates independent rear suspension because power train length becomes a prime consideration.

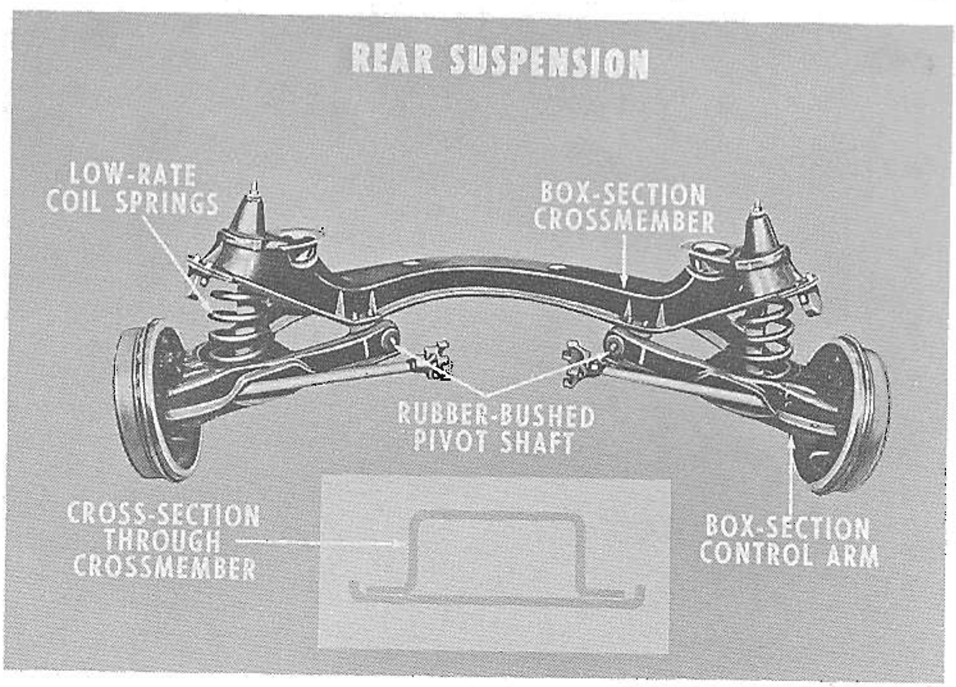


Figure 22

Since the Corvair passenger car was to have independent rear suspension, a study was made to determine if any of its components could be used. However, the wider tread, heavier load and longer service requirements of the compact truck restricted interchangeability. Only the passenger lower control arm with modifications could be used.

The rear suspension is installed as a unitized assembly to the body at four points through resilient rubber mounts. The main element is a heavy-duty suspension crossmember which is fabricated from heavy-gauge steel stampings. The upper stamping is hat-shaped in cross-section. A steel plate, welded to the brim, or flanges, of the hat section, encloses the structure and provides the beam strength and rigidity required for positioning the suspension system components.

The outer extremities of the crossmember incorporate steel towers which house the coil springs and shock absorbers. In addition to providing a convenient means of attaching the upper end of the coil springs and shock absorbers, the towers afford a degree of protection to the springs and eliminate the need for shock absorber dust covers.

Each rear suspension control arm is an assembly of two stampings welded flange-to-flange and mounted on forged pivot shafts. Both arms support the wheel bearings and brake backing plates and serve as a mounting base for the springs and shock absorbers. The arms, which pivot on rubber bushings, are located in a trailing fashion to permit the axle shafts to pass through an opening in the arm.

Frictionless coil springs perform as the suspension medium while double-acting shock absorbers provide the required damping

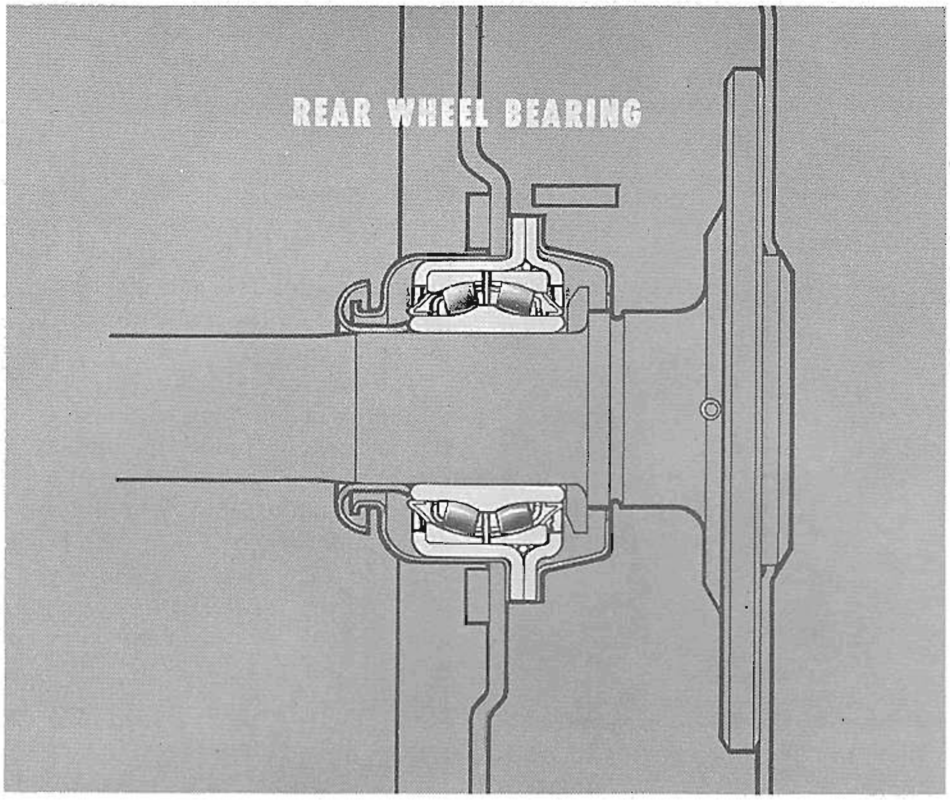


Figure 23

action. The coil springs are made of AISI 5160 steel stressed to 139,000 pounds per square inch at the metal stop. Tests established a spring rate at the wheel of 177 pounds per inch.

The heavy duty rear wheel bearing (Fig. 23) is of the spherical type to allow for variations between the pivot center of the control arm and the center of the universal joint. Since it was necessary to locate the center of the universal joint somewhat inboard from the control arm pivot centers, a further need for a spherical bearing was evident. The rear wheel bearings are permanently lubricated for long life and minimum service.

As in all swing axle designs, the rear wheels change camber with ride motions. Figure 24 shows the relationship between rear wheel camber angle and ride motions.

The somewhat trailing position of the control arms and the previously mentioned relation between the universal joint centers and the pivot centers, causes a change in toe-in during vehicle ride motions, (Fig. 25). Because the rear wheels are independently suspended, new geometry factors must be considered. Toe-in, for example, is designed to increase positively as the suspension moves up or down from the design height position. Thus, since the outside wheels carry the greatest weight during turns, the toeing-in characteristics of the rear suspension create a desirable understeer geometry.

To adjust the basic toe-in setting, the transmission mounts in front and the engine mounts in the rear may be shimmed to move the engine-transaxle assembly fore or aft. This action results in a corresponding movement of the universal joint centers, making it

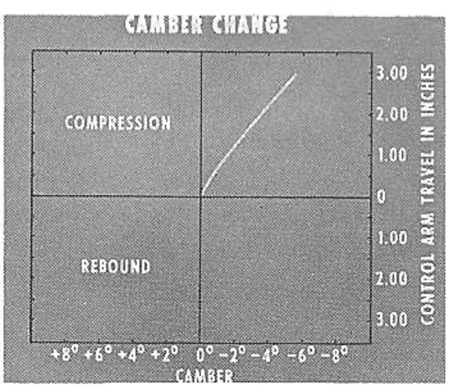


Figure 24

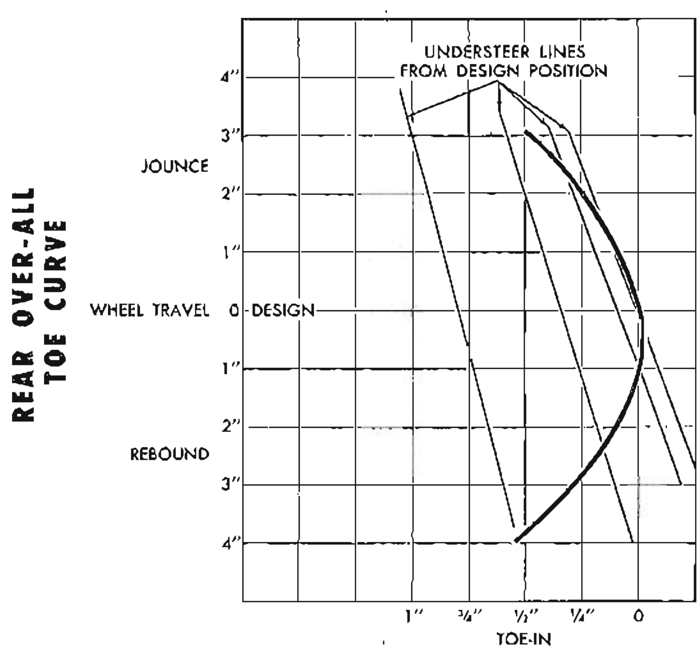


Figure 25

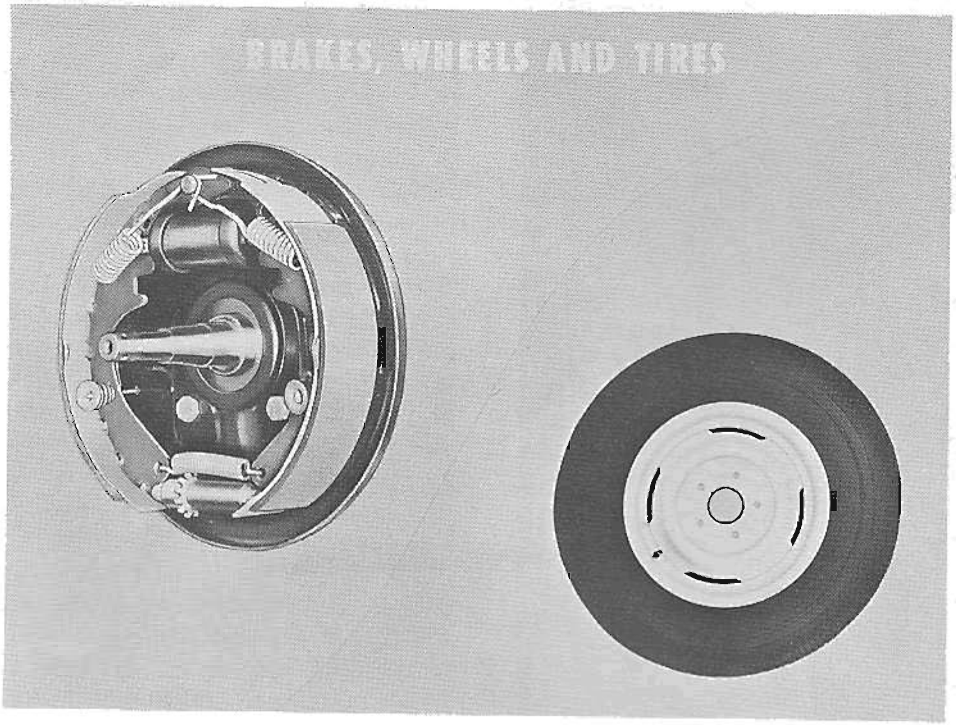


Figure 26

possible to obtain the proper straight-ahead alignment at design weight. Initial toe-in setting is 1/8 inch at design load and 1/4 inches at curb.

To assure good durability, rear suspension assemblies were designed to the following criteria:

- Those components affected by bump loads must be stressed to 1/6 the yield of the material in question, based on the design load.

- Those components affected by braking loads must be stressed to 1/2 the yield of the material in question, based on a vehicle loaded to 112-1/2 percent of rated GVW during a full panic stop with a tire coefficient of 1.0.

- Those components affected by acceleration loads must be stressed to 1/2 the yield of the material in question, based on a vehicle loaded to 112-1/2 percent of rated GVW with acceleration in the greatest numerical gear reduction at peak engine torque, full weight transfer, and considering a tire coefficient of 1.0.

Brakes

Four-wheel hydraulic brakes (Fig. 26) of duo-servo design provide effective braking with minimum pedal effort. Brakes are 11 inches in diameter and lining width is 2 inches, resulting in a lining area of 167 square inches. The linings are of molded asbestos composition bonded to the shoes. Brake drums have a pressed steel web with cast iron drum flange. The brake assemblies are identical to those used on the conventional 1/2 ton truck models.

The master cylinder which has a diameter of one inch is mounted on the underbody below the driver's compartment, and is actuated by a floor-mounted pedal. Wheel cylinder diameters of 1-1/8 inch front and one inch rear are employed. The parking brake utilizes cables and linkage to the rear service brakes and is applied by pulling a ratcheting, pistol-grip hand lever.

Wheels and Tires

Five 14 x 5J wheels, with 7.00-14 S.P. tubeless tires are provided on short-spoke 5 stud disk wheels. The tires were designed specifically for this application and incorporate a very low cord angle and other construction features to eliminate wind steer problems encountered early in the development of these vehicles. This problem is covered in greater detail in another section of this report. The tires carry the special designation, "SP" for special purpose.

All wheel and tire assemblies are factory checked for static unbalance. Weights, if needed, are added to the inside of the wheel rim to keep maximum unbalance to 5 ounce-inches.

POWERTRAIN

The Powerplant assembly is a heavier duty version of the Corvair passenger car engine. This Powerplant has been adequately covered in a previous SAE paper; thus, the discussion here will be confined mainly to the differences that exist.

The engine, transmission and rear axle are all assembled as a unit and located under the rear load floor. The engine (Fig. 27) is a horizontally-opposed powerplant with a 145 cubic inch displacement. It is air-cooled and features extensive use of aluminum in many of its components. Since truck engines are subjected to more severe service, the main and connecting rod bearings are of steel-backed sintered copper lead in place of the lighter-duty bearings used in the Corvair passenger car. A heavier duty 9-1/8 inch diameter clutch is also used.

The Corvair 95 engine and transaxle are fully accessible through two removable panels at the rear of the underbody assembly (Fig. 28). The panel immediately adjacent to the rear door opening (rearmost panel) gives access to the engine, while the panel beyond it (foremost panel) gives access to the transaxle. Effective sealing is assured with closed-cell sponge rubber seals around the periphery of the panels. Rattle-free panel retention is provided with screw fasteners.

On panel and station wagon models, the vehicle interior is insulated from engine heat and noise by employing double-wall construction for the rearmost removable panel and adding to its undersurface a 5/8-inch thick blanket of fiber glass over a 1/8-inch thick layer of undercoating. To eliminate the possibility of any loose particles of fiber glass being drawn into the engine air cleaner, the first 1/8-inch of the fiber glass blanket is of higher density than the remainder of the blanket. The foremost removable panel of panel and station wagon models also carries a fiber glass blanket, providing additional insulation from heat and noise.

Above the rear bumper, a door affords access to the engine oil filler tube and dipstick as well as other components such as the distributor, coil, generator, and oil filter. The door is hinged at the bottom with a roll-type hinge, and supported in the open position with slotted links. Retention of the door is through a slam-type lock, which is opened with a lift handle located above the license plate.

A flat closed-cell sponge rubber seal around the door opening assures rattle-free retention of the door and a positive seal against road dirt and moisture.

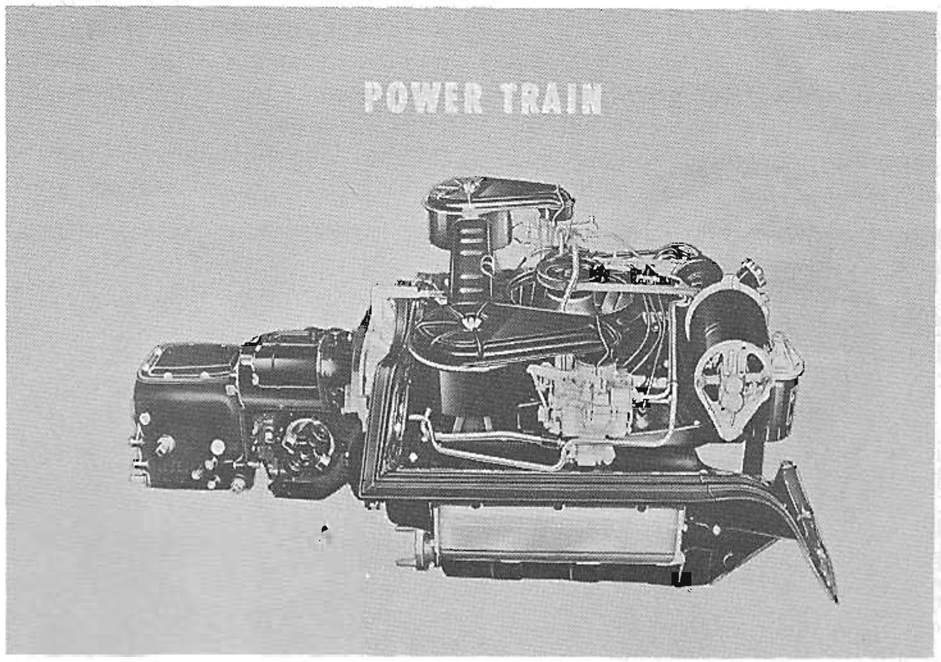


Figure 27

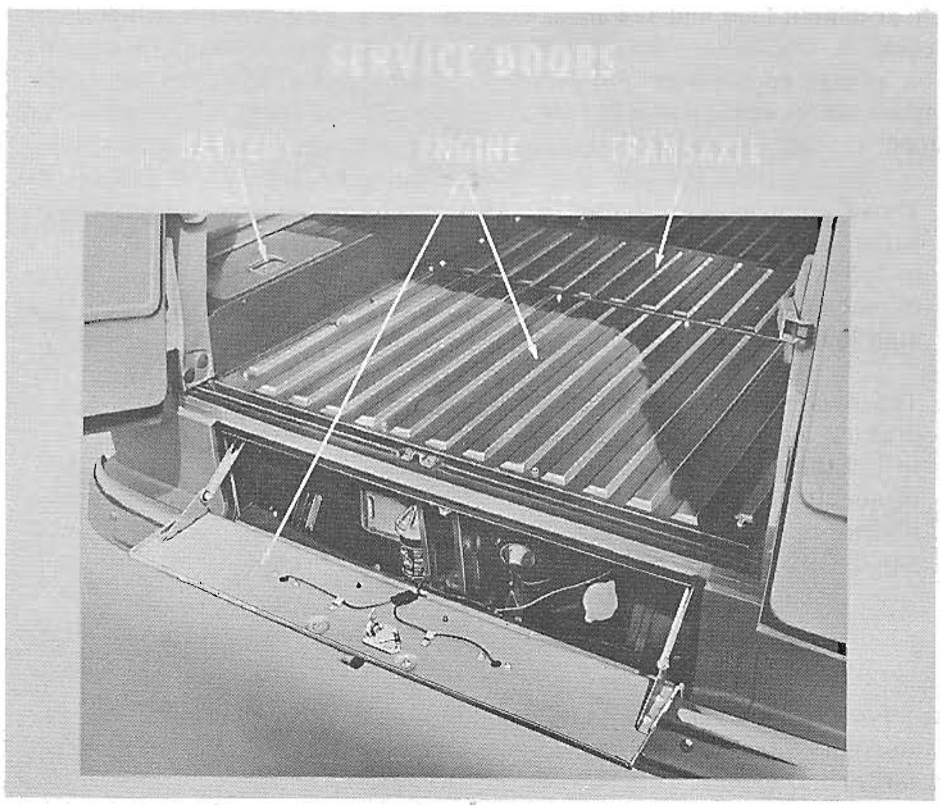


Figure 28

Transaxles

Transaxle design (Fig. 29), available with either a 3-speed or 4-speed synchromesh or a 2-speed automatic transmission, achieves the compactness necessary to avoid encroachment on the space requirements for cargo, passenger or suspension.

Base equipment on the Corvair 95 is a conventional 3-speed synchromesh transmission. This unit has a cast iron case, helical gears and is synchronized in second and third gears. Gear ratios are 3.50-to-1 for first; 1.99-to-1 for second; direct for third; and 3.97-to-1 for reverse.

The optional 4-speed transmission also features a cast iron case and helical gears, however, this unit is fully synchronized in all forward speeds. A wide selection of gear ratios provides a versatile range of engine-to-vehicle speeds. Gear ratios are 3.65-to-1 for first; 2.35-to-1 for second; 1.44-to-1 for third; direct for fourth; and 3.66-to-1 for reverse.

A 2-speed fully automatic transmission brings passenger car driving ease to the new light-duty trucks. A three-element torque converter provides a starting ratio of 2.5-to-1. Low gear reduction is 1.82-to-1. Since these vehicles are associated with more severe service than the passenger cars, a transmission oil cooler located in the engine air induction system, is provided.

The rear axle is identical with the Corvair passenger car except the ratio is 3.89:1. It is located between the engine and transmission and consequently the transmission input shaft must pass thru the axle on the axle pinion centerline. The ring gear and pinion are hypoid gears for quiet operation and good durability. It has a two pinion differential.

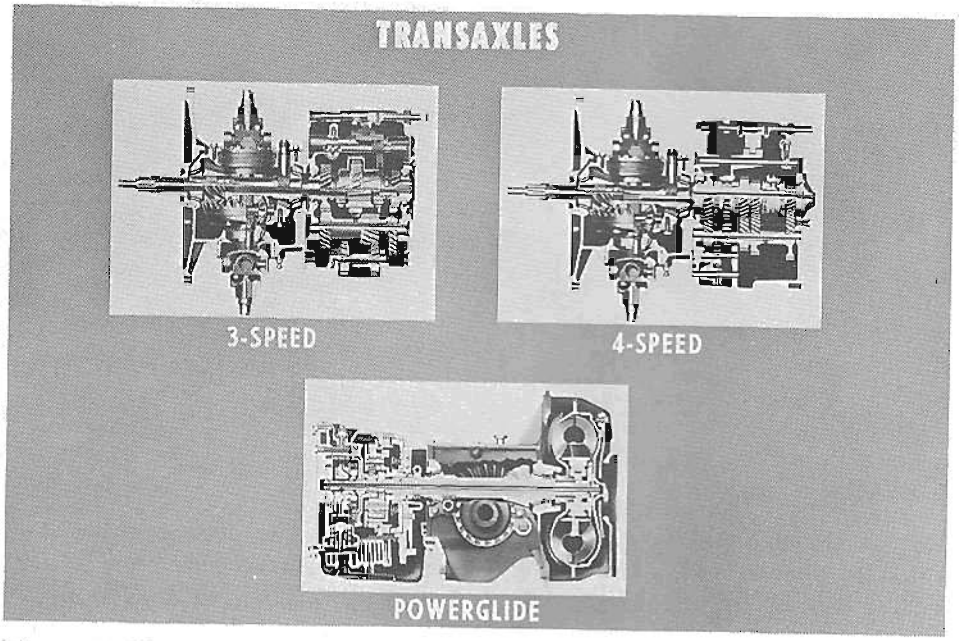


Figure 29

Figure 30

Engine Cooling and Carburetor Air Supply

The flat, air cooled, rear mounted engine has many virtues. It is the factor, in our opinion, which makes a compact truck acceptable. Its location affords good access to passenger or load areas and contributes significantly to equal front and rear tire load distribution. However, it does have special requirements, which if not considered carefully, could be troublesome. An important requirement for this design is an air intake system which provides clean air for engine cooling and carburetor intake.

An extensive test program was launched (Fig. 30), to find the cleanest possible source for air. Prototype trucks were built with movable air inlets. Accurate measurements of contamination of the air filter and engine compartment were made and finally a location was found that was superior to the conventional front engine inlet. Louvers and ducts located high in the body side panels convey air to the engine compartment.

Controls

The rear engine and transmission require remote controls. The clutch, accelerator, choke, and the automatic transmission are all actuated by the use of appropriate cables adequately shielded to provide protection from the elements.

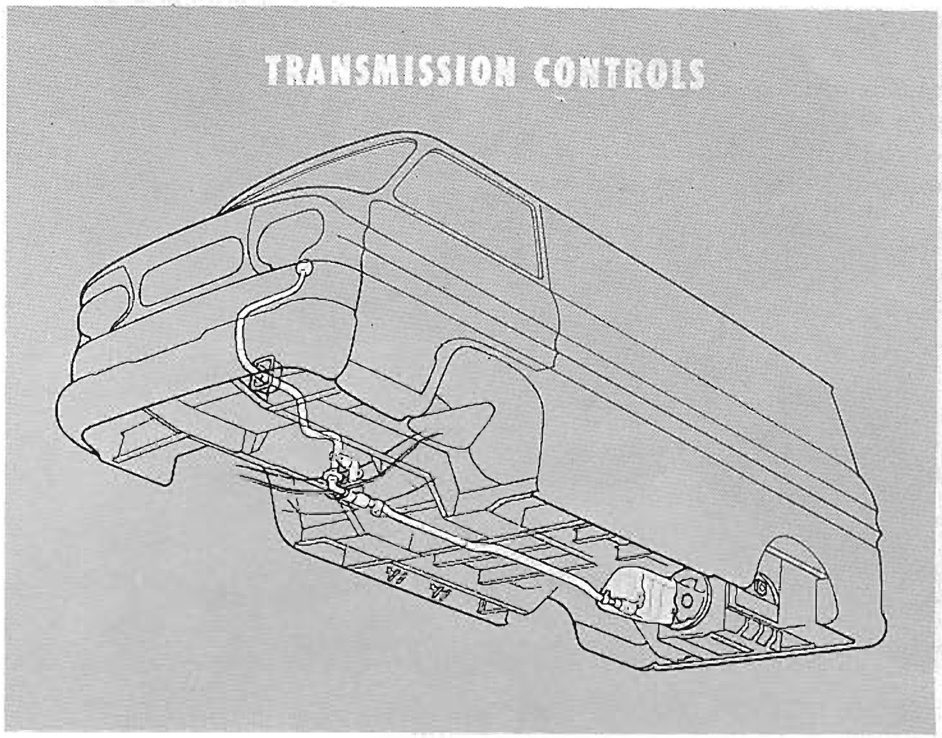


Figure 31

The manual transmission controls are accomplished with levers, rods, pivots and bushings. Figure 31 shows the 3-speed transmission linkage to illustrate the design approach taken to make the remote shift firm and positive. All floor shift lever knobs are etched with the transmission shift pattern. The automatic transmission control lever and position indicator is located on the instrument panel.

DIMENSIONS AND WEIGHTS

Corvair 95 models are efficiently proportioned to provide a favorable combination of exterior compactness and interior roominess (Fig. 32). Although the vehicles measure only 179.7 inches in length, 70 inches in width, and 68.5 inches in height, the panel model load compartment is a full 120.9 inches long, 61.2 inches wide, and 53.8 inches high. Pickup box load length is 103.1 inches. Cargo capacities are more than 191 cubic feet for the panel and 80 cubic feet for the pickup. This compares with 176 cubic feet and 60 cubic feet respectively for the conventional 1/2-ton panel and pickup.

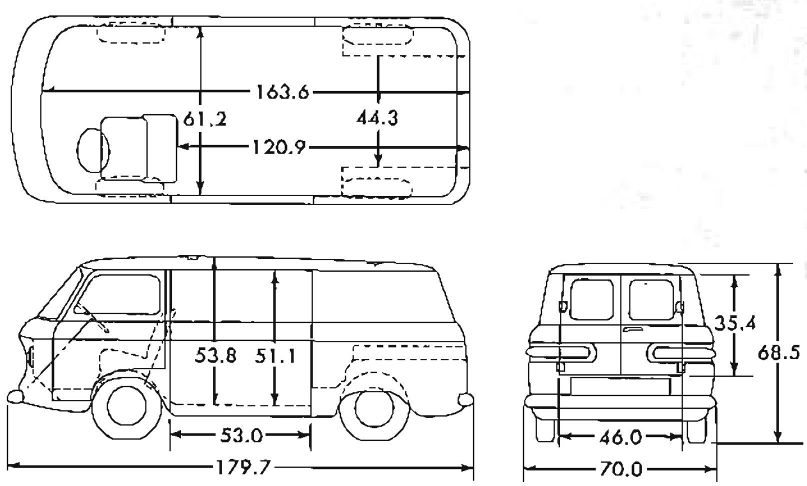


Figure 32

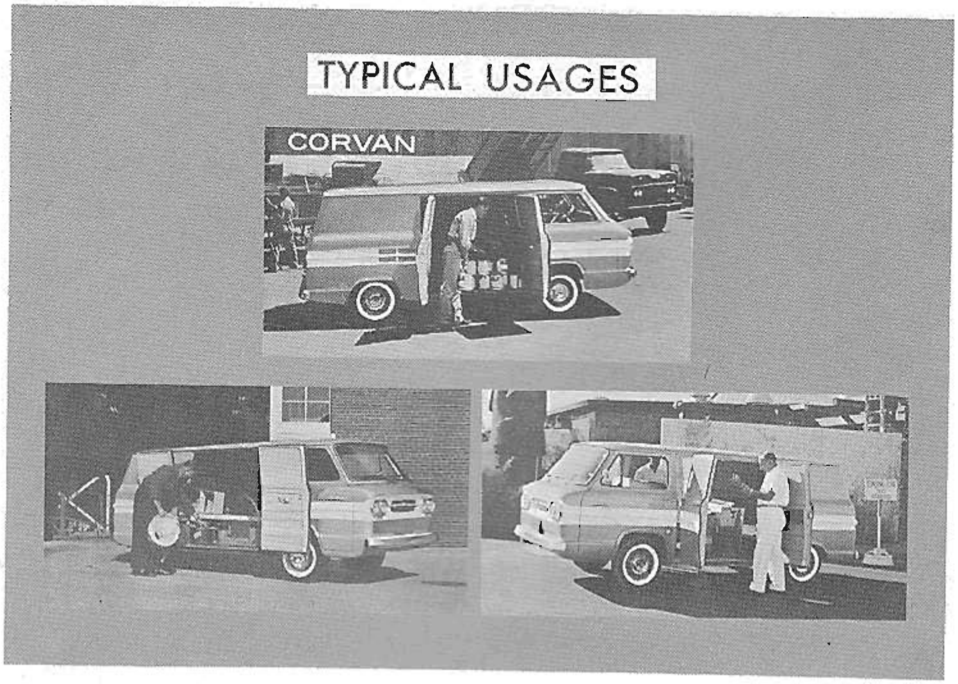


Figure 33

Figure 34

Because the body-frame integral construction permits placing the underbody closer to the ground than with conventional models, ground-to-load floor heights are substantially lower. Convenient side door access is afforded to the load floor. The drop-center design provides a walk-in load compartment which is less than 15 inches off the ground.

Rear door or tailgate load height is only 27.1 inches. Similar convenience upon entry and exit through the front doors is afforde with a step height of 17.3 inches

Large door and tailgate opening also facilitate loading and unload ing, their size easily accommo dating the variety of bulky carg encountered in commercial us (Fig. 33). A crate as large as 51. inches high by 53.0 inches wid can be loaded through the doubl side doors of panel and statio wagon models. The rear door open ing of panel and station wago models measures 35.4 inches hig by 46.0 inches wide, while th tailgate opening on pickups meas ures 43.9 inches wide. The Ramp side pickup has a rampgate openin width of 45.7 inches.

Based on a maximum GVW ratin of 4600 pounds, payload capacitie for Corvair 95 models range fron 1600 to 1900 pounds. Maximun payload capacity is 1900 pound for pickups, 1800 pounds for pan els, and 1600 pounds for statio wagons. Even with a 9-passenge load, 250 pounds of additional carg can be carried in the station wagon

There also is exceptional drive comfort and convenience in th roomy front compartment (Fig. 34 A large one-piece windshield ventipanes and door windows resul in visibility areas of almost 248 square inches on the panel model and 2400 square inches on th pickups. Driver compartmen roominess is achieved with meas urements of 53.4 inches for ha room, 59.5 inches for shoulde room, 61.4 inches for hip room 40.5 inches for head room and 44.5 inches for leg room.

Vehicle ride and handling are enhanced with the stability gained from the relatively equal and constant vehicle weight distribution. unloaded and loaded. Weight distribution remains relatively unchanged due to the drop-center underbody which cradles the majority of the load between the front and rear wheels.

ACCESSORIES

A complete line of functional and decorative accessories are available for the Corvair 95 models; however, only the more novel Direct Air Heater and Level Load Floor will be covered here.

The direct air heating system (Fig. 35) utilizes the engine heat rejection principle to warm the passenger and load compartment. All major components are mounted to the underbody. The system consists of two main units: a rectangular-shaped air mixing chamber mounted directly over the transaxle area and a 3-speed centrifugal blower attached to the underside of the air mixing chamber.

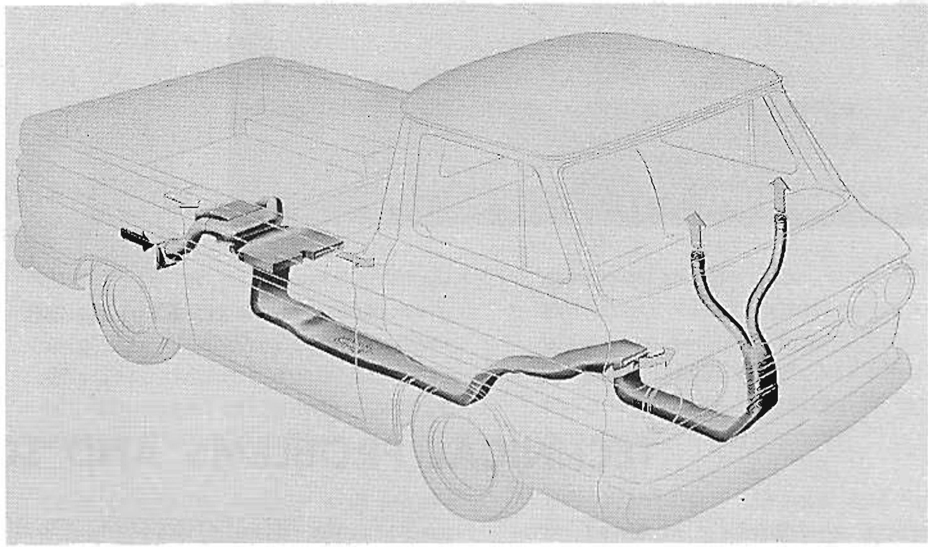
In operation, hot air from plenum chambers surrounding the cylinder banks is transferred through circular ducts to the air mixing chamber. Cold air from the engine compartment is introduced through the body side panel air inlet louvers. The cold air is forced by the engine centrifugal blower to the air mixing chamber inlet through ducting extending from the front of the engine upper shroud. The amount of cold air to be metered into the air chamber is governed by the position of the cold air shut-off door located in the air chamber inlet. A pivoting door directly over the blower blends the air entering the passenger and load compartment.

Heat outlets in the panel and station wagon models consist of a louvered opening in the front face of the rear underbody raised area, a transverse heat distributor mounted to the front seat riser, and defroster outlets. The pickup models however, incorporate only the forward outlet and defrosters.

A removable, 3-piece floor panel assembly (Fig. 36) is provided for pickup owners who require a level load area the full length of the pickup box. Panel material consists of 3/4-inch fir plywood. Each floor panel is supported with an inverted L-shaped angle iron bolted transversely to its underside. The supports seat on similar braces attached longitudinally to each pickup box inner side panel. In addition, folding legs riveted to the transverse member lend support to the center panel, which, in turn, strengthens the front and rear panels.

Pickup capacity is approximately 37 cubic feet with the level load floor installed. By lowering the rampgate on Rampside models, approximately 23 cubic feet of the space beneath the floor can be utilized for carrying additional cargo.

Figure 35 - Direct Air Heater



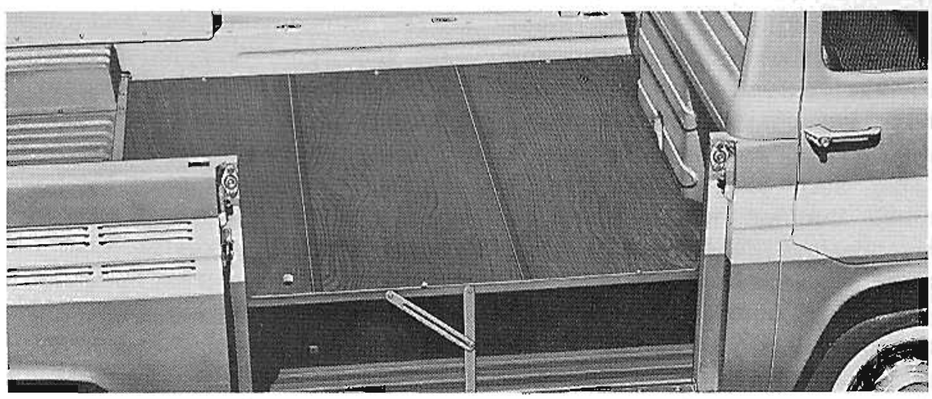


Figure 36 - Level Load Floor

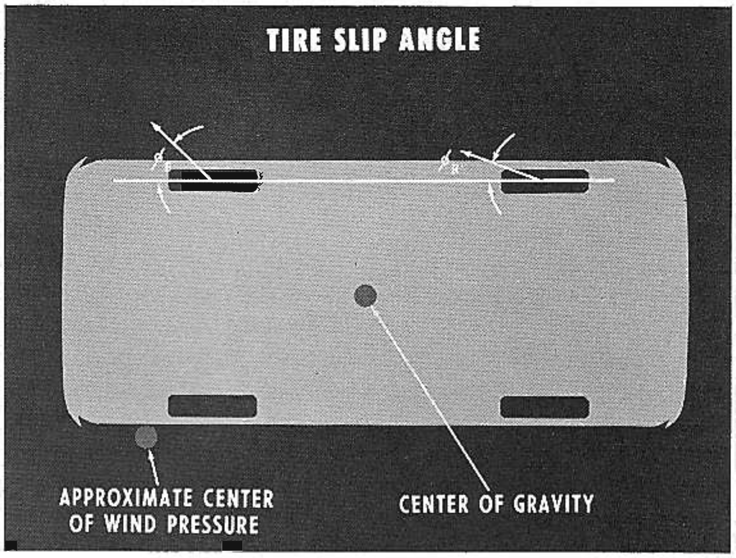


Figure 37

Figure 38

TECHNICAL PROBLEMS AND SOLUTIONS

Before a vehicle can enter production, much development and intensive test periods are required. During this time many problems appear. Most of the time the analysis and correction is easy, but some of the troubles are baffling and resist solution.

One such problem was windsteer. During the evaluation of the pre-test jobs, driving in a cross wind on a windy day was a difficult task. The panel and station wagon in particular rejected all attempts to steer straight down the road. This behavior appeared to be characteristic to all compacts, however, this handling problem was not acceptable by Chevrolet standards. The wind tunnel spotted the trouble immediately.

The shape of the Corvair 95, particularly of the panel and station wagon is such that the center of wind pressure is forward of the center of gravity (Fig. 37).

Since the front and rear tires have equal loading, and the CG is approximately between them, any side load at the CG will produce front and rear tire slip angles and no steering effect. However, a load applied ahead of the CG will cause greater slip angles on the front tires than on the rear and cause the vehicle to steer out of the wind and actually add to the side movement caused by the wind side force

One corrective measure is to lower the rear and raise the front tire pressure so that the rear slip angles will be greater than the front. This, of course, only works when a gust of wind hits. Under normal conditions the unit still oversteers and is completely unacceptable.

Extensive test work was conducted using variations in front and rear suspension and steering geometry, but none corrected the difficulty without having a detrimental effect on normal handling. Much work was done with tire pressure variations and it was noted that very high tire pressure, both front and rear, was good but, of course, the ride suffered. It was noted that another production vehicle, the one ton forward control panel, experienced no wind steer difficulties. This is a larger vehicle which uses high pressure truck tires. Softening its tires also p: duced dire results, so it was ob ous that the difficulty could corrected with tires which prod lower slip angles per unit of s load.

Extensive tests were conduc in the mountain cuts of Ariz where updrafts and variations wind direction subjected the ve cles to every conceivable w steer problem. Chevrolet's t suppliers participated fully in t program and their interest diligent research led to the s cessful development of a m lower cord angle tire.

The new low cord angle ti have a much higher lateral r with only a moderate increase vertical rate resulting in a sm reduction in ride value. With th tires, the vehicle handles v acceptably in the wind, and certa ly implies that many other vehic could be improved with some t work.

Another problem was that frequent high gear disengagem when running on rough roads (F 38). We felt at first that the l longitudal control rod vibra vertically, causing a length change. This change pulled the shift lever fore and aft and eventually forced the transmission out of gear. The rod was stiffened generously but to no avail. Its weight was decreased then increased, but still no cure. Various methods of tuning the linkage with heavy rubber insulated knobs were tried without success. It was discovered that the primary vibration of the shift linkage was at rear wheel hop frequency or at about 12 cycles per second. The truck was then put on the Bump Rig and run at wheel hop frequency; high gear disengagement occurred consistently. Observation clearly indicated that at this frequency, the powerplant was vibrating fore and aft on its mounts with sufficient amplitude to cause gear disengagement.

Retuning of the power plant mounting system frequency halted the motion and eliminated the disengagement of the transmission. Power plant isolation remained adequate.

CONCLUSION

The recent strong upsurge in compact truck sales clearly indicates that we're in the midst of an important revolution at the light-duty end of the truck market. For this reason, considerable time, effort and money was spent to develop a vehicle consistent with Chevrolet's position as a leading manufacturer of motor trucks. The result of these efforts is a vehicle which embodies the following definite attributes:

Compact size. Load space as a percent of total vehicle cube provides a good indication of compact size. In Chevrolet's Corvair 95, the load space represents better than 38 percent of the total vehicle cube. This compares with less than 35 percent for the most popular imports and 26 percent for Chevrolet's conventional 1/2 ton panel. This important feature was achieved without the disadvantage of excessive overall height. Chevrolet's maximum height of 69 inches is considerably less than the afore mentioned average minimum garage door height of 75 inches.

Low platform height and maximum cargo accessibility. These requirements are met in the drop center design of the load floor and the rear engine location. The drop center section of the underbody affords a platform height of less than 15 inches at the sides for outstanding loading ease; while the rear mounting of the engine assures obstruction-free access to the cargo area from either the driver's compartment or through the load doors.

Acceptable vehicle performance. The tried and proved air-cooled Corvair engine design delivers power efficiently and directly to the rear wheels. A selection of transmissions, 3-speed or 4-speed synchromesh, or 2-speed automatic are offered to cover a wide range of performance requirements.

Serviceability. Front and rear suspension assemblies and the powertrain are completely removable as separate units for easy repair and replacement. Frequently attended filling station service items are accessible through conveniently located service doors and panels.

In summation, the new line of trucks was carefully engineered to incorporate the characteristics and features found to be most desirable by users of compact vehicles. New concepts were introduced and full advantage was taken of proved designs to successfully develop Chevrolet's entry into the new light-duty truck market.

CHEVROLET ENGINEERING CENTER

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