

Evaluation of Traffic and Safety Conditions

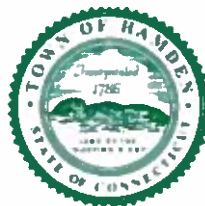
West Todd Street at Joyce Road II



February 2017

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Prepared for:



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Executive Summary

Parsons Brinckerhoff (PB) was retained by the Town of Hamden to conduct an assessment of the existing roadway conditions, traffic and safety analysis, and recommending improvement measures for the intersection of West Todd Street at Joyce Road II. The following is a summary of study findings and recommendations, which are described in detail with the supporting data in the body of the report.

Intersection problems and issues:

- Intersection approach sight line from Joyce Road II onto West Todd Road is inadequate for the posted speed limit on West Todd Road.
- An all-way stop control on West Todd Road is not warranted due to low traffic volume from Joyce Road II and low number of crashes of a type correctable by stop sign.

Recommendations for Improvements:

- Clear shrubs and vegetation within the intersection sight triangle (within the Rights of Way).
- Install "Intersection Ahead" warning signs along West Todd Street in both direction.
- Install temporary or permanent Speed Radar devices along West Todd Street for both approaches to Joyce Road II.
- Install white transverse pavement markings along West Todd Street westbound approach to the intersection.

The Town may wish to advance this study to design phase for development and implementation of proposed signs and pavement markings.

Introduction

Parsons Brinckerhoff is pleased to submit this traffic engineering report for assessing the existing traffic conditions and recommending improvement measures at the intersection of West Todd Street at Joyce Road II in the Town of Hamden, Connecticut. This report provides an evaluation of the existing traffic and safety conditions, assessment of traffic operations, and recommendation of appropriate improvement measures that may be considered for implementation.

1. Data Collection and Intersection Condition Evaluation

1.0- Existing Conditions

West Todd Road is a two-lane undivided facility classified as Urban Local Road. The posted speed limit is 25 MPH. The curb-to-curb width of the street is approximately 30 feet. Travel lanes are 11 feet wide and delineated by edge markings (2-4 inch shoulder width). Bituminous concrete curbing installed on both sides of West Todd Street. West Todd eastbound approach to the intersection of Joyce Road II has approximately 10% down grade. West Todd Road is operating under a free flow condition. There are no sidewalks or bike facilities present along West Todd Street.



Figure 1- Looking West on West Todd Street at Joyce Road II

Joyce Road II is a two way undivided roadway and classified as Local Road. Joyce Road is 30 feet wide curb-to-curb. Joyce Road II is a dead-end street. There are no sidewalks along Joyce Road II.



Figure 2 - Joyce Road II Looking West onto West Todd Street

1.1- Roadway Traffic Volumes

Roadway traffic count were collected on a Wednesday January 4 and Thursday January 5, 2017 by means of Automatic Traffic Recorders (ATR). Traffic counts were collected for all three approaches to the intersection of West Todd Street and Joyce Road II. Traffic volume count data is included in the appendix.

West Todd Street carried a total of 2, 287 vehicles per day (both directions). West Todd Street peak hours occurred between 8:00 a.m. and 9:00 a.m. (302 vehicle per hour eastbound and 121 vehicle per hour westbound) and between 5:00 pm and 6:00 pm (153 vehicles per hour eastbound and 327 vehicles per hour westbound).

Joyce Road II carried a total of 172 vehicles in a 24 hour period (87 vehicles and 85 vehicles on the northbound and southbound respectively). Joyce Road II peak hours occurred between 7:00 a.m. and 8:00 a.m. (4 vehicle per hour northbound and 9 vehicle per hour southbound) and between 3:00 pm and 4:00 pm (12 vehicles per hour northbound and 8 vehicles per hour southbound).

1.2- Speed Observations and Measurements

Vehicle speeds were also recorded with the 24-hour ATR counts. The 85th percentile speed is defined by the Federal Highway Administration (FHWA) as "the speed at or below which 85 percent of all vehicles are observed to travel under free-flowing conditions past a monitored point." The 50th percentile is defined

as “the speed at or below which 50 percent of all vehicles observed to travel under free-flowing conditions past a monitored point.” The 85th and 50th percentile speeds measured for all intersection approaches are summarized below and detailed in the appendix.

Table 1- Travel Speed at Joyce Road II and West Todd Street

| Speed Profile for Intersection Approaches (mph) | | | | |
|---|------------|------|------|--------|
| | | 85th | 50th | Posted |
| Joyce Road II | Northbound | 35 | 29 | none |
| | Southbound | 32 | 27 | none |
| W. Todd Street (West of Joyce Rd. II) | Eastbound | 44 | 39 | 25 |
| | Westbound | 47 | 41 | 25 |
| W. Todd Street (East of Joyce Rd. II) | Eastbound | 51 | 45 | 25 |
| | Westbound | 48 | 42 | 25 |

1.3- Pedestrian Observations

During the field reconnaissance, 1 pedestrian was observed along West Todd Street. Pedestrian volumes were not recorded by the ATR.

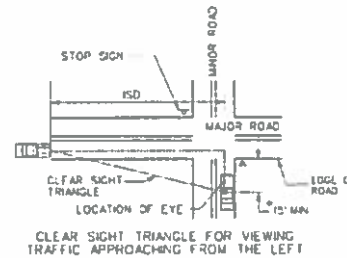
1.4- Intersection Sight Distance (ISD) Assessment

Intersection sight distances were measured based on the CTDOT Highway Design Manual, Sections 11-2.03.01 and 11-2.03.02. The intersection sight distance measurement methodology as described by the CTDOT Highway Design Manual is as following:

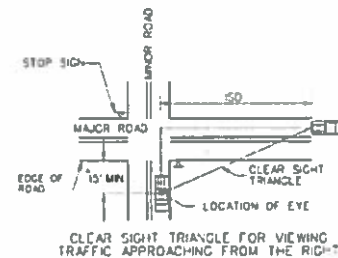
“The intersection sight distance is obtained by providing clear sight triangles both to the right and left as shown in Figures below. All legs of the intersections must be addressed similarly. The following discussion assumes a stop-controlled side street entering a major through street:

1. Minor Road. The length of leg along the minor road is based on two parts. The first is the location of the driver’s eye on the minor road. This is typically assumed to be 15 feet from the edge of the major road and in the center of the lane on the minor road; see Figure 11-2A. In restricted locations, this may be a minimum of 15 ft. from the traveled way of the major road. The second part is based on the distance to the center

of the vehicle on the major road. For right-turning vehicles, this is assumed to be the center of the closest travel lane from the left. For left-turning vehicles, this is assumed to be the center of the closest travel lane for vehicles approaching from the right; see Figure below.



- Height of Eye/Object.** The height of eye for passenger cars is assumed to be 3.5 feet above the surface of the minor road. The height of object (approaching vehicle on the major road) is also assumed to be 3.5 feet. An object height of 3.5 feet assumes that a sufficient portion of the oncoming vehicle must be visible to identify it as an object of concern by the minor road driver. If there are a sufficient number of trucks to warrant their consideration, assume an eye height of 7.6 feet for a tractor/semitrailer and 6 feet for single-unit trucks and buses. If a truck is the assumed entering vehicle, the object height will still be 3.5 feet for the passenger car on the major road. The designer must also ensure that adequate ISD for passenger cars is provided, because there are situations where trucks have ISD and smaller vehicles do not.



Within this clear sight triangle, if practical, the objective is to remove, lower any object, trim lower tree branches, etc., that obstruct the driver's view. These objects may include buildings, parked or turning vehicles, trees, hedges, tall crops, unmowed grass, fences, retaining walls and the actual ground line. In addition, where a crossroad intersects the major road near a bridge on a crest vertical curve, items such as bridge parapets, piers, abutments, guardrail or the crest vertical curve itself may restrict the clear sight triangle.

Table 2 provides a summary of roadway grades along West Todd Street. The average grades were calculated from the Town GIS mapping depicted on Figure 2.

Table 2- Grades of West Todd Street Eastbound Approach to Joyce Road II Intersection

| | Average Grade |
|---------------------------------------|---------------|
| Crest to Intersection (465') | -6.0% |
| Sight Distance to Intersection (200') | -9.9% |
| 100 Feet from Intersection | -11.3% |

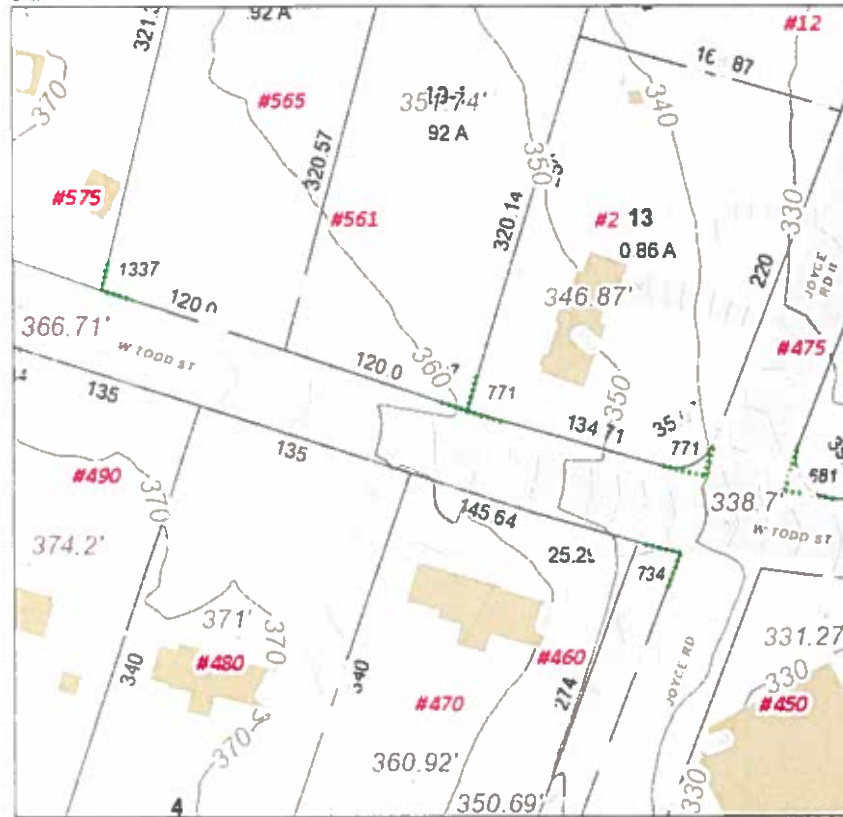
Source: Geographic Information System – Elevation Data, Town of Hamden

Figure 2- Town of Hamden GIS Topographic Map

Town of Hamden
Geographic Information System (GIS)



Date Printed: 2/1/2017



MAP DISCLAIMER - NOTICE OF LIABILITY
This map is for assessment purposes only. It is not for legal description or conveyances. All information is subject to verification by any user. The Town of Hamden and its mapping contractors assume no legal responsibility for the information contained herein.

Approximate Scale: 1 inch = 75 feet



Table 3 – Reference to Figure 11-2B of CTDOT Highway Design Manual

| Design Speed (V_{major}) (mph) | ISD (ft) | | |
|--|----------------|--------------------|----------------------|
| | Passenger Cars | Single-Unit Trucks | Tractor/Semitrailers |
| 20 | 225 | 280 | 340 |
| 25 | 280 | 350 | 425 |
| 30 | 335 | 420 | 510 |
| 35 | 390 | 490 | 595 |
| 40 | 445 | 560 | 680 |
| 45 | 500 | 630 | 765 |
| 50 | 555 | 700 | 850 |
| 55 | 610 | 770 | 930 |
| 60 | 665 | 840 | 1015 |
| 65 | 720 | 910 | 1100 |
| 70 | 775 | 980 | 1185 |

Based on the posted speed of 25 mph along West Todd Street, the CTDOT Highway Design Manual indicates that passenger cars from minor road require 280' of sight line for entering onto West Todd Street. Based on the recorded 85th percentile speeds of vehicles on West Todd Street (44 mph eastbound and 48 mph westbound) using linear interpolation, passenger cars require a clear sight line of 489 feet to the east and 566 feet west of intersection.

The current ISD to the left (westbound approach) is 85 feet, and to the right is 200 feet. Figure 3 thru 5 exhibits the existing ISD.

Figure 3- Intersection Sight Distance to the Right (West Todd Street Eastbound)



Figure 4 - Intersection Sight Distance to the Left (West Todd Street Westbound)



Figure 5- Existing and Required Intersection Sight Distance



2 – All-Way Stop Control Warrant Analysis

PB evaluated whether or not All-Way-Stop-Control (AWSC) is warranted for consideration at the intersection.

The following are four criteria to determine if an intersection is a candidate for AWSC, per current Manual on Uniform Traffic Control Devices (MUTCD) guidelines, Section 2B.07.

1. Traffic control signals are warranted

"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."

This warrant is used when a traffic control signal is needed, but due to time or budgetary concerns, this is not immediately possible.

- This intersection is not warranted for the installation of a traffic signal. Therefore, this intersection does not fulfill this requirement.

2. Turning collisions are high

"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."

Crash Data was collected from 2012-2016, both using the legacy CTDOT crash data, as well as the most recent Model Minimum Uniform Crash Criteria (MMUCC) State crash repository and database. In the past 3 years, there were only 2 crashes recorded, both in the winter of 2015. To meet this warrant, at least 5 turning collisions must occur in a 12 month period.

➤ This intersection does not meet Turning Collision warrant.

3. Volumes are high

- A. *"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*
- B. *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*
- C. *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 A and B."*

The volumes on West Todd Street do not meet 300 veh/hr for any 8 hours, and the volumes on Joyce Road II are well below 200 veh/hr. A detailed volume warrant analysis is included in the appendix.

➤ This intersection does not meet this warrant.

4. Multiple criteria at less extreme values

"Where no single criterion is satisfied, but where Criteria 1, 3.A, and 3.B are all satisfied to 80 percent of the minimum values. Criterion 3.C is excluded from this condition."

The intersection of West Todd Street and Joyce Road II do not satisfy 80 percent of the minimum volume requirements.

➤ This intersection does not fulfill this requirement.

All-Way Stop Control Impact on Level of Service

A Synchro 9® analysis was performed to demonstrate the impact of AWSC (All Way Stop Control) on the intersection operation during both the AM and PM peak hours, if AWSC installed.

Below describes the delay experienced at the intersection during AM and PM peak hours. The implementation of AWSC would add over an hour of vehicle delay during both the AM and PM peak hour. The analysis indicated that the decrease in delay on Joyce Road II is relatively low (due to very low volume) compared to the existing conditions analysis.

Table 3- Delay per Vehicle, and Total Delay per Approach

Vehicle Delay by Approach (seconds/ vehicle)

| | | AM PEAK | | PM PEAK | |
|------------------|----|--------------|----------------|---------------|----------------|
| | | EX. (Sec) | AWSC (Sec.) | EX. (Sec.) | AWSC (Sec.) |
| West Todd Street | EB | 0.1 | 9.5 | 0.0 | 8.3 |
| | WB | 0.0 | 8.0 | 0.0 | 9.8 |
| Joyce Road II | SB | 10.1 | 7.7 | 11.8 | 8.2 |

Total Delay by Approach (vehicle seconds)

| | | AM PEAK | | PM PEAK | |
|--------------------------------|----|---------------|----------------|---------------|----------------|
| | | EX. (Sec.) | AWSC (Sec.) | EX. (Sec.) | AWSC (Sec.) |
| West Todd Street | EB | 33 | 3088 | 0 | 1303 |
| | WB | 0 | 1056 | 0 | 3469 |
| Joyce Road II | SB | 91 | 69 | 118 | 82 |
| <i>Total Delay (Sec.)</i> | | 123 | 4213 | 118 | 4854 |
| <i>Change in Delay (Hours)</i> | | | 1.14 | | 1.32 |

3 – Recommended Improvement Strategies

The study identified the following 4 areas for improvement:

1. Improve Intersection Sight Distance from Joyce Road II onto West Todd Street
2. Reduce vehicular speed on West Todd Street
3. Increase gaps in time for Joyce Road II vehicles to turn
4. Alert drivers traversing West Todd Street of their approach to Joyce Road II

The recommended strategies to address the above issues are described below:

3.1- Clearing Shrubs

The driver sight line exiting from the Joyce Road II onto West Todd Street is very important. It is recommended to cut back and clear shrubbery, and low lying seedlings/trees within City's Right-Of-Way. The figure below illustrates the areas of clearing within the ROW.

Figure 6- Limits of Clearing Vegetation



3.2- Speed Enforcement and Intersection Warning Signs

1. It is recommended to enforce the speed limit at random intervals.
2. It is recommended to install Intersection Ahead (W2-2 (L and R)) signs with supplementary distance signs on West Todd Street – approximately “450 FT” and “400 FT” along eastbound and westbound approaches, respectively. The alternating flashers powered by solar panel are optional.
3. It is recommended to install solar powered Radar Speed Detectors along West Todd Street approximately at 370’ and 275’ for the eastbound and westbound approaches, respectively. The proposed locations of signs and Radar Speed Detectors are shown on Figure 9.

Figure 7- Intersection Sign and Radar Speed Detector



Figure 8- Proposed Warning Sign and Speed Radar Detector Location



3.3- Transverse Pavement Marking

In order to provide visual queue to the drivers to reduce speed approaching the intersection, it is recommended to install transverse pavement markings along West Todd Street.

Figure 9- Transverse Pavement Marking



APPENDIX

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-GIS Topography

-Raw Crash Data

-Raw Volume Data

-Raw Speed Data

-Synchro Reports

-AWSC Warrant Work Sheet and Calculations