Freight Railroads & Temperature Shifts

**Key Takeaway:** Extreme temperature variations pose challenges to steel railroad tracks. As climate change brings higher temperatures to various regions, railroads are applying their expertise and innovative technology to make their infrastructure more resilient and have successfully reduced the Class I mainline track-buckling accident rate by 52% between 2010 and 2021.

Trains run on steel tracks, which respond to changes in temperature. Steel contracts in the cold, which could cause rails to pull apart. It expands in the heat, which can make the track buckle sideways (known as a “sun kink”). As climate change raises temperatures in areas of the country that are generally not extremely hot, railroads are applying the same infrastructure development strategies they’ve used for years to safeguard the tracks that are critical to America’s rail network. Taken together, these strategies have helped reduce track buckling-caused accidents on Class I mainline tracks by 52% between 2010 and 2021.

**Steel rail is responsive.**

The steel rail you see may seem fixed, but they are dynamic pieces of infrastructure that railroads build, knowing temperatures vary throughout the network and that they can change. Teams of civil engineers, researchers, suppliers, geologists, metallurgists and others assess the terrain of where the tracks will travel through and build them to respond to the temperatures of that area.

Most rail on busier portions of the railroad network are welded together to form one uninterrupted rail that may be several miles long. These welded rails provide a smoother ride for trains and longer rail life. The Federal Railroad Administration (FRA) requires railroads to adopt and comply with procedures for installing, adjusting and inspecting continuous welded rail.

During installation, establishing the correct rail temperature is essential to ensure the rail does not later expand and become misaligned on the next hot summer day. During cooler weather, rails are heated to what is known as the “rail neutral temperature” (RNT) and then allowed to cool to ambient temperature after installation. Railroads are required to keep detailed records of when the track was laid or replaced and the rail temperature and ambient temperature when the rail was laid. For example, the foreman or supervisor will re-check the track in the spring if it was installed or repaired in the winter.

Additionally, adhering to FRA rules, railroads will also use fasteners to hold the rail in place and ensure ballast (the stones along the track that provide good support and allow drainage) is firm. And when temperatures exceed a certain level, a railroad may put out a heat order, which requires trains to operate at a reduced speed over a given section of track to minimize stress to the rails.
Railroads are expanding infrastructure strategies nationally.

Given the ongoing threat of climate change, railroads expect to see more significant swings in temperature in areas of the country that typically would not experience them, not just in the desert. Railroads have nearly 200 years of experience developing, installing, maintaining and modernizing infrastructure and equipment. As part of freight rail’s safety culture, railroads have dealt with this aspect of railroading for decades. They are ready to expand the same strategies used in places like Arizona, Nevada and New Mexico to places like Minnesota or Seattle.

Technology will further protect rail from sun kinks.

MxV Rail — formerly Transportation Technology Center, Inc. — is the railroad industry’s world-class rail research and testing facility that works to improve the safety and efficiency of freight railroads throughout North America and the world. For years, they have researched RNT, creating processes and guidelines to manage the risk of sun kinks better. Funded through AAR’s Strategic Research Initiatives program, MxV Rail is now creating computer software that will more accurately assess the risks of sun kinks, allowing railroads to manage these risks more effectively.