

## **Failure Analysis: Passenger Vehicle Wheel Separations** **By Sam Kodsi, B. Eng., P. Eng.**

Since wheel separations of passenger vehicles are less documented than commercial vehicles, we do not know how often this phenomenon occurs. The fact is that wheel separations do occur, whether on a truck, a light/SUV truck or a passenger vehicle.



The mechanics and causes of wheel separations on passenger vehicles may be similar to those of truck wheel separations: loose or over tightened wheel nuts, axle, bearing or disk/drum failures. Loose wheel nuts may eventually come off with normal use, or cause excessive shear forces on the studs as the wheel rocks back and forth. This may cause a sudden failure or an additional unbalanced load on the remaining nuts. If the nuts are over tightened (such as incorrect use of an impact wrench), the threaded studs may fail in tension due to the excessive load or the threads may break off the studs. An axle failure whether due to fatigue (cyclic loading) or impact with a foreign object will cause the entire wheel/brake assembly to separate from the vehicle. If the

bearing fails, the hub, disk/drum and wheel assembly will also likely separate.

The effect on the dynamics of an eighteen wheeler, after losing one set of wheels/tires is not as severe as losing one wheel out of four on a passenger vehicle. In the first case, the massive truck wheel becomes a hazard to other drivers, passengers and pedestrians, while in the second case the major hazard to the valuable human cargo becomes the vehicle itself. If the vehicle loses control, it may impact with other vehicles, fixed objects off the roadway, or pedestrians.

Symptoms prior to wheel separations range from nothing to significant noise, shaking and poor handling. Routine mechanical inspections may reduce the unlikely event of a wheel failure by identifying excessive wear and tear on mechanical items that can fail. These items must be repaired or replaced promptly in order to avoid any mishaps.

The direction of travel of the vehicle, after the loss of a wheel, is dependent on which wheel separates, the speed of the vehicle prior to failure, as well as acceleration/braking, or steering input by the driver. If a motorist is to lose a wheel, he/she should remain calm, maintain a firm grip on the steering wheel, and release the accelerator pedal. If there is a safe distance available, let the vehicle cruise to a stop without applying the brakes. If it is necessary to apply the brakes, they should be gently depressed, so as not to lock any of the remaining wheels.

