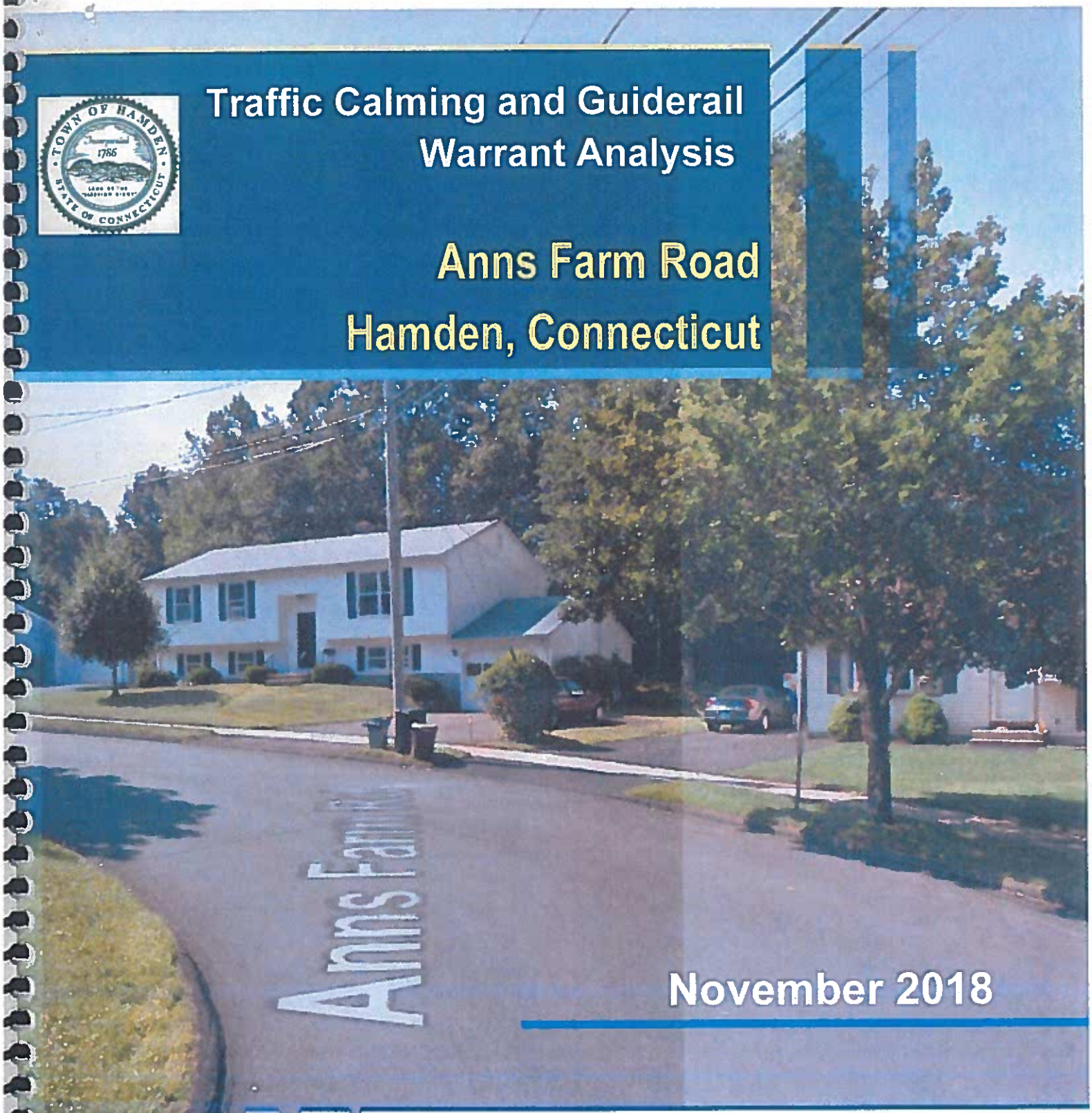
Traffic Calming and Guiderail Warrant Analysis

Anns Farm Road
Hamden, Connecticut



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TOWN OF HAMDEN, CONNECTICUT

TRAFFIC CALMING

AND

GUIDERAIL WARRANT ANALYSIS

ANNS FARM ROAD

TASK ORDER NO. 12

NOVEMBER 2018

INTRODUCTION

WSP USA has prepared this whitepaper to provide a Warrant Analysis for the placement of guiderail along a curved section of Ann Farm Road and a traffic calming conceptual design in the Town of Hamden. The purpose of the guiderail and placement of traffic calming countermeasures is to facilitate the historical accounts of errant vehicles leaving the road along a sharp curve along the alignment of Anns Farm Road. The existing curve will be examined to determine compliance with AASHTO and CTDOT design standards for the posted speed limit.

Purpose and need for guiderail will be determined as part of the evaluation. The function of the guiderail is to protect private property fronting this curve. All proposed work is to stay within the existing Ann Farm Road Right-of-Way with no encroachment onto private property. A description of findings and development of the warrant analysis is as follows:

METHODOLOGY

The subject curve will be evaluated to determine the current acceptable speed at which the curve is safe. A warrant analysis for the placement of roadside safety elements will also be evaluated. The guiderail warrant analysis will be based on *Chapter 13* of the CTDOT Roadway Design Manual. Placement of the traffic calming countermeasures will be based on ITE guidelines. The posted speed limit within the project limit is 25 miles-per-hour. However, the design speed of the curve appears to be 20 miles-per-hour through a rough assessment of the roadway geometrics. The warrant analysis will consist of the following:

- *Clear Zone Assessment*: Existing clear Zone available will be compared to the CTDOT standard. This will take slopes and roadway shoulders. Obstructions within this clear zone area will also be evaluated.
- *Sight Distance*: An evaluation of the stopping sight distance will also be performed regarding sight distance of the curve and roadside obstructions.

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- *Roadside signage*: Existing roadside signage will be evaluated and placement of proposed signage in as far as regulatory and/or warning signage will be evaluated.
- *Traffic Calming Countermeasures*: Need for placement of roadside countermeasures will be evaluated as part of the analysis in lowering approach speeds.

EXISTING CONDITIONS

Ann Farm Road is a local residential street as part of a local roadway neighborhood network. The existing roadway characteristics are as follows:

- Roadway Width (curb-to-curb): 30± feet
- Travel Lane configuration: Two, 12-foot lanes
- Shoulder: Var. 2-to-6 feet
- Curve Radius: 90 feet
- Sidewalks: 5-feet with 4-foot grass buffer
- ADT <750 Vehicles per day
- Posted Speed: 25 MPH

Curvature Design Speed Computation

The existing controlling curve radius has been determined to be approximately 90 feet. Based on the CTDOT Highway Design Manual based on the equation

$R = V^2/15\ (e + f)$

E =superelevation = 0

f = coefficient of friction (side) 0.30 (wet pavement)

V = velocity = 25 MPH

The value of R, based on the above equation is $R = 25^2/15\ (0 + 0.30) = 166.7$ feet. Therefore, radius is **NOT** sufficient for posted speed of 25 MPH. Design speed of existing curve is **20.2 MPH** based on a radius of 90 feet.

There are no warning signs or supplemental speed plaques to warn approaching vehicles of the substandard curve. No roadside safety devices are in place to guard against any errant vehicles. However, three chevron alignment signs (W1-8) are placed along the outside of the curve denoting the curve alignment limits. However, sign spacing is greater than that specified in the MUTCD.

Middle Ordinate Computation:

Based on the nature of the curve and decision sight distance (DSD) needed for a suburban local roadway to avoid an obstruction in the roadway. Based on Table 7.2A of the CTDOT Design Manual the DSD for an

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avoidance maneuver is 535 feet for 30 MPH (lowest speed on the table). The land inside of the middle ordinate should be clear of all obstructions to meet the DSD criteria. The existing condition yields the following:

Exiting Middle Ordinate (M) = 55 feet (graphical) measured from the center of inside travel lane.

Existing curve radius - 90 feet

Based on the required DSD, the required value of M is:

$$M = R\,(1-\cos\,(28.65(S)/R))$$

$$M = 90(1-\cos\,(28.65(535)/90$$

$$M = 90(1-\cos\,(28.65(535)/90) = 177.65 \text{ feet}$$

Since this distance is based on 30 MPH, 25 MPH is 83% of 30 MPH proportionally. Therefore, the required value of M for 25 is approximately 177.7 (.833) = 148 feet

Based on the above computation, an additional 58 feet inside of the curve needs to be cleared to provide additional distance. However, the design speed of the curve is 20 MPH therefore the required value of M would be:

DSD (20 MPH) = 535(0.67) =356 feet

M = 125 .6 feet

Therefore, an additional 70 feet (125'-55'=70') would need to be free of obstruction. Therefore, warning signage with supplemental speed plaque would be necessary since this is not achievable with the existing house.

GUIDERAIL WARRANT ANALYSIS

In addition to determination the design characteristics of the curve it is necessary to determine if roadside safety measures are necessary. Based on *Table 13-2A* in Chapter 13 of the Design Manual based on an ADT of <750 vehicles/day and a clear area flatter than 1:6, 7 feet of clear zone distance is recommended.

TRAFFIC CALMING COUNTERMEASURES

In addition to the recommended signage placement it would be advantageous to incorporate traffic calming countermeasures to ensure the reduction of vehicular speed approaching the curve. Based on the nature of the area and classification of roadway, implementation of level 3 traffic calming countermeasures can be implemented on a local, isolated level.

Placement of two speed humps placed approximately 50 feet up stream of the point of curvature on each approach would allow for sufficient reduction in speed. This reduction would bring vehicular speed below the curve speed threshold of 20 MPH. Warning signs would be placed in advance of the vertical deflection and appropriate pavement markings would be placed along the curve and on the speed humps signifying their presence in accordance with MUTCD. The attached is a traffic calming and signage conceptual plan.

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CONCLUSIONS

The proposed safety enhancements placed along the curve will allow for a safe travel along Anns Farm Road. These safety enhancements include placement of two speed humps placed approximately 50 feet in advance of the curve on each approach (each speed hump spans the entire street width). As well as placement of warning signs in advance of the curve. These signs will have a supplemental speed plaque of 15 MPH.

A guiderail warrants analysis was performed to determine if guiderail would be needed along the curve. The warrants analysis determined that guiderail would not be warranted at this location based on the following reasons:

1. A computation of the required clear zone was performed based on the classification, traffic volume and speed. This computation (based on Table 13-2A of the CTDOT Highway Design Manual) states that the required clear zone is 7-feet. No obstructions lie in this zone. The house is over 30 feet from the edge of roadway.
2. Anns farm Road is in a residential neighborhood with very low traffic volumes. With posted speed of 25 MPH below thresholds. The roadway is also curbed.
3. Placement of the guiderail would be at the face of curb based on the standards. With the compressed nature of the curvature and reduced arc length, there is insufficient room for the placement of the standard approach section. With this the blunt end, would act as a fixed obstruction and pose a safety hazard itself.

With the placement of the advance curve warning signs and supplemental 15MPH speed plaque along with the deployment of speed humps to be placed in advance of the curves on each approach, speeds will be reduced along the curve to levels that will foster better handling around the curve.

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