DOWNTOWN PEDESTRIAN SAFETY STUDY
HUDSON, OH

February 11, 2022

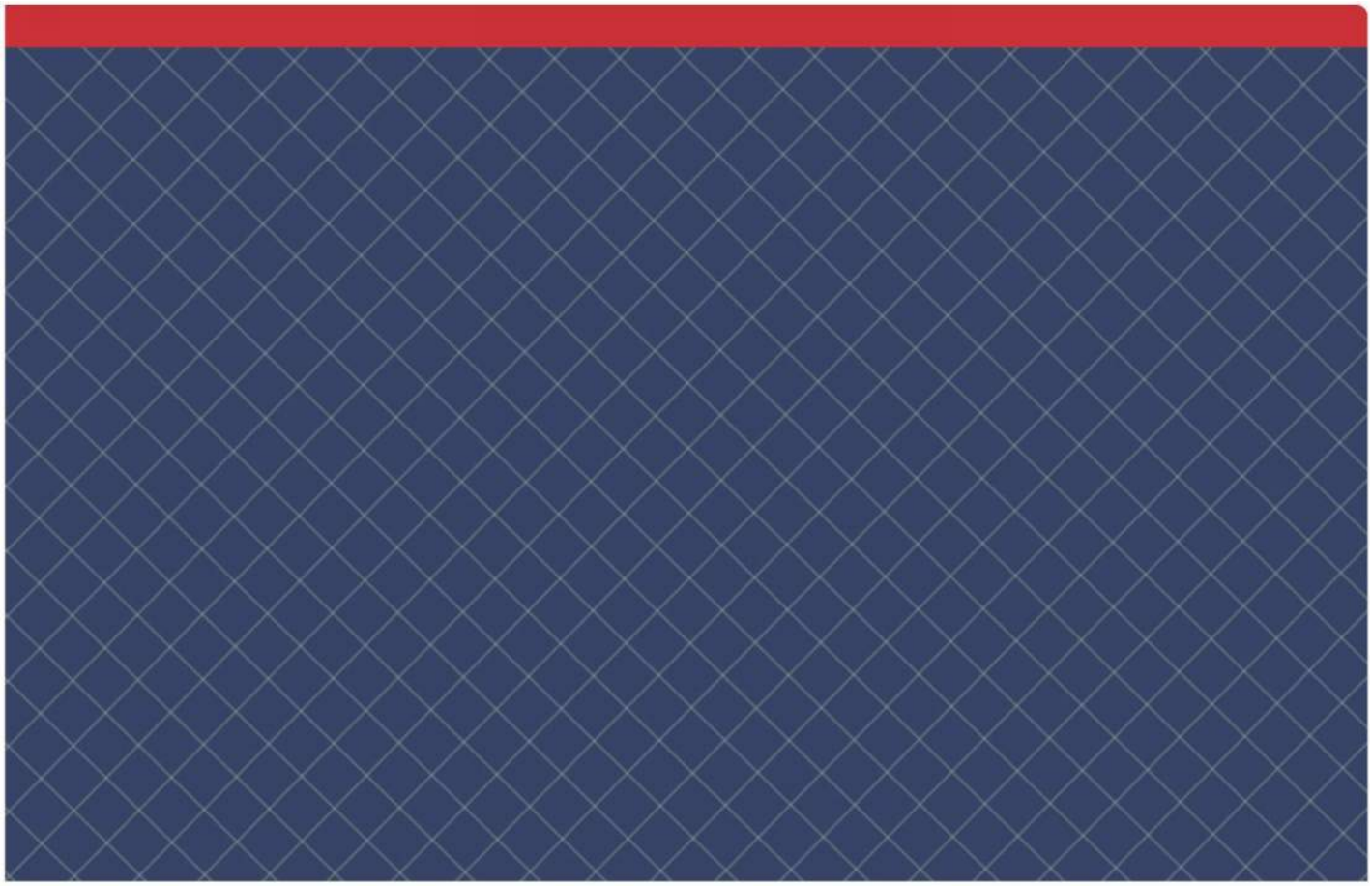

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

ACRONYM	DEFINITION
AMATS	Akron Metropolitan Area Transportation Study
APS	Accessible Pedestrian Signals
FHWA	Federal Highway Administration
HSP	Highway Safety Program
ITE	Institute of Transportation Engineers
MUTCD	Manual for Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
ODOT	Ohio Department of Transportation
OMUTCD	Ohio Manual for Uniform Traffic Control Devices
PHB	Pedestrian Hybrid Beacon (HAWK)
RRFB	Rectangular Rapid Flashing Beacon
STP	Signal Timing & Phasing

EXECUTIVE SUMMARY

The City of Hudson has asked LJB Inc. to study pedestrian and bicycle safety, evaluate the existing facilities within the Study Area (see **Figure 1** on the next page), and propose specific improvements to locations (see Evaluation Matrix on pages 20 through 25) in the study area, which includes:

- Aurora Street from E Main St to Hudson St
- Main St (SR 91) from Stoney Hill Dr to Prospect St
- Streetsboro St (SR 303) from Main St (SR 91) to Hayden Pkwy
- Library St, First St, Park Ln, Village Way, and Clinton St in the First & Main district

Considering the existing and anticipated future increases in Hudson pedestrian destinations and volumes, the purpose of this study is to ensure ADA compliance, improve safety for pedestrians by alleviating pedestrian and bicycle crash risk, and encourage pedestrian and bicycle travel throughout the project study area.

LJB reviewed previous studies and traffic counts for vehicles and pedestrians, collected field data for sight distance and curb ramp elevations, and researched crash history. Notable findings from the review of pedestrian crash data from 2011-2021 (11 years) include:

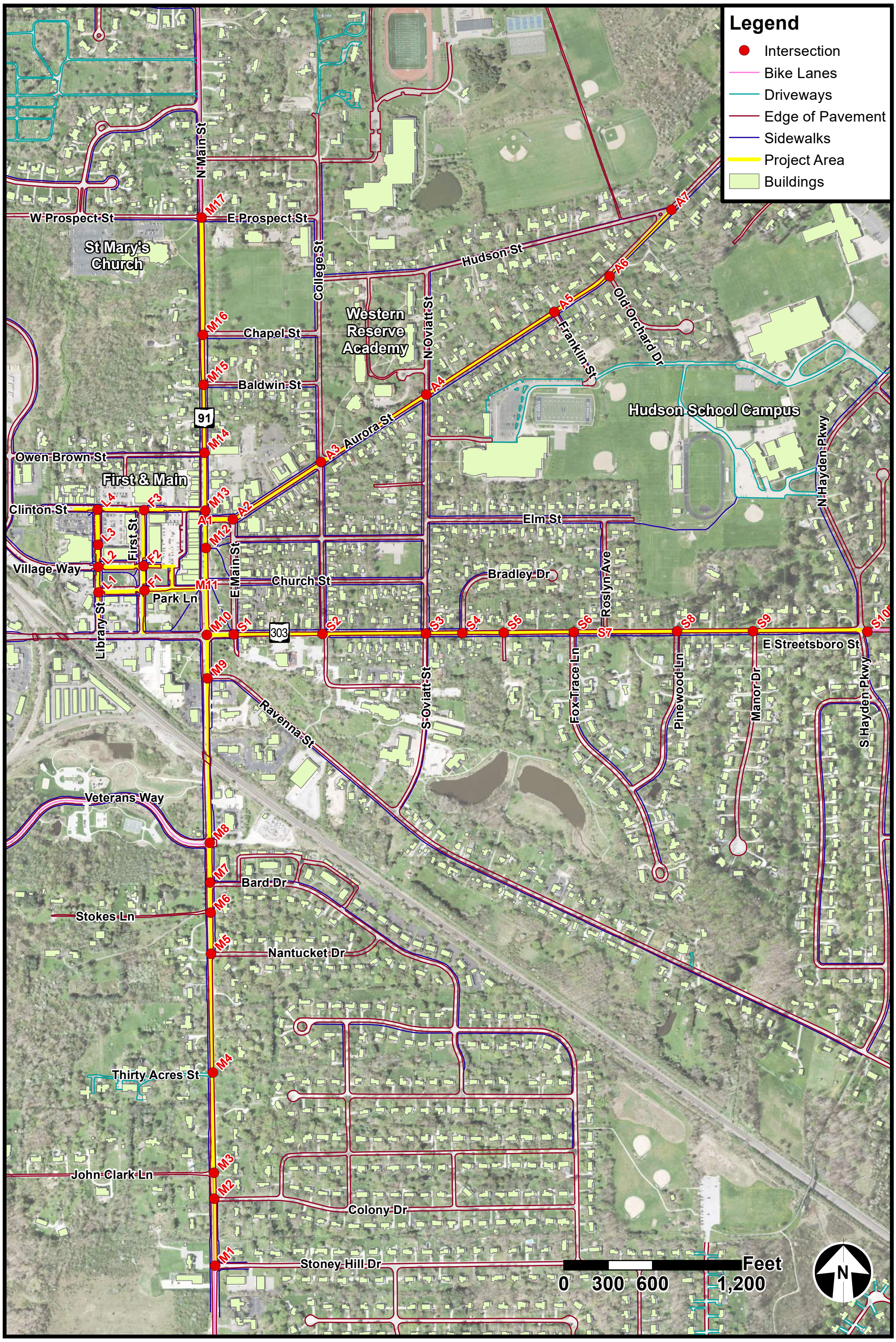
- Ten pedestrian crashes and 10 bicycle crashes occurred.
- In most crashes, pedestrians and bicyclists were using the crosswalks. No crashes were reported where cyclists were riding on the street.
- Eight of the 20 crashes involved children between the ages of 7 and 13. Two crashes included young drivers.
- A fatal bicycle crash was recorded, as well as 6 crashes resulting in minor injuries and 10 crashes with possible injuries. The overall injury rate is 85-percent. As vulnerable road users, pedestrians and bicyclists are susceptible to severe to fatal injuries, and in general bear higher injury rates when compared to motor vehicle occupants.
- The 5-year statewide average crash rate for pedestrian/bicycle crashes at urban intersections is 2%, whereas in this study area, pedestrian/bicycle crashes account for 3% of all crash types.

Following a thorough review of the existing facilities, this document identifies several **Recommended Improvements** listed below and detailed throughout the report.

- Construct improvements at 40 locations
- Establish a ***Pedestrian District*** around Downtown Hudson to create a more pedestrian-friendly character by using a 25 mph speed limit, high visibility crosswalk markings, and signs when entering the area.

Other general recommendations include widening of sidewalks as they are replaced, adding sidewalks to the other side of roads where they are missing, design of curb ramps during replacement to ensure ADA compliance, designation of alternative bicycle routes, and use of crossing guards where few gaps exist in traffic.

This document will be reviewed by city staff and the City Council. Then it will be presented to the public at an open meeting, where comments will be collected. The public comments will be incorporated into a Final Feasibility Study, which will be presented to the city.



> Downtown Hudson Pedestrian Safety Study

Figure 1: Project Overview

1. INTRODUCTION

BACKGROUND

The City of Hudson is located in northern Summit County, OH. The outer areas of the City are mostly residential in nature, with some commercial areas towards the center. There is also light industrial use in the southern portion of the city. The city is approximately a 5 mile square, bisected by SR 303 (Streetsboro Rd), running east and west, and by SR 91 (Main Street) running north and south. Aurora Street runs from the downtown area to northeast. The streets in the study area each have sidewalks on at least one side.

The aim of this study is to identify potential improvements to the City's pedestrian infrastructure, within the study area shown in **Figure 1** on page 2, which includes:

- Aurora Street from E Main St to Hudson St
- Main St (SR 91) from Stoney Hill Dr to Prospect St
- Streetsboro St (SR 303) from Main St (SR 91) to Hayden Pkwy
- Library St, First St, Park Ln, Village Way, and Clinton St in the First & Main district

Several pedestrian trip generators exist in and around the study area, including businesses, schools, a shopping center, and churches. Hudson Middle and Elementary Schools and Western Reserve Academy are additional major pedestrian trip generators located on the east end of the study area. In the past two decades, Hudson has reconfigured its downtown area – replacing a former light industrial facility with a new commercial district (First & Main), parking, and public library. The next phase of this development plan will add residential and additional commercial space just outside the study area to the west at the current site of the school district's bus garage.

Considering the existing and anticipated future increases in Hudson pedestrian destinations and volumes, the purpose of this study is to ensure ADA compliance, improve safety for pedestrians by alleviating pedestrian and bicycle crash risk, and encourage pedestrian and bicycle travel throughout the project study area.

PAST STUDIES

The City of Hudson has conducted numerous planning and safety studies in the past regarding transportation safety, operations, and economic development. Some of these studies are summarized below:

- **Downtown Development Project (2003-2004):** This project planned the development of Downtown Hudson and the First & Main district, including plans for the streets and parking areas to the west of SR 91, concept drawings for the entire downtown area. and landscaping plans of downtown showing pavement markings.
- **SR 91/Clinton Street/Aurora Street Intersections Alternates Study (2009):** This study looked at many alternates and resulted in a 472-page report and 1,470 pages of appendices. The study area included 22 existing intersections with 21 options for improvements. The recommendation was made to remove the Clinton St. approach to Aurora Street, change to parallel parking on SR 91 and improve the visibility of the midblock crossing. After completion of the study, the report was amended to include a temporary closure of Clinton Street and more options for the midblock crossing.
- **Signal Plans:** Existing signal plans were reviewed for Stoney Hill intersections (2003), downtown (2016), Prospect and SR 91 (2015).

- **SR 303 and SR 91 Proposed Intersection Improvement (2009-2010): This preliminary** engineering study looked at six intersections including SR 91 & SR 303 intersection. The study included extensive turn count data, crash analysis and capacity analysis for numerous build alternatives. The recommendations were not implemented.
- **SR 91 at Clinton/Aurora Street Intersection Improvements - Preliminary Study (April 2010):** This study looked at impacts of crosswalk locations and bulb outs on parking.
- **Eastern Downtown Prospect and College Western Reserve Academy Traffic Study (April 2014):** This study covered part of the eastern downtown area not documented elsewhere. Inventory of the existing conditions was included and evidence that raised crosswalks are effective was documented.
- **Roslyn Ave Crosswalk Study (September 2014):** Specific study to add a crosswalk at Roslyn and SR 303. This study included vehicular traffic turn counts and tube counts, crash analysis, sight distance evaluation and crosswalk evaluation. RRFBs were noted as an additional measure for consideration by the city. This study also pointed out that ADA requirements are not being met and called for more sidewalk along Streetsboro St.
- **Intersection Evaluation SR 91 and Prospect (August 2016):** This study reevaluated an earlier study, using updated traffic counts, to evaluate whether capacity improvements were needed at N Main St & Prospect due to the Downtown Phase II project. The study concluded that the previous design was still sufficient and the improvements were constructed in 2017.
- **SR 91 Barlow to Veterans Way Corridor and Safety Study (December 2016):** Safety study of southern end of S Main St. Stoney Hill Dr was listed on ODOT's and AMATS' HSP priority lists. The study called for adding bike lanes and walks. Resulted in a call to widen SR 91 and to apply for safety funding. Detailed concept plans with signing were included.
- **Hudson Downtown Phase 2 TIS (March 2019):** This Traffic Impact Study (TIS) has a wide-ranging list of improvements and history in the 9-page executive summary. The report lists several improvements needed and whether they are necessary with or without future development.
- **Ravenna Street/S. Main Street - Left Turn Restriction (2019):** Specific study to look at prohibiting the westbound LT during certain hours of the day. The report called for a follow-up study to determine the impacts. This recommendation had been rejected by council nine years earlier.
- **Hudson Adaptive Traffic Signals (ongoing):** The City of Hudson is managing a project to upgrade their traffic signals to use adaptive timing technology. The project is currently under design, with expected construction in 2022.
- **City of Hudson Policy - 10-20-2016:** This is a policy to respond to citizen requests for traffic calming using the latest ITE, FHWA and other research. It only applies to local roads and specifically does not apply to arterials, commercial or industrial streets and defers to professional engineering consultants.
- **City of Hudson Special Traffic Control Sign Policy (Update 8-11-2021):** This signing policy applies to currently unsignalized crossings and looks to improve connectivity to specific community locations. It includes LED augmented signs, RRFBs, pedestrian hybrid beacons, etc. It references ITE and FHWA. The policy seeks to limit enhanced crosswalks in order to not overuse them with reduced compliance. The policy contains a "warrant" for RRFBs based on NCHRP 562 and establishes the criteria for a new RRFB location is 20 pedestrians per hour or recommendation from a formal engineering study. This criterion is based on NCHRP Report 562, Appendix A.

These documents from AMATS and ODOT contain a wealth of information useful for improving safety in the city of Hudson:

- **AMATS Crash and Safety reports\2017-2019-Traffic-Crashes-Technical-Memorandum:** This report has local trends and details the most common bike and pedestrian crash types.
- **AMATS Crash and Safety reports\2017-2019-High-Crash-Roadway-Sections-by-Community:** Three roadway sections (all in the immediate center of town) rank in the AMATS crash reporting:
  - SR 91 from SR 303 to Aurora St. (Overall Rank#27)
  - SR 91 from Hudson to SR 303 (Overall Rank#151)
  - SR 303 from Boston Mills Rd to SR 91 (Overall Rank#47)
- **AMATS Crash and Safety reports\2017-2019-High-Crash-Intersections-by-Community:** Only two intersections in the study area are ranked in the AMATS reports:
  - SR 91 & SR 303 (Overall Rank#234)
  - SR 303 & Oviatt St. (Overall Rank#259)
- **Hudson School Travel Plan 2011-12-16:** This report contains a large amount of pedestrian-related data. Many specific improvements with maps and cost estimates were provided.

2. EXISTING CONDITIONS

ROADWAY CONDITIONS

Existing roadway conditions within the project area of Hudson are summarized in **Table 6.**

TABLE 1: SUMMARY OF ROADWAY CONDITIONS

ROADWAY	ODOT FUNCTIONAL CLASSIFICATION	POSTED SPEED LIMIT	LANE WIDTHS	ROADWAY SECTION	AADT*
Aurora Street	Major Collector	25 MPH	12- foot lanes	2-lane section with parking from N Main St to College St	6,400 ADT
Main Street (SR 91)	Principal Arterial	Varies 25 to 35 MPH	12-foot lanes	2-lane to 3-lane section	17,800 – S of SR303 13,800 – N of SR 303
Streetsboro Street (SR 303)	Minor Arterial	25 MPH	12-foot lanes	2-lane section	14,100 – W of SR 91 7,600 – E of SR 91

The cross streets intersecting the major streets above, within the project area, have a functional classification of Local and are generally 25 MPH, 2-lane sections with 12-foot lanes. Although trucks are permitted in the project area, there is a designated truck route to bypass Downtown Hudson via Terex Road. Field conditions and observations in the study area are summarized below.

Aurora Street – Main Street to Hudson Street

- The typical section of Aurora St is a 2-lane section with parking west of College St. At the intersection of Aurora St. and N Main St, the westbound approach has left and right turn lanes.
- Sidewalks are available on either side of Aurora St west of College St. East of College St there is a sidewalk on the south side only that ranges from 4 to 4.5 feet wide. Crossings are marked with two parallel crosswalk lines.
- Land Use: The land use along Aurora St is single-family residential. Downtown Hudson is located at the west end and Hudson Elementary/Middle school is located one block south of Aurora St.
- Traffic Control: All stop-controlled intersections are two-way stops with Aurora St as the continuous movement. Countdown pedestrian signal heads are provided at the signalized Aurora St & Main St intersection. There are no mid-block crossings are provided along the corridor.
- Lighting: Aurora St. is currently illuminated from N Main St to College St with minimal lighting east of College St.

Main Street – Stoney Hill Road to W Prospect Street

- The typical section of Main St varies between 2-lane and 3-lanes:
  - Main St from Stoney Hill Rd to John Clark Ln is a 3-lane section with two through lanes and a two-way left turn lane.
  - Main St from John Clark Ln to Veteran's Way is a 2-lane section.
  - Main St from Veteran's Way to Ravenna St is a 3-lane section with two through lanes and a two-way left turn lane.
  - Main St from Ravenna St to Prospect St is a 2-lane section with turn lanes at the Ravenna St and Streetsboro St intersections.

- Sidewalks are always available on one side of Main St, and sometimes on both sides:
  - Sidewalks are on both sides from Stoney Hill Dr to Colony Dr.
  - Sidewalk is on the west side only from Colony Dr to Nantucket Dr. There is no marked crossing of Main St where the sidewalk ends at either end.
  - Sidewalks are on both sides from Nantucket Dr to Church St
  - Sidewalk is on the west side from Church St to Aurora St. However, the east side is the Hudson Green with footpaths crossing it indirectly. There are marked crossings at Church St and Aurora St, where the crossing is signal controlled.
  - Sidewalks are on both sides from Aurora St to Chapel St.
  - Sidewalk is on the west side from Chapel St to Prospect St. There is no marked crossing of Main St at Chapel St where the east side sidewalk ends.
- Marked crosswalks with pushbuttons and pedestrian signal heads are provided at signalized intersections. There is a midblock crossing with a rectangular rapid flashing beacon (RRFB) between the intersections of Aurora St. and Church St and at Church St/Park Ln.
- Land Use: Land use varies along Main St between residential, commercial, and institutional. Just south of the project area along Main St, the land use is commercial. At Stoney Hill Dr, properties transition to single-family residential. At Veteran's Way, there is a park to the west and businesses to the east. This mix of parks and commercial use continues through Owen Brown St. From Owen Brown St to the north end of the project area at Prospect St and beyond, properties are single-family residential homes, with a church on the west side and Western Reserve Academy on the east side.
- Traffic Control: Existing traffic signals are located at the Stoney Hill Dr, Veteran's Way, Aurora St/Clinton St, and Prospect St intersections . All other intersections along Main St. are two-way stop controlled with Main St as the continuous movement.
- Lighting: Main St. is currently illuminated along the entire corridor.

Streetsboro Street – Main Street to Hayden Parkway

- Streetsboro St has a 2-lane section through the project area with turn lanes at the Main St intersection.
- Sidewalks are available on both sides of Streetsboro St from Main St (SR 91) to Bradley Dr. East of Bradley Drive, sidewalk is on the south side only. Marked crosswalks with accessible pushbuttons and countdown pedestrian signal heads are provided at the signalized Main St (SR 91)intersection. The accessible pushbuttons for each corner are on a single pedestal. No mid-block crossings are provided along the corridor.
- Land Uses: West of the project area, the land use along Streetsboro St. is commercial, with shops and a shopping center. In the project area, the land use along Streetsboro St is single-family residential with public schools one block to the north via Roslyn St and N Hayden Pkwy and emergency services one block to the south via S Oviatt St.
- Traffic Control: Existing traffic signals are located at the Main St and Hayden Pkwy intersections. All other intersections along Streetsboro St are two-way stop-controlled with Main Street remaining as free-flow movements.
- Lighting: Streetsboro St is currently illuminated along the entire corridor.

3. DATA COLLECTION

The City of Hudson and LJB gathered information from field observations, sight distance measurements, traffic counts, pedestrian counts, and available crash data in preparation of this safety study.

- LJB and the City Engineer toured the project area on December 9, 2021to make field observations.
- LJB measured sight distances at approaches where grades, parking, and other visual obstructions may limit visibility on December 22, 2021. A summary of sight distance measurements is provided in **Appendix A**.
- LJB measured curb ramp slopes and cross slopes on January 14, 2022. A summary of the measurements is provided in **Appendix A**.
- Traffic counts were collected by the City of Hudson from July 2020 to May 2021. A map of the study area highlighting the intersections where pedestrian and vehicular counts were collected is shown in **Figure 2** below. **Table 7** on the following page summarizes the pedestrian count data that was received from the city. Additional counts are planned for Spring 2022 when the weather will better support active transportation.

FIGURE 2: TRAFFIC COUNTS

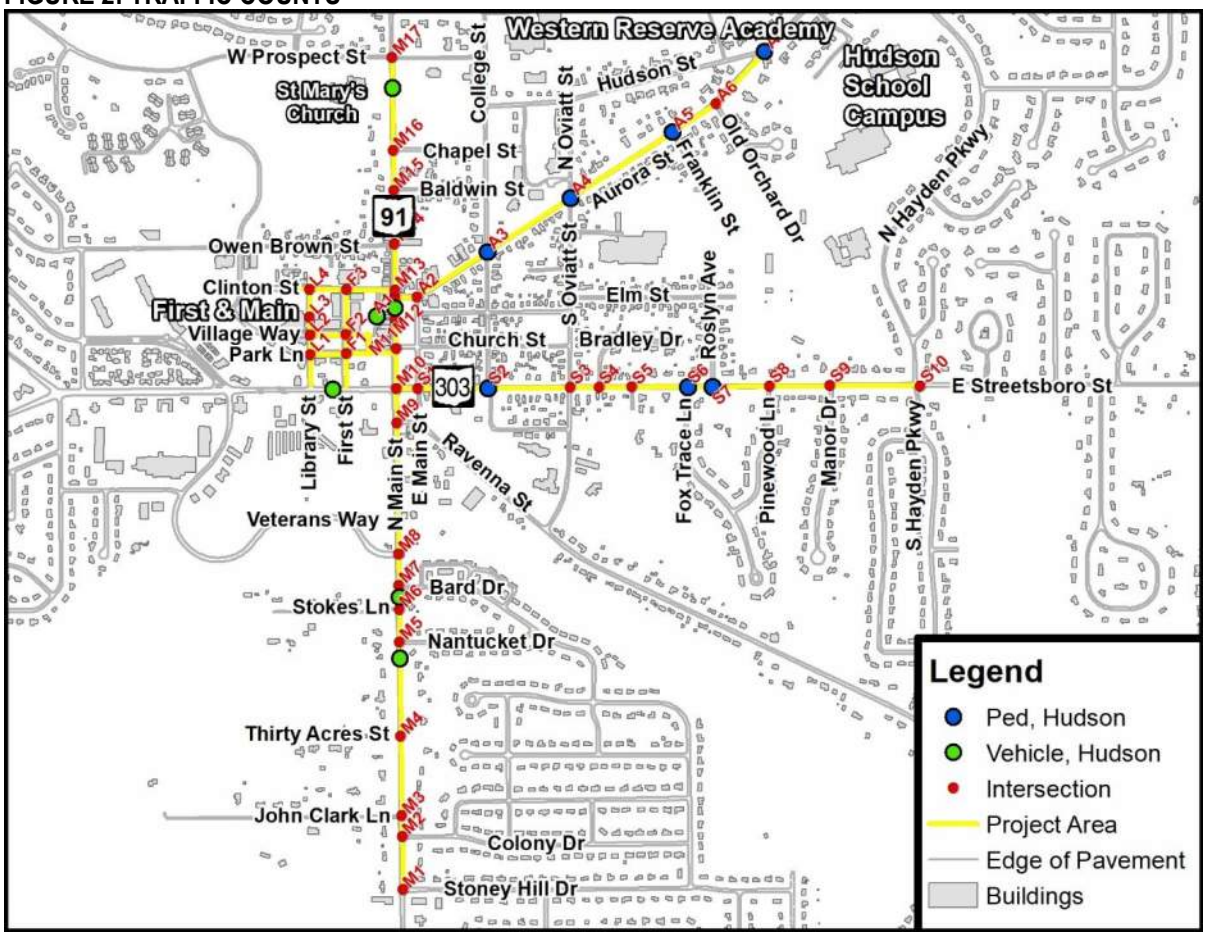


TABLE 2: PEDESTRIAN COUNT DATA

INTERSECTION	DATE	TIME	PEDESTRIAN COUNTS	TOTAL
Aurora St & College St	5/25/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	36 52 53	141
Aurora St & N Oviatt St	5/26/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	39 4 23	66
Aurora St & Franklin St	5/27/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	25 11 36	72
Aurora St & Hudson St	5/26/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	8 2 5	15
Streetsboro St & S College St	6/1/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	11 11 9	31
Streetsboro St & N Oviatt St	5/25/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	1 14 0	15
Streetsboro St & Fox Trace Ln	6/2/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	6 7 7	20
Streetsboro St & Roslyn St	6/2/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	15 2 12	29
Streetsboro St & Hayden Pkwy	6/25/21	7:15 – 9:30 am 11:45 am – 1:00 pm 2:30 – 4:30 pm	13 17 0	30

- Crash data was obtained from ODOT's website, using the GIS Crash Analysis Tool (GCAT) for the period between January 1, 2011 through November 1, 2021. As the focus of this study is pedestrian and bicycle facilities, only crashes involving pedestrians and bicyclists were collected for analysis.

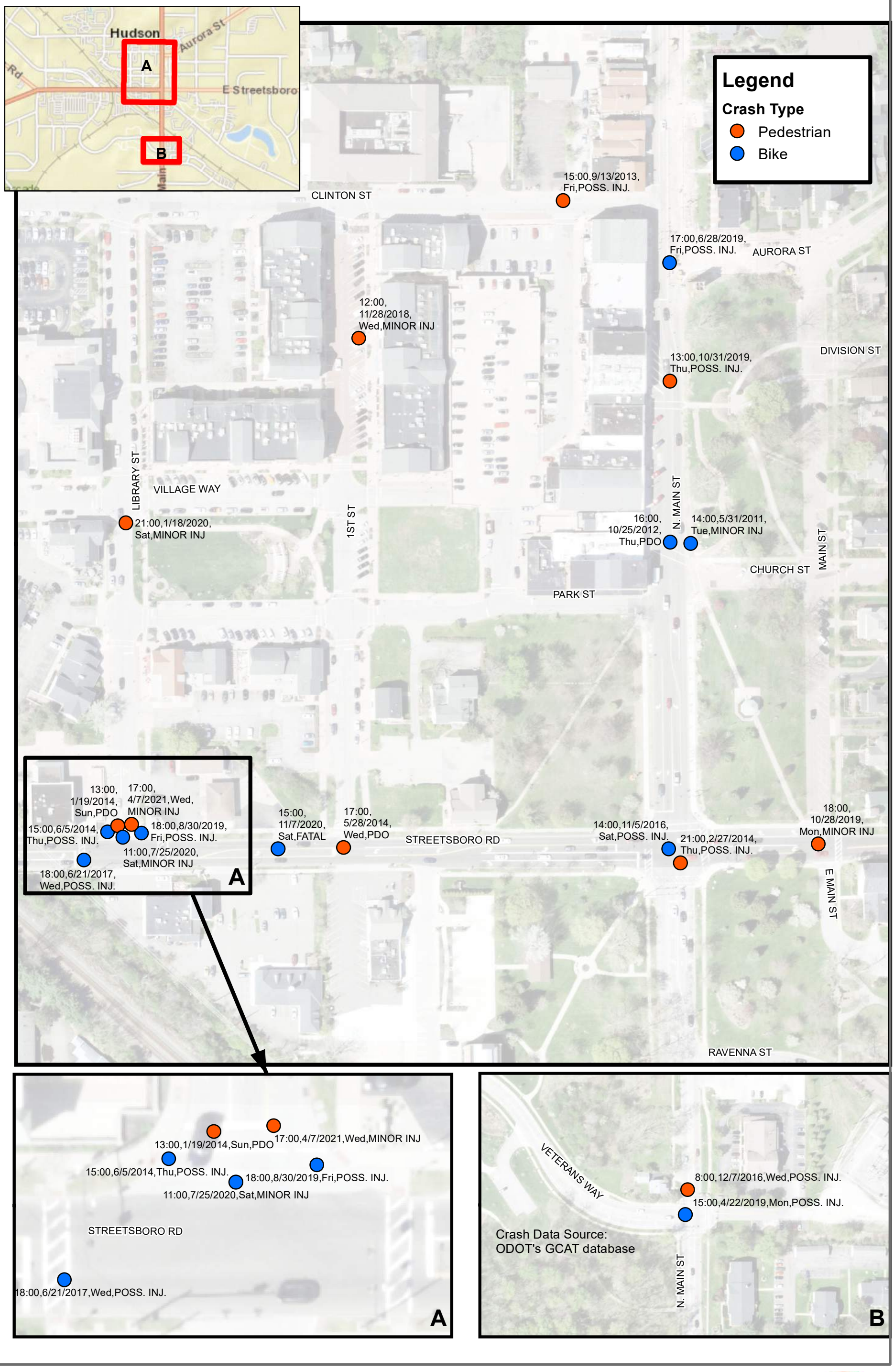
4. CRASH ANALYSIS

Crash data was obtained from ODOT's crash database for the study area limits, encompassing 11 years of data between January 1, 2011 and December 31, 2021. The OH-1 crash report for each documented crash was reviewed to confirm accuracy and to locate crashes properly within the study limits. A crash diagram is shown on **Figure 3** and crash summaries are included in **Appendix B**. A total of 20 pedestrian and bicycle crashes were reported within the study limits during the analysis period. Key findings of the analysis include:

- A detailed review indicated that 10 crashes each were pedestrian and bicycle related.
- Most pedestrians and bicyclists (16 crashes) were using the crosswalks. 2 crashes involved pedestrians/bicyclists on the sidewalk that were struck by right turning vehicles. No crashes were reported where cyclists were riding on the street.
- Eight of the 20 crashes involved children between the ages of 7 and 13. Two crashes included young drivers.
- The most common pre-crash action was making a right turn (6 crashes or 30%), and the most common contributing factor was failure to yield (13 crashes or 65%). The combination of the two suggests drivers are unable to see or not looking for pedestrians and cyclists.
- **Injuries:** A fatal bicycle crash was recorded, as well as 6 crashes resulting in minor injuries and 10 crashes with possible injuries. The overall injury rate is 85-percent. As vulnerable road users, pedestrians and bicyclists are susceptible to severe to fatal injuries, and in general bear higher injury rates when compared to motor vehicle occupants.
- **Weather/Pavement condition:** Wet pavement and rain was noted for 5 crashes (25%), slightly higher than the statewide average of 18-percent with wet pavement conditions. During adverse weather conditions, visibility is impaired for drivers, and wet pavement also reduces pavement friction.
- **Lighting:** Seventeen crashes (85%) occurred during daylight conditions between 8 am and 6 pm. Two crashes noted roadway lighting under dark conditions and 1 crash noted dark-roadway (no lighting) conditions.
- **Location:** Seventeen crashes were at marked crosswalks, with only 3 crashes reported at midblock locations.
    - **Signalized Intersections**: Eleven crashes were recorded at 4 signalized intersections; the intersection of Streetsboro St & Library St experienced most crashes (6 crashes). Two crashes were recorded at the Main St & Streetsboro St and S Main St & Veterans Way intersections.

        Streetsboro St & Library St intersection: Of the 6 crashes at this intersection, 5 were recorded on the north crosswalk. In 4 crashes, pedestrians and bicyclists were struck by a southbound vehicle turning right on red. One crash involved an eastbound left turn vehicle turning during a permissive phase, striking a bicyclist in the north crosswalk. Another crash was recorded in the west crosswalk, where a pedestrian was struck by a vehicle that stopped ahead of the stop line.

        The city has recently (2020) installed 'No Turn on Red' signs to restrict right turns on red for the north and south approaches. This measure will help mitigate the pedestrian/right turn vehicle crash pattern.



> Downtown Hudson Pedestrian Safety Study

Figure 3: Bike & Ped Crashes (2011-2021)

- **Main St & Streetsboro St intersection:** Two pedestrian crashes, one each in the west and east crosswalks, were recorded. A pedestrian in the west crosswalk that had entered during walk phase was struck by a southbound vehicle that turned right on red.

  A second crash involved a pedestrian that entered the east crosswalk during the 'Do Not Walk' phase and was struck by a southbound left turn vehicle during the protected left turn phase.

- **S Main & Veterans Way intersection:** Two pedestrian crashes were recorded in the east crosswalk. Both crashes involved a southbound pedestrian in the crosswalk struck by a westbound vehicle turning right on red.

  The northeast corner of the intersection has clear sight triangles, and landscaping is limited to lawn grass, so pedestrian visibility is not a concern. However, westbound drivers intending to turn right were observed routinely travelling past the stop line and entering the crosswalk while looking to their left for a gap in oncoming traffic. Drivers are not necessarily looking for pedestrians approaching from right.

- **Uncontrolled –marked crosswalk locations**:

  - **Main St between Church St and Aurora St**: Two uncontrolled marked crosswalks are provided on N Main St between Church St and Aurora St. The southern crosswalk is on the north leg of the N Main St & Church St intersection, N Main St is free-flow at this intersection, and Church St is one-way eastbound (entering only). The northern uncontrolled crosswalk is a midblock location. Both crosswalks connect pedestrians from housing, east of N Main St, to shopping on the west side of N Main St. Pedestrian traffic is frequent in this area during pleasant days.

    Two bicycle crashes were recorded at the southern crosswalk, and a pedestrian was struck while in the northern crosswalk.

  - **Library St & Village Way (4-way stop)**: A pedestrian in the south crosswalk was struck by a westbound left turn vehicle. This intersection is a four-way stop controlled intersection, and the crash was recorded during the 9 pm hour under dark conditions.

> **Fatal Crash:** On Saturday, November 7, 2020 during the 3 pm hour, a bicyclist (age 7) traveling westbound (riding on the sidewalk) was struck by a northbound right turn vehicle exiting a parking lot at 60 W Streetsboro St. The northbound driver was looking left (west) for gaps in the oncoming eastbound traffic and did not notice bicyclists passing in front from right. The bicyclist was struck and succumbed to injuries. The weather was noted as clear. The bicyclist was riding as a group with his family.

The AMATS 2017-2019 Traffic Study Crashes and Safety Performance Measures Technical Memorandum defines a high crash segment as a segment with 10 or more crashes per mile per year and a high crash intersection as an intersection with 10 or more crashes in the 3-year study period. Three segments and 2 intersections met these criteria in Hudson:

- Segment: SR 91 from SR 303 to Aurora St. (Overall Rank#27)
- Segment: SR 91 from Hudson to SR 303 (Overall Rank#151)
- Intersection: SR 303 from Boston Mills Rd to SR 91 (Overall Rank#47)
- Intersection: SR 91 & SR 303 (Overall Rank#234)

- Intersection: SR 303 & Oviatt St. (Overall Rank#259)

Note that each of these segments has high traffic volumes, which is not considered in the designation of high crash segment or intersection. One segment and no intersections were on ODOT's Highway Safety Improvement Program 2018 list: SR 303 near Stow Rd. (Rank #463 of 500).

5. COUNTERMEASURES

METHODOLOGY

The first focus of this study is to address facilities that are not in compliance with the Americans with Disabilities Act (ADA), which establishes pushbutton, sidewalk, and curb ramp required criteria such as slope, visibility, and detectable warnings.

To increase safety, many additional recommendations made in this study are adopted from the list of Proven Safety Countermeasures, which are based on research conducted by FHWA on the effectiveness of various countermeasures. FHWA has also developed guidance on when to apply pedestrian crash countermeasures based on the adjacent roadway characteristics. A summary of this guidance is shown in **Figure 4**.

This study also makes additional recommendations to encourage active transportation, which is in keeping with the City's commitment to connectivity throughout the community.. The perception of safety and ease of use are important factors travelers make when choosing a travel mode. If the travel experience is pleasant on foot or bicycle, travelers are more likely to choose those modes over vehicular modes.

FIGURE 4: APPLICATION OF PEDESTRIAN CRASH COUNTERMEASURES BY ROADWAY FEATURE

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 8 ❾
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 8 ❾

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- ● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Rectangular Rapid-Flashing Beacon (RRFB)**
8 Road Diet
9 Pedestrian Hybrid Beacon (PHB)**

Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.
***It should be noted that the PHB and RRFB are not both installed at the same crossing location.*

A list of potential countermeasures for each intersection is provided in this study. However, some countermeasures are appropriate at several locations or apply to an area rather than a single segment or intersection.

BICYCLE INFRASTRUCTURE

There are bicycle lanes on N Main St north of Chapel St. South of this point, the roadway narrows and a Share the Road sign communicates that the southbound bike lane is ending. Because Main St is a state route on the National Highway System, one 12' lane in each direction is required. Due to this restriction and development in the Downtown Area, extension of this bike lane is not recommended.

Streetsboro St has two 12' lanes. Even if the lanes were narrowed to 10', the existing width of the road would not be sufficient for bike lanes. Furthermore, the bike lanes would not connect into a larger network of bike infrastructure. Similarly, the portion of Aurora St that is wide enough for bike lanes has on-street parking on the south side. This parking is frequently used, which could result in poor compliance and parking in the bike lane, increasing bicycle crash risk.

As an alternative, some of the more contiguous lower volume streets could be designated as bike routes. This removes bicycles from the higher volume corridors while still providing a method to traverse the city. The system of bike routes, indicated as such through signing, would connect back to the bike lanes on N Main St at Prospect St. A map showing potential alternative bike routes is provided in **Figure #** on the next page.

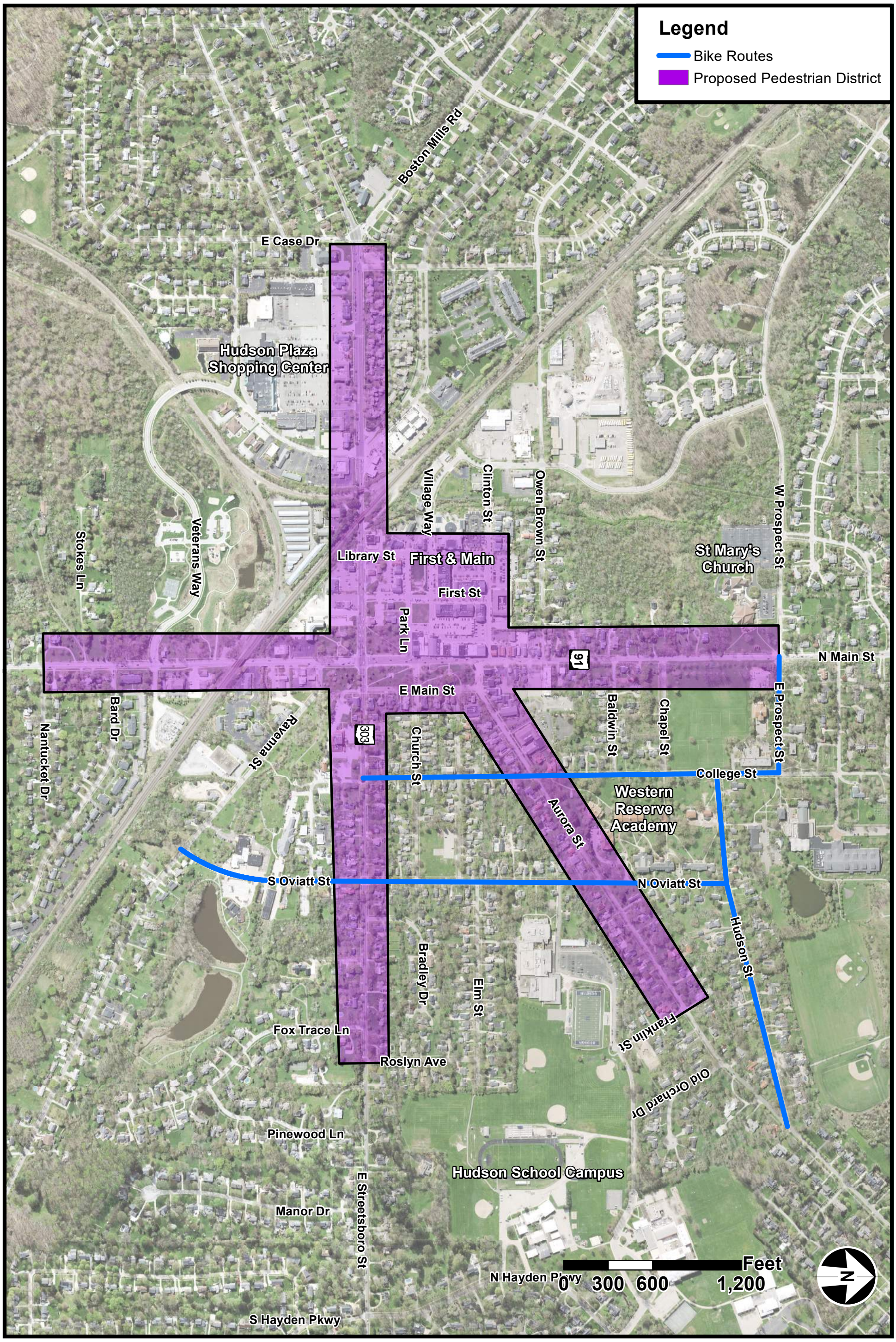
HUDSON DOWNTOWN PEDESTRIAN DISTRICT

The study area of this report represents the zones where the most pedestrian travel occurs in Hudson. At the fringes of the study area, the demand for pedestrian facilities is lower, increasing at locations closer to Downtown Hudson where pedestrian volumes reach a peak. In this inner area of higher pedestrian volumes, **a pedestrian district should be established.** A map showing the proposed district boundaries **Figure 5** on the next page.

The Hudson Downtown Pedestrian District is an adaptation of the concept where a street or area is set aside for the exclusive use of pedestrians. In Hudson's case, special emphasis is placed on pedestrians however motor vehicles are not excluded. The concept of Pedestrian "Zones" (also known around the world as "auto-free zones", "car-free zones", "pedestrian precincts" and "pedestrian malls") were created with the intent to make the area more attractive to pedestrians, improve air quality and noise quality, and to reduce accidents. Historically, pedestrian zones were enacted in Venice Italy and in remote mountainous villages. In modern times, they have been enacted on nearly every continent. In the US, pedestrian malls were first created in Kalamazoo, Michigan and have been enacted in 75 cities, such as:

- Fresno, CA
- Los Angeles, CA
- Sacramento, CA
- Santa Monica, CA
- Boulder, CO
- Denver, CO
- Miami Beach, FL
- Honolulu, HI
- Salem, MA
- Cumberland, MD
- Minneapolis, MN
- Buffalo, NY
- Ithaca, NY
- Madison, WI
- Charlottesville, VA
- Burlington, VT

During the Covid-19 pandemic some cities pedestrianized additional streets as a means of increasing social distancing and to increase dining spaces for restaurants. New York City alone added over 100 miles of pedestrian malls during the pandemic.



> Downtown Hudson Pedestrian Safety Study

Figure 5: Pedestrian District and Alternative Bicycle Routes

The National League of Cities has published "Streets as Connectors: Pedestrian Zones in Cities" which defines a pedestrian zone as:

> *Pedestrian zones are areas that are permanently, periodically or occasionally closed to vehicular traffic. Some pedestrian zones allow public transit vehicles, delivery trucks or residents to drive in the space, while others are completely closed to vehicles. Pedestrian zones can be permanent fixtures in a city, recurring closures — such as the first Saturday of every month — or more sporadic, such as an annual or seasonal event closure.*

The difference between a pedestrian-only/motor vehicle prohibited zone and the district recommended for Hudson lies in the amount of emphasis on the pedestrian. The roadway network in Hudson does not lend itself to completely removing motor vehicles. Shops will still require deliveries, customers will want to drive to the downtown area, and through traffic on the State Highway system cannot be completely removed without consequences.

The Pedestrian District concept in Hudson will have the following features:

- A consistent 25 MPH speed limit
- Greater use of high intensity crosswalks on all marked crossings.
- RRFBs and curb bump outs where deemed appropriate.
- An identifiable district where additional focus has been placed on pedestrian safety. This identity can be shown on city maps, in a report, or physically in the street through signs. Signs when entering the pedestrian district would advise drivers to look for pedestrians. In addition to entry signing, this identity could extend to special lighting, specific color sign supports, signal supports, etc.

In general, the Hudson Downtown Pedestrian District will have a series of countermeasures and enhancements consistently applied to pedestrian facilities to increase drivers' awareness of pedestrians.

The area of the pedestrian district should be limited to where the demand is highest. An area too large may result in drivers losing focus and reduced effectiveness. Based on destinations and pedestrian counts taken throughout the study area, the following boundaries are recommended:

- Main St from Nantucket Dr to Prospect St
- Streetsboro St from Boston Mills Rd to Roslyn St
- Aurora St from N Main St to Franklin St

SCHOOL CROSSING GUARDS

School crossing guards are one of the more effective means of controlling traffic during school travel hours. The OMUTCD identifies three types of crossing supervision:

A. Adult control of pedestrians and vehicles by adult crossing guards
B. Adult control of pedestrians and vehicles by uniformed law enforcement officers
C. Student and/or parent control of only pedestrians with student and/or parent patrols

While the OMUTCD provides commentary and qualifications for crossing guards, it does not include guidance for when to provide crossing guards. This will vary widely based on factors such as the community, availability of adults to serve as crossing guards, and number of student walkers and bicyclists. In addition, when older children or guardians (Type C) are able to escort younger students, fewer crossing guards are necessary. Law enforcement officers (Type B) are the only type of crossing guard that can countermand the indications of a traffic signal.

The National Center for Safe Routes to School and Pedestrian and Bicycle Information Center prepared the Adult School Crossing Guard Guidelines[1], which recommend a crossing guard where fewer than one gap occurs per minute during school travel hours. Crossing guards should be deployed as available, prioritizing locations where there are few gaps for crossing during school travel hours.

PEDESTRIAN & BICYCLE SAFETY – EDUCATION PROGRAMS

As noted in the crash analysis section, school age children (age 7-13) were involved in 40 percent of the crashes. Pedestrian and bicycle education programs at schools will be ideal. Programs such as Safety Town conducted by emergency services help educate school children. The City of Hudson police offer online virtual Safety Town opt-in programs. If possible given COVID protocols, in-person sessions on an annual basis are recommended. Additionally, if these sessions are conducted as an activity during the school day rather than as an extracurricular activity, they would have a wider reach.

STREET LIGHTING

The project area corridors are generally lit on one side by streetlights, with one light at each intersection. Lighting recommendations are based on Illuminating Engineer Society of North American criteria, which considers adjacent land use, the function of the road, and other factors. The City is currently implementing a program to replace the existing fixtures with LED fixtures. This plan would improve pedestrian safety and make parked vehicles more visible. This study recommends that the City completes this program, then considers a second luminaire at each intersection to improve the lighting of pedestrian crossings. If areas are found to be too dark after LED installation, trimming of tree canopies may be necessary to prevent them from obscuring the light.

GENERAL COUNTERMEASURES

There are other improvements that apply to multiple locations:

- **Widen 4’ sidewalk to 5’:** Some corridors have 4’ sidewalk. The minimum for ADA sidewalks is 3’, with passing spaces every 200’ if the sidewalk is less than 5’ wide. Appropriately graded driveways may serve as passing spaces. Because this is not an ADA compliance issue and it may be cost prohibitive to remove all the 4’ sidewalk and replace it with 5’ at once, when portions are repaired or new portions added, they should be 5’ wide, which gives space for two wheelchairs to pass. In situations where there is a 4’ sidewalk on one side and no sidewalk on the other, it is preferable to construct a new 5’ sidewalk on the side without one rather than removing the existing sidewalk and replacing in-place, if right-of-way and curb ramps are available.

- **Replace existing curb ramps that have excessive running or cross slopes:** The grade of the existing curb ramps in the project area were measured using a digital level and compared to ODOT’s standard construction drawing BP-7.1, which shows the maximum slopes permitted on curb ramps. The maximum running slope is 13:1 (7.6%) and the maximum cross slope is 64:1 (1.6%). At a glance, this comparison identified several curb ramps that exceed the requirements. However, there are exclusions for areas with existing sidewalks and historic areas. These exclusions are limited by the maximum rise, and the maximum sidewalk length to meet existing is capped at 15’.

  As curb ramps are replaced, they should be replaced with the appropriate grades. Where this is not feasible due to existing conditions, the curb ramp should be designed to fit within the exceptions.

- **Construct sidewalk on second side of corridors:** Some corridors have sidewalk on only one side. ADA compliance does not require sidewalk on both sides, and if funding is limited then

[1] http://guide.saferoutesinfo.org/

it is best spent ensuring compliance for one side. However, there are benefits to having sidewalk on both sides. It serves to reduce crossings not at crosswalks, the overall number of crossings necessary, the number of pedestrians walking in the roadway, shoulder, or private property, and generally encourages active transportation.

- **Make pedestrian warning and school crossing signs front- and back-mounted:** Many crossings are already equipped with pedestrian warning (W11-2) and school crossing (S1-1) signs, as well as the corresponding directional arrows (W16-7p). These signs are shown in **Figure 5**. These signs are placed on both sides of crossings, but only display facing oncoming traffic so that vehicles approaching the crossing see the sign on the right side of the road. These signs should be double-mounted so that oncoming vehicles see signs at both sides of the crossing, framing it as they approach.
- **Prohibit crossings where they are not desired:** Whether there is a marked crosswalk or not, every perpendicular crossing of an intersection is legal unless it is specifically prohibited by signage (R9-3). These signs are shown in **Figure 5**. Although no locations were identified in the study as needing such prohibition based on crossing patterns or crash history, the City should monitor trends and prohibit unmarked crossings at locations if necessary in the future.

FIGURE 6: SIGNS FROM THE OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES

EVALUATION MATRIX

The Evaluation Matrix on the following pages identifies recommend improvements at each intersection. The countermeasures in the columns are recommended at multiple locations. A brief definition of each countermeasure is:

- **Countdown Pedestrian Heads:** Countdown pedestrian heads show a timer during the flashing Don't Walk phase. These were recommended at locations that already had pedestrian signals that do not count down. Countdown heads are not required for ADA compliance, but have been shown to reduce crashes by about 9%[2]. An example is shown in **Figure 6** on the next page.
- **Sidewalk:** Sidewalk should be at least 5' wide. For ADA compliance, the grade is limited to 2%, except when matching the grade of the adjacent roadway. Short portions of higher grades are allowable, but level landings are required intermittently where higher grades persist.
- **High Visibility Crosswalk Markings:** High visibility crosswalk markings include some sort of element that is transverse or parallel to the direction of travel. There are two types commonly used in Hudson at this time: diagonal hatching between two parallel lines and wide perpendicular markings, also known as piano keys or zebra stripes or ladder style. High visibility crosswalks can reduce pedestrian injury crashes up to 40%[3]. All crosswalks must be separated by at least 4' from the stop line.

[2] http://www.cmfclearinghouse.org/detail.cfm?facid=8790
[3] https://safety.fhwa.dot.gov/provencountermeasures/crosswalk-visibility.cfm

TABLE 3: AURORA ST EVALUATION MATRIX

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
A1	North Main Street SR 91	4							Upgrade ex. ped heads to countdown.	Safety
A2	East Main Street				60	2			East approach sidewalk undermined by tree. Connect corner to curb walk to provide ADA-compliant walk. To the east, north side sidewalk by church is steeper than street grade.	ADA
A3	College Street		1		10	2	3		Remove diagonal crossing and NW corner stairs. Add perpendicular west approach crossing with an RRFB. Reconstruct the SE curb ramp crossing College.	ADA (curb ramps), Safety (markings)
A4	Oviatt Street		1			1	1	2	Add detectable warnings on curb ramps across Oviatt. Repair NE corner curb ramp. Add high vis markings across south approach.	ADA (curb ramps), Safety (markings)
A5	Franklin Street					1	1	1	Replace east corner curb ramp, add detectable warnings to south corner curb ramp. Add high vis markings across south approach. Maintain east corner bushes to prevent future sight distance obstructions.	ADA (curb ramps), Safety (markings and trimming)
A6	Old Orchard Street					1	2		Replace narrow curb ramps crossing Old Orchard. Alternative 1: Remove/trim south side bushes to improve sight distance, Alternative 2: Move crossing closer to Aurora St. Add high vis markings across south approach.	ADA (curb ramps), Safety (markings and trimming)

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
A7	Hudson Street		1			3	2	2	Reconfigure Hudson approach to keep movements on right of the island. Add a yellow centerline/edge lines near intersection. Alternative 1: Extend island to the west down Hudson for use as ped refuge.	Safety (island and markings)
			1		22	2	2		Alternative 2: Add crossing of Hudson with signs and yield markings just east of driveway.	Safety (markings)

TABLE 4: MAIN ST EVALUATION MATRIX

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
M1	Stoney Hill Drive	4							Replace ex. ped heads with countdown heads	Safety
M2	Colony Drive		1		22	2	4		Alternative 1: Add ped refuge on south approach with RRFB.	Safety
					1585		1		Alternative 2: Extend the sidewalk east of S Main St. up to Nantucket Dr.	Safety, Encourage
					22	1	2		Alternative 3: Add RRFB and new curb ramps to cross the south approach	Safety
					22	1	2		Alternative 3: Add warning signs and markings and new curb ramps to cross the south approach	Safety
M3	John Clark Lane					1			Restripe crosswalk so north curb ramp is inside	ADA

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
M4	Thirty Acres Street						2		Add curb ramps, cross walk markings, and a stop sign.	ADA (curb ramps), Safety (markings)
M5	Nantucket Drive					1	1		Add a curb ramp to the southeast corner and add high vis markings.	Safety (markings), Encourage (curb ramp)
M6	Stokes Lane								Because the road is not paved, keep the sidewalk, and do not install curb ramps. Install a stop sign.	Safety
M7	Bard Drive					1	1		Replace northeast corner curb ramp to address cross slope issues and add high vis markings.	ADA (curb ramp), Safety (markings)
M8	Veterans Way	8			10				Add small concrete walk areas between NE and SE curb ramp and pushbutton. Replace signs that say "Milford Connector" with "Veteran's Way".	ADA (sidewalk), Safety (signs)
-	Railroad Overpass								No work is proposed at this location.	
M9	Ravenna Street								No work is proposed at this location.	
M10	Streetsboro St (SR 303)	8				4			Add additional pedestal at each corner to separate Accessible Pedestrian Signal (APS) pushbuttons. Replace poorly applied high vis markings.	ADA (APS), Safety (markings)
M11	Church Street/ Park Lane					1			Add yield markings and high vis crosswalk markings to SR 91 crossing	Safety

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
M12	Hudson Green Crossing					1			Add yield markings and high vis crosswalk markings to SR 91 crossing	Safety
A1	Aurora Street	See A1 above								
M13	Clinton Street								Countdown head included with A1 above	
M14	Owen Brown Street		1	1			2		Extend curb extension further into SR 91. Add a curb ramp for the accessible parking space.	ADA (curb ramp), Safety (extension)
M15	Baldwin Street		1		40	2	3		South of Baldwin, sidewalk grade exceeds road grade. Dropoff next to walk here as well, side of sidewalk exposed. Consider railing or curb. Alternative 1: At Baldwin, remove steps on SE corner and replace existing curb ramp with excessive slope. Add curb ramps, RRFB, yield markings, and high vis markings for north approach crossing.	ADA (sidewalk, curb ramps), Safety (RRFB and markings) Encourage (railing)
					40	2	3		Alternative 2: Install curb ramps, high vis markings, yield markings, and signs for new north approach Main St crossing	ADA (sidewalk and curb ramps) Safety (markings) Encourage (railing)

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
M16	Chapel Street				30	2	4		Replace damaged NE corner curb ramp and reconstruct sidewalk to line up with it. Reconstruct SE curb ramp with excessive grade, raise curb along radius. Alternative 1: Add an RRFB on the new Main St crossing	Safety (markings and RRFB), Encourage (new crossing)
					30	2	4		Alternative 2: Install high vis markings, yield markings, and signs for new Main St crossing	Safety (markings) Encourage (new crossing)
M17	Prospect Street	4							Replace the existing pedestrian signals with countdown heads.	Safety

TABLE 5: LIBRARY ST EVALUATION MATRIX

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
L1	Park Ln					2			Add high vis markings at the two marked crossings.	Safety
L2	Village Way					4			Move stop signs/stop lines 4' from crosswalks (especially north approach)	ADA
L3	Hudson Library			1		1			Add high vis markings, signs, and yield markings for midblock crossing. Add curb extension on east side.	ADA (curb ramp) Safety (markings)

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
L4	Clinton Street					1	2		Alternative 1: If drive remains where it is, add crossing between offset north/south approaches at curb extensions. Alternative 2: If it is moved to better align with Library, add east approach crossing to where existing drive is.	Safety

TABLE 6: FIRST ST EVALUATION MATRIX

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
F1	Park Ln					4			Add high vis markings at the marked crossings.	Safety
F2	Village Way					4			Add high vis markings at the marked crossings.	Safety
F3	Clinton Street					3			Add high vis markings at the marked crossings.	Safety

TABLE 7: STREETSBORO ST EVALUATION MATRIX

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
M10	Main Street SR 91	See M10 above								

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
S1	East Main		1				3		Reconstruct SW and SE corner curb ramps, Add vertical barrier (railing or high curb) between road and narrow roadside sidewalk between College and E Main. Alternative 1: Add an RRFB for crossing Streetsboro St.	ADA (curb ramps) Safety (markings and RRFB) Encourage (railing)
							3		Alternative 2: Install high vis markings, yield markings, and signs for east approach crossing	ADA (curb ramps) Safety (markings) Encourage (railing)
S2	College Street		1			2	3		Reconstruct SW corner curb ramp and wider crosswalk markings across College south approach. Add curb ramp on NE corner to better line up diagonal crosswalk (avoid catch basin). Alternative 1: Install RRFB for east approach crossing	ADA (curb ramps) Safety (markings, RRFB)
						2	3		Alternative 2: Install high vis markings, yield markings, and signs for east approach crossing	ADA (curb ramps) Safety (markings)
S3	Oviatt Street		2			4	8		Reconstruct all eight curb ramps. Add signs to the back of school crossing signs. Alternative 1: Install RRFBs for the east and west approach crossing	ADA (curb ramps) Safety (RRFBs and markings)
						4	8		Alternative 2: Install pedestrian hybrid beacon	ADA (curb ramps)

No.	Intersection	Count Down Heads (each)	RRFB (crossing)	Curb Extensions (each)	Sidewalk (ft)	High Visibility Markings (crossing)	Curb Ramps (each)	Detectable Warnings (each)	Proposed Work Notes	Purpose
										Safety (PHB and markings)
S4	Bradley Drive					1			Add high vis markings at the marked crossing.	Safety
S5	Edward (private)								Because there is sidewalk and driveway apron, do not install curb ramps. No work is proposed at this location.	
S6	Fox Trace Lane					1			Add high vis markings at the marked crossing.	Safety
S7	Roslyn Street								RRFB planned by other project. Make signs double sided.	Safety
S8	Pinewood Lane					1		2	Add detectable warnings and high visibility markings	ADA (detectable warnings) Safety (markings)
S9	Manor Drive					1			Add high vis markings at the marked crossing.	Safety
S10	Hayden Parkway	4				1	2	1	Reconstruct west side curb ramps that have excessive slope. Add detectable warnings on SE corner. Replace pedestrian signals with countdown heads.	ADA (curb ramps) Safety (markings, ped signals))

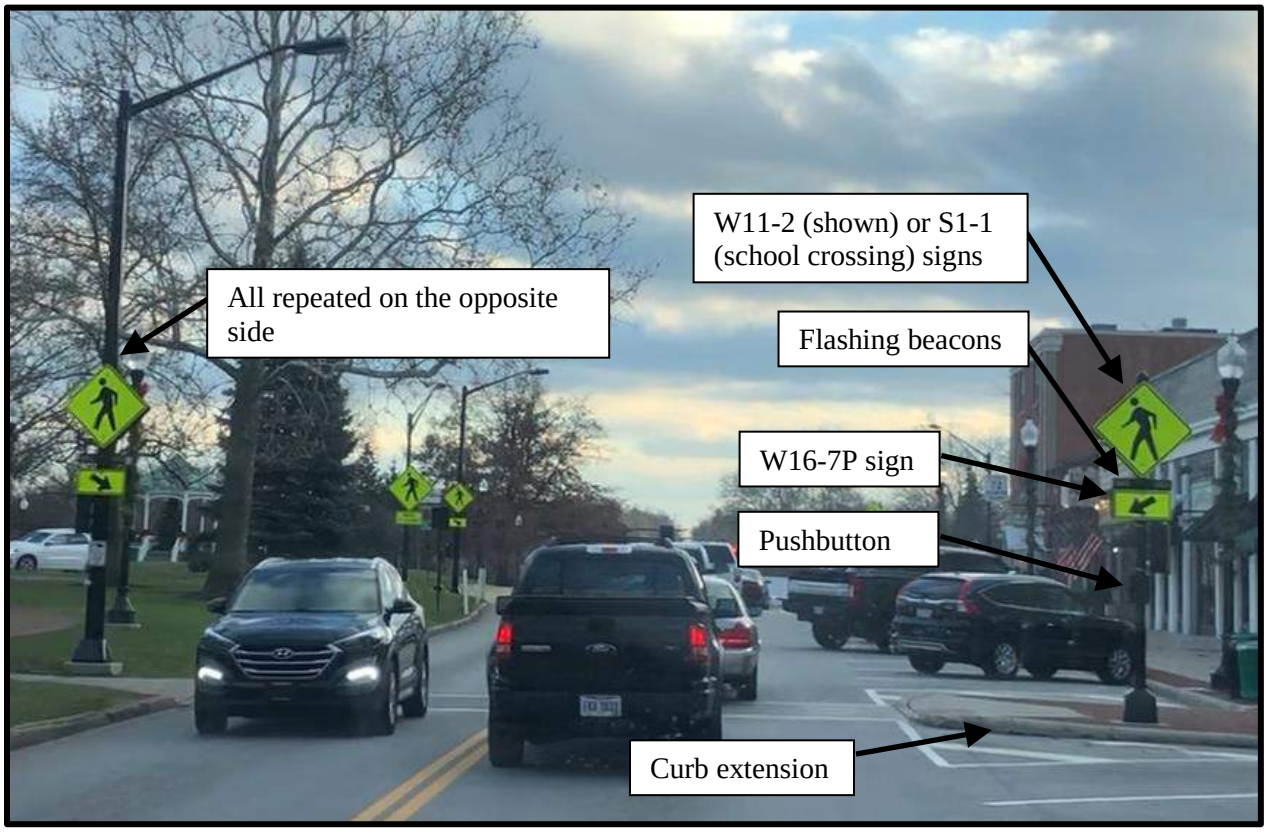
FIGURE 7: EXAMPLES OF PEDESTRIAN FEATURES AT N MAIN ST & AURORA ST WITH COMPONENTS LABELED

- **Pedestrian Refuge Island:** A pedestrian refuge island is a raised space between two lanes of travel that allows a pedestrian to stop and rest or wait for a gap in traffic. An island shortens the overall crossing distance, makes pedestrians more visible to traffic, and calms traffic. A raised island may reduce pedestrian crashes by up to 56%[4]. When recommended in this study, it includes curb ramps with detectable warnings to enter and exit the island. Where possible, a Z-crossing is used, which directs the pedestrian to turn to face traffic as they approach the edge of the island by making a Z-shaped path from one end to the other.
- **Curb Ramp:** Curb ramps are required by ADA, which stipulates the slope, cross-slope, and landing size required. When recommended in this study, they include a new curb ramp or full replacement. Curb ramps always include a detectable warning panel.
- **Detectable Warning:** Detectable warnings are required on curb ramps to alert pedestrians with visual impairments that they are approaching a roadway. They are recommended in this study for curb ramps that are sufficient in other aspects but lack detectable warnings.
- **Curb Extension:** Curb extensions, also referred to as bump-outs or bulb-outs, extend the sidewalk and curb further into the roadway at a crossing, narrowing the lane of travel or taking the place of a parking lane. Doing so decreases crossing distance, makes pedestrians more visible as they approach the roadway, and calms traffic.

[4] https://safety.fhwa.dot.gov/provencountermeasures/ped_medians.cfm

- **Rapid Rectangular Flashing Beacon (RRFB):** RRFBs are flashing beacons that are manually actuated by pedestrians. The beacons may be solar-powered. The flashing lights are yellow warning lights, so vehicles are not required to stop. However, the warning lights increase motorist yielding rates and can reduce pedestrian crashes up to 47%[5]. Local pedestrians are already familiar with RRFBs, as there are several throughout Hudson. When recommended in this study, an RRFB includes at least two pedestals and the signs, pushbuttons, and flashing beacons. **Figure 7** shows an example of an appropriate RRFB in Hudson with some key components labeled.

FIGURE 8: RRFB AT N MAIN ST & HUDSON GREEN WITH COMPONENTS LABELED



- **Pedestrian Hybrid Beacon (PHB or HAWK):** A hawk is a traffic signal that provides a red indication to oncoming traffic only when a pedestrian presses a pushbutton. The signal first displays yellow during the clearance interval, then red during the Walk and Flashing Don't Walk intervals. Otherwise, all displays facing vehicles remain off. PHBs are good options when a firmer red indication is desired for oncoming traffic, but a full traffic signal installation is not warranted or desired.

Other countermeasures and descriptions specific to that location are included in the Proposed Work Notes column. Improvements that are suggested outside of an intersection area have been included with the nearest intersection for the purpose of this evaluation matrix.

[5] https://safety.fhwa.dot.gov/provencountermeasures/rrfb.cfm

FIGURE 9: EXAMPLE IMAGE OF A PEDESTRIAN HYBRID BEACON (PHB OR HAWK)

Source: FHWA, Safety Effectiveness of the HAWK Pedestrian Crossing Treatment (2010)

Many pedestrian and bicycle crashes involved turning movements and failure to yield to pedestrians. The safety-related countermeasures proposed increase pedestrian visibility through several means:

- Curb extensions reduce the crossing distance for pedestrians and start the crossing in a more visible position to drivers
- All proposed crossings of the major street include advance warning signs for pedestrian crossings
- RRFBs are proposed at several locations to provide an actuated, flashing warning for drivers
- High visibility markings increase the visibility of the crosswalk
- Pedestrian refuge island decrease the crossing distance and calm traffic

ALTERNATIVES EVALUATION

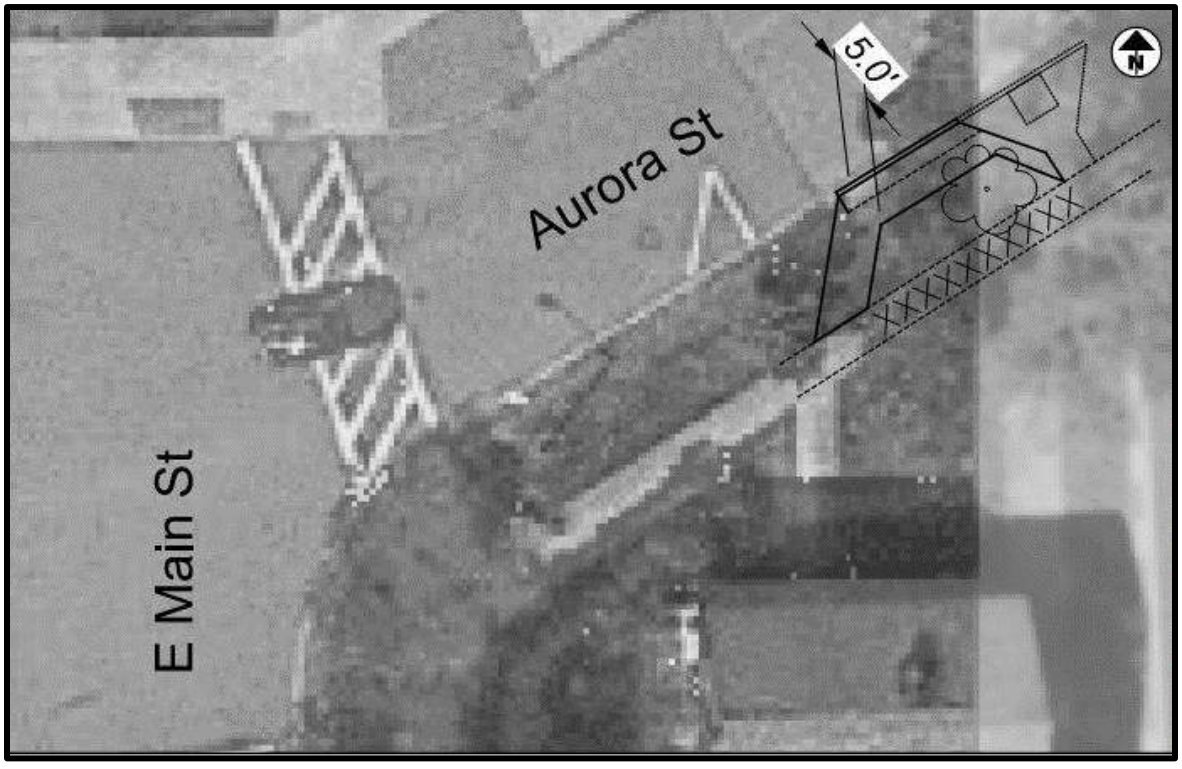
Table 1, the Evaluation Matrix presented earlier on pages 3 through 7 of the Executive Summary, identifies recommend improvements at each intersection. The following section discusses locations where the more complex alternatives are proposed or where more than one alternative is proposed. The concept plans shown are for the purpose of evaluation and are not to scale or intended for construction.

Aurora St & E Main St

To the east of this intersection, the south side sidewalk along Aurora St has been undermined by tree roots. Replacing the sidewalk in place at the base of the tree would likely result in repeated future issues or potential damage to the tree. Instead, the damaged sidewalk could be removed and the sidewalk could be built to the north of the tree by widening the existing curb walk between the tree and Aurora St.

FIGURE 10: SIDEWALK ALONG AURORA ST – EAST OF E MAIN ST

FIGURE 11: SIDEWALK ALONG AURORA ST – EAST OF E MAIN ST

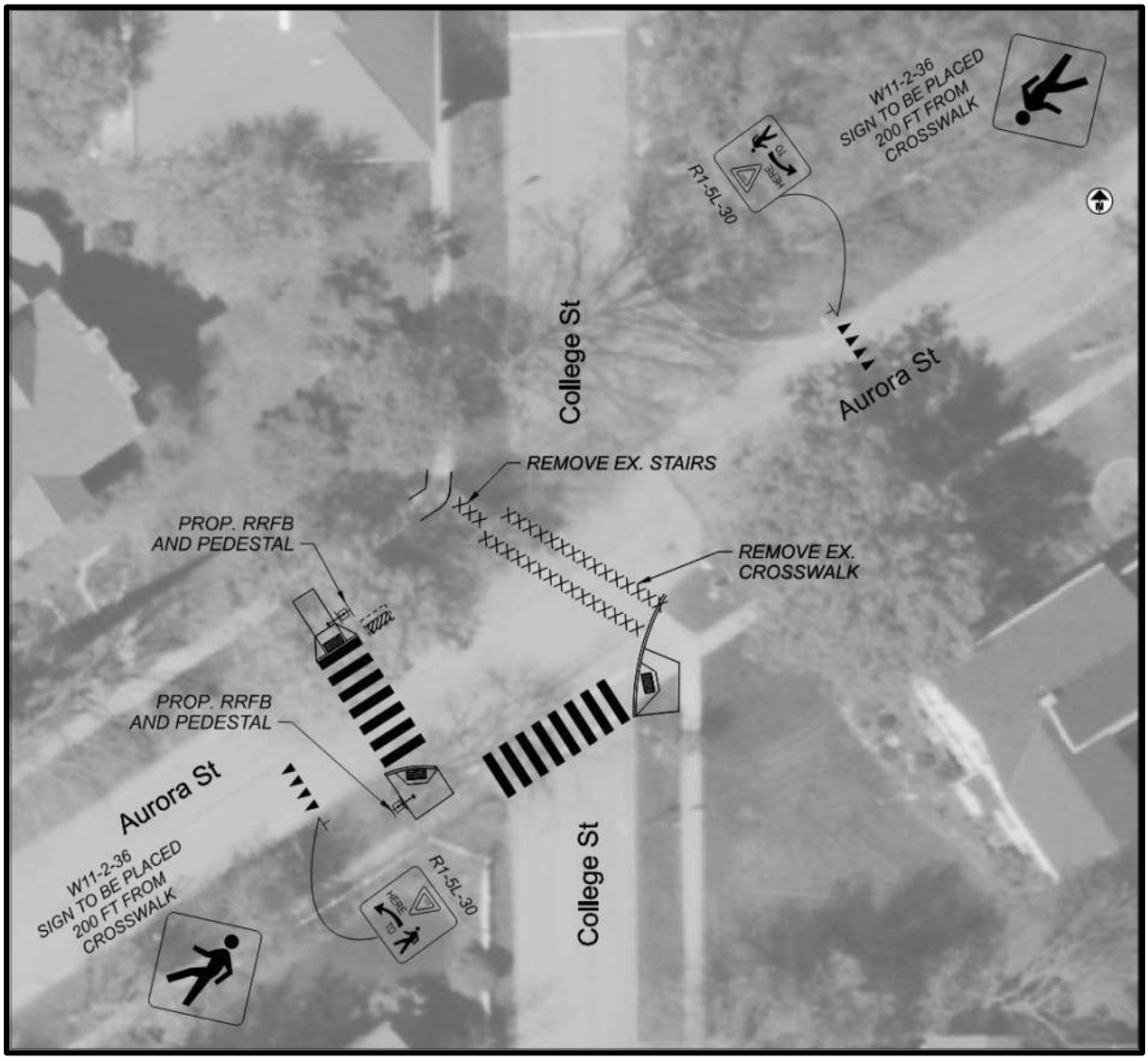


Aurora St & College St

There is currently a diagonal crossing marked at this intersection from the northwest to southeast. Diagonal crossings are not recommended because they expose pedestrians to conflict from all four approaches simultaneously. Furthermore, pedestrians and drivers are not familiar with the format. Pedestrians may not look at all four approaches, and drivers may misjudge where the pedestrian is going. The northwest corner also uses a staircase, which is not ADA-compliant, rather than a curb ramp. The southeast corner curb ramp for crossing College St has excessive running and cross slopes.

The recommendation is to remove the staircase and diagonal crossing markings. A new crossing of Aurora St should be added on the west approach to connect the sidewalk on the north and south side of Aurora St. The crosswalk should be perpendicular to Aurora St to minimize the distance. The new curb ramp on the north side should be constructed just west of the existing catch basin, without impacting it. Both marked crossings should use high visibility markings as this is inside the proposed pedestrian district. The southeast curb ramp for crossing College St should be replaced with appropriate grades, and the curb should be rebuilt to remove the other curb ramp on the southeast corner.

FIGURE 12: AURORA ST & COLLEGE ST RECOMMENDED IMPROVEMENTS



Aurora St & Old Orchard St

The curb ramps at Old Orchard St are narrow and have excessive slopes and cross slopes. Additionally, a vehicle stopped 4' behind the crosswalk on Old Orchard St does not have a clear line of sight to the east due to vegetation, as shown in **Figure 10**. This blocked view increases risk of a pedestrian or cyclist on the sidewalk being struck if a stopped vehicle is unable to see them.

This study presents two alternatives at this intersection, both shown in **Figure 11**. Alternative 1 is to replace the curb ramps on both sides at the same location with ADA-compliant slopes and widths. To improve sight distance, the vegetation should be cleared or trimmed regularly to maintain visibility of oncoming pedestrians and cyclists from the east. Note that the vegetation is within public right-of-way.

Alternative 2 is to move the crossing closer to Aurora St. By doing so, pedestrians become more visible to motorists, although the crossing distance increases. This also moves the stop line closer to Aurora St, improving the intersection sight distance for vehicles. Because pedestrians are moved away from the obstruction, this alternative does not rely on regular maintenance as Alternative 1 does if the vegetation is not removed.

FIGURE 13: SIGHT DISTANCE AT AURORA ST & OLD ORCHARD ST

FIGURE 14: AURORA ST & OLD ORCHARD ST ALTERNATIVES

Aurora St & Hudson St

Approaching this intersection, there is sidewalk on both sides of Hudson St and on the south side of Aurora St. The sidewalk on the south side of Hudson St ends near the intersection without a marked crossing, although there is a narrow curb ramp without detectable warnings. A raised island sits in the intersection area, splitting left and right turns from Hudson St to either side of it. There are no centerlines on Hudson St or signs to indicate which side of the island left turning vehicles onto Hudson St must turn. The raised island does not serve as a pedestrian refuge.

This study presents two alternatives at this intersection. Both alternatives include an RRFB for crossing Aurora St at the existing crossing location. Alternative 1 extends the island in a tear drop shape to the north along Hudson St. The extended island serves two purposes. First, it is large enough to provide curb ramps and sidewalk to establish a crossing of Hudson St. Second, along with yellow centerline and edge line markings, it splits inbound and outbound traffic, reducing the conflict points at the intersection. If landscaping is used in the island, it must not be anything that hides pedestrians or draws attention away from traffic control devices and must be crash safe.

Alternative 2 also directs inbound and outbound traffic to one side of the island each, but does not extend the island. Instead, Alternative 2 uses pavement markings. Because the island is not extended, there is no pedestrian refuge area in the crossing. Two new curb ramps would be added on either side of Hudson St to form a direct crossing. This would occur upstream from the stop line, which is less desirable than the position in Alternative 1. However, it does allow the crossing to be made without modifying the existing island.

FIGURE 15: AURORA ST & HUDSON ST ALTERNATIVE 1

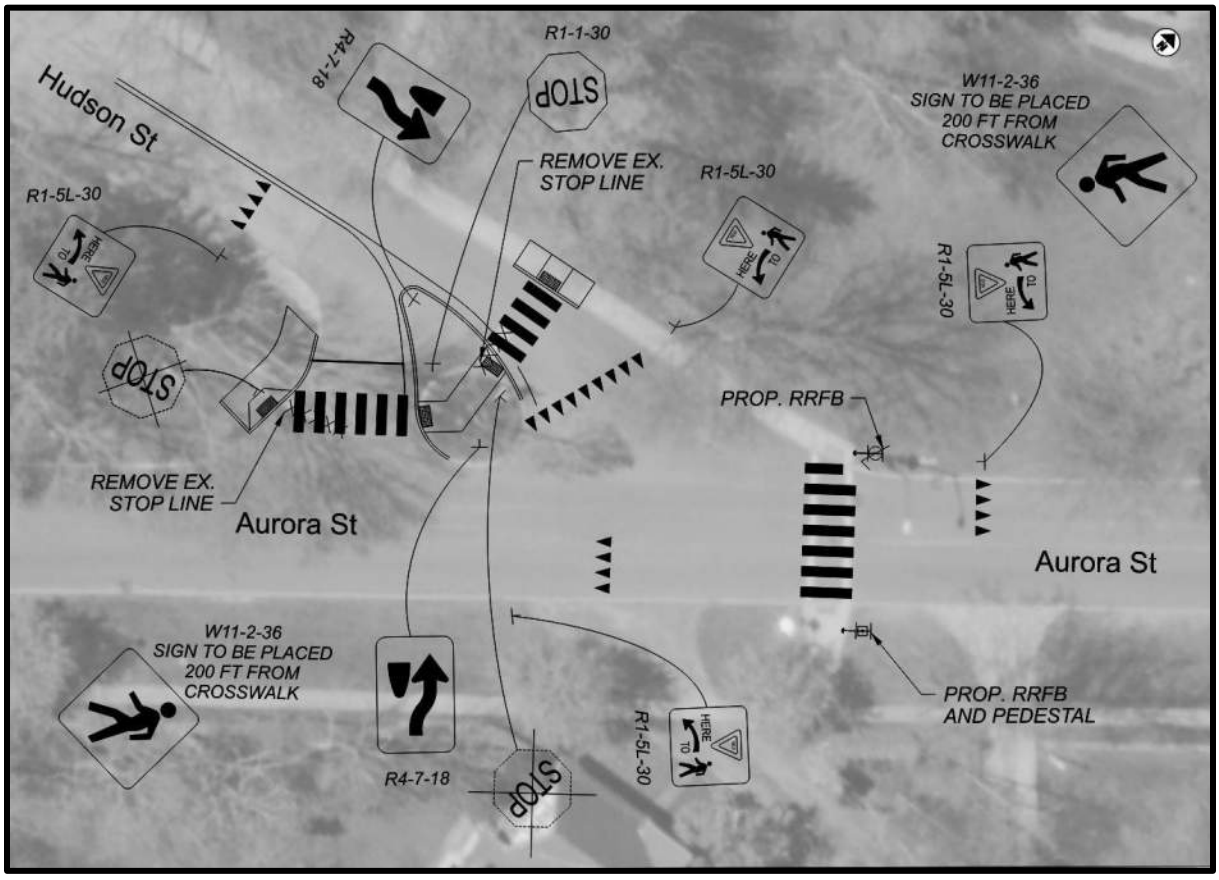
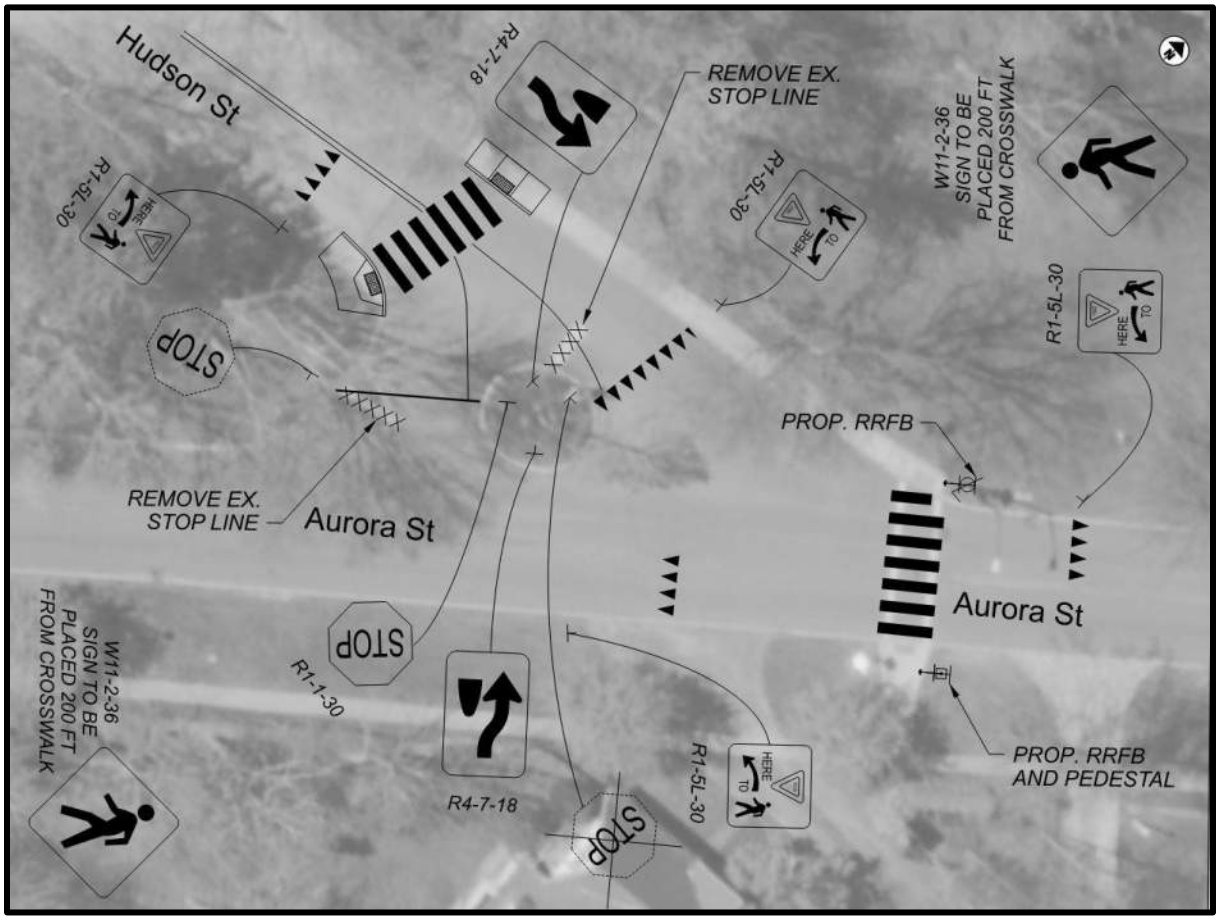


FIGURE 16: AURORA ST & HUDSON ST ALTERNATIVE 2



S Main St and Colony Dr

The sidewalk on the east side of S Main St ends at Colony Dr with no marked crosswalk. The nearest crossing of Main St is 415' south at Stoney Hill Dr. This study presents four alternatives at this intersection.

Alternative 1 is a crossing be installed with a raised pedestrian median island on the south approach of the intersection. The south approach was chosen to maintain the left turn lane onto Colony Dr. The space where the island is proposed is currently reserved from use by transverse line pavement markings. New curb ramps should be installed on both sides of S Main St, along with an RRFB. The proposed island uses a Z-crossing, which encourages pedestrians to look towards oncoming traffic as they traverse the island. To increase the traffic calming effect of the island, it could be extended further south. The additional median space could be paved, grass, or landscaped. If landscaping is used, it must not be anything that hides pedestrians or draws attention away from traffic control devices and must be crash safe.

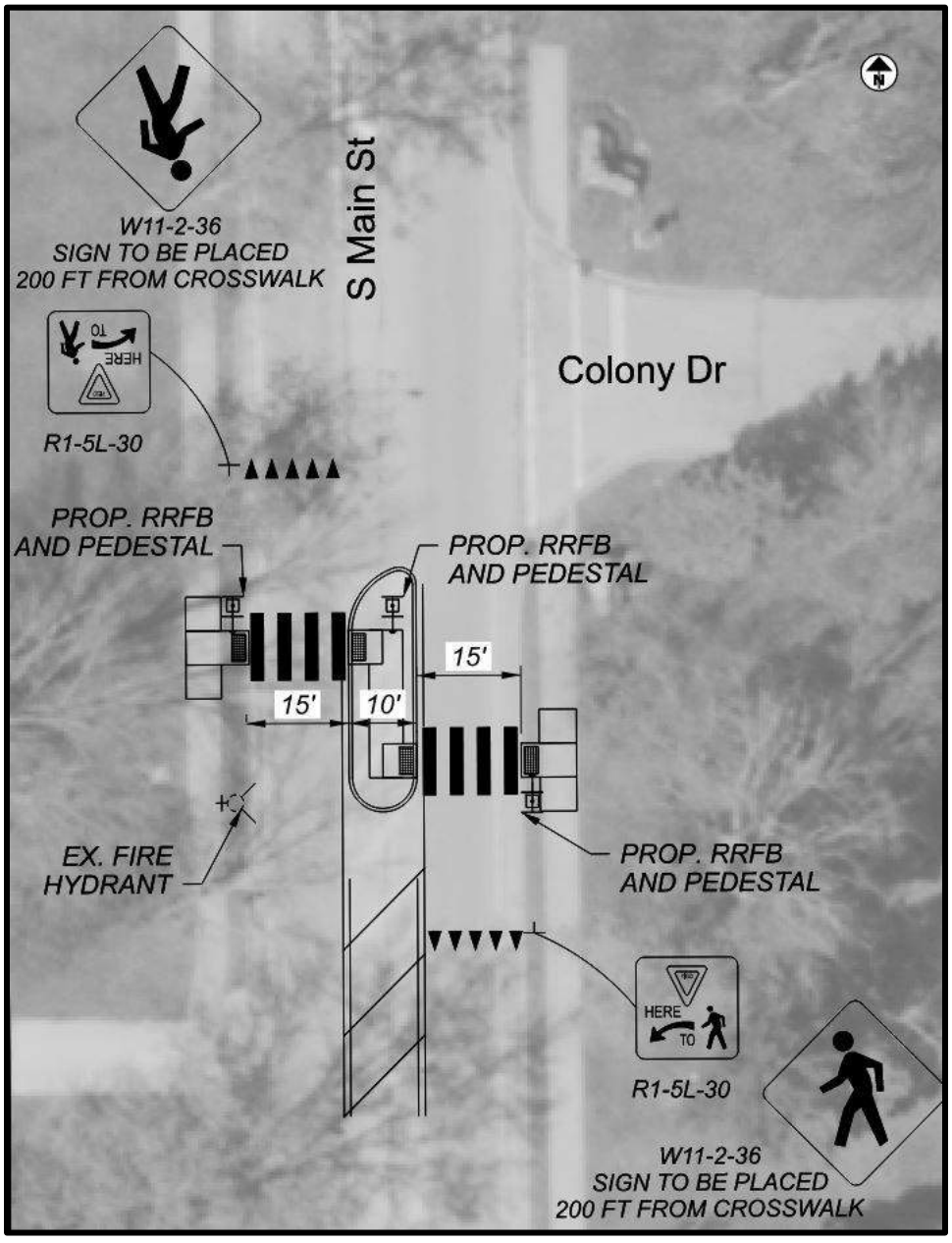
Alternative 2 is to close the 1600' gap in sidewalk along the east side of S Main St between Colony Dr and Nantucket Dr. The sidewalk should be 5' wide and will require earthwork, clearing vegetation, and replacing mailboxes.

Alternative 3 is similar to Alternative 1, but without a raised pedestrian island. The crossing would be on the south approach of the intersection with a new curb ramp on the west and east side of the S Main St, along with an RRFB.

Alternative 4 is similar to Alternative 3, but does not include the RRFB. The crossing would be marked by a high visibility crosswalk, advance warning signs, and yield markings. New curb ramps would be needed as in the other alternatives with a crossing.

Alternative 2 is not mutually exclusive to the others. The sidewalk would provide connectivity for pedestrians regardless of which direction they come from. The pedestrian island in Alternative 1 would also serves as a traffic calming measure for vehicles approaching the downtown area from the south.

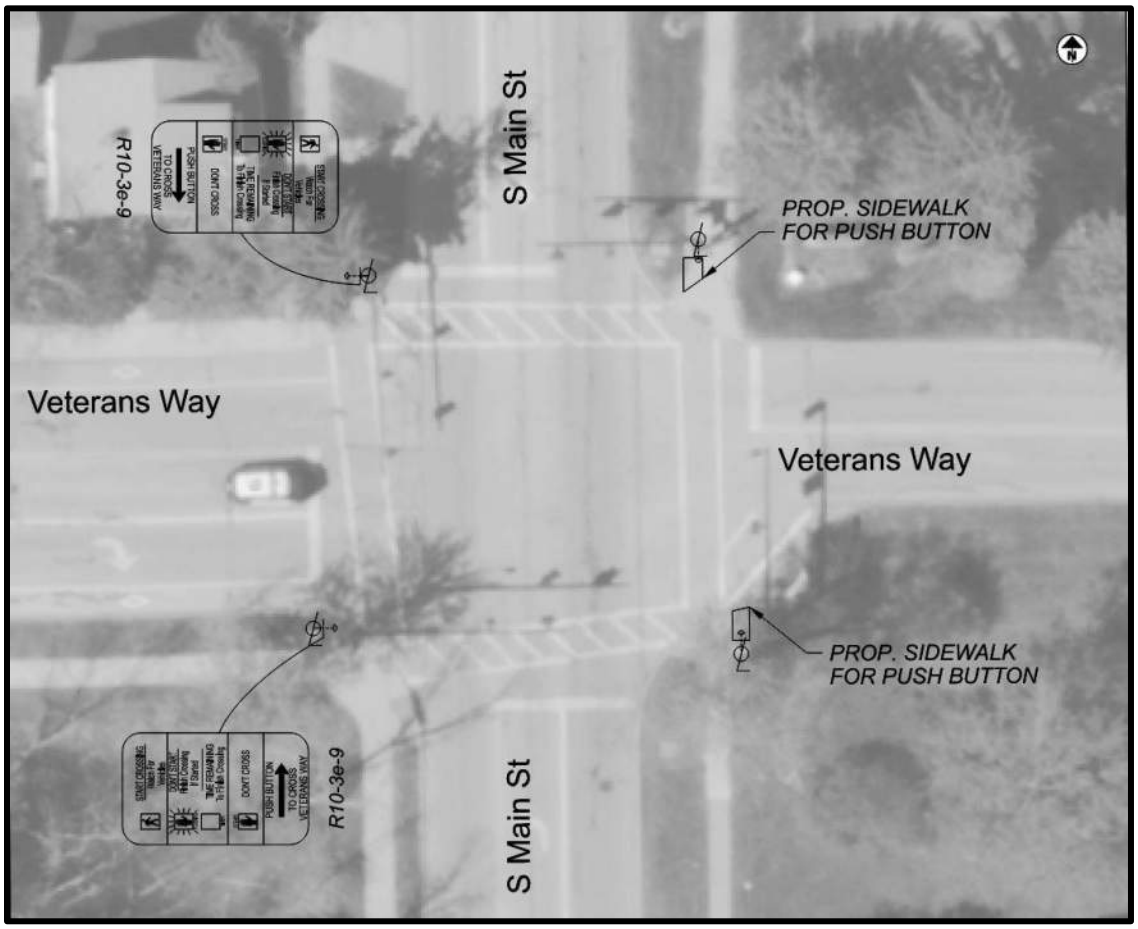
FIGURE 17: S MAIN ST & COLONY DR ALTERNATIVE 1



S Main St & Veteran's Way

This intersection is signalized, with Veteran's Way on the west approach and a driveway, signed as Veteran's Way, to the east. There are two pushbuttons on each of the corners, providing pedestrian detection for all four approaches. However, ADA requires a clear and level space in front of pushbuttons. To achieve that, small portions of sidewalk should be added in front of one pushbutton on the northeast corner and one on the southeast corner. On the west side, signs read "Push Button to Cross Milford Connector." However, none of the approaches are signed as Milford Connector. To reduce confusion and potential crossing errors, those two signs should be replaced with signs that read "Push Button to Cross Veteran's Way." The nonmatching signs may confuse pedestrians, who may hit the wrong button and then cross during the wrong phase either mistakenly or after waiting too long.

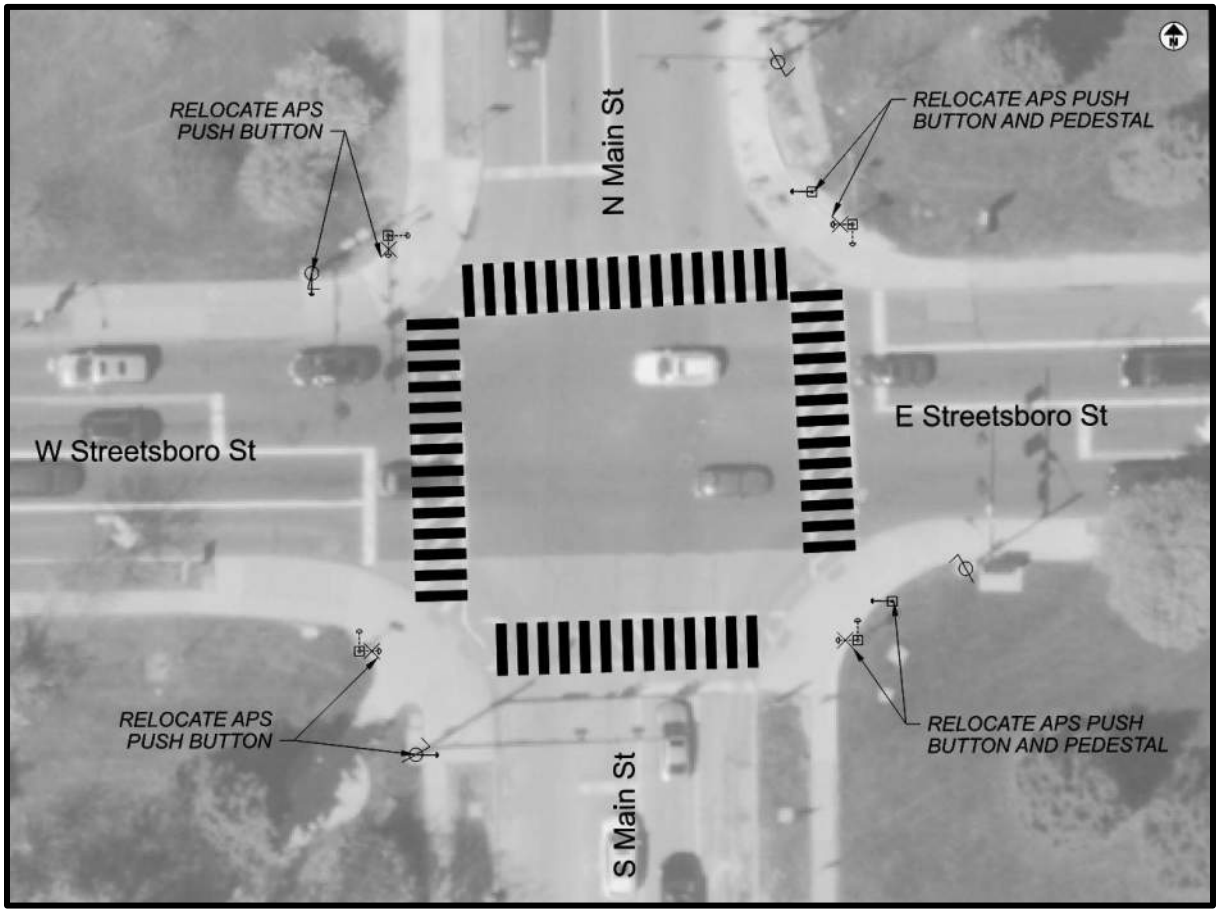
FIGURE 18: S MAIN ST & VETERAN'S WAY RECOMMENDED IMPROVEMENTS



Main St & Streetsboro St

This intersection is signalized, with Accessible Pedestrian Signals (APS) that have contoured pushbuttons and audible guiding sounds for pedestrians with visual impairments. Each crossing is equipped with pedestrian signals, but they are not countdown heads. The best practice is to place APS pushbuttons on separate pedestals at least 10' apart to avoid conflicting or misunderstood messages to pedestrians. There are two buttons on each corner on the same pedestal. APS pushbuttons should be moved to a signal support or new pedestal to separate the buttons. The existing pedestrian signals should be replaced with countdown heads at the same location. Additionally, the existing high visibility markings are worn at this intersection and should be replaced.

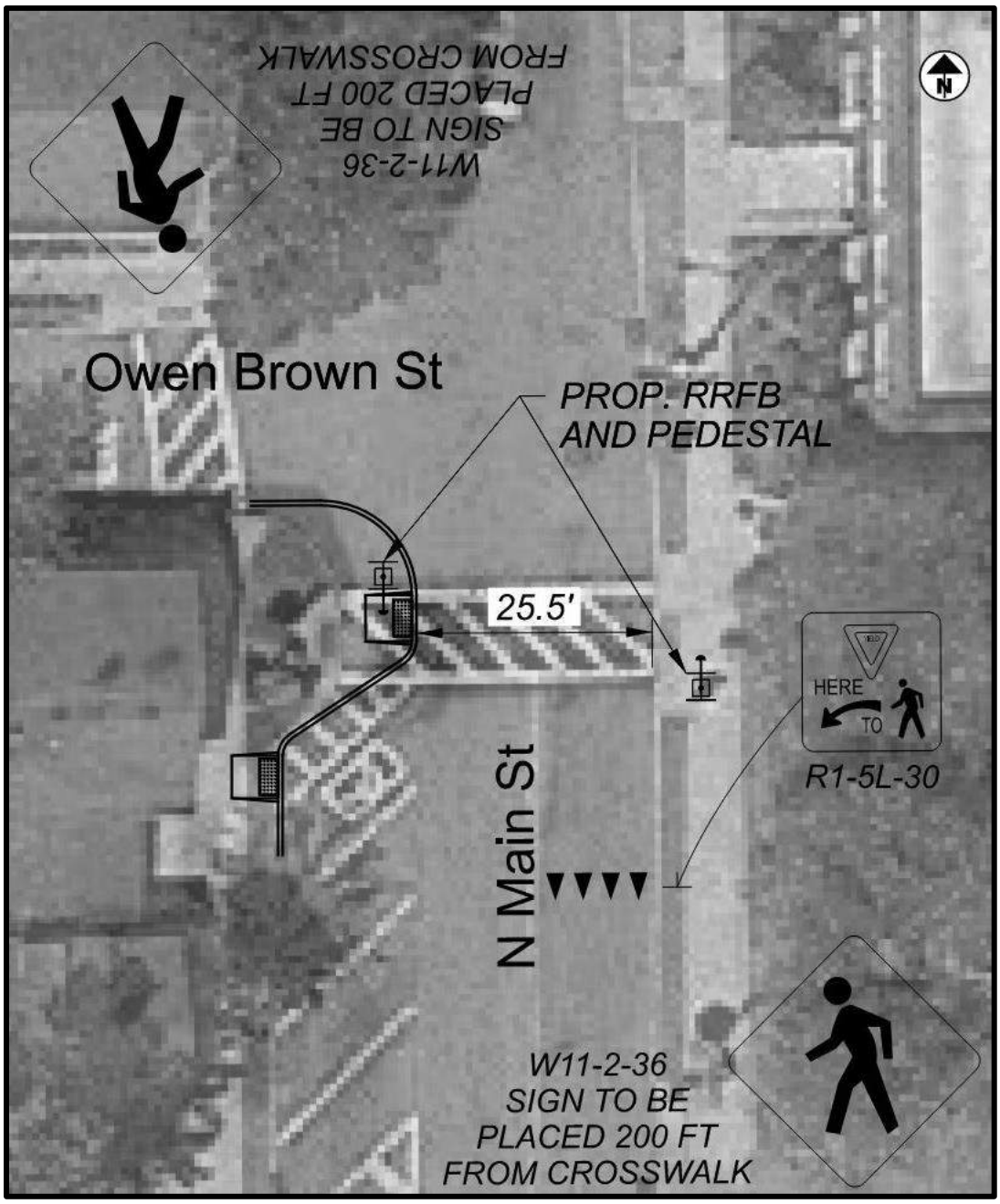
FIGURE 19: MAIN ST & STREETSBORO RECOMMENDED IMPROVEMENTS



N Main St & Owen Brown St

A curb extension was previously installed on the west side of N Main St. However, it does not extend the full width of the parking lane, potentially due to the previous use of the parking lane for parallel parking rather than diagonal parking. The curb ramp also pools water during rain events. As diagonal spaces are now in use, the curb extension should be brought farther into the roadway to decrease crossing distance and improve pedestrian visibility. If addition of appurtenances is to be placed, such as trash cans or planters, they should be limited to locations that do not reduce sight distance. The drainage profile of the sidewalk and curb ramp should be improved to prevent ponding. An RRFB should be installed for the N Main St crossing as well.

FIGURE 20: N MAIN ST & OWEN BROWN ST RECOMMENDED IMPROVEMENTS

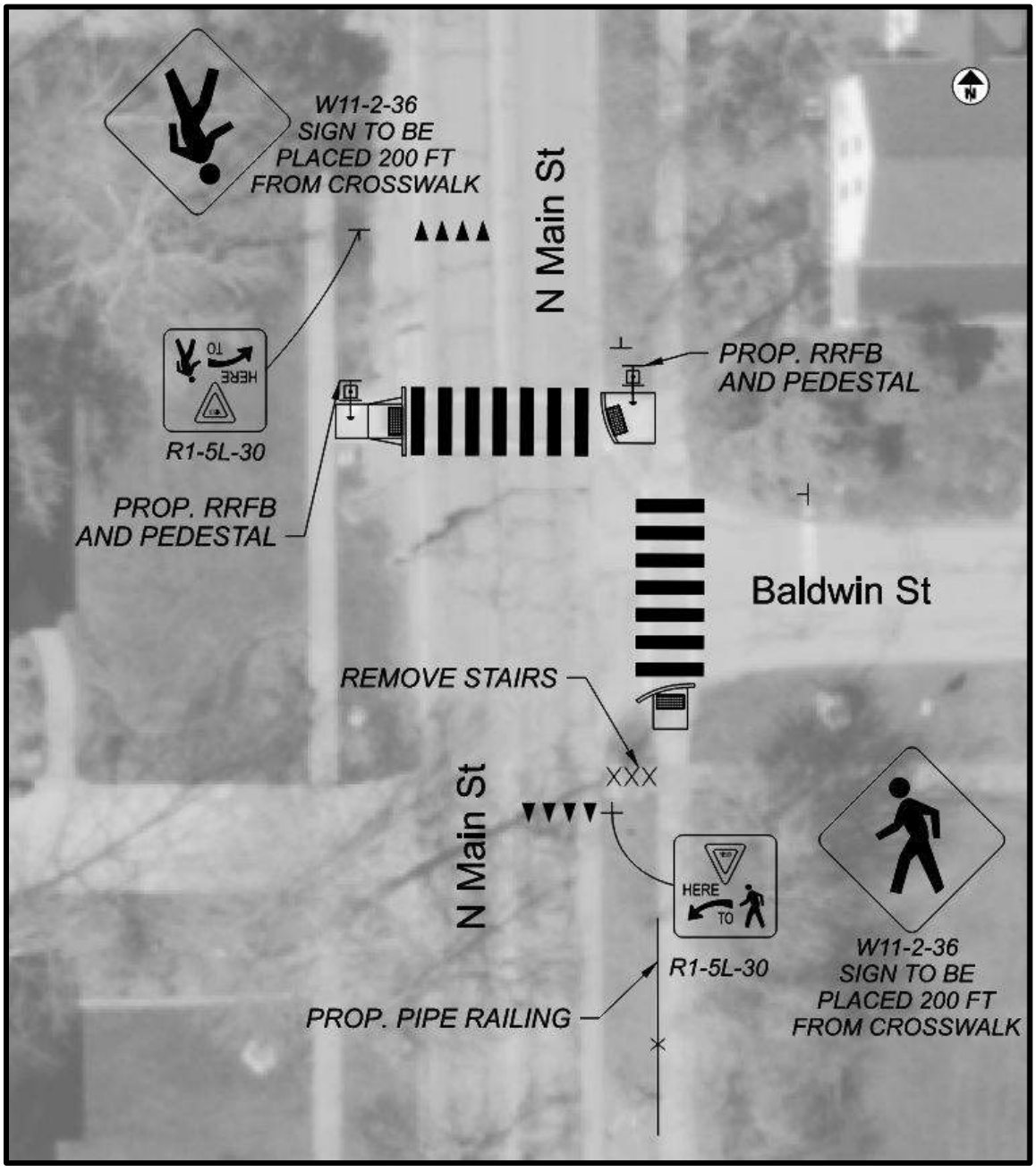


N Main St & Baldwin St

This intersection currently has marked crossings of the east and north approaches. In addition, there is a staircase leading from the sidewalk to the roadway on the east side of the south approach across from a driveway. Because of the position of the driveway and the grade, the uphill north approach crossing should be developed into an ADA compliant crossing by installing curb ramps on both sides of N Main St. The staircase should be removed, and a new curb ramp should be installed on the south side of the east approach due to excessive grades and cross slope.

Alternative 1 includes an RRFB for the N Main St crossing to increase visibility as motorists navigate the hill. Alternative 2 only includes the high visibility crosswalk, advance warning signs, and yield markings.

FIGURE 21: N MAIN ST & BALDWIN ST RECOMMENDED IMPROVEMENTS

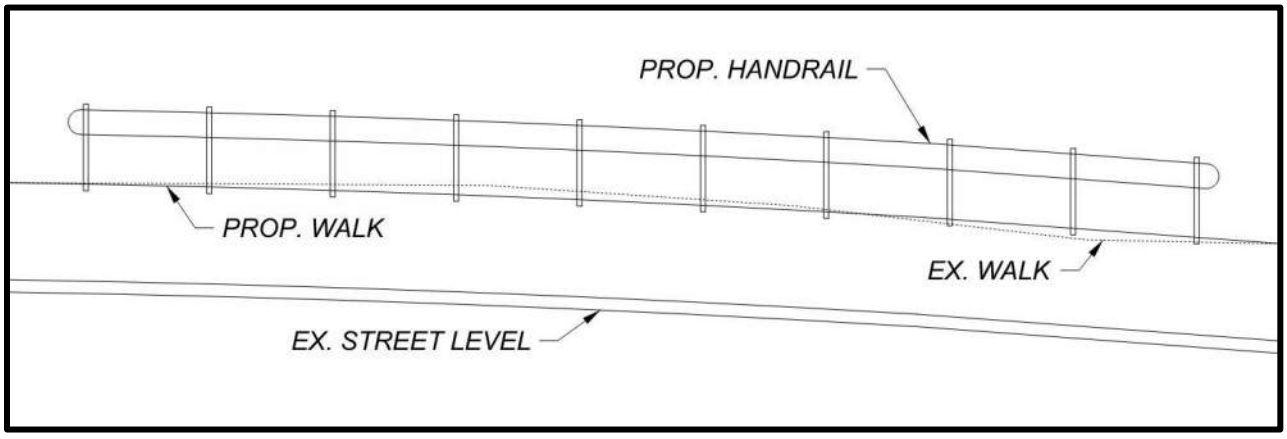


N Main St South of Baldwin St

South of Baldwin St, the sidewalk (shown in **Figure 19**) varies in grade and is steeper than the adjacent N Main St grade, which is not ADA-compliant. In addition, there is a steep drop off between the sidewalk and street, which may discourage pedestrian activity. Because of the elevation difference between Owen Brown St and Baldwin St, it is not feasible to use a 2% grade. However, this sidewalk should be reconstructed to be the same slope as the adjacent section of N Main St. A 5' width should be used to allow pedestrians more space from the edge. In addition, a pipe railing or alternative is recommended along the portions where elevation difference is highest.

FIGURE 22: MAIN ST SIDEWALK SOUTH OF BALDWIN ST

FIGURE 23: BALDWIN ST RAIL PROFILE



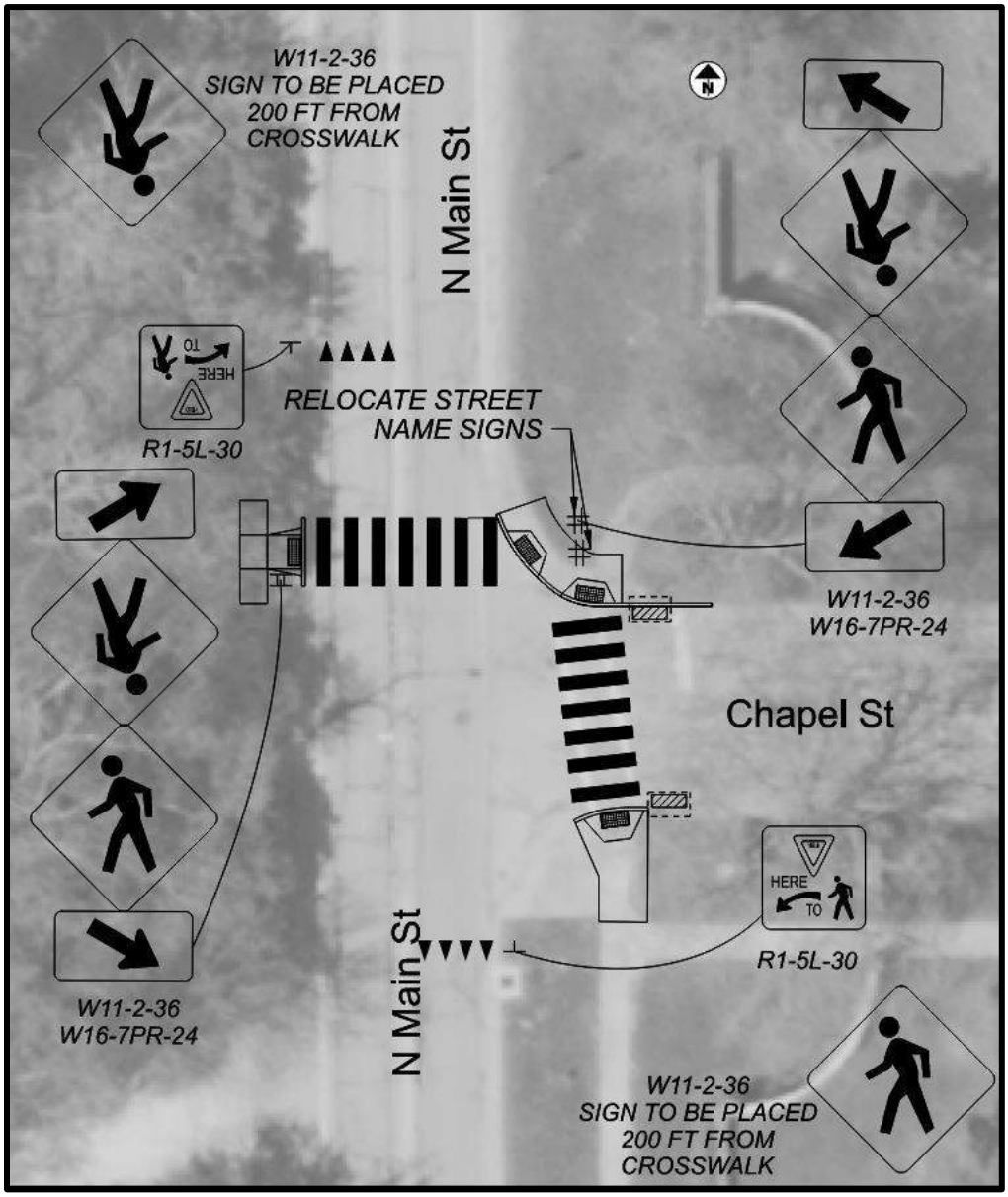
N Main St & Chapel St

Chapel St serves as an entrance to Western Reserve Academy. The east side sidewalk ends here, but there is no marked crossing. The northeast corner curb does not wrap around the corner, leaving the edge of pavement difficult to discern, despite a pad of detectable warnings. The southeast approach curb ramp is excessively steep.

The northeast corner should be rebuilt with two new curb ramps, without impacting the existing catch basin. A new curb ramp should be added on the west side of N Main St to form a perpendicular crossing. Likewise, the curb ramp on the southeast corner should be reconstructed with an appropriate slope, avoiding impacts to the existing catch basin.

Alternative 1 includes an RRFB for the N Main St crossing to increase visibility of crossing pedestrians. Alternative 2 only includes the high visibility crosswalk, advance warning signs, and yield markings.

FIGURE 24: N MAIN ST & CHAPEL ST ALTERNATIVE 2



Streetsboro St & E Main St

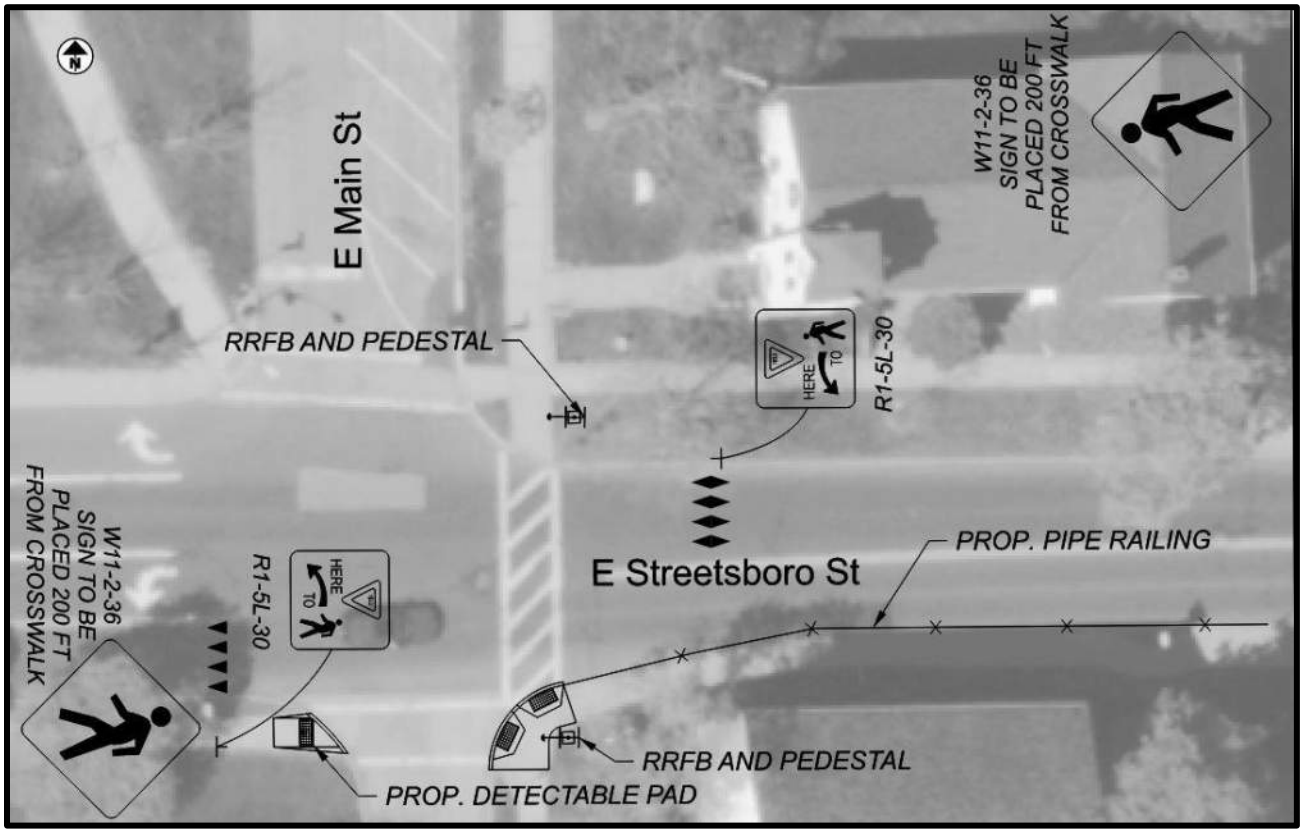
E Main St to the north is a one-way southbound roadway. The southeast corner curb ramp is very wide, does not have detectable warnings, and has an excessive cross slope. The curb ramp on the southwest corner also has excessive cross slopes. The sidewalk on the south side of the east approach varies between 4’ and 4.5’ and is directly adjacent to the curb and roadway.

The southeast corner curb ramp should be reconstructed into two curb ramps, one facing north and the other west. The southwest corner curb ramp should be reconstructed as well with an appropriate cross slope.

Alternative 1 includes an RRFB for the east approach crossing in order to increase visibility of pedestrians to motorists that may be focusing on the upcoming intersection of Streetsboro St & N Main St. Alternative 2 only includes the high visibility crosswalk, advance warning signs, and yield markings.

While the sidewalk width and proximity to the roadway is not in violation of ADA standards, it does create a potential deterrent to use. Due to existing structures and right-of-way, it would be difficult to create a tree lawn or widen the sidewalk consistently. To increase the comfortability of using the sidewalk, a pipe railing or alternative could be installed along the curb line. Alternative methods include bollards, higher curb, delineators. The barrier should be breakaway and safe for use in the vehicular clear zone. Note that this barrier would require maintenance by the city in the case of a vehicular strike.

FIGURE 25: STREETSBORO ST & E MAIN ST ALTERNATIVE 1

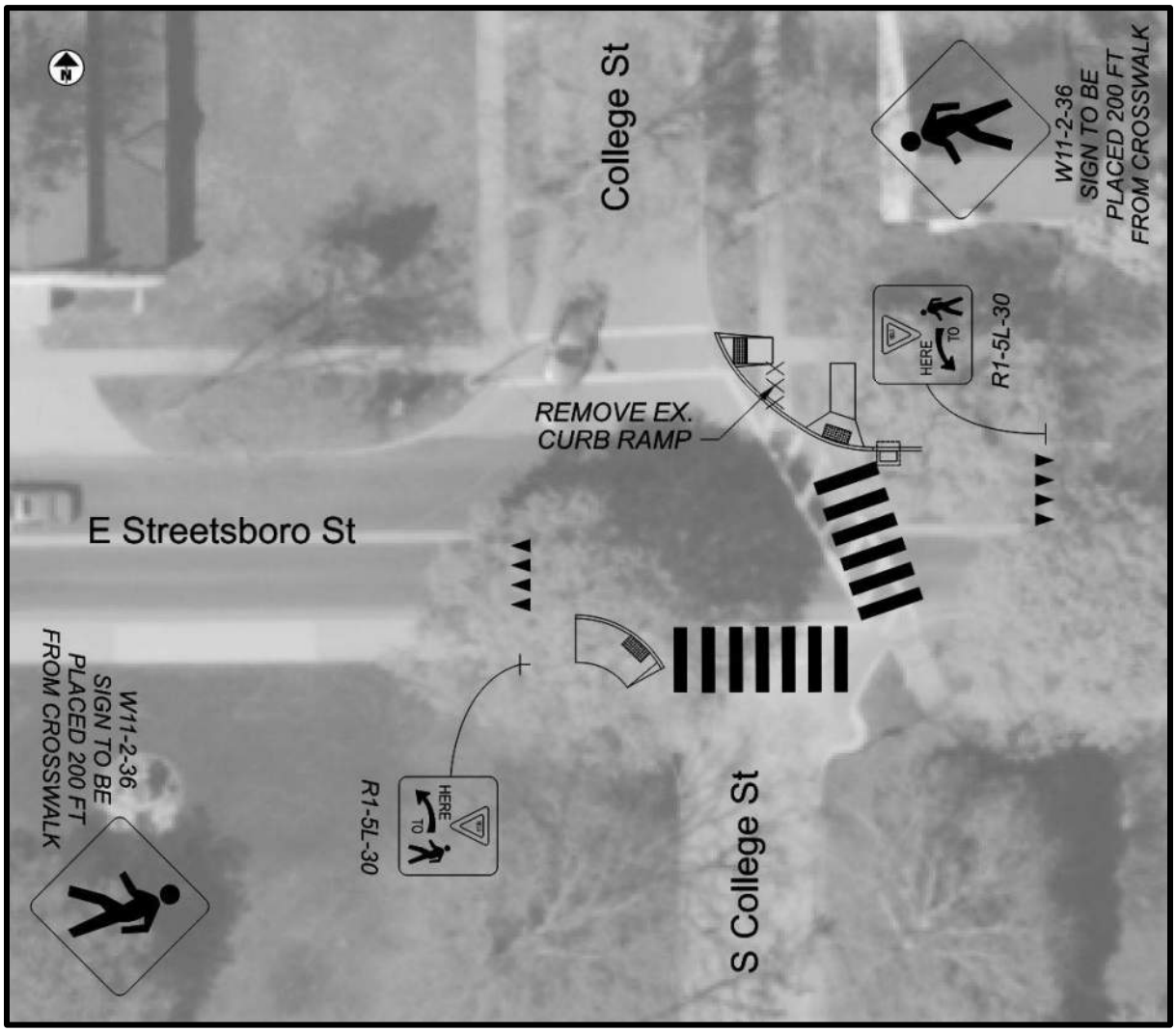


Streetsboro St & College St

The north and south approaches of College St are offset at this intersection, creating a non-perpendicular crossing of the east approach. The crosswalk lines across the south approach are narrow and do not fully include the southeast corner curb ramp. The southwest corner curb ramp has an excessive slope and a 4.3' landing where the minimum required landing size is 5'. Similarly, the northeast corner curb ramp crossing College St has an excessive running slope.

Due to the offset and an existing catch basin on the north side of Streetsboro St, a perpendicular crossing is not feasible. However, the angle can be reduced by moving the north side curb ramp to the east without impacting the existing catch basin. The narrow crosswalk lines across the south approach should be replaced with high visibility crosswalk markings. The southwest corner curb ramp should be replaced with an appropriate slope and landing size, as should both curb ramps on the northeast corner.

FIGURE 26: STREETSBORO ST & COLLEGE ST RECOMMENDED IMPROVEMENTS



Streetsboro St & Oviatt St

Oviatt St is a north-south street that connects several pedestrian destinations: Western Reserve Academy, Hudson Public Schools, Old School Green Park, and the Barlow Community Center. Because of this connectivity and space from other crossings, an improved crossing is recommended. Each of the curb ramps at this intersection have excessive running and cross slopes.

This study presents two alternatives for improving the Streetsboro St crossings. Both alternatives recommend replacement of all curb ramps with curb ramps of appropriate slopes. Alternative 1 is to install an RRFB on the east approach crossing to increase pedestrian visibility.

Alternative 2 is to install a pedestrian hybrid beacon (PHB), also known as a HAWK. A PHB is a signal that shows a red light to oncoming traffic when a pushbutton is activated. Note that in the current version of the OMUTCD (Ohio Manual for Uniform Traffic Control Devices), PHBs are not permitted at intersections or at major driveways. In the upcoming update to the Federal MUTCD, the FHWA has announced its intent to eliminate that restriction. The State of Ohio is likely to do the same following official publication from the FHWA, but at this time the proposed configuration of Alternative 2 would not conform with current standards.

FIGURE 27: STREETSBORO ST & OVIATT ST ALTERNATIVE 1

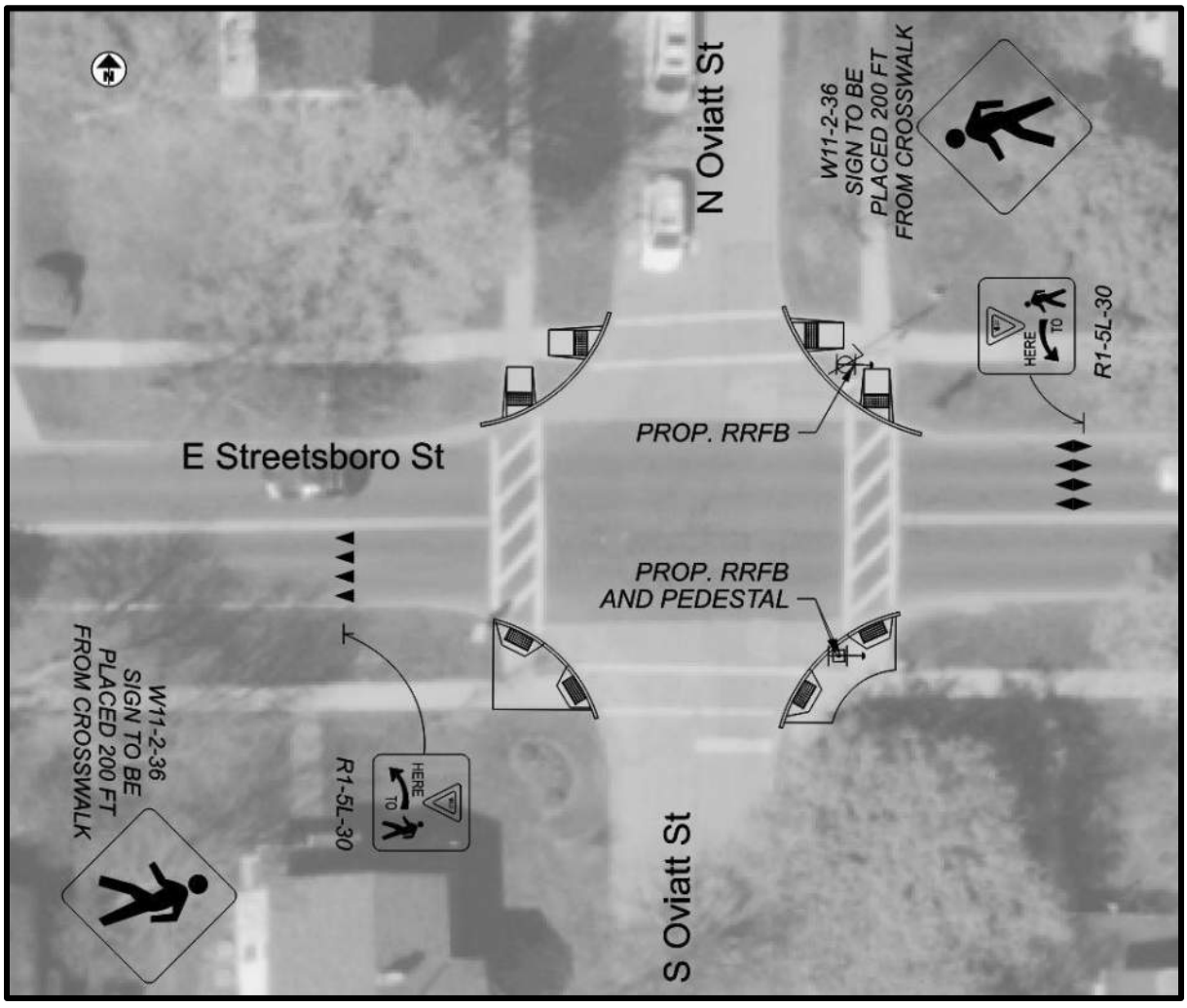
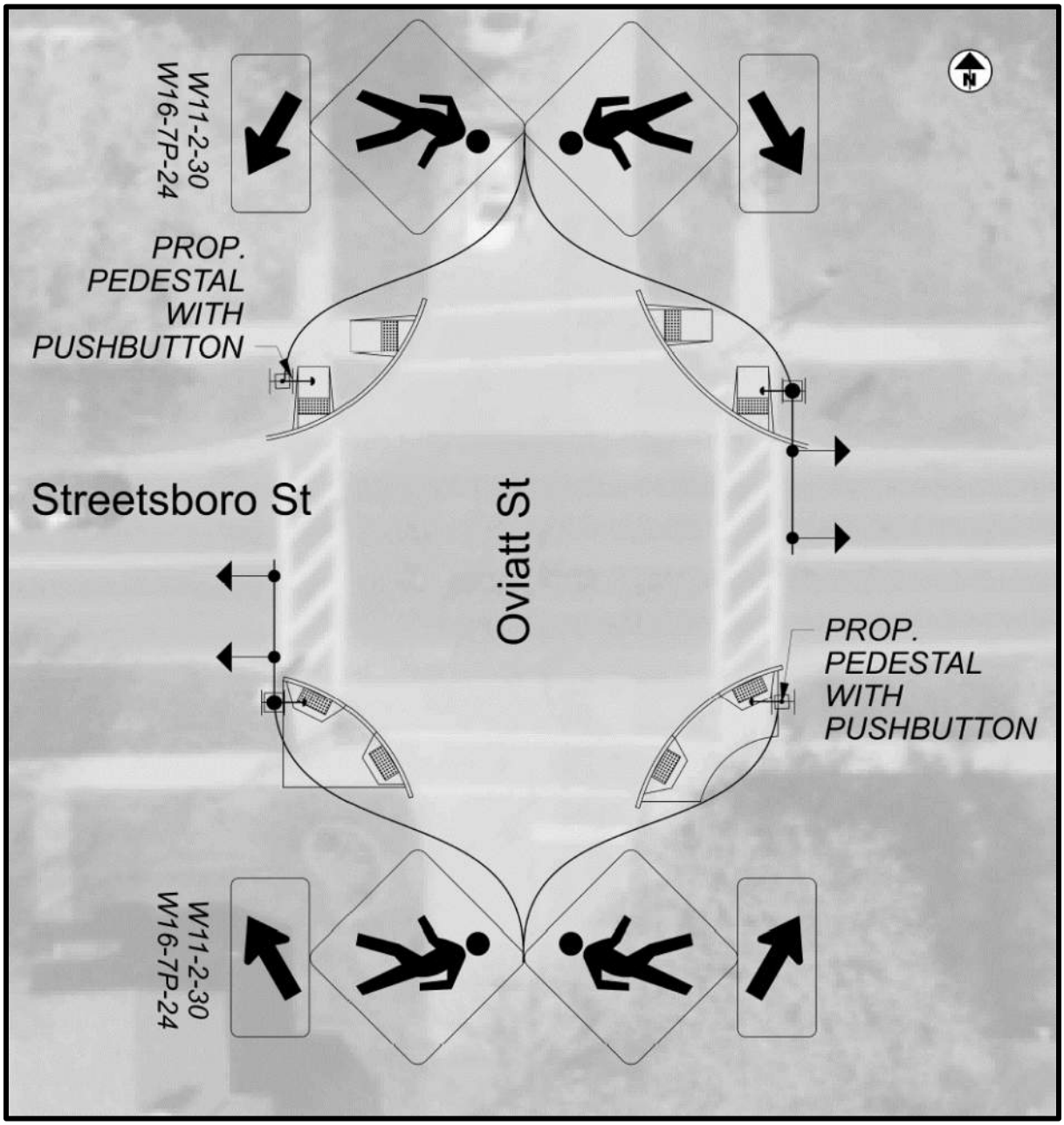


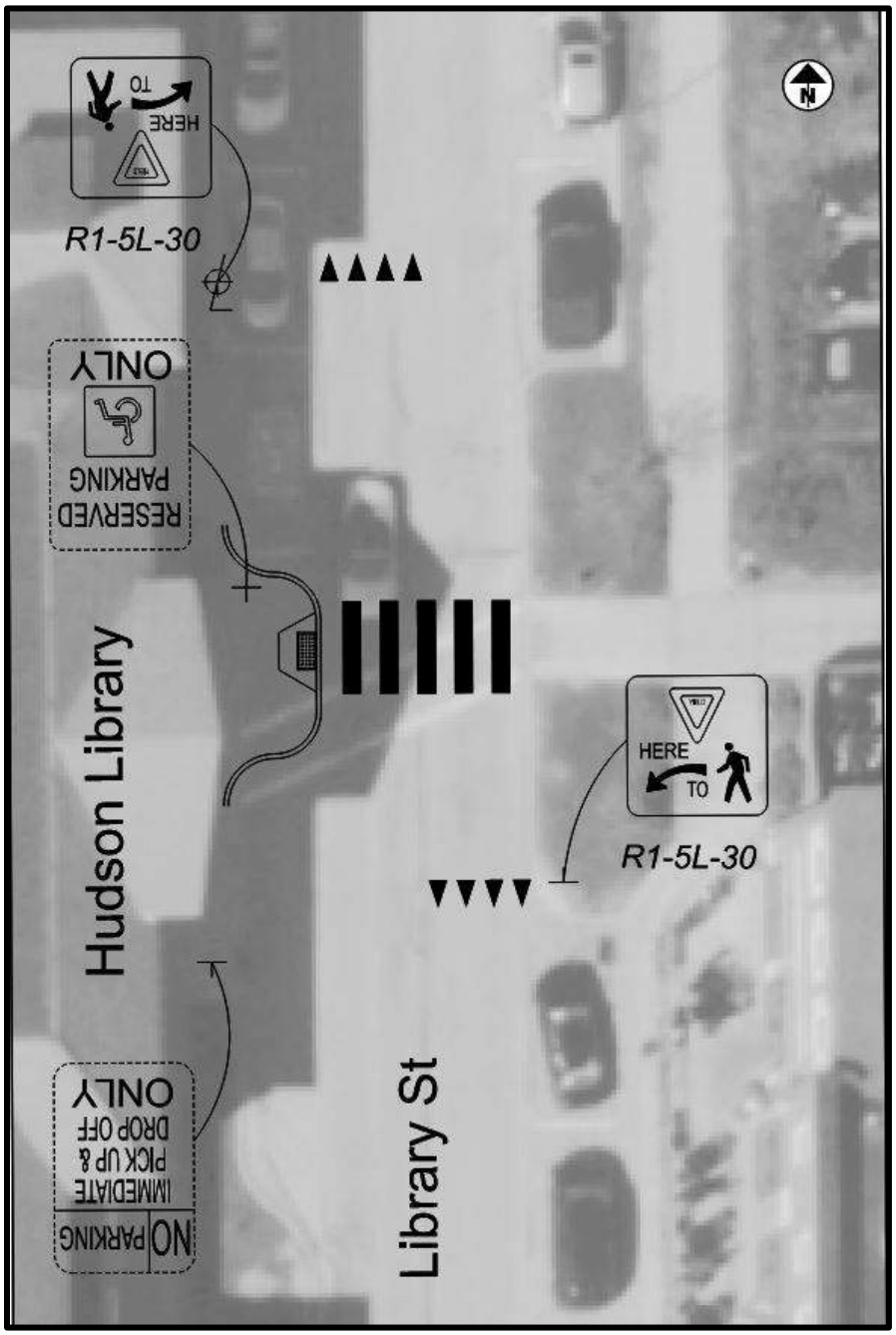
FIGURE 28: STREETSBORO ST & OVIATT ST ALTERNATIVE 2



Library St & Hudson Library

There is a marked crosswalk at the entrance to the Hudson Library and Historical Society on Library St. The crosswalk is at an angle across Library St, and the running slope is excessive on the west side. A curb extension should be constructed perpendicular to the existing east side curb ramp. The crossing will increase pedestrian visibility from behind the parked cars along Library St and reduce the length of the crossing. The curb extension has been shown as narrow to avoid impacts to street parking to the north and the drop off zone to the south.

FIGURE 29: LIBRARY ST & HUDSON LIBRARY RECOMMENDED IMPROVEMENTS



Clinton St & Library St

There is a marked crosswalk for crossing Library St at this intersection, but no marked crossing of Clinton St. During field observations, crossings by pedestrians were noted to reach the parking lot on the north side of Clinton St. The City noted that they are considering reconstructing the driveway to the parking lot to better align with Library St. Alternatives for the existing configuration and for the potential relocated driveway scenario are presented in this report.

For the existing driveway location, Alternative 1 proposes that a crossing is added between driveway and Library St approaches in line with the existing east side sidewalk on Library St. Alternative 2 assumes that the driveway will be relocated to align with its western curb line and maintain the existing width. In this scenario, a crossing should be added across the east approach of the intersection. A curb extension should be added to improve pedestrian visibility from behind parked cars along Clinton St. Note that because there is already a curb extension, including one in the proposed scenario is possible without reducing the existing number of parking stalls.

FIGURE 30: LIBRARY ST & CLINTON ST ALTERNATIVE 1

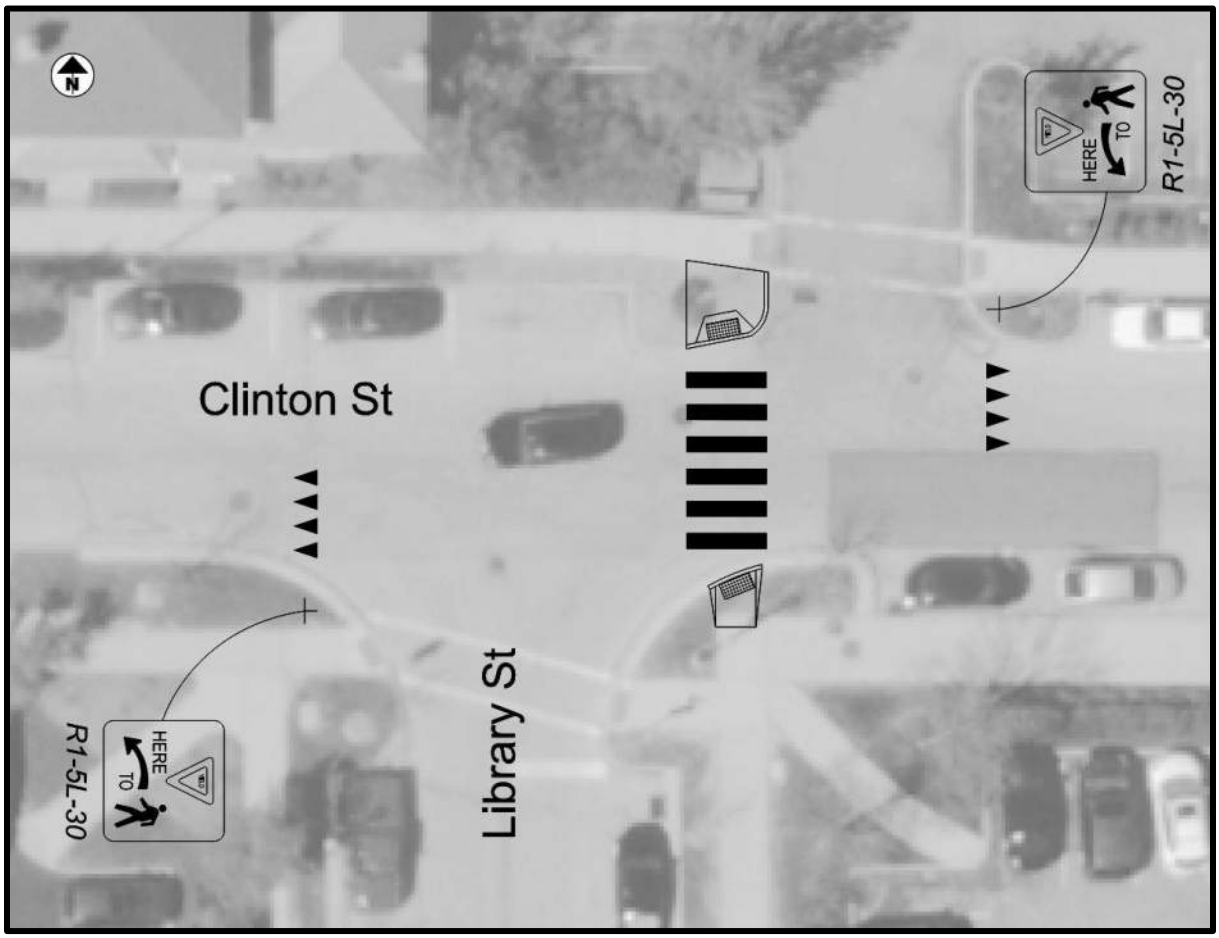
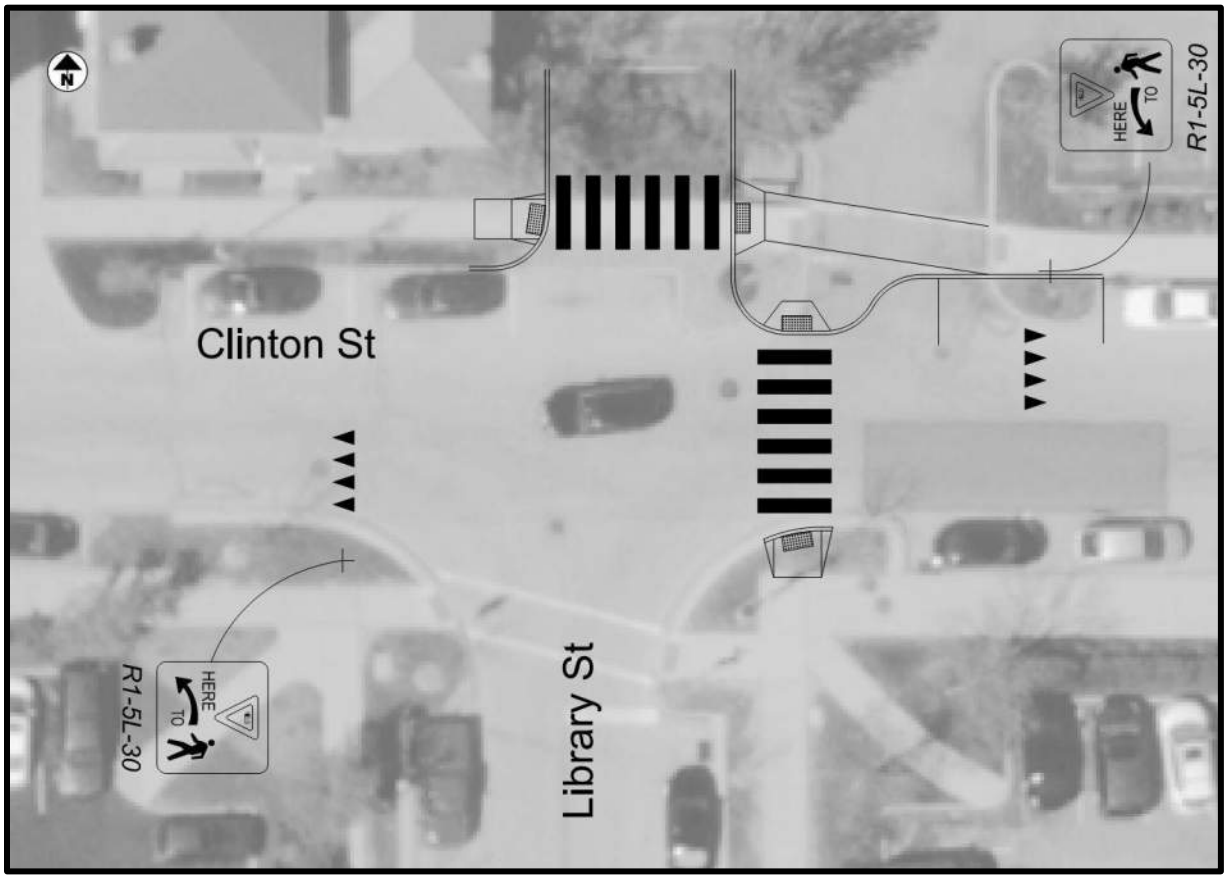


FIGURE 31: LIBRARY ST & CLINTON ST ALTERNATIVE 2



6. COST ESTIMATE SUMMARY

Cost estimates were assembled for each location where improvements were suggested. Where multiple alternatives were presented, costs were assessed separately. The cost estimate includes a 25% predesign contingency to account for design and construction risk due to utilities, inflation, etc. Additional details of the cost estimates are shown in **Appendix C**.

The total given represents the construction cost of implementing Alternative 1 at each intersection. The improvements identified are independent of each other. Based on factors such as funding, material availability, and public interest, it may be best to program the projects in groups, corridors, or otherwise divide the work. The costs shown in **Table 8** are the estimated construction cost (developed in Appendix C) plus 10% design, 10% bonding, and 25% construction contingency. Construction is assumed to be in summer or fall of 2022. If construction were to be conducted later, inflation should be considered.

TABLE 8: COST ESTIMATE SUMMARY

No.	Intersection	Alternative 1	Alternative 2	Alternative 3	Alternative 4
A1	North Main Street	$37,000	-		
A2	East Main Street	$16,500	-		
A3	College Street	$17,900	-		
A4	Oviatt Street	$40,400	-		
A5	Franklin Street	$4,800	-		
A6	Old Orchard Street	$7,900	$19,000		
A7	Hudson Street	$66,700	$52,000		
M1	Stoney Hill Drive	$5,500	-		
M2	Colony Drive	$75,200	$303,600	$46,800	$12,100
M3	John Clark Lane	$1,100	-		
M4	Thirty Acres Street	$7,700	-		
M5	Nantucket Drive	$3,300	-		
M6	Stokes Lane	$1,100	-		
M7	Bard Drive	$3,300	-		
M8	Veterans Way	$17,300	-		
M9	Ravenna Street	$1,100	-		
M10	SR 303	$43,100	-		
M11	Church Street/Park Lane	$1,100	-		
M12	Hudson Green Crossing	$1,100	-		
A1	Aurora Street	See above			
M14	Owen Brown Street	$66,300	-		
M15	Baldwin Street	$96,200	$61,100		
M16	Chapel Street	$26,100	$5,500		

No.	Intersection	Alternative 1	Alternative 2	Alternative 3	Alternative 4
M17	Prospect Street	$5,500	-		
L1	Park Ln	$1,100	-		
L2	Village Way	$5,500	-		
L3	Hudson Library	$13,000	-		
L4	Clinton Street	$12,100	$12,100		
F1	Park Ln	$4,400	-		
F2	Village Way	$4,400	-		
F3	Clinton Street	$3,300	-		
M10	Main Street	See above			
S1	East Main	$68,800	$36,500		
S2	College Street	$17,100	-		
S3	Oviatt Street	$63,400	$126,600		
S4	Bradley Drive	$1,100	-		
S5	Edward (private)	$0	-		
S6	Fox Trace Lane	$1,100	-		
S7	Roslyn Street	$0	-		
S8	Pinewood Lane	$1,300	-		
S9	Manor Drive	$1,100	-		
S10	Hayden Parkway	$12,000	-		

* Does not include cost of relocated driveway or curb extension.

Each of the improvements could be constructed individually without relying on improvements at other locations. At many locations, there are multiple options. As shown above in **Table 8**, individual improvements range from $1,100 to $303,600 in the highest case. If all improvements were to be constructed, the price would range from $507,000 to $1.1 million dollars, depending on the selection of alternatives.

7. CONCLUSIONS AND NEXT STEPS

The City of Hudson has a number of residential areas, schools, businesses, and green spaces that encourage pedestrian activity. Furthermore, development efforts that will generate additional pedestrian demand on the main streets and throughout Downtown Hudson are ongoing. This study assessed the pedestrian facilities on Main St, Streetsboro Rd, Aurora St, and in the First & Main area with the purpose of ensuring ADA compliance, improving safety for pedestrians, and encouraging pedestrian and bicycle travel throughout the project area in Hudson. To this end, pedestrian counts, field observations, and sight distance measurements were taken. An analysis of crash data showed that 10 pedestrian crashes occurred in the study area from 2011-2021, including one fatal crash in November 2020.

This Feasibility Study represents a list of recommended improvements submitted to the City of Hudson. These improvements include pedestrian signals and beacons, curb extensions and pedestrian islands, signs, and sidewalk improvements. The study also proposes a pedestrian district around Downtown Hudson to create a more pedestrian-friendly character.

ODOT HSIP Funding Program can be utilized to implement recommendations from this study. Both Formal application and pedestrian Systemic application options are available. **Appendix D** includes documentation on the ODOT's new pedestrian Systemic application.

This document will be reviewed by city staff and the City Council. Then it will be presented to the public at an open meeting, where comments will be collected. These comments will be incorporated into a Final Feasibility Study, which will be presented to the city.

APPENDIX A
FIELD MEASUREMENTS

		Measured	Approach	Direction	Distance (ft)	Notes
A	1. Aurora Street					
A1	g. North Main Street SR 91	None				
A2	f. East Main Street	None				
A3	e. College Street	Standard	NB	East	300+	
				West	205	
			SB	West	215	
A4	d. Oviatt Street	Standard	NB	West	275	
				East	175	
			SB	East	350	
A5	c. Franklin Street	Standard	NB	West	335	
A6	b. Old Orchard Street	Pedestrian	NB	East	27	SE corner, bushes and tree block pedestrians
A7	a. Hudson Street	Pedestrian	EB	South	55	Vegetation blocks pedestrians crossing Hudson
M	2. Main Street SR 91/Darrow Road					
M1	a. Stoney Hill Drive	None				
M2	b. Colony Drive	None				
M3	c. John Clark Lane	None				
M4	d. Thirty Acres Street	None				
M5	e. Nantucket Drive	None				
M6	f. Stokes Lane	None				
M7	g. Bard Drive	None				
M8	h. Veteran's Way	None				
M9	i. Ravenna Street	None				
M10	j. Streetsboro Street SR 3	Standard	EB	North	176	Elevation difference on south approach, right turn lane vehicles
M11	k. Church Street/Park Lane	Standard	EB	North	91	
M12	l. Hudson Green Crossing	None				
A1	m. Aurora Street	None				
M13	n. Clinton Street	Standard		North	91	Blocked by parked car
			EB	South	154	
M14	o. Owen Brown Street	Standard	EB	South	144	Blocked by parked car
M15	p. Baldwin Street	None				Under construction, no measurements could be taken
M16	q. Chapel Street	Standard	WB	South	402	Limited by hill on Main St
M17	r. Prospect Street	Standard	EB	North	290	
		Pedestrian	EB	West	215	Limited SD of crossing peds due to elevations on Prospect
	3. Library Street					
L1	Park Ln					
L2	a. Village Way	None				
L3	midblock at Hudson Library	None				
L4	b. Clinton Street	None				
	4. First Street					
F1	Park Ln					
F2	a. Village Way	Pedestrian	EB	South	57	SE corner, blocked by parked cars
F3	b. Clinton Street	Pedestrian	NB	West	80	SE corner
	5. Streetsboro Street SR 303					
M10	a. Main Street SR 91					
S1	b. East Main	Standard	NB	East	211	
S2	c. College Street	Standard	NB	East	400+	

		Measured	Approach	Direction	Distance (ft)	Notes
		Standard	SB	East	420+	
S3	d. Oviatt Street	Standard	NB	West	357	
S4	e. Bradley Drive	None				
S5	f. Edward (private)	None				
S6	g. Fox Trace Lane	Standard	NB	West	425	
S7	h. Roslyn Street	None				
S8	i. Pinewood Lane	None				
S9	j. Manor Drive	Standard	NB	West	440+	
S10	k. Hayden Parkway	Standard	NB	East	300	
			SB	East	452	

Notes:

Standard: Vehicular sight distance at approach, using standard 14.5' from EOP. The 14.5 is' generally in the crosswalk.

Pedestrian: Sight distance for pedestrians at or just stepping off curb ramps

Only approaches and directions where sight distance is limited were measured.

		Curb Ramps								
		North Approach		East Approach		South Approach		West Approach		
Intersection	**Measurement**	**West**	**East**	**North**	**South**	**West**	**East**	**North**	**South**	**Other Measurements and Notes**
	Running Slope		9.7	7.3						
	Cross Slope		0.8	0.6						
Aurora & N Main	Side Flares		4.9 / 2.6	3.4 / 6.2						
	Running Slope			9	6.4	3.6	5.5			Sidewalks to the east are between 4 and 4.5 feet. The grade of the sidewalk varies, exceeding the road grade in places.
	Cross Slope			1.2	3.2	0.5	1.5			
Aurora & E Main	Side Flares			2.9 / 8		9.7 / 2.6	14			
	Running Slope				12.7	5.1	12.1	STAIRS		The grade on College is 6% (4.9% cross slope). The grade on Aurora is 0.7% (5.6% (cross slope).
	Cross Slope				2.3	2.7	5.1			
Aurora & College	Side Flares									
	Running Slope				2.3	11.8	5.9	7.7		The grade on Oviatt is 5.2% (0.9% cross slope). The grade on Aurora is 1.5% (4.1% cross slope). A portion of the sidewalk to the east is 3.5' wide.
	Cross Slope				2.2	2.3	2.9	8.9		
Aurora & Oviatt	Side Flares									
	Running Slope					9.9	15.9			The grade on Franklin is 4.7% (1.5% cross slope).
	Cross Slope					10.8	3.3			
Aurora & Franklin	Side Flares									
	Running Slope					5	10.9			The grade on Orchard is 2% (1.5% cross slope).
	Cross Slope					5.2	2.3			
Aurora & Old Orchard	Side Flares									
	Running Slope	2.6		2.5	1.1					
	Cross Slope	1.6		1.1	0.6					
Aurora & Hudson	Side Flares	3 / 9.2		25 / 27						
	Running Slope	2.6					8.2			
	Cross Slope	5.8					2			
Main & Pleasant	Side Flares						4.6 / 8			
	Running Slope			1.6	11.8					The grade on Chapel is 2.3% (1.8% cross slope). The grade on Main is 0.6% (5.2% cross slope).
	Cross Slope			3	1.3					
Main & Chapel	Side Flares				1.7					
	Running Slope	SOIL		6.7	8.8		STAIRS			The grade on Baldwin is 7.2% (1.7% cross slope). The grade on Main is 3.5% (1.7% cross slope). To the south the grade of the east side sidewalk varies, exceeding the road grade in places.
	Cross Slope			6	6.7					
Main & Baldwin	Side Flares									

		Curb Ramps								
		North Approach		East Approach		South Approach		West Approach		
Intersection	**Measurement**	**West**	**East**	**North**	**South**	**West**	**East**	**North**	**South**	**Other Measurements and Notes**
	Running Slope							10.5	3.3	
	Cross Slope							1.7	1.3	
Main & Clinton	Side Flares							3 / 11.8	5.6 / 1.6	
	Running Slope	5.6	5.3							
	Cross Slope	1.3	2.2							
Main & Hudson Square RRFB	Side Flares	10.6 / 9								
	Running Slope				11.2	3.4	2.1			
	Cross Slope				5.2	1.6	1.7			
Main & Church	Side Flares				0.8 / 10.8	5.7 / 8.3	12.3 / 8.2			
	Running Slope			2.7	7.7	2.5	7	4.7	2.2	
	Cross Slope			1.8	1.8	2.7	6.2	2.8	1.7	
Main & Streetsboro	Side Flares			8.8 / 5.9	5.7 / 15	14.2 / 7.3	6.2 /13.5	14.6 / 1.9	3.4 / 8	
	Running Slope			0.1	3					
	Cross Slope			1	0.9					
Main & Ravenna	Side Flares			3.8 / 0	2.7 / 4.9					
	Running Slope		5.4	4.8				6.2	8	
	Cross Slope		3.6	0.7				0.7	3.7	
Main & Veterans	Side Flares		8.7 / 3.6	9.7 / 7.3				5.6 / 5.5	5.6 / 12.9	
	Running Slope			3.8	1.9					South approach sidewalk grades range from 5% to 9%, while Main road grade is 3.5%.
	Cross Slope			3.3	1.2					
Main & Bard	Side Flares			8.1 / 3.7	9.1 / 0.7					
	Running Slope			7						East side sidewalk ends at this intersection with no crossing to the west side sidewalk.
	Cross Slope			0.7						
Main & Nantucket	Side Flares			21.5 / 15.5						
	Running Slope							4.7	3.7	
	Cross Slope							0.2	2.1	
Main & John Clark	Side Flares									
	Running Slope				2.7	4.2				
	Cross Slope				0.9	2.8				
Main & Colony	Side Flares									

		Curb Ramps								
		North Approach		East Approach		South Approach		West Approach		
Intersection	Measurement	West	East	North	South	West	East	North	South	Other Measurements and Notes
	Running Slope	2.5	7							
	Cross Slope	1.1	0.4							
Main & Stoney Hill	Side Flares	32.3 / 19.7	6.1 / 7.1							
	Running Slope	11.5	5.2	2.9	1.9	3.2				
	Cross Slope	6.1	1.4	1.2	3	3.4				
Streetsboro & E Main	Side Flares	3								
	Running Slope	7.8	7.4		5.9	11.2				The grade on Streetsboro is 3.9% (3.4% cross slope). The grade on College is 3.7% (0.1% cross slope). Southwest curb ramp landing is 4.3' wide.
	Cross Slope	1.3	10.7		1	1.6				
Streetsboro & College	Side Flares	3.1			6.9 / 30.2					
	Running Slope	7	12	8.5	11.1			8.6	11.6	The grade on Oviatt is 1.7% (0.8% cross slope). The grade on Streetsboro is 0.3% (4.8% cross slope).
	Cross Slope	2.8	3	2.7	5.5			0.8	2.8	
Streetsboro & Oviatt	Side Flares									
	Running Slope					4.6	1.7			Fox Trace grade is 2.6% (1.6% cross slope).
	Cross Slope					0.4	2.8			
Streetsboro & Fox Trace	Side Flares									
	Running Slope							4.3	8.5	
	Cross Slope							0.6	1	
Streetsboro & Roslyn	Side Flares									
	Running Slope					2.7	7			
	Cross Slope					1.5	1.3			
Streetsboro & Pinewood	Side Flares									
	Running Slope					1.3	3.3			
	Cross Slope					0.6	1			
Streetsboro & Manor	Side Flares									
	Running Slope					7.3	10.8	6	15.7	
	Cross Slope					8	3	5	2.5	
Streetsboro & Hayden Run	Side Flares						NA / 14.5		NA / 27	
	Running Slope	4.7	3.7	3.7	5.1	0.8	6.7	9.5	5.4	
	Cross Slope	0.6	0.7	1.4	1.9	0.8	0.3	0.8	3	
First & Park	Side Flares									

		Curb Ramps								
		North Approach		East Approach		South Approach		West Approach		
Intersection	**Measurement**	**West**	**East**	**North**	**South**	**West**	**East**	**North**	**South**	**Other Measurements and Notes**
	Running Slope	3.5	5.8	3	10.2	13.1	2.7	5.9	13.4	
	Cross Slope	1	1	0.1	2.3	1.5	4.4	1.4	6.8	Broken domes on south curb ramp on west approach
First & Village	Side Flares									
	Running Slope			7.2	2.5	7	8.1			
	Cross Slope			0.6	1.6	2	0.6			
First & Clinton	Side Flares						7.2 / 7.2			
	Running Slope	2.4	5.3			1	2.3			
	Cross Slope	1.7	1.9			0.4	1.5			Broken domes on east curb ramp on south approach
Library & Clinton	Side Flares									
	Running Slope	10.4	8.3							
	Cross Slope	0.2	1.5							
Library & Hudson Library	Side Flares	9 / 7	28 / 16.2							
	Running Slope	2.5	6.6	5.6	7.6	4	5.8	4.6	9.6	
	Cross Slope	1.7	0.6	1.6	1.1	2.2	1.9	1.7	0.2	
Library & Village	Side Flares				2.9 / NA					
	Running Slope			5.5	5.2	7.3	8.2	1.4	1.8	
	Cross Slope			1.5	0.2	1.7	0.5	1.6	1.5	
Library & Park	Side Flares									

APPENDIX B
CRASH SUMMARIES

DOWNTOWN HUDSON PED/BIKE CRASHES

Crash Summary Sheet

Fatalities	1
Serious Injuries	0
Other Injuries	16

Crashes Per Year	1.82
Fatal and All Injury Crashes	17
Percent Injury	85.0%
Equivalent PDO Index Value	7.71

Crash Severity	Crashes	%
(1) Fatal	1	5.00%
(3) Minor Injury Suspected	6	30.00%
(4) Injury Possible	10	50.00%
(5) PDO/No Injury	3	15.00%
Grand Total	20	100.00%

Year	Crashes	%
2011	1	5.00%
2012	1	5.00%
2013	1	5.00%
2014	4	20.00%
2016	2	10.00%
2017	1	5.00%
2018	1	5.00%
2019	5	25.00%
2020	3	15.00%
2021	1	5.00%
Grand Total	20	100.00%

Day of Week	Crashes	%
(1) Sunday	1	5.00%
(2) Monday	2	10.00%
(3) Tuesday	1	5.00%
(4) Wednesday	5	25.00%
(5) Thursday	4	20.00%
(6) Friday	3	15.00%
(7) Saturday	4	20.00%
Grand Total	20	100.00%

Crash Type	Crashes	%
Pedestrian	10	50.00%
Pedalcycles	10	50.00%
Grand Total	20	100.00%

Hour of Day	Crashes	%
8	1	5.00%
11	1	5.00%
12	1	5.00%
13	2	10.00%
14	2	10.00%
15	4	20.00%
16	1	5.00%
17	3	15.00%
18	3	15.00%
21	2	10.00%
Grand Total	20	100.00%

Month	Crashes	%
1	2	10.00%
2	1	5.00%
4	2	10.00%
5	2	10.00%
6	3	15.00%
7	1	5.00%
8	1	5.00%
9	1	5.00%
10	3	15.00%
11	3	15.00%
12	1	5.00%
Grand Total	20	100.00%

DOWNTOWN HUDSON PED/BIKE CRASHES

Crash Summary Sheet

Weather Condition	Crashes	%
Clear	13	65.00%
Cloudy	4	20.00%
Rain	3	15.00%
Grand Total	20	100.00%

Road Condition	Crashes	%
Dry	15	75.00%
Wet	5	25.00%
Grand Total	20	100.00%

Light Condition	Crashes	%
Daylight	16	80.00%
Dark - Lighted Roadway	2	10.00%
Other / Unknown	1	5.00%
Dark - Roadway Not Lighted	1	5.00%
Grand Total	20	100.00%

Number of Units	Crashes	%
2	20	100.00%
Grand Total	20	100.00%

ODOT Location	Crashes	%
Not An Intersection	7	35.00%
Four-Way Intersection	6	30.00%
T-Intersection	4	20.00%
Driveway/Alley Access	3	15.00%
Grand Total	20	100.00%

Work Zone Related	Crashes	%
No	20	100.00%
Grand Total	20	100.00%

Alcohol Related	Crashes	%
No	20	100.00%
Grand Total	20	100.00%

Drug Related (Inc. Marijuana)	Crashes	%
No	20	100.00%
Grand Total	20	100.00%

Contour	Crashes	%
Straight Grade	1	5.00%
Straight Level	19	95.00%
Grand Total	20	100.00%

Marijuana Related	Crashes	%
No	20	100.00%
Grand Total	20	100.00%

Roadway Departure	Crashes	%
No	20	100.00%
Grand Total	20	100.00%

Older Driver (65+)	Crashes	%
No	16	80.00%
Yes	4	20.00%
Grand Total	20	100.00%

Intersection Related	Crashes	%
Yes	14	70.00%
No	6	30.00%
Grand Total	20	100.00%

Young Driver (15-25)	Crashes	%
No	17	85.00%
Yes	3	15.00%
Grand Total	20	100.00%

Speed Related	Crashes	%
No	19	95.00%
Yes	1	5.00%
Grand Total	20	100.00%

Motorcycle Involved	Crashes	%
No	20	100.00%
Grand Total	20	100.00%

DOWNTOWN HUDSON PED/BIKE CRASHES

Crash Summary Sheet

Unit 1 Summary

Unit 1 Pre-Crash Action	Crashes	%
Making Right Turn	6	30.00%
Straight Ahead	4	20.00%
Walking, Running, Jogging, Playing	2	10.00%
Data Not Valid or Not Provided	2	10.00%
Making Left Turn	2	10.00%
Backing	1	5.00%
Entering Traffic Lane	1	5.00%
Entering or Crossing Specified Location	1	5.00%
Slowing or Stopped In Traffic	1	5.00%
Grand Total	20	100.00%

Unit 1 Contributing Factor	Crashes	%
Failure to Yield	13	65.00%
Other Improper Action	3	15.00%
Improper Crossing	2	10.00%
Ran Red Light	1	5.00%
None	1	5.00%
Grand Total	20	100.00%

Unit 1 Object Struck	Crashes	%
Nothing Struck	20	100.00%
Grand Total	20	100.00%

Unit 1 Traffic Control	Crashes	%
Signal	10	50.00%
No Control	9	45.00%
Stop Sign	1	5.00%
Grand Total	20	100.00%

Unit 1 Posted Speed	Crashes	%
0	4	20.00%
25	15	75.00%
35	1	5.00%
Grand Total	20	100.00%

Unit 1 Direction From	Crashes	%
East	7	35.00%
North	5	25.00%
West	4	20.00%
South	4	20.00%
Grand Total	20	100.00%

Unit 1 Direction To	Crashes	%
North	8	40.00%
West	6	30.00%
East	3	15.00%
South	2	10.00%
Southwest	1	5.00%
Grand Total	20	100.00%

Unit 1 Type	Crashes	%
Passenger Car	8	40.00%
Sport Utility Vehicle	5	25.00%
Pedestrian/Skater	3	15.00%
Bicycle	3	15.00%
Passenger Van (minivan)	1	5.00%
Grand Total	20	100.00%

Unit 1 Special Function	Crashes	%
None	19	95.00%
Snow Removal	1	5.00%
Grand Total	20	100.00%

DOWNTOWN HUDSON PED/BIKE CRASHES

Crash Summary Sheet

Unit 2 Summary

Unit 2 Pre-Crash Action	Crashes	%
Straight Ahead	6	30.00%
Entering or Crossing Specified Location	5	25.00%
Walking, Running, Jogging, Playing	5	25.00%
Making Right Turn	1	5.00%
	1	5.00%
Entering Traffic Lane	1	5.00%
Making Left Turn	1	5.00%
Grand Total	20	100.00%

Unit 2 Contributing Factor	Crashes	%
None	16	80.00%
Vision Obstruction	1	5.00%
Other Improper Action	1	5.00%
Improper Crossing	1	5.00%
Failure to Yield	1	5.00%
Grand Total	20	100.00%

Unit 2 Direction From	Crashes	%
East	5	25.00%
North	6	30.00%
South	3	15.00%
West	6	30.00%
Grand Total	20	100.00%

Unit 2 Direction To	Crashes	%
East	7	35.00%
North	3	15.00%
South	4	20.00%
West	6	30.00%
Grand Total	20	100.00%

Unit 2 Type	Crashes	%
Pedestrian/Skater	7	35.00%
Bicycle	7	35.00%
Sport Utility Vehicle	3	15.00%
Unknown or Hit/Skip	1	5.00%
Passenger Car	1	5.00%
Passenger Van (minivan)	1	5.00%
Grand Total	20	100.00%

Unit 2 Special Function	Crashes	%
None	16	80.00%
	4	20.00%
Grand Total	20	100.00%

APPENDIX C
COST ESTIMATES

REF NO.	SHEET NO.	STATION TO STATION		630 SIGN, FLAT SHEET SF	630 GROUND MOUNTED SUPPORT, NO. 3 POST FT	630 SIGNING, MISC.:SOLAR POWERED RECTANGULAR RAPID FLASHING BEACON (RRFB) EACH	632 PEDESTAL FOUNDATION EACH	625 GROUND ROD EACH	644 YIELD LINE FT	644 CROSSWALK LINE, 12" FT	644 CROSSWALK LINE, 24" FT	632 PEDESTRIAN SIGNAL HEAD (LED), TYPE D2, COUNTDOWN, AUDIBLE, AS PER PLAN EACH	608 4" CONCRETE WALK SF	608 CURB RAMP SF	608 DETECTABLE WARNING SF	644 CENTER LINE MILE	625 TRENCH IN PAVED AREA FT	625 CONDUIT, 2", 725.04 FT	632 SIGNAL CABLE, 5 CONDUCTOR, NO. 14 AWG FT	630 REMOVAL OF GROUND MOUNTED SIGN AND DISPOSAL, AS PER PLAN EACH	202 WALK REMOVED SF	644 STOP LINE FT	644 REMOVAL OF PAVEMENT MARKING FT	632 ACCESSIBLE PEDESTRIAN PUSHBUTTON, AS PER PLAN EACH
			UNIT PRICE	$ 30	$ 20	$ 10,500	$ 1,200	$ 250	$ 16	$ 10	$ 15	$ 950	$ 25	$ 25	$ 75	$ 9,000	$ 65	$ 28	$ 3	$ 25	$ 8	$ 11	$ 12	$ 950
			Aurora Street																					
A1		**$ 3,800.00**	North Main Street SR 91									4												
A2		**$ 12,360.00**	East Main Street							96	100		300								300			
A3		**$ 11,986.00**	College Street							96	100		50	180	8						280		78	
A4		**$ 28,310.00**	Oviatt Street			2	2	2		48	50			60	16						60			
A5		**$ 3,810.00**	Franklin Street							48	50			60	8						60			
A6		**$ 5,333.00**	Old Orchard Street							48	50			120							120	13		
		$ 10,570.00	Old Orchard Street-**Option 2**							112	110			240							225			
A7		**$ 41,946.00**	Hudson Street-**Option 1**	70.5	140	2	2	2	56	48	50		75	240		0.02				1	315	15	20	
A7		**$ 36,336.00**	Hudson Street-**Option 2**	70.5	140	2	2	2	56	48	50		25	120		0.02				1	145	15	20	
			Main Street SR 91/Darrow Road																					
M1		**$ 3,800.00**	Stoney Hill Drive									4												
M2		**$ 44,835.00**	Colony Drive	45.5	84	3	3	3	30	48	50			120		0.03					120			
M3		**$ 1,230.00**	John Clark Lane							48	50													
M4		**$ 1,230.00**	Thirty Acres Street							48	50													
M5		**$ 2,730.00**	Nantucket Drive							48	50			60										
M6		**$ 1,230.00**	Stokes Lane							48	50													
M7		**$ 2,730.00**	Bard Drive							48	50			60										
M8		**$ 13,865.00**	Veteran's Way	1.5						192	200	8	50							2				
M9		**$ 1,230.00**	Ravenna Street							48	50													
M10		**$ 29,750.00**	Streetsboro Street SR 303				4	4				8					100	100	1000					4
M11		**$ 1,230.00**	Church Street/Park Lane							48	50													
M12		**$ 1,230.00**	Hudson Green Crossing							48	50													
M13		**$ -**	Aurora Street (SEE A1 ABOVE)																					
M14		**$ 31,200.00**	Clinton Street	30.5	56	2	2	2	30				25	120							145			
M15		**$ 40,585.00**	Baldwin Street	30.5	56	2	2	2	30	48	50		200	180							430			
M16		**$ 18,295.00**	Chapel Street	34.5	70				30	96	100		150	240						2	390			
M17		**$ 3,800.00**	Prospect Street									4												
			Library Street																					
L1		**$ 1,230.00**	Park Ln							48	50													
L2		**$ 5,688.50**	Village Way	6.25	14					192	200									1		12	12	
L3		**$ 6,825.00**	Hudson Library	48.5	84				30	48	50			60							60			
L4		**$ 8,805.00**	Clinton Street	48.5	84				30	48	50			120							120			
			First Street																					
F1		**$ 4,920.00**	Park Ln							192	200													
F2		**$ 4,920.00**	Village Way							192	200													
F3		**$ 3,690.00**	Clinton Street							144	150													
			Streetsboro Street SR 303																					
S1		**$ 30,225.00**	East Main	30.5	56	2	2	2	30	48	50			60	8						60			
S2		**$ 13,245.00**	College Street	48.5	84				30	144	150			180							180			
S3		**$ 44,715.00**	Oviatt Street-**Option 1**	30.5	56	2	2	2	30	96	100			480							480			
		$ 22,150.00	Oviatt Street-**Option 2**	33			2	2		96	100	4		480										
S4		**$ 1,230.00**	Bradley Drive							48	50													
S5		**$ -**	Edward (PRIVATE)																					
S6		**$ 1,230.00**	Fox Trace Lane							48	50													
S7		**$ -**	Roslyn Street (SEPARATE PROJECT)																					
S8		**$ 1,380.00**	Pinewood Lane							48	50				2									
S9		**$ 1,230.00**	Manor Drive							48	50													
S10		**$ 8,735.00**	Hayden Parkway							48	50	4		120	3						60			
TOTALS CARRIED TO GENERAL SUMMARY																								

REF NO.	SHEET NO.	STATION TO STATION					202	202	608	202	609	517	203	252	203		630				611	611	660	666
							CATCH BASIN REMOVED	WALK REMOVED	4" CONCRETE WALK	CURB REMOVED	CURB, TYPE 2-A, AS PER PLAN	RAILING, PIPE	EXCAVATION	FULL DEPTH PAVEMENT SAWING	EMBANKMENT		SIGNING, MISC.:PEDESTRIAN HYBRID BEACON				CATCH BASIN, NO. 3A WITH DIAGONAL GRATE	12" CONDUIT, TYPE B	SODDING UNSTAKED	PRUNING EXISTING TREE, 3 TO 8-INCH DIAMETER
							EACH	SF	SF	FT	FT	FT	CY	FT	CY		EACH				EACH	FT	SY	EACH
			UNIT PRICE				$ 500	$ 8	$ 25	$ 25	$ 37	$ 175	$ 35	$ 6	$ 40		$ 70,000				$ 2,750	$ 125	$ 35	$ 200
			Aurora Street																					
A1		**$ 21,734.00**	North Main Street SR 91				1		413	71	88		16	88	1						1	16		
A2		**$ -**	East Main Street																					
A3		**$ 1,296.00**	College Street					59		12	12				2									
A4		**$ -**	Oviatt Street																					
A5		**$ -**	Franklin Street																					
A6		**$ 600.00**	Old Orchard Street-**Option 1**																					3
		$ 7,700.00	Old Orchard Street-**Option 2**						290	18														
A7		**$ 4,545.00**	Hudson Street-**Option 1**							48	80		1										10	
A7		**$ -**	Hudson Street-**Option 2**																					
M		**$ -**	**Main Street SR 91/Darrow Road**																					
M1		**$ -**	Stoney Hill Drive																					
M2		**$ 6,802.00**	Colony Drive						84		84		11	84	1								19	
M3		**$ -**	John Clark Lane																					
M4		**$ -**	Thirty Acres Street																					
M5		**$ -**	Nantucket Drive																					
M6		**$ -**	Stokes Lane																					
M7		**$ -**	Bard Drive																					
M8		**$ -**	Veteran's Way																					
M9		**$ -**	Ravenna Street																					
M10		**$ -**	Streetsboro Street SR 303																					
M11		**$ -**	Church Street/Park Lane																					
M12		**$ -**	Hudson Green Crossing																					
M13		**$ -**	Aurora Street (SEE A1 ABOVE)																					
M14		**$ 12,722.00**	Clinton Street					196	325	30	48		5	48	1									
M15		**$ 26,250.00**	Baldwin Street									150												
M16		**$ 660.00**	Chapel Street							10	10				1									
M17		**$ -**	Prospect Street																					
			Library Street																					
L1		**$ -**	Park Ln																					
L2		$ -	Village Way																					
L3		**$ 2,589.00**	Hudson Library							30	42		7		1									
L4		**$ -**	Clinton Street																					
			First Street																					
F1		**$ -**	Park Ln																					
F2		**$ -**	Village Way																					
F3		**$ -**	Clinton Street																					
			Streetsboro Street SR 303																					
S1		**$ 18,900.00**	East Main									108												
S2		**$ -**	College Street																					
S3		**$ -**	Oviatt Street-**Option 1**																					
		$ 70,000.00	Oviatt Street-**Option 2**														1							
S4		**$ -**	Bradley Drive																					
S5		**$ -**	Edward (PRIVATE)																					
S6		**$ -**	Fox Trace Lane																					
S7		**$ -**	Roslyn Street (SEPARATE PROJECT)																					
S8		**$ -**	Pinewood Lane																					
S9		**$ -**	Manor Drive																					
S10		**$ -**	Hayden Parkway																					
TOTALS CARRIED TO GENERAL SUMMARY																								

APPENDIX D
PEDESTRIAN SAFETY RESOURCES

6.6 Systemic Safety Funding Application

6.6.1 Overview

ODOT has developed a new systemic safety funding application that will focus on two major crash types in Ohio – roadway departure and pedestrians. It will be funded through the Highway Safety Improvement Program. This new program is intended to be a proactive approach to reducing crashes on target facilities or roadways. HSIP staff has identified target facilities and proven safety countermeasures that are eligible for funding based on historical crash trends and national research.

The systemic safety funding application is due to Central Office annually by **January 31** of each year. Local sponsors should coordinate applications with their local district office at least six weeks in advance of this deadline. Every application and supporting documentation must be reviewed and approved by the district prior to submission to Central Office. This application and supporting documentation will be used by the Safety Program Committee to set the safety program priorities

6.6.2 Systemic Pedestrian Program

Locations within projects applied for under the systemic pedestrian program should meet the following requirements. This information can be found in TIMS, as well as the Safety Map Viewer:

- On a Principal or Minor Arterial or Major Collector (Functional Classifications 3, 4, and 5)
- On a segment in which the posted speed limit is 45 mph or below
- Within or adjacent to a census block group with a combined Active Transportation Demand and Need Score of 5 or greater
    - Project sponsors may include locations below this threshold if they can justify why this score may not be accurate for one or more of their project locations

The promoted countermeasures for systemic pedestrian treatments are listed below. Countermeasures beyond this list may be considered, but it is recommended project sponsors utilize this list. If countermeasures not on this list are applied for, written justification should be provided:

- Pavement Markings
    - High Visibility Crosswalks
    - Advance Yield Markings
    - Signage
    - Standard Crosswalk Signs
    - RRFBs
    - Overhead Signs
- Signals
    - Pedestrian Hybrid Beacons
    - Accessible Pedestrian Signals
    - Pedestrian Countdown Signals
    - Leading Pedestrian Intervals
- Geometric Changes
    - Curb Ramps
    - Raised Crosswalks
    - Curb Extensions
    - Reduced Curb Radii
    - Refuge Islands
    - Sidewalk
    - Road Diets

- Lighting
    - Pedestrian Scale Lighting
    - Intersection Lighting

6.6.3 Systemic Roadway Departure Program

Locations within projects applied for under the systemic pedestrian program should meet the following requirements. This information can be found in TIMS, as well as the Safety Map Viewer:

- On a Principal or Minor Arterial or Major Collector (Functional Classifications 3, 4, and 5)
- Speed limit of…
    - 35 mph or greater in urban/suburban settings
    - 45 mph or greater in rural settings

The promoted countermeasures for systemic pedestrian treatments are listed below. Countermeasures beyond this list may be considered, but it is recommended project sponsors utilize this list. If countermeasures not on this list are applied for, written justification should be provided:

- Increasing pavement width to accommodate centerline and/or edge line rumble strips or stripes
- Wider shoulders for bicycles and/or buggies
- Improving roadside safety in a…
    - Rural context:
        - Flattening end condition slopes
        - Modifying ditches
        - Removing type-A guardrail
        - Removing/relocating fixed objects (trees, utility poles, etc.)
    - Urban/suburban context:
        - Removing type-A guardrail
        - Removing/relocating fixed objects (trees, utility poles, etc.)
        - Road diets

MAKING OUR ROADS SAFER

One Countermeasure at a Time

28 Proven Safety Countermeasures that offer significant and measurable impacts to improving safety

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Proven Safety Countermeasures

SPEED MANAGEMENT

Speed Safety Cameras

Variable Speed Limits

Appropriate Speed Limits for All Road Users

ROADWAY DEPARTURE

Wider Edge Lines

Enhanced Delineation for Horizontal Curves

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

SafetyEdge℠

Roadside Design Improvements at Curves

Median Barriers

INTERSECTIONS

Backplates with Retroreflective Borders

Corridor Access Management

Dedicated Left- and Right-Turn Lanes at Intersections

Reduced Left-Turn Conflict Intersections

Roundabouts

Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

Yellow Change Intervals

PEDESTRIANS/BICYCLES

Crosswalk Visibility Enhancements

Bicycle Lanes

Rectangular Rapid Flashing Beacons (RRFB)

Leading Pedestrian Interval

Medians and Pedestrian Refuge Islands in Urban and Suburban Areas

Pedestrian Hybrid Beacons

Road Diets (Roadway Reconfiguration)

Walkways

CROSSCUTTING

Pavement Friction Management

Lighting

Local Road Safety Plans

Road Safety Audit

U.S. Department of Transportation
Federal Highway Administration

Crosswalk Visibility Enhancements

Poor lighting conditions, obstructions such as parked cars, and horizontal or vertical roadway curvature can reduce visibility at crosswalks, contributing to safety issues. For multilane roadway crossings where vehicle volumes are in excess of 10,000 Average Annual Daily Traffic (AADT), a marked crosswalk alone is typically not sufficient. Under such conditions, more substantial crossing improvements could prevent an increase in pedestrian crash potential.

Three main crosswalk visibility enhancements help make crosswalks and the pedestrians, bicyclists, wheelchair and other mobility device users, and transit users using them more visible to drivers. These include high-visibility crosswalks, lighting, and signing and pavement markings. These enhancements can also assist users in deciding where to cross. Agencies can implement these features as standalone or combination enhancements to indicate the preferred location for users to cross.

Safety Benefits:

High-visibility crosswalks can reduce pedestrian injury crashes up to:

40% [1]

Intersection lighting can reduce pedestrian crashes up to:

42% [2]

Advance yield or stop markings and signs can reduce pedestrian crashes up to:

25% [3]

High-visibility crosswalks

High-visibility crosswalks use patterns (i.e., bar pairs, continental, ladder) that are visible to both the driver and pedestrian from farther away compared to traditional transverse line crosswalks. They should be considered at all midblock pedestrian crossings and uncontrolled intersections. Agencies should use materials such as inlay or thermoplastic tape, instead of paint or brick, for highly reflective crosswalk markings.

Improved Lighting

The goal of crosswalk lighting should be to illuminate with positive contrast to make it easier for a driver to visually identify the pedestrian. This involves carefully placing the luminaires in forward locations to avoid a silhouette effect of the pedestrian.

Enhanced Signing and Pavement Markings

On multilane roadways, agencies can use "YIELD Here to Pedestrians" or "STOP Here for Pedestrians" signs 20 to 50 feet in advance of a marked crosswalk to indicate where a driver should stop or yield to pedestrians, depending on State law. To supplement the signing, agencies can also install a STOP or YIELD bar (commonly referred to as "shark's teeth") pavement markings.

In-street signing, such as "STOP Here for Pedestrians" or "YIELD Here to Pedestrians" may be appropriate on roads with two- or three-lane roads where speed limits are 30 miles per hour or less.

Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_VizEnhancemt2018.pdf.

1 Chen, L., C. Chen, and R. Ewing. The Relative Effectiveness of Pedestrian Safety Countermeasures at Urban Intersections - Lessons from a New York City Experience. (2012).
2 Elvik, R. and Vaa, T. Handbook of Road Safety Measures. Oxford, United Kingdom, Elsevier, (2004).
3 Zeeger et al. Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, FHWA, (2017).

FHWA-SA-21-049

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Rectangular Rapid Flashing Beacons (RRFB)

A marked crosswalk or pedestrian warning sign can improve safety for pedestrians crossing the road, but at times may not be sufficient for drivers to visibly locate crossing locations and yield to pedestrians. To enhance pedestrian conspicuity and increase driver awareness at uncontrolled, marked crosswalks, transportation agencies can install a pedestrian actuated Rectangular Rapid Flashing Beacon (RRFB) to accompany a pedestrian warning sign. RRFBs consist of two, rectangular- shaped yellow indications, each with a light-emitting diode (LED)-array-based light source.[1] RRFBs flash with an alternating high frequency when activated to enhance conspicuity of pedestrians at the crossing to drivers.

For more information on using RRFBs, see the Interim Approval in the *Manual on Uniform Traffic Control Devices (MUTCD)*.[1]

Safety Benefits:

RRFBs can reduce crashes up to:

47%

for pedestrian crashes.[4]

RRFBs can increase motorist yielding rates up to:

98%

(varies by speed limit, number of lanes, crossing distance, and time of day).[3]

RRFBs used at a trail crossing.
Source: LJB

Applications

The RRFB is applicable to many types of pedestrian crossings but is particularly effective at multilane crossings with speed limits less than 40 miles per hour.[2] Research suggests RRFBs can result in motorist yielding rates as high at 98 percent at marked crosswalks, but varies depending on the location, posted speed limit, pedestrian crossing distance, one- versus two-way road, and the number of travel lanes.[3] RRFBs can also accompany school or trail crossing warning signs.

RRFBs are placed on both sides of a crosswalk below the pedestrian crossing sign and above the diagonal downward arrow plaque pointing at the crossing.[1] The flashing pattern can be activated with pushbuttons or passive (e.g., video or infrared) pedestrian detection, and should be unlit when not activated.

Considerations

Agencies should:[2]

- Install RRFBs in the median rather than the far-side of the roadway if there is a pedestrian refuge or other type of median.
- Use solar-power panels to eliminate the need for a power source.
- Reserve the use of RRFBs for locations with significant pedestrian safety issues, as over-use of RRFB treatments may diminish their effectiveness.

Agencies shall not:[2]

- Use RRFBs without the presence of a pedestrian, school or trail crossing warning sign.
- Use RRFBs for crosswalks across approaches controlled by YIELD signs, STOP signs, traffic control signals, or pedestrian hybrid beacons, except for the approach or egress from a roundabout.

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_RRFB_2018.pdf.

1 *MUTCD* Interim Approval 21 - RRFBs at Crosswalks.
2 "Rectangular Rapid Flash Beacon" in PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System. FHWA, (2013).
3 Fitzpatrick et al. "Will You Stop for Me? Roadway Design and Traffic Control Device Influences on Drivers Yielding to Pedestrians in a Crosswalk with a Rectangular Rapid-Flashing Beacon." Report No. TTI-CTS-0010. Texas A&M Transportation Institute, (2016).
4 NCHRP Research Report 841 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, (2017).

FHWA-SA-21-053

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Medians and Pedestrian Refuge Islands in Urban and Suburban Areas

A **median** is the area between opposing lanes of traffic, excluding turn lanes. Medians in urban and suburban areas can be defined by pavement markings, raised medians, or islands to separate motorized and non-motorized road users.

A **pedestrian refuge island** (or crossing area) is a median with a refuge area that is intended to help protect pedestrians who are crossing a road.

Safety Benefits:

Median with Marked Crosswalk

46%

reduction in pedestrian crashes.[2]

Pedestrian Refuge Island

56%

reduction in pedestrian crashes.[2]

Pedestrian crashes account for approximately 17 percent of all traffic fatalities annually, and 74 percent of these occur at non-intersection locations.[1] For pedestrians to safely cross a roadway, they must estimate vehicle speeds, determine acceptable gaps in traffic based on their walking speed, and predict vehicle paths. Installing a median or pedestrian refuge island can help improve safety by allowing pedestrians to cross one direction of traffic at a time.

Transportation agencies should consider medians or pedestrian refuge islands in curbed sections of urban and suburban multilane roadways, particularly in areas with a significant mix of pedestrian and vehicle traffic, traffic volumes over 9,000 vehicles per day, and travel speeds 35 mph or greater. Medians/refuge islands should be at least 4-ft wide, but preferably 8 ft for pedestrian comfort. Some example locations that may benefit from medians or pedestrian refuge islands include:

- Mid-block crossings.
- Approaches to multilane intersections.
- Areas near transit stops or other pedestrian-focused sites.

Example of a road with a median and pedestrian refuge islands. Source: City of Charlotte, NC

Median and pedestrian refuge island near a roundabout. Source: www.pedbikeimages.org / Dan Burden

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_PedRefugeIsland2018.pdf.

1 National Center for Statistics and Analysis. (2020, March). Pedestrians: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 850). National Highway Traffic Safety Administration
2 Desktop Reference for Crash Reduction Factors, FHWA-SA-08-011, September 2008, Table 11.

FHWA-SA-21-044

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Safety Benefits:

55%
reduction in pedestrian crashes.[2]

29%
reduction in total crashes.[3]

15%
reduction in fatal and serious injury crashes.[3]

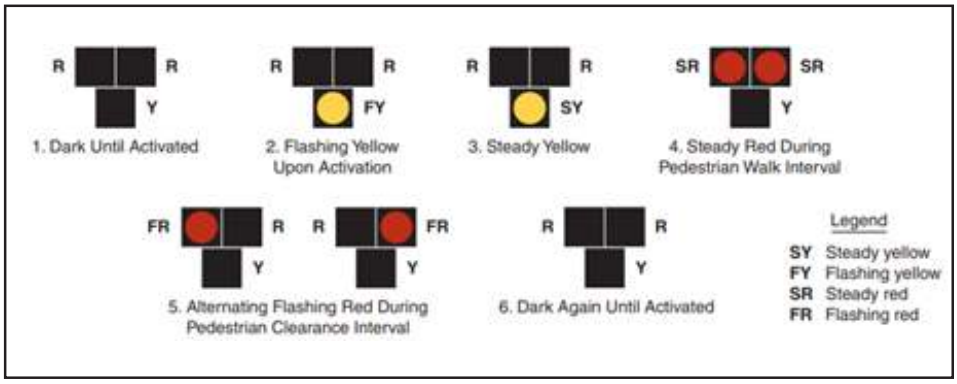
Example of PHBs mounted on a mast arm. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/resources/docs/fhwasa18064.pdf.

FHWA-SA-21-045

Pedestrian Hybrid Beacons

The pedestrian hybrid beacon (PHB) is a traffic control device designed to help pedestrians safely cross higher-speed roadways at midblock crossings and uncontrolled intersections. The beacon head consists of two red lenses above a single yellow lens. The lenses remain "dark" until a pedestrian desiring to cross the street pushes the call button to activate the beacon, which then initiates a yellow to red lighting sequence consisting of flashing and steady lights that directs motorists to slow and come to a stop, and provides the right-of-way to the pedestrian to safely cross the roadway before going dark again.



Sequence for a PHB. Source: MUTCD 2009 Edition, p. 511, FHWA

Nearly 74 percent of pedestrian fatalities occur at non-intersection locations, and vehicle speeds are often a major contributing factor.[1] As a safety strategy to address this pedestrian crash risk, the PHB is an intermediate option between a flashing beacon and a full pedestrian signal because it assigns right of way and provides positive stop control. It also allows motorists to proceed once the pedestrian has cleared their side of the travel lane(s), reducing vehicle delay.

Transportation agencies should refer to the *Manual on Uniform Traffic Control Devices* (MUTCD) for information on the application of PHBs.

In general, PHBs are used where it is difficult for pedestrians to cross a roadway, such as when gaps in traffic are not sufficient or speed limits exceed 35 miles per hour. They are very effective at locations where three or more lanes will be crossed or traffic volumes are above 9,000 annual average daily traffic. Installation of a PHB must also include a marked crosswalk and pedestrian countdown signal. If PHBs are not already familiar to a community, agencies should conduct appropriate education and outreach as part of implementation.

1 National Center for Statistics and Analysis. (2020, March). Pedestrians: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 850). National Highway Traffic Safety Administration
2 Zegeer et al. NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. TRB, (2017).
3 Fitzpatrick, K. and Park, E.S. Safety Effectiveness of the HAWK Pedestrian Crossing Treatment, FHWA-HRT-10-042, (2010).

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Proven Safety Countermeasures

Safety Benefits:

Sidewalks

65-89%

reduction in crashes involving pedestrians walking along roadways.[3]

Paved Shoulders

71%

reduction in crashes involving pedestrians walking along roadways.[3]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=1.

FHWA-SA-21-047

Walkways

A walkway is any type of defined space or pathway for use by a person traveling by foot or using a wheelchair. These may be pedestrian walkways, shared use paths, sidewalks, or roadway shoulders.

With more than 6,200 pedestrian fatalities and 75,000 pedestrian injuries occurring in roadway crashes annually,[1] it is important for transportation agencies to improve conditions and safety for pedestrians and to integrate walkways more fully into the transportation system. Research shows people living in low-income communities are less likely to encounter walkways and other pedestrian-friendly features.[2]

Well-designed pedestrian walkways, shared use paths, and sidewalks improve the safety and mobility of pedestrians. Pedestrians should have direct and connected network of walking routes to desired destinations without gaps or abrupt changes. In some rural or suburban areas, where these types of walkways are not feasible, roadway shoulders provide an area for pedestrians to walk next to the roadway, although these are not preferable.

Transportation agencies should work towards incorporating pedestrian facilities into all roadway projects unless exceptional circumstances exist. It is important to provide and maintain accessible walkways along both sides of the road in urban areas, particularly near school zones and transit locations, and where there is a large amount of pedestrian activity. Walkable shoulders should also be considered along both sides of rural highways when routinely used by pedestrians.

Example of a sidewalk in a residential area. Source: pedbikeimages.org / Burden

Paved shoulder used as a walkway. Source: pedbikeimages.org / Burden

1 National Center for Statistics and Analysis. (2020, March). Pedestrians: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 850). National Highway Traffic Safety Administration.
2 Gibbs, et all. Income Disparities in Street Features that Encourage Walking. Bridging the Gap, (2012, March).
3 Gan et al. Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects. Florida DOT, (2005).

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Appropriate Speed Limits for All Road Users

There is broad consensus among global roadway safety experts that speed control is one of the most important methods for reducing fatalities and serious injuries. Speed is an especially important factor on non-limited access roadways where vehicles and vulnerable road users mix.

A driver may not see or be aware of the conditions within a corridor, and may drive at a speed that feels reasonable for themselves but may not be for all users of the system, especially vulnerable road users, including children and seniors. A driver traveling at 30 miles per hour who hits a pedestrian has a 45 percent chance of killing or seriously injuring them.[1] At 20 miles per hour, that percentage drops to 5 percent.[1] A number of cities across the United States, including New York, Washington, Seattle and Minneapolis, have reduced their local speed limits in recent years in an effort to reduce fatalities and serious injuries, with most having to secure State legislative authorization to do so.

States and local jurisdictions should set appropriate speed limits to reduce the significant risks drivers impose on others—especially vulnerable road users—and on themselves. Addressing speed is fundamental to the Safe System Approach to making streets safer, and a growing body of research shows that speed limit changes alone can lead to measurable declines in speeds and crashes.[2]

Safety Benefits:

Traffic fatalities in the City of Seattle decreased 26 percent after the city implemented comprehensive, city-wide speed management strategies and countermeasures inspired by Vision Zero. This included setting speed limits on all non-arterial streets at 20 mph and 200 miles of arterial streets at 25 mph.[5]

One study found that on rural roads, when considering other relevant factors in the engineering study along with the speed distribution, setting a speed limit no more than 5 mph below the 85th-percentile speed may result in fewer total and fatal plus injury crashes, and lead to drivers complying closely with the posted speed limit.[6]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/speedmgt/ref_mats/.

Applications

Posted speed limits are often the same as the legislative statutory speed limit. Agencies with designated authorities to set speed limits, which include States, and sometimes local jurisdictions, can establish non-statutory speed limits or designate reduced speed zones, and a growing number are doing so. While non-statutory speed limits must be based on an engineering study, conducted in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD) involving multiple factors and engineering judgment, FHWA is also encouraging agencies to use the following:[3]

- Expert Systems tools.
  - USLIMITS2.
  - NCHRP 966: Posted Speed Limit Setting Procedure and Tool.
- Safe System approach.

Based on international experience and implementation in the United States, the use of 20 mph speed zones or speed limits in urban core areas where vulnerable users share the road environment with motorists may result in further safety benefits.[4]

Considerations

When setting a speed limit, agencies should consider a range of factors such as pedestrian and bicyclist activity, crash history, land use context, intersection spacing, driveway density, roadway geometry, roadside conditions, roadway functional classification, traffic volume, and observed speeds.

To achieve desired speeds, agencies often implement other speed management strategies concurrently with setting speed limits, such as self-enforcing roadways, traffic calming, and speed safety cameras. Additional information is in the following FHWA resources:

- FHWA Speed Management website.
- Self-Enforcing Roadways: A Guidance Report.
- Noteworthy Speed Management Practices.
- Jurisdiction Speed Management Action Plan Development Package.
- Traffic Calming ePrimer.

1 Reducing the speed limit to 20 mph in urban areas: Child deaths and injuries would be decreased.
2 Lowering the speed limit from 30 to 25 mph in Boston: effects on vehicle speeds.
3 FHWA's Methods and Practices for Setting Speed Limits: An Informational Report, (2012).
4 Recommendations of the Academic Expert Group for the 3rd Global Ministerial Conference on Road Safety.
5 https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa20047/sec8.cfm#foot813
6 Safety and Operational Impacts of Setting Speed Limits below Engineering Recommendations.

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FHWA-SA-21-034

https://safety.fhwa.dot.gov/provencountermeasures/

FHWA-SA-21-071

STEP Safe Transportation for Every Pedestrian

Pedestrians accounted for **15%** of all roadway fatalities in the US in 2015.[1]

66% of pedestrian fatalities occurred at uncontrolled and non-intersection locations.[1]

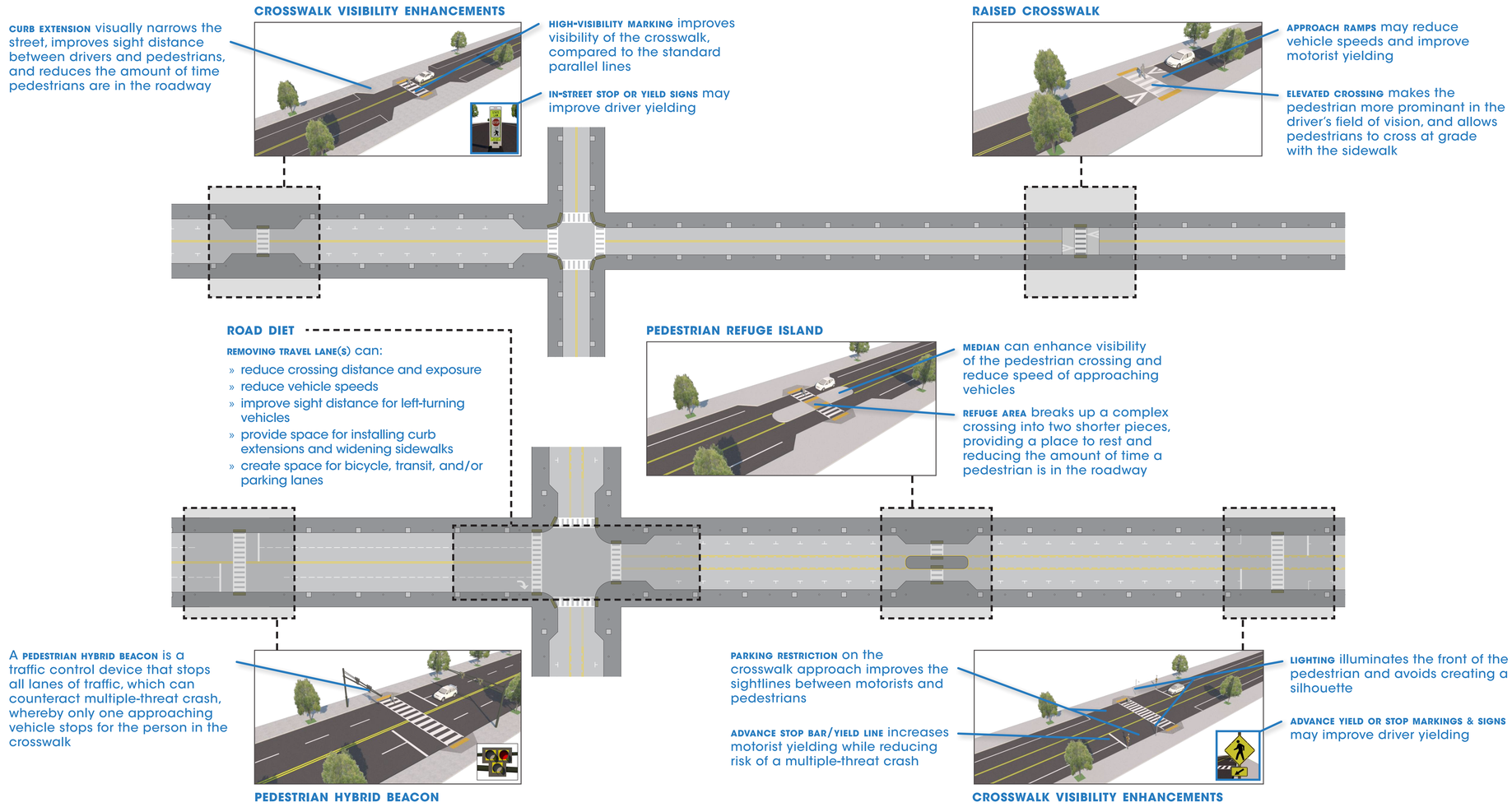
[1]*NHSTA FARS, "2015 Motor Vehicle Crashes: Overview,"(2016). https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812318*

The Federal Highway Administration (FHWA) is working to reduce pedestrian fatalities and injuries at uncontrolled crossing locations through Safe Transportation for Every Pedestrian (STEP). STEP is part of the fourth round of Every Day Counts (EDC-4), and its extensive outreach and technical assistance activities are promoting cost-effective countermeasures with known safety benefits to State and local transportation agencies nationwide.

The STEP program focuses on crossing treatments designed to improve pedestrian safety at uncontrolled crossing locations. FHWA is promoting five countermeasures and their associated benefits through STEP.

Most of the STEP countermeasures have been evaluated for their effectiveness to reduce pedestrian crash rates. Where available, the Crash Reduction Factor (CRF) is reported for each countermeasure below, based on national transportation safety studies. The CRF is the expected percent reduction in the number of pedestrian crashes after implementing a countermeasure. Please consult PEDSAFE, the Pedestrian Safety Guide and Countermeasure Selection System (http://www.pedbikesafe.org), for more information about CRFs and guidance for application of these countermeasures to various roadway and safety conditions.

Phoenix, AZ. Credit: Mike Cynecki



Drawings not to scale

5 Proven Countermeasures

CROSSWALK VISIBILITY ENHANCEMENTS — CRF: *25–48%**

Crosswalk visibility enhancements are added features that increase the prominence of crosswalks and pedestrians to oncoming drivers, such as lighting, warning signage, or varied crosswalk markings. Common examples include using a ladder design for the crosswalk markings (instead of two parallel lines) and installing in-street warning signage.

RAISED CROSSWALK — CRF: *not available*

Raised crosswalks span the width of a roadway at a crossing point, often at mid-block crossings. These raised speed tables calm vehicular traffic and create a level crossing at sidewalk height for pedestrians.

PEDESTRIAN REFUGE ISLAND — CRF: *32%*

Pedestrian refuge islands are raised islands within a street, located at intersections or mid-block crossings. Pedestrian refuge islands break up a complex crossing into two shorter crossings and separate motor vehicle and pedestrian crossing movements.

PEDESTRIAN HYBRID BEACON (PHB) — CRF: *55%*

PHBs are pedestrian-activated warning devices designed for higher speed, multilane roadways. PHBs are typically installed at the side of the road or on mast arms over uncontrolled midblock pedestrian crossings. When activated, the device displays a sequence of flashing yellow, steady yellow, solid red (pedestrians get a walk symbol; drivers must stop), and flashing red (pedestrians finish crossing; drivers stop and proceed once the roadway is clear).

ROAD DIET — CRF: *29%*

Road Diets reconfigure existing roadways by reducing the number of vehicular travel lanes. This frees up space for pedestrian refuge islands, curb extensions, bicycle lanes, or other features that improve conditions for pedestrians. The most common type of Road Diet involves converting a four-lane, undivided roadway to two through lanes and a center two-way left-turn lane.

**Advanced Yield or Stop marking and signs have been found to reduce pedestrian crash risk by 25%. High-visibility crosswalk markings have been shown to reduce pedestrian crashes by up to 48%. Parking restrictions on crosswalk approaches are proven to reduce pedestrian crashes by 30%. The addition of overhead lighting is proven to reduce total injury crashes by 28%.*

STEP Contacts

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Safe Roads for a Safer Future
Investment in roadway safety saves lives

EDC every day counts