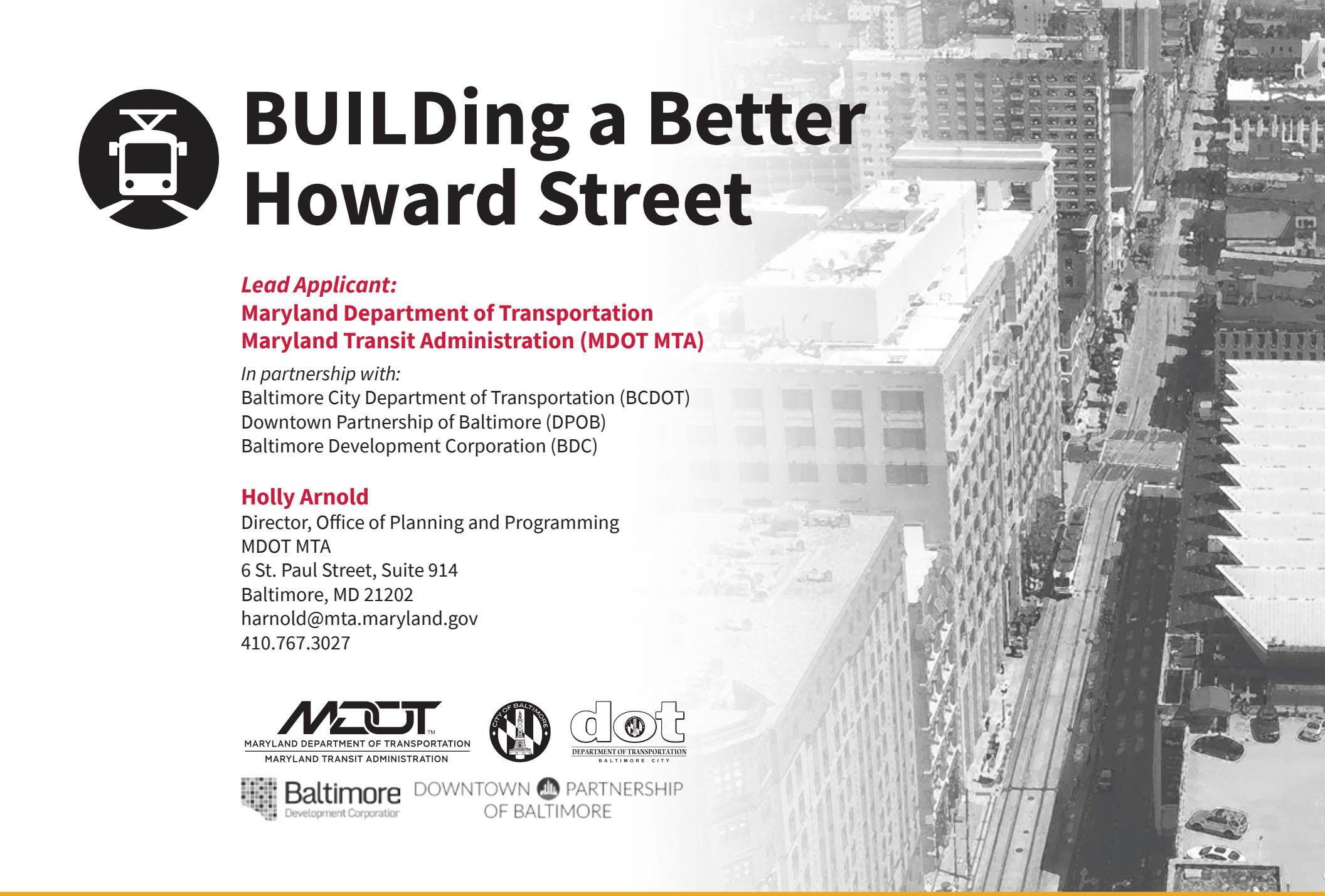
BUILDing a Better Howard Street



Lead Applicant:
Maryland Department of Transportation
Maryland Transit Administration (MDOT MTA)

In partnership with:
Baltimore City Department of Transportation (BCDOT)
Downtown Partnership of Baltimore (DPOB)
Baltimore Development Corporation (BDC)

Holly Arnold
Director, Office of Planning and Programming
MDOT MTA
6 St. Paul Street, Suite 914
Baltimore, MD 21202
harnold@mta.maryland.gov
410.767.3027

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION

DEPARTMENT OF TRANSPORTATION
BALTIMORE CITY

Baltimore Development Corporation

DOWNTOWN PARTNERSHIP OF BALTIMORE

FY 2018 BUILD Discretionary Grant Program
Total Project Costs: $71.3 Million
BUILD 2018 Funds Requested: $25.0 Million

BUILDing a Better Howard Street

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The historical photo of Howard Street used as a backdrop throughout this application is by Robert Mottar / Baltimore Sun

PROJECT OVERVIEW

INTRODUCTION

Howard Street was once downtown Baltimore's premier shopping district, but in the 1970s it went into decline. The thoroughfare's commerce and culture could not be sustained despite the introduction of Light RailLink service in the early 1990s, and in the intervening decades Howard Street has suffered from vacancies and blight.

While vacant storefronts and buildings remain, Howard Street has recently had notable successes, including the Centerpoint Apartments, Mt. Vernon Marketplace, and numerous smaller commercial establishments. However, economic growth is hampered by infrastructure repairs needed along the corridor.

BUILDing a Better Howard Street (BBHS) transcends historical investment silos by coupling much-needed infrastructure improvements to spur development activity. The project repairs and replaces aging Light RailLink tracks and makes other infrastructure improvements that provide an opportunity to revitalize Baltimore's downtown core.

PROJECT ELEMENTS

MDOT MTA is requesting US DOT BUILD funding of $25.0 million, a contribution that will support a $71.3 million program of improvements in the corridor:

- **Replace and realign Light RailLink tracks,** resulting in safer, more efficient, more reliable, and quieter service through downtown.
- **Update Light RailLink stations** with modern amenities and better connections between rail modes. The five stations within the corridor constitute approximately one-third of daily boardings across the light rail system.
- **Create a one-block shared transit street** activated with landscaping, lighting, furniture, and art.
- **Upgrade water and power utility connections** that have been barriers to development.
- **Enhance the streetscape** to improve accessibility, safety, comfort, and visual appeal, including improving the connection to the Lexington Market Metro SubwayLink Station.

PROJECT BENEFITS

- **Safety:** Over 100 crashes involving Light RailLink vehicles have occurred in the last three years. BBHS will reduce crashes by 28% by eliminating locations where cars and pedestrians cross the tracks.
- **Travel Time Savings:** Accommodating several locations where cars cross the tracks along with uncoordinated traffic signals results in excessive passenger delay through the corridor. BBHS will reduce travel time by up to 1.5 minutes (10% savings) by eliminating track crossings and providing traffic signal communications to support coordinated signal timing.
- **Reliability:** Light RailLink currently suffers from service disruptions and operates under frequent slow zone restrictions due to the worn tracks. BBHS will repair the poor track conditions that currently result in over 100 days of speed restrictions or service disruptions per year.
- **Revitalization:** BBHS will make Howard Street more inviting and productive for retail business and residents by replacing deteriorated sidewalks, providing pedestrian lighting, and improving connections to Metro SubwayLink, bus, and bicycling options.
- **Reinvestment:** Inadequate utility access and deteriorated street conditions contribute to numerous vacant and underutilized properties along Howard Street, despite successful investment and redevelopment on nearby blocks. BBHS will spur private investment along Howard Street by providing needed water, power and telecommunications utility access, and by creating a vibrant and functional street environment.

1

1.1 Corridor Overview

For over 200 years, the Howard Street corridor ("project corridor") has served as a destination shopping district for downtown Baltimore, complementing Charles Street, the city's primary axis. The project corridor is anchored by Lexington Market, which was established in 1782 and is one of the longest-running public markets in the world.

In the late 19th century, department stores flourished along Howard Street, including Hutzler's, Hochschild Kohn's, Hecht's,

Figure 1: Historic Lexington Market

and Stewart's. These stores clustered to take advantage of Lexington Market's hustle and bustle, with three of the stores operating side entrances off the east-west Lexington Street.

Post-World War II suburbanization brought a gradual decline in foot traffic and retail sales, as most of the economic energy along Howard Street relocated to larger sites further from the CBD.

A major road project along Howard Street in the late 1980s, coupled with the immediate implementation of the Light Rail in the early 1990s, created significant and sustained disruptions to businesses.

Combined with population decline in the inner city since the 1960s, many large commercial outlets closed for good. In the intervening decades, the project corridor has suffered from vacancies and blight.

Today, changing demographics and market demand for urban living that combines quality places with major transit options position Howard Street to participate in and support the City's economic revitalization and urban renaissance. The downtown district is, by far, Baltimore's fastest growing residential area.


Figure 2: WWII view of Howard Street


Figure 3: Hustle and bustle at the Mount Vernon Marketplace

PROJECT DESCRIPTION

Although vacant storefronts and buildings remain, over $1.5 billion in mixed-use, residential, retail, and hotel investment has occurred within a 10-minute walk of Howard Street over the past three years, along with $35M in funding for parks and infrastructure.

The project corridor is home to many notable redevelopment successes, including the Centerpoint Apartments, the Atrium Apartments, the Le Mondo arts and community hub, and Mt. Vernon Marketplace; multiple ongoing projects on Howard Street in the three-block stretch between Saratoga Street and Centre Street; numerous smaller commercial establishments; and the conversion of two flagship retail properties from shuttered spaces into vibrant mixed-use developments.

These successes are, in part, the result of over a decade of concerted efforts by the City, Maryland Department of Transportation Maryland Transit Administration (MDOT MTA), and other project partners to revitalize the City's Westside. Since its establishment in 2012, the Bromo Tower Arts & Entertainment District ("the Bromo"), which occupies much of the project corridor, has been a catalyst for reactivating Howard Street.

As shown in Figure 4, Howard Street forms a crucial north-south transit link between the multimodal connections available at Baltimore-Penn Station to the north, significant employment opportunities within the dense downtown

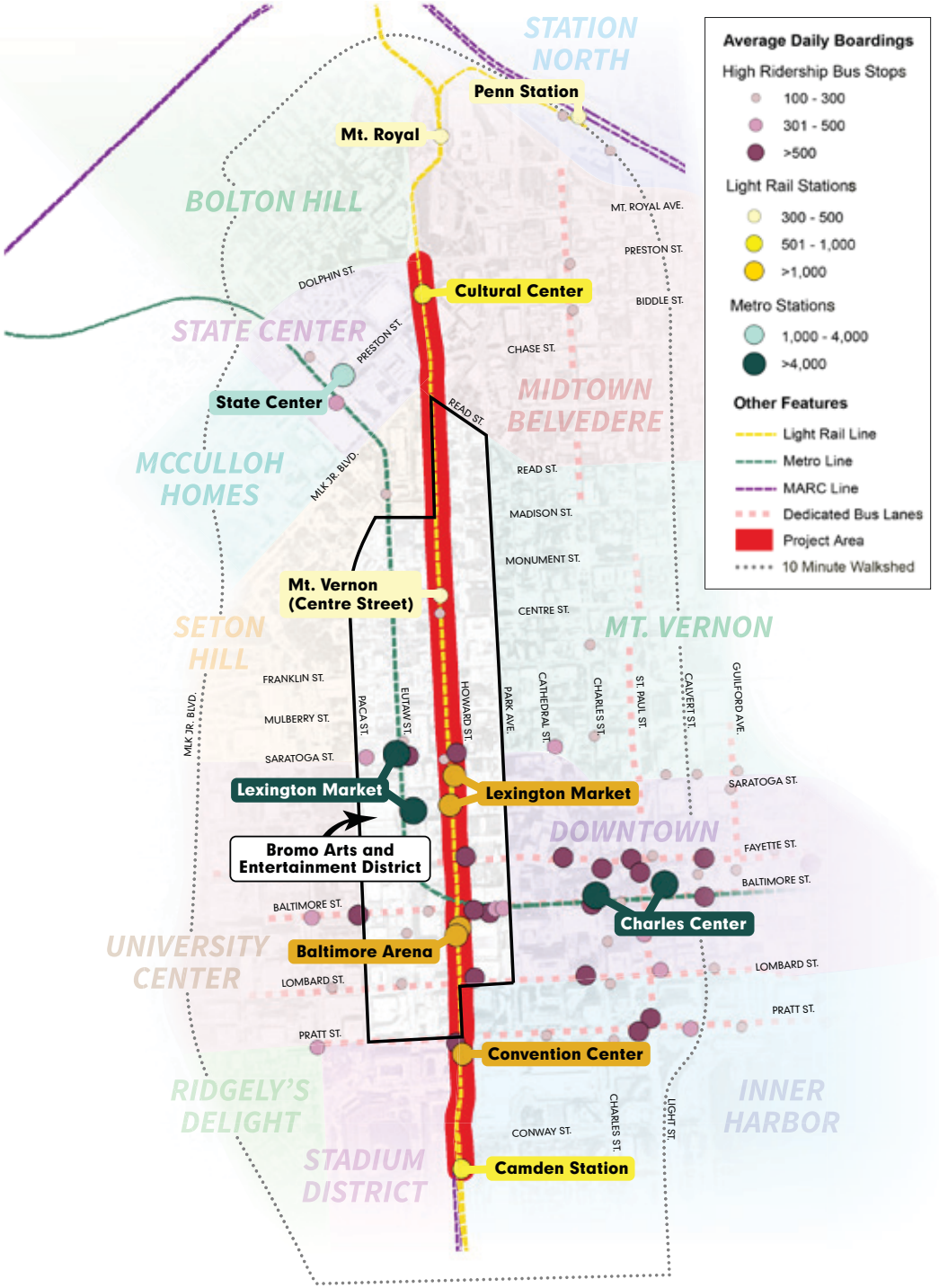


Figure 4: Transportation overview

CBD immediately to the east, tourist- and family-oriented destinations along the Inner Harbor to the southeast, major sports venues just to the south, and the University of Maryland at Baltimore (UMB) campus to the west.

The 1.3-mile segment of Howard Street between stations at Cultural Center and Convention Center offers high-frequency transit service (7.5 minutes peak and 10 minutes off-peak) that connects suburban communities and emerging employment to the north with the Baltimore Washington International Thurgood Marshall Airport (BWI) and its employment district located 10 miles south.

Owing to their prime accessibility to CBD employment and other significant trip generators (e.g., convention center, ballpark, arena, four medical centers, two universities, the state government complex, six fine arts venues, and historic Lexington Market), **the five Light RailLink stations within the project corridor constitute approximately one-third of the average weekday boardings across the 33-station system.** The stations with the highest light rail ridership are:

- First: Lexington Market (3,175 average weekday boardings)
- Second: Baltimore Arena (2,300 average weekday boardings)
- Fifth: Convention Center (1,050 average weekday boardings)

Transit Connections to Howard Street

RAIL
- 2 Metro SubwayLink stations

BUS
- 11 CityLink (high-frequency service)
- 9 LocalLink (standard service)
- 6 Express BusLink (peak-only service)

OTHER TRANSIT
- Free Charm City Circulator
- UMB campus shuttles

PRIVATE SERVICES
- 4 Baltimore Bike Share stations
- 4 Zipcar pick-up/drop-off points

Howard Street has Light RailLink's most closely spaced stations with frequent intersecting streets, including four east-west thoroughfares with dedicated bus lanes implemented as part of MDOT MTA's 2017 BaltimoreLink bus network redesign.

Maintaining reliable Light RailLink operations along this segment is critical because it features the only two transfer points (Cultural Center and Lexington Market) where passengers can connect to the Metro SubwayLink, which runs between Owings Mills and Johns Hopkins Hospital.

Providing predictable service ensures that riders disembarking for long-haul journeys outside of the region make their time-sensitive intercity rail, bus, and air connections at Penn Station (two stops north with Amtrak, MARC commuter rail connection, and Boltbus), Camden Yards Station (one stop south with MARC commuter rail), and BWI Thurgood Marshall Airport station.

BBHS will realize the following benefits:

- Reduce travel time by 10 percent (up to 1.5 minutes);
- Reduce Light Rail collisions by 28 percent;
- Eliminate consistent slow orders and maintenance-related service outages (107 days in the last year); and
- Eliminate barriers to redevelopment by providing utility and streetscape upgrades.

1.2 BUILDing a Better Howard Street

Despite its central location and myriad operational synergies, Light RailLink service along the project corridor is hindered by a combination of state of good repair (SGR) and safety issues that threaten the long-term viability of reliable transit service.

Furthermore, antiquated utilities beneath Howard Street, particularly weak water main connections that prevent compliance with fire code requirements for sprinkler systems, jeopardize the continued revitalization of the Howard Street corridor.

PROJECT DESCRIPTION

To that end, MDOT MTA has engaged its partners at the Baltimore City Department of Transportation (BCDOT), the Downtown Partnership of Baltimore (DPOB), and the Baltimore Development Corporation (BDC), as well as the Bromo, the Market Center Merchants Association, the University of Maryland Medical System (UMMS), and other corridor stakeholders, to collaboratively develop a suite of capital enhancements that combines critical Light RailLink SGR activities with transformative changes to the built environment that will **unlock the redevelopment potential of the Howard Street corridor.**

It should be noted that the major elements of the project scope were developed based on recommendations from four separate planning studies in the corridor conducted since 2010, as detailed in ***Section 4.2 Project Readiness***. Furthermore, the rail replacement component of the scope is already programmed in the *MDOT FY 2018-2023 Consolidated Transportation Program (CTP)*.

As shown in Figure 5, BUILDing a Better Howard Street (BBHS) features the following improvements:

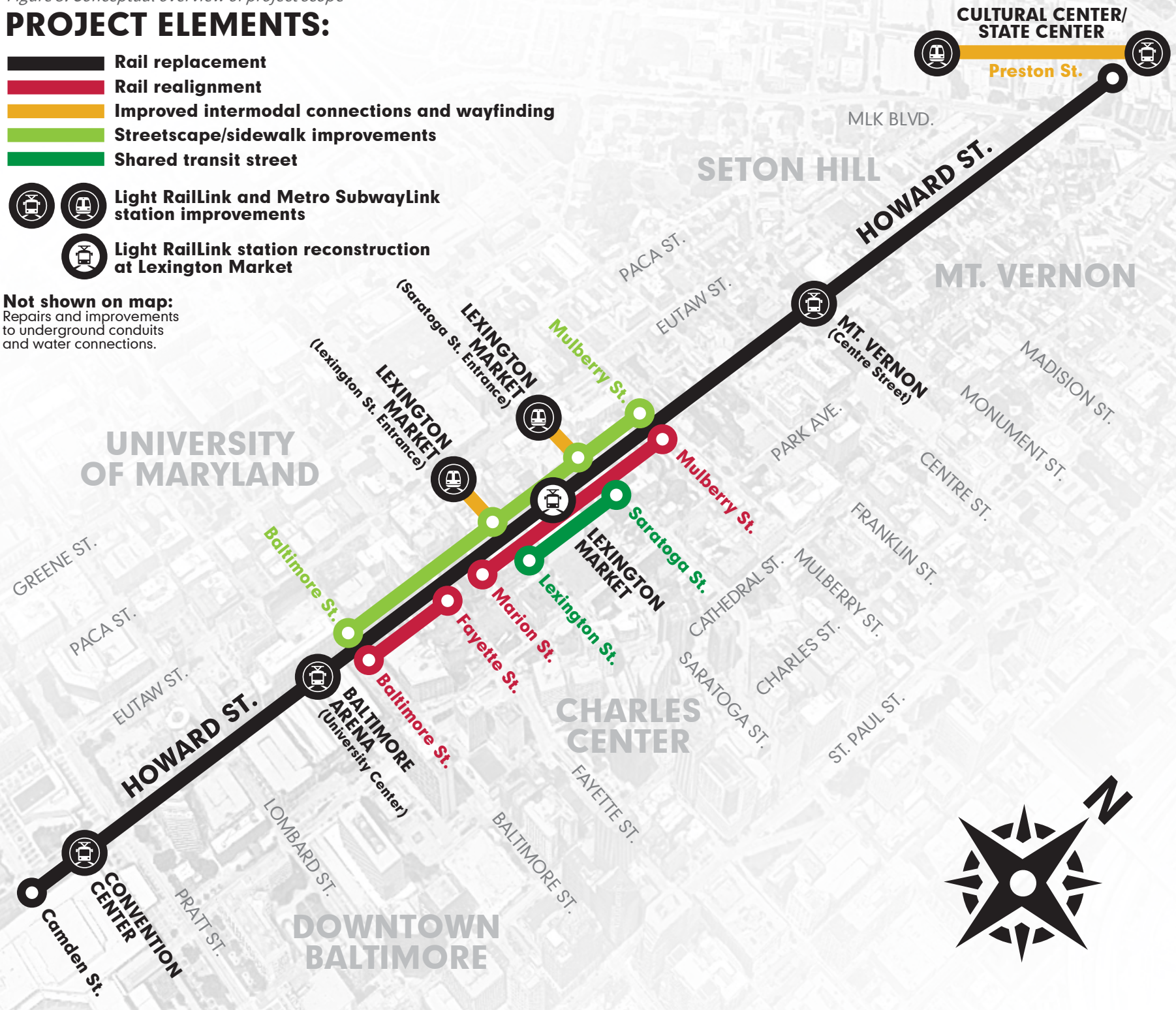
- Replacement of 1.3-miles of embedded rail from Cultural Center to Convention Center, including a new trough drainage system and a state-of-the-art elastomeric grout system in the realigned sections, to maintain a state of good repair, avoid significant disruptions to the corridor, reduce passenger delays, and ensure reliability;
- Realignment of curved sections and reconstruction of the northbound platform at Lexington Market to increase transit speeds, improve multimodal safety, simplify traffic operations, reduce noise nuisances from car horns and wheel squeal, and extend the useful life of critical assets;
- Upgrade of water, power, and telecommunications lines and connections concurrently at strategically identified locations to remove existing barriers to redevelopment along Howard Street and limit disruptions to abutting businesses;
- Development of a one-block shared transit street at Lexington Market (Saratoga Street to Lexington Street) activated with landscaping, lighting, furniture, and art;
- Implementation of streetscape enhancements from Mulberry Street to Baltimore Street to improve pedestrian and ADA accessibility, safety, passenger comfort, and corridor aesthetics;
- Update of stations with modern amenities (integrated canopies with real-time information and security cameras, new wayfinding) to enhance the passenger experience and improve safety;
- Implementation of new wayfinding systems, ADA elements, and crossing improvements to strengthen the connection between Light RailLink and Metro SubwayLink stations;
- Integration of wireless communications at traffic signals that enable synchronization along the corridor to improve transit and vehicular travel times;
- Installation of a new train detection system at Read Street to enable signal preemption and increase transit speeds; and
- Stabilization, rehabilitation, and upgrades to historic properties along this corridor to reduce vacancy and blight, and strengthen local businesses.

Figure 5: Conceptual overview of project scope

PROJECT ELEMENTS:

- **Rail replacement**
- **Rail realignment**
- **Improved intermodal connections and wayfinding**
- **Streetscape/sidewalk improvements**
- **Shared transit street**
- **Light RailLink and Metro SubwayLink station improvements**
- **Light RailLink station reconstruction at Lexington Market**

Not shown on map:
Repairs and improvements to underground conduits and water connections.



1.3 Project Need

BUILDing a Better Howard Street will address several needs related to state of good repair, safety, economic and community development, and the environment. These needs are summarized below, and how the proposed project meets these needs is described in ***Section 4.1 Merit Criteria***.

State of Good Repair

The majority of the embedded rail in the project corridor is in poor condition which results in the routine imposition of slow orders and, when the rail sections break, significant disruptions to transit service and local businesses. In addition to the operational impacts, the rail breaks increase MDOT MTA's operations and maintenance (O&M) costs, with broken rail repairs averaging over $328,000 per incident when accounting for design, construction, and bus bridge operations.

A total of 16 speed restrictions spanning 91 days of service (approximately 25 percent of annual service days) were issued along Howard Street from May 2017 to April 2018 due to track conditions, **reducing transit speeds from the intended 25 miles per hour (mph) design speed to either five or ten mph.**

In the majority of cases, each time broken rail is repaired Howard Street must be closed to both vehicular and transit traffic from Friday at 8:00 PM to Monday at 4:00 AM, creating travel challenges and delays for both transit users and motorists that ultimately decrease patronage of local businesses and curtail the number of visitors to the various points of interest surrounding the project corridor.

While the poor condition of the rail is partially a function of the asset's age, there are two underlying issues that contribute to the accelerated degradation of the infrastructure, safety risks, and increased noise and vibration – the lack of adequate drainage and the embedded track's inadequate seal.

The current absence of a functional trough drainage system, which conveys water away from the embedded rail, has led to moisture infiltration, producing voids and surface irregularities. As the foundation upon which the rail was cast becomes less solid, the pavement beneath it begins to buckle or subside and the infrastructure starts to wear unevenly. These irregular profiles create a situation where one minor issue, when coupled with standard Light RailLink operations, generates other problems that result in the need for significant repairs (i.e. "systemic failure").

Figure 6: Poor track conditions generate slow orders

This drainage issue is particularly problematic along sections where the realignment and new drainage system is proposed. For instance, subsidence of the support slabs along the block between Lexington and Fayette Streets in 2016 led to sections of rail that were "floating" within the troughs which, in turn, caused the rail to pump as each train passed, leading to the wheel flanges fracturing the concrete filler grout into pieces and exposing rail hold-down bolts.

It should be noted that this buckling and subsidence issue also applies to the adjacent roadway, creating an uneven profile along the road and causing additional wear and tear on passenger vehicles.

Along with escalating maintenance costs, the loose rail sections increase noise and vibration, decrease passenger comfort, and pose potential safety concerns, as the movement of the vehicles becomes less constrained and the wheel flanges begin to knock loose components of the embedded rail.

An inadequate seal, coupled with decades of freeze-thaw cycles and the City's application of de-icing salt during winter months, has led to premature corrosion of the rails. Additionally, when road salt is applied and snow plows pass, the salt is

swept into the voids between the rail and the base's concrete fill, further eroding the foundations that hold the rail in place.

The eroded foundations caused by salt amplify stray current problems within the system. Recent positive testing (2018) confirms the presence of stray current which could accelerate the degradation of public utilities underneath the embedded track.

Finally, Light RailLink operations through the three curves cause moderate to severe rail corrugations on the tread surfaces. As the tread surface becomes less uniform, the vehicle loads become more uneven and the head of the rail begins to flatten at the weld points, thereby reducing the useful life of the asset.

Safety

For much of the project corridor, the two Light RailLink tracks occupy the western side of Howard Street; however there are three weaving sections within the five-block stretch from Mulberry Street to Baltimore Street (see Figures 7 and 8).

Figure 7: Potential train-vehicle conflict point near Lexington Street

When the roadway configuration changes, the weaving movements generate conflicts between Light RailLink trains and passenger vehicles, as evidenced by the **102 collisions between trains and motorists** reported between MLK Jr. Boulevard (Cultural Center) and Camden Yards from January 2015 to March 2018.

In addition to the property damage and injuries associated with these train-vehicle collisions, service must be suspended in both directions between North Avenue and Camden Yards stations while MDOT MTA and Baltimore City police investigate the train-vehicle collision, resulting in an average passenger delay of approximately 40 minutes per incident.

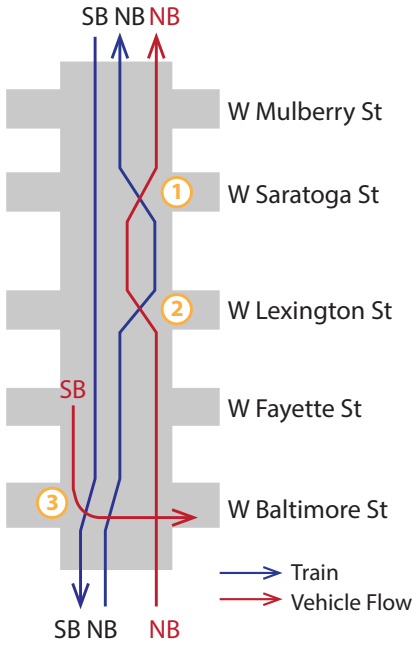


Figure 8: Light RailLink weaving movements and train-vehicle conflict points

From 2014 to 2016 an annual average of nine pedestrian-involved crashes occurred along Howard Street and the east-west streets that connect the Light RailLink stations with Metro SubwayLink headhouses (Lexington, Saratoga, and Preston Streets). Given the significant concentration of destinations and transit transfers within the area, particularly near Lexington Market, there is currently an unmet need for pedestrian safety improvements along the project corridor.

Economic and Community Development

These maintenance and safety issues result in the underperformance of the light rail system, which produces negative externalities at both the macro- and micro-economic scales. Slowed and stopped operations impact not just travelers to and from Howard Street, but all light rail transit users who travel through it to reach regional destinations.

Based on a review of MDOT MTA's maintenance, service, and ridership records, it is estimated that the 16 slow zones issued between May 2017 and April 2018 generated approximately **27,600 passenger-hours (1,150 passenger-days) of delay** over the course of 91 speed-restricted days.

PROJECT DESCRIPTION

These significant delays translate into substantial economic costs in the form of lost productivity for riders and increased O&M costs for MDOT MTA. Delayed operations exert a negative impact on Baltimore's regional economy by constricting personal mobility and reducing its economic competitiveness relative to other regions with high-performing transit. In fact, the underperformance of the region's transit system is often cited by exiting college graduates as one of the top barriers preventing them from staying.

Furthermore, persistent suspensions of service, such as the 18-day shutdown in the summer of 2017 to perform critical rail repairs, and frequent all-weekend closures of the corridor severely limit the ability for residents to thrive and for Howard Street's businesses to prosper.

In addition to the service delays and suspensions, each of the traffic signals along the project corridor currently operates according to its own internal clock. The signals are not interconnected, so there is no available means to force them into operating as a unified system for controlling traffic flows along Howard Street, which results in persistent stop-and-go operations for both Light RailLink trains and passenger vehicles.

Although Transit Signal Priority (TSP) and signal preemption capabilities exist along the corridor, the absence of synchronized signals limits the effectiveness of TSP and signal preemption.

Connectivity between transit modes is another contributing factor to economic competitiveness and quality of life; the ease of transferring to other services speeds travel and provides options for residents and visitors alike, which in turn makes the surrounding community more appealing to both.

Although the distances between the Light RailLink stations at Cultural Center and Lexington Market and the Metro SubwayLink stations at State Center and Lexington Market, respectively, are relatively short (less than two blocks), limited wayfinding, coupled with poor ADA and pedestrian accessibility, along Lexington and Saratoga Streets (Lexington Market) and Preston Street (Cultural Center-State Center) often inhibit seamless transfers between two rail systems that served an average of approximately 50,300 unlinked trips per day in 2017.

As evidenced by several recent or ongoing redevelopment projects adjacent to the project corridor, the development community has begun to show a heightened interest in leveraging Howard Street's proximity to the CBD, various points of interest nearby, and rail transit to implement large infill mixed-use developments. **However, developers seeking to realize their visions along the project corridor are hindered by existing utilities infrastructure, primarily weak connections to the water main.**

Figure 9: New high-density and legacy low-rise developments on Howard Street

Currently underground connections running from the water main to the parcels fronting Howard Street fail to deliver a level of pressure that is sufficient to operate a building-wide sprinkler system, which is required by the fire code. Thus, any developer seeking to re-use one of the corridor's older structures or construct an entirely new building cannot obtain a building permit from the City of Baltimore without incurring substantial costs.

Redevelopment along Howard Street is complicated by the inherent difficulty of accessing water and other utilities situated beneath an active roadway and Light RailLink infrastructure, as well as the associated costs for maintenance of traffic and bridging transit service. For the recent projects abutting the project corridor, developers sought to avoid upheaval along Howard Street by running connections 1,200 feet to the east from the nearest trunk line at Charles Street.

Additionally, existing power and telecommunications lines are at capacity which limits the ability for developers to accommodate the modern operational needs of future tenants.

The Howard Street corridor lacks a unifying aesthetic treatment, as evidenced by multiple unimproved building facades at vacant properties and little to no streetscaping elements that create a distinguishable sense of place. Thus, despite a white-hot development climate in the surrounding area, revitalization of the Howard Street corridor specifically has largely been deferred as developers seek relatively easier and higher returns elsewhere.

1.4 Introduction to Project Benefits

At its core, BUILDing a Better Howard Street identifies synergies between addressing long-standing SGR, safety, and operational needs of the Light RailLink system while establishing a firm built environment foundation to realize high-density transit-oriented development. BBHS will concurrently upgrade utilities to effectively increase the development capacity of Howard Street while undertaking transit- and pedestrian-oriented improvements.

Table 1 aligns each element of the project scope with its associated benefits, which are described in greater detail in ***Section 4.1 Merit Criteria***.

	MAINTAIN STATE OF GOOD REPAIR	IMPROVE SAFETY	INCREASE TRANSIT SPEEDS	MINIMIZE DISRUPTIONS TO BUSINESSES	ENHANCE RELIABILITY / REDUCE DELAYS	REDUCE NOISE & VIBRATION	REMOVE BARRIERS TO REDEVELOPMENT	IMPROVE CORRIDOR AESTHETICS	ENHANCE PASSENGER COMFORT
Rail Replacement	✓		✓	✓	✓	✓			
Realignment of Curves	✓	✓	✓	✓	✓	✓			✓
Utilities Upgrades				✓			✓		
Streetscaping		✓	✓				✓	✓	
Station Wayfinding and Connectivity Improvements		✓						✓	✓
Signals & Communications			✓		✓				
Historic Property Upgrades and Public Art							✓	✓	

Table 1: Project scope and benefits

2 PROJECT LOCATION

2.1 Project Location

Howard Street is located near the center of the Baltimore, Maryland urbanized area, home to 2.23 million residents in 2010. Most of the corridor is situated within Maryland's Seventh US Congressional District apart from the southernmost block near the Convention Center and Oriole Park at Camden Yards (Pratt Street to Camden Street) which occupies a portion of the Third US Congressional District.

The majority of the project corridor is included within at least one of the following special planning and/or historic districts: the Baltimore City Enterprise Zone, the Baltimore City Historic District, the Mount Vernon National Register Historic District (NRHD), the Market Center NRHD and Urban Renewal Area, and the Bromo Tower Arts & Entertainment District.

As outlined in Figure 10, this five-station segment of the Light RailLink system affords pedestrian access to the Baltimore Convention Center, the Baltimore Arena,

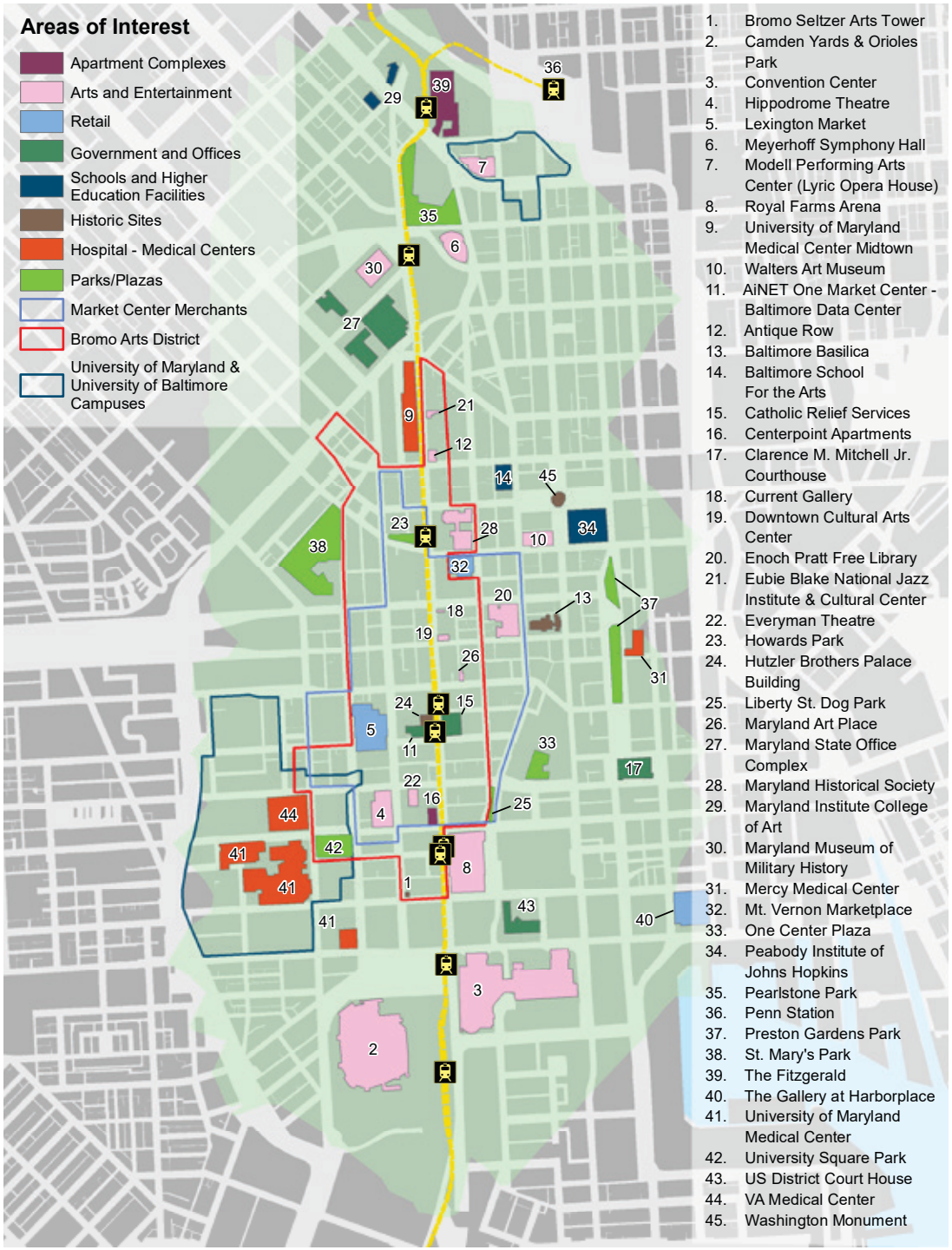


Figure 10: Major destinations within the project's 10-minute walkshed

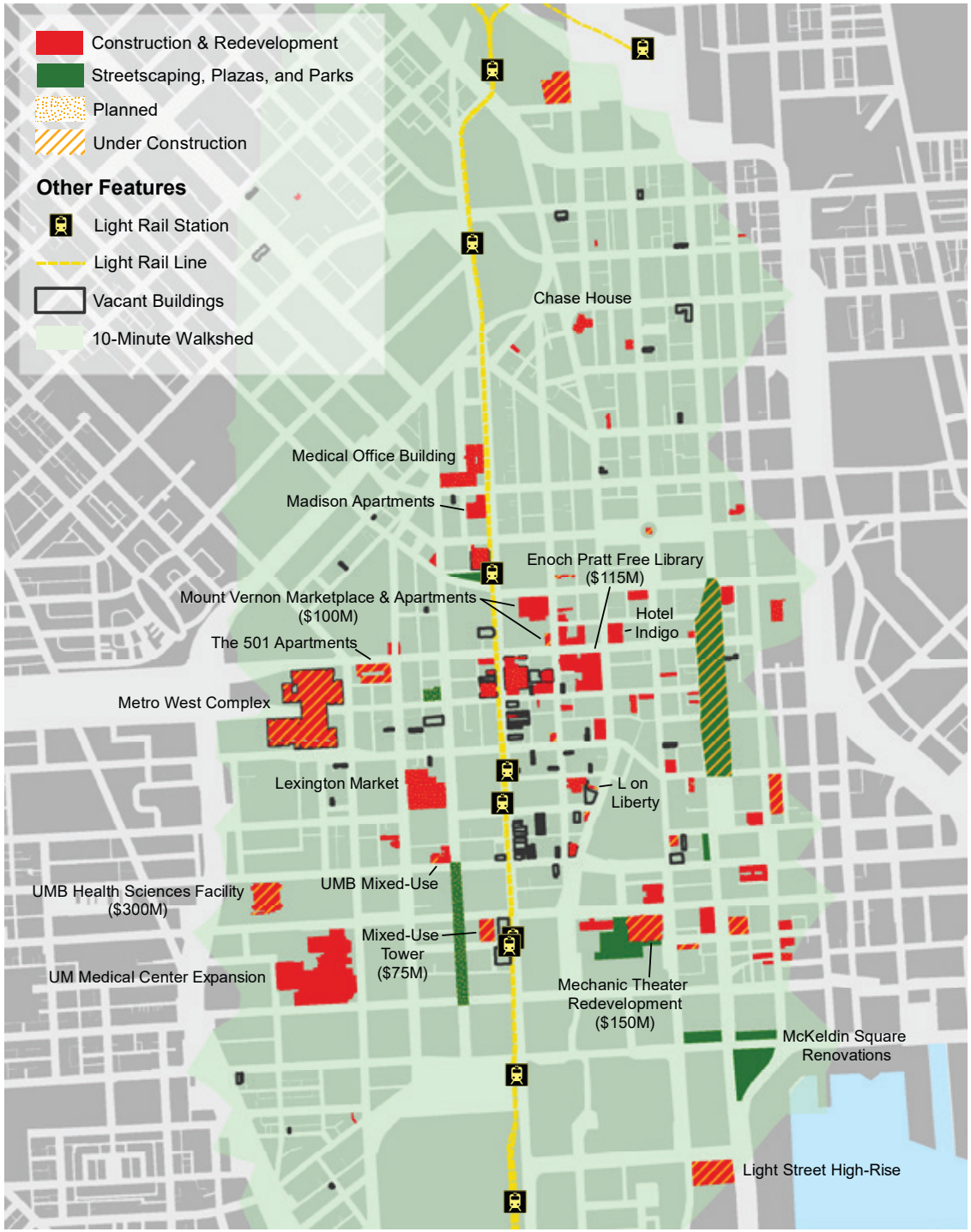


Figure 11: Recent developments, upcoming projects, and lingering vacancies

Oriole Park at Camden Yards, the Maryland State Government Complex, US District and City courthouses, historic Lexington Market, four regional medical centers, two university campuses, the performing arts center, symphony hall and Lyric Opera, two libraries, multiple historic theaters, a dog park, several recent or upcoming redevelopment projects, and a plethora of DIY galleries and artist collectives that constitute the Bromo. Approximately 86,500 jobs are located within the project corridor's 10-minute walkshed.

The project corridor is anchored by two major rail stations. Located two stations north of Cultural Center, Penn Station is the region's premier multimodal transportation hub that offers connections to Amtrak Acela Express and Northeast Regional intercity rail services, the Penn Line of the MARC commuter rail system, which serves Perryville to the north and BWI Airport, the New Carrollton Washington DC Metro station, and Washington DC's Union Station to the south, and Boltbus intercity bus service.

Positioned 700 feet south of and one stop away from Convention Center is the Camden Yards Station that provides access to the Camden Line of the MARC commuter rail system which runs southward and serves two Washington DC Metro stations before terminating at Union Station. Thus, in addition to serving local transit trips, the project corridor serves as a vital connection for those making long-distance journeys and often functions as visitors' introduction

to the City of Baltimore. A map of recently completed, under construction, or planned redevelopment or rehabilitation projects is provided in Figure 11. The projects shown represent over $1.5 billion of investment.

Note that while the market is driving major investment in the project area, **significant vacancies remain along Howard Street due in part to the added costs associated with the infrastructure needs,** which BBHS will address.

While the project corridor predominately consists of commercial and retail parcels, an emerging residential base has recently developed as vacant spaces have been converted into infill mixed-use developments, including the Centerpoint Apartments, the Atrium, and multiple ongoing or recently permitted projects within each of the four blocks of Howard Street between Saratoga Street near Lexington Market and Monument Street north of Centre Street. There are also three upcoming expansions to hospitals and medical facilities.

Both the State and City have allocated significant funding towards the $40M redevelopment of Lexington Market which will replace the existing commercial hub with an outdoor park and convert an adjacent surface parking lot to the south into a more productive use.

According to recent estimates from the US Census Bureau, relative to their counterparts in Baltimore and Maryland, a greater proportion of corridor residents: rely heavily on walking and/or transit for their commutes, possess college degrees, are employed, and live in poverty. This reflects the presence of a significant number of medical students performing their residencies at one of the four medical institutions within a 10-minute walk from Howard Street, including the Baltimore VA and Johns Hopkins Hospital located three stations west of Lexington Market on the Metro SubwayLink.

Thus, the corridor is home to a growing group of well-educated and emerging professionals that value access to non-motorized transportation options.

3

3.1 Capital Sources of Funds

BUILDing a Better Howard Street is estimated to cost approximately $71.33M in year of expenditure (YOE) dollars. MDOT MTA has committed $31.01M from its Transportation Trust Fund to the project. Through the BCDOT and BDC, the City of Baltimore will contribute $7.00M towards upgrades to conduit and historic properties. DPOB will provide $30,000 for public art installations, resulting in a non-federal share of 53.3 percent.

MDOT MTA will utilize $8.29M in its Federal Transit Administration (FTA) Section 5307 formula funding, leaving the balance - 35.0 percent - of project funding proposed to come from the FY 2018 Better Utilizing Infrastructure to Leverage Development (BUILD) program in the form of a $25.00M award. Table 2 summarizes funding sources and their share of project cost.

These costs are in addition to the $800,000 in MDOT MTA funding spent to date on project design activities, and a total of $2.5M in state funding which will be spent on environmental review and design activities prior to the obligation of a future BUILD grant.

As described in the ***Partnership*** section, DPOB, BDC, and the Maryland Department of Housing and Community Development (DHCD) have contributed funding to many street and building improvements along Howard Street. Table 3 presents highlights from the $1.5 billion in investments within the project's 10-minute walkshed that have occurred within the corridor over the past three years.

3.2 Capital Uses of Funds

Table 4 summarizes the cost for each element of the BBHS project.

FUNDING SOURCE	CAPITAL COST ($M)	SHARE OF COST (%)
MDOT Transportation Trust Fund	$31.01	43.5%
City of Baltimore (BCDOT)	$6.00	8.4%
BDC & DPOB	$1.03	1.4%
FTA Section 5307	$8.29	11.6%
BUILD	$25.00	35.0%
TOTAL	**$71.33**	**100.0%**

Table 2: BBHS capital funding sources

PROJECT DESCRIPTION	CAPITAL COST ($M)	STATUS
666 W. Baltimore Street UMB Health Sciences Facility III for the Medicine, Dentistry, and Pharmacy Schools (Figure 12)	$305.4	Opening September 2018
325 W. Baltimore Street 32-story Class A mixed-use tower	$75.0	Under construction
400 N. Howard Street Four mixed-use projects on the entire formerly-vacant block with 123 apartments and live/ work spaces, ground-floor retail, and Le Mondo, a performing arts center (Figure 12)	$17.7	Under construction; first project opened May 2017
500 Park Avenue Mount Vernon Marketplace (Figure 3) and 171 luxury apartments	$100.0	Phase II opened April 2017
211 W. Mulberry Street 68-units of family housing (Figure 19)	$22.3	Opened February 2017

Table 3: Recently completed or under construction investments in the corridor

PROJECT ELEMENT	CAPITAL COST ($M YOE)	SHARE OF TOTAL (%)
Rail Replacement	$20.60	28.9%
Realignment of Curves	$33.00	46.3%
Utilities Upgrades	$6.40	9.0%
Streetscaping	$4.25	6.0%
Station Wayfinding and Connectivity Improvements	$0.80	1.1%
Signals and Communications	$0.85	1.2%
Historic Property Upgrades and Public Art	$1.08	1.5%
Project Management, Design, and Outreach	$4.35	6.1%
TOTAL	**$71.33**	**100.0%**

Table 4: BBHS capital cost estimate

3.3 Operations and Maintenance Cost Uses of Funds

Annual O&M costs for the Light RailLink system are $32.3M. Over the past three years, MDOT MTA has spent an annual average of $1.2M in repairs due to rail breaks and other issues that will be resolved through the BBHS project. Thus, MDOT MTA anticipates that the project will result in a 3.7 percent savings in annual O&M costs for the Light RailLink system.

Figure 12: Recent development (UMB Expansion and Le Mondo)

4

SELECTION CRITERIA

4.1 Merit Criteria

State of Good Repair

The cornerstone of BUILDing a Better Howard Street is the replacement of 1.3-miles of embedded rail along the project corridor. According to MDOT MTA's 2017 Transit Asset Management Plan, the average TERM Lite condition rating of embedded track within the Light RailLink system is 2.83 compared to a 3.52 average across all track types.

The poor condition of the existing rail leaves this critical downtown section of the Light RailLink system susceptible to multi-day service suspensions when broken sections are identified and must be repaired, as well as persistent slow zone orders when routine track inspections reveal degraded segments.

In fact, the Light RailLink service was suspended between North Avenue and Camden Yards over an 18-day period in summer 2017 while necessary rail replacement and track maintenance was performed. In addition to the negative impacts to riders, residents, and businesses along the project corridor, the persistent state of good repair issues also increase O&M costs for MDOT MTA.

As the BBHS project will replace all rail sections, this effort is anticipated to save MDOT MTA approximately $1.2M in annual O&M spending on broken rail repairs, equivalent to a 3.7 percent savings relative to current expenditures.

Figure 13: State of good repair deficiencies lead to delays, service suspensions, and corridor closures

The average interval between rail breaks has been 45 days over the past two years of service and repairs require that service be suspended through the downtown trunk from Friday evening to Monday morning.

This deficiency results in an average of 16 days of suspended weekend rail service per year (15 percent of all non-work days) during which train riders utilizing any of the three Light RailLink service patterns must alight at either Mt. Royal or Camden Yards and board a bus bridge to continue their trip.

Furthermore, the weekend track work imposes significant impacts on those who do not use the transit service, as the repair activities also require the closure of the roadway. The inability for motorists, cyclists, and pedestrians to access the corridor during bouts of broken rail creates a level of inconvenience that ultimately causes patronage of local businesses fronting Howard Street to fall during these periods.

Frequent speed restrictions - present during 24 percent of all weekday service and 27 percent of all weekend service over the last year alone - stemming from the poor rail condition generate delays for both weekday and weekend riders, giving weight to the notion that the Light RailLink is only a service for those who lack access to other alternatives.

Complete replacement of embedded rail along the corridor will eliminate the consistent slow orders and maintenance-related service outages **that represented 107 days of service interruptions in the last year alone.**

The reduction in transit travel time will increase customer satisfaction and potentially induce new transit trips that are currently completed via passenger vehicles, thereby reducing wear to the roadway portion of Howard Street.

Figure 14: missing chunks of embedded rail and depressed roadway pavement

Figure 15: Missing segments of textured pedestrian crossing

To ensure the replaced assets will achieve their expected useful life of 30 years, a trough drainage system and new elastomeric grout system will be installed. Implementation of a new trough drainage system will prevent moisture from seeping into the sub-base and causing perturbations in the rail and road's foundation. By encapsulating the rail on either side to create a floating system within the trough, installation of an elastomeric grout system will restrict road salt from corroding the rails, as well as limit the potential for stray current to reach the underground utilities, corrode the water main.

Aside from the poor rail condition, the presence of three curves between Mulberry Street and Baltimore Street also reduce the useful life of the rail due to the increased friction between the steel wheels and the track when passing through the curves. Transformation of the three weaving sections into tangent track will increase the useful life of the replaced track relative to maintaining the same alignment.

Furthermore, as MDOT MTA is undergoing a $160M mid-life overhaul of the Light RailLink fleet, the rail replacement efforts will assist MDOT MTA in deriving the maximum value from the overhaul by reducing wear and tear on the wheels and chassis.

MDOT MTA classifies rail track as "Critical Assets", as it has the potential to impact passenger safety. The Administration is committed to investing strategically to optimize performance, maintain a state of good repair, and incorporate new technologies and amenities into its light rail system.

Aside from the Purple Line, MDOT MTA currently allocates $2.2 billion (94 percent of the six-year capital budget) towards system preservation projects, including $42M for the rail replacement component of the BBHS project.

MDOT MTA uses IBM's Maximo Work Order Management System to maintain and constantly update its Light RailLink Asset Inventory, schedule preventive maintenance and inspection activities, record the results of quality assurance efforts, track performance measures, and prioritize high-return projects for limited capital funding.

For trackwork, ten Master Preventive Maintenance Records (PMs) require two redundant crews to inspect the mainline weekly (e.g., seven days for each crew to inspect one of five mainline sections) while another Master PM requires individual inspection of switch machines on a semi-annual basis. MDOT MTA inspects and maintains all guideway assets.

Safety

Safety is one of four of MDOT MTA's vision statement core principles. The Administration is committed to providing a safe and secure environment for every customer and employee. MDOT MTA strives to ensure that its transit system is resilient to both natural and man-made hazards. In May 2018, FTA certified MDOT to act as the State Safety Oversight (SSO) entity for MDOT MTA's Light RailLink and Metro SubwayLink services, making Maryland one of 13 states that has achieved SSO Program certification.

From January 2015 to March 2018 a total of 102 collisions (31 crashes per year) involving Light RailLink trains and passenger vehicles were reported along Howard Street within the project limits. Hotspots included the segment between

SELECTION CRITERIA

Saratoga Street and Lexington Street where the Lexington Market platforms are located and the intersection of Howard Street at Baltimore Street near the Baltimore Arena platforms.

Crash data for the Light RailLink system is presented in Table 5. Based on a detailed review of the incident locations, approximately one-half of reported collisions occurred along segments in which the BBHS rail realignment is proposed. After inspecting the crash reports, it is estimated that 58 percent of those crashes within the realignment area or 28 percent of all collisions within the project area could have been avoided if the realignment was in place.

By eliminating the three curves that introduce transit-vehicular conflicts at Saratoga, Lexington, and Baltimore Streets, **the BBHS project will reduce the number, rate, and severity of train-vehicle crashes within the corridor.**

Figure 16: Automobile skirts traffic by blocking Light RailLink train

Figure 17: Pedestrians of all ages and abilities will benefit from safer crossings

Given that transit is a safer alternative to traveling by private automobile and the provision of faster and more reliable transit service will shift some vehicular trips to transit, BUILDing a Better Howard Street is expected to result in further reductions in the number, rate, and severity of crashes along Howard Street.

From 2014 to 2016 an annual average of nine pedestrian-involved crashes occurred within the project corridor. Proposed streetscaping efforts along Howard Street, as well as the east-west facilities that serve to connect the Light RailLink and Metro SubwayLink stations, will include pedestrian crossing improvements to address this unmet safety need.

The provision of ADA-compliant curb ramps, audible pedestrian signals, countdown timers, pushbuttons, and tactile transition surfaces will increase safety for the most vulnerable users – pedestrians with limited vision and persons using assistive mobility devices.

Implementation of the realignment will necessitate the reconstruction of Lexington Market's northbound platform, moving it from the east side to the center of the street. As the current platform was constructed prior to MDOT MTA's adoption of updated design standards, the BBHS project provides an opportunity to incorporate enhancements that foster better ADA compatibility and improve passenger safety and security.

LOCATION	TOTAL CRASHES	AVOIDABLE WITH BBHS	% AVOIDABLE
ALONG ENTIRE PROJECT CORRIDOR	**102**	**29**	**28%**
TOTAL IN RAIL REALIGNMENT AREA:	**50**	**29**	**58%**
Howard Street at Baltimore Street	21	12	57%
Howard Street at Fayette Street	10	0	0%
Lexington Market Station Area	18	17	94%
Howard Street Saratoga Street	1	0	0%

Table 5: Light RailLink train-vehicle crashes, January 2015 - March 2018

Additionally, changes in traffic operations stemming from the rail realignment will lead to reductions in the number, rate, and severity of traditional vehicle-vehicle crashes. Northbound left turns from Madison Street onto Howard Street, which are currently permitted, will be prohibited. The conversion of Howard Street between Baltimore and Fayette Streets from two-way to one-way northbound traffic will eliminate crashes involving southbound vehicles performing left turns from Howard Street onto Baltimore Street.

The monetized value of these safety improvements is approximately $319,000 in undiscounted 2017 dollars each year.

Additional information is provided in ***Appendix I Benefit Cost Analysis***.

Economic Competitiveness

BUILDing a Better Howard Street will truly leverage investments in infrastructure to realize broader development goals. But it will also improve access to existing regional economic drivers; facilitate needed underground utility improvements; and result in travel time savings that will improve the productivity of transit riders in and through the corridor. These economic benefits are summarized below, and quantified, as appropriate, in ***Appendix I Benefit Cost Analysis***.

Access to Corridor Economic Assets

Within a 10-minute walkshed the project corridor provides access to a total of approximately 86,500 jobs, capturing the majority of white collar employment opportunities located in the Baltimore downtown CBD and Charles Center to the east, the Inner Harbor to the southeast, and the Maryland State Government Complex (Departments of Budget and Management, Assessments and Taxation, and Health) to the northwest, as well as blue collar positions within the hospitality, entertainment, and food service industries that serve the Inner Harbor's tourist attractions, special events to the south at the Convention Center, Baltimore Arena, and Camden Yards, and the Lower Bromo theatre district.

Two public universities with a combined 2018 enrollment of approximately 12,500 students are also present – the large downtown University of Maryland Baltimore campus, which is located three blocks west and spans from Lexington Market to Convention Center, and the University of Baltimore that sits two blocks northwest of Cultural Center.

Additionally, four medical centers are present within the 10-minute walkshed, including the UMMS main campus (7,500 jobs) and the Baltimore V.A. Medical Center (3,200 jobs) housed within the UMB campus, the UMMS Midtown campus (1,500 jobs) located on the west side of Howard Street between Cultural Center and Centre Street, and Mercy Medical Center five blocks northeast of Lexington Market.

Figure 18: Mulberry at Park Apartments (211 W. Mulberry Street) (Enterprise Community Partners)

Utility Improvements

One of the marquee improvements included within the BUILDing a Better Howard Street scope is the upgrading of underground utilities beneath Howard Street to spur private sector redevelopment of properties that front the project corridor.

Currently developers seeking to repurpose existing buildings or construct new facilities along Howard Street must either connect to the other utilities trunk line located 1,200 feet east along Charles Street or impose significant interruptions to travelers and local businesses while they uncover and alter the existing utilities.

Both of these options entail significant risks and increase the cost of redevelopment relative to improving other nearby parcels located off the corridor.

However, with improved water connections at strategically identified

locations comes the removal of the major barrier to redevelopment of Howard Street, providing developers with an opportunity to finally realize their high-density visions along this multimodal corridor.

Additionally, the telecommunications and power conduits that sit beneath Howard Street are currently at capacity.

Upgrading the communications conduits will enable more data-intensive uses to front the roadway, including high-density residential and large-scale, centrally-located commercial office. Improvements to these utilities will further enable additional development that approaches the maximum build-out permitted under the zoning ordinance.

New Development Potential

Substantial demand for new market-rate multi-family and single-family attached residential units already exists within downtown Baltimore.

According to the Downtown Partnership's 2017 study, *Downtown Baltimore: Outlook 2022*, within the one-mile radius of the intersection of Pratt Street and Light Street (four blocks east of the Convention Center platforms) the local housing market will be able to absorb between 6,685 and 7,025 new rental and for-sale units over the next five years.

The upgraded water connections will remove the major impediment to redevelopment along Howard Street and open these parcels for business, ensuring that a portion of the demand for new housing units is absorbed along this transit-rich corridor (Figure 19).

While upgrades to the physical infrastructure beneath Howard Street will enable higher-density development, the provision of faster and more reliable transit service will further encourage white collar employers to add new jobs along Howard Street, as they continue to seek new office locations that offer workers convenient alternatives to commuting by private automobile.

Furthermore, by demonstrating the City's continued commitment to improving the project corridor, the implementation of historic property upgrades and streetscaping will increase developers' willingness to redevelop parcels fronting Howard Street. **Thus, the project will increase the economic productivity of land, capital, and labor at parcels abutting Howard Street.**

Travel Time Savings

Rail replacement and realignment will increase transit speeds and result in fewer unanticipated service interruptions. At the macro-economic level, reduced transit delays will eliminate the current loss of productivity for Light RailLink riders and strengthen Baltimore's economic competitiveness by improving personal mobility throughout the region. At the micro-economic level, fewer service interruptions and all-weekend closures of Howard Street will provide corridor residents with better, more reliable access to the region's economic opportunities and ensure that potential patrons of businesses fronting Howard Street are able to access and support these establishments.

As shown in Table 6, VISSIM modeling shows that the rail realignment and associated traffic operations changes - including transit-based signal preemption enabled by the new train detection system

Figure 19: Recent redevelopment at 520 Park Apartments

	AM PEAK (MINUTES)			PM PEAK (MINUTES)		
DIRECTION	Existing	Projected	Savings	Existing	Projected	Savings
Northbound	14:50	13:52	- 0:58	15:37	14:29	- 1:08
Southbound	15:33	13:54	- 1:39	14:34	13:40	- 0:54

Table 6: Estimated BBHS transit travel time savings

at Read Street, as well as preemption and corridor-wide signal synchronization via new wireless communications - will reduce northbound and southbound AM and PM peak transit travel times by a range of approximately 55 to 100 seconds between Mt. Royal and Camden Yards relative to existing un-delayed operations. Furthermore, the reliability benefits of eliminating service interruptions due to poor rail condition is not reflected in the VISSIM model.

The elimination of 91 days of speed restrictions is expected to **save passengers approximately 27,600 hours (1,150 days) in annual delays.**

In addition to reducing travel times for transit riders, the BBHS project will also result in substantial delay reductions for motorists. The installation of wireless communications at traffic signals along the project corridor, coupled with retiming the signals, will finally enable corridor-wide synchronization of both transit and vehicular flows along Howard Street.

The rail realignment will result in the removal of southbound traffic between Fayette Street and Baltimore Street, as well as the signal phases associated with the eastbound left turn from Howard Street onto Baltimore Street.

As Table 7 shows, these changes are anticipated to reduce northbound automobile travel times during the AM and PM peak hours along the project corridor by almost 60 and 30 seconds, respectively. While southbound drivers are expected to experience a two second increase in PM peak hour travel times, southbound motorists traveling during the AM peak hour are anticipated to save approximately 15 seconds.

	AM PEAK (MINUTES)			PM PEAK (MINUTES)		
DIRECTION	Existing	Projected	Savings	Existing	Projected	Savings
Northbound	12:38	11:41	- 0:57	12:00	11:31	- 0:29
Southbound	11:00	10:43	- 0:17	11:32	11:34	+ 0:02

Table 7: Estimated BBHS vehicular travel time savings

The monetized value of these transit and roadway time savings is approximately $1.53M in undiscounted 2017 dollars each year.

Additional information on the derivation of this is estimate is provided in ***Appendix I Benefit Cost Analysis***.

Environmental Protection

Numerous corridor stakeholders identified frequent auditory disturbances as a major nuisance caused by existing Light RailLink operations along Howard Street. The noise problem is primarily due to horns emanating from passenger vehicles when drivers navigate through the train-vehicle conflict points. Additionally, relative to a tangent section, the increased friction between the wheel and steel rail that is present when passing through the curves generates wheel squeal and additional vibration.

Given that BBHS will eliminate the curved rail sections, as well as the train-vehicle conflict points, the project will result in a significant decrease in transportation-related noise and a decrease in transit-related vibration along the project corridor.

The provision of faster, more reliable transit service will increase its appeal,

thereby shifting a portion of trips that are currently completed via passenger vehicles to rail transit. Relative to traveling by private automobile, transit trips are less energy-intensive and result in reduced air and water pollution per passenger. Thus, the mode shift associated with the transit improvements will reduce transportation-related energy use and pollution.

Upgrading the water connections will allow developers seeking to redevelop parcels fronting Howard Street to **avoid incurring significant risks and substantial costs.**

By increasing the ability for developers to realize higher returns along the project corridor, this project will ensure that a portion of the regional demand for new housing and commercial space is absorbed within the dense, energy-efficient downtown area instead of the outlying suburbs.

Concentrating development downtown will decrease transportation-related energy consumption, as well as air and water pollution, by reducing commuting distances and enabling discretionary trips to be completed via transit or active transportation modes.

As the lack of a water-tight seal has begun to limit the ability of the rubber boot system to discharge stray current from the overhead catenary system, Light RailLink operations could result in electrolysis damage to the water main beneath Howard Street if the rail is not replaced.

Installation of the elastomeric grout system will encapsulate the embedded rail, thereby effectively **limiting the potential for future transit-induced corrosion of the water main.**

Quality of Life

As current Light RailLink operations along this arts-oriented corridor are frequently plagued by maintenance- and collision-related service outages and delays, BUILDing a Better Howard Street will significantly enhance the passenger experience through this section of downtown Baltimore and improve access to essential services nearby, as well as the many educational, cultural, historical, and recreational destinations that are situated along or adjacent to Howard Street.

Through the provision of faster, more reliable Light RailLink operations and an enhanced pedestrian realm, the BBHS project will benefit not only corridor residents and businesses, but also government workers, people with disabilities, veterans, medical residents, university students, local artists, tourists, private developers, regional workers employed at sites near the transit stations, those seeking access to government assistance, and Baltimoreans interested in maintaining their long-term health.

The project corridor provides proximate pedestrian access to a variety of essential services, including four state government departments (three within the complex near Cultural Center as well as the Department of Human Services near Lexington Market), four medical centers (UMMS main campus and the Baltimore V.A. near UMB, UMMS Midtown, and Mercy Medical Center), two courthouses (the Edward Garmetz US District Court House and the City's Clarence Mitchell Jr. Court House), two public schools (Baltimore School for the Arts and the Midtown Academy), two specialty libraries (the State Library for the Blind and Physically Handicapped and the Enoch Pratt Free Library), and four public parks.

Figure 20: Baltimore V.A. Medical Center

In addition to directly serving the student bodies and faculties of the UMB and the University of Baltimore, the five-station segment is also adjacent to the Maryland Institute College of Art. Given that MDOT MTA operates a College Pass program, all the region's college students have the potential to benefit from enhancements to an already affordable means of transportation.

Transit riders will experience more reliable access to Lexington Market, as well as

many adjacent small retail outlets that offer clothing, household goods, and electronics.

Residents and visitors alike will experience better access to the area's major sports and entertainment venues (Baltimore Arena, Camden Yards, Convention Center), traditional fine arts programming (performing arts center and symphony), the Eubie Blake National Jazz Institute & Cultural Center, Lexington Market, and the Bromo's ever-changing lineup of innovative arts programming (Figure 21).

The development of "Howard Street Walk," which will transform the one-block segment of Howard Street which contains Lexington Market Station from a one-way northbound roadway to a shared transit street, **will create a distinct sense of place at this regional transit and commercial node while prioritizing pedestrian safety and accessibility,** as seen in Figure 23.

The Bromo Tower Arts & Entertainment District occupies the majority of the Howard Street corridor, running roughly from MLK Jr. Boulevard in the north to Baltimore and Lombard Streets to the south, with its center straddling Howard Street and Eutaw Street. By offering state and local income and property tax incentives to artists, arts organizations, and creative enterprises residing or producing within its boundaries, this state-designated district ensures that the creative community which was instrumental in re-activating the corridor

Figure 21: The Bromo's arts-oriented programming continues to energize the corridor (rendering)

will continue to thrive and attract new residents and tourists to the district.

The Bromo is divided into three sections, each with its own niche. Upper Bromo (Cultural Center to Centre Street) features the nation's oldest antiques district, Antique Row, and has come to serve as an incubator for downtown's emerging craftsman community. Middle Bromo (Centre Street to Lexington Market) houses ample space for galleries, venues, and community-oriented workshops, and, most importantly, functions as an affordable haven for the local arts community where resident artists live, work, and mentor emerging creators in collectively-owned spaces. Lower Bromo (Lexington Market to Convention Center) serves as the City's theatre and entertainment district and includes the iconic Bromo Seltzer Arts Tower, a former beverage plant that is now the site of a thriving multi-story artist collective.

As detailed in ***Section 4.2 Project Readiness***, the project scope builds upon nearly a decade of previous planning studies, each of which sought to leverage the presence of high-frequency rail transit to stimulate private redevelopment of the corridor. Thus, this project is consistent with local land use and community developments plans that emphasize the desire for new transit-oriented development along Howard Street. Finally, implementation of the much-needed transit improvements will be paired with capacity upgrades to the telecommunications lines under Howard Street. Thus, this synergistic effort will allow for concurrent installation of broadband equipment.

Innovation

To assist Light RailLink trains in navigating a corridor that features frequent traffic signals, the BBHS project will install wireless communications at traffic signals. The new wireless communications will enable corridor-wide signal synchronization as well as signal

Figure 22: Bromo Arts and Entertainment District within the context of downtown Baltimore

SELECTION CRITERIA

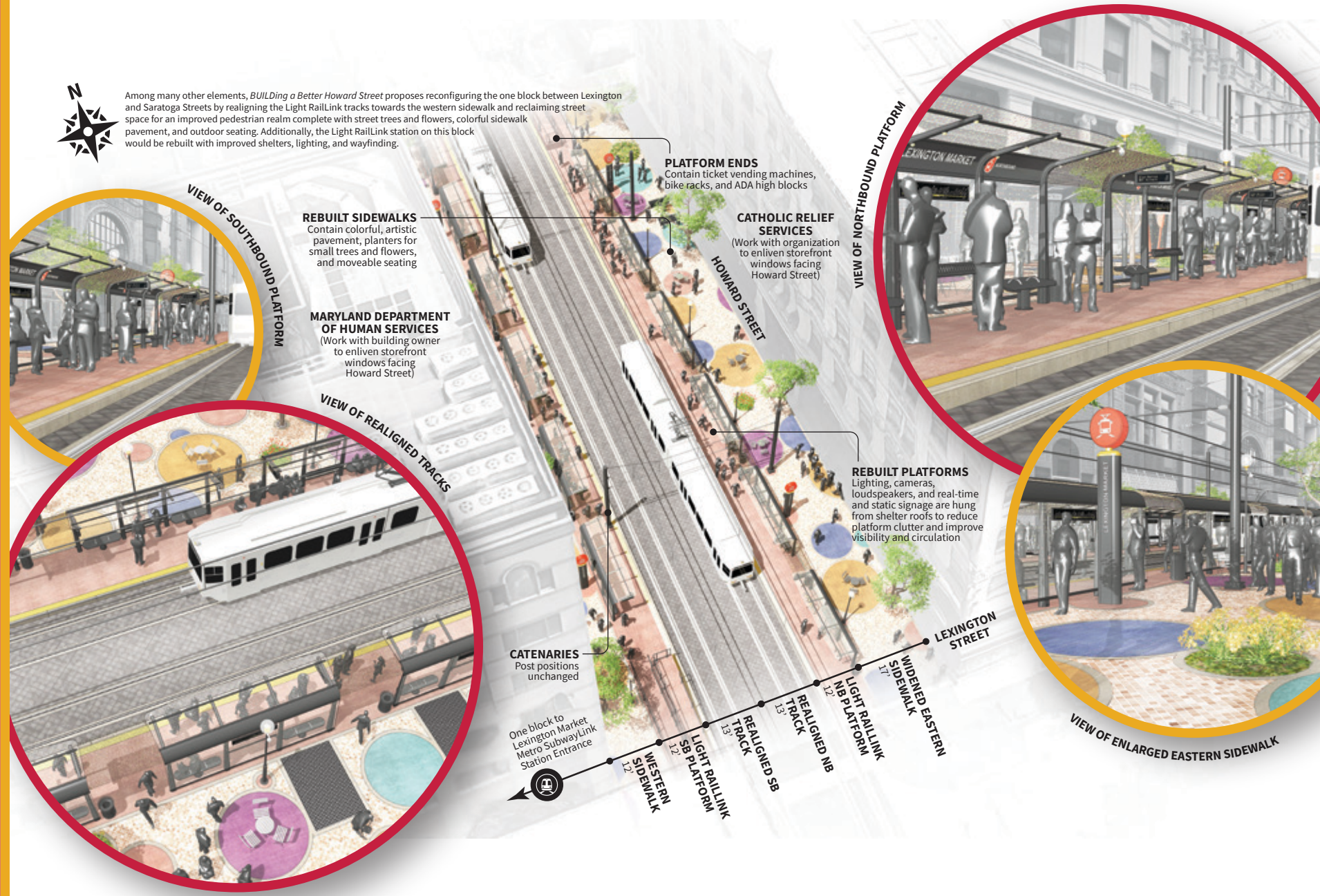


Figure 23: Proposed shared transit street along Howard Street between Lexington and Saratoga Streets

preemption at intersections where trains are consistently delayed. This feature will support faster, more reliable travel times for transit users and motorists while also mitigating potential conflicts with passenger vehicles by prioritizing transit movements through congested intersections.

In June 2017, MDOT MTA collaborated with New York City Transit to conduct an FTA-sponsored pilot project for a "Fixed Location Train Detection and Worker Warning System" called ZoneGuard. The objective of the system is to provide highly reliable railway worker protection by equipping workers with handheld electronic devices that notify them of approaching trains and update the watchman, lookout, or employee-in-charge when the crew has cleared the tracks.

This patent-pending system utilizes diverse and redundant train detection sensors (LiDAR, night vision cameras, and accelerometers) that are connected to a wireless mesh data radio network to detect and track trains. MDOT MTA intends to conduct its pilot deployment of ZoneGuard during implementation of BUILDing a Better Howard Street. This advanced technology will improve the detection, mitigation, and documentation of safety risks, including the identification of near-miss incidents.

In addition to the lack of a drainage system, third-party visual track inspections cited the lack of an effective

Figure 24: ZoneGuard train detection system

seal as a major underlying issue that contributes to poor rail condition. To shield the steel rails from the corrosive impact of road salts, MDOT MTA has identified an innovative elastomeric grout system that is specifically designed for embedded rail applications.

The elastomeric grout system will prevent salt-related corrosion while providing superior electrical isolation, resilience, and sound and vibration damping. This product will ensure that replaced sections perform for their 30-year useful life and also eliminate the stray current issue.

Partnership

MDOT MTA has been working with a variety of partners to improve transit service – and access to it – in the project corridor. These partners not only support these improvements but many of them are contributing cash and in-kind services towards BUILDing a Better Howard Street. Examples of these types of support include:

- BCDOT will provide $6M to upgrade the power and telecommunications conduits;
- BDC will commit $1M towards historic property upgrades; and
- DPOB will also contribute $30,000 to support public art installations.

In addition to these capital cost contributions, several private sector partners have agreed to contribute funding to support the increased O&M costs associated with the new streetscaping elements, including landscaping, street furniture, and public art. DPOB and the property owners along the corridor, including the Centerpoint Apartments, the Atrium, and Catholic Relief Services, will be active participants in the streetscape design and will maintain landscape elements and seasonal plantings, clear trash regularly and

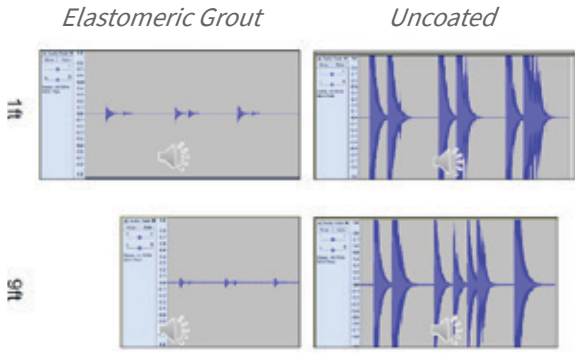


Figure 25: Elastomeric grout system provides for significant reduction in noise

PROJECT PARTNERS	
Funding Partners	Baltimore City Department of Transportation Baltimore Development Corporation Downtown Partnership of Baltimore
Government Agencies	Baltimore City Department of Planning Baltimore Office of Promotion and the Arts MD Department of Housing and Community Development MD Department of Planning MD Stadium Authority
Elected Officials	Governor Larry Hogan Mayor Catherine Pugh US Sen. Ben Cardin US Sen. Chris Van Hollen US Rep. Elijah E. Cummings US Rep. Steny Hoyer US Rep. Dutch Ruppersberger US Rep. John P. Sarbanes US Rep. Andy Harris US Rep. John K. Delaney US Rep. Anthony G. Brown US Rep. Jamie Raskin Baltimore City Council President Jack Young Baltimore City Councilman Eric T. Costello Baltimore City Councilman Leon Pinkett State Senator Barbara A. Robinson State Delegate Antonio Hayes State Delegate Robbyn Lewis State Delegate Brooke E. Lierman
Anchor Institutions	University of MD Baltimore University of MD Medical System
Businesses and Business Organizations	Baltimore Gas and Electric Greater Washington Partnership Paradise Management Company MD Chamber of Commerce MD Retailers Association
Advocacy Groups	Bikemore Blue Water Baltimore Center for Mobility Equity Downtown Baltimore Family Alliance Transit Choices Visit Baltimore
Arts Institutions	Bromo Arts District Current Space Hippodrome Theatre Le Mondo Inc. Maryland Art Place

Table 8: BBHS project partners

perform other cleaning and maintenance activities as needed. In addition, DPOB and the Bromo Arts District will provide programmed events in the newly improved plaza areas.

Finally, building facade upgrades along Howard Street will be completed later this year using a combination of state funds provided by DHCD and private funds.

Thus, the project will garner both public and private sector contributions that will further assist MDOT MTA in improving its service, activating the corridor, and enhancing the public realm.

Non-Federal Revenue for Transportation Infrastructure Investment

With the launch of the bus network redesign and rebranding effort known as BaltimoreLink in June 2017, MDOT MTA collaborated with BCDOT to implement bus-only lanes along the east-west couplets of Fayette Street/Baltimore Street and Lombard Street/Pratt Street.

To ensure that these reliability-enhancing features remain unobstructed by private automobiles, BCDOT levies a $250 fine for all drivers who block these facilities. Additionally, the City of Baltimore recently increased the fines to $75 for parking within downtown bus stops.

Routine enforcement by city parking officials generated $1.3M in collections related to these two types of violations between June 2017 and May 2018.

The incremental increase in parking revenues associated with the new bus lane violations and the increased fines for expired meters and blocked bus stops essentially functions as a new source of revenue that allows the BCDOT to contribute $6M towards the BBHS project.

4.2 Project Readiness

MDOT MTA and its partners have been engaged in BUILDing a Better Howard Street for nearly a decade. The proposed project scope combines major recommendations from four previous plans conducted along the project corridor into a single complementary package of improvements. Each of these plans identified the presence of reliable Light RailLink service along Howard Street as the primary asset that will help attract private sector investment to revitalize the corridor. These plans are described in Table 9.

BUILDing a Better Howard Street is consistent with MDOT MTA's recently adopted *Light RailLink Cornerstone Plan* – a 25-year strategy for the maintenance and expansion of the region's light rail system. The plan identifies three next steps for the "Howard Street Corridor Improvements" project: 1) complete a feasibility study (i.e., the 2018 Howard Street Rail Realignment Concept Report); 2) coordinate with stakeholders (ongoing); and 3) and pursue grant funding – which is the subject of this BUILD grant.

	NAME	RELEVANT GOALS	RELEVANT RECOMMENDATIONS
2010	Strategic Plan to Enhance the Howard Street Corridor	• Improve quality of transit service • Enhance public space and the pedestrian environment	• Rail realignment • Reconstruct Lexington Market Station • Streetscaping to spur redevelopment and facade improvements
2014	Market Center Urban Renewal Plan	• Revitalize area as a mixed-use neighborhood linking University Center with CBD • Use transit to stimulate retail development and activity	• Leverage joint development opportunities in the reconstruction of Lexington Market Station
2015	Bromo Arts and Entertainment District Vision Plan	• Use strong arts presence as a foundation to reactivate underutilized parcels and attract new users	• Pedestrianize Howard Street • Provide mixed-use infill • Station upgrades
2018	Visual Track Inspections and Rail Realignment Concept Report	• Improve transit to bolster economic growth • Increase multimodal safety • Extend useful life of critical assets • Improve traffic operations	• Rail replacement • Rail realignment • Pedestrianize Howard Street • Concurrent upgrade of underground utilities • Streetscaping • Reconstruct Lexington Market

Table 9: Relevant planning studies since 2010

Technical Feasibility

MDOT MTA has long and deep experience in the planning, design, and construction of major transit capital projects. In FY 2017, MDOT MTA delivered a $580M capital program across the State of Maryland, including $56.8M for rail improvements. MDOT MTA recently completed the $15M renewal of interlockings at Reisterstown Plaza West, Portal, and Rogers Avenue East, which is very similar to the BBHS scope of work, on schedule and within budget.

The BUILDing a Better Howard Street project cost estimate is based on 65 percent design plans, contractor quotes for station work, and recent experience for public art, streetscape, and work associated with capital improvements needed to comply with the Americans with Disability Act.

Project Schedule

MDOT MTA has developed a conservative project schedule which anticipates obligation of the BUILD grant by the Fall of 2019 and expenditure of all funding by mid-2022, as shown in Figure 26. MDOT MTA and FTA have discussed the project and its NEPA class of action, and plan to initiate the process later this Summer for a Documented Categorical Exclusion (DCE).

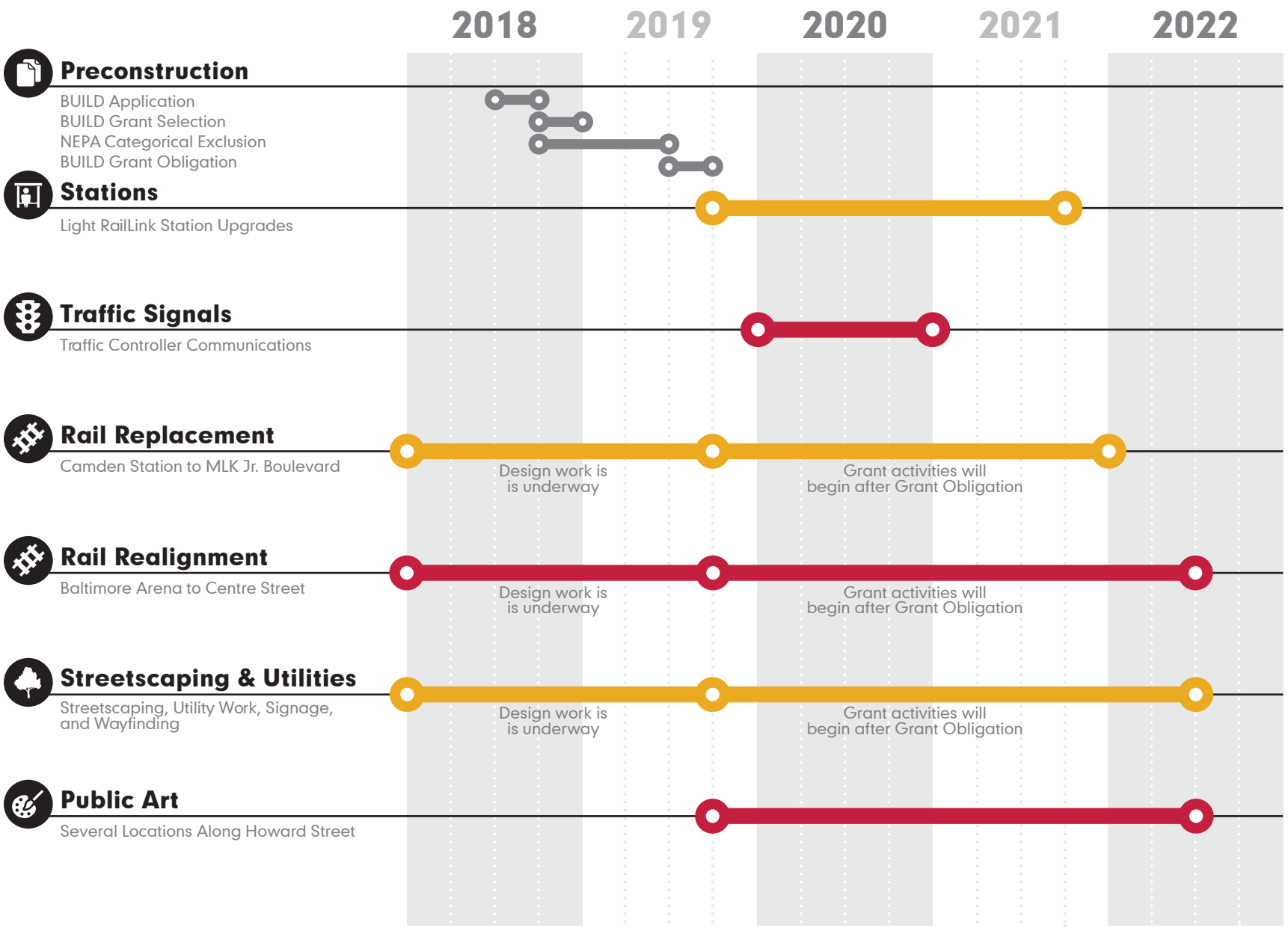


Figure 26: BUILDing a Better Howard Street project schedule

Required Approvals

As noted in the project schedule, it is assumed that a DCE is the appropriate NEPA Class of Action. Upon award of the BUILD grant, the Baltimore Regional Transportation Board has committed to expeditiously adding the project to its Transportation Improvement Program, as described in its attached letter of support (***Appendix II***). All non-BUILD funds are committed to the project and no further approvals for their use are necessary.

Assessment of Risks and Mitigation Strategies

As the builder, operator, and maintainer of a nearly 30-mile light rail transit system, MDOT MTA has gained tremendous experience in the implementation of complex transit capital projects. It understands the risks associated with such investments, and considers them in the development of project schedules and budgets, such as those presented earlier.

MDOT MTA has environmental, design, and construction contracts in place to ensure the timely activation of the resources needed to carry out the scope of work. Even then, the project schedule carries significant float which ensures that all statutory BUILD program deadlines will be met.

MDOT MTA's $3.23 billion six-year capital program has sufficient capacity in the unlikely event that the project experiences a cost overrun.

Figure 27: Bird's eye view of the Howard Street corridor

5

A Benefit Cost Analysis (BCA) was conducted for this project for submission to the USDOT as a requirement of this BUILD Discretionary Grant program application. The analysis was conducted in accordance with the benefit-cost methodology as recommended by the USDOT in the 2018 Benefit-Cost Analysis Guidance for Discretionary Grant Programs.

The complete BCA is provided in ***Appendix I Benefit Cost Analysis***. The period of analysis corresponds to 34 years and includes four years of construction and 30 years of recurring costs and benefits after operations begin in 2022.

5.1 MAJOR QUANTITATIVE BENEFITS

The primary driver of quantifiable project benefits within the BCA is the travel time savings that will accrue to transit riders due to the rail realignment. As the realignment will straighten existing curves and streamline transit operations, transit speeds through the central section of the project corridor will increase.

Additionally, motorists will realize substantial travel time benefits through the implementation of corridor-wide signal improvements and synchronization.

A USDOT-compliant analysis estimates that **the project's travel time components will save riders and drivers approximately 3.36M hours over the 30-year analysis period** or 97,487 passenger-hours in the first year following project completion.

The rail realignment component will also produce significant safety benefits via the implementation of streetscaping improvements, such as pedestrian safety crossing improvements, that will effectively reduce the rate and severity of pedestrian-involved collisions along Howard Street, as well as along the three east-west streets that connect Light RailLink and Metro SubwayLink stations.

The BCA estimates that the project's safety components **will avoid 90 injury crashes and 180 property-damage-only collisions.**

5.2 MAJOR QUALITATIVE BENEFITS

While the project benefits identified within the BCA were limited to the effects of the rail realignment and streetscaping improvements, it is worth noting that the positive impacts of two integral components of BUILDing a Better Howard Street – rail replacement and utilities upgrades – are not readily quantifiable.

Significant safety benefits will be generated by eliminating the three train-vehicle conflict points that currently present opportunities for passenger vehicles to collide with Light RailLink trains. **28 percent of train-vehicle collisions (or approximately nine crashes per year) would be avoided with BBHS,** but available data did not allow for an accurate monetization of this benefit.

Given the inherent difficulty of incorporating the impact of all-weekend corridor closures during the repair of broken rail sections, the BCA was not able to account for the following issues:

- Passenger delays associated with transferring from light rail to a bus bridge;
- Motorist delays associated with using alternate routes; and
- Reduction in patronage of local businesses that abut Howard Street.

By installing new guideway assets, including drainage improvements, the rail replacement component will significantly extend the time between corridor closures, thereby reducing delays for both passengers and motorists and ensuring that potential patrons can reliably access establishments along Howard Street.

In addition to the transportation benefits provided by the project, the concurrent utilities upgrades and, to a lesser extent, the historic property upgrades and public art components will remove existing barriers to redevelopment of properties abutting Howard Street while minimizing disruptions to local businesses.

To avoid upheaval along the corridor developers of the recent redevelopments along Howard Street relied on establishing underground utility connections to the nearest trunk line along Charles Street which is approximately 1,200 feet east of the corridor. While this approach can pencil out given the right pro-forma, it is very expensive and has limited applicability for developers seeking to re-use existing structures.

Upgrading the water main connections will allow developers to easily meet the fire code's requirement for building-wide sprinklers without removing the pavement. Additionally, upgrades to the capacity-constrained telecommunications and power conduits will provide developers with a solid foundation upon

Figure 28: Platforms at Cultural Center Station

which high-density office and residential uses can come to fruition. The utility upgrades will reduce the costs of private development efforts, thereby making redevelopment along Howard Street a more lucrative proposition.

Finally, the implementation of streetscape improvements, historic property upgrades, and public art will create a safer, more engaging built environment with a unified aesthetic, especially along the one-block shared transit street near Lexington Market station. These improvements will ultimately enhance property values and further attract interest in redeveloping properties fronting Howard Street.

5.3 SUMMARY RESULTS

Table 10 shows the overall results of the BCA assuming a one percent annual growth in Light RailLink ridership. At a seven percent discount rate, the project yields a benefit-cost ratio of 0.60 over a 30-year analysis period while the use of a three percent discount rate generates a benefit-cost ratio of 1.02. Table 11 presents the anticipated benefits by category from the proposed BUILD improvements.

DISCOUNT RATE	DISCOUNTED NET PRESENT VALUE ($2017 M)	BENEFIT COST RATIO
7%	-$21.50	0.60
3%	$1.03	1.02

Table 10: Summary results from the benefit cost analysis

BENEFITS CATEGORY	DISCOUNT RATE = 7%		DISCOUNT RATE = 3%	
	PRESENT VALUE ($2017 M)	% BENEFITS	PRESENT VALUE ($2017 M)	% BENEFITS
Travel Time Savings	$18.04	85.7%	$35.11	86.4%
Safety Improvements	$3.02	14.3%	$5.55	13.6%
TOTAL	**$21.06**	**100.0%**	**$40.66**	**100.0%**

Table 11: Summary benefits by category