Memorandum

To: Eric Jewell, Hermitage Police Department

From: Sarah Wetzel, EIT, LTAP

Date: August 5, 2021

Subject: Safety Concerns at the Intersection of Lynnwood Drive and Hoezle Road in Mercer County

BACKGROUND

In response to a technical assistance request from the City of Hermitage, Sarah met with Eric Jewell on June 24, 2021 to examine the intersection of Lynnwood Drive and Hoezle Road. The City is considering making the intersection a multi-way stop and requested assistance in evaluating the intersection. We drove and walked the area around the intersection and evaluated existing conditions (see Figure 1).

Figure 1: Lynnwood Drive at Hoezle Road

The intersection of Lynnwood Drive and Hoezle Road is currently a one-way stop. Lynnwood Drive is two-way and both approaches are uncontrolled. Hozele Road is two-way and the approach is stop controlled. The posted speed on Lynnwood Drive is 35

MPH. Hoezle Road does not have a posted limit. We do not have PennDOT volume data for the roads included in this study. The land use in the vicinity of the intersection is residential / business. There is a veterinarian on the northwest corner of the intersection and a proposed animal shelter in the vicinity of the vet.

Note that field observations, discussions with municipal personnel, highway safety research, and traffic engineering experience are largely responsible for the content and findings of this memo.

In addition, specific references that were consulted include:

- 2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD)
- PennDOT Publications 46, 111, 212, 236, and 383
- PA Vehicle Code, Title 75

Pennsylvania LTAP is willing to clarify and provide additional information relating to any of the potential solutions listed.

EXISTING CONDITIONS

Sight Distance

The City was concerned with sight distance for vehicles attempting to make left turns from Lynnwood Drive onto Hoezle Road. The sight distance is limited for both approaches on Lynnwood Drive due to both overgrown vegetation, roadway grade, and horizontal geometry.

We conducted an intersection sight distance study for the intersection. The study was conducted in accordance with the requirements of PennDOT Publication 212 (Pub 212). Pub 212, *Appendix Section 16.ii, Corner Sight Distance*, requires that the measurement be made 10 feet back from the edge of the travel lane, from a driver's eye height of 3.5 feet looking for an object height of 3.5 feet.

We measured the sight distance for Hoezle Road and Lynnwood Drive as follows:

- Southbound Hoezle Rd looking east (to the left): 382 feet
- Southbound Hoezle Rd looking west (to the right): 239 feet
- Eastbound Lynnwood Dr looking for oncoming traffic: 127 feet

Assuming an 85th percentile speed of 35 MPH (posted speed limit on Lynnwood Drive), and slopes of +3.1% and +5.6% (grade measured at the intersection approaches), according to Pub 212, Table B – *Minimum Stopping Sight Distance*, the required sight distance is 239 feet for Hoezle Rd looking to the east and 233 feet for Hoezle Rd looking to the west. While the existing sight distance of 382 feet and 239 feet looking to the left and right from the Hoezle Rd approach is adequate, the sight distance of <239 feet for turning vehicles on Lynnwood Dr is not adequate.

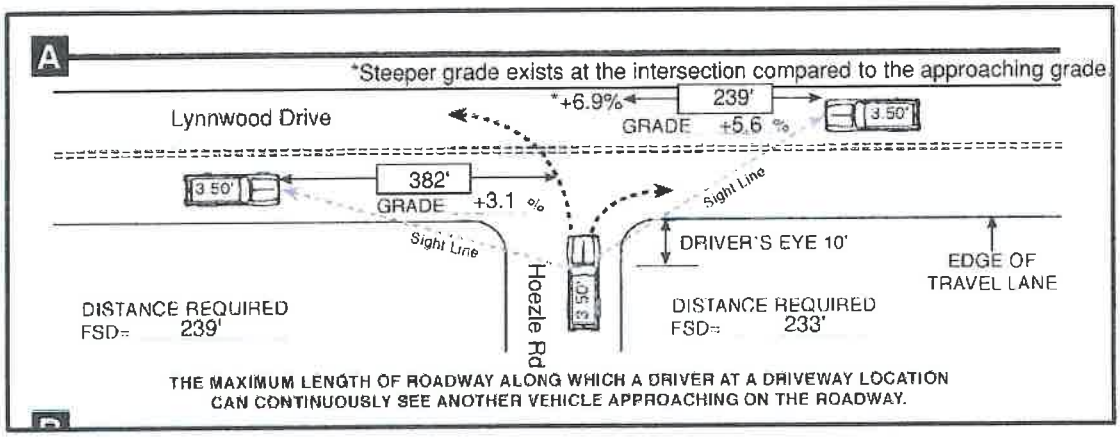

Figure 2: Sight distance calculations from Hoezle Road.

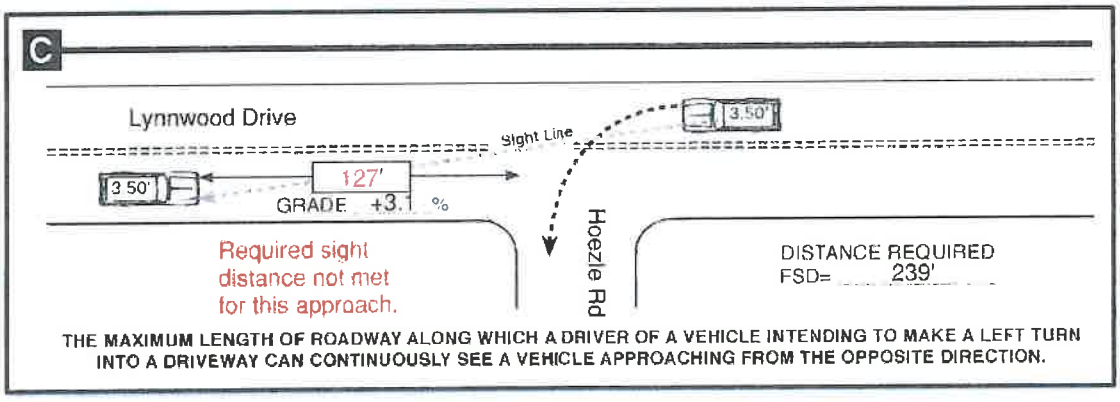

Figure 3: Sight distance calculations for turning vehicle on Lynnwood Drive.

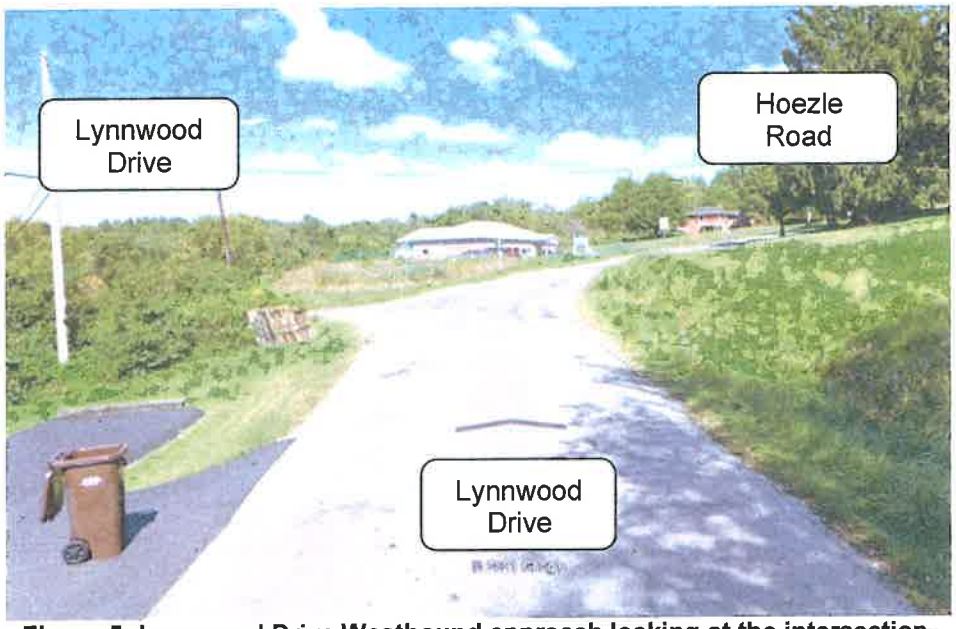

Figure 5: Lynnwood Drive Westbound approach looking at the intersection.

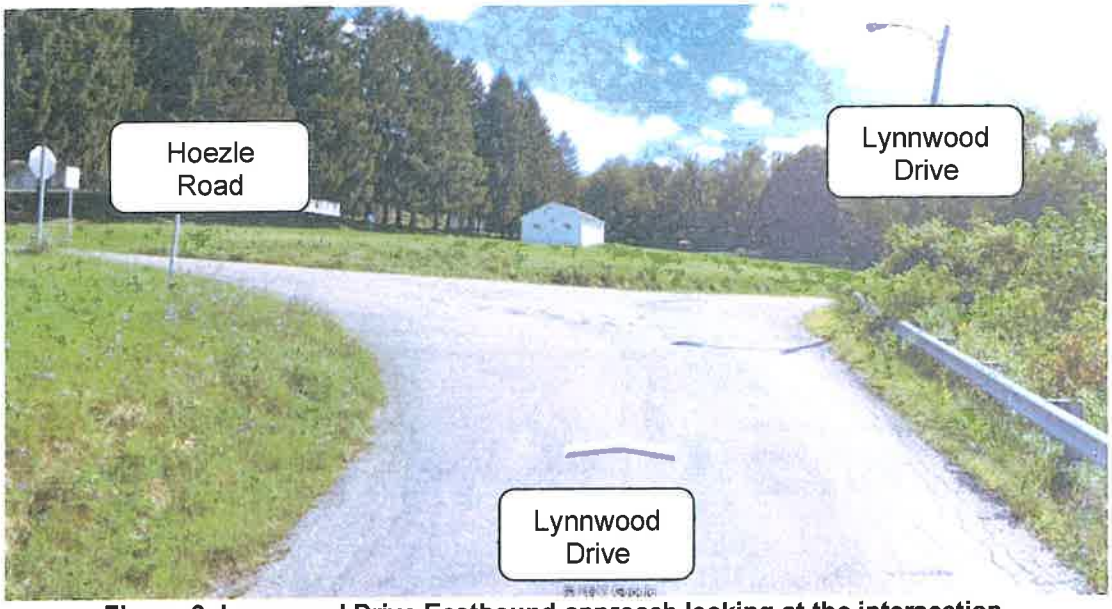

Figure 6: Lynnwood Drive Eastbound approach looking at the intersection.

Crash Analysis

Crash data for a five-year period starting from December 2015 through December 2020 was obtained from PennDOT. This data indicates that there was only one reportable crash during this timeframe at the intersection of Lynnwood Drive and Hoezle Rd.

DISCUSSION

Warrants for a Multi-Way Stop Controlled Intersection

PennDOT and the MUTCD have specific warrants for the installation of multi-way stop control at an intersection. There are four main warrants from MUTCD Section 2B.07:

Section 2B.07 Multi-Way Stop Applications

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.

PennDOT has some additional warrants for multi-way STOP signs in Section 212.106(c) of Title 67 (PennDOT Publication 212):

(c) *Multiway stop applications.* In addition to the criteria and options warranting multiway stop applications in the MUTCD, the following apply:

(1) The five or more reported crashes in a 12-month period for Warrant B may include both reportable crashes, and nonreportable crashes that are documented in the police files, that occurred during a 12-month period during the most recent 3 years of available crash data.

(2) Multiway stop applications may not be used because of limited available corner sight distance unless there is no practical method of improving the sight distance or reducing the speed limit to satisfy the minimum corner sight distance values.

After a review of the existing conditions and the multi-way stop criteria listed above, this intersection does not warrant a multi-way stop. The criteria in the MUTCD, Section 2B.07 are not met for a multi-way stop based on the data collected during the field view and are summarized as follows:

- (A.) A signal is not being considered nor is one warranted.
- (B.) There was only 1 reportable crash. PennDOT Pub 212 allows the use of non-reportable crashes. Non-reportable crashes were not requested; however, it is not likely that 5 or more non-reportable crashes occurred during a 12-month period during the most recent 3 years of available crash data.
- (C. & D.) Volumes on the major road will not meet minimum volumes as stated in the MUTCD based on the counts collected. Volumes were not collected on the minor road.
- (Other Criteria.) PennDOT Pub 212 (c)(1) states that "The five or more reported crashes in a 12-month period for Warrant B may include both reportable crashes, and nonreportable crashes that are documented in the police files, that occurred during a 12-month period during the most recent 3 years of available crash data." The reportable and non-reportable crash data provided by the police department showed a total of 9 accidents over the most recent 3 years of data. 4 of those crashes were non-reportable and 5 were considered reportable. 7 of the 9 accidents occurred within a 12-month window in 2020. While this data satisfies Pub 212 (c)(1), multiple accidents only involved one vehicle and occurred during the same snow event. The installation of a multi-way stop sign would not correct this weather-related issue. In addition, Pub 212(c)(2) does not warrant a multi-way stop at this location.

Unwarranted All Way Stop Control

The installation of all ways stops has been a controversial subject for many years. There is a significant amount of research on the topic, including one study that summarized 70 prior studies. This summary paper stated that highway safety research concludes the following:

1) *Multi-way stops **do not control speeds, nor** do they **reduce speeds** on residential streets.*

2) ***Stop compliance is poor*** *where a sign is unwarranted (meaning it is there despite the MUTCD's rules) at a multi-way stop.*
3) ***Speeds actually increase*** *at a distance from the intersection as motorists "make up that time". Overall, speed decreases when such stop signs are removed.*
4) ***Safety*** *of pedestrians at unwarranted signs* ***is decreased****, esp. for children, as they expect the vehicles to stop, while many motorists have gotten in the habit of running the sign.*
5) ***Unwarranted multi-way stops may present potential liability problems*** *for a governing unit's undocumented exceptions to accepted warrants. Many times the unwarranted stop signs are installed without a warrant study or some documentation.*
6) *Stop signs* ***increase noise and pollution*** *in the vicinity of an intersection. The noise is created by the vehicle braking noise at the intersection and the cars accelerating up to speed. The noise is created by the engine exhaust, brake, tire and aerodynamic noises.*
7) *Multi-way stop signs have* ***high operating costs*** *based on vehicle operating costs, vehicular travel times, fuel consumption and increased vehicle emissions.*
8) *Unwarranted stop signs* ***do not significantly change the safety*** *of an intersection.*

CONSIDERATIONS

Although multi-way stop control was not warranted at the intersection of Lynnwood Drive and Hoezle Road, consider the following to address the sight distance issues and improve safety:

- Trim the overgrown vegetation behind the guiderail to improve overall sight distance at the intersection.
- Due to roadway geometry, relocate stop control from the Hoezle Rd approach to Lynnwood Dr to control traffic moving eastbound and remove old stop sign. Since there is a sight distance issue here that is partially due to the geometry and grade of the roadway, the main road and right-of-way could be given to Lynnwood Dr westbound to Hoezle Rd northbound. The vehicles approaching from Lynnwood heading eastbound already slow down or stop due to the sight distance issue. In addition to installing a Stop Sign (R1-1), install a Stop Ahead Sign (W3-1), and place a stop bar pavement marking as shown in Figure 7. Pavement markings (including both centerline and edge lines) are another low-cost improvement that can be added to improve safety at the intersection by clearly delineating the right-of-way.

Figure 7: Proposed low-cost safety improvements at Lynnwood Dr and Hoezle Rd.

- Monitor future developments near the intersection and conduct updated traffic counts to determine the feasibility of a multi-way stop sign with future traffic conditions.

SUMMARY AND NEXT STEPS

Based on a field view of the study intersection, a review of the sight distances, and a review of the appropriate criteria, the intersection of Lynnwood Drive and Hoezle Road does not warrant a multi-way stop. The City should consider trimming vegetation obstructing sight lines and relocating the existing stop sign to further improve safety.