

Our editorial experience with the Buick Riviera has led us into many an argument about the qualities of this car. We like it so much that the editorial staff has run up an aggregate total in excess of 5000 miles on assorted Rivas, and we often extoll its virtues at the lunch table or at cocktail parties. Our opponents assert that the car is a big heavy Buick and therefore completely undesirable for people who have enjoyed Jaguars, 300 SLs, or even Corvettes. Actually the Riviera is different from the other big Buicks, and it stands alone among American cars in providing a combination of luxury, performance and general roadworthiness that approaches Bentley Continental standards at less than half the price.

Buick's design objectives make it clear that the Riviera is not a sports car. The engineers wanted the ride to be firm and well-controlled with precise handling and a good feel of the road but without compromising the riding comfort which is expected in a luxury car. An acceptable compromise is what they aimed at, but we felt a little too isolated from the road, without precise information about what's really going on. The wheel travel seemed excessive while the shock absorbers were just inadequate.

Its overall behavior is still so good that we were often tempted into using sports car driving methods with the Riviera. We sometimes amused ourselves catching TR-4s and big Healeys on fast bends—this is not only well within the realms of possibility but completely safe. The car is well balanced, although a firm

CAR and DRIVER
**ROAD
RESEARCH
REPORT**

BUICK RIVIERA

The 1964 model of the
car that most
impressed us in '63
survives an acid test

understeerer, which means that at the point where the sports cars begin to hang their tails out, the Riviera is plowing a bit. It's only on rough roads that the Riviera loses something of its composure. On small bumps the direction of the car will be affected (although the steering wheel remains in splendid isolation from road shocks) and steering corrections will be necessary, sometimes even for traveling in a straight line. The absolute worst was experienced when negotiating a winding road with a succession of dips and rises at a fast clip, when the car moved forward in a series of enormous lurches, the springs being fully compressed one moment and fully extended a few seconds later. Fortunately we were comfortably seated and strapped in and never got really worried. One can forgive a lot when correctly seated.

As Buick well knows, the design factors which produce sports car handling are not normally compatible with those that produce a luxury car ride. In the early design analysis of the Riviera, Buick's engineers evaluated numerous combinations of parameters affecting ride and handling. They considered variations of wheelbase, front and rear track, spring stiffness and roll steer geometry. From this analysis, and from subsequent development work on early test cars, they arrived at a combination which was built into the final pre-production prototypes. There may be, says Buick, harder-riding cars with handling characteristics more to the liking of sports car enthusiasts, but the Riviera is an excellent overall blend of riding comfort and handling qualities. We agree that the design objectives have been achieved, but we also wish that the objectives had been more in line with the needs of a rally driver. Yet, in view of what can be done in major rallies by a car such as the Rover 3-liter, with its lower power, inadequately clamped down rear axle and relatively soft springs, it is logical that the Riviera should be at least equally suitable for competition.

But the British car that the Riviera can perhaps best be compared to is the Jaguar Mark X, which, with a similar forward accent in weight distribution, has nearly neutral steering characteristics. This is mainly because the roll axis of the Riviera is sloping forward while that of the Mark X is almost horizontal. It is interesting also to bring the Corvette into this comparison:

	Roll center height (in)	
	Front	Rear
Buick Riviera	1.63	12.60
Corvette 1962	0.00	9.00
Corvette 1963	3.40	8.13
Jaguar Mark X	4.38	4.72

Basically, a high roll center gives reduced lateral weight transfer, lower roll couple rates, and, with independent suspension, permits the retention of negative camber on deflection. It's clear that the Riviera has far greater weight transfer at the front than at the rear, inducing understeer, while the Mark X has just slightly higher weight transfer at the front.

While the spring rates of the Riviera are higher at the front and lower at the rear than on the Wildcat and Electra models, they are somewhat out of line with European practice, as even much lighter cars of old-world origin prefer higher front spring rates:

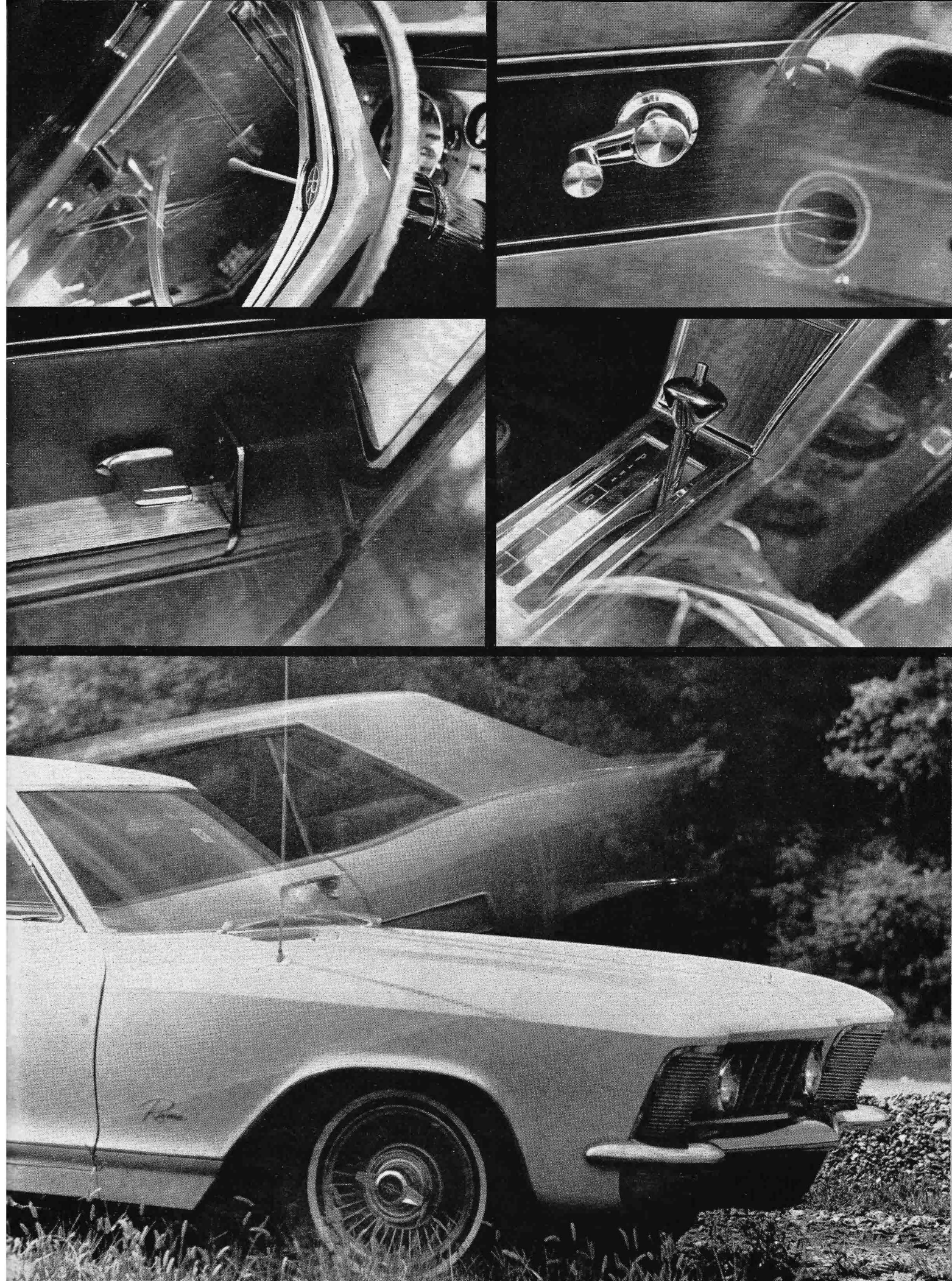
	Spring rates lbs/in (at the wheel)			
	Front		Rear	
	Load	Rate	Load	Rate
Buick Riviera	1114	99	986	91
Corvette 1963	757	93	750	125
Jaguar Mark X	1115	175	1013	116.5
Volvo P-1800	672	107	545	95

The directional stability of the Riviera is superior to

It's all done with mirrors—and Dave Gittens' camera. Clean and functional design puts cranks and handles unobtrusively where they are needed. Ashtray and lighter are hidden under panel in front of shift lever. Exterior is unchanged except for trim and cosmetic items. Nobody ever said it wasn't luxurious.

almost any normal road car. It is not greatly affected, with its very high polar moment of inertia, by changing road camber and is markedly insensitive to crosswinds. In view of these characteristics and the considerable weight of the car (although about 500 pounds lighter than an Electra 225), power steering was considered a necessity. It is geared to give $3\frac{1}{2}$ turns of the wheel lock to lock, which is a bit slow—the turning circle is 43.2 feet. The steering unit is made by Saginaw, and as Saginaw also produces the excellent power steering for the Corvette, it is a pity, and almost puzzling, that Buick did not try to adapt it for the Riviera. While the muscular effort required to turn the car is very low, even at low speeds, the amount of twirling that has to be done with the wheel feels excessive. But the gearing, strangely, is quick enough to make it possible to beat the power assist. If you try to throw the Riviera into a turn, you may find yourself halfway into it, with a sudden, if momentary, loss of power assist, and lacking the physical strength to turn the wheel enough to get through in clean style. Fortunately the power mechanism catches up with you in time to complete the maneuver without disgrace. The car responds best to a smooth, almost gentle, style of driving. By such methods it is, in fact, possible to get around sharp corners with great agility. But the Riviera likes to be held back before the turn, then accelerated through it. The same applies on winding roads, but with increased familiarity with the Riviera, the driver will find that the bends and turns he has to brake for get fewer and farther between. We found that on hilly and winding but fast roads we got the best results by putting on plenty of lock on the way into the curve, finding the correct throttle opening, and just holding the wheel beautifully still until it could be eased back to a straight position, while drivers of cars of other makes were sawing wildly at the wheel trying to keep up.

The Riviera leans very little and never looks out of shape on a fast bend. The low center of gravity (at 19.7 inches) is a major factor here; so is the 0.844-inch anti-roll bar. Reduced roll almost invariably provides higher ultimate cornering capacity and more precise maneuverability at speed. The front roll couple for the Riviera is slightly greater than for the Electra, with the front wheels taking over 57%, as against 56% in the other big Buick. P.C. Bowser and S.C. Richey, the Buick engineers mainly in charge of developing the Riviera, say quite frankly that they do not believe the Riviera has just exactly the right combination of roll couple, front and rear understeer and camber geometry, but if they had to do it over again, they would be hard pressed to find a better starting point. This way of looking at the Riviera indicates that the manufacturer regards it in the same perspective that we



Road Research Report: Buick Riviera

Manufacturer: Buick Motor Division of General Motors Corporation
East Hamilton Avenue, Flint, Michigan.

PRICES:

Basic price	\$3,995.00
Options fitted	430.00
Air conditioner	43.00
Tilting wheel	178.45
Power seat and windows	56.97
AC Cruise Control	90.30
Radio	17.00
Seat belts (front)	

Price as tested \$4,810.72

ENGINE:
Water-cooled 90° V-8, cast iron block, 5 main bearings.
Bore x stroke 4.31 x 3.64 in, 109.5 x 92.5 mm
Displacement 425 cu in, 6918 cc
Compression ratio 10.25 to one
Carburetion Single four-barrel Carter AFB (1.56-in primary, 1.69-in secondary).
Valve gear Pushrod-operated overhead valves, hydraulic lifters
Valve diameter Intake 1.875 in, exhaust 1.50 in
Valve timing:
Intake opens 29° BTC
Intake closes 81° ABC
Exhaust opens 71° BBC
Exhaust closes 48° ATC
Valve lift 0.44 in
Power (SAE) 340 bhp @ 4400 rpm
Torque 465 lb-ft @ 2800 rpm
Specific power output 0.80 bhp per cu in, 49 bhp per liter
Usable range of engine speeds 500-5000 rpm
Electrical system 12-Volt, 70-Amp-hr battery, Delcotron alternator
Fuel recommended Premium
Mileage 12-18 mpg
Average throughout test 15.21 mpg
Range on 20-gallon tank 240-360 miles

DRIVE TRAIN:

Transmission: Super Turbine 400 hydraulic torque converter and three-speed planetary transmission.

Gear	Ratio	Overall	Max mph
Rev	2.08	6.78	55
1st	2.48	7.61	48
2nd	1.48	4.54	82
3rd	1.00	3.07	125

Maximum torque multiplication (at stall) 2.15 to one
Final drive ratio 3.07 to one

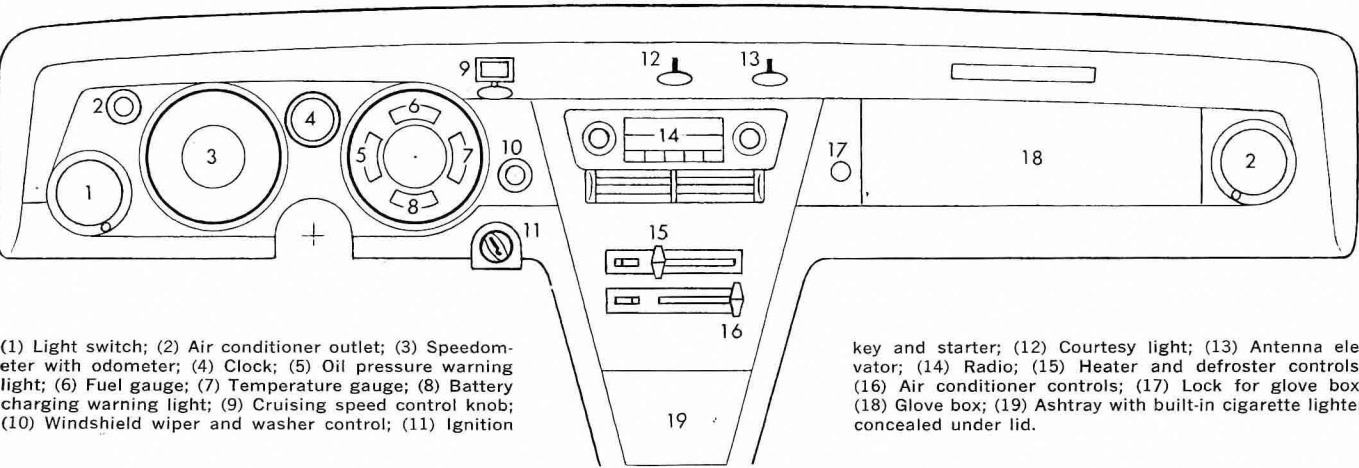
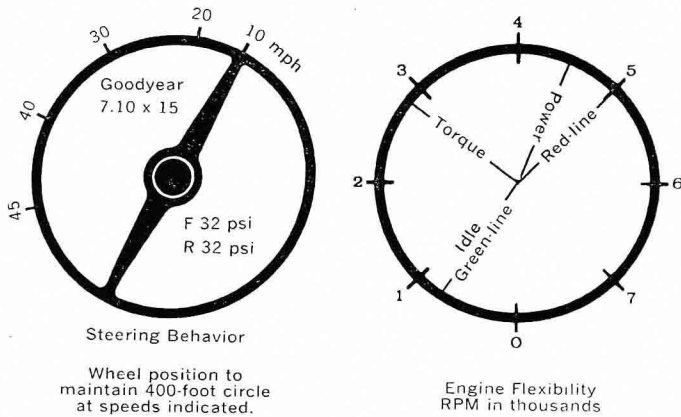
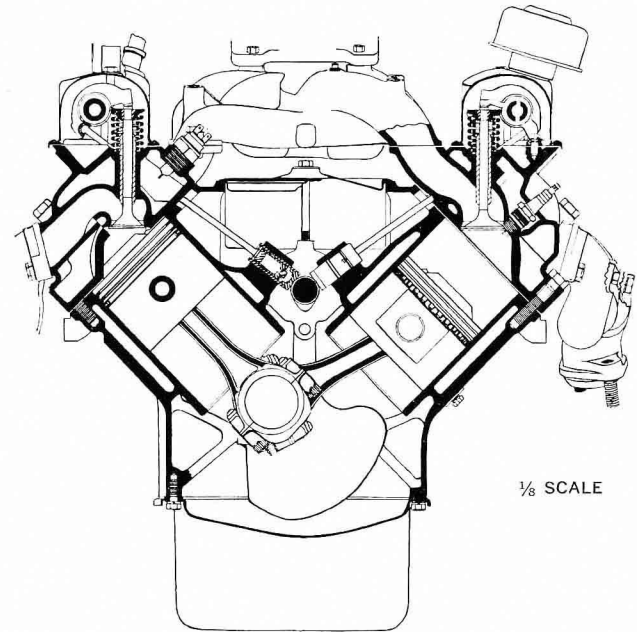
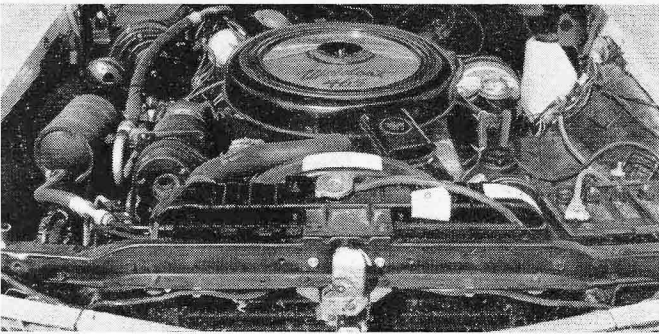
CHASSIS:
Cruciform channel-section frame, all-steel closed body.
Wheelbase 117 in
Track F 60, R 59 in
Length 208 in
Width 75.5 in
Height 53.2 in
Ground clearance 5.70 in
Curb weight 4200 lbs
Test weight 4460 lbs
Weight distribution % front/rear 53/47
Pounds per bhp (test weight) 13.9
Suspension: F: Ind., wishbones and coil springs, anti-roll bar.
R: Rigid axle, trailing arms and torque member, panhard rod, coil springs.
Brakes 12-in drums F and R, 320.5 sq in swept area
Steering Recirculating ball
Turns lock to lock 3.5
Turning circle 43.2 ft.
Tires 7.10 x 15
Revs per mile 744

MAINTENANCE:
Crankcase capacity 4 qts (without filter)
Oil change interval 5000 miles
Number of grease fittings 9

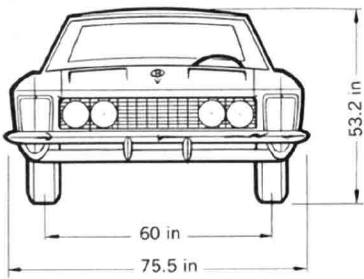
ACCELERATION:

Zero to	Seconds
30 mph	3.1
40 mph	4.4
50 mph	6.0
60 mph	8.3
70 mph	11.1
80 mph	14.6
90 mph	19.0
100 mph	25.5

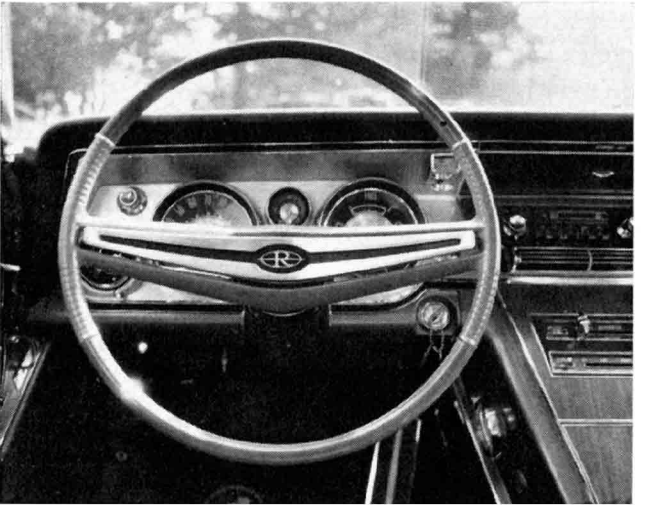
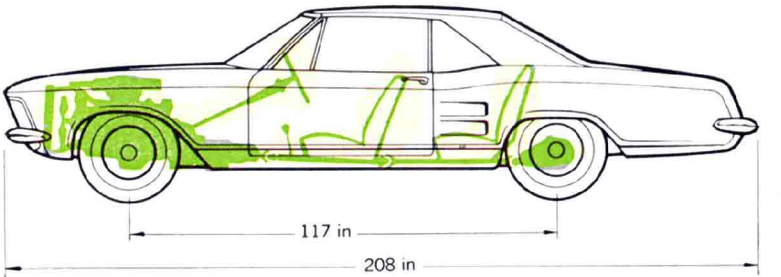
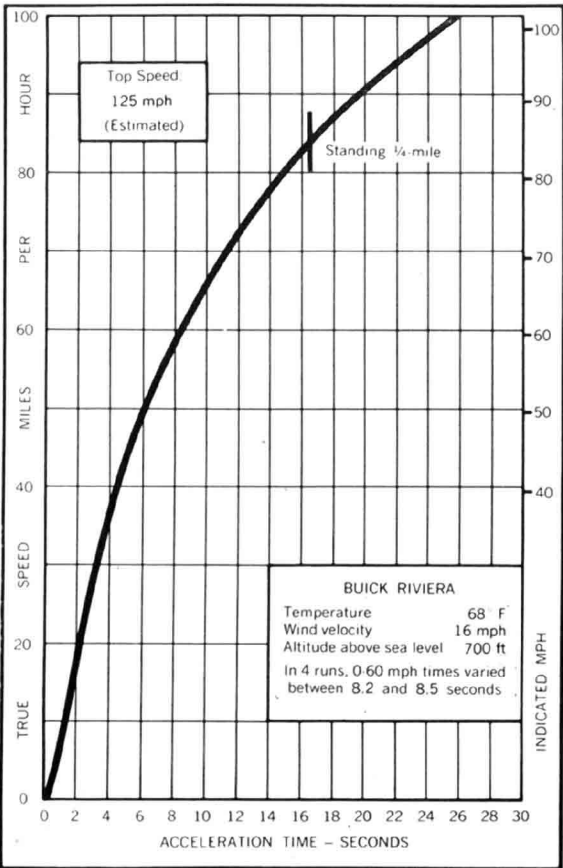
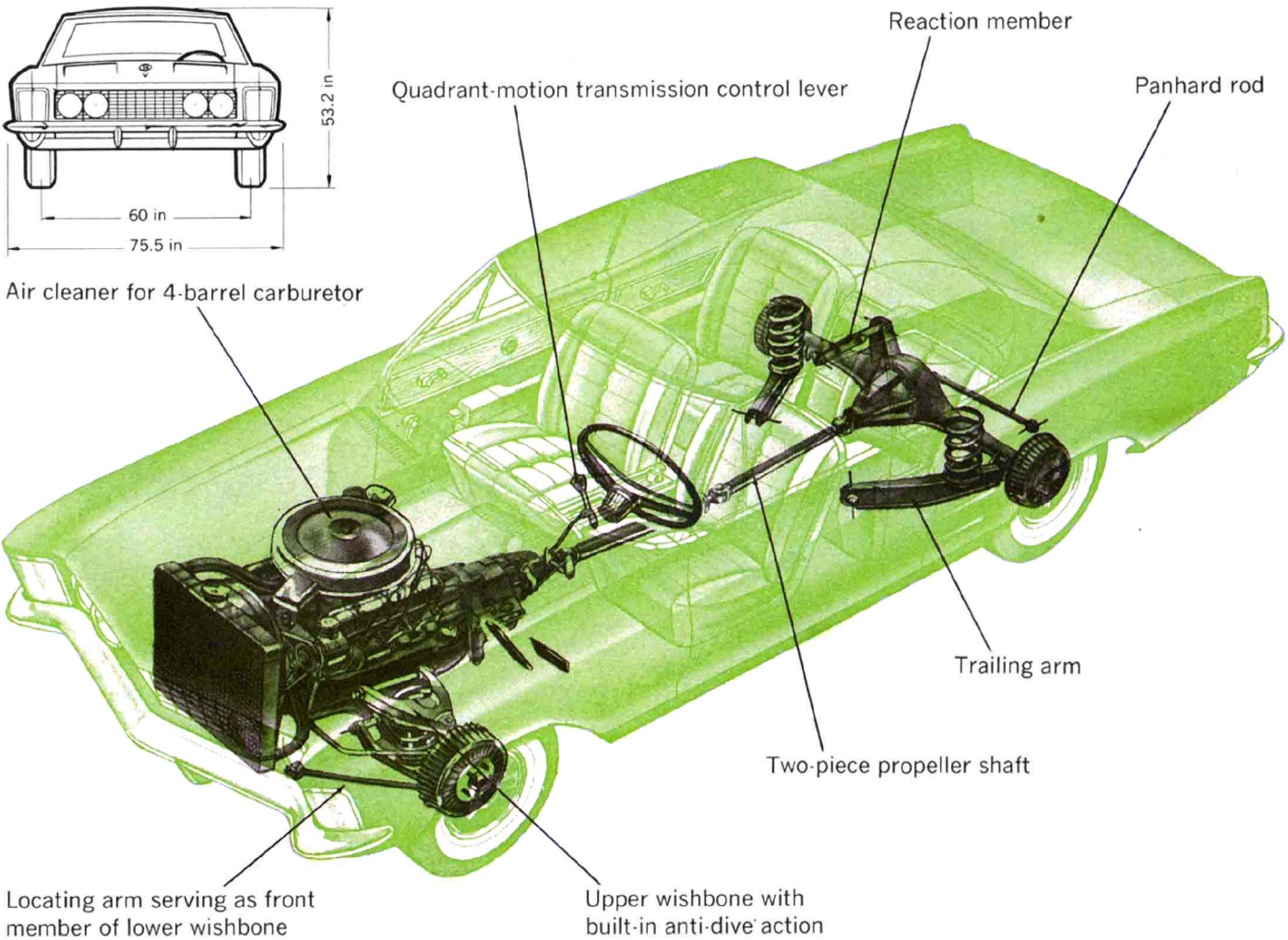
Standing quarter-mile 16.6 sec @ 83 mph

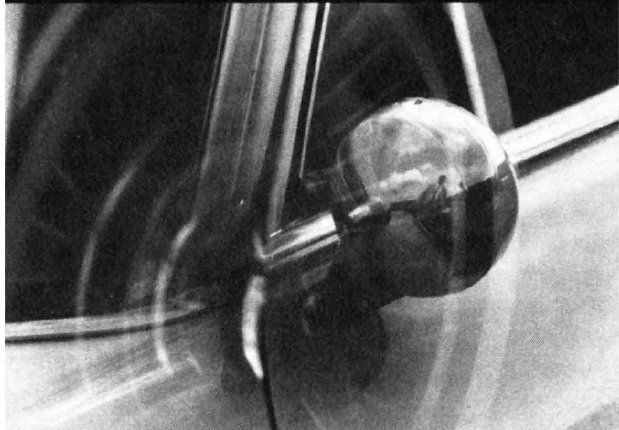


(1) Light switch; (2) Air conditioner outlet; (3) Speedometer with odometer; (4) Clock; (5) Oil pressure warning light; (6) Fuel gauge; (7) Temperature gauge; (8) Battery charging warning light; (9) Cruising speed control knob; (10) Windshield wiper and washer control; (11) Ignition key and starter; (12) Courtesy light; (13) Antenna elevator; (14) Radio; (15) Heater and defroster controls; (16) Air conditioner controls; (17) Lock for glove box; (18) Glove box; (19) Ashtray with built-in cigarette lighter concealed under lid.

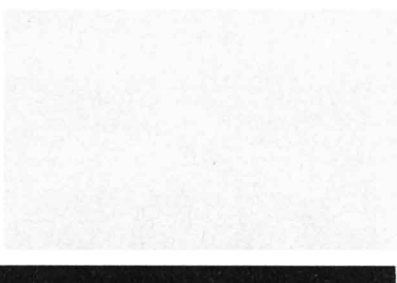


Air cleaner for 4-barrel carburetor





The Riviera copies nothing—it has a true American style and an indefinable personality that is bound to find many followers—within General Motors as well as outside.



have come to look on it. It's the first of a new breed of American automobile, with a chassis design that has been liberated of all superstitions and prejudices while constituting nothing so radical as to shock the vehicle operator who is totally unaccustomed to sports cars.

Our readers will remember that Buick seemed wedded to the torque tube from pre-war days through 1960. At that time the open drive line was introduced in conjunction with the new rear suspension, and this is the system the Riviera has. Using two lower trailing control arms, a panhard rod for lateral location, plus a reaction member on the right-hand side of the axle housing (in the manner of the C-type Jaguar) this system prevents rotation about the attachment points of the two trailing arms during braking and acceleration. It effectively prevents axle wind-up, but the torque of the Riviera engine is so great that the right rear wheel does lose grip on full-throttle acceleration, although there is no axle tramp and the wheel is in visible ground contact all the time. The torque forces on the axle housing are so great as to overcome the individual wheel loading.

The intended boulevard ride of the Riviera is good for any speeds the car is capable of attaining, so long as the surface is smooth. It's on the turnpike that the car is at its luxurious best, with low wind noise, no mechanical noise, and tire noise depending entirely on the road surface. It will cruise all day at any speed between 0 and 120 mph, and when we say cruise, this means a steady speed with a maximum momentary deviation of 2.5 mph from the desired average, regardless of gradient, thanks to the AC Electro-Cruise Speed Control System.

Its operation couldn't be simpler. You set a special second needle on the speedometer at the desired speed, press the "cruise" knob, and accelerate until the standard needle reaches or passes it. Then a green light comes on and the accelerator can be released, while the car travels at the set speed. To disengage the speed control system, either pull the knob back or touch the brake pedal. Exceeding the set cruising speed, for passing, for instance, is possible by merely depressing the accelerator, and this maneuver does not disengage the cruise control. When the accelerator is again released, the car resumes the set speed. We were hesitant about accepting the speed control system purely as a means of reducing driver fatigue on modern superhighways, but have become quite convinced of its value.

How does it really work? The desired cruising speed is fed into a speed-sensing transducer, which is an integral part of the speedometer. The set speed is then compared to the prevailing road speed as measured by the speedometer. The difference between the desired speed and the indicated speed represents a speed error. This speed error, in the form of a pulse-modulated electrical signal, is sent through a transistorized current amplifier to a vacuum diaphragm power unit, which is coupled to the throttle linkage. In response to the signal, the power unit adjusts the throttle linkage to cancel the speed error, speeding up or slowing down the engine as directed.

The choice of an engine for the Riviera was a simple one. Buick's first V-8 from 1953 has been modernized over the years, and a special big-bore version (425 cu. in. instead of 401) was produced to reach the performance goal intended for this car. With a single four-throat carburetor it develops 340 bhp; a twin four-throat setup is optional and boosts power output to 360 bhp. Both block and head are cast iron, and the steel crankshaft runs in five main bearings of 2½ in. diameter. The block extends well below the crankshaft center line. Some other

(Continued on page 86)

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RIVIERA CONTINUED FROM PAGE 30

automotive divisions of GM have more modern engines than Buick, both in basic concept and in detail design. But the Riviera has a well-tried and reliable high-performance unit, and what a major redesign would achieve would chiefly be a weight reduction.

Ever since the introduction of the Dynaflow in 1948 Buick has led the development of torque-converter transmissions (although Packard's Ultramatic was a close second in the early 50s). The latest Buick development is the Super Turbine 400, a water-cooled unit which has an electrical-impulse kickdown control, contains an aneroid bellows in the shift mechanism to compensate for changes in altitude, and carries counter-phased (for quiet running) planetary gears in sets of four (instead of the normal three) pinions for increased durability. The Super Turbine 400 eloquently confirms Buick's position of leadership.

Getaway from standstill, while never really a weak point with the Turbine Drive of the 1963 Riviera, has been much improved in the Super Turbine 400 transmission of the 1964 model. The limiting factor in acceleration now is wheelspin, while it used to be transmission flexibility.

The transmission is controlled by a lever moving in a quadrant on the console between the front seats, its pattern being the P-R-N-D-L currently favored by most manufacturers. The Super Turbine 400 is based on the Turbine Drive, and consists of a three-element torque converter (incorporating the Buick-developed variable-pitch stator) coupled to a planetary transmission with two gear trains, one for Low range, the other for Drive range. The new transmission starts in first, giving a 50% increase in starting thrust over the Turbine Drive, and intermediate and direct are later engaged according to speed and throttle opening. In direct drive, the planetary transmission is locked up and rotates as a unit, while all needs for gearing changes are taken care of by the torque converter. The changes in the planetary transmission are carried out by overrunning (one-way) clutches and multiple-disc clutches in combination. One gear is released by the instantly-effective over-running clutches while the next is engaged by smoothly acting multiple-disc clutches.

With a minimum throttle opening, the car gets into intermediate range at 10 mph and direct at 20 mph. Opening the throttle to the halfway point (where an extra return spring

gives added resistance to the accelerator) moves the change points up to 35 mph and 55 mph. On full throttle, first gear is held to 48 mph and intermediate to 82 mph. If the driver wishes to use Low in the speed range between 35 and 50 mph *without fully opening the throttle*, as for instance on a winding road with both up and down gradients, this can be done by moving the shift lever into Low position. For extra acceleration in Drive range, below 70 mph, simple kickdown is enough to get Intermediate, which then carries the car up to 82 mph, at which point the planetary transmission locks up and the torque converter alone provides a down-gearing. Its maximum torque multiplication is 2.15.

Using the engine as a brake is possible in the new Riviera. Moving the lever into Low position between 60 and 30 mph engages Intermediate, and the torque converter is sufficiently reversible to provide a moderate braking force in this condition. When the speed falls to 25 mph, 1st gear is automatically engaged and the car is again ready for maximum acceleration. If full engine braking is still needed, after speeding up, merely leaving the lever in Low position will keep 1st gear engaged. But if only moderate braking is desired, this can be achieved by changing from Low to Drive and right back again.

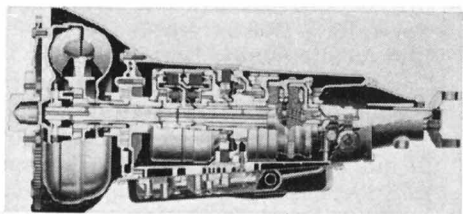
Of course, all the efficiency and versatility of the new transmission have not been achieved without introducing some disadvantage. The new Riviera has a rather strong creep, although without the accompanying vibration usually associated with automatic transmissions when held back on the brake.

With such performance as the Riviera offers, it's obvious that above-average brakes are needed. Buick found that the Electra brakes with specially developed organic linings gave satisfactory results. Since Buick introduced the finned aluminum brake drum with bonded cast iron liners on the front wheels of the 1958 models we have held them to be the best in the industry—probably about twice as good as any other drum brakes fitted to American cars. Most of our complaints about American drum brakes lie in their poor heat dissipation. Buick's aluminum alloy drum conducts heat faster through the drum (heat conductivity of aluminum is three times that of cast iron) to the peripheral cooling fins. These fins swirl air into contact with the hottest surface areas of the drum. Aluminum also dissipates heat to the air quicker than iron. Because more

heat can be carried off, more heat can safely be generated, and the brakes can be made to operate at high loads for long periods while keeping the temperature of the brake linings below the point of beginning brake fade.

Rear wheel drums on the Riviera are cast iron, but also carry fins for improved heat dissipation. The Moraine servo unit is tremendously powerful and almost too sensitive. A mere 30 pounds of pedal pressure gives a 400-pound line pressure, and the car can be brought to an abrupt stop almost inadvertently by a driver unaccustomed to hyper-sensitive power brakes. In an emergency, even a conditioned Riviera driver might react by pushing too hard on the pedal, and we feel that a more conventionally balanced power assist would be an improvement. But this is the only improvement we can think of. The hardest driving we could put the car through failed to produce any fade or smell of burned brake lining, the car invariably pulled up in a straight line; and, again a tribute to the suspension, there is no nose dive and the rear wheels do not lose their grip. Even a rough surface could not upset braking effect.

For the 117-inch wheelbase Riviera, Buick decided to use a separate frame rather than integral construction because, in Buick's experience, a frame allows more flexibility of design. The cruciform frame is based on that of the large Buicks (introduced in 1961). The absence of side rails alone means a weight saving of some 70 pounds, and passenger com-



A sectional view of the Super Turbine 400 shows the very compact mechanical parts.

fort is better because the underbody sections can be lowered and the entrance and exit dimensions of the door sill stepover can be reduced. Buick also claims improved lateral stiffness with less shake and vibration from their method of spreading the rails in the rear.

The Riviera is a passenger's car as much as the driver's. It's spacious and extremely well finished, with deep, soft seats and plenty of legroom, hiproom and headroom. But the driver is the privileged one, having a four-way power-operated seat,

and a seven-position steering wheel. These refinements however are of restricted utility. The seat has no variation of angle between the backrest and the seat cushion, and the wheel positions tend to the unnatural because the jointed boss is pivoted at a point on the steering column eight inches from the rim of the steering wheel. This means that when the wheel is nearest to a truck- or Indy-style position it is also at its maximum height from the seat while it ought to be at the minimum height. Conversely, when the wheel is nearest to a vertical position, it is at its lowest height, while it ought to be higher. Most of our driving was consequently done with the wheel in a perfectly normal position.

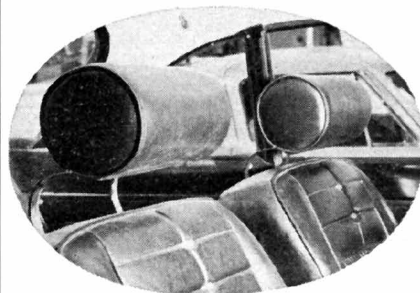
No matter what the road conditions or how many hours we stayed at the wheel, we never got tired. It's possible to spread the legs about as much as on a 300 SLR, and the arms can be held as straight as in a Grand Prix Maserati. The seat permits minute changes in position, so as to limit physical fatigue in any particular part of the driver's body without forcing him to sit differently. It's really very very nice, and our test drivers all agreed that they enjoyed getting back into the car every time.

The worst that can possibly be said about the Riviera from the passenger's point of view is that the air conditioner blows the ashes off his cigarette before he reaches the console-mounted ashtray. The air conditioner, of course, is a Frigidaire unit. It has three outlets; one wide grille in the center of the dashboard and two holes at the extremes, all with some adjustment for air flow direction. The fan has four speeds. During the 1963 model year, this air conditioner was fitted to 60% of the Riviera production. The air conditioning unit is completely separate from the heater and defroster, which offers particularly good temperature control by elimination of the water-control valve; the water circulates through the heater core at all times, regardless of heater control settings.

We can think of few more satisfying ways of travel than to ride behind the slim-rimmed wheel of a Buick Riviera, looking out over the wide and gently sloping hood and watching the fender tips and the oval Riviera emblem eat up the road ahead in majestic silence. The visual enjoyment is backed up by a degree of physical well-being which may well be unsurpassed. Like the Buick engineers, we might not make the Riviera exactly what it is if we were to start with a clean sheet, but we would be sorely tempted to use the existing model as a basis. **C/D**

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