

April 2003

**ROUND & ROUND WE GO**  
**By Mike Perkins**  
**BMW CCA Technical Advisor**  
**Owner - Bavarian Machine Specialties**

"How can my steering wheel still shake!" she exclaimed. "I've had the tires balanced several times and even had the alignment checked." Does this sound all too familiar? This is one of the most common complaints I see, and unless properly addressed, can lead to expensive front end repairs, or worse, a loss of driving enjoyment from ones BMW. Her 1997 528i recently had new tires installed and thereafter developed a slight shimmy, nothing big, just an annoyance in the 50-60 mph range. 2000 miles later, the car had a full blown steering wheel shake. How can this seemingly simple job of mounting and balancing tires end up becoming such a problem situation? Simply put, there is a lot to having the job completed successfully. This article will point out some of the basic concepts involved in achieving the smoothest ride and longest term tire wear from your BMW. When diagnosing and correcting front end related vibrations, there are three major areas that must be investigated. These areas are steering and suspension components, tire and rim run-out, and tire and rim imbalance.

PART I - STEERING AND SUSPENSION COMPONENTS

It is essential to start with an initial inspection of the front end steering and suspension components. Minor wear in suspension bushings, ball joints, tie rods, center links, idler arms, or steering gear can amplify or even induce a front end shimmy. For example, weak front shock absorbers are the classic problem when it comes to irregular tire wear. Tires that exhibit a "scalloped" outer edge or are extremely "cupped" in places are the result of shocks that can not handle the bounce of the wheels. This can also be a cause and effect issue. By virtue of an out of balance tire, the shock wears out prematurely. Wear or play in any component can only be detected by a detailed inspection of each piece. A push/pull or clamp/release method is usually employed to test joints for wear. However, it must be recognized that if a car is on a lift with its wheels hanging down, there will be a different joint reaction than one on a lift that leaves the wheels in a loaded position. Generally speaking, Houston roads are brutal on a highly tuned and responsive suspension such as that found on BMWs. It has become the norm to see worn out shocks, ball joints, and broken bushings by 60,000 miles. The nimble suspension we all appreciate degrades quickly without upkeep and will definitely wear your tires.

Tire pressure has a major influence on tire wear and can influence tire bounce especially if the tire is over-inflated. A simple rule of thumb: For every 10°F of temperature change, your tire pressure changes 1 psi. The pressure increases with higher temperatures and conversely with lower. It is best to only check tire pressure when the car has not been driven or has not been sitting in the sun. Each BMW has a handy little label on the driver's "B" pillar (inside the door jam) giving you a recommended tire inflation pressure to follow.

Just 2 psi can make a big difference.

A component that can greatly affect tire shimmy or shake is a worn wheel bearing. Usually a BMW wheel bearing will let you know when a problem exists by a growling noise above 25 mph which is especially noticeable when driving on smooth pavement. This noise is not to be confused with a tire roar from uneven tread wear. Some tires, because of tread design, are inherently louder and actually worsen with mileage due to the "blocky" tread design. This kind of tire requires more frequent rotation.

Another kind of shimmy is when the brake is applied at speeds above 50 mph. If you are thinking rotor shimmy, you would be partly correct. Add another dimension to it and you have rotor induced suspension shimmy. This is where the applied braking force collapses the strut arm bushings and starts an oscillation that produces a perverse front end shake that makes it seem like the dash is vibrating.

A last item I consider part of the steering and suspension category is the overall alignment. Many times I have been asked to check the front end alignment because the steering wheel has a shimmy. From experience, I know that no amount of re-aligning the front end of your BMW will change the degree of steering wheel shimmy. A properly aligned car will help prevent a shimmy problem down the road by keeping tires wearing evenly but it will never correct the actual shimmy. This is definitely a cause and effect issue.

## PART II - TIRE AND RIM RUN-OUT

The second area that must be investigated is tire and rim run-out. This is the most common and most overlooked problem. Tire and rim run-out are identified as radial and lateral run-out. Radial run-out is an excessive amount of "hop" in the wheel and lateral run-out is an excessive amount of "wobble" in the wheel. No matter how well a wheel is balanced, it will always cause a vibration if either type of run-out exists. This run-out can be a bent rim or simply a tire that has not retained its original round shape. New tires can even have excessive radial or lateral run-out. It is a prerequisite for the person installing your tires to test for any rim run-out. This, unfortunately is where the job has problems before it even gets started. The rim must be measured with a dial indicator to identify any problems. Minor rim run-out can be accepted if the rims are to be used in the rear of the car but must be marked to avoid future problems when rotating. Rims to be used on the front of the car must have less than .040" run-out as measured on the inside of a dismounted rim lip. This means the person installing your tires must dismount all the rims and pick the best two for use on the front of the car before even considering tire mounting. However, some rims on late model BMWs are of different widths. If any rim in this case exceeds the maximum run-out, the rim can possibly be straightened and then installed in its original position.

Once the tires are mounted, the radial and lateral testing process must now be applied to the tires. Tires must not exceed a limit of .060" run-out after final mounting. If not, a process of phase matching should be used. This process corrects for radial or lateral run-out in tires. Dismounting the tire from its wheel position and remounting it matching the minimum tire run-out point to the maximum rim run-out point will produce a rounder tire/wheel combination. In some extreme cases, a new tire is required. To further complicate this situation, most higher performance tires are pre-marked for mounting position. Specifically, the manufacturer has indicated a mounting position in reference to the valve stem. A relatively new style of balancer has been marketed by Hunter which actually applies a rolling force to the tire to measure uniformity of the wheel. This is the latest in balancer technology and certainly helps the operator obtain a true balance.

## PART III - TIRE AND RIM IMBALANCE

The third major area of concern when investigating a front end vibration is actual tire or rim imbalance. All wheels must be balanced using an on-the-car or off-the-car dynamic spin balancer to achieve any decent level of overall balance.

There are many good brands of balancers being used in shops today and most are off-the-car types. However, the key to receiving the best job still lies with the skill of the technician. Balancers can be set to read in grams or ounces, rounded or precise numbers, and display at least four different positions where the weight can be placed on the rims. Wheel weights also come in specific profiles to exactly fit the rim lip. You must be sure the shop has the correct style weight to fit a BMW rim, otherwise they will fly off and you will immediately develop an imbalance. The factory 2 piece wheel weight is always a very good system, although very few places use them because of the cost and additional time to install. There is also no way of hiding a factory weight on the inside of the wheel as you would a tape weight.

For those of you who prefer that the weight not be visible, please realize not only does it take more weight when located in the middle of the rim, but the wheel balance will never be as accurate. Every wheel has 2 planes for balancing, the inside and outside of the wheel on the outer edges of the rim. The idea of balancing a wheel is to use the least amount of weight (usually below thirty grams) and in the most accurate position. To achieve this, stay with the conventional style of balancing, one weight on each side of the wheel. When I am confronted with a rounded or polished outer rim profile, I will use a "drop center" method (hiding the outer weight behind the spokes) but still

maintain the inner weight in the normal position. In addition

to having the weight in the correct position on the rim, it is imperative to use the exact amount of weight needed. Many shops that balance wheels allow the balancing machine to operate in a "round off" mode. This means there is a margin for error of + / - five grams. Therefore, your wheel might be ten grams out of balance on at least one side of the rim and yet show the operator it is perfectly balanced. This allows for quicker balancing but over time and mileage, the tire will show the negative results of an imprecise balancing job. Have your wheels balanced to non-round off specs. If you really want to see if a good job is being done, look for a digital scale next to the balancing machine that the operator uses to check the weights he trims by hand! As long as we are being picky, make sure all pebbles are removed from the tread prior to balancing. Another thing to mention about balancing machines is the way the wheel is attached to the balancing arbor. Most machines and shops use a cone which lends itself to inaccurate readings. A finger type hub that engages the tapered lug holes is a much more accurate method of attachment. These hubs are expensive but an excellent investment for a dedicated shop.

Two tire balance situations come to mind that should be avoided. Anytime you use a liquid fix-a-flat product consider the tire to be worthless. It either hardens on one side of the tire, or never hardens and continually changes the tire balance. In either case, it is next to impossible to balance. The second situation is a warning about gas stations that do not drain their air compressor (air compressor tanks fill with water from the hot air condensing and the tank needs to be maintained). Each time you fill your tires with air from one of these compressors, you will also add a small amount of water into your tires. You can guess the result, so make sure you have a reliable air source.

On a final note about balancing tires, I strongly advocate rotating and balancing wheels every 6000-8000 miles. It is within the normal scope of everyday driving that tires and rims will change shape and balance, not to mention hitting pot holes, railroad tracks, or broken concrete. For those of you who have either different size wheels (front to rear) or directional tires, you can still at least rebalance on a regular basis without rotating. It is also a viable option to dismount your wheels and swap the tires from side to side.

It is understandable how someone might think "How hard can it be, it's only tires?" This might be true when it comes to a truck or a car with a less sophisticated suspension. However, what makes the cars you and I drive so special is the precise nature in which a BMW commands the road. To expect that level of precision requires a mind set above the average approach to a seemingly simple job.