

# Northstar Commuter Rail Extension Feasibility Assessment

## Summary Report

July 31, 2020



Photo Credit: Dave Gonzalez

Prepared for



by



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## 1. Introduction

Northstar commuter rail passenger service currently provides peak hour train service on weekdays with five inbound trips and one outbound trip in the morning peak and five outbound trips and one inbound trip in the afternoon peak between Target Field Station in Minneapolis, MN and Big Lake, MN. Weekend service on a more limited schedule is also provided. The service operates over BNSF Railway's (BNSF) tracks and provides intermediate station stops in Fridley, Coon Rapids-Riverdale, Anoka, Ramsey, and Elk River, MN. A dedicated locomotive and passenger car maintenance facility for Northstar service is located at Big Lake, MN and is operated by Metro Transit. BNSF train crews that operate the Northstar commuter service are based at BNSF's Northtown Yard.

At the direction of the Minnesota State legislature, the Minnesota Department of Transportation (MnDOT) is studying the extension of Northstar service to St. Cloud, MN, a city located approximately 27 miles northwest of Big Lake, and approximately 67 miles from Target Field Station in Minneapolis. In furtherance of this legislative directive, MnDOT and Metro Transit convened a project team to assess the operational feasibility of a Northstar extension.

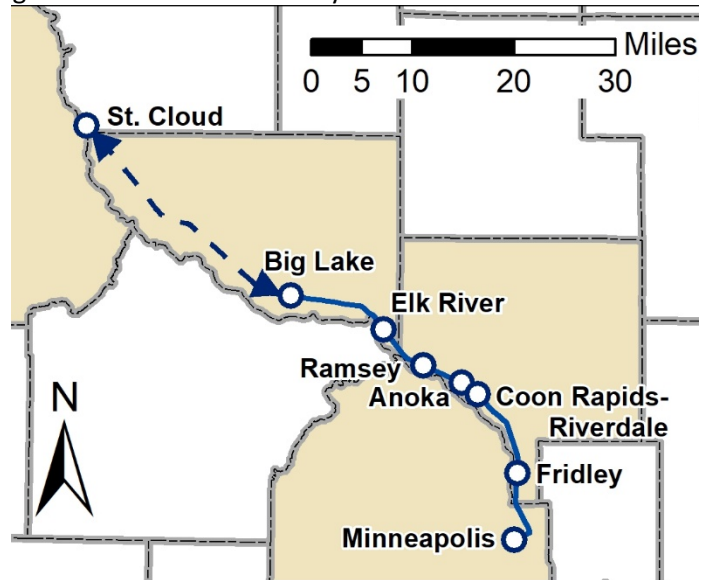


Figure 1: Northstar Corridor Map

## 2. Objective

The objective of this feasibility assessment is to provide decision makers with the estimated capital, operating, and maintenance costs of a range of service alternatives to extend Northstar service to St. Cloud that have been determined to be operationally feasible by BNSF. This was accomplished using the following analysis.

- Using Rail Traffic Controller™ (RTC) modeling software, identify the track and signal improvements required to operate the service alternative's schedule reliably and without undue impact on freight traffic.
- Identify additional equipment requirements and corresponding maintenance facility expansion needs.
- Prepare conceptual design plans for the anticipated track improvements.
- Estimate the capital cost for track, signal, equipment, and facilities for each service alternative.
- Estimate the direct operating and maintenance costs for each service alternative. (This excludes the cost associated with gaining access to the BNSF track.)

One or more of these service alternatives would then be carried forward for additional analysis including

ridership, revenue, and cost-effectiveness studies. Governance and funding also need to be addressed.

### 3. Existing Conditions

This section defines the technical terms used throughout this report and describes the existing track, signal, and traffic conditions on BNSF between St. Cloud and Minneapolis.

#### 3.1. Technical Terms

Several technical railroad terms, which are used in the description of Existing Conditions and the Proposed Capital Improvements, are explained below:

- **Main Track:** A track – not including yard or auxiliary tracks extending through yards and between stations – over which a railroad’s trains operate under the authority of a train dispatcher (also known as a Centralized Traffic Control (CTC) control operator). See definition of ‘CTC’ below.
- **Subdivision:** The main track(s) from one station on the railroad to another. A Subdivision may be single track, or there are two or more parallel main tracks. See definition of ‘station’ below.
- **Siding:** A track that is parallel to the main track and is for the meeting or passing of trains. Siding track is used only under the authority of the train dispatcher or CTC control operator.
- **Junction:** A point where one or more railroad Subdivisions converge.
- **Wye Track:** A track configuration at a junction, generally in the shape of the letter “Y,” that enables a train from one Subdivision to proceed onto another subdivision in either direction.
- **Milepost:** A sign located beside the main track bearing a number that indicates the number of miles from the beginning of the Subdivision, junction, or major terminal. Stations, CTC control points, junctions, and signals each are assigned a “milepost” (such as milepost 21.1) to indicate the specific location of the feature along the Subdivision. Milepost is shortened to “MP”.
- **Station:** A place with a railroad feature designated by name and milepost location on the subdivision page of a railroad’s operating timetable. (Example: “CP Interstate” is the name of a “station” at MP 15.5 on BNSF’s Staples Subdivision at which a CTC control point is located.) There is no requirement for a “station” to have facilities to serve passengers, though some do.
- **Turnout:** Special trackwork with two movable rails, often referred to as a “switch,” that enables a train to diverge onto another track. Turnouts are used in main tracks, in terminals, in yard tracks, and for access to industry, maintenance facilities, and storage tracks.
- **Crossover:** Special trackwork consisting of a turnout, a short segment of connecting track and another turnout, that connects two parallel main tracks so that a train moving *in one direction* (For example: westbound) at that location can switch from one track to the other while still moving in the same direction.
- **Universal Crossover:** Special trackwork that provides two connections between parallel main tracks. This allows a train moving *in either direction* (westbound or eastbound) to switch from one track to the other while still moving in the same direction.

- **Wayside Signals:** Color lights displayed along the track that display aspects visible to the locomotive engineer. Signals are located on high masts beside the track, on cantilever or signal bridge structures over the track or on ground level installations (often used in yards and terminals).
- **Signal Aspect:** The appearance of a wayside signal as viewed by a locomotive engineer that indicates the condition of the track ahead as well as speed and route information.
- **Centralized Traffic Control (CTC):** Turnouts and crossovers may be operated manually or remotely. CTC is a signal system installed along the railroad that enables the control operator to operate track switches, crossovers, and display signals located at CTC control points (CP) from a remote office location. It enables the control operator to route trains from track to track without the need for the train crew to stop the train and operate track switches by hand. The CTC system relays information to the trains via indications displayed on wayside signals. These indications authorize train movements and provide warnings requiring a train to slow down or stop. CTC provides a railroad additional capacity compared to the same railroad without CTC installed.
- **CTC Control Point (CP):** An installation with a specific name and milepost location (Example: CP Coon Creek-MP 21.0) on the railroad where the switches and signals are under the control of the train dispatcher or control operator. Within the limits of the CP, the switches are power-operated and controlled by the control operator. The signal aspects (what the locomotive engineer sees from the cab) indicate when it is permissible for a train or engine to proceed, the route to be used, and the maximum speed permitted over the switches on that route.
- **Positive Train Control (PTC):** A GPS-based safety system which enforces the signal indications displayed by the CTC signals. PTC tracks the locations of all trains in the PTC territory and uses their length, weight, and speed to ensure the CTC indications are enforced. PTC can slow down or stop trains in violation of CTC. The main purposes of PTC are to:
  - Prevent train accidents by enforcing maximum speed limits and speed restrictions;
  - Prevent a train from operating beyond its limit of authority by enforcing the indications displayed by the signals;
  - Prevent a train from passing over a turnout that is not properly lined for the train's movement; and
  - Prevent a train from entering the working limits of maintenance-of-way crews working on the tracks with men and equipment and where the track may also be impassable.
- **Diverging Route:** A track route by which a train or engine uses one or more turnouts and/or crossovers to leave the track it is on and move to another track or route created by their switches. (Example: At CP Coon Creek, a westbound train from Northtown Yard could use a diverging route to proceed from the Staples Subdivision onto the Hinckley Subdivision to Superior and Duluth.) The railroad prescribes the maximum speed for passenger and freight trains using diverging routes. These speeds are typically published in the railroad's System Timetable & Special Instructions. (For example: A Northstar commuter passenger train moving

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along the BNSF main track may be permitted to proceed at 79 miles per hour. If the train needs to operate through a turnout or crossover on a diverging route (such as at CP Coon Creek), the maximum safe speed on that diverging route may be limited to a lower speed such as 40 miles per hour.)

- **Crew Change Point:** A location where a train will stop on either of the two main tracks or in the yard to change crews. The train crew's hours of service are regulated by FRA. Fresh outbound crews are scheduled to replace inbound crews on through-trains at designated crew change points such as Northtown Yard. The crew change includes exchange of information and instructions and requires a test of the PTC system. It may also require a test of the air brake system. Crew changes can take anywhere from 15-60 minutes depending on conditions and the availability of the outbound crew. If the crew change occurs on the main track, that track becomes unavailable for use by any other train in either direction until the stopped train departs with the fresh crew.
- **Changing Ends:** A term that, in this report, describes the activities of a Northstar commuter train crew which has arrived at the end of its trip and must prepare the train for changing its direction of travel. Once the train stops at the station and passengers have alighted, the locomotive engineer sets the brakes and controls in the locomotive, then walks back to the cab control car ("cab car") on the opposite end of the train, and sets the brakes and controls in the cab to the proper position. The engineer and conductor must make a test of the air brake system functionality and then the engineer must test the functionality of the PTC system which includes contacting the railroad's back office computer and ensuring that all electronic files for the planned movement are properly synchronized. Once passengers are aboard and the train has received an authorizing signal from the CTC system, it can depart. This process usually takes just under 15 minutes for a commuter train if no abnormalities are discovered during the process.
- **Trainset:** In this report, the term refers to the equipment that comprises one Northstar commuter train. A trainset typically includes one locomotive, three bi-level commuter passenger coaches, and one bi-level commuter cab control car. Northstar trains have a locomotive on the west end of the train facing away from Target Field Station on westbound trips (pulling the train). On eastbound trips, the locomotive engineer operates the train from the cab in the east end of the cab control car, which is the leading car of the inbound train with the locomotive pushing the train. Although Northstar trains normally have four coaches, the platforms at Northstar stations can accommodate a five-car Northstar train if necessary.
- **Z-Train:** BNSF's designation of an intermodal freight train that is usually the fastest and highest priority freight train on the railroad. Z-Trains carry time-sensitive cargo on carefully coordinated, high-performance, guaranteed delivery schedules. The trains normally carry cargo in Trailers-On-Flat-Car (TOFC) or double stack freight containers or both. Customers are required to deliver their trailer or containers to the railroad's terminal at origin by a specific time for loading. The railroad's terminal logistics, train operations, and track maintenance activities are arranged to ensure that the Z-Trains depart at the scheduled time, run without delays, connect only at certain major terminals with other trains, and arrive at their destinations on schedule. The customers' trailers or containers are then taken off the rail cars and made available to the customers' transport service at destination by a specific time so that they can

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continue in the customer’s logistical operations to their final destinations. Several of the nation’s parcel delivery services, refrigerated transport carriers and high-priority freight consolidating companies move their commodities on BNSF’s Z-Trains.

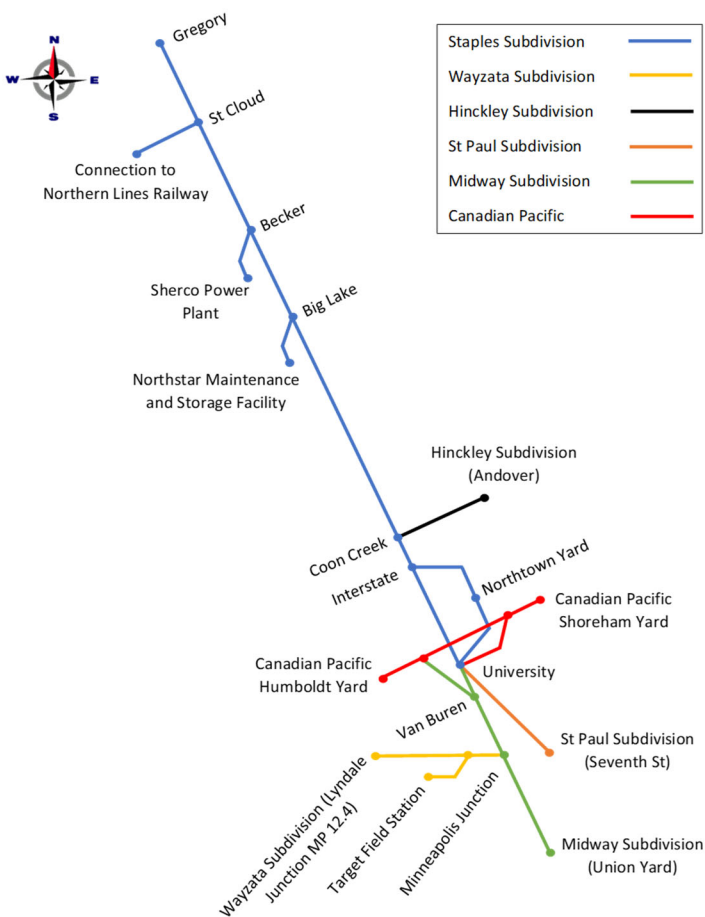
### 3.2. Existing Conditions

The Northstar corridor consists of the tracks owned by BNSF between St. Cloud, MN and Minneapolis, MN. For the feasibility assessment, the Northstar corridor was divided into three physical segments as follows:

- St. Cloud to Big Lake, including CP Big Lake
- Between CP Big Lake and CP Coon Creek, not including CP Coon Creek
- CP Coon Creek to Target Field Station in Minneapolis.

Figure 2 presents key locations within the Northstar corridor.

**Figure 2: Northstar Corridor Key Locations**



The sections below discuss the key locations in the Northstar corridor by segment.



#### 3.2.1. St. Cloud to Big Lake

The segment between St. Cloud and Big Lake is on the BNSF Staples Subdivision. The railroad has two main tracks equipped with CTC and PTC. Track 1 is the north/east track and Track 2 is the south/west track. On the railroad, trains moving away from Minneapolis are considered “westbound” trains. Trains moving toward Minneapolis are considered “eastbound” trains. The maximum speed for passenger trains (Amtrak and Northstar) is 79 MPH and for freight trains is 60 MPH.

CTC control points with crossovers are currently located at St. Cloud (MP 73.6), MP 66 (MP 66.1), CP 528 (MP 52.8), and Big Lake (MP 46.6). BNSF’s freight traffic in this segment consists of a high volume of time-sensitive, high-performance (guaranteed arrival/Z-Trains) intermodal trains, other intermodal trains of trailers-on-flat-cars, domestic and international cargo containers and automobiles, manifest trains of mixed freight car types and cargo, unit trains of coal, grain, ore, aggregates, sand, petroleum products, and other commodities. Approximately 293 freight trains per week are estimated to operate on this segment today, including 57 guaranteed arrival/Z-Trains.

Amtrak’s Empire Builder intercity passenger train between Chicago and the Pacific Northwest has a station stop in St. Cloud. The station also serves as the base for a BNSF local freight train and the Northern Lines Railway, a short line railroad serving industries in the St. Cloud area. Unit trains of granite ballast originate at a large quarry southwest of St. Cloud and move through St. Cloud via the west and east wye tracks near the station to destinations on the BNSF system.

Another major freight customer, the Sherco coal-fired electrical generating station is located at Becker, 16.4 miles southeast of St. Cloud. Trains serving Sherco normally arrive loaded from the west and depart empty back to the west via one manually operated turnout located on Main Track 2 at MP 57.2 (Becker). The St. Cloud-Norhttown Yard BNSF local freight train stops at the Becker siding off Track 1, twice daily, to set out and pick up freight cars. Because there are no crossovers between main tracks at Becker, the area becomes very congested with trains accessing Sherco.

Existing Northstar commuter rail service currently terminates at the Big Lake Station. The Big Lake Northstar station serves passengers on a stub track off Main Track 2 at MP 48.8. Northstar equipment is inspected, serviced, maintained, and stored at the Big Lake Maintenance Facility (BLMF) located on a group of tracks off the Big Lake Station track about one-half mile east of the Big Lake Station. The BLMF is currently operating at its maximum capacity for Northstar trainset storage.

#### 3.2.2. Between CP Big Lake and CP Coon Creek

The segment between CP Big Lake and CP Coon Creek is also on the BNSF Staples Subdivision. Maximum train speeds and track designations are the same as in the St. Cloud to CP Big Lake segment. CTC control points are located at CP 421 (MP 42.1), West Elk River (MP 36.9), East Elk River (MP 36.7), Ramsey (MP 29.3), West Anoka (MP 27.3), East Anoka (MP 27.0), CP 254 (MP 25.4) and CP 251 (MP 25.1 at Coon Rapids-Riverdale). The east end of this segment terminates at and does not include CP Coon Creek (MP 21.0).

Between Big Lake and Coon Creek, the train traffic, volume, and speed limits are generally the same as in the St. Cloud to CP Big Lake segment with three important exceptions:



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- Coal trains to and from Becker do not travel via this segment and there are no major industrial customers in this segment that receive or generate a high volume of rail traffic.
- Northstar commuter service between Big Lake and Minneapolis currently provides service to four stations including Elk River, Ramsey, Anoka, and Coon Rapids-Riverdale with 12 trains each weekday and 6 trains on Saturdays, Sundays, and holidays. Extra Northstar trains are operated to serve some sporting events in Minneapolis. Northstar trains normally stop at all stations in both directions.
- Amtrak's Empire Builder intercity trains have no scheduled stops in this segment.

Approximately 251 freight trains per week operate in this segment, including 57 guaranteed arrival/Z-Trains.

### 3.2.3. CP Coon Creek and Target Field Station in Minneapolis

The segment beginning with CP Coon Creek at MP 21 and ending at Target Field Station in Minneapolis is complex, congested, and constrained. Between CP Coon Creek and CP University, the track is part of the BNSF Staples Subdivision, and includes Northtown Yard and its lead tracks stretching from MP 16.3 to MP 11.5 at CP University. East of CP University, two tracks of the BNSF Midway Subdivision are parallel to two tracks of the BNSF St. Paul Subdivision to about MP 11.0. From CP Van Buren around the wye at Minneapolis Junction through CP Harrison Street to Target Field Station, the track is part of the BNSF Wayzata Subdivision.

The railroad has two main tracks with CTC and PTC from CP Coon Creek to CP Van Buren and a single main track from CP Van Buren through Minneapolis Junction to Target Field Station. Train speeds reduce from 79 MPH for passenger trains at CP Coon Creek to 40 miles per hour around Northtown Yard. Freight trains speeds reduce from 60 MPH at CP Coon Creek to speeds as low as 10 miles per hour in the Northtown area as trains go through turnouts and crossovers at junctions and while entering and leaving Northtown Yard. Through-freight trains, most of which are well over one mile long, stop on the main tracks near MP 15 at Northtown Yard to change crews. Frequently, freight trains are stopped alongside Northtown Yard on both main tracks simultaneously changing crews. Following trains often queue up behind the trains changing crews, blocking junctions and access to connecting tracks.

During the AM and PM peak periods, BNSF normally reserves one main track paralleling Northtown Yard for Northstar commuter trains to operate unimpeded. This restricts freight trains to one track, creating congestion and delaying freight trains until a track is available for them to operate. Amtrak's eastbound Empire Builder Train No. 8 operates through the Northstar Corridor in the AM peak period along with Northstar commuter trains. The westbound Empire Builder, Train No. 7, normally operates after 10:00 PM and avoids both peak periods and Northstar commuter trains. Amtrak trains have no scheduled stops in this segment.

This segment has several key junctions and connections with other BNSF lines and other freight railroads. It begins with the junction at CP Coon Creek (MP 21.0). The single-track Hinckley Subdivision diverges to the north at CP Coon Creek and extends to Superior, WI and Duluth, MN. At CP MP 16.3, the two long lead tracks extending from the west end of Northtown Yard join the parallel two-main-track Staples Subdivision. The Northstar Fridley station is located at MP 16.0 on the west side of Main Track

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2. Northstar trains in both directions use Track 2 at this point to serve Fridley. CP Interstate (MP 15.5) is the west end of Northtown Yard where several crossovers are located to enable freight trains to enter and leave the yard and to change main tracks while remaining on the Staples Subdivision. At CP 35<sup>th</sup> Avenue (MP 12.6), a new connecting track from the Canadian Pacific Railway (CPR) joins the recently reconstructed BNSF lead to CP Van Buren, providing a direct main track connection for CPR freight trains to and from the west to connect with BNSF.

CP University (MP 11.5) is the busiest of the junctions in this segment. It is the east end of Northtown Yard where BNSF switching movements frequently use the lead tracks and main tracks to assemble outbound freight trains. It is also the connection with CPR's Shoreham Yard. The Staples Subdivision terminates at CP University, with the two-main-track St. Paul Subdivision diverging to the east/southeast and the two main track Midway Subdivision continuing southeast to CP Van Buren. At CP Van Buren (MP 10.3), the Midway Subdivision becomes single track for a short distance, continues east to BNSF's busy Union Yard and on to 7<sup>th</sup> Street in St. Paul and Chicago. Union Pacific Railroad (UPRR) and CPR freight trains also use this route. At CP Van Buren, Northstar trains use the west leg of the wye at Minneapolis Junction to reach the Wayzata Subdivision at CP Harrison Street. Northstar trains continue down the Wayzata Subdivision, crossing the Mississippi River, and entering Target Field Station at CP Stadium. The Wayzata Subdivision continues to the southwest linking BNSF's Midwest grain lines to the Twin Cities. Freight trains of the Twin Cities & Western Railroad (operating the former Milwaukee Road lines in Minnesota) also use the Wayzata Subdivision to access the Twin Cities.

Approximately 411 freight train movements currently operate in various portions of this segment each week. Some are through-trains, including Z-Trains, that only change crews at Northtown Yard. Others originate or terminate at Northtown Yard, and others stop, set out, and pick up cars, change locomotives and crews, and then continue through. The number of trains varies each day. Some through-trains are counted twice; first as an inbound movement to Northtown and hours later as an outbound movement from Northtown Yard. Both scheduled and on-demand trains (coal, grain, aggregate, petroleum, etc.) move in this segment. Because of the many junctions and freight yard connections, all the freight trains move more slowly and/or stop in this segment. Many of the train movements in and out of yard tracks, through diverging movements at junctions and following other trains, are made at only 10 miles per hour. At junctions, trains must frequently stop and wait for other trains to clear before they are able to proceed. As a result, the combination of more trains, conflicting routes, and trains moving more slowly creates a system bottleneck for BNSF.

## 4. Alternatives Considered

Initially, four Service Alternatives were identified by MnDOT for evaluation. The Service Alternatives covered a range of options to extend rail service to St. Cloud from the very minimum (two trips per day serving St. Cloud) to the maximum (12 trips per day serving St. Cloud); all trips would have been extensions of existing Northstar service trains.

In coordination with BNSF, Quandel Consultants developed schedules for the initial Service Alternatives, reflecting the constraints of the BNSF corridor (**Appendix A** discusses the existing constraints in detail). As this work progressed, schedules for an "intermediate" Service Alternative and the "maximum" Service Alternative were determined to be infeasible because of the potential impacts to BNSF

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operations and to operating and maintenance costs. Two additional Service Alternatives were developed to replace the two determined to be infeasible.

The final four Service Alternatives include a minimum service option, an option that would provide four trips per day to St. Cloud, an option that would provide four Express trips per day to St. Cloud, and an option that would provide nine trips per day to St. Cloud, including a later evening train from Minneapolis to St. Cloud. Except for minor schedule adjustments, the four Service Alternatives preserved the existing Northstar service between Minneapolis and Big Lake.

The Service Alternatives considered in this Feasibility Assessment include:

- Minimum Service Alternative
  - One peak direction trip – morning and afternoon peak periods
- Minimum Bi-Directional Service Alternative
  - One peak direction, one off-peak direction – morning and afternoon peak period
- Northstar Express Service Alternative
  - One peak direction Express, one off-peak direction Express – morning peak period
  - One peak direction Express, one off-peak direction Express – afternoon peak period
- Bi-Directional Service Alternative
  - Two peak direction, one off-peak direction – morning peak period
  - Three peak direction, two off-peak direction – afternoon peak period
  - One additional SB train from Big Lake to Minneapolis
  - One late evening NB trip from Minneapolis to St Cloud

Each Service Alternative includes two inbound and two outbound Express service trains between Minneapolis and St. Cloud on Saturdays and Sundays/holidays in addition to the current level of service offered on weekends and holidays.

Table 1 presents the number of trains operating on weekdays by Service Alternative.

**Table 1: Trains Operating between Minneapolis (Mpls) and St. Cloud by Service Alternative**

|                                       | Weekday           |                   |                   |                   |                   |                   |                   |                   |
|---------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                                       | Morning           |                   |                   |                   | Afternoon         |                   |                   |                   |
|                                       | Local             |                   | Express           |                   | Local             |                   | Express           |                   |
|                                       | St. Cloud to Mpls | Mpls to St. Cloud | St. Cloud to Mpls | Mpls to St. Cloud | St. Cloud to Mpls | Mpls to St. Cloud | St. Cloud to Mpls | Mpls to St. Cloud |
| <b>Minimum Service</b>                | 1                 | -                 | -                 | -                 | -                 | 1                 | -                 | -                 |
| <b>Minimum Bi-Directional Service</b> | 1                 | 1                 | -                 | -                 | 1                 | 1                 | -                 | -                 |
| <b>Northstar Express Service</b>      | -                 | -                 | 1                 | 1                 | -                 | -                 | 1                 | 1                 |
| <b>Bi-Directional Service</b>         | 2                 | 1                 | -                 | -                 | 2                 | 4*                | -                 | -                 |

\*One NB trip would operate in the evening

## 5. Development of Operating Assumptions

Operating assumptions reflect a variety of factors considered in the operations analysis of the proposed service. Assumptions were developed for the operation of each of the four Service Alternatives considering Federal Railroad Administration (FRA) regulations, physical limitations of the railroad, operating requirements of the railroad, locomotive and passenger car fleet needs, existing service contracts between BNSF and Metro Transit, labor agreements, and more. The following appendices document the operating assumptions for the four Service Alternatives:

- **Appendix B** – Technical Memorandum on Operating Assumptions for the Minimum Service Alternative
- **Appendix C** – Technical Memorandum on Operating Assumptions for the Minimum Bi-Directional Service Alternative
- **Appendix D** – Technical Memorandum on Operating Assumptions for the Northstar Express Service Alternative
- **Appendix E** – Technical Memorandum on Operating Assumptions for the Bi-Directional Service Alternative

Discussions of the removal of the original “intermediate” alternative and the original “maximum” alternative are included in Appendix C and Appendix E, respectively.

## 6. Rail Operations Modeling

Once the Service Alternatives’ operating assumptions were reviewed by BNSF, Rail Traffic Controller™ (RTC) software was utilized to evaluate the impact that each Service Alternative had on current and future BNSF traffic. Track and signal improvements and passenger train equipment required to operate each Service Alternative schedule reliably and without undue impact on freight traffic were identified.

Using an RTC model provided by BNSF in 2013, new models were developed to replicate existing

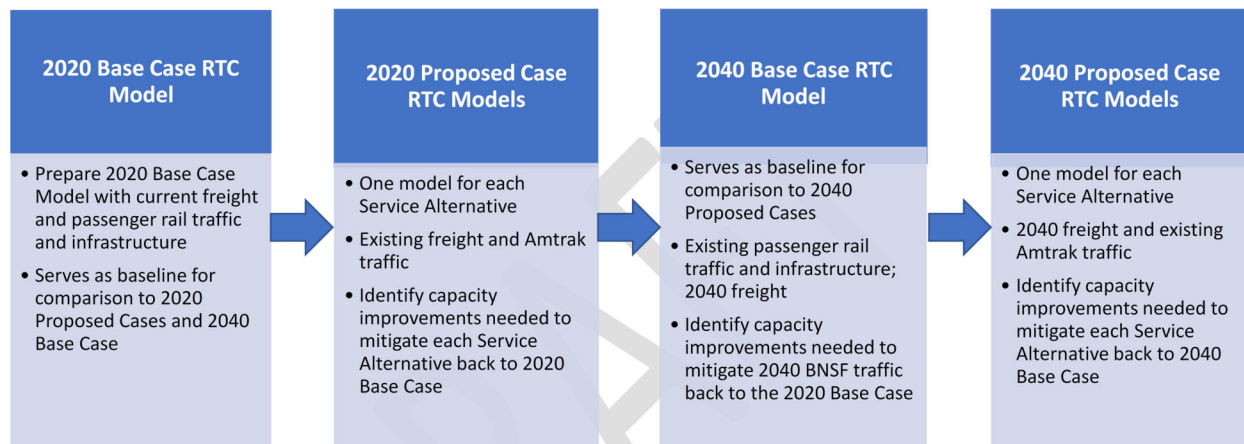
conditions (2020) and future conditions in a horizon year (2040). The following elements were updated in the models to reflect changes in rail infrastructure and traffic since 2013:

- Track
- Signal types, locations, and aspects
- Speed limits on main track and through turnouts and crossovers
- Weekly train counts and schedules for Northstar and Amtrak intercity passenger rail services
- Weekly freight counts and train types

For 2040 analyses, freight traffic was projected to grow through the 20-year horizon period by increasing the number of freight cars by 2% per year compounded. Each train type was evaluated separately as certain traffic is expected to remain constant (i.e., coal traffic), while other train types are expected to grow or fluctuate (i.e., grain traffic depends on U.S. trade agreements).

A four-part analysis was used to evaluate the impacts of the proposed Northstar Service Alternatives on existing and future BNSF traffic. Using RTC, any significant impact caused by the service expansion was measured and mitigated. Through this process, the infrastructure needed to implement the proposed Service Alternatives was identified. Figure 3 presents the methodology.

**Figure 3: RTC Methodology**



### 6.1. 2020 Observations

In the 2020 Base Case RTC Model, congestion was observed near Becker, where loaded and empty unit coal trains arrive at and leave from the Sherco power plant, and between CP Coon Creek and CP Harrison St, where several hundred freight train movements occur per day, traversing the track and accessing BNSF’s Northtown Yard.

The 2020 Minimum Service Alternative and the 2020 Minimum Bi-Directional Service Alternative models showed that additional congestion would occur at the proposed St. Cloud Station and at the Big Lake Station. Because these alternatives propose extending existing Northstar trains from Big Lake to St. Cloud, new corridor congestion was only observed between Big Lake and St. Cloud resulting from interference between the new Northstar service and freight trains.

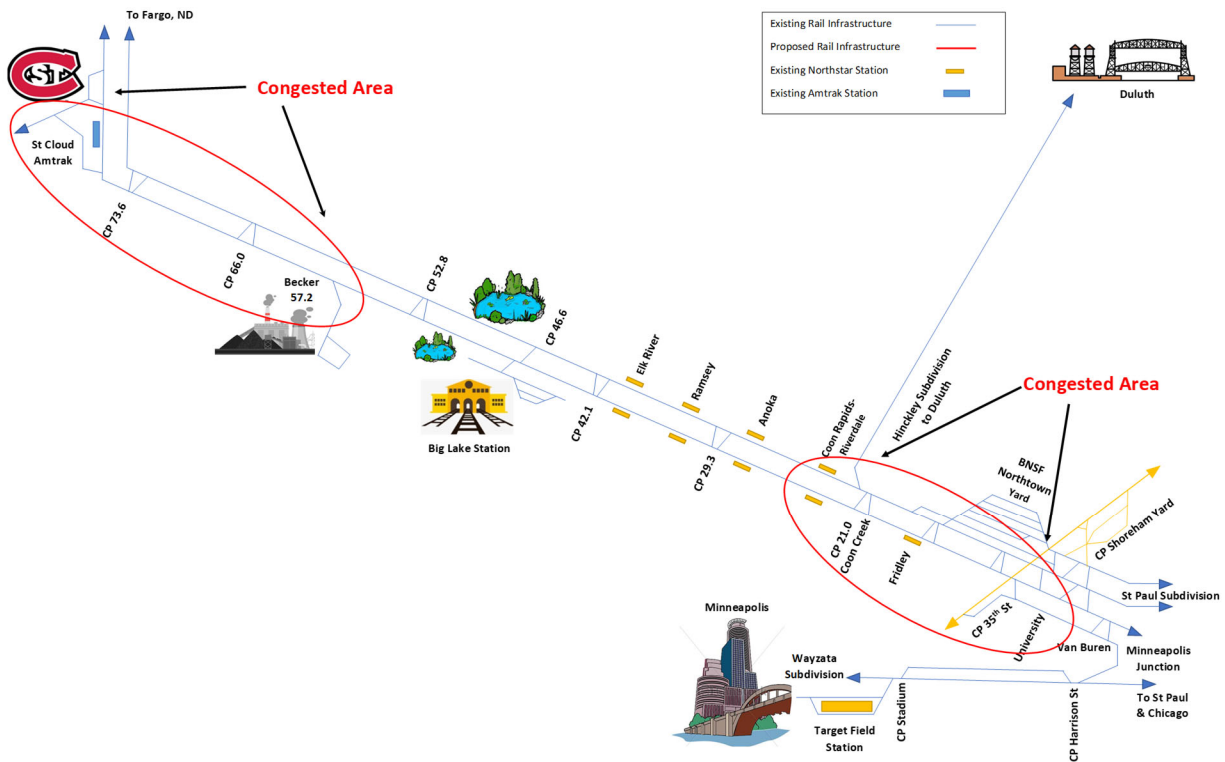
The 2020 Northstar Express Service Alternative and the 2020 Bi-Directional Service Alternative propose

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to add new trains throughout the entire corridor. In addition to the congested segments discussed for the Minimum and Minimum Bi-Directional Service Alternatives, congestion was observed between CP Coon Creek and CP Interstate.

Figure 4 illustrates the congested areas in the corridor in 2020.

**Figure 4: 2020 Congested Areas**



## 6.2. 2040 Observations

In 2040, the number of freight trains operating in the corridor would increase by about 10% over 2020 levels. Areas that were congested in existing conditions would see more congestion. In addition, the CP Van Buren to CP Stadium segment of track was observed to become more of a bottleneck.

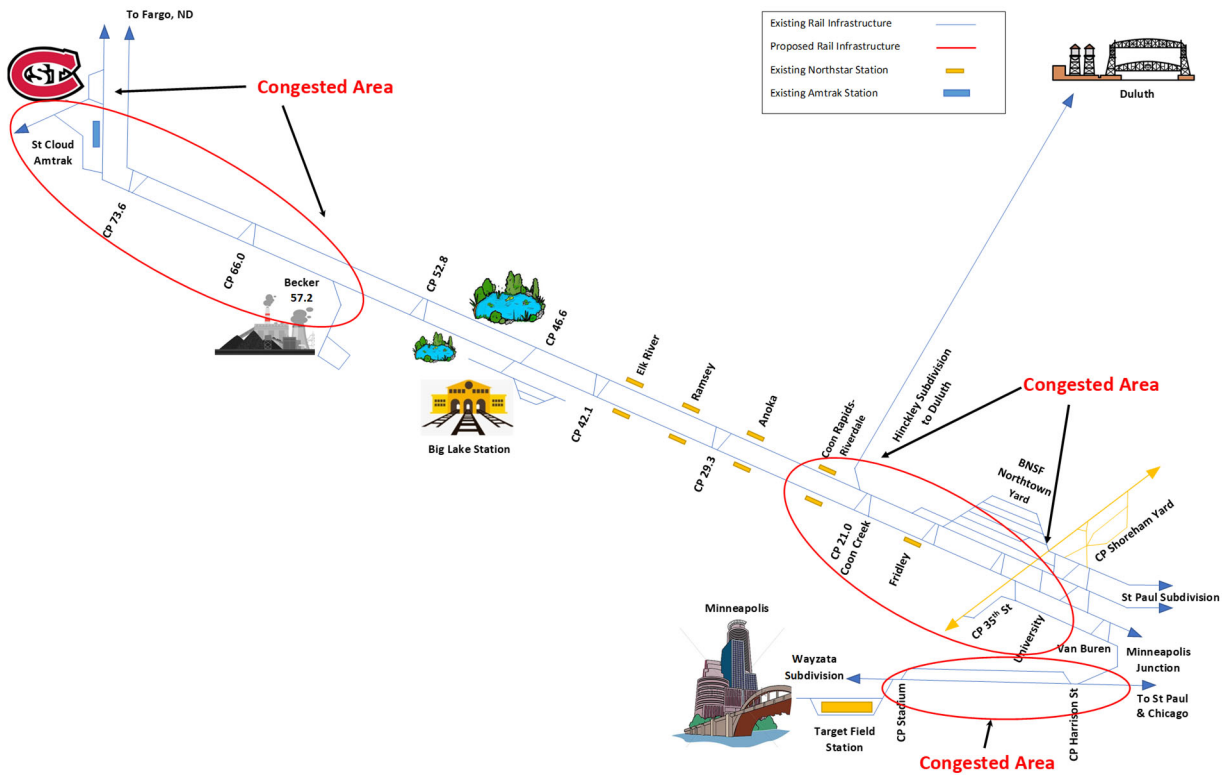
The 2040 Minimum Service Alternative and the 2040 Minimum Bi-Directional Service Alternative models showed that additional congestion would occur at St. Cloud and Big Lake, near Northtown Yard, and between CP Van Buren and CP Stadium.

The 2040 Northstar Express Service Alternative and the 2040 Bi-Directional Service Alternative models showed that additional congestion would occur between St. Cloud and Big Lake and between CP Coon Creek and CP Stadium.

Figure 5 illustrates the congested areas in the corridor in 2040.



Figure 5: 2040 Congested Areas



A detailed discussion of the RTC modeling methodology and results is presented in **Appendix F**.

## 7. Recommended Capital Improvements

Based on the results of the RTC modeling, the following track, signal, equipment, and facilities improvements are recommended for each Service Alternative for initial operation.

- Minimum Service Alternative
  - Extend and connect north end of Big Lake station track to BNSF main track
  - Add station track to St. Cloud station
  - Upgrade universal crossover east of St. Cloud Station
  - Install new CTC Control Point and universal crossover west of St. Cloud station
- Minimum Bi-Directional Service Alternative
  - All the above plus:
    - Add a center platform at Big Lake Station
    - Acquire one additional trainset
    - Expand Big Lake Maintenance Facility to accommodate additional trainset
- Northstar Express Service Alternative
  - All the above plus
    - Third main track between CP Coon Creek and CP Interstate
    - (Exclude center platform at Big Lake Station)

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- Bi-Directional Service Alternative
  - *All the above plus:*
    - Upgrade universal crossover at MP 66
    - Install new CTC Control Point at Becker
    - Center platform at Big Lake Station

In addition,

- All options require upgrade of fare collection systems.

Table 2 provides an overview of the capital improvements needed for each Service Alternative. Cells in blue indicate improvements needed for initial operation and orange cells indicate improvements needed by 2040.

**Table 2: Capital Improvements by Service Alternative**

| Improvements Needed for Initial Operation<br>Improvements Needed by 2040       | Minimum Service Alternative | Minimum Bi directional Alternative | Northstar Express Alternative | Bi Directional Alternative |
|--|-----------------------------|------------------------------------|-------------------------------|----------------------------|
| <b>Overhead and Equipment Costs</b>  |                             |                                    |                               |                            |
| Upgrade Fare Collection Systems  | Blue                        | Blue                               | Blue                          | Blue                       |
| Acquire one additional Northstar trainset                                      |                             | Blue                               | Blue                          | Blue                       |
| Expand Big Lake Maintenance Facility   |                             | Blue                               | Blue                          | Blue                       |
|  |                             |                                    |                               |                            |
| <b>Station Improvements</b>  |                             |                                    |                               |                            |
| Extend and connect Big Lake Station spur track to the north                    | Blue                        | Blue                               | Blue                          | Blue                       |
| Build station siding at St Cloud Station                                       | Blue                        | Blue                               | Blue                          | Blue                       |
| Construct center through platform at Big Lake Station                          |                             | Blue                               | Blue                          | Blue                       |
|  |                             |                                    |                               |                            |
| <b>Control Points, Crossovers and Sidings</b>                                  |                             |                                    |                               |                            |
| Upgrade existing universal crossover east of St Cloud station                  | Blue                        | Blue                               | Blue                          | Blue                       |
| Install new CTC Control Point and universal crossover west of St Cloud station | Blue                        | Blue                               | Blue                          | Blue                       |
| New CTC Control Point at Becker  | Orange                      | Orange                             | Orange                        | Blue                       |
| Upgrade Universal Crossover in CTC Control Point MP 66                         |                             | Orange                             | Orange                        | Blue                       |
| Big Lake West Siding   |                             |                                    |                               | Orange                     |
|  |                             |                                    |                               |                            |
| <b>Additional Mainline Track</b>   |                             |                                    |                               |                            |
| Third Main track CP Coon Creek to CP Interstate                                | Orange                      | Orange                             | Blue                          | Blue                       |
| Third Main Track CP Interstate to CP Van Buren                                 |                             |                                    | Orange                        | Orange                     |
| Second Main Track CP Van Buren to CP Stadium                                   | Orange                      | Orange                             | Orange                        | Orange                     |
|  |                             |                                    |                               |                            |

Conceptual engineering plans and documentation of engineering standards and assumptions are included in **Appendix G**.

## 8. Estimated Capital Costs for Track, Systems, and Equipment

Capital costs were estimated for the Northstar Commuter Rail Extension Feasibility Assessment based on a quantification of the infrastructure improvements necessary to accommodate the expanded

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Capital costs were prepared in 2020 dollars and were forecasted to 2025 dollars using FRA's Standard Cost Category and inflation worksheet. The overall capital costs include professional services fees to cover design costs, program management costs, construction management and oversight costs, and integration, testing and commissioning costs. These costs are included in the estimate as a percentage of construction cost. Contingency costs were also included and were calculated as a percentage of the total capital cost. Contingencies are an allowance for unexpected costs added to the estimated construction costs based on past experience for projects in early stages of definition. Their purpose is to account for items and conditions that cannot be identified with certainty during the conceptual design phase of the project. Contingency percentages vary depending on the level of design completed for the work elements included in a particular category.

Estimated capital costs range from \$36 to \$188 million (2025\$) for capacity improvements required for initial operation.

- Minimum Service Alternative \$36 million
- Minimum Bi-Directional Service Alternative \$96 million
- Northstar Express Service Alternative \$141 million
- Bi-Directional Service Alternative \$188 million

As BNSF freight train traffic rises, additional improvements will be required to maintain service. Total capital costs through year 2040 range from \$139 million to \$257 million.

- Minimum Service Alternative \$139 million
- Minimum Bi-Directional Service Alternative \$207 million
- Northstar Service Express Alternative \$190 million
- Bi-Directional Service Alternative \$257 million

Costs for the individual capital improvements are shown in Table 3.

**Table 3: Costs for Capital Improvements (2025\$)**

| Capital Improvements                            | Cost (2025\$)  |
|---|----------------|
| St. Cloud Improvements                          | \$25.9 million |
| Upgrade Universal Crossovers at CP MP 66        | \$7.6 million  |
| New Becker CTC Control Point                    | \$7.8 million  |
| Big Lake West Siding                            | \$36.2 million |
| Big Lake Track Connection                       | \$9.6 million  |
| Big Lake Station Expansion                      | \$31.1 million |
| Big Lake Maintenance Facility Expansion         | \$8.0 million  |
| Third Main Track CP Coon Creek to CP Interstate | \$76.5 million |
| Third Main Track CP Interstate to CP Van Buren  | \$14.0 million |
| Two Main Tracks CP Van Buren to CP Stadium      | \$19.2 million |
| Equipment Procurement                           | \$21.0 million |

The Technical Memorandum on Capital Cost Estimates is included as **Appendix H** and the Capital Cost Estimating Methodology is **Appendix I**.

## 9. Operating and Maintenance Costs

Operating and Maintenance Costs (O&M costs) represent the expenditures necessary to provide daily commuter rail service and to keep the railroad and equipment in safe operating condition. O&M costs include fuel, salaries and benefits for personnel, cleaning, inspection and minor repair of equipment, track inspection, minor tie and rail replacement, bridge inspection, and maintenance of signal, communications, and grade crossing warning equipment. Annual O&M costs for each Service Alternative were developed in partnership with Metro Transit and were based on their 2020 Northstar O&M budget.

Annual O&M costs are based directly on the operating characteristics of a service. As the number of train miles increases, for instance, the O&M costs increase. The following operating characteristics were used to estimate the annual O&M costs for the Service Alternatives:

1. Number of Stations
1. Maintenance and Storage Facility
2. Operating Train Sets
3. Locomotives
4. Train Cars
5. Staffing

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6. BNSF Train Crews
7. Weekly Crew Van Trips
8. Scheduled Miles

Annual O&M costs were calculated for the following Northstar budget categories:

1. Labor and Benefits
2. Contracted Services
3. Materials, Parts & Supplies
4. Other Expenses
5. Allocated Expenses

Table 4 presents the estimated annual O&M costs in 2025 dollars for existing Northstar service and the four Service Alternatives.

**Table 4: Annual O&M Costs for Existing Northstar and Proposed Service Alternatives (2025\$)**

|                             | Existing Northstar Service (millions) | Minimum Service Alternative (millions) | Minimum Bi-Directional Service Alternative (millions) | Northstar Express Service Alternative (millions) | Bi-Directional Service Alternative (millions) |
|-----------------------------|---------------------------------------|--|---|--|---|
| Labor and Benefits          | \$5.9                                 | \$5.9                                  | \$6.6   | \$6.6  | \$6.6   |
| Contracted Services         | \$9.5                                 | \$11.7                                 | \$13.3  | \$13.6   | \$15.2  |
| Materials, Parts & Supplies | \$2.8                                 | \$4.0                                  | \$4.3   | \$5.3  | \$6.8   |
| Other Expenses              | \$3.8                                 | \$5.1                                  | \$5.5   | \$6.6  | \$8.2   |
| Allocated Expenses          | \$3.0                                 | \$3.0                                  | \$3.0   | \$3.0  | \$3.0   |
| <b>Total O&amp;M Costs</b>  | <b>\$25.0</b>                         | <b>\$29.7</b>                          | <b>\$32.7</b>   | <b>\$35.1</b>                                    | <b>\$39.7</b>                                 |

The cost for a future operator to gain access to the BNSF infrastructure to operate trains between Big Lake and St. Cloud and to operate additional trains between Minneapolis and Big Lake has not been estimated and was not included in the above O&M estimates.

The O&M cost estimating methodology and detailed breakdown of annual O&M costs are presented in **Appendix J**.

## 10. Summary of Next Steps

The analysis described above is limited to operational feasibility and does not address ridership forecasts, revenue projections, cost-effectiveness evaluation, governance, funding, or other analyses that may be necessary to evaluate the appropriateness of proceeding with the Northstar extension project. Once a decision is made to proceed with implementation and prior to the commencement of extended Northstar train service to St. Cloud, additional actions would need to be undertaken.

## **10.1. Preliminary Engineering/NEPA**

Preliminary Engineering (PE) will need to be completed for the proposed capital improvements to support the identified Service Alternative(s). To support PE, the following activities would be undertaken or refined:

1. Documentation of alternatives and selection of preferred alternative
2. Operations modeling
3. Station and Access Analysis
4. Operating and Maintenance Costs
5. Capital Replacement Forecast
6. Capital Cost Estimates

PE will identify any unanticipated engineering issues and confirm the preliminary capital, operating, and maintenance cost estimates. Completion of PE is necessary to complete an environmental review of the project.

In addition, an environmental review of the project will need to be conducted. A determination will need to be made as to which Federal agency has jurisdiction. Typically, the Federal Transit Administration (FTA) is responsible for reviewing commuter rail projects and FRA reviews intercity passenger rail projects.

Once the appropriate Federal agency is identified, the level of environmental review required will be determined. It is possible that the proposed capital improvements in the corridor could be reviewed as Categorical Exclusions. Capacity improvements for the third main between CP Coon Creek and CP Interstate were included as part of the Northern Lights Express Environmental Assessment (EA) and are included in the Finding of No Significant Impact (FONSI) issued by FRA in February 2018.

## **10.2. Equipment Acquisition**

Equipment Acquisition for the locomotive(s) and passenger cars is considered a “long lead time item” which must be carefully addressed at the outset of the project. The agency that will own the equipment is normally the agency that undertakes the acquisition process. Specifications and performance requirements for the equipment must be established and approved by the agency in cooperation with BNSF and the operator. The principal categories of equipment acquisition activity normally include:

- Locomotives
- Passenger Coaches
- Control Cab Passenger Coaches (cab cars)
- Spare Parts Inventory
- Special Tooling & Equipment Required to Test & Maintain locomotives and cars

Timing of the Equipment Acquisition is important. Once the vendor selection process has been completed, the equipment (potentially from several vendors on separate purchase orders) must be constructed to approved specifications (with agency inspectors at the plants to observe construction), delivered, tested, and commissioned before the start of system testing with the trains in the field. If the equipment is being added to an existing fleet, then the equipment should, to the extent possible, meet



the specifications of the existing fleet.

If the existing fleet has been in service several years and may be nearing the period when it is due for a mid-life rebuild, the acquisition of new equipment for the service extension can be scheduled as the first step in the fleet rebuild process. The trainset planned for the service extension could be purchased earlier than needed and used to replace an existing trainset so that train can be released to vendors for mid-life rebuild. When the first rebuilt train is completed, the second train to be rebuilt is sent away, and the process continues until all locomotives and cars of the existing fleet have been rebuilt. The train set purchased for the extension would then become available to fulfill its original role. Using this approach has many advantages both in cost and in system dependability.

If the new equipment to be purchased is for a new fleet and a new service that is not integrated with an existing fleet, then a different schedule would be established. That schedule would need to ensure that the new equipment arrives after track and facilities have been constructed to receive it, and before it is needed for testing and commissioning, new employee training, and system testing and acceptance.

Equipment is normally leased from another railroad equipment owner or purchased new or used from one or equipment manufacturers or re-manufacturers. If used equipment is acquired from an equipment owner, then there should be an expectation that the equipment may have to be rebuilt and modified to meet the needs of the new service. In all cases, delivery inspection, correction of defects, testing and commissioning will be required for the equipment. This can be a time when disputes may arise between the acquiring agency and the vendors(s), so it may be prudent to build time in the project schedule to anticipate and manage these events, should they occur.

### 10.3. Final Design/ Construction

Once PE/NEPA is completed and approved, Final Design (100% design) and construction will be performed in accordance with PE design and environmental documents<sup>1</sup>. Final Design (FD) includes a complete set of plans, specifications, schedules, and cost estimates. FD could be prepared for individual capital improvement projects or for a package of projects within the corridor. FD documents would include sufficient documentation for a contractor to bid and complete work.

For this type of project, BNSF may choose to prepare FD documents for work inside the BNSF right-of-way themselves or may contract with an engineering firm (Contractor) to prepare FD. Once FD is complete and BNSF approves the FD plans, MnDOT (or a federal funding grantee, if applicable) would review and approve FD plans. Once the FD package has been approved and signed by all Stakeholders, it would be submitted to FTA or FRA for approval. BNSF typically constructs improvements within its own right-of-way through BNSF force accounts.

For improvements outside the BNSF right-of-way, such as stations and maintenance facilities, FD could be prepared, and improvements constructed by Contractor(s) through a competitive bidding process conducted by MnDOT or the facility owner.

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<sup>1</sup> Construction, Operating, and Maintenance agreements are typically required by funding agencies prior to the commencement of Final Design and construction

The following elements could be part of an FD plan set:

- *Geotechnical Survey.* The Contractor would perform geotechnical investigation services to support the design of structural elements, such as bridges, culverts, and other structures included in the project. The work could include, among other things, soil borings, geotechnical analysis, and recommendations for FD and construction.
- *Track and Siding.* The Contractor would prepare FD drawings sufficient for construction of main track and siding track. FD will include development of plan sheets, specifications, schedules, and construction cost estimates for the track and siding improvements.
- *Turnouts and Crossovers.* The Contractor would prepare FD drawings sufficient for construction of turnouts and crossovers. FD will include development of plan sheets, specifications, schedules, and construction cost estimates for the turnouts and crossovers.
- *Grade Crossings.* The Contractor would prepare FD drawings sufficient for modifications and improvements at grade crossings. FD would include development of plan sheets and descriptions as required to improve the crossings. FD will include development of plan sheets, specifications, schedules, and construction cost estimates for the crossing improvements.
- *Hydrology and Hydraulic.* The Contractor would prepare FD for culvert and bridge improvements based on field investigations and PE deliverables. FD would include development of plan sheets and descriptions as required to construct the structural improvements and to document that all work will be in compliance with NEPA requirements and that the property impacts are consistent with the approved PE/NEPA documents.
- *Utilities.* The Contractor would identify the need for relocation of utilities based on conflicts between existing utility locations and the proposed infrastructure improvements. The specific utility relocation needs determined in the FD phase would be implemented. The determination of responsibility, including costs and scheduling utility work, is dependent on the utility occupancy agreement between the host railroad, roadway jurisdiction, or property owner and the utility.
- *Station and Maintenance Facilities.* The Contractor would prepare FD for the following areas: site work, grading, utility coordination and utility work, storm-water management, station building (including architectural features), elevator towers, pedestrian walkway (overpass), ramps, and elevators/escalators. Finishes, required ramps and railings, fencing, signage, ticketing machine installations, ITS/Signage/public address system/train warning system and GPS location installation, conduit installation, landscaping, lighting, markings, station platforms and canopies (if needed), and other elements required for the construction of station improvements. The station would be designed to meet ADA requirements for passenger rail facilities. FD documentation would include plans, specifications, schedules, and cost estimates for all components of station and maintenance facility improvements that would be incorporated into construction bid packages.
- *Signals and Communication.* The scope of signals and communication improvements includes the installation of CTC and PTC associated with new track, turnouts/crossovers, new signals, and new control points. FD documentation would include drawings, specifications, and cost

estimates. Design of PTC equipment would conform to BNSF and FRA requirements.

Capital improvements would be constructed in accordance with the environmental review and approved FD documentation prepared for the projects.

#### **10.4. Testing/Commissioning**

Capital improvements needed to support the extension of Northstar commuter service to St. Cloud would be constructed in accordance with detailed final design plans previously approved by BNSF, MnDOT, Metro Transit and any other Stakeholders specifically involved. During construction, field inspection and oversight would be conducted by the railroad and by the senior agency with whom the railroad has contracted to construct the improvements. Prior to initiating revenue service over a capital improvement, BNSF inspectors would carefully measure and examine all elements of track construction, including any required ultrasonic inspection to identify any rail or welding defects. All aspects of track construction must meet or exceed the FRA track standards for the speeds to be operated. Coordination would also be required with the BNSF signal department to ensure that all signal improvements function properly before revenue service could begin.

Construction and testing for new or modified signal installations would follow a similar, but far more detailed process, using final design plans and procedures approved by BNSF’s signal department. After construction and initial testing and before revenue operations could begin, BNSF and signal contractors would conduct a detailed signal cut-over and testing following a step-by-step, circuit-by-circuit plan to ensure that all portions of the system function properly. Approved, accurate signal drawings must be placed or placed on file at the required locations and BNSF must ensure that all FRA system configuration management requirements have been met. No revenue trains would be permitted to operate through the affected area during a signal cut-over and testing process. Once the railroad has confirmed that the signal system functions correctly, it would be turned over to the train dispatcher to enable the beginning or resumption of revenue train operations. This process would be used for each new or modified signal installation.

#### **10.5. Potential Schedule**

A preliminary estimate of the time required to complete the above steps for the 2040 Bi-Directional Service Alternative is as follows:

- |  |              |
|--|--------------|
| 1. Preliminary Engineering/Environmental Review                        | 18-24 months |
| 2. Equipment Acquisition (concurrent with PE/NEPA and FD/Construction) | 36 months    |
| 3. Final Design/Construction   | 3½-4½ years  |
| 4. Testing/Commissioning (overlaps with construction)                  | 6 months     |

A preliminary estimate of the time required to complete the above steps is 5½-7 years.

Because the Minimum Service Alternative would need less infrastructure and no equipment acquisition to operate, the schedule for PE/NEPA, FD/Construction, and Testing Commissioning could be less than 5½ years.