



NTSB

SAFETY ALERT

National Transportation Safety Board



Railroad Signal Visibility (Conspicuity)

Railroads should be aware that LED signals may mask light from incandescent signals

The problems:

- Light-emitting diode (LED) railroad signals may mask nearby incandescent signals, preventing incandescent signals from being visible to train crews.
- Under some conditions, if LED and incandescent signals are installed in proximity to one another, the LED signal may appear brighter or closer, causing crews to confuse the sequence of the signals as they approach. This effect may be more pronounced the closer the train gets to the signals.
- Control points with incandescent signals are at increased risk of being masked when they are located near control points with LED signals, particularly at night.
- Stacking routes may increase the risk of accidents in areas where LED and incandescent signals are in proximity to one another because of possible signal aspect (color) confusion.

Related accident:

Railroads are increasingly replacing traditional incandescent signals with LED signals and installing new LED signals. On September 22, 2014, a control point with LED signals began operating in Galva, Kansas. Three days later, an eastbound Union Pacific Railroad (UP) freight train collided with the fifth car from the rear of a westbound UP freight train near the new control point. The dispatcher had planned to route the westbound train into the siding (passing track) and have the eastbound train stay on the main track so they could pass each other. The dispatcher requested a westbound route into the siding track and an eastbound route on the main track. The computer-aided dispatch (CAD) system stacked the requests, so the eastbound train should have been stopped at the red signal until the entire westbound train was in the siding.

The eastbound train was traveling on the main track and passed the front of the westbound train, which was still moving onto the siding track. The incandescent signal at the east end of the main track was displaying red or "stop," while the LED signal beyond that was displaying green or "proceed." Event recorder data show the engineer of the eastbound train advanced the throttle and increased the speed of the train as it continued past the westbound train.

However, the end of the westbound train was still on the main track as the eastbound train passed, causing the eastbound train to collide with the side of the westbound train. Two locomotive units and four multi-platform intermodal cars on the eastbound train derailed; five multi-platform intermodal cars derailed from the westbound train. The train crew was not seriously injured in the accident, and there was no fire. The railroad estimated damages at \$3.2 million.

During the interviews with NTSB investigators, the train crew said they observed a clear or green signal and proceeded accordingly. A postaccident test of the signal's visibility (or conspicuity) indicated the new control point's green LED light was visually dominant and masked the red incandescent lamp. As a result, the eastbound train crew was unable to see the red signal as it approached from a distance.

Following the accident, UP implemented a procedure for dispatchers at the Harriman Dispatch Center in Omaha, Nebraska. The procedure prevents a dispatcher from lining the control point signals for a route in non-sequential order at Galva until a train clears the main track. At the accident site, UP changed the incandescent signal to an LED light unit and used a higher mast to raise the signal head, enhancing a train crew's ability to see the signal and determine its sequence in relation to the subsequent signal. UP also realigned the existing LED signal to limit the range of visibility. In addition, UP reviewed other signal locations with signal block spacing of less than 10,000 feet and where LED and incandescent signals are used to ensure conditions similar to those in Galva were not present elsewhere.

How can railroads avoid similar accidents?

- Identify locations where the close spacing of signals may cause a signal to either mask or visually dominate another signal—especially at locations where LED and incandescent light units have been installed in close proximity.
- Evaluate the railroad computer aided dispatching (CAD) software to prevent stacked requests from lining routes non-sequentially at multiple control points—particularly at locations where signals are located near one another.
- In addition to performing all mandatory operational tests on signals, railroads should conduct a hazard analysis that includes testing signal visibility (conspicuity test) with input from train crews.
- Configuration management is critical in evaluating the safety of proposed changes to railroad systems, including signals and train control, motive power, rail cars, methods of operation, and track. Implement procedures to notify all personnel of changes they may encounter.