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 & Gerdes Ave
Township of Verona, Essex County, NJ
Project No.: 192555

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 & Gerdes 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, school, and public green space) 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 did not observe any parking restrictions near the study intersection. Crosswalks are striped across the roadway in a "ladder" pattern. We observed curb ramps and tactile surfaces at all four corners of the intersection, however, sidewalk is not continuous through the roadway segment. Both the status of the sidewalk and roadway surfaces appeared to be in good, serviceable condition. We noted during our site visit that there was an orange traffic barrel present in the center of the intersection, over an approximately 4'x2' cut out in the asphalt surface. 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.

Gerdes Ave is an east-west oriented roadway which spans approximately 0.34 miles through Verona Township. There are no NJDOT Straight-line Diagrams available for this roadway. Gerdes Ave is bounded by Fairway Ave to the west, and Pleasant Valley Way/ Lakeside Ave (*CR 636*) to the east. We note that the Township's jurisdiction runs from Fairway Ave to Barbara Ave. We did not observe any speed limit signs posted at the study location. 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 30 feet of pavement width at the intersection and allows for two-way travel. Parking is permitted on the both sides of the roadway. We did not observe parking prohibition signs in the study area. Crosswalks are striped across the roadway 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.

Bright View Engineering *Moving you forward*	**Forest Ave & Gerdes 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.

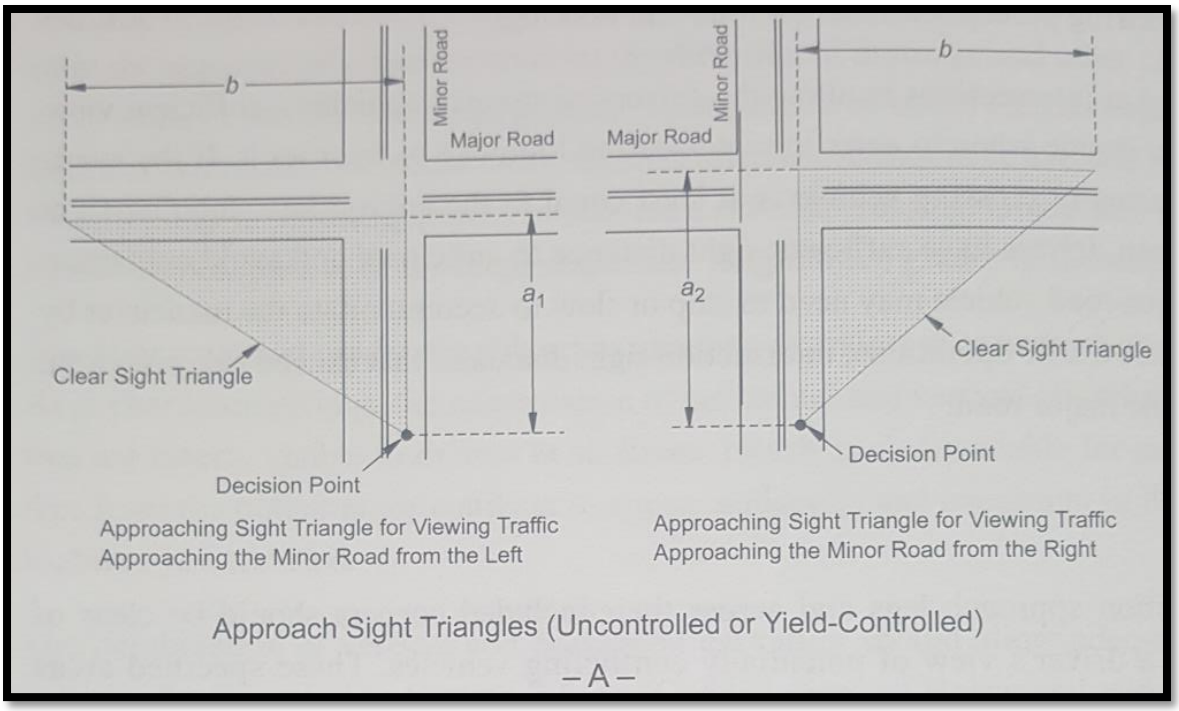

Figure 2 – Sight Triangles

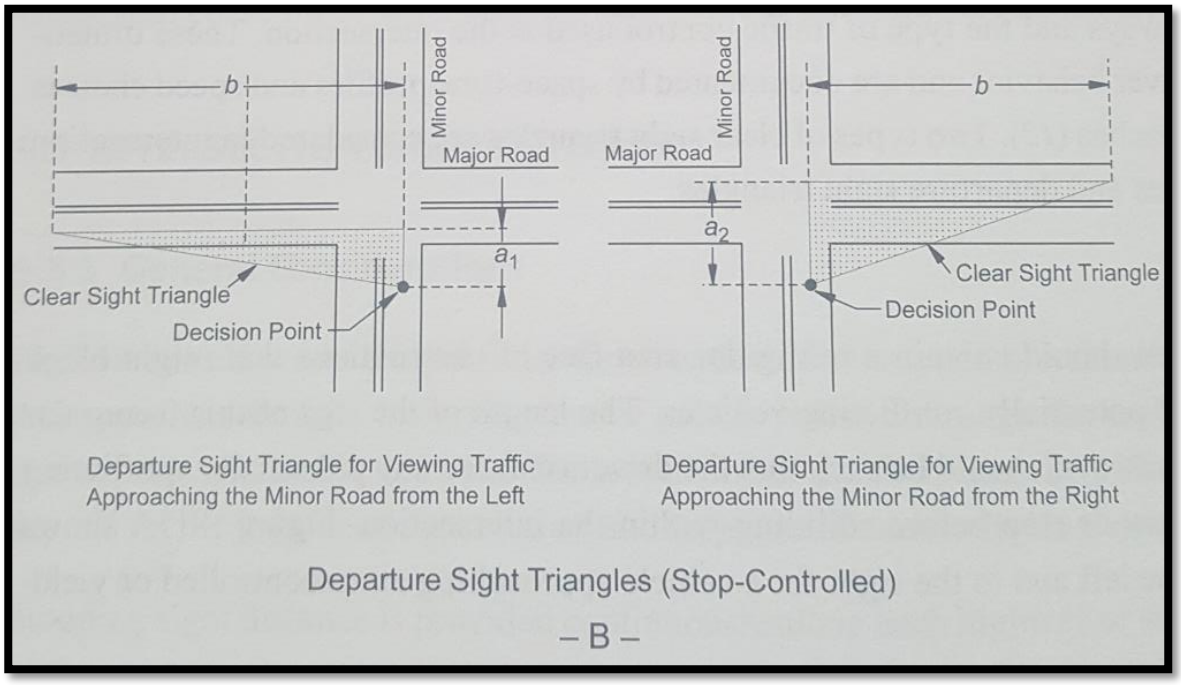

Figure 2 (*continued*)

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 Gerdes Ave (*335' min. req. for left; 290' for a through/ right*) to be insufficient. The Sight Triangles at the study intersections contained obstructions, which included both foliage and landscaping features along the corner properties, and grade changes between the corner properties and the adjacent roadway surface on the side street. 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. Additionally, we did not observe any parking prohibition signs or striping at any of the corners to the intersection. So, while residents did not appear to be parked on the street during our site observations the potential for parked vehicles to create site obstructions remains present.

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. We noted that the Forest Avenue Elementary School is located approximately 3 blocks north of the study intersection and that this intersection is located on a school route. 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.

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. We have included photos of the sight distance conditions for this intersection and attached them below. We took photographs which are representative of a vehicle stopped at the STOP Sign and within the crosswalk area of each STOP Controlled approach facing both north and south.

(from left to right) The first image represents a car stopped at the STOP Sign/ STOP Bar along the west leg of Gerdes Ave facing southbound; The second image represents a car stopped at the STOP Sign along the west leg of Gerdes Ave facing northbound.


(from left to right) The first image represents a car stopped at the crosswalk along the west leg of Gerdes Ave facing southbound; The second image represents a car stopped at the crosswalk along the west leg of Gerdes Ave facing northbound.


(from left to right) The first image represents a car stopped at the STOP Sign/ STOP Bar along the east leg of Gerdes Ave facing southbound; The second image represents a car stopped at the STOP Sign along the east leg of Gerdes Ave facing northbound.


(from left to right) The first image represents a car stopped at the crosswalk along the east leg of Gerdes Ave facing southbound; The second image represents a car stopped at the crosswalk along the east leg of Gerdes Ave facing northbound.

Based upon the sight distance conditions observed at the study intersection, it is our opinion that these conditions present a safety concern for both vehicles and pedestrians, and that this location meets the requirements set forth within the optional guidance presented within MUTCD for considering the implementation of a Multi-Way STOP control (*2B.07 – Parts 05.A, 05.C & 05.D*). The aforementioned requirements are outlined within the *Summary* section.

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 parking prohibition striping be refreshed, as needed, and that older/ faded signs be replaced in order to provide motorists and pedestrians better visual cues of the traffic controls in place.

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
02/02/19	Forest Ave	Gerdes Ave, 25'S	Backing	None; Backing Unsafely

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 "backing" 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 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 Gerdes 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 7:45 AM to 8:45 AM and PM Peak Hours were observed from 4:45 PM to 5:45 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			Gerdes Ave WB			Forest Ave NB			Gerdes Ave EB		
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
7:45 AM 8:45 AM	3	13	6	5	3	1	0	21	0	4	4	14
4:45 PM 5:45 PM	24	16	4	5	9	1	2	8	0	0	11	14

From **Table 3** above we noticed that the Forest Ave approaches process approximately 60% of the traffic through the study intersection during both the AM and PM Peak Hour Periods. Based upon the existing traffic conditions, Forest Ave is clearly defined as the mainline approach at the study 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, based upon the existing roadway geometry, surrounding land uses, and sight distance conditions, we would recommend that the Multi-Way STOP Control be implemented at this location, creating a four-way STOP controlled intersection. It is our opinion that this is appropriate based upon the existing sight distance limitations at the intersection and safety concerns for the adjacent elementary school. 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 recommended** at the intersection of Forest Ave & Gerdes Ave due to the existing geometric conditions and surrounding land uses. 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 and/ or refreshed if already in place, 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 recommended*** for Forest Ave & Gerdes Ave at this time. We provide the following reasons to substantiate our findings:

- While the volumes observed at the study intersection did not meet the criteria set forth by MUTCD for a Multi-Way STOP application, we did have some concerns regarding pedestrian safety and circulation through the intersection due to the location of the adjacent elementary school and public green space. Additionally, a Multi-Way STOP control at the study intersection would help improve the overall safety and operation of traffic along the Forest Ave roadway segment;

- 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 intersections were obstructed due to foliage, fencing, sign poles, utility poles, changes in grade, and landscaping features adjacent to the travel way along adjacent property frontage. The Township should work with its residents to address some of these issues, within reason. We did note however that when motorists pulled their vehicles forward passed the STOP Bar that visibility would improve;

- 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;

- Additional treatments such as rumble strips, pavement surface treatments (*Safe-T-Grip*), or micro-milling should be considered near the elementary school. This, along with school zone signs, school crossings signs, and school zone flashing signs will make drivers more aware of the adjacent school facilities and help improve safety along the school route; and

- Any school zone striping and signage should be refreshed if already in place or implemented if it not already in place, 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/192555-Forest-Ave-Gerdes-Ave/6-Reports_Analysis/Forest-Gerdes-Multi-STOP-08-27-19.docx