

## FINAL 30% ENGINEERING REPORT

December 6, 2022

To: Sarah Hope, Meredith Chaiken  
Organization: Greater Baybrook Association (GBA)  
From: Stacie Desai; Rob Pinckney, PE, Toole Design  
Anthony Coppola, KCI  
Project: Baybrook Connector  
Toole Design Project Number: N0002

**Re: Final 30% Engineering Report**

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### Project Description and Purpose

The Baybrook Connector will create a safe, comfortable place to walk, bike, or roll between the neighborhoods of Cherry Hill, Brooklyn, Brooklyn Park, and Pumphrey for users of all ages and abilities. The Baybrook Connector fills a critical gap in the regional trail system and the East Coast Greenway. It connects major employers, schools, parks, recreation centers, shopping, and the Nursery Road Light Rail Station.

The project is located in Anne Arundel County and Baltimore City. It begins at the Nursery Road Light Rail Station, remains on local streets, and becomes a shared use path on Belle Grove Road. The project heads north to S. Hanover Street where it becomes a two-way separated bike lane adjacent to existing sidewalk. The bike lanes continue north over the S. Hanover Street bridge, and the project terminates at MedStar Harbor Hospital. The total project length is just under 3.5 miles.

This 30% Design Report includes, existing conditions, tree, utility, parking and property impacts as well as documents design criteria and standards that will be used during the design and potential design deviations/waivers required.

### Existing Conditions

South Hanover Street bridge has three travel lanes in the Northbound direction, an approximately 7-foot striped buffer, a 6-foot one-way bike lane, and 5-foot sidewalk. S. Hanover Street south of Frankfur Avenue has one travel lane in each direction and parking along both sides of the road. Belle Grove Road (MD-170) has one travel lane in each direction. Shoulder widths vary from 0 feet at its narrowest point South of 10<sup>th</sup> Avenue to Gibbons and has larger shoulders, as much as 12' in some of the commercial business areas and 7' in the residential areas. Some cars park in these wider shoulders, despite not being signed for parking. The character of Belle Grove changes block to block with varying shoulder widths and missing sidewalks. Many existing sidewalks are deficient in width, or have existing utility poles in the middle, thereby not meeting ADA requirements. There are signalized intersections at Frankfur Avenue, Patapso Avenue, and S. Hanover/Potee/Belle Grove Rd. The

next signalized intersection is more than 2 miles to the south at Belle Grove Rd/Baltimore Annapolis Blvd/N Camp Meade Rd.

## **Public Engagement**

Robust public engagement was done from the onset of the project. In the fall, we attended multiple pop-up events in Baltimore City and Anne Arundel County. An initial online survey that ran from November 11, 2022 to December 10, 2022 focused on travel habits and user experience. A second survey that ran from December 22, 2022 to January 07, 2023 focused on route options and user preferences. We received over 150 responses to the surveys. Events and surveys were promoted on GBA's social media and newsletters. We held a stakeholder presentation in March 2022 and a virtual public meeting in May 2022 to communicate the 10% concept design. Both meetings were well attended and we received a lot of valuable feedback. The team also presented the project at another round of pop-up events in April and May 2022. A final round of public engagement was done in October and November 2022 to present the 30% design plans.

## **Stormwater Management (SWM) Opportunities**

Subconsultant, CityScape Engineering performed a study to analyze preliminary SWM requirements and provide recommendations for SWM practice locations within the project corridor. Potential SWM facilities and impervious removal areas and along Belle Grove Road as well as a proposed rain garden in the Frankfurst curb extension are shown on the 30% design plans. Additional detail on his SWM analysis can be found in the Baybrook Connector Shared Use Path Preliminary Stormwater Management Study.

## **Environmental Constraints**

Subconsultant, Rossi Group performed an environmental inventory report as part of this project. This report included an inventory of natural resources, including soils, forest and tree impacts, threatened and endangered species, wetlands and waterways, and floodplain analysis. Refer to this report for more information on these inventories as well as anticipated permitting requirements.

## **Tree Assessment**

Existing tree locations shown on the 30% design plans are from the LIDAR topographic survey base map. The preservation of mature trees was a consideration in this design and was implemented whenever possible. Overall, a total of approximately 7 trees are anticipated to be impacted along Belle Grove Road. This design does not anticipate any tree impacts on S. Hanover Street in the Baltimore City section as the proposed bike lane is within existing curbs. Inventories to assess tree height, maturity, and condition should be performed in future phases.

## **Utility Impacts**

Subconsultant, CV Inc. performed LIDAR topographic surveys. Overall, a total of approximately 35 utility and/or light poles and approximately 7 mailboxes are anticipated to be impacted along Belle Grove Road. Where possible the proposed shared use path can be reduced in width to avoid impacted poles at the paths edge. Appropriate pavement markings and/or object marker signage should be determined in the next phase. This design does not anticipate any utility impacts on S. Hanover Street in the Baltimore City section as the proposed bike lane is within existing curbs. Utility coordination needs to be done in the next phase of the project to gain an understanding of utility owners and understand necessary agreements. Surveyed property boundaries will determine which poles are within existing right-of-way. Because these factors are unknown at this time, we added a large contingency to the opinion of probable cost.

## Property Impacts

Subconsultant, CV Inc. compiled the property mosaic based on existing records. Based on this mosaic, approximately four (4) parcels could require temporary construction easements and 13 parcels could require right-of-way acquisition along Belle Grove Road, in Anne Arundel County. See tables below. The 30% design through S. Hanover Street in Baltimore City does not anticipate any right-of-way acquisitions. It shall be noted that existing right-of-way lines in some areas are within existing sidewalk and or roadway pavement. Boundary surveys need to be conducted in a future phase to determine more accurate right-of-way lines, acquisitions, and easements.

POTENTIAL RIGHT-OF-WAY ACQUISITIONS	
ADDRESS	OWNER
5825 BELLE GROVE ROAD	LEONA E JAMES, SHARON L TURNER
5823 BELLE GROVE ROAD	ARTHUR BEASLEY
5757 BELLE GROVE ROAD	ANNE ARUNDEL COUNTY
5701 BELLE GROVE ROAD	CHAS QUEEN, ADELE M QUEEN
PATAPSCO STATE PARK	STATE OF MARYLAND
5632 BELLE GROVE ROAD	MARK SCOTT, MARIAN SCOTT
5622 BELLE GROVE ROAD	PANIAGUAS ENTERPRISES DEVELOPMENT CO LLC
5526 BELLE GROVE ROAD	PATRICK HENRY POST #34 AMR LEGION
322 6TH AVENUE	STEVEN A WIESECKEL
4503 BELLE GROVE ROAD	CHARLES C COLMUS
112 2ND AVENUE	CHARLES L STUMP, MARY M STUMP
4109 BELLE GROVE ROAD	AAREI LLC
105 1ST AVENUE	WADE CURRIE
4000 RITCHIE HIGHWAY	SOUTHLAND CORP

POTENTIAL REQUIRED EASEMENTS	
ADDRESS	OWNER
4501 BELLE GROVE ROAD	ANGELA M BECK
314 5TH AVENUE	BRIAN E TENNY, KIMBERLY D TENNY
311 4TH AVENUE	LUIS GUARDADO
4301 BELLE GROVE ROAD	RUTH E SPIELMAN, HENRY W SPIELMAN
4205 BELLE GROVE ROAD	CHRISTAN M WALLACE
4109 BELLE GROVE ROAD	AAREI LLC
105 1ST AVENUE	WADE CURRIE

## Parking Impacts

Existing parking was analyzed and parking exhibits (see screen shot below) were provided as part of the planning task. We counted publicly available spaces and private parking lots in the area that service the retail corridor to show a comparison of what existed and what would be impacted. It was determined that people who live, work, or spend time in the project area use a mix of on-street and off-street parking. Belle Grove has portions of roadway with wider shoulders, where residents park, despite not being signed as legal parking. This parking was a consideration in our design and measures were taken to preserve this space where possible. Along S. Hanover Street parallel parking exists along both sides of the street. This 30% design proposes to eliminate parking on the

Northbound side of S. Hanover Street to accommodate the separated two-way bike lane. A parking inventory and analysis showed ample parking on side streets and lots along S. Hanover Street.



## Design Criteria and Basis of Design

Toole Design and KCI reviewed the following documents to identify the design criteria:

- Baltimore Complete Streets Manual, March 2021 (BCSM)
- Baltimore City Official Truck Routes Map, 2012
- Baltimore City Revised Code, May 2020
- MDOT Book of Standards for Highway and Incidental Structures, Revised March 2022
- MDOT SHA Access Manual, Updated August 2016
- MDOT/SHA – Accessibility Policy and Guidelines for Pedestrian Facilities along State Highways, June 2010
- Maryland Manual for Uniform Traffic Control Devices (MUTCD)
- National Association of City Transportation Officials' (NACTO) Urban Street Design Guide
- NACTO Designing for All Ages and Abilities
- American Association of State Highway Transportation Officials' (AASHTO) Guide for the Development of Bicycle Facilities (AASHTO Bike Guide) \*
- AASHTO Policy on Geometric Design of Highways and Streets (AASHTO Green Book)
- American with Disabilities Act (ADA)
- Manual on Uniform Traffic Control Devices (MUTCD)

*\*As the primary authors for the forthcoming 5<sup>th</sup> Edition of AASHTO's Bike Guide, Toole Design has also considered the draft design guidance from this unpublished document, where appropriate.*

Toole Design and KCI reviewed design criteria associated with MDOT Book of Standards for Highway and Incidental Structures and Baltimore Complete Streets Guide. The following tables provides key design criteria associated with the roadway.

### Roadway Design Criteria

	Source	Standard
Design Vehicle	See List Above	See Design and Control Vehicles
Lane Width		Varies 10-11 feet
Cross Slope		Match existing
Design Speed	Posted Speed	Belle Grove Rd. – 30 mph S. Hanover St. – 25 mph
Crosswalk Marking		10' min width. 2' stripe, 3' gap.
Curb Ramp		Balt City Std No. BC 655.11-13 BC 655.22 MDOT Std No. MD-655.11, 655.12

Toole Design reviewed design criteria associated with shared use path design; the following table provides key design criteria.

### Shared Use Path and Bikeway Design Criteria

	Source	Standard
Design Speed	AASHTO Bike Guide	Bicycle – 18 mph
Sight Distance		
Width		10-12' Desired 8' Min in Constrained Locations
Horizontal Clearance		2' Desired 1' Min
Path Cross Slopes		2.0% Max
Side Slopes		3:1 Desired 2:1 Max

### Design and Control Vehicles

Toole Design established the project corridor design and control vehicles using the guidance provided in the Baltimore Complete Streets Manual. The following describes the selection of each design and control vehicle

based on the street type, the relevant encroachment policy, resources used to evaluate the street type, and a summary of the design and control vehicles used throughout the Baybrook project corridor.

**Design Vehicles**

Design vehicles are the least maneuverable vehicles that routinely use a street. They are used to set lane widths, corner radii, median nose design, and slip lane design. Baltimore City Code Art. 26 Subtitle 40 Complete Streets SS 40-27 Design Vehicle defines a design vehicle based on “the most recent edition of the National Association of City Transportation Officials Urban Street Design Guide” and “Transit Street Design Guide” (NACTO Urban Street Design Guide and Transit Street Design Guide).

Design vehicles vary by Street Type, and exceptions should be considered to design for smaller vehicles on specific intersection corners that do not need to accommodate a bus or a truck.

As established in Baltimore City Code Art. 26 Subtitle 40 Complete Streets SS 40-27(B) and based on the most recent edition of NACTO Urban Street Design Guide, the design vehicle for a street is set by the following criteria:

Route	Route Source	Design Vehicle	Design Vehicle Source
All Non-Truck Routes and Non-Transit Streets	Baltimore City Official Truck Route and MTA Transit Route Map	DL-23	NACTO Urban Street Design Guide
Transit Street	MTA Transit Route Map	BU-40	NACTO Urban Street Design Guide
Truck Routes	Baltimore City Official Truck Route	WB-50 (1)	NACTO Urban Street Design Guide

(1) WB-67 are permitted on Interstates and in Industrial areas.

**Control Vehicle**

Control Vehicles are vehicles that infrequently use a facility but still must be accommodated. Control vehicles can include Emergency Service (EMS), fire engines, moving trucks, and sanitation trucks.

Per the guidance provided in the Baltimore Complete Streets Manual, at intersections, Toole Design assumed that control vehicles may encroach into the opposing traffic lanes, make multiple-point turns, or have minor encroachment into the side street (providing they avoid impacts to utilities, lights, signal equipment, signs, and the sidewalk zone).

Control vehicles accommodate in the Baybrook project corridor are as follows:

- Emergency Vehicle Response: Ladder Truck/Fire Engine (per City specifications)
- Sanitation Truck: The maneuverability of a sanitation truck is similar enough to a DL-23; therefore, a roadway that accommodates one should adequately serve the other.

## Design and Control Vehicle by Intersection

Along the project corridor, the design and control vehicle vary based on the Street Type. Toole Design assessed the Route Types using the Baltimore City Official Truck Routes Map (2012) <sup>1</sup> and Maryland Transit Administration’s online bus schedule and route maps. <sup>2</sup>

The proposed bikeway along S Hanover Street (from Potee Street to the project terminus at Reedbird Avenue) is on a Through Truck Route and Transit Route. However, the design vehicle for intersection throughout the corridor varies depending on the specific intersection.

The table below identifies each cross street of the project corridor, the Design Vehicle, Control Vehicle, and the Route Type(s).

Intersection of S Hanover Street at:	Design Vehicle	Control Vehicle	Route Type(s)
Potee St/Belle Grove Rd	WB-50	Emergency Vehicle	Through Truck Route(s)
E Patapsco Ave	BU-40	Emergency Vehicle	Local Truck Route/ Transit Street
Baltic Ave	BU-40		
Frankfurt Ave	WB-50	Emergency Vehicle	Through Truck Route
All other side streets	DL-23	Emergency Vehicle	Non-Truck Route Non-Transit Street

Turn template exhibits for the Baltimore City, S. Hanover Street section are provided as an appendix.

## Design Elements

The design team used the design criteria identified in this memo to support the development of the project elements. In locations where the design criteria cannot be met, the team has documented why and how the Project is addressing any concerns that result from not meeting the criteria in the following sections.

### Shared Use Path as it Crosses Driveways along Belle Grove Road

Currently the wide existing sidewalk/path along Belle Grove ramps down from sidewalk height to roadway level at driveway entrances between Gibbons and Thomas Avenue. Our recommendation would be to continue the shared use path at curb height to provide a smoother, more continuous ride for cyclists. It also prioritizes the pedestrians and bicycles, improves safety, and slows turning speeds. See MD Std 630.01 as an example of this

<sup>1</sup> Baltimore City Official Truck Routes Map 2012: [https://transportation.baltimorecity.gov/sites/default/files/City%20Truck%20Routes%20Map\\_Aproved.pdf](https://transportation.baltimorecity.gov/sites/default/files/City%20Truck%20Routes%20Map_Aproved.pdf)

<sup>2</sup> Maryland Transit Administration (MTA) Bus Route Maps & Schedules: <https://www.mta.maryland.gov/>

proposed treatment. In areas where width allows, the 10-foot path could be reduced to 8' at curb height with the remaining 4 feet of driveway apron (comprised of gutter pan, curb and 2' of path) being at the 12:1 max slope (or steeper as other guidelines except 10-15% on driveway aprons).



**SHA - ACCESSIBILITY POLICY & GUIDELINES FOR PEDESTRIAN FACILITIES ALONG STATE HIGHWAYS**



**Figure 6: Maryland Standard 630.01**

**Proposed Crosswalks on Belle Grove Road**

Belle Grove Road and 10<sup>th</sup> Avenue - We recommend adding a high visibility crosswalk at this intersection as the proposed facility will cross Belle Grove Road from the existing path on the western side to the proposed shared use path on the eastern side of Belle Grove Road continuing northbound. Existing curb ramps have been previously constructed to accommodate this crosswalk. We recommend that a traffic study be conducted to determine if volumes and speeds warrant a traffic signal or Rectangular Rapid Flashing Beacon (RRFB). At a minimum we would propose warning signage (W11-2's) to alert drivers that pedestrians and cyclists would be crossing at this location. The proximity to Belle Grove Elementary School and Brooklyn Park add to the need for a crosswalk and warning signage. Residents who attended public meetings asked for pedestrian crossing improvements to be considered at this intersection.





Belle Grove Road and 5<sup>th</sup> Avenue - Currently there are no existing crosswalks on Belle Grove Road except the one single crossing of Belle Grove Road at 5<sup>th</sup> Avenue. Given that this crossing serves as the main route for students and families to access the elementary school, we recommend restriping this crosswalk and adding a RRFB at this intersection as well.

Belle Grove Road and Gibbons Avenue and St. Charles Road - We recommend additional crosswalks on Belle Grove at Gibbons Avenue and St. Charles Road to connect to the proposed sidewalk on the east side of Belle Grove Road. Residents who attended public meetings asked for pedestrian crossing improvements to be considered at these intersections.



### **Shoulder Width Design Exception on Belle Grove Road**

Proposed design deviates from AASHTO Green Book which states 4' minimum shoulder for this roadway classification. This design waiver request to reduce shoulder widths is necessary to accommodate the new shared use path while minimizing impacts to private property owners, utility poles, and trees. This proposed design has been discussed with John Maclouf at MDOT/MDSHA, who explained that we would follow the online process to submit a design waiver. The proposed design will reduce the existing (~4') northbound shoulder to a consistent 2' shoulder on Belle Grove Road between 10<sup>th</sup> Ave and Potee St (approx. STA. 149+75 to 196+00). The existing southbound shoulder will be modified in the following areas:

- STA. 162+00 to 162+50: transition from full width shoulder (~16') to a minimum 7' shoulder to allow for parking.
- STA. 162+50 to 181+50: maintain a minimum 7' shoulder to allow for parking.
- STA. 182+00 – hold existing shoulder width until Potee St intersection.

### **Curb and Flexible Delineator Post Treatment in Buffers**

The 30% plans show a precast curb as the buffer treatment (similar to photo below on left side). The goal of this treatment is to provide more permanent vertical elements in a less disruptive manner than cast-in-place curbs which require excavation of pavement, have stormwater management consequences, and require a more complicated maintenance of traffic plan to construct. We recommend wider precast curbs, preferable 14" in width, 10' in length, with a beveled edge along the bikeway side to avoid pedal strikes and maximize the operating width of bikeway. Curbs can be doveled into the pavement to prevent movement. The wider curb allows for flexible delineator posts to be mounted on top or they can be affixed to the pavement between curbs. We recommend a 5' gap between curbs to allow positive drainage. Precast curbs would require a special provision as neither MDOT nor BCDOT have a standard item for this treatment. Similary flexible delinators mounted on top of curbs would also require a special provision given that MDOT standard MD-665.01/665.03 Post Mount Delineators are only to be affixed to asphalt pavement.



## Bus Stop Design

We recommend a raised floating bus island design for bus stops on South Hanover Street. The materials can be determined in future design phase but could be a zicla material, like the all black version being used on Hartford Street at Hamilton Avenue in Baltimore City (see first photo) or a more colorful version used in Washington DC (see second photo).



## Signal Design

### MD-170/Belle Grove Rd/S. Hanover St at MD-2/Governor Ritchie Hwy/Potee St

Recommendations:

- Propose Bicycle Signals to control bicycle movements through the intersection.
- MD-170 and S. Hanover St are split phased, recommend adding Bicycle phasing and No Right Turn on red signage where appropriate at the intersection to protect the bicycle movements.
- Lane use and phasing recommendations are draft recommendations. Traffic analysis, including additional traffic data collection, is recommended prior to next milestone submission to confirm and refine phasing and lane use. See design plans for proposed modifications.

### S. Hanover St. at W. Patapsco Ave

Recommendations:

- Based on geometry and anticipated cyclist sight lines, bicycles using the pedestrian signals would be feasible at this location. However, it is recommended to provide bicycle signalization to be consistent with adjacent signals.
- Recommend No Right on Red signage where appropriate.

### S. Hanover St at Frankurst Ave

Recommendations:

- Propose Bicycle Signals due to geometry, bicyclists will not be able to see the Pedestrian signal indications, therefore will require dedicated traffic control.
- Frankurst Ave operates split phased, and S. Hanover St has its own phase as well. Recommend providing a bicycle phase and No Right Turn on red signage where appropriate.
- Lane use and phasing recommendations are draft recommendations. Traffic analysis, including additional traffic data collection, is recommended prior to next milestone submission to confirm and refine phasing and lane use. See design plans for proposed modifications.
- Converting Frankurst Avenue to two-way operation to add a left turn lane for vehicles to travel south on Potee Street, to be studied in a future phase of design.

### Overall:

Recommend providing Bicycle Signals at all intersections along the path of the bicycle lane to create a consistency and vehicle/bicycle expectation corridor wide.

### Assumptions:

30% design is based on minor modifications to existing signals. Design assumes no full reconstruction of signals.

## Future Data Needs and Considerations

### Traffic Study

We recommend gathering turning movement and classification counts at the three signalized intersections and all crossing locations, and conducting traffic analysis to refine phasing recommendations, crossing treatment design, and vehicular lane assignments. Vehicular speed data should also be collected at uncontrolled crossing locations.

### East Coast Greenway Wayfinding Signage

Our site visit revealed several, very faded East Coast Greenway wayfinding pavement markings along the proposed route and one existing sign panel on the signal pole at the S. Hanover St/Reedbird Avenue Intersection. Adding more of these wayfinding signs would help communicate this connection as part of the overall East Coast

Greenway. Sign panels could be mounted on signal and utility poles to help reduce sign post clutter. We recommend discussing this in the next design phase.



### Related Projects

[The Masonville Cove Multi-Modal Transportation Feasibility Study](https://mpa.maryland.gov/greenport/Documents/MasonvilleCoveMultimodalFeasibilityStudyApril2018.pdf) (<https://mpa.maryland.gov/greenport/Documents/MasonvilleCoveMultimodalFeasibilityStudyApril2018.pdf>) was published in April 2018. The study presents intersection improvements for the Frankfurst Ave./S. Hanover St. intersection and a proposed shared use path along Frankfurst Avenue east to Masonville Cove. The design of this intersection should be coordinated with this project in future phases.

### BWI/Nursery Spur Trail

The project intends to extend the existing BWI Trail from its northern terminus at the Linthicum Heights Light Rail Station approximately 1.35 miles to the Nursery Road Light Rail Station. The project proposes to construct a 10-foot-wide asphalt paved trail, with the goal of improving safety and accessibility for pedestrians and bicyclists within the project corridor. While the majority of the trail alignment is offset from MD 170, a portion is proposed adjacent to the roadway separated by concrete barrier. The design of this trail should be coordinated with this project in future phases.

Sincerely,

A handwritten signature in black ink, appearing to read "Stacie Desai".

**Stacie Desai** | Project Engineer

**TOOLE DESIGN**

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