

January 29, 2021

ECKERT SEAMANS CHERIN & MELLOTT, LLC
600 Grant Street, 44th Floor
Pittsburgh, PA 15219

RE: Safety Review of Camp Meeting Road
Citizens for a Great School / Quaker Valley High School Relocation
Leet Township, Allegheny County, Pennsylvania

French Engineering was engaged by the Citizens for a Great School to review the impacts of the proposed relocation of Quaker Valley High School to Camp Meeting Road in Leet Township, Allegheny County, Pennsylvania. At this time, the traffic study is still being prepared by the school district. In the interim, a review of potential safety concerns was conducted for Camp Meeting Road between the proposed high school and Beaver Street, as these concerns may have some bearing on special exception criteria, particularly:

The special exception shall not involve any element or cause any element or condition that may be dangerous, injurious or noxious to any other property or persons, and shall comply with the performance standard of § 27-701.

The project area was field viewed on Thursday, January 14, 2021 during daylight hours and Sunday, January 17, 2021 during nighttime / snow conditions. In general, the roadway was found to have one lane in each direction with no turn lanes at any driveway or intersection. It had a steep upgrade in the northbound direction (away from Beaver Street), numerous horizontal curves, and a posted speed limit of 25 mph. According to PennDOT functional class maps, it is classified as an urban major collector. It is owned by Allegheny County and is a non-state federal aid roadway. It was last counted on September 19, 2019 (Thursday), at which time 2,800 vehicles were counted in a 24-hour period.

Numerous concerns were identified during the field view, which are categorized into the following general areas:

- (1) Inadequacies at the Beaver Street / Camp Meeting Road intersection
- (2) Poor geometry for Camp Meeting Road between the proposed High School and Beaver Street
- (3) Roadside hazards along Camp Meeting Road
- (4) Substandard signing and pavement markings on Camp Meeting Road
- (5) Dark areas along Camp Meeting Road due to gaps in the street lighting

Organization of this Document

This document has three main parts:

1. Discussion of the specific challenges presented by teenaged drivers, which will be a major component of the traffic generated by the high school.
2. Discussion of the specific safety concerns observed on Camp Meeting Road and the Camp Meeting Road / Beaver Street intersection.
3. Approximate costs of improvements that would be considered to address some of the safety concerns.

Teenaged Drivers

As the safety concerns are presented in this document, special consideration should be given to the high school aged drivers that will be attracted to this area with the proposed high school. Their inexperience will compound the identified issues. According to the Center for Disease Control (CDC), motor vehicle crashes are the second leading cause of death for U.S. teens. The CDC noted:

The risk of motor vehicle crashes is higher among teens aged 16–19 than among any other age group. In fact, per mile driven, teen drivers in this age group are nearly three times as likely as drivers aged 20 or older to be in a fatal crash.

The following materials from the CDC outline the specific risk factors associated with teenaged drivers:

- *Inexperience* - *Teens are more likely than older drivers to underestimate or not be able to recognize dangerous situations. Teens are also more likely than adults to make critical decision errors that can lead to serious crashes.*
- *Nighttime and Weekend Driving* - *In 2018, 37% of motor vehicle crash deaths among teen drivers and passengers aged 13–19 occurred between 9 pm and 6 am, and 52% occurred on Friday, Saturday, or Sunday.*
- *Not Using Seat Belts* - *Compared with other age groups, teens and young adults often have the lowest seat belt use rates. Among teen drivers and passengers 16–19 years of age who died in car crashes in 2018, almost half were unrestrained at the time of the crash (when restraint use was known).*
- *Speeding* - *Teens are more likely than older drivers to speed and allow shorter headways. In 2018, 30% of male drivers aged 15–20 years and 18% of female drivers aged 15–20 years who were involved in fatal crashes were speeding. These were the highest percentages by sex as compared with all other age groups*
- *Alcohol Use* - *Drinking any amount of alcohol before driving increases crash risk among teen drivers as compared with older drivers. Teen drivers have a much higher risk for being involved in a crash than older drivers at the same blood alcohol concentration (BAC), even at BAC levels below the legal limit for adults.*

Source: https://www.cdc.gov/transportationsafety/teen_drivers/teendrivers_factsheet.html

Safety Concerns

(1) Inadequacies at the Beaver Street / Camp Meeting Road intersection

The following are specific concerns related to the Beaver Street / Camp Meeting Road intersection.

- A. Restricted sight distance looking right from Camp Meeting Road at Beaver Street due to a wall and utility pole in the northwestern corner. This leads to an increased risk that a motorist on Camp Meeting Road will pull out in front of a motorist heading eastbound on Beaver Street, resulting in an angle collision.



View of Camp Meeting Road from eastbound Beaver Street. As can be seen, all but the last few feet are hidden by the wall and utility pole. This photo also shows the lack of pavement markings on Beaver Street in the Camp Meeting Road intersection.



View looking right from Camp Meeting Road from the perspective of a vehicle stopped at the stop sign. The stop sign is well behind the wall lining Beaver Street.

- B. General difficulty pulling out of Camp Meeting Road at Beaver Street due to cross traffic, the three-way stop to west, and the VFW parking lot. This could lead to vehicles pulling out in front of traffic on Beaver Street, either due to confusion or risk-taking behavior caused the lack of acceptable gaps in Beaver Street traffic. The consequences of such actions are typically angle collisions in the intersection.



The stop sign has a supplemental sign indicating “OPPOSING TRAFFIC DOES NOT STOP USE CAUTION AT INTERSECTION”.

During the field view, the driver also experienced difficulty in finding a gap in Beaver Street traffic due to overall congestion conditions. It is anticipated that this will be identified and addressed in the traffic study being conducted by the school district. It is expected that alternative traffic control (i.e., signalization, all-way stop, etc) will be evaluated and proposed by the traffic study.

C. Skew in Camp Meeting Road / Beaver Street intersection

There is a slight skew (<10 degrees) in Beaver Street near the Camp Meeting Road intersection. Westbound traffic must turn to the left to continue following the Beaver Street alignment. Eastbound traffic must turn to the right. If a westbound driver fails to make the turn, they will hit the wall and utility pole in the northwest quadrant. (see photo below). Skewed intersections are generally undesirable because they complicate driver tasks such as navigating the intersection and identifying gaps in traffic into which to turn.



Photo shows skew in Beaver Street at its intersection with Camp Meeting Road. It also shows the lack of pavement markings.

D. Lack of pavement markings on Beaver Street

As can be seen in the photos above, Beaver Street lacks double yellow center lines. White edge lines are generally not required next to curb but could be beneficial in this case given the width of the road and low curb reveal. Pavement markings may help to delineate the skew of the intersection. Also to be noted, the “Pedestrian” sign with supplemental “Yield to Peds in Crosswalk” sign is shown in the photo above with no visible crosswalk on the pavement. The purpose of pavement markings are to provide guidance to the driver and can be used to convey regulations, guidance, and warnings in ways that are not obtainable by the use of other devices. The consequences of missing pavement markings are typically related to drivers leaving their assigned path, such as run-off-the road crashes, opposite direction sideswipe crashes, and head-on crashes.

E. Inadequate turning radii in the intersection to turn larger sized vehicles, including school buses.

The two figures below show school buses turning in and out of Camp Meeting Road from each direction of Beaver Street with a vehicle waiting on Camp Meeting Road attempting to turn out. This illustrates the tight radii on each corner, as well as how the sight obstructions caused by the wall and utility pole in the northwestern quadrant greatly reduce what limited room is available in the intersection for turning. The consequences of the poor turning radii include the potential for buses to hit the obstructions in the corner while turning, or to hit other vehicles in

the intersection because the buses are forced into opposing traffic lanes while turning around the obstructions in the corner.



Turning simulation showing the school bus turning right into Camp Meeting Road



Turning simulation showing the school bus turning left into Camp Meeting Road

(2) The curvature and steepness of Camp Meeting Road.

A. Steep grade on Camp Meeting Road

The grade on Camp Meeting Road between the proposed high school driveway and Beaver Street was estimated at 10% using measurements and tools in Google Earth. This would be considered a steep roadway by most highway standards. Downgrades increase braking distance, speeding, and difficulty stopping and slowing in poor weather conditions. The consequences include an increased risk of hitting fixed objects in the roadside or hitting other vehicles on Camp Meeting Road. Downgrades can also increase the likelihood of sliding off of sharp horizontal curves, which the corridor has many. The following photo shows the W7-1 “hill” sign installed on Camp Meeting Road, which is warranted in the Manual on Uniform Traffic Control Devices (MUTCD) based on the steepness and length of the grade. According the MUTCD, this sign *should be used in advance of a downgrade where the length, percent of grade, horizontal curvature, and/or other physical features require special precautions on the part of road users.*



Hill (W7-1) and Winding Road (W-15) signs on southbound Camp Meeting Road approaching the school area

Note the W-15 “winding road” sign that has also been installed. This sign is correctly applied and is warranted when there are three or more changes in roadway alignment each separated by a tangent distance of less than 600 feet.

B. Speeding and aggressive driving on Camp Meeting Road

During the field view, the engineer drove downgrade at the posted speed limit of 25 mph and had a queue of vehicles form behind it, including those honking horns and aggressively driving. It is anticipated that a spot speed study on the roadway would reveal that operating speeds are in excess of the 25-mph speed limit. Speeding increases the likelihood and consequences of crashes and can reduce the effectiveness of certain roadway design elements, such as guide rail, guide rail end treatments, and superelevation on horizontal curves. It also requires increased sight distance to safety stop in response to hazards, which may not be available.

C. Inadequate sight distance on select horizontal curves on Camp Meeting Road

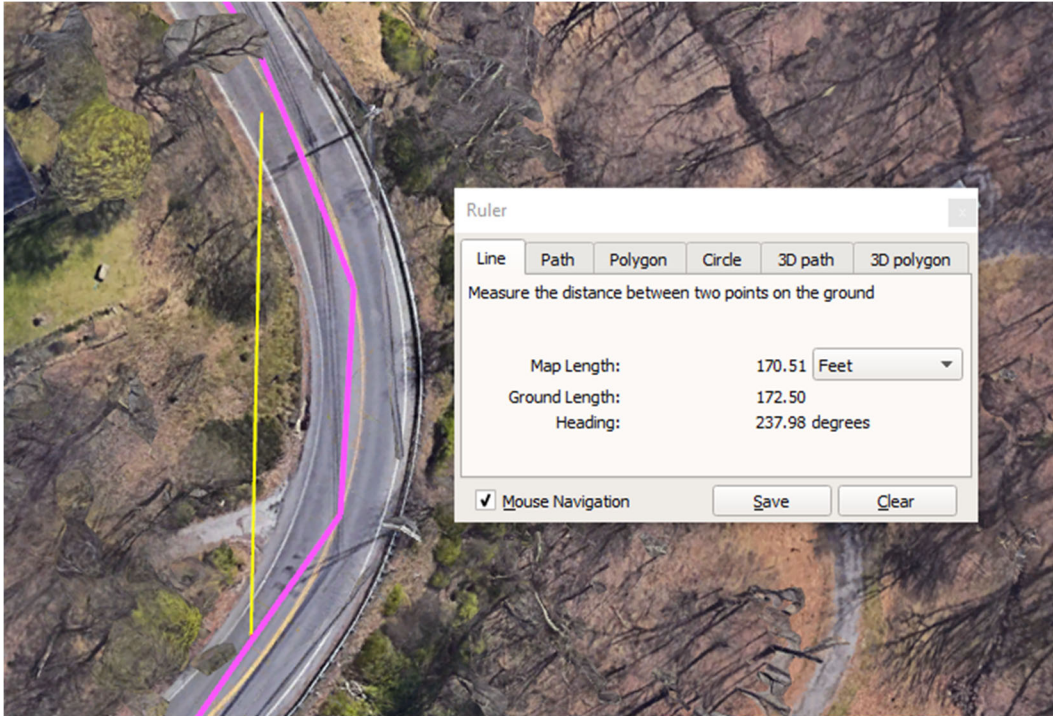
According to the Policy on Geometric Design of Highways and Streets, Table 3-2 Stopping Sight Distance on Grades, the stopping sight distance for 25 mph speeds on 9% grades are as follows:

Upgrade = 140-ft

Downgrade = 173-ft

There are multiple examples along Camp Meeting Road where these minimums are not met because of embankments and / or vegetation on the inside of horizontal curves obstructing visibility. The consequences of inadequate sight distance are an increased risk of hitting objects in the road, including other vehicles, such as those that might be moving slow or queued due to congestion.

The following three figures illustrate this point. The first is an aerial photo that shows a measured distance of 173-ft being blocked by a wall / embankment. The final two are photos taken from ground view upstream of horizontal curves with sight distance limited by obstructions on the inside of the curve.



Measured length of 170-ft blocked by embankment that is located at the edge of road on the inside of the curve.



Sight distance in horizontal curve approximately 1200-ft from Beaver Street



Sight distance in horizontal curve approaching stop sign at Beaver Street

In addition, a driveway on a horizontal curve was observed with a mirror across the road to assist with sight distance. The following photo shows this mirror. PennDOT policy generally discourages the use of mirrors and will only allow them if there are no other practical alternatives for improving the sight distance or providing an alternate method of traffic control. They are a last resort for sight distance problems and should be considered atypical.



Mirror at a driveway along Camp Meeting Road due to poor sight distance

D. The series of horizontal curves on Camp Meeting Road (winding road conditions)

Camp Meeting Road has a series of reverse and broken back horizontal curves between the proposed school site and Beaver Street. The curves are of such frequency and spacing that the winding road sign is warranted and installed in both directions, as noted previously. In addition, one curve of particular concern is the curve with the intersection of Myrtle Hill Road. This curve has the “hairpin curve” (W1-11) sign installed because the MUTCD indicates it can be applied when *the curve has a change in horizontal alignment of 135 degrees or more*. In this case, the change in horizontal alignment is approaching 180 degrees, as shown in the following aerial photograph. Horizontal curves carry increased risk of sliding off the road or rolling over. A series of horizontal curves increase demands on the driver. Reverse curves complicate efforts to provide proper superelevation around curves, especially at the entrances to the curves. Substandard superelevation makes the curves even more susceptible to run off the road crashes.



Curve with “Hairpin Curve” (W1-11) sign installed



"Hairpin Curve" sign (W1-11) in the northbound direction. A second sign is installed southbound.

(3) Camp Meeting Road has numerous roadside hazards that can cause or worsen crashes for vehicles leaving the traveling lane. The roadside hazards include the following:

A. Narrow shoulders on Camp Meeting Road

While the lane widths on Camp Meeting Road appear to be approximately 12-ft, shoulder widths are narrow and on the order of a couple of feet. This leaves very little buffer / recovery area between the travel lane and hazards present in the roadside, which increases the likelihood of the hazards being struck. Most of the previous photos presented along Camp Meeting Road illustrate the narrow shoulders.

B. Unprotected fixed object hazards including rock outcroppings, trees, rollover embankments, retaining walls, and inlet headwalls. Trees and utility poles do not generally need to be protected unless they are likely to be hit due to geometric roadway conditions (outside of a curve, steep grade at beginning of a curve, etc.).

The following photos show a few examples of items in the immediate roadside that would cause or worsen a crash by a vehicle leaving the traveling lane.



Blunt end of a retaining wall sitting at the back of the shoulder, only a couple of feet from the travel lane. In addition, in the background, pieces from the wall can be seen laying on the shoulder. Blunt fixed objects can lead to high deceleration in the crash and / or spearing of the vehicle, the consequences of which are more severe crashes.



Headwall of an inlet that presents a blunt end fixed object hazard. In addition, some of the inlets have broken or depressed grates / sidewalls that could grab a tire, thus increasing the potential severity of the crash.



One example of a rock outcropping that presents a fixed object hazard. PennDOT Design Manual 2, Chapter 12, indicates *a steep, rough-sided rock cut should normally begin outside the clear zone or be shielded. A rock cut is normally considered to be rough-sided when the face can cause excessive vehicle snagging rather than provide relatively smooth redirection.*



Trees greater than 4" in diameter are considered fixed object hazards. Steep embankments can cause rollover crashes or fixed object crashes. The photo also shows another inlet headwall protruding prominently from the earth around it.

- C. Inadequate guide rail including outdated equipment, lack of guide rail backup, fixed object hazards right behind guide rail, and guide rail damage

The following photos show guide rail that has been hit and not repaired, as well as guide rail that is sliding due to sliding of the earth into which it is imbedded. The purpose of guide rail is to protect drivers from the hazards that are behind it by redirecting motorists back into the roadway. If it is not functioning properly or designed and installed in accordance with the latest standards, it can fail in this regard and / or simply be another roadside hazard.

With respect to sliding guide rail, it should be noted that there should be 2-ft of somewhat level earth behind the guide rail posts to secure them in the ground. This is not likely to be present throughout, especially if the posts are sliding.

In addition, there should be a clear area behind the guide rail posts that is at least equal to the deflection distance of the guide rail. Without a detailed examination, of the guide rail, it will not be possible to know the deflection distance. According to the PennDOT Roadside Safety Pocket Guide, deflection distances range from 1.5-ft to 9-ft. It is likely that there are obstructions, namely utility poles and trees, within the deflection distance of the guide rail that has been installed.

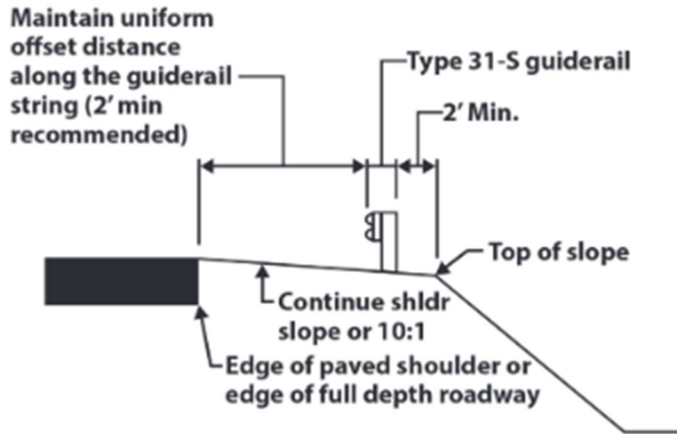
**Deflection Table
(Minimum Unobstructed Distance)***

	Type	Deflection (ft)	Post Spacing (ft-in)	Mounting Height
Flexible	2-W	9	12' - 6"	32"
	2-WC	6.5	6' - 3"	
	2-WCC	5.5	3' - 1 ½"	
Semi-Rigid	31-S	4	6' - 3"	31"
	31-SC	3	3' - 1 ½"	
	31-SCC	1.5	1' - 6 ¾"	
Rigid	Concrete Barrier	0	-	32" or 50"

*Measured from the rear face of the guide rail post to the front face of the obstruction.

Excerpt from PennDOT Roadside Safety Pocket Guide showing deflection distances of guide rail.

For Optimum Performance



Excerpt from PennDOT Roadside Safety Pocket Guide showing 2-ft minimum distance between the back of the guide rail post and the top of slope on embankments.



Photo shows sliding guide rail, likely due to earth sliding behind it.



Damaged guide rail. Also, potential fixed object hazards behind the guide rail within the deflection distance.



Earth around guide rail posts is eroding away from the posts in the background of the photo.

(4) Substandard signing and pavement markings on Camp Meeting Road

A. Non-compliant horizontal curve signing

Design criteria for horizontal curve signing needed to be brought into compliance with new requirements in the MUTCD by the end of 2019. It does not appear that the signing on Camp Meeting Road has been updated to these new standards. However, further detailed study would be required to make a final determination. Consistent signing on horizontal curves is essential to helping drivers successfully navigate the roadway alignment. Failure to do so increases the risks of run off the road crashes.

B. Lack of delineation

As a roadway through a wooded area with only sporadic lighting, the roadway would benefit from delineation in accordance with PennDOT standards (TC-8604). If uniform lighting were provided, delineation would not be beneficial. Like pavement markings, delineation guides drivers along the alignment of the roadway. If drivers fail to follow the alignment, they leave the roadway and are subject to hitting objects in the roadside.

(5) Dark areas along Camp Meeting Road due to gaps in the street lighting

Generally speaking, Camp Meeting Road has a series of light and dark areas because lighting is only provided in the horizontal curves. Additional lighting could be installed to uniformly light the entire roadway. Roadway lighting can reduce nighttime crashes that result from poor visibility.

Cost of Safety Improvements

While it is beyond the scope of this review to conduct a detailed estimate of the cost to improve Camp Meeting Road, the following “order of magnitude” construction cost estimations are provided in this regard. Note that other costs including but not limited to design, utilities, right-of-way, maintenance and operation are not included.

It may be possible to address some of the concerns with low-cost safety improvements, such as signing, pavement markings, and delineation:

- The estimated cost for a typical post-mounted sign (e.g., 36” x 36”) is approximately \$600. It is reasonable to expect that the signing could be upgraded for \$5,000 to \$10,000.
- The estimated cost for durable thermoplastic pavement markings is approximately \$5.00 per linear foot. This is a high-quality pavement marking that is superior and more expensive than paint. Installing it along the 0.67-mile length of Camp Meeting Road between Beaver Street and the proposed school driveway would cost approximately

\$70,000. Installing similar markings along Beaver Street through the Camp Meeting Road intersection area would cost approximately \$2,500.

- Post mounted delineators cost approximately \$50 each and delineators on guide rail cost approximately \$20 each. Installing delineation along the corridor would cost approximately \$5,000.

Some medium cost items include upgrading the guide rail / end treatments, replacing the inlets, installing additional lighting, and installing high friction surfacing on the curves.

- Guide rail – Typical guide rail costs approximately \$25 per linear foot, with end treatments estimated at \$3,500 each. Guide rail currently runs along the eastern side of Camp Meeting for nearly all of the length between Beaver Street and proposed school. Replacing this guide rail would cost approximately \$50,000 (includes end treatments). This also gives an idea of what it might cost to add guide rail at select locations on the other side of the roadway, acknowledging that hazards on the other side of the roadway would likely most be dealt with by removing them.
- Inlets – We estimate that replacing one of the older style inlets will cost approximately \$7,500 each. A quick investigation revealed at least six of these inlets, which amounts to a total of \$45,000.
- Lighting – Between Beaver Street and the vicinity of the proposed high school driveway, there are seven existing street lights, and up to 6 more could be added to provide more uniform lighting. It is anticipated that most of these could be added by mounting them on an existing utility pole. It may be necessary to install one or two on new poles depending on the outcome of the lighting design. It is roughly estimated at \$1,500 to mount a new light on an existing utility pole and \$7,000 if a new pole is required. Using these assumptions, the cost to improve the lighting is estimated at \$15,000 to \$20,000 plus the ongoing costs of electrifying them.
- High Friction Surface – Given the steep grades, series of closely-spaced horizontal curves, and intersection at the bottom of the grade, it is assumed that high friction surface would be applied along most of the length of roadway. At an estimated cost of \$50 per square yard, applying the treatment in both lanes along the entire length would cost \$236,000, which serves as the upper limit on the cost of the improvement.

If a traffic signal becomes necessary at the intersection of Beaver Street and Camp Meeting Road, this will cost upwards of \$250,000 plus the cost of any roadway improvements required to accommodate the signalization, which could include turning lanes, improved turning radii in the corners, and other modifications required to place the signal equipment. A project such as this could cost upwards of \$500,000 depending on the magnitude of the roadway improvements.

Finally, some concerns will not be feasible to address, including some of the major concerns related to the steep grades and sharp horizontal curves. It is also questionable as to whether all of the roadside hazards can be satisfactorily addressed without impacting adjacent properties and / or acquiring right-of-way. It is also uncertain what can be done about the speeding and aggressive driving in the corridor without additional law enforcement. Ultimately, even if unlimited funds were available, there is only so much that can be done with the roadway given its existing alignment and the topography through which it runs.