City of Hartford

Complete Streets Plan

October 2020

Contents

Cover Art by Stantec, as part of the *Reimagining Mainstreet* Project

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Introduction and Purpose

In the interest of improving the quality of city streets for all users, this document has been prepared by the City of Hartford Complete Streets Task Force comprising representatives of various City departments, civic organizations, design professionals, and other stakeholders.

The plan has been developed consistent with the Hartford Complete Streets Policy[1] and in alignment with the City's Plan of Conservation and Development[2] and the Complete Streets Plan of the Capitol Region Council of Governments[3]. The purpose of this plan is to assist the City in achieving Complete Streets by providing standards, plans, and additional guidance for their implementation. Complete Streets are streets that safely, conveniently, and invitingly serve road users of all ages and abilities including pedestrians, transit users, bicyclists, those using wheelchairs or other assistive devices, and motor vehicle operators (Figure 1). The Complete Street design approach represents a major change in emphasis from decades of designing the transportation system primarily for automobiles and other motor vehicles.

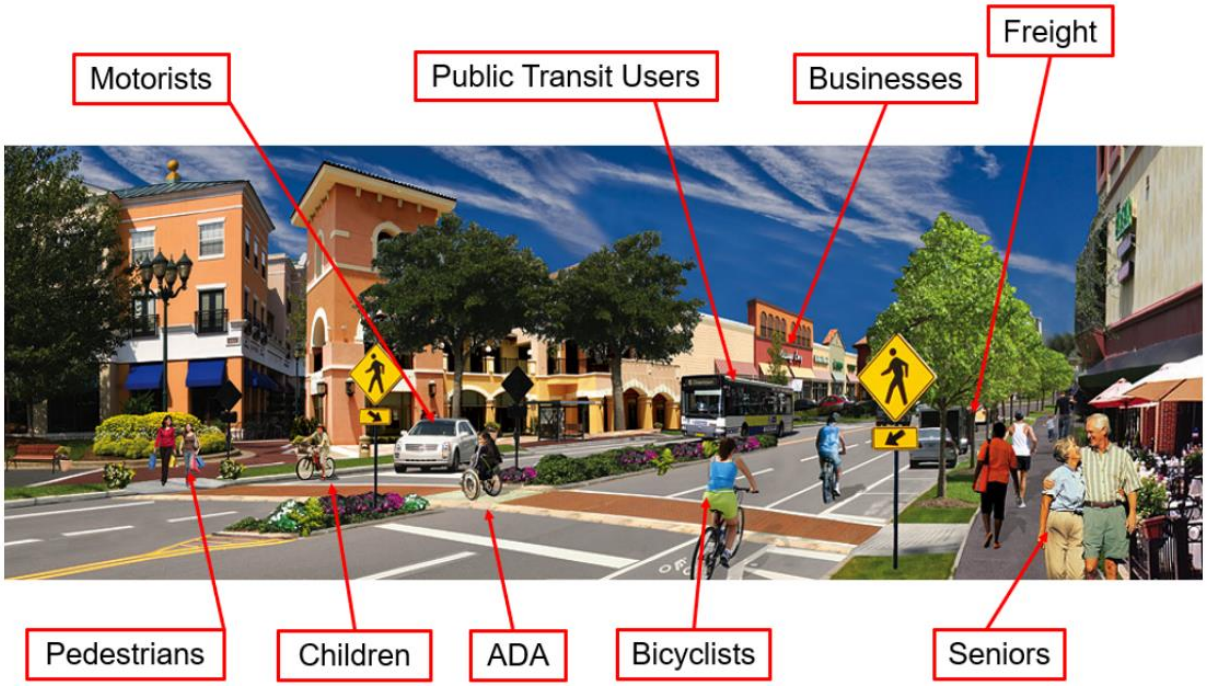


Figure 1 Complete street and its users. Source: AARP

[1] Hartford, Connecticut – Code of Ordinances, Chapter 31, Article X, adopted August 8, 2016, https://library.municode.com/ct/hartford/codes/code_of_ordinances?nodeId=PTIIIMUCO_CH31STSI_ARTXCOSTPO

[2] https://secureservercdn.net/198.71.233.179/3vb.f1d.myftpupload.com/wp-content/uploads/2020/05/ApprovedPOCD.pdf

[3] https://crcog.org/wp-content/uploads/2020/03/draft-plan-revised05182020.pdf

Complete Streets Task Force includes representatives from:

City of Hartford Departments
- Development Services
- Health and Human Services
- Office of Sustainability
- Police
- Public Works

City Council
City Residents
City Planning and Zoning Commission
Hartford Parking Authority
Capitol Region Council of Governments
Travelers
iQuilt
Hartford Business Improvement District
Center for Latino Progress
Transport Hartford
BiCi Co
East Coast Greenway Alliance
Bike Walk CT
Watch for Me CT

Consulting Firms
- CDM Smith
- FHI
- Fuss & O'Neill

The plan is intended to inspire, to allow all those who spend time in the city to envision a place where traffic is calm, pedestrians and bicyclists travel freely and safely, transit is efficient and effective, and the livability of Hartford is recognized and celebrated. The plan is intended for a variety of audiences:

- Policy makers who have the power to put more force behind the recommendations herein.
- City staff, developers and their consultants, and the CT Department of Transportation as they consider changes and upgrades to the City's transportation system and how these changes relate to the livability of the community.
- Residents of the City who will find the plan helpful as they advocate for safety improvements in their neighborhoods.

As the City moves forward on its path to develop a network of fully complete streets there will be companion documents developed that dive into more specifics. Particularly, there is a need for design guidance that fleshes out design standards to assist all departments, developers and designers with roadway design and maintenance projects. While this guide goes into some detail regarding traffic signals, it does not provide this in-depth guidance for all roadway elements that would be included in a design guide. This plan incorporates by reference the Bicycle Master Plan[4] adopted in 2019. The Bicycle Plan includes design guidance and identifies where and what type of bike facilities should be provided throughout the City. It focuses primarily upon the roadway system and not on the details of bike path/trail opportunities and challenges. This Complete Streets Plan also reflects feedback that was provided by *Walk Friendly Communities* when evaluating Hartford and ranking it as a silver level walk friendly community. It further develops policies introduced in the Hartford Zoning Regulations.[5]

[4] http://www.hartford.gov/images/Planning/DocumentLibrary/TransitBikePed/FINALHartfordBicyclePlanReport0206_2019.pdf

[5] Zoning Code as adopted in 2016 and updated through 6/5/2020 https://www.hartfordct.gov/files/assets/public/development-services/planning-zoning/pz-documents/zoning-regulations/zoning-regulations-06052020.pdf

Vision and Goals

Vision: By ensuring that all city streets are complete streets, Hartford will be a place where choosing to walk, use public transit, or bike will be a safe, easy, and desirable option for anyone.

History has left Hartford with a rich legacy of infrastructure to support very desirable, sustainable, and healthy alternatives to the prevalent automobile dominated lifestyle. Hartford is a city with sidewalks lining nearly every roadway. Hartford has an extensive bus-based local transit system, that includes the CTfastrak rapid transit system and swiftly improving rail-based connections to destinations beyond. Hartford is a city of extensive parks with park roadways and paths that serve pedestrians and cyclists well. Hartford is well equipped to become a safe, convenient, and inviting city offering the increasingly sought-after opportunity for living and working without strict reliance on an automobile for access to all daily needs.

Figure 2 Downtown bus stop, Main Street

Complete Streets is a design philosophy that considers the full role that streets play in the lives of the residents and visitors who use them. A key aspect of Complete Streets is the recognition that good streets play a far larger role than providing unconstrained access for motor vehicles. Complete Streets meet the needs of other modes of transport and also serve as a shared, public space for living, Figure 5.

Figure 3 CTrail service at Union Station

The Complete Streets design philosophy meshes with the City's Plan of Conservation and Development which recognizes the vital need for City streets to serve more than just motor vehicles. Working with the rich infrastructure of Hartford, the Complete Streets plan will provide guidance for improving access and amenities for all modes. It lays out a road map for bringing Hartford the sustainability, cleaner air, livability, lower cost, and public health benefits afforded by good, multi-modal transportation options for everyday living. Finally, the plan will guide the transformation of Hartford's streets to a network of livable, attractive, inviting, and well-kept streets.

Figure 4 Example of Hartford park roadway, in Keney Park

While the vision for this Complete Streets plan is quite simple, achieving this vision will require the concerted effort of many parties, including City staff, developers, and state and regional officials. This plan identifies the actions needed to be taken to achieve the vision. The plan is organized by the following goal areas.

Figure 5 An inviting streetscape on Farmington Avenue

Goal 1: Improve safety and convenience for all users and all modes

Goal 2: Complete bicycle and pedestrian networks by connecting them to each other, to transit, and to other important destinations

Goal 3: Encourage multi modal transportation, including walking, bicycling and use of transit

Goal 4: Create streets that are livable, attractive, inviting and well cared for

Goal Area 1: Improve safety and convenience

Improve safety and convenience for all roadway users and all modes

The City's Plan of Conservation and Development lays out a hierarchy for serving users of our transportation system in priority order from highest to lowest: pedestrians, transit users, bicyclists, and motor vehicles. This represents a sea change in thinking from how the transportation system has been perceived and designed.

Since the 1950's, car culture has ruled supreme here in Hartford as throughout the United States. In Hartford this has resulted in large swaths of valuable real estate being given over to interstate highways and parking lots as clear in Figure 6. This automobile focus resulted in the evaluation of city streets strictly in terms of their ability to move commuters into and out of the City by personal motorized vehicles with a disregard for pedestrians (Figure 7).

Figure 6 Interstate highways and vast parking lots occupy a large fraction of downtown Hartford. (Google Earth Image)

Beginning in the early 2000's, however, the City began to change this pattern of thinking by implementing neighborhood level traffic calming and by paying more attention to roadway design outside of the curb to curb roadway surface. Many practices of the past are already being re-evaluated, including traffic signal design and street design. But the impact of the past devotion to motor vehicles is evident in safety statistics for vulnerable users and in the travel choices made daily by users of Hartford's streets. Looking at the period from 1995 to 2019, pedestrian and bicycle crashes make up less than 7% of total crashes in the city, but 20% of crash fatalities (Figure 8). Figures 9 shows this data in another way – for every year since 1995 except 2018, pedestrian fatalities are less than motor vehicle fatalities. But the rate of fatalities

Figure 7 Pedestrian access is provided to the Bulkeley Bridge, but it requires a harrowing journey across highway ramps.

per 100 crashes is consistently higher for pedestrians as compared to motorists. Put another way, a pedestrian is about three times more likely to die if they are involved in a crash compared to motorists.

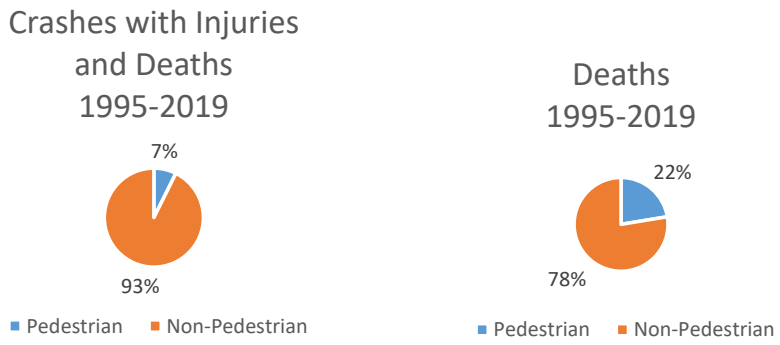


Figure 8 Comparison of non-motorized vs. motorized share of total crashes and fatal crashes. Source: UConn Crash Data Repository

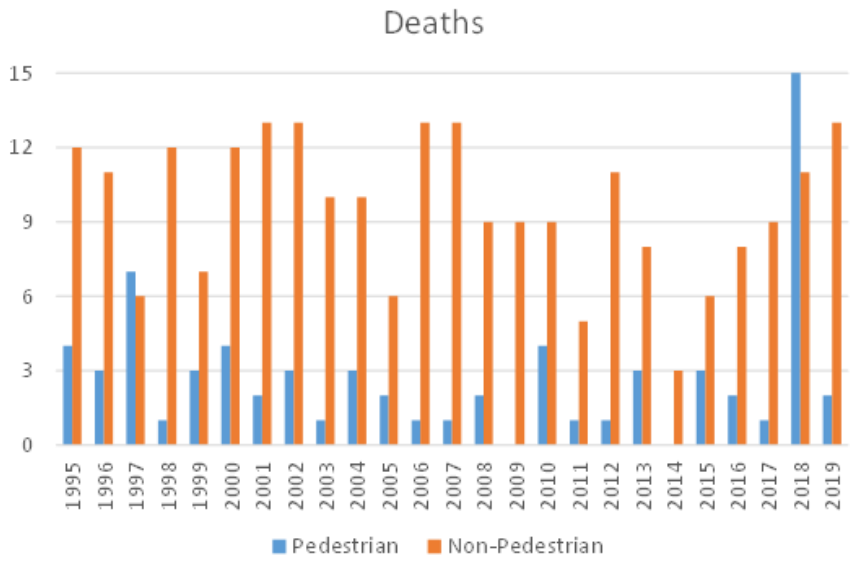


Figure 9 Fatalities by year. Source: UConn Crash Data Repository

The City's roadway design has influenced choice of travel mode. As Figure 10 shows, since 1970, the percentage of workers in Hartford commuting by transit, carpool, walking and bicycling has declined while the percentage driving alone in a car and working from home has increased.

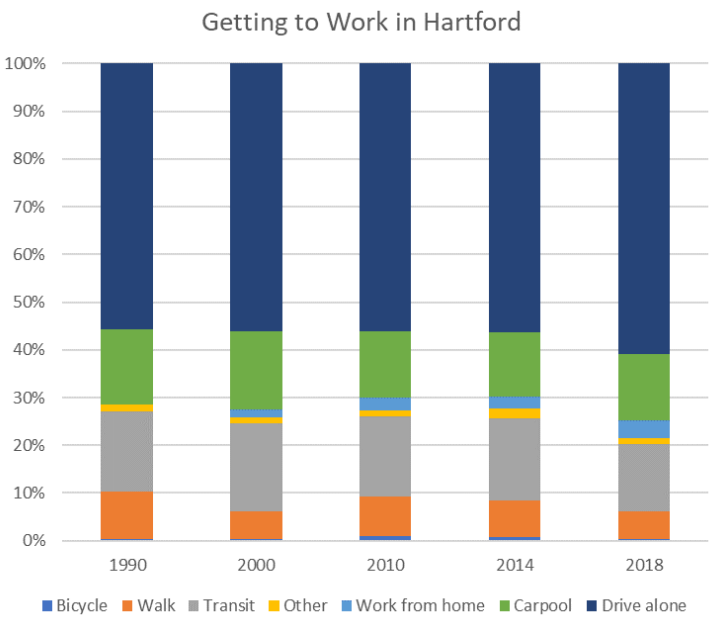


Figure 10 Workers in Hartford by mode of transportation to work. Source: American Community Survey 5-year averages, except 1990 and 2000 which are sourced from the decennial census.

To continue to correct past practices where provisions for bicyclists, pedestrians and transit users have been an afterthought in the roadway design process, this plan seeks to reprioritize the safety and convenience of **all** roadway users. The proposed strategies in this goal area seek to implement this new awareness and approach.

There is a particular focus in this goal area upon strategies related to roadway crossings. Crossings, both signalized and unsignalized, present conflict between motor vehicles and pedestrians, and strategies that can help to increase safety at these locations are identified along with implementation guidance. Also, past practices with respect to traffic signal design need to be re-examined. The following paragraphs provide context for the strategies related to roadway crossings.

Signalized Intersections

Over the years, the City has developed a default design of traffic signals where the pedestrian must push a button to request the walk signal (Figure 11) and where the pedestrian crossing period for the traffic signal takes place when all other traffic has a red light. This latter practice is known as an exclusive pedestrian phase as opposed to a concurrent pedestrian phase, where pedestrians cross when the parallel traffic receives a green light.

Figure 11 Pedestrian push button.

The push-to-cross and exclusive pedestrian phase design defaults, while they may seem to build in safety, present problems. With the push button requirement, the button does not immediately call up the pedestrian signal but tells the traffic controller to bring in the pedestrian phase at the next opportunity in a predefined cycle. This can lead to lengthy waits for pedestrians. For example, the walk light might be set up to occur after the north/south green signal has gone to red. If the pedestrian arrives at the signal just as the light is turning red for the north/south movement, the pedestrian will have to wait an entire signal cycle before the walk light comes up. This delay leads many pedestrians to cross the street illegally and unsafely - without the benefit of the walk signal when they

perceive it to be safe. Then when the walk signal (ped phase) comes up, the pedestrians are long gone, and drivers are frustrated by waiting through the walk signal when no one is waiting to cross the street. This leads to diminished respect between motor vehicle operators and pedestrians and to dangerous behavior on the part of both.

In addition to the above described problem with the push button activation of pedestrian signals, exclusive phasing also leads to faulty thinking on the part of both motorists and pedestrians. Motorists get lulled into thinking that they never have to look for pedestrians in crosswalks when they are turning right or left. Pedestrians have an expectation that no vehicles will turn during the walk light. A 2015 study by researchers at UConn found that pedestrian crashes at exclusive signals are more severe than crashes at concurrent signals, because so many pedestrians ignore the exclusive signals.[6] Therefore, careful consideration must be given to placing exclusive signals only in locations where pedestrians are likely to actually obey them.

The criteria for implementing concurrent versus exclusive signals as contained in the Goal 1 strategies below are based upon experience in other communities and observations in Hartford. There are situations where exclusive pedestrian phasing works well and provides improved safety. Generally, this is where pedestrian volumes are high, and turning vehicle volumes are also high. The intersection of Main Street and Pearl/Central Row in downtown is a location where exclusive phasing works well. In most other locations, exclusive phasing is not recommended. In fact, the newly adopted Hartford Plan of Conservation and Development also endorses the conversion of signals to concurrent operation.

Unsignalized Intersections

For many years there has been a bias in the United State against marking crosswalks at unsignalized intersections. Seminal work was completed in 2005, however, that began to turn this thinking around.

Until 2005, the conventional wisdom, based upon research conducted beginning in the 1970's, was that marking crosswalks at unsignalized intersections decreases pedestrian safety and therefore crosswalk markings should be used very sparingly. What the 2005 research found was that when roadway characteristics were closely examined, the results look much different. In many situations, marking a crosswalk does improve safety[7]. But under particular conditions a crosswalk alone is not enough, and other countermeasures are required to improve safety.

The 2005 study found that if a roadway has any of the following characteristics, then additional countermeasures are required to improve pedestrian safety:

- Traffic volumes over 14,000 vehicles per day, or
- Speeds over 40 mph, or
- Four or more lanes.

[6] "Safety Effects of Exclusive and Concurrent Signal Phasing for Pedestrian Crossing", John Ivan, Kevin McKernan, Yaohua Zhang, Nalini Ravishanker, Sha Mamun—UConn, 2015. http://www.pedbikeinfo.org/trbped/documents/2015/2015_John_Ivan-Safety_of_Exclusive_and_Concurrent_Pedestrian_Phasing.pdf

[7] FHWA Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Intersections, September 2005 https://www.fhwa.dot.gov/publications/research/safety/04100/04100.pdf

Since this important research was disseminated, the Federal Highway Administration (FHWA) has undertaken numerous studies that have further refined this work and FHWA now makes available a list[8] of nine (9) countermeasures that are proven to improve pedestrian safety at unsignalized intersections. Hartford has already made use of some of these countermeasures, and the strategies listed below provide clearer guidance for when these countermeasures are appropriate.

It is important to note that according to CT state statutes, even if a crosswalk is not marked, it is defined as the extension of the sidewalk across the intersection. Further, motor vehicle operators are required to yield the right of way to pedestrians within a crosswalk, either marked or unmarked, as long as the location is not controlled by a traffic signal. An exception is that, at an intersection between two traffic signal-controlled intersections, a pedestrian crossing at an unmarked crosswalk is not granted the right of way. It cannot be assumed that every user of the streets is aware of these traffic rules; likely a majority of drivers and pedestrians alike are not aware of these rules in detail. The City of Hartford must aspire to design its public areas, crosswalks in particular, so that it is intuitive for drivers and pedestrians to use them correctly and safely.

Goal 1 Strategies:

1.A. Improve Safety at Signalized Crossings

1. **Adopt traffic signal policies that provide greater safety and convenience for pedestrians.**
    a. Use concurrent pedestrian signals, where the pedestrian crosses when the parallel traffic receives a green light, to the extent possible. Consider concurrent pedestrian signals where any of the following criteria are met:
        i. Conflicting turn volumes are low, less than 250 Vehicles Per Hour (VPH) right plus left,
        ii. Sight distance exceeds the minimum stopping sight distance criteria listed in chapter 3 of AASHTO's *A Policy on Geometric Design of Highways and Streets*[9]
    b. With concurrent pedestrian signals, include Leading Pedestrian Intervals to enable pedestrians to establish themselves in the intersection before the parallel traffic gets a green signal, as in Figure 12.
        i. Follow CTDOT policy: "A Leading Pedestrian Interval (LPI) should be used in conjunction with concurrent pedestrian phasing whenever possible. However, LPI should typically not be used where (leading) protected/ permitted left-turn phasing is provided for the parallel roadway."

Figure 12 Leading Pedestrian Interval: walk sign lit while vehicle signals are all red, allows pedestrian time to become established in crosswalk before parallel traffic receives a green signal.
Source: Florida DOT, CUTR Report BDV25-977-22

[8] https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf
[9] https://books.google.com/books?id=MWHBDwAAQBAJ&pg=SA3-PA1&source=gbs_toc_r&cad=3#v=onepage&q&f=false

ii. Where leading protected/permitted left-turn phasing is provided for the parallel roadway, give serious consideration to modifying the protected left turn phasing to be lagging rather than leading thus enabling the use of LPI.

c. With concurrent signals, provide signage that notifies motor vehicles and pedestrians of potential conflicts: "Turning vehicles yield to pedestrians," R10-15 in the Manual of Uniform Traffic Control Devices, Figure 13 should be used in all cases. A pedestrian warning sign which says "Watch for turning vehicles" should be considered. This latter sign is not standard and should be used only in exceptional circumstances that warrant explicit pedestrian notification. Overuse of such signs could lead to a perceived shift of responsibility onto the pedestrian.

Figure 13 R10-15 signs

d. With exclusive walk signals, preference should be given to the imposition of *no turn on red* restrictions where possible. Diagonal cross walks should also be considered.

e. Provide automatic recall for pedestrian signals in the following situations:
   i. Where automatic recall is useful for signal coordination, i.e., regular calls work better with signal progression rather than random pedestrian calls
   ii. At high pedestrian volume locations during hours when pedestrian actuations occur for more than 50% of all cycles and/or there are more than 250 pedestrians crossing per hour in at least one crosswalk
   iii. Provide 24/7 pedestrian recall at intersections with concurrent pedestrian operation where it would not significantly impact traffic operations. (For example, use at an intersection with low side street volumes, long pedestrian crossing distances for the side streets, and low pedestrian traffic, could result in unnecessarily long red signal time for the predominant vehicle traffic direction in spite of no conflicting vehicle or pedestrian traffic.)
   iv. In the long term, utilize the traffic detection cameras that are part of the City's updated signal system to detect pedestrians, request the pedestrian call, extend the pedestrian phase, and subsequently extend the signal cycle as needed.

f. Crosswalks will be marked on all legs of signalized intersections unless there is a significant safety reason for not doing so.

g. Except for simple signals where traffic movement can be easily assessed by individuals with vision impairments, all signals will be upgraded with accessible pedestrian signals (APS).

h. All pedestrian crossing times will be updated to meet the latest MUTCD guidance for pedestrian walking speeds.

i. Undertake a public outreach campaign prior to any changes from exclusive pedestrian signals to concurrent. This campaign will inform both motorists and pedestrians about the use of concurrent signals. A program of enforcement should also be considered.

2. **Overnight flashing of signals**: Eliminate nighttime flashing at all signals that have functional vehicle detection and/or are located on principal or minor arterials. Any signals without functional vehicle detection (i.e. pre-timed) that are located on local roads may retain

nighttime flash with all red flashing until the signal equipment is upgraded to provide functional vehicle detection. Hours for flashing will be 1 am to dawn. During these hours, where possible implement "rest in red" for fully actuated signals.

The above guidance will be used in all signal upgrade projects and all roadway design projects.

1.B. Improve Safety at Unsignalized Crossings

1. **Follow FHWA Guidance[10] (See Appendix 1) for improving unsignalized intersections.** While the CTDOT has developed its own set of countermeasures from the FHWA guidance, they removed the more urban appropriate measures of the FHWA guidance. As an urban area, Hartford is best served by the FHWA guidance.

   The countermeasures that can be considered for improving pedestrian safety at unsignalized crossings, and that are appropriate for consideration in Hartford include:

High visibility crosswalk, including lighting. A high visibility crosswalk is well marked (in the City we will use the Continental marking), has parking set back 20 to 30 feet from the crosswalk, and has lighting 10 to 15 feet in advance of the crosswalk on all approaches. The space between the crosswalk and the intersection can be used as parking for Micromobility devices (shared bicycles and scooters). Removing parked cars improves driver visibility of the intersection and cross walks creating a "daylighting" effect at the intersection.[11]

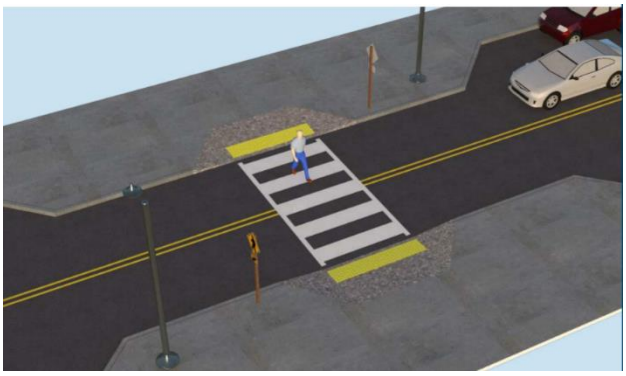


Figure 14 High visibility crosswalk

Raised crosswalk. A raised crosswalk serves as a traffic calming speed table and keeps the crosswalk at the same elevation as the sidewalk.

Figure 15 Raised crosswalk

[10] Guide for Improving pedestrian Safety at Uncontrolled Crossing Locations. https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf

[11] https://www.streetfilms.org/making-streets-safer-with-on-street-bike-parking/

Advance yield here to pedestrians sign and yield line. These signs are placed 30 to 50 feet in advance of the crosswalk and are accompanied by a "shark's teeth" yield line. They lead the motorist to expect and watch for pedestrians.

Figure 16 Advance yield sign and "shark's" teeth marking

In street pedestrian crossing sign. The in-street sign reminds motorists that they are to yield to pedestrians in crosswalks. Hartford already utilizes these signs in more than 50 locations.

Figure 17 In-street pedestrian crossing sign

Curb extension: a curb extension (sometimes called a bulbout or bumpout) extends the sidewalk into the roadway or parking lane. It makes the pedestrian crossing distance shorter and makes the waiting pedestrian more visible to traffic.

Figure 18 Curb extension on Vernon street

Pedestrian Refuge Island. A pedestrian refuge island provides a place for pedestrians to wait while crossing a roadway and enables the pedestrian to cross the street in 2 steps. Typically, it is used with 4 lane roads. The median refuge must be at least 6 feet wide. Maintenance of this type feature must be considered when evaluating implementation.

Figure 19 Pedestrian refuge island

Rapid Rectangular Flashing Beacon (RRFB). This treatment has been used in Hartford. It includes large warning signs with beacons incorporated at the bottom of the sign. The beacon is activated when a pedestrian presses the actuation button, and the highly visible beacon is more noticeable to the motorist.

Figure 20 RRFB activation button, street markings, and pedestrian sign with flashers

Road diet. A road diet changes the roadway cross section, generally changing from a 4-lane cross section to a 3-lane cross section with a 2-way center turn lane or opposing left turn lanes. The City has used this configuration extensively, an example is Wethersfield Avenue, which was converted from 4 lanes to 3 in the early 2000's.

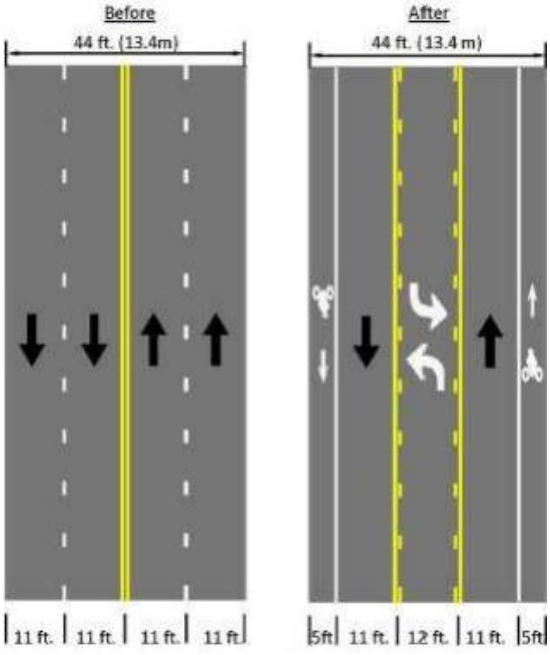


Figure 21 Typical road diet. Source: CTDOT

Pedestrian Hybrid Beacon PHB (formerly HAWK). The City does not have any of these in place yet. The PHB is a three-lens signal and the signal is dark until a pedestrian presses the activation button. The signal then flashes yellow, then solid yellow, letting motorists know it will soon turn red. The red phase is timed for the length of time it will take a pedestrian to cross the street. The signal then goes to flashing red, telling the motorist to stop and make sure the crosswalk is clear before proceeding. And finally, the signal goes dark. The pedestrian sees a walk indication, flashing don't walk, and countdown signal similar to a regular pedestrian signal. These are most often used at mid-block crossings.

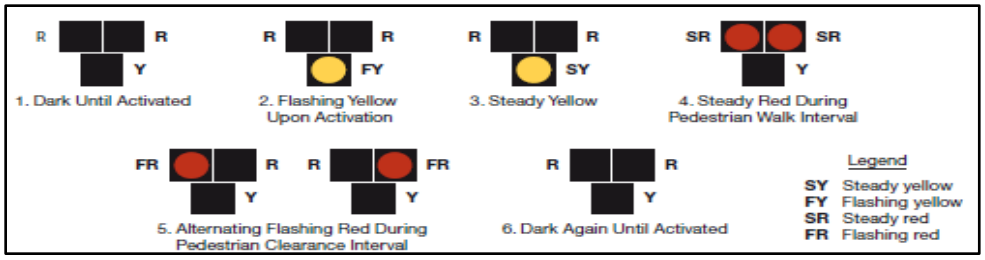


Figure 22 Dot.gov explanation of PHB operation

2. **Mid-block crossings:** Where midblock crossings are warranted by demand, utilization of curb bumpouts is highly recommended. Where internal sidewalks in campus developments encourage mid-block crossings, encourage the property owner to direct pedestrians to intersections where crossings are more easily handled.

3. **In crosswalk yield signs**, see Figure 7**:** Maintain the current program wherein the DPW receives input from neighborhood groups and determines if a location is a candidate site, and then DPW crews place the signs in early spring and retrieve them in late fall. Seek stewards for the crosswalk signs who will notify the City if signs are damaged and will bring the signs off the road before a snow event, allowing the signs to remain on the road for more of the year.

1.C. Provide Standard Street markings

1. **The Continental crosswalk will be the standard crosswalk marking,** for the City of Hartford. Decorative crosswalks will all include reflective white continental bars to insure visibility. Research has proven that this type crosswalk is more visible from a distance than crosswalks that only have their edge lines marked or have a ladder style marking.

Figure 23 Continental crosswalk

2. **The standard marking pattern for school zones,** as developed by the Safe Routes to Schools program in 2011 (included in Appendix 2), and based upon the 2009 Manual on Uniform Traffic Control devices, will be implemented at all schools

3. The City will undertake **a proactive program to mark crosswalks** in locations where they are needed to improve visibility of crossings. Priority will be given first to locations where pedestrian crashes have occurred, then school zones, then signalized intersections, then stop-sign-controlled intersections, and then based upon requests/demand. The default will be to have marked crosswalks. Marked crosswalks will only be excluded in circumstances where visibility or other issues make safe crossing highly impractical.

4. **Advance stop bars** will be provided at all signalized intersections so that motorists stop well before the crosswalk (and bike box if applicable), improving visibility of pedestrians.

Figure 24 Advance stop bars

1.D. Limit Driveway Openings

1. **Use access control to limit the number of driveway openings and curb cuts in commercial corridors**. Driveways present conflicts for pedestrians as motor vehicle operators seldom look for pedestrians when they pull into or out of driveways. This is particularly a problem in commercial and retail corridors that attract a lot of pedestrians.

2. **Limit driveway widths** in accordance with the City zoning regulations

1.E. Adopt Speed Policies

Speed creates several safety problems for pedestrians and bicyclists. The faster a car travels, the more likely it is to result in a serious or fatal injury if a driver crashes into a pedestrian. At 20 mph, there is a 5% chance that the crash will be fatal; at 30 mph, the likelihood of a fatality increases to 40%; and at 40 mph, there is an 80% chance that the pedestrian struck will be killed (Figure 25). A second issue with high speeds is that a driver's braking distance increases, and a driver's ability to react to a pedestrian or bicyclist in the road decreases. Finally, as a vehicle travels faster the operator's field of vision narrows, so that the driver is less likely to see a pedestrian or bicyclist along the edge of the road. The following speed policies are designed to better match speeds to roadway function.

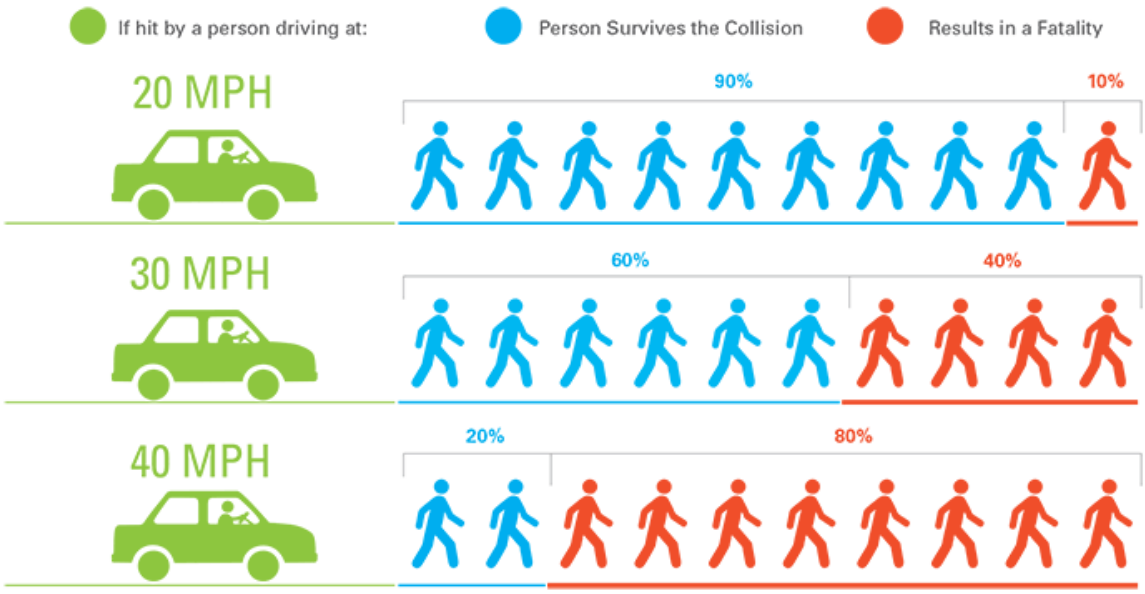


Figure 25 Vehicle Speed comparison to chance of Pedestrian Injury and Fatality. Image Credit: San Francisco MTA Vision Zero Action Plan, February 2015: https://view.joomag.com/vision-zero-san-francisco/0685197001423594455?short

1. **Lower speed limits**
   a. **Establish the City's default speed limit at 25 mph, with anything higher requiring study to justify.** Under current laws and regulations, this change will require that the City work with the Office of the State Traffic Administration (OSTA) in order to implement this new default speed. The 25 mph default is prematurely posted, and ignored widely, on some existing signs such as in Figure 26. This effort should be started by addressing one commercial corridor (e.g. Farmington Avenue) and one residential corridor (e.g. Fairfield Avenue) which currently have 30 mph speeds.

Figure 26 Default speed limit is not yet in place

   b. **Downtown:** In November of 2018 the City submitted a request to OSTA to lower traffic speeds in the downtown (see Appendix 3). This request must be resubmitted by the City. As this proceeds, it will help in the development of the ask for the default speed limit discussed above.
   c. **School Zones:** Work with OSTA to establish school zone speeds of 20 mph.

2. **Regularly monitor speeds on city streets.** By regularly monitoring speeds on city streets, we can identify locations that would most benefit from targeted speed enforcement or traffic calming. (The UConn T2 Center has speed monitoring equipment that can be borrowed for this purpose.)

3. **Enforce speed limits:** Enforcement should focus on roadways with high crash rates, especially pedestrian crashes, and those that regular monitoring shows have excessive speeds. Automated speed enforcement would be useful for this, but it is not currently permitted under Connecticut statutes. Speed monitoring signs (Figure 27) can encourage the prudent driver to slow down, but have little impact upon reckless drivers.

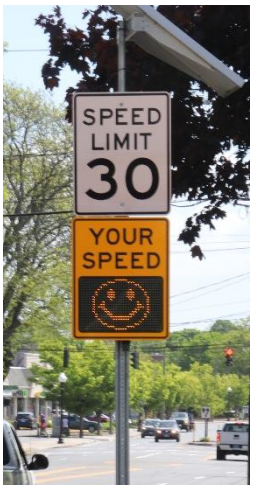


Figure 27 Speed monitoring sign

4. **Develop a regular program of traffic calming to create physical improvements that discourage speeding** (see more detail on this recommendation in Goal Area 2a)

1.F. Provide amenities for transit to make the use of transit convenient and comfortable

1. **Bus stop spacing:** Strive for bus stop spacing of about 1200 feet. Do not make bus stop spacing any less than 700 feet.

2. **Bus stop amenities**
   a. All stops should have a bus stop sign with routes called out, as in Figure 28.
   b. Stops with daily boardings of over 300 or that are major transfer points will be provided with a Ride-a-Guide and bus shelter. If there is not enough space for a shelter to be installed, a bench will be installed for customer convenience.
   c. At major transfer locations, electronic next bus information will be provided, as in Figure 29.

3. **Enhance transit priority corridors as identified in CRCOG transit plan (Farmington Avenue, Franklin Avenue, Park Street, Albany Avenue, Main Street):** CRCOG issued an RFP in May 2020 for consulting assistance to move the transit priority corridor idea forward to implementation. The City will work closely with CRCOG as this study proceeds. In the meantime, the City should work to move the following ideas forward:

Figure 28 Bus stop sign

a. Work to provide transit prioritization – at signals, possibly with bus lanes
b. Prioritize upgrades to bus stops on these transit priority routes

Figure 29 Next bus info display

1.G. Make pedestrian infrastructure fully ADA accessible

1. **Continue to retrofit intersections with fully compliant curb ramps.** Federal guidance and court findings require that any missing ramps be installed as part of repaving projects.
2. **Continue to upgrade traffic signals to be fully compliant APS (Accessible Pedestrian Signals).** Accessible pedestrian signals provide audible indications so that individuals who are unable to use visual cues can understand the signal and are able to operate the signal. An important element of APS is a locator tone which enables an individual to find the push button, if one is needed to activate the pedestrian signal.

Figure 30 ADA compliant curb ramp

1.H. Provide convenient bicycle parking throughout the City

The City shall work to install bicycle racks on public rights of way in all commercial corridors, using the City's preferred rack type – the post and ring, as seen in Figure 31.

Figure 31 Post and ring bike rack

1.I. Educate all road users on how to safely share the road

1. **Pedestrian and Bicycle Safety campaigns**
   a. Work with *Watch for Me CT* and the Hartford Business Improvement District (HBID) to develop a safety awareness campaign specifically for Hartford, and also to develop awareness of the HBID's Bicycle Roadside Assistance Program.[12] The campaign can

[12] http://blockbyblock.com/program/hartford-bid

include street level signage, digital messaging, public outreach events, and hosted table opportunities at other community events. Educational outreach should strive to reach people of all ages, including children, families, and older adults. Consider education for targeted groups such as the disabled, commuters, transit users, non-native English speakers, and others.

b. Work with the Board of Education to fine tune and upgrade their pedestrian and bicycle safety education programs. Investigate whether Bike Walk CT's 4th grade bicycle skills program can be adopted or adapted by Hartford Schools.
c. Work with BiCiCo and Bike Walk CT to build upon their existing offerings to develop a comprehensive bicycle education program for all ages in Hartford. Ensure that affordable bicycle safety and basic riding courses are available to Hartford residents.

Goal Area 2: Complete Bicycle and Pedestrian Networks

Complete bicycle and pedestrian networks by connecting them to each other, and to transit, and to other important destinations.

Multimodal transportation is important for many reasons and this is particularly the case in Hartford.

Census data shows that just under 1/3 of households in Hartford[13] do not have access to a car and therefore are dependent upon bicycling or walking or transit in order to meet their daily needs and to access the economy. Many individuals are unable to drive due to age or disability or because they cannot afford a car. The Greater Hartford Community Wellbeing Index (2019) found this to result in underemployment and missed medical appointments – both of which contribute to poor health outcomes.

Individuals who rely on travel means other than automobiles need safe connected networks that can get them where they need to go. Moreover, alternatives to an auto-based lifestyle are needed to retain and attract the next generation workforce. Further, the City could not thrive if everyone were to drive for all their transportation needs. We could not afford to build enough roads and highways for this, and even if we could, we would not like the resulting urban design.

But the benefits of a robust, safe and interconnected bicycle and pedestrian network go well beyond mobility benefits. Increased levels of biking and walking can improve public and individual health, improve the environment, combat climate change, improve sustainability, and improve the economy.

In Hartford, this is particularly important, where health disparities between lower income and higher income areas and among people of color result in poorer health, premature deaths, and unnecessary health care costs[14]. The Hartford Department of Health and Human Services has begun to address these disparities by working toward building active and walkable communities.

Connecticut has some of the worst ozone air pollution (smog) in the eastern United States. Ozone develops in the atmosphere when pollutants from motor vehicles, power plants and industrial

[13] Data Haven CT, 2018, 5 year average
[14] https://www.cthealth.org/publication/health-disparities-in-connecticut-causes-effects-and-what-we-can-do/

complexes interact with sunlight. Climate scientists say global warming is increasing the health risks from ozone pollution.[15] The Hartford-East Hartford area is ranked 25th in the nation for ozone pollution.[16]

According to a New York Times article from October 2019, the Greater Hartford area has seen an increase in carbon dioxide (CO2) emissions from passenger and freight traffic of 12% since 1990.[17] This trend can be reversed if more people choose walking, bicycling or transit for traveling in the area.

When individuals can choose to walk or bicycle or use transit and no longer need to own a car, it is estimated that they can save approximately $5000 to $10,000 per year. This is money that can be spent in the local economy, supporting local businesses. Additionally, it is less costly for the City to build accommodations for pedestrians and bicyclists than to build new lanes of roadway.

The health benefits of regular walking and biking to complete daily tasks, like commuting to work and shopping, are well documented[18]. For children, regular physical activity, like walking to school, results in improved memory and improved scores in reading, math and spelling. For those over the age of 60, regular physical activity results in measured improvements in brain activity and cognition. And for all, regular physical activity, like walking to a bus stop, bicycling to work, or walking or bicycling for regular activities, results in better weight control and improved physical health outcomes, including minimizing the risk of developing chronic conditions (for example, hypertension, hyperlipidemia, and or diabetes.) Additionally, if more people walk and bicycle, emissions from motor vehicles are reduced and people suffering from pollution aggravated illnesses, like asthma and emphysema stay healthier.

Hartford has an extensive sidewalk system, with very few roadways missing sidewalks. Additionally, Hartford has an extensive parks system with park roadways and paths that serve very well as biking and walking paths. On the other hand, the on-road bicycle network is underdeveloped, with bike lanes sprinkled throughout the city but not linked into a network or connected to park pathways. And while there is an extensive sidewalk system, many sidewalks feel threatening because of speeding traffic and missing crosswalks.

The strategies in this goal area are focused upon building out the pedestrian and bicycle networks, implementing city wide traffic calming, connecting the pathway system, and training staff to fully understand complete streets design principles. These strategies will increase the number of persons with safe and accessible places for physical activity, provide greater access to the economy for those who can't afford a car, and provide non-motorized access to everyday destinations where residents can live, work, and play.

[15] https://www.courant.com/news/connecticut/hc-news-bad-ct-air-quality-report-20190424-37tp7xx4b5c5lf3il6yzaybyya-story.html
[16] http://www.stateoftheair.org/city-rankings/most-polluted-cities.html
[17] https://www.nytimes.com/interactive/2019/10/10/climate/driving-emissions-map.html
[18] https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm

Goal 2 Strategies

2.A. Planning

The City has several guidance documents that will assist with this task – the Bicycle Plan, the 2005 Traffic Calming Plan, The Capital City Parks Plan, and the Plan of Conservation and Development. Additionally, several neighborhood traffic plans (Trident Plans, 2010; Asylum Hill, 2013; Fairfield Avenue, 2015) are available. To date, however, these documents have not been drawn together to create an overall strategy for implementation. In this task City staff will establish priorities for implementation of bicycle facilities, pedestrian facilities, and traffic calming.

1. Conduct neighborhood outreach to discuss the recommendations contained in the guidance documents. Create a list of recommendations that are strongly supported by the neighborhood. Identify new ideas that surface through this process, particularly related to traffic calming. This effort will build upon the outreach that has already been underway in four neighborhoods to discuss bicycle boulevards.
2. Compare the recommendations from the guidance documents with upcoming transportation projects – repaving, streetscape, and other – to identify opportunities for moving specific recommendations forward to implementation as part of those projects.
3. Identify those projects which cut across several of the guidance documents and can meet several objectives. Also examine the projects relative to crash history.
4. Identify easily implementable projects.
5. Combine the output of tasks 1 to 4 to create a list of prioritized projects and a 10-year plan for implementation. Identify approximate design cost and capital cost for each project identified for implementation over the next three years.

2.B. Design for Bicycle and Pedestrian Improvements

1. Until a comprehensive Complete Streets Design Guide is developed, utilizing either in house expertise or consultant assistance, bicycle/pedestrian design staff in the Planning Division will:
    a. Provide design assistance to the Department of Public Works (DPW) for facilities that can be built as part of repaving
    b. Provide advice on streetscape and other roadway design projects
    c. Assist with the development of grant applications for construction of the complete streets network.
    d. Provide advice on which projects might be implemented initially as quick build/tactical urbanism projects
2. Develop a phased approach to project implementation, so that the prioritized list of projects moves forward. An annual project list should include projects of all types – traffic calming, bicycle facilities, pedestrian improvements, and connections between on-street bicycle and pedestrian facilities, and off-street trails. Funding sources will also be identified.
3. Develop a **Complete Streets Design Guide**. This will incorporate design guidance contained within the Bicycle Plan and the Zoning Regulations. It will include guidance on pedestrian facilities, transit stops, and roadway elements. Where appropriate, it will refer to other published documents, rather than reinventing the wheel. (Several large cities and states

have developed extensive guides, such as Boston's guide[19]; Figure 32. Other notable guides include San Francisco's *Better Streets Plan*[20], Chicago's *Complete Streets Guidelines*[21], and The Florida Department of Transportation and Smart Growth America's *Complete Streets Implementation Plan*[22].) Hartford's *Completes Streets Design Guide* will address tactical urbanism and quick build concepts, such as are explained in CRCOG's Quick Build Guide[23]. It will include green infrastructure design as developed under Strategy 4.B. It will include instructions regarding maintenance, both winter and ongoing, for complete streets design elements. Development of the *Completes Streets Design Guide* will be undertaken in close coordination with the Department of Public Works to ensure that DPW has the resources needed to maintain any new facilities.

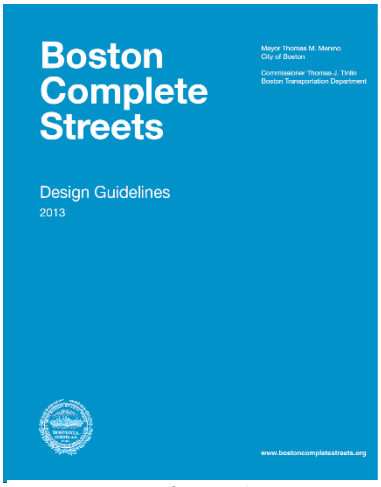


Figure 32 One of several extensive guides developed by US cities

4. Design of pathways. Because the Bicycle Plan did not directly address multi use paths or bicycle paths, the Plan of Conservation and Development and Capital City Parks Plan provide more guidance on these. The City will likely need to hire a trail design consultant to design the paths identified in these documents:
    a. Design the trails identified in the Plan of Conservation and Development (POCD)
        i. East Coast Greenway through City
        ii. Continue development of CT River trails, both North and South
        iii. Build walking paths – North Branch of Park River and Homestead Avenue
    b. Design the bike path system identified in the Capital City Parks Plan, Figure . Key elements include:
        i. Improve the connection between the segments of Keney Park north and south of Tower Ave. The National Parks Service Rivers and Trails Conservation Assistance program is already providing the City technical assistance regarding this trail connection.
        ii. Provide 2-way bicycle paths along park roadways
        iii. Complete the South Branch multi use path and the connecting Bankside Grove Path in Pope Park
        iv. Provide connection from Keney Park to CT River trail

[19] https://www.boston.gov/sites/default/files/file/2019/12/BCS_Guidelines.pdf

[20] https://sfplanning.org/sites/default/files/archives/BetterStreets/docs/Better-Streets-Plan_Final-Adopted-10-7-2010.pdf

[21] https://www.chicago.gov/content/dam/city/depts/cdot/Complete%20Streets/CompleteStreetsGuidelines.pdf

[22] https://www.aarp.org/content/dam/aarp/livable-communities/livable-documents/documents-2016/FDOT%20Complete%20Streets%20Implementation%20Plan%20120715.pdf

[23] https://crcog.org/wp-content/uploads/2020/03/CRCOG_TUGuide-FINAL.pdf

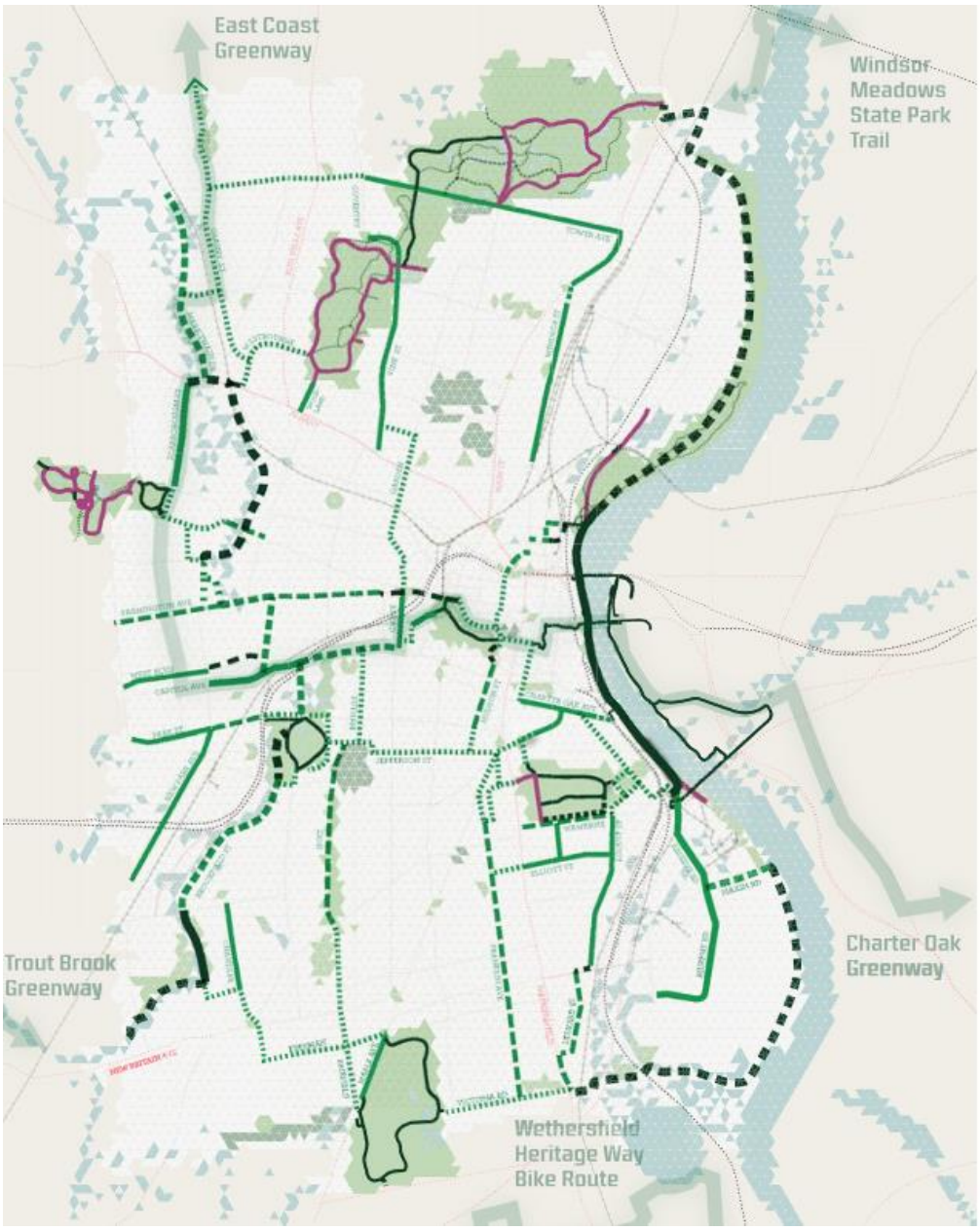


Figure 33 Bike path system from Capital City Parks Plan

c. Utilize the subdivision process and master plan development to integrate the path system into development projects. The reconstruction plans for the former Westbrook Village project include segments of the East Coast Greenway. Likewise, the University of Hartford master plan includes an allowance for pathway connections.

2.C. Construction

1. Incorporate sufficient funding in each annual CIP for constructing each year's recommended program (see Implementation of the Plan).

2. To the extent possible, coordinate the bike and pedestrian improvements with other efforts underway in the City such as the paving program and streetscape/roadway design projects.
3. Employ tactical urbanism/quick build to test out concepts. The City should have a regular annual program for developing quick build projects, and another for conversion of successful quick builds to permanent implementation.

2.D. Maintenance

Providing for ongoing maintenance of any roadway improvements is extremely important. New facilities that cannot be maintained are not worth the initial investment. Therefore, maintenance of facilities is included as a separate strategy within this goal area.

1. On an annual basis, identify street markings (crosswalks, roadway striping, bike symbols, tactical urbanism) and street signage that need to be refreshed.
2. Remove any reflective delineators or other items that could be plowed up before snow season begins.

2.E. Staff training

1. Staff from both DPW and DDS will attend training that addresses bicycle and pedestrian safety and design, and/or complete streets policy and design. Aim to have each engineer and each planner attend at least 8 hours of training over the next year. Each new planner or engineer will attend 8 hours of training.
2. Possible training resources:

    - FHWA courses: Designing for Pedestrian Safety; Developing a Pedestrian Safety Action Plan; Planning and Designing for Pedestrian Safety; Pedestrian Facility Design; Bicycle Facility Design[24]
    - Smart Growth America: Complete streets e-learning courses[25]
    - Pedestrian and Bicyclist Information Center[26]
    - The National Association of City Transportation Officials (NACTO)[27]

Goal Area 3: Encourage multi modal transportation

Encourage multi-modal transportation, including walking, bicycling, and use of transit

Currently, many people in the City of Hartford bike or walk or use transit because it is the only means of transportation available to them. There are many others who could or would use these modes more often if given the proper encouragement. The strategies in this goal area seek to expand the number of pedestrians, cyclists, and transit users in the City. Some will be encouraged by messages relating to convenience, for others, messages regarding health and safety will resonate.

[24] https://www.nhi.fhwa.dot.gov/course-search?tab=0
[25] https://smartgrowthamerica.org/program/national-complete-streets-coalition/complete-streets-e-learning/
[26] http://www.pedbikeinfo.org/webinars/
[27] https://nacto.org/events/

Goal 3 Strategies

3.A: Safe routes to schools

1. Working with the Board of Education, identify one school where a large number of students live within walking distance, then work with that school to set up a Safe Routes to School program. This will require coordination with DDS, DPW, HPD, HHS, BOE, and the individual school.
2. Based upon the success of the above, expand to additional schools
3. Work with the Hartford Department of Health and Human Services to develop healthy living messages targeted to school children and their families that encourage walking to school

3.B Wayfinding signage

1. Develop a neighborhood wayfinding signage program coordinated with the Department of Health and Human Services to encourage and motivate individuals to become more physically active. Begin with the Hampton Street bike boulevard/slow street. Encourage walks to and through neighborhood parks and recreation areas
2. Identify walk routes and install wayfinding signage to help visitors, residents, and downtown employees, to guide people to interesting places, as for example in Figure 34, or to achieve walking goals(5,000 and 10,000 steps) such as Walk Boston has created for neighborhoods in several MA cities and towns[28].
3. Build upon recommendations in the Capital City Parks Plan to create a color-coded bicycle routing system

Figure 34 Downtown Hartford walking guides

3.C. Bike/Walk/Transit to Work

1. Work with Office of Sustainability, BiCiCo, BikeWalk CT and CT Rides to develop a comprehensive program to encourage year-round commuting by means other than the single occupant vehicle.
2. Sponsor local employer competitions to reduce Vehicle Miles Travelled (VMT) per employee

3.D Bike Share Program – the City will work with CRCOG and its selected vendor(s) to implement bicycle share and other Mobility as a Service (MaaS) efforts.

Goal Area 4: Create streets that are livable

Create streets that are livable, attractive, green, inviting, and well cared for

Our streets matter. They occupy a large percentage of Hartford's land area, more than 11% of the City's landmass is dedicated to roadways, with an additional 20% of land occupied by driveways and parking lots. Conversely, just 9% of city space is used for parks and recreation. Streets largely define the environment in our neighborhoods and commercial centers. A street with a canopy formed by street

[28] https://walkboston.org/resources/maps/

trees lining each side feels very different and sends a different message than a street that is defined purely by the hard surfaces of sidewalks and roadways. A street lined with surface parking lots feels very different than a street lined with active storefronts. And with green infrastructure, the street environment can be utilized to improve the city's sustainability.

The strategies in this goal area address parking policy, street plantings and green infrastructure.

Goal 4 Strategies

4.A Increase utility of walking, bicycling, and transit by actively managing parking.

Achieving the overall goal of increased multi-modal transportation within Greater Hartford is highly dependent on the parking management system implemented. Parking strategies should be applied to on-street parking, surface parking lots, and structured parking (garages.) Proper management of parking supply can reduce congestion on local streets, open roadway width to bike/pedestrian movement, and improve safety for vulnerable road users such as bicyclists and pedestrians. The Plan of Conservation and Development (POCD) calls for district parking plans to be developed and further calls for surface parking lots to be converted to new development. In addition, the POCD includes recommendations to add to parking facilities charging stations for electric vehicles to help accelerate conversion to cleaner, less polluting vehicles.

Hartford currently has an overabundance of surface parking lots, many of which are private and unavailable to the general public. By encouraging a well-managed and coordinated public parking supply, private property owners will be encouraged to construct buildings on surface parking lots, replacing fallow ground with productive uses. In fact, this is expected to happen over the next four years in the Downtown North, DONO area, resulting in a decrease of 1200 spaces in surface lots.

Driveways into surface parking lots can create unsafe conditions for pedestrians on sidewalks and often for bicyclists in bicycle lanes. Motor vehicle operators entering and exiting parking lots focus their attention on conflicting traffic and often do not pay attention to activity on the sidewalks or in bike lanes. Additionally, surface parking lots, with large expanses of parked vehicles and/or pavement adjacent to the sidewalk, detract from the aesthetics of a street.

As the City moves forward with the bike plan implementation, competition for use of street real estate will continue to create conflicts between on street parking and bicycle facilities. An upfront assessment of need will help the City to properly understand on street parking requirements and to make good decisions regarding where on street parking supply must be maintained and where it can be reduced.

1. This plan **supports the effort of the Hartford Parking Authority**, in cooperation with the City, **to conduct a survey of parking supply and demand throughout the City**, focusing upon the downtown and commercial corridors. It is expected that this effort will lead to the development of new shared public parking, both in new parking structures and in new public lots. A coordinated approach to parking will enable consolidation of supply and

placement of supply where it is most needed and will also make considerations for electric vehicle charging where appropriate.

2. This plan **supports the efforts of the Hartford Parking Authority to manage on street parking with pricing** matching the purpose of the parking (quick turnover vs. longer term) and with an easily accessible parking app (woonerf).

4.B Implement Green Infrastructure

Given Hartford's aging 150-year-old combined sewer system and greater frequency of increasingly intense storms, it is becoming more important to incorporate green infrastructure at scale in the city. During dry weather the combined sewer system delivers all sewage flow to the treatment plant. When rain falls, however, stormwater flows (called runoff) combine with the sewage flow and overwhelm the capacity of pipes, resulting in stormwater-sewage overflows that enter streams and rivers and that can also cause localized flooding and sewage backups. The Metropolitan District Commission (MDC), the regional water and sewer utility, has developed a program of deep storage tunnels that will eventually receive and hold much of the overflow until it can be pumped to the sewage plant for treatment. But even with this storage system, decreasing stormwater flows before they enter a pipe will help reduce excess burden on the system and can have a positive impact on both the quality of water bodies and sewage treatment costs. Additionally, for those segments of the Hartford system where stormwater and sewage pipes are completely separated, intercepting stormwater flow before it reaches the stormwater pipe and/or cleaning of some of the flow before it reaches the storm system provides benefits. This will help improve water quality in both local and regional watersheds and can also help decrease localized flooding.

Green infrastructure uses or mimics natural processes to intercept and/or treat stormwater runoff at its source, reducing the volume of stormwater and also improving the water quality of the runoff. Measures that can be considered include drainage areas adjacent to the street that allow rain flow to percolate through the ground before entering the drainage system. These might be as simple as tree planting areas that capture sidewalk runoff or permeable pavement, or more complex systems like rain gardens with curb openings that direct runoff from the street into the garden area. At this time, the City has extensive green space areas but limited examples of rain gardens or permeable pavement.

Figure 35 Rain garden with curb openings

One of the more notable benefits of green infrastructure is the reduction in volume of runoff, which can help to improve water quality. Hartford's urban tree canopy, the most extensive form of existing green infrastructure in the city, clearly illustrates these benefits. A 2015 American Forests study found that Hartford's canopy intercepts 590 million gallons of stormwater every year. Additionally, the urban tree canopy improves air quality and creates a cooling effect which counters the urban heat island effect allowing pedestrians to be more comfortable when walking on a hot day. In order to maximize the benefits of green infrastructure, the following strategies are designed to build on tree planting efforts and to enable the City to pilot and implement other green infrastructure techniques.

1. **Provide an abundant and attractive street canopy and plantings**. The City of Hartford Mayor's Office of Sustainability, in cooperation with the Department of Public Works, the Hartford Tree Advisory Commission and other stakeholders has developed a strategic plan for urban tree canopy management. This ambitious plan includes a framework for prioritizing tree planting and maintenance in the City, particularly on the public right of way. This plan should be referenced in the implementation of the below:
    a. Regularly measure the health and extent of the tree canopy.
    b. Preserve existing street trees and vegetation
    c. Replace damaged/dying street trees
    d. Install trees in locations where there is insufficient canopy.
    e. Where appropriate, consider alternative tree planting methods for new tree installations, such as utilizing structural cells or structural soil to help improve site conditions and tree health to better insure survival
    f. Install street trees and plantings with flush planter edges, to the extent possible, to enable sidewalk runoff to be captured by tree planting beds

2. **Implement green streets designs that work for the City of Hartford**

    With clay soils underlying much of the City, common green streets elements, such as rain gardens and permeable pavement, require replacement of undersoil and or underdrains to work adequately. This work can increase costs and labor, and can decrease the benefit of the green elements, especially if none of the runoff goes into the soil but ends up being piped away. These limitations can inhibit efforts to implement green infrastructure.

    a. To identify and overcome these potential issues, a study should be conducted to develop standard green streets elements that would be most effective in Hartford. This study should provide design specifications that estimate construction and maintenance costs and measurable benefits for any recommended techniques. This information will enable the City to more readily move forward with green infrastructure. To fund this study and the implementation of any recommendations, grant funding can be pursued to cover a portion of the cost.
    b. In 2017 the City received an Environmental Protection Agency (EPA) technical assistance grant that supported a community workshop and produced a memo laying out steps that can be taken to move forward with green and complete streets. Given the stakeholder input and buy-in resulting from the workshop and

memo, the document should be reviewed, and relevant components should be integrated into future efforts and recommendations.

c. Once Hartford specific designs are created, green infrastructure should be included in all streetscape and roadway design projects going forward.

4.C Motor vehicle level of service (LOS) should be one consideration of many, and possibly a consideration at a lower level than others, during street design decisions. The following will also be considered:

1. Quality of travel for all modes[29]
2. Safety for all modes
3. In all road design projects, the context and typology of the road will be considered before any design work is done

Implementation of the Plan

Implementation of this plan will require focused effort and resources and prioritization of actions.

Staffing:

The City does not currently have sufficient design capacity to create designs for the projects that are identified as priorities in the planning stage (Strategy 2.B.) There are 2 alternatives for filling this void: one, hire an on-call design consultant to assist with design; or alternatively, the City might choose to hire design expertise within its own staff. This plan recommends hiring an on-call consultant because the need for design services will be focused in the first few years of implementation and then will tail off. Further, it will likely be easier for the City to tap into the specialized skills needed by hiring a consultant. One or two additional staff members would not likely bring the breadth of skills that are needed.

Staffing recommendations:

- The City will select an **on-call consultant** to be available specifically for guidance regarding the design of pedestrian and bicycle facilities and to develop a complete streets design guide. The selected consultant shall have expertise in complete streets design, tactical urbanism, and multi-use path design. A strong background in traffic engineering will also be required.
- **Additional staff:**
    - even with the design assistance of an on-call consultant, current staffing in DDS may be insufficient to enable the extensive outreach effort required in Strategy 2.A and to oversee the encouragement tasks. This should be monitored as implementation begins.
    - The City's Health and Human Services Department is willing to take on some of the encouragement tasks (Goal Area 3). These fit well with other health encouragement programming that the department conducts.

[29] https://nacto.org/wp-content/uploads/2015/04/nchrp_w128_MLOS_UsersGuide.pdf

- The Department of Public Works may also need additional staff in order to implement this ambitious plan. If the City continues to have difficulty in hiring a city traffic engineer, possible regional sharing of traffic expertise should be explored with CRCOG and the T2 center. It may be advisable for DPW to add to their engineering design staff in order to move the implementation of the bike and ped network (Goal area 2 tasks) forward.

Funding

The following is a summary of expected funding (not including any additional staff) needed to implement this plan:

Modifying traffic signals:	This plan assumes that any traffic signal updates will be accomplished as part of traffic signal upgrades, and will not be undertaken as an independent project. Therefore, there is no cost estimated for these changes.
Street marking program:	The City should provide $150,000 annually to allow for updating crosswalks and other street markings using epoxy paint.
Install bike parking:	Allocate $25,000 annually for purchase and installation of bike parking.
On-call consultant services:	$100,000 per year in years 1 and 2, $25,000 to $50,000 in subsequent years
Construction funding:	$250,000 should be made available each year to allow for pedestrian, transit, and bicycle facility upgrades outside of the regular paving program or streetscape projects
Maintain street canopy:	$100,000 should be allocated annually
Green Infrastructure Design:	$300,000 to complete this study. The study will identify construction and maintenance costs that can be used to develop future budget estimates.
Encouragement activities:	$10,000 per year
Total funding required in the first three years:	$2,080,000
Recommended annual funding after year 3:	$ 560,000

Evaluation – Measuring Our Success

This plan's ultimate success will be measured by decreases in pedestrian and bicycle crashes, and increases in non-motorized vehicle mode share. Evaluation measures listed below will measure how well we are doing in implementing the recommendations of this plan.

A. Create a regular data collection program

1. Establish some permanent bicycle, pedestrian, and motorized vehicle count locations, and some movable counters
2. Develop a Database for storing count information
3. Work with the HPD to develop a program for regular traffic counts (including bicycles and pedestrians) from their security cameras

B. Create an inventory of traffic features in GIS, including
    1. traffic signals, by type of pedestrian accommodation and fixed vs. actuated
    2. crosswalks
    3. sidewalks
    4. bike lanes (by type)

C. Create annual complete streets report as required by Complete Streets Policy
    1. Total miles of bike lanes/ trails built or striped
    2. Linear feet of new sidewalks and repaired sidewalks
    3. Number and location of ADA accommodations built in public sidewalks and streets
    4. Number of transit accessibility accommodations built or installed
    5. Number of new curb ramps installed on city streets;
    6. Number of new street trees planted and removed by the department of public works;
    7. Crosswalk and intersection improvements;
    8. Rate of crashes, injuries and fatalities by mode;
    9. Performance of the transportation and complete streets network, including speeds volumes and comparison to goals;
    10. Number and location of exemptions granted from the Complete Streets policy
    11. Bicycle and pedestrian counts at key locations, which may be conducted by city employees or obtained from other governmental or private entities.
    12. Changes to transportation mode split over time – using the most recent US Census/American Community Survey data as a baseline.

Appendices

Appendix 1: FHWA Countermeasures for Unsignalized Intersections

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 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)**

City of Hartford

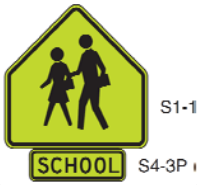
School Zone Signage, Crossing and Pavement Marking Guide

School zone signage varies considerably throughout the City of Hartford, as it does throughout the state and country, yet the efficacy of signage is dependent upon the consistency and appropriateness of its use. This guide should set forth a clear set of standards for the use of school zone signage, pavement markings and related devices within the City of Hartford.

This guide is based upon standards within the 2009 Manual on Uniform Traffic Control Devices (MUTCD). The recommendations herein are typical solutions; signage and pavement markings should be applied respecting the unique needs of each school environment. The location of signage and distances relative to the school grounds noted here should be considered "best practice".

Standard Signage & Pavement Markings for Hartford School Zones

The following signs are recommended for use in the City of Hartford. Refer to the attached MUTCD guidance on page 4 of this document or the 2009 MUTCD for full guidance.



School Zone Warning Sign

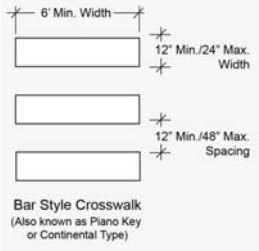
This sign is used on all approaches that enter a school zone. The school zone should extend a minimum of 200' to a maximum of 500' from the school grounds. In an urban environment such as Hartford, the 200' minimum would most often be applied. This sign is an assembly of two signs and includes the "School" marker sign (S4-3P) below the school warning sign (S1-1). The marker sign should always be used to distinguish this warning sign from school crosswalk signage. Note that school zone signage should be retroflective yellow-green.

School Crosswalk Sign

This sign assembly is used to identify a crosswalk that is not protected by an all-way stop or a traffic signal. This sign is used primarily within the school zone and occasionally outside of the school zone where a significant student crossing exists. When used outside of the school zone, this sign must be accompanied by the School Advance Crossing Assembly. This sign should be placed a minimum of 4' ahead of the crosswalk, but as close to the crossing as possible.

School Advanced Crossing Sign

This sign, while often misapplied, is used exclusively in conjunction with the School Crosswalk Sign as a means of advanced warning. This sign is only used when the school crosswalk exists outside of the posted school zone, and therefore acts in lieu of the School Zone Warning Sign in those areas. It should precede the School Crosswalk Sign by a minimum of 200', or as conditions permit.



Marked Crosswalk

All designated pedestrian crossings within a school zone should be marked with a bar style crosswalk (also known as piano key or continental type). This is preferred over the formerly conventional use of "zebra" stripes, due to its visibility and durability. Marked crosswalks not protected by signalization or stop control should always be accompanied by school crosswalk signage. Additional protection may include in-street crosswalk signs, refuge islands, raised crosswalks and/or flashing beacons.

Optional Signage & Pavement Markings for Hartford School Zones

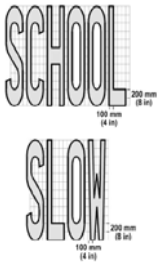
School Speed Limit Sign

This sign assembly is used where the speed limit within a school zone is greater than 30mph or where conditions warrant additional speed control. School zone speed limit designation can be established on local roads after investigation by the City and approval by the State Traffic Commission. Given that most streets in Hartford have a posted speed limit below 30mph, this sign would only occasionally be used.

This sign should be placed a minimum of 200' in advance of the school zone. The "When Flashing" marker should be used if the sign is automated with a flashing beacon. If not automated with a beacon, the marker sign should read "When Children are Present". This marker is preferred over a sign that lists school times, as school hours vary from year to year, and the information is often too small and complex to be comprehended by a passing driver.

Warning Beacons

Warning Beacons should be used to call attention to a school speed limit sign assembly or a school zone sign assembly. This system is most effectively applied to arterial and/or multi-lane roadways where drivers would not otherwise note school zone signage due to traffic conditions, speed of travel, and competing signage. The flashing lights are timed to correspond to school arrival and dismissal times. Warning beacons may also be used with the School Crosswalk Assembly or Advanced Crosswalk Assembly.



"Slow School" Pavement Markings

This pavement marking should be used as an additional warning where vehicle speeds are a concern. It should be placed in proximity to School Zone or School Speed Limit signage. These markings are most effective on single lane local or collector streets, where they are visible from a distance and not obscured by heavy vehicle traffic. This application offers a cost-effective alternative to flashing beacons and may be more appropriate in a residential environment where flashing beacons may not be desirable.

In-Street School Crosswalk Sign

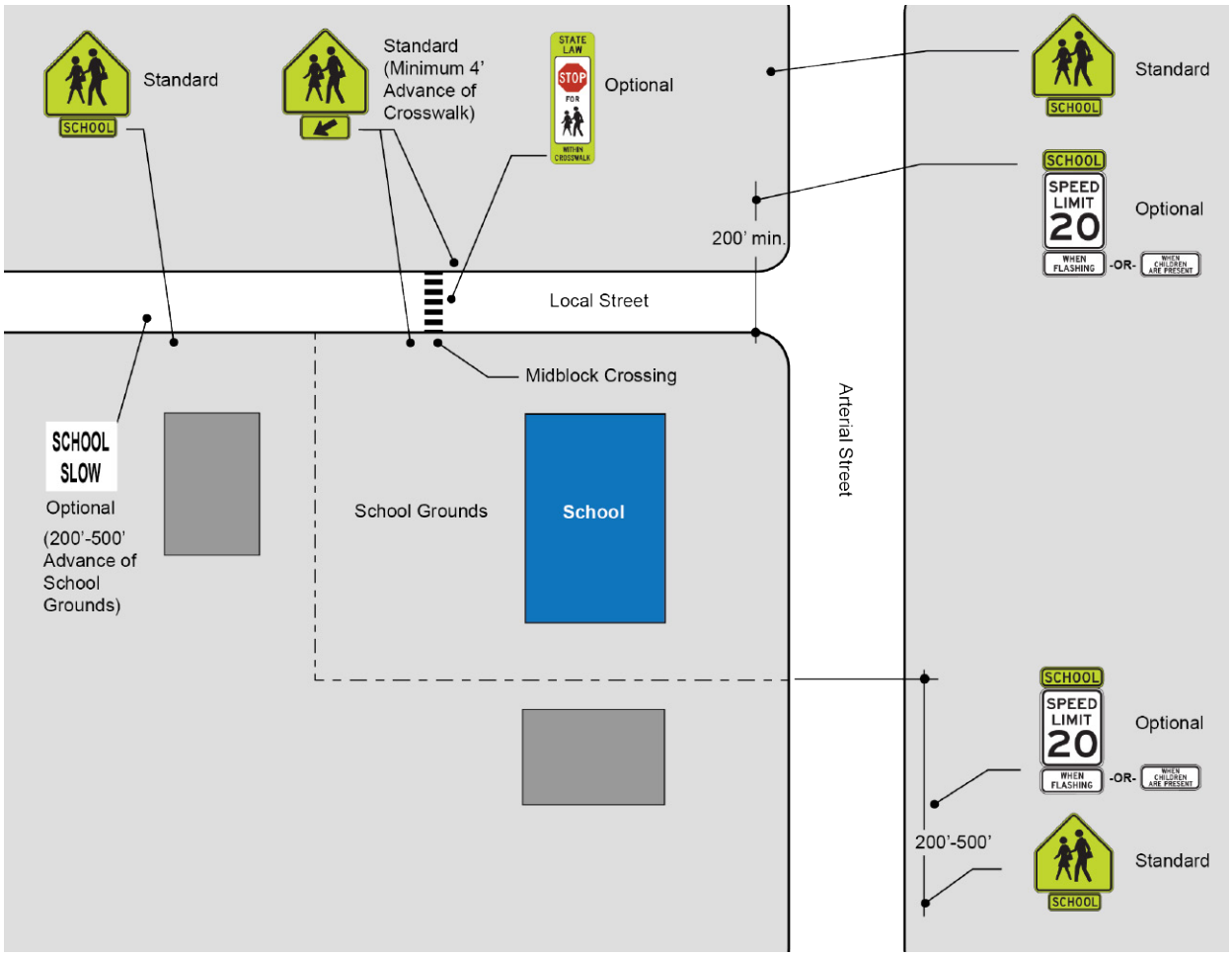
This sign should be used at mid-block crosswalks that are not protected by stop signs or signalization. The sign is placed on the yellow centerline immediately adjacent to (not within) the crosswalk. It should be placed on the side of the crosswalk that most vehicles approach from or as geometry permits.

Vertical Reflective Strip

This reflective strip should be used at stop controlled intersections that have crosswalks within the school zone to call extra attention to the stop sign. Reflective strips may also be used on School Zone Warning signs where necessary. The color of the reflective strip must match the sign background.

Sign Placement

While the MUTCD provides guidance for type of signage and application, placement of school zone signage is often dictated by standards set forth by state and local jurisdictions. Connecticut has no such standards, therefore the location of signs and distances relative to the school zone recommended here should be considered “best practice”. Refer to the diagram below for sign placement.



Signage Selection Matrix

Signs must be selected in response to the type of roadway and pedestrian crosswalk facilities located within proximity of a school. The following matrix should be used as a guide for signage options.

Condition	School Warning Sign S1 + S4-3P	Crosswalk Warning Sign S1 + W16-9P	Crosswalk Sign S1 + W16-7P	In-Street Crosswalk Sign R1-6C	School Speed Limit Sign S4-3P + R2-1 + S4-2P (or S4-4P)	Flashing Beacon	Slow School Pavement Marking	Oversized Signage
Local or Collector Street	•						○	
Arterial Street or Multi-Lane Street	•					○		○
Streets w/ speed limit 30mph or above	•				•	○	○	○
Midblock Crosswalk within School Zone			•	○				
Midblock Crosswalk outside of School Zone		•	•	○				

• Standard Application

○ Optional Application

MUTCD Guidance

The guidance below has been extracted from the 2009 MUTCD. This guidance supports the preceding school zone recommendations for the City of Hartford. The language below, although accurate, has been edited for brevity. For full text, refer to the MUTCD.

School Zone Signage (MUTCD Chapter 7B)

Caution against the Excessive Use of Signs (MUTCD Section 2A.04)

Regulatory and warning signs should be used conservatively because these signs, if used to excess, tend to lose their effectiveness. If used, route signs and directional guide signs should be used frequently because their use promotes efficient operations by keeping road users informed of their location.

Size of School Signs (MUTCD Section 7B.01)

The sizes of signs and plaques to be used on conventional roadways in school areas shall be as shown in the table below. The sizes in the Conventional Road column shall be used unless engineering judgment determines that a minimum or oversized sign size would be more appropriate.

The sizes in the Minimum column shall be used only where traffic volumes are low and speeds are 30 mph or lower, as determined by engineering judgment.

The sizes in the Oversized column should be used on roadways that have four or more lanes with posted speed limits of 40 mph or higher. The sizes in the Oversized column may also be used at other locations that require increased emphasis, improved recognition, or increased legibility.

Sign	Sign Designation	Section	Conventional Road	Minimum	Oversized
School	S1-1	7B.08	36 x 36	30 x 30	48 x 48
School Bus Stop Ahead	S3-1	7B.13	36 x 36	30 x 30	48 x 48
School Bus Turn Ahead	S3-2	7B.14	36 x 36	30 x 30	48 x 48
Reduced School Speed Limit Ahead	S4-5, S4-5a	7B.16	36 x 36	30 x 30	48 x 48
School Speed Limit XX When Flashing	S5-1	7B.15	24 x 48	—	36 x 72
End School Zone	S5-2	7B.09	24 x 30	—	36 x 48
End School Speed Limit	S5-3	7B.15	24 x 30	—	36 x 48
In-Street Ped Crossing	R1-6, R1-6a, R1-6b, R1-6c	7B.11, 7B.12	12 x 36	—	—
Speed Limit (School Use)	R2-1	7B.15	24 x 30	—	36 x 48
Begin Higher Fines Zone	R2-10	7B.10	24 x 30	—	36 x 48
End Higher Fines Zone	R2-11	7B.10	24 x 30	—	36 x 48

Plaque	Sign Designation	Section	Conventional Road	Minimum	Oversized
X:XX to X:XX AM X:XX to X:XX PM	S4-1P	7B.15	24 x 10	—	36 x 18
When Children Are Present	S4-2P	7B.15	24 x 10	—	36 x 18
School	S4-3P	7B.09, 7B.15	24 x 8	—	36 x 12
When Flashing	S4-4P	7B.15	24 x 10	—	36 x 18
Mon-Fri	S4-6P	7B.15	24 x 10	—	36 x 18
All Year	S4-7P	7B.09	24 x 12	—	30 x 18
Fines Higher	R2-6P	7B.10	24 x 18	—	36 x 24
XX Feet	W16-2P	7B.08	24 x 18	—	30 x 24
XX Ft	W16-2aP	7B.08	24 x 12	—	30 x 18
Turn Arrow	W16-5P	7B.08, 7B.09, 7B.11	24 x 12	—	30 x 18
Advance Turn Arrow	W16-6P	7B.08, 7B.09, 7B.11	24 x 12	—	30 x 18
Diagonal Arrow	W16-7P	7B.12	24 x 12	—	30 x 18
Diagonal Arrow (optional size)	W16-7P	7B.12	21 x 15	—	—
Ahead	W16-9P	7B.11	24 x 12	—	30 x 18

Note: 1. Larger sizes may be used when appropriate
2. Dimensions are shown in inches and are shown as width x height
3. Minimum sign sizes for multi-lane conventional roads shall be as shown in the Conventional Road column

Sign Color for School Warning Signs (MUTCD Section 7B.07)

School warning signs, including the “SCHOOL” portion of the School Speed Limit (S5-1) sign and including any supplemental plaques used in association with these warning signs, shall have a fluorescent yellow-green background with a black legend and border unless otherwise provided in this Manual for a specific sign.

School Sign (S1-1) and Plaques (MUTCD Section 7B.08)

School Zone Warning Sign

S1-1

S4-3P

Many state and local jurisdictions find it beneficial to advise road users that they are approaching a school that is adjacent to a highway, where additional care is needed, even though no school crossing is involved and the speed limit remains unchanged. Additionally, some jurisdictions designate school zones that have a unique legal standing in that fines for speeding or other traffic violations within designated school zones are increased or special enforcement techniques such as photo radar systems are used. It is important and sometimes legally necessary to mark the beginning and end points of these designated school zones so that the road user is given proper notice.

The School (S1-1) sign has the following four applications:

A. School Area – the S1-1 sign can be used to warn road users that they are approaching a school area that might include school buildings or grounds, a school crossing, or school related activity adjacent to the highway.

B. School Zone – the S1-1 sign can be used to identify the location of the beginning of a designated school zone.

C. School Advance Crossing – if combined with an AHEAD (W16-9P) plaque to comprise the School Advance Crossing assembly, the S1-1 sign can be used to warn road users that they are approaching a crossing where schoolchildren cross the roadway

D. School Crossing – if combined with a diagonal downward pointing arrow (W16-7P) plaque to comprise the School Crossing assembly, the S1-1 sign can be used to warn approaching road users of the location of a crossing where schoolchildren cross the roadway.

School Advance Crossing Assembly (MUTCD Section 7B.11)

School Advance Crossing Assembly

S1-1

W16-9P

The School Advance Crossing assembly shall consist of a School (S1-1) sign supplemented with an AHEAD (W16-9P) plaque.

A School Advance Crossing assembly shall be used in advance of the first School Crossing assembly that is encountered in each direction as traffic approaches a school crosswalk.

The School Advance Crossing assembly may be omitted where a School Zone (S1-1) sign is installed to identify the beginning of a school zone in advance of the School Crossing assembly.

School Crossing Assembly (MUTCD Section 7B.12)

School Crossing Assembly

S1-1

W16-7P

If used, the School Crossing assembly shall be installed at the school crossing, or as close to it as possible, and shall consist of a School (S1-1) sign supplemented with a diagonal downward pointing arrow (W16-7P) plaque to show the location of the crossing.

The School Crossing assembly shall not be used at crossings other than those adjacent to schools and those on established school pedestrian routes. The School Crossing assembly shall not be installed on approaches controlled by a STOP or YIELD sign.

The In-Street Schoolchildren Crossing (R1-6c) sign may be used at unsignalized school crossings. If used at a school crossing, a 12 x 4-inch SCHOOL (S4-3P) plaque (see Figure 7B-6) may be mounted above the sign. The STATE LAW legend on the R1-6 series signs may be omitted. The In-Street Schoolchildren Crossing sign shall not be used at signalized locations.

R1-6c

School Speed Limit Assembly (MUTCD Section 7B.15)

A School Speed Limit assembly or a School Speed Limit (S5-1) sign shall be used to indicate the speed limit where a reduced school speed limit zone has been established based upon an engineering study or where a reduced school speed limit is specified for such areas by statute.

The School Speed Limit assembly or School Speed Limit sign shall be placed at or as near as practical to the point where the reduced school speed limit zone begins.

If a reduced school speed limit zone has been established, a School (S1-1) sign shall be installed in advance of the first School Speed Limit sign assembly or S5-1 sign that is encountered in each direction as traffic approaches the reduced school speed limit zone.

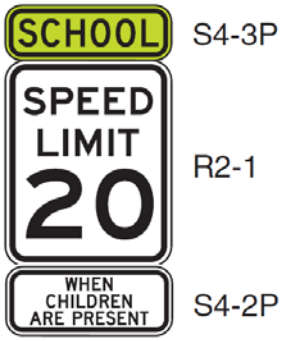
A standard Speed Limit sign showing the speed limit for the section of highway that is downstream from the authorized and posted reduced school speed limit zone may be mounted on the same post above the END SCHOOL SPEED LIMIT (S5-3) sign or the END SCHOOL ZONE (S5-2) sign.

The beginning point of a reduced school speed limit zone should be at least 200 feet in advance of the school grounds, a school crossing, or other school related activities; however, this 200-foot distance should be increased if the reduced school speed limit is 30 mph or higher.

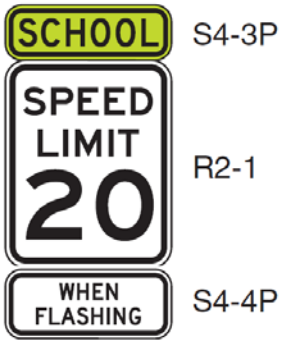
The fixed-message School Speed Limit assembly shall consist of a top plaque (S4-3P) with the legend SCHOOL, a Speed Limit (R2-1) sign, and a bottom plaque (S4-1P, S4-2P, S4-4P, or S4-6P) indicating the specific periods of the day and/or days of the week that the special school speed limit is in effect.

A Speed Limit Sign Beacon also may be used, with a WHEN FLASHING legend, to identify the periods that the school speed limit is in effect.

School Speed Limit Assembly



School Speed Limit Assembly



Enhanced Conspicuity for Standard Signs (MUTCD Section 2A.15)

Based upon engineering judgment, where the improvement of the conspicuity of a standard regulatory, warning, or guide sign is desired, any of the following methods may be used, as appropriate, to enhance the sign's conspicuity:

- Increasing the size of a standard regulatory, warning, or guide sign.
- Adding a warning beacon (see Section 4L.03) to a standard regulatory (other than a STOP or a Speed Limit sign), warning, or guide sign.
- Adding a speed limit sign beacon (see Section 4L.04) to a standard Speed Limit sign.
- Adding a strip of retroreflective material to the sign support (in compliance with the provisions of Section 2A.21).

Sign conspicuity improvements can also be achieved by removing non-essential and illegal signs from the right-of-way and by relocating signs to provide better spacing.

Vertical Reflective Strip

Posts and Mountings (MUTCD Section 2A.21)

Where engineering judgment indicates a need to draw attention to the sign during nighttime conditions, a strip of retroreflective material may be used on regulatory and warning sign supports. If a strip of retroreflective material is used on the sign support, it shall be at least 2 inches in width, it shall be placed for the full length of the support from the sign to within 2 feet above the edge of the roadway, and its color shall match the background color of the sign, except that the color of the strip for the YIELD and DO NOT ENTER signs shall be red.

Parking and Stopping Signs (MUTCD Section 7B.17)

Parking and stopping regulatory signs may be used to prevent parked or waiting vehicles from blocking pedestrians' views, and drivers' views of pedestrians, and to control vehicles as a part of the school traffic plan. Parking signs and other signs governing the stopping and standing of vehicles in school areas cover a wide variety of regulations. Typical examples of regulations are as follows:

- No Parking X:XX AM to X:XX PM School Days Only
- No Stopping X:XX AM to X:XX PM School Days Only
- XX Min Loading X:XX AM to X:XX PM School Days Only
- No Standing X:XX AM to X:XX PM School Days Only

Typical R-7 Series Parking Sign

Flashing Beacons (MUTCD Section 4L)

General Design and Operation of Flashing Beacons (MUTCD Section 4L.01)

A Flashing Beacon is a highway traffic signal with one or more signal sections that operates in a flashing mode. A beacon shall not be included within the border of a sign except for SCHOOL SPEED LIMIT sign beacons. If used to supplement a warning or regulatory sign, the edge of the beacon signal housing should normally be located no closer than 12 inches outside of the nearest edge of the sign.

Warning Beacon (MUTCD Section 4L.03)

Typical applications of Warning Beacons include the following:

1. As supplemental emphasis to warning signs;
2. As emphasis for midblock crosswalks;
3. In conjunction with a regulatory or warning sign that includes the phrase WHEN FLASHING in its legend to indicate that the regulation is in effect or that the condition is present only at certain times.

- A Warning Beacon shall consist of one or more signal sections of a standard traffic signal face with a flashing CIRCULAR YELLOW signal indication in each signal section.
- A Warning Beacon shall be used only to supplement an appropriate warning or regulatory sign or marker.
- Warning Beacons should be operated only during those periods or times when the condition or regulation exists.
- Warning Beacons that are actuated by pedestrians, bicyclists, or other road users may be used as appropriate to provide additional warning to vehicles approaching a crossing or other location.

Flashing Beacons

Speed Limit Sign Beacon (MUTCD Section 4L.04)

A Speed Limit Sign Beacon shall be used only to supplement a Speed Limit sign. A Speed Limit Sign Beacon shall consist of one or more signal sections of a standard traffic control signal face, with a flashing CIRCULAR YELLOW signal indication in each signal section. If applicable, a flashing Speed Limit Sign Beacon (with an appropriate accompanying sign) may be used to indicate that the displayed speed limit is in effect. A Speed Limit Sign Beacon may be included within the border of a School Speed Limit (S5-1) sign.

School Crossings (MUTCD Section 7A, Section 4C)

School Routes and Established School Crossings (MUTCD Section 7A.02)

To establish a safer route to and from school for schoolchildren, the application of planning criterion for school walk routes might make it necessary for children to walk an indirect route to an established school crossing located where there is existing traffic control and to avoid the use of a direct crossing where there is no existing traffic control. School walk routes should be planned to take advantage of existing traffic controls.

The following factors should be considered when determining the feasibility of requiring children to walk a longer distance to a crossing with existing traffic control:

A. The availability of adequate sidewalks or other pedestrian walkways to and from the location with existing control
B. The number of students using the crossing
C. The age levels of the students using the crossing, and
D. The total extra walking distance.

School Crossing Control Criteria (MUTCD Section 7A.03)

The frequency of gaps in the traffic stream that are sufficient for student crossing is different at each crossing location. When the delay between the occurrences of adequate gaps becomes excessive, students might become impatient and endanger themselves by attempting to cross the street during an inadequate gap. In these instances, the creation of sufficient gaps needs to be considered to accommodate the crossing demand. A recommended method for determining the frequency and adequacy of gaps in the traffic stream is given in the “Traffic Control Devices Handbook” (see Section 1A.11).

School Crossings (MUTCD Section 4C.06, Warrant 5)

The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word “schoolchildren” includes elementary through high school students.

The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see MUTCD Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.

Pavement Markings (MUTCD Ch.7C)

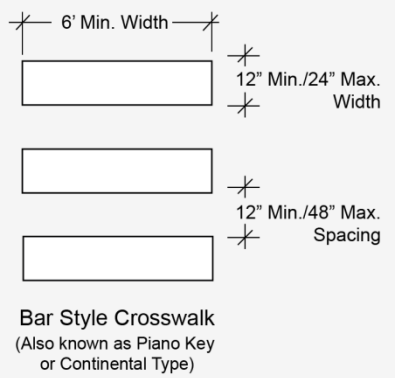
Functions and Limitations of Pavement Markings (MUTCD Section 7C.01)

Markings have definite and important functions in a proper scheme of school area traffic control. In some cases, they are used to supplement the regulations or warnings provided by other devices, such as traffic signs or signals. In other instances, they are used alone and produce results that cannot be obtained by the use of any other device. In such cases they serve as an effective means of conveying certain regulations, guidance, and warnings that could not otherwise be made clearly understandable.

Pavement markings have some potential limitations. They might be obscured by snow, might not be clearly visible when wet, and might not be durable when subjected to heavy traffic. In spite of these potential limitations, they have the advantage, under favorable conditions, of conveying warnings or information to the road user without diverting attention from the road.

Crosswalk Markings (MUTCD Section 7C.02, Section 3B.18)

Crosswalks should be marked at all intersections on established routes to a school where there is substantial conflict between motorists, bicyclists, and student movements; where students are encouraged to cross between intersections; where students would not otherwise recognize the proper place to cross; or where motorists or bicyclists might not expect students to cross.



Bar Style Crosswalk
(Also known as Piano Key or Continental Type)

Crosswalk lines should not be used indiscriminately. An engineering study considering the factors should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign.

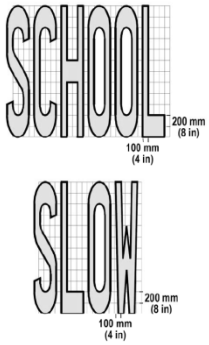
The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either: The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater; -or- The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.

Because non-intersection school crossings are generally unexpected by the road user, warning signs should be installed for all marked school crosswalks at non-intersection locations. Adequate visibility of students by approaching motorists and of approaching motorists by students should be provided by parking prohibitions or other appropriate measures.

Pavement Word, Symbol, and Arrow Markings (MUTCD Section 7C.03)

If used, the SCHOOL word marking may extend to the width of two approach lanes. If the two-lane SCHOOL word marking is used, the letters should be 10 feet or more in height.



The Need for Standards (MUTCD Section 7A.01)

Regardless of the school location, the best way to achieve effective traffic control is through the uniform application of realistic policies, practices, and standards developed through engineering judgment or studies. Pedestrian safety depends upon public understanding of accepted methods for efficient traffic control. This principle is especially important in the control of pedestrians, bicycles, and other vehicles in the vicinity of schools.

Neither pedestrians on their way to or from school nor other road users can be expected to move safely in school areas unless they understand both the need for traffic controls and how these controls function for their benefit. Procedures and devices that are not uniform might cause confusion among pedestrians and other road users, prompt wrong decisions, and contribute to crashes. To achieve uniformity of traffic control in school areas, comparable traffic situations need to be treated in a consistent manner. Each traffic control device and control method described in Part 7 (of 2009 MUTCD) fulfills a specific function related to specific traffic conditions.

A uniform approach to school area traffic controls assures the use of similar controls for similar situations, which promotes appropriate and uniform behavior on the part of motorists, pedestrians, and bicyclists. A school traffic control plan permits the orderly review of school area traffic control needs, and the coordination of school/pedestrian safety education and engineering measures. Engineering measures alone do not always result in the intended change in student and road user behavior.

A school route plan for each school serving elementary to high school students should be prepared in order to develop uniformity in the use of school area traffic controls and to serve as the basis for a school traffic control plan for each school.

The school route plan, developed in a systematic manner by the school, law enforcement, and traffic officials responsible for school pedestrian safety, should consist of a map (see Figure 7A-1) showing streets, the school, existing traffic controls, established school walk routes, and established school crossings. The type(s) of school area traffic control devices used, either warning or regulatory, should be related to the volume and speed of vehicular traffic, street width, and the number and age of the students using the crossing. School area traffic control devices should be included in a school traffic control plan.

Reduced speed limit signs for school areas and crossings are included in this Manual (2009 MUTCD) solely for the purpose of standardizing signing for these zones and not as an endorsement of mandatory reduced speed zones.

Appendix 3: Requested Downtown Speed Limits