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Before the United States Senate Committee on Commerce, Science and

Transportation for a Hearing on

"Next Steps for Positive Train Control Implementation"

July 31, 2019

Washington, D.C.

Good Morning Chairman Wicker, Ranking Member Cantwell and members of the Committee. Thank you for inviting me today to provide an update on BNSF's implementation of Positive Train Control (PTC) technology. As Assistant Vice President of Network Control Systems, I have responsibility for the railroad's ongoing implementation of PTC along with other safety and operations technology initiatives. PTC is an important component of BNSF's overall risk reduction program that has resulted in meaningful progress toward our vision of zero accidents and injuries.

 BNSF is a wholly-owned subsidiary of Berkshire Hathaway, Inc. and one of North America's leading freight transportation companies. BNSF operates a rail network of 32,500 route miles, serving 28 states in the western two-thirds of the United States and three Canadian provinces. BNSF handled 10.7 million units of freight in 2018, an all-time volume record for our railroad. BNSF operates about 1,500 trains per day, including 245 passenger trains that run over our network.

BNSF Commitment to Safety

Safety is the most important thing we do at the railroad. BNSF's ongoing risk reduction efforts combine a robust capital investment program, training that reinforces safe operating practices and maintenance of a strong safety culture among our employees. It also increasingly involves technology development and deployment to drive the next level of safety and efficiency improvements on the railroad.

Our ongoing and significant capital investments play a key role in our ability to safely deliver the best transportation services for our customers. To maintain, optimize and position our network for opportunities, BNSF has invested nearly $65 billion in private capital back into

the railroad since 2000 and plans to invest more than $3.5 billion in 2019. The railroad's

physical plant is in the best condition in its history.

BNSF is committed to a culture that continuously examines the effectiveness of its safety

processes and performance, and we've made steady improvements over time in reducing

employee injuries and the number of mainline derailments. We've also made steady

improvements in grade crossing safety. Since 2009, BNSF's employee injury frequency ratio

has been reduced by 55% while the rail equipment incident rate has been reduced by 26%.

BNSF's highway grade crossing incident rate has decreased by 21% over this same time period.

BNSF has made significant safety progress in partnership with our employees and by

continually investing in new technologies that help make the railroad safer and more efficient.

Technology is playing a key role in how we "design-in" safety on our railroad to drive additional

improvements throughout the system. PTC is an example of this, with deployment of the

technology helping to address human factor risks associated with train operations. While PTC

has received the most public attention in recent years when it comes to railroad safety, there are

also many other important safety technologies being developed and deployed on the railroad.

For example, BNSF has 4,000 trackside detectors across the network that monitor and

analyze trains as they roll by, helping to proactively identify and address issues that may

otherwise cause equipment to fail. These detectors, which utilize infrared, vision, force, acoustic

and laser technologies, among others, provide us with more than 35 million readings a day about

the health of our locomotives and the railcars moving along our network.

Yet another example is deployment of an evolving fleet of advanced rail inspection

vehicles, placing a premium on automated inspections that allow for near-continuous observation

of the state of the railroad infrastructure. This reduces the risk of derailment while also allowing for better management and planning of preventative track maintenance.

Because of these and other technological advancements and our commitment to continuous improvement, we are working closely with the Federal Railroad Administration (FRA) in support of moving towards a regulatory paradigm that incentivizes and empowers innovation. The regulatory treatment of PTC, for example, should ultimately be managed in a manner that will not impede—and actually encourage—the next generation of rail operational technologies that will be built upon the foundation of PTC and drive safety, expand network capacity and increase performance. This means in part that regulatory oversight should focus not on monitoring and inspecting every aspect of the equipment and technology but rather on the overall functionality and effectiveness of the system to deliver expected safety outcomes.

PTC Implementation

PTC is an important safety development and also one of the most significant, costly and complex technologies that the rail industry has ever deployed. BNSF's capital investment in PTC will exceed $2 billion. It is an unprecedented "system of systems" that integrates advanced analytics, wireless communications networks, GPS, trackside and locomotive hardware and software and a back office computer system.

PTC is technology that provides a safety overlay over the existing infrastructure and operating rules that ensure safe operations today. PTC determines the location, direction and speed of a train; ensures the train does not exceed the authorities granted to it by the dispatching system; warns the train crew of a potential problem; and takes corrective action by stopping the train if there is not a response from that crew.

BNSF made the decision to develop and deploy PTC technology on certain portions of its network before Congress mandated it in the Rail Safety Improvement Act of 2008 (RSIA). BNSF developed a form of PTC—the Electronic Train Management System (ETMS)—and in 2003 submitted the system to the FRA for approval. BNSF partnered with the FRA to initially pilot ETMS technology on our Beardstown subdivision in central Illinois and over time expanded testing to more complex operating environments on our network. ETMS is the platform upon which the industry's current PTC technology is based.

Today, BNSF has PTC infrastructure installed on all 88 subdivisions required to be equipped under the federal mandate, covering more than 11,500 route miles and 80% of our freight volume. We have also equipped and are operating PTC on nine non-mandated subdivisions, providing an additional 2,000 miles of PTC protection. We are running more than one thousand trains daily with PTC in revenue service, and have run more than two and a half million trains with PTC since December 2012. BNSF has trained more than 21,000 employees to operate and maintain PTC trains and equipment, and the volume of PTC trains running on our network demonstrates that our people know how to manage and support the system.
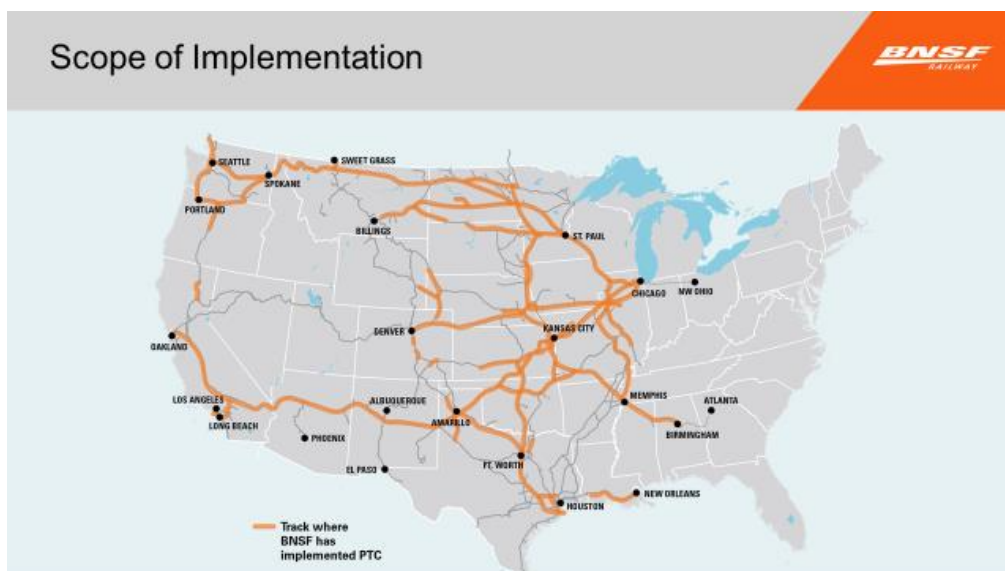
<u>Driving Continuous Improvement</u>

Moving forward, BNSF is working to address remaining technological and operational challenges with PTC to ensure high reliability of the system. Always with safety in mind, railroads still need to operate trains and serve customers as they work through these issues. There may also be occasions where the rail network is under stress—this year's unprecedented flooding is a good recent example—where flexibility is needed to recover operations and maintain the flow of commerce. With the underlying infrastructure and operating rules in place that ensure safe operations today, we continue to work cooperatively with the FRA to ensure railroads have the flexibility to avoid severe disruptions to their operations.

BNSF closely tracks and analyzes key performance metrics to understand the root cause of any issues with the PTC system and has three major focus areas to drive continuous improvement with PTC: ensuring reliability, fully integrating PTC into our train operations and related work processes, and achieving full interoperability.

We are working closely with our vendors to ensure the reliability of the system, which includes having sufficient capacity and redundancy in our communication systems, continuous monitoring and maintenance of wayside devices and making enhancements to our back office systems. Like other railroads implementing PTC, BNSF is closely engaged with Wabtec, the supplier of our onboard hardware and software, to refine key components of the system and ensure they have the necessary capacity, longevity and reliability to support our operations.

To operate PTC, we have essentially built a "digital railroad," which needs to be maintained right alongside the physical railroad. However, PTC implementation does not just involve technology; it requires changes to the work processes of our various operations team, including Transportation, Mechanical and Engineering, along with a host of other departments.

Examples include additional equipment moves to build trains with PTC-equipped locomotives in the lead; maintaining technologically sophisticated locomotives that are becoming rolling data centers; and maintaining thousands of additional devices along the track. BNSF has been focused on integrating PTC into our operations for several years, and while we must continue to test and refine this highly complex system to support safe and, importantly, efficient and fluid train movement, running trains on our PTC network is becoming just a part of how we do business.

Interoperability

The lynchpin of a fully functioning and interconnected PTC system across the country is interoperability. Interoperability for BNSF requires that all railroads operating across our PTC-equipped lines be capable of operating with our PTC system, and vice versa where BNSF trains operate over another rail carrier's PTC network. Railroads also exchange locomotives routinely, and the locomotives owned by other railroads need to be able to operate PTC in our trains. BNSF is actively working with each of the approximately 30 railroads—including other Class Is, short lines and passenger operations—with which we need to be interoperable to identify their needs and whether and how BNSF can help. This assistance ranges from technical, operational and regulatory advice to a variety of services such as back office hosting and crew training.

Aware that BNSF's PTC reliability would in part be dependent upon the reliability of every other railroad with which we interoperate, we engaged early on with each of the passenger and freight tenant carriers that will operate PTC on BNSF track. We sought to establish certain protocols between BNSF and its tenants to ensure implementation of PTC technical solutions which meet the regulatory and operational requirements of interoperability; communicate

expectations for participation in a PTC testing program to verify functionality and interoperability; and facilitate the exchange of technical information needed to effectively and efficiently implement PTC.

BNSF has now achieved interoperability with—and PTC is currently active on—ten of the 23 tenant railroads that will operate PTC on our network. That includes all passenger railroads, including Amtrak, Metra, Metrolink, Northstar and Sound Transit where they run on BNSF. We are also interoperable with short line railroads Montana Rail Link, the Otter Tail Valley Railroad, Louisiana & Delta Railroad, and the Portland and Western Railroad. We have worked closely with these short lines to enable their PTC-equipped locomotives to function with BNSF's PTC back office while operating on our track. Last month we began what we call production interoperability (operating PTC trains in revenue service) with the Union Pacific, our largest interchange partner and the first Class I freight railroad with which we've achieved interoperability. While BNSF and UP are fierce competitors in the freight transportation marketplace, we cooperate on safety and our technical teams worked well together to achieve this important milestone. PTC is in fact a prime example of how the entire industry comes together to advance safety.

BNSF will be able to fully test interoperability upon completion of bilateral testing with each of the remaining Class I railroads. This is an intensive process that involves federation of each railroads' back office servers, commissioning of locomotives, and lab and field testing followed finally by revenue service production interoperability. We conduct weeks, and in some cases months, of testing and preparation with each railroad.

Once we are interoperable, we need to maintain the flow of accurate information between railroads to ensure smooth interchange of trains and prompt resolution of any technical problems.

For example, with the Union Pacific alone we have over 200 locations where our tracks connect on PTC territory. For each of those we must make digital connections to match the physical connection, ensure communication systems can hand off trains without interruption of data flow, and be able to provide real-time information to another railroad's trains and crews.

The amount of data that will ultimately be transmitted between railroads and the various components that comprise the PTC system is significant. While the industry's modeling shows we will have sufficient spectrum in the industry's most heavily trafficked areas (e.g. Chicago), that will be confirmed when all railroads are fully implemented there. Similarly, we are working closely with our supplier to ensure that upcoming software releases will accommodate the amount of data required for full nationwide interoperability, and testing to prove that out will be ongoing.

Conclusion

The implementation of PTC—layered on top of an already safe rail network and in combination with current and emerging innovative risk mitigation efforts—is already advancing railroad safety for BNSF and its employees and will create a foundation upon which additional safety and efficiency technologies can one day be deployed. We have accomplished much but still have significant work to do in the coming months to ensure a highly reliable PTC system. This is important not only for the safety benefits it delivers but also essential to efficiently meeting the freight transportation needs of our customers. BNSF will continue to work collaboratively with all involved stakeholders to meet the goal of implementing an interoperable PTC system as Congress envisioned.