Solving Wheel and Tire Vibration Problems

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It is possible that our ZR-1's are becoming more susceptible to tire and wheel assembly vibrations as time goes on. On most ZR-1's the suspension linkage bushings are getting firmer as they harden with age. Most of the OE rubber bushings are no longer available. Polyurethane replacement bushings are available for repairs and upgrades. The firmer polyurethane bushings are good for handling but are not so good for isolating and damping vibration.

Today a small vibration on a ZR-1 is likely to be the most noticeable at about 70 mph. At 70 mph the tires are rotating at about 15 turns per second. The resonant frequency of the new car C4 chassis is 12 -14 Hz.(1) A small rotational imbalance or runout is likely to manifest itself at the resonant frequency because the chassis is most sensitive to excitation at that point. As the chassis stiffens with age the resonant frequency may be a little higher than when the car was new and the bushings were softer.

These are potential sources of vibration:
- Tire or wheel imbalance
- Tire sidewall stiffness variation
- Tire or wheel runout
- Brake rotor imbalance.

Tire or wheel imbalance.
The assembly should be balanced to less than .5 oz. The typical tire balancing machine will show zero when the value is less than .5 oz. Note that .4 oz. of residual imbalance will read out as zero on a machine that is setup up this way.

Tire sidewall stiffness variation.
The Hunter GSP9600, GSP9700 or similar balancing machine can measure the variation in radial tire stiffness. It's termed Road Force ™. The variation of a very good tire will be less than 26 pounds as measured by the machine. The machine has a feature called ForceMatching ™. The stiff spot on the tire sidewall can be matched to the low runout spot on the rim to minimize the effect of a radial stiff spot. If the variation is still too high nothing can be done except replace the tire or live with it.

Tire or wheel runout.
The face of the rotor must be clean and free of rust for the wheel to seat squarely. Rust on the bearing flange side (back side) of the rotor should be sanded or abrasive blasted clean. Corrosion on the wheel can be removed with abrasive paper.

The tire and or wheel could have radial or lateral runout. This can be measured with a dial gage. The GM service specification is .030" maximum for aluminum wheels. The best way to correct for this runout is an analysis on the Hunter tire machine. The machine has a special operational mode called ForceMatch ™ where the runout of the tire and wheel are measured separately. The machine calculates the best clocking of the tire

runout to the wheel runout. That is, the sum of the runouts that is closest to zero. The operator dismounts the tire and rotates it to the specified position on the wheel where the runout of the tire and wheel have their best match. Note that this a complicated technical maneuver that requires a skilled technician. The technician should have received training from Hunter or has learned the procedure in the Hunter operator's manual.

Brake rotor imbalance.

The brake rotor could be out of balance. The rotor can be mounted on the tire balancing machine. An automotive machine shop with a flywheel balancing machine can also perform this operation. Another option is to purchase a quality rotor that has been balanced. Some cheap rotors are not balanced.

[1] Corvette From the Inside. Dave McLellan. Page 165.