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Minn.-based Twin Cities & Western Railroad. "[PTC] is going to play a large role in what we invest in our infrastructure."

Numerous improvements by railroads might prove insufficient for some customers. Grain elevators may still have to compete for space on freight trains with coal mines, oil producers and other shippers, especially during the fall harvest. Rail service is likely to remain slower and less reliable for small-volume shippers because railroads will continue to allocate more resources to operating shuttle trains and other long trains dedicated to a single commodity.

But railways are reluctant to add unnecessary capacity—to lay more track, buy more equipment or hire more workers than demand justifies—because idle assets weigh upon their balance sheets. During and after the Great Recession, weak freight demand led railroads to mothball locomotives, sideline or scrap railcars, and lay off thousands of workers.

Railroads aim to satisfy most customers most of the time, aware that their projections of demand may miss the mark if market conditions change. "If we had perfect demand forecasting, running a railroad would be really easy," said Rose of BNSF. "The reality is that we don't; markets are dynamic; [demand for] these commodities is all driven by world markets."

Crude oil is a case in point. Just as low crop prices reduced crop shipments last fall, the rapid drop in the price of oil in recent months is likely to cut crude-by-rail shipments from the Bakken oilfields and Canadian oil sands. In January, North Dakota oil production fell to just under 1.2 million barrels per day, according to the state Department of Mineral Resources. If oil prices remain depressed, "you have to see some drop-off in oil shipments, and that'll free up capacity to move grain" this spring, Nahass said. Fewer black tank cars on the rails would also make room for other commodities such as ethanol, coal, chemicals and metal ores.

However, future oil prices are uncertain; a rebound could stimulate oil production on both sides of the border and increase demand for tank car and track capacity in the district.

In coming months, railroads will be watching the price of oil, along with a multitude of other factors that affect rail demand. They want to avoid a reprise of the scheduling hitches and breakdowns that afflicted rail service in the district for much of the past two years. "We know that when we get into an issue with congestion, the cost of that congestion is very high, and quite frankly we miss market opportunities," Rose said.

So do thousands of businesses in the district when the train fails to reach its destination on time. f

—Research Analyst Dulguun Batbold contributed data research to this article.

Not your father's railroad

Rail expansion efforts include spending on innovations that make freight trains safer and more efficient

For over a century, the technology required to build and operate a freight railroad was fairly simple. You needed railcars to carry various types of commodities, locomotives to pull them and track for trains to run on. Over the decades, railroads introduced innovations such as diesel locomotives, which displaced steam power in the 1950s; the use of remotely controlled auxiliary locomotives to help propel long trains; and radio communication to direct traffic on rail networks.

But many advances in railroad technology are relatively recent, introduced over the past decade and a half in response to government regulations and competition from the long-haul trucking industry.

In addition to investing massively in basic equipment and infrastructure, Ninth District railroads are spending heavily to implement new technologies that make rail transport safer and more efficient. Some of these technologies increase network capacity by speeding up trains and reducing delays and service disruptions.

"Railroads often aren't thought of as being very technological, but in terms of information power and diagnostic power and motive power, they're world leaders," said Anthony Hatch, a railroad industry consultant.

Major railroads have responded to rising traffic volume and congestion on some routes by installing centralized traffic control (CTC), a train signaling system that puts a central dispatcher in charge of routing actions previously performed by train crews. With the click of a mouse, the dispatcher remotely controls signals and powered switches next to the rail line. CTC supports higher train speeds and helps to avoid lost time and accidents due to misrouted trains.

Canadian Pacific's 2014-16 capital plan calls for over $30 million to be spent on installing CTC along the mainline between Glenwood, Minn., and Portal, N.D., on the Canadian border. This year, BSNF planned to continue deploying CTC on routes linking Minot and Bismarck, N.D., to eastern North Dakota and the Twin Cities.

Under federal law, major freight railroads must also implement positive train control (PTC) by the end of the year. The main purpose of these satellite-controlled signal systems is safety; PTC is intended to prevent train collisions, and derailments such as a recent fiery crash in West Virginia by a train carrying Bakken crude oil. But the technology also confers business benefits—for example, allowing trains to follow more closely and enabling dispatchers to respond quicker to traffic disruptions.

PHOTOS BY DEAN RIGGOTT

Workers installing CTC on a Canadian Pacific line in North Dakota.

Last year, BNSF spent about $200 million installing PTC in the district and elsewhere on its network and plans a similar outlay this year. Twin Cities & Western Railroad, a short-line railroad spanning southern Minnesota, will spend at least $500,000—almost one quarter of its capital budget—to implement PTC this year on stretches of Twin Cities track at BNSF's request.

Other technological innovations not specific to the district implemented by railroads include:

- Fuel-efficient locomotives. In 2013, U.S. railroads moved a ton of freight an average of 473 miles per gallon of fuel, according to the Association of American Railroads. The fuel efficiency of heavy-haul diesel locomotives has steadily improved over the past 15 years, and because of more stringent federal environmental rules, they also emit less soot, nitrous oxide and other pollutants than older models. Railroads also conserve fuel by cutting idling time with automated shutdown and startup systems, and assembling trains more efficiently with the aid of computers.

- Track and railcar inspection devices. On-track inspection vehicles use ultrasonic and optical instruments to check track alignment and look for internal defects in rails caused by the continual impact of train wheels or extreme temperatures. Railroads also deploy wayside acoustic detector systems that listen for the sound of damaged wheels, overheated bearings, dragging hoses and other problems with railcars. Defective railcars are tagged in a computer database and routed to repair shops, averting breakdowns that delay trains.

- Advanced demand forecasting. Major railroads develop computer models to predict long- and short-term freight demand based on factors such as regional and national economic conditions, market forecasts for various commodities, seasonal fluctuations in volumes and the production outlook for specific industries. But the science of demand forecasting is still imperfect. Hatch said that BNSF and other railroads failed to anticipate the impact of burgeoning crude-by-rail shipments on their networks. "[Demand forecasting is] incredibly sophisticated, but it can still fail if you drop a brand new, billion-dollar business into North Dakota."

—Phil Davies