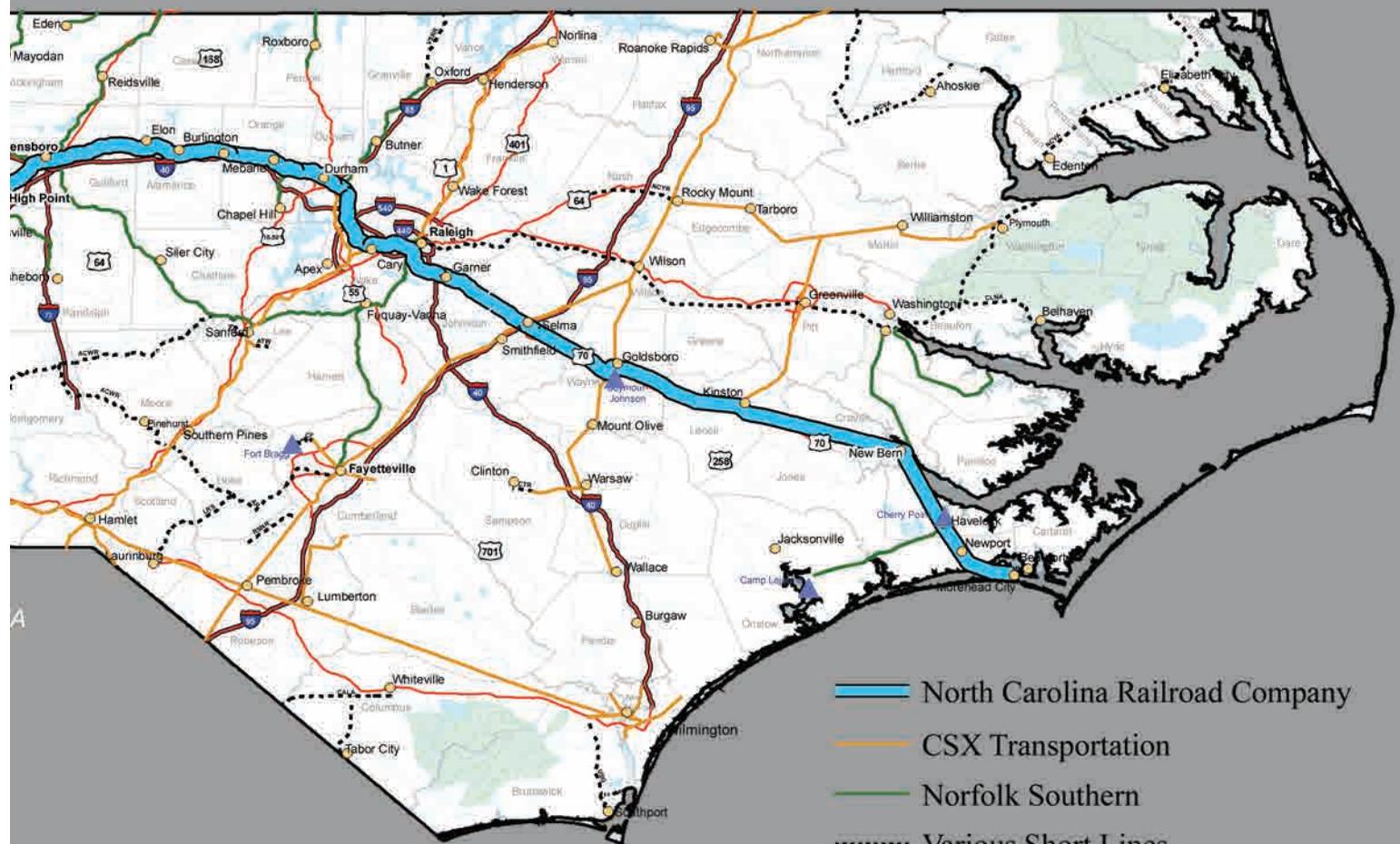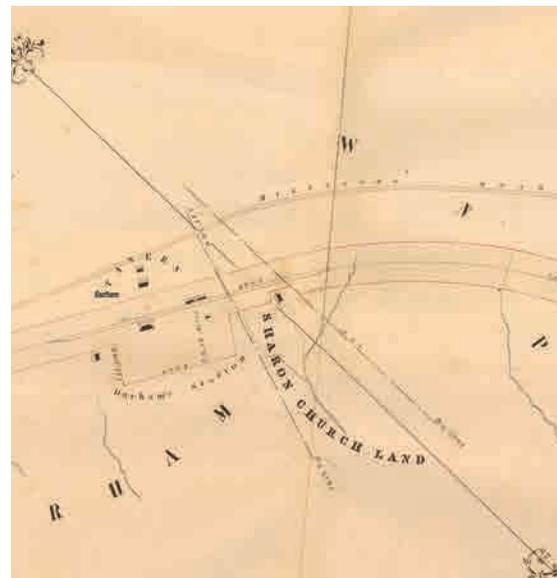# History and
TECHNOLOGY
Merge Geospatially

By Janet Jackson, GISP

The North Carolina Railroad fast-tracked to success by combining old paper maps with the latest in geospatial technology.

All images courtesy North Carolina Railroad Company.

Legend:
- ▬▬ North Carolina Railroad Company
- ▬▬ CSX Transportation
- ▬▬ Norfolk Southern
- ······ Various Short Lines

LEFT
Parcels that are adjacent to the NCRR corridor are categorized so that they are easy to identify during a phased project.

TOP
The NCRR corridor spans 317 miles (and 16 counties) from the port at Morehead City to Charlotte—*courtesy North Carolina Railroad Company.*

CENTER
Hand-drawn 1851 maps recorded the track corridor and adjoining land-owner information.

RIGHT
The NCRR track corridor is easy to see and allows railroad management to make decisions quickly based on the layers of old and new datasets.

Y ou wouldn't think that a train could sneak up on you, but when your head is down and you're busy inputting data, and you're used to the sound of trains, before you know it the train is there," said Kristian Forslin, GISP, GIS coordinator for the North Carolina Railroad Company (NCRR).

Kristian knows exactly how it feels to focus on his work but also stay alert for the oncoming trains. His job is to keep the NCRR digital records organized, compiled, and accurately displayed in a geographic information system (GIS). That involves keeping accurate records for all the land base data, utilities, and buildings that are within or adjacent to the 317 miles of railroad corridor that cross 16 counties. "Ninety percent of my work is done in the office, but once in a while I need to visit the corridor to get more accurate information or to verify our digital records," he says.

Over the 160 years the North Carolina Railroad has been in continuous operation, the record keeping has progressed from maps hand drawn in 1851 to today's high-resolution aerial photography. Chuck Burnell, assistant vice president, real estate for the North Carolina Railroad, explained, "We are working hard to provide a variety of information, including GIS, to educate and collaborate with those who need it."

Organizing 160 Years of Data

NCRR manages the corridor from Morehead City to Charlotte so that people, goods, services, and trains can travel safely. To do that, the railroad needs to make sure that everyone in the railroad, real estate, development, land planning, highway construction, tax assessment, and utilities industries have the most accurate corridor information. And it seems that GIS is doing its part to keep everyone successful.
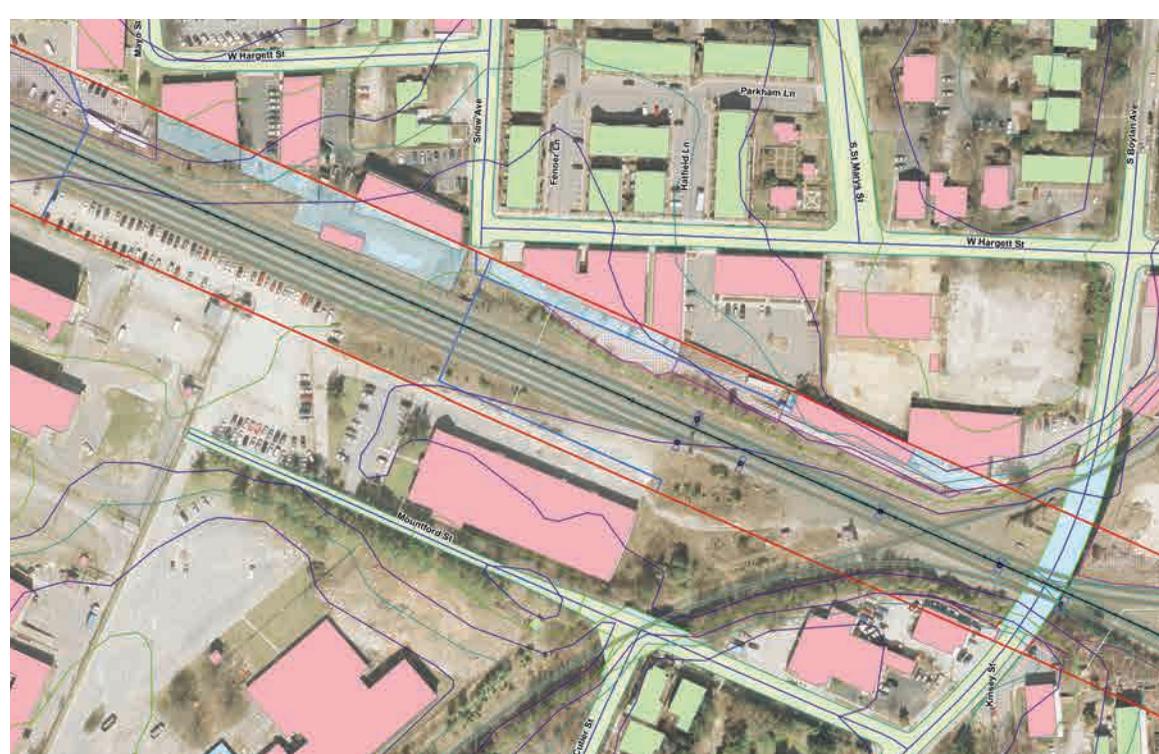
GIS is providing a superior means to visually assess features, such as utilities, along with the potential impact of any proposed action along the corridor. Any time someone needs an agreement with the railroad for an occupancy along the corridor, whether a surface land use (overflow parking, fences, etc.) or utility installation, the railroad must consider

CLOCKWISE:
Kristian Forslin, GISP, GIS coordinator for The North Carolina Railroad Company, collects field data in the Raleigh freight yard.

GIS layers are created for buildings, roads, and streets and overlaid with aerial photos so that accurate placement for new services can be decided.

Old hand-drawn valuation maps are georeferenced over new base mapping data as GIS technology is used to interrelate old and new information.

proved that, by using big-picture thinking and keeping details in the forefront, it could be done successfully. NCRR knew its pre-Civil War era maps were valuable to a variety of end users, but not if they were confined to dusty old books.

In 2004, the railroad began the data migration process. The first step was to scan the maps into a digital format. The next step was to georeference the maps over a current land base and aerials within GIS. This step proved informative yet challenging, as often the only way to line up the old and the new images was using a common landmark such as a river or stream. Houses, buildings, and streets on the 1851 maps didn't prove very useful when overlaid on top of today's base maps.

After the 1851 maps and a set of proprietary valuation maps from the early 1900s were scanned and fully transferred into the GIS, a 200-foot-wide vector buffer, which simulates the corridor distance 100 feet on each side of the centerline track, was created. "It was fascinating to see 150 years of corridor changes right in front of your eyes," Forslin said. "In the past five years we have created dozens of specific GIS layers that are used every day to assist with the management of the entire corridor." And management of the corridor is needed more than ever, as rail service, especially for heavy trucked items, is providing an alternative to interstate congestion.

Partnering with Surveyors

Surveyors have played a very active role in the development of the corridor for the past 160 years. The 1849 charter states, "the State conveyed all of its lands to the NCRR located in the corridor and other rights through direct provisions in the NCRR Charter. … the state granted
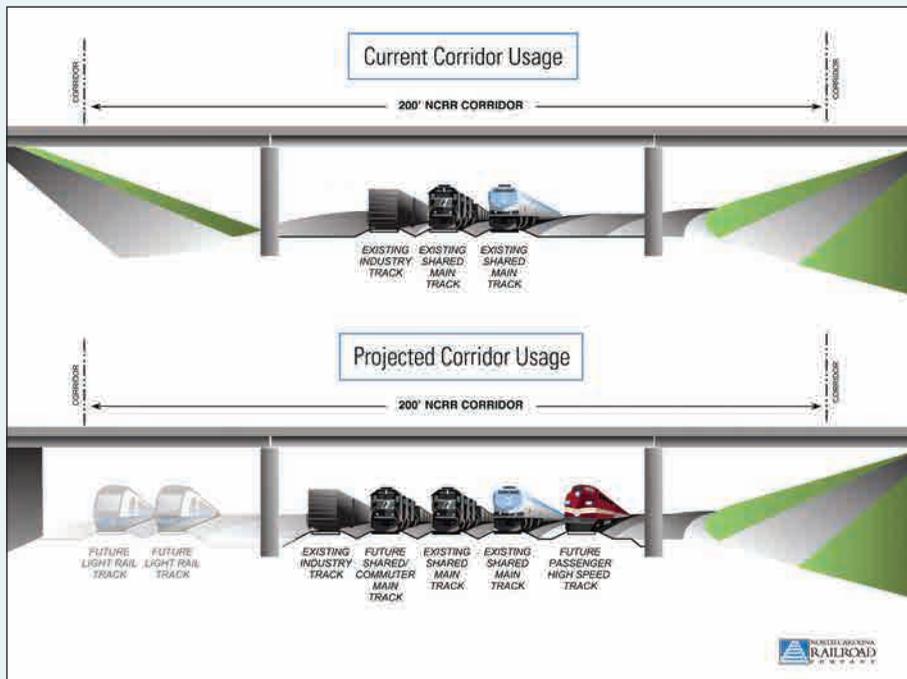
the existing and possible future actions in the vicinity of the proposed project— sometimes for miles in either direction of the current project. GIS has become the perfect tool for conducting both the visual process and the underlying analysis.

Because of its ability to store, view, and create layers, custom reports, and analysis, GIS is a central repository for the railroad's combined documents: layers such as existing and pending land-use commitments, utility installations, railroad at-grade crossings, and config-

urations of tracks, signal installations, and crossing gates. Countless hours of research time during the review and approval process are saved because the GIS database contains these combined details. "Organizing 160 years of data into a GIS now gives us the confidence that we are seeing and making decisions from a compiled resource that has never been available before," says Burnell.

Data Migration

Combining old data with new technology has its challenges, but the NCRR

Current Corridor Usage
200' NCRR CORRIDOR
EXISTING INDUSTRY TRACK • EXISTING SHARED MAIN TRACK • EXISTING SHARED MAIN TRACK

Projected Corridor Usage
200' NCRR CORRIDOR
FUTURE LIGHT RAIL TRACK • FUTURE LIGHT RAIL TRACK • EXISTING INDUSTRY TRACK • FUTURE SHARED COMMUTER MAIN TRACK • EXISTING SHARED MAIN TRACK • EXISTING SHARED MAIN TRACK • FUTURE PASSENGER HIGH SPEED TRACK

make it extremely difficult to determine where these boundaries are today without an effective way to relate to the location of the centerline in 1851.

The monumentation project is the most cost-effective way of accurately documenting the corridor boundary and providing stationary X/Y coordinates. Surveyors will then have highly accurate and convenient monuments to use, making entry into the busy rail corridor unnecessary in most cases. "Safety is paramount, and providing a safe basis for future rail engineering projects is a significant factor in this project," Forslin said.

Planning for the Third Century

With so much happening on so many different tracks of progress, keeping all the data organized in GIS makes sense. "Our plan is to keep the corridor open and operating to its fullest extent. We are planning to increase our corridor traffic and are working to upgrade our railway infrastructure," said Burnell. As the NCRR plans for more rail traffic in its corridor, towns, cities, and destination points along the way are looking forward to the boost in economic development the trains will bring them.

So how is it that North Carolina's oldest corporation, the North Carolina Railroad, fast-tracked to success by combining old, yellowed, paper maps with the latest in geospatial technology? It happened because dedicated leadership saw a vision to create a safer and more productive corridor. They also saw the benefits and opportunities produced when geospatial technology was combined with surveying.

But those aren't the only reasons. It also happened because of their willingness to collaborate and educate surveyors and other stakeholders, their effective and daily use of data management, and especially their hard and fast resolve to keep their 317-mile corridor safe for people, goods, and services. ⩒

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to NCRR the power of eminent domain and the power to purchase land for the corridor" (*Understanding the Corridor Management and Protection Program*, a brochure provided by NCRR to help understand the corridor management program). With these grants and powers, the corridor was rapidly surveyed and built.

The North Carolina Railroad is still working hard to build and maintain a collaborative effort with local and regional surveyors. Again, the railroad decided to use the latest internet technology to increase its "partnering" with surveyors by placing the historical maps on the North Carolina Society of Surveyors website (www.ncsurveyors.com). Now, NCSS members can view the maps at their convenience. "Educating surveyors on our corridor management program has really made a difference," Burnell said. "We know the general public depends on professional surveyors for property information, so we felt it was important to provide our corridor property and boundary maps to surveyors to be used to their fullest benefit."

And it's easy to understand why it takes a professional surveyor to help explain and untangle the boundaries and special situations that reside up and down the corridor. Many of the latest expansions of the rail corridor for bridge and track straightening are well documented in the public records, but the acquisition of the original corridor oc-

curred before the public records were well organized. Some corridor sections were obtained under the charter grant by the state and did not require deeds or other evidence of conveyance from landowners. NCRR's historical maps document the corridor's original width and location with a survey from that era. Making these original 1850-era maps available to surveyors is just one more informative and progressive step for the North Carolina Railroad.

Surveying Work Continues

"Today we are working toward a monumentation project to accurately document the centerline of the track as it was placed in 1851," said Forslin. "If we could only go back in a time machine, to 1851, with a survey-grade GPS receiver, then we could document the track shift between then and now. Unfortunately, time machine technology has not been invented yet."

But if GIS provides an accurate view of where the tracks reside today, why is there a need to back up to 1851? Because many past surveys of property adjacent to the railroad are tied to features now within the rail corridor to define their boundaries. And there has been a century and a half of additional land purchases, track relocations, curve straightenings, bridge replacements, soil subsidences, and everyday use by very heavy trains. All of these conditions