Rail Gauge

Taken by John Maxwell in 1947. RD024-037

A standard gauge diesel locomotive sits on a track next to a narrow gauge steam locomotive.

Introduction

Rail gauge is an important measurement because this measurement tells you exactly how far apart the rails should be. If this measurement is off even by the slightest amount it can cause derailments.

Most American railroads have tracks that are classified as **standard gauge** because their rails are 4 feet and 8 ½ inches apart.

Not all American railroads are standard gauge. The Cumbres & Toltec Scenic Railroad is one exception. The Cumbres & Toltec Scenic Railroad's rails are only three-feet apart. This is called **narrow gauge** because it is narrower than standard gauge.

Standard Gauge

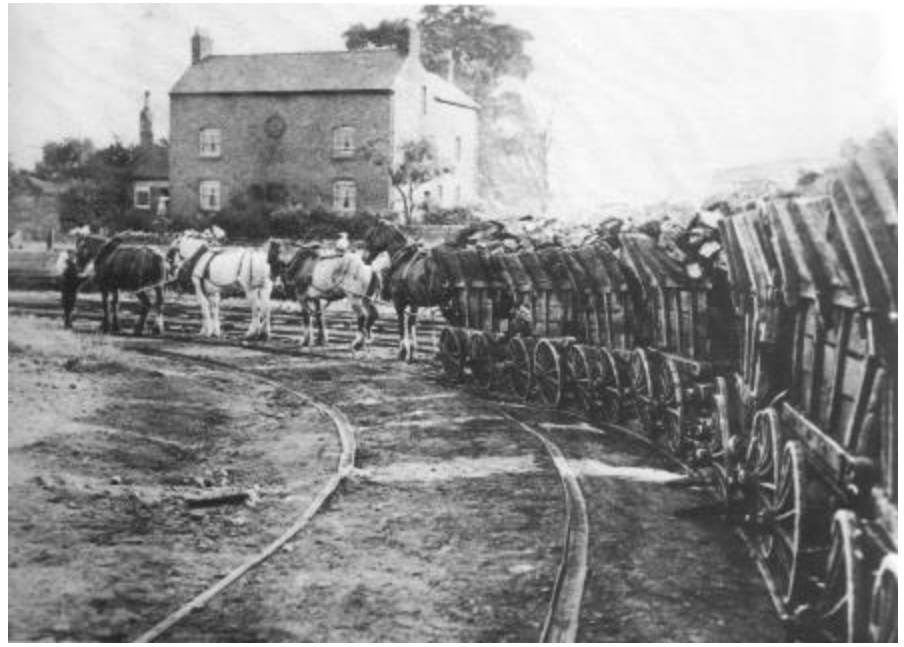
Standard Gauge is the gauge most widely used on railroads in the United States. The measurement between the rails is 4 feet 8 1/2 inches.

This number may sound a little weird, but there is a reason for it. It started a long time ago, in a land across the Atlantic Ocean.

When the Ancient Romans crossed the channel from Europe to Britain in the first century, their goal was to take over. They brought an army complete with chariots. As the chariots crossed Britain, they left ruts across the countryside, creating roads. After the Romans left, the English made use of these roads. They made the wheels the same distance apart as the Roman chariot wheels to keep the wheels and axles on their wagons from breaking.

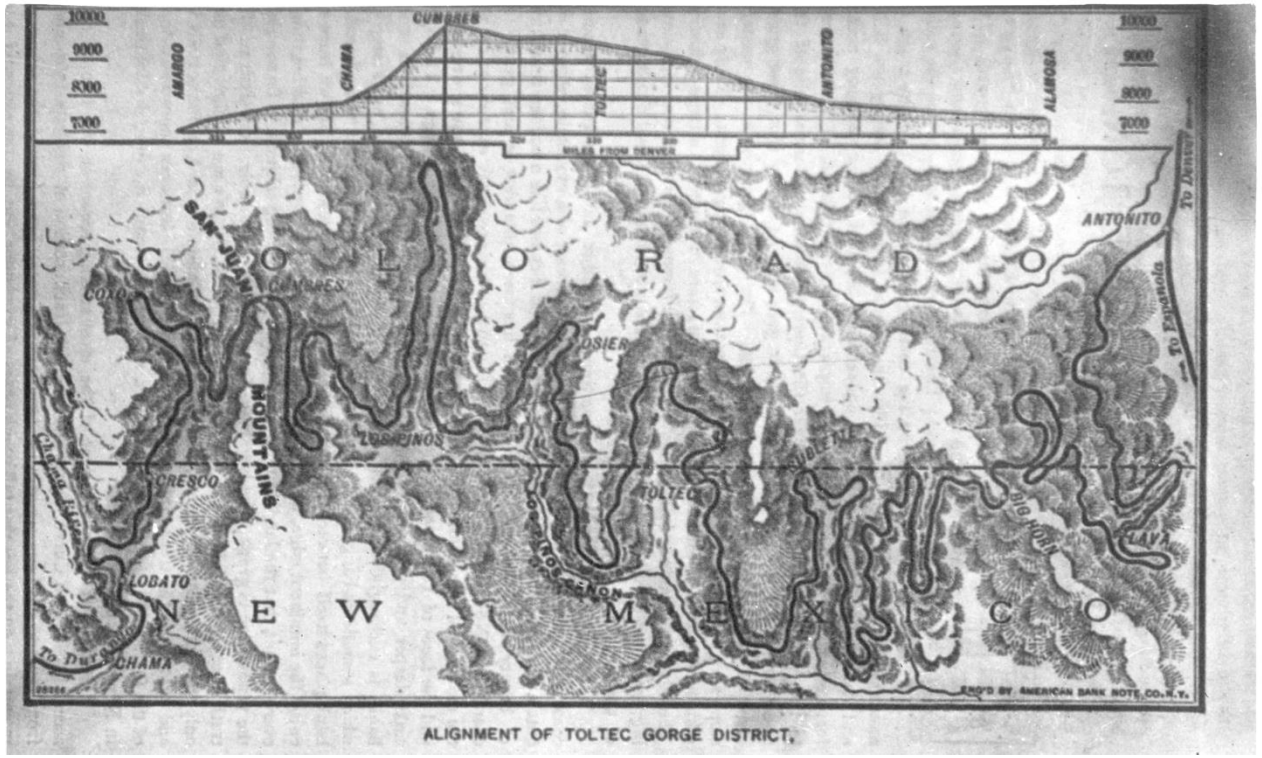
The English wagon builders began building wagon tramways or wagonways. They used the same tools as they had for building regular wagons. Wagonways were horse-drawn wagons strung together in a line and pulled along tracks by horses. The rails under the wheels allowed a few horses to pull multiple wagons along the tramway easily.

The same people who built the early wagonways were England's early railroad builders. Many of the parts used in early American railroads came from England. These included locomotives, tools, and even laborers. Because much of our equipment came from England, many of our railroads are built in the same standard gauge as England's.



Top: *Apollo Driving the Chariot of the Sun* is an example of what a Roman Chariot looked like.
Bottom: An English wagonway with horses pulling a "train" of wagons along rails.

Narrow Gauge & the Mountains



ALIGNMENT OF TOLTEC GORGE DISTRICT.

Some railroads are built as narrow gauge, meaning the distance between the rails is narrower than the standard gauge. The Denver & Rio Grande Railroad (D&RG) narrow gauge was 3 feet wide. The Cumbres & Toltec Scenic Railroad was originally one small part of the San Juan Extension of the D&RG and later the Denver & Rio Grande Western (D&RGW). This line was built in the late 1800s. The San Juan Extension was established to carry **freight** to and from mines and logging operations in the San Juan Mountains of southwestern Colorado and northwestern New Mexico. Due to the rugged mountainous terrain, the railroad's leaders believed they could save money by building and operating the railroad with narrow gauge tracks. A narrow gauge track would allow them to have a narrower roadbed and lighter rails. This would allow the construction crews to wind the tracks along canyon walls and use loops to climb steep ridges and go over mountain passes.

Building a standard gauge route with a wider roadbed and heavier rails would have made it impossible to make these tight curves.

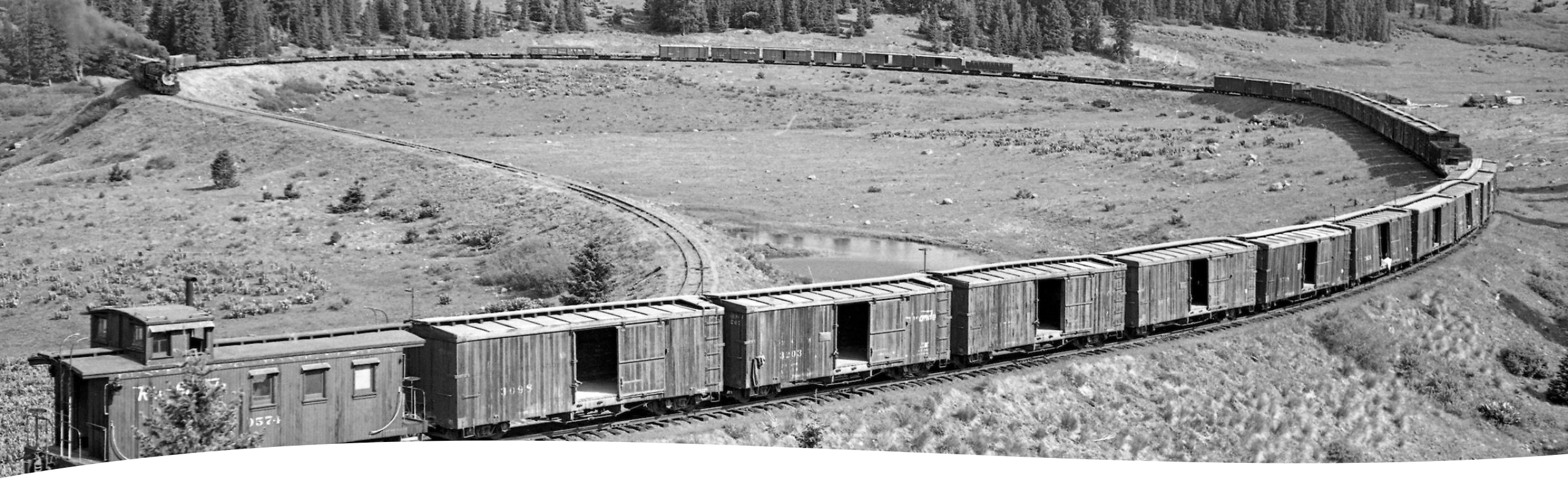
A map showing the tight turns and elevation changes along the Cumbres & Toltec Scenic Railroad.

Narrow Gauge, Smaller Equipment & Time

The D&RG believed that a narrow gauge railroad would allow them to save money on equipment. Locomotives and cars would be smaller and less expensive to buy.

The railroad was also in a hurry to beat competitors and get their railroad built. A narrow gauge railroad would allow them to complete the line more quickly than their competitors. They were correct in this assessment because the narrow gauge roadbeds could be built faster and required less digging and tunneling.

Top: A standard gauge locomotive on the left and a narrow gauge locomotive on the right.
Bottom: A standard gauge passenger car sits in front of a narrow gauge passenger car on the three-rail track in Alamosa, Colorado.



Experience the Narrow Gauge Onboard the Cumbres & Toltec Scenic Railroad

When riding a train on today's Cumbres & Toltec Scenic Railroad, you will see how the track twists and turns in places such as Toltec Gorge, and how the D&RG's builders looped the rails at Tanglefoot Curve just west of Cumbres Pass and at Whiplash, which is the site of the former Big Horn Section House. The loops helped the railroad gain elevation by adding more track length in areas with slopes too steep for trains to climb straight up.

A 55-car-long freight train loops around Tanglefoot Curve, east of Cumbres Pass, to help the train gain elevation without making the track too steep.

Challenges on the San Juan

One author described the geographical challenges posed by building the San Juan Extension. According to Robert Athearn's *The Denver & Rio Grande Western Railroad*, the extension

> "was constructed in the face of the most complicated problems that ever confronted American engineers. With the flat distances of the high parks left behind, heavy rock-work was encountered in the jagged mountains that guarded the San Juan. From Cumbres Pass to Chama the grade was 4 percent, the curvature bad, and construction generally of the most expensive nature. At one point, to cover the distance of only half a mile, it was necessary to build two and a half miles of track, trestle, and embankment, one mile of which alone cost $140,000. Nor was this the exception, for to cover the larger distance of thirty-five miles, some sixty-four miles of track had to be laid."

A livestock train with four locomotives, winds around Windy Point on the climb to the highest point on what is now the Cumbres & Toltec Scenic Railroad.

Is narrow gauge worth it?

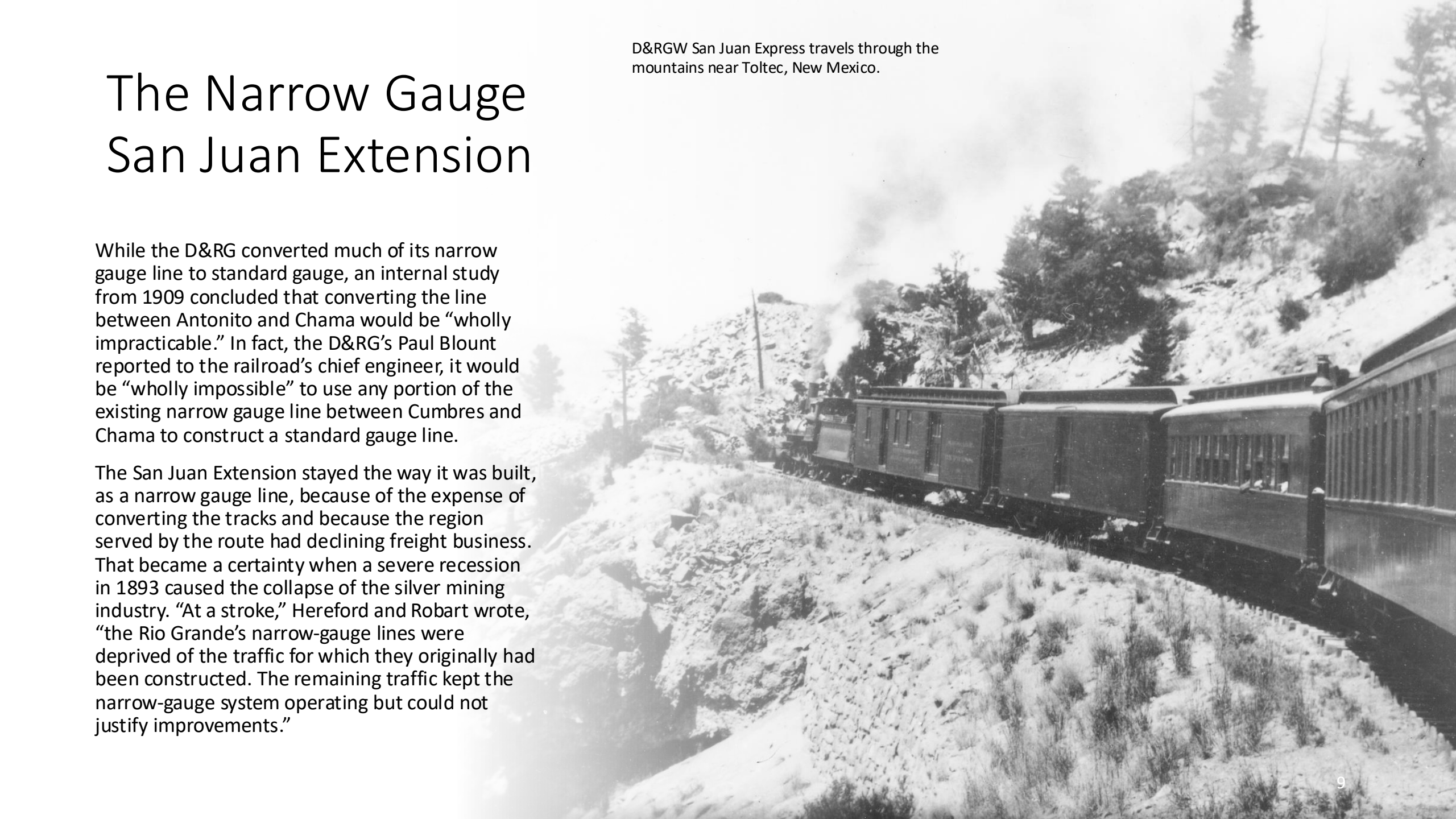
For many railroads, narrow gauge proved to be shortsighted. The D&RG and other railroads found that choosing narrow gauge for their routes slowed their freight operations while adding extra costs to handling freight. This was because a lot of freight carried by railroads needed to come from or go to places served by different railroads. One standard gauge line could easily hand off a loaded freight car to another standard gauge line to deliver it to its destination. The freight arriving at a narrow gauge line from a standard gauge line, or vice-versa, had to be transferred from one railroad's cars to the different-sized cars of the other railroad. The need to transfer freight in this manner added expenses and prompted the D&RG and many other railroads to convert their narrow gauge lines to standard gauge.

Workers move lumber from narrow gauge to standard gauge cars in Alamosa, Colorado.

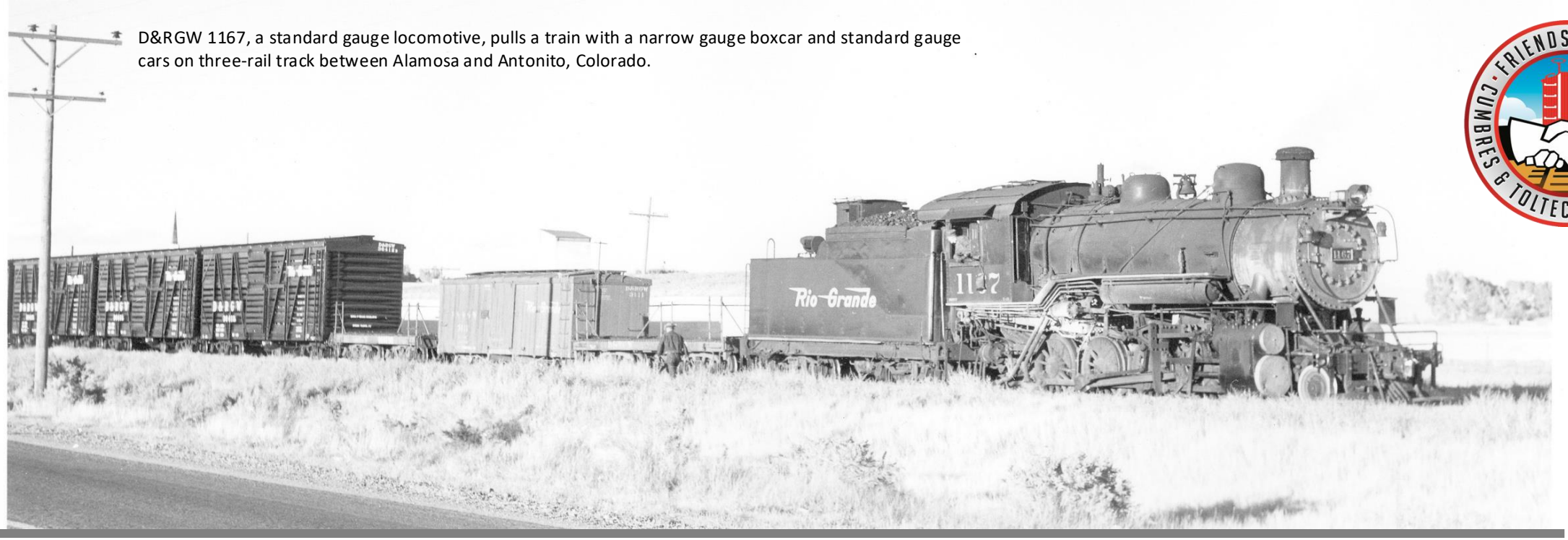
The Narrow Gauge San Juan Extension

While the D&RG converted much of its narrow gauge line to standard gauge, an internal study from 1909 concluded that converting the line between Antonito and Chama would be “wholly impracticable.” In fact, the D&RG’s Paul Blount reported to the railroad’s chief engineer, it would be “wholly impossible” to use any portion of the existing narrow gauge line between Cumbres and Chama to construct a standard gauge line.

The San Juan Extension stayed the way it was built, as a narrow gauge line, because of the expense of converting the tracks and because the region served by the route had declining freight business. That became a certainty when a severe recession in 1893 caused the collapse of the silver mining industry. “At a stroke,” Hereford and Robart wrote, “the Rio Grande’s narrow-gauge lines were deprived of the traffic for which they originally had been constructed. The remaining traffic kept the narrow-gauge system operating but could not justify improvements.”



D&RGW San Juan Express travels through the mountains near Toltec, New Mexico.



D&RGW 1167, a standard gauge locomotive, pulls a train with a narrow gauge boxcar and standard gauge cars on three-rail track between Alamosa and Antonito, Colorado.

Three-Rail Track

For a time, the D&RG operated some segments of its system as both narrow and standard gauge tracks by adding a third rail. One of those locations included Alamosa, Colorado, to Antonito, Colorado. Alamosa was the base for the D&RGW's narrow gauge operation before abandonment and where it connected with the railroad's standard gauge track.

The **three-rail track**, also known as a **dual gauge**, provided a way for both standard gauge and narrow gauge trains to travel the same route without building an entirely new set of rails. Trains on these sections of track could be standard gauge, narrow gauge, or a combination of the two.

When trains were made up of both narrow gauge and standard gauge cars, they used idler flat cars between standard gauge and narrow gauge cars to connect them. The standard gauge cars were much taller than narrow gauge cars. The idler flat cars had special couplers that allowed them to connect to either type of railroad car.

To learn more about Dual Gauge Track watch this short video about the construction of the Three-Rail Track exhibit in Antonito, Colorado: https://youtu.be/1EmU9HUlDIs?si=GRkVeOkbpyhbD3Jn

A Cumbres & Toltec Scenic Railroad photo charter at Phantom Curve.

The Cumbres & Toltec Scenic Railroad

And now, the Cumbres & Toltec Scenic Railroad is a popular tourist line and living history museum owned and operated by the states of Colorado and New Mexico. Its continued operation keeps steam-powered locomotives more than 100 years old chugging across a particularly scenic part of the Rocky Mountains. The railroad was designated a National Historic Landmark in 2012. At the same time, the railroad's existence and the jobs it provides help support the economies of rural areas of the two states. It is worth noting that the limited number of narrow gauge railroads still operating in the United States include another former segment of the D&RG's San Juan Extension, the Durango & Silverton Narrow Gauge Railroad. Other prominent narrow gauge railroads still operating in the United States include Alaska's White Pass & Yukon Route, and the recently rejuvenated East Broad Top in Pennsylvania.

Additional Materials

Rail Gauge Printable Booklet with Activities

Glossary

Dual Gauge: See three-rail track.

Freight: Goods transported in bulk

Narrow Gauge: Railroad track where the distance between the rails is narrower than standard gauge

Rail Gauge: The measurement between rails on a railroad

Standard Gauge: In America, the standard distance between railroad rails is 4 feet 8 ½ inches

Three-Rail Track: Three-rail track has three rails and can be used with both standard and narrow gauge trains

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