DEPARTMENT OF ENVIRONMENTAL SERVICES

Nelly Custis Drive (Lorcom Lane to Military Road) & Military Road (North Old Glebe Road to Langston Boulevard) Speed Limit Study

Prepared for:

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I. Executive Summary

This technical report presents the findings of a traffic engineering investigation of the speed limit along Nelly Custis Drive (from Lorcom Lane to Military Road) and for Military Road (from North Old Glebe Road to Langston Boulevard) in Arlington County, Virginia. The Nelly Custis Drive and Military Road corridors are under the jurisdiction of Arlington County within the abovementioned limits, in which both facilities are classified as a Minor Arterial. These roadways were evaluated concurrently since Nelly Custis Drive and Military Road form a continuous facility within the study limits. The existing posted speed limit is 30 miles per hour (mph) on both roadways as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code.

In order to establish a new speed limit along Nelly Custis Drive/Military Road, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

RK&K was tasked by Arlington County to conduct a traffic engineering investigation of the speed limit of the Nelly Custis Drive/ Military Road corridor based on guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998). Several factors were considered for analysis, including speed statistics, crash history, pedestrian activity, and roadway characteristics.

The speed data analysis does not support lowering the speed limit for the entire corridor. However, for Military Road between Nelly Custis Drive and Langston Boulevard, the comparatively low speeds (median speed of 28 mph), collision history (2 pedestrian-related crashes within this segment during the analysis period from 2016 through 2021), pedestrian and bicycle activity (199 pedestrians crossed the corridor at the intersection of Vacation Lane during the 12-hour count period), land use, and roadway characteristics support lowering the speed limit for this segment of the corridor. Therefore, in aggregate, it is recommended to maintain the existing 30 mph speed limit on Military Road for the section north of Nelly Custis Drive as well as the entire study section of Nelly Custis Drive, and to establish a new speed limit of 25 mph on Military Road between Nelly Custis Drive and Langston Boulevard.

II. Introduction

Nelly Custis Drive (from Lorcom Lane to Military Road) and Military Road (from North Old Glebe Road to Langston Boulevard) in Arlington County are classified as Minor Arterials. The corridor's typical cross section from north to south is as follows:

Military Road:

- Two-lane undivided, with bike lanes on both sides from North Old Glebe Road to North Glebe Road ramp terminal intersection
- Two-lane undivided, with on-street parking and bike lanes on both sides from North Glebe Road ramp terminal intersection to 31st Street North
- Two-lane undivided, with on-street parking on both sides, a northbound bike lane, and southbound shared lane markings from 31st Street North to 30th Street North
- Two-lane undivided, with on-street parking and bike lanes on both sides from 30th Street North to Nelly Custis Drive
- Two-lane undivided, with on-street parking on both sides from Nelly Custis Drive to Lorcom Lane
- Two-lane undivided, with on-street parking on both sides and a northbound bike lane from Lorcom Lane to Vacation Lane
- Two-lane undivided, with on-street parking on both sides, a southbound bike lane, and northbound shared lane markings from Vacation Lane to Langston Boulevard

Nelly Custis Drive:

- Two-lane divided, with on-street parking and buffered bike lanes on both sides from Lorcom Lane to Military Road

On-street parking, bike lanes, and ART bus transit stops exist throughout most of the study corridor. Land use primarily consists of low-density residential use, though service-commercial development exists towards the southern study limits near the intersection of Military Road and Langston Boulevard. Public areas (such as Gulf Branch Nature Center, Zachary Taylor Park, and Marcey Park) as well as a semi-public facility (Washington Golf & Country Club) also exist along the study corridor. Taylor Elementary School and Dorothy Hamm Elementary School are both located within 1,000 feet of Military Road within the study limits.

The existing posted speed limit is 30 miles per hour (mph) throughout the study corridor, as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code. North of Nelly Custis Drive on Military Road, the posted 30 mph speed limit signs are supplemented with 'Speeding Additional $200 Fine' plaques, and there are Speed Feedback Indicator Signs (SFIS) in both directions approaching 30th Street North. Also on Military Road, there are 20 mph School Speed Limits (When Flashing) in effect through the school zones at Dorothy Hamm Middle School and Taylor Elementary School. Approaching the three-leg, single-lane roundabout at the intersection of Military Road and Nelly Custis Drive, there are posted Circular Intersection warning signs (W2-6) with 15 mph advisory speed plaques (W13-1P) on all three approaches. **Figure 1** shows the study corridor, its functional classification, and the estimated 2019 AADTs per segment.

In accordance with the Adopted Streets element of the Arlington Master Transportation Plan, the existing speed limit along Nelly Custis Drive (from Lorcom Lane to Military Road) and Military Road (from North Old Glebe Road to Langston Boulevard) in Arlington County is being reviewed. To do so, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

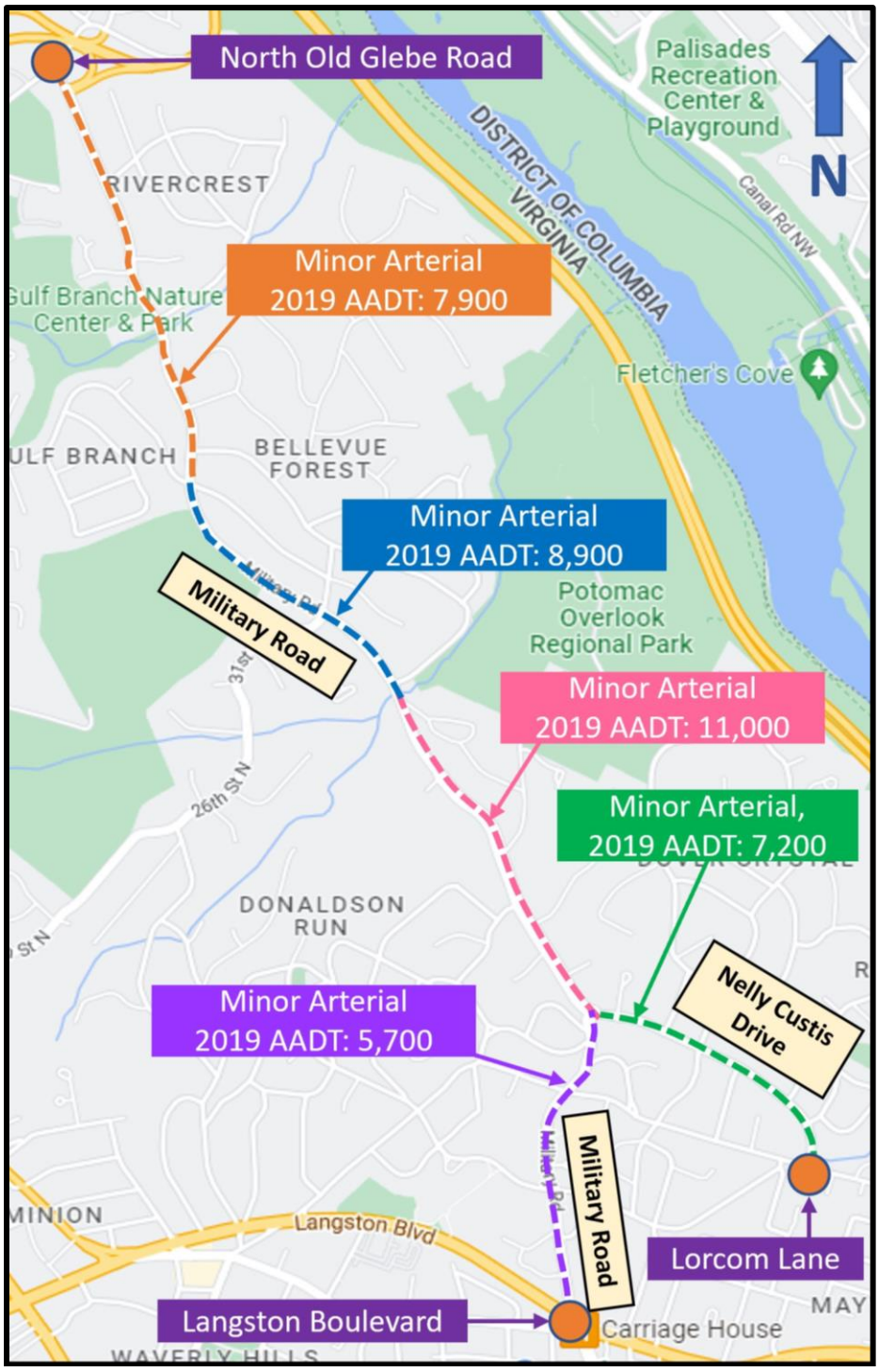

Figure 1 – Map of Nelly Custis Drive (Lorcom Lane to Military Road) and Military Road (North Old Glebe Road to Langston Boulevard)

AADT Source: [Traffic Data - Info | Virginia Department of Transportation (virginiadot.org)]

III. Analysis

RK&K was tasked by Arlington County to conduct a traffic engineering investigation of the speed limit along the Nelly Custis Drive and Military Road corridors. Guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998) provided the basis for the investigation. From these publications, the following factors were considered for analysis:

- 85th Percentile Speed
- Median (50th Percentile) Speed
- Pace Speed
- Crash History during Analysis Period
- Pedestrian and Bicycle Activity
- Parking Activity
- Roadside Development and Environment
- Roadway Characteristics

a. Speed Statistics

Section 2B.13 of the MUTCD provides guidance that a posted speed limit should be within 5 mph of the 85th-percentile speed of free-flowing traffic and includes an option that pace speed be considered as another factor.

The 85th-percentile speed is the speed at or below which 85% of counted vehicles are observed to travel under free-flowing conditions. The median speed is the speed at or below which 50% of counted vehicles are observed to travel under free-flow conditions. The pace speed is the 10-mph range in which the highest number of vehicles counted were traveling. To analyze the speed statistics of the corridor, speed data were collected at the following six mid-block locations on April 25th and 26th, 2023:

Collected on Military Road:
- Between North Old Glebe Road and 38th Street North
- Between North Pollard Street and North Quincy Street
- Between 31st Street North and 30th Street North
- Between Intersections with 25th Place North (N/S Legs)
- Between Vacation Lane and 22nd Street North

Collected on Nelly Custis Drive:
- Between North Quebec Street and North Quincy Street

The speed data collection points are presented in **Figure 2,** while the raw speed data are presented in Appendix 1. **Table 1** presents the 85th percentile, median, 10-mph pace speed, and percent in pace for Nelly Custis Drive/Military Road by segments of data collection.

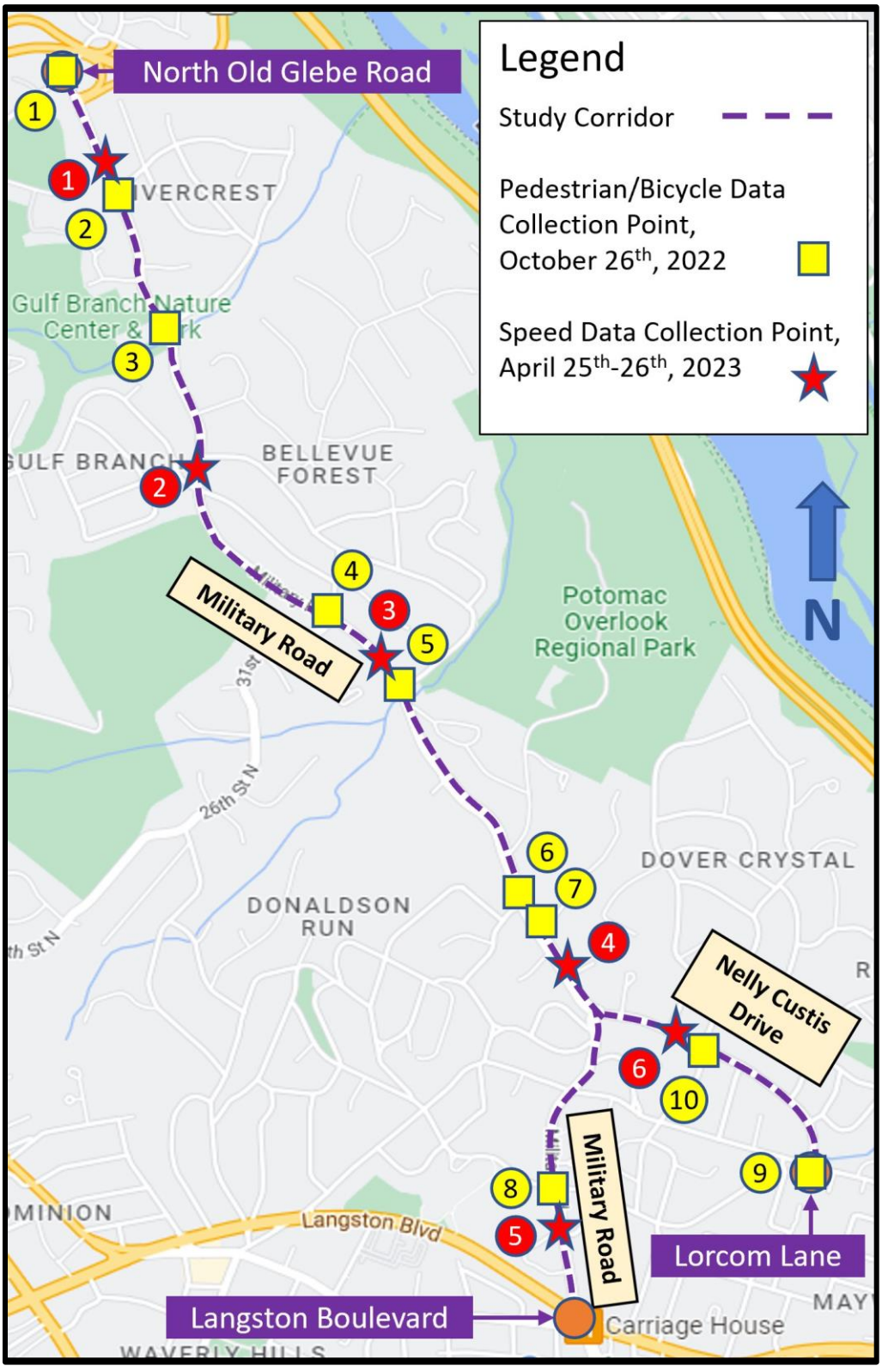

Figure 2 – Speed and Pedestrian/Bicycle Data Collection Points

Table 1 – Nelly Custis Drive/Military Road Speed Data

Speed Zone	85th-Percentile Speed	Median Speed	10-mph Pace Speed	Percent in Pace
Military Road				
Between North Old Glebe Road and 38th Street North	38 mph	33 mph	29-39 mph	68.0%
Between North Pollard Street and North Quincy Street	37 mph	33 mph	28-38 mph	74.0%
Between 31st Street North and 30th Street North	37 mph	32 mph	28-38 mph	72.8%
Between Intersections with 25th Place North	37 mph	33 mph	29-39 mph	79.3%
Between Vacation Lane and 22nd Street North	34 mph	28 mph	24-34 mph	60.0%
Nelly Custis Drive				
Between North Quebec Street and North Quincy Street	35 mph	30 mph	26-36 mph	68.2%

The speed data for the section of Military Road between North Old Glebe Road and 38th Street North shows an 85th-percentile speed of 38 mph, a median speed of 33 mph, and a 10-mph pace speed of 29-39 mph with 68.0% of vehicles in pace.

Between North Pollard Street and North Quincy Street, the collected data shows an 85th-percentile speed of 37 mph, a median speed of 33 mph, and a 10-mph pace speed of 28-38 mph with 74.0% of vehicles in pace.

Between 31st Street North and 30th Street North, the collected data shows an 85th-percentile speed of 37 mph, a median speed of 32 mph, and a 10-mph pace speed of 28-38 mph with 72.8% of vehicles in pace.

Between the Military Road intersections with 25th Place North (offset T-intersections), the collected data shows an 85th-percentile speed of 37 mph, a median speed of 33 mph, and a 10-mph pace speed of 29-39 mph with 79.3% of vehicles in pace.

For the final location on Military Road, between Vacation Lane and 22nd Street North, the collected data shows an 85th-percentile speed of 34 mph, a median speed of 28 mph, and a 10-mph pace speed of 24-34 mph with 60.0% of vehicles in pace.

On Nelly Custis Drive, between North Quebec Street and North Quincy Street, the collected data shows an 85th-percentile speed of 35 mph, a median speed of 30 mph, and a 10-mph pace speed of 26-36 mph with 68.2% of vehicles in pace.

Overall, the collected speed data demonstrates that motorists are comfortable driving at or above the existing posted speed limit of 30 mph for most of the study corridor. However,

noticeably lower speeds were observed on Military Road between Vacation Lane and 22nd Street North, where the median speed was 28 mph during the collection period (whereas the median speed ranged from 32-33 mph at the other four locations on Military Road, and the median speed on Nelly Custis Drive was 30 mph). A reduction of the posted speed limit could therefore be considered through this segment on Military Road.

b. Collision History

Section 2B.13 of the MUTCD provides optional guidance relative to reported crash trends for at least a 12-month period. This MUTCD section suggests that reported crash experience for at least 12 months be considered as a factor when establishing a speed limit. To analyze crash experience, a crash history of the Nelly Custis Drive/Military Road corridors compiled for the six-year period spanning from January 1st, 2016 through December 31st, 2021. Generally, crash rates are determined by a calculation involving annual average daily traffic (AADT) volumes, corridor length, and total number of crashes within the study period. The AADT is the total volume of vehicles traveling along a roadway for a year divided by 365 days. The number of million vehicle-miles traveled was produced by multiplying the AADT by the corridor length. Crash rates (R) were then calculated using the following formula:

R= (1,000,000 * C) / (365* AADT * L * N)

Where:

R = Crash rate for the road segment expressed as crashes per million vehicle-miles of travel (VMT)

C = Total number of crashes in the study period.

N = Number of years of data.

AADT = Number of vehicles per day (both directions).

L = Length of the roadway segment in miles.

The number of crashes per million vehicle miles traveled was calculated for each segment based on available crash data.

To determine the relative safety of the Nelly Custis Drive/Military Road corridors, the crash rates were compared with the average crash rates calculated for similar corridors (in terms of roadway classification) within Arlington County as follows:

- Total number of crashes along the corridor including the intersection crashes
- Total number of crashes along the corridor excluding the intersection crashes

These rates have been calculated by Arlington County TE&O and provided to RK&K; the rates for roadways classified as minor arterials are as follows: Inclusive of intersection crashes, the average crash rate for Arlington County (from 2013 through 2018) was calculated to be 4.21 crashes per million vehicle miles traveled. Excluding the intersection crashes, the average crash rate was calculated to be 1.11 crashes per million vehicle miles traveled.

While research links vehicular speeds with crashes and crash severity, relationships between speed limit increases/decreases, crash rates, and crash severity are complex. Adding to the complexity are countless other variables including: highway design, vehicle design, speed enforcement, level of urbanization, type of topography (flat, hilly, mountainous), weather

conditions, and characteristics of the driving population. In this study, the "average" crash rate is used to provide some consistency with data collected over a period of time to represent typical roadway conditions with consideration for the complex variables that shape the driving experience.

Table 2 outlines vehicle and pedestrian/bicycle crashes, AADT, and crash rates for each segment of the Military Road and Nelly Custis Drive study corridors. Comparing the calculated crash rates with the average rates in Arlington County is a significant factor for consideration in establishing an appropriate speed limit.

Table 2 - Crash History (01/01/2016 - 12/31/2021)

Segment	No. of Total Crashes	No. of Non-Intersection Crashes	No. of Pedestrian /Bicycle Related Crashes	No. of Severe Injury/ Fatal Crashes	Approx. 2019 AADT	Crashes per Million Vehicle Miles (Total Crashes)	Crashes per Million Vehicle Miles (Non-Intersection Crashes)
Military Road							
North Old Glebe Road to 35th Street North / North Quincy Street	13	5	1 / 0	1 / 0	7,900	0.96	0.37
35th Street North / North Quincy Street to North Beechwood Circle	7	2	0 / 0	0 / 0	8,900	0.75	0.21
North Beechwood Circle to Nelly Custis Drive	10	3	0 / 0	1 / 0	11,000	0.75	0.23
Nelly Custis Drive to Langston Boulevard	14	7	2 / 0	0 / 0	5,700	2.20	1.10
Nelly Custis Drive							
Military Road to Lorcom Lane	8	0	0 / 0	2 / 0	7,200	1.15	0.00

The crash history for the first segment of Military Road (North Old Glebe Road to 35th Street North/North Quincy Street) shows that the total crash rate of 0.96 is below the latest available Arlington County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.37, which is again below the latest available Arlington County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 13 crashes within this segment during the six-year analysis period, 5 of which were non-intersection crashes. There was one pedestrian-related crash within this segment, and speeding was a contributing factor to 2 crashes. There was one severe-injury related crash reported for this segment during the analysis period.

For the second segment of the Military Road corridor (35th Street North/North Quincy Street to North Beechwood Circle), the total crash rate of 0.75 is below the latest available Arlington County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.21, which is again below the latest available Arlington County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 7 crashes within this segment during the six-year analysis period, 2 of which were non-intersection crashes. There were no pedestrian-related crashes within this segment, nor were there any fatal or severe injury-related crashes. Speeding was a contributing factor to 2 crashes reported for this segment during the analysis period.

For the third segment of the Military Road corridor (North Beechwood Circle to Nelly Custis Drive), the total crash rate of 0.75 is below the latest available Arlington County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.23, which is again below the latest available Arlington County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 10 crashes within this segment during the six-year analysis period, 3 of which were non-intersection crashes. There were no pedestrian-related crashes within this segment. Speeding was a contributing factor in 2 crashes. There was one severe injury-related crash reported for this segment during the analysis period.

The fourth and final segment of the Military Road corridor (Nelly Custis Drive to Langston Boulevard) had a total crash rate of 2.20, which is below the latest available Arlington County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 1.10, which is approximately equal to the latest available Arlington County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 14 crashes within this segment during the six-year analysis period, 7 of which were non-intersection crashes. There were 2 pedestrian-related crashes within this segment, while speeding was also a contributing factor in 2 crashes. There were no fatal or severe injury-related crash reported for this segment during the analysis period.

The crash history for the study segment of Nelly Custis Drive from Lorcom Lane to Military Road shows that the total crash rate of 1.15 is below the latest available Arlington County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of zero (i.e. all 8 reported crashes were intersection-related). There were no pedestrian-related crashes within this segment, however there were 2 severe injury-related crashes. Speeding was not a contributing factor in any of the crashes reported for this segment during the analysis period.

In summary, the reported crash rates for all segments analyzed were lower than the Arlington County average crash rates during the analysis period, and there were no fatalities reported within the study corridor. However, when excluding intersection crashes for the segment of Military Road from Nelly Custis Drive to Langston Boulevard, the non-intersection crash rate was approximately equal to the countywide average, and 2 of the 3 pedestrian-related crashes along the study corridor occurred within these limits. Therefore, a reduction of the posted speed limit would be justified for this section based on the crash data.

c. Pedestrian and Bicyclist Activity

Section 2B.13 of the MUTCD provides optional guidance that pedestrian activity be considered as a factor when establishing a speed limit.

Pedestrian and on-street bicycle volumes were collected for 12 hours (7:00 AM to 7:00 PM) at 10 intersections within the study area on October 26th, 2022. These locations include:

- Military Road at North Old Glebe Road
- Military Road at 38th Street North
- Military Road at 36th Road North
- Military Road at 31st Street North
- Military Road at 30th Street North
- Military Road at 26th Road North
- Military Road at 26th Street North
- Military Road at Vacation Lane
- Nelly Custis Drive at Lorcom Lane
- Nelly Custis Drive at North Quincy Street

The raw intersection turning movement counts are included in Appendix 2. These pedestrian and bicycle volumes capture the peak 12 hours of significant activity along each segment which is a reasonable representation of the daily activity on a typical weekday. Volumes for pedestrian and bicycle activity as well as the presence of high-visibility crosswalks are provided in **Table 3**.

Table 3 - Pedestrian and Bicyclist Activity

Intersection	Crosswalk Control/ Warning Signs if Uncontrolled?	Weekday Pedestrian Traffic, Crossing Study Corridor	Weekday Bicycle Traffic, Crossing Study Corridor*	High-Visibility Crosswalks Across Study Corridor?	Weekday Pedestrian Traffic, Total at Intersection	Weekday Bicycle Traffic, Total at Intersection
Military Road						
North Old Glebe Road	Stop-Controlled	83	58	Yes (north leg)	92	82
38th Street North	Uncontrolled/ Warning signs exist; advance warning sign exists (NB); R1-6a signs exist	50	0	Yes (south leg)	58	38
36th Road North	Uncontrolled/ Warning signs exist (in advance and at point of crossing)	88	0	Yes (south leg)	112	36
31st Street North	Uncontrolled/ Warning signs exist; advance warning sign exists (SB)	36	7	Yes (south leg)	107	65
30th Street North	Uncontrolled/ Warning signs exist; advance warning sign exists (NB); R1-6a signs exist	104	4	Yes (south leg)	113	55
26th Road North	Uncontrolled/ Warning signs exist (S1-1); R1-6a signs exist	65	6	Yes (south leg)	155	68
26th Street North	Uncontrolled/ R1-6a signs exist	20	2	Yes (south leg)	91	69
Vacation Lane	Uncontrolled/ Warning signs exist (S1-1; in advance and at point of crossing); R1-6a signs exist	199	13	Yes (both legs)	410	80
Nelly Custis Drive						
Lorcom Lane	Stop-Controlled	16	43	Yes (north leg)	21	51
North Quincy Street	Uncontrolled/ Warning signs exist	63	21	Yes (south leg)	119	55

***This includes side-street bicycle thrus and lefts, and mainline lefts; and bicycles traveling on the crosswalks across the mainline.**

On a typical weekday, the collected data shows that there is significant pedestrian and bicycle activity throughout the Military Road and Nelly Custis Drive study corridors. Contributing to this activity are pedestrian and bicycle generators/attractors such as residential development, public parks such as Zachary Taylor Park and Marcey Park, and schools such as Taylor Elementary School and Dorothy Hamm Elementary School. Bicycle activity consisted mainly of thru traffic on Military Road and Nelly Custis Drive, though significant bicycle crossing volumes were observed at the study terminal intersections at North Old Glebe Road and Lorcom Lane. While pedestrian activity was distributed fairly evenly throughout the study area, there was notably heavier pedestrian activity towards the southern end of the Military Road corridor near Vacation Lane (199 crossing pedestrians and 410 total pedestrians during the 12-hour count period). The collected pedestrian and bicycle data supports a reduction of the posted speed limit, particularly on Military Road south of Nelly Custis Drive.

d. Roadway Characteristics

Section 2B.13 of the MUTCD suggests that roadside development and environment, as well as parking practices, be considered as a factor when establishing a speed limit.

The study area of Nelly Custis Drive/Military Road is a pedestrian and bike-friendly environment with transit commuter bus operations, sidewalks, marked crosswalks, and bicycle lanes throughout most of the corridor. The roadside development detailed below is based on the Arlington County General Land Use Plan (GLUP), the Arlington County Zoning Boundaries, and existing roadside development (see **Figure 3A** and **3B**).

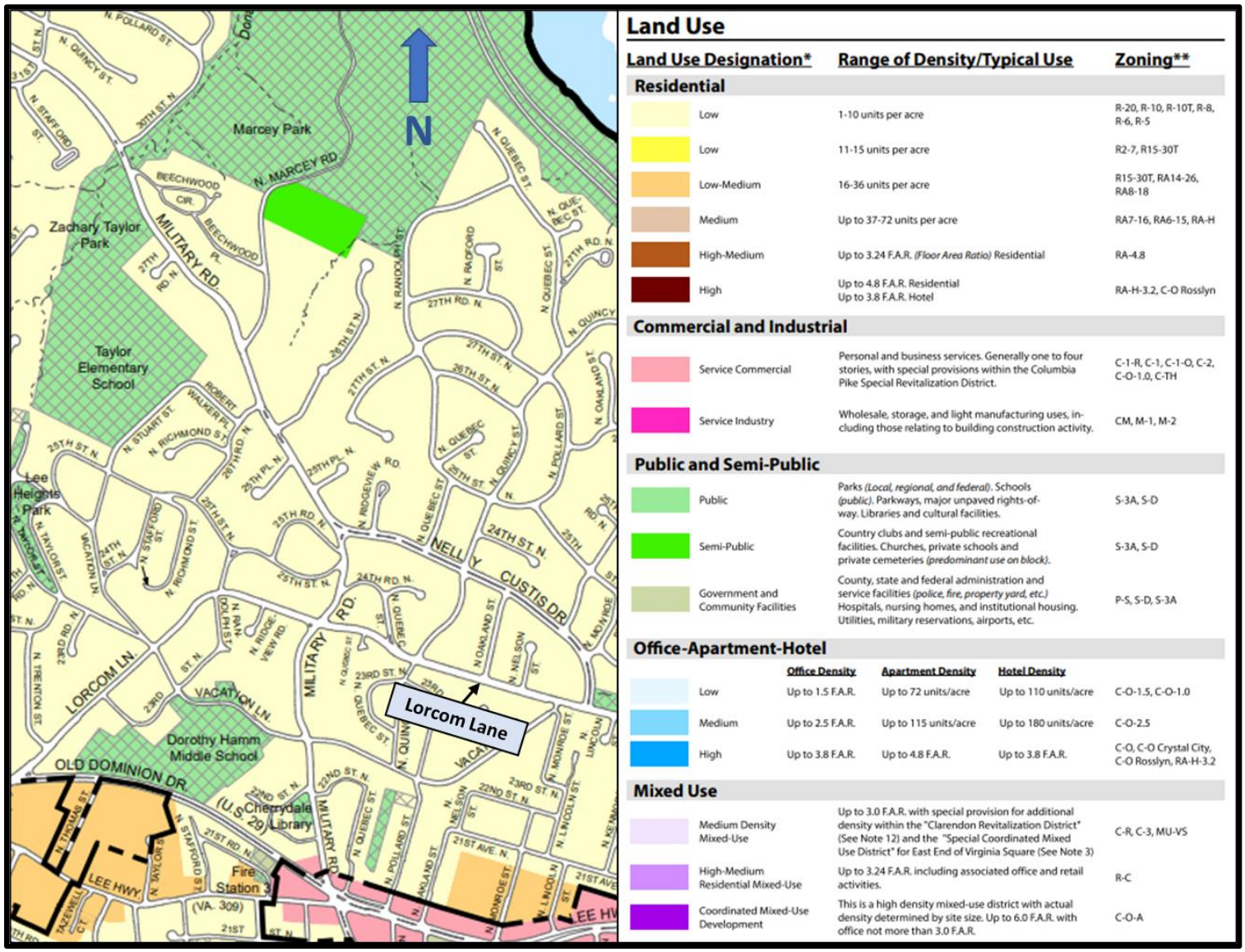

Figure 3A - General Land Use Plan Map

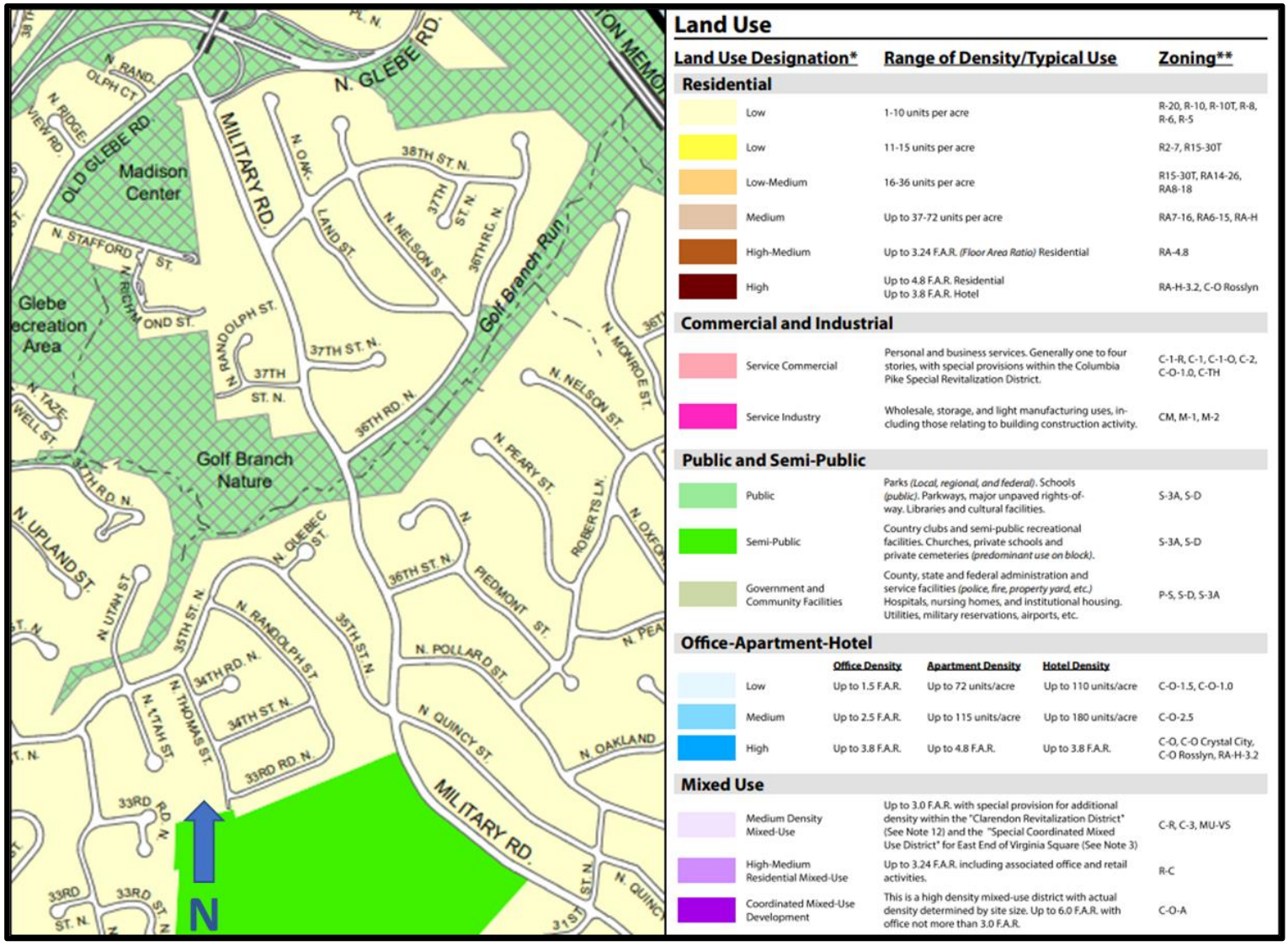

Figure 3B - General Land Use Plan Map (Continued)

Table 4 describes the roadway characteristics along the Nelly Custis Drive/Military Road corridors with consideration for number of lanes, on-street parking activity, driveway density, and sight distance impacts. Nelly Custis Drive is mostly planned for low-density residential uses while Military Road is mostly planned for low-density residential and public uses.

Table 4 - Roadway Characteristics

Segment	Length (mi.)	Lanes per Direction	On-Street Parking Activity	Driveway Density	Primary Roadside Land Uses	Sight Distance Restrictions
Military Road						
North Old Glebe Road to 36th Street North	0.42	1+bike lane both sides	Street parking both sides	High 37 driveways 88/mi	Residential, Public	Low: vegetation, horizontal and vertical curvature, street parking
36th Street North to 30th Street North	0.71	1+bike lane NB side	Street parking both sides	Moderate 47 driveways 66/mi	Residential, Public, Semi-Public	Moderate: vegetation, horizontal curvature, street parking
30th Street North to 27th Road North	0.16	1+bike lane both sides	Street parking both sides	None	Residential, Public	Moderate: vegetation, horizontal curvature, street parking
27th Road North to North Marcey Road	0.15	1+bike lane both sides	Street parking NB side	Moderate 8 driveways 53/mi	Residential, Institutional	Low: horizontal curvature, street parking
North Marcey Road to Nelly Custis Drive	0.27	1+bike lane both sides	Street parking both sides	Moderate 20 driveways 74/mi	Residential	Low: horizontal curvature, street parking
Nelly Custis Drive to Lorcom Lane	0.14	1	Street parking NB	Moderate 9 driveways 65/mi	Residential	Low: horizontal curvature, street parking
Lorcom Lane to Vacation Lane	0.16	1+bike lane NB	Street parking both sides	Moderate 9 driveways 56/mi	Residential, Institutional	Low: horizontal curvature, street parking
Vacation Lane to 22nd Street North	0.07	1+bike lane SB	Street parking SB side	High 6 driveways 86/mi	Residential	Low: Street parking
22nd Street North to Langston Boulevard	0.12	1+bike lane SB	Street parking both sides	Very High 13 driveways 108/mi	Residential, Commercial	Low: vertical curvature, street parking
Nelly Custis Drive						
Lorcom Lane to Military Road	0.45	1+bike lane both sides	Street parking both sides	Moderate 32 driveways 71/mi	Residential, Institutional	Moderate: vegetation, horizontal and vertical curvature, street parking

Nelly Custis Drive and Military Road are both two-lane roadways, with no dedicated turn lanes except at the intersections with Lorcom Lane (on both roadways) and Langston Boulevard (on Military Road). As noted in the previous section, significant pedestrian and bicycle activity was observed throughout both corridors due to residential development, schools, recreational areas, and trailheads in this vicinity.

Despite on-street parking, overgrown trees, bus transit operations, and horizontal and vertical curves along both corridors, sight distance is overall sufficient throughout the study area. A combined eighteen high-visibility crosswalks along the corridors provide adequate identification for access to bus transit stops on the east and west sides. Fifteen of these crosswalks are uncontrolled, with pedestrian warning sign (W11-2 or S1-1) assemblies at the point of crossing.

The intersection of Nelly Custis Drive and Military Road, which connects the two study corridors, was the subject of a pilot project which implemented a temporary roundabout design (previously a traditional T-intersection with northbound Military Road operating under stop control) in October 2021 as part of the Military Road Safety Improvements Project. Following a one-year study period, a roundabout was confirmed to be the preferred design alternative for the study intersection. Interim improvements to the roundabout in February 2023 included the installation of splitter islands, a mountable curb within the central median, and improved pedestrian and bicycle accommodations throughout the roundabout area. Final design and construction of the roundabout are expected to be completed in 2025.

Considering the enhancements being implemented as part of this project, and the speed reduction already necessitated by the roundabout design (note: there are posted warning signs with 15 mph advisory speed plaques on all three approaches to the roundabout), a reduction of the posted speed limit would be justified based on the roadway characteristics in the vicinity of the roundabout (i.e. the three intersecting legs on Military Road and Nelly Custis Drive).

IV. Conclusion

This study was performed to investigate the appropriateness of the existing 30 mph speed limit on Nelly Custis Drive (from Lorcom Lane to Military Road) and on Military Road (from North Old Glebe Road to Langston Boulevard) in Arlington County. Based on guidance presented in the MUTCD and other FHWA publications as well as the County's Vision Zero goals, several characteristics of the Nelly Custis Drive/Military Road corridors were analyzed in support of examining the existing posted speed limit. These characteristics included speed statistics, crash history, pedestrian and bicyclist activity, roadway characteristics, future roadway development and its impacts on traveling modes, activity generators, and other contributors. Considering all factors, the recommendation is to establish a new speed limit of 25 mph on Military Road between Nelly Custis Drive and Langston Boulevard, and maintain the existing 30 mph speed limit on the section of Military Road north of Nelly Custis Drive as well as the entirety of the Nelly Custis Drive corridor.

V. Recommendation

Based on all factors considered in analyzing the existing posted speed limit for Nelly Custis Drive (from Lorcom Lane to Military Road) and for Military Road (from North Old Glebe Road to Langston Boulevard) in Arlington County, the data supports reducing the speed limit from 30 mph to 25 mph on Military Road between Nelly Custis Drive and Langston Boulevard, and maintaining the existing 30 mph speed limit on the section of Military Road north of Nelly Custis Drive as well as the entirety of the Nelly Custis Drive corridor.

Following appropriate Board action, a new speed limit of 25 mph will be implemented along Military Road from Nelly Custis Drive to Langston Boulevard by installing 25 mph speed limit signs along this section in accordance with Chapter 8, Section 46.2-878 of the Motor Vehicle Code of the Commonwealth of Virginia. This section of the code states that "Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs". It is expected that a thorough onsite evaluation will be completed to ensure an appropriate sign replacement strategy to install the new speed limit signs along Military Road. Final sign locations will be based on Section 2B.13 of the MUTCD.

VI. References

1. U.S. Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices*, 2009 Edition. December 2009.
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4. VDOT Crash Map https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=ef9957cd10964a7286d2f9df5b85e833
5. https://www.arlingtonva.us/Government/Projects/Project-Types/Transportation-Projects/Military-Road-Safety-Improvements
6. https://www.arlingtonva.us/files/sharedassets/public/v/1/transportation/documents/final_milly-nelly-open-house-boards.pdf

Appendix 1

Speed Statistics

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\Nelly Custis Dr_Military Rd.zip

Appendix 2

Intersection Turning Movement Counts

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\Nelly Custis Dr_Military Rd.zip

ARLINGTON
VIRGINIA

DEPARTMENT OF ENVIRONMENTAL SERVICES

Carlin Springs Road
(North Glebe Road to County Line)
Speed Limit Study

Prepared for:
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I. Executive Summary

This technical report presents the findings of a traffic engineering investigation of the speed limit along Carlin Springs Road from North Glebe Road to the County Line in Arlington County, Virginia. Under the jurisdiction of Arlington County within the abovementioned limits, Carlin Springs Road is classified as a Minor Arterial and a Principal Arterial north and south of North George Mason Drive, respectively. North of US-50 (Arlington Boulevard), the study corridor is considered North Carlin Springs Road, while south of US-50, the corridor becomes South Carlin Springs Road. The existing posted speed limit is 30 miles per hour (mph) as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code.

In order to establish a new speed limit along Carlin Springs Road, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

RK&K was tasked by Arlington County Transportation Engineering and Operations Bureau (TE&O) to conduct a traffic engineering investigation of the speed limit of the Carlin Springs Road corridor based on guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998). Several factors were considered for analysis, including speed statistics, crash history, pedestrian activity, and roadway characteristics.

The speed data analysis does not support lowering the speed limit for the entire corridor. However, for the segment of Carlin Springs Road from North Glebe Road to North George Mason Drive, the collision history (3 pedestrian crashes, 2 severe injury-related crashes, and the highest overall crash rate of the segments analyzed from 2016 through 2021), pedestrian and bicycle activity (540 pedestrians and 30 bicycles crossing the study corridor between the two intersections evaluated), land use, roadway characteristics, and comparatively lower operating speeds (10-mph pace speed of 24-34 mph) support lowering the speed limit for this segment of the corridor. Therefore, in aggregate, it is recommended to establish a new speed limit of 25 mph between North Glebe Road and North George Mason Drive, and maintain the existing 30 mph speed limit between North George Mason Drive and the County Line.

II. Introduction

Carlin Springs Road from North Glebe Road to the County Line in Arlington County is classified as a Minor Arterial and a Principal Arterial north and south of North George Mason Drive, respectively. The corridor's typical cross section from north to south is as follows:

- Two-lane undivided from North Glebe Road to North Thomas Street, with on-street parking and shared lane markings on both sides of the segment
- Two-lane undivided from North Thomas Street to North Abingdon Street, with on-street parking and bike lanes on both sides of the segment
- Four-lane divided from North Abingdon Street to 1st Street South, with on-street parking throughout most of the northbound direction of the segment and bike lanes on both sides from North Abingdon Street to North George Mason Drive
- Four-lane undivided from 1st Street South to 7th Road South
- Four-lane undivided with two-way left turn lane (TWLTL) from 7th Road South to 8th Place South
- Two-lane undivided from 8th Place South to the County Line, with on street parking on the northbound direction

WMATA and ART bus transit stops exist throughout the study corridor. Land use primarily consists of low-density residential use, though higher-density residential/mixed-use developments exist towards the northern study limits near the intersection with North Glebe Road (i.e. approaching Ballston). Public areas (such as Bluemont Park, Kenmore Middle School, and Campbell Elementary School) as well as government and community facilities also exist along the study corridor.

The existing posted speed limit is 30 miles per hour (mph) throughout the study corridor, as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code. There is a 20 mph School Speed Limit (When Flashing) in effect during designated hours through the school zones at Kenmore Middle School and Campbell Elementary School along the study corridor. South of the interchange at North George Mason Drive, the posted 30 mph speed limit signs are supplemented with 'Speeding Additional $200 Fine' plaques, and there are Speed Feedback Indicator Signs (SFIS) in both directions approaching the North Harrison Street intersection. **Figure 1** shows the study corridor, its functional classification, and the estimated 2019 AADTs per segment.

In accordance with the Adopted Streets element of the Arlington Master Transportation Plan, the existing speed limit along Carlin Springs Road from North Glebe Road to the County Line in Arlington County is being reviewed. To do so, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

Figure 1 – Map of Carlin Springs Road from North Glebe Road to County Line
AADT Source: [Traffic Data - Info | Virginia Department of Transportation (virginiadot.org)]

III. Analysis

RK&K was tasked by Arlington County to conduct a traffic engineering investigation of the speed limit along the Carlin Springs Road corridor. Guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998) provided the basis for the investigation. From these publications, the following factors were considered for analysis:

- 85th Percentile Speed
- Median (50th Percentile) Speed
- Pace Speed
- Crash History during Analysis Period
- Pedestrian and Bicycle Activity
- Parking Activity
- Roadside Development and Environment
- Roadway Characteristics

a. Speed Statistics

Section 2B.13 of the MUTCD provides guidance that a posted speed limit should be within 5 mph of the 85th-percentile speed of free-flowing traffic and includes an option that pace speed be considered as another factor.

The 85th-percentile speed is the speed at or below which 85% of counted vehicles are observed to travel under free-flowing conditions. The median speed is the speed at or below which 50% of counted vehicles are observed to travel under free-flow conditions. The pace speed is the 10-mph range in which the highest number of vehicles counted were traveling. To analyze the speed statistics of the corridor, speed data were collected at two mid-block locations:

Collected on October 18th-19th, 2022:
- Between North Vermont Street and North Wakefield Street
- Between North Frederick Street and North Greenbrier Street

Collected on December 6th-7th, 2022:
- Between 1st Street South and 2nd Street South
- Between 6th Road South and 7th Road South

Collected on April 12th-13th, 2023:
- Between Robinwood Lane and 8th Place South

The speed data collection points are presented in **Figure 2,** while the raw speed data are presented in Appendix 1. **Table 1** presents the 85th percentile, median, 10-mph pace speed, and percent in pace for the Carlin Springs Road corridor by segments of data collection.

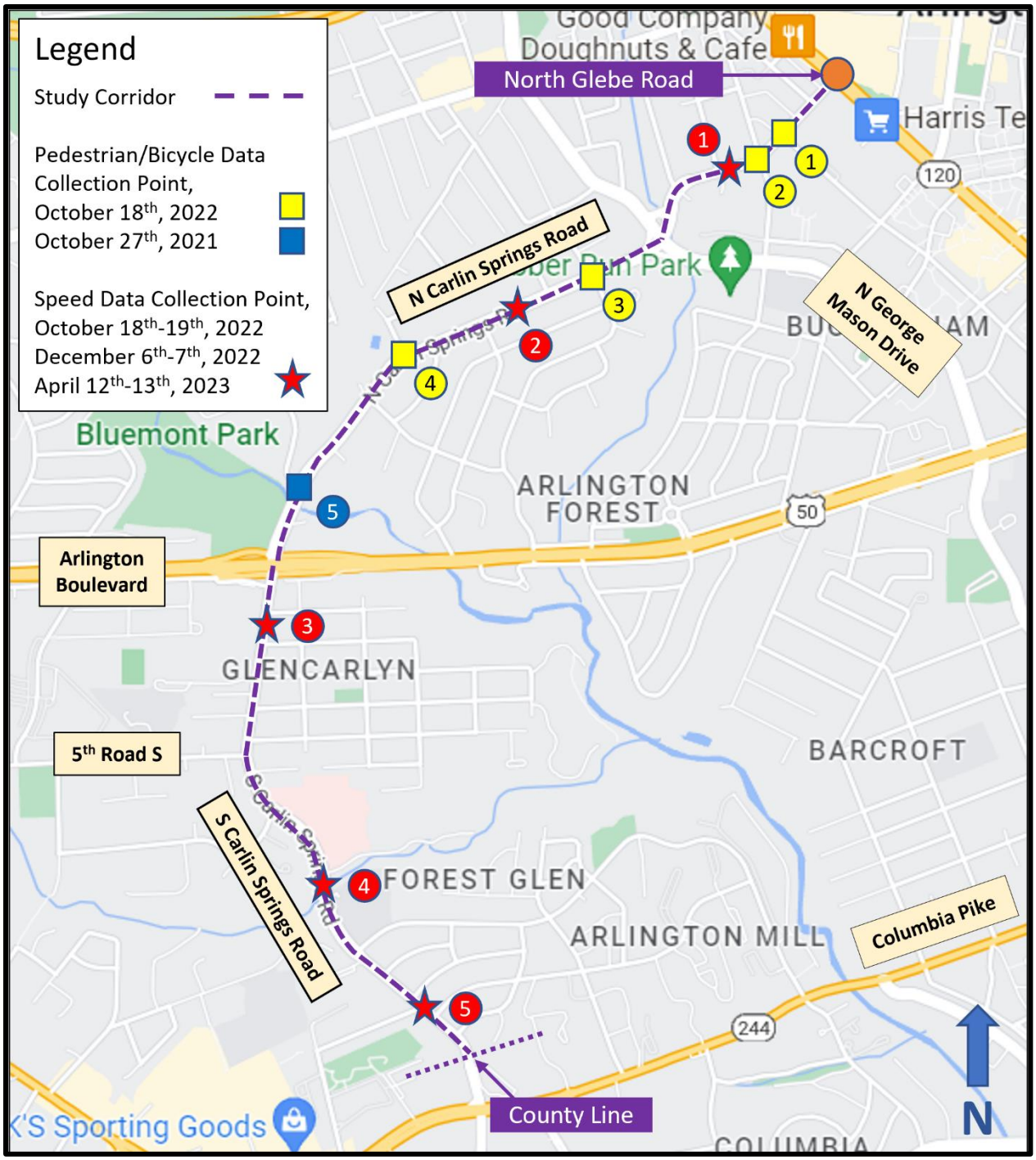


Figure 2 – Speed and Pedestrian/Bicycle Data Collection Points

Table 1 – Carlin Springs Road Speed Data

Speed Zone	85th-Percentile Speed	Median Speed	10-mph Pace Speed	Percent in Pace
Between North Vermont Street and North Wakefield Street	32 mph	28 mph	24-34 mph	78.3%
Between North Frederick Street and North Greenbrier Street	41 mph	36 mph	32-42 mph	76.5%
Between 1St Street South and 2nd Street South	32 mph	26 mph	21-31 mph	58.5%
Between 6th Road South and 7th Road South	40 mph	35 mph	31-41 mph	68.2%
Between Robinwood Lane and 8th Place South	36 mph	31 mph	27-37 mph	66.1%

The speed data for the section between North Vermont Street and North Wakefield Street shows an 85th-percentile speed of 32 mph, a median speed of 28 mph, and a 10-mph pace speed of 24-34 mph with 78.3% of vehicles in pace.

Between North Frederick Street and North Greenbrier Street, the collected data shows an 85th-percentile speed of 41 mph, a median speed of 36 mph, and a 10-mph pace speed of 32-42 mph with 76.5% of vehicles in pace.

Between 1st Street South and 2nd Street South, the collected data shows an 85th-percentile speed of 32 mph, a median speed of 26 mph, and a 10-mph pace speed of 21-31 mph with 58.5% of vehicles in pace.

Between 6th Street South and 7th Street South, the collected data shows an 85th-percentile speed of 40 mph, a median speed of 35 mph, and a 10-mph pace speed of 31-41 mph with 68.2% of vehicles in pace.

Finally, between Robinwood Lane and 8th Place South, the collected data shows an 85th-percentile speed of 36 mph, a median speed of 31 mph, and a 10-mph pace speed of 27-37 mph with 66.1% of vehicles in pace.

Overall, the collected speed data demonstrates that motorists are comfortable driving at or above the existing posted speed limit of 30 mph for most of the study corridor. However, noticeably lower speeds were observed between North Vermont Street and North Wakefield Street, and between 1st Street South and 2nd Street South. A reduction of the posted speed limit could therefore be considered along these segments. For the latter segment, though, vehicular speeds are likely impacted by congestion from the signalized intersections at the US-50 ramp terminals, and there is also a 20 mph School Speed Limit (When Flashing) in this vicinity. Therefore, a reduction of the posted speed limit through this segment may not be appropriate based on free-flowing speeds.

b. Collision History

Section 2B.13 of the MUTCD provides optional guidance relative to reported crash trends for at least a 12-month period. This MUTCD section suggests that reported crash experience for at least a twelve-month period be considered as a factor when establishing a speed limit. To analyze crash experience, a crash history of the Carlin Springs Road corridor was compiled for the six-year period spanning from January 1st, 2016 through December 31st, 2021. Generally, crash rates are determined by a calculation involving annual average daily traffic (AADT) volumes, corridor length, and total number of crashes within the study period. The AADT is the total volume of vehicles traveling along a roadway for a year divided by 365 days. The number of million vehicle-miles traveled was produced by multiplying the AADT by the corridor length. Crash rates (R) were then calculated using the following formula:

$$R = (1{,}000{,}000 * C) / (365 * AADT * L * N)$$

Where:

R = Crash rate for the road segment expressed as crashes per million vehicle-miles of travel (VMT)

C = Total number of crashes in the study period.

N = Number of years of data.

AADT = Number of vehicles per day (both directions).

L = Length of the roadway segment in miles.

The number of crashes per million vehicle miles traveled was calculated for each segment based on available crash data.

To determine the relative safety of Carlin Springs Road corridor, the crash rates were compared with the average crash rates calculated for similar corridors (in terms of roadway classification), within Arlington County as follows:

- Total number of crashes along the corridor including the intersection crashes
- Total number of crashes along the corridor excluding the intersection crashes

These rates have been calculated by Arlington County TE&O and provided to RK&K. Because the roadway classification for Carlin Springs Road varies within the study limits (Minor Arterial and Principal Arterial north and south of North George Mason Drive, respectively), two separate sets of countywide crash rates were used. From 2013 through 2018, the average crash rates for roadways classified as principal arterials were calculated to be 3.80 (including intersection crashes) and 0.79 (excluding intersection crashes) crashes per million vehicle miles traveled. During the same period, the average crash rates for roadways classified as minor arterials were calculated to be 4.21 (including intersection crashes) and 1.11 (excluding intersection crashes) crashes per million vehicle miles traveled.

While research links vehicular speeds with crashes and crash severity, relationships between speed limit increases/decreases, crash rates, and crash severity are complex. Adding to the complexity are countless other variables including highway design, vehicle design, speed enforcement, level of urbanization, type of topography (flat, hilly, mountainous), weather conditions, and characteristics of the driving population. In this study, the "average" crash rate is used to provide some consistency with data collected over a period of time to represent typical

roadway conditions with consideration for the complex variables that shape the driving experience.

Table 2 outlines vehicle and pedestrian/bicycle crashes, AADT, and crash rates for each segment of the corridor; the corridor is divided into smaller segments based on the AADT estimates. Comparing the calculated crash rates with the average rates in Arlington County is a significant factor for consideration in establishing an appropriate speed limit.

Table 2 - Crash History (01/01/2016 - 12/31/2021)

Segment	No. of Total Crashes	No. of Non-Intersection Crashes	No. of Pedestrian /Bicycle Related Crashes	No. of Severe Injury/ Fatal Crashes	Approx. 2019 AADT	Crashes per Million Vehicle Miles (Total Crashes)	Crashes per Million Vehicle Miles (Non-Intersection Crashes)
North Glebe Road to North George Mason Drive	30	3	3 / 0	2 / 0	10,000	3.31	0.33
North George Mason Drive to Arlington Boulevard	41	20	2 / 0	1 / 0	17,000	1.25	0.61
Arlington Boulevard to 5th Road South	33	10	3 / 0	2 / 0	33,000	1.36	0.41
5th Road South to County Line	59	26	2 / 0	1 / 0	31,000	1.36	0.60

The crash history for the first segment (North Glebe Road to North George Mason Drive) shows that the total crash rate of 3.31 is below the available County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.33, which is again below the available Arlington County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 30 crashes within this segment during the six-year analysis period, 3 of which were non-intersection crashes. Also, there were 3 pedestrian-related crashes within this segment. Speeding was a contributing factor to 4 crashes. There were 2 severe injury-related crashes reported for this segment during the analysis period.

For the second segment of the corridor (North George Mason Drive to Arlington Boulevard), the total crash rate is 1.25 which is below the available Arlington County average crash rate of 3.80 crashes per million vehicle miles traveled on a principal arterial. Excluding the intersection

crashes, this segment has a non-intersection crash rate of 0.61, which is again below the available County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 41 crashes within this segment during the six-year analysis period, 20 of which were non-intersection crashes. There were 2 pedestrian-related crashes within this segment. Speeding was a contributing factor to 4 crashes. There was one (1) severe injury-related crash reported for this segment during the analysis period.

The crash history for the third segment (Arlington Boulevard to 5th Road South) shows that the total crash rate of 1.36 is below the available County average crash rate of 3.80 crashes per million vehicle miles traveled on a principal arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.41, which is again below the available County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 33 crashes within this segment during the six-year analysis period, 10 of which were non-intersection crashes. There were 3 pedestrian-related crashes within this segment. Speeding was a contributing factor to 5 crashes. There were two (2) severe injury-related crashes reported for this segment during the analysis period.

The crash history for the last segment (5th Road South to County Line) shows that the total crash rate of 1.36 is below the available County average crash rate of 3.80 crashes per million vehicle miles traveled on a principal arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.60, which is again below the available County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 59 crashes within this segment during the six-year analysis period, 26 of which were non-intersection crashes. There were 2 pedestrian-related crashes within this segment. Speeding was a contributing factor to 6 crashes. There was one (1) severe injury-related crash reported for this segment during the analysis period.

In summary, the reported crash rates for all segments analyzed were lower than the Arlington County average crash rates during the analysis period, and there were no fatalities reported within the study corridor. However, there were 10 crashes involving pedestrians and 6 severe injury-related crashes, while 19 crashes involved speeding as a contributing factor. This data justifies implementing a lower speed limit along the corridor to support Arlington County's efforts toward Vision Zero, particularly for the segment north of North George Mason Drive where the overall crash rate was significantly higher than the remaining segments analyzed.

c. Pedestrian and Bicyclist Activity

Section 2B.13 of the MUTCD provides optional guidance that pedestrian activity be considered as a factor when establishing a speed limit.

Pedestrian and on-street bicycle volumes were collected for 12 hours (7:00 AM to 7:00 PM) at five intersections within the study area:

Collected on October 18th, 2022:

- North Carlin Springs Road at North Thomas Street
- North Carlin Springs Road at North Vermont Street / North Park Drive
- North Carlin Springs Road at North Edison Street
- North Carlin Springs Road at North Harrison Street

Collected on October 27th, 2021:

- North Carlin Springs Road at North Kensington Street

The raw intersection turning movement counts are included in Appendix 2. These pedestrian and bicycle volumes capture the peak 12 hours of significant activity along each segment which is a reasonable representation of the daily activity on a typical weekday. Volumes for pedestrian and bicycle activity as well as the presence of high-visibility crosswalks are provided in **Table 3**.

Table 3 - Pedestrian and Bicyclist Activity

Intersection	Crosswalk Control/ Warning Signs if Uncontrolled?	Weekday Pedestrian Traffic, Crossing Carlin Springs Road	Weekday Bicycle Traffic, Crossing Carlin Springs Road*	High-Visibility Crosswalks Across Carlin Springs Road?	Weekday Pedestrian Traffic, Total at Intersection	Weekday Bicycle Traffic, Total at Intersection
North Thomas Street	Uncontrolled/ Warning signs exist, R1-6 signs exist	384	19	Yes (both legs)	1,115	85
North Vermont Street / North Park Drive**	Uncontrolled/ Warning signs exist, R1-6 signs exist	156	11	Yes (both legs)	458	55
North Edison Street	Uncontrolled/ Warning signs exist (in advance and at point of crossing), RRFBs exist	104	15	Yes (north leg)	197	53
North Harrison Street	Uncontrolled/ Warning signs exist (in advance, overhead, and at point of crossing), RRFBs exist, R1-6 signs exist	43	11	Yes (south leg)	76	24
North Kensington Street	Uncontrolled/ No Warning signs	19	Not Collected	No	161	Not Collected

***This includes side-street bicycle thrus and lefts, and mainline lefts; and bicycles traveling on the crosswalks across the mainline.**

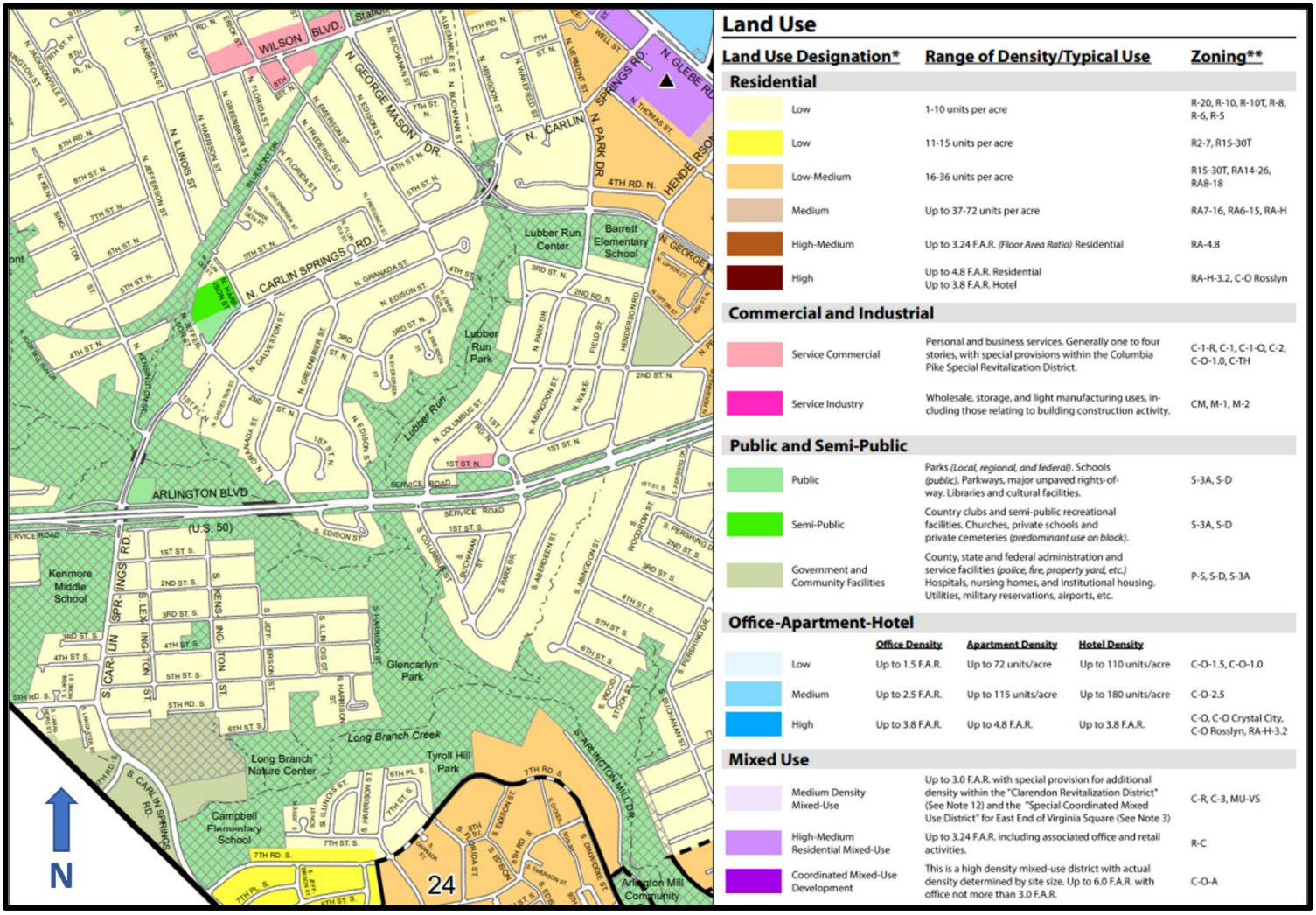
****Intersection with North Vermont Street / North Park Drive was converted to All-Way Stop (AWS) Control after data collection occurred for this speed limit study**

On a typical weekday, the collected data shows that there are several intersections where more than 100 pedestrians cross the Carlin Springs Road corridor, as well as more than 10 bicyclists at each of the four intersections where bicycles were counted. Pedestrian and bicycle activity is highest towards the northern end of the study corridor (approaching North Glebe Road) and gradually becomes lighter to the south, though significant pedestrian volumes were observed throughout. Contributing to this activity are pedestrian and bicycle generators/attractors such as residential/mixed-use development (particularly within the Ballston neighborhood at the northern end of the corridor), public parks such as Lubber Run, and schools such as Kenmore Middle School and Campbell Elementary School. The collected pedestrian and bicycle data supports a reduction of the posted speed limit, particularly within the segment from North Glebe Road to North George Mason Drive.

d. Roadway Characteristics

Section 2B.13 of the MUTCD suggests that roadside development and environment, as well as parking practices, be considered as a factor when establishing a speed limit.

Carlin Springs Road is a pedestrian and bike-friendly environment with transit commuter bus operations, sidewalks, trailhead access, and marked crosswalks throughout much of the corridor. The roadside development detailed below is based on the Arlington County General Land Use Plan (GLUP), the Arlington County Zoning Boundaries, and existing roadside development (see **Figure 3**).



Land Use

Land Use Designation*	Range of Density/Typical Use	Zoning**
Residential		
Low	1-10 units per acre	R-20, R-10, R-10T, R-8, R-6, R-5
Low	11-15 units per acre	R2-7, R15-30T
Low-Medium	16-36 units per acre	R15-30T, RA14-26, RA8-18
Medium	Up to 37-72 units per acre	RA7-16, RA6-15, RA-H
High-Medium	Up to 3.24 F.A.R. *(Floor Area Ratio)* Residential	RA-4.8
High	Up to 4.8 F.A.R. Residential Up to 3.8 F.A.R. Hotel	RA-H-3.2, C-O Rosslyn
Commercial and Industrial		
Service Commercial	Personal and business services. Generally one to four stories, with special provisions within the Columbia Pike Special Revitalization District.	C-1-R, C-1, C-1-O, C-2, C-O-1.0, C-TH
Service Industry	Wholesale, storage, and light manufacturing uses, including those relating to building construction activity.	CM, M-1, M-2
Public and Semi-Public		
Public	Parks *(Local, regional, and federal)*. Schools *(public)*. Parkways, major unpaved rights-of-way. Libraries and cultural facilities.	S-3A, S-D
Semi-Public	Country clubs and semi-public recreational facilities. Churches, private schools and private cemeteries *(predominant use on block)*.	S-3A, S-D
Government and Community Facilities	County, state and federal administration and service facilities *(police, fire, property yard, etc.)* Hospitals, nursing homes, and institutional housing. Utilities, military reservations, airports, etc.	P-S, S-D, S-3A

Office-Apartment-Hotel	Office Density	Apartment Density	Hotel Density	
Low	Up to 1.5 F.A.R.	Up to 72 units/acre	Up to 110 units/acre	C-O-1.5, C-O-1.0
Medium	Up to 2.5 F.A.R.	Up to 115 units/acre	Up to 180 units/acre	C-O-2.5
High	Up to 3.8 F.A.R.	Up to 4.8 F.A.R.	Up to 3.8 F.A.R.	C-O, C-O Crystal City, C-O Rosslyn, RA-H-3.2

Mixed Use		
Medium Density Mixed-Use	Up to 3.0 F.A.R. with special provision for additional density within the "Clarendon Revitalization District" (See Note 12) and the "Special Coordinated Mixed Use District" for East End of Virginia Square (See Note 3)	C-R, C-3, MU-VS
High-Medium Residential Mixed-Use	Up to 3.24 F.A.R. including associated office and retail activities.	R-C
Coordinated Mixed-Use Development	This is a high density mixed-use district with actual density determined by site size. Up to 6.0 F.A.R. with office not more than 3.0 F.A.R.	C-O-A

Figure 3 - General Land Use Plan Map

Table 4 describes the roadway characteristics along the Carlin Springs Road corridor with consideration for number of lanes, on-street parking activity, driveway density, and sight distance impacts. Carlin Springs Road is mostly planned for low-density residential uses.

Table 4 - Roadway Characteristics

Segment	Length (mi.)	Lanes Per Direction	On-Street Parking Activity	Driveway Density	Primary Roadside Land Uses	Sight Distance Restrictions
North Glebe Road to First Presbyterian Driveway	0.1	1	Street parking SB side	Low, 3 driveways 30/mile	Residential/ Mixed-Use	Low: Parked/Parking Vehicles, Trees
First Presbyterian Driveway to North Thomas Street	0.05	1	Street parking	None	Residential/ Mixed-Use	Low: Parked/Parking Vehicles, Trees
North Thomas Street to North Park Drive	0.05	1+bike lane	Street parking NB side	None	Residential	Low: Parked/Parking Vehicles, Trees
North Park Drive to North Abingdon Street	0.15	1+bike lane	Street parking SB side	High, 12 driveways 80/mile	Residential	Low: Parked/Parking Vehicles, Trees
North Abingdon Street to North George Mason Drive SB Ramps	0.1	2+bike lane	-	None	Residential	Low: Trees, Horizontal Curves
North George Mason Drive SB Ramps to 1st Place	0.6	2	Street Parking NB side	Very High, 64 driveways 107/mile	Residential/ Public (park)	Low: Parked/Parking Vehicles, Trees
1st Place to Ardley Court	0.95	2	-	Low, 24 driveways 25/mile	Residential/ Public (school, parks)/ Community (medical)	Low: Trees, Horizontal Curves
Ardley Court to 8th Place South	0.2	2+TWLTL	-	Moderate, 11 driveways 55/mile	Residential	Low: Trees
8th Place South to County Line	0.05	1	Street parking NB side	Moderate, 2 driveways 40/mile	Residential	Low: Parked/Parking Vehicles, Trees

Carlin Springs Road is a two-lane road between North Glebe Road and North Abingdon Street, where it transitions to a four-lane road between North Abingdon Street and 8th Place South before returning to a two-lane road between 8th Place South and the County Line. Dedicated turn lanes are generally not provided at minor intersections along the corridor, though several dedicated left turn lanes are provided towards the southern portion of the study segment (including at 5th Road South, 6th Road South/Medical Center, Campbell Elementary School, and Ardley Court/7th Road South). As noted in the previous section, the corridor experiences moderate to heavy pedestrian and bicycle activity due to the numerous trailheads, parks, schools, and residential/mixed-use developments.

Despite on-street parking, vegetation, and bus transit operations, sight distance is sufficient, as the corridor is relatively straight with gentle horizontal and vertical curves along its length, except between 5th Road South and 7th Road South (series of moderate horizontal curves with radii of approximately 450 feet) and between the US-50 overpass and North Harrison Street (moderate vertical curvature). There are nineteen high-visibility crosswalks along the corridor which provide adequate identification for access to bus transit stops, residences, and parks/trails on both sides of the roadway. Eight of these crosswalks are uncontrolled (seven of which are located north of US-50), with pedestrian warning sign (W11-2) assemblies at the point of crossing.

The South Carlin Springs Safety Measures project, an Arlington County project, is pending phase 3 construction of the following roadway enhancements:

- Replace the existing two-way left-turn lane with left-turn pockets at the intersections with 7th Place South, 8th Street South, Robinwood Lane, and 8th Road South
- Install Rectangular Rapid Flashing Beacon and two-staged crossing median on the southbound approach of the intersection with 8th Road South (constructed)
- Raised medians with no crossings between 7th Place South and 8th Street South and south of 8th Place South

The South Carlin Springs Road Signal Upgrade Project, an Arlington County project, is in final design for the following intersection enhancements:

- Replace traffic signals, including accessible pedestrian pushbuttons at crossings
- Improve intersection lighting
- Widen sidewalks with landscape buffer and add curb extension at the intersection with 6th Road South
- Add curb extension at the intersection with 5th Road South/5th Street South
- Widen sidewalk and move bus stop out of the intersection with 3rd Street South/Kenmore Middle School driveway

Considering the enhancements proposed with the completion of these projects, and the presence of controlled pedestrian crossings at multiple signalized intersections towards the southern end of the study corridor, it is recommended to retain the existing 30 mph speed limit for these segments on South Carlin Springs Road.

IV. Conclusion

This study was performed to investigate the appropriateness of the existing 30 mph speed limit on Carlin Springs Road from North Glebe Road to the County Line in Arlington County. Based on guidance presented in the MUTCD and other FHWA publications as well as the County's Vision Zero goals, several characteristics of the Carlin Springs Road corridor were analyzed in support of examining the existing posted speed limit. These characteristics included speed statistics, crash history, pedestrian and bicyclist activity, roadway characteristics, future roadway development and its impacts on traveling modes, activity generators, and other contributors. Considering all factors, the recommendation is to establish a new speed limit of 25 mph between North Glebe Road and North George Mason Drive, and maintain the existing 30 mph speed limit between North George Mason Drive and the County Line.

V. Recommendation

Based on all factors considered in analyzing the existing posted speed limit for Carlin Springs Road from North Glebe Road to the County Line in Arlington County, the data supports reducing the speed limit from 30 mph to 25 mph between North Glebe Road and North George Mason Drive, and maintaining the existing 30 mph speed limit between North George Mason Drive and the County Line.

Following appropriate Board action, a new speed limit of 25 mph will be implemented along Carlin Springs Road from North Glebe Road to North George Mason Drive by installing 25 mph speed limit signs along this section in accordance with Chapter 8, Section 46.2-878 of the Motor Vehicle Code of the Commonwealth of Virginia. This section of the code states that "Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs". It is expected that a thorough onsite evaluation will be completed to ensure an appropriate sign replacement strategy to install the new speed limit signs along Carlin Springs Road. Final sign locations will be based on Section 2B.13 of the MUTCD.

VI. References

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Appendix 1

Speed Statistics

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\Carlin Springs Rd.zip

Appendix 2

Intersection Turning Movement Counts

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\Carlin Springs Rd.zip

DEPARTMENT OF ENVIRONMENTAL SERVICES

George Mason Drive
(County Line to Yorktown Boulevard)
Speed Limit Study

Prepared for:

Arlington County Department of Environmental Services

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I. Executive Summary

This technical report presents the findings of a traffic engineering investigation of the speed limit along George Mason Drive from the County Line to Yorktown Boulevard in Arlington County, Under the jurisdiction of Arlington County within the abovementioned limits, George Mason Drive is classified as a as a Minor Arterial and a Principal Arterial north and south of US-29 (Langston Boulevard), respectively. North of US-50 (Arlington Boulevard), the study corridor is considered North George Mason Drive, while south of US-50, the corridor becomes South George Mason Drive. The existing posted speed limit is 30 miles per hour (mph) as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code.

In order to establish a new speed limit along George Mason Drive, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

RK&K was tasked by Arlington County Transportation Engineering and Operations Bureau (TE&O) to conduct a traffic engineering investigation of the speed limit of the George Mason Drive corridor based on guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998). Several factors were considered for analysis, including speed statistics, crash history, pedestrian activity, and roadway characteristics.

The speed data analysis does not support lowering the speed limit for the entire corridor. However, noticeably lower speeds were observed at the collection point between 4th Street North and North Henderson Road, where the median speed (27 mph) suggests that most motorists travel below the posted 30 mph speed limit. Significantly higher pedestrian activity was also observed in this vicinity (approximately 800 pedestrians crossing the mainline and 1,200 total pedestrians between the North George Mason Drive intersections at 4th Street North and at North Park Drive), due to the higher density of residential development and other activity generators. Furthermore, the overall crash rate during the six-year analysis period (2.51 per million vehicle miles traveled) between US-50 and North Carlin Springs Road was the highest of all segments analyzed throughout the corridor (3 pedestrian-related crashes also occurred along this segment). While similar crash rates (and an additional 8 pedestrian-related crashes) were reported along South George Mason Drive (i.e. the segments south of US-50), the higher operating speeds, lower-density roadside development, and relatively light pedestrian activity suggest that a reduction of the posted speed limit is not appropriate for these sections, though alternative crash countermeasures should be investigated. Therefore, the recommendation is to implement a new speed limit of 25 mph on North George Mason Drive from US-50 to North Carlin Springs Road, and to retain the existing 30 mph speed limit for the remainder of the study segment.

II. Introduction

George Mason Drive from the County Line to Yorktown Boulevard in Arlington County is classified as a Minor Arterial and a Principal Arterial north and south of US-29, respectively. The corridor's typical cross section from south to north is as follows:

- Four-lane divided, with shared lane markings on both sides, from the County Line to South Dinwiddie Street
- Four-lane divided, with on-street parking and shared lane markings on both sides, from South Dinwiddie Street to South Columbus Street
- Four-lane divided, with on-street parking in the northbound direction and bike lanes on both sides, from South Columbus Street to South Four Mile Run Drive
- Four-lane divided, with on-street parking on both sides, from South Four Mile Run Drive to Columbia Pike
- Four-lane divided, with on-street parking and shared lane markings on both sides, from Columbia Pike to 4th Street South
- Four-lane divided, with on-street parking on both sides, a northbound bike lane, and southbound share lane markings from 4th Street South to just south of US-50
- Four-lane divided, through the US-50 interchange area
- Four-lane divided, with on-street parking on both sides, from just north of US-50 to North Pershing Drive
- Four-lane divided, with on-street parking in the northbound direction, from North Pershing Drive to 4th Street North
- Four-lane divided, from 4th Street North to North Buchanan Street
- Four-lane divided, with on-street parking in the southbound direction, from North Buchanan Street to Wilson Boulevard
- Four-lane divided, with on-street parking in the northbound direction and bike lanes on both sides, from Wilson Boulevard to the Escuela Key Elementary School parking lot entrance
- Four-lane divided, with on-street parking in the southbound direction and a northbound bike lane, from the Escuela Key Elementary School parking lot entrance to Fairfax Drive
- Four-lane divided, with a northbound bike lane and southbound shared lane markings, from Fairfax Drive to 10th Street North
- Four-lane divided, with bike lanes on both sides, from 10th Street North to 11th Street North
- Four-lane divided, with on-street parking on both sides, a northbound bike lane, and southbound shared lane markings, from 11th Street North to Washington Boulevard
- Four-lane divided, with shared lane markings on both sides, from Washington Boulevard to 16th Street North
- Four-lane divided, with on-street parking in the northbound direction, from 16th Street North to the Virginia Hospital Center entrance
- Four-lane divided, from the Virginia Hospital Center entrance to 19th Street North
- Four-lane divided, with on-street parking and shared lane markings on both sides, from 19th Street North to US-29
- Two-lane divided, with on-street parking and bike lanes on both sides, from US-29 to Yorktown Boulevard

WMATA and ART bus transit stops exist throughout most of the study corridor. Land use primarily consists of low to medium-density residential use, along with public areas such as Doctors Run Park, Alcova Heights Park, Lubber Run Community Center, and Lacey Woods Park. Wakefield High School, Randolph Elementary School, Barrett Elementary School, and Escuela Key Elementary School are all located along the study corridor. Service-commercial developments also exist near the intersections with Wilson Boulevard and US-29. Additional developments of significance include the Army National Guard Readiness Center (just south of US-50) and the Virginia Hospital Center of Arlington (between 16th Street North and 19th Street North).

The existing posted speed limit is 30 miles per hour (mph) throughout the study corridor, as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code. There are 20 MPH School Speed Limits (When Flashing) in effect through the school zones at Wakefield High School, Randolph Elementary School, Barrett Elementary School, and Escuela Key Elementary School during designated hours. There are Speed Feedback Indicator Signs (SFIS) posted in the southbound direction of South George Mason Drive, approaching 4th Street South and just south of South Edison Street. Horizontal alignment warning signage with 25 mph advisory speed plaques exist on the approaches to several curves along the corridor, including near South Columbus Street (southbound only), between 4th Street South and 6th Street South (reverse curve, northbound only), between 2nd Road North and North Pershing Drive (both directions), and between North Carlin Springs Road and 6th Street North (reverse curve, both directions, supplemented with chevron alignment signs). **Figure 1** shows the study corridor, its functional classification, and the estimated 2019 AADTs per segment.

In accordance with the Adopted Streets element of the Arlington Master Transportation Plan, the existing speed limit along George Mason Drive from the County Line to Yorktown Boulevard in Arlington County is being reviewed. To do so, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

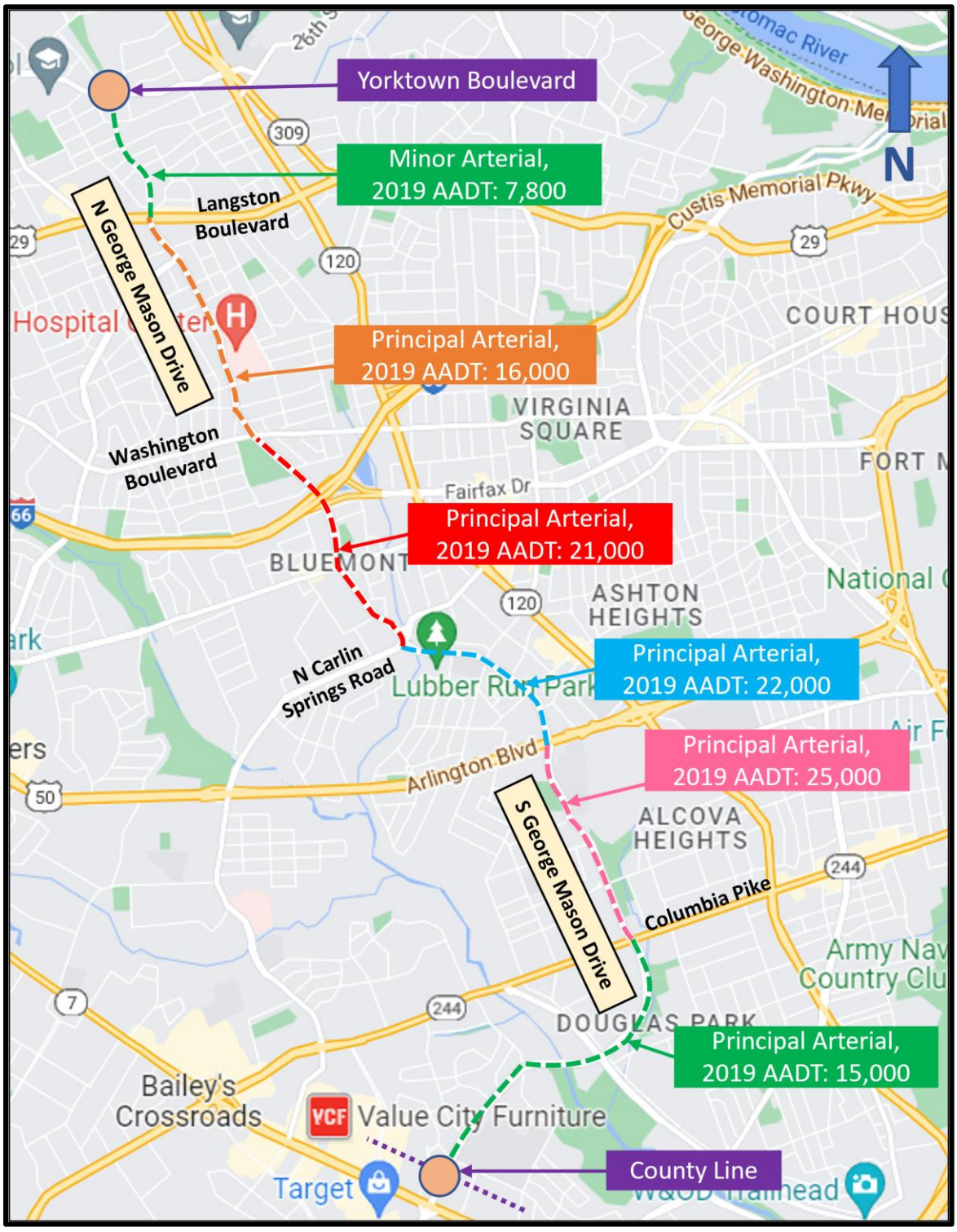


Figure 1 – Map of George Mason Drive from County Line to Yorktown Boulevard
AADT Source: [Traffic Data - Info | Virginia Department of Transportation (virginiadot.org)]

III. Analysis

RK&K was tasked by Arlington County to conduct a traffic engineering investigation of the speed limit along the George Mason Drive corridor. Guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998) provided the basis for the investigation. From these publications, the following factors were considered for analysis:

- 85th Percentile Speed
- 50th Percentile (Median) Speed
- Pace Speed
- Crash History during Analysis Period
- Pedestrian and Bicycle Activity
- Parking Activity
- Roadside Development and Environment
- Roadway Characteristics

a. Speed Statistics

Section 2B.13 of the MUTCD provides guidance that a posted speed limit should be within 5 mph of the 85th-percentile speed of free-flowing traffic and includes an option that pace speed be considered as another factor.

The 85th-percentile speed is the speed at or below which 85% of counted vehicles are observed to travel under free-flowing conditions. The median speed is the speed at or below which 50% of counted vehicles are observed to travel under free-flowing conditions. The pace speed is the 10-mph range in which the highest number of vehicles counted were traveling. To analyze the speed statistics of the corridor, speed data were collected at the following mid-block locations:

Collected on May 9th-10th, 2023:
- Between South Edison Street and 12th Street South
- Between 13th Road South and South Four Mile Run Drive
- Between 8th Street South and 6th Street South

Collected on April 26th-27th, 2023:
- Between 4th Street North and North Henderson Road
- Between 11th Street North and Washington Boulevard
- Between 19th Road North and 20th Street North
- Between 25th Road North and 25th Place North

Collected on September 21st-22nd, 2022:
- Between North Henderson Road and North Park Drive (WB Only)
- Between North Park Drive and North Carlin Springs Road (EB Only)

The speed data collection points are presented in **Figure 2**, while the raw speed data are presented in Appendix 1. **Table 1** presents the 85th-percentile, median, 10-mph pace speed, and percent in pace for the George Mason Drive corridor by segments of data collection.

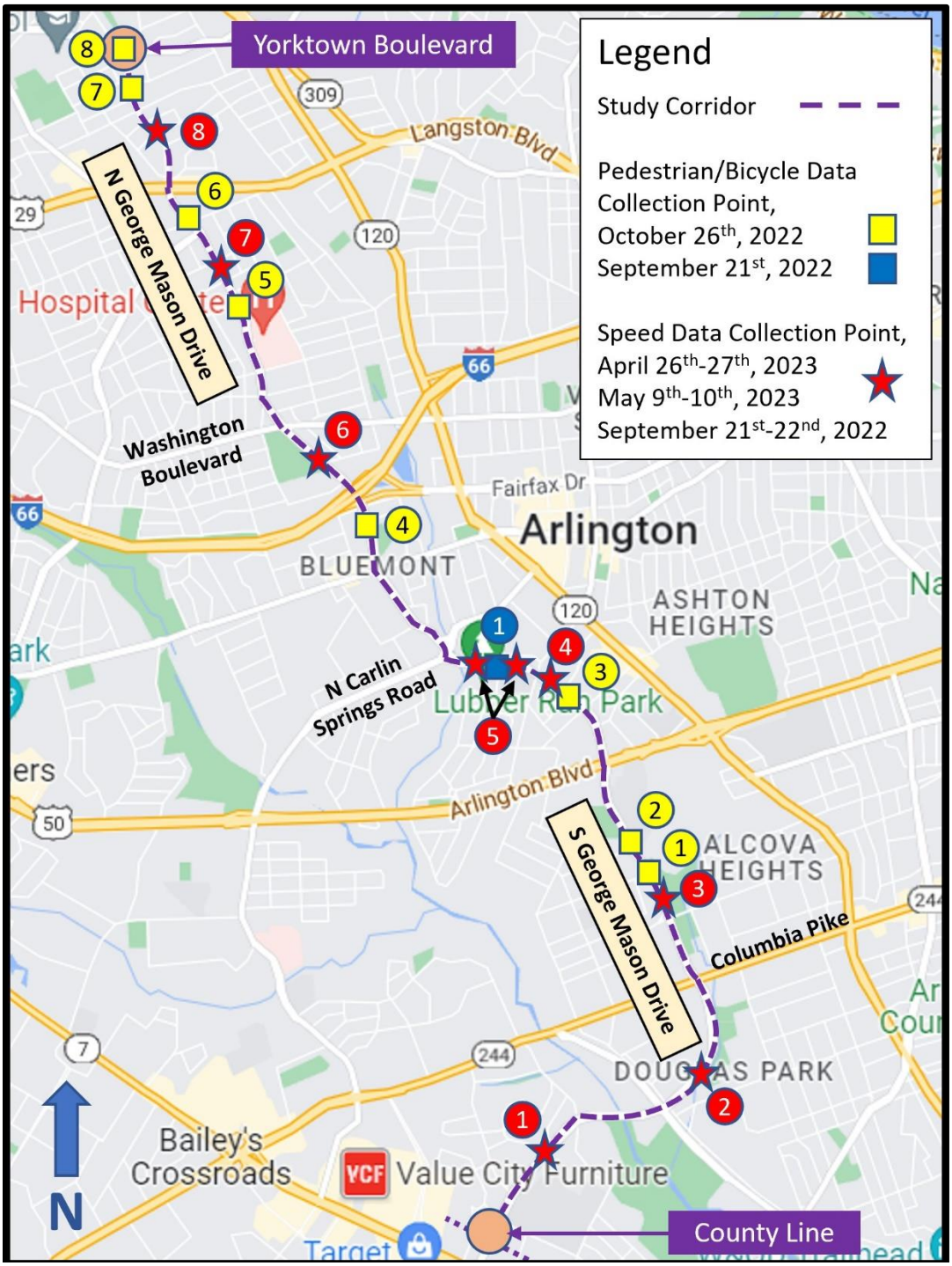


Figure 2 - Speed and Pedestrian/Bicycle Data Collection Points

Table 1 – George Mason Drive Speed Data

Speed Zone	85th-Percentile Speed	Median Speed	10-mph Pace Speed	Percent in Pace
Between South Edison Street and 12th Street South	38 mph	32 mph	28-38 mph	65.2%
Between 13th Road South and South Four Mile Run Drive	36 mph	32 mph	28-38 mph	68.1%
Between 8th Street South and 6th Street South	36 mph	31 mph	27-37 mph	71.2%
Between 4th Street North and North Henderson Road	32 mph	27 mph	23-33 mph	65.5%
Between North Henderson Road and North Park Drive (WB Only)	35 mph	31 mph	27-37 mph	79.5%
Between North Park Drive and North Carlin Springs Road (EB Only)	38 mph	33 mph	29-39 mph	77.1%
Between 11th Street North and Washington Boulevard	40 mph	35 mph	30-40 mph	73.3%
Between 19th Road North and 20th Street North	37 mph	33 mph	29-39 mph	74.2%
Between 25th Road North and 25th Place North	35 mph	30 mph	26-36 mph	77.5%

The speed data for the section of South George Mason Drive between South Edison Street and 12th Street South shows an 85th-percentile speed of 38 mph, a median speed of 32 mph, and a 10-mph pace speed of 28-38 mph with 65.2% of vehicles in pace.

On South George Mason Drive between 13th Road South and South Four Mile Run Drive, the collected data shows an 85th-percentile speed of 36 mph, a median speed of 32 mph, and a 10-mph pace speed of 28-38 mph with 68.1% of vehicles in pace.

On South George Mason Drive between 8th Street South and 6th Street South, the collected data shows an 85th-percentile speed of 36 mph, a median speed of 31 mph, and a 10-mph pace speed of 27-37 mph with 71.2% of vehicles in pace.

On North George Mason Drive between 4th Street North and North Henderson Road, the collected data shows an 85th-percentile speed of 32 mph, a median speed of 27 mph, and a 10-mph pace speed of 23-33 mph with 65.5% of vehicles in pace.

On North George Mason Drive between North Henderson Road and North Park Drive (WB only), the collected data shows an 85th-percentile speed of 35 mph, a median speed of 31 mph, and a 10-mph pace speed of 27-37 mph with 79.5% of vehicles in pace.

On North George Mason Drive between North Park Drive and North Carlin Springs Road (EB only), the collected data shows an 85th-percentile speed of 38 mph, a median speed of 33 mph, and a 10-mph pace speed of 29-39 mph with 77.1% of vehicles in pace.

On North George Mason Drive between 11th Street North and Washington Boulevard, the collected data shows an 85th-percentile speed of 40 mph, a median speed of 35 mph, and a 10-mph pace speed of 30-40 mph with 73.3% of vehicles in pace.

On North George Mason Drive between 19th Road North and 20th Street North, the collected data shows an 85th-percentile speed of 37 mph, a median speed of 33 mph, and a 10-mph pace speed of 29-39 mph with 74.2% of vehicles in pace.

Finally, on North George Mason Drive between 25th Road North and 25th Place North, the collected data shows an 85th-percentile speed of 35 mph, a median speed of 30 mph, and a 10-mph pace speed of 26-36 mph with 77.5% of vehicles in pace.

Overall, the collected speed data demonstrates that motorists are comfortable driving at or above the existing posted speed limit of 30 mph for most of the study corridor, though noticeably lower speeds were observed between 4th Street North and North Henderson Road. For this location, however, vehicular speeds are likely impacted by congestion from the signalized intersections at North Henderson Road and at North Pershing Drive, the 20 MPH School Speed Limit (When Flashing) for Barrett Elementary School, and the pedestrian crossings over both legs of the mainline at 4th Street North (for which the northern leg is equipped with RRFBs). Therefore, a reduction of the posted speed limit through this segment may not be appropriate based on free-flowing speeds.

b. Collision History

Section 2B.13 of the MUTCD provides optional guidance relative to reported crash trends for at least a 12-month period. This MUTCD section suggests that reported crash experience for at least 12 months be considered as a factor when establishing a speed limit. To analyze crash experience, a crash history of the George Mason Drive corridor was compiled for the six-year period spanning from January 1st, 2016 through December 31st, 2021. Generally, crash rates are determined by an intricate calculation involving annual average daily traffic (AADT) volumes, corridor length, and total number of crashes within the study period. The AADT is the total volume of vehicles traveling along a roadway for a year divided by 365 days. The number of million vehicle-miles traveled was produced by multiplying the AADT by the corridor length. Crash rates (R) were then calculated using the following formula:

$$R = (1{,}000{,}000 * C) / (365 * AADT * L * N)$$

Where:

R = Crash rate for the road segment expressed as crashes per million vehicle-miles of travel (VMT)

C = Total number of crashes in the study period.

N = Number of years of data.

AADT = Number of vehicles per day (both directions).

L = Length of the roadway segment in miles.

The number of crashes per million vehicle miles traveled was calculated for each segment based on available crash data.

To determine the relative safety of the George Mason Drive corridor, the crash rates were compared with the average crash rates calculated for similar corridors (in terms of roadway classification), within Arlington County as follows:

- Total number of crashes along the corridor including the intersection crashes
- Total number of crashes along the corridor excluding the intersection crashes

These rates have been calculated by Arlington County TE&O and provided to RK&K. Because the roadway classification for George Mason Drive varies within the study limits (Minor Arterial and Principal Arterial north and south of US-29, respectively), two separate sets of countywide crash rates were used. From 2013 through 2018, the average crash rates for roadways classified as principal arterials were calculated to be 3.80 (including intersection crashes) and 0.79 (excluding intersection crashes) crashes per million vehicle miles traveled. During the same period, the average crash rates for roadways classified as minor arterials were calculated to be 4.21 (including intersection crashes) and 1.11 (excluding intersection crashes) crashes per million vehicle miles traveled.

While research links vehicular speeds with crashes and crash severity, relationships between speed limit increases/decreases, crash rates, and crash severity are complex. Adding to the complexity are countless other variables including: highway design, vehicle design, speed enforcement, level of urbanization, type of topography (flat, hilly, mountainous), weather conditions, and characteristics of the driving population. In this study, the "average" crash rate is used to provide some consistency with data collected over a period of time to represent typical roadway conditions with consideration for the complex variables that shape the driving experience.

Table 2 outlines vehicle and pedestrian/bicycle crashes, AADT, and crash rates for each segment of the corridor; the corridor is divided into smaller segments based on the AADT estimates. Comparing the calculated crash rates with the average rates in Arlington County is a significant factor for consideration in establishing an appropriate speed limit.

Table 2 - Crash History (01/01/2016 - 12/31/2021)

Segment	No. of Total Crashes	No. of Non-Intersection Crashes	No. of Pedestrian /Bicycle Related Crashes	No. of Severe Injury/ Fatal Crashes	Approx. 2019 AADT	Crashes per Million Vehicle Miles (Total Crashes)	Crashes per Million Vehicle Miles (Non-Intersection Crashes)
County Line to Columbia Pike	100	48	6 / 0	2 / 0	15,000	2.45	1.18
Columbia Pike to US-50	98	47	2 / 0	0 / 0	25,000	2.28	1.09
US-50 to North Carlin Springs Road	81	32	3 / 0	2 / 0	22,000	2.51	0.99
North Carlin Springs Road to Washington Boulevard	39	20	1 / 0	0 / 0	21,000	0.86	0.44
Washington Boulevard to US-29	62	13	3 / 0	1 / 1	16,000	1.99	0.42
US-29 to Yorktown Boulevard	16	6	0 / 0	1 / 0	7,800	1.95	0.73

Note: South George Mason Drive from South Dinwiddie Street to 6th Street South is included in Arlington County's High-Injury Network (HIN) and is currently under review though a Vision Zero safety audit

The crash history for the first segment (from the County Line to Columbia Pike) shows that the total crash rate of 2.45 is below the County average crash rate of 3.80 crashes per million vehicle miles traveled on a Principal Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 1.18, which is above the County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 100 crashes within this segment during the six-year analysis period, 48 of which were non-intersection crashes. There were six (6) pedestrian related crashes within this segment. Speeding was a contributing factor to 19 crashes. There were 2 severe injury-related crashes reported for this segment during the analysis period.

The crash history for the second segment (Columbia Pike to US-50) shows that the total crash rate of 2.28 is below the County average crash rate of 3.80 crashes per million vehicle miles traveled on a Principal Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 1.09, which is above the County average crash rate of 0.79 crashes

per million vehicle miles traveled. There were 98 crashes within this segment during the six-year analysis period, 47 of which were non-intersection crashes. There were two (2) pedestrian related crashes within this segment. Speeding was a contributing factor to 13 crashes. There were no fatal or severe injury-related crashes reported for this segment during the analysis period.

The crash history for the third segment (US-50 to North Carlin Springs Road) shows that the total crash rate of 2.51 is below the County average crash rate of 3.80 crashes per million vehicle miles traveled on a Principal Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.99, which is above the County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 81 crashes within this segment during the six-year analysis period, 32 of which were non-intersection crashes. There were three (3) pedestrian related crashes within this segment. Speeding was a contributing factor to 11 crashes. There were two (2) severe injury-related crashes reported for this segment during the analysis period.

The crash history for the fourth segment (North Carlin Springs Road to Washington Boulevard) shows that the total crash rate of 0.86 is below the County average crash rate of 3.80 crashes per million vehicle miles traveled on a Principal Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.44, which is again below the latest available Arlington County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 39 crashes within this segment during the six-year analysis period, 20 of which were non-intersection crashes. There was one (1) pedestrian related crash within this segment. Speeding was a contributing factor to 6 crashes. There were no fatal or severe-injury related crashes reported for this segment during the analysis period.

For the fifth segment of the corridor (Washington Boulevard to US-29), the total crash rate is 1.99 which is below the County average crash rate of 3.80 crashes per million vehicle miles traveled on a Principal Arterial. Excluding the intersection crashes, this segment has a non-intersection crash rate of 0.42, which is again below the latest available Arlington County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 62 crashes within this segment during the six-year analysis period, 13 of which were non-intersection crashes. There were three pedestrian-related crashes within this segment. Speeding was a contributing factor to 7 crashes. There was one (1) fatal and one (1) severe-injury related crashes reported for this segment during the analysis period. The reported fatal crash involved a pedestrian and a southbound thru vehicle on North George Mason Drive, in dark conditions (10:50pm on Friday, June 14th, 2019) with no adverse weather or surface conditions reported, and speeding was not identified as a contributing factor. The crash occurred in the roadway (southbound lanes) near the bus transit stop between 17th Street North and the Virginia Hospital Center entrance. Street lighting exists at this location and there is a protected pedestrian crossing at the signalized intersection for the hospital entrance (approximately 40 feet south of the reported crash location).

The crash history for the final segment (US-29 to Yorktown Boulevard) shows that the total crash rate is 1.95 is below the available County average crash rate of 4.21 crashes per million vehicle miles traveled on a Minor Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.73, which is again below the latest available Arlington County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 16 crashes

within this segment during the six-year analysis period, 6 of which were non-intersection crashes. There were no pedestrian-related crashes within this segment. Speeding was a contributing factor to 2 crashes. There was 1 severe-injury related crash reported for this segment during the analysis period.

Based on the reported crashes throughout the study corridor, a reduction of the posted speed limit would be justified for the southern portion spanning from the County Line to North Carlin Springs Road (i.e. the first three analysis segments presented in Table 2). Within this section, the non-intersection crash rates exceeded the Countywide averages for a Principal Arterial. Of the 279 total crashes reported from the County Line to North Carlin Springs Road, there were 11 pedestrian-related crashes, 4 severe injury-related crashes, and 43 crashes in which speeding was a contributing factor.

c. Pedestrian and Bicyclist Activity

Section 2B.13 of the MUTCD provides optional guidance that pedestrian activity be considered as a factor when establishing a speed limit.

Pedestrian and on-street bicycle volumes were collected for 12 hours (7:00 AM to 7:00 PM) at nine intersections within the study area:

Collected on October 26th, 2022:
- South George Mason Drive at 6th Street South
- South George Mason Drive at 4th Street South
- North George Mason Drive at 4th Street North
- North George Mason Drive at 9th Street North
- North George Mason Drive at 19th Street North
- North George Mason Drive at 22nd Street North
- North George Mason Drive at 27th Street North
- North George Mason Drive at Yorktown Boulevard

Collected on September 21st, 2022:
- North George Mason Drive at North Park Drive

The raw intersection turning movement counts are included in Appendix 2. These pedestrian and bicycle volumes capture the peak 12 hours of significant activity along each segment which is a reasonable representation of the daily activity on a typical weekday. Volumes for pedestrian and bicycle activity as well as the presence of high-visibility crosswalks are provided in **Table 3.**

Table 3 - Pedestrian and Bicyclist Activity

Intersection	Crosswalk Control/ Warning Signs if Uncontrolled?	Weekday Pedestrian Traffic, Crossing George Mason Drive	Weekday Bicycle Traffic, Crossing George Mason Drive*	High-Visibility Crosswalks Across George Mason Drive?	Weekday Pedestrian Traffic, Total at Intersection	Weekday Bicycle Traffic, Total at Intersection
6th Street South	Uncontrolled/ Warning signs exist (in advance and at point of crossing), R1-6a signs exist	75	19	Yes (Both Legs)	257	66
4th Street South	Uncontrolled/ Warning signs exist (in advance and at point of crossing), R1-6a signs exist	21	6	Yes (South Leg)	56	41
4th Street North	Uncontrolled/ Warning signs exist, RRFBs exist	433	13	Yes (Both Legs)	600	41
North Park Drive	Uncontrolled/ Warning signs exist (in advance and at point of crossing), RRFBs exist	355	53	Yes (North Leg)	611	101
9th Street North	Uncontrolled/ Warning signs exist (S1-1)	42	8	Yes (South Leg)	197	56
19th Street North	Uncontrolled/ Warning signs exist	41	2	Yes (South Leg)	234	25
22nd Street North	Uncontrolled/ Warning signs exist (in advance and at point of crossing)	88	16	Yes (Both Legs)	186	58
27th Street North	Uncontrolled/ No warning signs	65	5	Yes (North Leg)	279	42
Yorktown Boulevard	Stop-controlled	97	29	Yes (South Leg)	260	51

*** This includes side-street bicycle thrus and lefts, and mainline lefts; and bicycles traveling on the crosswalks across the mainline.**

On a typical weekday, the collected data shows that there are generally fewer than 100 pedestrians crossing the George Mason Drive corridor at uncontrolled locations, except at the intersections with 4th Street North and North Park Drive. The 4th Street North and North Park Drive intersections with North George Mason Drive experienced heavy pedestrian activity (approximately 800 pedestrians crossing the mainline and 1,200 total pedestrians between the two intersections) which is attributed to several activity generators in the area, including Barrett Elementary School, Lubber Run Community Center, Lubber Run Park (and trailhead), and a higher density of residential development compared to the remainder of the corridor. Based on the collected data, a reduction of the posted speed limit would be justified through this section of North George Mason Drive.

d. Roadway Characteristics

Section 2B.13 of the MUTCD suggests that roadside development and environment, as well as parking practices, be considered as a factor when establishing a speed limit.

George Mason Drive is a pedestrian and bike-friendly environment with transit commuter bus operations, sidewalks, bicycle lanes, and marked crosswalks throughout much of the corridor. The roadside development detailed below is based on the Arlington County General Land Use Plan (GLUP), the Arlington County Zoning Boundaries, and existing roadside development (see **Figure 3A** through **Figure 3C**).

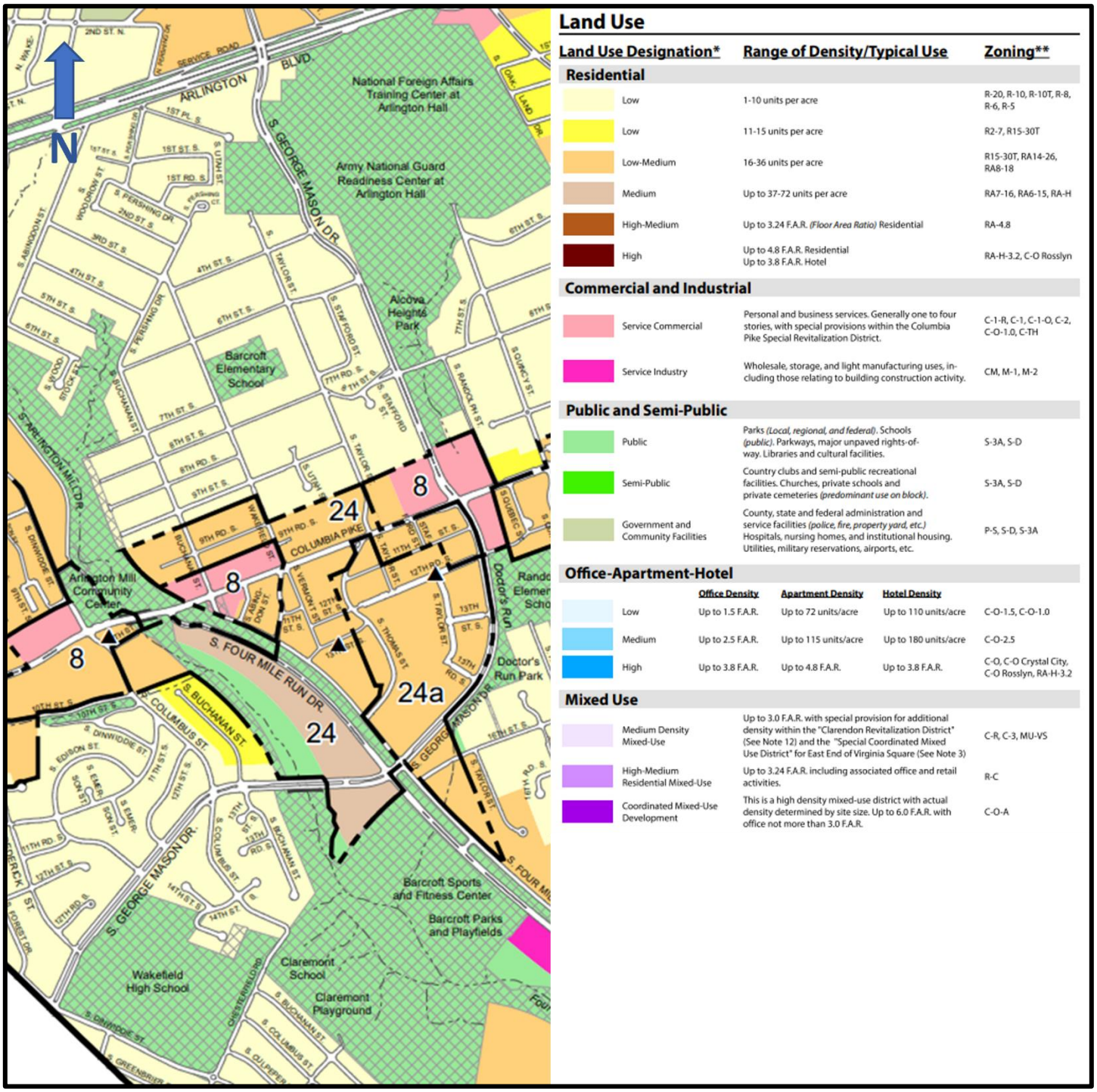
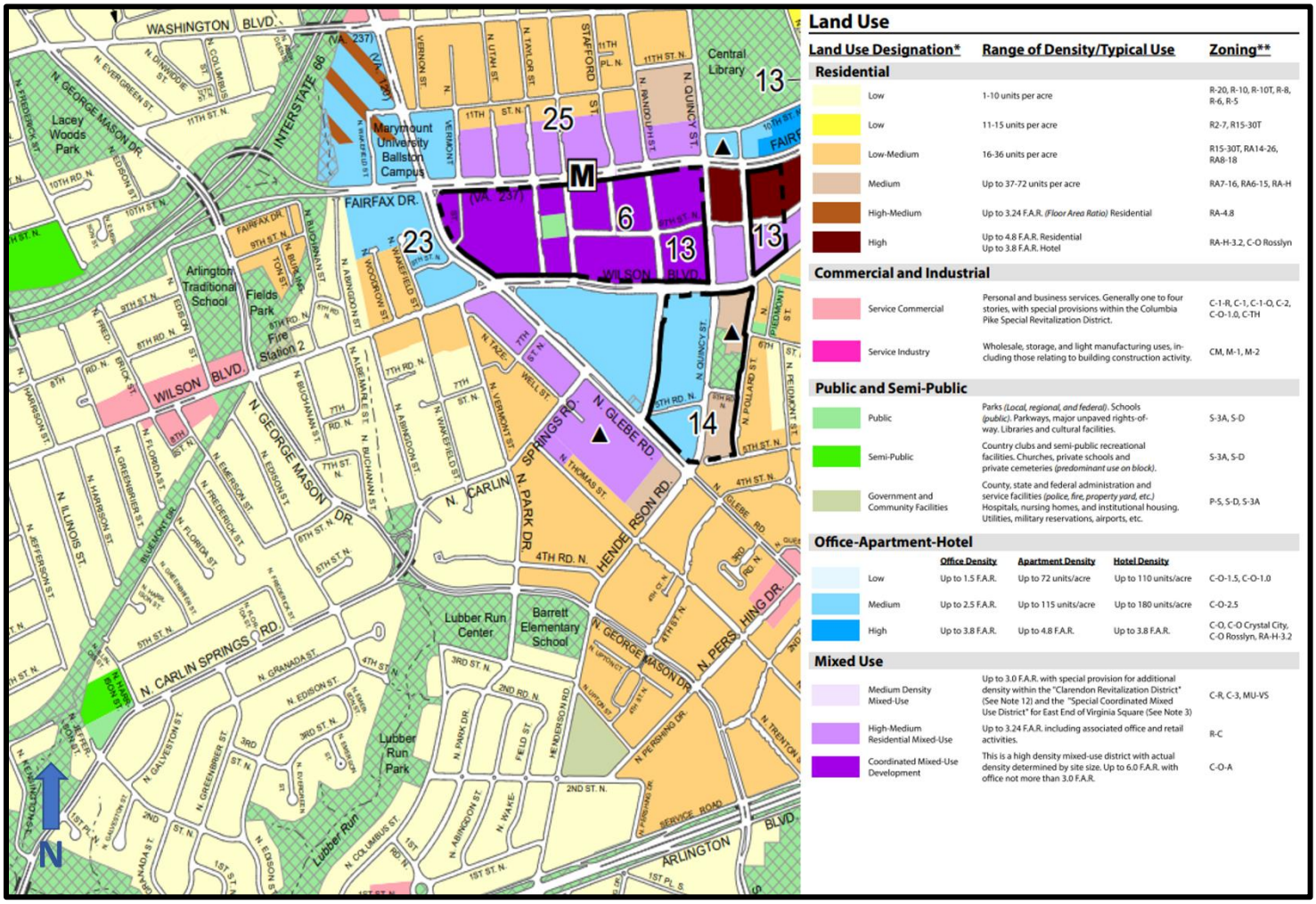


Figure 3A - General Land Use Plan Map (Sheet 1)



Land Use

Land Use Designation*	Range of Density/Typical Use	Zoning**
Residential		
Low	1-10 units per acre	R-20, R-10, R-10T, R-8, R-6, R-5
Low	11-15 units per acre	R2-7, R15-30T
Low-Medium	16-36 units per acre	R15-30T, RA14-26, RA8-18
Medium	Up to 37-72 units per acre	RA7-16, RA6-15, RA-H
High-Medium	Up to 3.24 F.A.R. *(Floor Area Ratio)* Residential	RA-4.8
High	Up to 4.8 F.A.R. Residential Up to 3.8 F.A.R. Hotel	RA-H-3.2, C-O Rosslyn
Commercial and Industrial		
Service Commercial	Personal and business services. Generally one to four stories, with special provisions within the Columbia Pike Special Revitalization District.	C-1-R, C-1, C-1-O, C-2, C-O-1.0, C-TH
Service Industry	Wholesale, storage, and light manufacturing uses, including those relating to building construction activity.	CM, M-1, M-2
Public and Semi-Public		
Public	Parks *(Local, regional, and federal)*. Schools *(public)*. Parkways, major unpaved rights-of-way. Libraries and cultural facilities.	S-3A, S-D
Semi-Public	Country clubs and semi-public recreational facilities. Churches, private schools and private cemeteries *(predominant use on block)*.	S-3A, S-D
Government and Community Facilities	County, state and federal administration and service facilities *(police, fire, property yard, etc.)* Hospitals, nursing homes, and institutional housing. Utilities, military reservations, airports, etc.	P-S, S-D, S-3A

Office-Apartment-Hotel	Office Density	Apartment Density	Hotel Density	
Low	Up to 1.5 F.A.R.	Up to 72 units/acre	Up to 110 units/acre	C-O-1.5, C-O-1.0
Medium	Up to 2.5 F.A.R.	Up to 115 units/acre	Up to 180 units/acre	C-O-2.5
High	Up to 3.8 F.A.R.	Up to 4.8 F.A.R.	Up to 3.8 F.A.R.	C-O, C-O Crystal City, C-O Rosslyn, RA-H-3.2

Mixed Use		
Medium Density Mixed-Use	Up to 3.0 F.A.R. with special provision for additional density within the "Clarendon Revitalization District" (See Note 12) and the "Special Coordinated Mixed Use District" for East End of Virginia Square (See Note 3)	C-R, C-3, MU-VS
High-Medium Residential Mixed-Use	Up to 3.24 F.A.R. including associated office and retail activities.	R-C
Coordinated Mixed-Use Development	This is a high density mixed-use district with actual density determined by site size. Up to 6.0 F.A.R. with office not more than 3.0 F.A.R.	C-O-A

Figure 3B - General Land Use Plan Map (Sheet 2)

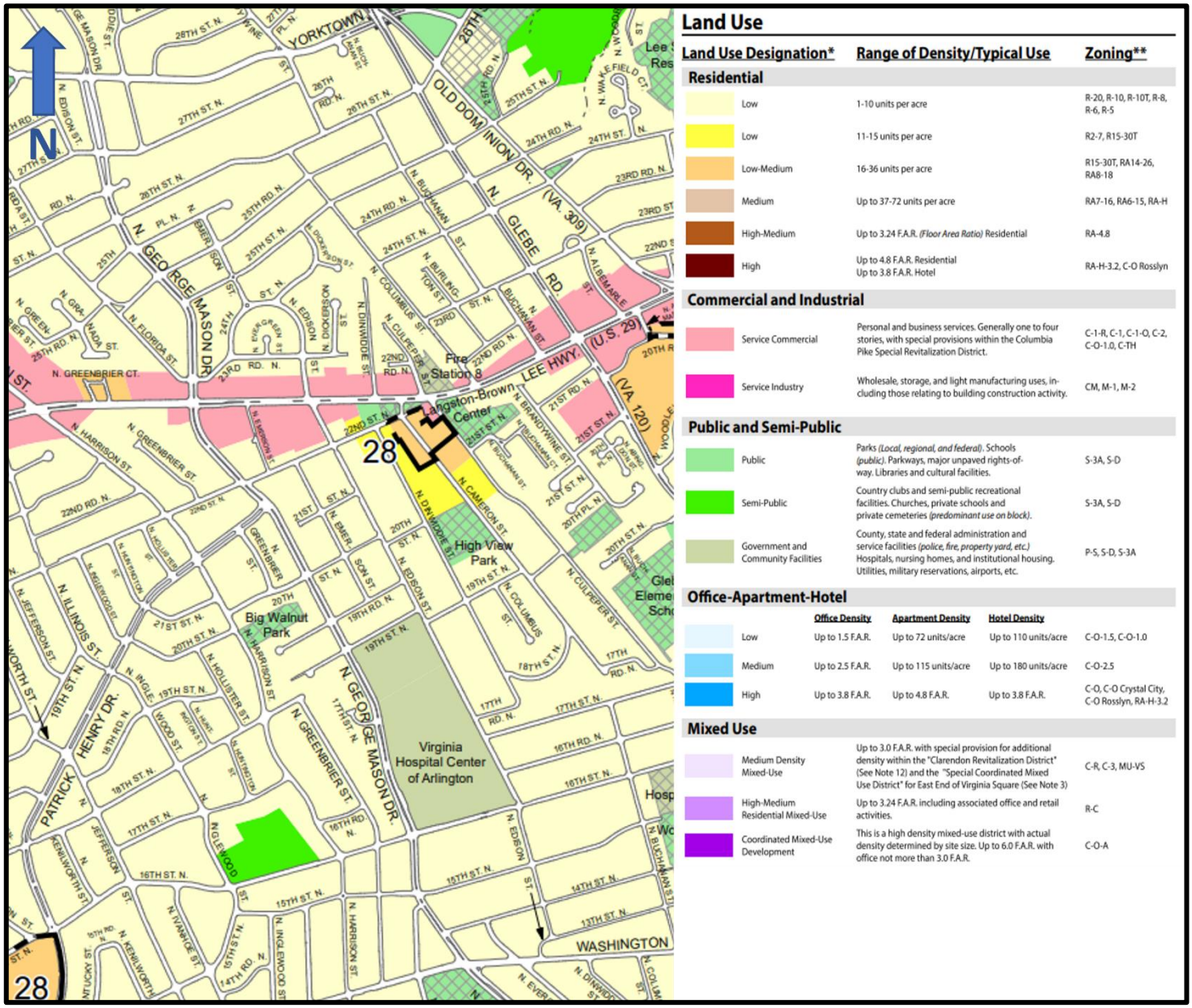


Figure 3C - General Land Use Plan Map (Sheet 3)

Table 4 describes the roadway characteristics along the George Mason Drive corridor with consideration for number of lanes, on-street parking activity, driveway density, and sight distance impacts. George Mason Drive is mainly planned for low to medium-density residential uses.

Table 4 - Roadway Characteristics

Segment	Length (mi.)	Lanes per Direction	On-Street Parking Activity	Driveway Density	Primary Roadside Land Uses	Sight Distance Restrictions
County Line to Dinwiddie Street	0.01	2	None	None	Residential	Low: Trees
Dinwiddie Street to Columbus Street	0.42	2	Street parking both sides	High 36 dvwys 85/mi	Residential, Public	Low: Trees, vertical curve, parked cars
Columbus Street to South Buchanan Street	0.05	2+bike lanes both sides	Street parking NB side	Moderate 3 dvwys 60/mi	Residential	Low: Horizontal curve, parked cars
South Buchanan Street to George Mason Village Driveway	0.16	2+bike lanes both sides	None	Low 4 dvwys 25/mi	Residential	Low: Trees
George Mason Village Driveway to South Four Mile Run Drive	0.07	2+bike lanes both sides	Street parking NB side	None	Residential	Low: Trees, parked cars
South Four Mile Run Drive to 4th Street South	1.00	2	Street parking both sides	Low 29 dvwys 29/mi	Residential, Commercial, Public	Low: Trees, horizontal curve, parked cars
4th Street South to Arlington Boulevard	0.32	2+bike lane NB side	Street parking SB side	Low 6 dvwys 19/mi	Residential, Public	Low: Trees, horizontal curve, parked cars
Arlington Boulevard to North Pershing Drive	0.18	2	Street parking both sides	Low 1 dvwy 6/mi	Residential	Low: Trees, parked cars
North Pershing Drive to 4th Street North	0.09	2	Street parking NB side	None	Residential	Low: Trees, parked cars

Segment	Length (mi.)	Lanes per Direction	On-Street Parking Activity	Driveway Density	Primary Roadside Land Uses	Sight Distance Restrictions
4th Street North to North Buchanan Street	0.51	2	None	Low 3 dvwys 6/mi	Residential, Public	Low: Trees, horizontal curve
North Buchanan Street to Wilson Boulevard	0.27	2	Street parking SB side	Very High 37 dvwys 137/mi	Residential	Low: Trees, parked cars
Wilson Boulevard to 11th Street North	0.40	2+bike lanes both sides	None	Low 9 dvwys 23/mi	Residential, Commercial, Public	Low: Trees
11th Street North to Washington Boulevard	0.19	2+bike lane NB side	Street parking both sides	Moderate 12 dvwys 63/mi	Residential, Public	Low: Trees, parked cars
Washington Boulevard to 16th Street North	0.20	2	None	Moderate 13 dvwys 65/mi	Residential	Low: Trees, horizontal curve
16th Street North to Virginia Hospital Center Driveway	0.10	2	Street parking NB side	Moderate 4 dvwys 40/mi	Residential, Public	Low: Trees, parked cars
Virginia Hospital Center Driveway to 19th Street North	0.17	2	None	Moderate 6 dvwys 35/mi	Residential, Public	Low: Trees
19th Street North to US-29	0.41	2	Street parking both sides	High 30 dvwys 73/mi	Residential, Commercial	Low: Trees, vertical curve, parked cars
US-29 to Yorktown Boulevard	0.49	1+bike lanes	Street parking both sides	Moderate 33 dvwys 67/mi	Residential, Commercial	Low: Trees, horizontal curve, parked cars

George Mason Drive from the County Line to Yorktown Boulevard is primarily a four-lane divided roadway (two-lane divided between US-29 and Yorktown Boulevard), with dedicated turn lanes at signalized intersections along with many unsignalized intersections. The study segment experiences moderate pedestrian and bicycle activity throughout most of the corridor, though much heavier activity was observed between the North George Mason Drive

intersections at 4th Street North and North Park Drive, due to nearby public areas including Lubber Run Community Center (and trailhead) and Barrett Elementary School along with higher-density residential development in this vicinity.

Despite on-street parking, overgrown trees, bus transit operations, and areas of curvature, sight distance is generally sufficient throughout the corridor. High-visibility crosswalks along the corridor provide adequate identification for access to bus transit stops, residences, and parks/trails on both sides of the roadway. Crosswalks at uncontrolled locations are generally equipped with pedestrian warning sign (W11-2) assemblies at the point of crossing and often in advance of the crossing. There are pedestrian hybrid beacons (PHBs) provided at the South George Mason Drive intersections with 13th Street South, Army National Guard Readiness Center, and South Frederick Street. These PHBs are slated to be replaced with full signals.

The South George Mason Drive Multimodal Study reviewed the two-mile segment of this corridor spanning from the County Line to US-50 (Arlington Boulevard). This area was reviewed for potential improvements in line with the County's Master Transportation Plan. As of Spring 2023, the project team has finalized the multimodal study, which includes preferred design concepts for the corridor and its major intersections. Funding for further design and construction of these planned improvements will be considered in the next Capital Improvement Program process led by the County Manager's Office beginning in Fall 2023. Additionally, South George Mason Drive from South Dinwiddie Street to 6th Street South is included in Arlington County's High-Injury Network (HIN) and is currently under review though a Vision Zero safety audit.

Considering the roadside development characteristics along the study corridor, a reduction of the posted speed limit would be justified through sections with higher concentrations of residential development and public land use, particularly south of I-66.

IV. Conclusion

This study was performed with to investigate the appropriateness of the existing 30 mph speed limit on George Mason Drive between the County Line and Yorktown Boulevard in Arlington County. Based on guidance presented in the MUTCD and other FHWA publications as well as the County's Vision Zero goals, several characteristics of the George Mason Drive corridor were analyzed in support of examining the existing posted speed limit. These characteristics included speed statistics, crash history, pedestrian and bicyclist activity, roadway characteristics, future roadway development and its impacts on traveling modes, activity generators, and other contributors. Considering all factors, the recommendation is to establish a new speed limit of 25 mph on North George Mason Drive between US-50 and North Carlin Springs Road, and maintain the existing 30 mph speed limit for the remainder of the study section.

V. Recommendation

Based on all factors considered in analyzing the existing posted speed limit for George Mason Drive between the County Line and Yorktown Boulevard in Arlington County, the data supports reducing the speed limit from 30 mph to 25 mph between US-50 and North Carlin Springs Road on North George Mason Drive, and maintaining the existing 30 mph speed limit for the remainder of the study section.

Following an appropriate Board action, a new speed limit of 25 mph will be implemented along North George Mason Drive from US-50 to North Carlin Springs Road by installing 25 mph speed limit signs along this section in accordance with Chapter 8, Section 46.2-878 of the Motor Vehicle Code of the Commonwealth of Virginia. This section of code states that "Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs". It is expected that a thorough onsite evaluation will be completed to ensure an appropriate sign replacement strategy in order to install the new speed limit signs along North George Mason Drive. Final sign locations will be based on Section 2B.13 of the MUTCD.

VI. References

1. U.S. Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices*, 2009 Edition. December 2009.
2. U.S. Department of Transportation Federal Highway Administration. *Speed Concepts: Informational Guide*. September 2009.
3. Transportation Research Board. *Special Report 254 Managing Speed: Review of Current Practice for Setting and Enforcing Speed Limits*. National Academy Press, Washington D.C., 1998.
4. VDOT Crash Map https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=ef9957cd10964a7286d2f9df5b85e833
5. https://www.arlingtonva.us/Government/Projects/Project-Types/Transportation-Projects/S.-George-Mason-Drive-Multimodal-Transportation-Study

Appendix 1

Speed Statistics

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\George Mason Dr.zip

Appendix 2

Intersection Turning Movement Counts

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\George Mason Dr.zip

DEPARTMENT OF ENVIRONMENTAL SERVICES

Fairfax Drive
(North Kirkwood Road to I-66 Ramps)
Speed Limit Study

Prepared for:
Arlington County Department of Environmental Services
Transportation Engineering and Operations Bureau
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Prepared by: RK&K _____ Date: 1-9-2024

Reviewed by: Andrea Wilkinson Andrea Wilkinson Date: 1-30-24

Approved by: _____ Date: 02/09/2024

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I. Executive Summary

This technical report presents the findings of a traffic engineering investigation of the speed limit along Fairfax Drive from North Kirkwood Road to the I-66 ramps in Arlington County, Virginia. The Fairfax Drive corridor is under the jurisdiction of Arlington County within the abovementioned limits, in which it is classified as a Minor Arterial and a Principal Arterial east and west of North Glebe Road, respectively. The existing posted speed limit is 30 miles per hour (mph) as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code.

To establish a new speed limit along Fairfax Drive, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of the code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

RK&K was tasked by Arlington County Transportation Engineering and Operations Bureau (TE&O) to conduct a traffic engineering investigation of the speed limit of the Fairfax Drive corridor based on guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998). Several factors were considered for analysis, including speed statistics, crash history, pedestrian activity, and roadway characteristics.

Based on all factors considered in determining the speed limit for the Fairfax Drive corridor, the data supports establishing a uniform posted speed limit of 25 mph from North Kirkwood Road to the I-66 ramps. The speed data analysis (median speeds ranged from 26-28 mph), collision history (18 pedestrian-related crashes during the six-year analysis period), pedestrian and bicycle activity (nearly 2,000 pedestrian crossings at uncontrolled locations during the 12-hour count period), land use, and roadway characteristics suggest that a 25 mph speed limit is more appropriate than the existing posted speed limit of 30 mph. Therefore, it is recommended to establish a new speed limit of 25 mph on Fairfax Drive between North Kirkwood Road and the I-66 ramps.

II. Introduction

Fairfax Drive from North Kirkwood Road to the I-66 ramps in Arlington County is classified as a Minor Arterial and a Principal Arterial east and west of North Glebe Road, respectively. The corridor's typical cross section from east to west is as follows:

- Four-lane divided, with street parking and bike lanes on both sides from North Kirkwood Road to North Glebe Road
- Four-lane divided, with an eastbound bike lane and bi-directional off-street bike lanes on the westbound side, from North Glebe Road to North Wakefield Street
- Four-lane divided from North Wakefield Street to the I-66 ramps.

WMATA and ART bus transit stops exist throughout the length of the study corridor. Land use primarily consists of medium to high-density residential, office-apartment-hotel, and mixed-use development. Two Metro transit stations (Ballston and Virginia Square) and two college campuses (for Marymount University and George Mason University) also exist along the study corridor. The Custis Trail and the Bluemont Junction Trail can be accessed north and south of the study corridor, respectively, near the I-66 ramp junction on Fairfax Drive.

The existing posted speed limit is 30 miles per hour (mph) throughout the study corridor, as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code. **Figure 1** shows the study corridor, its functional classification, and the estimated 2019 AADTs per segment.

In accordance with the Adopted Streets element of the Arlington Master Transportation Plan, the existing speed limit along Fairfax Drive from North Kirkwood Road to the I-66 ramps in Arlington County is being reviewed. To do so, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

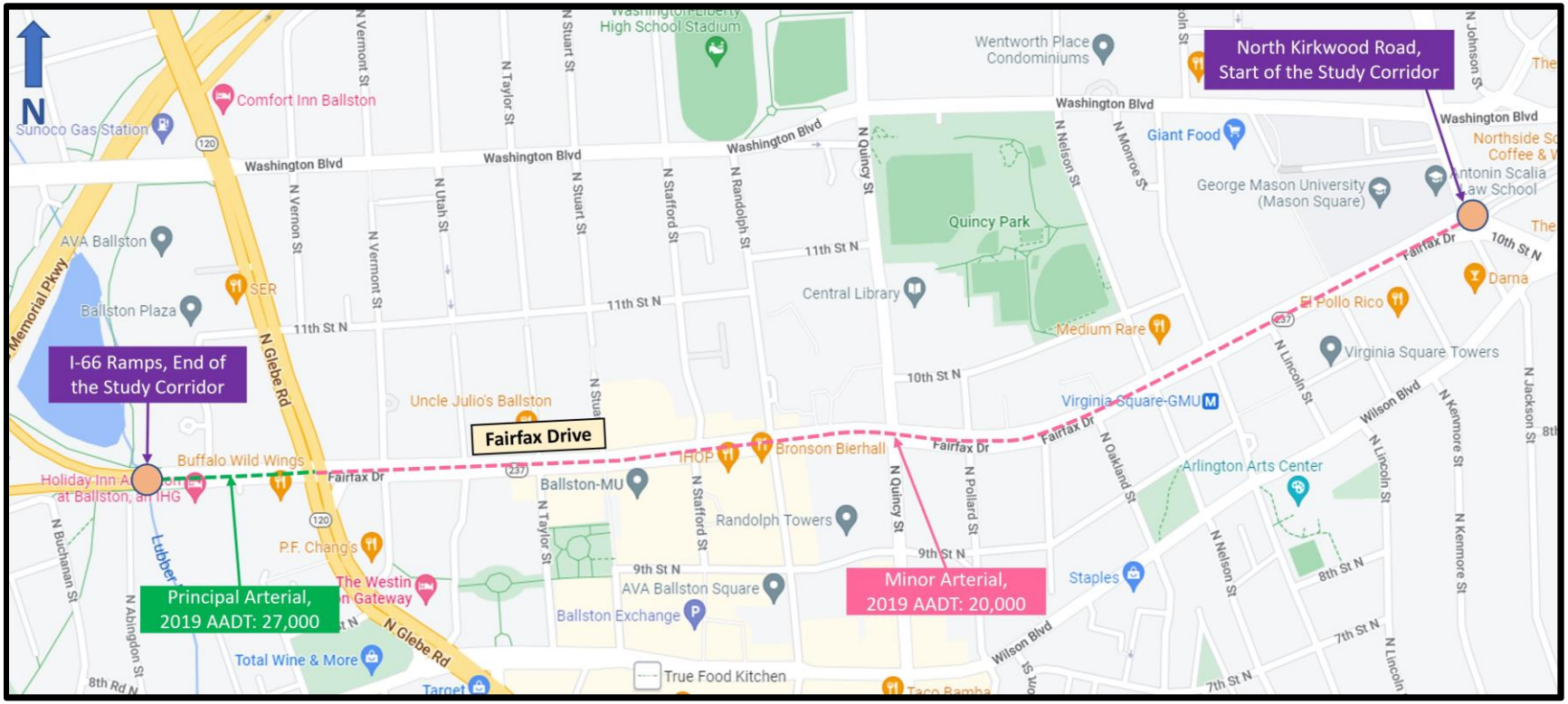


Figure 1 – Map of Fairfax Drive from N Kirkwood Road to I-66 Ramps
AADT Source: [Traffic Data - Info | Virginia Department of Transportation (virginiadot.org)]

III. Analysis

RK&K was tasked by Arlington County Transportation Engineering and Operations Bureau (TE&O) to conduct a traffic engineering investigation of the speed limit along the Fairfax Drive corridor. Guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998) provided the basis for the investigation. From these publications, the following factors were considered for analysis:

- 85th Percentile Speed
- Median (50th Percentile) Speed
- Pace Speed
- Crash History during Analysis Period
- Pedestrian and Bicycle Activity
- Parking Activity
- Roadside Development and Environment
- Roadway Characteristics

a. Speed Statistics

Section 2B.13 of the MUTCD provides guidance that a posted speed limit should be within 5 mph of the 85th-percentile speed of free-flowing traffic and includes an option that pace speed be considered as another factor.

The 85th-percentile speed is the speed at or below which 85% of counted vehicles are observed to travel under free-flowing conditions. The median speed is the speed at or below which 50% of counted vehicles are observed to travel under free-flowing conditions. The pace speed is the 10-mph range in which the highest number of vehicles counted were traveling. To analyze the speed statistics of the corridor, speed data were collected at three mid-block locations:

Collected on October 18th-19th, 2022:
- Between North Kansas Street and North Lincoln Street

Collected on May 31st-June 1st, 2023:
- Between North Oakland Street and North Pollard Street

Collected on March 1st-2nd, 2023:
- Between North Utah Street and North Vermont Street

The speed data collection points are presented in **Figure 2,** while the raw speed data are presented in Appendix 1. **Table 1** presents the 85th percentile, median, 10-mph pace speed, and percent in pace for the Fairfax Drive corridor by segments of data collection.

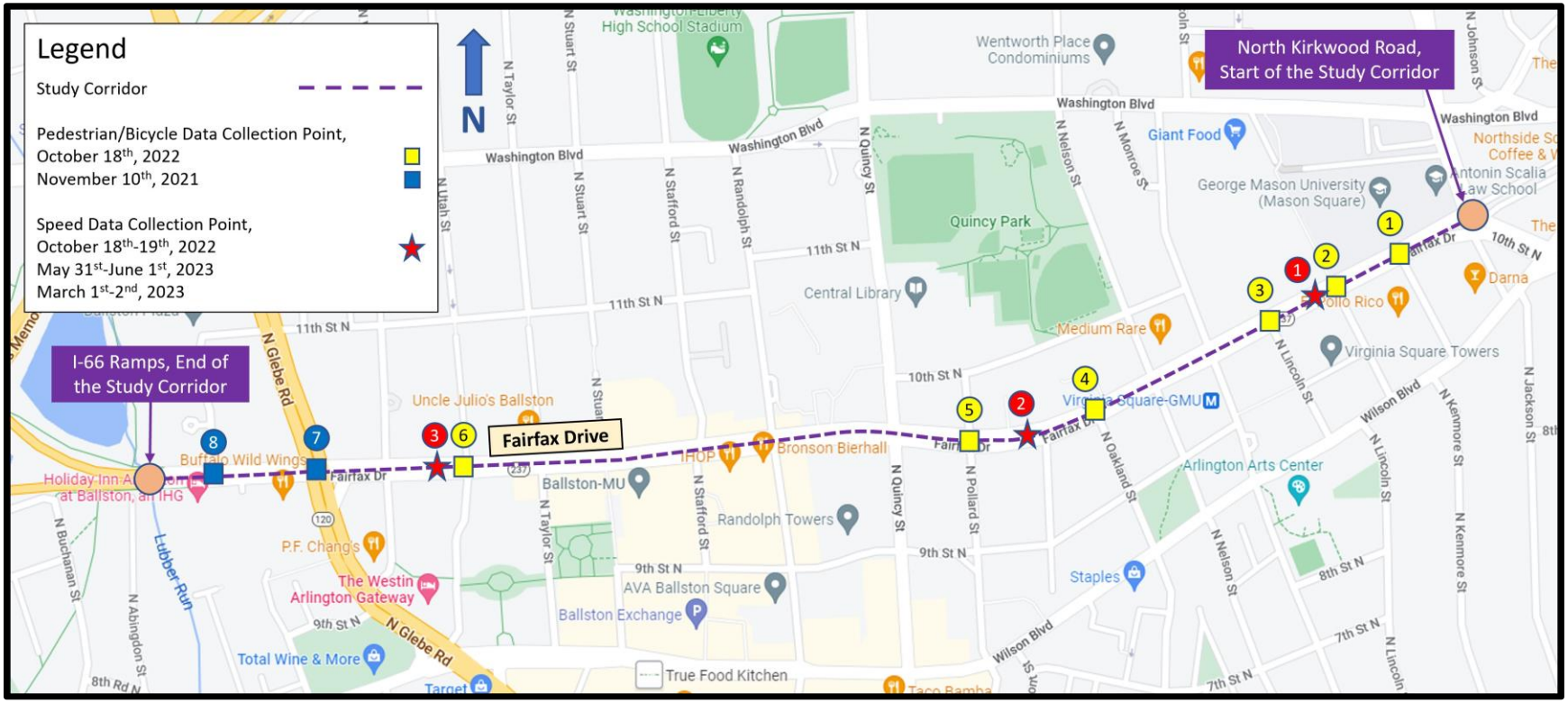


Figure 2 – Speed and Pedestrian/Bicycle Data Collection Points

Table 1 – Fairfax Drive Speed Data

Speed Zone	85th-Percentile Speed	Median Speed	10-mph Pace Speed	Percent in Pace
Between North Kansas Street and North Lincoln Street	33 mph	28 mph	24-34 mph	65.9%
Between North Oakland Street and North Pollard Street	33 mph	28 mph	24-34 mph	63.9%
Between North Utah Street and North Vermont Street	33 mph	26 mph	23-33 mph	54.8%

The speed data for the section of Fairfax Drive between North Kansas Street and North Lincoln Street shows an 85th-percentile speed of 33 mph, a median speed of 28 mph, and a 10-mph pace speed of 24-34 mph with 65.9% of vehicles in pace.

On Fairfax Drive between North Oakland Street and North Pollard Street, the collected data shows an 85th-percentile speed of 33 mph, a median speed of 28 mph, and a 10-mph pace speed of 24-34 mph with 63.9% of vehicles in pace.

Between North Utah Street and North Vermont Street, the data shows an 85th-percentile speed of 33 mph, a median speed of 26 mph, and a 10-mph pace speed of 23-33 mph with 54.8% of vehicles in pace.

Overall, the collected speed data demonstrates that a majority of motorists are unable to attain speeds that match or exceed the posted speed limit of 30 mph, as the observed median speeds ranged from 26 to 28 mph. This can be attributed to a number of factors, such as congestion due to heavy traffic volumes, signalization, and curbside activity on Fairfax Drive, and high pedestrian and bicycle volumes requiring vehicles to frequently yield at crossing locations. This data supports a reduction of the posted speed limit throughout the corridor.

b. Collision History

Section 2B.13 of the MUTCD provides optional guidance relative to reported crash trends for at least a 12-month period. This MUTCD section suggests that reported crash experience for at least 12 months be considered as a factor when establishing a speed limit. To analyze crash experience, a crash history of the Fairfax Drive corridor was compiled for the six-year period spanning from January 1st, 2016 through December 31st, 2021. Generally, crash rates are determined by a calculation involving annual average daily traffic (AADT) volumes, corridor length, and total number of crashes within the study period. The AADT is the total volume of vehicles traveling along a roadway for a year divided by 365 days. The number of million vehicle-miles traveled was produced by multiplying the AADT by the corridor length. Crash rates (R) were then calculated using the following formula:

$$R= (1{,}000{,}000 * C) / (365* AADT * L * N)$$

Where:

R = Crash rate for the road segment expressed as crashes per million vehicle-miles of travel (VMT)

C = Total number of crashes in the study period.

N = Number of years of data.

AADT = Number of vehicles per day (both directions).

L = Length of the roadway segment in miles.

The number of crashes per million vehicle miles traveled was calculated for each segment based on available crash data.

To determine the relative safety of the Fairfax Drive corridor, the crash rates were compared with the average crash rates calculated for similar corridors (in terms of roadway classification), within Arlington County as follows:

- Total number of crashes along the corridor including the intersection crashes
- Total number of crashes along the corridor excluding the intersection crashes

These rates have been calculated by Arlington County TE&O and provided to RK&K. Because the roadway classification for Fairfax Drive varies east and west of North Glebe Road (Minor Arterial on the east side and Principal Arterial on the west side), two separate sets of County calculated crash rates were used. From 2013 through 2018, the average crash rates for roadways classified as minor arterials were calculated to be 4.21 (including intersection crashes) and 1.11 (excluding intersection crashes) crashes per million vehicle miles traveled. During the same period, the average crash rates for roadways classified as principal arterials were calculated to be 3.80 (including intersection crashes) and 0.79 (excluding intersection crashes), respectively.

While research links vehicular speeds with crashes and crash severity, relationships between speed limit increases/decreases, crash rates, and crash severity are complex. Adding to the complexity are countless other variables including highway design, vehicle design, speed enforcement, level of urbanization, type of topography (flat, hilly, mountainous), weather conditions, and characteristics of the driving population. In this study, the "average" crash rate

is used to provide some consistency with data collected over a period of time to represent typical roadway conditions with consideration of the complex variables that shape the driving experience.

Table 2 outlines vehicle and pedestrian/bicycle crashes, AADT, and crash rates for each segment of the corridor; the corridor is divided into smaller segments based on the AADT estimates. Comparing the calculated crash rates with the average rates in Arlington County is a significant factor for consideration in establishing an appropriate speed limit.

Table 2 - Crash History (01/01/2016 - 12/31/2021)

Segment	No. of Total Crashes	No. of Non-Intersection Crashes	No. of Pedestrian /Bicycle Related Crashes	No. of Severe Injury/ Fatal Crashes	Approx. 2019 AADT	Crashes per Million Vehicle Miles (Total Crashes)	Crashes per Million Vehicle Miles (Non-Intersection Crashes)
North Kirkwood Road to North Glebe Road	139	31	18 / 0	6 / 0	20,000	3.49	0.78
North Glebe Road to I-66	23	8	0 / 0	0 / 0	27,000	3.24	1.13

The crash history for the first segment (North Kirkwood Road to North Glebe Road) shows that the total crash rate of 3.49 is below the available County average crash rate of 4.21 crashes per million vehicle miles traveled on a minor arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 0.78, which is below the available County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 139 crashes within this segment during the six-year analysis period, 31 of which were non-intersection crashes. There were 18 pedestrian-related crashes within this segment, and speeding was also a contributing factor to 18 crashes. There were 6 severe injury-related crashes reported for this segment during the analysis period.

For the second segment of the corridor (North Glebe Road to I-66), the total crash rate is 3.24 which is below the County average crash rate of 3.80 crashes per million vehicle miles traveled on principal arterial. Excluding the intersection crashes, this segment has a non-intersection crash rate of 1.13, which is above the available Arlington County average crash rate of 0.79 crashes per million vehicle miles traveled. There were 23 crashes within this segment during the six-year analysis period, 8 of which were non-intersection crashes. There were no pedestrian-related crashes within this segment. Speeding was a contributing factor to 4 crashes. There were no fatal and severe-injury related crashes reported for this segment during the analysis period.

In summary, the crash rates for the eastern segment (from North Kirkwood Road to North Glebe Road) were slightly lower than the County average rates, as was the total crash rate for the western segment (from North Glebe Road to I-66). The non-intersection crash rate for the western segment was higher than the Countywide average for this facility type. Even though

there are no fatal crashes reported for the study corridor between the years 2016 through 2021, the number of pedestrian crashes (18) and severe injury-related crashes (6) supports a reduction of the posted speed limit along the corridor.

c. Pedestrian and Bicyclist Activity

Section 2B.13 of the MUTCD provides optional guidance that pedestrian activity be considered as a factor when establishing a speed limit.

Pedestrian and on-street bicycle volumes were collected for 12 hours (7:00 AM to 7:00 PM) at six intersections within the study area on October 18th, 2022:

- Fairfax Drive at North Kenmore Street
- Fairfax Drive at North Kansas Street
- Fairfax Drive at North Lincoln Street
- Fairfax Drive at North Oakland Street
- Fairfax Drive at North Pollard Street
- Fairfax Drive at North Utah Street

Additional pedestrian and bicycle volumes collected under previous studies, for a 15-hour period (6:00 AM to 9:00 PM) on November 10th, 2021, were utilized at the following two intersections:

- Fairfax Drive at North Glebe Road
- Fairfax Drive at North Wakefield Street

The raw intersection turning movement counts are included in Appendix 2. These pedestrian and bicycle volumes capture the peak 12 hours of significant activity along each segment which is a reasonable representation of the daily activity on a typical weekday. Volumes for pedestrian and bicycle activity as well as the presence of high-visibility crosswalks are provided in **Table 3**.

Table 3 - Pedestrian and Bicyclist Activity

Intersection	Crosswalk Control/ Warning Signs if uncontrolled?	Weekday Pedestrian Traffic, Crossing Fairfax Drive	Weekday Bicycle Traffic, Crossing Fairfax Drive*	High-Visibility Crosswalks Across Fairfax Drive?	Weekday Pedestrian Traffic, Total at Intersection	Weekday Bicycle Traffic, Total at Intersection
North Kenmore Street	Uncontrolled/ Warning signs exist, advance warning signs exist (WB)	168	11	Yes (east leg)	386	243
North Kansas Street	Uncontrolled/ Warning signs and RRFBs exist	344	11	Yes (east leg)	2,216	253
North Lincoln Street	Uncontrolled/ Warning signs exist	257	8	Yes (east leg)	786	272
North Oakland Street	Uncontrolled/ Warning signs exist	265	8	Yes (west leg)	1,573	190
North Pollard Street	Uncontrolled/ Warning signs exist, advance warning signs exist	669	19	Yes (west leg)	2,113	248
North Utah Street	Uncontrolled/ Warning signs exist, advance warning signs exist (WB)	283	15	Yes (east leg)	2,706	213
North Glebe Road	Signalized	1,345	60	Yes (both legs)	2,921	259
North Wakefield Street	Signalized	325	85	Yes (both legs)	1,142	334

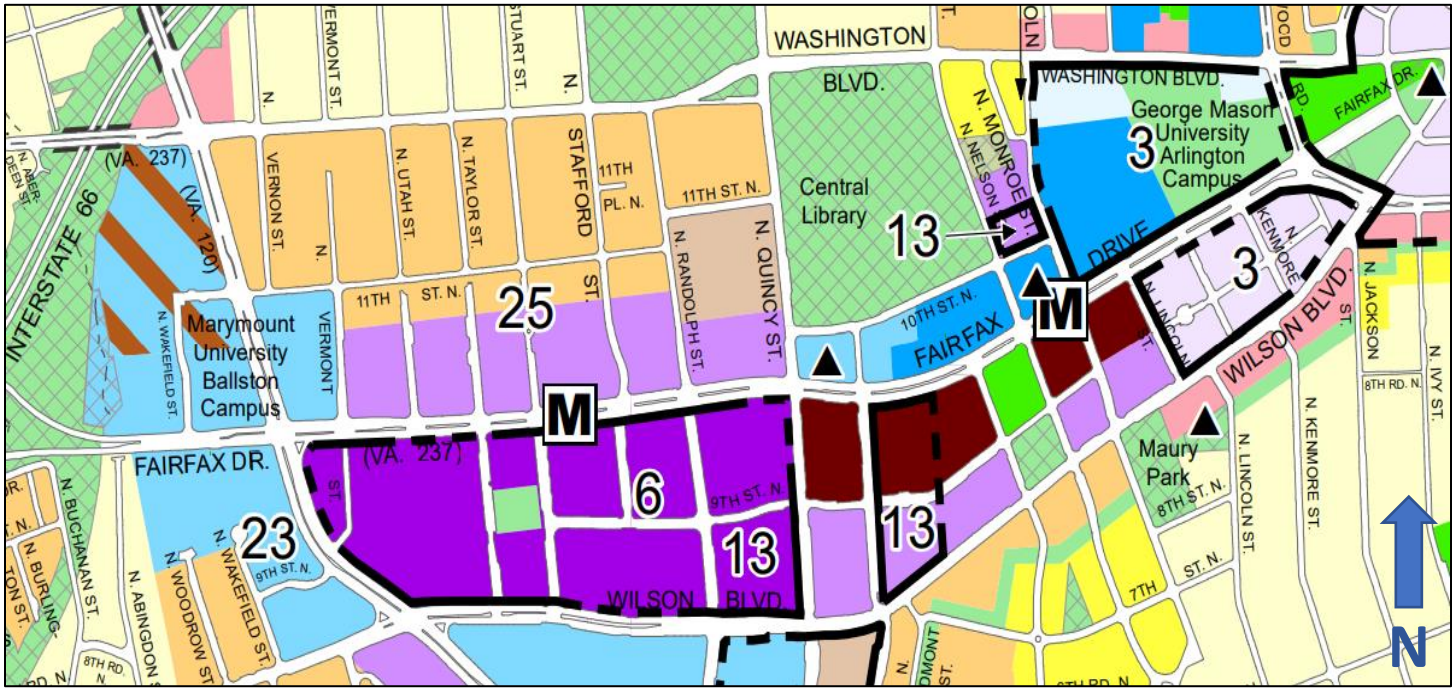
***This includes side-street bicycle thrus and lefts, and mainline lefts; and bicycles traveling on the crosswalks across the mainline.**

On a typical weekday, the collected data shows that there are heavy volumes of pedestrians crossing Fairfax Drive at each of the uncontrolled crossing locations within the study limits, with a minimum of 168 pedestrians (at North Kenmore Street) and a maximum of 669 pedestrians (at North Pollard Street) utilizing these crossings. In total, there were nearly 2,000 uncontrolled pedestrian crossings along the study corridor during the 12-hour count period. Bicycle activity was also substantial throughout the corridor, though most bicycle traffic did not cross Fairfax Drive. Contributing to these heavy volumes of non-motorized users are several medium to high-density residential, office-apartment-hotel, and mixed-use developments throughout the corridor, along with two Metro transit stations (Ballston and Virginia Square) and two college campuses (Marymount University and George Mason University) among various other facilities. The collected pedestrian and bicycle data supports a reduction of the posted speed limit throughout the study corridor.

d. Roadway Characteristics

Section 2B.13 of the MUTCD suggests that roadside development and environment, as well as parking practices, be considered as a factor when establishing a speed limit.

Fairfax Drive is a pedestrian and bike-friendly environment with transit commuter bus and rail operations, sidewalks, bicycle lanes, and marked crosswalks throughout much of the corridor. The roadside development detailed below is based on the Arlington County General Land Use Plan (GLUP), the Arlington County Zoning Boundaries, and existing roadside development (see **Figure 3**).



Land Use Designation*	Range of Density/Typical Use	Zoning**
Residential		
Low	1-10 units per acre	R-20, R-10, R-10T, R-8, R-6, R-5
Low	11-15 units per acre	R2-7, R15-30T
Low-Medium	16-36 units per acre	R15-30T, RA14-26, RA8-18
Medium	Up to 37-72 units per acre	RA7-16, RA6-15, RA-H
High-Medium	Up to 3.24 F.A.R. *(Floor Area Ratio)* Residential	RA-4.8
High	Up to 4.8 F.A.R. Residential Up to 3.8 F.A.R. Hotel	RA-H-3.2, C-O Rosslyn
Commercial and Industrial		
Service Commercial	Personal and business services. Generally one to four stories, with special provisions within the Columbia Pike Special Revitalization District.	C-1-R, C-1, C-1-O, C-2, C-O-1.0, C-TH
Service Industry	Wholesale, storage, and light manufacturing uses, including those relating to building construction activity.	CM, M-1, M-2
Public and Semi-Public		
Public	Parks *(Local, regional, and federal)*. Schools *(public)*. Parkways, major unpaved rights-of-way. Libraries and cultural facilities.	S-3A, S-D
Semi-Public	Country clubs and semi-public recreational facilities. Churches, private schools and private cemeteries *(predominant use on block)*.	S-3A, S-D
Government and Community Facilities	County, state and federal administration and service facilities *(police, fire, property yard, etc.)* Hospitals, nursing homes, and institutional housing. Utilities, military reservations, airports, etc.	P-S, S-D, S-3A

Land Use Designation*	Range of Density/Typical Use			Zoning**
Office-Apartment-Hotel	**Office Density**	**Apartment Density**	**Hotel Density**	
Low	Up to 1.5 F.A.R.	Up to 72 units/acre	Up to 110 units/acre	C-O-1.5, C-O-1.0
Medium	Up to 2.5 F.A.R.	Up to 115 units/acre	Up to 180 units/acre	C-O-2.5
High	Up to 3.8 F.A.R.	Up to 4.8 F.A.R.	Up to 3.8 F.A.R.	C-O, C-O Crystal City, C-O Rosslyn, RA-H-3.2
Mixed Use				
Medium Density Mixed-Use	Up to 3.0 F.A.R. with special provision for additional density within the "Clarendon Revitalization District" (See Note 12) and the "Special Coordinated Mixed Use District" for East End of Virginia Square (See Note 3)			C-R, C-3, MU-VS
High-Medium Residential Mixed-Use	Up to 3.24 F.A.R. including associated office and retail activities.			R-C
Coordinated Mixed-Use Development	This is a high density mixed-use district with actual density determined by site size. Up to 6.0 F.A.R. with office not more than 3.0 F.A.R.			C-O-A

Figure 3 - General Land Use Plan Map

Table 5 describes the roadway characteristics along the Fairfax Drive corridor with consideration for number of lanes, on-street parking activity, driveway density, and sight distance impacts. Fairfax Drive is planned for a variety of land uses including all levels of mixed-use developments, high-density residential areas, and medium to high-density office-apartment-hotel uses.

Table 4 - Roadway Characteristics

Segment	Length (mi.)	Lanes per Direction	On-Street Parking Activity	Driveway Density	Primary Roadside Land Uses	Sight Distance Restrictions
North Kirkwood Road to North Kenmore Street	0.05	2+bike lane	Street parking SB side	Low, 1 driveway 20/mile	Public (university)/ Mixed-Use	Low: Parked/Parking Vehicles, Trees
North Kenmore Street to North Vermont Street	0.80	2+bike lane	Street parking both sides	Low, 7 driveways 9/mile	Office/ Apartment/ Hotel/Mixed-Use	Low: Parked/Parking Vehicles, Trees
North Vermont Street to North Glebe Road	0.05	2+bike lane	Street parking NB side	None	Office/ Apartment/ Hotel/Mixed-Use	Low: Parked/Parking Vehicles, Trees
North Glebe Road to Holiday Inn Driveway	0.05	2+bike lane (dual SB, single NB)	-	Low, 1 driveway 20/mile	Office/ Apartment/ Hotel/Mixed-Use	Low: Trees
Holiday Inn Driveway to I-66 Ramps	0.05	2	-	Low, 1 driveway 20/mile	Office/ Apartment/ Hotel	Low: Trees

Fairfax Drive from North Kirkwood Road to the I-66 ramps is a four-lane roadway. Dedicated turn lanes are generally not provided at intersections along the corridor, with the exception of the North Quincy Street, North Glebe Road, and North Wakefield Street intersections. As mentioned in the previous section, the corridor experiences heavy pedestrian and bicycle activity due to the highly urbanized nature of roadside development and land use in this vicinity.

Despite on-street parking, landscaped vegetation, and bus transit operations, sight distance is sufficient as the corridor is relatively straight with gentle horizontal and vertical curves along its length. There are twenty-three high-visibility crosswalks along the corridor providing adequate identification for access to bus transit stops on both sides of the roadway. Six of these crosswalks are uncontrolled, with pedestrian warning sign (W11-2) assemblies at the point of crossing.

Signal upgrades planned by Arlington County include the intersection of Fairfax Drive and North Monroe Street. This project is currently in the construction phase and is expected to be completed by Fall 2023. In addition to improving the overall signal infrastructure, these upgrades include accessible pedestrian pushbuttons and improved lighting at the intersection.

A new multi-use building including office, retail, and public plaza space is planned along Fairfax Drive between North Quincy Street and North Pollard Street. The development (3901 Fairfax Drive) will include underground parking for both vehicles and bicycles, attracting additional multimodal roadway users to the corridor.

Considering the enhancements proposed with the completion of these projects and the highly urbanized nature of roadside development and land use throughout the corridor, a reduction of the posted speed limit to 25 mph is justified for the study section of Fairfax Drive from North Kirkwood Road to the I-66 ramps.

IV. Conclusion

This study was performed to investigate the appropriateness of the existing 30 mph speed limit on Fairfax Drive between North Kirkwood Road and the I-66 ramps in Arlington County. Based on guidance presented in the MUTCD and other FHWA publications as well as the County's Vision Zero goals, several characteristics of the Fairfax Drive corridor were analyzed in support of examining the existing posted speed limit. These characteristics included speed statistics, crash history, pedestrian and bicyclist activity, roadway characteristics, future roadway development and its impacts on traveling modes, activity generators, and other contributors. Considering all factors, the recommendation is to establish a new speed limit of 25 mph between North Kirkwood Road and the I-66 Ramps on Fairfax Drive.

V. Recommendation

Based on all factors considered in analyzing the existing posted speed limit for the Fairfax Drive corridor from North Kirkwood Road to the I-66 ramps in Arlington County, the data supports reducing the speed limit from 30 mph to 25 mph for the entire length of the study corridor.

Following an appropriate Board action, a new speed limit of 25 mph will be implemented on Fairfax Drive by installing 25 mph speed limit signs along this section in accordance with Chapter 8, Section 46.2-878 of the Motor Vehicle Code of the Commonwealth of Virginia. This section of code states that "Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs". It is expected that a thorough onsite evaluation will be completed to ensure an appropriate sign replacement strategy in order to install the new speed limit signs along the Fairfax Drive corridor between North Kirkwood Road and the I-66 ramps. Final sign locations will be based on Section 2B.13 of the MUTCD.

VI. References

1. U.S. Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices*, 2009 Edition. December 2009.
2. U.S. Department of Transportation Federal Highway Administration. *Speed Concepts: Informational Guide*. September 2009.
3. Transportation Research Board. *Special Report 254 Managing Speed: Review of Current Practice for Setting and Enforcing Speed Limits*. National Academy Press, Washington D.C., 1998.
4. VDOT Crash Map https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=ef9957cd10964a7286d2f9df5b85e833
5. https://www.arlingtonva.us/Government/Projects/Project-Types/Uncategorised/Traffic-Signal-Upgrades
6. https://3901fairfax.com/

Appendix 1

Speed Statistics

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\Fairfax Dr.zip

Appendix 2

Intersection Turning Movement Counts

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\Fairfax Dr.zip

ARLINGTON
VIRGINIA

DEPARTMENT OF ENVIRONMENTAL SERVICES

10th Street North
(Arlington Boulevard to North Kirkwood Road)
Speed Limit Study

Prepared for:
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Prepared by: RK&K _____ Date: 1-9-2024

Reviewed by: Andrea Wilkinson Andrea Wilkinson Date: 1-30-24

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I. Executive Summary

This technical report presents the findings of a traffic engineering investigation of the speed limit along 10th Street North from Arlington Boulevard to North Kirkwood Road in Arlington County, Virginia. Under the jurisdiction of Arlington County within the abovementioned limits, 10th Street North is classified as a Minor Arterial. The existing posted speed limit is 30 miles per hour (mph) as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code.

In order to establish a new speed limit along 10th Street North, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

RK&K was tasked by Arlington County Transportation Engineering and Operations Bureau (TE&O) to conduct a traffic engineering investigation of the speed limit of the 10th Street North corridor based on guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998). Several factors were considered for analysis, including speed statistics, crash history, pedestrian activity, and roadway characteristics.

Based on all factors considered in determining the speed limit for the 10th Street North corridor, the data supports establishing a new posted speed limit of 25 mph from Washington Boulevard to North Kirkwood Road and retaining the existing 30 mph speed limit from Arlington Boulevard to Washington Boulevard. Within the western portion of the corridor (i.e. west of Washington Boulevard), the speed data analysis (median speed of 27 mph, pace speed of 23-33 mph), collision history (9 pedestrian-related crashes during the six-year analysis period), pedestrian and bicycle activity (nearly 700 crossings at uncontrolled locations during the 12-hour count period), land use, and roadway characteristics suggest that a 25 mph speed limit is more appropriate than the existing posted speed limit of 30 mph. East of Washington Boulevard, notably higher operating speeds (median speed of 31 mph, pace speed of 27-37 mph) were recorded, and land use consists primarily of low to medium-density residential development (whereas the western portion is primarily commercial/mixed-use). Although pedestrian and bicycle data were not collected along the eastern portion of the segment (between Arlington Boulevard and Washington Boulevard) due to the lack of uncontrolled crossing locations, the crash data revealed 4 pedestrian-related crashes (including a pedestrian fatality) within this segment, and alternative countermeasures will be considered at these locations. Therefore, it is recommended to establish a new speed limit of 25 mph on 10th Street North between Washington Boulevard and North Kirkwood Road, and retain the existing 30 mph speed limit from Arlington Boulevard to Washington Boulevard.

II. Introduction

10th Street North from Arlington Boulevard to North Kirkwood Road in Arlington County is classified as a Minor Arterial. The corridor's typical cross section from east to west is as follows:

- Four-lane divided, from Arlington Boulevard to Washington Boulevard
- Four-lane divided, with on-street parking in the westbound direction, from Washington Boulevard to North Garfield Street
- Four-lane divided, with on-street parking in both directions, from North Garfield Street to North Ivy Street
- Four-lane divided, with on-street parking in the westbound direction, from North Ivy Street to North Kirkwood Road

On-street parking exists for most of the western portion of the corridor (west of Washington Boulevard) and sidewalks are provided in both directions for the length of the study section. There are no bike lanes or bus transit stops within the study limits. Land use consists primarily of low to medium-density residential, medium-density mixed-use, and service-commercial development. Arlington County Fire Station #4 is located on the northwest quadrant of the 10th Street North and North Hudson Street intersection.

The existing posted speed limit is 30 miles per hour (mph) throughout the study corridor, as established by § 14.2-12 "Maximum and Minimum Speed Limits" in the Motor Vehicles and Traffic chapter of the Arlington County Code. There are Speed Feedback Indicator Signs (SFIS) in both directions near the intersection with North Danville Street, and "30 MPH" pavement message markings within both westbound travel lanes just west of the Arlington Boulevard ramps. **Figure 1** shows the study corridor, its functional classification, and the estimated 2019 AADTs per segment.

In accordance with the Adopted Streets element of the Arlington Master Transportation Plan, the existing speed limit along 10th Street North from Arlington Boulevard to N Kirkwood Road in Arlington County is being reviewed. To do so, the requirements of § 46.2-878 of the Code of Virginia must be satisfied. This section of code addresses the authority to change speed limits and states that "[the] authority having jurisdiction over highways may decrease or increase speed limits… on any highway under its jurisdiction. Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs."

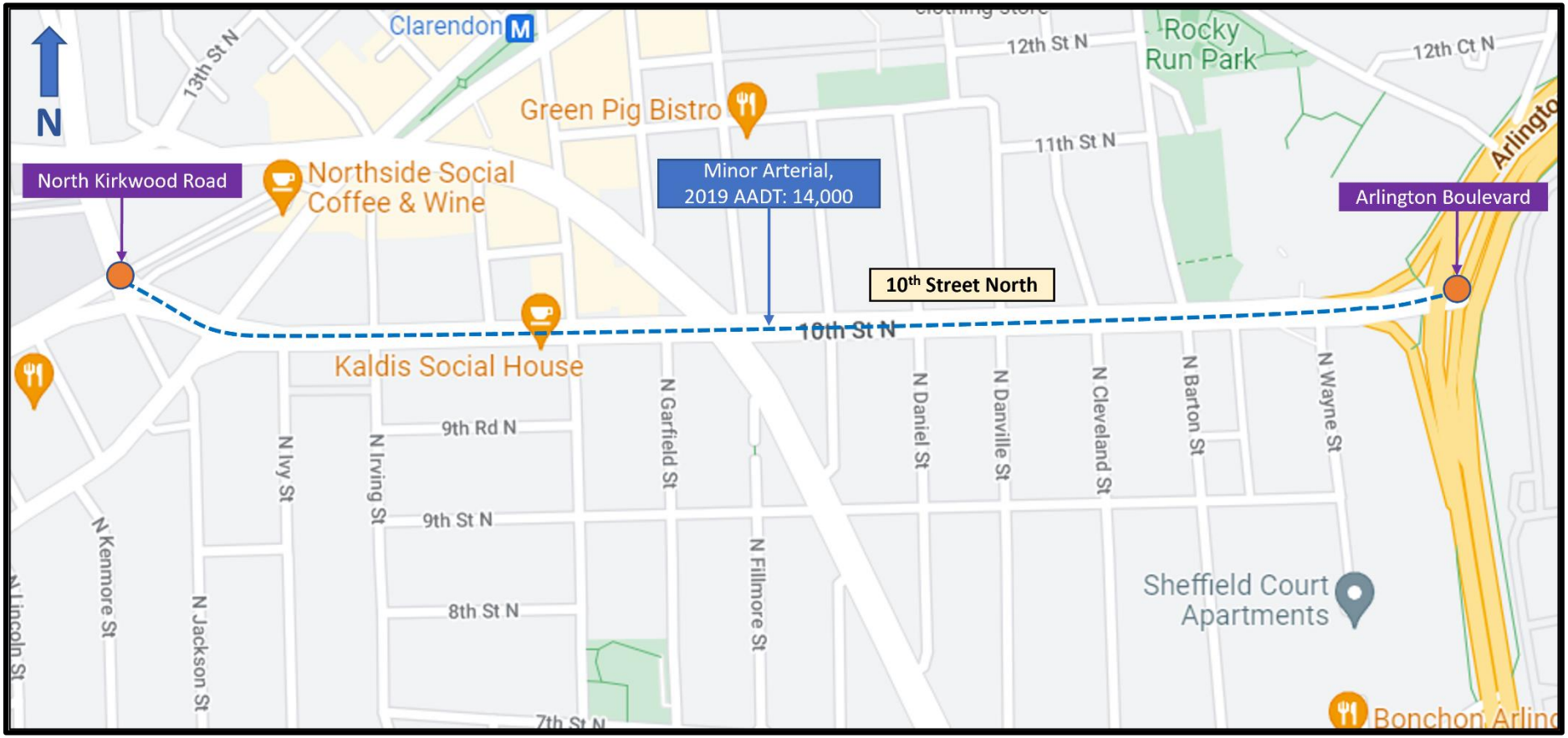


Figure 1 – Map of 10th Street from Arlington Boulevard to N Kirkwood Road,
AADT Source: [Traffic Data – Info | Virginia Department of Transportation (virginiadot.org)]

III. Analysis

RK&K was tasked by Arlington County to conduct a traffic engineering investigation of the speed limit along the 10th Street North corridor. Guidance contained in the *Manual on Uniform Traffic Control Devices* (MUTCD, 2009), Federal Highway Administration (FHWA) Publication: *Speed Concepts Informational Guide* (2009), and Transportation Research Board (TRB) Publication: *Special Report 254* (1998) provided the basis for the investigation. From these publications, the following factors were considered for analysis:

- 85th Percentile Speed
- Median (50th Percentile) Speed
- Pace Speed
- Crash History during Analysis Period
- Pedestrian and Bicycle Activity
- Parking Activity
- Roadside Development and Environment
- Roadway Characteristics

a. Speed Statistics

Section 2B.13 of the MUTCD provides guidance that a posted speed limit should be within 5 mph of the 85th-percentile speed of free-flowing traffic and includes an option that pace speed be considered as another factor.

The 85th-percentile speed is the speed at or below which 85% of counted vehicles are observed to travel under free-flowing conditions. The median speed is the speed at or below which 50% of counted vehicles are observed to travel under free-flowing conditions. The pace speed is the 10-mph range in which the highest number of vehicles counted were traveling. To analyze the speed statistics of the corridor, speed data were collected at two mid-block locations:

Collected on May 9th-10th, 2023:
- Between North Danville Street and North Daniel Street

Collected on May 31st-June 1st, 2023:
- Between North Hudson Street and North Irving Street

The speed data collection points are presented in **Figure 2** and the speed data are presented in Appendix 1. **Table 1** presents the 85th percentile, median, 10-mph pace speed, and percent in pace for the 10th Street North corridor by segments of data collection.

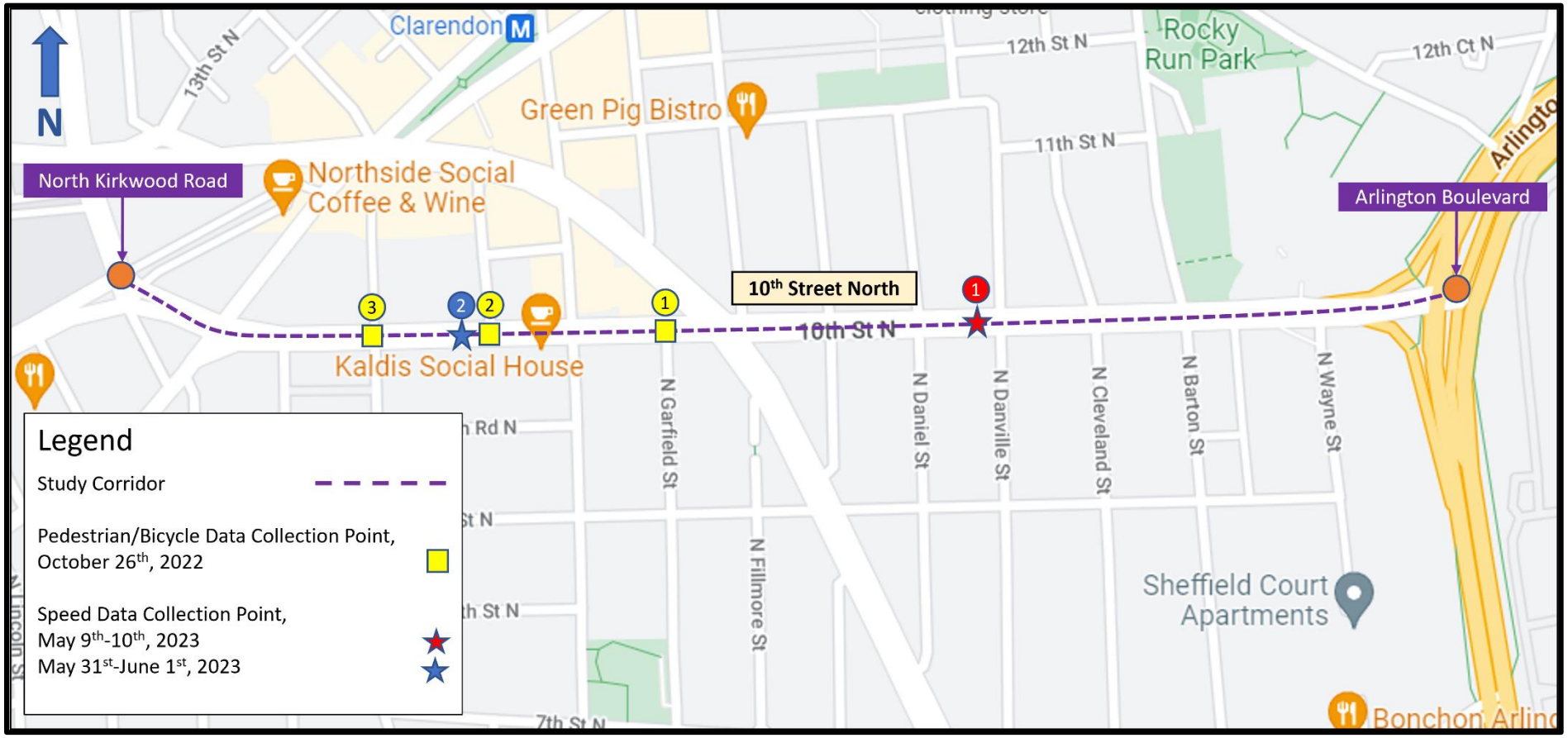


Figure 2 - Speed and Pedestrian/Bicycle Data Collection Points

Table 1 – 10th Street North Speed Data

Speed Zone	85th-Percentile Speed	Median Speed	10-mph Pace Speed	Percent in Pace
Between North Danville Street and North Daniel Street	36 mph	31 mph	27-37 mph	73.3%
Between North Hudson Street and North Irving Street	33 mph	27 mph	23-33 mph	67.5%

The speed data for the section of 10th Street North between North Danville Street and North Daniel Street shows an 85th-percentile speed of 36 mph, a median speed of 31 mph, and a 10-mph pace speed of 27-37 mph with 73.3% of vehicles in pace.

For the section of 10th Street North between North Hudson Street and North Irving Street, data shows an 85th-percentile speed of 33 mph, a median speed of 27 mph, and a 10-mph pace speed of 23-33 mph with 67.5% of vehicles in pace.

Overall, the collected speed data suggests that more than half of motorists are comfortable driving at or above the existing posted speed limit of 30 mph towards the eastern end of the study corridor, while most vehicles were traveling below the posted speed limit towards the western end of the corridor. Therefore, establishing a posted speed limit of 25 mph for the western portion of the study section (i.e. west of the signalized intersection at Washington Boulevard) is justified based on the collected speed data.

b. Collision History

Section 2B.13 of the MUTCD provides optional guidance relative to reported crash trends for at least a 12-month period. This MUTCD section suggests that reported crash experience for at least 12 months be considered as a factor when establishing a speed limit. To analyze crash experience, a crash history of the 10th Street North corridor was compiled for the six-year period spanning from January 1st, 2016 through December 31st, 2021. Generally, crash rates are determined by an intricate calculation involving annual average daily traffic (AADT) volumes, corridor length, and total number of crashes within the study period. The AADT is the total volume of vehicles traveling along a roadway for a year divided by 365 days. The number of million vehicle-miles traveled was produced by multiplying the AADT by the corridor length. Crash rates (R) were then calculated using the following formula:

$$R = (1{,}000{,}000 * C) / (365 * AADT * L * N)$$

Where:

R = Crash rate for the road segment expressed as crashes per million vehicle-miles of travel (VMT).

C = Total number of crashes in the study period.

N = Number of years of data.

AADT = Number of vehicles per day (both directions).

L = Length of the roadway segment in miles.

The number of crashes per million vehicle miles traveled was calculated for each segment based on available crash data.

To determine the relative safety of the 10th Street North corridor, the average crash rates were compared with the average crash rates calculated for similar corridors (in terms of roadway classification), within Arlington County as follows:

- Total number of crashes along the corridor including the intersection crashes
- Total number of crashes along the corridor excluding the intersection crashes

These rates have been calculated by Arlington County TE&O and provided to RK&K. Inclusive of intersection crashes, the average crash rate for roadways classified as minor arterials within Arlington County (from 2013 through 2018) was calculated to be 4.21 crashes per million vehicle miles traveled. Excluding intersection crashes, the average crash rate was calculated to be 1.11 crashes per million vehicle miles traveled.

While research links vehicular speeds with crashes and crash severity, relationships between speed limit increases/decreases, crash rates, and crash severity are complex. Adding to the complexity are countless other variables including: highway design, vehicle design, speed enforcement, level of urbanization, type of topography (flat, hilly, mountainous), weather conditions, and characteristics of the driving population. In this study, the "average" crash rate is used to provide some consistency with data collected over a period of time to represent typical roadway conditions with consideration for the complex variables that shape the driving experience.

Table 2 outlines vehicle and pedestrian/bicycle crashes, AADT, and crash rates for the corridor. Comparing the calculated crash rates with the average rates in Arlington County is a significant factor for consideration in establishing an appropriate speed limit.

Table 2 - Crash History (01/01/2016 - 12/31/2021)

Segment	No. of Total Crashes	No. of Non-Intersection Crashes	No. of Pedestrian /Bicycle Related Crashes	No. of Severe Injury/ Fatal Crashes	Approx. 2019 AADT	Crashes per Million Vehicle Miles (Total Crashes)	Crashes per Million Vehicle Miles (Non-Intersection Crashes)
Arlington Boulevard to Washington Boulevard	65	15	4 / 0	2 / 1	14,000	4.75	1.10
Washington Boulevard to North Kirkwood Road	76	19	9 / 0	3 / 0	14,000	6.73	1.68

The crash history for the first segment (Arlington Boulevard to Washington Boulevard) shows that the total crash rate of 4.75 is above the available County average crash rate of 4.21 crashes per million vehicle miles traveled on a Minor Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 1.10, which is approximately equal to the County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 65 crashes within this segment during the six-year analysis period, 15 of which were non-intersection crashes. There were four (4) pedestrian-related crashes within this segment, including one (1) fatal pedestrian crash involving an eastbound thru vehicle approximately 150 feet east of North Barton Street. This fatal crash occurred in darkness (8:57pm on Monday, February 20th, 2017) with no adverse weather or surface conditions reported, and speeding was not identified as a contributing factor. In addition to this fatal crash, there were two (2) severe-injury related crashes reported for this segment during the analysis period. Speeding was a contributing factor in 11 reported crashes.

For the second segment of the corridor (Washington Boulevard to North Kirkwood Road), the total crash rate of 6.73 is significantly higher than the County average crash rate of 4.21 crashes per million vehicle miles traveled on a Minor Arterial. Excluding intersection crashes, this segment has a non-intersection crash rate of 1.68, which is again higher than the County average crash rate of 1.11 crashes per million vehicle miles traveled. There were 76 crashes within this segment during the six-year analysis period, 19 of which were non-intersection crashes. There were nine (9) pedestrian-related crashes within this segment, along with three (3) severe-injury related crashes reported during the analysis period. Speeding was a contributing factor in 11 reported crashes.

In summary, the crash history for 10th Street North supports implementing a lower speed limit along the corridor, most notably within the segment from Washington Boulevard to North Kirkwood Road due to high crash rates and pedestrian-related crashes.

c. Pedestrian and Bicyclist Activity

Section 2B.13 of the MUTCD provides optional guidance that pedestrian activity be considered as a factor when establishing a speed limit.

Pedestrian and on-street bicycle volumes were collected for 12 hours (7:00 AM to 7:00 PM) at three intersections within the study area on October 26th, 2022. The pedestrian/bicycle data collection locations are listed below and presented in **Figure 2**.

- 10th Street North at North Garfield Street
- 10th Street North at North Hudson Street
- 10th Street North at North Irving Street

The raw intersection turning movement counts are included in Appendix 2. These pedestrian and bicycle volumes capture the peak 12 hours of significant activity along the corridor, which is a reasonable representation of the daily activity on a typical weekday. Volumes for pedestrian and bicycle activity as well as the presence of high-visibility crosswalks are provided in **Table 3**.

Table 3 - Pedestrian and Bicyclist Activity

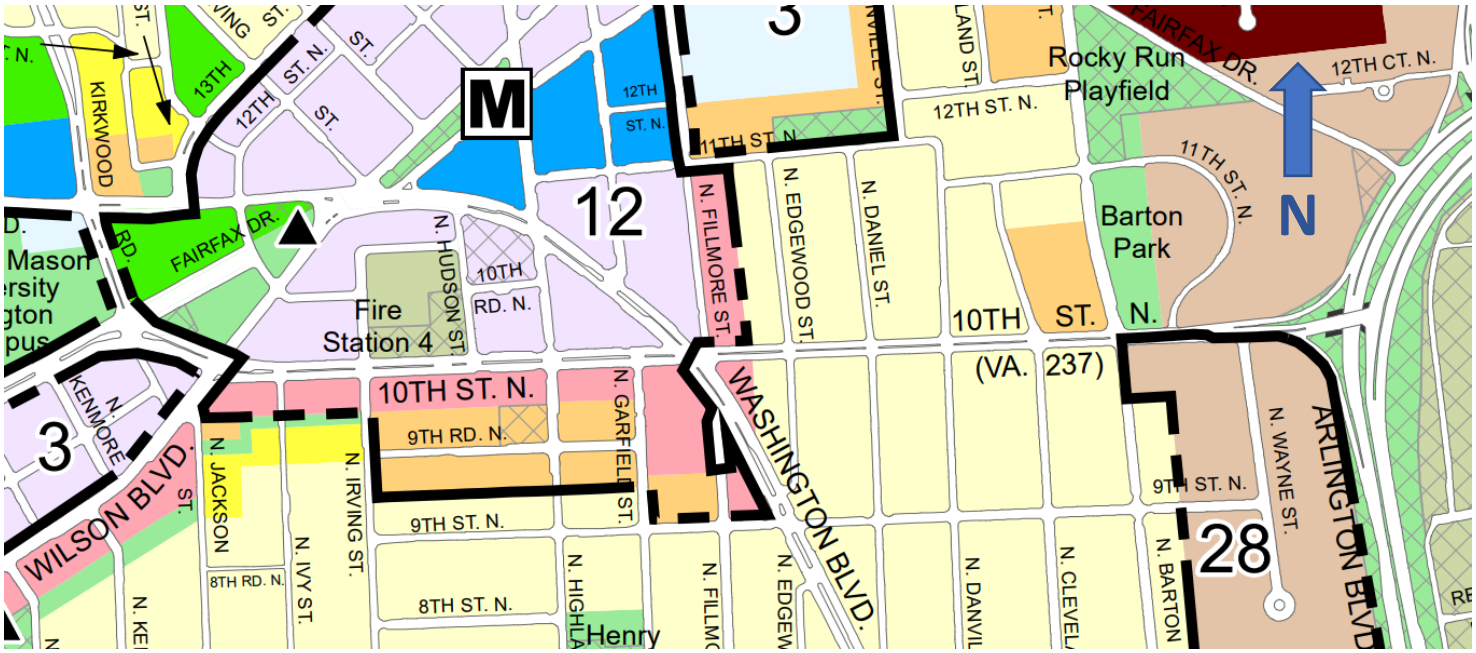
Intersection	Crosswalk Control/ Warning Signs if Uncontrolled?	Weekday Pedestrian Traffic, Crossing 10th Street North	Weekday Bicycle Traffic, Crossing 10th Street North*	High-Visibility Crosswalks Across 10th Street North?	Weekday Pedestrian Traffic, Total at Intersection	Weekday Bicycle Traffic, Total at Intersection
North Garfield Street	Uncontrolled / Warning signs exist, advance warning signs exist WB	290	8	Yes (West Leg)	456	32
North Hudson Street	Uncontrolled / Warning signs exist, advance warning signs exist WB	179	1	Yes (East Leg)	327	45
North Irving Street	Uncontrolled / Warning signs exist, advance warning signs exist EB, RRFBs exist	178	30	Yes (East Leg)	764	94

***This includes side-street bicycle thrus and lefts, and mainline lefts; and bicycles traveling on the crosswalks across the mainline.**

On a typical weekday, the collected data shows that there are nearly 700 pedestrians and bicyclists (combined) crossing the 10th Street North corridor at the three uncontrolled crossing locations within the study limits, and over 1,700 pedestrians and bicyclists in total at these intersections. All three uncontrolled crossings on 10th Street North are located west of Washington Boulevard, while east of Washington Boulevard, the only available crossings exist at the signalized intersection with North Barton Street. Pedestrian and bicycle activity generators in the vicinity of the study corridor primarily include residential, commercial, and mixed-use developments, which are heavily concentrated in the Clarendon and Virginia Square neighborhoods to the north and to the west of the study corridor, respectively. The collected pedestrian and bicycle data supports a reduction of the posted speed limit west of Washington Boulevard.

d. Roadway Characteristics

Section 2B.13 of the MUTCD suggests that roadside development and environment, as well as parking practices, be considered as a factor when establishing a speed limit. The roadside development detailed below is based on the Arlington County General Land Use Plan (GLUP), the Arlington County Zoning Boundaries, and existing roadside development (see **Figure 3**).



Land Use Designation*	Range of Density/Typical Use	Zoning**
Residential		
Low	1-10 units per acre	R-20, R-10, R-10T, R-8, R-6, R-5
Low	11-15 units per acre	R2-7, R15-30T
Low-Medium	16-36 units per acre	R15-30T, RA14-26, RA8-18
Medium	Up to 37-72 units per acre	RA7-16, RA6-15, RA-H
High-Medium	Up to 3.24 F.A.R. *(Floor Area Ratio)* Residential	RA-4.8
High	Up to 4.8 F.A.R. Residential Up to 3.8 F.A.R. Hotel	RA-H-3.2, C-O Rosslyn
Commercial and Industrial		
Service Commercial	Personal and business services. Generally one to four stories, with special provisions within the Columbia Pike Special Revitalization District.	C-1-R, C-1, C-1-O, C-2, C-O-1.0, C-TH
Service Industry	Wholesale, storage, and light manufacturing uses, including those relating to building construction activity.	CM, M-1, M-2
Public and Semi-Public		
Public	Parks *(Local, regional, and federal)*. Schools *(public)*. Parkways, major unpaved rights-of-way. Libraries and cultural facilities.	S-3A, S-D
Semi-Public	Country clubs and semi-public recreational facilities. Churches, private schools and private cemeteries *(predominant use on block)*.	S-3A, S-D
Government and Community Facilities	County, state and federal administration and service facilities *(police, fire, property yard, etc.)* Hospitals, nursing homes, and institutional housing. Utilities, military reservations, airports, etc.	P-S, S-D, S-3A

Land Use Designation*	Range of Density/Typical Use			Zoning**
Office-Apartment-Hotel	**Office Density**	**Apartment Density**	**Hotel Density**	
Low	Up to 1.5 F.A.R.	Up to 72 units/acre	Up to 110 units/acre	C-O-1.5, C-O-1.0
Medium	Up to 2.5 F.A.R.	Up to 115 units/acre	Up to 180 units/acre	C-O-2.5
High	Up to 3.8 F.A.R.	Up to 4.8 F.A.R.	Up to 3.8 F.A.R.	C-O, C-O Crystal City, C-O Rosslyn, RA-H-3.2
Mixed Use				
Medium Density Mixed-Use	Up to 3.0 F.A.R. with special provision for additional density within the "Clarendon Revitalization District" (See Note 12) and the "Special Coordinated Mixed Use District" for East End of Virginia Square (See Note 3)			C-R, C-3, MU-VS
High-Medium Residential Mixed-Use	Up to 3.24 F.A.R. including associated office and retail activities.			R-C
Coordinated Mixed-Use Development	This is a high density mixed-use district with actual density determined by site size. Up to 6.0 F.A.R. with office not more than 3.0 F.A.R.			C-O-A

Figure 3 - General Land Use Plan Map

Table 4 describes the roadway characteristics along the 10th Street North corridor with consideration for number of lanes, on-street parking activity, driveway density, and sight distance impacts. 10th Street North is mostly planned for low to medium-density residential, medium-density mixed-use, and service-commercial uses.

Table 4 - Roadway Characteristics

Segment	Length (mi.)	Lanes per Direction	On-Street Parking Activity	Driveway Density	Primary Roadside Land Uses	Sight Distance Restrictions
Arlington Boulevard to Washington Boulevard	0.44	2	None	Low 9 dvwys 20/mi	Residential, Public	None
Washington Boulevard to North Garfield Street	0.04	2	Street parking WB side	None	Service-Commercial	Low: Trees, parked cars
North Garfield Street to North Ivy Street	0.23	2	Street parking both sides	Low 5 dvwys 22/mi	Mixed-Use, Service-Commercial	Low: Trees, parked cars
North Ivy Street to North Kirkwood Road	0.10	2	Street parking WB side	Moderate 5 dvwys 50/mi	Commercial	None

10th Street North from Arlington Boulevard to North Kirkwood Road is a four-lane roadway with no turn lanes or turn bays, except at its intersections with Washington Boulevard and Wilson Boulevard. The corridor attracts large numbers of pedestrians, which is mostly due to the commercial and mixed-use developments along the western portion of the study section and in the Clarendon and Virginia Square neighborhoods immediately north and west of the corridor.

Despite on-street parking, sight distance is sufficient as the corridor is relatively straight with a gentle horizontal curve at the intersection with Wilson Boulevard and a slight vertical curve (hill crest) just east of the intersection with North Danville Street. There are ten (10) high-visibility crosswalks along the corridor which provide adequate identification for access to commercial developments and residences north and south of the study corridor.

No background or planned roadway projects were identified along this segment of 10th Street North that would impact speed limit considerations.

Considering the urbanized nature of roadside development and land use on 10th Street North between Washington Boulevard and North Kirkwood Road, a reduction of the posted speed limit to 25 mph is justified for this section. East of Washington Boulevard, the existing 30 mph speed limit is appropriate given the primarily residential (low to medium-density) land use.

IV. Conclusion

This study was performed to investigate the appropriateness of the existing 30 mph speed limit on 10th Street North between Arlington Boulevard and North Kirkwood Road in Arlington County. Based on guidance presented in the MUTCD and other FHWA publications as well as the County's Vision Zero goals, several characteristics of the 10th Street North corridor were analyzed in support of examining the existing posted speed limit. These characteristics included speed statistics, crash history, pedestrian and bicyclist activity, roadway characteristics, future roadway development its impacts on traveling modes, activity generators, and other contributors. Considering all factors, the recommendation is to establish a new speed limit of 25 mph on 10th Street North between Washington Boulevard and North Kirkwood Road, and retain the existing 30 mph speed limit from Arlington Boulevard to Washington Boulevard.

V. Recommendation

Based on all factors considered in analyzing the existing posted speed limit for the 10th Street North corridor between Arlington Boulevard and North Kirkwood Road in Arlington County, the data supports reducing the speed limit from 30 mph to 25 mph between Washington Boulevard and North Kirkwood Road, and retaining the existing 30 mph speed limit from Arlington Boulevard to Washington Boulevard.

Following an appropriate Board action, a new speed limit of 25 mph will be implemented along 10th Street North between Washington Boulevard and North Kirkwood Road by installing 25 mph speed limit signs along this section in accordance with Chapter 8, Section 46.2-878 of the Motor Vehicle Code of the Commonwealth of Virginia. This section of code states that "Such increased or decreased speed limits… shall be effective only when prescribed after a traffic engineering investigation and when indicated on the highway by signs". It is expected that a thorough onsite evaluation will be completed to ensure an appropriate sign replacement strategy in order to install the new speed limit signs along 10th Street North. Final sign locations will be based on Section 2B.13 of the MUTCD.

VI. References

1. U.S. Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices*, 2009 Edition. December 2009.
2. U.S. Department of Transportation Federal Highway Administration. *Speed Concepts: Informational Guide*. September 2009.
3. Transportation Research Board. *Special Report 254 Managing Speed: Review of Current Practice for Setting and Enforcing Speed Limits*. National Academy Press, Washington D.C., 1998.
4. VDOT Crash Map https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=ef9957cd10964a7286d2f9df5b85e833

Appendix 1

Speed Statistics

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\10th St N.zip

Appendix 2

Intersection Turning Movement Counts

Provided separately

Individual data reports intentionally not included due to file size.

Reports can be accessed at:

\\acg.arlington.local\arlgov\dept-des\Dept\TEO\01_Collaborative\Counts\Speed Limit Report Appendices\10th St N.zip