Sensors that we can use it

1-Hotbox or Hot Bearing Detectors

Two infrared eyes sit on each side of the tracks looking up at the train's bearings. They register the radiation from every journal that passes over them. If a bearing reaches the maximum temperature for safe travel, the detector will flag and count it as a defect

2-Dragging Equipment Detectors

A column of cones sits across the whole width of the railroad (just like a cross tie) attached to a switch. Anything dragging from the train will hit this cone, thus pushing it back, thus breaking a contact. It then returns to its normal position to prepare for anything else that might be dragging under the train. The detector will register this action and flag it as a defect

3-Wheel Impact Detectors (often placed at the entrances of delicate high speed track like Amtrak's Northeast Corridor)

4-Wheel sensors along the tracks feel for flat spots on the train's wheels. Any flat wheel that becomes too dangerous to travel on (a big flat spot on the train wheel) will be counted as a defect. Typically, these systems utilize accelerometers, strain gauges, fiber optic methods, or the very latest (WIPD) wheel impact phase detector. A wheel impact load detector (WILD) measures impacts, but does not normalize these impact measurements against anything: simply the impact reading. They do not attempt to cater for differences in sprung mass, as they are measuring wheel defect impact rather than impact load. Therefore, the same wheel defect will register a much larger impact when a wagon is loaded, versus when it is empty. A wheel condition monitoring detector monitors the condition of the wheel independent of sprung mass – independent of load. They do this by subtracting the wheel mass to get the normalized impact value. These systems are therefore typically better at detecting smaller defects with greater resolution.

5-Bogie performance detectors monitor bogie tracking geometry, and hunting (instability) behaviour.

Bogie tracking geometry includes tracking position and angle of attack on a per-axle basis, as well as rotation, shift, inter-axle misalignment, and tracking error on a per-bogie basis.

Bogie performance detectors can provide early detection of bogie defects, and early warning of derailment risks through flange climb or rail break.

Bogie performance detectors most often use optical methods, and are installed adjacent to the track with wheel sensors clamped to the rails.

6-Weighing in Motion sensors for axle loads or imbalances.

7-Wheel detector (Frauscher’s Sensor) The use of Wheel detection equipped with sensors plays a significant role in railway industries worldwide. They are reliable and relatively cheap based on range of signaling applications such as for level crossing protection system. However, there are many different ways in which wheel detection system can be used nowadays. Further to their detection functions, they are also used for additional signals such as direction of the traffic, wheel diameter, wheel center pulse as well as modern interfaces, opening up further new fields of applications [19] and [20]. Wheel sensor are devices installed on the rail track side to detect the existence of rail wheel (Figure 9). The installation and type of wheel sensor will determine the wheel diameter based on the signal output. Normally the devices has one or two inductive coils. Train’s speed and direction signals can be determined using the two single coil devices. Other than direction, wheel diameter etc., wheel detector also has an advantage of determining the speed of the train. To do this, the wheel detector’s evaluation board (EB) converts analogue signals from the wheel sensor coils to a digital signal. This can be output via vital dry contact relay or opt coupler

Reference:

1-https://en.wikipedia.org/wiki/Defect\_detector#Sensors

2-https://www.researchgate.net/publication/317552127\_Design\_of\_Automated\_Unmanned\_Railway\_Level\_Crossing\_System\_Using\_Wheel\_Detector\_Sensor\_Technology#pf1e