Customer Service and Operations Committee

Board Information Item III-B

October 9, 2014

Major Red Line Construction

Washington Metropolitan Area Transit Authority

Board Action/Information Summary

○ Action ◉ Information	MEAD Number: 201055	Resolution: ○ Yes ◉ No

TITLE:

Major Red Line Construction

PRESENTATION SUMMARY:

This presentation provides an overview of Metro's comprehensive long-term solution for addressing tunnel water infiltration near Medical Center station, construction of Purple Line interfaces, and other infrastructure improvements.

PURPOSE:

To inform the Board of Metro's measures for addressing tunnel leaks along a portion of the Red Line tunnel between the Friendship Heights and Medical Center stations, while advancing construction of Purple Line interfaces and other planned infrastructure work to continue improving customer satisfaction, reliability and safety.

DESCRIPTION:

Key Highlights:

- After extensive work, Metro has developed a resolution to the water infiltration issue in the tunnel near Medical Center station.
- These tunnel leaks cause one third of Metro's arcing insulators between Friendship Heights and Medical Center stations, leading to service disruptions and extensive maintenance on the Red Line.
- The first waterproofing approach required to eliminate the leaks was scheduled to take a complete five-week shutdown of the area. However, not wanting to severely disrupt operations for customers for that extended length of time, Metro did further work and developed an alternative approach that would require 14 weekend shutdowns.
- Metro will maximize the use of the 14 weekend shutdown periods by coordinating and advancing construction of Purple Line interfaces and other infrastructure improvements to minimize impact on future service disruptions.
- The 14 weekend shutdown periods is estimated to begin in Summer/Fall 2016.

Background and History:

One third of the WMATA arcing insulators occur in the tunnel between the Friendship Heights and Medical Center portal. Since Metro opened the Bethesda and Medical Center stations in 1984, water infiltration in this section of the Red Line has caused operation disruptions and has required extensive maintenance over the years to control

it. The tunnel requires ongoing pumping, dredging and cleaning to keep switches in service and to prevent arcing insulators.

Over the years, a series of studies has been conducted by Metro to determine the reasons for the water leaks in the crossover cavern. The 2004 US Geological Service (USGS) Report “Hydrogeologoic Controls on Ground-Water Discharge to the Washington Metro Subway Tunnel near the Medical Center station and Crossover, Montgomery County Maryland” concluded: “The potential or driving force for water intrusion into the Medical Center station and crossover is due to the difference between the hydraulic head in the fractures in the surrounding rock and the tunnel, which is atmospheric pressure”.

In recent years, restoring the crossover function at Medical Center station has become critical for rail operations in its effort to improve on-time performance. In addition, by waterproofing the crossover, the current yearly $3 to $4 million maintenance cost could be dramatically reduced.

On November 25, 2013, Metro engineers discussed the first design of the Medical Center Crossover Waterproofing called the Geomembrane method. This method requires a five-week long 24/7 showdown for both Bethesda and Medical Center stations. Concerned by potential extensive disruption of services to the customers, Metro requested that the American Public Transportation Association (APTA) conduct peer review for the Geomembrane design. On January 28, 2014, the APTA Panel delivered their findings and recommended that alternative design options be considered.

Discussion:

Based on the APTA Panel’s recommendations, our engineering group expanded the waterproofing approach to the Precast Panel method, which is similar to the station dome structure. Since the majority of the concrete work is precast construction, which is performed outside of the tunnel, the required shutdowns have been reduced from the original five week – 24/7 shutdown period to fourteen weekend shutdowns, in which the last seven shutdowns are required to be consecutive weekends.

Metro hired a consultant to conduct a risk analysis on the Precast Panel preliminary design. The consultant suggested that the probability for successful completion of the waterproofing within the fourteen weekends shutdown is 95%.

Metro is proceeding with the Precast Panel design option as well as the 14 weekend shutdown plan.

Metro is looking for ways to minimize service disruption impacts to our Red Line riders by maximizing the fourteen weekend shutdown plan with the advance of other future work required such as:

Purple Line - New Metro Bethesda Mezzanine: The Purple Line Project’s anticipated beginning construction in 2015 and operations in 2020 will include a new entrance to the Bethesda Metrorail station at the south end of the Red Line platform providing a

direct connection between the Red Line and the Purple Line. As agreed with the Maryland Transit Administration (MTA), Metro will be responsible for the work within the existing Metrorail station structure, interfaces from the existing system to the new south entrance system, and changes to the station. Therefore, Metro needs to perform the mezzanine work in line with the Purple Line Project schedule.

This work will include an opening on the side of the existing station structure for connection of the new entrance, elevators between Metrorail platform and mezzanine levels, transformers and electrical distribution panels for Metrorail loads, electrical power cables between electrical room and Metro facilities, lighting changes, and architectural finishes. The scope of work also includes a new kiosk, access control system, fare collection system, and communication system for elevators, HVAC, electrical power, etc.

Grosvenor Aerial Structure Retrofit: There are 21 single piers supporting the aerial structure above Route 355 and the Beltway, between the Grosvenor and Medical Center stations. Each single pier supports the cross box above which is cantilevered from piers on both sides. On the average, there are 40 six-feet long elongated bolts connecting the cross box to each pier. Timely rehabilitation is required to avoid compromised bolt restraint and prevent aerial structure failure, ensuring customer safety. Therefore Metro engineers developed a retrofit design called “Hammer Head”, which transfers the bridge load directly from the bridge deck to the piers instead of through the bolts. The hammer head can be constructed during regular work hours; however, shutdowns are required to pour and cure the concrete grout pads between the hammer heads and the bridge decks. In August 2014, one of the 21 piers, Pier 5290 was retrofitted as the pilot project. A hammer head structure was built prior to the Labor Day weekend shutdown. Metro utilized the Labor Day weekend shutdown to complete the grout pad for Pier 5290.

To complete the remaining 20 pier hammer head retrofit work, 8 to 10 weekend shutdowns will be needed.

Grosvenor Platform Rehab: Grosvenor station is above ground and exposed to the elements. Similar to many aboveground stations, the ASR Alkali–silica reaction from the snow melt has caused concrete damage at the platform edge. Chunks of the concrete have fallen to the track bed, leaving no support for the granite edges in some locations. Tile replacement, grouting, and a weeping mechanism to divert water at the platform edge have abated the situations temporarily. Metro is planning to rebuild the platform concrete edge and replace the platform clay tiles by 2x2 concrete tiles during the 14 weekend shutdowns. The platform rehabilitation and the new concrete pavers will improve platform structural integrity and surface traction to enhance customer safety.

Friendship Heights to Grosvenor Tunnel Rehab: Heavy water infiltration into the tunnel section between the Friendship Heights and Grosvenor Portal has caused cable failures, ponding water in the track bed, broken tunnel lights and Emergency Trip Station (ETS) boxes. Engineers plan to rehab this section of tunnel during the 14 weekend’s shutdown period. Other detail work to be performed includes: power wash of the tunnel, crack injection for the minor leaks, installation of drain pipe for heavy leaks, replacement of track drain grates, tunnel lights, and electrical cables.

In addition, MTA plans to request future weekend shutdown periods by the beginning of Winter 2017 to advance Purple Line interface work as follows:

Purple Line - Silver Spring Aerial Structure and Potential Mezzanine Connection: The Purple Line aerial structure will cross above Metro tracks immediately north of the Silver Spring Metro station. Metro will review and coordinate the intended construction method and sequence to ensure safe conditions and minimize operational impact to the Metro system.

The Purple Line Project will increase ridership at the Metro Silver Spring Station. The increased ridership will be channeled through either a new mezzanine directly linking the Purple Line station to Metro platform or modification to the existing south mezzanine at the Silver Spring station. Specific configuration of any new connection or modification of the existing Metro station will be finalized with the development of design with the successful MTA contractor. Metro work may include communication systems, access control and fare collection equipment.

FUNDING IMPACT:

Red Line Rehabilitation is funded in the existing capital budget (CIP 0108) with a current total approved budget of $195,128,681.

Purple Line interfaces is a reimbursable project funded by the State of Maryland. Metro will work with MTA to execute a second Memorandum of Understanding (MOU) to address future needs, such as the required reconfiguration of WMATA property and associated costs.

TIMELINE:

Previous Actions	N/A
Anticipated actions after presentation	• Future Board information items will be brought for review, as needed.

RECOMMENDATION:

None; this update is for information purposes.

Washington Metropolitan Area Transit Authority

Major Red Line Construction

Customer Service and Operations Committee

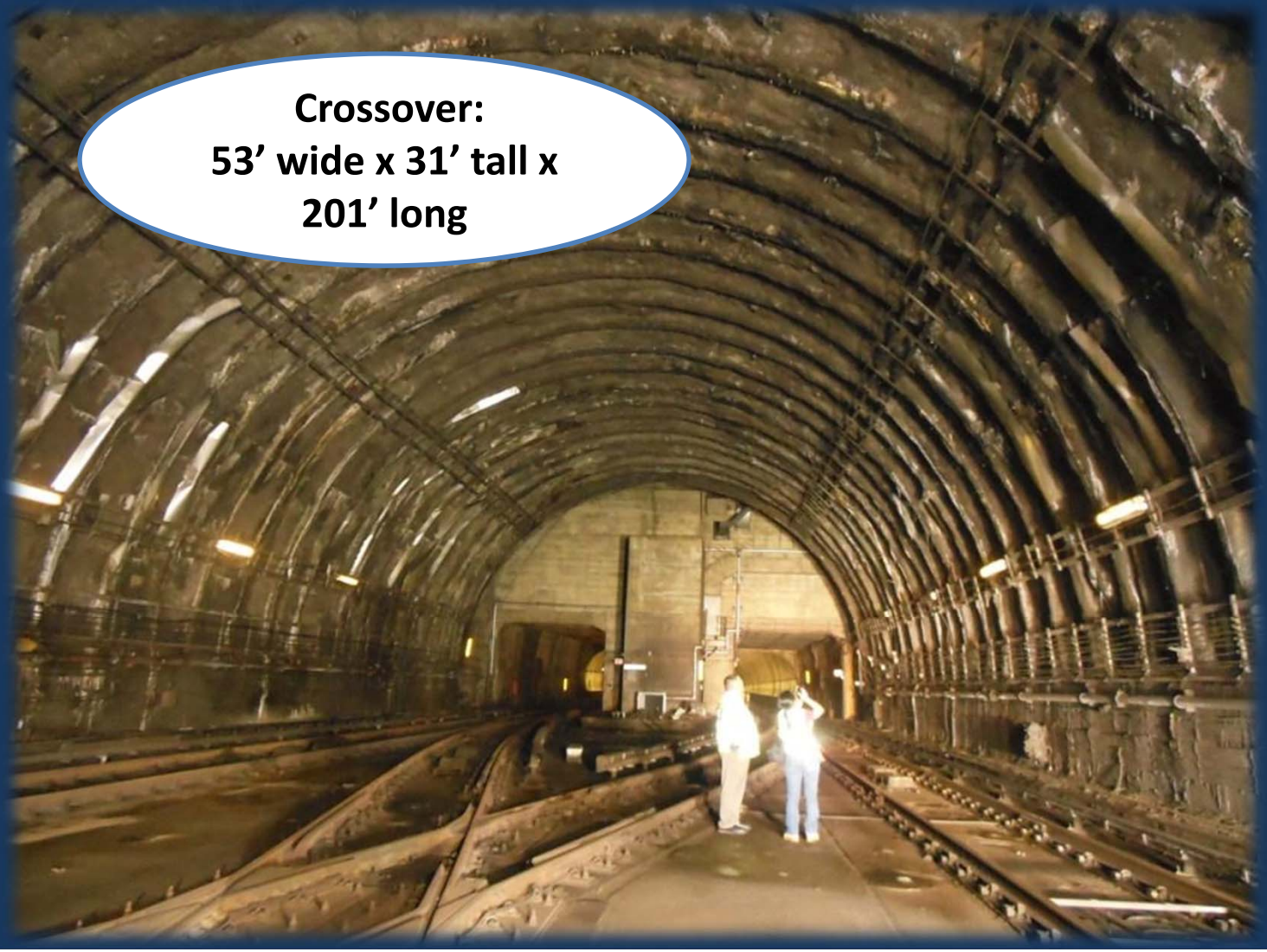
October 9, 2014

Purpose

To brief the Board on upcoming Purple Line interfaces, Medical Center water infiltration, and other needed Red Line upgrades

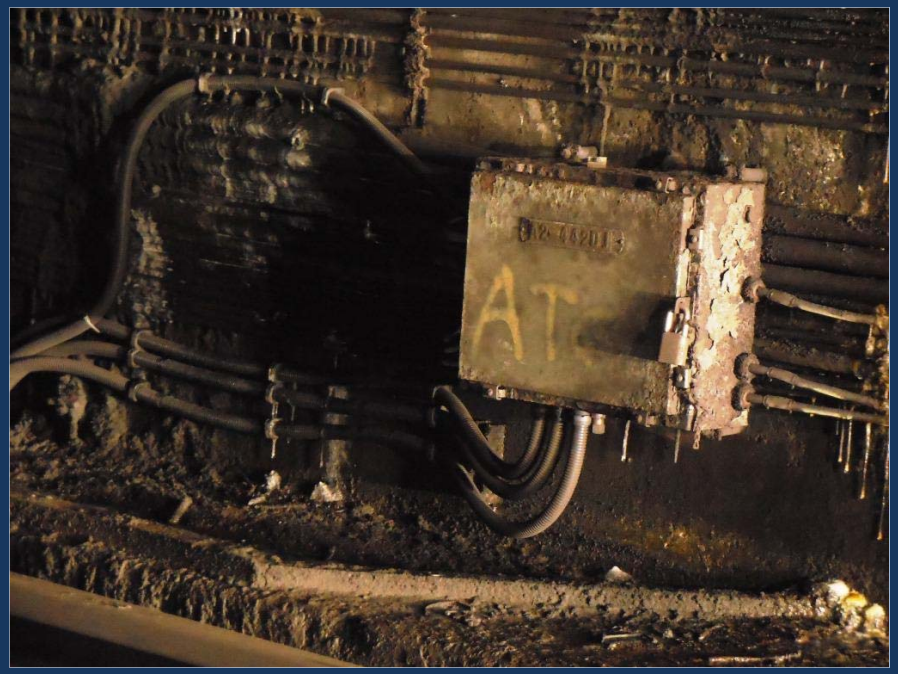
Medical Center Crossover

Existing Conditions and Water Intrusion Reasons



Medical Center Crossover

Existing Conditions and Water Intrusion Reasons

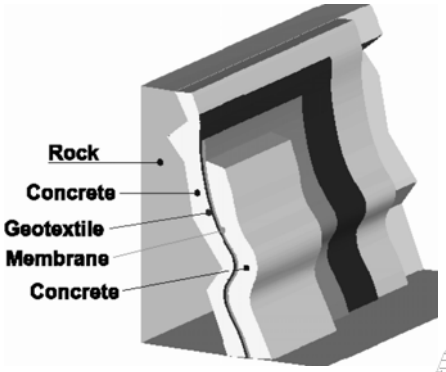


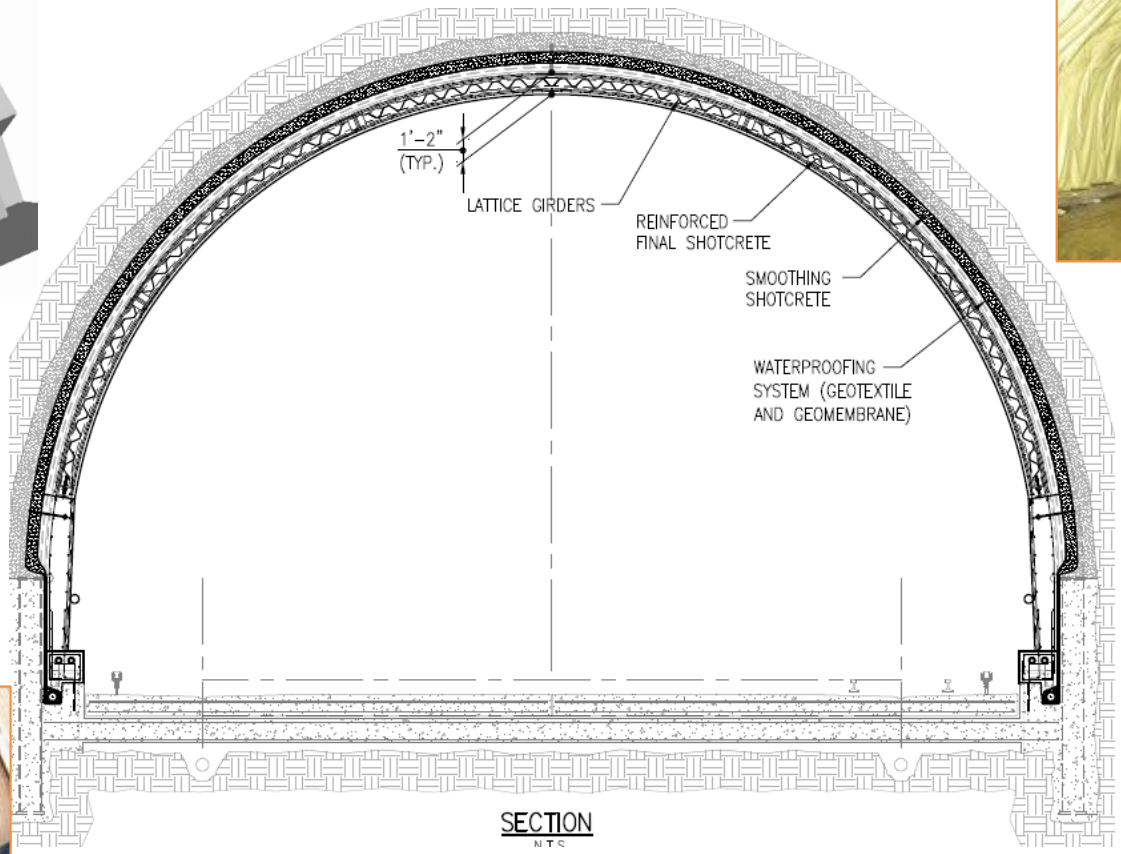
Rusted ATC Equipment

Corroded Running Rail

Crossover Waterproofing Options

Option 1 - Geomembrane System





Geomembrane System

Option 1 - Geomembrane System

Issues

- Intensive service disruptions – 5 week 24x7 shutdown + weekends shutdowns
- Liner is not accessible after construction
- More weekend shutdowns needed for starter wall

Total Project Cost

$ 9M - Construction

$ 10M - Bus Bridge

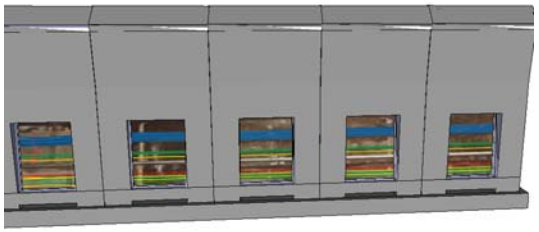
$ 19M - Total Cost

Risk Analysis

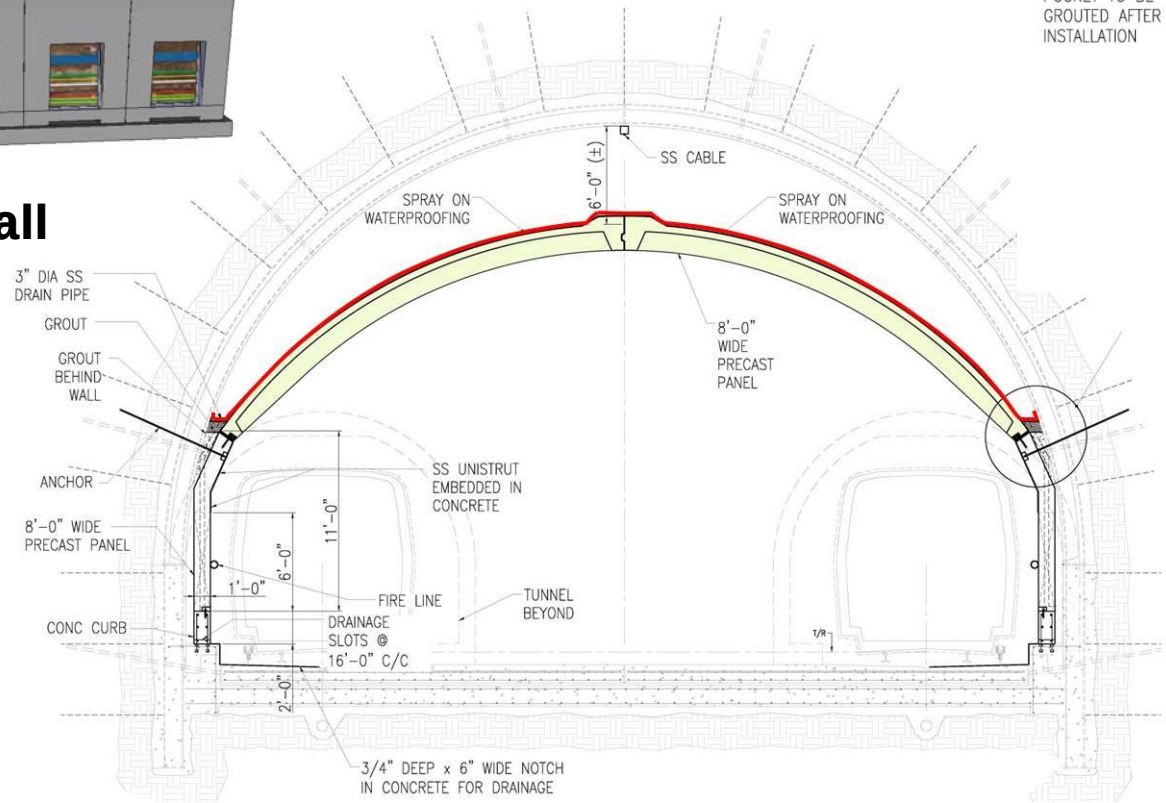
95% confidence of completing work within 5 weeks

Crossover Waterproofing Options

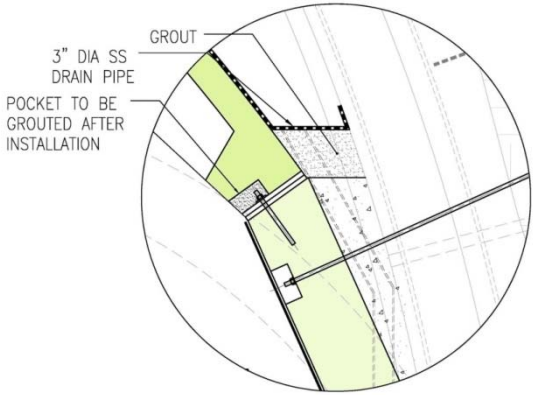
Option 2 – Precast Concrete Arch



Starter Wall



Precast Concrete Arch



Trough Detail

Option 2 – Precast Concrete Arch

Construction Steps

STEP 1 Reroute Standpipe and Radio Cable (Track 2)

STEP 2 Move up ATC and Power Cables (Track 2)

STEP 3 Transport and Erect Starter Wall (Track 2)

STEP 4 Move down ATC and Power Cables (Track 2)

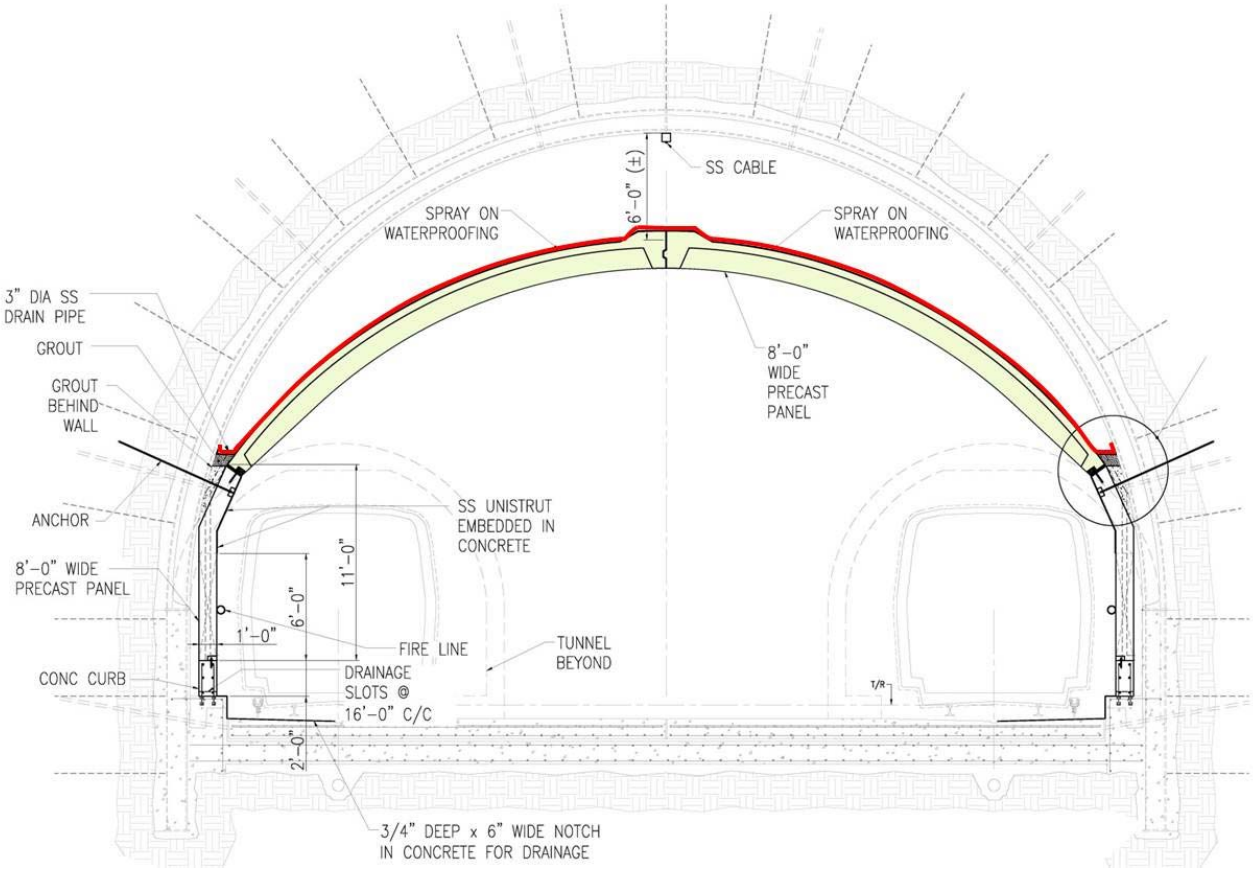
STEP 5 Repeat the above Steps for Track 1

STEP 6 Install Drainage System -Top of Starter Wall

STEP 7 Install Precast Arch

STEP 8 Install Waterproofing on top of the Precast

Option 2 – Precast Concrete Arch



Starter Wall:
7 weekend Shutdowns

+

Precast Arches:
7 consecutive weekend Shutdowns

Total
14 Weekend Shutdowns

Total Project Cost

$ 7.3M - Construction
$ 4.9M - Bus Bridge
$12.2M - Total Cost

Option 2 – Precast Concrete Arch

Advantages

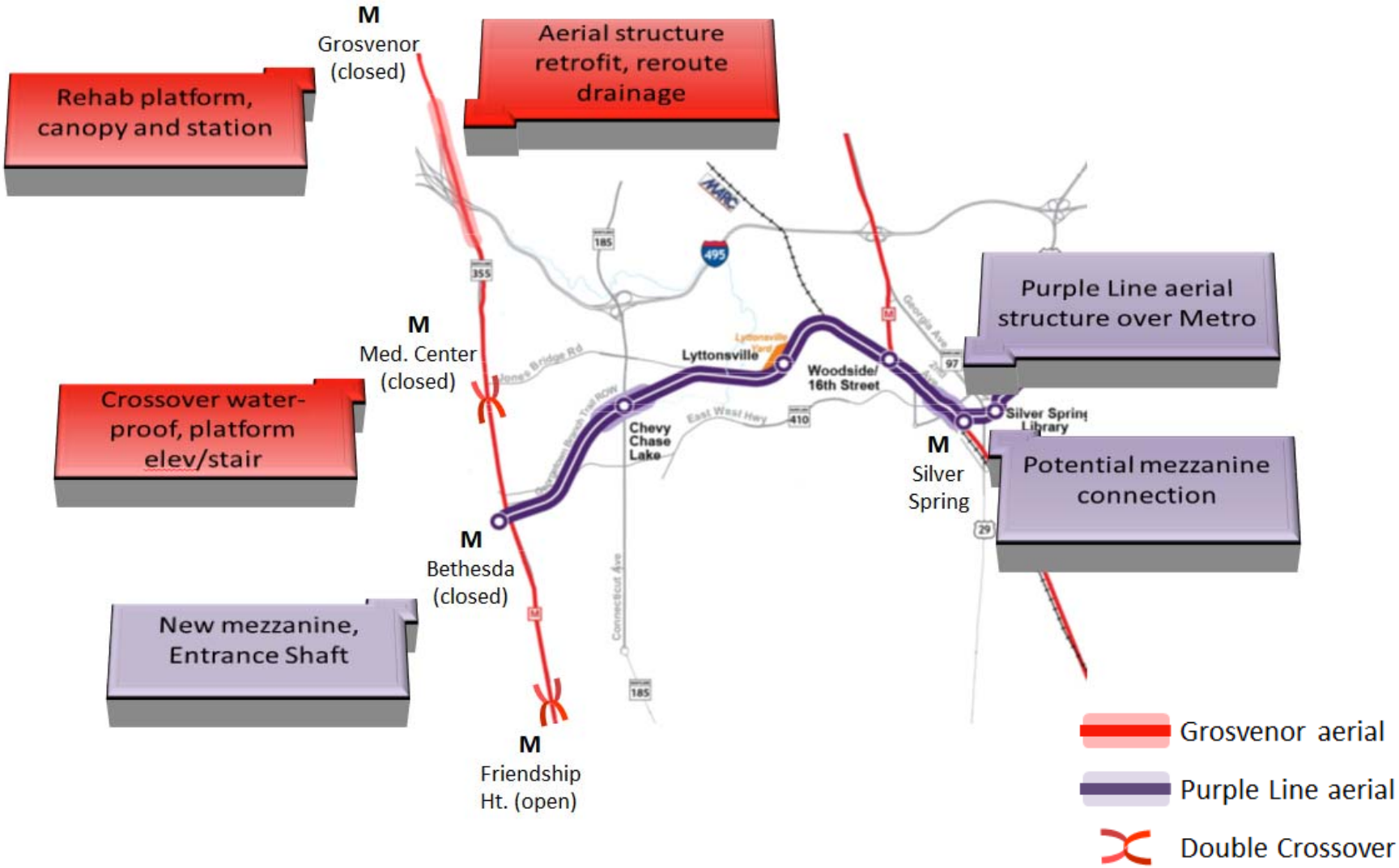
- Minimal number of pieces simplify erection, and
- Sections are simple and relatively lightweight
- Tunnel liner is accessible after construction
- Equipment can be used for the next crossover waterproofing
- Less service disruptions
- 14 Weekends shutdown provides the flexibility of the construction start date

Option Recommended and Selected

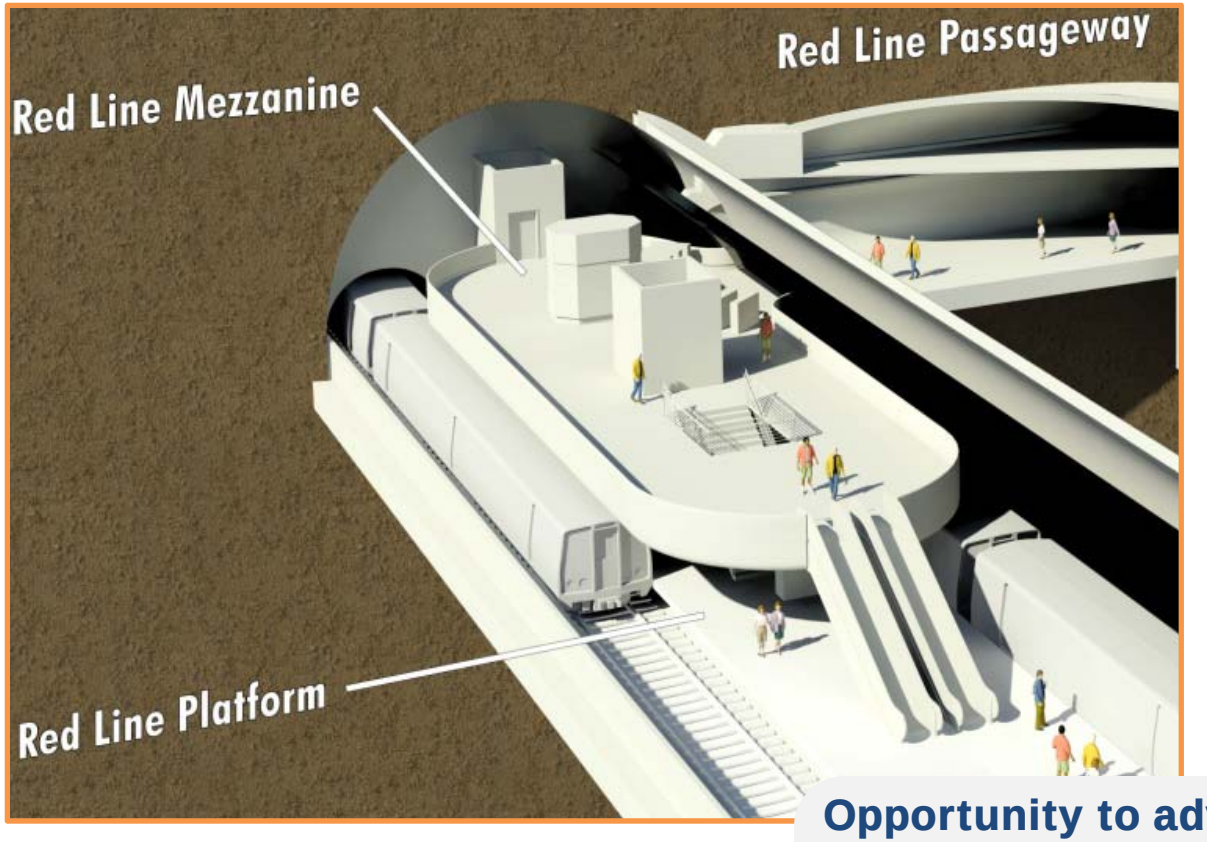
Geomembrane System	Precast Concrete Arch
1	2
5 Week 24x7 Shutdown	14 Weekend Shutdowns
$$$$ 19M	$$ 12.2M

Option Selected

Opportunity to Advance Additional Red Line Work



Purple Line – New Bethesda Mezzanine



Required work:

- Saw cut platform and invert slab
- Foundation for columns and elevators / escalator
- Mezzanine steel framing and concrete structures
- Elevators, escalator, communication systems, kiosk, fare collection

Opportunity to advance during the 14 weekend shutdowns:

- Some foundation work
- Mezzanine steel framing, mezzanine slab and parapet wall

Grosvenor Aerial Structure Retrofit

Required work:

- 21 Piers require anchor bolt repair
- Retrofit of girders at piers
- Grouting to transfer load
- Shutdown is needed to cure the grout

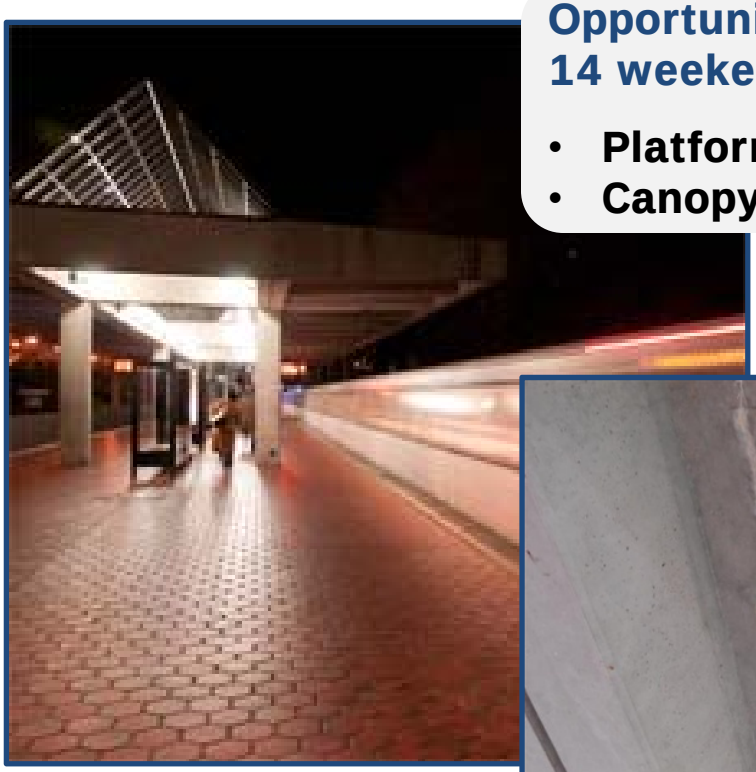
Opportunity to advance during the 14 weekend shutdowns:

- Grouting of the piers

Grosvenor Platform and Canopy Rehab

Opportunity to advance during the 14 weekend shutdowns:

- **Platform Structural Repairs**
- **Canopy Rehab**



Tentative Schedule

- Grosvenor Station
- Grosvenor Aerial
- Medical Center Waterproofing
- Bethesda New Mezzanine

→ Final Design, Procurement & Preparation

→ 14 Weekend Shutdowns

→ Begin in Summer/Fall 2016

- Entrance Shaft Bethesda
- Aerial Structure and Potential Connection Silver Spring

→ MTA Request on Weekend Shutdowns

→ Begin in Winter 2017 (Depends on MTA Contract)