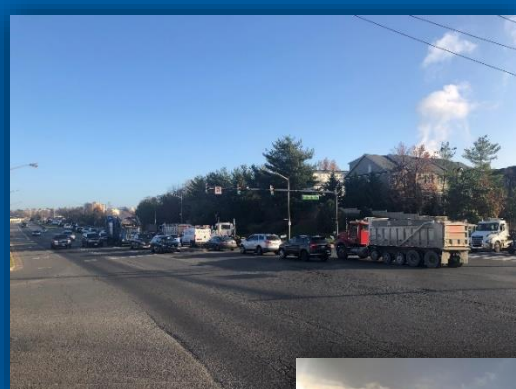
CITY OF Alexandria VIRGINIA

EISENHOWER WEST TRANSPORTATION ALTERNATIVES ANALYSIS (EWTAA) STUDY



TECHNICAL REPORT

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Eisenhower West Transportation Alternatives Analysis Study

Technical Report

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Prepared for

CITY OF Alexandria VIRGINIA

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Executive Summary

Purpose and Introduction

The City of Alexandria ("City") initiated Eisenhower West Transportation Alternatives Analysis (EWTAA) Study as an update to the 2015 Eisenhower West Transportation Study (EWTS). The EWTS was conducted as a transportation component of the Eisenhower West Small Area Plan (SAP), including land use and transportation network scenarios explored in SAP. The EWTS analyzed the impacts of the Multimodal Bridge and Farrington Connector on the transportation network in the Eisenhower West region. The EWTAA study area includes the South Van Dorn Street (Van Dorn Street) and Eisenhower Avenue corridors and corresponding intersections.

Review of Background Materials

A review of past studies in the Eisenhower West region to understand regional goals and objectives, travel volumes, travel patterns, updates to the current and future land uses, transit investments, and prioritization of corridors for improvements based on the needs was conducted. Below is a list of studies reviewed for the EWTAA study.

- Transitway Corridors Feasibility Study (2012)
- Eisenhower West Small Area Plan (2015; SAP)
- Eisenhower West Transportation Study (2015; EWTS)
- West End Transitway - Alternatives Analysis Report (2016)
- West End Transitway - Environmental Assessment Report (2017)
- Eisenhower West - Landmark Van Dorn Roadway Infrastructure Plan Multimodal Bridge Analysis Technical Memorandum (2018; 2018 Technical Memo)
- Landmark Van Dorn Corridor Plan (2019 & 2021) & Development Area Plans in Landmark/Van Dorn Corridor Plan
- Alexandria Mobility Plan (AMP)

The 2015 SAP, 2016 West End Transitway Alternative Analysis report, and 2018 Technical Memo establish background multimodal transportation networks for the study area. These background projects include additional connections between Eisenhower Avenue and South Pickett Street, the straightening of Eisenhower Avenue, and Bus Rapid Transit (BRT) along Van Dorn Street. Other relevant studies documented initial efforts leading to system-wide and corridor-wide recommendations in the Eisenhower West region.

Existing Conditions

The EWTAA study area is presented in **Figure 1.1**. The study limits along Van Dorn Street extend from Eisenhower Avenue to Edsall Road. Along Eisenhower Avenue, the study limits extend from Van Dorn Street to Clermont Ave/Eisenhower Avenue Connectors. Van Dorn Street is a north-south four-lane divided roadway classified as a Commercial Connector per the *City Complete Street Design Guidelines*. Eisenhower Avenue is an east-west five-lane roadway, with two lanes in each direction and a center two-way-left-turn-lane (TWLTL) and is classified as an Arterial. South Pickett Street and Edsall Road are classified as Commercial Connector and Industrial Street, respectively. The N.S. line travels through the study area and under the Van Dorn Street bridge. The future Multimodal Bridge discussed in the SAP and subsequent studies envision a bridge over N.S. Railroad.

All relevant data for analyzing the Existing conditions, including traffic volumes and signal timings, was obtained from the City and alternate data sources such as Streetlight Data. Based on Streetlight Data's 2019 versus 2021 traffic trends and in coordination with the City, a volume factor of 1.2 was identified and applied for the intersection volumes to account for demand disruption due to the COVID-19 pandemic.

A field visit was conducted on November 10, 2022, to observe typical traffic conditions during AM and PM peak hours, and the following are key observations:

- During the AM peak hour, substantial queuing (approximately 1,000-feet) was noticed along northbound Van Dorn Street at Eisenhower Avenue, extending upstream into Fairfax County. Queuing at the remaining study intersection approaches was observed to be relatively moderate (under 15-vehicles during each cycle) and was cleared during the same or following signal cycles.
- During the PM peak hour, both directions of Van Dorn Street were congested at the Eisenhower Avenue intersection, with the queue extending to the immediate upstream intersection. Similarly, the eastbound Edsall Road at Van Dorn Street intersection queue extended beyond the upstream South Whiting Road intersection.
- Pedestrian sidewalks were noticed along at least one side of roadways in the study area. No dedicated bicycle facilities, except along South Pickett Street, were noticed.

The Existing conditions roadway network for operational analysis was developed utilizing the Synchro model from 2015 EWTS, which was updated with current traffic volume data, signal timings, roadway configuration, and additional intersections being studied under EWTAA. The measures of effectiveness (MOEs) considered for this study include simulated vehicular delay (seconds per vehicle), simulated corridor travel times, and simulated maximum queue lengths from SimTraffic. The existing condition model was calibrated for vehicular throughput and pre-pandemic corridor (South Van Dorn Street and Eisenhower Avenue) travel times. The pre-pandemic (October 2019) corridor travel times within the study area were extracted from INRIX/RITIS database for comparison with model travel times. As scoped for this study, queue lengths at critical intersections were visually calibrated to reflect field observations. Initial simulation runs using the default driver behavior parameters showed simulation model output and travel time differences exceeding acceptable thresholds along Van Dorn Street. Therefore, movement-specific driver headway factors were iteratively adjusted in AM and PM Synchro models for the Van Dorn Street corridor (See **Table 3.3**). The AM and PM peak hour simulated travel times (See **Table 3.4**) for all segments along Van Dorn Street and Eisenhower Avenue achieved calibration targets (within 30% for arterial segments), with one exception. The simulated travel time for a relatively short segment (approximately 0.18-miles) of Eisenhower Avenue between Van Dorn Street and Metro Road is approximately 50% lower than the field travel time. Similarly, all approaches at the critical intersections satisfy the calibration threshold for vehicular throughput (See **Table 3.5**), indicating the model's ability to process all the coded input volumes. The existing condition operational analysis results (See **Table 3.6**) reflect field observations with substantial queuing along Van Dorn Street and congested operations at the Eisenhower Avenue, Edsall Road, and South Pickett Street intersections.

Future Scenarios, Forecasts, and Operational Results

EWTAA study was primarily initiated to evaluate the need for Multimodal Bridge and Farrington Avenue connector and develop a design concept to improve multimodal mobility across the Van Dorn Street bridge. The future concepts within the EWTAA study area are classified into the following scenarios for evaluation purposes.

- No-Build Scenario
  - The no-Build scenario would retain the existing Van Dorn Street bridge as the only connection between Eisenhower Avenue and South Pickett Street. All future background improvements, including BRT recommendations, are assumed to be in place under the No-Build scenario.
- Build Scenario A
  - Build Scenario A builds upon the No-Build scenario with two (2) additional bridge connections between Eisenhower Avenue and South Pickett Street. There would be no additional general-purpose lane capacity or pedestrian/bicycle facility improvements for the Van Dorn Street Bridge.
- Build Scenario B
  - Build Scenario B (See **Figure 4.1**) proposes multimodal facility improvements to the Van Dorn Street bridge without additional bridge connections between Eisenhower Avenue and South Pickett Street. The improved Van Dorn Street Bridge would have identical lane capacity for general-purpose traffic, a dedicated northbound BRT lane, and enhanced pedestrian/bicycle facilities.
- Build Scenario C
  - Build Scenario C proposes a narrow Multimodal Bridge to a pedestrian and bicycle only facility, in addition to multimodal facility improvements under Build Scenario B. The pedestrian and bicycle-friendly bridge proposed for evaluation by the City (hereafter referred to as Modified Multimodal Bridge) would prohibit all vehicular traffic and would improve non-vehicular mobility and connectivity near Van Dorn Street Metro Station.

The travel demand model maintained by the Metropolitan Washington Council of Governments (MWCOG) was primarily used to establish growth rates to estimate 2045 future traffic volumes. The projected growth in peak period traffic volumes within the study area was estimated by comparing the peak period traffic assignment for the Base year (2019) to the future No-Build year (2045) assignment for each roadway link in the travel demand model. The percentage growth was converted to a linear annual traffic growth rate and applied to each approach at the study intersections. The balanced 2045 No-Build forecasts were further adjusted to account for the expected straightening of Eisenhower Avenue, as identified in the SAP. As the vehicular connections between Eisenhower Avenue and South Pickett Street are identical between No-Build, Scenario B, and Scenario C, an identical set of volumes was used for analyses. Scenario A volumes were estimated by evaluating the shift in traffic volumes from the No Build network to the new links that represent the Multimodal Connector and Farrington Connector, as well as changes in traffic on other roadways in the network.

The calibrated Existing conditions AM and PM peak hour Synchro models were modified to reflect future No-Build conditions and Build Scenario A conditions. For vehicular traffic analyses, Scenario B and Scenario C operations are assumed to remain identical to the No-Build conditions as both build scenarios do not propose any vehicular capacity improvements.

- AM Peak Hour
    - The future year travel times for Van Dorn Street and Eisenhower Avenue corridors are anticipated to be similar (within 10%) under both No-Build and Scenario A conditions, indicating minimal impacts due to additional bridge connections.
    - The Van Dorn Street at Eisenhower Avenue intersection is expected to operate at LOS F under both No-Build and Build Scenario A. Although the Multimodal Bridge (Build Scenario A) would reduce southbound Van Dorn Street left-turn and westbound Eisenhower Avenue approach delays and queue lengths, additional traffic from Farrington Connector would shorten the mainline green time resulting in LOS F operations and queues exceeding 1,900 feet along northbound Van Dorn Street. The LOS F operations and queue spillback constrain vehicles arriving from Fairfax County into the City of Alexandria. **Figure 4.4** compares the change in approach delay at the critical intersections in the study area. The LOS F threshold operations at the Van Dorn Street and Eisenhower Avenue intersection constrain incoming traffic and likely underestimate the operations at downstream intersections.
- PM Peak Hour
    - The southbound Van Dorn Street and westbound Eisenhower Avenue would experience an approximately 88% and 30% respective increase in travel times under Scenario A compared to No-Build conditions. The significant (over 30%) increase in travel time under Scenario A is mainly attributed to the severely congested (LOS F) Van Dorn Street and Eisenhower Avenue intersection operations.
    - The Van Dorn Street intersections at Eisenhower Avenue and Edsall Road are expected to operate at LOS F under both No-Build and Build Scenario A, indicating a need for intersection improvement. Similar to the AM Peak hour, northbound Van Dorn Street queue length at the Eisenhower Avenue intersection is expected to spill back into Fairfax County. **Figure 4.4** compares the change in approach delay at the critical intersections in the study area. The LOS F threshold operations at the Van Dorn Street intersections with Eisenhower Avenue and Edsall Road constrain incoming traffic and likely underestimate the operations at downstream intersections.

The future traffic analyses anticipate LOS F threshold operations along the Van Dorn Street corridor, notably at the Eisenhower Avenue intersection, which remains a bottleneck for the corridor. The supplementary analysis proposes extending the Farrington Avenue eastbound right-turn lane storage length to 250-feet from the existing 75-feet at the Van Dorn Street and Eisenhower Avenue intersection. The supplemental analysis indicates an expected reduction in approach delay of at least 90-seconds per vehicle for the Farrington Avenue approach at the Van Dorn Street and Eisenhower Avenue intersection.

Benefit-Cost Ranking of Scenarios

A benefit-cost ranking was performed to compare the benefits using quantitative and qualitative measures of effectiveness.

- The No-Build scenario is not estimated to incur additional costs as the background improvements are independent of the EWTAA study.
- The Build Scenario A is estimated to cost approximately $194-million, including $151-million for the Multimodal Bridge and $43-million for the Farrington Connector bridge.
- The Van Dorn Street bridge multimodal facility improvements proposed under **Build Scenario B** are estimated to cost approximately $14-million.

- Lastly, the expected cost for Modified Multimodal Bridge proposed under Build Scenario C with pedestrian and bicycle facilities is approximately $73-million

A benefit-cost ranking methodology (See Section 5) was performed to evaluate build scenarios and was primarily developed relying on quantitative and qualitative effectiveness measures (MOEs). Overall, the benefit-cost ranking analysis resulted in the highest score of ten (10) for Build Scenario C and the second highest score of eight (8) for Build Scenario B.

Conclusion

In conclusion, the EWTAA study evaluated the need for Multimodal Bridge and Farrington Connectors, developed a multi-modal facility concept for Van Dorn Street bridge improvements, and performed planning level preliminary benefit-cost analysis for evaluated alternatives. Based on the analysis findings, Build Scenario B is recommended considering the operational and cost benefits. This study also recommends future studies to advance the feasibility of the Modified Multimodal Bridge (Build Scenario C) to improve non-vehicular mobility considering the future mixed-use development and land use changes surrounding the Van Dorn Street Metro Station.

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1 PURPOSE AND INTRODUCTION

The City of Alexandria ("City") initiated the Eisenhower West Transportation Alternatives Analysis (EWTAA) Study as an extension to the Eisenhower West Transportation Study (EWTS) completed in 2015 and the 2018 Eisenhower West – Landmark Van Dorn Roadway Infrastructure Plan Multimodal Bridge Analysis Technical Memorandum (2018 Technical Memo). The EWTS was conducted as the transportation component of the Eisenhower West Small Area Plan (SAP), including land use and transportation network scenarios explored in SAP. Notably, EWTS analyzed the impacts of the Multimodal Bridge and Farrington Connector concepts recommended in the 2009 Landmark/Van Dorn Corridor Plan to identify the alignments. This study (EWTAA) incorporated planned developments by utilizing the most recent Metropolitan Washington Council of Governments (MWCOG) travel demand model to evaluate the operational impacts of the Multimodal Bridge and Farrington Connectors in Eisenhower West. The goals of EWTAA are:

- Reevaluate the need for Multimodal Bridge and Farrington Connector, given updates to transportation and land use in the areas since 2018.
- Develop a concept for improvements to the Van Dorn Bridge without the connections mentioned above between South Pickett Street and Eisenhower Avenue.
- Perform a cost-benefit analysis to assess the need for future connections.

The Eisenhower West region constitutes the roadway network and land use in the southwestern portion of the City, along I-95/I-495 and bordering Fairfax County. The goals for Eisenhower West, as envisioned in the SAP, focus on creating a vibrant, sustainable, connected, transit-oriented community that contributes to the City's economic development goals while providing opportunities for living, working, learning, and creating. The City envisions Eisenhower West to support economic growth with a vibrant mix of co-existing land uses and multimodal facilities with safe, accessible, and efficient amenities for the community.

The EWTAA study area and roadway intersections under evaluation are shown in **Figure 1.1**. The study area includes the South Van Dorn Street (Van Dorn Street) and Eisenhower Avenue corridors and corresponding intersections. The study limits along Van Dorn Street extend from Eisenhower Avenue to Edsall Road. Along Eisenhower Avenue, the study limits extend from Van Dorn Street to Clermont Ave/Eisenhower Avenue Connector. The study area is nearby to major interstate corridors (I-95, I-395, and I-495) in Northern Virginia and also serves commuter traffic within the City. The boundaries of SAP and EWTS are larger than the current study area, as this study focuses explicitly on evaluating existing and potential transportation alternatives between South Pickett Street and Eisenhower Avenue.

This study includes an assessment of the existing condition operations, a review of background studies/improvements, travel forecasting based on expected 2045 Baseline conditions, an operational analysis of future conditions, including transportation network enhancements, and summarizing the operational analysis and benefit-cost analysis findings.

Figure 1.1

2 REVIEW OF BACKGROUND MATERIALS/INFORMATION

The changes in land use resulting from growth in the Eisenhower West region prompted the City to proactively undertake numerous planning and transportation studies over the past decade to improve multimodal mobility. Therefore, a review of previous study efforts, including identifying the regional goals and objectives, travel volumes, travel patterns, updates to the current and future land uses, transit investments, and prioritization of corridors for improvements based on the needs, was conducted. Below is a list of and brief summary of reviewed background studies. **Appendix A** includes the electronic version of the listed study reports.

- Transitway Corridors Feasibility Study (2012)
- Eisenhower West Small Area Plan (2015; SAP)
- Eisenhower West Transportation Study (2015; EWTS)
- West End Transitway - Alternatives Analysis Report (2016)
- West End Transitway - Environmental Assessment Report (2017)
- Eisenhower West - Landmark Van Dorn Roadway Infrastructure Plan Multimodal Bridge Analysis Technical Memorandum (2018; 2018 Technical Memo)
- Landmark Van Dorn Corridor Plan (2019 & 2021) & Development Area Plans in Landmark/Van Dorn Corridor Plan
- Alexandria Mobility Plan (AMP)

2.1 Transitway Corridors Feasibility Study (2012)

The Transitway Corridors Feasibility Study was aimed at providing enhanced transit services along three (3) corridors in the City. **Figure 2.1** presents a graphic excerpt from the study, and below is a summary of the study findings:

- Corridor A - North-South: This corridor follows Route 1 (Jefferson Davis Highway, Patrick Street, and Henry Street) from the Fairfax County line to the Arlington County line on the north. The limits of Corridor A are located outside the EWTAA study area, and recommendations proposed by Corridor Work Group, including two (2) circulator services, do not impact the current study.
- Corridor B - Duke Street: This corridor follows Duke Street between Fairfax County on the west and the vicinity of the King Street Metrorail station on the east. The challenges along Corridor B include significant peak hour congestion, limited right-of-way, land use compatibility, residential parking, and poor pedestrian/bicycle connectivity. Corridor B is also located outside the EWTAA study area, and the recommendations proposed by Corridor Work Group, including enhanced transit services, improving pedestrian/bicycle connectivity, and roadway improvements, do not impact the current study area.
- Corridor C - Van Dorn Street/Beauregard Street: This corridor runs along portions of Walter Reed Drive, Beauregard Street, Sanger Avenue, and Van Dorn Street. A wide array of operational challenges, including but not limited to peak hour congestion, limited right-of-way, environmental constraints, and poor pedestrian/bicycle connectivity, reinforced the need for enhanced transit service. The feasibility study evaluated seven (7) preliminary alternatives and recommended Alternative D to provide Bus Rapid Transit (BRT) connecting Pentagon to Shirlington and serving developments along Van Dorn Street. Furthermore, the Corridor Work Group concluded Corridor C as the top priority transportation project in the City.

2.2 Eisenhower West Small Area Plan (SAP; 2015)

The Eisenhower West Small Area Plan (SAP) includes 620 acres of land in the southwestern portion of the City. The SAP plan includes commercial, industrial, and residential land use (presented in **Figure 2.2**). SAP's purpose was to provide a framework to guide the development of the plan area over the next 25 years. It was developed through a community and stakeholder engagement process supported by an analysis of major elements, including urban design, land use, transportation, park and open space, energy, environment, and market economics. Within the EWTAA study area, SAP introduces and defines the following key elements relevant to transportation analysis.

- Establishes a new urban grid of streets and connections for pedestrians, bicycles, and cars. **Figure 2.3** presents the future street network, and **Figure 2.4** presents the future pedestrian and bicycle facilities for Eisenhower West. As Eisenhower West develops gradually, SAP anticipates additional sidewalk and shared-use path connections.
- Incorporates the straightening of Eisenhower Avenue in the vicinity of Van Dorn Street Metro Station to create a more urban pedestrian-oriented and scope for redevelopment. Per SAP, Eisenhower Avenue would be realigned approximately 400-feet east of the Metro Road intersection. Figure 2.3 also depicts the street network area affected by the straightening.
- Introduces five potential alignments for the Multimodal Bridge recommended in the 2009 Landmark/Van Dorn Corridor Plan between South Pickett Street and Eisenhower Avenue. Figure 2.3 identifies the potential alignments for the Multimodal Bridge. The bridge would improve connectivity between land uses on either side of the railroad and would reduce overall travel time to and from Van Dorn Street Metro Station to South Pickett Street.
- SAP also recommends Farrington Connector provide additional north-south connectivity between Edsall Road and Farrington Avenue. The potential alignment for Farrington Connector is identified in Figure 2.3.
- Lastly, SAP establishes a framework for future land uses and infrastructure development and identifies six distinct neighborhoods within the planned area. **Figure 2.5** presents the envisioned land use area for Eisenhower West.

SAP conducted a preliminary analysis of the future 2040 Baseline and Build scenarios (with and without the additional land use demanding transportation enhancements, including multimodal bridge, respectively) to serve the transportation needs in the Eisenhower West. The analysis findings suggest a significant widening of Van Dorn Street without a Multimodal Bridge to accommodate intersection improvements, dedicated transit lanes, and an improved pedestrian/bicycle connection between South Pickett Street and Eisenhower Avenue. The SAP study recommended mitigation strategies for scenarios with and without the Multimodal Bridge, including a wide array of intersection and system-wide multimodal and geometric improvements. It concluded that a relatively higher number of intersections in Eisenhower West would operate at LOS F without the Multimodal Bridge.

Figure 2.1

Figure 2.2. SAP – Illustrative Plan for Eisenhower West

Figure 2.3. SAP – Street Hierarchy for Eisenhower West

Figure 2.4. SAP – Pedestrian and Bicycle Facilities for Eisenhower West

Figure 2.5. SAP – Plan Area Land Uses for Eisenhower West

2.3 Eisenhower West Transportation Study (EWTS; 2015)

The EWTS is a transportation analysis component initiated to conduct a detailed operational evaluation of the 2040 Baseline and Build scenarios envisioned in the SAP. The EWTS study area is shown in **Figure 2.6** and extends the boundaries of SAP to be consistent with Clermont Avenue Interchange with I-95 – Final Environmental Assessment. The EWTS also evaluated the Multimodal Bridge concept recommended in the 2009 Landmark/Van Dorn Corridor Plan to refine the alignment and cross-section of the proposed bridge. The EWTS evaluated operations at forty-eight (48) intersections in the study area to assess the impacts of Multimodal Bridge, additional future land use, and roadway network enhancements. In relevance to the current EWTAA study objective, EWTS concludes:

- The highest number of congestion intersections in the EWTS study area would occur without the Multimodal Bridge and any demanding mitigation measures at intersections operating at LOS F.
- Although Multimodal Bridge and intersection improvements would improve the quality of vehicular operations in the study area, intersections operating at capacity (LOS E) or worse would still exist in the 2040 Baseline and Build scenarios.

Figure 2.6. Eisenhower West Transportation Study Area

2.4 West End Transitway Alternative Analysis (West End AA; 2016)

The West End Transitway Alternative Analysis (West End AA) report advances the recommendations from Transitway Corridors Feasibility relevant to Corridor C that approved Bus Rapid Transit (BRT) in dedicated lanes from the Van Dorn Street Metrorail Station to the Pentagon. The preferred Alternative (formerly Corridor C – Alternative D) is referred to as West End Transitway in this study and was refined in coordination with the public and local stakeholders. The West End AA report provides an overview of the alternative analysis process by defining the West End Transitway's purpose and need, alternative development and evaluation, and financial considerations. As documented in the Transitway Corridors Feasibility study, West End Transitway proposes transit improvements along portions of Eisenhower Avenue, Van Dorn Street, Mark Center Drive, and Beauregard Street in the City's West End. The West End AA further conducted a detailed evaluation of corridor issues and elements required for alternative analysis; and an overview of alternative selection is presented in **Figure 2.7**.

The West End AA study recommended a Build Alternative to include system-wide improvements, offers new sidewalks, upgraded streetscapes, enhanced bicycle and pedestrian facilities, and upgraded traffic signals and roadways. The Build Alternative ranks superior over the No-Build and TSM Alternative and also reflects the following:

- A better transit experience for people and a more efficient operation for the service
- Additional multimodal (pedestrian, bicycle, and safety) improvements along the transit corridor
- Greater consistency with adopted plans and higher potential to catalyze growth and create real estate value.

A follow-up Environmental Assessment (EA) was conducted in 2017 to comply with Federal Transit Administration (FTA) funding programs and reach a decision regarding the project's environmental effects adhering to the National Environmental Policy Act of 1969 (NEPA). This study found that no significant environmental impacts are anticipated to arise from any of the alternatives and that all identified negative effects will be minimized or mitigated to the maximum extent predictable.

The conceptual design plans for West End Transitway dedicated bus lanes are included in **Appendix B**. **Figure 2.8** presents an excerpt from the West End Transitway conceptual design plan for Van Dorn Street between Metro Road interchange and South Pickett Street. The northbound Van Dorn Street section upstream of Courtney Avenue would have dedicated 13-feet wide bus lanes in the median, and southbound BRT would share travel lanes with automobile traffic. North of Courtney Avenue, both directions of Van Dorn Street would have dedicated median bus lanes extending to Duke Street. The project is currently in the design phases, with an expected initial operation in 2028.

Figure 2.7.

Figure 2.8.

2.5 Eisenhower West - Landmark Van Dorn Roadway Infrastructure Plan Multimodal Bridge Analysis Technical Memorandum (2018)

This 2018 Technical Memo evaluated the feasibility of the Multimodal Bridge alternative (which connects Eisenhower Avenue to South Picket Street) by the Norfolk Southern Railroad (N.S.). The Multimodal Bridge and Farrington Connector were initially conceptualized in the Landmark Van Dorn Corridor Plan (2009), and further analyzed as part of the SAP and EWTS. **Appendix C** includes the concept plans and draft probable cost for Multimodal Bridge, and **Appendix D** includes the Farrington Avenue connector concept plans.

Although several potential alignments were analyzed for Multimodal Bridge, they were narrowed down to five (5) alignments. The N.S. Railroad undertook this preliminary analysis study in 2018 to assess the construction feasibility of 5-alignments based on design criteria, land use and development impact evaluation, connectivity evaluation, structural evaluation, and environmental evaluation. This study recommended the N.S. Preferred Alternative alignment to minimize the conflicts with existing N.S. facilities, truck movements, utilities, and operations due to the Multimodal Bridge and maximize future redevelopment within the immediate parcels. The 5-alignments initially studied, as well as the N.S. Preferred Alternative alignment are presented in **Figure 2.9**.

Figure 2.9. Bridge Alignment Options Proposed in the Eisenhower West Small Area Plan and the Norfolk Southern Preferred Alternative.

2.6 Landmark Van Dorn Corridor Plan (2019 & 2021) & Development Area Plans in Landmark/Van Dorn Corridor Plan

The Landmark/Van Dorn Corridor Plan was approved by the City Council in 2009, updated in 2019, and further amended in 2021. It establishes a future development framework for the area along Van Dorn Street, extending from the Landmark Mall to the Van Dorn Street Metro Station. However, the plan does not propose any land use, roadway network, or transit improvements to Van Dorn Street that are different from the SAP or other relevant studies mentioned above. **Figure 2.10** presents the Landmark/Van Dorn corridor planning area. The plan's vision focuses on the portion of area north of South Pickett Street and builds upon recommendations from SAP including the vision for multimodal facilities with mixed-use development in the study area.

Furthermore, the Landmark Mall site is currently being redeveloped as West End site with mixed-use community and hospital campus. The under-development site is anticipated to open in 2028 and amended Landmark/Van Dorn Corridor Plan envisions improved connectivity from the Van Dorn Metro Stations. However, no roadway network improvements are anticipated along Van Dorn Street concerning the EWTAA study area.

2.7 Alexandria Mobility Plan (AMP; 2021)

This is a strategic update to the 2008 Transportation Master Plan to accommodate growth, mobility, and environmental responsibility. It includes systematic strategies, initiatives, and policies that City plans to undertake to improve the overall quality of multimodal transportation while accommodating new technologies (Smart Mobility) to manage traffic, and it highlights future (2030) West End Transitway (Corridor C- Alternative D) from historical studies. In relevance to the objectives of the current EWTAA study, AMP prioritizes the pedestrian connectivity gaps and enhances bicycle connectivity within the EWTAA study area (See **Figure 2.11**)

Figure 2.10. Landmark/Van Dorn Plan Area.

Figure 2.11. Landmark/Van Dorn Plan Area.

3 EXISTING CONDITIONS

3.1 Roadway Network and Facilities

The EWTAA study area (Figure 1.1) includes twelve (12) intersections along Van Dorn Street and Eisenhower Avenue corridors located in the southwestern portion of the City, bordering Fairfax County. The study limits along Van Dorn Street extend from Eisenhower Avenue to Edsall Road. Along Eisenhower Avenue, the study limits extend from Van Dorn Street to Clermont Ave/Eisenhower Avenue Connectors. The study area includes portions of Edsall Road and South Pickett Street from Eisenhower Avenue to the respective intersections in the east. **Figure 3.1** presents the lane configuration at each of the study intersections, and **Figure 3.2** presents the existing pedestrian and bicycle facilities in the study area.

Van Dorn Street is a north-south four-lane divided roadway classified as a Commercial Connector per the *City Complete Street Design Guidelines*. The subject roadway has a posted speed limit of 35-miles per hour (MPH) and primarily serves commuter and commercial traffic. The roadway forms an overpass bridge (Van Dorn Street bridge) over N.S. Railroad and an interchange with Metro Road that connects to residential parcels and Van Dorn Street Metro Station. The land use adjacent to Van Dorn Street, south of the bridge, is industrial to the west and residential to the east. North of the bridge, Van Dorn Street serves mixed land uses, including commercial, industrial, and residential parcels. Van Dorn Street was estimated to have a 2019 Annual Average Daily Traffic (AADT) of 46,000 vehicles per day (vpd). The roadway has a pedestrian sidewalk facility at least along one-direction roadway between Edsall Road and Eisenhower Avenue. Van Dorn Street is classified as a bicycle route, and there are no dedicated bike lanes along the roadway.

Eisenhower Avenue is an east-west five-lane roadway, with two lanes in each direction and a center two-way-left-turn-lane (TWLTL), and is classified as an Arterial with a posted speed limit of 35-MPH. The Van Dorn Street Metro Station is located on Eisenhower Avenue (with access from Metro Road) just east of the Van Dorn Street intersection. The roadway primarily serves commuter traffic to the Metro Station and industrial land-use traffic located further east of Metro Road. Per the SAP, the City envisions a significant redevelopment (See Figure 2.2) along Eisenhower Avenue with planned mixed-use land use and multimodal transportation facilities along Eisenhower Avenue. Most notably, the SAP envisions straightening Eisenhower Avenue east of Metro Road to create a more urban pedestrian environment, increase flexibility in the redevelopment of adjacent parcels and facilitate connection to South Pickett Street through Multimodal Bridge. The roadway is estimated to have a 2019 AADT of approximately 11,000 vpd. There are pedestrian sidewalks along both sides of Eisenhower Avenue between Van Dorn Street and Eisenhower Avenue Connector for most (over 95%) of its length. The roadway is classified as a bicycle route, and no dedicated bicycle lanes exist. To the west of Van Dorn Street, Eisenhower Avenue is referred to as Farrington Avenue and is classified as an industrial street.

South Pickett Street and Edsall Road are classified as Commercial Connector and Industrial Street, respectively. Both roadways are posted at 25-MPH, serve mixed land uses, and are accommodated with pedestrian sidewalks. The three (3) signalized intersections formed by Van Dorn Street, Edsall Road, and South Pickett Street have pedestrian crosswalks across all four (4) legs of the intersections, and each connects to sidewalks on respective roadways. There are currently dedicated bike lanes along both directions of South Pickett Street between Van Dorn Street and Edsall Road.

The N.S. line travels through the study area and under the Van Dorn Street bridge. The future Multimodal Bridge discussed in the SAP, and subsequent studies envision a bridge over N.S. Railroad. The second rail line, CSX track, borders the City and Fairfax County and does not interfere with any roadways in the study area.

The EWTAA study area is served by different transit modes, including the Alexandria DASH bus, WMATA Metrobus, Fairfax Connector bus, and WMATA Metrorail. Below is a list of transit modes and corresponding routes serving the EWTAA study area, and **Figure 3.3** presents the transit network map with the study area.

- Alexandria DASH Bus: Line 30, Line 32, and Line 35
- WMATA Metrobus: Line 7A
- Fairfax Connector: Route 109, Route 231, Route 232, and Route 321,
- WMATA Metrorail: Blue Line

The Van Dorn Street bridge (VDOT ID#8011 and Federal ID#19911) is a 94-foot wide, three-span, continuous steel structure built in 1984. There are currently 2/3 travel lanes along northbound/southbound Van Dorn Street divided by a 14-foot wide median. Based on a recent 2019 VDOT 2019 bridge Inspection, the bridge structure has conditions ratings of 6/5/6 for the deck, superstructure, and substructure, respectively. The bridge has load rating factors all above 1.0 for design truck HL-93 and near or above 1.5 for all legal, permit, and specialized hauling vehicles. Overall, the Van Dorn Street bridge is currently in a “fairly good” condition.

Figure 3.1. EWTAA Study Area – Intersection Lane Configurations

Figure 3.2. EWTAA Study Area – Existing Pedestrian and Bike Facilities

Figure 3.3. EWTAA Transit Network Map

3.2 Traffic Data Sources

The City provided existing intersection turning movement counts (TMC) for a majority (9 of 12) of the intersections. Streetlight Data was also used as an alternate source to estimate TMC at three (3) intersections within the study area. **Table 3.1** presents the list of study intersections along with the TMC data source. The COVID-19 pandemic was known to have impacted travel patterns across the nation and the Northern Virginia region. Therefore, a pre-pandemic (October 2019) comparison with October 2021 travel patterns was conducted using Streetlight Data to estimate volume adjustment factors, if any. Based on the Streetlight Data 2019 versus 2021 traffic trends and in coordination with the City, a volume factor of 1.2 was identified and applied for the intersection volumes to account for demand disruption due to the pandemic. The Streetlight Data did not indicate any change in travel patterns at the Eisenhower Avenue intersection with Eisenhower Avenue Connector/Clermont Avenue; therefore, no adjustment factor was applied to the 2021 volumes. **Figure 3.4** presents the Existing conditions AM and PM peak-hour intersection traffic volumes. The Existing conditions peak hour factor (PHF) for each study intersection was derived from the intersection TMCs. However, no heavy vehicle, pedestrian, or bicycle count data was available in the City provided obtained counts. For EWTAA analyses, heavy vehicle percentages from the EWTS study were used.

Table 3.1 Data Source for Study Intersections

Int. No	Study Intersection	Source	Data Month/Year
1	S Van Dorn Street at Eisenhower Avenue	Vulcan Materials Development Study - Provided by City	October 2021
2	S Van Dorn Street at Metro Road		
3	S Van Dorn Street at Courtney Avenue		
4	S Van Dorn Street at S Pickett Street		
5	S Van Dorn Street at Edsall Road		
6	S Pickett Street at Edsall Road		
7	Metro Road at Summer Grove		
8	Metro Road at Eisenhower Avenue		
9	Eisenhower Avenue at UPS	Streetlight Data - RK&K	October 2021
10	Eisenhower Avenue at Eisenhower Avenue Connector	The Winchester Eisenhower Avenue Townhomes TIA Study	Year 2020
11	Farrington Avenue at Outlet	Streetlight Data - RK&K	October 2021
12	S Pickett Street at Shillings Street	Streetlight Data - RK&K	October 2021

As scoped for this study, no field-measured travel time data was collected. An alternative travel time source – RITIS/INRIX database- was used to extract the October 2019 travel times for Van Dorn Street and Eisenhower Avenue Corridors. **Table 3.2** presents the AM and PM peak hour travel times for Van Dorn Street and Eisenhower Avenue corridors.

The existing condition signal timings for study intersections were requested and obtained from the City. **Appendix E** includes the signal timings sheets.

Table 3.2 2019 INRIX/RITIS Peak Hour Travel Time Data

Segment		Length (Mi)	AM (s)	PM(s)
S Van Dorn St NB	I-495 Ramps to Metro Rd Ramp	0.52	116	123
	Metro Rd Ramp to Edsall Rd	0.46	99	123
	Total	0.98	215	247
S Van Dorn St SB	Edsall Rd to Metro Rd Ramp	0.46	74	93
	Metro Rd Ramp to I-495 Ramps	0.52	83	88
	Total	0.98	157	182
Eisenhower Ave WB	Van Dorn St to Metro Rd	0.18	30	31
	Metro Rd to Connector	1	121	127
	Total	1.18	151	159
Eisenhower Ave E.B.	Connector to Metro Rd	1	116	115
	Metro Rd to Van Dorn St	0.18	58	60
	Total	1.18	174	174

3.3 Field Observations

A field visit was conducted on November 10, 2022 to observe typical traffic conditions during AM and PM peak hours. **Figure 3.5** presents field pictures, and below is a summary of key observations:

- AM peak hour.
    - Queuing was noticed along northbound Van Dorn Street at Eisenhower Avenue, extending upstream into Fairfax County. This substantial queue (approximately 1,000-feet) at Eisenhower Avenue intersection was observed to remain for a significant duration (approximately over 30-minutes) of the peak hour observation. The slow-moving queue appears to result from traffic slowdown from downstream South Pickett Street intersection.
    - A relatively higher percentage of trucks was noticed along the Farrington Avenue approach at the Van Dorn Street intersection. The slow-moving trucks were observed to cause congestion/queueing along the eastbound Farrington Avenue approach.

  - Queuing at the remaining study intersection approaches was observed to be relatively moderate (under 15-vehicles during each cycle) and was cleared during the same or following signal cycles.
- PM peak hour
  - Both directions of Van Dorn Street were congested at the Eisenhower Avenue intersection. Notably, the southbound Van Dorn Street left-turn queue at the Eisenhower Avenue intersection exceeds the available storage length (400-feet). The subject approach queue length occasionally extended beyond the South Pickett Street intersection.
  - The eastbound Edsall Road at Van Dorn Street intersection queue extended beyond the upstream South Whiting Road intersection. However, vehicles were observed to clear the intersection during the same or following signal cycles.
  - Lastly, the queueing at the remaining study intersections was observed to be relatively moderate (under 15-vehicles) and was cleared during the same or following signal cycles.

Figure 3.4. Existing Condition (2021; Streetlight Adjusted) Intersection of Volumes

Figure 3.5. Field Visit Pictures Condition (2021; Streetlight Adjusted) Intersection of Volumes

3.4 Existing Condition Calibration and Operations Analysis Results

3.4.1 Calibration Methodology

The Existing conditions model was developed using Synchro and SimTraffic suite (Version 11). The Existing conditions roadway network was developed utilizing the Synchro model from 2015 EWTS, which was updated with current traffic volume data, signal timings, and roadway configuration. Notably, additional intersections as part of the EWTAA scope, including Farrington Avenue at Outlet, South Pickett Street at Shillings Street, and Metro Road at Summer Grove Road, were added to the EWTAA Synchro model. The Existing conditions model was also updated to reflect best coding practices per VDOT's Traffic Operations and Safety Analysis Manual (TOSAM 2.0) guidelines. The SimTraffic measures of effectiveness (MOEs) considered for this study include simulated vehicular delay (seconds per vehicle), simulated corridor travel times, and simulated maximum queue lengths. The simulated vehicular delays from SimTraffic are not equivalent to those calculated based on HCM (Highway Capacity Manual) methodologies. However, to help stakeholders better understand the differences between multiple scenarios, Level of service (LOS) estimates were provided based on the delays calculated in SimTraffic.

The MOEs considered for calibration include vehicular throughput and corridor (South Van Dorn Street and Eisenhower Avenue) travel times. The pre-pandemic (October 2019) corridor travel times within the study area were extracted from INRIX/RITIS database for comparison with model travel times. Given the variation in traffic volumes (pre-pandemic versus current conditions), the current-day typical field queue lengths would not represent the typical pre-pandemic conditions. Currently, there are no available resources to estimate typical queue lengths. Although Google Maps online resource was initially considered to explore queue length estimates, the available "Typical Traffic" data could not be tailored to fit the pre-pandemic condition requirements. As scoped for this study, queue lengths at critical intersections were visually calibrated to reflect field observations.

The calibration efforts primarily focused on simulating traffic volume and travel time within TOSAM acceptable tolerances, as shown in **Figure 3.6.** For this, the travel time calibration boundaries for Van Dorn Street and Eisenhower Avenue were dictated by available segment limits from the INRIX/RITIS database. Initial simulation runs using the default driver behavior parameters showed simulation model output and travel time differences exceeding acceptable thresholds along Van Dorn Street. Therefore, movement-specific driver headway factors were iteratively adjusted in AM and PM Synchro models for the Van Dorn Street corridor. A headway factor value lower than 1.00 would increase the saturation flow rate, while a higher value would decrease it. **Table 3.3** list the intersection locations and corresponding movements with adjusted headway factors.

Table 3.3 Adjusted Headway Factors for AM and PM Peak Hour Calibration

Intersection	Approach/Movement	Adjusted Headway Factor
Van Dorn Street at Eisenhower Avenue	Southbound Left	0.96
Van Dorn Street at Metro Road	Southbound Through and Rights	0.96
Van Dorn Street at Courtney Avenue	Southbound Through	0.94
Van Dorn Street at South Pickett Street	Westbound Left	0.80
	Northbound Through	0.90
	Southbound Through	0.94

3.4.2 *Existing Conditions Analysis Results*

3.4.2.1 Simulated Travel Time Calibration Results

The travel time results for Van Dorn Street and Eisenhower Avenue corridors for the calibrated AM and PM peak hour models against the field (pre-pandemic *INRIX/RITIS)* travel times are compared in **Table 3.4**.

The AM and PM peak hour simulated travel times for all segments along Van Dorn Street and Eisenhower Avenue achieved calibration targets (within 30% for arterial segments), with one exception. The simulated travel time for a relatively short segment (approximately 0.18-miles) of Eisenhower Avenue between Van Dorn Street and Metro Road is approximately 50% lower than the field travel time. Given the randomness associated with simulations and closely spaced signals, short segments are not uncommon to present different values than field travel times. Considering the cumulative travel times along Van Dorn Street and Eisenhower Avenue corridors satisfying the calibration targets, the model is considered calibrated for travel times.

3.4.2.2 Simulated Traffic Volume Calibration Results

Table 3.5 presents the approach level volume calibration results for the critical study intersections. The signalized intersections along Van Dorn Street and Eisenhower Avenue intersection with Metro Road are identified as critical intersections based on higher traffic volumes and known recurring congestion. As shown in **Table 3.5**, all approaches at the critical intersections satisfy the calibration threshold. A detailed simulated traffic volume calibration result worksheet for all individual movements is included in **Appendix F.** During the individual analysis hours for the AM and PM peak hours, the model throughputs were within calibration thresholds for over 95% of the individual movement (See Appendix F) at all study intersections. This indicates the model's ability to process all the coded input volumes within the calibration thresholds.

3.4.2.3 Intersection Operational Analysis Results

The EWTAA study intersection results by approach are presented in **Table 3.6,** and below is a summary of critical findings:

- AM peak hour:
    - The northbound approach of Van Dorn Street at Eisenhower Avenue operates at capacity (LOS E), most likely due to inadequate lane capacity. The expected queue along the subject approach is approximately 1,075-feet, extending into Fairfax County. All left-turn movements at this intersection currently operate at LOS F.
    - The westbound approaches of South Pickett Street and Courtney Avenue operates at capacity (LOS E).
    - At least one minor street movement at each of the Van Dorn Street intersections currently operates at LOS E or worse.
- During the PM peak hour:
    - As noticed during field observations, the southbound Van Dorn Street left-turn to Eisenhower Avenue operates at LOS F during the PM peak hour, and the queue extends to the upstream Courtney Avenue intersection. The northbound Van Dorn Street approach at the Eisenhower Avenue intersection also experiences congestion and operates at LOS E during the PM peak hour.
    - The southbound Van Dorn Street approach at Edsall Road and South Pickett Street intersections operate at or near capacity (LOS E) during the PM peak hour. Both approaches also experience moderate (approximately 700-feet) queueing.
    - Lastly, the westbound South Pickett Street approach at Van Dorn Street, notably the left-turn movement, operates at LOS F.

Figure 3.6. VDOT TOSAM Thresholds

Table 3.4 Comparison of Existing Condition Field (INRIX) Vs Model (SimTraffic) Travel Times

Segment	Length (Mi)	Existing AM			Existing PM		
		Field (INRIX) (s)	Model (s)	% Diff	Field (INRIX) (s)	Model (s)	% Diff
Northbound Van Dorn Street							
I-495 Ramps to Metro Rd Ramp	0.52	116.0	110.4	-5%	123.4	122.1	-1%
Metro Rd Ramp to Edsall Rd	0.46	98.9	83.5	-16%	123.1	127.7	4%
Total	**0.98**	**215.0**	**193.9**	-10%	**246.5**	**249.8**	1%
Southbound Van Dorn Street							
Edsall Rd to Metro Rd Ramp	0.46	73.9	77.3	5%	93.2	110.0	18%
Metro Rd Ramp to I-495 Ramps	0.52	83.4	80.9	-3%	88.4	85.0	-4%
Total	**0.98**	**157.3**	**158.2**	**0.0**	**181.6**	**195.0**	7%
Eastbound Eisenhower Avenue							
Van Dorn St to Metro Rd	0.18	30.2	13.9	-54%	31.4	15.1	-52%
Metro Rd to Connector	1.00	120.6	118.0	-2%	127.1	129.6	2%
Total	**1.21**	**150.9**	**131.9**	-13%	162.4	**129.6**	-20%
Westbound Eisenhower Avenue							
Connector to Metro Rd	1.00	116.4	116.4	0%	114.6	116.4	2%
Metro Rd to Van Dorn St	0.18	57.6	37.8	-34%	59.7	15.3	-74%
Total	**1.21**	**174.0**	**154.2**	-11%	**174.3**	**131.7**	-24%

Table 3.5 Comparison of Existing Condition Input Vs Simulated Model Output (SimTraffic) Throughput – Critical Intersections

Intersection Roadways (Direction)	Movement	Existing Conditions (2021)							
		AM Peak Hour				PM Peak Hour			
		Volume Input	Volume Output	Difference	Met TOSAM Criteria?	Volume Input	Volume Output	Difference	Met TOSAM Criteria?
S Van Dorn Street at Edsall Road	*EB*	835	829	-1%	Met	680	672	-1%	Met
	WB	385	393	2%	Met	535	563	5%	Met
	NB	1445	1459	1%	Met	1460	1482	2%	Met
	SB	840	845	1%	Met	1480	1491	1%	Met
	Overall	3505	3526	1%	Met	4155	4208	1%	Met
S Van Dorn Street at S Pickett Street	*EB*	145	144	-1%	Met	310	318	3%	Met
	WB	410	449	10%	Met	585	623	6%	Met
	NB	1995	2061	3%	Met	1960	2027	3%	Met
	SB	1210	1246	3%	Met	1690	1708	1%	Met
	Overall	3760	3900	4%	Met	4545	4676	3%	Met
S Van Dorn Street at Courtney Avenue	*W.B.*	20	20	0%	Met	25	29	16%	Met
	NB	2010	2020	0%	Met	1970	1974	0%	Met
	SB	1540	1621	5%	Met	2235	2317	4%	Met
	Overall	3570	3661	3%	Met	4230	4320	2%	Met
S Van Dorn Street at Eisenhower Avenue	*EB*	190	189	-1%	Met	115	116	1%	Met
	WB	715	721	1%	Met	845	848	0%	Met
	NB	1740	1742	0%	Met	1565	1556	-1%	Met
	SB	1395	1407	1%	Met	2075	2059	-1%	Met
	Overall	4040	4059	0%	Met	4600	4579	0%	Met
Eisenhower Avenue at Metro Road	*EB*	405	420	4%	Met	565	568	1%	Met
	WB	655	687	5%	Met	805	848	5%	Met
	SB	200	223	12%	Met	205	226	10%	Met
	Overall	1260	1330	6%	Met	1575	1642	4%	Met

Table 3.6 Comparison of Existing Condition Input Vs Simulated Model Output (SimTraffic) Throughput – Critical Intersections

Int. No	Intersection	Overall Delay	Eastbound					Westbound					Northbound					Southbound				
			L	T	R	Approach	Approach Max Q	L	T	R	Approach	Approach Max Q	L	T	R	Approach	Approach Max Q	L	T	R	Approach	Approach Max Q
			Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet
AM Peak Hour																						
1	S Van Dorn St at Eisenhower Ave	49.4	83.8	73.8	34.3	52.2	277	90.5	25.2	56.9	63.5	550	88.5	57.8	49.1	58.6	1071	82.5	21.5	6.1	30.2	310
2	S Van Dorn St at Metro Rd	2.3	-	-	0.1	0.1	6	-					-	2.1	0.9	2.1	4	-	2.7	0.0	2.7	208
3	S Van Dorn St at Courtney Ave	3.8	0.0	0.0	0.0	0.0	0	99.8	0.0	45.9	70.2	101	0.0	3.4	2.8	3.4	136	35.1	3.2	0.0	3.4	192
4	S Van Dorn St at S Pickett St	23.3	74.1	83.0	17.0	37.7	132	77.6	47.6	38.2	69.7	390	26.2	11.0	8.2	11.1	415	43.0	24.5	24.0	25.2	458
5	S Van Dorn St at Edsall Rd	38.8	50.3	63.0	21.7	41.1	490	59.2	62.1	21.3	50.5	356	89.6	22.0	19.4	32.7	457	80.7	39.3	32.9	41.7	416
6	S Pickett St at Edsall Rd	21.3	20.7	30.0	24.1	26.4	384	32.3	33.8	27.3	32.9	434	18.6	14.8	8.1	13.7	176	15.8	16.8	4.1	13.0	221
7	Metro Rd at Summer Grove	6.5	0.0	15.2	3.6	5.3	58	15.0	0.0	3.0	13.9	72	7.5	4.7	2.9	4.4	50	5.8	4.0	1.7	4.5	66
8	Metro Rd at Eisenhower Ave	8.2	11.0	4.9	0.0	5.2	137	0.0	6.1	2.4	5.9	200	0.0	0.0	0.0	0.0	0	35.4	1.0	8.3	20.8	193
9	Eisenhower Ave at UPS	3.7	0.0	2.6	1.7	2.5	65	9.7	2.5	0.0	2.5	132	40.3	0.0	15.9	36.2	142	37.4	0.0	7.5	11.9	40
10	Eisenhower Ave at Eisenhower Ave Connector	13.0	0.0	14.0	9.5	11.9	217	29.9	7.5	4.2	10.9	109	20.8	40.2	8.8	14.6	453	0.0	37.0	0.0	37.0	50
11	Farrington Ave at Outlet	0.5	49.1	58.6	82.5	21.5	310	6.1	30.2	49.4	0.3	0	0.0	0.0	0.0	0.0	0	5.1	0.0	0.0	5.1	30
12	S Pickett St at Shillings St	1.1	3.8	0.9	0.0	1.0	95	0.0	1.0	0.0	1.0	12	0.0	0.0	0.0	0.0	0	0.0	0.0	4.2	4.2	59
PM Peak Hour																						
1	S Van Dorn St at Eisenhower Ave	46.7	62.9	47.1	34.4	42.1	170	64.5	4.6	44.4	49.6	581	109.2	68.1	56.3	67.4	927	102.9	15.6	4.8	30.1	329
2	S Van Dorn St at Metro Rd	6.9	-	-	0.0	0.0	3	-					-	2.5	1.0	2.5	27	-	11.2	0.0	11.2	302
3	S Van Dorn St at Courtney Ave	10.3	0.0	0.0	0.0	0.0	0	70.4	0.0	55.8	66.9	99	0.0	15.1	11.5	15.1	525	23.7	5.4	0.0	5.4	246
4	S Van Dorn St at S Pickett St	45.9	49.6	64.5	45.6	48.5	329	118.0	54.6	57.6	101.4	526	58.1	22.8	17.1	22.9	427	55.1	52.3	50.2	52.4	760
5	S Van Dorn St at Edsall Rd	62.2	74.9	106.1	32.3	64.0	558	99.7	63.5	25.3	65.4	420	74.4	40.6	40.8	49.3	432	99.5	69.5	64.7	73.1	914
6	S Pickett St at Edsall Rd	24.8	23.3	28.5	25.1	25.7	336	30.6	34.7	26.1	32.4	357	33.1	19.6	11.9	19.7	194	17.0	33.5	13.4	24.8	484
7	Metro Rd at Summer Grove	4.4	0.0	0.0	3.2	3.2	32	13.3	0.0	2.3	10.9	61	6.8	3.9	2.4	4.0	32	4.0	3.0	0.9	3.1	76
8	Metro Rd at Eisenhower Ave	7.2	9.9	2.4	0.0	2.6	82	0.0	5.8	2.6	5.7	190	0.0	0.0	0.0	0.0	0	36.4	1.9	9.2	24.8	212
9	Eisenhower Ave at UPS	3.3	0.0	1.9	1.4	1.9	58	13.4	2.8	0.0	2.8	150	45.7	0.0	20.9	40.3	149	0.0	0.0	6.4	6.4	14
10	Eisenhower Ave at Eisenhower Ave Connector	21.4	0.0	26.6	18.8	25.1	310	31.3	8.4	4.8	19.7	210	29.3	47.7	6.3	18.8	282	0.0	43.6	6.6	31.3	42
11	Farrington Ave at Outlet	1.4	56.3	67.4	102.9	15.6	329	4.8	30.1	46.7	0.1	0	0.0	0.0	0.0	0.0	0	4.3	0.0	0.0	4.3	47
12	S Pickett St at Shillings St	15.4	10.2	2.0	0.0	2.2	219	0.0	32.2	35.8	32.4	559	0.0	0.0	0.0	0.0	0	0.0	0.0	10.7	10.7	78

Note: Delay values highlighted in Yellow, *Orange,* and Red indicate *LOS C or better*, *LOS D*, *LOS E,* and LOS F, respectively. All other values indicate LOS C or better operation.

4 FUTURE SCENARIOS, FORECASTS, AND OPERATIONAL RESULTS

4.1 Future Scenarios

EWTAA study was primarily initiated to evaluate the need for Multimodal Bridge and Farrington Avenue connector and develop a design concept to improve multimodal mobility across the Van Dorn Street bridge. As noted in Section 3, SAP envisioned multiple transportation and land use changes in the study area, enhancing multimodal connectivity for the future developments surrounding the Van Dorn Street Metro Station. The future concepts within the EWTAA study area are classified into the following scenarios for evaluation purposes.

- No-Build Scenario
    - No-Build scenario would retain the existing Van Dorn Street bridge as the only connection between Eisenhower Avenue and South Pickett Street. The typical section of the Van Dorn Street Bridge would remain as is without any additional lane capacity or pedestrian/bicycle facility improvements. The future background improvements, including BRT recommendations from the West End Transitway study and the straightening of Eisenhower Avenue that are independent of this current study, are assumed to be in place under the No-Build scenario.
- Build Scenario A
    - Build Scenario A builds upon the No-Build scenario with two (2) additional bridge connections between Eisenhower Avenue and South Pickett Street. Both Multimodal Bridge and Farrington Connectors, conceptualized in the 2018 Technical Memo (See Section 2.5), are assumed to build out. There would be no additional general-purpose lane capacity or pedestrian/bicycle facility improvements for the Van Dorn Street Bridge. The future background improvements noted in the No-Build scenario are assumed to be in place under Scenario A.
    - As shown in Appendix C, Multimodal Bridge would connect Eisenhower Avenue (east of Metro Road) and South Pickett Street (east of Schillings Street) to form an additional connection east of the Van Dorn Street bridge. The Bridge would have 6-10 feet sidewalks, a 12-foot cycle track, dedicated transit lanes, and general-purpose travel lanes.
    - Farrington Connector would connect Farrington Avenue (approximately 1,000-feet west of Van Dorn Street) and South Pickett Street (approximately 1,300-feet west of Van Dorn Street). The proposed connector roadway would have dedicated bicycle lanes, 6-foot sidewalks, and general-purpose travel lanes.
- Build Scenario B
    - Build Scenario B proposes multimodal improvements to the Van Dorn Street bridge and includes background improvements (West End Transitway BRT and Eisenhower Avenue Straightening) as in the No-Build scenario. However, Build Scenario B does not assume the construction of Multimodal Bridge and Farrington connectors. The improved Van Dorn Street Bridge would have identical lane capacity for general-purpose traffic, a dedicated northbound BRT lane, and enhanced pedestrian/bicycle facilities. Multiple design concepts were evaluated considering geometric constraints leading to the bridge, transition of pedestrian/bike facilities beyond the bridge limits, pedestrian/bicycle comfort and safety, and multimodal capacity through the bridge section. **Appendix G** includes the evaluated design concepts, and **Figure 4.1** presents the design concept for Build Scenario B selected for further evaluation in this study. The Build Scenario B proposes a 16-foot shared-use path and 5-foot wide sidewalk along northbound and

southbound directions of Van Dorn Street, respectively. The northbound shared-use path would connect to the proposed (under West End Transitway project) 12-foot wide shared-use path downstream of the bridge section. The southbound sidewalk is expected to improve connectivity between Courtney Avenue and Eisenhower Avenue along southbound direction.

- Build Scenario C
  - Build Scenario C proposes identical Van Dorn Street bridge improvements as in Scenario B. Additionally, Build Scenario C proposes to modify and narrow Multimodal Bridge to a pedestrian and bicycle only facility. The pedestrian and bicycle-friendly bridge proposed for evaluation by the City (hereafter referred to as Modified Multimodal Bridge) would prohibit all vehicular traffic and would improve non-vehicular mobility and connectivity in the vicinity of Van Dorn Street Metro Station. The concept design and estimation of pedestrian and bicycle volumes for the Modified Multimodal Bridge are excluded from the scope of this study. If any, the Modified Multimodal Bridge is not anticipated to have a negative impact on vehicular operations along the Van Dorn Street bridge.

In summary, each of the above-mentioned scenarios, including background improvements under future No-Build conditions, aims to improve multimodal connectivity in the vicinity of Van Dorn Street Metro Station. As noted in Section 3, traffic analyses for this study are conducted using Synchro/SimTraffic suite and is limited to operational evaluation of vehicular traffic. Notably, the facility improvements related to pedestrian, bike, and BRT modes cannot be quantified for this planning-level study using Synchro/SimTraffic. However, the Synchro/SimTraffic analyses output a few critical operational MOEs such as travel time, vehicular delay, and overall network performance values to assist with identifying advantages and disadvantages between evaluated scenarios. Furthermore, these MOEs were also used in cost-benefit analysis methodology to rank build scenarios and help in stakeholders' decision-making process.

4.2 Traffic Forecasts

The travel demand model maintained by the Metropolitan Washington Council of Governments (MWCOG) was primarily used to establish growth rates to estimate future traffic volumes. The Base year (2019) volumes were compared against the 2019 Average Annual Weekday Traffic (AAWDT) for high-level validation of model. **Appendix H** includes daily volume comparison table. Traffic forecasts for the study area were developed for the most recent horizon year 2045. The MWCOG travel demand model includes the forecasted land use for the horizon year within Eisenhower West and the projected transit service that would be available in the study area. The No-Build model includes all major transportation projects contained in the region's **Long Range Transportation Plan, *Visualize 2045,*** and represents the anticipated regional transportation network in 2045. The MWCOG model was checked for the correct number of lanes along Van Dorn Street, Eisenhower Avenue, Edsall Road, South Pickett Street, and Metro Road. The MWCOG network generally does not include extensive local street network detail; it was not within the project's scope to add extensive network updates and conduct link assignment validation. Prior to determining growth rates for the study area, the MWCOG travel demand model roadway network structure was modified to eliminate an erroneous direct connection between Farrington Avenue and Edsall Road for the 2045 Build scenario that is no longer considered in the Long Range Transportation Plan.

4.2.1 Forecasts without Multimodal Bridge and Farrington Connector

The projected growth in peak period traffic volumes within the study area was estimated by comparing the peak period traffic assignment for the Base year (2019) to the future No-Build year (2045) assignment for each roadway link in the travel demand model. The percentage growth was converted to a linear annual traffic growth rate. The estimated annual growth rate ranges along the major streets in the study area are shown in **Table 4.1** below. The growth rates reflect that most peak-period traffic growth is expected to occur in the off-peak directions.

Table 4.1 – Estimated Annual Linear Growth Rates (Percent per Year)

Roadway	Direction	AM	PM
Van Dorn Street	NB	0.8	0.7
	SB	1.1	0.5
Eisenhower Avenue	EB	3.2	1.5
	WB	1.3	2.5
Eisenhower Connector	NB	1.3	2.5
	SB	1.3	2.5
S Pickett Street	EB	0.7	0.9
	WB	1.5	0.5
Other Roadways	All	2.0	2.0

The growth rates were applied to the 2022 balanced peak hour volumes approaching and departing each intersection in the study area roadway network to develop 2045 No-Build volume estimates. These volume estimates were then manually adjusted between intersections to obtain a balanced volume network for the AM and PM peak hours.

The balanced 2045 No-Build forecasts were further adjusted to account for the expected straightening of Eisenhower Avenue, as identified in the SAP. The Eisenhower Avenue straightening would realign the existing curved alignment between Metro Road and the Covanta facility into a conventional urban grid. As shown in Figure 3.3 and Figure 3.5, the urban grid street network would facilitate roadway access to future land uses south of Eisenhower Avenue. In coordination with the City, anticipated traffic volume shifts were determined and reassigned in the traffic volume network. Considering the planning-level analysis conducted in this study, approximately 75% of the traffic was anticipated to utilize straightened Eisenhower Avenue. The remaining 25% of the traffic was assumed to end their trip within the urban grid network. As the vehicular connections between Eisenhower Avenue and South Pickett Street are identical between No-Build, Scenario B, and Scenario C, an identical set of volumes was used for analyses. **Figure 4.2** presents the forecasted volumes for scenarios without additional connections between Eisenhower Avenue and South Pickett Street.

4.2.2 Forecasts with Multimodal Bridge and Farrington Connector

To estimate the impact of the construction of the Farrington Connector and Multimodal Bridge (Scenario A) on future traffic volumes, links representing these connectors were coded in the 2045 MWCOG model. Scenario A volumes were estimated by evaluating the shift in traffic volumes from the No Build network to the new links that represent the Multimodal Connector and Farrington Connector, as well as changes in traffic on other roadways in the network. The raw model outputs were not utilized to develop the future volumes, as mentioned. The shift in volumes from roadways were utilized in determining these new link volumes. The hourly assignment changes were estimated by multiplying the changes in the link assignments by 0.33 (since the peak period in the MWCOG model represents 3 hours). The additions and subtractions to the link volumes were applied to No-Build volumes on the approach and departure links at the main intersections in the MWCOG network (Van Dorn Street at Eisenhower Avenue, South Picket Street at Edsall Road, and Eisenhower Avenue at Eisenhower Connector).

Once the Scenario A approach and departure link volumes were estimated using this approach, turning volumes at each intersection were estimated using the iterative proportional fitting method described in *Transportation Research Record 1287*. The 2045 No-Build volumes were used as the seed volume for each turning movement. Scenario A peak hour volumes were then manually adjusted for balance between intersections. Peak hour volumes on the Farrington Connector and Multimodal Bridge were estimated by applying the peak period/peak hour ratio to the link assignment in the travel demand model. Turning volumes at the new intersections that would be created by these connectors were estimated using the iterative proportional fitting method. **Figure 4.3** presents the forecasted volumes for Build Scenario A.

Figure 4.1 – Van Dorn Street Bridge Hybrid Concept Design

Figure 4.2 – Design Year (2045) Peak Hour Volumes

Figure 4.3 – Design Year (2045) Peak Hour Volumes – Sce A

4.3 Design Year (2045) Traffic Analysis

The calibrated Existing conditions AM and PM peak hour Synchro models were modified to reflect future No-Build conditions. Under the future No-Build conditions, all study intersections' lane configurations would remain identical to the Existing conditions, with one exception. The northbound Van Dorn Street dual left-turns at Edsall Road would be reduced to a single left-turn lane to accommodate BRT in the median. Furthermore, as part of the future straightening, Eisenhower Avenue would be realigned east of the Metro Road intersection. For the purpose of vehicular traffic analyses, Scenario B and Scenario C operations are assumed to remain identical to the No-Build conditions as both build scenarios do not propose any vehicular capacity improvements. In addition to the No-Build conditions model, Build Scenario A model reflecting corresponding Multimodal Bridge and Farrington Connector improvements was also developed for traffic analyses. No additional intersection or corridor geometric improvements within the study area are currently approved.

The future condition signal timings were optimized in Synchro, assuming the City would continue to upgrade signal timings to serve the growing demand efficiently. The measures of effectiveness (MOEs) considered for the Design Year remain consistent with the Existing condition analyses; and include simulated vehicular delay (seconds per vehicle), simulated corridor travel times, and simulated maximum queue lengths. The following text summarizes key highlights of the Design Year analyses with No-Build conditions as the baseline for comparing against the Build scenarios.

4.3.1 Simulated Travel Time Results

Table 4.2 compares the simulated travel time results for Existing, No-Build (also represents Build Scenario B and Build Scenario C operations) and Scenario A. The simulated travel times for Eisenhower Avenue are not directly comparable between Existing and future year conditions due to the roadway straightening east of Metro Road. The following summarizes travel time results:

- AM Peak Hour
    - When compared to the Existing conditions, the 2045 No-Build travel times are expected to increase by approximately over 100% and 16% along northbound and southbound directions of Van Dorn Street, respectively.
    - The future year travel times for Van Dorn Street and Eisenhower Avenue corridors are anticipated to be similar (within 10%) under both No-Build and Scenario A conditions. The Multimodal Bridge and Farrington Connectors are expected to have minimal impacts on corridor travel times.
- PM Peak Hour
    - Under the 2045 No-Build conditions, the northbound Van Dorn Street simulated travel times are expected to increase by approximately 86% compared to the existing conditions. The increase is attributed to the LOS F threshold at Eisenhower Avenue intersection, which is anticipated to have queue spillback extending well into Fairfax County. However, the southbound travel times would decrease by 28%. A review of simulations indicated that LOS F operations at Van Dorn Street and Edsall Road intersections constrain traffic flow into the network, and therefore fewer vehicles lead to shorter travel times.
    - The southbound Van Dorn Street and westbound Eisenhower Avenue would experience an approximately 88% and 30% respective increase in travel times under Scenario A compared to No-Build conditions. The significant (over 30%) increase in travel time under

Scenario A is mostly attributed to the severely congested (LOS F) Van Dorn Street and Eisenhower Avenue intersection operations. The proposed Farrington Connector under Scenario A would attract additional traffic from South Pickett Street, resulting in LOS F for eastbound and southbound approaches at the Van Dorn Street and Eisenhower Avenue intersection. Due to the additional traffic, the mainline southbound Van Dorn Street would have a relatively shorter green time. As no future improvements are planned at this intersection to improve lane capacity, the LOS F threshold operations result in higher travel times under Scenario A.

4.3.2 Intersection Operational Analysis Results

Table 4.3 presents a comparison of AM peak hour intersection analysis results for the No-Build and Build Scenario A. **Table 4.4** presents the comparison of PM peak hour intersection analysis results. The below text summarizes the findings at the critical intersections.

- AM Peak Hour
  - The Van Dorn Street at Eisenhower Avenue intersection is expected operate at LOS F under both No-Build and Build Scenario A. Notably, the additional traffic along the eastbound approach would reduce the effective green time for northbound Van Dorn Street under Build Scenario A. The Multimodal Bridge (Build Scenario A) would ease the study intersection's operational burden, reducing southbound Van Dorn Street left-turn and westbound Eisenhower Avenue approach delays and queue lengths. However, additional traffic from Farrington Connector would shorten the mainline green time. The LOS F operations indicate a need for intersection improvement in the future year, notably along the eastbound approach. Lastly, under both scenarios, the queue length along northbound Van Dorn Street is expected to exceed 1,900 feet and constrain vehicles arriving from Fairfax County.
  - The Van Dorn Street intersections with South Pickett Street and Edsall Road are expected to notice a reduction in westbound approach delay under Scenario A. The improvement is most likely attributed to traffic rerouting through the Multimodal Bridge.
  - The operations at the remaining Van Dorn Street intersections at Metro Road and Courtney Avenue are anticipated to remain at similar LOS under both No-Build and Build Scenario A conditions.
  - **Figure 4.4** presents a graphical comparison of the change in approach delay at the critical intersections. Thirteen (13) of eighteen (18) critical intersection approaches are expected to notice a reduction in delay under Scenario A compared to No-Build conditions. However, LOS F operations at the Van Dorn Street and Eisenhower Avenue intersection constrain incoming traffic and likely underestimate the operations.
- PM Peak Hour
  - The PM peak hour operations at Van Dorn Street at Eisenhower Avenue remain similar to the AM peak hour, with the intersection operating at LOS F under both No-Build and Build Scenario A. All approaches except for southbound Van Dorn Street would operate at LOS F, and deterioration of operations is attributed to the additional traffic from the Farrington Avenue connector. The LOS F threshold operations indicate a need for intersection improvement in the future year, notably along the eastbound approach. Lastly, under both scenarios, the queue length along northbound Van Dorn Street is expected to exceed 1,900 feet and constrain vehicles arriving from Fairfax County.

- The Van Dorn Street intersection with Edsall Road is expected to operate at LOS F under both No-Build and Build Scenario A conditions. Notably, the southbound Van Dorn Street approach would have an approach delay of approximately over 200-seconds per vehicle and constrain traffic entering the study area. Although all approaches at this intersection would operate relatively better under Build Scenario A, the intersection is still expected to operate at LOS F.
- The operations at the remaining Van Dorn Street intersections with South Pickett Street, Metro Road, and Courtney Avenue are anticipated to remain at similar LOS under both No-Build and Build Scenario A conditions.
- **Figure 4.4** presents a graphical comparison of the change in approach delay at the critical intersections. Twelve (12) of eighteen (18) critical intersection approaches are expected to notice a reduction in delay under Scenario A compared to No-Build conditions. However, LOS F threshold operations at the Van Dorn Street intersections with Edsall Road and Eisenhower Avenue intersection constrain incoming traffic and likely underestimate the operations.

The findings from the operational analyses align with the EWTS study's conclusions that a Multimodal Bridge connection would result in the fewest number of congested intersections, with mitigations at select locations. However, this study (EWTAA) does not assume future improvements at any of the study intersections. Moreover, the Van Don Street intersections at Eisenhower Avenue and Edsall Road noticeably result in congested operations within the EWTAA study area.

4.4 Design Year (2045) Supplementary Traffic Analysis

All future traffic analyses presented above anticipate LOS F threshold operations along Van Dorn Street corridor, notably at the Van Dorn Street and Eisenhower Avenue intersection. In addition to the background projects mentioned in this study, currently there are no intersection improvement projects envisioned in the SAP, City's Long Range Transportation Plan. Although the analysis findings anticipate the subject intersection to remain as a bottleneck and constrain traffic to Van Dorn Street bridge, additional lane capacity along Van Dorn Street was not deemed as a feasible option or within the scope of this study. An additional travel lane along Van Dorn Street would have significant right-of-way and construction costs. Therefore, this study conducted a supplementary analysis at the critical intersection to estimate prospective improvements with relatively low-cost measures compared to corridor wide widening. Considering potential constraints including but not limited to right-of-way, drainage or opposition from parcel owners, the intent of this supplementary analysis is to encourage stakeholders opt for spot improvements with relatively low costs.

The supplementary analysis proposes extending the Farrington Avenue eastbound right-turn lane storage length to 250-feet from the existing 75-feet at the Van Dorn Street and Eisenhower Avenue intersection. Both No-Build (also represents Build Scenario B and Build Scenario C for traffic analysis purposes) and Build Scenario A were run with extended storage length and intersection results are presented in **Table 4.5**.

- Compared to the No-Build (Also Scenario B and Scenario C) conditions, the extended eastbound right-turn lane storage length is expected to improve approach vehicular delay by at least 90-seconds per vehicle. The maximum queue length is also expected to reduce by at least 175-feet compared to the No-Build conditions.
- Similarly, the extended right-turn lane storage length is expected to improve Scenario A eastbound approach vehicular delay by at least 90-seconds per vehicle. The AM and PM peak

hour maximum queue lengths along the subject approach would have approximately 100-feet and 50-feet reduction, respectively.

Table 4.2 – Comparison of Corridor Travel Times – Existing, No-Build

#	From	Length (ft)	Length (Mi)	AM			PM		
				Existing AM (s)	No-Build AM (s)	% Diff	Existing PM (s)	No-Build PM (s)	% Diff
Northbound Van Dorn Street									
101	Van Dorn St: I-495 Ramps to Metro Rd Ramp	2740	0.52	110.4	285.2	158%	122.1	335.4	175%
102	Metro Rd Ramp to Edsall Rd	2420	0.46	83.5	116.8	40%	127.7	129.9	2%
Total	**I-495 Ramps to Edsall Rd**	**5160**	**0.98**	**193.9**	**402.0**	**107%**	**249.8**	**465.3**	86%
Southbound Van Dorn Street									
103	Edsall Rd to Metro Rd Ramp	2420	0.46	77.3	85.8	11%	110.0	62.1	-44%
104	Metro Rd Ramp to I-495 Ramps	2740	0.52	80.9	97.2	20%	85.0	77.9	-8%
Total	**Van Dorn St: Edsall Rd to I-495 Ramps**	**5160**	**0.98**	**158.2**	**183.0**	**16%**	**195.0**	**140.0**	-28%
#	**From**	**Length (ft)**	**Length (Mi)**	**AM**			**PM**		
				2045 No-Build AM (s)	**2045 Sce A AM (s)**	**% Diff**	**2045 No-Build PM (s)**	**2045 Sce A PM (s)**	**% Diff**
Northbound Van Dorn Street									
101	Van Dorn St: I-495 Ramps to Metro Rd Ramp	2740	0.52	285.2	309.1	8%	335.4	307.3	-8%
102	Metro Rd Ramp to Edsall Rd	2420	0.46	116.8	101.3	-13%	129.9	120.5	-7%
Total	**I-495 Ramps to Edsall Rd**	**5160**	**0.98**	**402.0**	**410.4**	**2%**	**465.3**	**427.8**	-8%
Southbound Van Dorn Street									
103	Edsall Rd to Metro Rd Ramp	2420	0.46	85.8	83.2	-3%	62.1	118.0	90%
104	Metro Rd Ramp to I-495 Ramps	2740	0.52	97.2	117.6	21%	77.9	145.8	87%
Total	**Van Dorn St: Edsall Rd to I-495 Ramps**	**5160**	**0.98**	**183.0**	**200.8**	**10%**	**140.0**	**263.8**	88%
Eastbound Eisenhower Avenue									
105	Van Dorn St to Metro Rd	940	0.18	19.7	18.6	-6%	26.9	18.8	-30%
107	Metro Rd to Connector_2	5280	1.00	131.7	144.5	10%	139.0	155.8	12%
Total		**6415**	**1.21**	**151.4**	**163.1**	**8%**	**165.9**	174.6	5%
Westbound Eisenhower Avenue									
108	Connector to Metro Rd_1	5280	1.00	143.7	155.8	8%	140.8	161.4	15%
110	Metro Rd to Van Dorn St	940	0.18	122.7	98.7	-20%	85.0	132.4	56%
Total	**Van Dorn St: Edsall Rd to I-495 Ramps**	**6415**	**1.21**	**266.4**	**254.5**	**-4%**	**225.8**	**293.8**	30%

Note: The No-Build condition values also represent travel times for Build Scenario B and Build Scenario C.

Table 4.3 – Comparison of AM Peak Hour Intersection Results – No-Build (Scenario B and Scenario C) Vs. Scenario A

Int. No	Intersection	Overall Delay	Eastbound L	Eastbound T	Eastbound R	Eastbound Approach	Eastbound Approach Max Q	Westbound L	Westbound T	Westbound R	Westbound Approach	Westbound Approach Max Q	Northbound L	Northbound T	Northbound R	Northbound Approach	Northbound Approach Max Q	Southbound L	Southbound T	Southbound R	Southbound Approach	Southbound Approach Max Q
			Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet
No-Build																						
1	***Van Dorn St at Eisenhower Ave***	126.0	226.5	208.6	170.4	191.2	430	122.9	105.5	57.5	75.0	716	244.9	234.6	236.4	235.5	1957	85.4	28.0	9.0	37.0	330
2	Van Dorn St at Metro Rd	5.5	-	-	0.4	0.4	14	-	-	-	-	0	-	1.8	0.9	1.8	0	-	10.1	0.0	10.1	338
3	***Van Dorn St at Courtney Ave***	5.2	0.0	0.0	0.0	0.0	0	83.6	0.0	51.0	67.9	112	0.0	5.2	4.2	5.2	249	35.5	4.1	0.0	4.3	246
4	***Van Dorn St at S Pickett St***	32.0	67.9	82.9	30.3	44.7	202	82.3	42.7	40.2	73.0	512	50.9	15.5	11.4	16.5	424	50.3	35.6	38.2	36.3	606
5	***Van Dorn St at Edsall Rd***	85.3	129.0	134.2	59.2	101.1	1263	159.6	59.8	26.2	79.7	407	109.3	47.9	48.5	57.5	666	168.9	104.4	93.5	108.9	849
6	S Pickett St at Edsall Rd	24.9	23.5	25.6	22.7	24.7	400	31.6	25.2	19.3	26.7	395	33.1	28.4	19.0	26.7	198	26.1	25.5	4.9	19.5	255
7	Metro Rd at Summer Grove	12.8	0.0	39.4	5.9	11.3	64	42.9	0.0	3.1	40.4	131	8.7	4.9	2.8	4.6	50	5.3	3.2	1.3	3.7	72
8	***Metro Rd at Eisenhower Ave***	11.6	13.1	4.1	0.0	4.5	100	0.0	13.9	3.6	13.4	281	0.0	0.0	0.0	0.0	0	29.8	1.4	10.1	21.4	196
9	Eisenhower Ave at UPS	7.0	0.0	7.8	0.0	7.8	191	17.5	4.1	0.0	7.2	171	15.4	1.4	7.0	5.6	206	14.6	0.0	5.4	6.7	58
10	Eisenhower Ave at Eisenhower Ave Conn.	28.3	0.0	8.6	8.0	8.4	189	24.5	5.1	1.8	8.1	116	106.3	46.4	19.1	53.9	745	0.0	31.7	0.0	31.7	51
11	Farrington Ave at Outlet	17.4	0.0	21.5	0.0	21.5	188	0.0	0.3	0.2	0.3	0	0.0	0.0	0.0	0.0	0	116.6	0.0	0.0	116.6	112
12	S Pickett St at Shillings St	1.7	4.0	0.9	0.0	1.0	71	0.0	2.3	0.0	2.3	152	0.0	0.0	0.0	0.0	0	0.0	0.0	4.8	4.8	54
13	Eisenhower Ave @ Straight Junc.	2.6	6.0	0.7	0.0	3.3	169	0.0	1.4	0.0	1.4	10	0.0	0.0	0.0	0.0	0	0.0	1.5	2.7	2.7	0
Build Scenario A																						
1	***Van Dorn St at Eisenhower Ave***	143.9	151.6	137.5	108.1	124.4	440	84.0	78.5	48.0	61.7	310	298.3	259.6	250.4	264.4	1955	73.4	43.3	14.6	43.8	327
2	Van Dorn St at Metro Rd	7.5	-	-	0.5	0.5	19	-	-	-	-	0	-	1.9	0.8	1.9	0	-	14.3	0.0	14.3	347
3	***Van Dorn St at Courtney Ave***	4.9	0.0	0.0	0.0	0.0	0	76.8	0.0	34.6	55.7	105	0.0	5.3	4.7	5.3	260	23.2	3.5	0.0	3.7	197
4	***Van Dorn St at S Pickett St***	31.5	67.5	71.0	17.6	46.2	176	75.3	44.4	46.8	64.7	468	36.5	18.5	11.8	17.6	422	39.4	30.6	31.5	31.4	512
5	***Van Dorn St at Edsall Rd***	61.3	129.2	137.1	40.0	99.7	1162	85.2	46.1	19.4	48.4	291	105.5	31.8	30.7	40.4	537	86.0	50.7	44.4	54.4	569
6	S Pickett St at Edsall Rd	28.8	24.9	32.5	29.7	30.0	545	57.6	47.0	44.0	50.0	582	24.7	22.2	14.7	20.7	196	22.0	21.5	4.5	16.6	242
7	Metro Rd at Summer Grove	12.4	0.0	42.8	6.5	11.9	78	40.1	0.0	3.4	37.4	125	9.9	5.2	2.8	4.8	46	5.4	3.7	1.7	4.1	70
8	***Metro Rd at Eisenhower Ave***	10.2	7.2	3.9	0.0	4.2	85	0.0	9.7	2.7	9.1	129	0.0	0.0	0.0	0.0	0	27.7	1.2	5.8	18.3	192
9	Eisenhower Ave at UPS	8.6	0.0	9.1	7.2	9.0	222	24.5	6.2	0.0	9.1	210	16.5	1.0	6.9	6.1	186	15.5	0.0	7.7	8.8	68
10	Eisenhower Ave at Eisenhower Ave Conn.	69.0	30.0	10.1	10.6	10.4	213	25.6	5.1	2.3	9.0	103	318.8	55.4	28.0	145.9	1295	0.0	35.7	7.0	26.1	51
11	Farrington Ave at Outlet	9.9	7.8	10.6	0.0	10.5	138	0.0	1.5	1.2	1.3	20	0.0	0.0	0.0	0.0	0	35.9	0.0	30.8	35.2	116
12	S Pickett St at Shillings St	1.8	5.3	1.9	0.0	2.0	204	0.0	1.3	0.8	1.3	71	0.0	0.0	0.0	0.0	0	0.0	0.0	5.1	5.1	50
13	Eisenhower Ave at Straight Junc.	2.1	3.9	0.5	0.0	2.2	101	0.0	1.2	0.0	1.2	4	0.0	0.0	0.0	0.0	0	0.0	1.8	3.2	3.2	0
14	Eisenhower Ave at Multimodal Bridge	11.1	0.0	0.0	0.0	0.0	0	13.0	1.1	12.4	12.5	235	0.0	6.4	7.7	7.6	107	11.1	8.3	0.0	11.0	173
15	Multimodal Brdg at S Pickett St	13.4	0.0	10.5	1.8	7.4	163	10.6	5.2	0.0	7.6	150	41.1	0.0	14.3	26.8	316	0.0	0.0	0.0	0.0	0

Note1: Italicized text represent critical intersections.

Note2: Delay values highlighted in Yellow, Orange, and Red indicate LOS C or better, LOS D, LOS ,E and LOS F, respectively. All other values indicate LOS C or better operation.

Table 4.4 – Comparison of PM Peak Hour Intersection Results – No-Build (Scenario B and Scenario C) Vs. Scenario A

Int. No	Intersection	Overall Delay	Eastbound					Westbound					Northbound					Southbound				
			L	T	R	Approach	Approach Max Q	L	T	R	Approach	Approach Max Q	L	T	R	Approach	Approach Max Q	L	T	R	Approach	Approach Max Q
			Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet	Delay (Secs/Veh)				Feet
No-Build																						
1	*Van Dorn St at Eisenhower Ave*	*116.8*	*186.1*	*187.7*	*134.8*	*153.6*	*390*	*72.3*	*67.3*	*42.4*	*50.4*	*696*	*279.6*	*284.2*	*279.9*	*283.5*	*1955*	*59.4*	*15.3*	*4.4*	*23.9*	*320*
2	Van Dorn St at Metro Rd	3.3	-	-	0.0	0.0	0	-	-	-	-	0	-	2.2	0.9	2.2	0	-	4.4	0.0	4.4	286
3	*Van Dorn St at Courtney Ave*	*7.2*	*0.0*	*0.0*	*0.0*	*0.0*	*0*	*77.1*	*0.0*	*54.1*	*73.8*	*119*	*0.0*	*9.4*	*7.9*	*9.4*	*427*	*39.5*	*3.9*	*0.0*	*3.9*	*208*
4	*Van Dorn St at S Pickett St*	*31.1*	*76.1*	*77.4*	*48.1*	*56.8*	*398*	*87.7*	*41.3*	*44.5*	*76.6*	*507*	*61.9*	*17.5*	*12.6*	*18.3*	*421*	*56.8*	*22.7*	*20.2*	*24.4*	*353*
5	*Van Dorn St at Edsall Rd*	*155.4*	*419.9*	*316.1*	*75.0*	*213.7*	*1283*	*80.3*	*135.2*	*92.9*	*108.6*	*1034*	*149.8*	*51.3*	*49.2*	*78.4*	*945*	*239.1*	*244.0*	*242.4*	*243.2*	*1260*
6	S Pickett St at Edsall Rd	107.4	53.8	33.5	26.1	40.2	347	91.0	86.9	80.0	87.7	764	40.3	17.0	10.7	19.0	194	72.7	253.2	229.9	236.8	1407
7	Metro Rd at Summer Grove	7.4	0.0	0.0	4.2	4.2	33	44.5	0.0	5.5	34.1	96	3.3	1.2	0.7	1.5	30	4.3	1.9	0.8	2.2	83
8	*Metro Rd at Eisenhower Ave*	*13.7*	*14.4*	*7.8*	*0.0*	*7.9*	*172*	*0.0*	*14.8*	*1.0*	*14.2*	*300*	*0.0*	*0.0*	*0.0*	*0.0*	*0*	*28.4*	*0.0*	*11.9*	*25.9*	*213*
9	Eisenhower Ave at UPS	7.6	0.0	6.7	6.1	6.7	198	16.6	5.0	0.0	8.1	197	18.0	2.1	6.6	7.2	178	0.0	0.0	5.0	5.0	28
10	Eisenhower Ave at Eisenhower Ave Conn.	129.7	0.0	15.5	12.4	14.9	285	85.5	6.6	2.2	46.6	369	625.6	161.8	127.1	402.4	1466	0.0	31.6	7.2	20.5	46
11	Farrington Ave at Outlet	1.6	0.0	0.2	0.0	0.2	0	0.0	0.2	0.1	0.2	0	0.0	0.0	0.0	0.0	0	4.9	0.0	0.0	4.9	59
12	S Pickett St at Shillings St	3.0	4.7	1.1	0.0	1.2	113	0.0	4.4	5.0	4.4	217	0.0	0.0	0.0	0.0	0	0.0	0.0	6.1	6.1	68
13	Farrington Ave at Outlet	3.2	9.7	1.1	0.0	5.5	208	0.0	2.3	0.0	2.3	29	0.0	0.0	0.0	0.0	0	0.0	0.0	0.4	0.4	0
Build Scenario A																						
1	*Van Dorn St at Eisenhower Ave*	*143.2*	*176.5*	*161.2*	*133.0*	*144.0*	*440*	*130.4*	*112.2*	*51.9*	*86.6*	*616*	*296.6*	*256.6*	*247.9*	*260.9*	*1945*	*90.0*	*47.6*	*16.7*	*49.5*	*335*
2	Van Dorn St at Metro Rd	19.2	-	-	0.0	0.0	0	-	-	-	-	0	-	2.1	0.9	2.1	0	-	37.2	0.0	37.2	364
3	*Van Dorn St at Courtney Ave*	*8.3*	*0.0*	*0.0*	*0.0*	*0.0*	*0*	*152.2*	*0.0*	*125.9*	*147.8*	*174*	*0.0*	*4.3*	*4.5*	*4.3*	*128*	*29.5*	*9.1*	*0.0*	*9.1*	*323*
4	*Van Dorn St at S Pickett St*	*37.1*	*62.1*	*74.0*	*36.9*	*53.0*	*368*	*80.5*	*38.9*	*42.8*	*63.8*	*473*	*48.5*	*21.5*	*15.7*	*20.6*	*414*	*73.1*	*34.9*	*37.4*	*39.8*	*519*
5	*Van Dorn St at Edsall Rd*	*110.1*	*141.8*	*78.0*	*26.9*	*69.1*	*394*	*66.7*	*92.7*	*52.1*	*72.8*	*837*	*84.1*	*45.8*	*44.5*	*54.1*	*576*	*227.3*	*200.3*	*198.5*	*204.0*	*1261*
6	S Pickett St at Edsall Rd	109.7	67.1	34.0	28.0	46.1	429	121.4	110.1	102.9	113.4	787	39.7	15.4	11.7	17.7	199	78.0	250.7	228.7	235.0	1403
7	Metro Rd at Summer Grove	7.3	0.0	0.0	5.1	5.1	32	44.0	0.0	6.0	32.8	87	4.8	1.8	1.3	2.2	31	3.7	1.7	0.6	1.9	69
8	*Metro Rd at Eisenhower Ave*	*10.6*	*10.1*	*3.3*	*0.0*	*3.7*	*71*	*0.0*	*8.1*	*0.3*	*7.6*	*193*	*0.0*	*0.0*	*0.0*	*0.0*	*0*	*31.2*	*0.0*	*7.6*	*27.2*	*219*
9	Eisenhower Ave at UPS	7.8	0.0	6.2	5.6	6.2	192	21.2	7.8	0.0	8.8	269	23.9	2.4	10.0	9.8	206	0.0	0.0	9.2	9.2	30
10	Eisenhower Ave at Eisenhower Ave Conn.	131.3	35.3	18.0	16.8	17.8	308	80.4	7.0	2.8	43.2	317	653.0	195.2	159.2	467.5	1465	28.3	34.2	6.8	25.0	49
11	Farrington Ave at Outlet	23.7	11.0	15.2	0.0	14.7	119	0.0	1.5	1.5	1.5	10	0.0	0.0	0.0	0.0	0	55.0	0.0	44.3	54.6	259
12	S Pickett St at Shillings St	2.8	7.7	3.5	0.0	3.6	260	0.0	1.1	0.7	1.1	58	0.0	0.0	0.0	0.0	0	0.0	0.0	5.7	5.7	66
13	Eisenhower Ave at Straight Junc.	2.5	6.4	0.8	0.0	3.7	113	0.0	2.0	0.0	2.0	21	0.0	0.0	0.0	0.0	0	0.0	1.8	1.1	1.1	0
14	Eisenhower Ave at Multimodal Bridge	23.1	0.0	0.0	0.0	0.0	0	21.3	0.0	18.6	19.4	292	0.0	7.5	8.4	8.3	123	32.1	33.6	0.0	32.2	521
15	Multimodal Brdg at S Pickett St	13.6	0.0	15.6	3.6	10.3	164	18.6	4.1	0.0	10.1	205	36.5	0.5	12.6	23.7	257	0.0	0.0	0.0	0.0	0

Note1: Italicized text represent critical intersections.

Note2: Delay values highlighted in Yellow, Orange, and Red indicate LOS C or better, LOS D, LOS ,E and LOS F, respectively. All other values indicate LOS C or better operation.

Table 4.5 – Comparison of PM Peak Hour Intersection Results – No-Build (Scenario B and Scenario C) Vs. Scenario A

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		Volume Output	HCM Delay[1]	Max Q (Feet)	Volume Output	HCM Delay[1]	95th Q[2] (Feet)
2045 No-Build (Scenario B and Scenario C)							
S Van Dorn St at Eisenhower Ave	*EB*	253	191.2	430	172	153.6	390
	WB	893	75.0	716	1000	50.4	696
	NB	1696	235.5	1957	1445	283.5	1955
	SB	1758	37.0	330	1947	23.9	320
	Overall	4600	126.0	0	4564	116.8	0
2045 No-Build (Scenario B and Scenario C) - Extended EB Storage Length							
S Van Dorn St at Eisenhower Ave	*EB*	283	53.6	255	170	60.6	170
	WB	893	66.1	648	983	49.7	671
	NB	1715	230.7	1957	1430	288.2	1956
	SB	1773	37.8	322	1943	25.0	323
	Overall	4664	115.1	0	4526	114.8	0

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		Volume Output	HCM Delay[1]	Max Q (Feet)	Volume Output	HCM Delay[1]	95th Q[2] (Feet)
2045 Build Scenario A							
S Van Dorn St at Eisenhower Ave	*EB*	358	124.4	440	374	144.0	440
	WB	520	61.7	310	593	86.6	616
	NB	1590	264.4	1955	1552	260.9	1945
	SB	1419	43.8	327	1595	49.5	335
	Overall	3887	143.9	0	4114	143.2	0
2045 Build Scenario A - Extended EB Storage Length							
S Van Dorn St at Eisenhower Ave	*EB*	375	46.4	335	435	51.0	397
	WB	519	62.9	276	596	70.2	654
	NB	1664	249.6	1959	1601	247.4	1954
	SB	1437	40.0	329	1662	43.9	333
	Overall	3995	130.9	0	4294	124.1	0

1. HCM 6th Delay represents Average Control Delay from *Synchro.* **Delay values highlighted in Green, Yellow, Orange, and Red indicated LOS A-C, D, E, and F, respectively.**
2. Max Q represents the maximum simulated queue in feet from *SimTraffic.*

Figure 4.4 – Graphical Comparison of Delays

5 BENEFIT-COST RANKING OF SCENARIOS

A benefit-cost ranking was performed to compare the benefits of the evaluated scenarios. The methodology used to estimate evaluated alternatives' scores included quantitative and qualitative measures of effectiveness. The following text presents the preliminary cost estimates for each scenario, followed by the methodology used to rank them.

5.1 Preliminary Cost Estimates

5.1.1 No-Build Scenario

The future year No-Build scenario was used as the baseline for cost estimates. The background improvements, including BRT and the straightening of Eisenhower Avenue projects, are independent of the EWTAA study and do not incur additional costs.

5.1.2 Build Scenario A

Build Scenario A proposes Multimodal Bridge and Farrington Connector across the N.S. Railroad track to provide additional connections between Eisenhower Avenue and South Pickett Street. As part of the 2018 Technical Memo, a draft opinion of the probable cost (OPC) was developed for the Multimodal Bridge based on the preliminary concept design and is included in **Appendix I.** The Multimodal Bridge is expected to cost approximately $151-million, including $76-million for construction costs.

No cost estimate was developed for the Farrington Connector as part of the 2018 Technical Memo. However, a preliminary estimate was developed based on approximate quantities from concept plans and line item costs from the adjacent Multimodal Bridge OPC. The Farrington Connector is estimated to cost approximately $43-million, and the corresponding cost-estimate worksheet is included in Appendix I.

5.1.3 Build Scenario B

Build Scenario B proposes pedestrian and bicycle facility improvements on the Van Dorn Street bridge, as shown in Figure 4.1. A preliminary construction feasibility evaluation of the bridge structure indicated any potential improvements would require bridge widening and can be efficiently achieved through rehabilitation. Given the typical bridge design life of 50-years and general condition and load rating being more than fair, the proposed improvements would not require a bridge replacement. The rehabilitation is expected to increase bridge service life up to an additional 50-year period. The expected cost for Van Dorn Street bridge improvements is approximately $14-million, and the corresponding cost-estimate worksheet is included in Appendix I.

5.1.4 Build Scenario C

The cost estimate for the Modified Multimodal Bridge was developed utilizing the OPC for Multimodal Bridge. As noted in Section 4.1, the Modified Multimodal Bridge stems from Multimodal Bridge without vehicular access. The development of detailed cost estimates for the Multimodal Bridge is excluded from EWTAA's study scope. However, for preliminary cost estimation purposes, a cost estimate was developed by utilizing the Multimodal Bridge draft OPC as a basis and modified to remove construction items related to vehicular travel. The expected cost for Modified Multimodal Bridge with pedestrian and bicycle facilities is approximately $73-million, and the corresponding worksheet is included in Appendix I. In total, Build Scenario C, including Van Dorn Street bridge improvements, is estimated to cost approximately $87-million.

5.2 Ranking Methodology

A benefit-cost ranking methodology was performed to evaluate build scenarios and was primarily developed relying on quantitative and qualitative effectiveness measures (MOEs). The No-Build scenario was used as the baseline for all MOEs, and relative scores were assigned to each alternative depending on the absolute MOE value. As noted earlier, Synchro/SimTraffic suite limits the MOEs to the vehicular mode of transport and excludes BRT, Pedestrian, and Bicycle. Therefore, qualitative MOEs were considered in ranking the scenarios in coordination with the City. Similar to operational analyses, Build Scenario B, and Build Scenario C are assumed to have identical performance as the No-Build scenario. The following text summarizes the MOEs, and **Table 5.1** presents the benefit-cost ranking criteria for each of the evaluated scenarios.

- **Vehicular Travel Time** – The AM and PM peak hour cumulative corridor travel time along both directions of Van Dorn Street was used as a metric in determining corridor operational performance. The assigned scores ranged from -5 to +5 depending on the relative percent increase in vehicular travel time over the No-Build conditions.
- **Pedestrian Comfort/Safety** – This MOE is a qualitative metric ranked based on the availability of pedestrian facilities between Eisenhower Avenue and South Pickett Street. The assigned scores vary from 1 (No dedicated pedestrian facility) to 5 (dedicated sidewalk along both directions), depending on the improvement proposed under each scenario.
- **Pedestrian Travel Time** – The pedestrian travel time is based on an average walking speed of 3.5-feet/second between Van Dorn Metro Station to South Pickett Street was used to evaluate pedestrian operational performance. The assigned scores ranged from -5 to +5 depending on the relative percent increase in pedestrian travel time over the No-Build conditions.
- **Bicycle Comfort/ Safety** – Similar to pedestrian MOE, this is a qualitative metric ranked for bicycles based on the availability of facilities between Eisenhower Avenue and South Pickett Street. The assigned scores vary from 1 (Not a bike route) to 5 (dedicated bicycle lane or cycle track) depending on the improvement proposed under each scenario.
- **Bicycle Travel Time** – The bicycle time is based on an average cycling speed of 13-MPH between Van Dorn Metro Station to South Pickett Street was used to evaluate bicycle performance. The assigned scores ranged from -5 to +5 depending on the relative percent increase in bicycle travel time over the No-Build conditions.
- **Vehicular Network Performance** – The AM and PM peak hour cumulative average network delay in seconds per vehicle was used to determine the overall network performance. The assigned scores ranged from -5 to +5 depending on the relative percent increase in network delay over the No-Build conditions.
- **Estimated Cost** – The construction cost for each scenario is a critical ranking parameter and most likely a notable reason for conducting the EWTAA study. The Multimodal Bridge and Farrington Connector were estimated to cost approximately $151-million and $43-million, respectively. Considering a high construction cost relative to Van Dorn Street Bridge improvements, the City initiated this study to evaluate cost-effective improvement. The assigned scores ranged from -1 to -5 depending on the relative $25-million increments in construction cost.

Overall, the benefit-cost ranking analysis resulted in the highest score of ten (10) for Build Scenario C and the second highest score of eight (8) for Build Scenario B.

Table 5.1 – Benefit-Cost Ranking Criteria

		Score	5	6	8	10
Measures of Effectiveness (MOE)	**Criteria**	**Score**	**No-Build**	**Scenario A**	**Scenario B**	**Scenario C**
Vehicular Travel Time	10%-20% Decrease	1	0	-2	0	0
	20%-30% Decrease	2				
	30%-40% Decrease	3				
	40%-50% Decrease	4				
	Above 50% Decrease	5				
	No Change	0				
	10%-20% Increase	-1				
	20%-30% Increase	-2				
	30%-40% Increase	-3				
	40%-50% Increase	-4				
	Above 50% Increase	-5				
Pedestrian Comfort/Safety	No Facility	1	3	5	4	5
	Multiuse Path One Direction	2				
	Dedicated Sidewalk One Direction	3				
	Multiuse Path Both Directions	4				
	Dedicated Sidewalk Both Directions	5				
Pedestrian Travel Time (Baseline Existing Conditions; Metro to Van Dorn St @ S Pickett St)	10%-20% Decrease	1	0	1	0	1
	20%-30% Decrease	2				
	30%-40% Decrease	3				
	40%-50% Decrease	4				
	Above 50% Decrease	5				
	No Change	0				
	10%-20% Increase	-1				
	20%-30% Increase	-2				
	30%-40% Increase	-3				
	40%-50% Increase	-4				
	Above 50% Increase	-5				
Bicycle Comfort/Safety	Not a bike route	1	2	5	4	5
	Shared Lane w Traffic - No Signage	2				
	Designated Shared Lane	3				
	Multiuse Path	4				
	Dedicated Bike Lanes or Cycle Track	5				
Bike Travel Time (Baseline Existing Conditions @ 13MPH)	10%-20% Decrease	1	0	3	1	3
	20%-30% Decrease	2				
	30%-40% Decrease	3				
	40%-50% Decrease	4				
	Above 50% Decrease	5				
	No Change	0				
	10%-20% Increase	-1				
	20%-30% Increase	-2				
	30%-40% Increase	-3				
	40%-50% Increase	-4				
	Above 50% Increase	-5				
Vehicular Network Performance	Up to 10% Decrease	1	0	-1	0	0
	10%-15% Decrease	2				
	15%-20% Decrease	3				
	20%-25% Decrease	4				
	Above 25% Decrease	5				
	No Change	0				
	Up to 10% increase	-1				
	10%-15% increase	-2				
	15%-20% increase	-3				
	20%-25% increase	-4				
	Above 25% increase	-5				
Construction Cost Estimate (Baseline No-Build)	No Change	0	0	-5	-1	-4
	Up to $25m	-1				
	Up to $50m	-2				
	Up to $75m	-3				
	Up to $100m	-4				
	Up to $125m and Over	-5				

6 CONCLUSIONS

The City of Alexandria ("City") initiated Eisenhower West Transportation Alternatives Analysis (EWTAA) Study as an update to the 2015 Eisenhower West Transportation Study (EWTS). The goals of the EWTAA study are to reevaluate the need for Multimodal Bridge and Farrington Connectors, develop a concept design for an improved Van Dorn Street bridge, and perform a cost-benefit analysis to assess the need. A review of past studies in the Eisenhower West region was conducted to understand regional goals and background projects in the study area. The background projects include the straightening of Eisenhower Avenue and Bus Rapid Transit (BRT) along Van Dorn Street.

The Existing conditions Synchro/SimTraffic model was calibrated to field conditions, primarily using travel times and volume throughput as critical Measures of Effectiveness (MOEs). The Existing condition operational analysis revealed peak hour congestion at the Van Dorn Street and Eisenhower Avenue intersection, most likely a result of inadequate lane capacity. During the AM peak hour, the northbound Van Dorn Street queueing extends into Fairfax County. During the PM peak hour, southbound Van Dorn Street left-turn movement at the Eisenhower Avenue intersection queues extends to the Van Dorn Street bridge. Overall, at least one minor street movement at each of the Van Dorn Street intersections currently operates at LOS E or worse.

In addition to the No-Build scenario, three (3) build scenarios were evaluated in this study in coordination with the City and are summarized below.

- Build Scenario A - This scenario considers Multimodal Bridge and Farrington Connector connections between Eisenhower Avenue and South Pickett Street. Both connections would have dedicated pedestrian and bicycle facilities. The Multimodal Bridge would also have a dedicated transit lane along each direction of the bridge. No improvements to the Van Dorn Street bridge are proposed under Build Scenario A.
- Build Scenario B - This scenario proposes to improve pedestrian and bicycle facilities on the existing Van Dorn Street bridge. The vehicular lane capacity along Van Dorn Street would remain unchanged.
- Build Scenario C - This scenario proposes to retain improvements to the Van Dorn Bridge under Build Scenario B, and additionally recommends modifying and narrowing the proposed Multimodal Bridge to a pedestrian and bicycle-only facility.

Overall, Traffic forecasts for the study area were developed for the most recent horizon year 2045 of the Metropolitan Washington Council of Governments (MWCOG). As the vehicular connections between Eisenhower Avenue and South Pickett Street are identical between No-Build, Scenario B, and Scenario C, an identical set of volumes was used for analyzing these scenarios. Additionally, the MWCOG model was modified to include Multimodal Bridge and Farrington Connectors and extract outputs for Scenario B.

The future condition operational analyses revealed increased congestion along Van Dorn Street, notably in the northbound direction. Compared to the Existing conditions, the northbound Van Dorn Street No-Build travel times are expected to increase by at least 85% during each peak hour. The future year Build Scenario A travel times for southbound Van Dorn Street are expected to be at least 85% higher than the No-Build conditions.

The future year intersection operations are summarized below:

- The Van Dorn Street at Eisenhower Avenue intersection is expected to operate at LOS F in the peak hours in future years, with anticipated northbound exceeding 1,900-feet upstream of Eisenhower Avenue and into Fairfax County in the PM peak hour. Between No-Build and Build Scenario A, operations are expected to be worse for the latter scenario with the addition of the two proposed bridges due to additional traffic from the Farrington Connector.
- The northbound Van Dorn Street approach at Eisenhower Avenue and southbound approach at Edsall Road would be heavily congested with vehicular delays of over 100-seconds per vehicle in the future years. It is noted that all of the evaluated scenarios are expected to have intersections that operate at a LOS F during peak hours with projected traffic growth. This indicates a need for intersection improvement at Van Dorn Street intersections with Edsall Road and Eisenhower Avenue, and a need to continue to encourage alternative modes to increase mode split and decrease the growth of vehicular traffic.
- Aside from the Eisenhower Avenue intersection, Multimodal Bridge under Scenario A indicated improved minor street operations at Edsall Road, South Pickett Street, and Eisenhower Avenue (westbound only).
- The supplementary analysis results indicate that extending the eastbound approach storage length at the Van Dorn Street and Eisenhower Avenue intersection would significantly improve the approach delay from LOS F to LOS D.

The preliminary cost estimates developed for each of the scenarios, using No-Build conditions as a baseline, are presented below:

- Build Scenario A - $194-millon, estimated for both Multimodal Bridge and Farrington Connector,
- Build Scenario B - $14-million, estimated for rehabilitation and widening of the existing bridge,
- Build Scenario C - $87-million, including $73-million for the Modified Multimodal Bridge.

A benefit-cost ranking was performed to compare the benefits of evaluated scenarios using qualitative and quantitative MOEs. Overall, the benefit-cost ranking analysis resulted in highest score of ten (10) for Build Scenario C and the second highest score of eight (8) for Build Scenario B. The MOEs considered in the ranking methodology include:

- Vehicular Travel Time – Van Dorn Street cumulative travel time
- Pedestrian Comfort/Safety – from Van Dorn Metro Station to South Pickett Street
- Pedestrian Travel Time – from Van Dorn Metro Station to South Pickett Street
- Bicycle Comfort/ Safety – from Van Dorn Metro Station to South Pickett Street
- Bicycle Travel Time – from Van Dorn Metro Station to South Pickett Street
- Vehicular Network Performance – Average network delay in seconds per vehicle
- Estimated Cost – Total construction costs for each of the evaluated scenarios.

In conclusion, the EWTAA study:

- Evaluated the need for Multimodal Bridge and Farrington Connectors. The operational analyses concluded Multimodal Bridge would improve minor street (westbound approaches) operations at the Van Dorn Street intersections. The Farrington Connector would attract additional traffic to the Van Dorn Street and Eisenhower Avenue intersection, leading to LOS F threshold operations at the intersection. However, it is critical to note the LOS F threshold functional similarities between Scenario A and No-Build conditions (also Build Scenario B and Build Scenario C).
- Developed a concept for Van Dorn Street bridge improvements, including pedestrian and bicycle-friendly facilities. A 16-foot shared-use path along the northbound and 5-foot sidewalk along the

southbound direction of Van Dorn Street would significantly enhance non-vehicular mobility to and from the Van Dorn Street Metro Station.

- Performed planning level preliminary benefit-cost analysis for evaluated alternatives.

Based on the analysis findings, Build Scenario B is recommended considering the operational and cost benefits. This study also recommends future study to advance the feasibility of the Modified Multimodal Bridge (Build Scenario C) to improve non-vehicular mobility considering the future mixed-use development and land use changes surrounding the Van Dorn Street Metro Station.