OCEAN VIEW AVENUE

COMPREHENSIVE TRANSPORTATION STUDY

December 2022

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Prepared for

THE CITY OF NORFOLK

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INTRODUCTION AND PURPOSE

In response to requests from the Ocean View area residential communities, the City of Norfolk retained Kimley-Horn to perform a comprehensive transportation study of the Ocean View Avenue corridor from Willoughby Spit to East Beach. Focusing on transportation and safety along the Ocean View Avenue corridor, this study evaluated the feasibility of transportation improvements such as a speed limit reduction, potential lane repurposing to accommodate bicycle and/or golf cart facilities, and improvements to pedestrian crossings and beach access. This project also stems from recommendations coming out of the City of Norfolk *Bicycle and Pedestrian Strategic Plan* as well as the *Multimodal Transportation Master Plan* and supports Norfolk's Vision Zero policy.

The purpose of this study was to take a comprehensive look at the Ocean View Avenue corridor with particular focus on:

- Completing gaps in the bicycle network based on recommendations from the City's *Bicycle and Pedestrian Strategic Plan*,
- Evaluating the feasibility of accommodating golf cart travel along and/or across the corridor,
- Improving pedestrian crossings and beach access, and
- Addressing speeding.

STUDY ELEMENTS

The comprehensive transportation study consisted specifically of the following study elements:

- Literature and industry review of golf cart accommodations
- Safety analysis
- Speed analysis
- Conceptual alternatives development and assessment
- Traffic operations analysis
    - Existing conditions
    - Future volume conditions with existing lane geometry
    - Future volume conditions with proposed lane repurposing from two travel lanes to one travel lane in each direction between 1st View Street and either 19th Bay Street or Pretty Lake Avenue

In addition, a central component of this study was engaging with the community. This was achieved through frequent meetings with a project Advisory Group of local stakeholders as well as multiple rounds of public engagement to gather input and feedback from the community at key steps during the study process. Each round of public engagement included a community workshop and an online survey.

KEY FINDINGS AND CONCLUSIONS

Based on the literature review findings and the results of the first public survey, golf carts are NOT recommended to operate along Ocean View Avenue and therefore were not included in any of the preliminary conceptual alternatives. However, in the future, certain signalized intersections may be identified to permit golf carts to cross Ocean View Avenue. Potential locations for golf cart parking will also need to be considered as part of this process.

The proposed lane repurposing—which will reduce the number of vehicle lanes to provide protected bike lanes—is a cost-effective approach to implement safe and comfortable bicycle accommodations on Ocean View Avenue and will provide benefits to cyclists, pedestrians, and motorists. Golf carts are not recommended to operate along Ocean View Avenue. Expanding the bike lanes will provide cyclists with a more comfortable travel option and better connections to existing bicycle infrastructure. Pedestrians will benefit from increased safety and walkability with fewer bicycle interactions on sidewalks, an added buffer from vehicle traffic, and shorter crossing distances across motorized vehicle traffic.

Buffered and/or protected bike lanes are also an effective traffic calming and safety tool. They have been shown to reduce total crash rates compared to streets with no bike lanes. Many case studies cited by the Federal Highway Administration (FHWA) show that lane reduction can result in lower vehicle speed variability, reduce vehicle speeds, and reduce the number of vehicles speeding excessively. Calmer vehicle speeds decrease the risk of severe and fatal crashes for all road users if a crash does occur.

Based on the traffic operations analysis, the proposed lane repurposing between 1st View Street and 19th Bay Street (Build 2 option) is not anticipated to adversely affect traffic operations along Ocean View Avenue and should be implemented to provide connectivity for cyclists and improve safety for all roadway users.

Recommendations

The following are recommended for the Ocean View Avenue corridor.

Near-Term Recommendations (<1 Year)

These recommendations are to be implemented quickly to address safety concerns raised by the community during the previous online surveys and community workshops.

- Install new pedestrian crossings with high visibility crosswalks at all locations identified for new crosswalks
- Install advanced yield lines (shark teeth) at all marked crosswalk locations
- Conduct comprehensive maintenance of existing sidewalks to clear overgrowth and debris and remove trip hazards
- Conduct comprehensive maintenance of existing bike lanes to replace missing signs and pavement markings, clear debris, smooth pavement, and address drainage issues
- Consider installing planned bicycle parking and scooter corrals
- Reduce speed limit to 30 MPH and provide targeted speed enforcement
- Initiate higher fines for speeding

Short Term Recommendations (1 to 2 Years)

These recommendations provide enhanced pedestrian treatments and take short-term actions to begin identifying additional parking opportunities and enhancements to public beach access.

- Install enhanced pedestrian crossing treatments (i.e., RRFBs and refuge islands) at identified locations
- Install overhead “State Law Yield to Pedestrians” signs at targeted crosswalk locations such as “gateways” to corridor segments

- Identify opportunities to provide additional on-street parking and public parking at beach access locations
- Identify potential locations to provide golf cart parking and allow golf carts to cross Ocean View Avenue at designated signalized intersections

Intermediate-Term Recommendations (2 to 5 Years):

Implementation of these recommendations will require more significant engineering design and therefore have longer timelines, which will also depend on funding availability.

- Install new traffic signal at 21st Bay Street intersection to facilitate safe pedestrian crossing
- Implement recommended lane repurposing from 1st View Street to Cape View Avenue, providing continuous directional bike lanes from 1st View Street to 19th Bay Street
- Provide alternative bike connection from 19th Bay Street to Pretty Lake Avenue as identified in the City of Norfolk *Bicycle and Pedestrian Strategic Plan*
- Perform before/after evaluation of corridor

Following successful implementation of lane repurposing, more transformative improvements may be considered for the corridor as a long-term vision. Building out the curbs to the edge of the travel lanes and using the reclaimed space to develop an enhanced roadside bike and pedestrian realm would further separate conflicting modes and improve the street-level experience with enhanced landscaping and street trees, street lighting, widened sidewalks, and sidewalk-level directional bike lanes. These long-term transformative improvements would come at a much higher cost and would require significant stormwater and utility coordination and drainage improvements.

NEXT STEPS

This study, the preferred conceptual alternative, and planning-level cost estimates are intended to be used as a planning tool to achieve the next steps of programming, designing, and constructing the recommended improvements in the study corridor.

1 INTRODUCTION

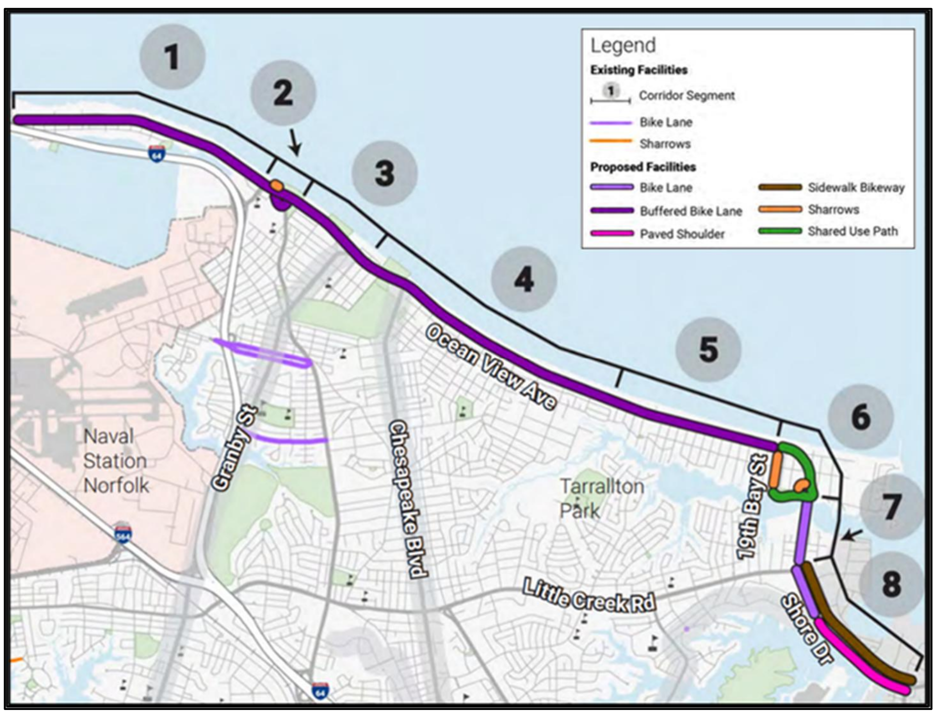
1.1 BACKGROUND

In response to requests from the Ocean View area residential communities, the City of Norfolk retained Kimley-Horn to perform a comprehensive transportation study of the Ocean View Avenue corridor from Willoughby Spit to East Beach. Focusing on transportation and safety along the Ocean View Avenue corridor, this study evaluated the feasibility of transportation improvements such as a speed limit reduction, potential lane repurposing to accommodate bicycle and/or golf cart facilities, and improvements to pedestrian crossings and beach access. This project also stems from recommendations coming out of the City of Norfolk *Bicycle and Pedestrian Strategic Plan* as well as the *Multimodal Transportation Master Plan* and supports Norfolk's Vision Zero policy.

1.1.1 Bicycle and Pedestrian Strategic Plan

In 2015, the Norfolk City Council adopted the City of Norfolk *Bicycle and Pedestrian Strategic Plan.* The plan identified 12 road corridors that residents ranked as the highest priority corridors for bike facilities, and US Route 60 (Ocean View Avenue) was among those priority corridors (Corridor 10). Ocean View Avenue also was identified as part of a potential 22.5-mile citywide recreational loop for cyclists As displayed in Figure 1,the *Bicycle and Pedestrian Strategic Plan* identified buffered bike lanes as the recommended bicycle facility along Ocean View Avenue from Willoughby Spit to 19th Bay Street (Segments 1-5), with a shared use path or neighborhood bypass identified from 19th Bay Street to Pretty Lake Avenue (Segment 6).

Figure 1: Ocean View Avenue (Corridor 10) Proposed Facilities from Strategic Plan

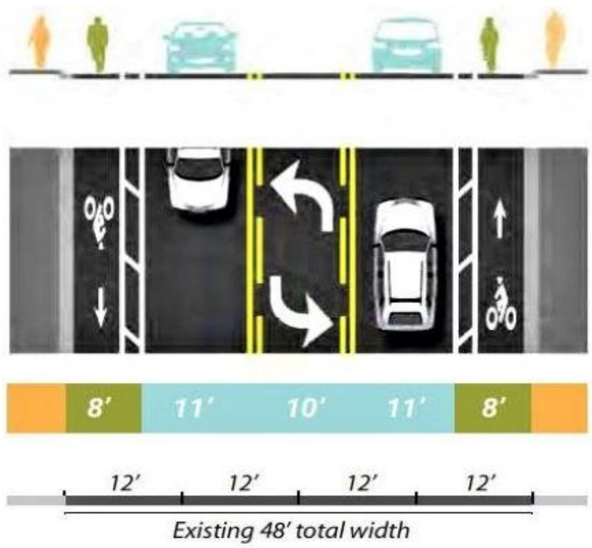


Source: Bicycle and Pedestrian Strategic Plan

Ocean View Avenue currently has existing bike lanes west of 1st View Street (Segments 1-2) and from Cape View Avenue to 19th Bay Street (Segment 5). However, gaps in the bicycle lane network still exist between 1st View Street and Cape View Avenue (Segments 3-4) as well as between 19th Bay Street and Pretty Lake Avenue (Segment 6).

To accommodate the recommended bike lanes, the *Bicycle and Pedestrian Strategic Plan* recommended a lane repurposing from two travel lanes to one travel lane in each direction for vehicular traffic, as shown in Figure 2.

Figure 2: Example Ocean View Avenue Proposed Cross Section from 2015 Strategic Plan



Source: Bicycle and Pedestrian Strategic Plan

The plan also noted that a traffic study would need to be completed to further assess the feasibility of the lane repurposing. Therefore, the City of Norfolk initiated this comprehensive transportation study to evaluate the feasibility of a lane repurposing project between 1st View Street and Cape View Avenue as well as between 19th Bay Street and Pretty Lake Avenue. The potential lane repurposing would complete the gaps in the bicycle lane network from Willoughby Spit to the intersection of Shore Drive and Pretty Lake Avenue.

1.1.2 Supporting Vision Zero

Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safety, mobility, and equity for all road users. In November 2019, Norfolk City Council adopted a Vision Zero policy establishing a goal of zero traffic-related fatalities and serious injuries while making the City's streets safer for all, especially for the most vulnerable users.

Bicyclists and pedestrians are the most vulnerable users on the road, and transportation networks that prioritize vehicle speed and capacity over safe and convenient travel for users outside of cars can have dangerous and life-threatening consequences. By better balancing the needs of all road users, the City of Norfolk can advance the Vision Zero goal of reducing traffic fatalities and severe injuries to zero.

To support Vision Zero, the City recently introduced a Neighborhood Speed Reduction Program to lower the speed limit on neighborhood "local" streets to 20 MPH without requiring an engineering study. At lower speeds, drivers have a wider field of view and are more likely to notice other road users, including pedestrians and bicyclists. This is especially important in neighborhoods where more people are walking, biking, scootering, or playing. A community task force identified the neighborhoods in the greater Ocean View area between Chesapeake Boulevard and Pretty Lake Avenue as one of the Priority Areas for implementation of this program. The Virginia Department of Transportation (VDOT) assigns a functional classification—a type of street hierarchy describing its purpose—to the roadway network. Since VDOT classifies Ocean View Avenue as a “major collector” west of 4th View Street and a "minor arterial” east of 4th View Street, an engineering study must be conducted to evaluate the potential for a reduced speed limit.

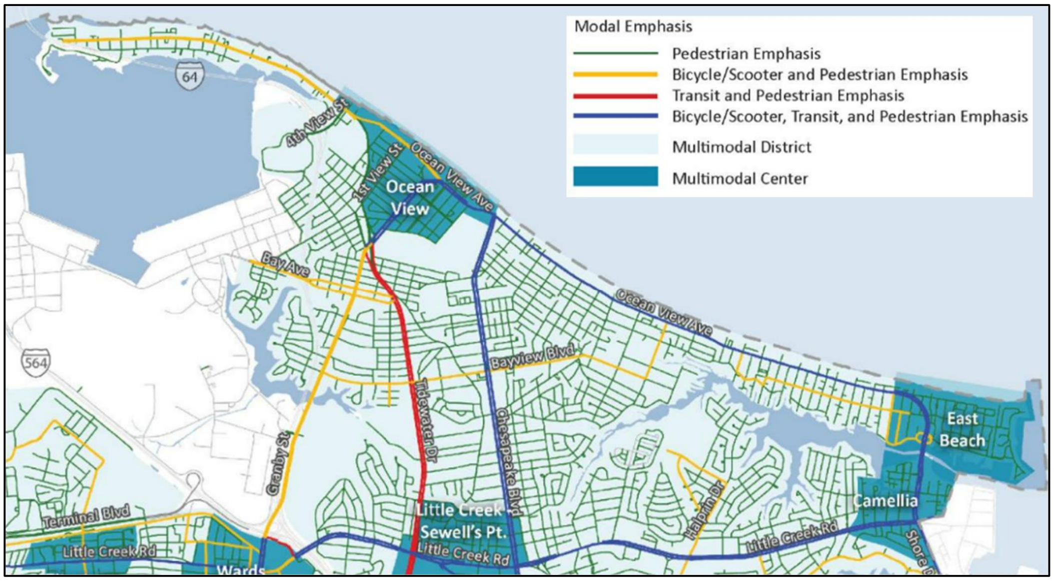
In addition to speed limit reduction, the daily traffic volumes along Ocean View Avenue make it a candidate for “lane repurposing,” which means a reduction in the number of vehicle lanes to make space for other road users. While some segments already have been modified to accommodate bike lanes, other segments along the corridor still provide four or five travel lanes for vehicles (two in each direction with a center left-turn lane). In addition to making space for other road users, vehicle lane repurposing is a proven safety countermeasure that has been shown to improve safety by reducing the severity and frequency of crashes and reducing the potential for speeding.

1.1.3 Multimodal Transportation Master Plan (MMTMP)

The City’s recently completed *Multimodal Transportation Master Plan* (MMTMP) identifies Ocean View Avenue as a multimodal corridor with a long-term vision for an emphasis on bicycles/scooters, transit, and pedestrians, as shown in Figure 3. Throughout the *MMTMP* public input process, the City received requests from the community to improve pedestrian crossings and beach access at various locations along Ocean View Avenue, including parts of Willoughby Spit.

The *MMTMP* identifies two “Multimodal Centers” on either end of the Ocean View Avenue corridor: Ocean View and East Beach. "Multimodal Centers" are areas with high existing and planned residential and employment densities where a variety of destinations are close together. Ocean View Avenue should serve as a critical connection between these two activity centers for all modes of transportation while providing safe and accessible travel whether by bike, scooter, foot, or bus. The plan also designates Ocean View Avenue as a “Major Avenue” corridor type, which means it contains the highest density of destinations, intensity of activity, and mix of travel modes. Major Avenues are intended to have lower design speeds and carry more localized vehicular traffic while supporting high numbers of pedestrians and on-road bicyclists

Figure 3: Ocean View Avenue Modal Emphasis from MMTMP



Source: Multimodal Transportation Master Plan

Lastly, the City has received inquiries from the residential communities along Ocean View Avenue regarding the potential use of golf carts to cross or to travel along Ocean View Avenue. Based on the City's current Code of Ordinances and the Commonwealth of Virginia code, a speed limit reduction would be required to allow golf cart operations along Ocean View Avenue. Currently, golf carts are permissible on neighborhood streets south of Ocean View Avenue and East Beach and are signed accordingly.

1.2 Purpose of Study

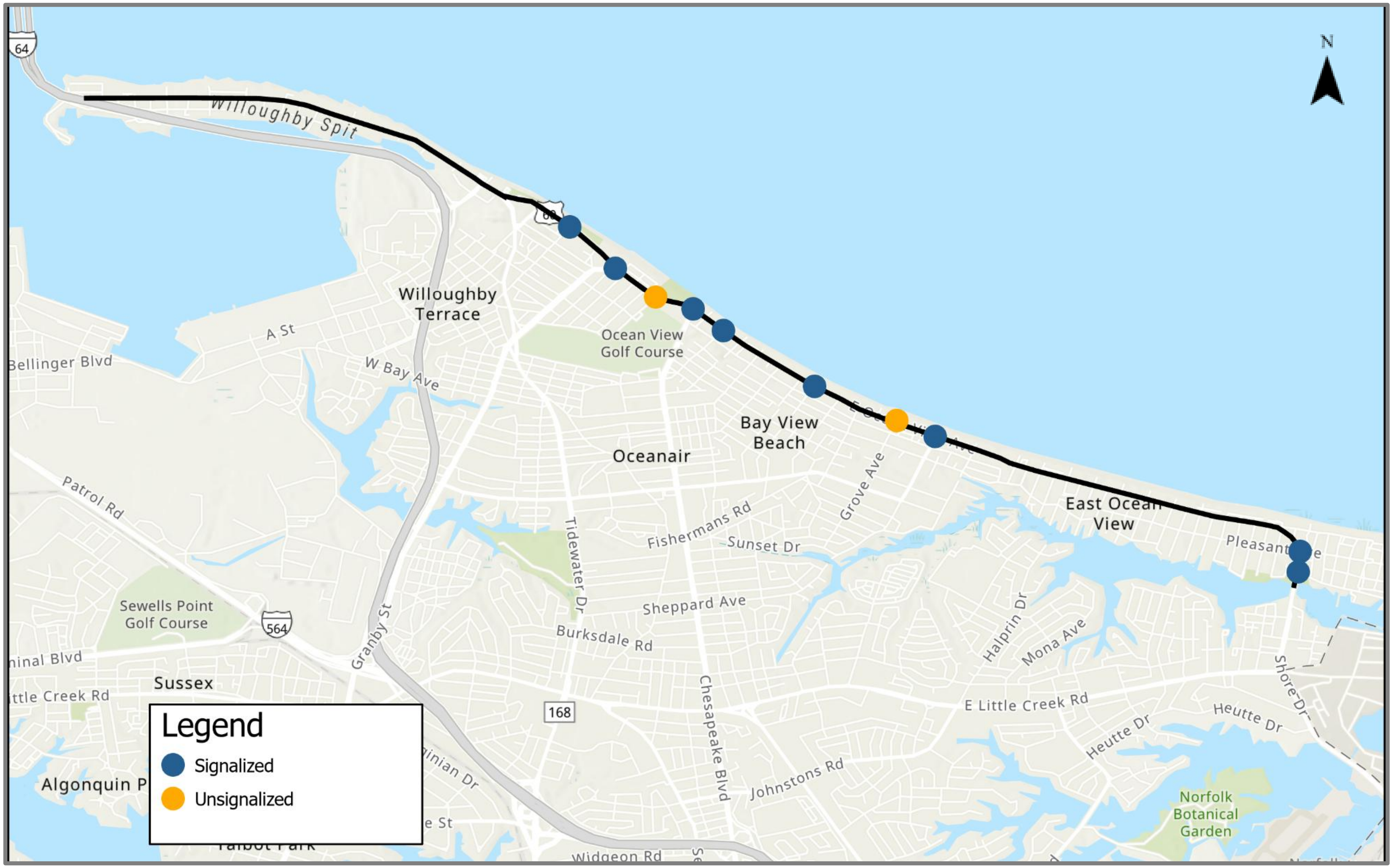
The purpose of this study was to take a comprehensive look at the Ocean View Avenue corridor with particular focus on:

- Completing gaps in the bicycle network based on recommendations from the City's *Bicycle and Pedestrian Strategic Plan*,
- Evaluating the feasibility of accommodating golf cart travel along and/or across the corridor,
- Improving pedestrian crossings and beach access, and
- Addressing speeding.

1.3 Study Area

The study area for the comprehensive transportation study is shown in Figure 4. The study area consists of the Ocean View Avenue corridor that extends for approximately 6.7 miles from Willoughby Spit to the intersection of Shore Drive and Pretty Lake Avenue. The corridor changes street name designations from Ocean View Avenue to Shore Drive at approximately the intersection with 20th Bay Street. There are ten study area intersections—eight signalized and two unsignalized—included in the detailed traffic operations analysis.

Figure 4: Study Area Location Map



2 EXISTING CONDITIONS

2.1 DATA COLLECTION

2.1.1 Traffic Count Data Collection

Turning movement counts (TMC) were collected by Kimley-Horn's subconsultant, Peggy Malone & Associates (PMA), on Wednesday, July 7, 2021 at the following study area intersections:

- Ocean View Avenue and 1st View Street (signalized)
- Ocean View Avenue and Granby Street (signalized)
- Ocean View Avenue and Norfolk Avenue (unsignalized)
- Ocean View Avenue and Chesapeake Boulevard (signalized)
- Ocean View Avenue and Chesapeake Street (signalized)
- Ocean View Avenue and Sturgis Street (signalized)
- Ocean View Avenue and Grove Avenue (unsignalized)
- Ocean View Avenue and Cape View Avenue (signalized)
- Shore Drive and Pleasant Avenue (signalized)
- Shore Drive and Pretty Lake Avenue (signalized)

The TMCs were collected from 6:00 AM to 9:00 AM, 11:00 AM to 1:00 PM, and 3:00 PM to 6:00 PM. Based on the TMC data, the AM peak hour generally occurs from 7:00 AM to 8:00 AM except for the Pleasant Avenue and Pretty Lake Avenue intersections which peak from 7:15 AM to 8:15 AM. For the PM peak hour, individual peak hours per intersection were used as consistent 15-minute volumes within the peak period created variability in overall intersection hours. The raw traffic volume data between the study area intersections was not balanced. Imbalances were not manually adjusted if driveways or intersections were present between the study area intersections. However, the existing TMCs between Pleasant Avenue and Pretty Lane Avenue were balanced due to the absence of driveways.

Average daily traffic (ADT) volume counts were collected by PMA for use in the traffic operations analysis. Bi-directional traffic volume and classification counts as well as speeds were collected for a total of seven days from Wednesday, July 7, 2021 to Tuesday, July 13, 2021 at the following locations:

- Ocean View Avenue west of 4th View Street
- Ocean View Avenue between Mason Creek Road and 1st View Street
- Ocean View Avenue between Wells Parkway and Hammett Parkway
- Ocean View Avenue between Grove Avenue and Cape View Avenue
- Ocean View Avenue between 8th Bay Street and 9th Bay Street
- Ocean View Avenue between 21st Bay Street and Pleasant Avenue

In addition, bicycle counts from May to September 2021 were provided by the City of Norfolk for Ocean View Avenue near 11th View Street, on the west side of the study area, and near 3rd Bay Street, on the east side of the study area. Each month, an average of 800-900 cyclists traveled in the eastbound direction while 400-500 cyclists traveled in the westbound direction.

2.1.2 Field Review

A preliminary field review of the study area was conducted on Thursday, July 29, 2021 to verify the existing roadway geometry along the corridor as well as lane designations and signal phasing at intersections.

In addition, the study team observed traffic operations, traffic flow, and multimodal activity along the corridor during the AM (6:30 AM to 8:30 AM) and PM (3:30 PM to 5:30 PM) peak periods.

The following notable observations were made regarding traffic operations:

- All queue lengths were within the available storage lengths during the AM peak period
- All queue lengths except the following were within the available storage lengths during the PM peak period:
  - Ocean View Avenue and 1st View Street – the northbound approach queued to A View Avenue, and downstream congestion was present at Mason Creek Road
  - Ocean View Avenue and Granby Street – the northbound right-turn lane queue blocked the northbound left-turn lane
  - Ocean View Avenue and Chesapeake Street – the northbound approach queued to Hillside Avenue
  - Ocean View Avenue and Pleasant Avenue – the eastbound approach queued to 21st Bay Street

The following notable observations were made regarding multimodal activity:

- Moderate pedestrian activity along Ocean View Avenue during both peak periods
- Observed multiple midblock crossings
- Observed multiple cyclists during both the AM and PM peak periods
- No golf cart activity was observed along Pleasant Avenue or Pretty Lake Avenue
- Golf cart activity was observed along Norfolk Avenue, adjacent to the Ocean View Golf Course

2.2 Existing Traffic Volumes and COVID-19 Adjustments

Historical traffic volume data was compiled to determine if an adjustment factor was needed to account for reductions in travel trends associated with the ongoing COVID-19 pandemic. Based on a comparison of pre-COVID-19 and current (2021) traffic volumes within the study area and discussion with the City of Norfolk, a 10% adjustment factor was applied to the existing traffic volume data.

The adjusted AM and PM peak hour traffic volumes and ADT volumes are illustrated in Figure 5. Heavy vehicle percentages were calculated for each intersection approach, while overall intersection peak hour factors were calculated then applied to each intersection movement.

Raw turning movement count data and ADT volume and classification data are provided in Appendix A.

2.3 Corridor Characteristics

As shown in Figure 6, the study corridor consists of multiple typical sections ranging from two mainline lanes with a center two-way left-turn lane (TWLTL) to four mainline lanes with a center TWLTL. Bicycle lanes are currently present in both directions between I-64 (15th View Street) and 1st View Street, as well as between Cape View Avenue and 19th Bay Street. Ocean View Avenue/Shore Drive is currently posted with a 35 mph speed limit along the entire study corridor.

Figure 5A: 2021 Existing Peak Hour Traffic Volumes

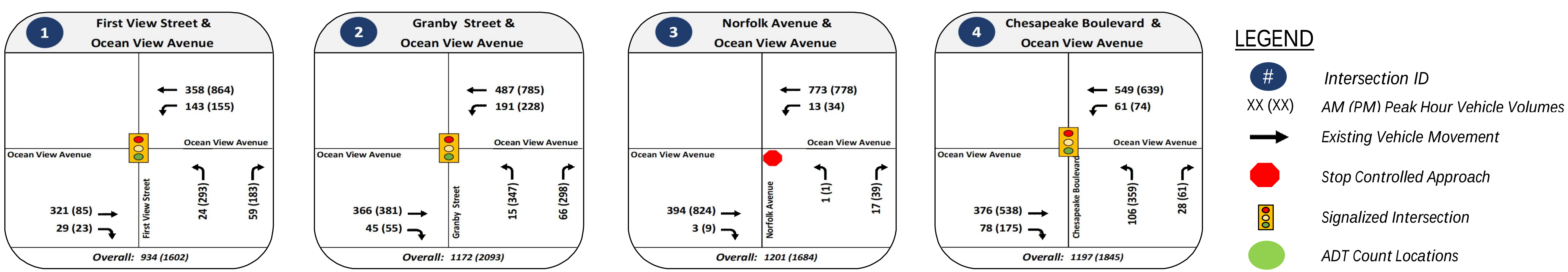


Figure 5B: 2021 Existing Peak Hour Traffic Volumes

Ocean View Avenue Transportation Study

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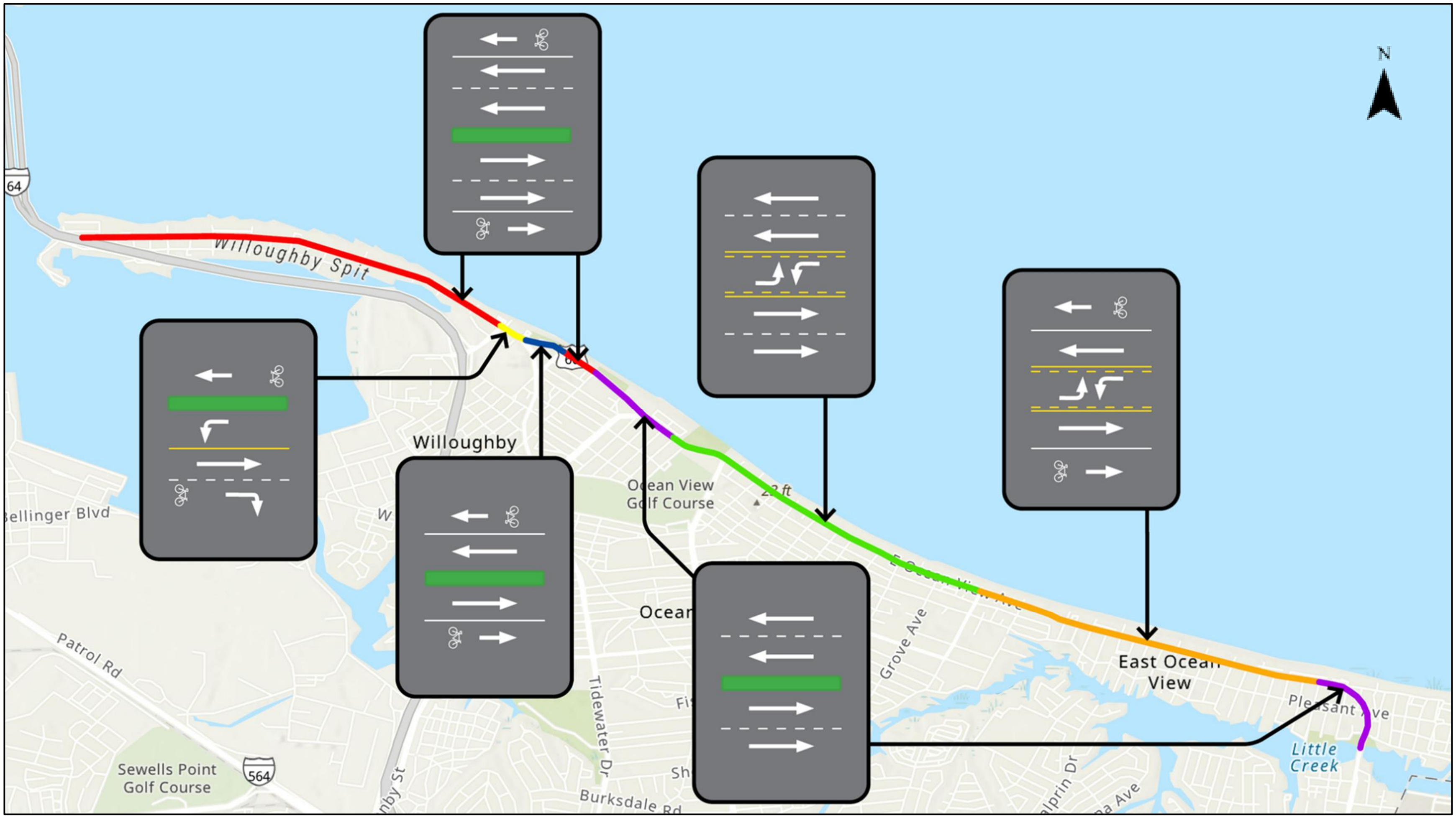
Figure 5C: 2021 Existing Peak Hour Traffic Volumes

Figure 6: Existing Roadway Cross Sections



2.4 Safety Analysis

The crash analysis was conducted using the most recently available five years of crash data from January 1, 2016 to December 31, 2020. Crash data was obtained from VDOT's Crash Analysis Online Tableau and did not include evaluations of individual crash reports.

The crash analysis evaluated the following crash characteristics over the entire study corridor:

- Crash Location
- Crash Year
- Crash Severity
- Crash Type
- Time of Day

In addition to the overall corridor, four hot spot locations were identified by City staff for further evaluation based on observed crash patterns:

- Ocean View Avenue and 1st View Street
- Ocean View Avenue and Chesapeake Boulevard
- Between 12th Bay Street and 13th Bay Street
- Between Pleasant Avenue and Pretty Lake Avenue

The following sections detail the corridor and hot spot crash evaluations.

2.4.1 Corridor Safety Analysis

A total of 387 crashes occurred along the study corridor from 2016 to 2020. Figure 7 illustrates the crash heat map along the study area corridor as well as the hot spot locations.

During this period, 8 bicycle crashes and 11 crashes involving pedestrians occurred throughout the study corridor. The bicycle and pedestrian crash locations and severities are indicated in Figure 8. Each bicycle crash resulted in a visible injury, and one resulted in a fatality. In addition, all but one of the pedestrian crashes resulted in severe or visible injuries, which is indicative of a 95% injury rate. This ratio is nearly *four times* greater than the proportion of injury or fatality crashes involving only vehicles (i.e., approximately 27% of vehicle-only crashes).

Figure 7: Corridor Crash Heat Map (2016-2020)

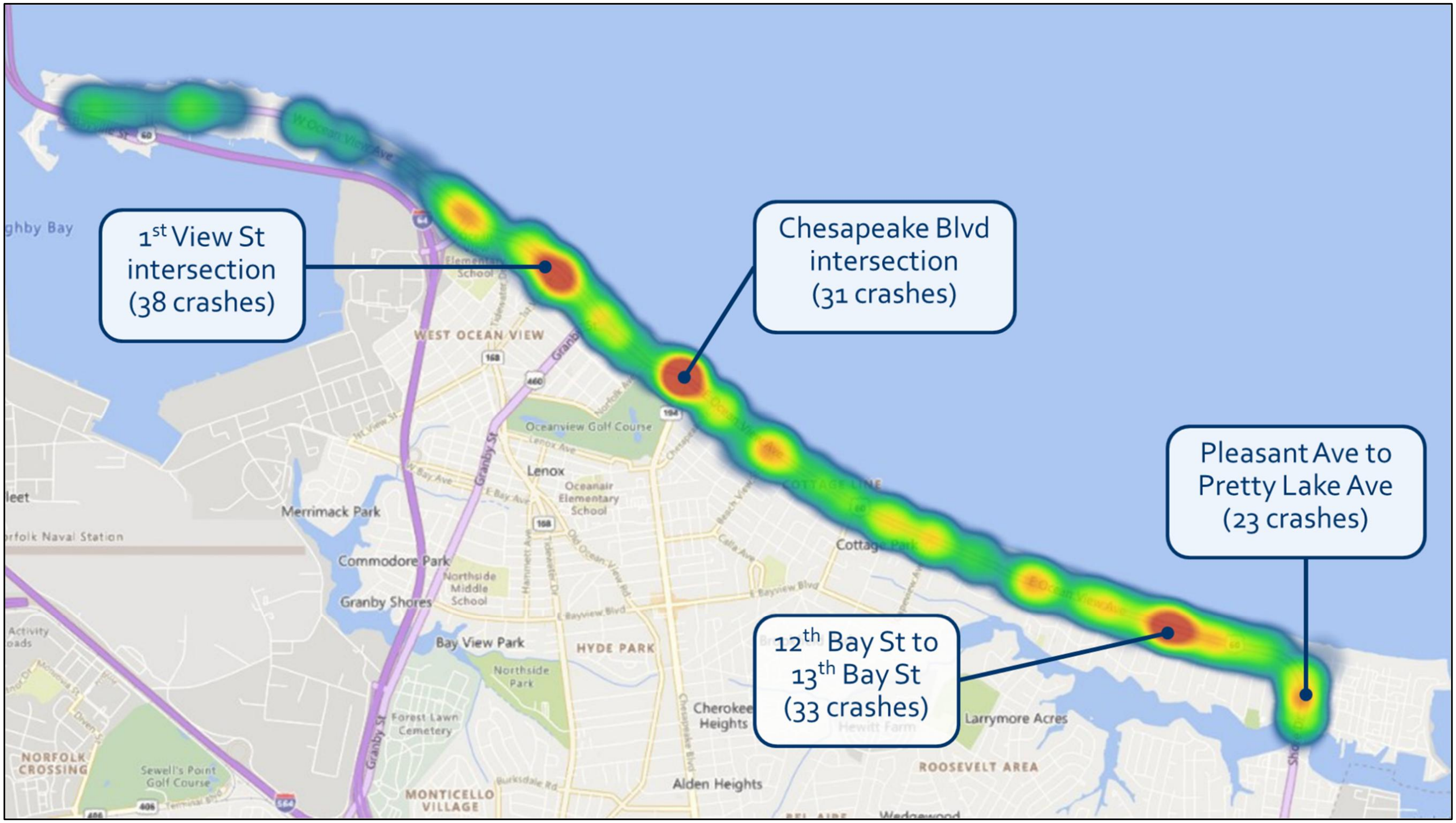


Figure 8: Bicycle and Pedestrian Crashes (2016-2020)

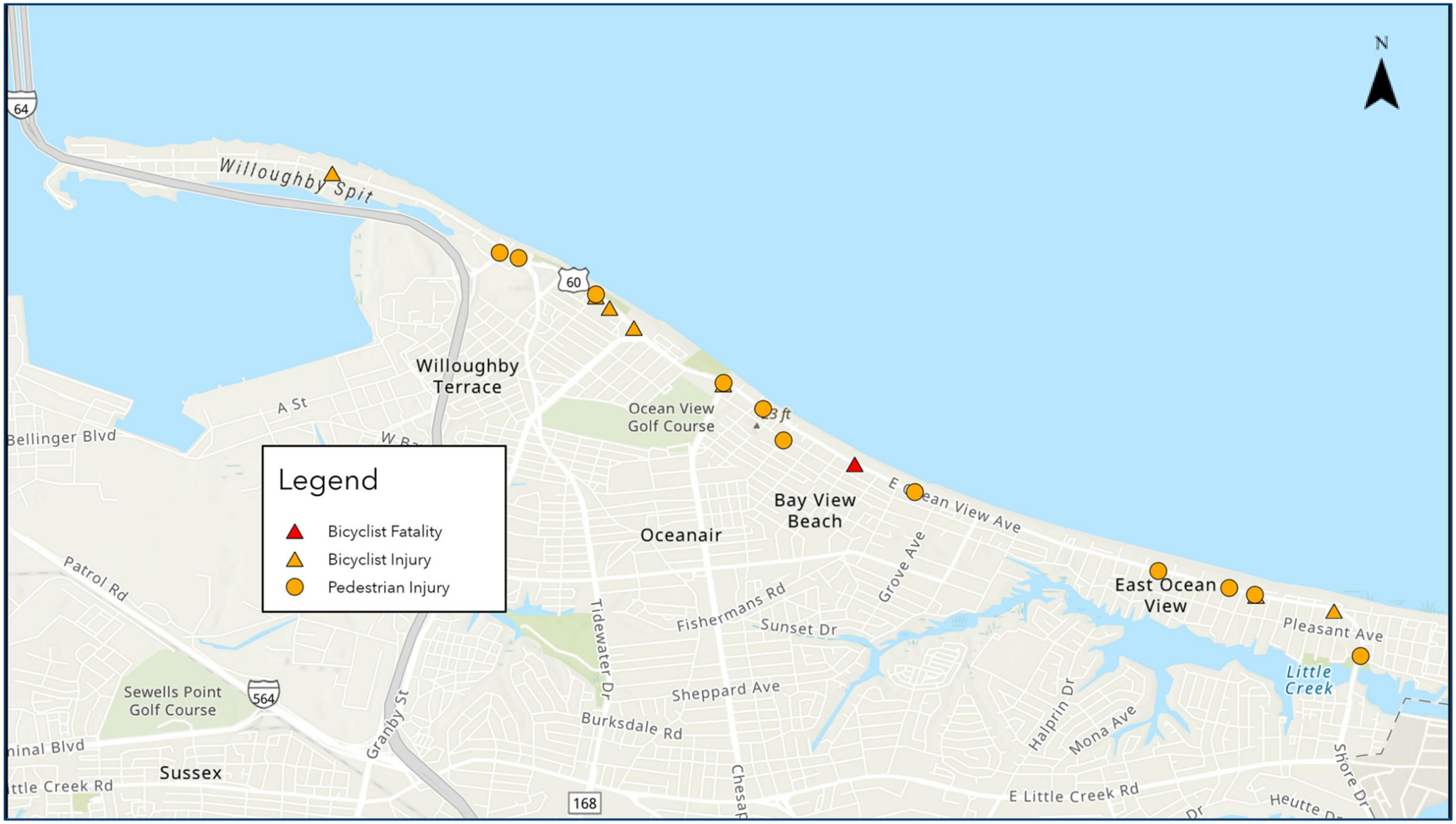
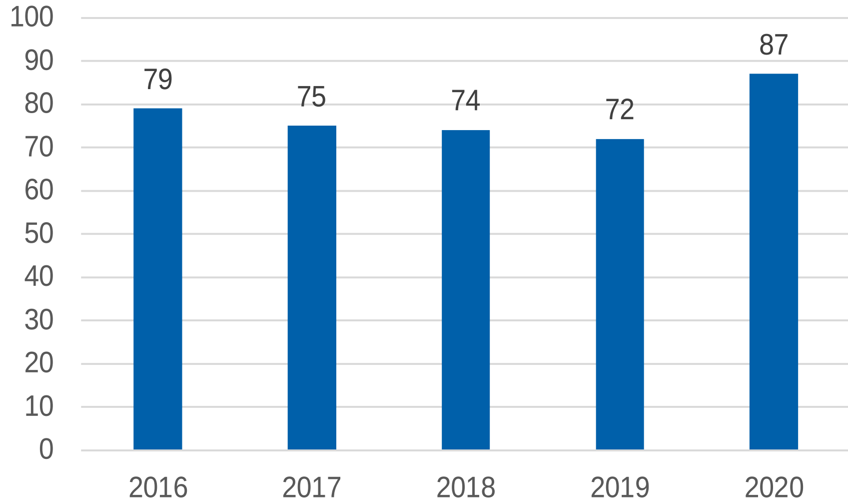


Figure 9 shows the annual distribution of crashes. Crashes had been on a slight decline from 2016 to 2019 but increased by more than 20 percent in 2020 with a total of 87 collisions.

Figure 9: Corridor Crashes by Year



Crash severity is coded using the KABCO scale, which is defined using the following classifications:

- K: Fatal Injury
- A: Severe Injury
- B: Visible Injury
- C: Nonvisible Injury
- PDO: Property Damage Only

Figure 10 summarizes crash severity within the study area. Two fatalities were reported along Ocean View Avenue. The first fatality occurred in March 2017 during the afternoon near the intersection of Ocean View Avenue and Tidewater Drive and involved a motorcyclist. The second fatality occurred in July 2017 during the evening near the intersection of Ocean View Avenue and Sturgis Street. This fatality involved a bicyclist and was alcohol related. Of the 387 crashes on the corridor, 31% (118 crashes) resulted in a visible or severe injury or fatality, while 61% (258 crashes) were property damage only.

Figure 11 summarizes the breakdown of crashes by type. Angle and rear end crashes were the most common crash types, accounting for approximately two-thirds (66%) of the total crashes. The next largest crash type was fixed object-off road accounting for 16% of the total crashes.

Figure 12 summarizes the breakdown of crashes by time of day. Approximately one-third of the total crashes occurred during the AM and PM peak periods, one-third during the midday period, and one-third during the evening/overnight hours.

Figure 10: Corridor Crashes by Severity

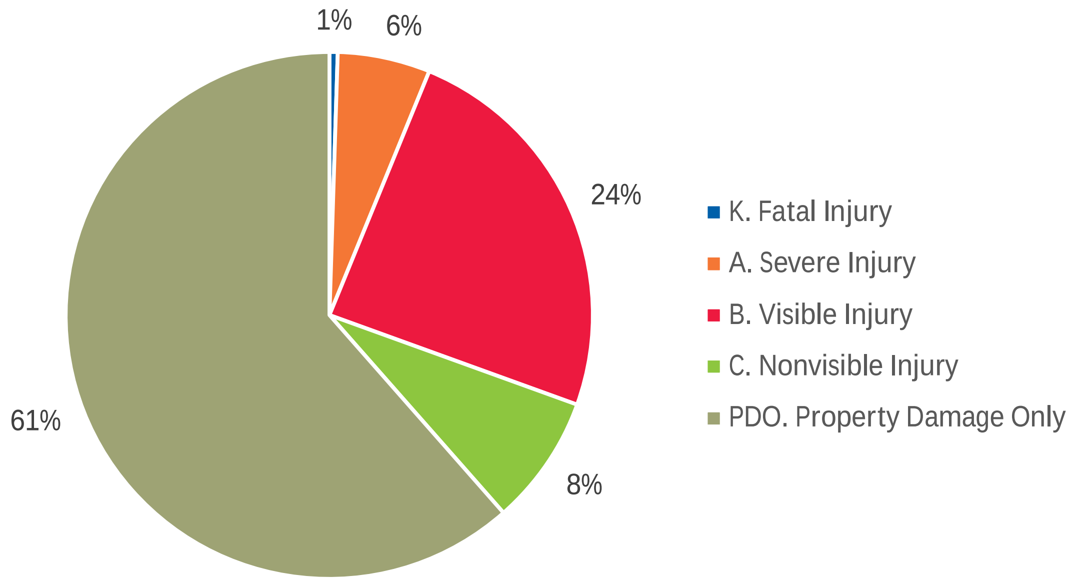


Figure 11: Corridor Crashes by Type

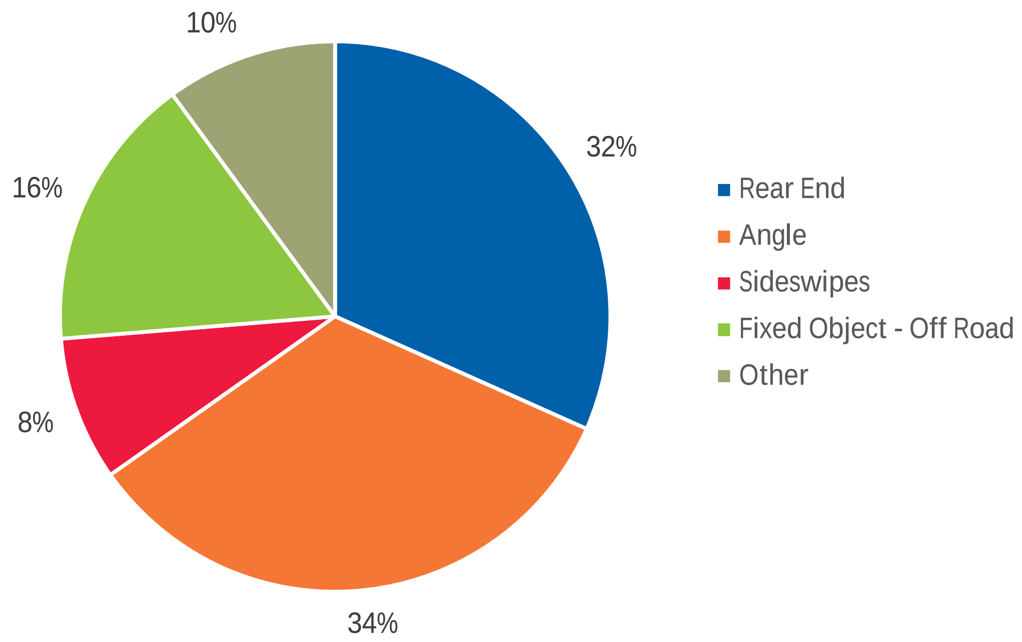
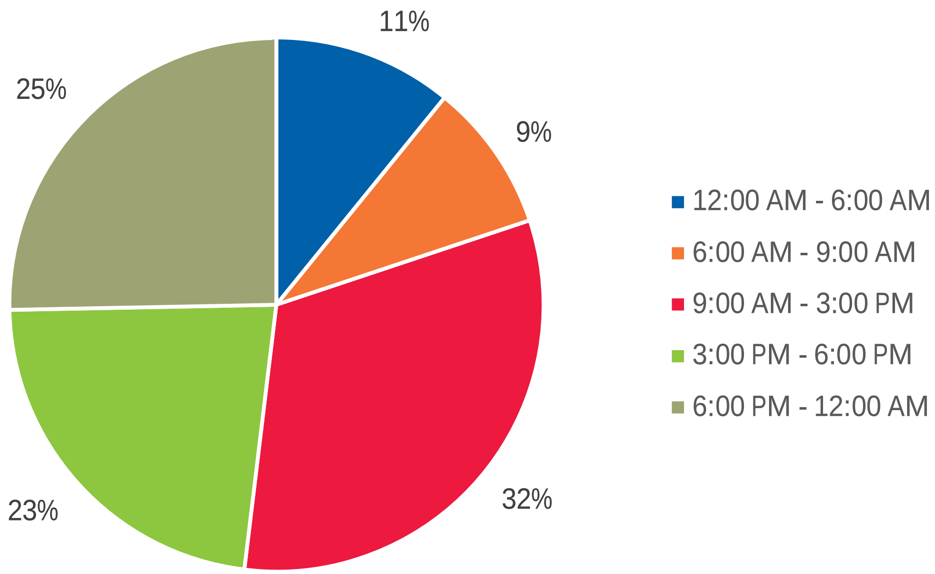


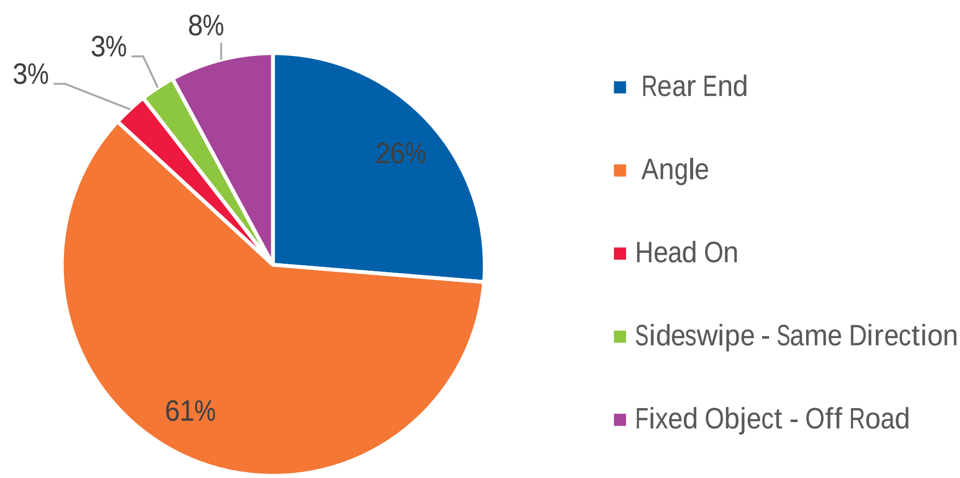
Figure 12: Corridor Crashes by Time of Day



2.4.2 Crash Hot Spot 1: Ocean View Avenue and 1st View Street

The intersection of Ocean View Avenue and 1st View Street and its influence area was chosen for additional hot spot crash analysis due to the frequency of crashes. This intersection experienced 38 crashes during the 5-year period, which is the largest number of concentrated crashes along the corridor. Of the 38 crashes at the intersection, 23 (61%) were angle crashes. Approximately one-third of the crashes at this location resulted in severe and visible injuries. In addition, approximately one-third of the total crashes occurred during the PM peak period (3:00 PM – 6:00 PM). Figure 13 shows a breakdown of the crashes at the intersection by collision type.

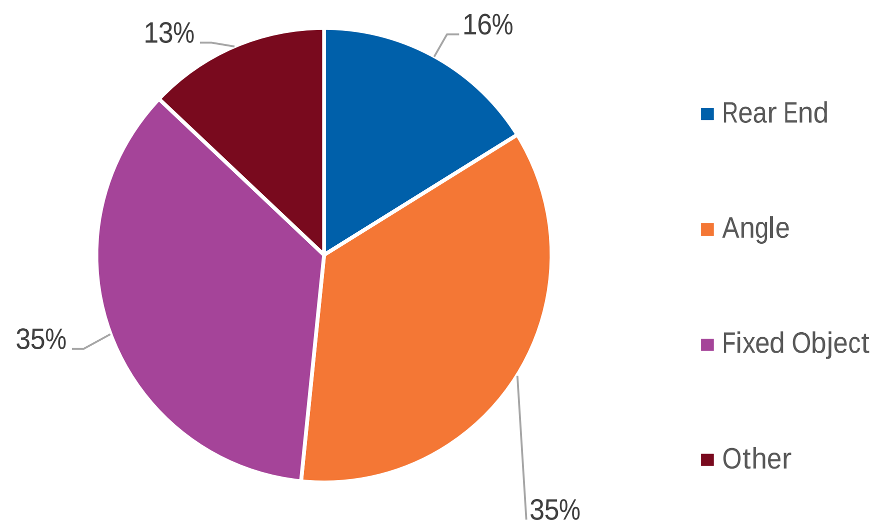
Figure 13: Ocean View Avenue and 1st View Street Crashes by Collision Type



2.4.3 Crash Hot Spot 2: Ocean View Avenue and Chesapeake Boulevard

The intersection of Ocean View Avenue and Chesapeake Boulevard and its influence area was also chosen for further analysis due to the frequency of crashes. This intersection experienced 31 crashes during the 5-year period, which is the third largest number of concentrated crashes along the corridor Angle and fixed object-off road crashes accounted for 70% (22 crashes) of the total crashes at this intersection. Of the 11 fixed object-off road crashes, 5 involved drivers striking a utility pole in the vicinity of the intersection. Severe and visible injuries accounted for 29% (7 crashes) of the total crashes. Approximately one-third (32%) of the total crashes occurred during the PM peak period (3:00 PM – 6:00 PM). Figure 14 shows a breakdown of the crashes at the intersection by collision type.

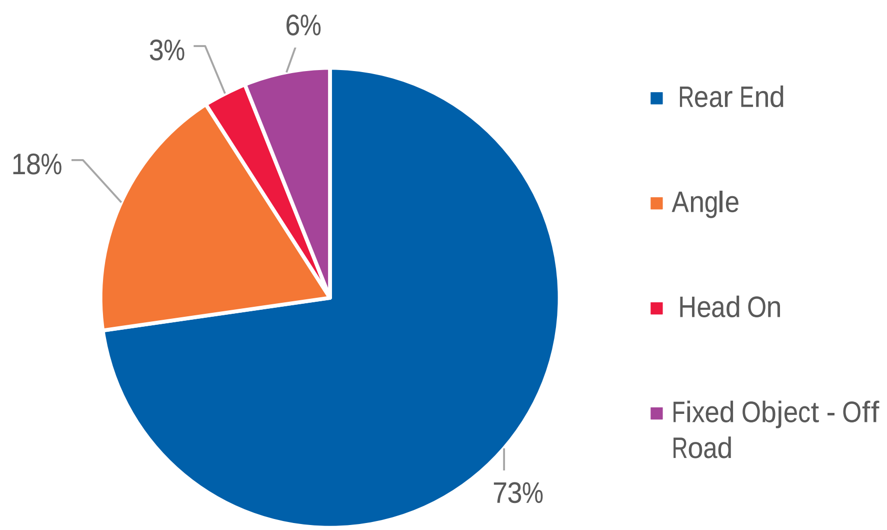
Figure 14: Ocean View Avenue and Chesapeake Boulevard Crashes by Collision Type



2.4.4 Crash Hot Spot 3: Ocean View Avenue between 12th Bay Street & 13th Bay Street

The segment of Ocean View Avenue between 12th Bay Street and 13th Bay Street was also chosen for a more detailed analysis due to the frequency of crashes. This segment of the corridor experienced 33 crashes in the 5-year period, which is the second largest number of concentrated crashes along the corridor. The number of annual crashes (5 to 6 crashes per year) was consistent from 2016 to 2019 but doubled to 11 crashes in 2020. Rear end crashes accounted for nearly three-quarters (24 crashes) of the total crashes in this area. Severe and visible injuries accounted for 27% (9 crashes) of the total crashes. Approximately one-third (10 crashes) of the total crashes occurred during the PM peak period (3:00 PM – 6:00 PM). Figure 15 shows a breakdown of the crashes at the intersection by collision type.

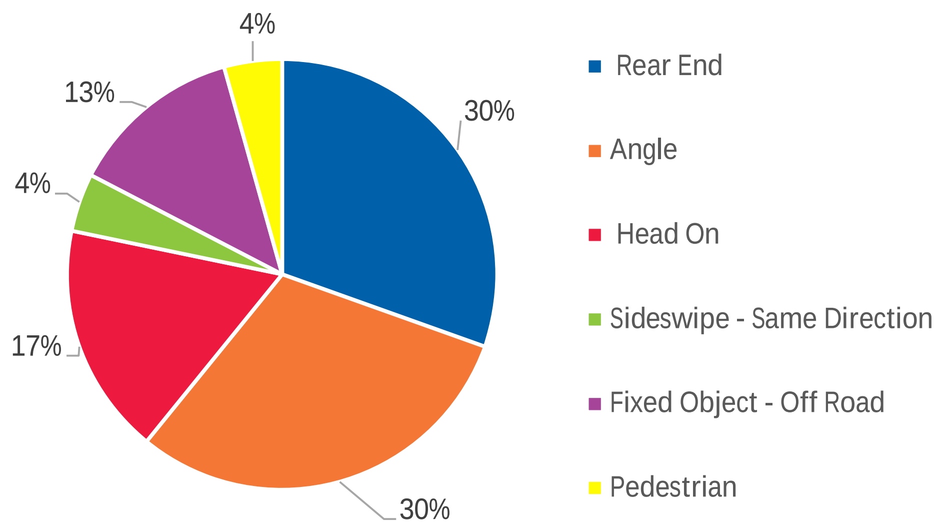
Figure 15: Ocean View Avenue between 12th Bay Street and 13th Bay Street Crashes by Collison Type



2.4.5 Crash Hot Spot 4: Shore Drive between Pleasant Avenue & Pretty Lake Avenue

The segment of Shore Drive between Pleasant Avenue and Pretty Lake Avenue was also chosen for a more detailed analysis due to the frequency of crashes. This segment of the corridor experienced 23 crashes within the 5-year period, which is the fourth largest number of concentrated crashes along the corridor. The number of annual crashes significantly increased to 9 crashes in 2020 while the previous years each averaged 3.5 crashes. Rear end and angle crashes accounted for approximately 60% (7 crashes) of the total crashes in this area. Severe and visible injuries accounted for 34% (8 crashes) of the total crashes. Approximately one-third (7 crashes) of the total crashes occurred during the PM peak period (3:00 PM – 6:00 PM). Figure 16 shows a breakdown of the crashes at the intersection by collision type.

Figure 16: Shore Drive between Pleasant Avenue and Pretty Lane Avenue Crashes by Collision Type



2.5 SPEED ANALYSIS

The speed analysis was conducted using the speed data collected along the study corridor in July 2021 (Appendix B). Speed data was collected at six locations along Ocean View Avenue to determine average, median, 85th percentile, and 15th percentile speeds, as displayed in Table 1. The 85th percentile speed is typically used as a major consideration in determining a street's posted speed limit. The 85th percentile speed is defined as the speed at which 85 percent of drivers will travel at or below under free-flowing conditions. The posted speed limit along the study corridor is 35 mph. On the western side of Ocean View Avenue between 4th View Street to Hammett Parkway, the 85th percentile speed ranged from 38 to 41 mph. The eastern portion of Ocean View Avenue between Grove Avenue and Pleasant Avenue experienced an 85th percentile speed between 40 and 44 mph which was higher than the western portion. The 85th percentile speeds are all above the posted speed limit but are generally observed to be lower in the sections where existing bike lanes are present. In Table 1, existing bike lane locations are indicated by the green cyclist symbol.

Table 1: Speed Analysis Results

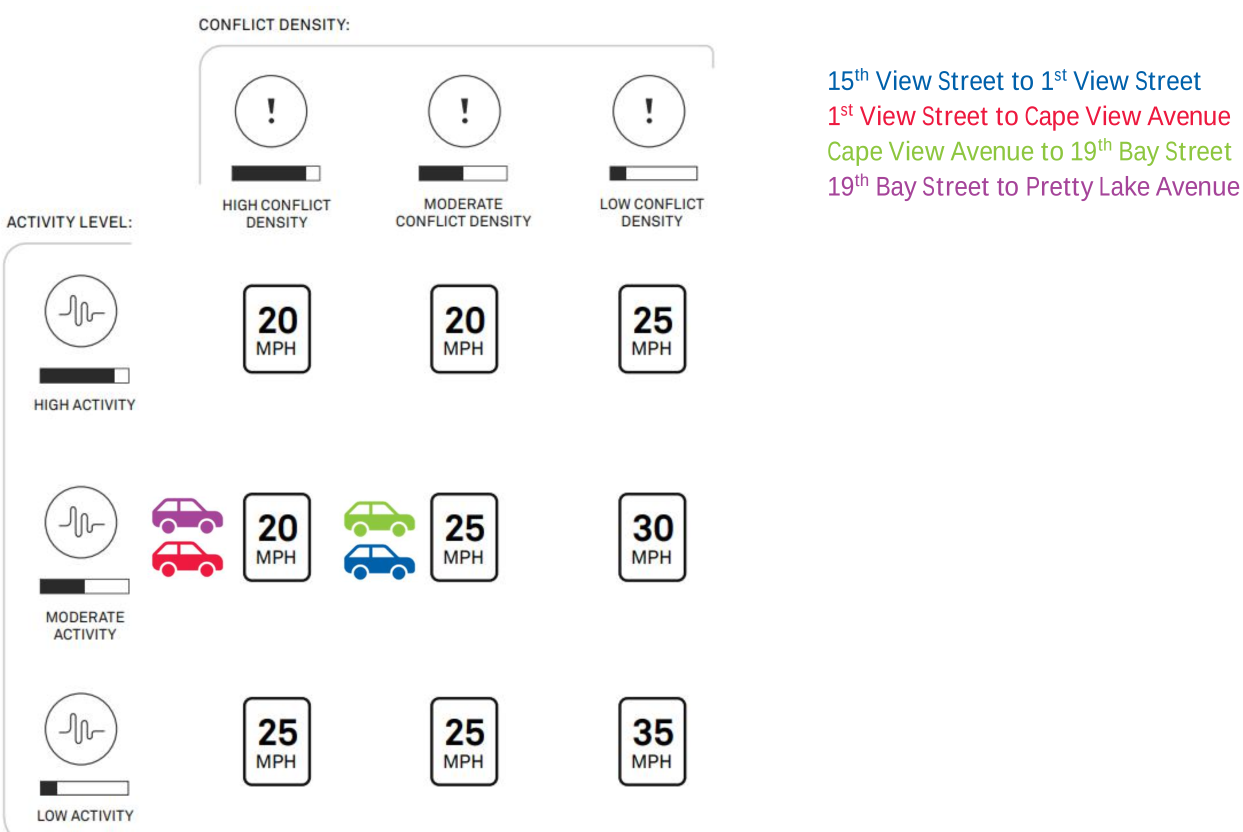
Location	Ocean View Ave *(west of 4th View)*		Ocean View Ave *(Mason Creek to 1st View)*		Ocean View Ave *(Wells to Hammett)*	
Direction	EB	WB	EB	WB	EB	WB
ADT (veh/day)	7,108	9,203	5,517	7,278	8,897	9,375
Pace Speed	25-35 mph	25-35 mph	25-35 mph	25-35 mph	25-35 mph	30-40 mph
Average Speed (mph)	32.0	33.7	33.1	33.4	33.4	35.4
Median Speed (mph)	32.4	33.8	33.3	33.6	33.5	35.5
85th Percentile Speed (mph)	38.3	38.8	38.6	39.2	38.2	41.0
15th Percentile Speed (mph)	25.3	28.1	27.5	27.3	28.8	29.8
Location	**Ocean View Ave *(Grove to Cape View)***		**Ocean View Ave *(8th Bay to 9th Bay)***		**Shore Dr *(21st Bay to Pleasant)***	
Direction	EB	WB	EB	WB	EB	WB
ADT (veh/day)	7,635	7,238	9,146	9,182	10,805	10,368
Pace Speed	30-40 mph	30-40 mph	30-40 mph	30-40 mph	30-40 mph	30-40 mph
Average Speed (mph)	38.3	39.5	36.0	36.0	37.1	35.2
Median Speed (mph)	38.3	39.4	36.4	36.3	37.1	35.5
85th Percentile Speed (mph)	42.8	44.0	40.2	40.5	41.9	40.3
15th Percentile Speed (mph)	33.3	34.5	31.2	31.2	31.9	29.9

Although 85th percentile speeds have been used by agencies in the past to set speed limits, the National Association of City Transportation Officials (NACTO) provides alternative guidance for setting safe speed limits in their publication *City Limits: Setting Safe Speed Limits on Urban Streets*. This guidance was used to further evaluate the speed limit on Ocean View Avenue using the measures of conflict density and activity level. Conflict density is defined as how frequently potential conflicts arise on a given roadway. The activity level is defined as how active a roadway is currently or expected to be. The risk matrix, as shown in Figure 17, was used to evaluate safe speed limits on Ocean View Avenue for the following four segments:

- Between 15th View Street and 1st View Street
- Between 1st View Street and Cape View Avenue
- Between Cape View Avenue and 19th Bay Street
- Between 19th Bay Street and Pretty Lake Avenue

Based on the NACTO Risk Matrix results, the suggested posted speed limits were 20 mph and 25 mph. Those segments of Ocean View Avenue that already have buffered bike lanes resulted in a higher suggested speed limit of 25 mph due to the lower conflict density compared to those segments without buffered bike lanes.

Figure 17: NACTO Speed Limit Matrix Results



Based on a review of the existing volume and speed data and NACTO guidance, as well as discussions with City staff and the study Advisory Group, a posted speed limit of 30 mph is recommended for the Ocean View Avenue corridor.

3 Traffic Operations Analysis

A detailed traffic operations analysis was performed for this study to evaluate the feasibility of a potential lane repurposing as recommended in the City of Norfolk *Bicycle and Pedestrian Strategic Plan.* This consisted of analyzing and comparing traffic conditions for the existing roadway configuration (i.e., two general-purpose vehicle lanes in each direction along Ocean View Avenue) to the potential future roadway configuration after lane repurposing (i.e., one vehicle lane in each direction along Ocean View Avenue).

3.1 Future Conditions for Feasibility Analysis

3.1.1 Analysis Scenarios

The following scenarios were analyzed under AM and PM peak hour conditions as part of this lane repurposing feasibility analysis:

- Existing Conditions: existing geometry with existing (2021) traffic volumes
- No Build Conditions: existing geometry with future (2031) traffic volumes
- Build 1 Alternative Conditions: potential Build 1 geometry with lane repurposing from 1st View Street to Pretty Lake Avenue and future (2031) traffic volumes
- Build 2 Alternative Conditions: potential Build 2 geometry with lane repurposing from 1st View Street to 19th Bay Street and future (2031) traffic volumes

Two different Build alternative scenarios were analyzed—Build 1 and Build 2. The only difference in these scenarios is the extent of the proposed lane repurposing. As shown in Figure 18 below, the Build 1 option assumes that the lane repurposing is continued along Ocean View Avenue from 1st View Street around the curve to the intersection of Shore Drive and Pretty Lake Avenue. The Build 2 option assumes that the lane repurposing extends from 1st View Street to its current endpoint at 19th Bay Street.

Figure 18: Build Alternative Extents for Analysis

3.1.2 Future (2031) Traffic Projections

Future (2031) traffic projections were determined using identified growth rates from the Hampton Roads Travel Demand Model (TDM). The TDM is a macroscopic model used to forecast future regional travel behavior and growth based on input data that consists of anticipated land use, demographics, and transportation network characteristics.

Growth rates were identified from the TDM for roadways within the City of Norfolk including Ocean View Avenue. These growth rates were compared to historical traffic data which shows little to no growth along Ocean View Avenue from 2016 to 2019. In order to provide a conservative analysis and reflect additional development in the East Beach area, an annualized growth rate of 1% was selected. Existing traffic volumes were grown by a total of 10.5% to determine the future (2031) AM and PM peak hour volumes.

Figure 19 (A-C) illustrates the resulting future (2031) AM and PM peak hour traffic volumes.

3.1.3 Future (2031) Background Improvements

As part of the future (2031) conditions, the following planned background improvements that are independent of the proposed lane repurposing were identified and included in the future analysis models for both the No Build and Build scenarios:

- Reduced the Ocean View Avenue posted speed limit from 35 mph to 30 mph
- Implemented a new, exclusive pedestrian phase at the signalized intersection at Sturgis Street
- Optimized traffic signal timings and offsets at all signalized intersections within the study area

Figure 19A: 2031 Future Peak Hour Traffic Volumes

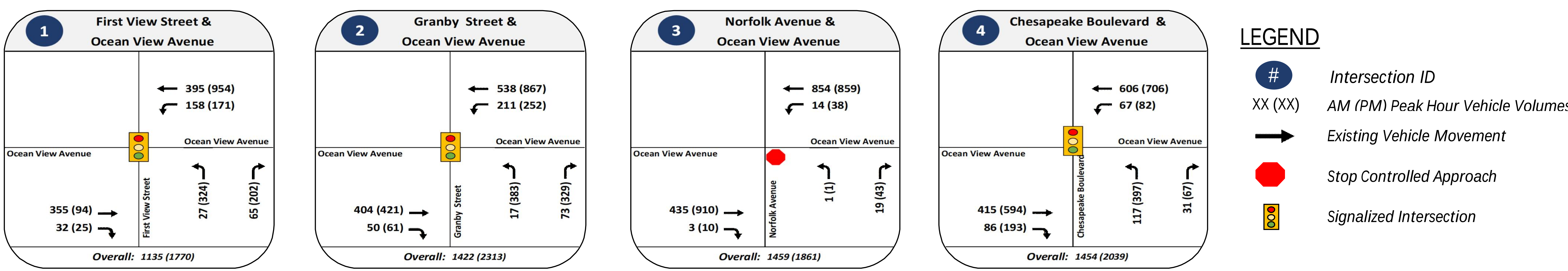
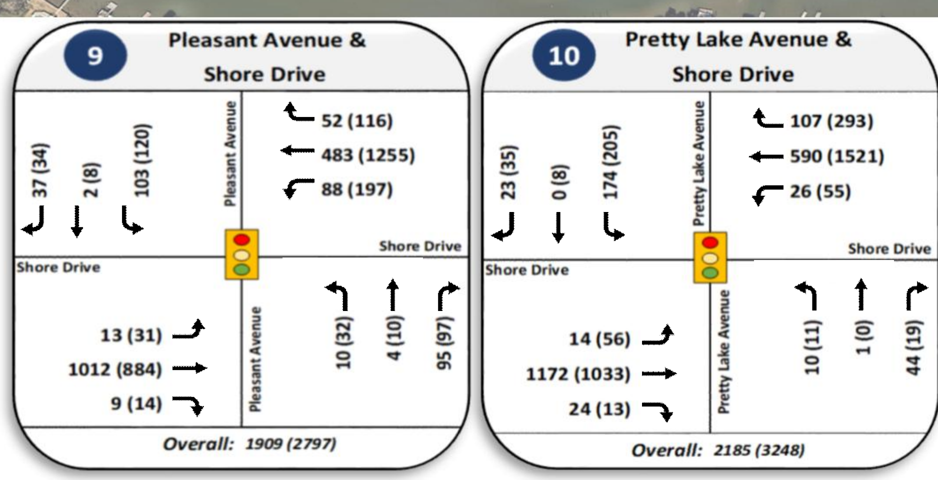


Figure 19B: 2031 Future Peak Hour Traffic Volumes

Figure 19C: 2031 Future Peak Hour Traffic Volumes



LEGEND

- # — *Intersection ID*
- XX (XX) — *AM (PM) Peak Hour Vehicle*
- → — *Existing Vehicle Movement*
- *Stop Controlled Approach*
- *Signalized Intersection*

3.1.4 Future (2031) Build Geometry with Potential Lane Repurposing

The future (2031) Build conditions include the above background improvements as well as the potential lane repurposing along Ocean View Avenue from two travel lanes to one travel lane in each direction between 1st View Street and either Pretty Lake Avenue or 19th Bay Street, depending on the Build alternative.

For the purposes of the traffic analysis, the extent of the lane repurposing and additional improvements in the future roadway configuration included the following:

- Eastbound Ocean View Avenue
  - The lane repurposing transition from the existing two lanes to one lane will occur at the eastbound approach of the 1st View Street intersection, with the outside through lane dropping as an exclusive right-turn lane.
  - The single travel lane will be continued along Ocean View Avenue to Cape View Avenue, tying into the existing single travel lane along Ocean View Avenue to the east of Cape View Avenue. The existing eastbound right-turn lane at the Cape View Avenue intersection will be used for the buffered bike lane, and the remaining through lane will be striped as a shared through and right-turn lane.
  - For the Build 1 alternative, the existing single travel lane will be continued from 19th Bay Street to Pretty Lake Avenue.
  - The Build 2 alternative will maintain the existing two lanes between 19th Bay Street and Pretty Lake Avenue.
- Westbound Ocean View Avenue
  - For the Build 1 alternative, the lane repurposing transition from the existing two lanes to one lane will occur at the westbound approach of the Pretty Lake Avenue intersection, with the outside through lane dropping as an exclusive right-turn lane.
  - For the Build 2 alternative, the transition will begin at the west leg of the Cape View Avenue intersection as a continuation of the existing single travel lane along Ocean View Avenue to the east of Cape View Avenue. The existing two lanes between 19th Bay Street and Pretty Lake Avenue will be maintained.
  - The single travel lane will be continued along Ocean View Avenue from each transition point to 1st View Street.
- Unless otherwise noted, exclusive left-turn and right-turn lanes will be maintained where they exist today (e.g., westbound left-turn lane at 1st View Street and eastbound right-turn lane at Granby Street).
- The northbound approach at the Ocean View Avenue and Granby Street intersections will be reconfigured to one exclusive left-turn lane and one exclusive right-turn lane. The existing dual westbound left-turn lanes will be maintained, and a northbound right-turn overlap phase will be installed.
- Existing 5-section signal heads for protected/permissive left-turn phases will be upgraded to flashing yellow arow indications, providing greater flexibility for signal progression.

3.2 Analysis Methodology

3.2.1 Tools and Assumptions

Traffic operational analyses were conducted using *Synchro 11* traffic analysis software, which utilizes methodologies that are consistent with the *Highway Capacity Manual* (HCM) published by the Transportation Research Board of the National Academies. In addition, the analysis methodology and assumptions were consistent with the standards in VDOT's *Traffic Operations and Safety Analysis Manual* (TOSAM) Version 2.0.

The City of Norfolk provided the existing signal timings and phasing for the study area intersections including the cycle lengths, splits, and offsets for the signalized intersections in coordination.

3.2.2 Measures of Effectiveness

For the intersection capacity analyses, three measures-of-effectiveness were evaluated: level of service (LOS), vehicle delay, and volume-to-capacity ratio (V/C). The planning-level corridor analyses considered overall corridor travel time in each direction as the primary metric for evaluation. For the purposes of this report, simplified definitions of these terms are provided in this section.

LOS describes the amount of traffic congestion at an intersection or on a roadway and ranges from A to F (A indicating a condition of little to no congestion and F a condition with severe congestion, unstable traffic flow, and stop-and-go conditions). LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. Generally, LOS A through LOS D are considered acceptable for overall intersection LOS in urban environments as a standard industry practice. However, it is not atypical for individual intersection approaches and movements to operate at LOS E or LOS F in more developed urban and suburban areas.

Delay and associated LOS for signalized intersections are reported from the *Synchro* analysis. A graphical depiction of overall intersection LOS is shown in Figure 20. Table 2 shows the corresponding thresholds in delay for both signalized and unsignalized intersections.

Figure 20: Overall Intersection LOS Depiction

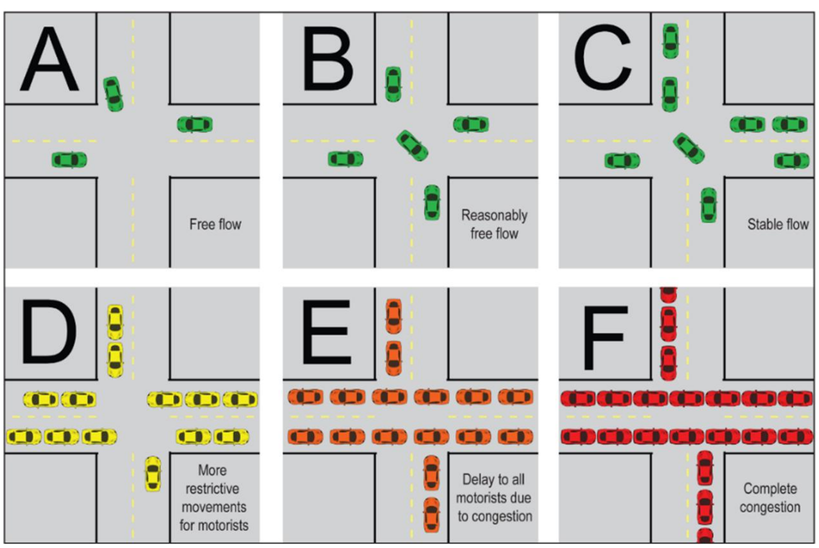


Table 2: LOS Control Delay Thresholds

LOS	Signalized Intersection Control Delay (Seconds/Vehicle)	Unsignalized Intersection Control Delay (Seconds/Vehicle)	Description
A	≤ 10	≤ 10	Free-flow traffic operations at average travel speeds. Vehicles completely unimpeded in ability to maneuver.
B	10 – 20	10 – 15	Reasonably unimpeded traffic operations at average travel speeds. Vehicle maneuverability slightly restricted.
C	20 – 35	15 – 25	Stable traffic operations. Lane changes becoming more restricted. Travel speeds reduced to half of average free flow speeds.
D	35 – 55	25 – 35	Small increases in traffic flow can cause increased delays.
E	55 – 80	35 – 50	Significant delays. Travel speeds reduced to one third of average free flow travel speed.
F	> 80	> 50	Extremely low speeds. Intersection congestion and extensive queues at intersections.

Intersection capacity is a general measure of the number of vehicles an intersection can process, or how many vehicles can move through the intersection, in a given time period based on the characteristics of the intersection including geometry, number of lanes, and traffic control. Intersection capacity utilization refers to how much of the available intersection capacity is being used by the traffic volume moving through the intersection in a given period, and it is expressed as a volume-to-capacity ratio (V/C ratio). A generally accepted guideline published in the Federal Highway Administration's (FHWA) *Informational Guide on Signalized Intersections* states that a V/C ratio less than 0.85 generally indicates that adequate capacity is available, and vehicles are not expected to experience significant queues and delays. As the intersection V/C ratio approaches 1.0, delay and queuing conditions may occur. Once the vehicle demand exceeds the capacity of the intersection (i.e., a V/C ratio greater than 1.0), vehicles may require more than one signal cycle to pass through the intersection, depending on several factors, including signal timing (i.e., how much time is allotted to each traffic movement in one signal cycle). The lower the V/C ratio, the more flexibility there is in the traffic signal timing to accommodate overall traffic for all movements.

Corridor travel time consists of the amount of time to traverse between two predefined points. Corridor travel time includes any stops and delays along the corridor within the study area limits. In this study, corridor travel times are used for reference in comparing traffic conditions with existing and proposed lane configurations.

The model estimates for these measures of effectiveness are theoretical values based on traffic model inputs and assumptions. The inputs and assumptions used for the *Synchro* models in this study provide a fair comparison between existing and potential future conditions.

3.3 INTERSECTION CAPACITY ANALYSIS

3.3.1 Ocean View Avenue at 1st View Street

As shown in Table 3, the intersection currently operates at overall LOS A and LOS B during the AM and PM peak hours, respectively, with all approaches operating at LOS C or better. Under future No Build conditions, delay for the northbound approach is anticipated to increase slightly due to the growth in traffic volumes, pushing it over the threshold for LOS D operations. The overall intersection approach is anticipated to remain a LOS A during the AM peak hour. Under future No Build conditions the PM peak hour is anticipated to operate similar to the existing PM peak hour at a LOS B. Under future No Build conditions, the intersection is anticipated to operate similar to future No Build condition at a LOS A with the northbound approach operating at a LOS D. Under future Build conditions the overall LOS is expected to deteriorate to a LOS C. This can be attributed to the westbound approach experiencing the most traffic in the PM peak hour in existing conditions and therefore subject to more capacity variations during the PM peak hour. With the lane repurposing under both Build conditions, delays will increase slightly during the PM peak hour, but both Ocean View Avenue approaches and the overall intersection are still anticipated to operate acceptably at LOS C or better during both peak periods.

Table 3: Ocean View Avenue at 1st View Street LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	A 8.0	A 3.5	C 31.4		A 7.7	B 10.7	A 7.0	C 34.2		B 15.4
2031 No Build	A 7.3	A 5.3	D 38.9		A 9.1	B 11.9	A 8.0	D 39.5		B 17.6
2031 Build 1	A 8.2	A 4.5	D 38.8		A 9.0	B 11.6	B 14.1	D 41.0		C 21.9
2031 Build 2	A 8.2	A 4.5	D 38.8		A 9.0	B 11.6	B 14.1	D 41.0		C 21.9

3.3.2 Ocean View Avenue at Granby Street

As shown in Table 4, the intersection currently operates at overall LOS B during both the AM and PM peak hours, with all approaches operating at LOS C or better. Under future No Build conditions, delay for the northbound approach is anticipated to increase, resulting in LOS D operations during the AM peak hour. The increased delay for this approach is due to a proposed change from the existing "Free" signal operations to running a set cycle length in order to coordinate operations with the adjacent signals and prioritize the traffic progression along Ocean View Avenue, which means that vehicles on the side street will need to wait longer before being served. With the lane repurposing under both future Build conditions, delays will increase along Ocean View Avenue, particularly in the eastbound direction which is anticipated to operate at LOS D during the PM peak hour. It should be noted the northbound approach at Granby Street is reconfigured under future Build conditions to one exclusive left-turn lane and one exclusive right-turn lane with a right-turn overlap phase. The overall intersection is still anticipated to operate acceptably at LOS C or better during both peak periods under both Build conditions.

Table 4: Ocean View Avenue at Granby Street LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	B 12.8	A 7.4	C 22.1		B 10.3	C 21.3	B 14.0	C 25.3		B 19.0
2031 No Build	A 5.6	B 15.5	D 44.3		B 14.1	C 24.5	B 18.8	C 33.7		C 24.6
2031 Build 1	A 8.0	B 17.1	C 30.7		B 14.8	D 39.7	C 31.7	C 29.5		C 32.7
2031 Build 2	A 8.0	B 17.1	C 30.7		B 14.8	D 39.7	C 31.7	C 29.5		C 32.7

3.3.3 Ocean View Avenue at Norfolk Avenue

As shown in Table 5, the stop-controlled northbound approach of Norfolk Avenue currently operates at LOS A and LOS B during the AM and PM peak hours, respectively. Under future No Build conditions, the intersection is anticipated to operate similar to existing conditions. With the lane repurposing under both future Build conditions, delays will increase slightly for the northbound approach, but it is still anticipated to operate acceptably at LOS C or better during both peak periods.

Table 5: Ocean View Avenue at Norfolk Avenue LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	A 0.0	A 0.1	A 9.9		A 0.2	A 0.0	A 0.4	B 11.6		A 0.5
2031 No Build	A 0.0	A 0.1	B 10.3		A 0.2	A 0.0	A 0.4	B 11.5		A 0.5
2031 Build 1	A 0.0	A 0.1	B 11.7		A 0.3	A 0.0	A 0.4	C 18.4		A 0.6
2031 Build 2	A 0.0	A 0.1	B 11.7		A 0.3	A 0.0	A 0.4	C 18.4		A 0.6

3.3.4 Ocean View Avenue at Chesapeake Boulevard

As shown in Table 6, the intersection currently operates at overall LOS A and LOS C during the AM and PM peak hours, respectively. During the PM peak hour, the northbound approach operates at LOS E with the existing signal timing parameters. Under future No Build conditions, delays are anticipated to increase for most approaches due to the increase in traffic volumes between existing and No Build conditions resulting in some changes to LOS. However, the northbound approach is expected to improve by 30 seconds to a LOS D during the PM peak hour due to signal timing optimization. With the lane repurposing under both future Build conditions, the intersection is expected to operate similarly to No Build conditions at overall LOS B during the AM peak hour. During the PM peak hour, delays will increase, but the overall intersection is anticipated to operate at overall LOS C with all approaches operating acceptably at LOS D or better.

Table 6: Ocean View Avenue at Chesapeake Boulevard LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	B 12.1	A 3.3	C 29.1		A 9.5	B 16.0	A 7.2	E 75.8		C 26.2
2031 No Build	A 7.7	B 10.4	D 39.3		B 12.6	C 23.3	B 13.1	D 44.1		C 24.1
2031 Build 1	A 7.5	B 13.3	D 38.5		B 13.9	C 28.0	C 25.8	D 44.1		C 30.8
2031 Build 2	A 7.5	B 15.7	D 38.5		B 15.2	C 28.0	C 26.7	D 44.1		C 31.1

3.3.5 Ocean View Avenue at Chesapeake Street

As shown in Table 7, the intersection currently operates at overall LOS B during both the AM and PM peak hours. All approaches operate at LOS C or better with the exception of the northbound approach during the PM peak hour, which operates at LOS D. With the increase in traffic volumes under future No Build conditions, delays are anticipated to increase for the northbound and southbound approaches, resulting in LOS D operations during both the AM and PM peak hours. However, traffic signal optimization is anticipated to result in overall LOS A operations during both peak hours. With the lane repurposing under both future Build conditions, the intersection is anticipated to operate similarly to No Build conditions at overall LOS A with the northbound and southbound approaches operating at LOS D.

Table 7: Ocean View Avenue at Chesapeake Street LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	B 11.9	A 7.4	C 34.7	C 33.4	B 10.7	B 11.4	A 8.5	D 35.4	C 33.4	B 11.8
2031 No Build	A 0.5	A 2.0	D 41.3	D 39.6	A 3.7	A 1.0	A 0.6	D 39.8	D 37.6	A 3.8
2031 Build 1	A 2.1	A 1.8	D 41.1	D 39.6	A 4.1	A 4.3	A 2.9	D 39.8	D 37.6	A 6.3
2031 Build 2	A 2.1	A 1.8	D 41.1	D 39.6	A 4.1	A 4.3	A 2.9	D 39.8	D 37.6	A 6.3

3.3.6 Ocean View Avenue at Sturgis Street

As shown in Table 8, the intersection currently operates at overall LOS A during both the AM and PM peak hours, with all approaches operating at LOS C or better. Under future No Build conditions, delays are anticipated to increase for the northbound approach resulting in LOS D operations. This is likely due to the addition of an exclusive pedestrian phase, which impacts the signal timing. With the lane repurposing under both future Build conditions, the intersection is anticipated to operate similarly to No Build conditions at overall LOS A with the northbound approach operating at LOS D during both peak hours.

Table 8: Ocean View Avenue at Sturgis Street LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	A 7.7	A 4.7	C 34.6		A 7.2	A 8.5	A 3.1	C 34.7		A 6.5
2031 No Build	A 2.3	A 2.0	D 43.5		A 3.6	A 3.2	A 6.2	D 43.6		A 6.3
2031 Build 1	A 2.8	A 4.9	D 45.6		A 5.5	A 5.6	A 8.2	D 43.6		A 8.4
2031 Build 2	A 2.8	A 5.5	D 45.6		A 5.7	A 5.6	A 8.7	D 43.6		A 8.6

3.3.7 Ocean View Avenue at Grove Avenue

As shown in Table 9, the stop-controlled northbound approach of Grove Avenue currently operates at LOS B during both the AM and PM peak hours. With future traffic volume growth and the proposed lane repurposing under both Build conditions, the northbound approach is anticipated to continue to operate at LOS B during both peak periods.

Table 9: Ocean View Avenue at Grove Avenue LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	A 0.0	A 0.1	B 11.6		A 0.2	A 0.0	A 0.1	B 11.3		A 0.2
2031 No Build	A 0.0	A 0.1	B 12.6		A 0.2	A 0.0	A 0.1	B 11.7		A 0.2
2031 Build 1	A 0.0	A 0.1	B 13.3		A 0.2	A 0.0	A 0.1	B 14.5		A 0.2
2031 Build 2	A 0.0	A 0.1	B 13.3		A 0.2	A 0.00	A 0.1	B 14.5		A 0.2

3.3.8 Ocean View Avenue at Cape View Avenue

As shown in Table 10, the intersection currently operates at overall LOS B during both the AM and PM peak hours, with all approaches operating at LOS C or better. With the future growth in traffic volumes under No Build conditions, delays are anticipated to increase, resulting in changes to LOS during both peak hours. With the lane repurposing under both future Build conditions, the intersection is anticipated to operate at overall LOS B and LOS C during the AM and PM peak hours, respectively, similar to No Build conditions. All approaches are anticipated operate at LOS D or better.

Table 10: Ocean View Avenue at Cape View Avenue LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	B 10.1	A 7.9	C 33.3		B 11.2	B 15.2	B 15.0	C 30.0		B 16.7
2031 No Build	B 18.5	B 12.3	D 39.1		B 17.4	C 20.1	C 20.5	D 35.6		C 22.0
2031 Build 1	B 15.3	A 8.2	D 39.0		B 14.1	C 24.2	B 16.5	D 35.6		C 21.4
2031 Build 2	B 15.3	B 10.9	D 39.0		B 15.4	C 24.2	B 19.6	D 35.6		C 23.0

3.3.9 Shore Drive at Pleasant Avenue

As shown in Table 11, the intersection currently operates at overall LOS B during the AM and PM peak hours. All approaches operate at LOS C or better with the exception of the northbound and southbound approaches during the PM peak hour, which operate at LOS D. Under future No Build conditions, delays are anticipated to increase for most approaches due to the increase in traffic volumes between existing and No Build conditions resulting in some changes to LOS. With the lane repurposing from 1st View Street to Pretty Lake Avenue under future conditions with the Build 1 option, delays are anticipated to increase significantly for several approaches, resulting in overall LOS D and LOS C during the AM and PM peak hours, respectively. In addition, LOS E is anticipated for the eastbound approach of Ocean View Avenue during the AM peak hour and the northbound approach during the PM peak hour.

The Build 2 option modifies the extents of the lane repurposing from 1st View Street to 19th Bay Street, so the lane configuration at this intersection would be the same under both No Build and Build 2 conditions. With these modified extents, the intersection is therefore anticipated to operate similarly to No Build conditions at overall LOS B during both peak hours.

Table 11: Shore Drive at Pleasant Avenue LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	B 18.7	A 7.1	C 33.2	C 28.8	B 16.5	B 16.8	A 9.5	D 39.3	D 36.1	B 14.9
2031 No Build	B 19.4	B 11.7	D 38.5	C 31.7	B 18.9	B 17.4	B 12.5	D 39.2	C 34.2	B 16.7
2031 Build 1	E 58.4	B 10.6	D 46.7	D 41.0	D 40.8	C 32.9	B 12.1	E 57.5	D 54.4	C 23.7
2031 Build 2	C 21.8	A 6.7	D 38.5	C 33.6	B 18.7	B 16.4	A 6.2	D 39.2	C 34.2	B 12.9

3.3.10 Shore Drive at Pretty Lake Avenue

As shown in Table 12, the intersection currently operates at overall LOS B during the AM and PM peak hours. All approaches operate at LOS C or better with the exception of the northbound and southbound approaches during the PM peak hour, which operate at LOS D and LOS E, respectively. Under future No Build conditions, delays are anticipated to increase for most approaches due to the increase in traffic volumes between existing and No Build conditions resulting in some changes to LOS. However, the southbound approach is expected to improve by 15 seconds to a LOS D during the PM peak hour due to signal timing optimization. With the lane repurposing from 1st View Street to Pretty Lake Avenue under future conditions with the Build 1 option, delays are anticipated to increase significantly for most approaches, resulting in overall LOS D during the PM peak hour. In addition, LOS D is anticipated for the westbound approach of Ocean View Avenue, and LOS F is anticipated for the southbound approach.

The Build 2 option modifies the extents of the lane repurposing from 1st View Street to 19th Bay Street, so the lane configuration at this intersection would be the same under both No Build and Build 2 conditions. With these modified extents, the intersection is therefore anticipated to operate similarly to No Build conditions at overall LOS A/B during both peak hours.

Table 12: Shore Drive at Pretty Lake Avenue LOS and Delay Summary

Scenario	Approach and Intersection Level of Service (Delay in Seconds)									
	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
2021 Existing	A 7.8	A 8.1	C 29.7	C 34.1	B 10.8	A 4.4	A 9.6	D 36.6	E 59.8	B 11.9
2031 No Build	A 5.2	A 9.2	C 32.7	D 40.7	B 10.4	A 6.8	B 13.9	C 33.1	D 45.0	B 14.0
2031 Build 1	B 15.0	B 11.0	D 41.3	D 50.7	B 17.6	A 7.6	D 53.0	D 53.8	F 133.6	D 43.8
2031 Build 2	A 2.8	A 8.3	C 33.1	D 39.7	A 8.7	A 2.6	B 13.9	C 33.1	D 45.0	B 12.6

3.3.11 Volume-to-Capacity Ratio

Table 13 and Table 14 show the overall intersection V/C ratios during the AM and PM peak hours, respectively. Detailed *Synchro* output reports are provided in Appendix C.

Table 13: Intersection Volume-to-Capacity Ratio Summary – AM Peak Hour

Intersection	Intersection V/C Ratio			
	2021 Existing	2031 No Build	2031 Build 1	2031 Build 2
1st View St and Ocean View Ave	0.21	0.27	0.31	0.31
Granby St and Ocean View Ave	0.34	0.32	0.44	0.44
Norfolk Ave and Ocean View Ave	*	*	*	*
Chesapeake Blvd and Ocean View Ave	0.32	0.37	0.55	0.55
Chesapeake St and Ocean View Ave	0.23	0.27	0.45	0.45
Sturgis St and Ocean View Ave	0.22	0.28	0.41	0.49
Grove Ave and Ocean View Ave	*	*	*	*
Cape View Ave and Ocean View Ave	0.37	0.43	0.39	0.39
Pleasant Ave and Shore Dr	0.44	0.52	0.78	0.48
Pretty Lake Ave and Shore Dr	0.50	0.59	0.87	0.54

**Synchro does not provide V/C ratios for unsignalized intersections*

Table 14: Intersection Volume-to-Capacity Ratio Summary – PM Peak Hour

Intersection	Intersection V/C Ratio			
	Existing	2031 No Build	2031 Build 1	2031 Build 2
1st View St and Ocean View Ave	0.52	0.56	0.86	0.86
Granby St and Ocean View Ave	0.62	0.64	0.94	0.94
Norfolk Ave and Ocean View Ave	*	*	*	*
Chesapeake Blvd and Ocean View Ave	0.57	0.60	0.85	0.85
Chesapeake St and Ocean View Ave	0.26	0.29	0.51	0.51
Sturgis St and Ocean View Ave	0.27	0.31	0.61	0.61
Grove Ave and Ocean View Ave	*	*	*	*
Cape View Ave and Ocean View Ave	0.54	0.58	0.58	0.58
Pleasant Ave and Shore Dr	0.50	0.57	0.91	0.58
Pretty Lake Ave and Shore Dr	0.59	0.66	1.04	0.66

***Synchro does not provide V/C ratios for unsignalized intersections*

Under existing conditions, all intersections operate with V/C ratios less than 0.85 (i.e., under capacity) during both the AM and PM peak hours. Under the future No Build conditions, the study area intersections are anticipated to operate with V/C ratios that are generally similar to existing conditions during both peak hours.

With the potential lane repurposing from 1st View Street to Pretty Lake Avenue under future conditions with the Build 1 option, the Shore Drive intersections with Pleasant Avenue and Pretty Lake Avenue are anticipated to begin approaching capacity. During the PM peak hour, the Shore Drive intersections with Pleasant Avenue and Pretty Lake Avenue are anticipated to operate near or above capacity with the lane repurposing.

The Build 2 option modifies the extents of the lane repurposing from 1st View Street to 19th Bay Street. With these modified extents, all study intersections are anticipated to operate well below capacity during the AM peak hour. During the PM peak hour, the Ocean View Avenue intersections with 1st View Street, Granby Street, and Chesapeake Boulevard are anticipated to operate near capacity while all other intersections will continue to operate well below capacity during the PM peak hour. The Granby Street intersection is anticipated to experience the highest V/C ratio due to the reconfiguration of the northbound approach in addition to the lane repurposing along Ocean View Avenue.

3.4 Corridor Travel Time Analysis

Corridor travel times were evaluated from 1st View Street to Pretty Lake Avenue. It should be noted that the No Build and Build travel time results include the impacts of the proposed speed limit reduction from 35 mph to 30 mph.

Table 15 summarizes the corridor travel time results during the AM and PM peak hours. Detailed travel time reports are provided in Appendix C.

Table 15: Corridor Travel Time Summary

Direction of Travel	Peak Hour	Travel Time in Minutes:Seconds (Difference from Existing)			
		Existing	2031 No Build	2031 Build 1	2031 Build 2
Westbound from Pretty Lake Avenue to 1st View Street	AM	8:12	09:07 (+55 sec)	09:07 (+55 sec)	09:10 (+58 sec)
	PM	8:39	9:40 (+59 sec)	10:57 (+138 sec)	10:14 (+95 sec)
Eastbound from 1st View Street to Pretty Lake Avenue	AM	09:05	09:59 (+54 sec)	10:09 (+64 sec)	9:37 (+32 sec)
	PM	9:19	10:14 (+55 sec)	10:55 (+96 sec)	10:40 (+81 sec)

Under future (2031) No Build conditions, corridor travel times in both the eastbound and westbound directions during both peak hours are anticipated to increase by approximately one minute compared to existing conditions due to future traffic volume growth and the proposed speed limit reduction.

With the potential lane repurposing from 1st View Street to Pretty Lake Avenue under future (2031) conditions with the Build 1 option, the corridor travel times are anticipated to be similar to No Build conditions during the AM peak hour. During the PM peak hour, the eastbound direction is anticipated to experience an increase of approximately 40 seconds, and the critical westbound direction is anticipated to experience an increase of approximately 80 seconds compared to future No Build conditions.

With the modified extents of the lane repurposing from 1st View Street to 19th Bay Street with the Build 2 option, it is anticipated that drivers in both directions will experience an increase of approximately 30 seconds in travel time over the entire 4-mile corridor when compared to future (2031) No Build conditions during the PM peak hour. The maximum anticipated travel time increase over existing conditions is 95 seconds, 59 seconds of which is attributable even under No Build conditions. This total increase over the existing travel time is less than 20 percent.

3.5 Traffic Operations Analysis Findings

Table 16 and Table 17 summarize the overall intersection LOS and average delay during the AM and PM peak hours, respectively.

Table 16: Intersection LOS and Delay Summary – AM Peak Hour

Intersection	Overall Intersection Level of Service (Delay in Seconds per Vehicle)			
	Existing	2031 No Build	2031 Build 1	2031 Build 2
First View St & Ocean View Ave	A (7.7)	A (9.1)	A (9.0s)	A (9.0s)
Granby St & Ocean View Ave	B (10.3)	B (14.1)	B (14.8s)	B (14.8s)
Norfolk Ave & Ocean View Ave	A (0.2)	A (0.2)	A (0.3s)	A (0.3s)
Chesapeake Blvd and Ocean View Ave	A (9.5)	B (12.6)	B (13.9s)	B (15.2s)
Chesapeake St & Ocean View Ave	B (10.7)	A (3.7)	A (4.1s)	A (4.1s)
Sturgis St & Ocean View Ave	A (7.2)	A (3.6)	A (5.5s)	A (5.7s)
Grove Ave and Ocean View Ave	A (0.2)	A (0.2)	A (0.2s)	A (0.2s)
Cape View Ave and Ocean View Ave	B (11.2)	B (17.4)	B (14.1s)	B (15.4s)
Pleasant Ave and Shore Dr	B (16.5)	B (18.9)	D (40.8s)	B (18.7s)
Pretty Lake Ave and Shore Dr	B (10.8)	B (10.4)	B (17.6s)	A (8.7s)

Table 17: Intersection LOS and Delay Summary – PM Peak Hour

Intersection	Overall Intersection Level of Service (Delay in Seconds per Vehicle)			
	Existing	2031 No Build	2031 Build 1	2031 Build
First View St & Ocean View Ave	B (15.4)	B (17.6)	C (21.9s)	C (21.9s)
Granby St & Ocean View Ave	B (19.0)	C (24.6)	C (32.7s)	C (32.7s)
Norfolk Ave & Ocean View Ave	A (0.5)	A (0.5)	A (0.6s)	A (0.6s)
Chesapeake Blvd and Ocean View Ave	C (26.2)	C (24.1)	C (30.8s)	C (31.1s)
Chesapeake St & Ocean View Ave	B (11.8)	A (3.8)	A (6.3s)	A (6.3s)
Sturgis St & Ocean View Ave	A (6.5)	A (6.3)	A (8.4s)	A (8.6s)
Grove Ave and Ocean View Ave	A (0.2)	A (0.2)	A (0.2s)	A (0.2s)
Cape View Ave and Ocean View Ave	B (16.7)	C (22.0)	C (21.4s)	C (23.0s)
Pleasant Ave and Shore Dr	B (14.9)	B (16.7)	C (23.7s)	B (12.9s)
Pretty Lake Ave and Shore Dr	B (11.9)	B (14.0)	D (43.8s)	B (12.6s)

Under both Existing conditions and future (2031) No Build conditions with anticipated traffic growth, there is available capacity in both directions of Ocean View Avenue, with all intersections operating at overall LOS C or better. With the potential lane repurposing from 1st View Street to Pretty Lake Avenue under future (2031) conditions with the Build 1 option, all intersections are anticipated to continue to operate at overall LOS C or better except for the Shore Drive intersections with Pleasant Avenue and Pretty Lake Avenue. These intersections are anticipated to operate at overall LOS D with the potential lane repurposing. The Build 2 option modifies the extents of the lane repurposing from 1st View Street to 19th Bay Street. With these modified extents, all intersections are anticipated to operate acceptably at overall LOS C or better during both peak hours under future (2031) conditions with the potential lane repurposing. Under Build 2 conditions, average vehicle delays are expected to increase by less than 10 seconds when compared to future (2031) No Build conditions.

4 Public Engagement

A central component of this study included engaging with the community. This was achieved through multiple rounds of public engagement to gather input and feedback at key steps during the study process. Each round of public engagement included a community workshop and an online survey.

Prior to the first community workshop and online engagement, the project team met with local civic leagues and stakeholder groups in February 2022 to give abbreviated presentations about the project and generate interest in the upcoming public engagement process. The project team met with the following groups:

- Bicycling and Pedestrian Trails Commission
- East Ocean View Civic League
- Cottage Line Civic League
- Willoughby Civic League
- Bayview Civic League
- Greater Pinewell Civic League

In addition, the City of Norfolk formed a project Advisory Group of local stakeholders to advise City staff throughout the study process. The Advisory Group consisted of 19 members including City Council Members Thomas Smigiel (Ward 5) and Andria McClellan (Superward 6) and representatives from the Ocean View Business Association, six local civic leagues (Bayview, East Ocean View, Cottage Line, Greater Pinewell, Ocean View, and Willoughby), the City of Norfolk Bicycling and Pedestrian Trails Commission, Hampton Roads Transit, Norfolk Public Schools, Norfolk Police & Fire Rescue, Nansemond on the Bay and Bay Breeze Point Homeowners Associations, Joint Expeditionary Base Little Creek-Fort Story, and Bike Norfolk.

The sections below include brief summaries of each round of public engagement. More detailed summaries of each round were previously published on the project website and can be found in Appendix D.

4.1 Round 1 Public Engagement – March to April 2022

The purpose of the first round of public engagement was to provide basic information about the project background and goals and to solicit input from the community to understand their concerns, ideas, and priorities for the Ocean View Avenue corridor. The first community workshop was held virtually via Zoom on March 14, 2022, and more than 60 community members attended. Following the workshop, more than 800 individuals—90% of whom live in the vicinity of Ocean View Avenue—responded to the online survey. In addition, more than 250 comments were placed on the interactive comment map, and nearly 100 additional comments and questions were submitted to the City of Norfolk through other means. Below are some of the key takeaways from the survey and comments received.

- Respondents were asked how they typically travel along Ocean View Avenue:
    - 88% drive a car either “always” or “almost always”
    - 57% ride a bike at least “sometimes”
    - 71% walk at least “sometimes”

- In addition to improving safety, respondents were asked to rank their top three priorities for transportation and mobility improvements in the study corridor. The following three priorities received both the most #1 rankings and the most total rankings:

  1. Increase the ease with which pedestrians can travel along and/or across Ocean View Avenue
  2. Reduce vehicle speeds
  3. Increase the ease with which bicycles and e-scooters can travel along and/or across Ocean View Avenue

- Respondents were asked about their experiences walking along Ocean View Avenue:

  - When traveling along Ocean View Avenue, 71% of the survey respondents say they walk or use a wheelchair along Ocean View Avenue at least "sometimes." Of those who do walk, 39% find it "somewhat difficult" or "very difficult." For those who do not walk along Ocean View Avenue or who find it difficult, the most common reasons given are that crossing Ocean View Avenue is too difficult or feels unsafe and that existing sidewalks do not feel safe.
  - The survey asked how willing respondents would be to walk along Ocean View Avenue if adequate facilities (such as sidewalks and crosswalks) were available. Nearly 60% indicated that they would be "very willing" to walk along Ocean View Avenue, with another 22% being "somewhat willing."

- Respondents were asked about their experiences biking along Ocean View Avenue:

  - When traveling along Ocean View Avenue, 57% of the survey respondents say they ride a bike or e-bike along Ocean View Avenue at least "sometimes." Of those who do bike, 62% find it "somewhat difficult" or "very difficult." For those who do not bike along Ocean View Avenue or who find it difficult, the most common reasons given are that there are not enough dedicated bike facilities (i.e., bike lanes) and that existing bike facilities do not feel safe or comfortable.
  - The survey asked how willing respondents would be to bike along Ocean View Avenue if adequate facilities (such as bike lanes) were available. One half (50%) of all respondents indicated that they would be "very willing" to ride a bike along Ocean View Avenue, with another 23% being "somewhat willing."

- Respondents were asked about their experiences with golf carts in the vicinity of Ocean View Avenue:

  - Because no specific concepts had been developed at the time of the first public survey, it did not directly ask respondents whether they would support accommodations for golf carts along Ocean View Avenue.
  - When asked whether they would be willing to travel along Ocean View Avenue by golf cart if adequate facilities were available, 34% of respondents said they would be "very willing" and another 19% said they would be "somewhat willing", while 41% said they would "not be willing at all". By contrast, only 21% of respondents said they would "not be willing at all" to travel by bicycle along Ocean View Avenue.
  - When asked about golf cart ownership, only 12% of respondents indicate that they own a golf cart while another 23% indicate that they do not own one but would be interested in using one

for personal transportation. In addition, respondents did not rank the ability for golf carts to travel along and/or across Ocean View Avenue in the overall top three priorities for the corridor.

- Many survey respondents used the open-ended questions to express their concerns about the possibility of golf cart operation on Ocean View Avenue, with more than 100 respondents choosing to comment in opposition to potential golf cart accommodations.
- Based on these results, it would appear that golf cart accommodations are only a priority for a small segment of the community and could potentially face significant opposition from other residents.

The feedback and input from the first round of public engagement had a significant impact on the alternatives development.

4.2 Round 2 Public Engagement – June to July 2022

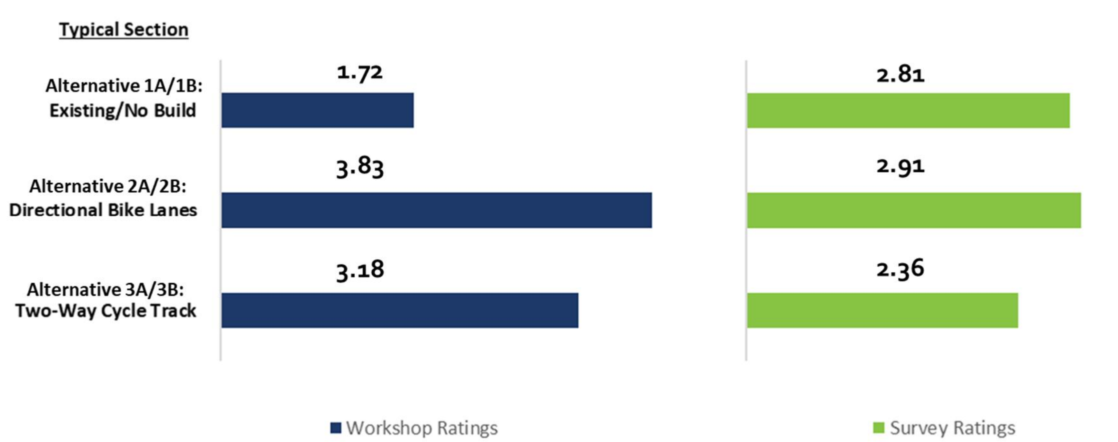
Based on the findings from the first round of public engagement, the project team developed preliminary conceptual alternatives for the community's consideration (see Section 6). These concepts focused on increasing pedestrian safety, reducing vehicle speeds, and improving travel for other road users such as cyclists—the top priorities for the corridor identified by the community. The purpose of the second round of public engagement was to gather community input and initial reactions to the preliminary conceptual alternatives.

Prior to the second community workshop and online engagement, the project team met with the study Advisory Group to present a summary of the first round of public engagement and to discuss and refine the draft concepts. The project team hosted the second community workshop at the East Ocean View Community Center on June 27, 2022, and more than 60 community members attended. Following the workshop, more than 700 individuals responded to the online survey. Below are some of the key takeaways from the workshop discussion and survey results.

4.2.1 Rating the Preliminary Conceptual Alternatives

Workshop attendees and online survey respondents were asked to rate each alternative on a scale of 1 to 5 with 1 being unfavorable, 3 being neutral, and 5 being strongly in favor. The average ratings for each concept are summarized in Table 18 below.

Table 18: Average Concept Ratings



As shown above, Alternative 1A/1B (Existing/No Build) was rated unfavorably by the workshop attendees and had the lowest average rating. Alternative 2A/2B (Directional Bike Lanes) was rated the highest by the workshop attendees. Alternative 3A/3B (Two-Way Cycle Track) was also rated favorably, but slightly less than Alternative 2A/2B, indicating a preference for the directional bike lanes.

The survey respondents rated all of the alternatives relatively similarly. Alternative 3A/3B (Two-Way Cycle Track) had the lowest average rating. Alternative 2A/2B (Directional Bike Lanes) was rated the highest by the survey respondents, although the rating for Alternative 1A/1B (Existing/No Build) was only slightly lower. When considering the results from both the workshop survey and the online survey, Alternative 2A/2B (Directional Bike Lanes) received the highest overall ratings.

4.2.2 Pedestrian Crossing Improvements

Workshop attendees and survey respondents were asked to identify their top locations for new pedestrian crossings and enhanced pedestrian crossing treatments. The following are the top locations that were mentioned by at least 30 individuals:

1. 21st Bay Street (85 mentions)
2. Cape View Avenue (53 mentions)
3. 1st View Street (52 mentions)
4. Sturgis Street (37 mentions)
5. 5th Bay Street (32 mentions)
6. Beach View Avenue (32 mentions)
7. Beaumont Street (32 mentions)
8. Norfolk Avenue (30 mentions)
9. 3rd Bay Street (30 mentions)
10. 11th View Street (30 mentions)

4.2.3 Additional Community Feedback

- Many workshop attendees and survey respondents also shared their feedback on the preliminary conceptual alternatives. The following are some of the most commonly noted refinements or feedback regarding the proposed concepts (in no particular order):
  - Widen sidewalks and add more trees to provide shade and protect pedestrians
  - Provide boardwalk or side path for biking and walking
  - Provide taller barriers between cyclists and motor vehicles
  - Provide consistent geometry and striping, and continue bike lanes around the curve to Pretty Lake Avenue
  - The two-way cycle track (Alternative 3A/3B) seems like it would make access to/from the residential driveways more difficult and could confuse drivers
- Of the 702 online survey respondents, 392 provided additional comments on the preliminary conceptual alternatives.
  - There were 175 respondents (45% of those leaving comments) who commented in favor of bike lanes. The most commonly cited reasons were the desire to improve safety for cyclists and to combat excessive speeding along Ocean View Avenue.

- There were 168 respondents (43% of those leaving comments) who commented against bike lanes. The most commonly cited reason was concerns about traffic congestion with the reduction to one travel lane in each direction.

- Workshop attendees and survey respondents also provided feedback regarding the following issues:
  - Need to combat excessive speeding and implement stricter speed enforcement (this was specifically noted by 76 survey respondents, or 19% of those leaving comments)
  - Need for better maintenance of existing sidewalks and bike lanes
  - Need for additional on-street parking and public parking at beach access locations

The feedback and input from the public outreach efforts were used to develop preliminary recommendations for the Ocean View Avenue corridor.

4.3 Round 3 Public Engagement – September to November 2022

Based on the findings from the second round of public engagement and on an evaluation of the conceptual alternatives, the project team developed preliminary recommendations for the Ocean View Avenue corridor, including a recommended preferred alternative for lane repurposing. The purpose of the third round of public engagement was to gather community feedback on the recommended preferred alternative and other preliminary study recommendations.

Prior to the third community workshop and online engagement, the project team met twice with the study Advisory Group to present a summary of the second round of public engagement and to discuss and refine the preliminary study recommendations. The project team hosted the third community workshop at the East Ocean View Community Center on October 17, 2022, and 40 community members attended. Following the workshop, more than 200 individuals responded to the online survey. Below are some of the key takeaways from the workshop discussion and survey results.

- Respondents were asked whether they support the recommended preferred alternative (Alternative 2A/2B) for lane repurposing.
  - Two-thirds (66%) of the respondents indicated that they support the recommended lane repurposing, and another 10% of respondents support the lane repurposing if their concerns are addressed.
  - Less than one-fourth (24%) of respondents indicated that they do not support the recommended lane repurposing.

- Respondents were also asked whether they support the recommended pedestrian crossing treatments and locations.
  - More than 80% of the respondents indicated that they support the pedestrian crossing recommendations, and another 10% indicated that they support the recommendations if their concerns are addressed.
  - Only 10% of the respondents indicated that they do not support the pedestrian recommendations.

The feedback and input from the public outreach efforts were used to finalize the recommendations for the Ocean View Avenue corridor.

5 GOLF CART LITERATURE AND INDUSTRY REVIEW

Prior to the first round of public engagement, a literature and industry review was conducted to better understand where golf cart accommodations have been implemented across the United States and their effectiveness with integrating with other modes. Eight communities were initially identified as potential sources, although separate off-street paths were found to be more common than on-street lanes. Ultimately, three communities with existing or planned golf cart lanes were chosen for a more detailed review based on their documentation of findings and functional similarities to the Ocean View Avenue corridor. The following sections summarize the reviews of Youngtown/Sun City (Arizona), Surprise (Arizona), and Lincoln (California).

5.1 YOUNGTOWN/SUN CITY, ARIZONA

Youngtown/Sun City, Arizona is located approximately 15 miles northwest of Phoenix, Arizona with a combined population of nearly 44,000 (i.e., 6,000 in Youngtown and 38,000 in Sun City). Approximately 75% of the population is over the age of 65. Golf carts have been an integral component in Youngtown/ Sun City since 1960 with 40-50% of households using golf carts per a 2014 survey. In August 2014, new Arizona state legislation was passed allowing golf carts to travel within the paved shoulders of roadways serving age-restricted communities outside of Youngtown/Sun City. In all other instances where roadways were not serving age-restricted communities, golf carts must travel in the general travel lanes. The new legislation led to a 2015/2016 study being conducted by the Maricopa County Department of Transportation (MCDOT) for 111th Avenue in the Town of Youngtown. The 111th Avenue corridor between Olive Avenue and Grand Avenue (approximately 2.75 miles) is a four-lane minor arterial with a posted speed limit of 35 mph that provides access to primarily residential and commercial land uses, as well as multiple golf courses. The corridor spans the entire length of Youngtown and carried approximately 7,000 to 10,000 vehicles per day in 2014.

During the study's concept screening process, an alternative including shared bicycle and golf cart lanes was screened out from further consideration due to safety concerns over their limited use in practice and ability for users to become familiar with how to use and operate bicycles and golf carts safely and correctly within the shared lanes. This planning decision also came at a time when Youngtown/Sun City was receiving consistent resident complaints of distracted golf cart driving and golf cart users not abiding to the rules and regulations. One instance in particular involved a fatal golf cart crash with a tractor-trailer truck when the golf cart driver did not yield the right of way.

The MCDOT planning study was ultimately completed with a selected preferred concept that included a lane reduction to two general purpose lanes with a center two-way left-turn lane, exclusive bicycle lanes in each direction, and off-street multiuse paths/sidewalks for pedestrians. Golf carts would be required to travel in the general-purpose lanes (i.e., no dedicated facilities for golf carts were proposed). As of 2022, the lane repurposing has not been constructed.

5.2 SURPRISE, ARIZONA

Surprise, Arizona is located approximately 20 miles northwest of Phoenix, Arizona with a population of approximately 135,000. In 2014, the City decided to modify Bullard Avenue to accommodate modal connectivity and address vehicle speeding. Bullard Avenue consisted of two general purpose travel lanes in each direction with a 45 mph posted speed limit. The proposed modification would repurpose Bullard

Avenue to one general travel lane, one exclusive lane for golf carts and neighborhood electric vehicles (NEV), and one exclusive bike lane in each direction. The posted speed limit under proposed conditions would also be reduced to 35 MPH.

After completion of the proposed roadway modifications, several community complaints were received from residents along Bullard Avenue. The complaints identified newly observed issues that included vehicles using the exclusive NEV/golf cart lanes to pass slower or stopped vehicles in the general travel lanes, conflicts between golf carts and school bus pickup and dropoff, and complaints that the State of Arizona was typically seeing more successful implementations within age-restricted communities, which is not consistent with the population along Bullard Avenue that primarily consists of generally younger families with children.

In response to the consistent complaints received, the 2014 improvements were removed in 2018/2019. Bullard Avenue was converted back to a 4-lane facility (i.e., two general travel lanes in each direction), but the exclusive bicycle lanes in each direction and reduced speed limit have remained in place. Following the reconversion, the City provided four lessons learned from their experience with attempting to integrate golf cart lanes:

- Communicate and then communicate more. Ensure residents are made aware of what is being planned and why.
- Stick with the plan. Success of implementation would have been enhanced if the City had emphasized compatibility and consistency with the City's 2035 General Plan which includes emphasis in alternative mode connectivity.
- Complete connections. The section of Bullard Avenue included with this project dead-ends at Greenway Road, effectively making it "a route to nowhere." Extending it into the adjoining City Center complex could have provided a more compelling value proposition for alternative mode accommodations.
- Be careful with terminology. The project was characterized as benefiting "golf carts" even though there are no golf courses along Bullard Avenue. The project could have had a better chance of success if it had focused on identifying how existing NEV traffic present along Bullard Avenue could be improved/enhanced.

5.3 LINCOLN, CALIFORNIA

Lincoln, California is located approximately 20 miles northeast of Sacramento, California with a population of approximately 47,000. In 2003, the City of Lincoln noted the presence of an aging community with rapid ongoing growth and a changing urban lifestyle. One of the more significant elements of the changing urban lifestyle was the increasing use of NEVs. A survey of current NEV owners conducted by the City of Lincoln indicated that approximately 54% of trips were classified as leisure, 43% were classified as trips to the doctor, shopping, and bank errands, and 3% were classified as business or work commuting. In response to providing a better quality of life for the community and NEV users, the City coordinated with other agencies and businesses in developing a robust NEV Transportation Plan.

As of 2014, the City has constructed approximately 21 miles of NEV lanes in roadways shared with automobiles (Class III), separate from automobiles but shared with bicycles/golf carts (Class II), and off-street NEV/golf cart paths (Class I). NEVs are allowed on all roadways posted at 35 MPH or less or on roadways with speed limits greater than 35 MPH where there are marked NEV/bike lanes. The City's current NEV Transportation Plan has received tremendous public and community support and also received the League of California Cities' 2006 Helen Putnam Award for Excellence.

The City of Lincoln has demonstrated significant success in implementing NEV lanes, but its successes are not a result of short-term reactions, but rather from extensive long-term planning since 2003. Currently, NEV considerations are integral in all types of roadway design projects. For example, in 2016, CALTRANS issued a design exception on the McBean Park Drive Bridge Project to fund two 8-foot shared NEV/bike lanes as part of the bridge widening, where initially CALTRANS saw the proposed lanes as not necessary and was only willing to fund 5-foot bicycle-only lanes. Continued success of the City's NEV and golf cart lane network is largely contributed from its public outreach. The City of Lincoln's website provides detailed maps of existing golf cart and NEV lanes within the City, along with an interactive map of the entire City's roadway network, identifying where NEVs and golf carts are allowed and prohibited.

5.4 FINDINGS AND CONCLUSIONS

Overall, the general review of existing facilities demonstrated that the integration of golf cart lanes was more effective in areas with age-restricted communities and areas that largely consist of short-distance residential/commercial trips. The number of households with golf cart ownership was also seen to be a significant factor, in that areas with more sporadic ownership tended to have more challenges integrating the mode of travel within their existing multimodal networks. It was also observed that isolated corridor implementations of golf cart facilities were not very successful. The more successful implementations occurred when golf cart "zones," consisting of subareas in locations with high golf cart ownership, were designated. Within these zones, not only are travel lanes provided, but also adequate parking facilities to safely accommodate golf carts.

Several concerns associated with on-street golf cart lanes were observed through the case studies reviewed, with one that included golf cart lanes being removed several years after construction due to safety along an isolated corridor that was also experiencing a vehicle speed problem. Concerns ranged from golf cart users' inability to become familiar with how to operate golf carts along roadways and within designated lanes (i.e., disregarding restrictions, signs, and markings), users' inability to safely integrate with other non-vehicle modes such as bicycles and pedestrians, and overall safety of golf cart users in areas where vehicle speeds and volumes are high (i.e., speeds greater than 35 miles per hour and volumes greater than 10,000 vehicles per day).

Based on the literature review findings and the results of the first public survey (see Section 4.1), golf carts are NOT recommended to operate along Ocean View Avenue. However, in the future, certain signalized intersections may be identified to permit golf carts to cross Ocean View Avenue. Potential locations for golf cart parking will also need to be considered as part of this process.

6 Conceptual Alternatives Development

6.1 Preliminary Conceptual Alternatives

Based on the findings from the first round of public engagement (Section 4.1) and a review of existing conditions and field observations, the project team developed three preliminary conceptual alternatives for the community's consideration for future funding and implementation along the Ocean View Avenue corridor. These concepts focused on increasing pedestrian safety, reducing vehicle speeds, and improving travel for other road users such as cyclists—the top priorities for the corridor identified by the community. As a result, two of the concepts include a lane repurposing that would reduce the number of travel lanes from two lanes in each direction to one lane in each direction in order to calm traffic and make space for other road users such as cyclists.

Based on feedback from the initial public survey (Section 4.1) and the results of a literature review (Section 5), golf carts are not recommended to operate along Ocean View Avenue and therefore are not included in any of the preliminary conceptual alternatives.

These alternatives were presented as "typical sections" to show what the corridor would look like with the potential lane repurposing. For each alternative, two variations were presented depending on the width of the existing pavement—one with on-street parking and one without. The typical sections represented what the corridor would look like between Norfolk Avenue and Cape View Avenue; however, the potential lane repurposing was evaluated between 1st View Street and Pretty Lake Avenue.

A summary of the alternatives considered is provided in Table 19 below, and the following sections describe each alternative in further detail.

Table 19: Preliminary Conceptual Alternatives

Typical Section	Without On-Street Parking (~54' Pavement Width)	With On-Street Parking (~64' Pavement Width)
Existing / No Build	Alternative 1A	Alternative 1B
Directional Bike Lanes	Alternative 2A	Alternative 2B
Two-Way Cycle Track	Alternative 3A	Alternative 3B

6.1.1 Alternative 1A/1B: Existing / No Build

This alternative does not include any changes to the existing roadway geometry and lane configuration. Features of this alternative include:

- Maintains the existing lane markings and configuration with two travel lanes in each direction
- Does not address the priority of improving bicycle travel along Ocean View Avenue
- Does not address the priority to reduce speeding without additional measures
- Alternative 1A (54' Pavement Width): Does not accommodate on-street parking (similar to existing conditions)
- Alternative 1B (64' Pavement Width): Accommodates on-street parking where feasible based on driveway spacing (similar to existing conditions)

Figure 21 and Figure 22 illustrate Alternative 1A and Alternative 1B, respectively.

6.1.2 Alternative 2A/2B: Directional Bike Lanes

This alternative includes a lane repurposing and provides directional bike lanes on each side of the roadway. Features of this alternative include:

- Repurposes one travel lane in each direction to provide buffered bike lanes
- Bike lanes will have physical separation where feasible based on driveway spacing and on-street parking spaces. Raised domes are shown for illustrative purposes, but other barriers such as delineator posts, rubberized parking stops, etc. may be used.
- Alternative 2A (54’ Pavement Width): Does not accommodate on-street parking with this pavement width (similar to existing conditions)
- Alternative 2B (64’ Pavement Width): Accommodates on-street parking where feasible based on driveway spacing (similar to existing conditions). Parking will be located against the curb, to the outside of the bike lane.

Figure 23 and Figure 24 illustrate Alternative 2A and Alternative 2B, respectively.

6.1.3 Alternative 3A/3B: Two-Way Cycle Track

This alternative includes a lane repurposing and provides a two-way cycle track on one side of the roadway. Features of this alternative include:

- Repurposes one travel lane in each direction and shifts the travel lanes to provide a two-way cycle track on one side of the roadway
- Cycle track will have physical separation where feasible based on driveway spacing. Raised domes are shown for illustrative purposes, but other barriers such as delineator posts, rubberized parking stops, etc. may be used.
- Will require modifications to existing traffic signals
- Alternative 3A (54’ Pavement Width): Does not accommodate on-street parking with this pavement width (similar to existing conditions)
- Alternative 3B (64’ Pavement Width): Accommodates on-street parking where feasible based on driveway spacing (similar to existing conditions). The two-way cycle track will be located against the curb, with parking in between the travel lane and the cycle track.

Figure 25 and Figure 26 illustrate Alternative 3A and Alternative 3B, respectively.

Figure 21: Alternative 1A: Existing / No Build (54’ Pavement Width)

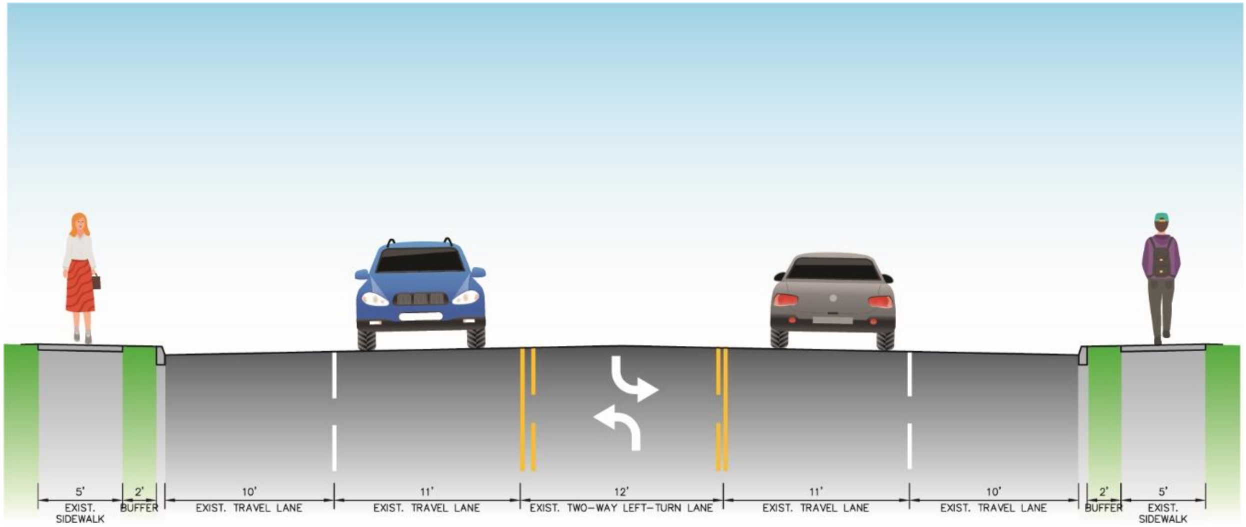


Figure 22: Alternative 1B: Existing / No Build (64' Pavement Width)

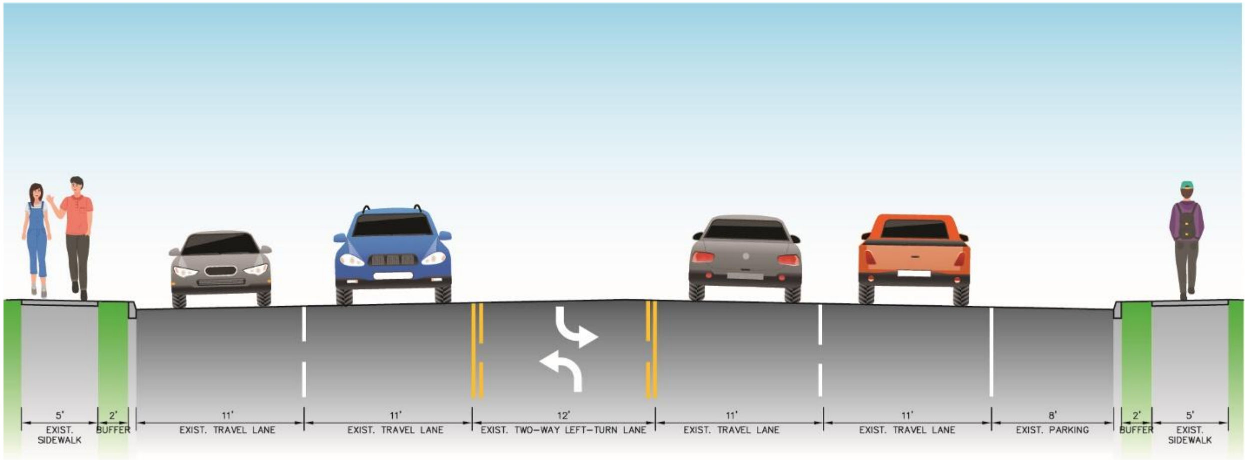


Figure 23: Alternative 2A: Directional Bike Lanes (54' Pavement Width)

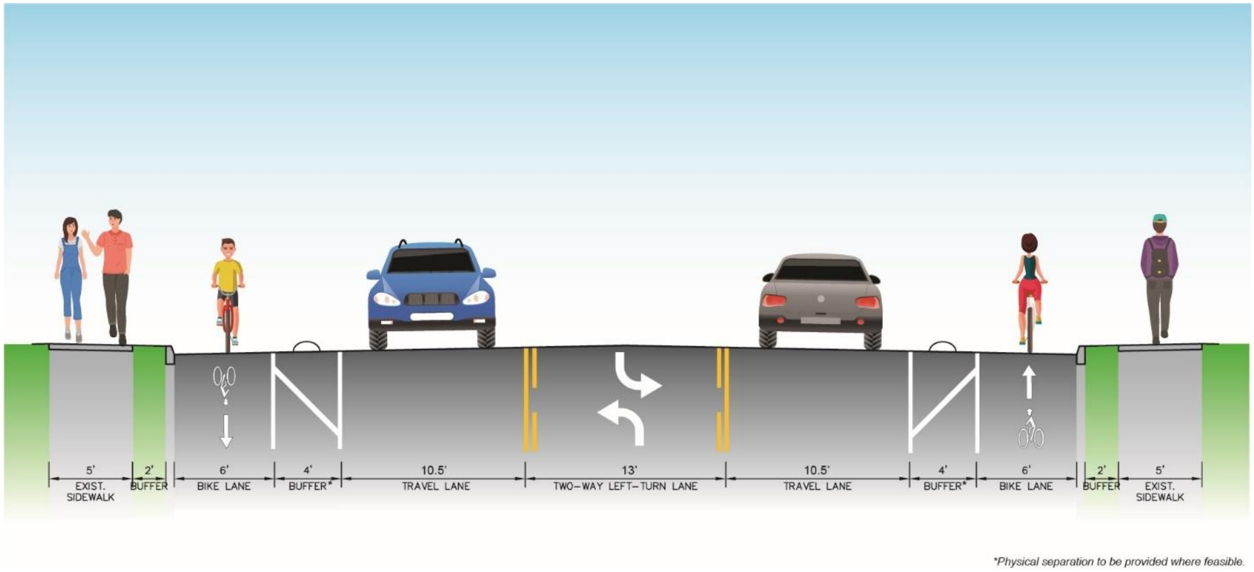


Figure 24: Alternative 2B: Directional Bike Lanes (64’ Pavement Width)

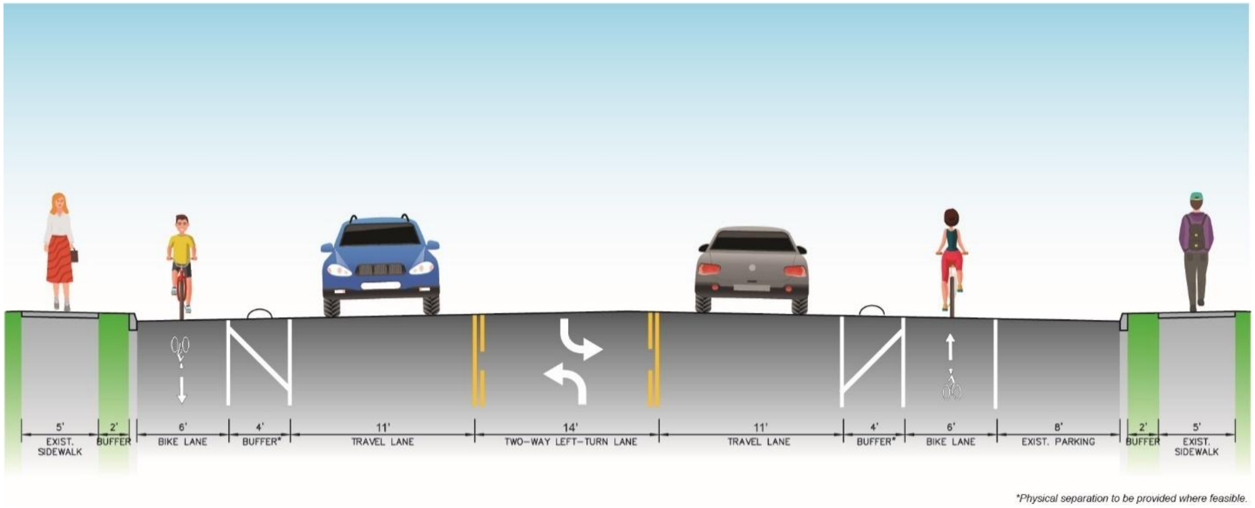


Figure 25: Alternative 3A: Two-Way Cycle Track (54’ Pavement Width)

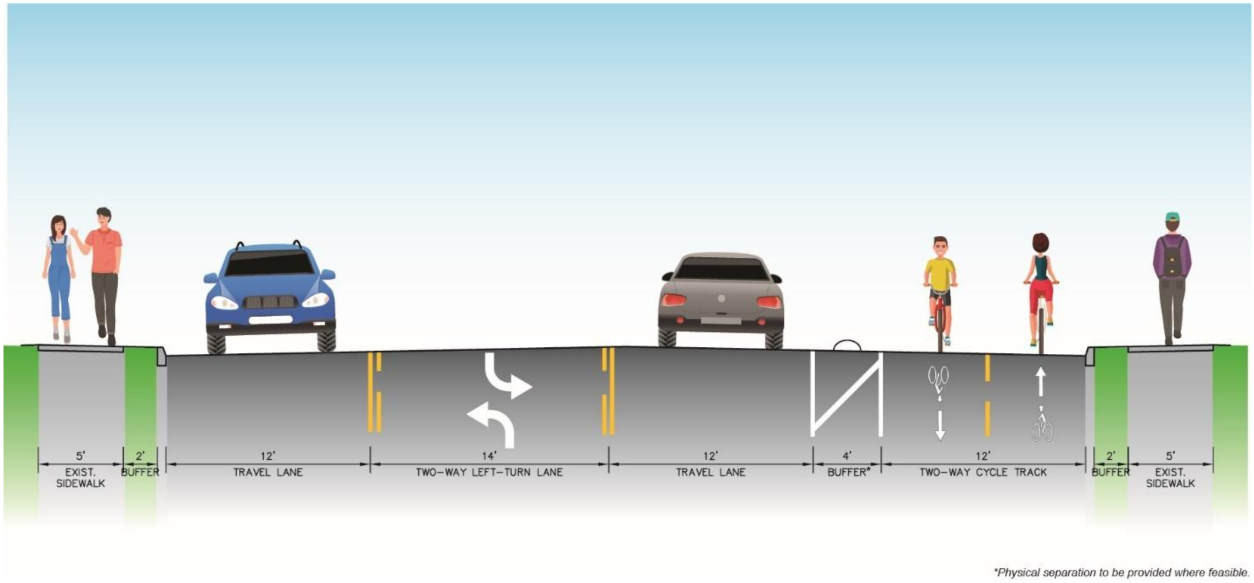
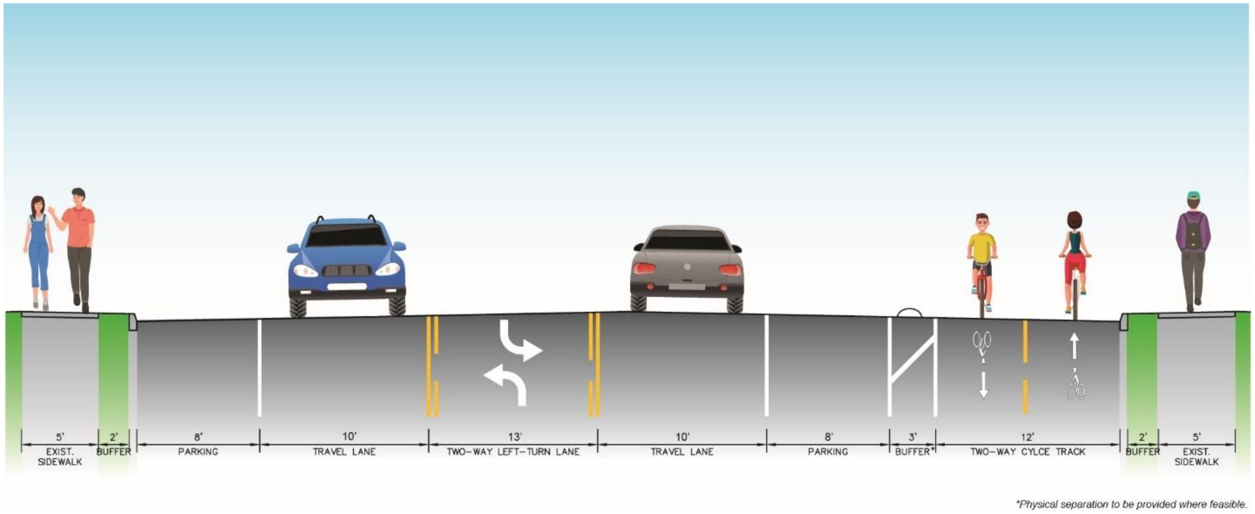


Figure 26: Alternative 3B: Two-Way Cycle Track (64' Pavement Width)



6.2 Preferred Alternative

The project team completed an alternatives evaluation to compare each of the preliminary conceptual alternatives based on the following criteria:

- Community feedback on each of the alternative (see Section 4.2)
- Traffic operations analysis results
- Consistency with the top priorities for the corridor identified by the community (see Section 4.1)
- Planning-level cost estimates for the potential lane repurposing

Based on this evaluation, the project team recommended Alternative 2A/2B (Directional Bike Lanes) as the preferred alternative as shown in Table 20 below.

Table 20: Preliminary Conceptual Alternatives Evaluation Matrix

Alternative	Typical Section	Community Ratings (1 to 5 Scale)		Traffic Analysis Results	Reduces Speeds	Improves Bicycle Travel	Planning-Level Cost
		Workshop	Survey				
1A / 1B	Existing / No Build	1.72	2.81	Excess capacity available	No	No	$0
2A / 2B	Directional Bike Lanes	3.83	2.91	LOS C or better (Build 2)	Yes	Yes	$2-4M
3A / 3B	Two-Way Cycle Track	3.18	2.36	LOS C or better (Build 2)	Yes	Yes	$10-11M

The proposed lane repurposing—which will reduce the number of vehicle lanes to provide protected bike lanes— is a cost-effective approach to implement safe and comfortable bicycle accommodations on Ocean View Avenue and will provide benefits to cyclists, pedestrians, and motorists. Expanding the bike lanes will provide cyclists with a more comfortable travel option and better connections to existing bicycle infrastructure. Pedestrians will benefit from increased safety and walkability with fewer bicycle interactions on sidewalks, an added buffer from vehicle traffic, and shorter crossing distances across motorized vehicle traffic.

Buffered and/or protected bike lanes are also an effective traffic calming and safety tool. They have been shown to reduce total crash rates compared to streets with no bike lanes. Many case studies cited by the Federal Highway Administration (FHWA) show that lane reduction can result in lower vehicle speed variability, reduce vehicle speeds, and reduce the number of vehicles speeding excessively. Calmer vehicle speeds decrease the risk of severe and fatal crashes for all road users if a crash does occur.

Based on the traffic operations analysis, the proposed lane repurposing between 1st View Street and 19th Bay Street (Build 2 option) is not anticipated to adversely affect traffic operations along Ocean View Avenue and should be implemented to provide connectivity for cyclists and improve safety for all roadway users.

The project team therefore recommends the following as the preferred alternative (Alternative 2A/2B):

- Repurpose one travel lane in each direction to provide buffered bike lanes
- Implement the "Build 2" option to repurpose the lanes between 1st View Street and 19th Bay Street
- Provide physical separation for bike lanes where feasible based on driveway spacing and on-street parking locations
- Provide on-street parking where feasible based on available pavement width and driveway spacing (similar to existing conditions); parking will be located against the curb, to the outside of the bike lane
- Provide alternative bicycle connection from 19th Bay Street to Pretty Lake Avenue as identified in the City of Norfolk *Bicycle and Pedestrian Strategic Plan*

The bike lanes are recommended to have physical protection from passing traffic based on traffic volumes and speeds along Ocean View Avenue. This is consistent with national guidance from the FHWA and other organizations. The most significant challenge to providing physical protection for the recommended bike lanes is the high density of driveways along Ocean View Avenue, which may not allow for physical barriers to be placed at recommended intervals. A combination of curbed concrete islands and ruggedized plastic "zebra" or "armadillo" style separators were recommended along the corridor where feasible based on driveway spacing and on-street parking locations. Further evaluation of the feasibility and placement of these barrier treatments will be required during the design phase of the project. The recommended concepts are illustrated in Figure 27 and Figure 28.

Figure 27: Preferred Alternative (2A) with Directional Bike Lanes (54' Pavement Width)

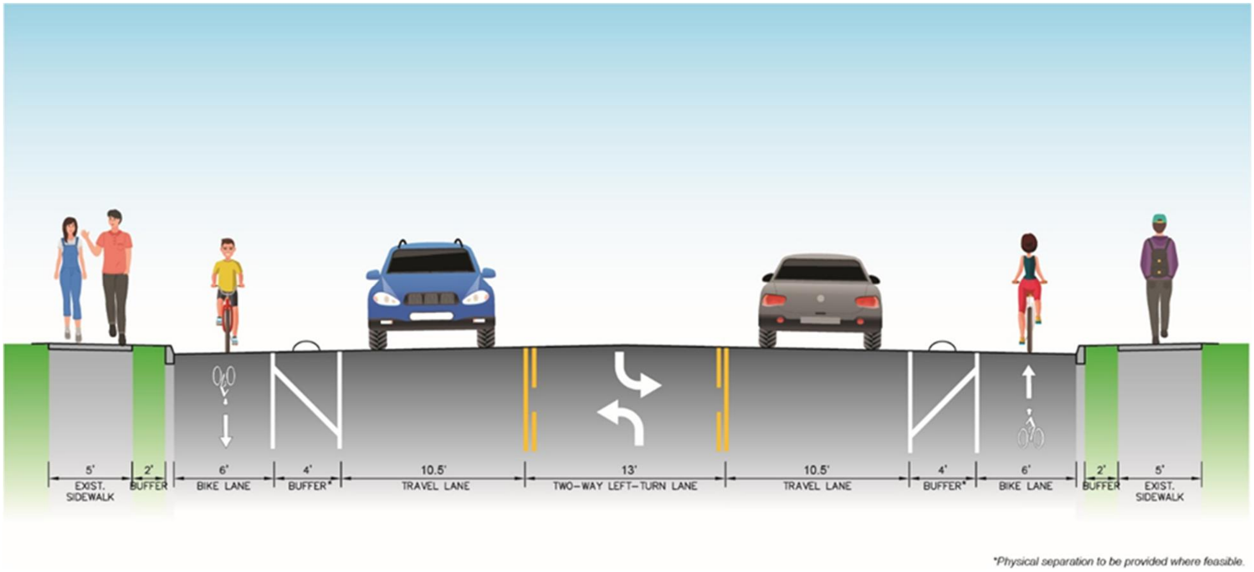
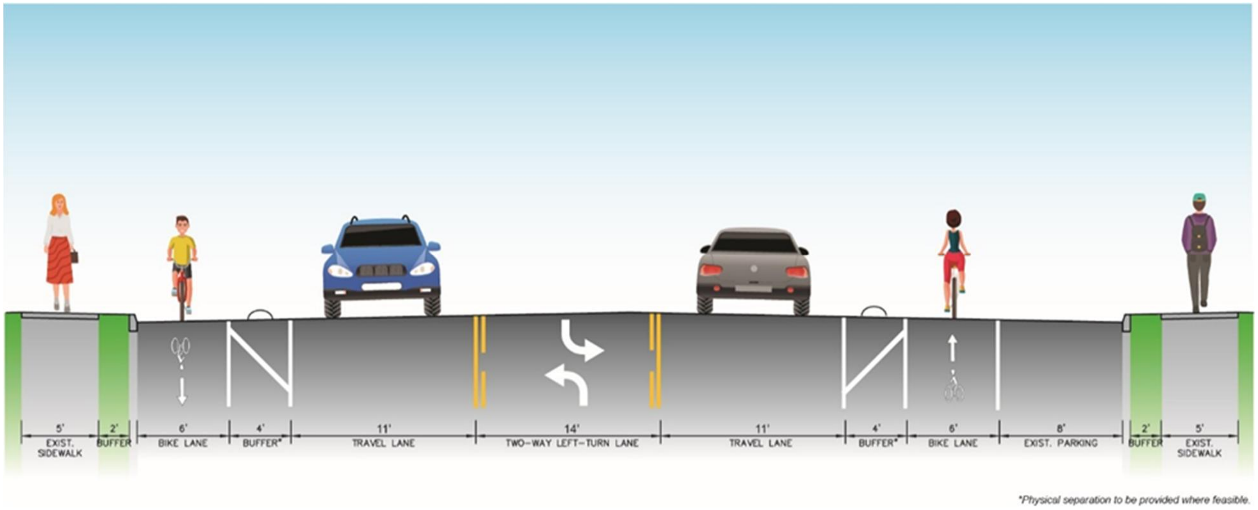


Figure 28: Preferred Alternative (2B) with Directional Bike Lanes (64’ Pavement Width)



7 PEDESTRIAN CROSSING RECOMMENDATIONS

7.1 PEDESTRIAN CROSSING RECOMMENDATIONS DEVELOPMENT

During the first round and second round of public engagement (Section 4), the community was asked to provide feedback on high priority locations for new pedestrian crossings or enhanced crossing treatments. Based on this feedback and a review of existing conditions and field observations, the project team developed a comprehensive set of recommendations for pedestrian crossing locations and enhanced treatments along the Ocean View Avenue corridor. The recommended crossing treatments were based on guidance from FHWA's *Guide for Improving Safety at Uncontrolled Crossing Locations*.

Based on these reviews and community feedback, new high-visibility crosswalks were recommended in eight locations that do not currently have a marked crosswalk of any kind. In addition, rectangular rapid flashing beacons (RRFBs) and pedestrian refuge islands were recommended at specific locations.

7.2 PEDESTRIAN CROSSING RECOMMENDATIONS

7.2.1 Rectangular Rapid Flashing Beacons (RRFBs)

There are currently four RRFBs along Ocean View Avenue at the following locations:

- Ocean View Beach Park
- Duffy's Lane
- Pretlow Library
- Community Beach Park

The RRFB located at Community Beach Park is shown as an example in Figure 29.

Additional RRFBs were recommended at the following locations:

- 5th Bay Street
- 19th Bay Street

Figure 29: Rectangular Rapid Flashing Beacon (RRFB)

7.2.2 Pedestrian Refuge Islands

There are currently four unsignalized intersections with pedestrian refuge islands along Ocean View Avenue. Based on community feedback and a review of the corridor, modifications were recommended at three of the four locations as follows:

- Warwick Avenue – recommended to reconstruct island on west side of road
- Beach View Street – recommended to reconstruct island on west side of road
- Grove Avenue – recommended to adjust current location of island on west side of road
- Inlet Road – no modifications recommended

The pedestrian refuge island located at Grove Avenue is shown as an example in Figure 30.

In addition, new pedestrian refuge islands were recommended at the following locations:

- 15th View Street
- 11th View Street
- 8th View Street
- Hammet Parkway
- Norfolk Avenue
- Atlans Street
- Beaumont Street
- 7th Bay Street
- 9th Bay Street
- 11th Bay Street
- 15th Bay Street
- 17th Bay Street

Figure 30: Pedestrian Refuge Island

The exhibits below illustrate the top priority pedestrian crossing locations identified by the community during the workshop and online survey as well as the recommended locations for new or enhanced pedestrian crossings:

- Figure 31: Willoughby
- Figure 32: West Ocean View / Pinewell
- Figure 33: Bayview / Cottage Line
- Figure 34: East Ocean View

Figure 31: Priority and Recommended Pedestrian Crossing Locations — Willoughby

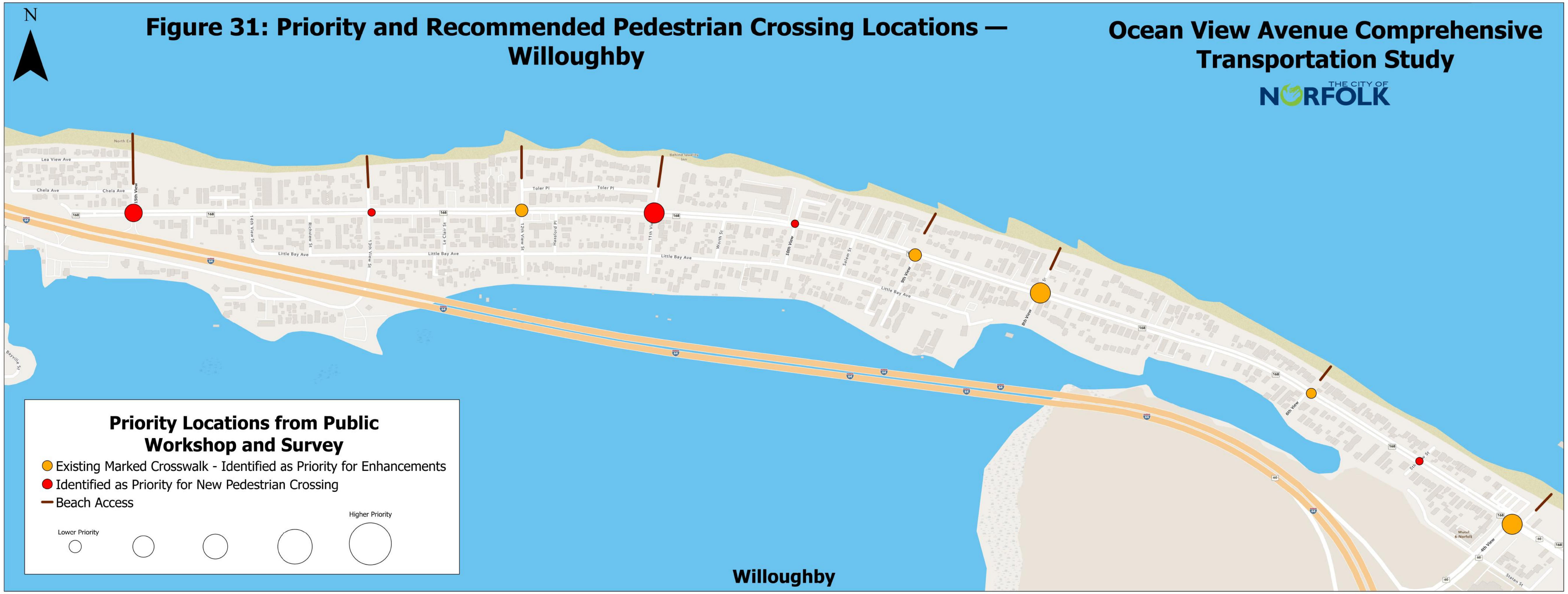


Figure 32: Priority and Recommended Pedestrian Crossing Locations — West Ocean View / Pinewell

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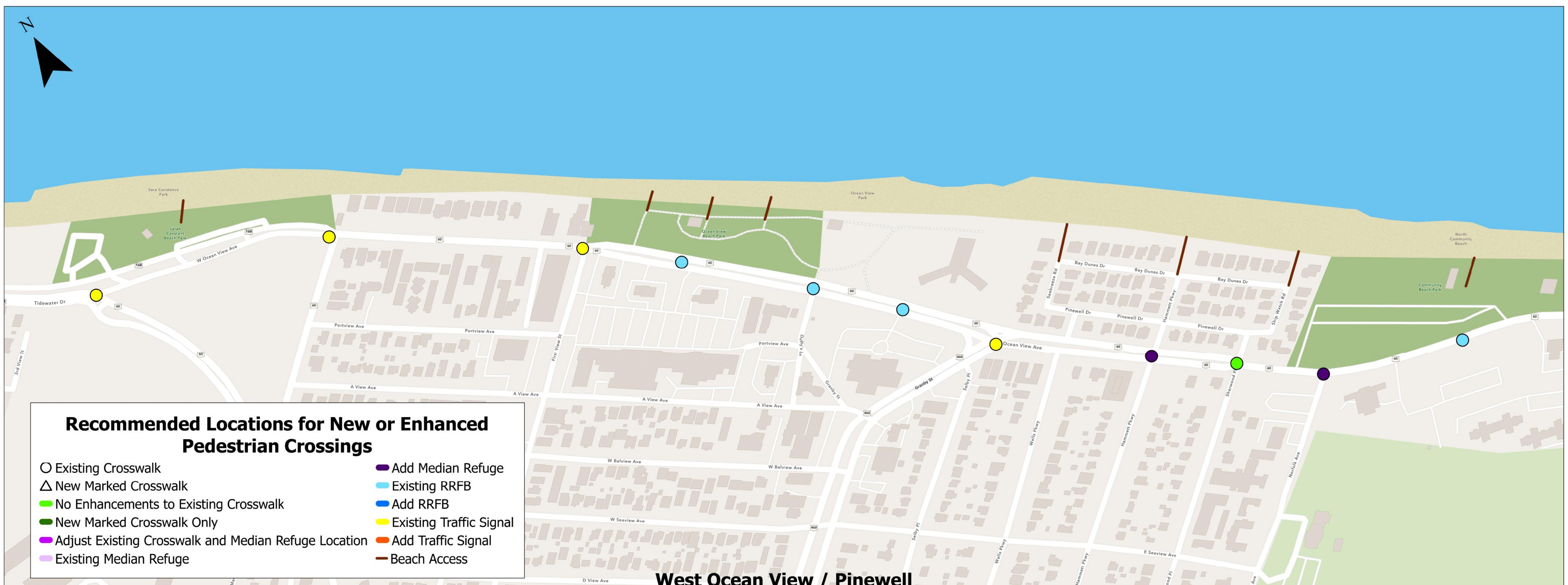

Figure 33: Priority and Recommended Pedestrian Crossing Locations — Bayview / Cottage Line

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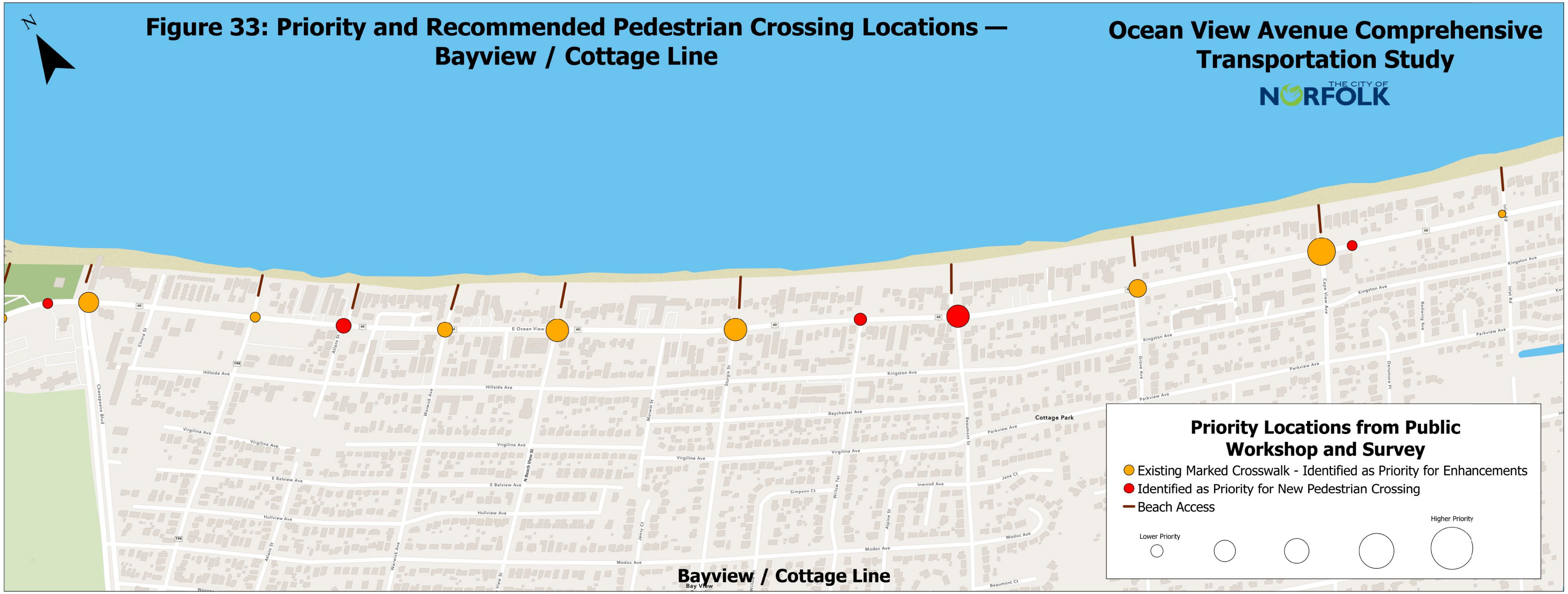

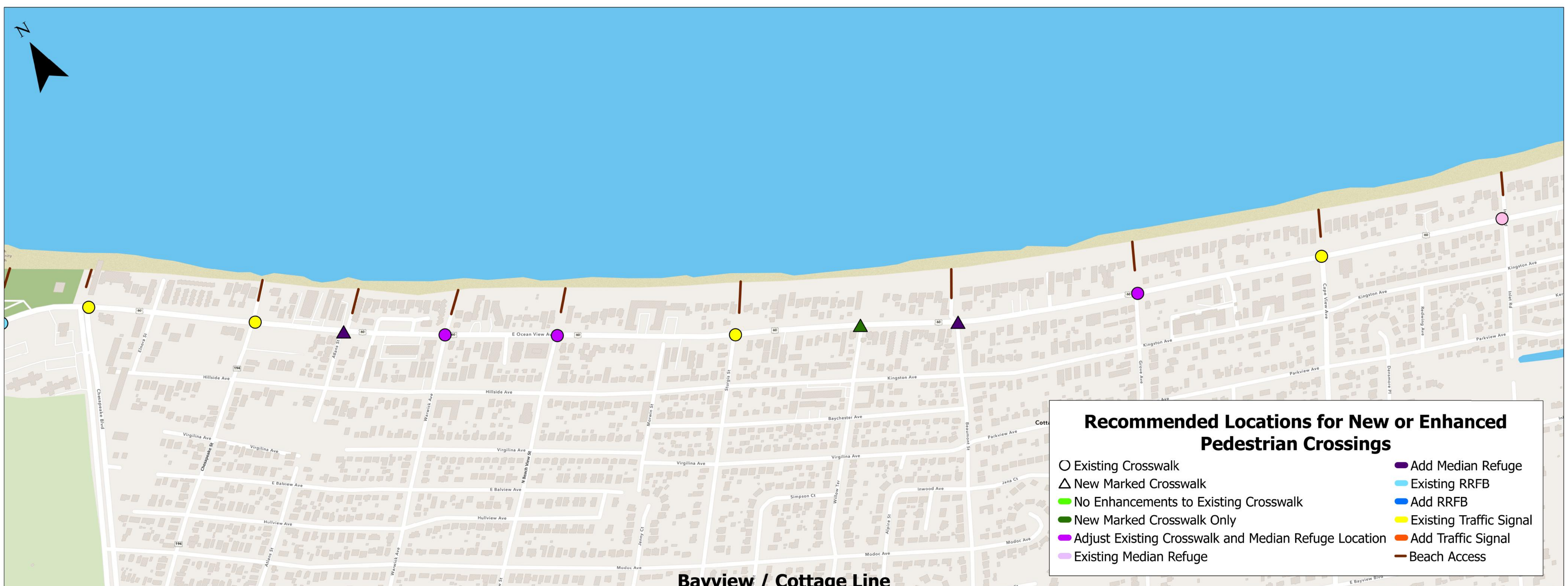

Figure 34: Priority and Recommended Pedestrian Crossing Locations — East Ocean View

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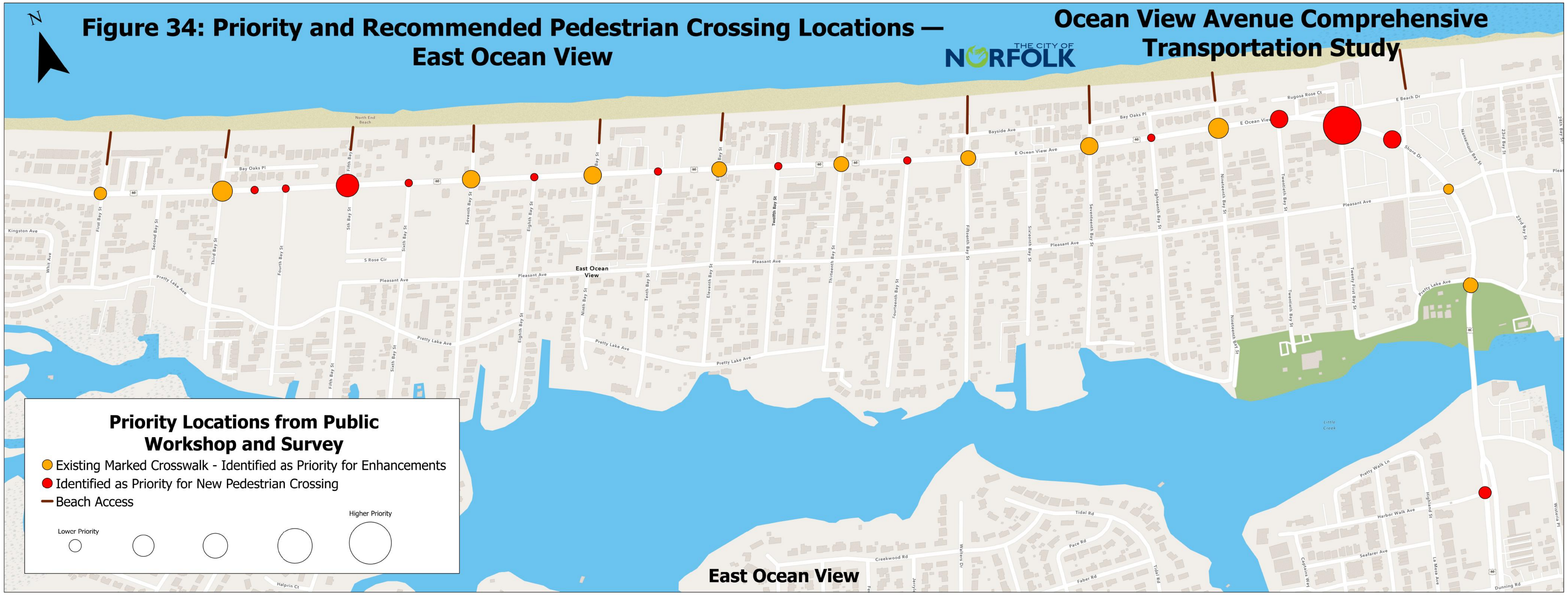

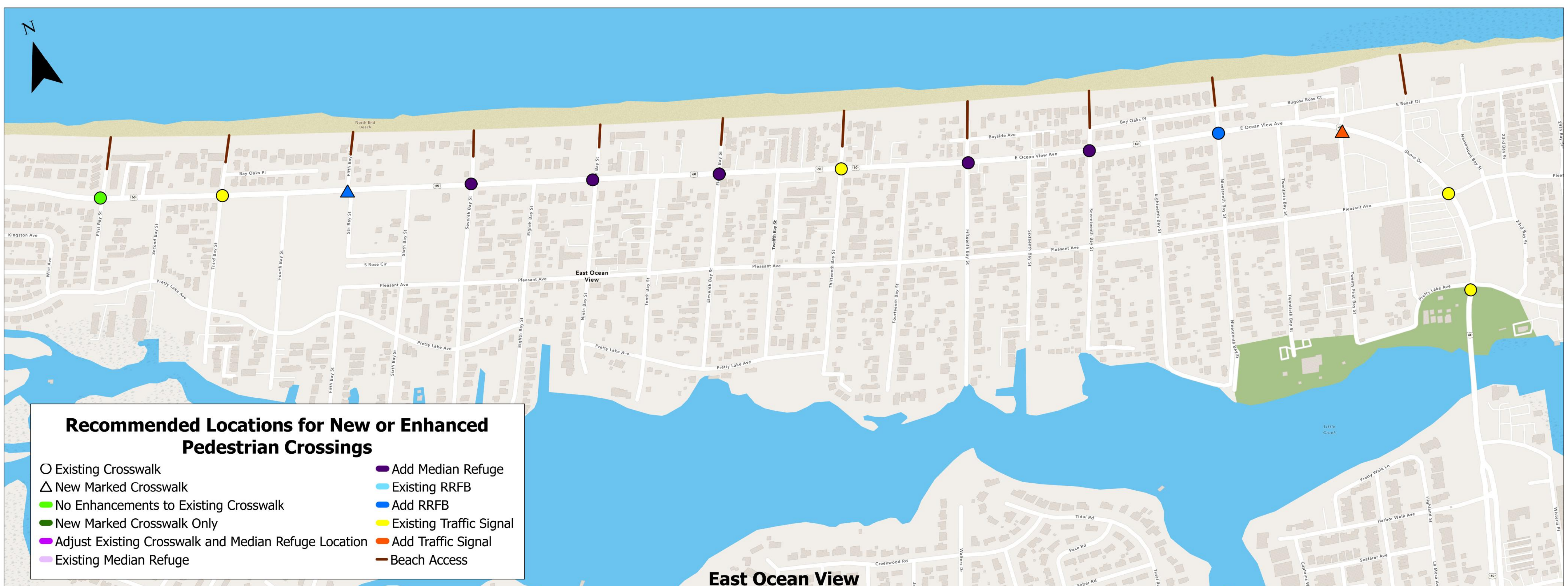

8 Conclusions and Recommendations

The proposed lane repurposing—which will reduce the number of vehicle lanes to provide protected bike lanes—is a cost-effective approach to implement safe and comfortable bicycle accommodations on Ocean View Avenue and will provide benefits to cyclists, pedestrians, and motorists. Golf carts are not recommended to operate along Ocean View Avenue. Expanding the bike lanes will provide cyclists with a more comfortable travel option and better connections to existing bicycle infrastructure. Pedestrians will benefit from increased safety and walkability with fewer bicycle interactions on sidewalks, an added buffer from vehicle traffic, and shorter crossing distances across motorized vehicle traffic.

Buffered and/or protected bike lanes are also an effective traffic calming and safety tool. They have been shown to reduce total crash rates compared to streets with no bike lanes. Many case studies cited by the Federal Highway Administration (FHWA) show that lane reduction can result in lower vehicle speed variability, reduce vehicle speeds, and reduce the number of vehicles speeding excessively. Calmer vehicle speeds decrease the risk of severe and fatal crashes for all road users if a crash does occur.

Based on the traffic operations analysis, the proposed lane repurposing between 1st View Street and 19th Bay Street (Build 2 option) is not anticipated to adversely affect traffic operations along Ocean View Avenue and should be implemented to provide connectivity for cyclists and improve safety for all roadway users.

The following are recommended for the Ocean View Avenue corridor.

8.1 Near-Term Recommendations (<1 Year)

These recommendations are to be implemented quickly to address safety concerns raised by the community during the previous online surveys and community workshops.

- Install new pedestrian crossings with high visibility crosswalks at all locations identified for new crosswalks
- Install advanced yield lines (shark teeth) at all marked crosswalk locations
- Conduct comprehensive maintenance of existing sidewalks to clear overgrowth and debris and remove trip hazards
- Conduct comprehensive maintenance of existing bike lanes to replace missing signs and pavement markings, clear debris, smooth pavement, and address drainage issues
- Consider installing planned bicycle parking and scooter corrals
- Reduce speed limit to 30 MPH and provide targeted speed enforcement
- Initiate higher fines for speeding

8.2 Short Term Recommendations (1 to 2 Years)

These recommendations provide enhanced pedestrian treatments and take short-term actions to begin identifying additional parking opportunities and enhancements to public beach access.

- Install enhanced pedestrian crossing treatments (i.e., RRFBs and refuge islands) at identified locations
- Install overhead "State Law Yield to Pedestrians" signs at targeted crosswalk locations such as "gateways" to corridor segments

- Identify opportunities to provide additional on-street parking and public parking at beach access locations
- Identify potential locations to provide golf cart parking and allow golf carts to cross Ocean View Avenue at designated signalized intersections

8.3 Intermediate-Term Recommendations (2 to 5 Years):

Implementation of these recommendations will require more significant engineering design and therefore have longer timelines, which will also depend on funding availability.

- Install new traffic signal at 21st Bay Street intersection to facilitate safe pedestrian crossing
- Implement recommended lane repurposing from 1st View Street to Cape View Avenue, providing continuous directional bike lanes from 1st View Street to 19th Bay Street
- Provide alternative bike connection from 19th Bay Street to Pretty Lake Avenue as identified in the City of Norfolk *Bicycle and Pedestrian Strategic Plan*
- Perform before/after evaluation of corridor

Following successful implementation of lane repurposing, more transformative improvements may be considered for the corridor as a long-term vision. Building out the curbs to the edge of the travel lanes and using the reclaimed space to develop an enhanced roadside bike and pedestrian realm would further separate conflicting modes and improve the street-level experience with enhanced landscaping and street trees, street lighting, widened sidewalks, and sidewalk-level directional bike lanes. These long-term transformative improvements would come at a much higher cost and would require significant stormwater and utility coordination and drainage improvements.

8.4 Next Steps

This study, the preferred conceptual alternative, and planning-level cost estimates are intended to be used as a planning tool to achieve the next steps of programming, designing, and constructing the recommended improvements in the study corridor.