vic roads

Testing Times

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Disc Brake Shudder

One of the most common complaints about disc brakes is that they shudder and/or the pedal pulsates. There are a several different causes of disc brake shudder such as:

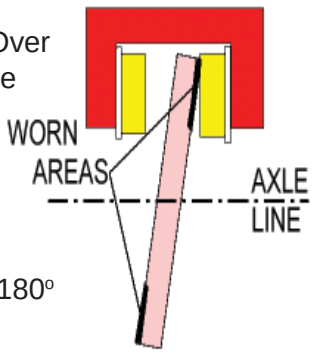
- **Disc Runout**
- **Disc Contamination/Glazing**
- **Disc Thickness Variation**

You should all be quite familiar with the first two so let's examine the last one in detail.

Disc Thickness Variation [DTV] is one of the major and least understood causes of brake shudder and pedal pulsations. The shudder caused by DTV is called cold shudder as it is not caused by temperature or friction variations.

So how does DTV cause the brakes to shudder and the pedal to pulsate? Let's take a look at how a disc brake works. When the brakes are applied, the disc pads on either side of the rotor move in and apply a clamping force to that part of the rotor between them. If the rotor is exactly the same thickness all the way round the clamping force will remain constant as the rotor rotates and the braking will be smooth. However, if the rotor thickness varies at all, the clamping force will be higher as the thicker parts go between the pads and lower for the thinner areas. This variation causes the brakes to shudder and the brake pedal to pulsate.

If the rotors are manufactured or machined to a uniform thickness, how does DTV occur? DTV is caused by the disc pads wearing the brake rotors unevenly when the brakes are **NOT** applied. Over thousands of kilometres the pads will lightly rub the rotor at the points of maximum runout. This continual light rubbing wears two areas, one on each side of the rotor and 180° apart as shown.



These two areas only need to be worn by 10 to 20 microns for brake shuddering to occur. When you consider the way the rotor has been worn and that there are 27 microns to one thousandth of an inch, you can see that running a dial gauge over the rotor will not detect DTV. In fact, the dial gauge will show even less runout than before the wear ocurred. You will need to use a micrometer to measure the thickness at about eight places around the rotor to detect DTV.

Rotor runout as small as 0.07mm [0.003"] may cause DTV on late model vehicles but it may not be apparent until the vehicle has travelled 5,000 to 10,000 km.

To reduce the likelihood of DTV occurring, obviously the brake components must be spotlessly clean before assembly, the rotor should be indexed to the hub to minimise runout and the wheel bearings must be in good condition and correctly adjusted. However, something that is often overlooked is that uneven or excessive wheel nut torque can distort the rotor leading to DTV. Rattle guns are notorious for being set at the maximum torque and this is usually much higher than the correct wheel nut torque.

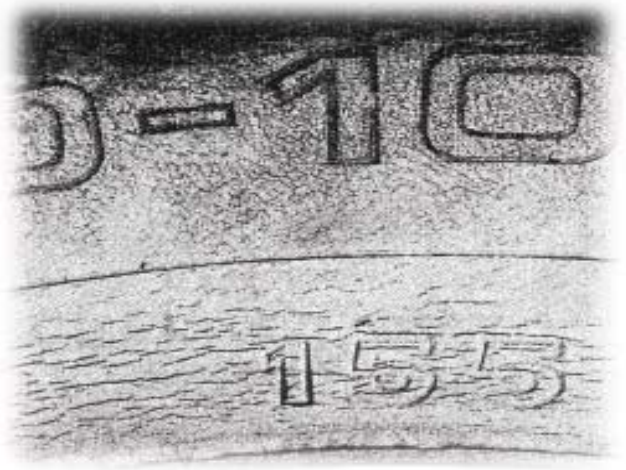
How much shudder makes a vehicle un-roadworthy? From a mechanical point of view, shudder can affect the braking performance but it will probably have to be so violent that it shakes the fillings out of teeth and then some, before the deceleration gets below acceptable levels. From the comfort side though, because of the shudder, the driver may not apply the brakes as hard as is needed in an emergency and this is a safety issue. Mild shudder is acceptable but if you find it quite uncomfortable then it could be grounds for rejecting the vehicle.

Cracked Tyres

Tread separations, deep sidewall cuts, damaged or exposed cords - these are all quite obvious tyre defects - but what about all those fine sidewall cracks you sometimes see?

That pattern of fine cracks is called “ozone cracking” and is caused by prolonged exposure to sunlight. It might also be caused or made worse by excessive sidewall loads or under inflation. Whatever the reason, it indicates that the rubber has started to lose flexibility and that is not good thing for a tyre. But just how bad must the cracking be before you reject the tyre?

Fine surface cracking like that in the upper part of the picture below is acceptable.



However, if it has got to the stage in the lower part of the picture or it exposes any of the cord material then the tyre should be rejected.