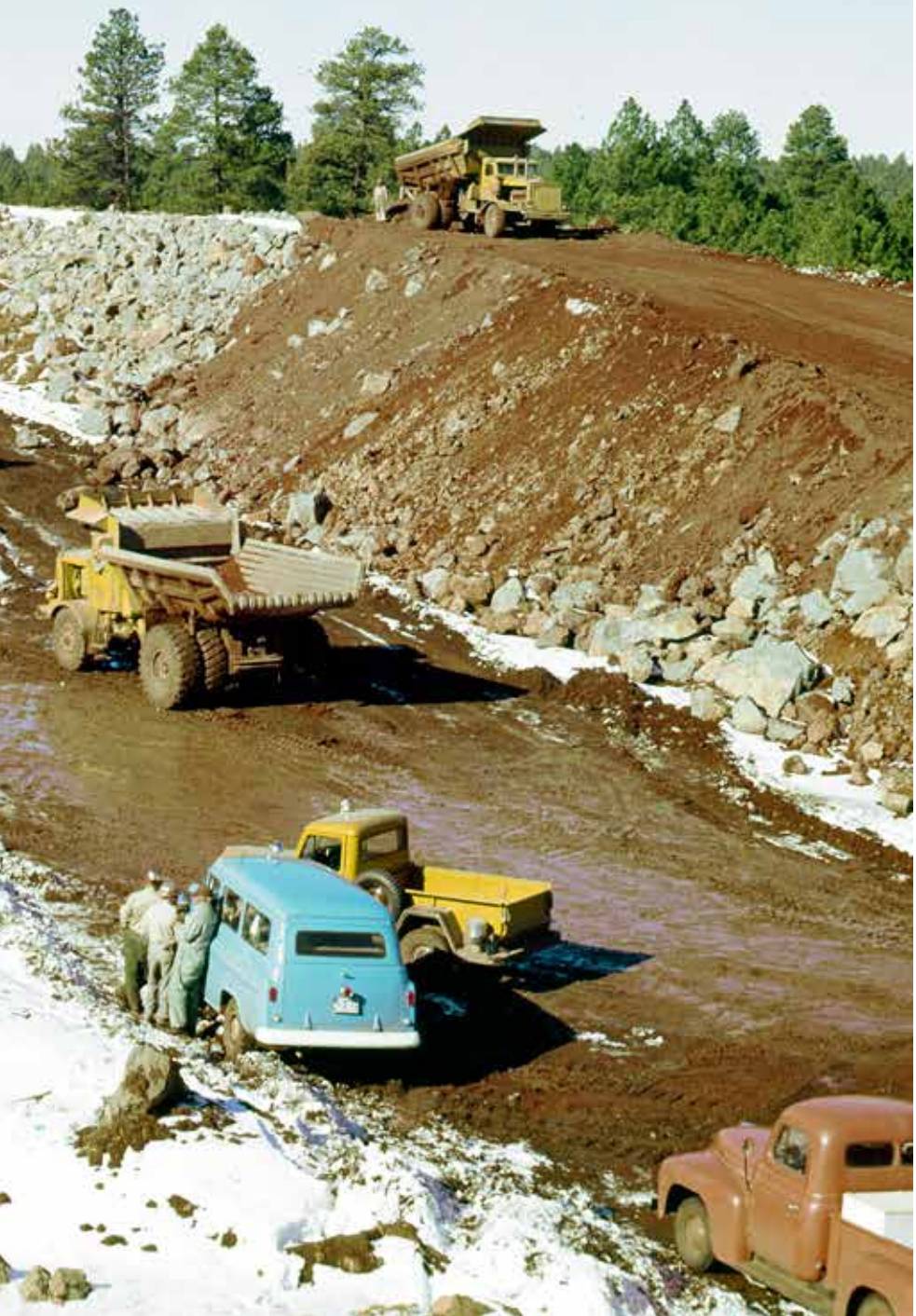
Santa Fe's

1 PERCENT DECISION

Opened in 1960, a 44-mile line relocation across northern Arizona reduced gradients, cut curvature, and saved time

By Donald Sims



Editor's note: Don Sims wrote this story for Trains magazine in 1961 but it was never published. In editing it for this issue of Classic Trains, we have retained the original text's present tense.

Say you're in a responsible position with a railroad. How do you justify the expenditure of 20 million of your company's hard-earned dollars? It may seem strictly academic to most people, but somewhere along the line, someone or a collection of someones has to make the decision. And it may come hard.

New and more powerful diesel locomotives? Perhaps; they're logical and they earn back the investment in a relatively short time. Specialty freight cars such as mechanical reefers, or perhaps some roller-bearing piggyback flats? Shippers smile at this form of capital expenditure on the part of a carrier, and the results look cheery in publicity releases.

But then you might be a railroad like the Santa Fe, possessing the longest single U.S. transcontinental run, a 2,200-mile-plus main line that already cards streamliners in 39¾ hours and makes third-morning delivery possible on the fastest freights.

In that case, you bet your money on some 44 miles of surveys and proposals having to do with Arizona real estate.

At left, an eastward freight on the old line passes men and equipment constructing the new right of way at what would become Williams Junction. Above, deep cuts on the new line helped keep the grade at 1 percent.
Left, Kansas State Historical Society; above, Donald Sims

Four F7s ease a California-bound train of reefers downgrade on the original 1883 line between Supai and Welch in a 1950s publicity photo.
Santa Fe

The finished product, Santa Fe's line relocation between Crookton and Williams Junction, might be colloquially described as just plain *Wow!* It is super railroading in all the sense that recent technology can supply, and if anyone thinks the long stretches of gently curved track and the lack of dramatic scenery imply it was an easy job, he's dead wrong. The Arizona high country with its lava underpinnings is not easily dealt with.

You don't cast a few million dollars about without ample reason, and for a railroad to spend that kind of money, there must be something of a bottleneck there, and this is precisely the story.

ARIZONA BOTTLENECK

The Santa Fe's Albuquerque Division is a long-haul operation, stretching from the Colorado River at Needles, Calif., across approximately 580 miles of high-density railroad to Albuquerque and Belen, N.Mex. On the east end, passenger trains course onward via Albuquerque and Raton Pass, while the low-grade freight route passes through Belen and on east via Amarillo, Texas.

To understand the importance of the Albuquerque Division, consider that across it moves tonnage that generates 49.3 percent of Santa Fe's gross freight revenue.

The diesel long ago dispensed with the 149-mile eastbound helper district from Needles to Seligman, Ariz. East of Seligman, though, was a few dozen miles of undulating country that represented the most restrictive territory for freight from Barstow clear through to Chicago. Starting from Seligman, the area was one of tough terrain, through which ran a double-track line that was frequently separated because in effect it was two different railroads, constructed at different times.

East of Williams, the rails of the Third District are reasonably fast, flowing through rolling land that becomes more stable as it ends at Winslow. Beyond division headquarters at Winslow is one of the fastest bits of iron around, the Second District, which cards three eastbound streamliners at an average of 72.7 mph for its 127-mile length, along

A 1944 photo shows an eastbound freight on the horseshoe curve west of Welch. FT diesel 126 is on the point, while across the horseshoe, a steam helper pushes behind the caboose.
Charles W. Lindenberg

In another 1950s company photo illustrative of the conditions on the old alignments, F7s roll reefers through the horseshoe curve east of Gleed. Santa Fe

with a westward fleet led by the *San Francisco Chief*'s 74.8-mph average. Into this generally high-speed artery was thrown 50 miles of line that necessitated helper engines and slow running for all classes of trains.

During a period when railroads handled 70 to 80 percent of intercity freight, the imposition of slow track was not the handicap it is now, when third morning Chicago–Pacific Coast freights are a daily habit for several carriers. Not counting the many other factors involved, the saving of over one hour of running time per freight train by eliminating the bottleneck was a tempting consideration to be put before the operating department.

The time savings could be achieved by getting trains off the slow-speed track. Westbounds were bogged down on 19 miles of curves, many as sharp as 10 degrees, mandating 15–20 mph maximum speed for freight, 20–30 mph for first-class runs. In addition, a narrow tunnel, built with the original line in 1883, caused westbound oversized loads to be moved against traffic on the eastward main, which opened in 1911.

Nor was the eastward iron any picnic, since it contained a 1.8 percent ruling grade from Ash Fork to Supai, necessitating helpers on most freights.

The westward track was curvaceous to the tune of 4,614 degrees, while the eastward track contained 3,490 degrees of circular motion.

In lieu of what existed, a proposal detailed what a maximum 1 percent grade, a similar figure of curvature, and modern signaling techniques could accomplish. Succumbing to logic, Santa Fe amputated the gnarled and crooked limb and replaced it with a vastly superior appendage.

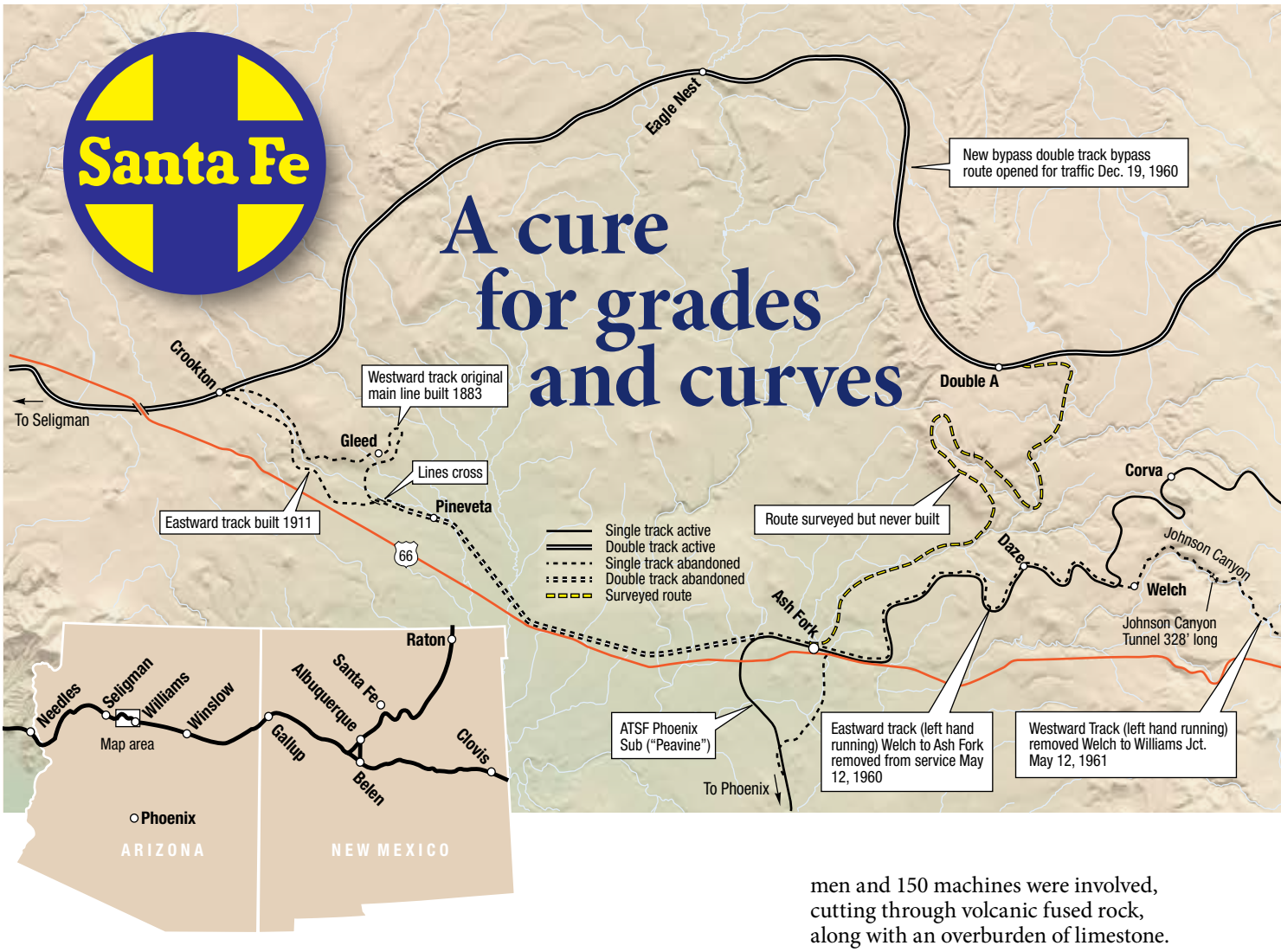
DISPATCHING WITH TCS

A condensed yet illuminating tale of modern railroading can be had in a few moments at division headquarters in Winslow, site of the dispatching office, a newly renovated room in which the smell of fresh paint is still evident. In a small cubicle is a common railroad sight these days — a man and a machine. Unlike the green color of earlier control machines, the form in the center of this room is predominantly black, with an etched-silver track diagram accented by small indicator lights.

A flashing lunar white indicates that a route is being established, and within a few minutes amber track-occupancy lights shift from the upper of two parallel track lines onto the lower, advance past a similar set of lights on the upper track, and then blink back up to their original course.

Behind the little lights was this reality: 2,800 tons of symbol freight took a crossover, passed a slower train of 5,500 tons moving in the same direction, and returned via a second crossover to its original track a few miles later.

They call this TCS, for Traffic Control



System, and it represents a miniaturized advancement of the Centralized Traffic Control theory. Where a CTC board capable of handling several hundred miles of railroad might be spread into three or four panels about the dispatcher, TCS can do the same job in a single panel. And if you're thinking the Winslow machine doesn't really accomplish much because it controls only 44 miles, then you must look to the blank space around it. Projected for future work, the small panel to the right of the current diagram will carry the balance of Third District track, while above it is space for the entire Kingman District. In short, this single panel will someday control 291 miles of double-track railroad.

Unlike older machines for push-button dispatching, TCS is built about a central console, thus eliminating separate levers for each switch and signal on the track diagram. And particularly unlike most installations is Santa Fe's method of linking machine and field units — microwave does the trick so there are no wires between Winslow and the line feed at Seligman. A pick-up station at this latter point feeds impulses to line points via a normal wire circuit.

In practice, TCS extends a few miles on either side of the line change, covering from the west end of Seligman, to Maine, 12 miles east of Williams Junction.

Skipping from a schematic model board to the real thing is certainly a revelation. The multi-colored lamps and straight-ruled track diagram give a compressed glimpse of operations, but nothing of topography.

WHAT $20 MILLION BUYS

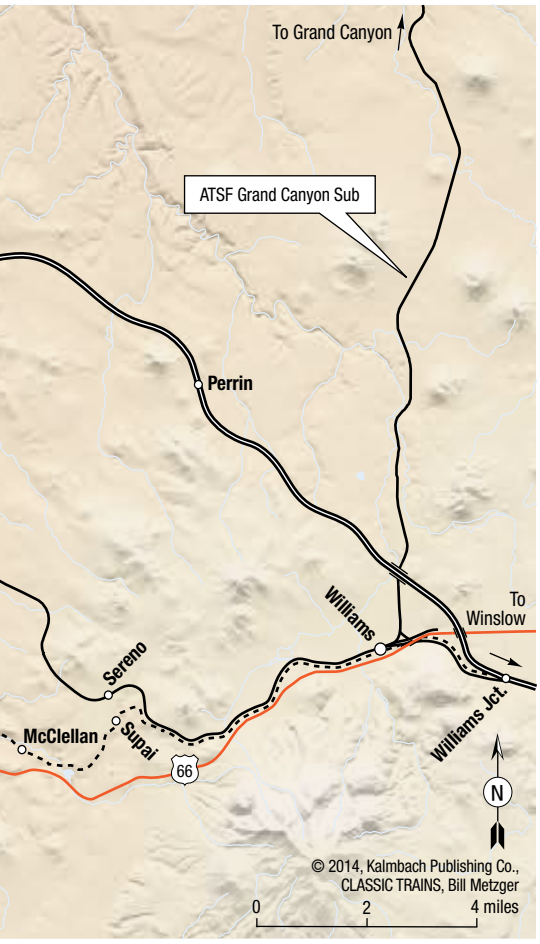
If you're impressed by statistics, then contemplate this: Beginning in May 1959, construction contractor Morrison-Knudsen moved something like 11 million cubic yards of material, involving a weight of 8½ million tons of rock and 10½ million tons of sandstone and limestone. During construction, almost 600 men and 150 machines were involved, cutting through volcanic fused rock, along with an overburden of limestone.

At one point, in order to maintain a maximum of 1 percent gradient, crews excavated a 2-mile cut with a maximum depth of 115 feet. Material removed from cuts was used to create numerous 30- and 40-foot-high fills.

With the work of grading completed, Santa Fe track gangs composed of Navajo Indians moved in. These were no maul-swinging gandy dancers, but crews familiar with the work of machinery that performs quicker and more uniformly, if less dramatically, than traditional track-laying techniques. And the 136-lb. rail had but little resemblance other than shape to the steel laid in 1883 and 1911. Santa Fe's line relocation is laid in 1,440-foot sections of welded rail, fabricated in Winslow and moved to the job site via strings of flatcars.

Effective with the Albuquerque Division timetable dated December 19, 1960, the 44 miles of new railroad was open for business.

For Santa Fe passengers, the most apparent element of the line change is a



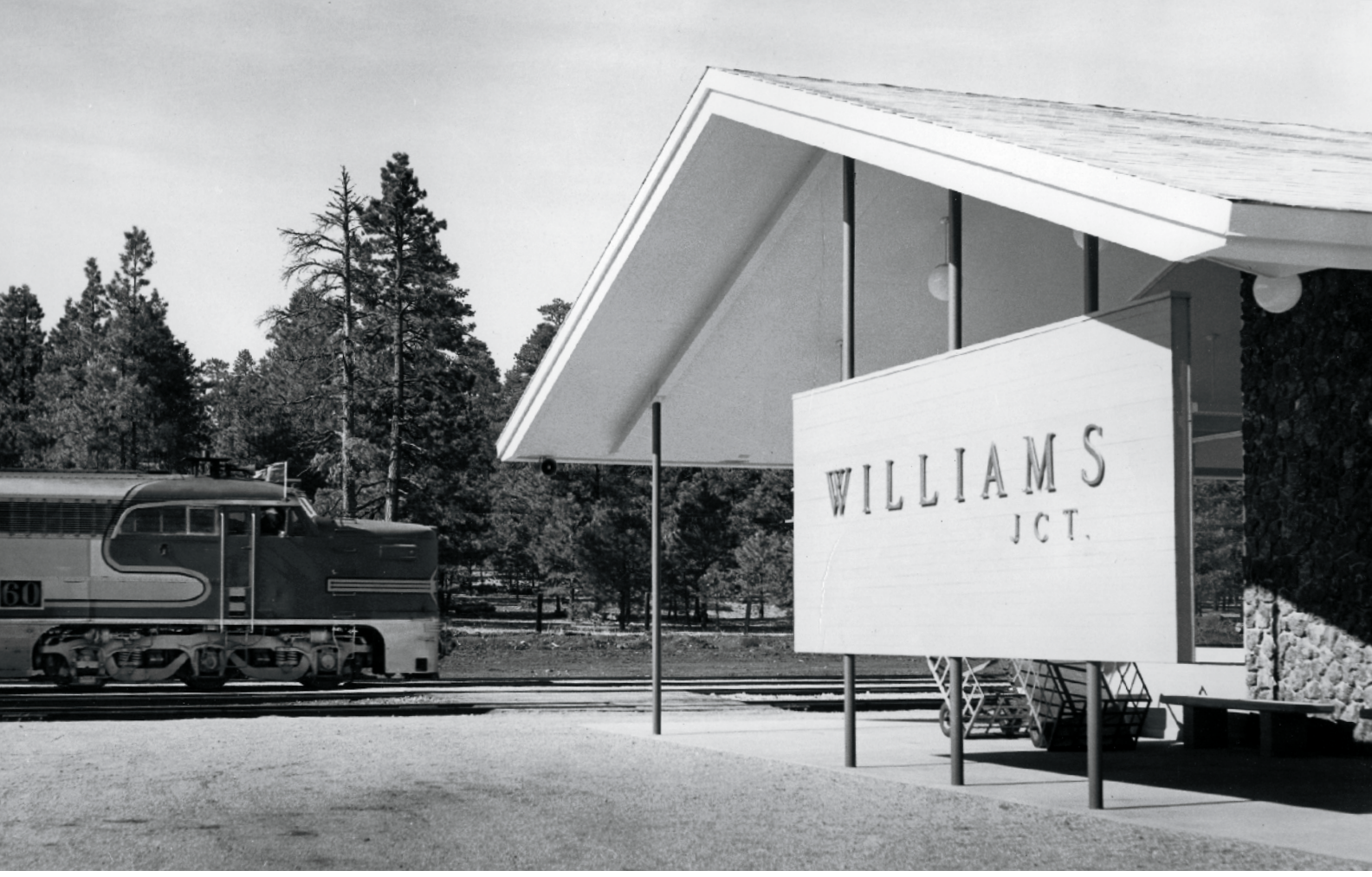
smartly designed structure of glass and stone at the eastern juncture of old and new alignments. The new line meant that transcontinental trains would bypass Williams, so the railroad put up new facilities 3½ miles to the east, located incongruously in the midst of a stand of pine trees. Williams Junction is one of the more unusual of modern rail stations by virtue of its backwoods locale.

By day Williams Junction is quiet, its pulse geared to the passage of Nos. 7 and 8, Santa Fe's 20-plus-car mail trains, and No. 19, the Chicago–Los Angeles *Chief*. At night the woods come alive, with 11 first-class trains between dusk and dawn. This includes the road's entourage of streamliners, plus a pair of Phoenix connections (which use the old line between Williams Junction and Ash Fork) and the local Grand Canyon connection in summer months.

Passengers laying over at the Williams Junction station can listen in on a transcontinental railroad hard at work. All trains in the area are equipped with two-way radio, a communication system whose vocal strains are sometimes discernible from the operator's open bay. A

Led by class unit No. 900, four new SD24s swing a westbound train off a fill, past the crossovers at Perrin, and into a deep cut. It's 1961, and the line relocation is less than a year old.

Two photos, Donald Sims



The Mid-Century Modern-style depot at Williams Junction, east end of the relocation, welcomes westbound mail train 7, led by Alco PA No. 60.

static-punctuated "highball" ringing in as an eastbound freight clears Seligman yard limits, or the questioning conversation between engine and caboose about a suspected hot box, are frequently infused into a normal pattern of domestic conversation.

East of Williams Junction, TCS extends to Maine, beyond which automatic block signals preside. Just west of the station, the line relocation swings to the right, dropping downhill slightly through a rock cut, while the original line heads toward Ash Fork and Phoenix.

The two tracks of the old line between Ash Fork and Crookton are slated for complete removal, while Ash Fork–Williams Junction will see one track retained for Phoenix trains. The track to be removed is the original 1883 survey through Johnson Canyon, the one with the narrow tunnel.

One's first impression of the line relocation, particularly at the east end, is one of skepticism. If the object were to circumnavigate mountainous railroading, then it appears that Santa Fe's efforts missed the mark. Deeper inspection reveals the full picture.

The line may seem unduly burdened with curves, given the capabilities of modern engineering. Then one discovers that arcs never exceed 1-degree maximum curvature. Almost 3,200 degrees of curvature — nearly nine full circles — were eliminated in building the new line.

A train, be it first class or extra freight, really doesn't operate across the new roadbed in the usual sense of perception. It seemingly flows, something like a liquid in a tube. Welded rail is responsible for part of this feeling, while the capability of slide rule and earth mover adds the final touch. Banked curves are indiscernible from short stretches of tangency, and only a freight train with its attendant problems of slack control will move a little jerkily.

Speed boards denote a steady overall maximum of 60 mph for freight, 90 for passenger, though right now first-class trains are held to 80. It will probably be a few months before the full 90 is permitted, since it's expected the virgin roadbed will settle slightly, then have a final layer of ballast added for programmed maximum speed.

Bidirectional signaling creates a two-way street out of each track, but for practical reasons and perhaps from past habit, left-hand running is the common mode of operation east of Seligman. In part, topography of the old line created this pattern — the 1911-built track, with its easier gradients for eastbounds, lies to the north of the original track — since grade conditions caused left-hand operations there and the theme was carried on beyond it.

VIEW FROM THE CAB

At about 10 a.m. on a Saturday morning, eastbound symbol freight BTX brakes to a halt at Seligman, its four big road-switchers coming to idle position after a 149-mile uphill trip from Needles, Calif. BTX is a Bakersfield–Texas regular, today hauling 3,544 tons of freight train across several states. Electro-Motive SD24s (Santa Fe's 900 class) and Alco RSD15s (800 class) in groups of four or five are taking over such runs from EMD F7s in five- or six-unit sets. The new units are programmed for Barstow–Kansas City service on symbol freights.

Seligman as a crew-change point

fades into a routine along with similar towns like Needles, Winslow, Gallup, Belen, and Clovis across Santa Fe's long trail. But 9 miles east of Seligman, the railroad is not routine, not at least until the sense of newness wears away from the welded rail that starts at Crookton.

BTX is under way just as soon as one crew can be substituted for another, and a radio can inform the engineer that a full complement is aboard. At milepost 419.5, a station sign reads CROOKTON and the noiseless quality of welded rail is first known. Off to the right lie two rusting tracks, the old main line waiting to be salvaged.

Even with four 2,400 h.p. units, BTX doesn't exactly rush up the steady 1 percent grade that dominates most of the line change. But it will cover the distance in a lot less time than on the old line, and it won't require a helper locomotive.

Between Crookton and Williams Junction, there are three sets of crossovers, at Eagle Nest, Doublea, and Perrin. Each of these has a short setout track, but otherwise the new line is devoid of sidings. They're not needed, since each main track serves as both high iron and runaround as circumstances dictate.

Curiously enough, when Santa Fe first ran proposals on its line relocation, it dusted off the original circa 1880 surveys. Early locating engineer Lewis Kingman had considered several paths west of Williams, but was swayed by a southerly route because of important mining activity and a desire to run the line down Johnson Canyon, where water for steam locomotives might be easier to obtain.

Additionally, the route Kingman selected avoided much of the tough volcanic malpais and lava that modern blasting methods can cope with, but which were insurmountable during the late 19th century.

A patchwork of colored rock, much of it red in hue, as is normal in northern Arizona, enlivens the walls of the new line's many cuts.

An SD24 quartet rides over a rock fill typical of those found throughout the new alignment.

East of Eagle Nest lies a 12-mile stretch of relatively open country, although even here several cuts are required to keep the grade from exceeding 1 percent. By Perrin, 10 miles farther east, the two tracks have immersed themselves in a veritable continuum of cuts, many of the them more than a half-mile in length, with their walls topping out at 50 feet or more.

From Perrin, it's 10 miles of steady 1 percent up to Williams Junction. At one point, the line passes under a natural gas pipeline that bridges over a cut and returns to a subterranean pathway.

Near Williams Junction, a long, high fill takes the new line over Santa Fe's single-track Grand Canyon District then, a mile later, U.S. Route 66. Off the fill the tracks plunge into a lightly wooded area, finally emerging at Williams Junction via a long, shallow cut.

The brief flirtation with habitation near Williams is out of step with much of the new line. For the most part it has been laid through sparsely settled country, with only a few ranch homes and dirt roads for company. Apart from the welded rail and searchlight signals, this must have been how Santa Fe looked many years ago — a time when trains were run with telegraph and flimsies, a time when oily engine smoke drifted over the land of the Navajo and Apache.

Perhaps someday the future will look back on the present with similar thoughts in mind, viewing what has just transpired as a period of antiquity. In the meantime 44 miles of super railroad looks darn good. And the $20 million that was spent is being earned back at a rate of $1 million per year, just in case any stockholders are listening. ■

State-of-the-art railroading, circa 1961: Modern tri-level auto-racks sail along a fill and over a local road on the new line north of Williams.

Three photos, Donald Sims