DRAFT-FINAL
Main Report

December 9, 2020

Mr. Stephen Farst, P.E., CFM
City Engineer
City of Groveport
655 Blacklick Street
Groveport, Ohio 43125
(614) 830-2067

Re: **Bixby Road & Ebright Road Traffic Study Letter Report**

Dear Mr. Farst:

IBI Group is pleased to submit this letter report for the traffic study conducted at the intersection of Bixby Road & Ebright Road in the City of Groveport. The City of Groveport initiated this study after citizen inquiry.

Location

Existing Conditions

The 4-leg, ~90^0 intersection of Bixby Road and Ebright Road is located northeast of the downtown area of the City of Groveport. At the intersection, Bixby Road is an east-west road, approximately 20 feet wide, with an asphaltic surface in good condition and narrow paved shoulders of one foot or less. Drainage is surface drainage with one catch basin located just off the radius in the southwest quadrant of the intersection.

The signed speed limit on Bixby Road is 35-mph. There is one 36" stop sign with vertical reflector panels and LED flashers on each Bixby Road approach to the intersection. Both Bixby Road approaches also have existing Stop Ahead signs.

The stop bars on Bixby Road are located about 10 feet and 15 feet, respectively, behind the Ebright Road pavement edge line extensions west and east of Ebright Road. In October 2020, the approach pavement and stop bars are in good condition and readily visible to drivers on Bixby Road. Google Earth screen shots from previous years (2015 to 2018) show well-worn stop bars with less visibility to drivers. In 2019 Bixby Road was resurfaced with a mill & fill from approximately 350 feet west of Ebright Road to Ebright Road and with full depth pavement reconstruction from Ebright Road to US 33 with new pavement markings on the new asphaltic surface.

Ebright Road runs north-south and has a signed 45-mph speed limit. The 20-foot pavement is asphaltic as well in good condition with narrow paved shoulders of one foot or less. There is surface drainage with very shallow ditches. Both Ebright Road approaches have Cross Road warning signs with D-8 Bixby Road name plaques. Both roads are essentially flat through the intersection area.

2020 Traffic Volume Count

IBI Group conducted a video-based traffic count at the intersection on September 15, 2020. To conserve costs, only 12 hours of the video data were post-processed to obtain turning movement volumes for the intersection. The actual extent of COVID-19 impacts to September 2020 volume count is unknown; however, statewide statistics show that a substantial portion of normal traffic had resumed by September following a large downturn in traffic volumes in April and May during the lockdown situation.

The 2020 morning peak hour is 7:15 to 8:15 AM. The critical N-S volume was 254 vehicles southbound on Ebright Road. The critical E-W volume was 276 vehicles eastbound on Bixby Road. Nearly equal volumes were counted on the two critical approaches.

The 2020 PM afternoon hour is 4:15 to 5:15 PM. The critical N-S volume was 484 vehicles southbound on Ebright Road. The critical E-W volume was 343 vehicles eastbound on Bixby Road. The southbound movement carried 141 more vehicles than the eastbound approach.

For the entire 12 hours which were post-processed, there were 1,675 vehicles southbound on Ebright Road and 1,159 vehicles eastbound on Bixby Road. The other approaches carried less traffic.

2025 peak hour volumes were calculated for the intersection using an assumed 1% annual linear assumed growth rate.

Traffic Analysis Summary

The 12-hour count post-processed data was used in traffic analyses for the following items and results:

Signal Warrants 2020

This intersection does NOT meet any of the traffic signal warrants contained in the OMUTCD; therefore, a traffic signal is NOT warranted.

Multi-Way Stop Application Warrant

Per the multi-way stop application questionnaire contained in OMUTCD Section 2B.07, this intersection DOES MEET one of the warrants for a multi-way stop installation: five or more angle-type crashes within a 12-month period. The traffic entering volumes part of the multi-way stop application questionnaire is NOT MET at this intersection.

It is noted that multi-way stop signs are generally used at intersections where the amount of traffic on the entering roads is approximately equal and where other less restrictive measures have been tried. At this intersection, during the morning peak hour, the entering volumes are approximately equal but during the afternoon peak hour Ebright Road carries significantly more traffic. On a 12-hour basis, Ebright Road has more traffic than Bixby Road.

Left Turn Lane Warrants AM and PM Peak Hours

Based upon the September 2020 traffic volume counts, exclusive left turn lanes are NOT necessary on any of the four approaches to the intersection.

Capacity Analyses for the AM and PM peak hours

HCS capacity analyses for the morning and afternoon peak hours were performed to determine the Level of Service (LOS). LOS is defined in terms of average delay per vehicle for both signalized and unsignalized intersections. The capacity analyses were performed for the current 2-way stop control, for 4-way stop control and for a possible 1-lane mini-roundabout. The criteria used by the American Association of State Highway and Transportation Officials (AASHTO) are listed below:

LOS Criteria for Intersections

Level of Service	Average Delay (in seconds/vehicle)	
	Signalized	Unsignalized
A	<10	<10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

LOS “A” and “B” are generally accepted as excellent operational results. LOS “C” and “D” are generally accepted as reasonable operational results. LOS “E” and “F” are generally unacceptable.

The intersection was analyzed using both 2020 and 2025 peak hour for several scenarios:

- 2-way stop control,
- 4-way stop control and
- 1-lane mini-roundabout.

Bixby Road & Ebright Road Traffic Study								
Capacity Analysis (Level of Service, Delay in sec.)								
Time Period	**AM Peak Hour**				**PM Peak Hour**			
Analysis Type	**2020 E-W Stop Controlled**	**2025 E-W Stop Controlled**	**2025 4-way Stop Controlled**	**2025 Mini Roundabout**	**2020 E-W Stop Controlled**	**2025 E-W Stop Controlled**	**2025 4-way Stop Controlled**	**2025 Mini Roundabout**
Intersection (Approach / Movement)	**-**	**-**	**A 8.2**	**A 4.9**	**-**	**-**	**A 9.5**	**A 5.7**
EB left/thru/right	B 11.4	B 11.6	A 8.2	A 4.1	B 14.2	B 14.8	B 10.2	A 5.9
WB left/thru/right	B 11.7	B 12.0	A 8.4	A 4.8	B 10.8	B 10.9	A 8.3	A 5.1
NB left/thru/right	A 2.3	A 2.4	A 8.1	A 4.2	A 0.7	A 0.7	A 9.0	A 5.4
SB left/thru/right	A 0.6	A 0.6	A 8.2	A 5.6	A 0.3	A 0.3	A 9.5	A 5.7

The results are shown in the table on the next page.

Table 1. Capacity Analysis Summary

The results show that the existing lanes provide sufficient capacity at this intersection. As a 2-way stop intersection, the LOS in 2020 and 2025 is B for both the morning and afternoon peak hours. As a 4-way stop intersection, the LOS would be A for both peak hours in both 2020 and 2025. Modeling the intersection as a 1-lane mini-roundabout also resulted in LOS A for both peak hours in 2025 but with less delay/vehicle than with 4-way stop control.

See attachments for traffic analysis summary items.

Crash Analysis Summary

2015-2019 Crash Data

IBI Group reviewed five years of crash data from 2015 through 2019. This data was obtained from the Ohio Department of Transportation and analyzed using ODOT's standard crash analysis tool.

A total of 19 crashes occurred during these five years for an average of 3.8 crashes per year. There were 17 angle crashes, one right turn crash and one crash coded as head-on. The head-on crash involved a northbound left turning vehicle which turned into a stopped vehicle on the west approach and struck it head-on. Interestingly, there were no left turn, sideswipe or rear end crashes which are typically logged at an intersection.

Looking at crash severity, 14 of the 19 crashes involved injury, apparent injury or possible injury. There were five property damage only crashes.

Exhibit 1 shows an intersection crash diagram using 2015-2019 crashes. The most noticeable pattern in the crash diagram is that 12 of the 19 crashes were angle crashes which involved an eastbound vehicle

on Bixby Road. Of these 12 angle crashes, the other vehicle was southbound in five cases and northbound in seven cases. There were five other angle crashes on Bixby Road which involved a westbound vehicle colliding with a southbound vehicle in three instances and a northbound vehicle in two other instances.

Over the five-year 2015-2019 period, the typical crash at this intersection was an angle crash which involved an eastbound driver and injury and occurred on a weekday, in daylight conditions, on dry pavement and between the hours of 3:00 and 7:00 PM in the afternoon/evening (69% of crashes). August, October and November had the most crashes. Because these afternoon angle crashes typically involved an eastbound driver on Bixby Road, poor stop sign visibility caused by the setting sun in the west was presumable not an issue.

In the 17 angle crashes, drivers on Bixby Road were cited for running the stop sign six times and failure to yield after stopping 10 times.

2020 Crash Data

Partial 2020 crash data was provided by the City of Groveport Police Department. Through mid-October 2020, there were seven crashes reported at the intersection, all of them angle crashes.

Exhibit 2, the 2020-only crash diagram, shows a pattern consistent with the 2015-2019 pattern. The most prevalent angle crashes (four of them) in 2020 involved an eastbound vehicle colliding with a southbound vehicle. There were also three angle crashes involving a westbound vehicle. Two of these occurred with a northbound vehicle and one occurred with a southbound vehicle. Six drivers were cited for failure to yield and one for failure to stop.

Two of the 2020 crashes occurred during the morning; the others occurred during the afternoon 3:00 to 7:00 PM period, like the 2015-19 pattern. The February 1, 2020 crash was logged at 6:48 PM when it was dark and rainy with wet pavement. All other 2020 crashes occurred during daylight hours on dry pavement. All 2020 crashes thus far in the year have been coded as Property Damage Only with no injuries reported.

Considered together with the 2015-2019 crash data, the 2020 data shows the same angle crash pattern involving mostly eastbound and southbound vehicles colliding. The frequency of such collisions was greater in 2020, even though 2020 traffic volumes are likely to have been lower than 2019 due to COVID-19.

See attachments for complete crash analysis summary.

Site Visit Summary

IBI Group made two site visits to this intersection to observe signing, pavement marking, pavement condition and cross corner sight distance. There are no apparent sight distance obstructions on either Bixby Road approach for a driver stopped at or slightly in advance of the stop bars. As noted above, the pavement and markings on the Bixby Road approaches were replaced in 2019 and are in very good condition. Site pictures on the following pages show the conditions in early November 2020.

Site Pictures

Bixby Road Eastbound
The stop ahead sign is located about 350-ft west of the stop bar under a pine tree. The pine tree provides shade on bright days, making the sign less visible.

The stop ahead sign located under the tree may be mounted slightly lower than recommended.

The stop bar and stop sign are readily visible to approaching drivers.

Sight distance to the north from the eastbound stop bar is shown in this picture. The sight distance is the most important view based upon the crash data for this intersection. The bush located next to the utility pole may slightly restrict an eastbound driver's cross-corner sight distance to the north.

Bixby Road Westbound
The westbound stop ahead sign is located about 680-ft east of the stop bar.

The westbound stop bar and stop sign are readily visible to approaching drivers.

Ebright Road Southbound
The southbound crossroad warning sign is located about 320-ft from the intersection and includes a Bixby Rd name plaque.

Ebright Road Northbound
The northbound crossroad warning sign is located about 360-ft from the intersection and includes a Bixby Rd name plaque.

Conclusions

- Traffic volumes appear not to be a problem during the peak hours based upon the September 2020 counts.
- The intersection currently operates with a high level of service during the peak hours. It is expected that this will continue at least through 2025.
- No turn lanes or additional through lanes are needed.
- There is an angle crash pattern involving mostly eastbound and southbound vehicles colliding within the intersection. The eastbound drivers have a Stop Ahead and Stop sign.
- Signing and marking are generally in good condition.
- The Bixby Road approaches were resurfaced along with new pavement markings in 2019.
- A traffic signal is not warranted; hourly volumes are well below the required levels.
- One of the Multi-Way stop warrant is met: five or more angle-type crashes in 12 months. However, the volumes on the approaching roads are not approximately equal which is generally preferred for 4-way stop intersections.

Recommendations

Immediate

- Install new dual 48" Stop signs (with Solar LED flashers on the right-hand sign only) on each Bixby Road approach. Vertical reflector panels should be installed on the sign supports. The bottom of the signs should be 7 feet vertically from the adjacent edge of pavement per OMUTCD requirements.
- Install a new single 48" W3-1 Stop Ahead sign on each Bixby Road approach; these signs should be placed about 565 feet from each Stop Bar. The sign locations should be adjusted as necessary to avoid driveways, intersections and close proximity to other signs. The bottom of the sign should be 7 feet vertically from the adjacent edge of pavement per OMUTCD requirements.
- Remove or prune any bushes, trees or other vegetation within the public right of way along Ebright Road in both directions from Bixby Road, especially the bush adjacent to the utility pole on the east side of Ebright Road about 225 feet north of Bixby Road.
- Continue to monitor crash frequency and severity at this intersection.

Medium-Term

- Install 4-Way Stop signs, if signing changes are not successful in reducing crashes

Four-way stop signs are not always the answer to reducing crashes. 4-way stop is the most restrictive type of traffic control since everyone is required to stop, every time. Stop signs delay drivers and many times the drivers become impatient. Impatient drivers may cause crashes. The over-proliferation of 4-way stop signs increases driver disregard for stop signs in general.

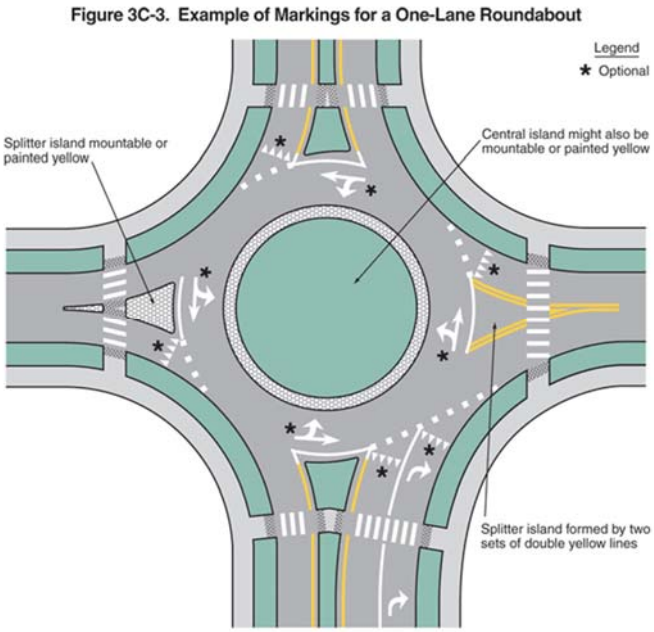
It is recommended that 4-way stop control should not be implemented at this intersection without first trying the less restrictive countermeasures recommended for immediate installation. If the signing changes are not effective in reducing the frequency of angle-type crashes, it is recommended to install 4-way stop signs with a media blitz and 30-day warning signing on all approaches prior to conversion to 4-Way Stop Control with dual signs and Stop Ahead signs on all approaches.

Long-Term

- Build modern 1-lane roundabout with appropriate advance signing and drainage accommodations.

Travel speeds through a roundabout are in the 20 to 23-mph range, thus eliminating one of the key elements involved in severe angle crashes: the high approach speeds on Ebright Road. The 1-lane roundabout can easily accommodate the 2025 and beyond traffic volumes with a high Level of Service. An additional benefit of the roundabout is 24-7 traffic calming at the intersection due to slower entry and exit speeds because of the roundabout. A typical layout for a roundabout at the intersection of two 2-lane roadways is depicted below.

Typical 1-Lane Roundabout Layout



A 1-lane roundabout has an inscribed circle size of around 120 feet. The actual size is usually based upon the largest truck expected to use the roundabout, typically WB-50 or, at intersections near interstate or freeway interchanges, WB-67.

The safety benefits of a modern roundabout are well known. High-speed right-angle crashes are not possible due to the design. Low speed crashes which do occur within a roundabout are generally much less severe than at a stop sign-controlled intersection.

Studies by the Insurance Institute for Highway Safety and the Federal Highway Administration have shown that roundabouts typically achieve:

- A 37 percent reduction in overall collisions
- A 75 percent reduction in injury collisions
- A 90 percent reduction in fatal collisions
- A 40 percent reduction in pedestrian collisions.

The cost of roundabouts can vary from $300,000 plus for a mini-roundabout to $1 million or more for a modern 1-lane roundabout. These costs do not include engineering or right-of-way costs.

IBI Group appreciates the opportunity to assist the City of Groveport with this traffic study and recommendations. Please let me know of any questions or need for additional information.

Respectfully,

James E. Brenneman, P. E.
Senior Project Manager
Registered Engineer #40680, State of Ohio

jim.brenneman@ibigroup.com
614-818-4900 ext. 2046

List of Exhibits
Exhibit 1 - 2015-2019 Crash Diagram from ODOT's GCAT Tool
Exhibit 2 - 2020 Crash Diagram

List of Attachments
12-hour traffic turning movement volume count
Traffic Crash Analysis from GCAT
1-Page Traffic Analysis Summary
HCS Capacity Analysis Results
Sidra Roundabout Analysis Results
Left Turn Lane Warrant Sheets
Signal Warrant Summary Sheet
Multi-Way Stop Warrant Summary Sheet

Exhibit 1A

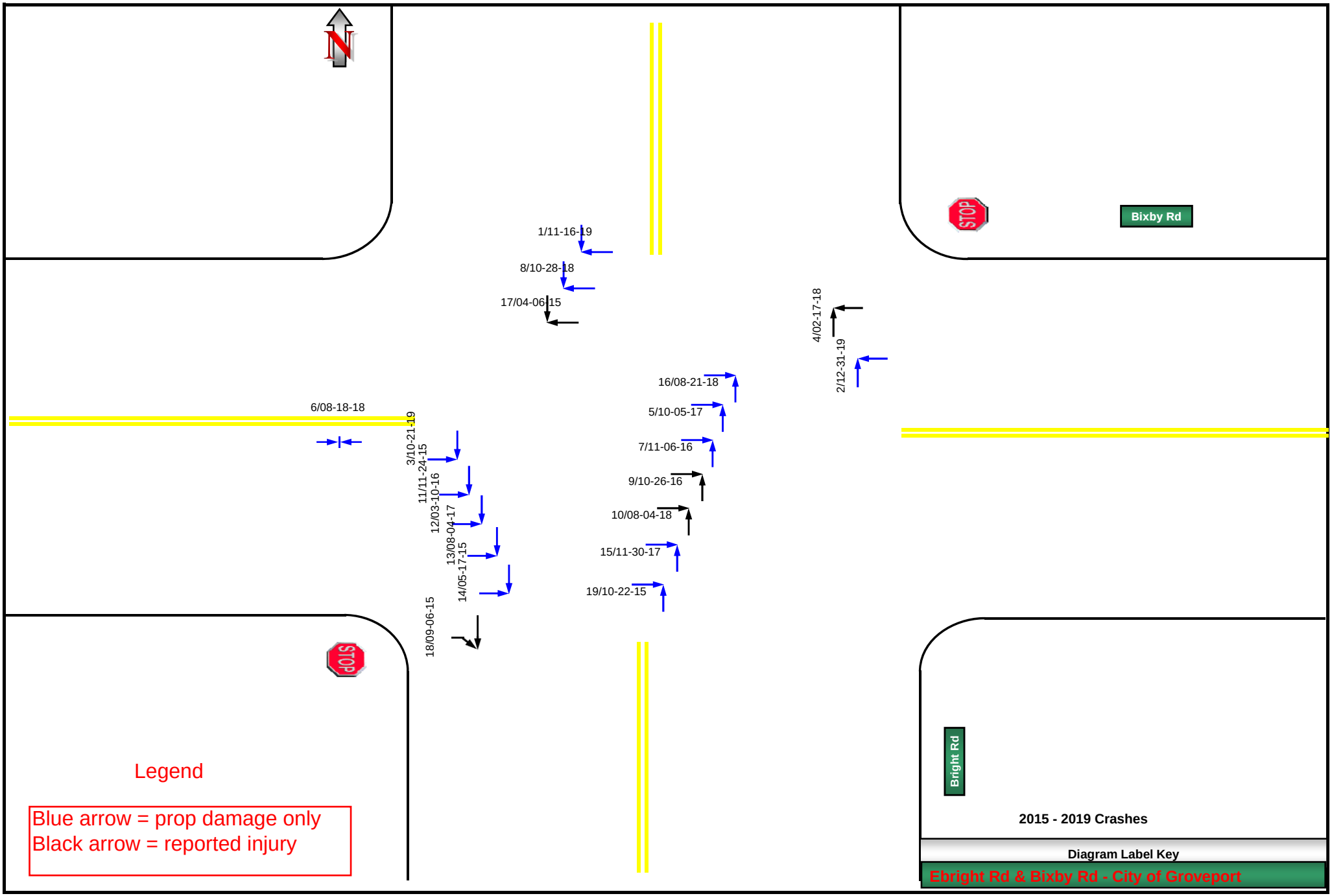

Bixby Rd
STOP
1/11-16-19
8/10-28-18
17/04-06-15
4/02-17-18
2/12-31-19
16/08-21-18
5/10-05-17
7/11-06-16
9/10-26-16
10/08-04-18
15/11-30-17
19/10-22-15
6/08-18-18
3/10-21-19
11/11-24-15
12/03-10-16
13/08-04-17
14/05-17-15
18/09-06-15
STOP
Bright Rd
Legend
Blue arrow = prop damage only
Black arrow = reported injury
2015 - 2019 Crashes
Diagram Label Key
Ebright Rd & Bixby Rd - City of Groveport

Exhibit 1B

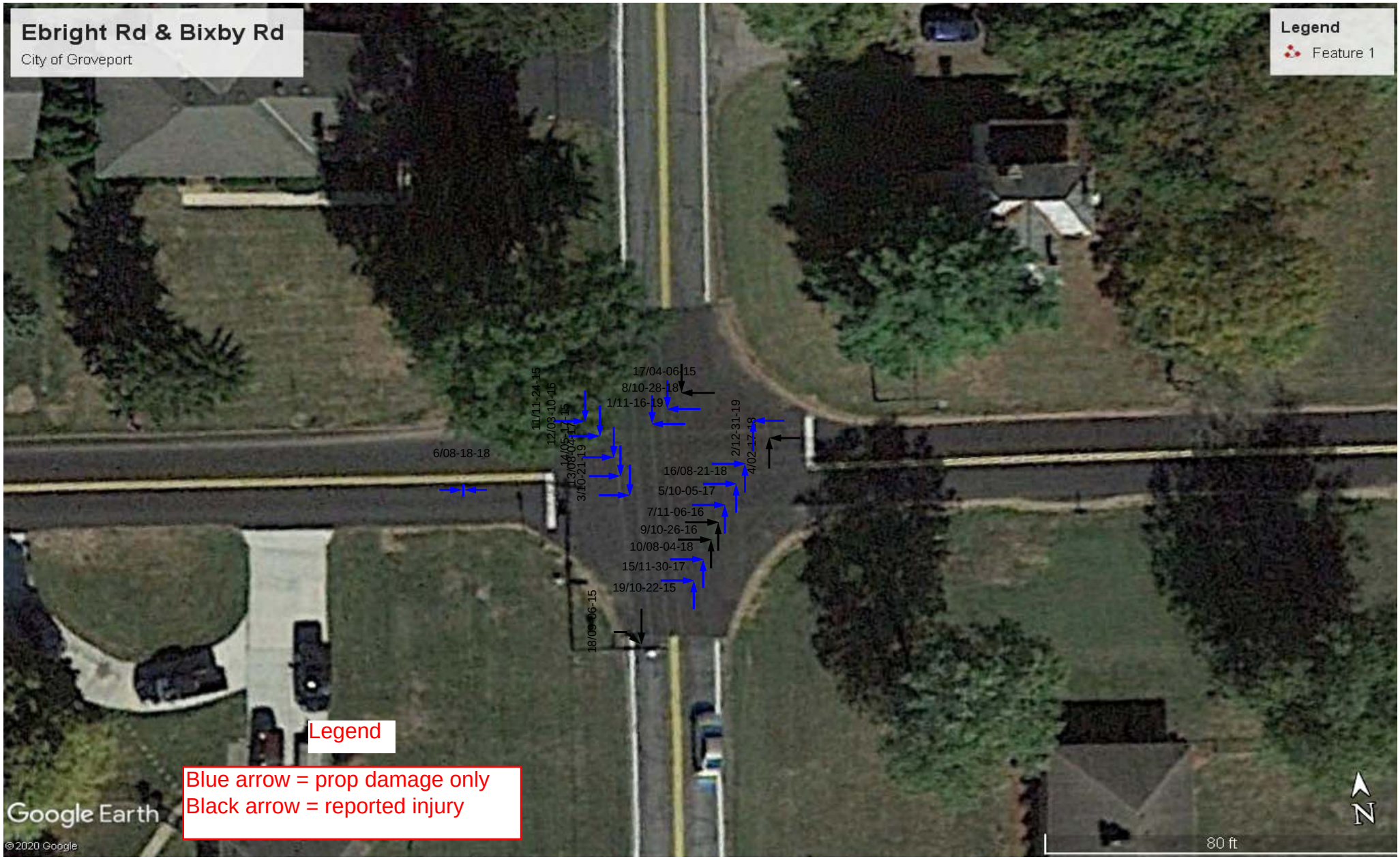
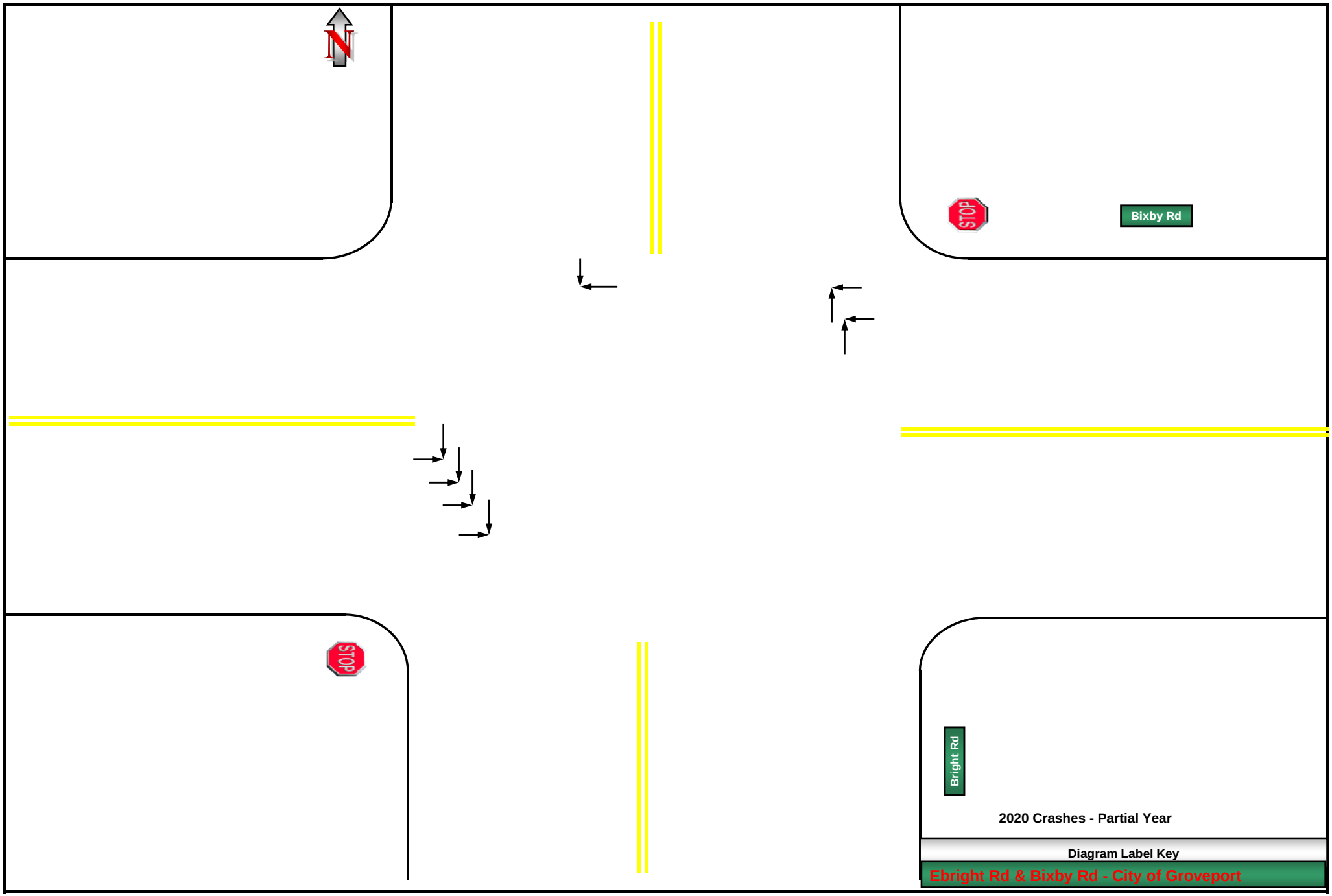

Ebright Rd & Bixby Rd
City of Groveport
Legend
Feature 1
17/04-06-15
8/10-28-18
1/11-16-19
11/11-24-15
12/03-10-15
14/05-17-15
13/04-17-19
3/10-21-19
6/08-18-18
2/12-31-19
4/02-17-18
16/08-21-18
5/10-05-17
7/11-06-16
9/10-26-16
10/08-04-18
15/11-30-17
19/10-22-15
18/09-06-15
Legend
Blue arrow = prop damage only
Black arrow = reported injury
Google Earth
©2020 Google
N
80 ft

Exhibit 2


N
STOP
Bixby Rd
STOP
Bright Rd
2020 Crashes - Partial Year
Diagram Label Key
Ebright Rd & Bixby Rd - City of Groveport