Calculating Railroad Capacity and Performance Impacts that Result from Changing the Maximum Permitted Speed of Specific Train Types

Introduction –

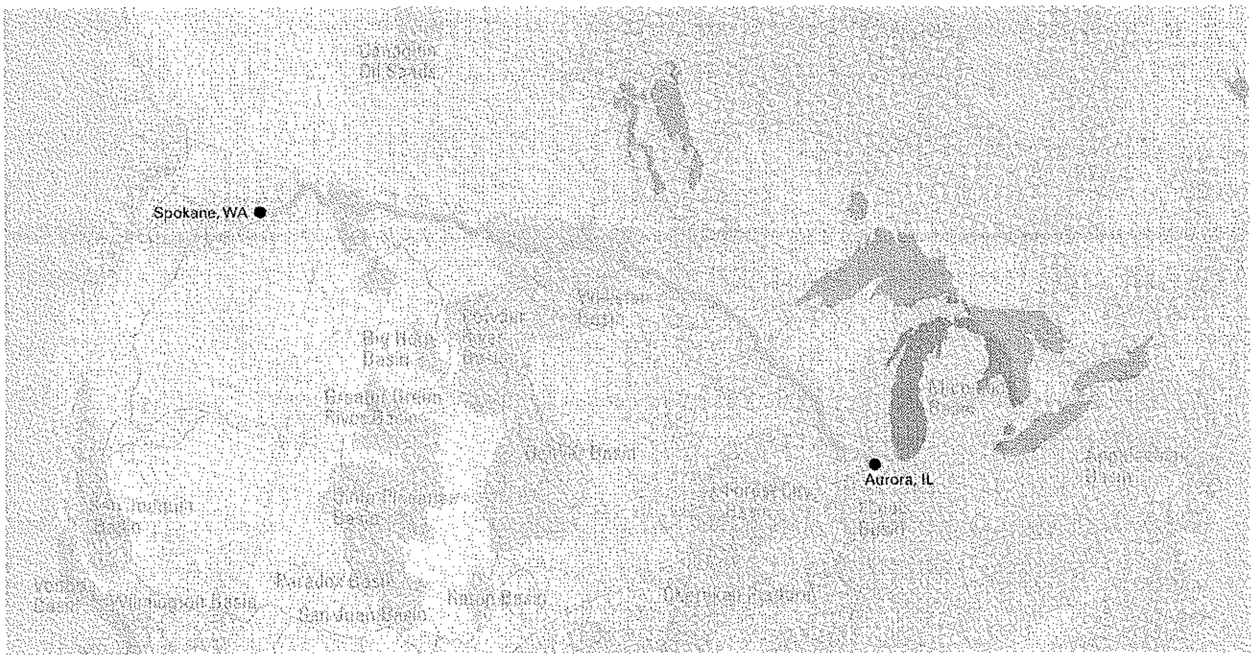
BNSF, like other North American Class 1 railroads, uses sophisticated simulation software to quantify the impacts that proposed changes in operating rules or conditions have on our capacity and expected train performance. This document will do three things:

- Describe the methodology we have used to calculate the impacts that restricting the speed of loaded crude oil trains would have on our operation.
- Present an example that shows exactly how the impacts of the proposed restriction would affect a 262 mile long segment of our 1,815 mile route between Aurora, IL and Spokane, WA.
- Expand that example to show the impacts that we have calculated would affect capacity and performance across the entire route, and, indeed, across our entire railroad.

Methodology –

The principal tool we use to quantify track capacity and train performance is a simulation software application called **R**ail **T**raffic **C**ontroller, or **RTC** for short. This software contains two basic types of files: one set represents infrastructure (track, signals, grades, curves, speed limits, etc.); the other set represents trains (type, frequency distribution, lengths, trailing weights, locomotive consists, priority, speed limits, schedule times, etc.). The dispatch logic in the simulation model replicates the logic that train dispatchers use when controlling the flow of trains across a railroad district: this logic has been repeatedly tested against observed reality to ensure that model results accurately predict the consequences that can be expected in day-to-day operations if changes are made to any of the many independent variables that can affect the railroad. Thus, the model can quantify the impact of adding or extending sidings, of adding more double or triple track main line, of increasing train lengths, of adding passenger trains to a freight route, of changing the signal system, or of changing operating rules.

In this case, we have used this software to calculate the impact of restricting loaded unit crude oil trains to 30 mph overall as well as 30 mph or 40 mph within major population centers instead of the currently permitted 50 mph. To measure the impact of the proposed speed restrictions, we have modeled our northern "Highline" route between Aurora, IL and Spokane, WA (this route passes through St. Paul, Minneapolis, Fargo, and Minot) once with the loaded crude oil trains allowed to operate at 50 mph, and again with reduced speeds for the loaded crude oil trains. Shown below is a map that outlines this portion of the BNSF network.



The only variable that we changed in these two comparison scenarios is the maximum speed for the loaded crude oil trains: everything else in the infrastructure and train files has been left exactly the same. That way, only the impact of the proposed change in oil train speed is measured.

There are a number of measures we can use to describe the results of the two comparable cases. We will present three:

- Change in average train speed (freight and passenger). This is an accepted industry measure of train performance, and is a proxy for commercial velocity.

- Change in track capacity as measured in maximum practical number of trains per day. This is an accepted industry measure of effective capacity at acceptable performance levels: if the number of trains to be operated across a line segment exceeds this threshold, we find congestion and delay increase very rapidly, and performance decays to levels that are unacceptable to our customers, to our tenants (e.g. Amtrak), and ourselves.

- Change in required schedule times to support dependable operating performance for different types of trains, both at 50 mph and at the reduced speeds for the loaded crude oil trains. As the transit time of the oil trains increases, so does the time required to move all other trains, since the amount of infrastructure is the same.

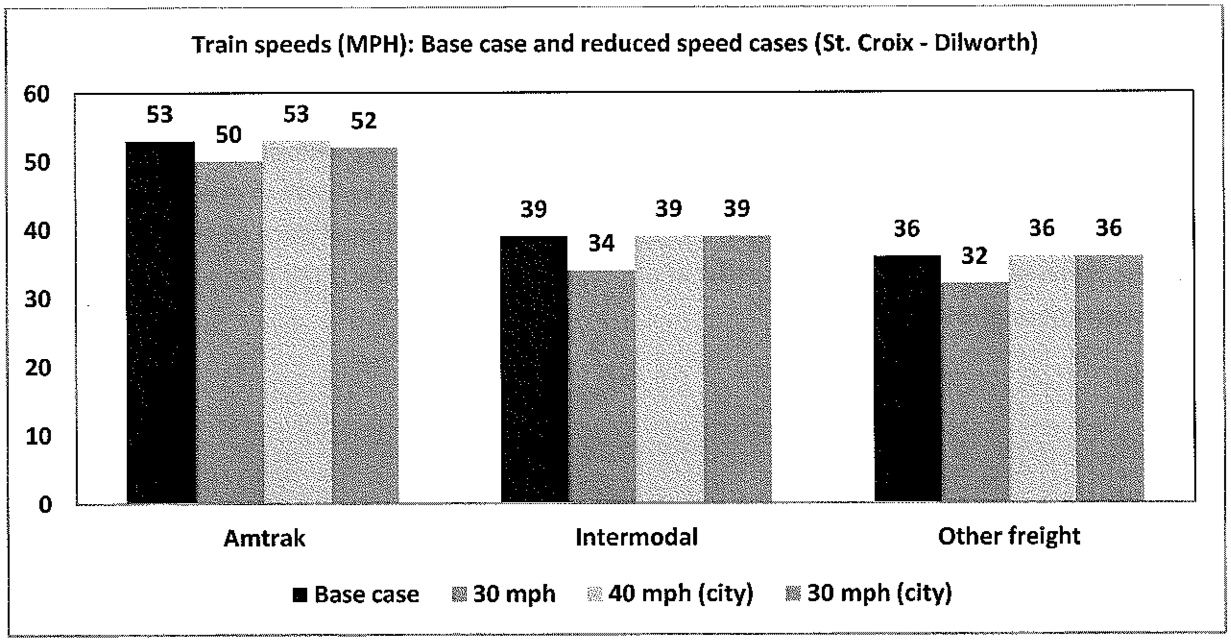
As this presentation will show, all three of these measures decay when the speed of the loaded oil trains is restricted. There is both a significant loss of capacity and a significant loss of performance when the restrictions are modeled, as compared to effective capacity and reliable performance under today's rules.

A Typical Example –

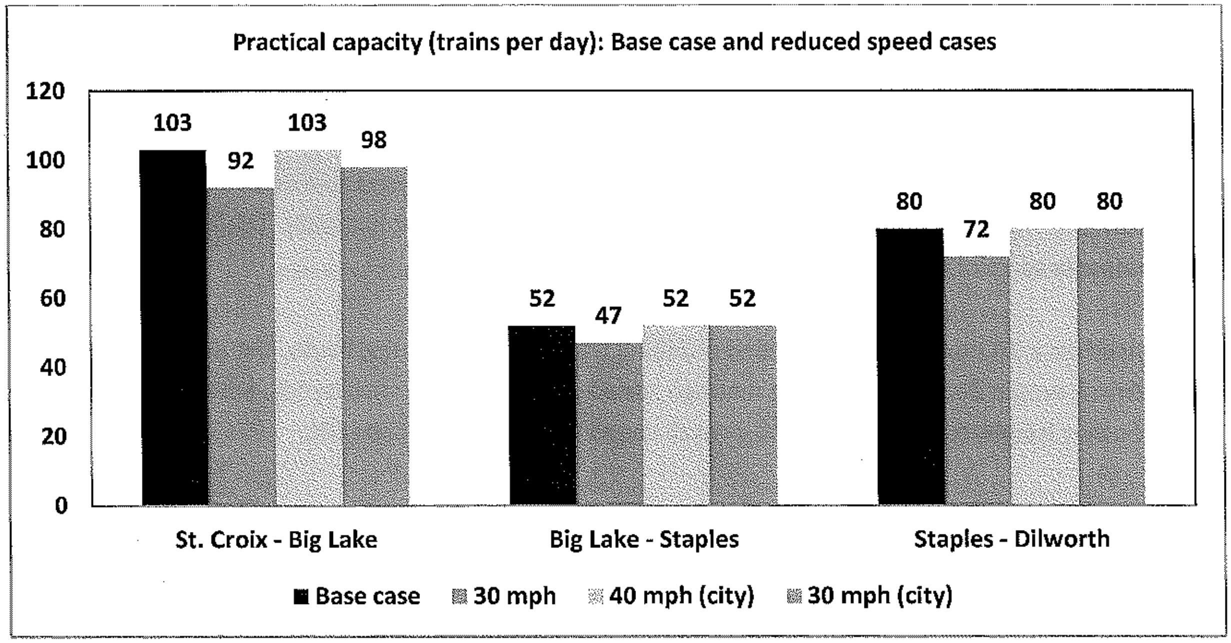
The snapshots that follow illustrate the difference in capacity and performance across a 262 mile portion of BNSF's Highline route. This particular segment extends from St. Croix, MN (near St. Paul), to Dilworth, MN (near Fargo, ND).

This segment contains 41 miles of single track, 173 miles of two-main tracks with signals for operation in both directions on both tracks, and 48 miles of double track, where trains operate in one direction only on each of the two tracks. Thus, the example includes all three of the principal track configurations we have on the Highline, and, indeed, across most of our system. Shown below is the map for this specific 262 mile segment on the highline route.

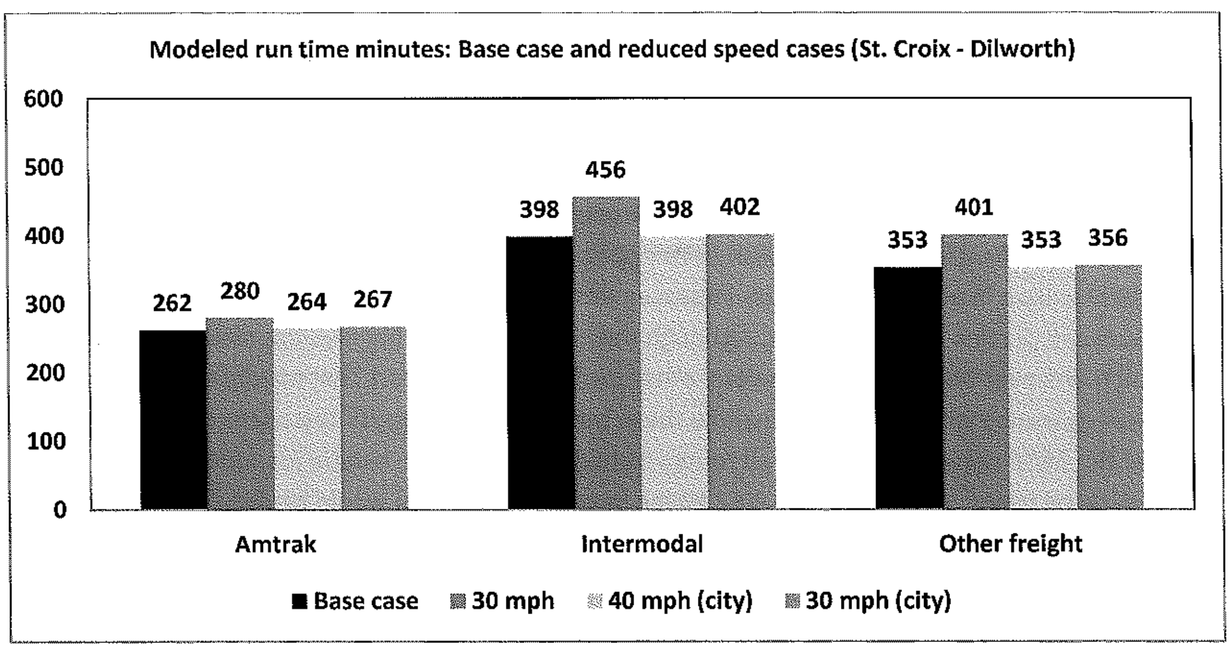
In the graph below, we show the difference in average speed for passenger trains, intermodal trains (including automotive trains), and for all other freight trains when comparing Base case (loaded crude oil trains at 50 mph maximum speed) with other cases where the speed of the loaded crude oil trains is reduced. In the case where the speed is restricted to 30 mph for the entire route, the decline in average speed is 3 mph (6%) for Amtrak, 5 mph (13%) for intermodal trains, and 4 mph (11%) for other freight trains on the St. Croix - Dilworth segment.



In the next graph, we show the difference in maximum practical capacity per day across various subsets within the St. Croix - Dilworth segment. This loss in capacity occurs regardless of whether the line is single track or double track. If the section is single track, the slower speed oil trains take longer to travel between sidings, and that delays the other trains. If there are two main tracks, or double track, but consequently no sidings, the faster trains must follow the slower ones, since there is no place for the slower trains to get out of the way of the faster ones – it's like a two-lane road with curves and steep grades: two yellow lines, so no passing, and no passing lanes: every car following a slow truck must simply slow down and wait the length of the stretch. This comparison shows that we will lose 10 to 11% of our effective slot capacity in number of trains per day if loaded crude oil trains are restricted to 30 mph over the entire route.



Finally, the last graph shows the modeled run times for the Amtrak trains, intermodal trains, and for all other freight trains as a result of restricting the speed of the loaded crude oil trains. The difference in these times would represent the additional time we would need to add to the schedules just to travel these 262 miles with something close to the same schedule dependability we have now. Based on reducing the speed to 30 mph for the entire route, this shows that we would have to add 18 minutes, or 7% to the Amtrak schedule time, 58 minutes, or 15% to the schedule of our intermodal trains, and 48 minutes, or 14% to the schedules of our other freight trains.



Expanded: the Impact System wide –

We have used this same methodology to assess the impact of this proposed rule across the entire highline between Aurora and Spokane (as noted before: 1,815 miles, not just 262). The resulting negative impacts to velocity and capacity are significant:

- Based on a 30 mph speed for loaded crude oil trains over the entire route, the average speed of Amtrak would decline by 8%; the average speed of intermodal trains by 5%, and average speed of other freight trains by 12%. The overall speed reduction would be 9%.

- The loss in track capacity per day would vary by subdivision across the route, but on a consolidated basis comes out to roughly 7% of our existing capacity to handle current, much less future demand. At today's volumes alone, we estimate that $800 million in additional capital would be required to re-gain this lost capacity just on the Aurora – Spokane portion of our network alone.

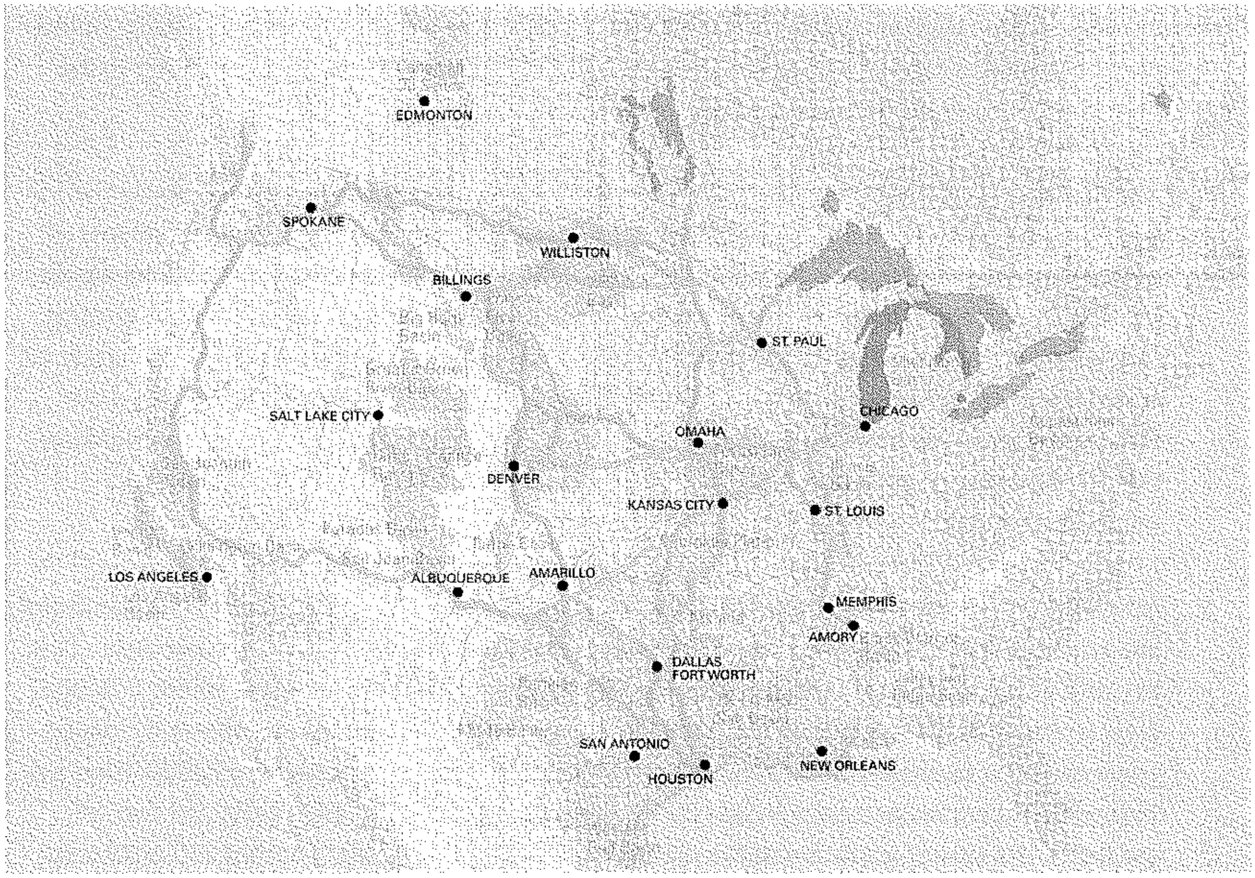
- If we carry out the calculations for added time requirements for Amtrak and freight trains across the entire Highline, we find that the Amtrak schedules would have to be lengthened by 2.2 hours, the intermodal schedules by 2.8 hours, and the other freight schedules by 6.1 hours to maintain the same reliability we have now. These longer schedules are not likely to be acceptable to both Amtrak and our freight customers for whom we must provide dependable service on commercially acceptable schedules. In particular, the domestic intermodal business across the highline route would be at risk, as we would no longer be competitive from a service standpoint. Intermodal is the most service-sensitive business on the Highline and generates approximately $600 million in annual revenue for BNSF.

- If this rule is imposed, BNSF will have to invest in substantial added track, in the form of otherwise unneeded sidings or additional mainline tracks, so that faster trains can overtake, or meet, the many slower crude oil trains. This is essentially an unfunded investment mandate, and would absorb capital that we (like other railroads), would prefer to spend on expanding our capacity to handle more trains with better performance. As stated above, we estimate up to $800 million in additional capacity improvements would be needed on just the Aurora – Spokane portion of our network. Although this route currently handles the majority of the crude oil trains over BNSF, there are several other routes in our network that handle these trains, as well as routes with potential to handle these trains. The last page of this memo contains a view of the BNSF network map, with all routes highlighted where we handle (or soon will handle) crude oil trains. We estimate that $2 billion in additional capital would be required to re-gain lost capacity on routes outside the Aurora – Spokane portion of our network.

- BNSF's crude oil transportation customers would experience a loss of delivery capability of their fleets. At current loading and delivery rates, 11,280 tank cars would have to be added to the fleet in order to regain the current flow rates.

- It would take BNSF about four years to overcome the loss of capacity caused by slowing the loaded crude trains. In the meantime, operating impacts would be severe. Immediate loss of capacity on principal routes which are now fully utilized would mean that some volume would be forced off of the railroad until investments replaced the lost utility. On the northern route that would imply that some major lines of business including grain, grain products and crude oil, would suffer service reductions during the recovery period. It is also important to point out that the system wide investment of approximately $2.8 billion in recovery capacity will change the cost of transportation to existing and new business volumes in order to finance this unfunded mandate.

- In addition to revenue losses during the four year utility recovery period there will be significant impacts to BNSF's cost of operation. Crew wages will rise by about $340 million per year because of the necessity to use two crews on all districts of 150 miles or more where only one crew is presently used as well as the need to relieve about 20% of crews not operating loaded crude oil trains because of the delays incurred following these trains. Another $200 million per year will be spent on increased freight car equipment rentals, locomotive costs and fuel, all caused by the slower operation of the railroad. We also estimate that another $90 million per year will be spent on lost productivity of track maintenance employees when line capacity is filled because of slow trains and overtakes. In summary, the imposition of significant maximum allowable train speed reductions for loaded crude trains will have a profound effect on BNSF's ability to serve its customers. The financial impact to BNSF would be approximately $2.8 billion to recover the utility of the network while annual additional costs of the impacted operation would be about $630 million per year.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