

5.6 Vehicle Track Interaction (VTI)

Vehicle Track Interaction (VTI) is a locomotive-mounted technology that evaluates how a vehicle interacts with the track structure. This tool is used to:

- Detect vehicle and track interaction anomalies.
- Provide a proactive approach to reducing damage to vehicles and track.
- Supplement the current track inspection process.
- Quantify and prioritize the exceptions.
- Prevent costly service and equipment failures.

VTI is a real-time system that continuously evaluates the track for exceptions. When exceptions are found, they are labeled with milepost, GPS coordinates, speed, date, and time.

5.6.1 Hardware Used for VTI System

The system uses accelerometers to find exceptions:

- Two accelerometers are mounted in the locomotive. They measure exceptions for car body lateral (CBL) and car body vertical (CBV).
- Accelerometers that measure axle vertical (AV) are mounted on each side of the front axle.

The VTI unit uploads the exception information through wireless communication to a central server. When an exception is found and processed, the information being furnished is in real time, except when the unit is out of cellular range. In these cases, the system will keep trying to send the exception until it is successful.

5.6.2 VTI Thresholds

VTI Thresholds have been established to prioritize the exceptions. Thresholds have been set for car body vehicle accelerations, car body lateral accelerations, and axle vertical force.

Exception	High Priority
CB Vertical	1.3 G
CB Lateral	0.8 G
Axle Vertical	140 kips

Axle verticals are measured as a force.

- 1 Kip (=1,000 pounds) are used for this measurement.

Car body vertical and car body lateral exceptions are measured in terms of acceleration.

- The units of measures for acceleration are Gs.
- An acceleration of 1 G is the same as the force due to gravity.

A. Car Body Verticals

Car body vertical exceptions are generally found in areas with profile issues, which may cause the locomotive to bounce up and down. Most car body verticals are apparent, but if the exception is difficult to see, watch a train traverse the location.

Car body vertical exceptions may be found in road crossings, bridge approaches, and mud spots.

B. Car Body Laterals

These exceptions are found when the locomotive moves from side to side, and can be caused by alignment deviations.

C. Axle Verticals

An axle vertical exception is measured as impacts, which can be used to eliminate potential service failures. The gap size, deflection, and speed all influence the size of the exception.

Some of the conditions that may generate axle vertical exceptions are:

- Rail diamonds
- Mismatched joints
- Crushed heads
- Joints with cracked angle bars
- Broken rails
- Frogs and broken bolts in frogs
- Wheel flanges hitting the top of the angle bar

5.6.3 Handling VTI Exceptions

When a VTI High Priority exception has been detected:

1. High Priority VTI exceptions are communicated through an E-mail message and must be inspected immediately. The Maintenance of Way Call-Out desk will also make a phone call upon receipt of the E-mail with High Priority exceptions, based upon the VRU set-up, and provide the exception information to the appropriate employee. A qualified Inspector will inspect the track for at least 0.05 mile (260 feet) either side of the reported condition and take appropriate remedial action.
2. If nothing is found wrong, then a 40 MPH temporary speed restriction will be placed for at least 0.05 mile either side of the reported condition (minimum of 0.1 mile-long slow order) until it is inspected and certified by the Roadmaster or the Roadmaster's designee (must be an exempt Engineering employee). If the Roadmaster or the Roadmaster's designee finds nothing wrong, then the Division Engineer must be contacted to discuss the condition(s) at the location prior to removal of the temporary speed restriction.