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# CV Joint Rubber Boot Condition, the Secret to the Life Span of Front-Wheel-Drive Cars' Drive Shafts

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***ABSTRACT:*** *'Information is Power' leads to the desire to produce this paper which tells us a lot on the secret to the safe working condition of the Drive shafts of Front-wheel-drive cars. The paper first introduced by little explanation what exactly is a Drive shaft. It then went ahead to state what Failure is in terms of material behaviour which is related to this research. The statement of problems, significance of the research and the aims along with objectives were all outlined. Comparism was made between front and rear wheel drive cars using the parameters of advantages and disadvantages of the constructions of the two classes of cars. Symptoms of how to determine if the drive shaft is indicating sign that it is about to fail were explicitly stated. Safe replacement procedures and precautions of changing drive shafts of front-wheel-drive cars were discussed and clearly stated. Finally recommendations were given and Conclusions were drawn on the essence of the entire write up.*
**Keywords:** CV Joint, drive-shaft, failure, front-wheel, rubber boot.

## I. INTRODUCTION

It is not unfamiliar in this country to see broken-down front-wheel-drive cars, in the middle of the road. This is usually attributed to the failure of the Drive-shaft. The phenomenon is identifiable as the wheel can be seen to be out of position. This constitutes a lot of problems; the car in the middle of the road becomes an obstacle which can cause accidents, it also brings about traffic jam which leads to traffic hold-ups which puts drivers in difficult and undesirable situations. Another problem is the disturbing repetitive constant sound experienced especially when negotiating corners or reversing, with front-wheel-drive cars. This sound emanates from the drive shaft, and it is probably giving the driver/owner of the car a sign that it will soon fail because most at times if it goes on for some time without check, it becomes really bad and eventually fail. These situations that have been illustrated make it paramount to conduct a study of the failure of drive-shafts for front-wheel-drive cars. The view that front-wheel-drive cars seen in the middle of the road with their wheels misaligned all have drive-shaft problem is not correct, rather, that constitutes another set of problems for instance, steering rod, upper arm or ball joint failure.

The benefits derivable from this research when concluded are numerous to mention. It will go a long way to enlighten drivers/users of these types of cars on the menace and possible ways of overcoming these unwanted situations. Drivers of front-wheel-drive cars will be offered advices on how to extend the useful life of front-wheel drive shafts. The aforementioned points would definitely offer guidance to the use of front-wheel drive shafts which will definitely increase the desire to own, maintain and use favorably these types of cars which constitute the majority of cars produced in recent times.

## II. DRIVE SHAFT

Drive shafts in cars are responsible for the transmission of motion as a result of engine power, from the gearbox through the differential, to the drive wheels.

The Drive shaft or propeller shaft on rear wheel drive cars is mostly made of tubular steel of one-piece construction. In certain rather rare applications, the drive shaft is made up of two concentric tubes separated by molded rubber rings to absorb vibrations (http://www.a1driveshaft.com/fwdaxles.html).

However, for front wheel drive cars, the drive line consists of a pair of universally-jointed drive shafts; the two drive shafts are often referred to as 'half shafts' (file:bldef-120a.html).

## III. FRONT-WHEEL DRIVE SHAFTS

Before commenting on the structure of front-wheel drive shafts, it is useful first to compare their duty with that of an equivalent single propeller shaft as in the case of a rear-wheel drive system.

1. The location of the drive shafts is such that they are necessarily shorter in length.
2. Since the drive shafts operate directly between the final drive and the road wheels, they transmit greater torque.
3. From point 2 above it also follows that they rotate at a slower speed.
4. When used in conjunction with inboard-mounted front brakes, the drive shafts must be able to withstand brake torque loading which can be applied more suddenly than that generated by the engine and transmission system.

Naturally the above considerations apply also to the drive shafts of independently sprung and driven rear wheels (Nunney, 1998).

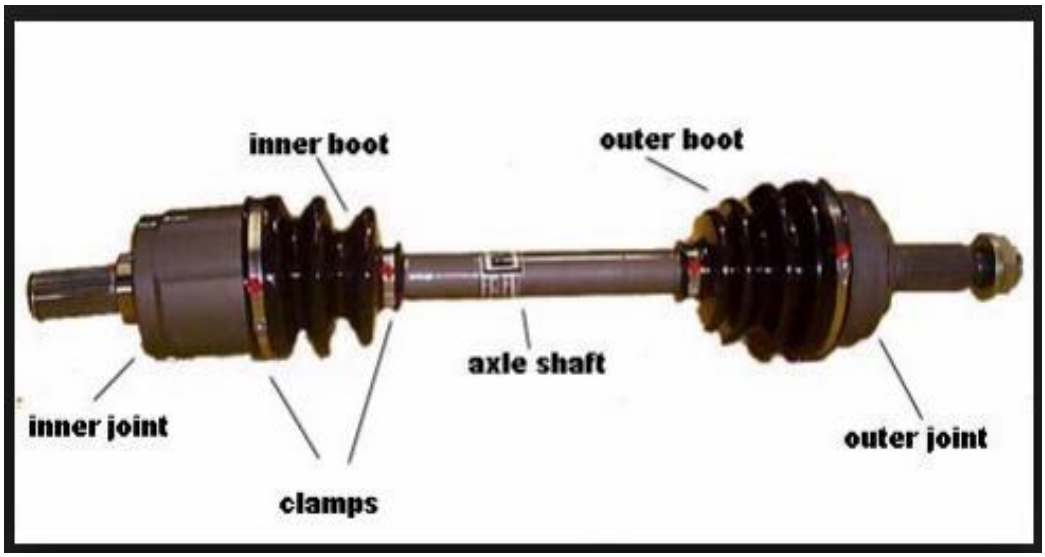


**Fig.** Drive-shaft

## IV. FAILURE

Failure is one of the most important aspects of material behavior, because it directly influences the selection of a material for a certain application, the methods of manufacturing, and the service life of the component. Because of the many factors involved, failure and fracture of materials are complex areas of study. Although failure of materials is generally regarded as undesirable, some products are designed in such a way that failure is essential for their function. Typical examples are food and beverages containers with tabs (or entire tops) which are removed by tearing the sheet metal along a prescribed path (Serope and Steven, 2005).

## V. STATEMENT OF THE PROBLEM

It is not unfamiliar in this country to see broken-down front-wheel-drive cars, in the middle of the road: this often occurs as a result of the drive shaft failing. It is easy to identify because, in most cases, the wheel appears misaligned. This causes two problems; firstly, the broken-down car constitutes an obstacle to the flow of traffic and may even cause accident. Secondly, it puts the car owner in trouble of having to see to the immediate repair of the car since it cannot be driven with this problem.

It is also common to experience a clicking sound, especially when negotiating corners, with front-wheel-drive cars. This sound emanates from the drive shaft, and it is probably giving the driver/owner of the car a sign that it will soon fail.

With these problems listed herein, it becomes essential to carry-out a study of failure of drive shafts of front-wheel-drive cars.

## VI. SIGNIFICANCE OF THE RESEARCH

This research when completed would provide the following:

1. Technical information on the causes and types of failure of drive shafts in front-wheel-drive cars.
2. The drivers of front-wheel-drive cars will be advised on how to extend the useful life of front-wheel drive shafts.

## VII. AIMS AND OBJECTIVES

The aim of this paper is to proffer advice on how to safeguard the life span of drive shafts of front-wheel-drive cars. The objectives include:

1. To identify the problems associated with the failure of front-wheel drive shafts.
2. To outline how it fails.
3. To provide recommendations on preventing failure of front-wheel drive shafts.

## VIII. COMPARISM OF PERFORMANCE OF FRONT AND REAR WHEEL DRIVE SYSTEMS

The comparism is done herein in terms of advantages and disadvantages of the front and rear wheels drive systems.

### 8.1 Advantages and Disadvantages of the Front and Rear Wheels Drive Systems

#### 8.1.1 Advantages of Front-Wheel Drive Systems

1. Interior space.
2. Weight.
3. Improved fuel efficiency due to less weight.
4. Less cost.
5. Improved drivetrain efficiency.
6. Assembly efficiency.
7. Placing the mass of the drivetrain over the driven wheels moves the centre of gravity farther forward than a comparable rear-wheel drive layout, improving traction and directional stability on wet, snowy, or icy surfaces.
8. Predictable handling characteristics.
9. A skilled driver can control the movement of the car even while skidding by steering, throttling and pulling the hand brake.
10. It is easier to correct trailing-throttle or trailing-brake oversteer.
11. The wheelbase can be extended without building a longer driveshaft

(http://en.wikipedia.org/wiki/Automobile_ layout).

#### 8.1.2 Disadvantages of Front-Wheel Drive Systems

1. Torque steer.
2. Lack of weight shifting will limit the acceleration of a front-wheel drive vehicle.
3. In some towing situations, front-wheel drive cars can be at a traction disadvantage.
4. Traction can be reduced while attempting to climb a slope in slippery conditions such as snow or ice covered roadways.
5. Due to geometry and packaging constraints, the CV joints (constant-velocity joints) attached to the wheel hub have a tendency to wear out much earlier than the universal joints typically used in their rear-wheel drive counterparts.
6. They cannot compete in the sport of drifting due to the need of rear-wheel drive to push rear of the vehicle in a circle.
7. Turning circle; front-wheel drive layouts almost always use a Transverse engine installation, which limits the amount by which the front wheels can turn (http://en.wikipedia.org/wiki/Automobile_ layout).

#### 8.1.3 Advantages Of Rear-Wheel Drive Systems

1. Even weight distribution.
2. Weight transfer during acceleration.
3. No torque steer (unless it's an all wheel steer with an offset differential).
4. Steering radius.
5. Better handling in dry conditions.
6. Better braking.
7. Towing.
8. Robustness.
9. Can accommodate more powerful engines as a result of the longitudinal orientation of the drivetrain (http://en.wikipedia.org/wiki/ Automobile_layout).

#### 8.1.4 Disadvantages Of Rear-Wheel Drive Systems

1. Under heavy acceleration oversteer and fishtailing may occur.
2. On snow, ice and sand, rear-wheel drive loses its traction advantage to front or all-wheel drive vehicles which have greater weight on the driven wheels.

3. Some rear engine cars can suffer from reduced steering ability under heavy acceleration.
4. Decreased interior space.
5. Increased weight.
6. Improper weight distribution when loaded.
7. Higher initial purchase price.
8. The possibility of a slight loss in the mechanical efficiency of the drivetrain.
9. The long driveshaft (on front engine cars) adds to drivetrain elasticity. (http://en. wikipedia.org/wiki/Automobile_layout).


Components of a constant velocity (CV) joint
A- Outer bearing race.
B- Stub shaft assembly.
C- Clamps.
D- Bearing cage.
E- Ball bearings.
F- Inner bearing race.
G- Rubber boot.

**NOTE:** Most professional Mechanics do not use split-boots because;
(1) They do not think a split-boot is as reliable or as long-lived as a one-piece original equipment style boot, and
(2) They do not like the idea of installing a new boot on a questionable joint.

By the time a damaged or leaking boot is noticed, the joint has usually lost most of its grease and/or the grease has been contaminated by dirt. Unless the joint is removed, disassembled, cleaned and inspected, there's no way to know if it is still in good enough condition to remain in service. If it is making noise, replacing the boot would be a waste of time because the joint is bad and needs to be replaced (most new joints come with a new boot, clamps and grease). But even if the joint is not making any noise, it may still have wear or internal damage that will soon cause it to fail.

**WARNING:** A CV joint failure can cause loss of steering control under certain circumstances. If the joint locks up, it can prevent the wheels from being turned (http:ques111_0.html).

## IX. SYMPTOMS OF CV JOINT FAILURE

Bad boots are not the only thing you need to look for. You also need to listen for noise or complaints that might indicate a CV joint problem. These include:

1. Popping or clicking noises when turning. This almost always indicates a worn or damaged outer CV joint. To verify this condition, place the vehicle in reverse, crank the steering wheel to one side and drive the vehicle backwards in a circle (check the rearview mirror first!). If the noise gets louder, it confirms the diagnosis and the need for a new CV joint or replacement shaft assembly.

2. A "clunk" when accelerating, decelerating or when putting the transaxle into drive. The noise comes from excessive play in the inner joint on FWD applications, either inner or outer joints in a RWD independent suspension, or from the driveshaft CV joints or U-joint in a RWD or AWD powertrain. The same kind of noise can also be produced by excessive backlash in differential gears. To verify the condition, back the vehicle up, alternately accelerating and decelerating while in reverse. If the clunk or shudder is more pronounced, it confirms a bad inner joint.
3. A humming or growling noise. Sometimes due to inadequate lubrication in either the inner or outer CV joint, this symptom is more often due to worn or damaged wheel bearings, a bad intermediate shaft bearing on equal length halfshaft transaxles, or due to worn shaft bearings within the transaxle.
4. A shudder or vibration when accelerating. May be caused by play in the inboard or outboard joints, but the most likely cause is a worn inboard plunge joint. Similar vibrations can also be caused by a bad intermediate shaft bearing on transaxles with equal length halfshafts, or by bad motor mounts on FWD vehicles with transverse-mounted engines.
5. A vibration that increases with speed. This symptom is rarely caused by a failing CV joint. An out-of-balance tire or wheel, an out-of-round tire or wheel, or bent rims are the more likely causes (Larry, 2004).

## X. CV JOINT REPLACEMENT

If you opt to replace a damaged boot, the CV joint should be removed from the shaft, disassembled and inspected for wear or damage. On most applications, the outer CV joint is held on the shaft by a snap ring or a lock ring, but some, such as Honda and Toyota can be tricky to remove. And if you run into a tripod outer CV joint on an old Toyota Tercel or Nissan Sentra, disassembly is not possible. The entire shaft assembly must be replaced.

Rzeppa-style CV joints can be disassembled by tilting the inner race to one side and inserting a dowel or similar tool into the splines of the inner shaft. Tilt the race as far as it will go to one side to expose one of the balls. Remove the ball from its cage window with a small screwdriver. The inner race can then be tilted to the opposite side so the next ball can be removed, and so on until all the balls have been removed. The cage can now be rotated sideways to remove it and the inner race.

Look for nicks, gouges, cracks, spalling, roughness, flaking, etc. on the surface of the balls or tracks in the inner and outer races. The cage windows should also be inspected for dimples, wear or cracks. Each ball should fit snugly in its respective cage window because looseness here is what often causes the clicking or popping noises associated with a worn CV joint (Larry, 2004).

**NOTE:** CV joints are precision fit assemblies. The balls should be kept in order so they can be reassembled in the same grooves and cage windows as before. Each ball and track develops a unique wear pattern, so don't mix them up.

If the CV joint shows no unusual wear or damage, it is OK to reassemble and repack with grease. Use the special CV grease provided with the replacement boot (never use any other type of grease!), and pack 1/3rd into the joint and place the remainder in the boot. To install the boot, slip it onto the shaft (large end out). Then push the CV joint onto the shaft until it clicks in place or until the snap ring can be locked in place. Pull the outer lip of the boot over the CV joint housing so it lines up with the recess in the housing. Make sure the boot is not crimped, twisted or collapsed; then install the clamps. Some types of clamps require special tightening/crimping tools, while others do not (Larry, 2004).

### 10.1 Cv Joint Replacement Tips

Since most technicians today opt to replace the entire shaft rather than individual CV joints, here are some suggestions that can help avoid problems later:

1) Make sure you have the right replacement CV joint or shaft for the vehicle. Chrysler FWD and Honda use CV joints from various suppliers, so be sure the replacement joint has the same length, shaft diameter and spline count as the original.
2) On Chrysler FWD cars and minivans, the transaxle must be centered so both shafts will have the proper amount of travel as the suspension moves up and down. The exact dimensions can be found in a service manual. The position of the transaxle can be moved by adjusting the right side motor mount.
3) When replacing the drive shafts on an older Ford FWD car (Escort, Lynx, Tempo & Topaz) with an automatic transaxle, replace the shafts one at a time or insert a transaxle plug or similar tool to prevent the differential side gears from slipping out of place. If the gears have slipped, remove the transaxle pan and push against the side gear to move it back into position. Then hold it in place with a plug or similar tool to prevent it from slipping until the drive shafts can be reinstalled.
4) The same precaution must be used on older Nissan FWD cars (Stanza & Maxima) with an automatic transaxle. On these applications, the right axle shaft must be removed first. When the right axle has been

pried out, insert a drift or screwdriver through the differential assembly to push out the left shaft. Then insert a bar into each side of the differential to prevent the side gears from slipping out of position.

5) On all vehicles equipped with ABS, the tone ring for the front wheel speed sensors is often located on the outer CV joint housing. If the joint or driveshaft is being replaced, make sure the replacement has the proper tone ring. An air gap adjustment may also be required for the speed sensor. Use a nonmagnetic brass or plastic feeler gauge to set the speed sensor air gap to specs.
6) Check the transaxle oil seals for leaks before the driveshaft are replaced. If they need attention, now's the time to fix them.
7) Replace the hub nut. Prevailing torque nuts lose their ability to stay tight once they are removed. The same goes for nuts that have to be staked in place. Most replacement shafts come with a new hub nut, but some new CV joints may not.
8) Use a torque wrench to tighten the ball joint and hub nut - never an impact wrench. Install new cotter pins and lock nuts if used. Most manufacturers also recommend replacing any suspension nuts that were removed with new fasteners.
9) Test drive the vehicle after the installation to make sure everything is working properly (no noise, vibrations, etc.) (Larry, 2004).

## XI. RECOMMENDATIONS

1. When front-wheel-drive shafts fail, replacing and not repairing is recommended, because repairing would only keep it working for a little time.
2. Users/drivers of front-wheel-drive cars should adopt the safety measures outlined for driving in order have a safe working drive-shaft assembly.

## XII. CONCLUSION

The Rubber boot is the component of the drive shaft assembly of front-wheel-drive cars that needs the utmost care. If it is safeguarded then, the drive shaft is protected against premature failure.

From comparism it is also evident that the advantages of the front over rear wheel drive cars are enormous and quite sensitive. While the disadvantages of rear wheel drive out weights that of front wheel drive. No wonder looking around us majority of modern cars are mostly front-wheel drive cars.

It is also established that the maintenance culture and expertise in handling during servicing or replacement of drive shafts for front-wheel-drive cars are major areas that need paramount attention and credible experience.

“So secure your RUBBER BOOT and enjoy your drive shaft”

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