

# Appendix C

## Intersection Treatments

### Treatment Types

Proposed treatments are based on established standards, including the 2010 Draft Update to the AASHTO Guide for the Development of Bicycle Facilities, the 2009 Manual of Uniform Traffic Control Devices (MUTCD), and the 2011 NACTO Urban Bikeway Design Guide. Greater detail on these sources is provided in Appendix D: Design Guidelines. Trail crossing types fall into three basic categories, described below as they apply to the Ecusta corridor. Appendix D provides more detail on the general criteria for each crossing type.

#### Type I – Unsignalized Crossings

Treatment consists of a crosswalk, signage on both the roadway and the trail, and a yield or stop control on either the roadway or the trail at a minimum. Figure C.1 shows a variety of sign control options that may be used at unsignalized crossings. Where width permits, center median refuges improve safety by minimizing the need for trail users to navigate traffic in two directions. Where safety is a concern but width does not allow a median refuge, center road signs are an intermediate option. Other elements to consider include high visibility crosswalks, and curb extensions. The AASHTO guide recommends that high-visibility crosswalks be used at all intersections.

In most cases, the yield or stop control at unsignalized crossings will be located on the trail. In the case of the many informal, unpaved crossings along the Ecusta, however, signage indicating the upcoming crossing on the trail may suffice with the yield control placed on the roadway. The latter approach is appropriate only when traffic on the informal roadway is rare and significantly exceeded by trail traffic (See AASHTO, Chapter 5, “Determining Priority Assignment”).

Cross access agreements may also be necessary with driveway crossings, which all fall into this crossing type.

#### Type II – Signalized Crossings

Treatments include a countdown signal on the roadway along with a crosswalk, signage, curb ramps, and a stop control on the trail. There are several options for signal types, including different varieties of actuated beacons or in-pavement flashing lights. Figure C.1 shows one of these options - the High-Intensity Activated Crosswalk or HAWK signal. This signal has been shown to achieve high driver compliance when compared to other signal options, and to improve crossing safety (See NACTO, “Signals”). Signals may be activated by push buttons or motion detectors, with crossing times dependent on the road width.



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Figure C.1 – Roadway & Trail Intersection Treatment Options



Type 1 crossings are unsignalized but clearly marked to indicate the presences of pedestrians and bicyclists to roadway traffic.



Equestrian Crossing Caution Sign

Sign on Roadway		W11-15/	Sign on Trail		W2-1
Yield Sign on Roadway		W16-7P	Yield Sign on Trail		W16-8P
Stop Sign on Roadway		R1-1	Stop Sign on Trail		D3-1
Center Sign on Roadway		R1-6	Stop Sign on Trail		R1-2
Activated Signal (High-Intensity Activated Crosswalk shown at right)			Stop with Median		See Stop Sign on Roadway



Source: www.pedbikeimages.org - Dan Burden



Source: www.pedbikeimages.org - Mike Cynecki

### Type III – Grade-Separated Crossings

These treatments are typically used on high-volume, high speed roadways and can consist of bridges or underpasses. There is one existing grade-separated rail crossing along the corridor that is a candidate for conversion to a grade-separated trail overpass.

#### Control Selection

Once a treatment type is selected, specific controls must be configured to suit the type of intersection encountered. The two major categories of intersection configurations are midblock trail crossings and crossings at existing intersections. Within these categories, different configurations require varying controls. Configurations seen along the Ecusta corridor are summarized in Figure C.2.

At midblock crossings where the trail does not cross the road at a right angle, it is preferable to bring the trail to a 90 degree angle to increase visibility for trail users (See AASHTO, Chapter 5, “Geometric Design Issues at Crossings”). At all midblock crossings, it is also recommended to include a “jog” in the trail before the crossing in order to slow down cyclists as they approach the intersection.

Preliminary type and control treatments for each Ecusta crossing are provided in Table C.1. Figure C.3 shows the location of each crossing, and Figure C.4 provides a concept detail for a typical midblock crossing to illustrate the application of these controls to a specific intersection.

Figure C.2 – Crossing Configurations

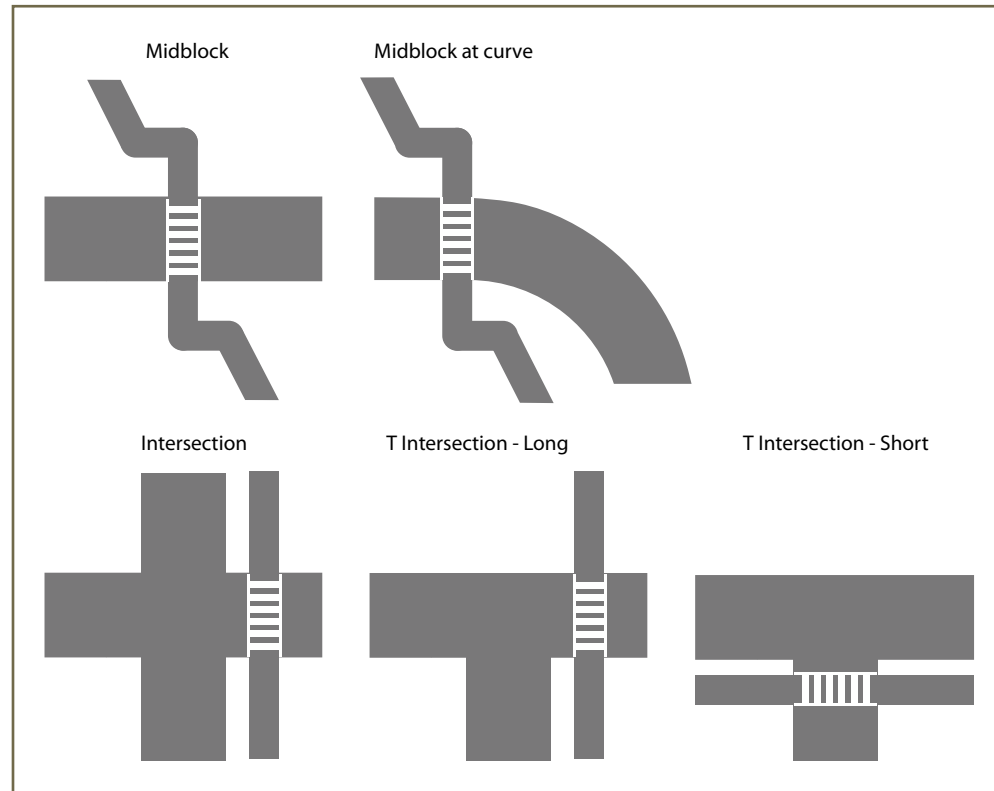


Table C.1 – Summary of Proposed Treatments at Road Crossings

ROAD NAME(S)	POSTED SPEED	NO. OF LANES	TRAFFIC VOLUME (2010 UNLESS NOTED)	ROAD CLASSIFICATION	INTERSECTION TYPE	PROPOSED TREATMENT	CONTROL ON TRAIL	CONTROL ON ROAD
Williams St & 1st Ave	20	2		Local	T Intersection/ Long	Type I	Stop	Stop
1st Ave E	20	2		Local	Midblock	Type I	Yield	Sign
S Grove St & E Caswell St	35	2	5,000	Local	Midblock	Type I	Stop	Center Sign Yield
S Main St (US 25 Bus) & S King St	25	3	13,000	Arterial	Midblock	Type II	Stop	Activated Signal
S Church St (US 25 Bus)	20	2	13,000	Arterial	Midblock	Type II	Stop	Activated Signal
Kanuga Rd & Willow Rd	25	2	8,400	Collector	T Intersection/Long	Type I	Stop with Median	Sign
Spring St & Dairy St	20	2		Local	T Intersection/Long	Type I	Yield	Sign
S Whitted St	20	2		Local	Midblock	Type I	Yield	Sign
W Allen St	25	2		Local	Midblock	Type I	Stop	Sign
3rd Ave W & Blythe St	25	2		Local	T Intersection/Long	Type I	Stop	Center Sign Yield
Jordan St & Midway St	25	2		Local	Intersection	Type I	Yield	Sign
5th Ave W & Broadway St	25	2	4,600	Collector	T Intersection/Long	Type I	Stop	Center Sign Yield
Glasgow Ln & Sweet Clover Ln/White Pine Dr	25	2		Local	T Intersection/Short	Type I	Yield	Center Sign Yield
Daniel Dr	25	2	3,300	Local	Midblock	Type I	Stop	Center Sign Yield
Windsor Dr & White Pine Dr	25	2		Local	T Intersection/Short	Type I	Yield	Sign
Shaws Creek Ln	15	2		Local	Midblock	Type I	Sign	Yield
Hillside Ln	15	2		Local	Midblock @ Curve	Type I	Stop	Center Sign Yield
Woodbridge Dr	15	2		Local	Midblock	Type I	Yield	Sign
Bonaire Dr	15	2		Local	Midblock @ Curve	Type I	Yield	Center Sign Yield
No Name		2		Unpaved	Midblock	Type I	Sign	Yield
Turley Falls Dr & Sky Lake Dr	35	2		Local	Intersection	Type I	Stop	Center Sign Yield
Yale Rd	25	2		Local	Midblock @ Curve	Type I	Stop	Center Sign Yield
Old Homestead Rd	25	2		Local	Midblock	Type I	Stop	Sign
Allstar Ln	15	2		Local	Midblock	Type I	Yield	Sign
Hunters Glen Ln	25	2	450	Local	Midblock	Type I	Stop	Center Sign Yield
US 64 & Battle Creek Rd	45	2	13,000	Arterial	T Intersection/Long	Type II	Stop	Activated Signal
No Name				Unpaved	Midblock	Type I	Sign	Yield
Banner Farm Rd	40	2	3,500	Collector	Midblock	Type II	Stop	Center Sign Yield
Horshoe Bend Rd	15	2		Local	Midblock @ Curve	Type I	Yield	Sign
Industrial Dr	25	2		Local	Midblock	Type I	Yield	Sign
No Name				Unpaved	Midblock	Type I	Sign	Yield
Brevard Rd/US 64 & McKinney Rd	45	3	9,500	Arterial	Intersection	Type II	Stop with Median	Stop
Etowah School Rd & Old Hwy 64	35	2	2,100 (2009)	Collector	T Intersection/Short	Type I	Stop	Stop
Timberlane Dr	20	2	450 (2009)	Local	Midblock	Type I	Stop	Center Sign Yield
Little Mountain Dr	10	2		Local	Midblock	Type I	Yield	Sign

Table C.1 -- Summary of Proposed Treatments at Road Crossings

ROAD NAME(S)	POSTED SPEED	NO. OF LANES	TRAFFIC VOLUME (2010 UNLESS NOTED)	ROAD CLASSIFICATION	INTERSECTION TYPE	PROPOSED TREATMENT	CONTROL ON TRAIL	CONTROL ON ROAD
Tower Cir	10	2		Local	Midblock	Type I	Yield	Sign
Walters Dr	15	2		Local	Midblock	Type I	Yield	Sign
Eade Rd	30	2	490 (2009)	Local	Midblock	Type I	Yield	Sign
Armstrong Rd	25	2	140 (2009)	Local	Midblock	Type I	Stop	Center Sign Yield
Driveway		1		Driveway	Midblock	Type I	Yield	Sign
Driveway		1		Driveway	Midblock	Type I	Yield	Sign
Penland		1		Local	Midblock	Type I	Yield	Sign
Grove Bridge Rd		2	830	Local	Midblock	Type I	Yield	Center Sign Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
Valley Green Dr		1		Local	Midblock	Type I	Yield	Sign
Apac		1		Local	Midblock	Type I	Sign	Yield
Crab Creek Rd	45	2	3,900	Collector	Midblock	Type II	Stop	Center Sign Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
Driveway				Driveway	Midblock	Type I	Yield	Sign
No Name				Unpaved	Midblock	Type I	Sign	Yield
Driveway				Driveway	Midblock	Type I	Yield	Sign
Driveway				Driveway	Midblock	Type I	Yield	Sign
No Name				Unpaved	Midblock	Type I	Sign	Yield
No Name				Unpaved	Midblock	Type I	Sign	Yield
Driveway				Driveway	Midblock	Type I	Yield	Sign
Driveway				Driveway	Midblock	Type I	Yield	Sign
Everett Rd	40	2	2,800 (2009)	Collector	T Intersection/Short	Type I	Stop	Stop
Driveway				Driveway	Midblock	Type I	Yield	Sign
Driveway				Driveway	Midblock	Type I	Yield	Sign
Driveway				Driveway	Midblock	Type I	Yield	Sign
No Name				Unpaved	Midblock	Type I	Sign	Yield
Old Hendersonville Hwy	35	2	5200	Collector	Midblock @ Curve	Type I	Stop	Center Sign Yield
Davidson River Rd	35	2	1,200 (2009)	Local	Grade-Separated	Type III	Stop	None
Ecusta Rd	35	2	5,100 (2009)	Collector	Midblock	Type I	Stop with Median	Center Sign Yield



Figure C.3 – Ecusta Rail Corridor Road Crossings

Crossing Type	Intersection Type	Count
Type I	Midblock	24
	Midblock @ Curve	5
	Midblock Unpaved	15
	Driveway	10
	Intersection	2
	T Intersection/ Long	5
	T Intersection/Short	4
Type II	Midblock	2
	Intersection	1
	T Intersection/Long	1
Type III	Grade-Separated	1

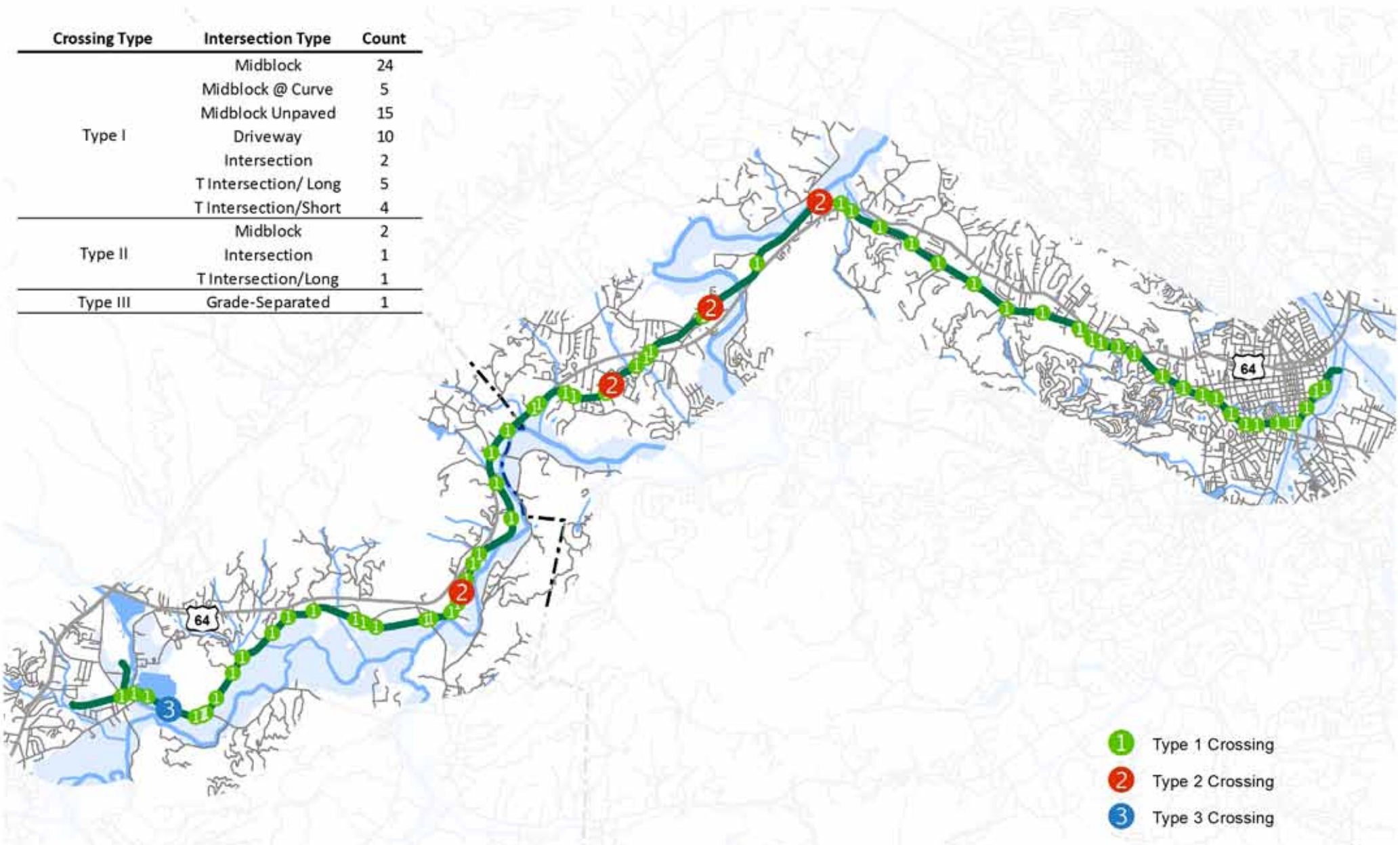


Figure C.4 – Midblock Crossing Detail

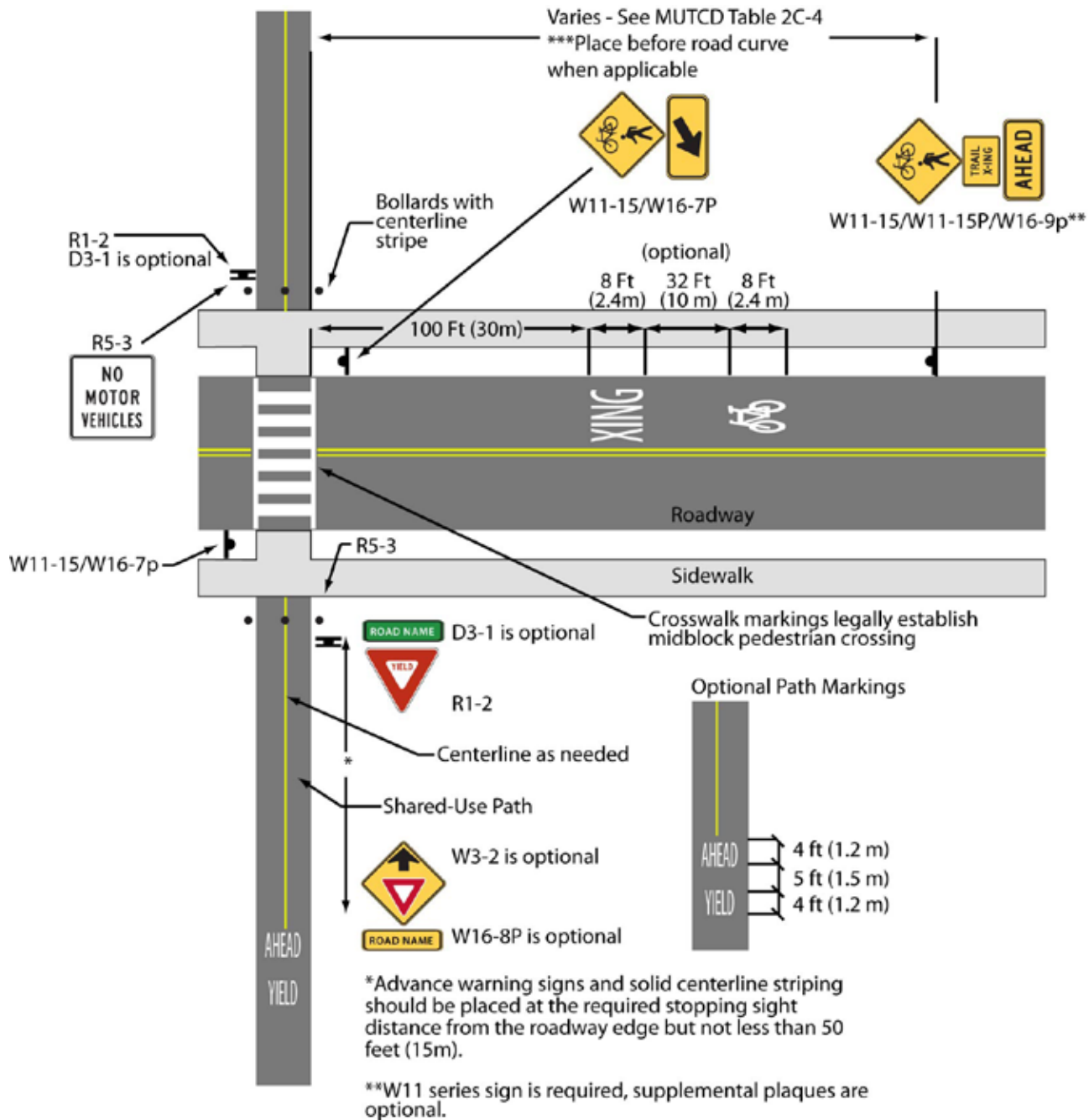
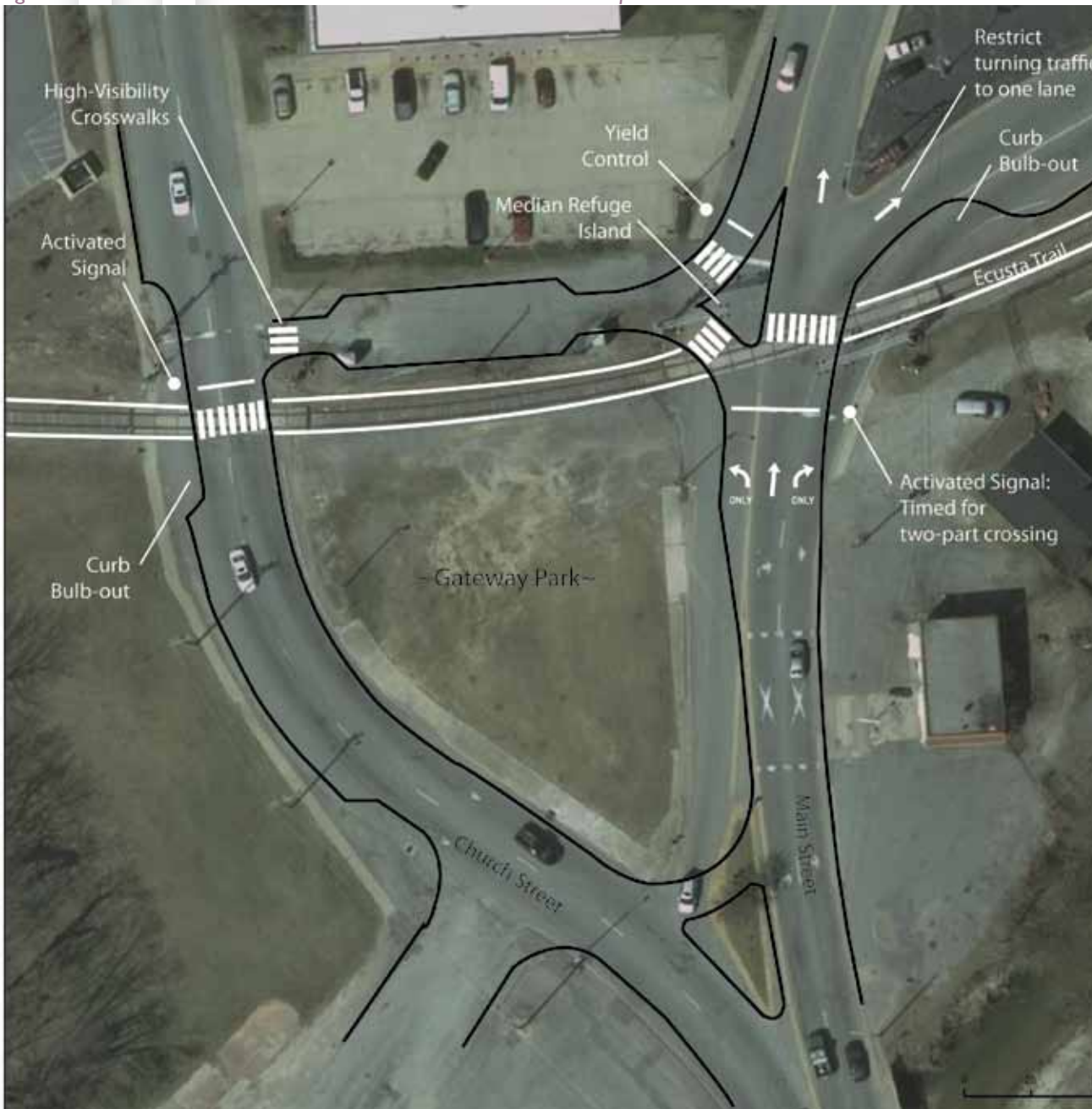


Figure C.5 – Ecusta & Main Street/Church Street Intersection Improvements



## Crossing Challenges

Several Ecusta crossings with more significant design challenges are illustrated in greater detail in the following figures. These figures are conceptual rather than comprehensive, showing unique elements to the crossing under consideration.

### Church Street & Main Street

The crossing of Church Street and Main Street in Hendersonville presents the greatest challenge. Given the speed, volume of traffic, and number of lanes on these roads, signals are recommended at both streets. The City of Hendersonville is currently renovating the intersection to accommodate Gateway Park, which sits between the two roadways. Figure C.5 shows the recommended controls that build upon the current design of the park and surrounding intersections. Curb bulb-outs and the median refuge island minimize the crossing distance for trail users, reduce traffic speeds, and provide a space for plantings. Further study of the impacts of this design on vehicular traffic is required.



View looking east across Main Street



### Brevard Road & Battle Creek Road

The crossing of Brevard Road at its intersection with Battle Creek Road requires a signal given the volume and speed of traffic on this road. A reduction in the turning radius from Battle Creek Road onto Brevard Road is also recommended, since this turn occurs just west of the signal head. Further, the trail should be oriented to be perpendicular to the road to the extent that right-of-way and topography allow.



*Existing crossing of Brevard Road*

*Figure C.6 – Ecusta & Brevard Road/Battle Creek Road Intersection Improvements*



### Brevard Road & McKinney Road

The crossing of Brevard Road at McKinney Road is three lanes wide. For this reason a median refuge island is recommended, along with adjustments to the trail approach so that it crosses the road at a 90 degree angle. Turning radius reductions are also recommended to slow turning vehicles as they approach the trail crossing.

Figure C.7 – Ecusta & Brevard Road/McKinney Road Intersection Improvements

