Bright View Engineering
Moving you forward

May 30, 2018

VIA EMAIL
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Michael Vreeland, P.E.
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Re: 5-Points Intersection
Stillwater Road, Old Foundry Road & 5 Points Lane
Stillwater Township, Sussex County, New Jersey
Project No.: 172701

Dear Mr. Vreeland,

Bright View Engineering, LLC, was tasked by Stillwater Township (*the Township here-in)* with performing an evaluation of the existing traffic pattern at the intersection of Stillwater Road, Old Foundry Road & 5 Points Lane. This analysis was performed to assess the operation of traffic at intersection and provide recommendations for improvement.

Bright View Engineering (*BVE here-in*), in coordination with the Township, collected data during various site visits 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. Our methodology conforms with the provisions set forth in NJSA 39:4-8 and the applicable requirements of the Manual on Uniform Traffic Control Devices (*MUTCD*). 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;
- Speed data collection along roadway segments interconnecting the study intersections;
- Traffic volume data collection along roadway segments interconnecting the study intersections; 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:

Stillwater Road (*C.R. 521*) is a north-south oriented roadway which runs through Stillwater Township. The available NJDOT Straight-line Diagram for this roadway (*last inventoried June 2012*), indicates that the Stillwater Road roadway segment is under County jurisdiction between the intersections of Morning Side Drive and Fredon Road (*CR 610*). At approximately M.P. 13.82, the roadway segment splits off with Stillwater Road/ C.R. 521which continues east, and Stillwater Road (*Local*) continues north toward the project intersection. This north leg of Stillwater Road was not classified within the available Straight-Line Diagram, however, based on the operating characteristics of the roadway it is our opinion that the segment functions as a *Rural Local* road.

The speed limit along the roadway is posted at 35 MPH along the south approach to the project intersection, and 45 MPH along the north approach to the project intersection. The roadway provides for a variable pavement width of approximately 22 – 24 feet, allowing for bidirectional travel. We did not observe any parking prohibition signs along either of the approaches. Opposing travel directions are demarcated by a single yellow centerline along the north leg, while no striping was observed along the south leg of the roadway. Pavement was observed to be worn from every day use, but in serviceable condition. Stillwater Road is considered the mainline at the study intersection as it is permitted free flow movement. The surrounding land uses were noted as primarily residential throughout the study area.

Old Foundry Road is an east-west oriented roadway which spans approximately 3.5 miles through Stillwater Township between the roadway segments of Mt. Benevolence Road and Fairview Lake Road. There were no NJDOT Straight-line Diagrams available for this roadway segment, however, based upon the existing conditions and operating characteristics observed, it is our opinion that the roadway segment functions as a *Rural Local* road. A posted speed limit of 35 MPH was observed. The roadway provides for a variable pavement width of approximately 22 – 24 feet, allowing for bidirectional travel. We did not observe any parking prohibition signs along either of the approaches. Opposing travel directions are demarcated by a double yellow centerline. Both approaches of the roadway segment are governed by a STOP Sign Control at the study intersection.

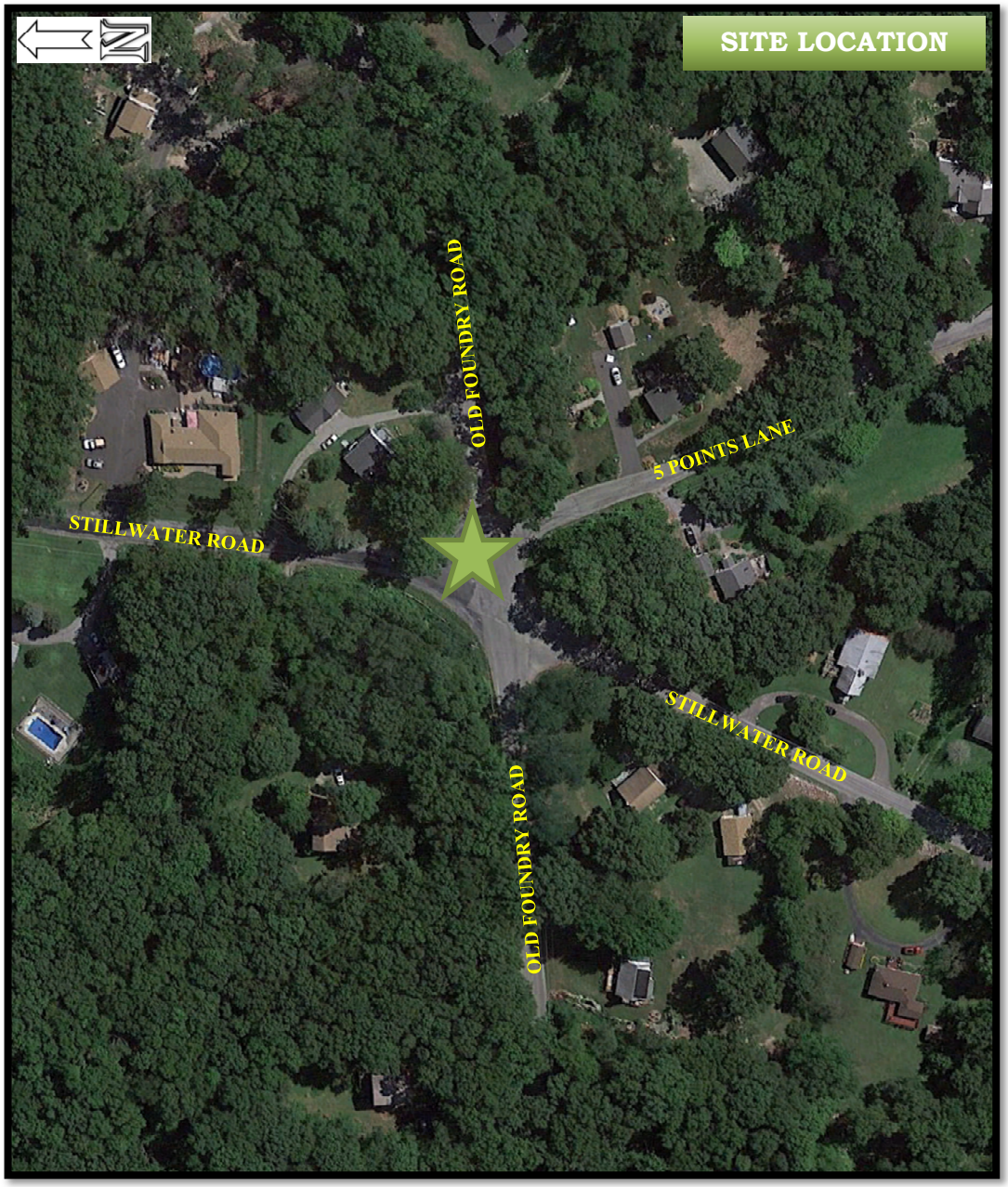
5 Points Lane is a north-south oriented roadway which spans approximately 0.27 miles through Stillwater Township between the 5 Points Intersection and Camp Lou Henry Hoover Road. There were no NJDOT Straight-line Diagrams available for this roadway segment, however, based upon the existing conditions and operating characteristics observed, it is our opinion that the roadway segment functions as a *Rural Local* road. There was no posted speed limit observed in the study area, but based upon Title 39:4-98, it is our opinion that this roadway segment may be posted at 35 MPH. The roadway provides for a variable pavement width of approximately 22 – 24 feet, allowing for bidirectional travel. We did not observe any parking prohibition signs along either of the approaches. We did not observe any pavement markings in at the study intersection along this approach. The 5 Points Lane approach is governed by a STOP Sign Control.

Based on our site visits and data collection performed for the study area, we note that the intersection in question does present a traditional geometric layout per the Highway Capacity Manual (*HCM*). We found throughout the course of our study that our traffic analysis software would not produce a suitable output for the existing conditions at this location due to this fact. The five existing approaches form a five-point or "star" type intersection. As seen in **Figure 1**, this creates spacing and offset issues between all approaches as the center of the intersection is wider than a traditional intersection. All approaches intersect at an angle (*no right angles*), and none of the curb lines are aligned in a traditional manner where a motorist would typically expect to give clear definition to the intended travel path and opposing/ intersecting movements. This is a point of concern as sight distance issues may be created due to this geometry, making it more difficult for users to safely traverse the intersection. Below, we provide historical images of the intersection depicting where STOP Bars were placed in order to clearly define where motorists should stop along the minor street approaches. We note that the STOP Bar in many cases was 40' or more further out from the STOP Sign.

It is possible, as an interim measure, to use striping to address some of the issues created by the existing intersection configuration. Striping can be used to more clearly define the travel way along each approach, divide opposing movements, better define where motorists should stop. However, we must emphasize that this would only be a temporary measure while more long-term solutions are implemented.

During our field visits we observed that a School Bus stops near the northeast corner of the intersection, along the east leg of Old Foundry Road. The school bus was observed just before 7 AM. Some children were also noted to be waiting along the grass area of Old Foundry Road for the School Bus. We also observed parents stopped in their vehicles along the approaches to the intersection waiting for the School Bus. Upon arrival, we noted approximately 10 – 15 children would enter the intersection and get unto the school bus. Some vehicles were observed stopping within the intersection to drop off children.

FIGURE 1



Bright View Engineering *Moving you forward*	**Stillwater Road, Old Foundry Road & 5 Points Lane Intersection Analysis Stillwater Twp., Sussex County, NJ**	**FIGURE** **1**

DATA COLLECTION

ACCIDENT HISTORY DATA

BVE performed an accident analysis for the intersection of Stillwater Road, Old Foundry Road & 5 Points Lane utilizing the Rutgers Center for Advanced Infrastructure and Transportation (*CAIT*) Plan4Safety Comprehensive Crash Analysis Program. BVE performed a search query for all incidents within the Township which occurred "at an intersection". This search provided data from the years 2012 – 2016, where seventy – eight (78) total accidents were coded. We then narrowed this search down for all incidents which occurred at the study intersection within this time frame. Below is a tabulation of the accident data provided:

Table 1 – Accident Data 09/14 to 04/16 (*Stillwater Road, Old Foundry Road & 5 Points Lane)*

DATE	STREET	CROSS STREET	TYPE
04/01/16	Stillwater Road	Old Foundry Road	Right Angle
01/06/11	Stillwater Road	Old Foundry Road	Animal

From this data, we noted two (2) incidents occurred at the study intersection, one (1) Right Angle and one (1) Animal related incident. While a STOP control may minimize the amount of right angle crashes, or incidents relating to motorist failing to properly yield the Right-of-Way and may minimize the occurrence of traffic accidents overall, we note that the existing geometry creates a particular set of conditions. As the amount of approaches to an intersection are increased, we increase the amount of potential conflicting traffic movements which motorists must account for at an intersection. While we did not observe a high volume or frequency of preventable incidents due to the low volumes at the intersection, it is our opinion that the geometry of the intersection should be altered in order to improve both safety and efficiency of operation. Please note that BVE has requested the latest accident information for this location from the Township in order to confirm both the volume and frequency of incidents in the study area.

SPEED SURVEY DATA

Speed data was collected by BVE and analyzed as per the recommended ITE and MUTCD standards. Data was collected along both approaches of Stillwater Road on 05/22/18 & 05/23/18. The findings of the speed survey may be seen below:

Table 2 – Speed Survey Data

	Stillwater Road			
	Average Speed (MPH)	**85th Speed (MPH)**	**% of Data Points Exceeding 35 MPH**	**Highest Recorded Speed (MPH)**
Direction 1 (SB)	28	35.5	24	40
Direction 2 (NB)	28	35	21	43
ROADWAY	28	35.5	23	43

Please note that the north leg of Stillwater Road is posted at 45 MPH while the south leg is posted at 35 MPH at the study intersection. We observed seven (7) data points at 40 MPH or greater.

From **Table 2a** above we observe that the average of the speeds observed are no greater than 28 MPH, while the 85th Percentile speeds of vehicles are no greater than 35.5 MPH. The largest number of vehicles traveling over 35 MPH were observed in the southbound travel. The highest speed observed for the roadway was 43 MPH in the northbound direction. We concluded from this data and our field investigation that while some instances of speeding do occur along this roadway segment, it does not appear to be a significant issue based on the infrequency of reportable incidents which report "speeding" as a contributing factor and the low average and 85TH Percentile Speeds observed.

Given that the observed speeds where within the 35 MPH range, it would be our recommendation that both legs of Stillwater Road be posted at 35 MPH. However, in order to do so, we also recommend that a comprehensive speed study be performed in accordance with MUTCD and Title 39 requirements. Once performed, the speed limits in the area should be set by the engineering study and enforced by ordinance.

TRAFFIC VOLUME DATA

In order to gain a better understanding of existing traffic conditions, BVE collected traffic data at the intersection of Stillwater Road, Old Foundry Road & 5 Points Lane, on Wednesday, February 21, 2018. The traffic volume data was collected using *Manual Turning Movement* (MTM) counts. 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 4:45 PM to 5:45 PM. The following table details the peak hour traffic volumes observed at the study interaction:

Table 2a – 2018 Existing Traffic Volumes – AM Peak Hour

	Stillwater Road From North						Old Foundry Road From East						5 Points Lane From Southeast					
Start Time	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:00 AM																		
07:00 AM	**1**	5	0	**1**	0	7	**1**	**2**	0	**1**	0	**4**	0	**1**	1	0	0	2
07:15 AM	1	**17**	0	0	0	**18**	1	0	**1**	0	0	2	**1**	0	**3**	**1**	0	**5**
07:30 AM	1	11	**1**	0	0	13	0	1	1	1	0	3	0	1	0	1	0	2
07:45 AM	1	13	0	1	0	15	1	0	1	0	0	2	0	0	1	0	0	1
Total Volume	4	46	1	2	0	53	3	3	3	2	0	11	1	2	5	2	0	10
% App. Total	7.5	86.8	1.9	3.8	0		27.3	27.3	27.3	18.2	0		10	20	50	20	0	

(Table 2a continued)

Stillwater Road From South						Old Foundry Road From West						
Hard Right	Right	Thru	Left	Peds	App. Total	Right	Bear Right	Thru	Left	Peds	App. Total	Int. Total
0	**3**	3	0	0	**6**	**1**	0	**8**	0	0	**9**	28
0	1	2	0	0	3	0	**1**	2	1	0	4	**32**
0	1	1	0	0	2	0	0	3	1	0	4	24
0	1	**4**	0	0	5	0	1	5	**2**	0	8	31
0	6	10	0	0	16	1	2	18	4	0	25	115
0	37.5	62.5	0	0		4	8	72	16	0		

Table 2b – 2018 Existing Traffic Volumes – PM Peak Hour

	Stillwater Road From North						Old Foundry Road From East						5 Points Lane From Southeast					
Start Time	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 04:45 PM																		
04:45 PM	0	0	0	0	0	0	3	1	1	**2**	0	7	**1**	1	**1**	0	0	3
05:00 PM	0	4	**1**	**2**	0	7	0	3	**3**	0	0	6	1	**2**	0	**1**	0	**4**
05:15 PM	0	**8**	1	0	0	**9**	0	3	0	1	0	4	0	1	1	0	0	2
05:30 PM	0	6	0	1	0	7	**4**	**7**	2	0	0	**13**	1	2	0	1	0	4
Total Volume	0	18	2	3	0	23	7	14	6	3	0	30	3	6	2	2	0	13
% App. Total	0	78.3	8.7	13	0		23.3	46.7	20	10	0		23.1	46.2	15.4	15.4	0	

(Table 2b continued)

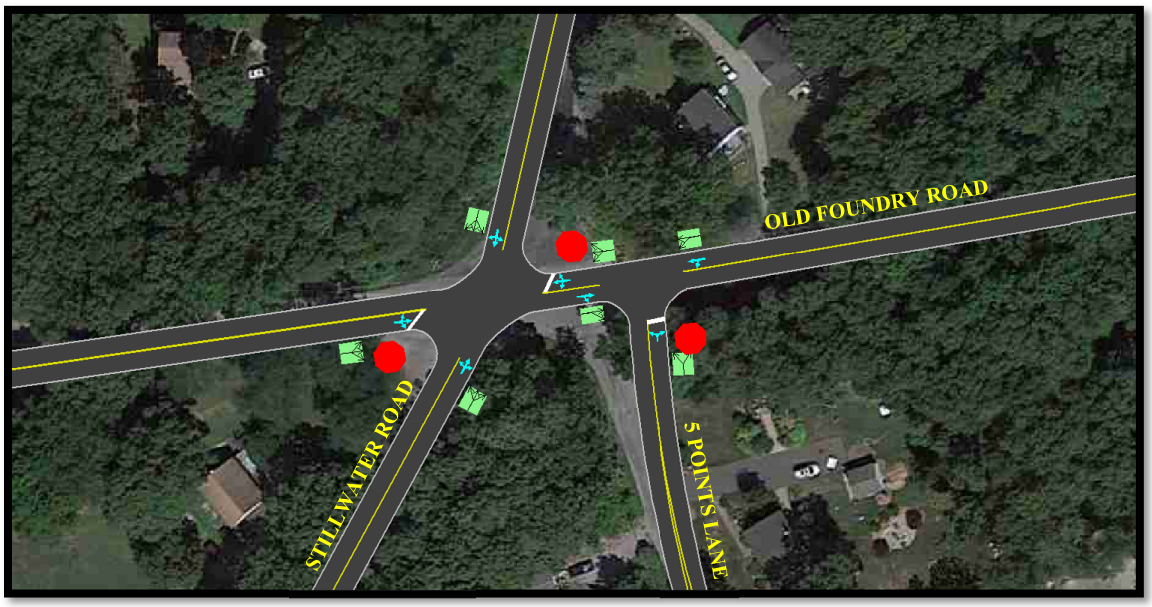
Stillwater Road From South						Old Foundry Road From West						
Hard Right	Right	Thru	Left	Peds	App. Total	Right	Bear Right	Thru	Left	Peds	App. Total	Int. Total
0	0	5	0	0	5	0	0	2	1	0	3	18
0	1	8	0	0	9	0	0	**3**	**2**	0	**5**	31
0	1	10	**1**	0	12	0	**1**	1	0	0	2	29
0	**2**	**15**	1	0	**18**	0	0	0	0	0	0	**42**
0	4	38	2	0	44	0	1	6	3	0	10	120
0	9.1	86.4	4.5	0		0	10	60	30	0		

From the above table we note there is a relatively equal amount of traffic at the intersection during the AM Peak Hour (*115 veh*) and the PM Peak Hour (*120 veh*). A clear directional flow is also present, as the Stillwater Road SB approach process the greatest amount of traffic during the AM Peak Hour, and the Stillwater Road NB approach process the greatest amount of traffic during the PM Peak Hour. We also observe that approximately ±10% of the total volume at the intersection is process through the 5 Points Lane approach.

PROPOSED CONCEPT SKETCHES

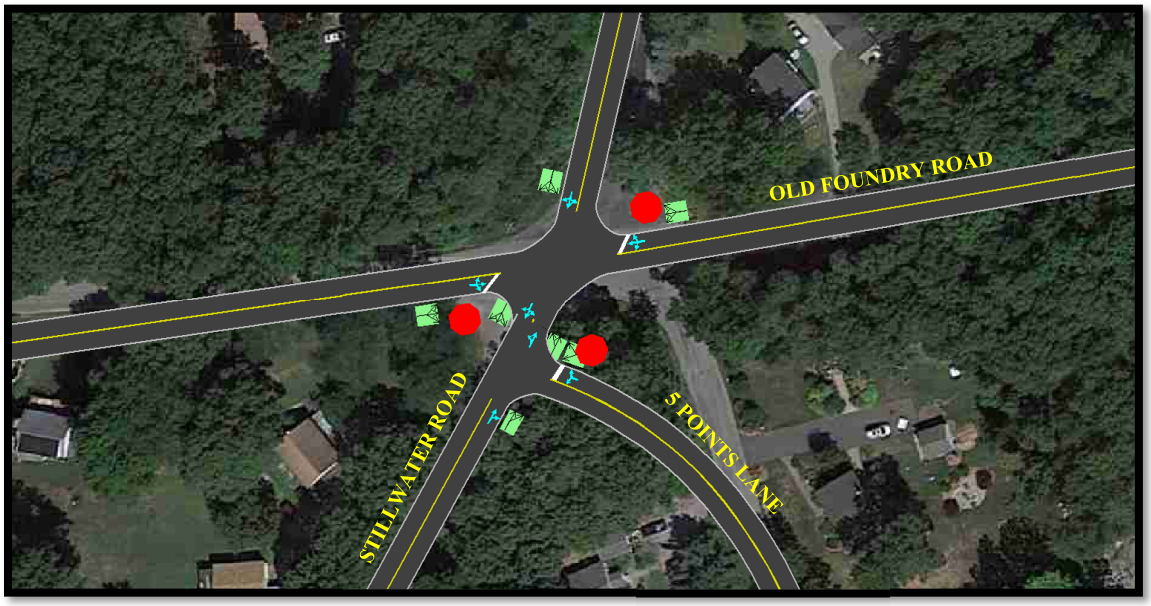
BVE performed an in-depth analysis of the study intersection and proposes the following three concept sketches. The focus of our proposed concepts is to alter the existing geometry at the study intersection in order to create a more traditional intersection layout which we all see on a daily basis, a four-approach intersection. By either eliminating or shifting one approach at the study intersection we can emulate this more traditional layout, reduce the amount of conflicting movements, and allow the intersection to operate more safely and efficiently.

Concept #1



Concept #1 above, depicts the approach of 5 Points Lane shifted over approximately 50'east along Old Foundry Road creating a simpler, STOP Sign Controlled, T-intersection. The east leg of Old Foundry Road is then extended further west in order to create a four-approach intersection with Stillwater Road. Both approaches of Old Foundry Road would be STOP Sign Controlled as in the existing conditions, with Stillwater Road remaining the mainline through the area. This concept would reduce the amount of movements and simplify the intersection. Sight conditions would also be improved through updated striping and traffic controls. If the property needed for this improvement becomes available and the Township has the funds available within its budget, Concept #1 would be a suitable improvement in the ***short term*** as it would improve the operation of the intersection and add benefit to the community.

Concept #2

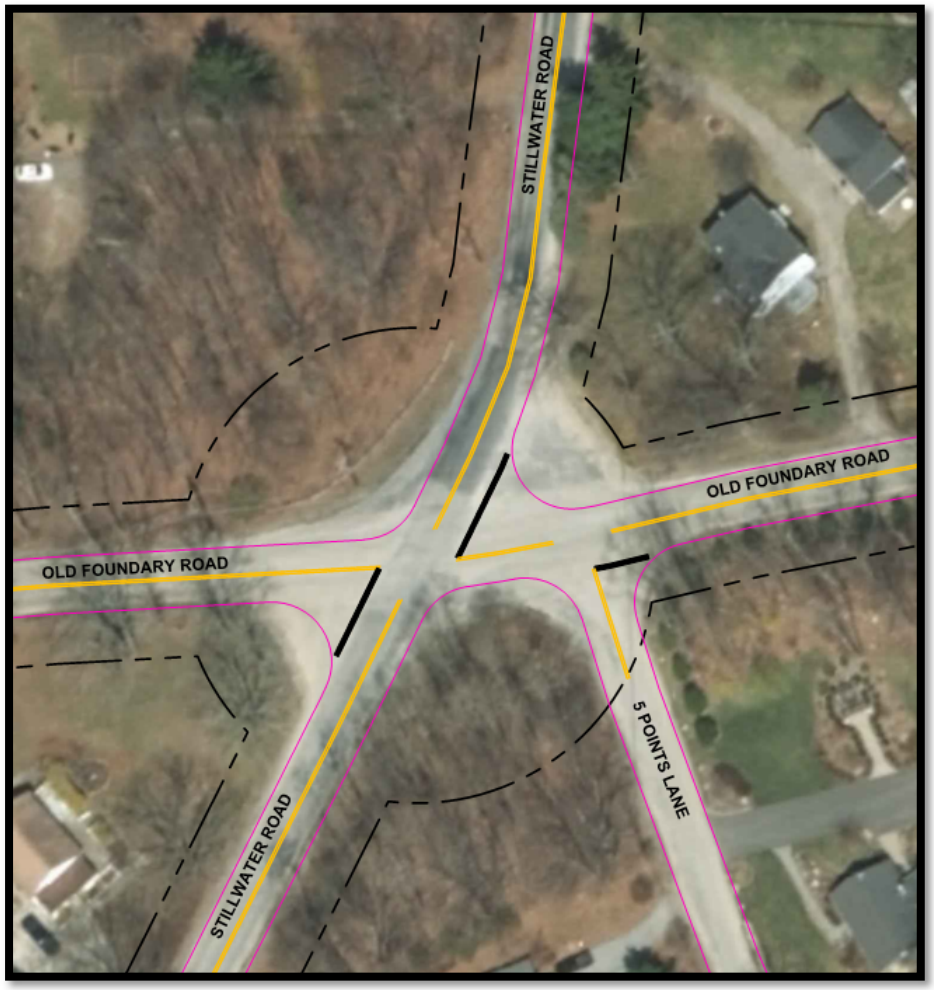


Concept #2 above, depicts the approach of 5 Points Lane shifted over approximately 75'south and connecting to Stillwater Road directly, creating a simpler, STOP Sign Controlled, T-intersection. As in the previous concept, the east leg of Old Foundry Road is then extended further west in order to create a four-approach intersection with Stillwater Road. Both approaches of Old Foundry Road would be STOP Sign Controlled as in the existing conditions, with Stillwater Road remaining the mainline through the area. This concept would reduce the amount of movements and simplify the intersection. Sight conditions would also be improved through updated striping and traffic controls.

Concept #3

Concept #3 above, depicts the approach of 5 Points Lane as a dead end and a new road which bypasses the existing 5 Point intersection and connect 5 Points Lane with Old Foundry Road. This concept would maintain the 5 Points Lane approach as a "dead end" so that the existing residences have access to the roadway, but access to Old Foundry Road is proposed via a new road which intersects with 5 Points Lane approximately 400' south of Old Foundry Road and intersects with Old Foundry Road approximately 550' east of Stillwater Road. The east leg of Old Foundry Road is then extended further west in order to create a four-approach intersection with Stillwater Road. Both approaches of Old Foundry Road would be STOP Sign Controlled as in the existing conditions, with Stillwater Road remaining the mainline through the area. This concept would reduce the amount of movements and simplify the intersection. Sight conditions would also be improved through updated striping and traffic controls. If the property needed for this improvement becomes available and the Township has the funds available within its budget, Concept #3 would be a suitable improvement in the ***long term*** as it would improve the operation of the intersection and add the most benefit to the community out of all the proposed concepts.

Concept from Township



The above concept plan provides a lay out of potential geometry for a roundabout, highlighted by the outer radius and right-of-way lines. Roundabouts provide many benefits, such as reducing head-on and right angle conflicts, eliminating the need for signal and electrical hardware, reducing the associated maintenance costs with electrical equipment, they simplify the traffic pattern at an intersection, they reduce travel speeds, and while roundabouts may require more space within an intersection they actually allow for us to design more efficient intersections with less lanes on each approach than a traditional signalized intersection. Based on the existing tax map this design will require significant right of way taking. While we agree with the benefits of this type of circulatory intersection it would require the greatest effort and financial consideration from the Township to implement. It is our recommendation that the other Concepts presented in this report be fully considered prior to a roundabout as they would require minimal right-of-way acquisition.

SUMMARY & CONSLUSIONS

We believe based upon our analysis and firsthand knowledge of the existing traffic conditions within the Township of Stillwater, that the intersection of Stillwater Road, Old Foundry Road & 5 Points Lane poses certain geometric constraints in the existing conditions. As the intersection is composed of five (5) full movement approaches, with three (3) legs governed by STOP Signs, there are a greater amount of potential conflicts than we would normally observe at a more traditional intersection. We did note based on the accident data from the Rutgers database, that a minimal amount of accidents were reported between 2012 – 2016. However, it is our recommendation that geometric changes be made at this location in order to avoid the potential for future conflicts. We recommend the Township consider the following in their evaluation of this intersection:

- Manual Turning Movement Counts (*MTMC*) were performed for the study intersection on Wednesday, February 21, 2018. We noted from this count data that the AM and PM Peak Hour Periods processed a relatively equal amount of total volume through the intersection. A clear directional flow is also present, as the Stillwater Road SB approach processes the greatest amount of traffic during the AM Peak Hour, and the Stillwater Road NB approach processes the greatest amount of traffic during the PM Peak Hour.

- Approximately ±10% of the total volume at the intersection is processed through the 5 Points Lane approach;

- Speed survey data was gathered on Tuesday, May 22 & Wednesday, May 23, 2018. Over 200 data points were collected along Stillwater Road near the project intersection. We noted only seven (7) points which were at or above 40 MPH. Average speeds were noted at 28 MPH and the 85TH Percentile Speed for the roadway was 35.5 MPH;

- Based on the speed survey data collected, we did not observe any significant instances of speeding at the study intersection along Stillwater Road. It is our recommendation that a supplemental study be performed in accordance with Title 39 and justification be provided to revise the speed limits on both legs of Stillwater Road which may be posted at 35 MPH as this is generally the ambient travel speed observed through the study intersection;

- The five approaches form a five-point or "star" type intersection. Unfortunately, this geometry creates spacing and offset issues between all approaches as the center of the intersection is wider than a traditional intersection (*three or four approaches*). All approaches intersect at an angle (*no right angles*), and none of curb lines are aligned in a traditional manner. This may cause some confusion as to the intended travel path at the intersection;

- Sight distance issues may be created due to the existing geometry, making it more difficult for users to safely traverse the intersection. We presented historical images where these issues were attempted to be resolved by striping the STOP Bars further out into the center of the intersection. We note that the STOP Bar in many cases was 40' or more further out from the STOP Sign at each approach;

- It is our opinion that an appropriate striping layout may be implemented to **temporarily** address the existing geometric issues at the intersection. By striping centerlines, fog lines, gore areas, and STOP Bars we can more clearly define the intended travel area for each approach at the intersection and reduce some of the potential conflicts;

- We presented three (3) concept sketches above based upon our existing conditions model. The focus of our proposed concepts was to create a more traditional intersection layout by either eliminating or shifting one approach at the study intersection. By doing so, we can emulate a more traditional layout four-approach intersection and reduce the amount of conflicting movements allowing the intersection to operate more safely and efficiently;

- We agree with the benefits of circulatory intersections such as a roundabout. While they provide significant benefits, it would require the greatest effort and financial consideration from the Township to implement. It is our recommendation Concepts 1 – 3 be fully considered prior to a roundabout as they would require minimal property and right-of-way acquisition;

- Based on the data collected and our analysis of traffic in this area, it is our opinion that **Concept #1** is a suitable **short-term** solution for the existing issues at the study intersection. **Concept #3**, in our opinion, would be the most suitable, **long-term** alternative to implement as it would provide the greatest safety and operational benefit to the community. Please note that implementation of either concept is dependent upon the availability of requisite property and available funding to design and build the project; and

In our opinion the next steps are for the Township to commission a comprehensive engineering study of the speeds on Stillwater Road and prepare the necessary justifications and ordinance to provide a reduced speed limit. Next the Township should determine if any of the concepts presented are acceptable and pursue the agreed upon concept. If right of way acquisition is needed detailed striping plans can be prepared to provide immediate, albeit short term, improvements to the intersection while detailed engineering drawings are prepared to implement the selected concept.

Should you have any questions or require additional information please do not hesitate to contact me 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
w/ Enclosures
https://bvengr.sharepoint.com/sites/bvengr/proj/172701-stillwater-5-points-int/6-reports_analysis/int-analysis_05-30-18-r1.docx