

Installing Pedestrian Tunnels in a 30-Hour Work Window

Planning for Success

Authors:

Bret M. Farmer, P.E.
Manager, Rail Division
TKDA
444 Cedar Street, Suite 1500
Saint Paul, MN 55101
Phone: (651) 292-4447
Fax: (651) 292-0083

James E. Hoschka, P.E.
Manager, Track and Yard Group
TKDA
444 Cedar Street, Suite 1500
Saint Paul, MN 55101
Phone: (651) 292-4424
Fax: (651) 292-0083

Clyde D. Stack
Manager Engineering
BNSF Railway Company
80 44th Avenue NE
Minneapolis, MN 55421
Phone: (763) 782-3489
Fax: (763) 782-3061

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ABSTRACT

Railroads are continually approached by public and private entities soliciting authorization to construct tunnel crossings below their mainline tracks. Unless they are eliminating an at-grade crossing, these requests often provide no benefit to the railroad, and usually present a challenge to the railroad with respect to safety, schedules, and the use of valuable rail personnel and resources. When negotiations result in the decision to construct a new tunnel under the mainline, BNSF knows that planning is the key to successful work window tunnel construction.

BNSF demands significant planning from contractors who enter BNSF property to construct tunnels below mainline track. Depending on the rail traffic, a 30-hour work window is typically the maximum window allowed for construction. This includes the removal and reinstallation of the track. Although significant effort goes into creating plans and specifications and outlining a contractor's required qualifications, BNSF monitors the contractor's means and methods closely to assure the project is completed safely, within schedule, and without incident. Penalties associated with not meeting these goals can be enormous.

A recent successful pedestrian tunnel installation took place on the Northstar Commuter Rail Station Pedestrian Tunnel in Minneapolis, Minnesota. The 160 foot tunnel was constructed across five tracks using the open cut method during a 30-hour work window. BNSF partnered

with TKDA to coordinate construction planning activities with Park Construction, the successful bidder. Our presentation will highlight this project, as well as give planning insight to others who encounter this challenge.

INTRODUCTION

In preparation for the commuter rail line station on Minnesota's Northstar Line, TKDA worked with Kimley-Horn and Associates, Inc., the Northstar station designers, to create a plan to deliver a pedestrian underpass crossing to handle commuters traveling in and out of Northstar's Fridley station. The solution was a 160-foot-long precast concrete box culvert tunnel. Because the tunnel passes beneath five tracks including an industry track, two mainline tracks, a pullback track, and a material yard lead track, BNSF required that the project be completed as quickly as possible in order to minimize disruption to the railroad operations. The solution was to specify an open-trench method requiring construction during two simultaneous work windows; the first being 96 hours, and the second, containing the two mainline tracks and two siding tracks to be no longer than 30 hours.

PREPARATION

To meet the prescribed work windows, significant planning needed to take place.

Communication was also a critical element to this project. The tunnel combined 32 precast sections, each five feet long to obtain the 160-foot passage. When manufacturing was complete for all the sections, the engineers visited the plant and thoroughly inspected each section to confirm that they met specifications and were free of defects which may have occurred during casting (see Figure 1). Each section was numbered and test-fitted at the plant before being delivered to the site. In order to expedite the material testing process on site, the aggregate and backfill materials for the project were also tested and pre-approved prior to stockpiling in order to minimize on-site delays.



Figure 1: Concrete culvert inspection at the manufacturing facility.

The construction site was surveyed and cleared before excavation began. In preparation for moving the rails, excavation limits were provided to BNSF. With this information, BNSF was able to identify the rail removal limits. Prior to construction, BNSF cut the rail at the excavation limits and bolted them back together so the track could continue being used. BNSF also double-spiked the ties and replaced bad ties to ensure that the ties would come out of the ground intact with the rails to facilitate a quick removal process. Prior to the work windows, the contractor was allowed to perform limited excavation below ground-level at each end of the tunnel so that this work did not have to be done during the work window hours. In addition, BNSF coordinated the relocation of their Signal and Telecom utilities prior to the start of work window construction.

The most critical component for preparation of this project was assembling and organizing the necessary materials and construction equipment on site prior to starting the work windows. This included securing a location to store the granular backfill, aggregate base, sub-ballast, geogrid, draining and utility piping systems, inspection manhole, reinforced concrete pipe, and precast tunnel pieces. Every piece of required equipment was strategically organized on site as well, and backup equipment was required in case failure occurred during the work window. This was critical for the contractor since the specification stated that passenger and freight train delays be kept to a minimum.

To best communicate the construction sequencing to BNSF and TKDA during the two work windows, the contractor created a scale model of the site, showing the equipment location, trench excavation, rail relocation, and staging areas (see Figure 2). The process gave the owner confidence that the right equipment would be used on the project, construction would meet the owner's schedule, and that the BNSF mainline track would be up and running within the allotted timeframe.

The contract indicated that the contractor would construct the tunnel over the mainline tracks over the 2008 Memorial Day or Labor Day weekends, but BNSF reserved the right to postpone the work. BNSF also reserved the right to delay the project due to weather. The contractor and the railroad diligently tracked the weather prior to the work window. If weather did not cooperate, the work windows would be postponed until the 4th of July or Labor Day weekends.



Figure 2: Scale model of the work site.

WORK WINDOW NO. 1 - INDUSTRY TRACK TUNNEL CONSTRUCTION

Construction of the tunnel began from the west end with the removal and replacement of the Industry Track section (see Figure 3). The contract allowed for 96 hours for this window, but the contractor was able to complete the work in less than 48 hours, which included time for BNSF to remove the track section over the planned excavation and to replace the track section and ballast following the tunnel installation. The project began by removing the bolted rail sections that were previously cut and lifting the track section out of the excavation area. Next, the open cut excavation began under the industry track area, and the five-foot tunnel sections were installed as numbered in the plant. Joints were waterproofed, and the open cut area was backfilled.

To prepare for the future station platform, couplers were installed at selected joints between the industry track and Mainline Track 2, which allowed for “break-away” points to accommodate the future station structure.

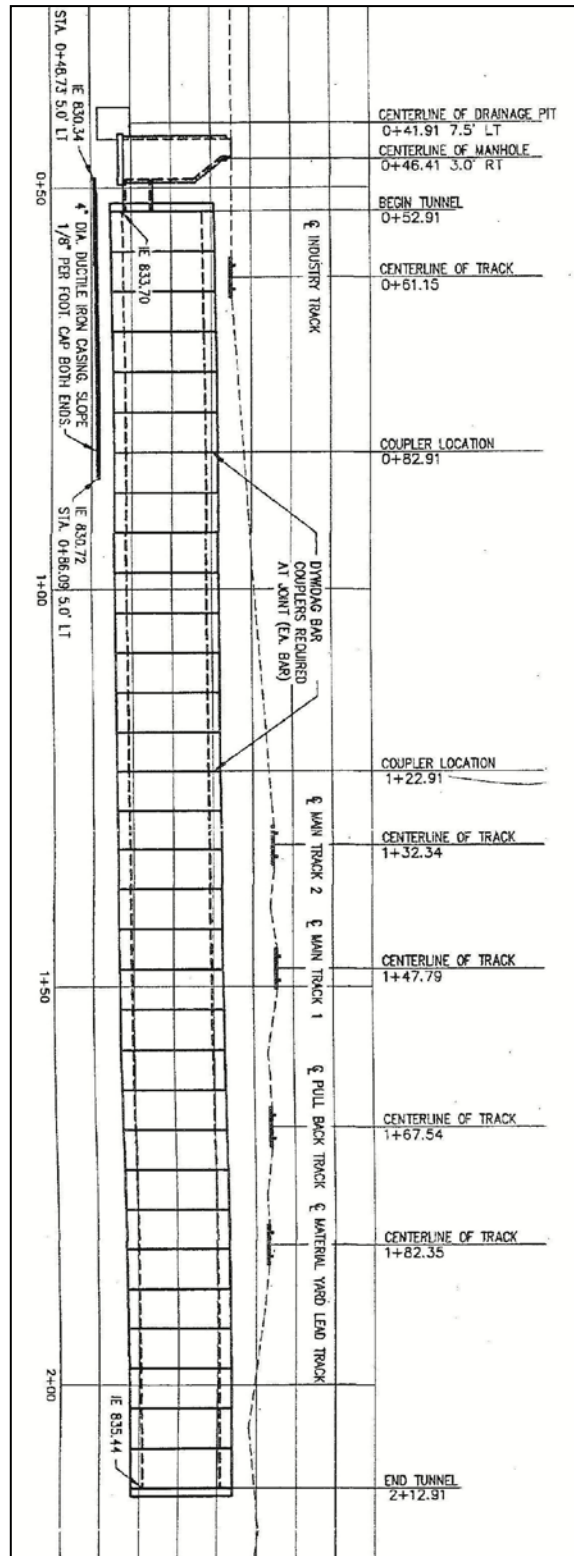


Figure 3: Site elevation

WORK WINDOW NO. 2 - MAINLINE TRACK TUNNEL CONSTRUCTION

The contractor was given 30 hours to construct the remainder of the tunnel below the tracks for Mainline Tracks 1 and 2, the Pull Back Track, and the Material Yard Lead Track. Of the 30 hours, BNSF allotted four hours at the beginning of the Work Window to take the four track sections out of service. It was then required that Mainline Track 2 be back in service within 20 hours from the start of the work window, including two hours for BNSF to reinstall the track and ballast. Theoretically, this left only 14 hours for the contractor to install the box segments required to support the Mainline Track 2. The contractor was allowed, however, to work concurrently with BNSF to take full advantage of the available work window hours.

Excavation began immediately and workforces were brought in to do around-the-clock construction to complete the work within the scheduled time. Each workforce that came in received a separate safety briefing prior to starting work and all schedules were met. The sections were installed, joints were waterproofed, and the structure was backfilled to prepare to have the track reinstalled. Because this tunnel was constructed to handle pedestrian traffic for a future station, the project concluded with capping both ends of the 160-foot tunnel and installing an inspection manhole at the east end for emergency and inspection access.

PLANNING INSIGHT

1. Include a Bidders Qualification Statement

Because of the sensitive nature of this type of project, it is highly recommended to include a Bidders Qualification Statement in the specifications. This detailed checklist helps the railroad

ensure that the selected contractor has the experience and knowledge to successfully complete this type of project. For example, this particular Statement asked for five references showing similar type work. All references were contacted to confirm the reputation of the contractor.

2. Communicate Excavation Limits Early

The railroad schedules are busy and delay time costs the railroads money, so it is extremely important to have the rails and ties properly prepared ahead of time so they can be removed quickly on the day of construction. By providing the railroad with excavation limits early, they can schedule brief periods of downtime to splice the rails and bolt them back together for continued use, as well as double spike and/or replacing the ties. It also allows the contractor time to plan equipment movements, as well as pre-excavation activities prior to the critical work windows.

3. Move All Utilities Prior to Work Windows

Moving utilities takes time and unforeseen conflicts are often found underground and among utility agencies. Clearing all obstacles ahead of time will allow for the contractor and railroad to focus solely on the critical construction activities during the work window.

4. Have All Materials and Equipment Organized and Prepared on Site

It is critical to have all materials and equipment on site prior to the start of the work windows. This includes pre-tested granular backfill materials stockpiled in convenient locations; the box culvert tunnel sections numbered and organized in order; and any temporary shoring, culvert ties,

erosion control materials, equipment, and backup equipment necessary to successfully complete the project on time.

5. Create a Communication Plan

Communication between contactors, subcontractors, and the railroad must move smoothly, and decisions must happen quickly among this group during the work window. An effective Communications Plan provides direction to all parties on the flow of communications and hierarchy of decision making, including contact information for people who may be needed, but not necessarily at the site.

ACKNOWLEDGEMENTS

Designer: Sara Nelson, P.E., Project Manager, Kimley-Horn and Associates, Inc.

Contractor: Jeff Carlson, President, Park Construction Company

FIGURES AND CAPTIONS

Figure 1: Concrete culvert inspection at the manufacturing facility.

Figure 2: Scale model of the work site.

Figure 3: Site elevation.

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Clyde D. Stack, BNSF
Bret M. Farmer, P.E., TKDA
James E. Hoschka, P.E., TKDA

Northstar Corridor Map

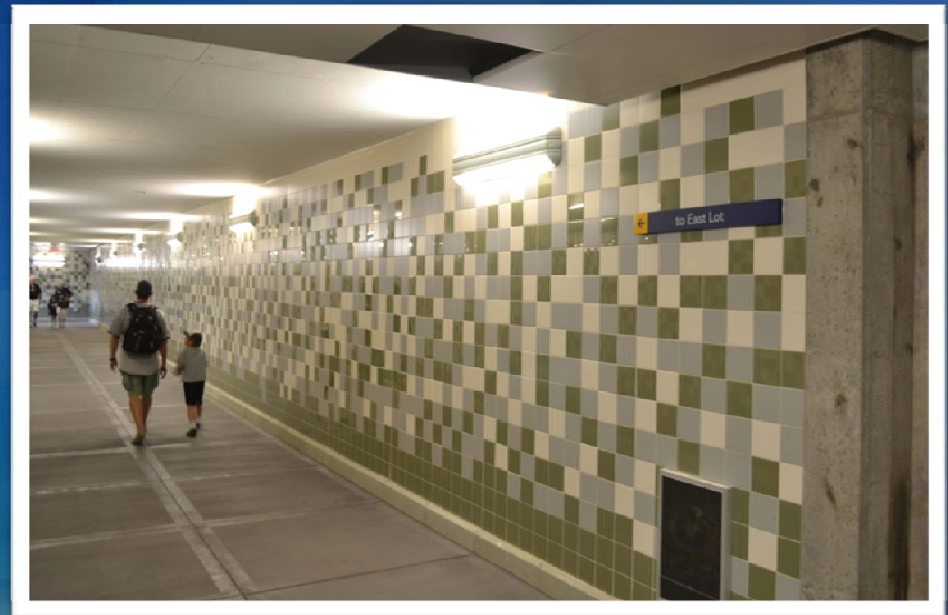
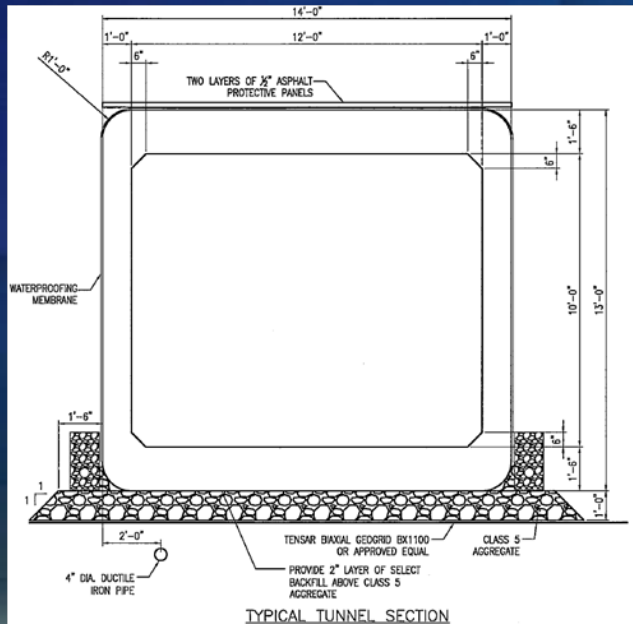


Northstar Corridor Map



Project Agenda

- Precast concrete box culvert tunnel
- Constructed using open trench method
- 2 consecutive work windows



Project Stats

- Team: BNSF, TKDA, Kimley-Horn, Park Construction
- Tunnel length: 160 feet
- Interior Dimensions: 10'h x 12'w
- Number of segments: 32
- Construction cost: \$1 million
- May 2008

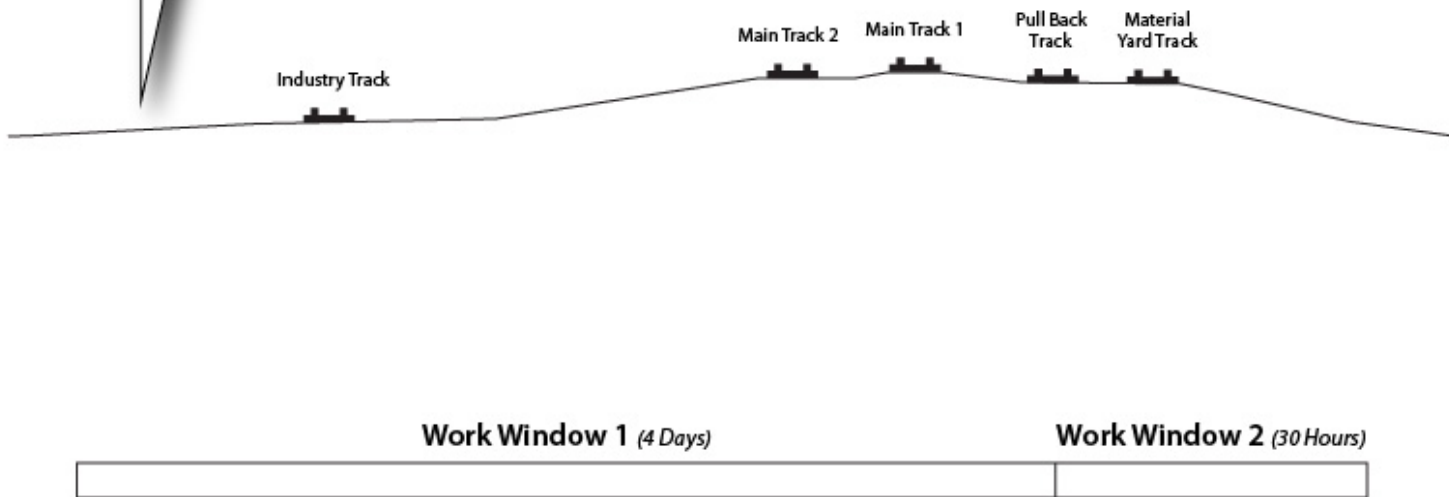
Preparation

- Preconstruction planning meetings
- Box culvert inspection and preassembly
- Construction site survey and prep
- Track prep
- Construction equipment/materials on site

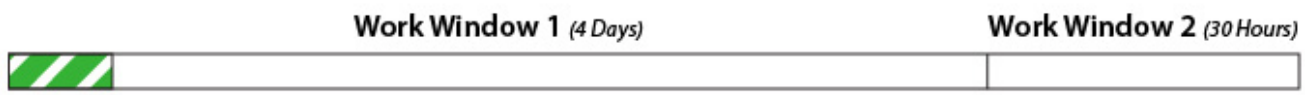
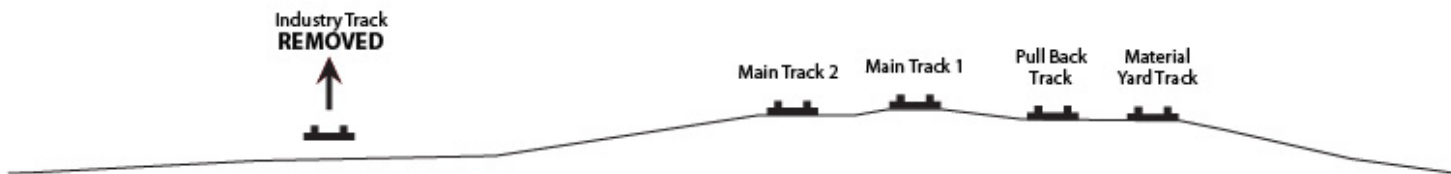


Work Window No. 1

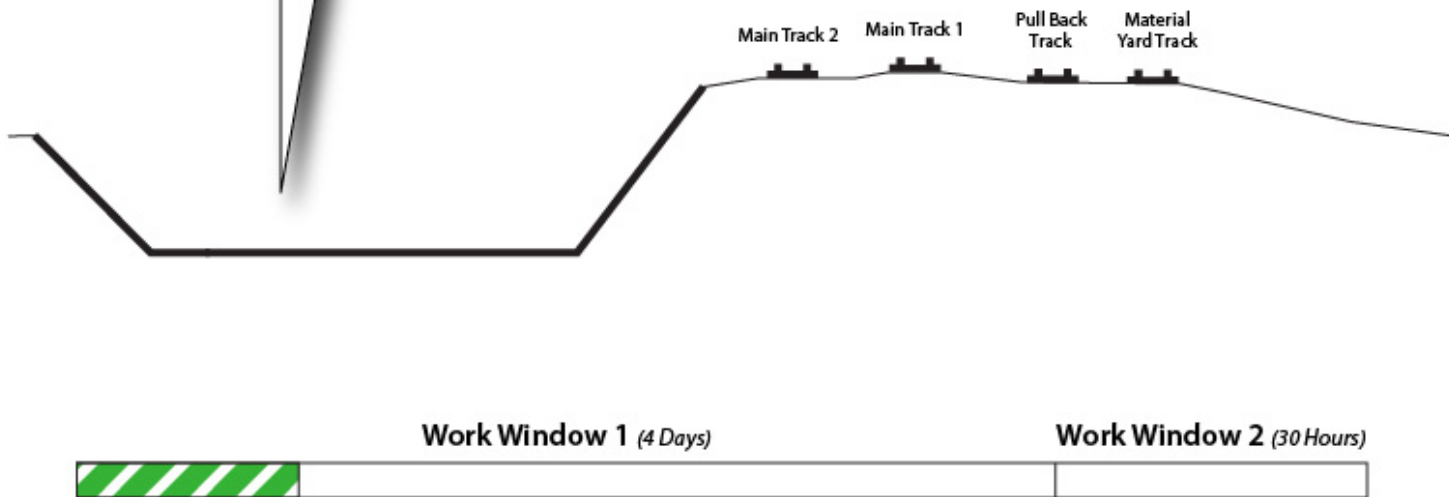
- Tunnel under Industry track
- 4 days allowed
 - Thursday-Sunday
 - Memorial Day Weekend
- 48 hours: contractor completed work



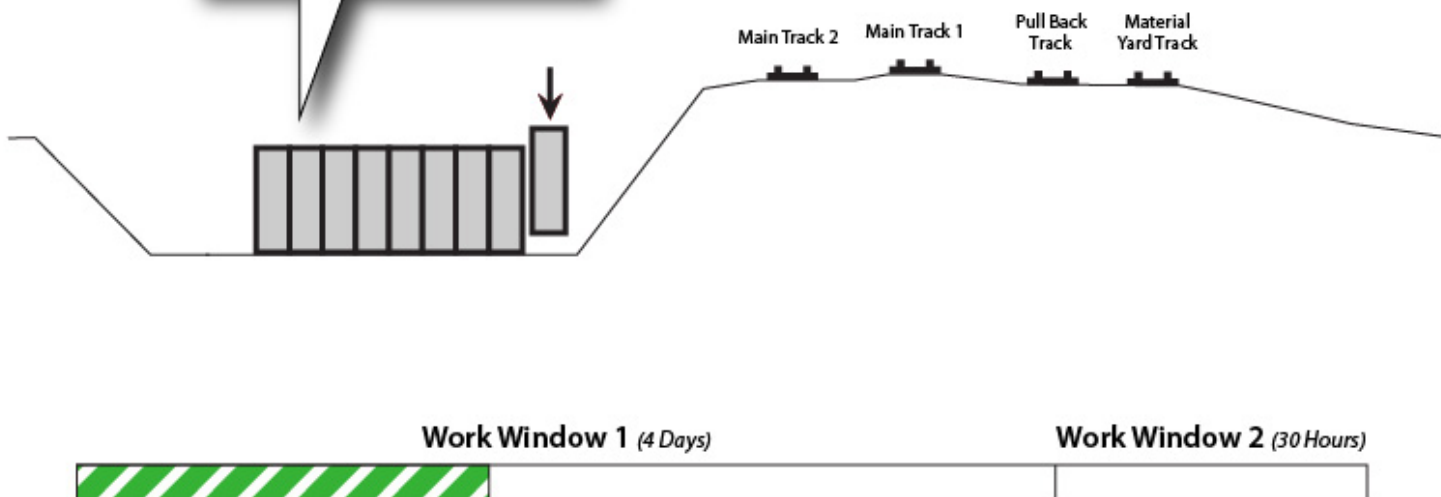
TIMELINE



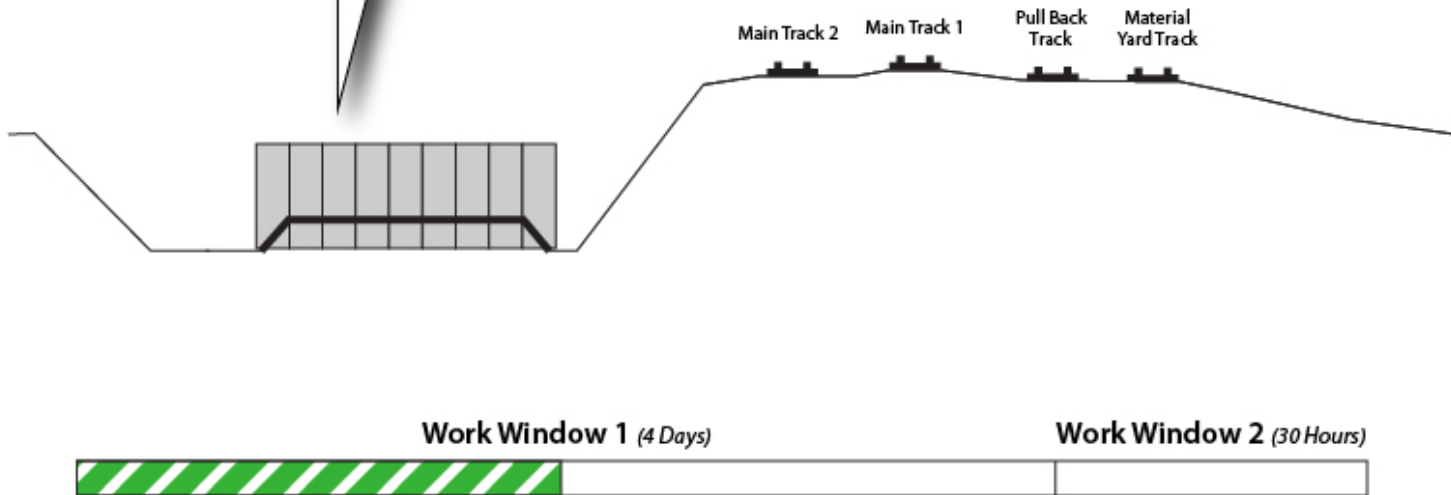
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TIMELINE



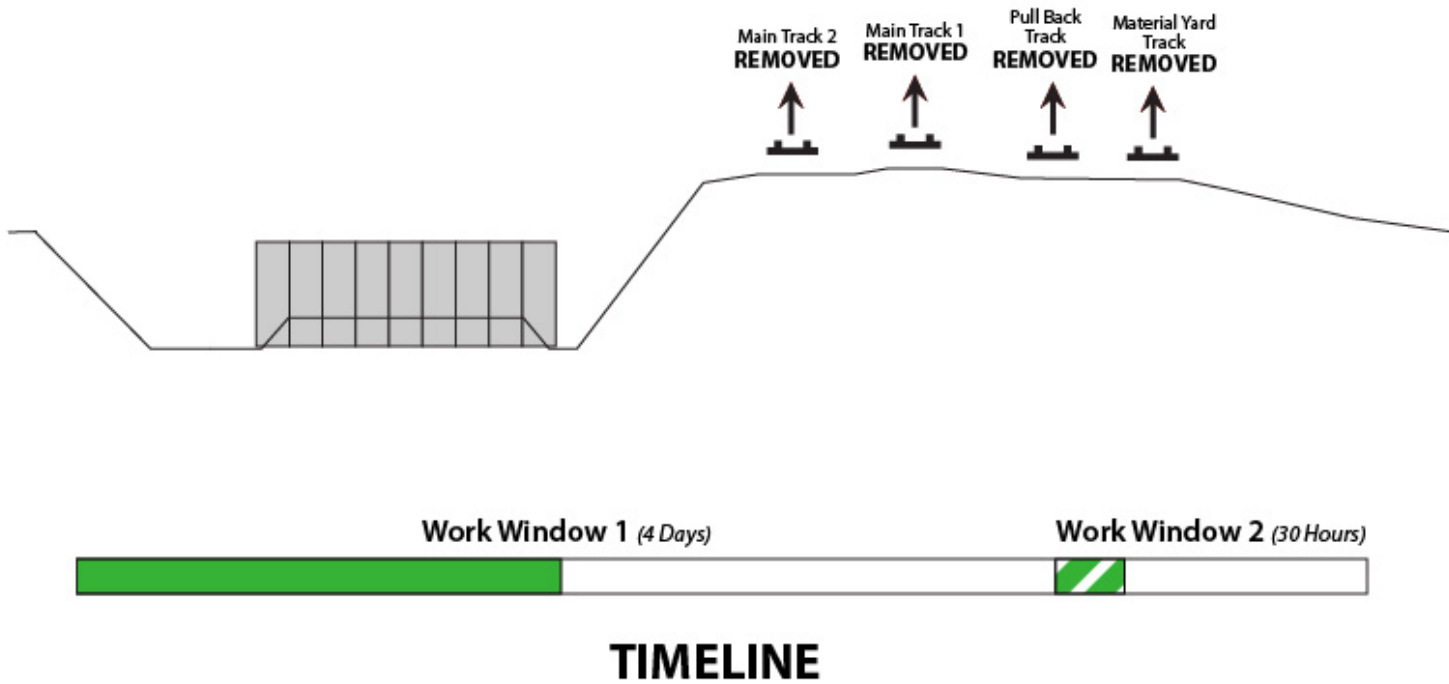
TIMELINE



TIMELINE

Work Window No. 2

- Tunnel under 4 remaining tracks
- 30 hours allowed
- 20 hours to return Mainline 2 to service



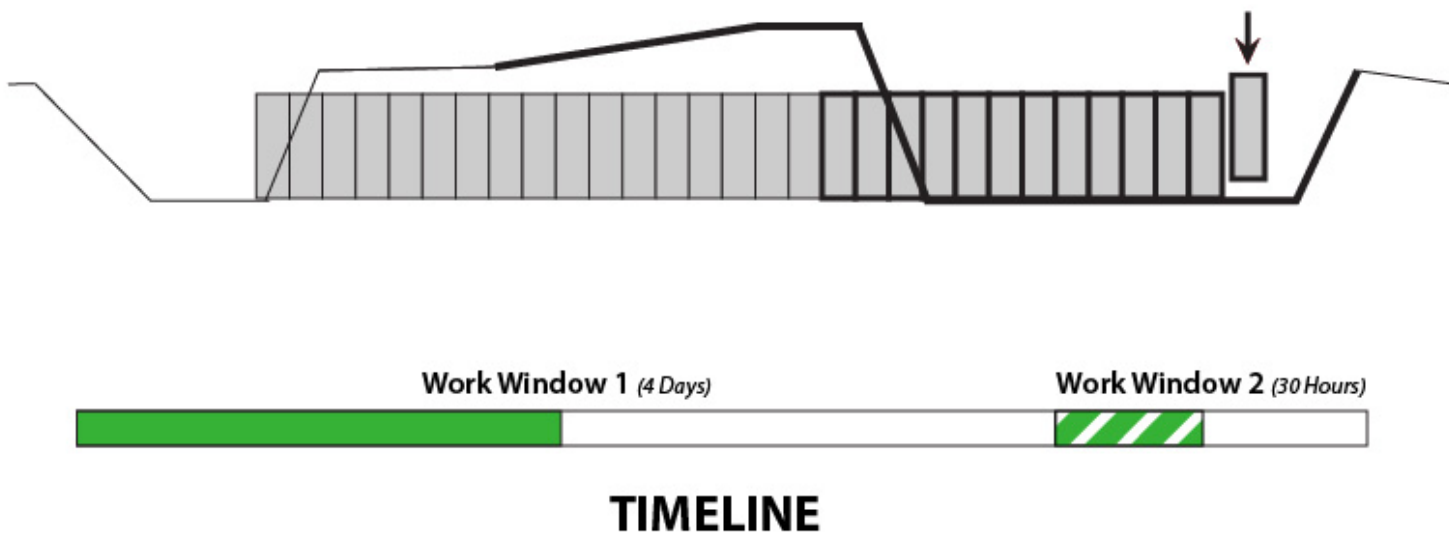


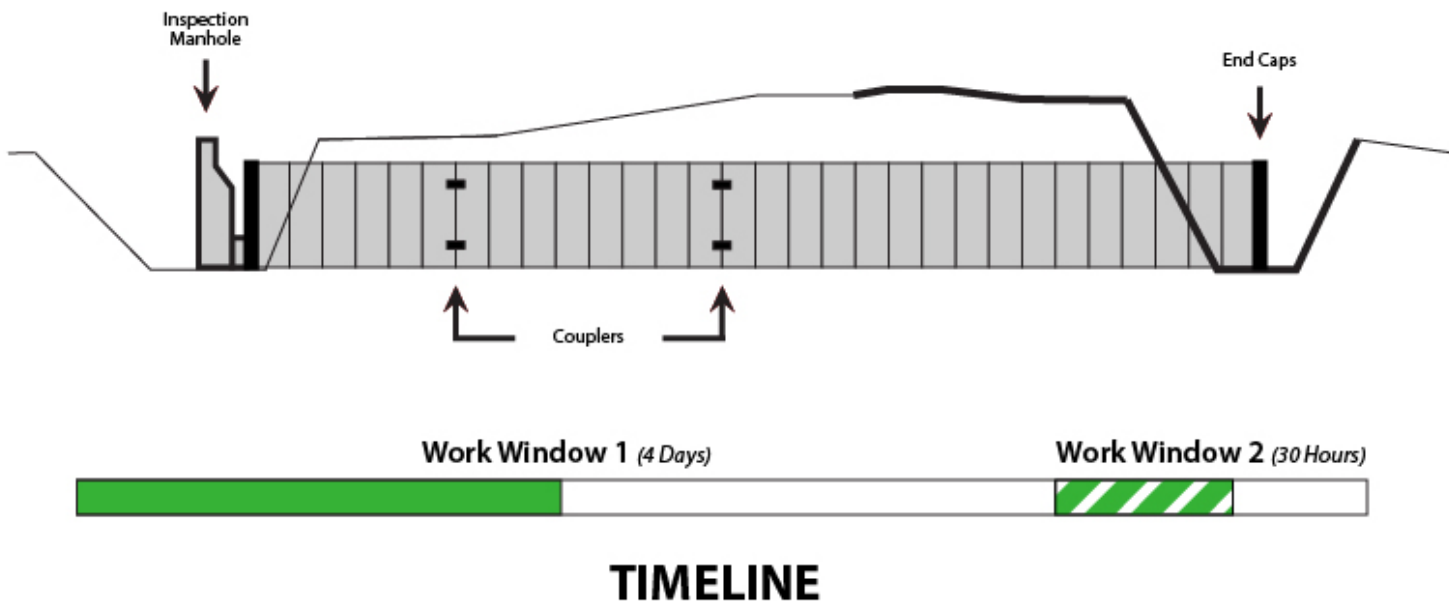
Work Window 1 (4 Days)

Work Window 2 (30 Hours)



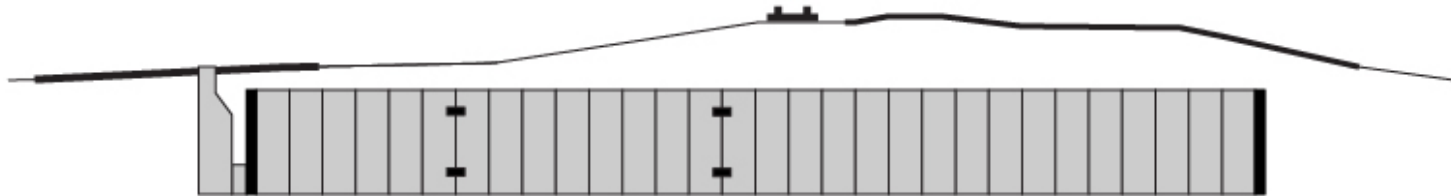
TIMELINE







Main Track 2
REPLACED

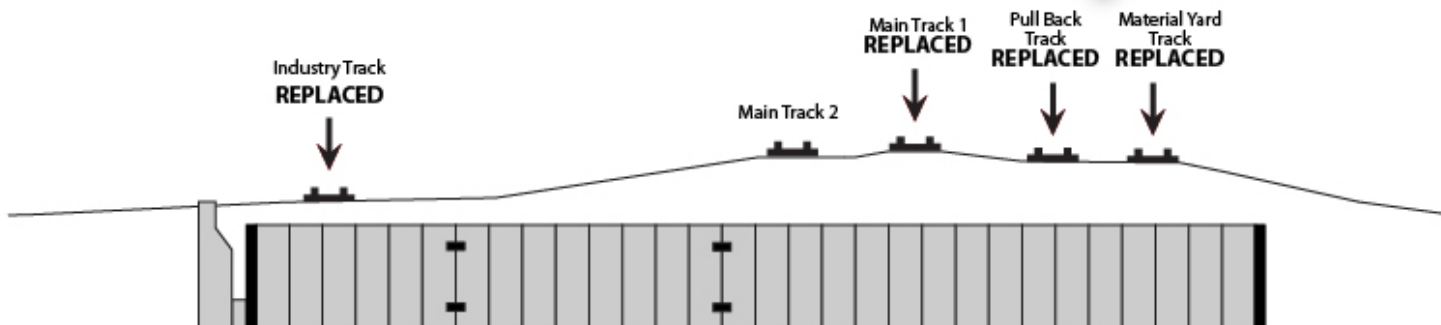


Work Window 1 (4 Days)

Work Window 2 (30 Hours)



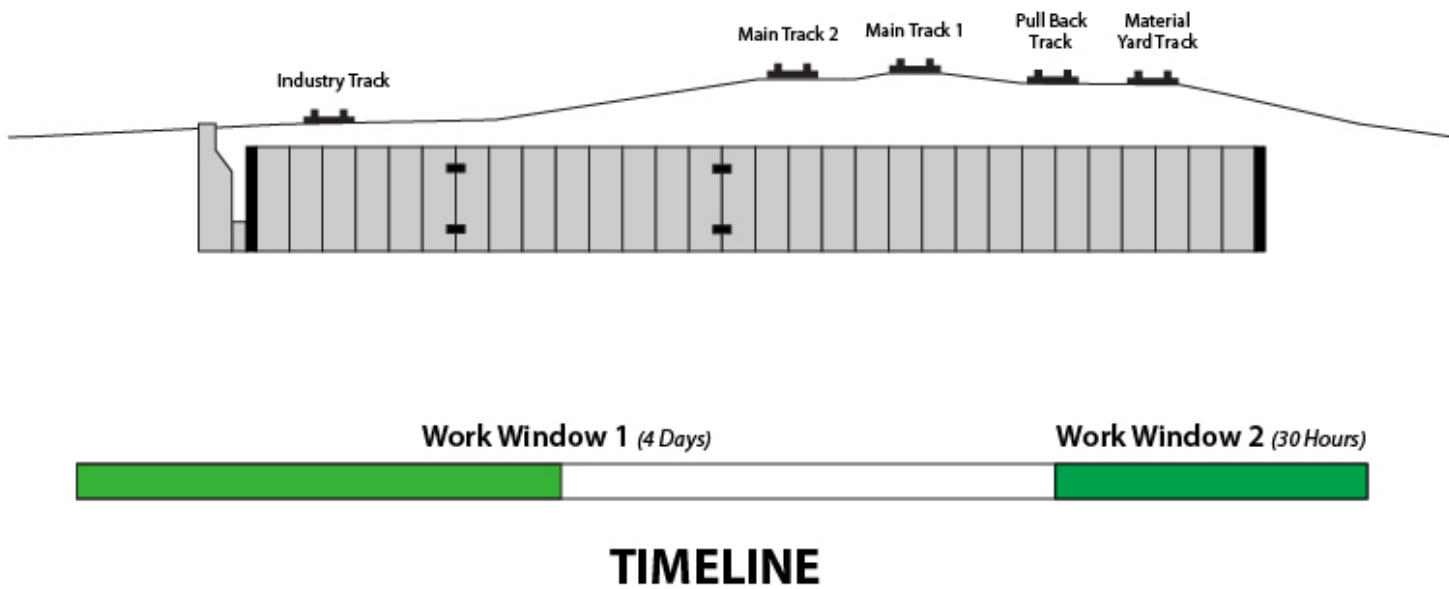
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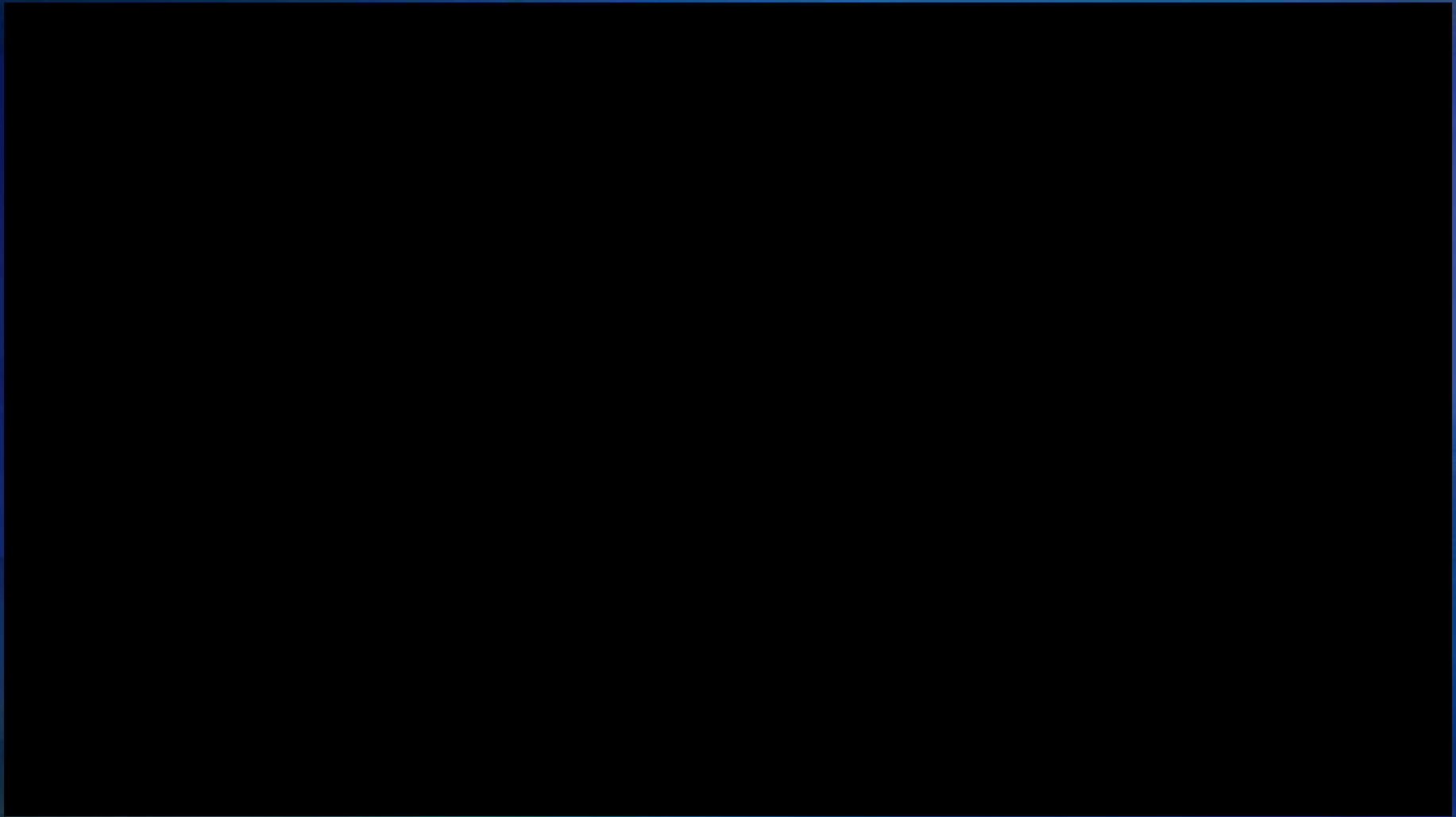
Work Window 1 (4 Days)

Work Window 2 (30 Hours)

TIMELINE



Time-lapse Video



Planning Insight

- Bidders' qualification statement
- Communicate excavation limits early
- Move all utilities prior to work windows
- Have all materials and equipment organized and prepared on site
- Communications plan

Thank You Questions?



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