



The N.C. Transportation Museum Roundhouse and Turntable

*Designated a Historic Mechanical Engineering Landmark
March 19, 2011*





Spencer Shops Roundhouse Circa 1945



Spencer Shops

In 1896, only two years after Southern Railway was assembled from several smaller railroads, the company began construction of Spencer Shops. The facility soon became one of the railroad's primary sites for locomotive maintenance. The company elected to name both the shops and the adjacent new town to honor Samuel Spencer, who as president had championed the investment. The Southern repeatedly used these shops to test and develop new technology to maintain steam, and later, diesel locomotives. The shops were continually rebuilt and upgraded through the 1950s to sustain their high standards of maintenance. As the main shop on Southern's Eastern Lines, crews at Spencer worked on several hundred steam and diesel locomotives each year, with over 3000 people employed at the facility at its peak.

Spencer Shops actually consisted of two different, though inter-related, types of shops. The large, rectangular erecting shop north of the roundhouse was the center of the back shop complex where locomotives received major repairs. There locomotives could be completely disassembled and rebuilt, and various supporting shops cast, forged, and machined almost any part needed.

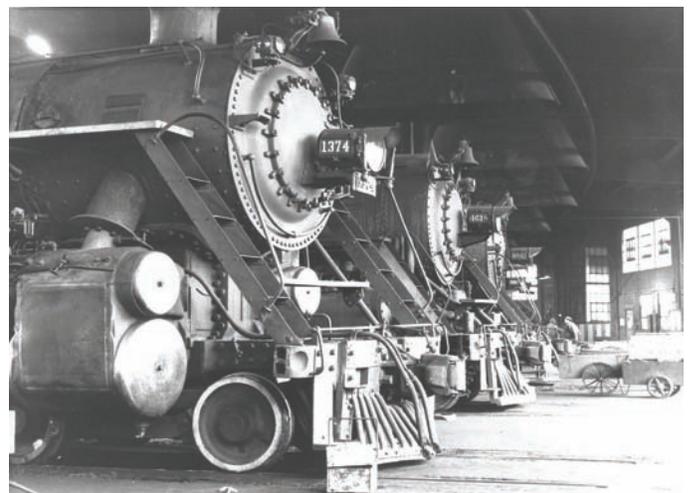
The roundhouse and turntable were the center of running maintenance, those inspection and light maintenance activities needed to service arriving locomotives and prepare them for another run. The roundhouse crews performed such tasks as monthly federal inspections, boiler washouts, wheel changes, brake work, and a variety of running gear adjustments that could be done quickly. Locomotives needing more than a day or two of work were usually sent to the back shop.

Historical Significance

Spencer Shops is one of the few remaining early-20th-Century railroad locomotive facilities in the United States. A majority of the buildings used originally in steam locomotive repair and maintenance are still intact.

One of those buildings is the Robert Julian Roundhouse. Following a typical roundhouse design, the building is circular in shape, built around a turntable, allowing for ease in moving locomotives in and out of the building for repair and maintenance.

The origin of the first locomotive roundhouses has been described by retired Smithsonian curator John White as "uncertain". Claims of building the first of these highly specialized structures were made by both England and the United States in the 1830s. Boom years of roundhouse construction occurred in the mid 19th century and again at the turn of the 20th century, as railroads and their engines grew larger. The earliest roundhouses were usually complete circles with a roof covering a central turntable and the radial stalls, but the need to service larger locomotives generally modified the basic design into one with an outdoor turntable and a separate building enclosing a ring of stalls set well back from the turntable. This design allowed larger stalls and more of them. A final roundhouse boom occurred between 1920 and 1940 that further enlarged the concept and employed modern fire-resistant materials. It was during this time, in 1924, that the Robert Julian Roundhouse was constructed at Spencer Shops.



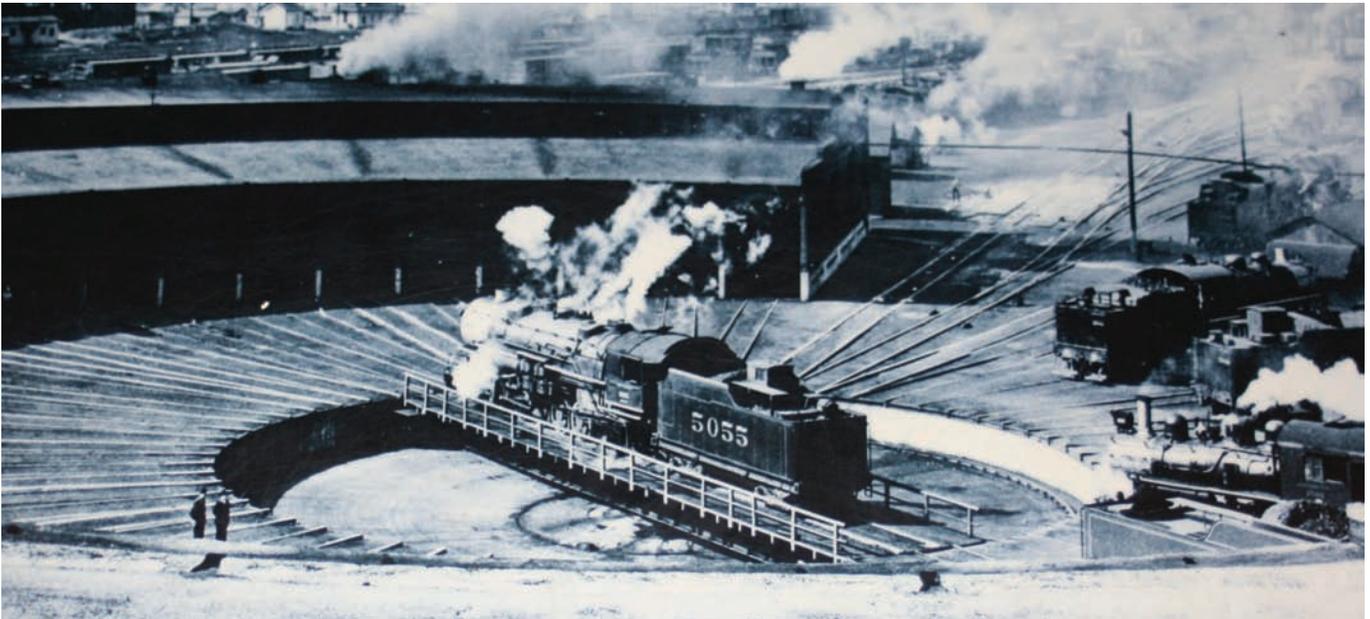
Steam locomotives in the Roundhouse. The smoke jacks are visible above the engines.

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While an estimated 3000 roundhouses once existed in North America, the Spencer Shops Roundhouse is now one of less than 200 that remain standing. With 37-stalls, it is the largest remaining roundhouse in North America that remains in operation, and its design and materials typify the last era of roundhouse construction.

Robert Julian Roundhouse and Turntable Design

In February 1924, Southern Railway officials announced plans to demolish the 15-stall roundhouse built in 1896 along with the obsolete 60-foot-long turntable, and construct a massive 37-stall roundhouse in its place that could accommodate modern locomotives. The new roundhouse consisted of concrete and brick around a steel frame. The steel slab roof had a top layer of tar and gravel that was pierced by a “smoke jack” over each stall. These smoke jacks allowed ventilation of the coal smoke from the steam locomotives. An arc-shaped clerestory admitted natural light.



Each of the 37 stalls had a depth of 106 feet, long enough to house the Southern’s largest steam locomotives. Nine of the stalls were equipped with pits and drop tables for changing wheels, which were rolled to and from the wheel shop through doors in the back wall. In stalls not used for changing wheels, a shallow pit ran between the rails for most of the stall’s length, allowing workmen to get under the locomotives. In an unusual action, the company named the new roundhouse in honor of Robert L. “Bob” Julian, a long-time roundhouse foreman who began working at Spencer in 1897, only one year after it opened. A plaque high on the building’s end wall bears his name. While the building’s official name is the Robert Julian Roundhouse, it is often referred to on signs and in publications as the Bob Julian Roundhouse.

The Machine Shop

As part of the original construction, a machine shop was built on the rear of the roundhouse. The machines housed there were used in repairs that were not severe enough to send the locomotive in question to the back shop. Eleven new machines with individual electric motors were located in the machine shop.

An office building was also constructed on the back of the roundhouse. At the start of each shift, the foreman issued tickets from that office indicating the repairs required for each engine.

The floor of the machine shop and roundhouse stalls consisted of creosoted, end-grain wood blocks that covered the concrete foundation. Wood block flooring was commonly used in locations where heavy parts or machines might be dropped. The wood blocks absorbed impacts, resulting in less damage to both the parts and the floor. The wood blocks also absorbed spilled oil and grease, thus reducing the occurrence of dangerous slick spots.

The Turntable

Unlike diesel locomotives that run equally well in either direction, most steam locomotives were designed to pull trains in only one direction, which meant that they often needed to be turned to face in the direction they would leave the adjacent Spencer Yard. Thus the center of the roundhouse was a new 100-foot turntable, and all roundhouse tracks radiated from it, including some known as garden tracks.

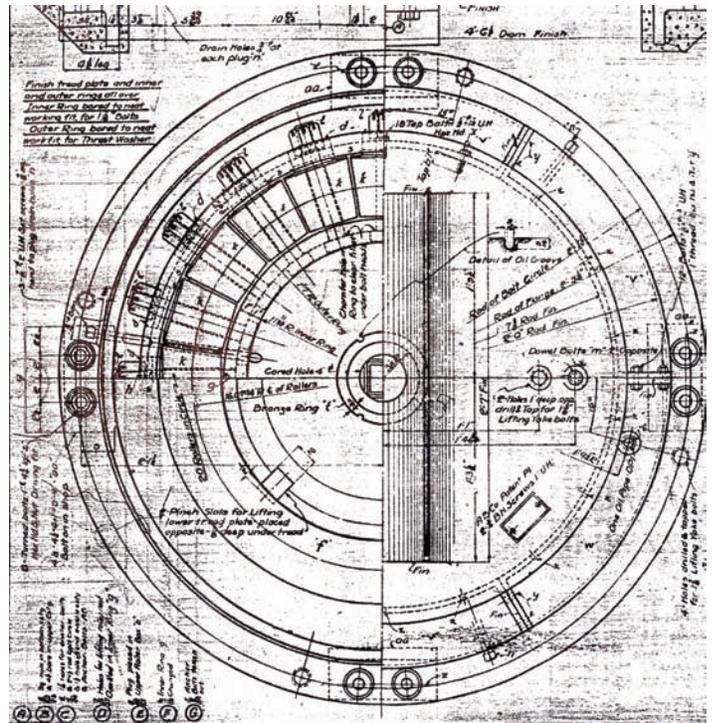
The turntable, which rotated 360 degrees about a central spindle, was also supported at each end by wheels rolling on a circular rail in the floor of a 101-foot-diameter concrete pit. Designed by the railway's engineering staff and fabricated at Spencer, the new turntable was similar to a deck-plate-girder bridge. It was powered by two 25-horsepower alternating current electric motors. Wooden walkways with metal handrails extended along both sides of the track, and a small cab at one end enclosed the simple controls.

The Southern Railway spared no expense in constructing the Robert Julian Roundhouse and turntable. The estimated final cost of the project, completed in December 1924, was approximately \$500,000.

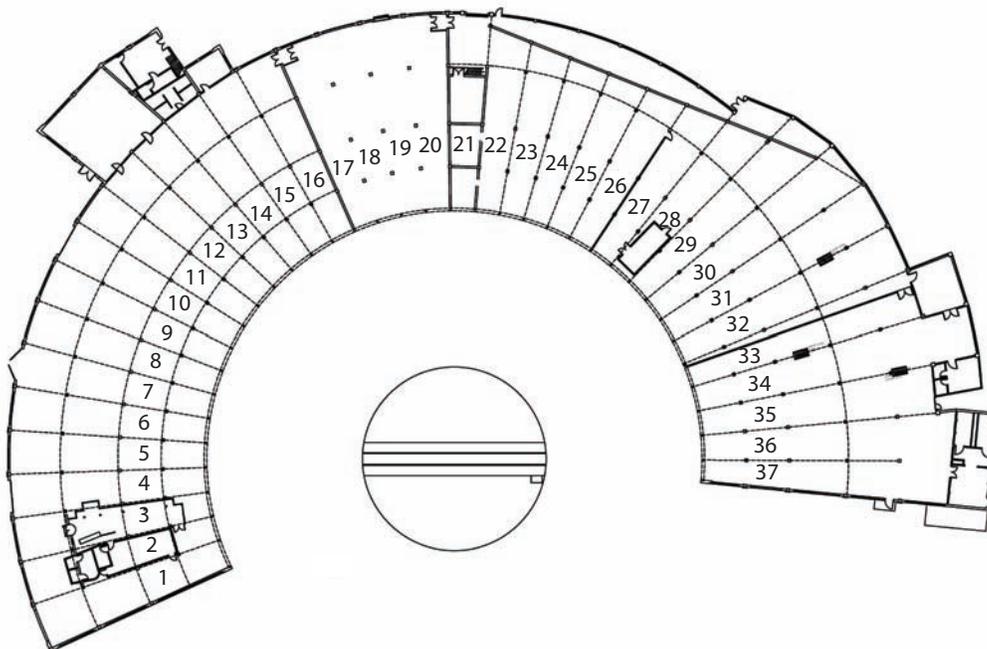
Roundhouse Layout

For repairing steam locomotives, the roundhouse stalls were divided by the type of work that would be done. Viewing the roundhouse from the turntable, the 37 stalls were numbered consecutively from left to right and divided according to purpose.

Stalls 1 and 2 were used for repairs likely to require more than one day, and stalls 3 through 11 had the drop pits used to change wheels. The remaining stalls handled most inspection and running repair work. These stalls



A copy of the original blueprint for the turntable's center bearing.



Present day CAD rendering of the Roundhouse. The stalls are numbered as they originally existed in 1924. During the Roundhouse renovation in 1996, stalls 3 and 4 were converted to an orientation gallery. Stalls 17-20 were enclosed for use as exhibit areas, while stalls 21-28 were converted to open space used for renovaton of rail equipment.

were normally divided between passenger, freight, and yard engines, but any available stall could accommodate any locomotive when necessary.

Overhead cranes could travel the entire length of the roundhouse along a set of rails 29 feet apart and over 20 feet above the floor. Parts could be transported to any section of the building using these cranes, which had capacities between 1.5 and 10 tons.

Conversion To Diesel Locomotive Service

Diesel locomotives began arriving at Spencer in 1941. From 1948 to 1950, Southern officials worked to convert the roundhouse and other buildings to properly maintain them.

The major changes to the roundhouse involved eleven stalls. The pits in two stalls were filled in and the track was removed so that a concrete floor could be poured. Equipment was installed in this area to clean filters from diesel locomotives. The rear wall of nine stalls was removed and a new one built 26¼ feet back. The pits and rail in these stalls were extended 36 feet to accommodate the longer, multi-unit diesel locomotives. The side of the roundhouse was extended, and the equipment used to recycle water from steam locomotives removed. An area for servicing locomotive speed recorders was added along with a small machine shop and a drop table for changing diesel locomotive wheels and traction motors.

Raised platforms were built level with the doors on the sides of the locomotives to allow workers easy access to the engine compartments. Workers could step into a locomotive and remove many components without using the large overhead cranes. Swinging, wooden, double doors were also installed for protection from inclement weather during the diesel conversion.

By June 1953 the Southern Railway was completely dieselized, and the stalls of the Spencer Roundhouse that had not been converted to service diesel locomotives were outdated. The pits in seventeen stalls were filled in, leaving the track in place, to make a storage area.



Raised platforms in Stall 32



Many of the changes made to the roundhouse for servicing diesel locomotives can still be seen in this present-day photo, including the swinging wooden doors installed on stalls 33-37. The roll-up steel doors on stalls 29-32 were added in 1968.

Four other pits were filled in and the track removed. A new concrete floor was poured, and floor-to-ceiling walls were built on either side to create a large room where individual diesel locomotive components, such as batteries, fuel injectors, and pumps were serviced.

After heavy repair work was moved to other locations and the back shop closed in 1960, some diesel locomotives continued to be serviced at the roundhouse. Many diesels were inspected and refueled at Spencer, with minor running repairs handled in the roundhouse. In 1968 steel roll-up doors were installed on four stalls, and a concrete block fire wall was built. These changes confined work to these stalls only. The roundhouse did not close completely until the Spencer Yard was shut down upon completion of the new Linwood Yard five miles north in 1979.



The Roundhouse pre-renovation, circa the late 1970's

Roundhouse Restoration

With most of the Spencer Shops complex closed and abandoned by 1977, the North Carolina Department of Cultural Resources proposed the concept of creating a museum at the site that would focus on the state's transportation history. The Southern Railway found the concept attractive and donated most of the old back shop and its land to the state for the project. After the completion of Linwood Yard two years later, the company donated the remaining buildings and 57 additional acres of land.

The Department of Cultural Resources, along with a non-profit support organization, the North Carolina Transportation History Corporation, began the long task of finding the funds needed to restore and rebuild the shops, as well as locate historic items for display. While some critical work was done soon after acquisition that enabled the North Carolina Transportation Museum to open in 1980, the funds needed for renovation were slow in coming. Area volunteers stepped in to do all they could, contributing thousands of hours to the effort.

Restoration finally began on the Robert Julian Roundhouse and Turntable in 1994, with the help of grants and funds from the Intermodal Surface Transportation Efficiency Act (ISTEA). Also, a fundraising campaign called "Building on the Past, Looking to the Future" showcased the museum's role as an economic tool, resulting in a large number of public donations to the roundhouse project. In the end, the North Carolina



Volunteer William Weant at the Roundhouse circa 1985.

Transportation History Corporation, state government, individuals, corporations, and foundations pumped some \$8 million into the project to revitalize the roundhouse, the turntable, and other areas of the museum. As work continued through 1995, state officials awarded the project an extra \$1.6 million. The revitalization of the roundhouse and turntable was completed in September 1996.

The museum and its collection have continued to grow and develop, while equipment used in the museum's on-site train ride are maintained in the roundhouse. The Robert Julian Roundhouse now features an orientation gallery and video in stalls 3 and 4, rolling stock on display in stalls 4 through 16, washrooms where workers once cleaned up, the ticket office where employees received work orders, over 8,000 square feet of exhibit space, the still-active stalls where visitors can view volunteers working on the museum's rail equipment, and the completely restored 100-foot turntable. Rides on the turntable are available, but locomotives still have priority.

**HISTORIC MECHANICAL ENGINEERING LANDMARK
SPENCER SHOPS ROUNDHOUSE AND TURNTABLE
1924**

THIS 37-STALL ROUNDHOUSE AND 100-FOOT TURNTABLE BUILT BY THE SOUTHERN RAILWAY ARE AMONG THE FEW SURVIVORS OF A DISTINCTIVE TYPE OF LOCOMOTIVE REPAIR FACILITY THAT WAS ONCE COMMON ACROSS NORTH AMERICA. THE RADIAL TRACK AND TURNTABLE ARRANGEMENT WAS BASED ON THE OPERATIONAL AND MAINTENANCE NEEDS OF STEAM LOCOMOTIVES, THOUGH THIS FACILITY RECEIVED MODIFICATIONS AFTER 1950 TO SERVICE DIESELS.

WHILE OTHER ROUNDHOUSES SURVIVE, THIS IS AMONG THE BEST PRESERVED EXAMPLES OF A LARGE, MODERN ROUNDHOUSE THAT CONTINUES TO FUNCTION AS A RAILROAD SHOP.



THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS 2011

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The History and Heritage Program of ASME

The History and Heritage Landmarks Program of ASME (the American Society of Mechanical Engineers) began in 1971. To implement and achieve its goals, ASME formed a History and Heritage Committee initially composed of mechanical engineers, historians of technology and the curator of mechanical engineering at the Smithsonian Institution, Washington, D.C. The History and Heritage Committee provides a public service by examining, noting, recording and acknowledging mechanical engineering achievements of particular significance. This Committee is part of ASME's Center for Public Awareness. For further information, please contact Public Awareness at ASME, Three Park Avenue, New York, NY 10016-5990, 1-212-591-7020 and <http://www.asme.org/history>.

Designation

Since the History and Heritage Program began in 1971, nearly 250 landmarks have been designated as historic mechanical engineering landmarks, heritage collections or heritage sites. Each represents a progressive step in the evolution of mechanical engineering and its significance to society in general. Site designations note an event or development of clear historic importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The Landmarks Program illuminates our technological heritage and encourages the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians and travelers. It helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

ASME helps the global engineering community develop solutions to real world challenges. Founded in 1880 as the American Society of Mechanical Engineers, ASME is a not-for-profit professional organization that enables collaboration, knowledge sharing and skill development across all engineering disciplines, while promoting the vital role of the engineer in society. ASME codes and standards, publications, conferences, continuing education and professional development programs provide a foundation for advancing technical knowledge and a safer world.

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Keith Hardison, Director of the Division of State Historic Sites
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