



*No. 103, fresh from the assembly line and paint shop at Electro-Motive's La Grange plant in 1939.*

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# FIRST ROAD FREIGHT DIESEL

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A National Historic Mechanical  
Engineering Landmark

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National Museum of Transport  
St. Louis, Missouri

# NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK

## Freight-Service Diesel-Electric Locomotive 1939

This lead unit of the four-unit EMD-103 demonstrator locomotive became the prototype of the first mass-produced diesel-electric locomotives used for freight service in the United States. They rapidly replaced the steam locomotive.

The design was led by Richard M. Dilworth, chief engineer of the Electro-Motive Division of the General Motors Corporation.

It was in regular service as Southern Railway Locomotive Unit No. 6100 from 1941 to 1960.

## THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS - 1982

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### “THE DIESEL THAT DID IT!”

When David P. Morgan, editor of **Trains**, recounted the story of Electro-Motive No. 103 whose lead unit became Southern's No. 6100, he entitled the article in the magazine's February, 1960, issue "The Diesel That Did It." That seems a particularly apt heading for the chronicle of a piece of machinery that brought on a quiet revolution not only in railroad motive power but in virtually every aspect of the railroad business.

Who would have thought that the snub-nosed, dark green machine that rolled out of General Motors' La Grange, Ill., plant in November, 1939, would spark a new era in American freight railroading?

Even the builder considered it largely an experiment. But Electro-Motive No. 103 -- a 193-foot-long, 900,000-pound, 5,400-horsepower diesel-electric road freight locomotive -- was about to usher in a new way of life for freight hauling railroads in America.

In an effort to prove what then was just a theory, No. 103 set out

on an 83, 764-mile working journey from coast to coast over a number of railroads. From Oakland and Seattle, through Moffat Tunnel near Colorado's Great Divide to Southern Railway's famous "Rathole Division" in central Kentucky and East Tennessee, No. 103 met and overmatched the best performance steam could offer.

Eleven months later, the verdict was in. Steam locomotives, that had dominated America's rails for a Century, would have to take a back road in the future. No. 103, faster and more efficient than any steam

locomotive in existence, became the prototype for a line of diesel-electric units whose efficiency and dependability changed the shape of American railroads for good.

The FT series that No. 103 spawned has, of course, been replaced by other and more modern diesel locomotives over the years. Yet the old fleet had a long and useful life, some of them later being converted to GP-9's through EMD's upgrading program. The lead unit of No. 103 had a long and successful career as Southern Railway No. 6100 (with



*Richard M. Dilworth, leader of the design team for No. 103, the diesel road freight locomotive that changed railroading.*

the other three units renumbered 6150, 6151 and 6104). Purchased by Southern in May, 1941, the locomotive went into regular service running out of Chattanooga.

After almost 20 years of service on Southern's Cincinnati, New Orleans and Texas Pacific line between Cincinnati and Chattanooga, Unit 6100 was retired from service on March 8, 1960, at Spencer, N. C. Little more than a year later -- on June 27, 1961 -- the historic unit took up residence at the National Museum of Transport at St. Louis. There it remains, surrounded by a number of the steam locomotives it helped put out of business.

### ONE MAN'S DREAM -- AND A COMPANY'S GAMBLE

Number 103 and the FT series was the brainchild of Richard M. Dilworth, Electro-Motive's chief engineer. A former Navy electrician, Dilworth got his start with GE and joined Electro-Motive in 1926 to set up its first engineering department.

Dilworth's name is linked with the early passenger diesel locomotives, and he is credited with many of the innovations that freed diesel locomotives from

steam-era design. Turning to freight locomotives, he tapped the 567-series diesel engine, a 16-cylinder model that first came off the La Grange line in 1938.

Dilworth's new freight locomotive design carried two four-wheel trucks, with all axles powered. This differed significantly from -- and provided more horsepower than -- the A1A - A1A (two 6-wheel trucks, each with 2 powered axles and a center idle axle) configuration used with passenger trucks. By Dilworth's reckoning, a cab and booster semi-permanently coupled with a drawbar could produce 2700 horsepower, equalling the power of a 2-8-2 or even 2-10-2 steam

locomotive then typically used for freight runs.

Two prototype cab and booster units were built at La Grange. They were relatively short and snub-nosed, unlike Electro-Motive's E6 passenger units, and were geared for maximum 75-mph speed.

### THE DAWNING OF A NEW ERA

From November, 1939, to October, 1940, No. 103 (with individual units named A, B, C and D) ran freight hauls in 35 states, over the lines of 20 Class I Railroads. One after another of the roads challenged No. 103 with steep grades, tight curves, lengthy

*At the presentation ceremony in 1961, W. H. Moore (third from right), then Southern's general manager, Western Lines, formally transferred title to Unit No. 6100 to the National Museum of Transport through its chairman, A. K. Atkinson.*



tunnels, extremes of temperature and just plain long hours. They pitted the 103 against the most impressive steam power of the day.

The results always were the same, as the new diesel-electric proved its superiority time and again. Steam freight schedules were consistently beaten for comparable tonnage hauls.

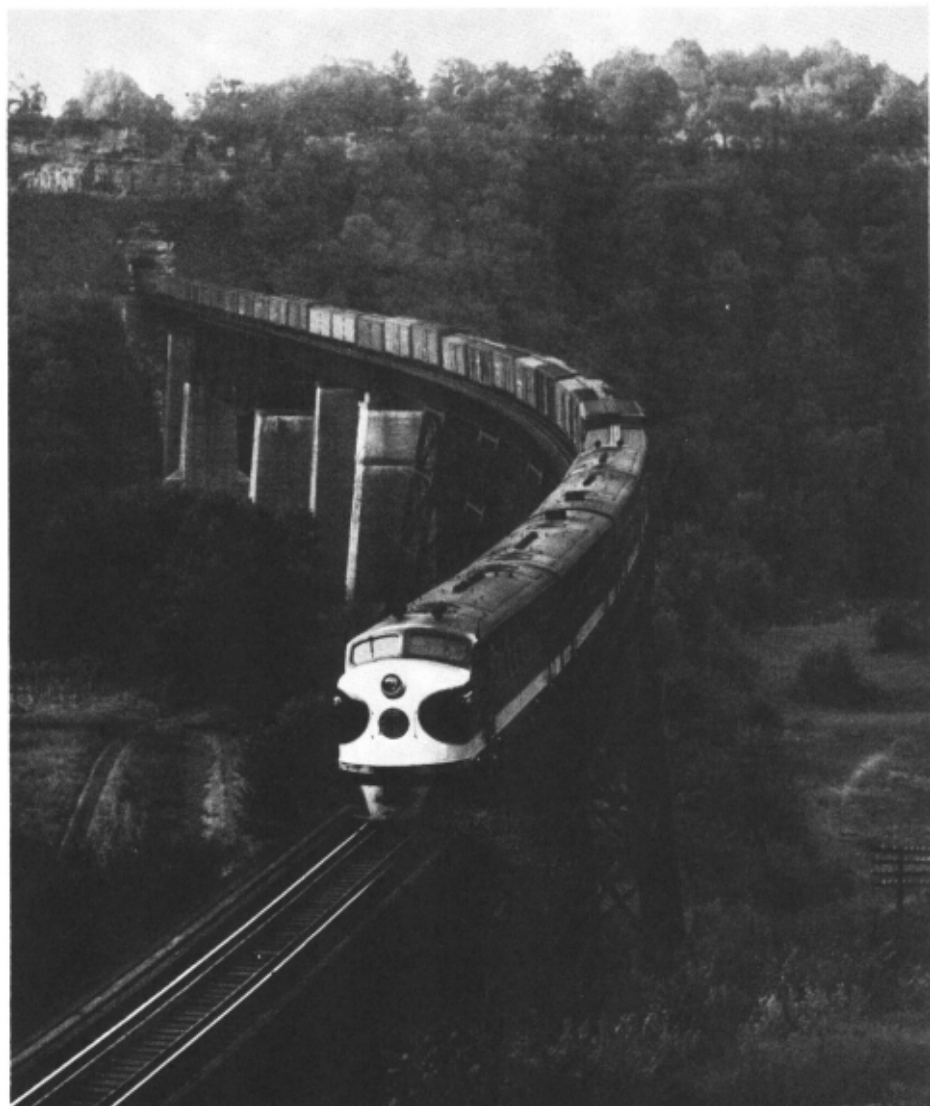
One of the best "test tracks" was the Baltimore & Ohio's Cumberland Division, especially its West End. Along that road are several summits, tunnels and 2.2 percent grades. The toughest climb on the division for eastbound coal is an 11.4-mile stretch of 2.2 percent grade from M&K Junction to Terra Alta, W. Va.

The B&O typically used a 2-8-8-0 with two 2-8-8-0 helpers at 4590 adjusted tons to run the route. This consist took 80.5 minutes to run the section, averaging 8.4 mph. But when No. 103 left M&K with 1952 adjusted tons, it made the run to Terra Alta in 41.3 minutes -- alone -- and averaging 16.6 mph.

When No. 103 tackled the Moffat Tunnel route from Denver to Bond, Colo., the results were much the same. There is nearly a mile climb over the first 50 miles of the run and 30 tunnels, including the 6.21-mile Moffat Tunnel. The 103, moving 1780 adjusted tons, made the run in five hours 20 minutes, compared to the 6½ hours needed by an L-131 2-8-8-2 carrying only one percent more tonnage.

But that wasn't the 103's only advantage on this mountain route. The diesel never lost power, even at 9200 feet elevation, and it ran almost smokeless through the lengthy Moffat Tunnel. With a hard-puffing steam consist moving through such a long tunnel, the cloud of smoke was enough to asphyxiate livestock.

On the Southern's own CNO&TP subsidiary between Cincinnati and Chattanooga -- dubbed the "Rathole Division" -- No. 103 really showed its mettle. The standard 2-



*Following its nationwide demonstration tour, the lead unit of No. 103 became Southern No. 6100 and the four-unit locomotive went into regular freight service on the Southern in 1941. The locomotive is shown here that same year crossing Cumberland River Bridge near Burnside, Ky., with a Southern freight train. This became a classic railroad picture -- the first diesel road freight locomotive, with a bridge, a curve and a tunnel all in the same scene. Now hardly anything of the scene remains. The lead locomotive is in a museum, the other units rebuilt or scrapped, and the freight cars long since scattered. The bridge is gone, replaced by a newer structure, and all you see here below the top of the tunnel mouth lies beneath the waters of Wolf Creek Dam reservoir.*

8-2 steam locomotive could haul 3000 or more tons on the outer thirds of the run but grades on the Danville, Ky., to Oakdale, Tenn., section cut the engine's rating nearly in half. Number 103 ran the entire Cincinnati-to-Chattanooga route -- carrying 4000 tons -- and cut an hour from the six-hour run between Danville and Oakdale.

But the toughest competition of all came out west in California's Tehachapi Pass. The Santa Fe pitted the 103 against its own 5001-class 2-10-4, with 74-inch drivers. The route was the 152 miles between Bakersfield and Barstow, Calif. In both directions, No. 103 won hands-down. The Texas-type locomotives needed helpers in

both directions to haul similar tonnages, and didn't come close to the time schedules that the diesel posted.

Even though 103 was a freight locomotive, it also made its point in passenger service during the test period. The Northern Pacific, at the end of its tonnage tests, hooked up the diesel units to its trains 1 and 2, the **North Coast Limited**, between Livingston and Missoula, Mont. This 240-mile stretch of mountain road rose more than 2000 feet in altitude, over 2.2 percent grades. A 4-6-6-4 could handle 10 cars alone, required one helper for 12 cars and two for more than 12 cars. The schedule was 6 hours 30 minutes westbound and 6 hours 38 minutes eastbound.

With 103 at the head of a 17-car train, the westbound trip took 6 hours 19 minutes; the eastbound 6 hours 24 minutes.

By the end of the 11-month testing phase, the diesel's hauling power was uncontested. Unfortunately, though, it took a bit longer for veteran railroaders to realize the full cost implications of the new type of locomotive. Besides fuel cost savings, there were additional savings to be realized from the elimination of water tanks, ash pits, roundhouses and other steam-related equipment.

Railroads already were lining up to acquire the new locomotives. The Santa Fe was the first customer for the 1350-horsepower FT, available in several configurations. Many Class I railroads quickly followed suit. Over the years, many of these locomotive units ran up more than 1 million miles; some ran

still longer after being upgraded into 1750-horsepower GP9 units at La Grange.

Number 103 itself, after reconditioning, was painted in the Southern's black and white livery and put to work on the CNO&TP subsidiary line. There, it worked for the next two decades, gradually being surpassed by newer and

more powerful diesel-electric locomotives.

On June 27, 1961, in a ceremony attended by Southern officials, the A unit of the old 103 was given over to officials of the National Museum of Transport in St. Louis. There, it serves as a symbol of the end of one era in railroading, and the dawning of a new one.

*In almost a year No. 103's test runs covered 83,764 miles, on 20 railroads in 35 states from coast to coast -- and steam's century-old grip on rail freight service was permanently broken.*



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The 1939 Freight Service Diesel-Electric Locomotive is the 77th National Landmark to be designated by ASME since the program began in 1973. Five state, nine international and 63 National Historic Mechanical Engineering Landmarks have been designated to date. For a complete list and information about the ASME History and Heritage program, please contact the ASME Public Information Department, 345 E. 47th Street, New York, N. Y., 10017, telephone (212) 705-7740.

# ACKNOWLEDGEMENTS

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