Bright View Engineering
Moving you forward

August 27, 2019

VIA EMAIL
mdecarlo@veronanj.com

Michael DeCarlo
Engineering Manager
Township of Verona Engineering Dept.
10 Commerce CT., Verona, NJ 07044
(973) 239-8146

Re: **Multi-Way STOP Analysis**
Forest Ave & Fairway Ave
Township of Verona, Essex County, NJ
Project No.: 192556

Dear Mr. DeCarlo,

Bright View Engineering, LLC, was tasked by The Township of Verona (*the Township here-in*) with performing an evaluation of the existing traffic pattern at the intersection of Forest Ave & Fairway Ave. This analysis was performed to assess the implementation of a Multi-Way STOP control at the subject intersection and to assess the necessity for any additional traffic treatments which could be considered in the study area.

Bright View Engineering (*BVE here-in*), in coordination with the Township, collected data during various site visits and was provided data by the Township to assess the existing conditions at the project intersection. The collected data and observations were utilized to determine if the existing traffic conditions in the project area justify the implementation of the new traffic pattern. This analysis was performed per the standards set forth within NJSA 39:4-8, 39:4-138 & 39:4-197 (*Title 39*), the applicable requirements of the Federal Highway Administration's (*FHWA*) Manual on Uniform Traffic Control Devices (*MUTCD*), and the American Association of State Highway and Transportation Officials' (*AASHTO*) A Policy on Geometric Design of Highways and Streets (*The Green Book*). The following points were considered within the scope of our study:

- An inventory of the roadway facilities in the project vicinity, including the existing physical and traffic operating characteristics;
- Accident data along roadway segments interconnecting the study intersections;
- Traffic volume data collection at the study intersection; and
- Summary and Conclusions.

EXISTING CONDITIONS

Multiple field investigations were conducted to obtain an inventory of existing roadway conditions, posted traffic controls, adjacent land uses, lane configurations of the roadways in the study area, and existing vehicular and pedestrian traffic patterns. The following is a brief description of the roadways:

Forest Ave is a north-south oriented roadway which spans approximately 0.68 miles through the Township of Verona. The roadway segment is bounded by Fairway Ave to the south and Bloomfield Ave (CR 506) to the north. Forest Ave continues on past Fairway Ave into the Municipality of West Orange. There are no NJDOT Straight-line Diagrams available for this roadway. We did not observe any speed limit signs posted in the study area, however, based on the surrounding land uses (residential) and the operating characteristics of the roadway, it is our opinion that the speed limit should be posted at 25 MPH; Per the guidance presented within the New Jersey Statutes Title 39, Chapter 4, Section 98, and the provisions set forth in R.S.39:4-96 and R.S.39:4-97.

Forest Ave operates as the mainline at the study intersection and is allowed free flow movement in the study area. The roadway provides for approximately 28 feet of pavement width at the intersection. Two-way travel is permitted along Forest Ave in the study area. We observed parking prohibition signs along the roadway based upon time of day; we did not observe any parking prohibition along the corners of the intersection. A crosswalk is striped across the north approach of the roadway in a "ladder" pattern. We observed curb ramps and tactile surfaces at all corners except for the south east corner. Both the status of the sidewalk and roadway surfaces appeared to be in good, serviceable condition. We observed that sidewalk was not continuous through the area. Based on our review of its operating characteristics, it is our opinion that this roadway should be classified as a "*Local Road*" under Municipal jurisdiction.

Fairway Ave is an east-west oriented roadway which spans approximately 0.73 miles through Verona Township. There are no NJDOT Straight-line Diagrams available for this roadway. Fairway Ave is bounded by itself to the west, and Pleasant Valley Way/ Lakeside Ave (*CR 636*) to the east. We note that the Township's jurisdiction runs from Forest Ave westward. We did not observe any speed limit signs posted in the study area. Based on the surrounding land uses (mainly residential in nature) and the operating characteristics of the roadway, it is our opinion that the speed limit should be posted at 25 MPH. Per New Jersey Statutes Title 39, Chapter 4, Section 98, and the provisions set forth in R.S.39:4-96 and R.S.39:4-97, the study area should be posted at 25 MPH as it is mainly residential in nature. The roadway provides for approximately 28 feet of pavement width at the intersection and allows for two-way travel. Parking is permitted on the both sides of the roadway. We observed parking prohibition signs for time of day, but no parking prohibition along the corners of the intersection. A crosswalk is striped across the roadway's west approach in a "ladder" pattern. Based on our review of its operating characteristics, it is our opinion that this roadway should be classified as a "*Local Road*" under Municipal jurisdiction.

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Forest Ave & Fairway Ave
Multi-Way STOP Analysis
Verona Twp., Essex County, NJ

FIGURE
1

SIGHT DISTANCE

BVE performed multiple site visits throughout the course of this project. During our site visits to the study intersection we observed some issues with sight distance for both stopped vehicles on the side street approaches and for vehicles approaching along the mainline. We observed foliage, landscaping treatments, signs, utility poles, and grade changes which affect the site triangles along both approaches to Forest Ave.

We based our findings upon guidance from *AASHTO's A Policy on Geometric Design of Highways and Streets, 2011 Edition*. From this design manual we utilized the guidance provided for sight distance for vehicles performing either a through/ right turn movement or a left turn movement from a full stop (*Tables 9-6 & 9-8*). Based on the speed limit, we estimated a Design Speed of 30 MPH for both roadways. We then used *Table 9-6* to determine a Stopping Sight Distance of 200' and an Intersection Sight Distance of 335' for a left turning vehicle from a full stop. This movement requires the greatest sight distance. We then used *Table 9-8* to determine an Intersection Sight Distance of 290' for a through/ right turning vehicle from a full stop.

Figure(s) 2, below, depicts the sight lines and sight triangle for a vehicle at an intersection.

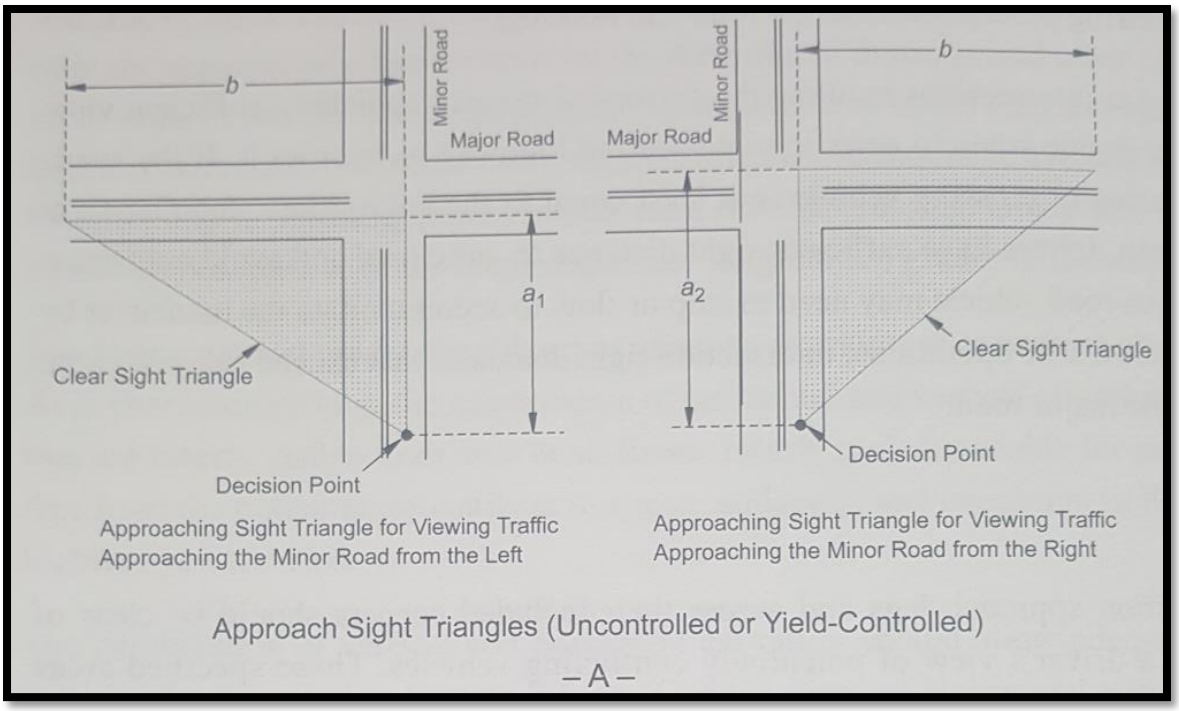

Figure 2 – Sight Triangles

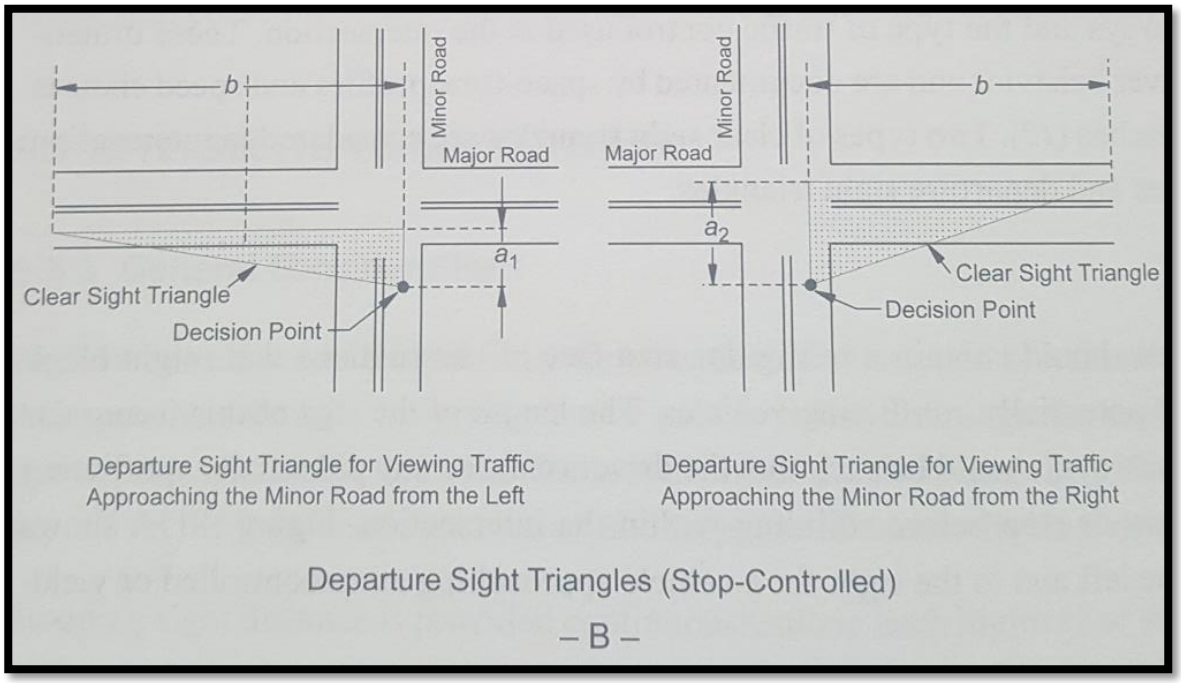

Figure 2 (*continued*)

We found both the Stopping Sight Distance for an approaching vehicle on Forest Ave (*200' min. req.*) and Intersection Sight Distance for stopped vehicles on Fairway Ave (*335' min. req. for left; 290' for a through/ right*) to be insufficient. In particular, we observed that the northeast and southwest corners were most obstructed due to existing foliage, fencing, utility poles, vent pipes, landscaping features, and grade changes along the corner properties. While we did not observe any parked vehicles along the street for any of the approaches, we did note that on-street parking did not appear to be restricted along the corners.

We observed that visibility was somewhat improved when motorists pulled their vehicles forward into the crosswalk area and observed traffic, however, sight obstruction at the corners still remained. Stopping sight distance was also affected by the sight obstructions on the corners. Approaching vehicles would have difficulty observing stopped vehicles until they began pulling into the crosswalk area along the side streets; particularly when facing the northeast and southwest corners.

It is our opinion based upon the AASHTO Guidelines that obstructions exist within the sight triangles at the study intersection and **sight distance requirements for both approaching and stopped vehicles are not met at the study intersection**.

Based upon the existing conditions at the intersection we would like to recommend alternative traffic treatments be implemented to help improve the safety and operation of the intersection.

These treatments include striping parking prohibition areas along the corners of all approaches to the study intersection. This will help keep the corners clear of parked vehicles and help reduce obstructions within the sight triangles. We recommend that the Township work with the property owners along the corners to trim back/ remove overgrown foliage which is currently obstructing the sight triangles. Additionally, we recommend that striping be refreshed, as needed, and that older/ faded signs be replaced in order to provide motorists and pedestrians better visual queues of the traffic controls in place. As the east leg of Fairway Ave runs into the municipality of West Orange, we recommend that the Township consult with West Orange prior to making any changes along this approach.

DATA COLLECTION

ACCIDENT HISTORY DATA

BVE was provided with accident data by the Verona Township Police Department for the Forest Ave roadway segment. This accident data ranged from October 2016 to January 2019. Based upon this information, we observed that there was one (1) incident reported at or in the area of the study intersection for this time frame. Below is a brief tabulation of the accident data provided:

Table 1 – Accident Data 10/16 – 01/19 (*Gerdes Ave & Forest Ave)*

DATE	STREET	CROSS STREET	TYPE	CIRCUMSTANCE
11/30/18	Forest Ave	Fairway Ave	Right Angle	None; Failure to Keep Right, Failed to Yield ROW to Veh/ Ped

Based upon the provided accident data, we observe that only one (1) accident has been reported at the intersection of Gerdes Ave & Forest Ave from October 2016 to January 2019 (*approximately 28 months or 2.3 years*). This accident was coded as a "right angle" type incident. Per the provided data we observe an accident frequency of approximately 0.4 accidents per year at the study intersection over this time frame. No other accidents were reported at this location for the provided accident range. We note from the contributing circumstances that the cause of the accident was attributed to vehicle #2, which was making a turn from the mainline onto the minor approach, failing to keep right and striking a stopped vehicle.

We note that this location does not meet or exceed the accident requirements set forth within MUTCD to fulfill the accident warrant criteria; as there is no 12-month period of time where five (5) or more accident are reported which would be correctable by a STOP/ Multi-STOP control.

TRAFFIC VOLUME DATA

Traffic Volume data was collected by Bright View Engineering and analyzed as per the recommended ITE and MUTCD standards. Manual Turning Movement Counts (*MTMC*) were collected at the intersection of Fairway Ave & Forest Ave on Tuesday, August 13, 2019, for both AM and PM Peak Periods. We elected to collect our data on Tuesday as this represents a typical weekday under normal traffic operation. It is important to note, however, that this data was collected during August when school is out of session. As such, this data does not account for school traffic.

Counts were conducted between the weekday hours of 7:00 AM and 9:00 AM in the morning and 4:00 PM and 6:00 PM in the evening. Based on the traffic volumes observed, the intersection AM Peak Hours occurred from 7:00 AM to 8:00 AM and PM Peak Hours were observed from 4:00 PM to 5:00 PM. The following table details the peak hour traffic volumes observed at the study interactions:

Table 3 – 2019 Existing Traffic Volumes

Peak Hour of Operation	Forest Ave SB			Fairway Ave WB			Forest Ave NB			Fairway Ave EB		
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
7:00 AM 8:00 AM	2	5	5	1	0	1	1	9	0	0	9	2
4:00 PM 5:00 PM	2	4	1	6	3	1	5	6	1	2	10	0

From **Table 3** above we noticed that the between the AM and PM Peak Hours, both approaches operated similarly, each processing approximately 50% of the traffic through the study intersection; when considering both peak hours together. We noted that during the AM Peak Hour Forest Ave processed approximately 60% of the traffic volume through the intersection, while during the PM Peak Hour Fairway Ave processed approximately 60% of the traffic volume through the intersection.

We observe from the Count Data above in **Table 3** that the volumes at the intersection do not meet the volume requirements set forth for a Multi-Way STOP which are detailed below. As the AM and PM Peak Hours typically represent highest two (2) hours of traffic experienced at an intersection or along a roadway segment, and neither of these hours meet or exceed the criteria set forth below, based upon the data collected the volume criteria is not satisfied.

- the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and

- the combined vehicular, pedestrian, and bicycle volume entering the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours.

We observe from the volume table above that the volumes for both the major and minor streets do not meet the 300 and 200 vehicles per hour volume requirements respectively during the peak hour. As such, the installation of a Multi-Way STOP at this location **cannot be warranted** based upon the volume requirements at this time. HOWEVER, due to the roadway geometry and sight distance concerns, we do recommend that additional traffic treatments be implemented in order to improve the safety and operation of traffic; such treatments include posting speed limits signs along the roadway segments, and posting parking prohibition signage and striping at all corners of the intersection. Our recommendations are based upon the guidance presented within sections 2B.04, 2B.05, 2B.06, & 2B.07 of the MUTCD.

SUMMARY

BVE performed on-site observations and an in-depth review of both traffic volume, speed, and accident data provided by the Township of Verona for the study intersections.

The results of our analysis indicate that a Multi-Way STOP **is not recommended** at the intersection of Forest Ave & Fairway Ave due to the existing geometric conditions. Based upon the existing traffic conditions at the study intersection, the current volumes do not meet the guidelines set forth within the MUTCD. Based upon the accident data provided the intersection does not meet the guidelines for accident history set forth within the MUTCD. Based upon the existing sight distance conditions, we recommend that the Township work with property owners at the corner properties in order to maintain and trim back overgrown foliage and landscaping features, as reasonable, in order to maintain better sight distance.

Parking prohibition signage and striping should be implemented at all corners based upon the guidance presented within Title 39. Prohibiting parking along this area will help reduce potential sight obstructions at the corners of the intersection.

We utilized the following criteria in evaluating the study location for the application of a Multi-Way STOP treatment. Based upon MUTCD, Section 2B.07 Multi-Way Stop Applications, the following justification is provided:
Support:

01 Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.

02 The restrictions on the use of STOP signs described in Section 2B.04 also apply to multi-way stop applications.

Guidance:

03 *The decision to install multi-way stop control should be based on an engineering study.*

04 *The following criteria should be considered in the engineering study for a multi-way STOP sign installation:*

A. *Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.*

B. *Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.*

C. *Minimum volumes:*

1. *The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and*
2. *The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but*
3. *If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.*

D. *Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.*

Option:

05 Other criteria that may be considered in an engineering study include:

A. The need to control left-turn conflicts;

B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;

C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and

D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.

CONCLUSIONS & RECOMMENDATIONS

It is our opinion, based on our field observations, the above guidance from MUTCD, and the existing geometric conditions at the study intersections that a Multi-Way STOP application ***is not recommended*** for Forest Ave & Fairway Ave at this time. We provide the following reasons to substantiate our findings:

- The volumes observed at the study intersection did not meet the criteria set forth by MUTCD for a Multi-Way STOP application;

- The accident data presented did not meet the requirements set forth within the MUTCD for a Multi-Way STOP Control (*5 correctable incidents within a 12-month period*). Only one (1) accident was reported at or near the accident location since October 2016 for an accident frequency of 0.4 accidents per year for the provide data range;

- We observed limited sight distance for both stopped vehicles and for vehicles approaching the study intersection. We found both the Stopping Sight Distance along the mainline (*200' min. req.*) and Intersection Sight Distance for stopped vehicles on the side street (*335' for left; 290' for right*) to be insufficient. Our findings were based upon guidance from AASHTO's Policy on Geometric Design of Highways and Streets;

- The sight triangles along the corners at the study intersection were obstructed due to foliage, fencing, sign poles, utility poles, vent pipes, changes in grade, and landscaping features adjacent to the travel way along adjacent property frontage. This was particularly prevalent along the southwest and northeast corners of the intersection. The Township should work with its residents to address some of these issues, within reason;

- We recommend that the intersection be striped to prohibit parking near points of conflict per the guidance set forth in *MUTCD* and *Title 39:4-138*. This will help keep vehicles off of the corners at intersection and improve sight distance.

- We did not observe any speed limit signs during our field visits to the study intersection. We recommend that the Township consider posting speed limit signs more prevalently

along the roadway segment, solar-powered driver feedback signs can also be considered. We have observed in the field that roadways which give live driver feedback for approaching vehicle travel speed tend to experience lower speeds than roadway segments which do not;

- It is our recommendation that the Township consider implementing an international crosswalk pattern throughout all its pedestrian crossings. This striping pattern should be comprised of white 24" wide bars, set 4' on center, and no less than 6' tall; we would recommend an 8' tall crossings from curb line to curb line, particularly around the elementary school. This pattern provides greater visibility for both pedestrians and motorists who approach the facility, greater painted surface area provides greater reflectivity during night-time lighting conditions, and due to how the pattern is laid out it may require less upkeep costs for the Township due to reduced wear and tear;

- As the east leg of Fairway Ave borders the jurisdiction of West Orange, we recommend that the Township work with West Orange should they decide to make any changes along this approach to the study intersection; and

- Any school zone striping which is in place along the pavement surface should be refreshed and striped more prominently in advance of the elementary school. We recommend that the Township work to ensure that only high visibility, MUTCD compliant signs are utilized.

Should you have any questions or require additional information please do not hesitate to contact us at (732) 236-7557.

Very truly yours,

John Jahr, P.T.P., T.S.O.S.
Principal
Bright View Engineering, LLC
732-236-7557

JJJ/jdr

Https://bvengr.sharepoint.com/sites/bvengr/proj/192556-Forest-Ave-Fairway-Ave/6-Reports_Analysis/Forest-Fairway-Multi-STOP-08-27-19.docx