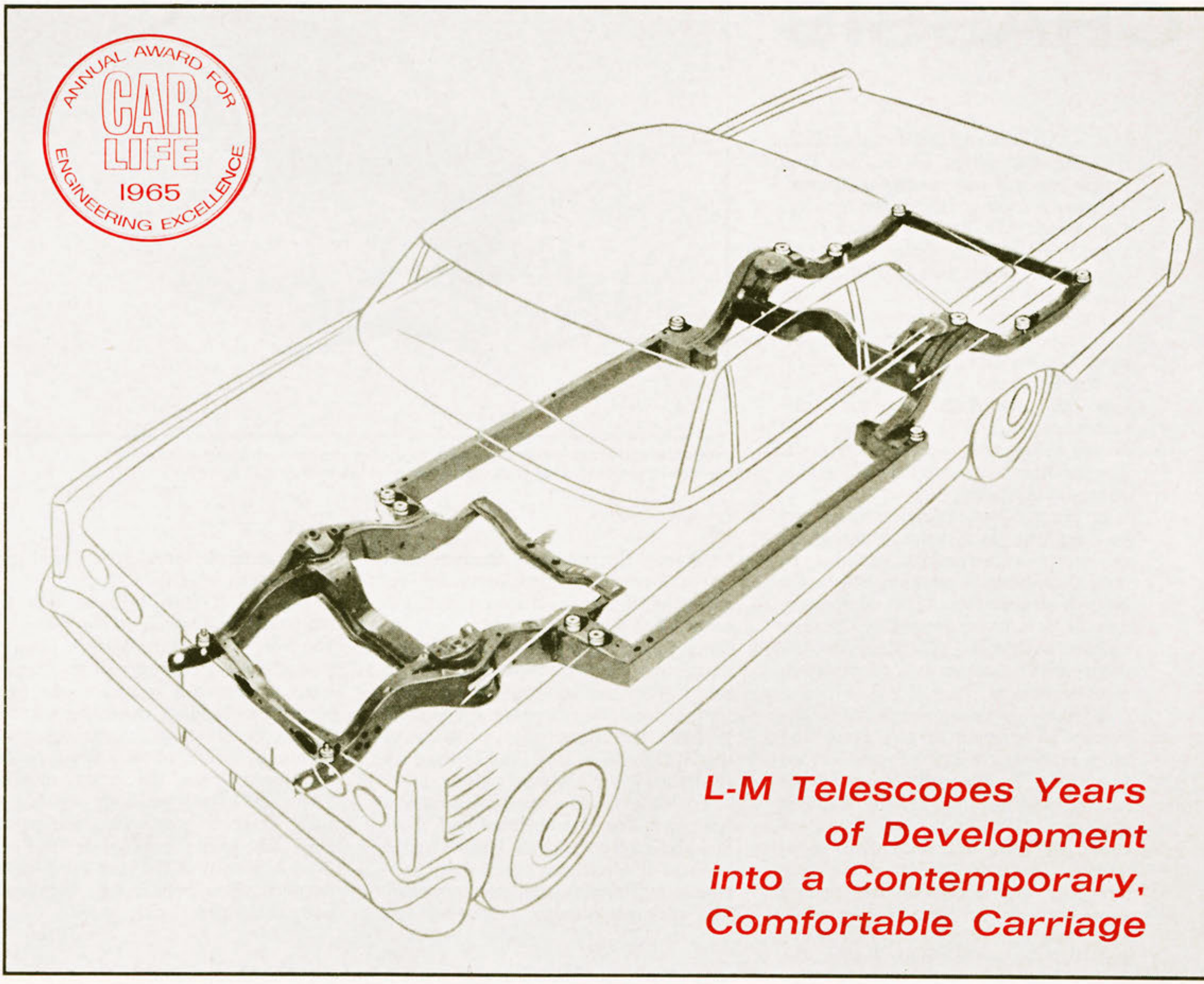


L-M Telescopes Years of Development into a Contemporary, Comfortable Carriage

THE MERCURY CHASSIS

BY JOHN R. BOND

WHEN THE FIRST Mercury was introduced by Ford (in the fall of 1938) its basic concept required a slightly larger and more luxurious car than the standard Ford V-8.

This policy is still in evidence today although, in the meantime, the standard Ford has grown from a wheelbase of 112 to 119 in. Thus the 1965 Mercury has become as large as the Lincoln. In fact, it has the same wheelbase (123 in.) as the 1961–63 Lincolns and is actually longer overall than the 1964–65 Lincoln.

	'65 Merc.	'65 Linc.	'63 Linc.
wheelbase, in.	123.0	126.0	123.0
overall length	218.4	216.3	213.3
width	79.6	78.6	78.6
height	55.1	54.2	53.5
box vol., cu. ft.	554	535	517
curb weight, lb.	4010	5275	5200

The major changes in the 1965 Mercury (along with all-new bodies) are found in the completely redesigned and longer chassis. The two principal changes are a perimeter-type frame and a coil spring rear suspension system.

Obviously, the novelty of any such changes has long since disappeared. But Mercury engineers specified box-section side and front rails, with only the farthest aft crossmember with an open side. The center side rails are formed from a single piece of 0.106-in. thick steel, butt-welded with a single seam.

Torque boxes, built up of 0.132 in. formed steel plate, weld the side rails to front and rear frame rails. These, located at the extreme corners of the passenger compartment, permit the slight twisting or flexing of the outboard rails to absorb shock from the suspension mountings.

The Lincoln Continental, since 1961, has used a unit frame and body and it's no secret that this type of design has two disadvantages: 1) styling changes are expensive, and 2) larger cars tend to be relatively heavy. Thus it is not at all surprising to find that the first all-new Mercury in several years continues with a separate frame and body. In fact, *Car Life* feels that Lincoln-Mercury chassis engineers are several jumps ahead of their competi- ▶

tion in this area and the feat of actually reducing the weight of the new and longer car is a major accomplishment. This car is fractionally longer than the Continental Mk. III, yet weighs more than 1000 lb. less; the 300-lb. frame alone saves 36 lb. over that of the '64 Mercury.

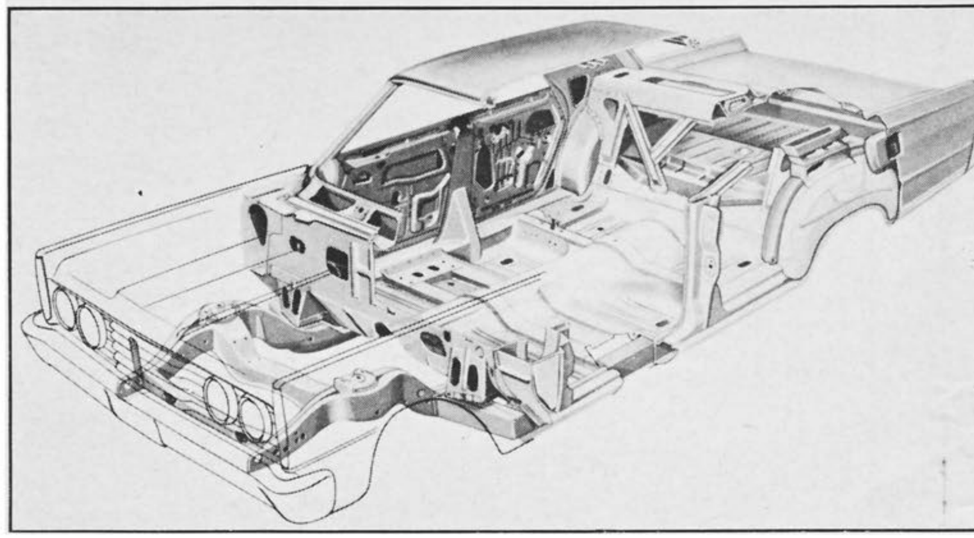
The concept of the perimeter frame has been the subject of much discussion. The principal advantage, at least to the consumer, is that placing the side rails out under the body sills makes entrance and exit easier, and allows a low and relatively flat floor. The problem with such a frame is lack of torsional rigidity.

In essence, the perimeter frame can be described (in a slight exaggeration) as merely a convenient structure to hold the wheels in position before the body is dropped on. This philosophy was, in fact, first expressed by Chrysler engineers when the 1934 Chrysler Airflows with "semi-unit" construction were introduced.

To avoid shake on rough roads, engineers have come to rely more and more on body rigidity, less and less on the frame. In the new Mercury, the total chassis torsional rigidity factor is just over 5000 lb.-ft. per degree of twist. Of this, the body itself contributes about two-thirds of the total strength. The accompanying section views through the frame/rocker panel area show that though the 1965 frame rail itself is smaller than before, the surrounding box sections of the body are more massive.

Not only in massive structure, but also in material specifications have changes been made for the Mercury. Where 0.048 and 0.035-in. steel was specified in '64 for the rocker panel/sill area, now the steel is 0.060 in. throughout. It is worth noting, too, that the U-channel nesting of sill over side rail has eliminated much complicated metal bending and bracing which had been the case before, along with flatter, wider floor areas.

In the cowl area, an important contribution to overall body strength has resulted from the double-wall construction. This also incorporates an entirely new cowl ventilation system, carrying the intake ducts down the side walls to the kick panel, a measure which also adds a bridge-truss sort of strengthening to the area. A subsidiary benefit is the ability to mount the heater core and blower into this cavity from the engine compartment side, which both clears out the clutter of plumbing and removes a source of noise from the passenger compartment.



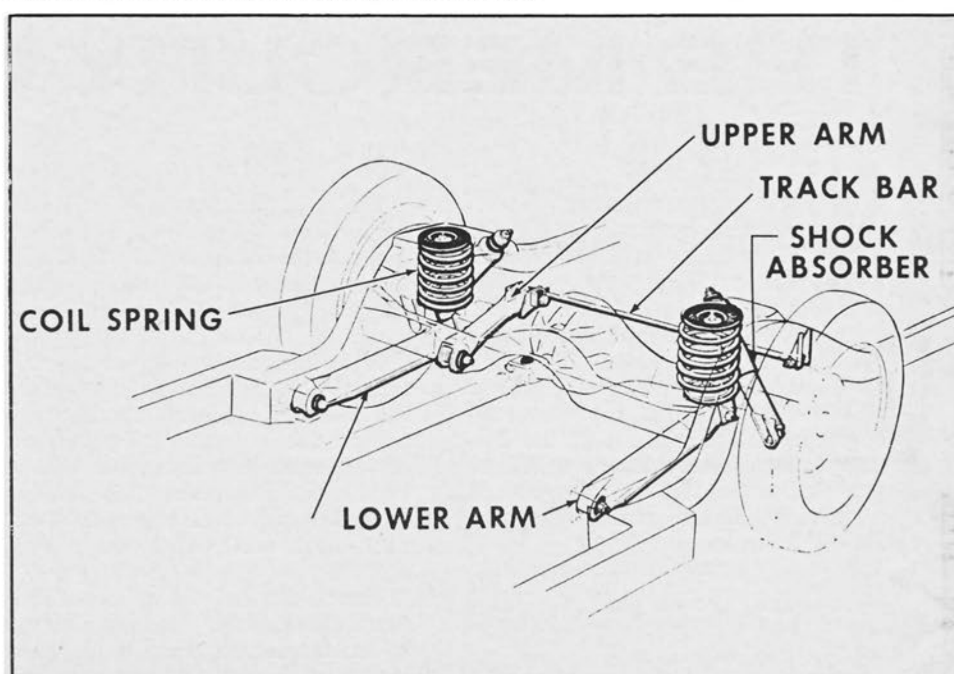
PHANTOM CUTAWAY of frame and body illustrates sturdy construction of latter, particularly in double cowl area, across rear package shelf, and in lower sills.

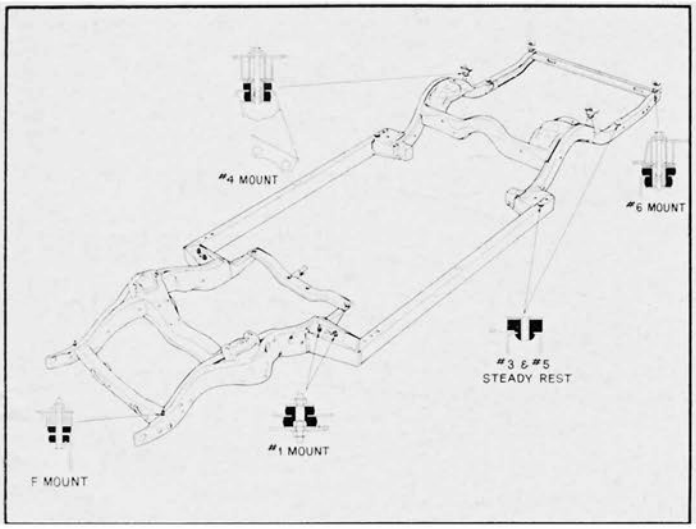
The perimeter frame problem resolves inself into a chassis tuning exercise. The idea is to select body-to-frame mounting points so that the two structures complement each other—to gain rigidity, yet transmit no vibration. In other words, it's more economical to build the frame/body structure so that it "gives" a little, rather than try to design it for absolute rigidity.

To locate body mounting points, a test car is first instrumented with pickups and run on various types of road surfaces to determine wheel hop resonances and predominant shake modes. The pickups contain a moving coil which generates an electric signal proportional to velocity.

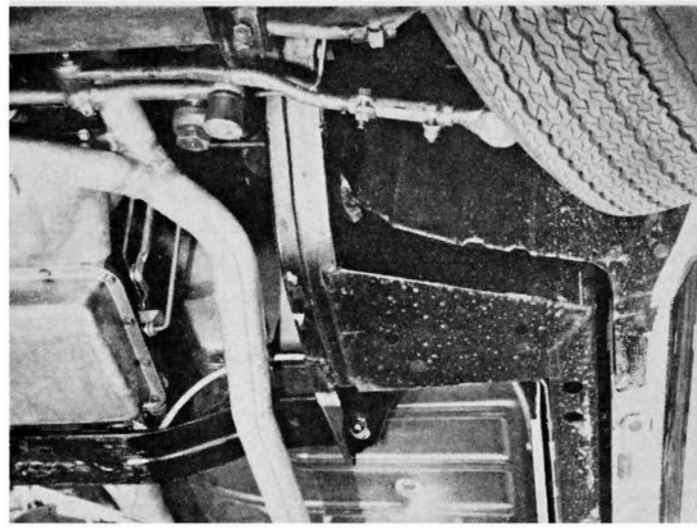
The car is then brought into the laboratory and set up on the shake rig. The front or rear suspension is vibrated through the frequency range encountered during road operation. By measuring the bending deflection through the use of vibration pickups, the nodal points, or points of least displacement are located for the body mounts. There are only three body mounts, as such, on each side. Two are paired atop the front torque box and the third is just aft of the rear axle kickup. Between these points, the "rigidized" body is bridged.

REAR SUSPENSION diagram locates various components in the all-new layout. Three-link system, still carrying live axle, permits softer ride.





LOCATIONS OF body mounts and "steady rest" bumpers are shown in this diagram. Body bridges between Mounts #1 and 4.



UNDERSIDE VIEW of side rail and front torque box shows how body sills fold around them in sturdy U channel.

The final result is that the Mercury uses 12 rubber biscuits located near the ends of the frame. (The side rails are, in effect, free to vibrate.) These are double-cushion pads of butyl rubber which, while they do not securely fasten the body to the frame, are under slight tension to effectively cushion compression and jounce loads by maintaining continuous contact with the body. Additional bumpers are required, however, for the convertible. The frame for that body has much heavier side rails as well as heavier rocker panel sections in the body proper.

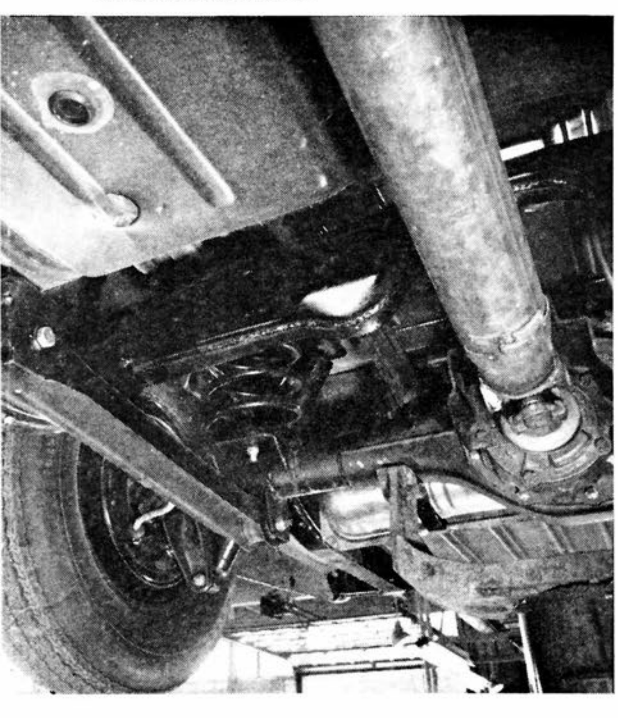
The noise, vibration and harshness problem also involves the suspension system and the engine mounts. Even the tire vibration characteristics come in for study and analysis, and a special machine (CL, December) has been built to evaluate tires without the time-consuming procedure of actual road tests.

The torsional systems of a vehicle power-train are extremely complex, involving everything from the rear tires to the engine crankshaft. The complexity of power-train torsional problems such as clutch chatter and standard transmission gear rattle precludes analysis by manual calculations. The digital computer with its rapid data handling facility enabled Mercury to predict the effects of changing various components—directing its vehicle development efforts.

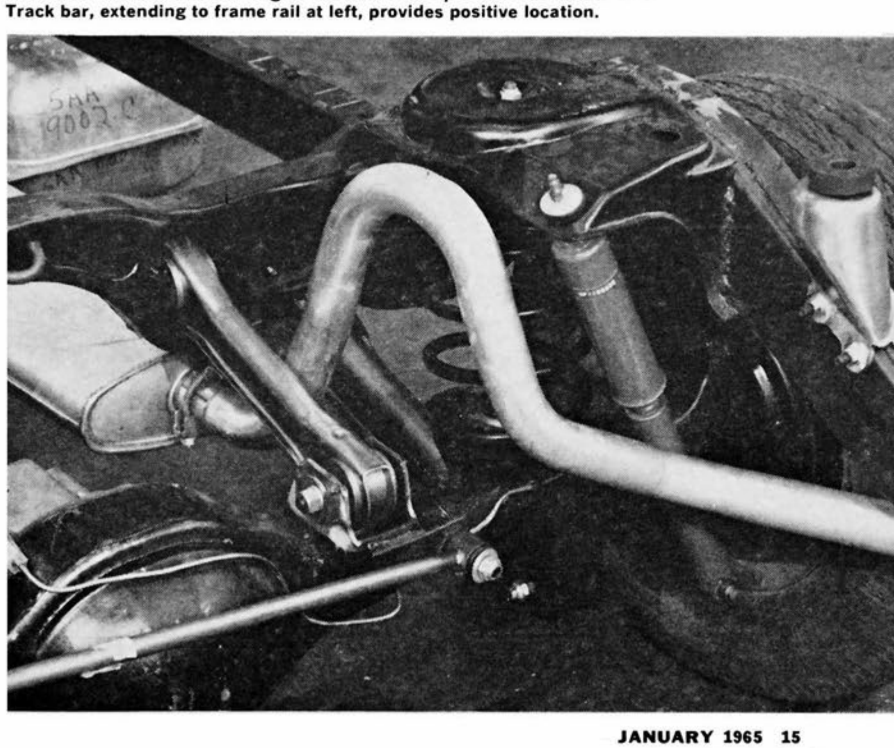
The completed computer calculations require visualization for the engineer to determine the effects of the subject changes over the speed range. The data plotter will draw the amplitude of standard transmission gear rattle and show problem areas which need correction.

It was studies such as this which led to something new in propeller shafts. This tubular device has always been an effective transmitter—even an amplifier—of rear axle gear noise. The ▶

LOWER ARM takes driving and braking forces as it carries axle.



UPPER CONTROL arm is designed to control torque reaction in the axle. Track bar, extending to frame rail at left, provides positive location.

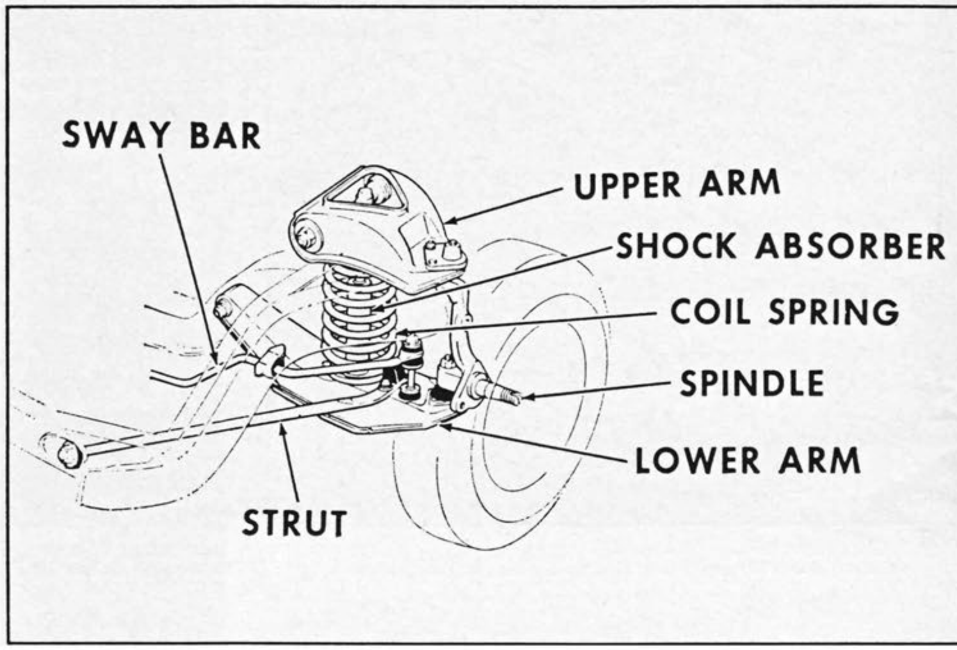


CHASSIS

Mercury production shaft incorporates a series of rubber rings inside the tube, retained by expanding steel clamps. Their number, positioning and even the rubber compound are important for optimum effectiveness as noise-stoppers.

The front suspension of the car has been completely redesigned and a drag strut replaces the former cranked-arm device to provide fore and aft compliance at the lower control arm. Every suspension arm, front and rear, as well as all the rubber cushions, come in for thorough vibration-transmission study and it is interesting to note that front spring loads and forces are aligned with the front engine mount crossmember. This is to eliminate couple-forces and resultant front end sheet metal shake, a factor proved out in our subsequent road tests.

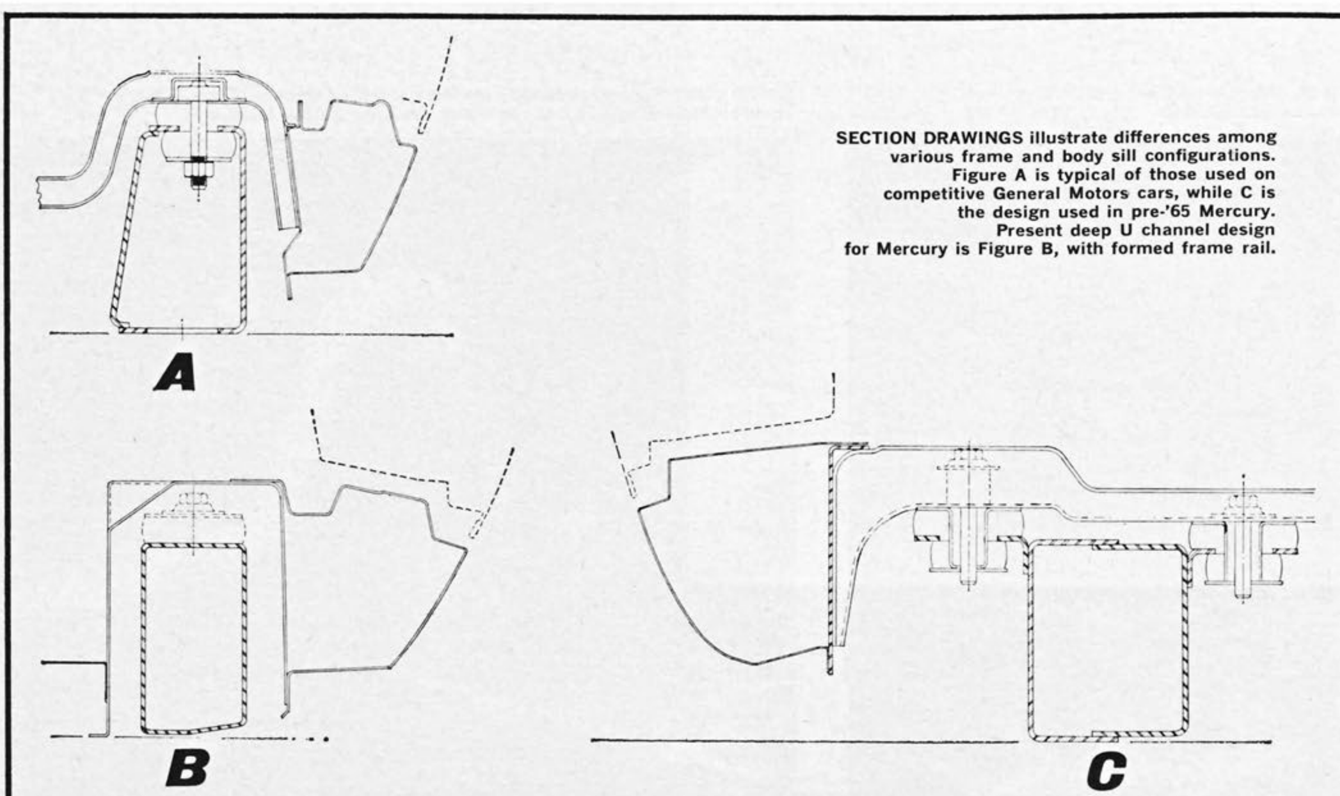
Finally the "acoustical package," as the engineers call it, was developed. These pieces are called "fixes," it being impossible to cure all problems 100% without them. The new Mercury embodies every possible and practical device known to absorb any stray vibration and noise which may get into the passenger compartment.



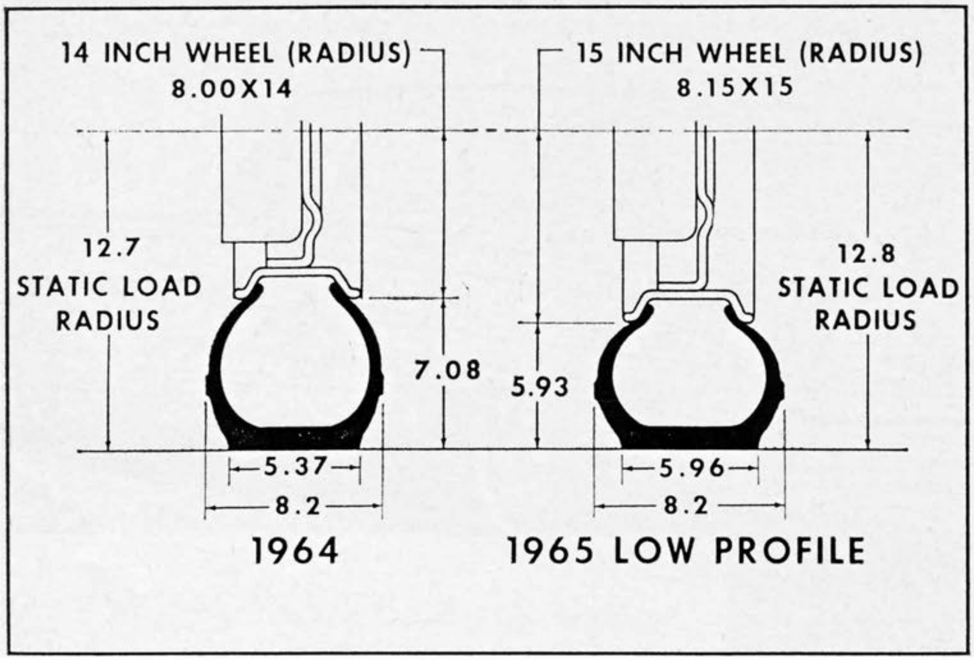
FRONT SUSPENSION borrows from Lincoln Continental. Former crank-like compliance link is replaced with rubber-bushed drag strut for that purpose.

All the foregoing has been outlined in some detail, but it fails to show the tremendous amount of time, money and talent involved. The new results are obvious immediately to the average owner, particularly if he happens to have a 10-year-old second car for comparison. Mercury engineers merely point out that the passenger compartment noise level averages 6% better than that for a Rolls Royce, as measured by proper instrumentation.

Engine and drive-train components are substantially unchanged from 1964, although clutch and/or converter housings have been re-designed for reduced bending and less drive-train resonance. As before, the standard engine is the



SECTION DRAWINGS illustrate differences among various frame and body sill configurations. Figure A is typical of those used on competitive General Motors cars, while C is the design used in pre-'65 Mercury. Present deep U channel design for Mercury is Figure B, with formed frame rail.



BETTER TRACTION and more cooling air around brake drums result from switch to low profile tires and 15-in. wheels. Note little change in height.

TAKE A CLEAN SHEET OF PAPER

Mercury engineers made a multitude of detail changes to maintain competitiveness in their marketing area. Among them:

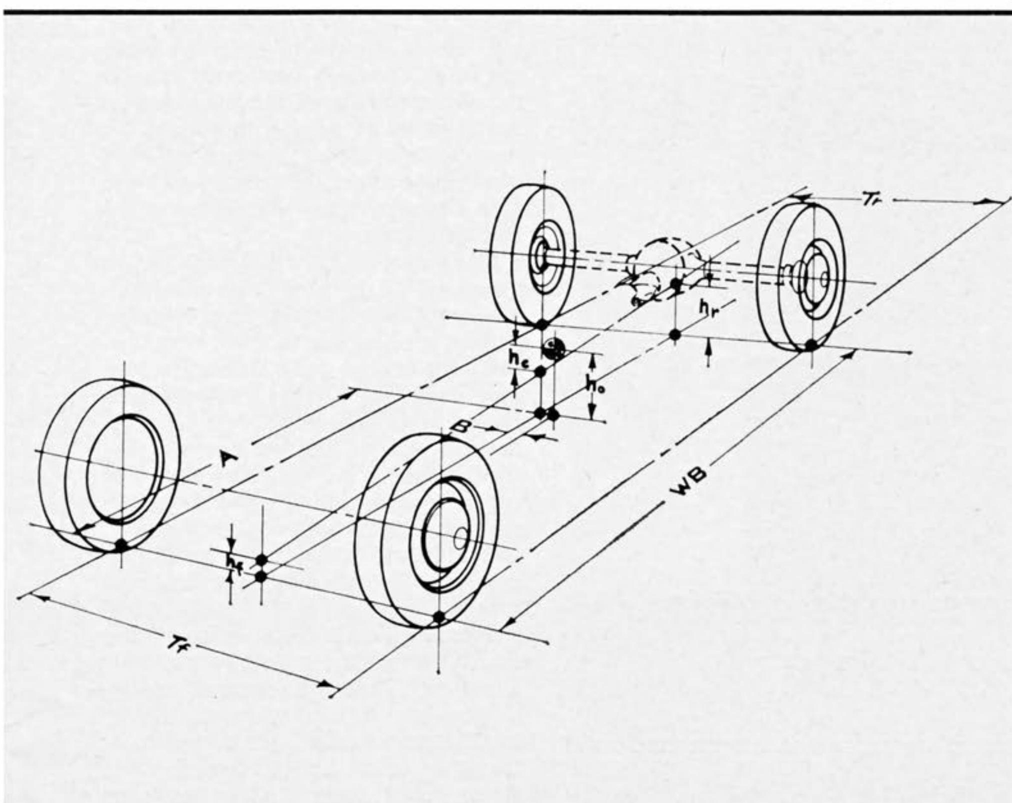
1. Front and rear track widened to 62 in.
2. Return to 15-in. wheels with low profile tires.
3. Relocate fuel tank for better protection, space useage.
4. Cowl ventilation with kick-panel outlets.
5. Higher capacity alternator and new regulator specified.
6. Improved fuel pump supplied.
7. Suspended accelerator pedal.
8. Smaller transmission tunnel in lowered floor.
9. New power steering system with less effort.
10. Curved side glass.
11. Greater trunk capacity with new springs and fuel tank location.
12. Double wall cowl for strength, noise isolation.
13. Three-phase shock absorbers.
14. Reduce rear unsprung weight.
15. Three-link suspension incorporating anti-lift and anti-squat.
16. Anti-dive designed into front suspension geometry.
17. New battery, mufflers specified.

Ford-built 390-cu. in. V-8 with horsepower options from 250 to 330. As a special option, buyers can order the 427-cu. in./425-bhp engine, but it should be borne in mind that this engine cannot be ordered with power steering, power brakes, air conditioning or automatic transmission.

Transmission options include the excellent Ford-built, all synchromesh 3- or 4-speed units, or the 3-speed plus converter Merc-O-Matic. All these mechanical components have been in production for a number of years.

In summary, the Mercury combines years of background experience with three years of concentrated engineering development work into a package which *Car Life* considers the best new car of 1965 from an engineering point of view. There may be cars that appear more novel in some particular areas, but we consider the Mercury an all-around well-balanced design—one that will be very hard to improve upon and one that well deserves our 1965 Award for Engineering Excellence. ■

KEY MEASUREMENTS and data for new Mercury suspension are diagramed here. Table at right gives values for keyed points in drawing. All figures are taken from standard 4-door sedan equipped with automatic transmission, power steering and brakes, tilting wheel.



Sym.	Description	Value
W	Total car weight	4850* lb.
Wf	Front end weight	2561 lb.
Wr	Rear end weight	2289 lb.
Wu	Unsprung weight	540 lb.
Wuf	Front unsprung weight	210 lb.
Wur	Rear unsprung weight	330 lb.
WB	Wheelbase	123 in.
Tf	Tread, front	62 in.
Tr	Tread, rear	62 in.
A	c.l., front wheel to c.g.	58.1 in.
B	c.l., car to c.g.	0 in.
h_o	Ground to c.g.	22.4 in.
k_f	Front ride rate**ø	108 lb./in.
k_r	Rear ride rate**ø	101 lb./in.
K_f	Front roll rateø	435 lb.-ft./deg.
K_r	Rear roll rateø	156 lb.-ft./deg.
h_f	Front roll center height	1.25 in.
h_r	Rear roll center height	15.34 in.
h_c	Roll center ht. to c.g.	14.51 in.
M	Roll couple	520 lb.-ft.
M_f	Front roll couple	383 lb.-ft.
M_r	Rear roll couple	137 lb.-ft.
K	Total roll rateø	591 lb.-ft./deg.
a	Cornering acceleration	0.1G ft./sec.^{2}
f_f	Front suspension frequencyø	65 cpm
f_r	Rear suspension frequencyø	75 cpm

ø Vehicle measurements
** With tires
* 5-passenger load