Cobb County Bicycle and Pedestrian Improvement Plan

Chapters 2-5
Goals, Objectives and Policy Recommendations
Existing Conditions
Infrastructure Needs
Implementation Opportunities

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Chapter 2: Goals, Objectives, and Policy Recommendations

This Chapter identifies Goals and Objectives for this *Bicycle and Pedestrian Improvement Plan*. The task of meeting these goals and objectives will be assisted by the infrastructure improvements identified in Chapters 5 and 6, and can also be assisted by policy decisions related to County practices, development policy and program activity, all of which are described in this chapter. The goals and objectives are derived from and support the goals and objectives of the County's adopted 2020 Comprehensive Transportation Plan, while the policy recommendations are derived from various "best practices" that may be applicable Cobb County's needs and its aspiration to provide true multimodal options to its residents and visitors. Finally, this chapter includes a synopsis of recommended amendments or updates to the existing plans and studies which are discussed in detail in Chapter 3.

2.1 GOALS AND OBJECTIVES

Cobb County's 2030 Comprehensive Transportation Plan (*CTP*) was adopted in February 2008. The *CTP* established the following vision statement for Cobb County's Transportation System:

> *Cobb County's transportation system will be a safe and efficient network providing multimodal service to coordinated land uses throughout the county, including to green space and "live-work-shop-play" communities.*

The CTP then proposes four goals that support that vision, which are in turn supported by specific objectives that are intended to assist in the achievement of those goals.

This *Bicycle and Pedestrian Improvement Plan* is intended to follow the lead of the *CTP* and focus attention more specifically on non-

motorized modes of transportation. The vision for this plan, then, is the same as the vision of the *CTP*. The goals and objectives of this plan will also be derived from the goals and objectives developed for the *CTP,* but more sharply focused on non-motorized modes.

In order to provide a direct link to established priorities for transportation in Cobb County, this section quotes the goals of the *CTP* and any supporting objectives that are relevant to improving bicycling and pedestrian conditions. These excerpts from the *CTP* (printed in *italics*) are then followed by proposed goals and objectives that are specifically tailored to bicycling and walking. These new goals and objectives are intended to serve as more sharply focused extensions of the general goals and objectives described in the *CTP.*

The following objectives outline specific and measurable steps that should contribute to the achievement of the goals, which in turn should assist in Cobb County realizing the vision it has established for its transportation future.

2.1.1 SYSTEM PERFORMANCE AND SAFETY

GOAL FROM CTP:
Improve the overall performance and safety of the transportation system.

Objectives from CTP:

- *Maximize use of public transit.*
- *Reduce number of pedestrian and bicycle accidents.*

NON-MOTORIZED SYSTEM PERFORMANCE GOAL: Improve the overall performance of Cobb County's

streets to make bicycling and waking viable transportation options for bicycling and walking along Cobb County's major thoroughfares (Arterial Streets, Major Collectors, and Minor Collectors), local streets, and shared use paths.

Performance Objectives:

- Achieve Bicycle Level of Service "C" on an additional 20% of bicycle study network[1]

[1] The study network is defined in the prioritization methodology in Chapter 4. The

miles by 2030.
Achieve Pedestrian Level of Service "C" on an additional 20% of pedestrian study network[2] miles by 2030.

- Identify a network of 100 additional miles of "Family Friendly Routes" by 2030.[3]
- Require accommodation of bicycles and pedestrians to Bicycle and Pedestrian Levels of Service "C" in all new development and redevelopment projects.
- Require accommodation of bicycles and pedestrians to Bicycle and Pedestrian Levels of Service "C" in all new roadway construction and reconstruction projects.
- Establish a baseline measure of bicycle and pedestrian traffic volume on Cobb County's major thoroughfares and shared use paths by 2015.[4]
- Increase bicycle and pedestrian traffic volume by 10% by 2030.

NON-MOTORIZED SAFETY GOAL:
Improve the safety of biking and walking along Cobb County's major thoroughfares (Arterial Streets, Major Collectors, and Minor Collectors).

Safety Objectives:

- Reduce the crash rate between bicycles and motor vehicles on Cobb County's major thoroughfares, once a baseline statistic has been established.
- Reduce the crash rate between pedestrians and motor vehicles on Cobb County's major thoroughfares, once a baseline statistic has been established.
- Develop, promote and implement programs to promote bicycle and pedestrian safety in Cobb County.

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study network for bicycling includes both roadways and proposed shared use paths and totals approximately 677 miles. At the time of this study, 77 miles of study network roadway were found to meet or exceed Bicycle Level of Service "C", or approximately 13% of the 564 miles of the roadways of the study network.

[2] The study network for pedestrian facilities includes only roadways and equals approximately 564 miles. At the time of the study, 102 miles of roadways were found to meet or exceed Pedestrian Level of Service "C", or approximately 18% of the 564 mile of study network roadways.

[3] A "family-friendly" bicycle route shall be comprised of a continuous sequence of local streets, shared use paths and major thoroughfares that serve locally identified destinations. Such routes shall have a Bicycle Level of Service of "B" or better, and safe crossings where necessary. A "family-friendly" pedestrian route shall also be comprised of a continuous sequence of local streets, shared use paths and Major Thoroughfares with a Pedestrian Level of Service of "B" or better, and safe crossings where necessary.

[4] This baseline measure of volume will provide a context for the crash data being evaluated in the safety objectives, as raw crash numbers alone do not account for the increased exposure occasioned by increased levels of walking and bicycling. It is expected that crashes might increase if bike and/or pedestrian volumes increase dramatically, due to the increased exposure. A method of tracking volumes will allow the incidence of crashes to be normalized as rates against those volumes.

2.1.2 MULTIMODAL

GOAL FROM CTP:
Develop a multimodal system in which each mode is optimized by providing the citizens of Cobb County with attractive and realistic travel alternatives.

Objectives from CTP:

- *Increase bicycle connections to activity centers.*
- *Increase supply and upgrade pedestrian and bicycle facilities.*
- *Increase alternatives to use of private vehicles.*
- *Reduce/moderate increases in annual vehicle miles traveled.*
- *Increase the flexibility of the transportation system to serve all the members of the community.*

NON-MOTORIZED MULTIMODAL GOAL:
Provide transportation options by providing the citizens of Cobb County with attractive and realistic opportunities for bicycling and walking, and, by extension, improve access to public transit.

Multimodal Objectives:

- Achieve Pedestrian Level of Service "C" on 30% of Study Network segment miles which are served by or intersect with Cobb Community Transit Routes by 2030.[5]
- Achieve Bicycle Level of Service "C" on 30% of Study Network segment miles which are served by or intersect with Cobb Community Transit Routes by 2030[6].
- Double the rate of trips under five miles made by bicycle by 2030[7].
- Develop a policy to provide secure bicycle parking at Cobb Community Transit stops, based on transit stop volumes and characteristics.

[5] As of 2009, only 2.1 miles of the 143 miles (1.5%) of Study Network segments that are served by or intersect Cobb Community Transit routes perform at Pedestrian Level of Service "C" or better.

[6] As of 2009, only 1/2 mile of the 143 miles (less than 1%) of Study Network segments that are served by or intersect Cobb Community Transit routes perform at Bicycle Level of Service "C" or better.

[7] According to the 2001National Household Travel Survey, 1% of trips under five miles in metropolitan Atlanta were made by bicycle.

2.1.3 TRANSPORTATION/LAND USE CONNECTIVITY

GOAL FROM CTP:
Develop a transportation system that is appropriate to the land uses it serves.

Objectives from CTP:

- *Increase mixed use developments that optimize both use of land and transportation resources.*
- *Increase greenspace set asides within new developments and increase greenways.*
- *Increase higher density and mixed use development along major transportation corridors.*
- *Increase transportation facilities that will encourage mixed use developments.*

NON-MOTORIZED LAND USE GOAL:
Establish development standards to provide a higher level of accommodation for bicyclists and pedestrians within areas defined as "Activity Centers" on the Future Land Use Map developed as part of Cobb County's Comprehensive Plan.

Land Use Objectives:

- Require that all new development and roadway reconstruction within the areas identified as "Activity Centers" on the Cobb County's Future Land Use Map accommodate pedestrians to Pedestrian Level of Service "B", and accommodate bicyclists to Bicycle Level of Service "B".
- Incorporate bicycle and pedestrian facilities into all new greenway projects.
- Require or incentivize the inclusion of long and short term bicycle parking in development agreements for commercial property.
- Require or incentivize the inclusion of showering and changing facilities for bicycle commuters in development agreements for commercial property.

2.1.4 FINANCIAL MANAGEMENT AND SYSTEM PRESERVATION

GOAL FROM CTP:
Ensure that adequate financial resources are available to properly maintain the transportation system and to grow and adapt the system in keeping with changes in land uses.

Objectives from CTP:

- *Increase availability of funds to make improvements to the transportation system.*
- *Increase use of public- private partnerships to fund transportation improvements.*
- *Implement countywide impact fees to fund transit and road improvements.*
- *Increase investment to a level that will bring all roads to at least LOS D.*

NON-MOTORIZED FINANCIAL GOAL: Ensure that adequate financial resources are available to maintain facilities for non-motorized transportation and to grow and adapt the non-motorized system in keeping with changes in land uses.

Financial Objectives:

- Dedicate a specific share of funds from Cobb County's Transportation budget for improvements to the system of facilities for non-motorized transportation.
- Seek outside grants as well as public-private partnerships to fund improvements to the system of facilities for non-motorized transportation.
- Include accommodation of bicyclists and pedestrians in Development Agreements.
- Include accommodation of bicyclists and pedestrians in impact fee calculations, and dedicate a specific share of impact fees for investment in facilities for non-motorized transportation, when impact fees are implemented.

NON-MOTORIZED SYSTEM PRESERVATION GOAL: Maintain new and existing facilities for non-motorized transportation so that they serve residents of and visitors to Cobb County for years to come.

System Preservation Objectives:

- Develop a maintenance protocol for Cobb County's bicycle system.
- Develop a maintenance protocol for Cobb County's pedestrian system.
- Develop a maintenance protocol for Cobb County's system of shared use paths.

2.2 POLICY RECOMMENDATIONS

The goals and objectives listed in the preceding section will provide Cobb County with ideals and attainable milestones as it seeks to improve its bicycling and walking conditions. Needs for improvements to existing infrastructure are established in Chapter 4, and opportunities for implementing such improvements are outlined in Chapter 5. In addition to the

specific facility improvements, however, governing policies should be considered by the county that will place the infrastructure improvements within a context of expected bicycle and pedestrian accommodation, supported not only by investment in infrastructure, but also in the practices of County departments. The County should promote programs of encouragement and education that will demonstrate to the public how bicycling and walking are viable transportation choices in Cobb County. Additionally, enforcement measures should be enacted that will help ensure that those who choose these modes—and the motorists who interact with them—do so in safety and in compliance with all applicable laws. An effective policy context will contribute greatly to realization of the goals described above and help Cobb County achieve a future that includes active lifestyles for its residents as well as greater transportation options. This section describes some of these policies and programs and how they work in a general sense, and provides examples of local best practices, where applicable. These best practices can serve as a guide for the County as it considers which forms of these policy initiatives are most appropriate for development in Cobb County.

Additionally, it should be noted that in the Atlanta Regional Commission's (ARC) Bicycle Transportation and Pedestrian Walkways plan, adoption of bicycle and pedestrian friendly policies by local jurisdictions was identified as a likely factor in assigning priorities for project funding assistance. The ARC Plan did not include a specific formula for scoring policies, but suggested the types of policies that would be given recognition for being bicycle or pedestrian friendly; the policy rating would then be worth up to 10% of the total benefit score given to a segment. ARC has indicated an intention to develop a checklist or certification process for local communities. The policy recommendations in this section cover many of the types of policies the ARC document identifies as possible criteria for determining the "bicycle friendliness" of local jurisdictions, including:

- adoption of performance standards for accommodation;
- adherence to AASHTO design guidance or equivalent for facilities;
- land development policies for accommodation and access;
- bicycle parking requirements; and
- bicycle programs.

The ARC document also mentions agency staffing commitments such as hiring a bike-ped coordinator, which is not specifically recommended at this time. Training of engineers and planners in facility design is also a possible staffing commitment, which is recommended among the education programs. The ARC document also names consideration of the relative proportion of the jurisdiction's transportation budget to non-motorized facilities and programs, identification of specific funding targets is among this Plan's objectives, described in section 2.1.

2.2.1 PLANNING RECOMMENDATIONS

Policy Recommendation: The Bicycle and Pedestrian Improvement Plan shall be integrated into all relevant existing plans, and shall be reviewed for all related projects.

Numerous Cobb County planning documents refer to pedestrian and bicycle improvements and even make recommendations. Cobb County has been including an emphasis on Bicycle and Pedestrian facilities and infrastructure in all levels of its planning documents, from corridor plans to the Comprehensive Transportation Plan. For example, the Six Flags Drive Corridor Study lists as one of its short term goals adding sidewalks and pedestrian refuge islands, and long term, a Multi-Use Trail. The Comprehensive Transportation Plan creates a strong framework for the identification and analysis of facility needs, as well as policy recommendations. Additional plans that include an emphasis on bicycle and pedestrian improvements include the Canton Road Corridor Main Street Design Principles Plan and Recommendations, the Historic Mabelton Preservation and Improvement Plan, the Macland Road Corridor Study and the Cobb County Comprehensive Plan.

This new *Bicycle and Pedestrian Improvement Plan* develops the County's vision to such a degree that it should be the reference guide when reviewing all relevant existing plans or

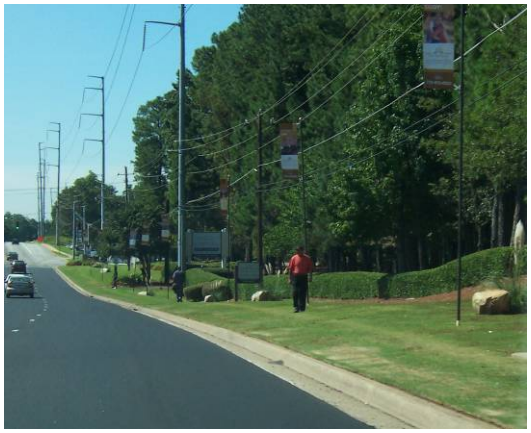
planning for new projects. The facility recommendations of this plan should be should be reviewed in conjunction with any county roadway project to insure facilities are added whenever possible, with the knowledge that the particular opportunities presented by a specific project may actually exceed those envisioned in this long range plan.

Policy Recommendation: The Bicycle and Pedestrian Improvement Plan shall be reviewed and revised to ensure it is changing to address the needs of Cobb County as it grows.

This document reflects the nature of Cobb County at the time of its writing. Recommendations for facility improvements have been identified based on numerous factors and reflect the manner in which the County intends to grow. The adoption of the Complete Streets policy and the emphasis on ARC's LCI program in the County's Comprehensive Plan acknowledge the increasing importance of developing Cobb County as a community with very high quality of life standards. To ensure that the Plan continues to support the efforts of the County, it should be reviewed at a regular interval to confirm that it continues to reflect the County's needs and goals. This interval may be coincident with the revisions for the Long Range Transportation Plan or may be on its own schedule.

Policy Recommendation: Treatments and policies should be evaluated for effectiveness and modified as necessary.

To affirm the application of the plan, all recommended treatments and policies should be evaluated to determine that they are achieving the desired goals. Surveys and analyses should be done after construction to gather information regarding community usage. This feedback is critical to building on the support that already exists for the Plan and it has been shown that popular facilities build support for the overall vision. All new policies and policy changes should be evaluated the same way and adjusted as necessary.



2.2.2 FACILITY PERFORMANCE RECOMMENDATIONS

Policy Recommendation: Practice routine accommodation by including bicycle and pedestrian needs in resurfacing and reconstruction projects.

Like Complete Streets, Routine Accommodation incorporates bicycle and pedestrian modes of travel into roadway projects. An important element of any implementation plan is to coordinate the meeting of bicycle and pedestrian needs with other projects scheduled by the County, GDOT, one of the municipalities, or private developers. If careful steps are taken to insure the needs of bicyclists and pedestrians are met in all phases of projects, from planning to construction documents, the goals of improving system performance for these modes will be more quickly achieved. Every resurfacing project presents the opportunity to review all aspects of the roadway to determine whether adjustments could be made to allow for better accommodating of bicyclists and pedestrians.

Please see Section 5.1 of this document for additional discussion about Routine Accommodation.

Policy recommendation: Review and revise the existing Complete Streets policy.

On January 27, 2009 the Cobb County board of Commissioners adopted an agenda item requiring the Cobb County DOT incorporate complete streets concepts in future transportation projects to ensure safe access for all users. The policy was effective immediately; it reads as follows.

> Cobb County will implement the Complete Streets concept by considering safe access for all users, to include motorists, bicyclists, pedestrians and transit users, including individuals with physical disabilities and senior citizens, in the planning, design, construction and operation of streets within its jurisdiction.

Communities are beginning to understand the impact that well designed streets have on their communities. The Cobb County

Complete Streets policy approaches the effort from a safety perspective, recognizing what well designed streets have the potential to reduce injuries. Other communities across the country are taking a more holistic approach to streets in terms of safety and quality of life. Denver, Colorado is implementing a "Living Streets" program where they define them as not only streets that maximize trip efficiency but are also integrated with the use and form of adjacent development to achieve great destinations. They go on to describe how Living Streets can simultaneously promote healthier living, economic development, and increased mobility.[8] Broadening the understanding of a street to be a place and not simply a thoroughfare allows the integration of many characteristics that will have multi-faceted community benefits.

Policy recommendation: Appropriate performance thresholds for accommodating bicycling and walking should be incorporated into the County's Technical Standards and Comprehensive Plan.

The facility recommendation section outlines potential projects for improving existing roadways to community supported performance standards of Bicycle Level of Service "C" and Pedestrian Level of Service "C" for facilities on the Plan's Study Network and Bicycle Level of Service "D" and Pedestrian Level of Service "D" for all other Major Thoroughfares.

On newly constructed or reconstructed existing roadways, the County should seek to meet or exceed a performance standard of Bicycle Level of Service and Pedestrian Level of Service "C" on all Collector and Arterial Roadways, following the facility design guidelines outlined in Chapter 6 of this plan. The Cobb County Development Standards, section 401.20 Major Thoroughfares should also be updated to reflect the goal of providing bicycle/pedestrian Level of Service "C" in projects of this type.

Section 400 of the Cobb County Technical Standards should be updated to include references to the newly adopted Complete Streets policy. Section 401.20.05 (Bikeways) should be updated to reflect the County's goals to achieve a minimum Level of Service "C" on identified facilities. It should refer to the recommended facilities of this plan for any resurfacing projects, and should mention the expected performance of Level of Service "C" on any reconstruction or new construction project. This section should also refer to the Design Guidelines developed as part of this Plan. If Bicycle Level of

[8] Denver Living Streets Initiative, http://denverlivingstreets.org/

Service "C" cannot be reached, provision of a 6-foot bike lane should be considered a reasonable accommodation.

Sidepaths are an increasingly popular option in many communities, and are recommended in this plan as potential improvements to constrained existing roadway. It should be noted, however, that the provision of a sidepath should not preclude the inclusion of an on-street facility. Bike lanes are the preferred facility type for many bicyclists and should be considered on new construction projects whenever possible to further develop the County's on-street bicycle network and maximize the options available to cyclists of all skill levels.

Section 4001.20.06 (Non-Motorized Accommodation) should be updated to reflect the county's goals to provide a minimum Level of Service "C" on all pedestrian facilities. If Pedestrian Level of Service "C" cannot be reached, then a minimum 6-foot sidewalk, placed a close to the limits of ROW as practicable, should be considered.

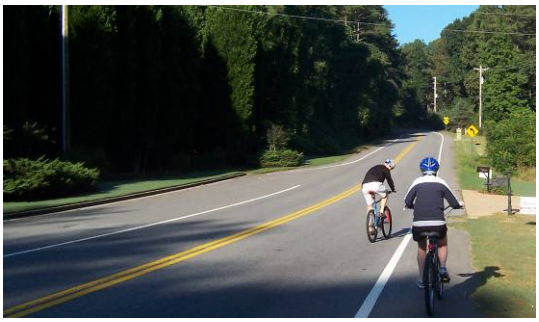
The Cobb County Comprehensive Plan affirms the link between land use and transportation and details various operational improvements that can be made to the County's existing transportation network, including the installation of sidewalks or bicycle lanes. It also incorporates various findings from the approved Livable Cities Initiative studies into the plan. In doing so the County, acknowledges the role of higher density areas, defined as Activity Center (AC). Activity Centers are a neighborhood or community focal point with a concentration of commercial/retail activities and a potentially higher residential density than the surrounding areas. They also tend to have open space or other areas that promote public gathering and social interaction. The Comprehensive Plan acknowledges that pedestrian activity is critical to the success of the ACs and that designing them requires a comprehensive strategy ensuring pedestrian facilities throughout the activity enter and requires connections to existing established neighborhoods, stating that "Pedestrian facilities in these areas should be developed in a manner that provides a level of safety in its interaction with the vehicular traffic and is well-connected to facilitate movement between buildings."[9] Given the emphasis on pedestrian safety and even more significantly on pedestrian activity as a function of these areas, it is recommended that the County consider striving for a higher level of pedestrian accommodation in these areas, perhaps equal Pedestrian Level

[9] Cobb County Comprehensive Plan, P 10

of Service “B”, to be implemented as part of designs associated with development within these areas.

Policy Recommendation: Crossing conditions should be considered in all roadway and intersection design projects; midblock crossing treatments should be considered on long blocks or in areas of demonstrated demand.

Cobb County has a number of major thoroughfares that present challenges for pedestrian crossing due to their width and traffic conditions. While this Plan identifies needs for longitudinal walking conditions in great detail, it is important to recognize that pedestrian trips usually require crossing the road to access important destinations and transit stops. Design of roadways should include consideration of crossing needs, either at intersections or at midblock locations.



Accommodation of mid-block pedestrian street crossings should be considered on blocks longer than 660’ and at locations with demonstrated high demand for crossing assistance. The Design Guidelines provide guidance on mid-block crossing design.

Policy recommendation: Bicycle Parking and other end-of-trip facilities shall be considered on all new and redevelopment projects.

Surveys of bicyclists or would-be-cyclists show that parking and the availability of end-of trip facilities influence their willingness to ride. The Cobb County Development Code should be updated to reflect the desire to increase bicycle ridership by including requirements for bicycle parking and encouraging other end-of-trip facilities such as showers and lockers. The following paragraphs describe best practices from around the country that may help the County implement a practice that is effective and responsive to the specific development conditions of Cobb County.

2.2.3 END-OF-TRIP FACILITY RECOMMENDATION

Policy recommendation: Provision of adequate and secure bicycle parking shall be considered in all County facilities and new land development projects in Cobb County.

Bicycle Parking

The current zoning code makes no provision for bicycle parking. In municipalities across the country bicycle parking requirements are being added or reviewed. In light of the need for bicycle parking, the zoning code/ development standards should be amended to require bicycle parking as a percentage of vehicle parking,

typically 3-5%. This may be made up by a combination of long and short term parking, each having slightly different needs. While the short term user may be running an errand and need a convenient, safe place to leave their bike for a few hours, commuters need longer-term, more secure bicycle storage. Santa Cruz, CA has codified the differences in bicycle parking facilities and defines them as follows and then defines the percentage of type of facility at various development types:[10]

Class 1 bicycle facility means a locker, individually locked enclosure or supervised area within a building providing protection for each bicycle therein from theft, vandalism and weather.

Class 2 bicycle facility means a stand or other device constructed so as to enable the user to secure by locking the frame and one wheel of each bicycle parked within. Racks must be easily usable with U- and cable locks and should support bikes in a stable, upright position.

To set an example for the private sector in the county, bicycle parking should be required at all Cobb County Government buildings, school properties, County parks, shelter-type bus stops, and libraries. An audit and improvement plan should be developed for existing facilities, and such facilities should be mandated at all new facilities.

Table 2.1 shows the off-street bicycle parking requirement from the Seattle, WA municipal code. It defines the number of spaces in relation to the land use of the building in question. The County may wish to consider this as a starting point for any requirements it chooses to develop.

[10] Santa Cruz Bicycle Parking Ordinance, 24.12.250 Bike Parking Requirements, Section 4. Classification of Facilities

Use	Requirement
Office	1 space per 5,000sf gross floor area of office use
Hotel	.5 spaces per hotel room
Retail use over 10,000sq ft	1 space per 5,000 of gross floor area of retail use
Residential	1 space for every 2 dwelling units

Table 2.1: Parking space requirements from Seattle, WA

These spaces may be co-located (shared among developments), but must be within 100 feet of the location they are intended to serve, and must be in a safe, accessible and convenient location. For non-residential uses, Seattle's policy allows for a fee to be paid to a special fund if circumstances do not permit satisfying the location requirements. These requirements have been reviewed by Seattle for their most recent plan update; the requirements were raised to satisfy the increasing demand for facilities in Seattle.[11]

As mentioned above, calculation of expected bicycle parking can be simplified to be a percentage of spaces or be a ratio of motor vehicle parking requirements. In Scottsdale, AZ, buildings with 40 or more spaces must provide one bicycle parking space for every 10 vehicle spaces. In areas where parking requirements may not be not easily satisfied, co-locating parking within a reasonable distance should be considered.

Bike racks are a key component in any bicycle parking plan. They are available in a number of different formations and are frequently specified as part of an urban design or streetscape enhancement program. The Canton Corridor Streetscape and Architectural Guidelines specify that bicycle racks should be provided 1 per land parcel. The length of a "rack" varies, so the number of spaces provided may also be variable. Racks for street parking are available in a

variety of different forms, from the ribbon style specified in the Canton Corridor guidelines, to a simple inverted U, and conditions may dictate what type of rack is chosen. The Association of Pedestrian and Bicycle Professionals has published a guide to

[11] Seattle Bike Master plan, p.41; http://www.seattle.gov/transportation/docs/bmp/final/BikeMasterPlanCOMPLETE.pdf

bicycle parking equipment and design, which is freely available on the internet.[12]

Some local governments have developed programs to add bicycle parking in cooperation with local businesses and residents. The Seattle Department of Transportation runs a Bicycle Spot Improvement Program that installs racks in neighborhood business districts. The racks are installed according to certain criteria at the request of citizens and business owners. This program can also be managed as a partnership between the County and the property owners, with fees being contributed to a fund managed by DOT.

In Activity Center areas and corridors that are being developed with a greater multi-modal emphasis, bicycle racks and storage should especially be encouraged, offering visitors a realistic alternative mode choice.

Showers and Changing Facilities

The availability of showers and changing facilities is critical to getting people to ride to work. To support commuting by bicycle, we recommend an audit be taken of all existing county buildings as a baseline and require all newly constructed county buildings contain two shower areas, one per gender.

Shower facility and storage facilities requirements exist in development codes throughout the country and have been evolving for some time. Downtown Seattle currently requires one shower per gender in every structure for office user over 250,000 square feet. The current proposal requires showers for every 100,000 square feet of office use.[13] Portland, OR worked to implement a program whereby shared facilities at the YMCA and various health clubs are available to 476 bicycle commuters.[14] Palo Alto, CA handles their ordinance a little differently, specifying number of showers by use and square footage.[15]

[12] http://www.apbp.org/resource/resmgr/publications/bicycle_parking_guidelines.pdf

[13] Seattle Bike Master plan, p41; http://www.seattle.gov/transportation/docs/bmp/final/BikeMasterPlanCOMPLETE.pdf

[14] Portland Bicycle Master plan, p12; http://www.portlandonline.com/Transportation/index.cfm?a=71843&c=34812

[15] Palo Alto, CA Zoning Code: Shower requirements

Use	Gross Floor Area of New Construction	Number of Showers Required
Medical Professional	0-9,999 sq ft	No requirement
General Business Offices	10,000-49,999 sq. ft	1
Financial Services	20,000-49,999 sq. ft	2
	50,000 and up	4
Retail	0-24,999 sq ft	No requirement
Eating and Drinking	25,000-49,000 sq ft	1

Table 2.2: Palo Alto, CA recommendations for shower facilities

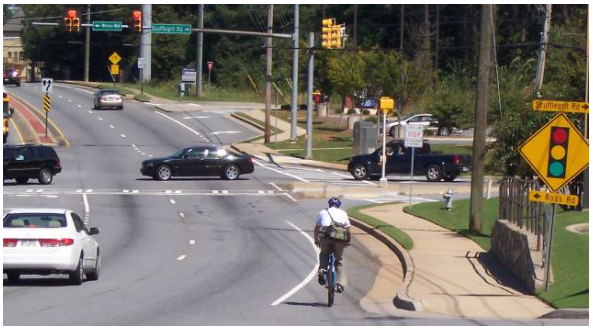
Incentives can be established for developers to include shower and changing facilities, in buildings and developments of less square footage as well. Expedited review time, density bonuses relative to the area added for the facilities or exemption from taxes for the facility square footage could be offered as part of the policy to encourage facility inclusion.

2.2.4 CONNECTIVITY RECOMMENDATION

Policy recommendation: Pedestrian connectivity shall be required between and within developments wherever possible.

On county property, for facility developments, schools, parks, and other uses with an expectation of public access, standard design scopes shall seek to maximize feasible non-motorized access to any adjoining right of way or publicly owned property beyond the primary motor vehicle entrance. The goal is connect the parcels, thereby creating a pedestrian friendly environment.

Private developments should be required to provide non-motorized connections between cul-de-sacs and to external streets, at intervals similar to those described in the ARC Bicycle Transportation and Pedestrian Walkways Plan. Frequently residents of subdivisions have to go significantly out of their way to walk to a nearby store or to see friends. Requiring the connections, wherever reasonable may help reduce roadway congestion, provide safer and more direct travel routes for bicyclists and pedestrians, and may provide safe routes to school for neighborhood children.



Developers may be incentivized to include connections and/or trails by offering them open space credit for the area of the path or by offering them bonus density credit for the amenity. Any path or trail earning credit should comply with the design guidelines developed as part of this plan as well as the AASHTO *Guide for the*

Development of Bicycle Facilities, and must be publicly accessible.

2.2.5 PROGRAM RECOMMENDATION

Policy recommendation: Cobb County shall support bicycling and walking in the community with a variety of programs including education campaigns, encouragement and enforcement.

Safe and well maintained bicycle and pedestrian facilities represent only part of the effort to get people walking and bicycling. Communities all over the country are creating and supporting a variety of programs for adults and children. These programs can be categorized as education, encouragement, and enforcement. Descriptions of each type are included below. The County should look to maximize opportunities by coordinating across departments and agencies that may have some interest in or ability to administer such programs.

Education Programs

The County DOT and Parks, Recreation and Cultural Affairs Department can coordinate to plan and promote existing rides, events, programs and groups that promote bicycling. The County can be active in its support of events throughout the community. Taking part in national events like Bike-to-Work day is a great way to for the county to engage people who might want to try riding to work.

Often information is needed to help riders feel comfortable, from routes to ways to connect with transit.

Cities like Portland, OR and Seattle, WA[16] have launched encouragement and information campaigns targeted at people that are willing to consider riding. Vancouver, BC offers an interactive map that lets users choose from routes that range from most efficient to least polluting.[17]

Education and awareness should be promoted for users of all modes of transportation, so Share-the-Road and other awareness campaigns and dissemination of information regarding laws pertaining to riding and driver behavior are critical. All groups need to be educated and frequently reminded of the rules of the road. Those campaigns can take the form of PSAs or billboards, printed materials that can be handed out at community

[16] http://www.ci.seattle.wa.us/waytogo/
[17] http://www.cyclevancouver.ubc.ca/

events or community education classes. Education and awareness can contribute to a reduction in crashes and to create safer more bicycle friendly environment.

Educating young riders is critical and should be targeted with age-appropriate lessons and teaching. While education is a component of Safe Routes to School programs, bicycle safety can be taught as part of most curriculums and can be encouraged as part of a community safety program.

Finally, ongoing education and training for County employees in pedestrian and bicycle facility design should be encouraged to make sure County practices keep up with innovation and best practices.

Encouragement Programs

There are a number of innovative community-based programs being used around the country to encourage bicycling and walking. In Chicago, IL and Portland, OR, Sunday Parkways are essentially turning local streets into parks for a day or part of a day while providing a great way to get neighborhoods riding and walking. Selected roads are closed to vehicle traffic allowing the community can take advantage of a normally vehicle filled space and have fun doing it. Boulder, CO supports a Bike-to-Work Seek which includes snacks and beverages *en route* and a tee-shirt commemorating the effort. Many communities organize Bike to Work Days to raise awareness about the alternative options to get to work.

International Walk to School Day is an increasingly popular program that encourages children to walk to school. This is often a significant event, coordinated by the schools and celebrated by entire communities.

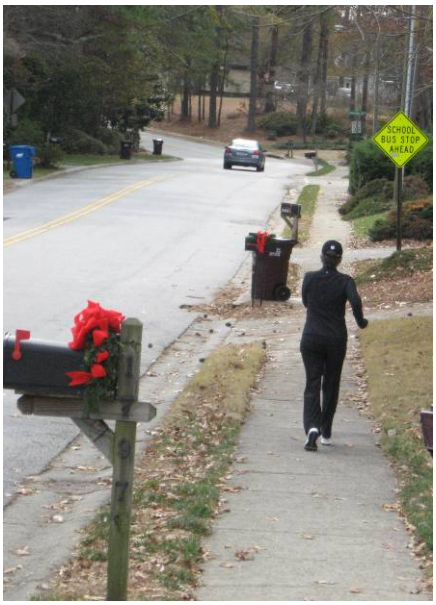
In addition to providing end-of-trip facilities, employers can support employees riding to work by offering incentives such as raffles or contests for most miles ridden. This sort of program can be held in conjunction with Bike-to-Work or on its own.

Enforcement Programs

Any enforcement program will need to target drivers, cyclists and pedestrians to enforce the appropriate laws. Typically, enforcement works in conjunction with an education campaign that raises the awareness of all users because most motorists and bicyclists are themselves unaware of the laws they often violate.

Enforcement programs should also include training for law enforcement officers, who have an opportunity to educate the community while enforcing the laws. Specific training

programs should be designed to highlight the laws pertaining to bicyclists and pedestrians. Public education programs should be targeted at users to raise the level of awareness regarding bicyclist and pedestrian rights and responsibilities. Law enforcement should also be included in community events that focus on bicycling and safety.



The effort to enforce the traffic laws as they relate to bicycle safety should be addressed in an overall, countywide, coordinated bicycle enforcement campaign. Sporadic enforcement will not result in significant improvements to cyclist behavior and will likely result in resentment of law enforcement personnel. Those behaviors to be targeted should be determined at the outset of the law enforcement campaign. The following behaviors are recommended to be targeted:

- riding at night without lights;
- violating traffic signals; and
- riding against traffic on the roadway.

These three behaviors were chosen for two reasons. First, they represent particularly hazardous behaviors which result in many crashes. Secondly, and very importantly, the enforcement of these behaviors is easy to justify to the public. When coupled with (and in fact preceded by) a large scale education campaign, the public will understand the importance of the campaign and consequently will accept the enforcement activity.

2.3 RECOMMENDATIONS FOR AMENDMENTS OR UPDATES TO EXISTING STUDIES

Numerous existing studies were reviewed by the consultant team in the course of this project. These are discussed in detail in Chapter 3; the following amendments or additions to existing plans and studies are recommended for continuity of the Cobb County transportation planning process:

Cobb County Access to Jobs Plan (2001)

A future study could look at access to transit and jobs from bikeable distances; The plan should be updated with respect to the findings of the bicycling conditions evaluation in the *Bicycle and Pedestrian Improvement Plan*

Cobb County Senior Adult Transportation Study (2007)

An update of the study should include both bicycling and walking as modes of transportation and could address the feasibility of the modes for those seniors willing to walk or ride.

Cobb County Transit Development Plan (2003)

In the context of the Livable Centers Initiative Studies and the role densely populated, walkable districts play in the complexity of transit operations, pedestrian and bicycling access should be integrated into the plan

Austell Road Corridor LCI Study (2007)

The filling of sidewalk gaps and careful intersection upgrades should be beneficial to pedestrian mobility. Improved access to the trail will improve recreational opportunities and bicycle commutes to destinations outside the study area. There is little mention of on-street bicycling conditions in the study area. Any possible improvements to the corridor identified in the *Bicycle and Pedestrian Improvement Plan* should be incorporated to plans for the corridor.

Six Flags Drive Corridor Study (2007)

Any improvements in on-street bicycling conditions identified on the *Bicycle and Pedestrian Improvement Plan* should be incorporated into any plans for the corridor. One of the longer term objectives of the plan was the development of a shared-use path along the north side of roadway. As the road is improved, this goal should be addressed.

Macland Road Corridor Study (2007)

Additional sidewalks and well-designed paths would undoubtedly improve pedestrian and bicycle mobility in this area where such facilities are very limited. No mention is made of on-street bicycle accommodation in the study. Any opportunities for improving on street accommodations should be included in any improvement plans. Routine accommodation policies, which are described in this plan, would help Cobb County coordinate with GDOT to provide appropriate bicycle accommodation in GDOT widening projects.

Canton Road Corridor Study (2005)

Recommendations also include a 12-foot wide shared use path through the corridor, intersection improvements such as crosswalk markings, turn lane channelization islands, signal improvements and ramp improvements. Many of the recommended projects should improve pedestrian and bicycle mobility. Access management not only benefits motorists, but reduces the number of conflict points where turning motorists cross the paths of bicyclists and pedestrians. Enhanced crossing treatments at intersections and channelization islands can be especially helpful for pedestrians attempting to cross such a fast and busy corridor.

Delk Road Transit Oriented Development Study (2004)

Un-met pedestrian demand in the area is made obvious by the presence of desire lines along some roadways. The study notes that neither on-street bicycle facilities nor shared use paths were found in the area at the time of the study. The study notes that with the existing density of development in the area, there is a strong potential for pedestrian activity, which would likely increase with the introduction of the BRT facility. Any plans for this area should incorporate bicycle and pedestrian facilities.

ARC Connect Six (State Route 6) Corridor Study (2008)

The proposed parkway sidepath for Hiram-Lithia Springs Road should, if properly designed, also benefit non-motorized mobility and draw on the qualities of two regional attractors for outdoor recreation. It should be noted, however that many bicyclists prefer riding in the roadway over using sidepaths, so shoulders or bike lanes may be useful on such roadways as well.

Chapter 3: Existing Conditions

3.1 EXISTING STUDIES, PLANS, AND CODES

The Scope of Work section of the *Professional Services Contract* for this project calls for the consultant team to review numerous existing regional, County, and local plans, studies and ordinances to provide context for work associated with the development of the *Bicycle and Pedestrian Improvement Plan*. The following section includes summaries of those scope-identified studies, details their relevance to bicycle and pedestrian issues, and identifies ways in which portions of the current study will clarify issues raised or complement recommendations made by the existing studies. Where applicable, recommendations for potential amendments to these documents will be in Chapter 5, Implementation Opportunities and Recommendations. The documents reviewed include regional-scale planning and policy documents, County-wide planning and policy documents, specific corridor studies, and specific sections of the Official Code of Georgia and the Cobb County Code of Ordinances.

3.1.1 REGIONAL PLANS

ARC Bicycle Transportation and Pedestrian Walkways Plan (2007)

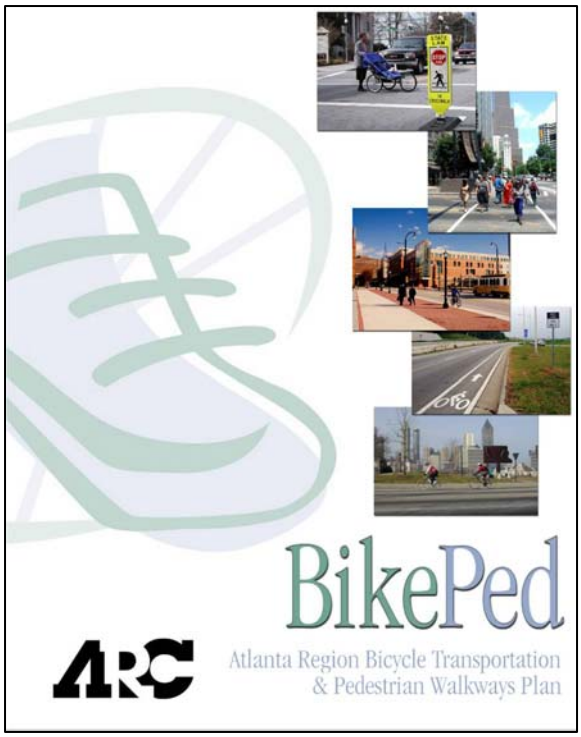


Figure 3.1: Cover of the ARC Bicycle Transportation and Pedestrian Walkways Plan (2007)

This regional plan focused on the improvement of bicycling and walking conditions along corridors of the Atlanta Regional Commission's (ARC) "Regionally Strategic Transportation System" (RSTS) and within ARC-defined activity centers. These priority corridors and centers were chosen as priorities due to their ability to affect change on regional issues including air quality, congestion, and safety, and due to their relevance to other ARC initiatives on healthy living and creating livable communities.

The plan's goals and objectives focus on providing safe and convenient bicycling and walking access along the roadways of the RSTS, to the region's schools and other high demand destinations. The plan's existing conditions report described bicycling conditions (using the Bicycle Level of Service Model) on a study network of selected RSTS roadways including the following Cobb County Roadways:

- Cobb Parkway
- Veterans Memorial Highway
- Bells Ferry Road
- Austell Road
- Roswell Road
- Lake Acworth Drive
- Powder Springs Road
- Atlanta Road
- C.H. James Parkway
- North Main Street (Acworth)
- Alabama Road/ Woodstock Road (SR 92)
- South Cobb Drive
- Powers Ferry Road
- Chastain Road/ McCollum Parkway
- Mableton Parkway
- Canton Road

The plan set an expectation for RSTS roadways to accommodate bicycling at Bicycle Level of Service "C" or better on RSTS routes, and Bicycle Level of Service "B" or better within the boundaries of activity centers (defined as those areas identified on the ARC Unified Growth Policy Map as either "regional places" or Livable Centers Initiatives (LCI) study sites) ; in Cobb County, only Cobb Parkway between Cumberland parkway and Roswell Road scored a Bicycle Level of Service "C," but is within an activity area, and so is still determined to be in need of improvement.

The plan included a regional scale Latent Demand evaluation, which examined many of the same corridors as the Bicycle Level of Service evaluation. In Cobb County, portions of Atlanta Road and Cobb Parkway scored in the highest two classifications for bicycling potential, while portions of Atlanta Road, Powder Springs Road and Lake Acwoth Drive scored in the highest two classifications for walking potential. The plan also included evaluation of sample pedestrian conditions in high demand areas. Atlanta Road, Powder Springs Road, and nearby South Cobb Drive were selected for this evaluation; most segments performed at Pedestrian Level of Service "C," while a segment of Powder Springs Road with no sidewalk on one side and segment of Atlanta Road with sidewalk only four feet wide each scored as Pedestrian Level of Service "D." The plan used the results from the Bicycle Level of Service, Pedestrian Level of Service, and Latent Demand evaluations as the basis of a methodology by which ARC will give priority to projects for funding assistance based on their contribution to meeting regional goals and objectives.

The plan also includes the following regional policy recommendations:

- Strategically target bicycle and pedestrian investments;
- Implement the practices of routine accommodation and "Complete Streets";

- Identify re-stripe candidates (for development of bike lanes and shoulders);
- Improve crossings at un-signalized intersections and mid-block locations;
- Increase availability of end-of trip facilities (e.g. bike parking, lockers and showers);
- Improve neighborhood connectivity for bicycles and pedestrians; and
- Promote bicycle and pedestrian planning and implement programs.

ARC Regional Transportation Plan (2007)

This *Regional Transportation Plan* (*RTP*) seeks to provide a strategy for preserving mobility as the Atlanta Region takes on an expected 2.3 million more residents over the next 25 years. Bicycle and pedestrian concerns figure into the plan in numerous ways, most notably as critical links to transit, as primary modes of circulation within the proposed "Livable Centers" and along the Beltline Corridor and as amenities popular with the public. Land use planning and bicycle and pedestrian system development are identified as strategies toward demand management, one of the priority investment areas that will help the region manage its continued growth. The plan also identifies the Bicycle and Pedestrian System as one of five major systems of the overall transportation network. The plan's funding focus for this system is toward facilities that serve regional needs by serving priority corridors and centers. *The Bicycle Transportation and Pedestrian Walkways Plan* (see above) is identified as the principal document for describing bicycle and pedestrian oriented policies and identifying projects; the policy recommendations of the *Bicycle Transportation and Pedestrian Walkways Plan* were incorporated directly into the *RTP*

ARC Regional Development Plan (2004)

The *Regional Development Plan* (*RDP*) serves as the comprehensive land use plan for the Atlanta Region. Among its goals is to create incentives for the use of transportation alternatives. Section 7 of the *RDP*'s Technical report, the Transportation Element, highlights funding for bicycle and pedestrian facilities from the 2003-2005 Transportation Improvement Program and maps then-existing facilities. The *RDP* reports that in 2004 Cobb County had 22.3 miles of "Bike Lanes" and 1.2 miles of "Separated Greenway/Bike Path."

A more current and complete inventory of Cobb County's bicycle facilities is provided later in this chapter, in Section 3.2, "Existing Infrastructure."

ARC Regional Access to Jobs Plan

This study was done in conjunction with the Cobb County *Access to Jobs Plan* (see below). The plan examined the spatial relationships between recipients of Temporary Aid to Needy Families (as proxies for low-income families), transit stops, day-care facilities, and employment centers with need for low-skilled workers. The study used a grid of

1000' x 1000' cells across the region to analyze the proximity of residences, day-care centers, and jobs to transit stops; the intersection of a cell of this scale with a transit route indicates a walkable proximity for the purposes of this study.

The study makes recommendations for reaching unserved populations, but these are focused primarily on changing or supplementing Cobb Community Transit Service.

The study methodology does not account for the quality of the pedestrian environment and assumes walkability to be consistent along the roadway network. The results of the existing conditions portion of the *Bicycle and Pedestrian Improvement Plan* will provide information about walking conditions along Cobb County's Major Thoroughfares, which could complement a future update of the *Access to Jobs Plan*. This study also focuses on walking-transit combination trips as the principal alternative to trips in personal automobiles. A future study could also look at access to transit and jobs from bikeable distances; bicycling conditions will are evaluated as part of this *Bicycle and Pedestrian Improvement Plan* and could complement a future update of the *Access to Jobs Plan*.

3.1.2 COUNTYWIDE PLANS

Cobb County Bicycle / Transportation Plan (1993)

This purpose of the *Bicycle and Pedestrian Improvement Plan* is to update this original 1993 plan. The plan was prepared in response to a request from the Atlanta Regional Commission (ARC) for member agencies to submit plans for inclusion in a regional plan, itself prepared to meet the requirements of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.

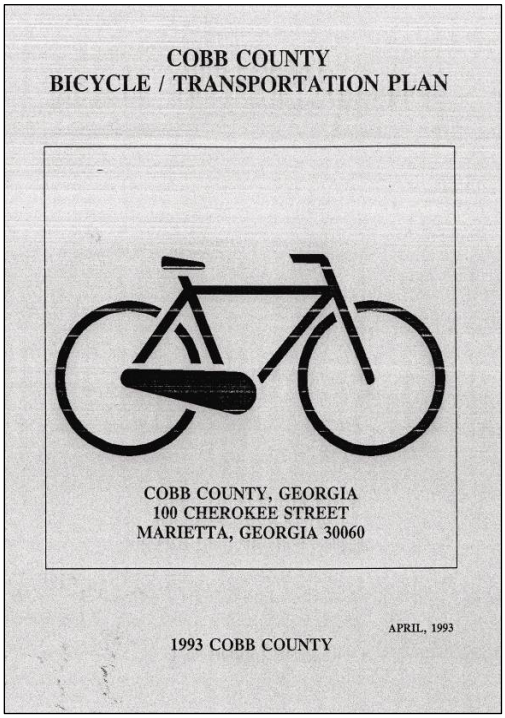


Figure 3. 2:Cover of the Cobb County Bicycle/Transportation Plan

Due to the accelerated timeline requested by ARC, the Cobb County plan was submitted as a "skeletal plan," intended to be refined and amended later. The plan's goals were to establish biking and walking as essential

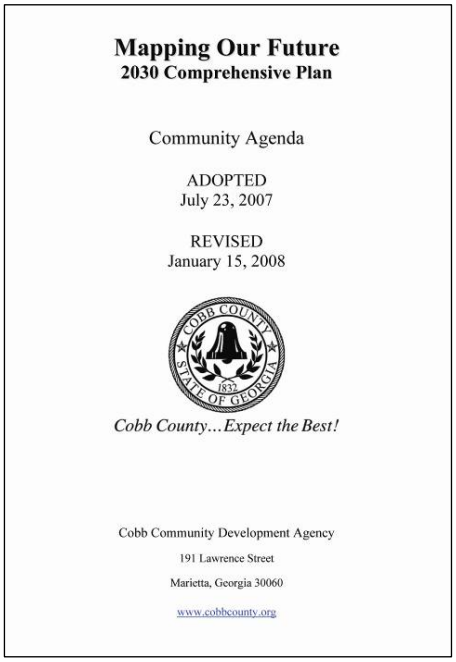
components of Cobb County's transportation system, plan a comprehensive system of bicycle and pedestrian facilities, develop an implementation process for bicycle and pedestrian oriented projects, and promote and enforce bicycle and pedestrian safety.

The "skeletal plan" identified primary corridors for the development of facilities, and key destinations that would be served by improved access. The plan outlined funding sources and proposed design criteria for both shared use paths and on-street bicycle facilities. The new *Bicycle and Pedestrian Improvement Plan* updates the 1993 plan in several ways. It examines bicycling and walking conditions on all of the County's Major Thoroughfares, recommends and prioritizes improvement projects, and updates the County's design criteria for facilities.

Cobb County 2030 Comprehensive Plan (2007, revised 2008)

"Mapping Our Future" is the title of Cobb County's *2030 Comprehensive Plan*, a document that "points Cobb County towards its preferred future" in a variety of areas such as growth management, neighborhood and economic development, and transportation.

The plan's Community Vision section names several ways in which attention to bicycle and pedestrian issues will contribute to Cobb County's future aspirations. The County desires to be a place with quality recreational opportunities, a multimodal transportation system that is supportive of a variety of land uses, including "significant greenspace, and live-work-play communities." The plan describes different Character Areas within the county, and describes the desirable bicycle and pedestrian facilities for many of them, depending upon their development patterns and intensity. Desired improvements include increased connectivity in Suburban Residential and Redevelopment Residential areas, improved crossing treatments along Corridors, and


Mapping Our Future
2030 Comprehensive Plan

Community Agenda

ADOPTED
July 23, 2007

REVISED
January 15, 2008

Cobb County...Expect the Best!

Cobb Community Development Agency
191 Lawrence Street
Marietta, Georgia 30060
www.cobbcounty.org

Figure 3.3: Cover of the Cobb County 2030 Comprehensive Plan

streetscape amenities and bicycle parking in Redevelopment Commercial Areas. The plan's Transportation section identifies investment in bicycle and pedestrian facilities as important to the provision of transportation alternatives and overall operational alternatives. Policies recommended by the *Comprehensive Plan* which directly encourage investment in bicycle and pedestrian facilities include Policy 6.6, which encourages the development of

multi-use greenways, and Policy 7.6, which calls for the promotion of transportation alternatives. The Implementation section calls for the review and update of the County Trail Plan and the continual upgrade of bicycle and pedestrian infrastructure**.** The *Comprehensive Plan* clearly and explicitly endorses the continued improvement of bicycle and pedestrian infrastructure in the county in ways described above. Improved bicycling and walking conditions may contribute to other areas of concern outlined the *Comprehensive Plan* as well, including economic development and quality of life.

Cobb County 2030 Comprehensive Transportation Plan (2008)

The *2030 Comprehensive Transportation Plan* (*CTP*) serves as the "blueprint" for Cobb County's transportation investments until 2030. The plan outlines strategies for bicycling and walking, as well automobiles, transit, freight movement via truck and rail, and the County's airport at McCollum Field.

Designated bike lanes, sidewalks and "bike paths" were identified as desired areas for improvement by respondents to a telephone survey conducted in the course of the plan.

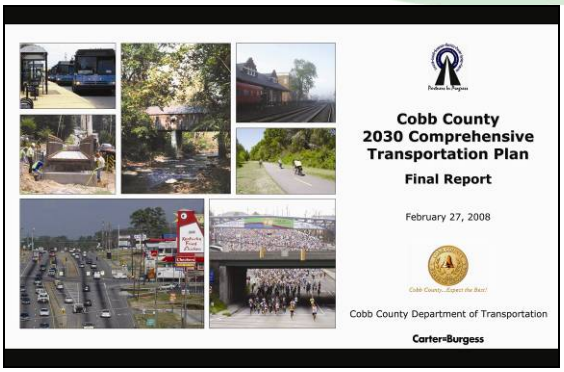


Figure 3.4: Cover of the Cobb County 2030 Comprehensive Transportation Plan

Plan goals and objectives directly relevant to bicycling and walking include reducing the number of pedestrian and bicycle accidents, as well as increasing the supply of and upgrading pedestrian and bicycle facilities. The plan includes implementation strategies such as increasing safety by lighting the County's trail system, coordinating land use decisions with parking, bicycle, pedestrian and transit access, and establishing a fund for bicycle and pedestrian facility projects.

The plan analyzed the performance of bicycle and pedestrian facilities by reviewing safety, connectivity and "predicted level of service for bicycle facilities."[1] The plan described the distribution of pedestrian crashes in the County and found a higher frequency on certain major roadways with limited crossing opportunities. The plan also identified priority areas for sidewalk coverage, based on proximity to activity centers, schools, transit stops and hospitals.

[1] Cobb County Department of Transportation, "Cobb County 2030 Comprehensive Transportation Plan: Final Report," 2008, pp. 5-23

The plan's analysis of bicycling conditions is based on a four point scale, with four being the best conditions for bicycling. All of Cobb County's roadways—including local streets—were given points based five characteristics—roadway volume, roadway speed, roadway functional class, combined width of outside lane and shoulder, and percentage of truck traffic. The total score was then divided by five to assign each segment a final score. The suitability analysis determined that 21 percent of the County's roadways have the best conditions for bicycling, 72.2 percent have medium conditions, 4.6 percent have difficult conditions, and 2.0 percent very difficult conditions.

The Bicycle Level of Service model, the method of analysis used in this Bicycle and *Pedestrian Improvement Plan*, uses some of the same data points—volume, speed, and mix of traffic, total width of outside lane and shoulder—as the method used in the *CTP,* but also uses two additional data points: the width of a differentiated shoulder (if present) and pavement conditions. The model processes these data to assign a score based on the responses of actual cyclists judging actual roadways for how well those roadways accommodate their needs. The model has been used on tens of thousands of miles of roadway across the United States, and has been accepted as the basis of a methodology to measure bicycling conditions for the upcoming revision of the highway capacity model. Its use will provide Cobb County with an assessment of cycling conditions that is more easily compared to peer communities and will allow "pre-testing" to measure the benefit to cycling conditions occasioned by any proposed facility investments.

The *CTP*'s main report is supplemented by technical reports which provided more detailed analysis and recommendations relative to each mode; Technical Report C3 deals with Bicycles and Pedestrians. The report describes the existing (at the time of the *CTP*) policy environment relative to bicycles and pedestrians, identifies needs relative to each mode, and recommends new policies to assist in developing the transportation network to meet those needs. The existing policy environment cited the ARC *Bicycle Transportation and Pedestrian Walkways Plan* and the Livable Centers Initiatives (LCI) program, including studies conducted by Cobb County, local municipalities and the Towne Centre and Cumberland Community Improvement districts. Public input to the *CTP* identified increased mileage of bike lanes, sidewalks, and shared use paths, as well as end-of-trip facilities (such as bicycle parking) as needs for Cobb County. Trail and bike lane projects were identified from existing plans and studies, and then prioritized according to several factors. Trail prioritization included proximity to existing and proposed facilities, connection to LCI study areas, and, adjacency to proposed roadway widening projects. Bike lane prioritization included proximity to existing and proposed facilities, proximity to attractors, and results from the Latent Demand analysis from the ARC *Bicycle Transportation and Pedestrian Walkways Plan*. Pedestrian

needs were identified by analysis of crash locations and sidewalk coverage maps. Public input described needs for pedestrian accommodation in new roadway and residential development projects as well as improved crossing conditions on multi-lane roadways. The technical report describes several challenging walking conditions on Cobb County's roadways including lack of sidewalks on many major arterials, intersection and mid-block crossing locations that are uncomfortable for pedestrians, and discontinuity in the sidewalk system. Sidewalk projects were identified from existing plans and studies and supplemented by opportunities associated with roadway reconstruction projects, along existing arterial roadways, and near certain attractors and activity centers. These projects were prioritized according to perceived safety needs, their having been identified in previous studies, or their proximity to certain activity centers and attractors. Crossing and signalization projects were identified from existing studies and from pedestrian crash data. Bicycle and pedestrian policies were borrowed directly from the ARC *Bicycle Transportation and Pedestrian Walkways Plan* (see above), and supplemented by a recommendation to require bicycle and pedestrian facilities in all future projects funded via the County's Special Local Option Sales Tax (SPLOST).

Cobb County Senior Adult Transportation Study (2007)

This study focuses primarily on the needs of seniors who are transitioning away from driving and toward use of "provided" rides, whether from fixed route transit or subsidized door-to-door service. It makes no mention of bicycling or walking as primary modes. It does, however, acknowledge that lack of pedestrian access to transit can make transit an infeasible choice for those seniors who are willing or able to walk short distances. The lack of sidewalks was a point made by several participants at the plan workshops and in submitted comments. The plan's gap analysis indicates that the distance to Cobb Community Transit stops is an impediment to residents with limited mobility. Upgrading bus stops to ADA standards and improving the "path of travel" to transit stops are listed as strategies in the plan of action.

Cobb County Transit Development Plan (2003)

This plan focuses almost exclusively on transit routing, operations, and fleet maintenance. It makes no mention of pedestrian or bicycle access needs or issues. It does mention that Livable Centers Initiatives (LCI) Studies should benefit transit operations, by creating densely populated, walkable districts that will complement transit service.

This *Bicycle and Pedestrian Improvement Plan* includes an assessment of pedestrian accommodations on Cobb County's Major Thoroughfares, and proximity to transit is a factor in the Latent Demand Method, which is proposed to be used in determining project priority. Both of these elements will help Cobb County form a better assessment of transit related pedestrian needs.

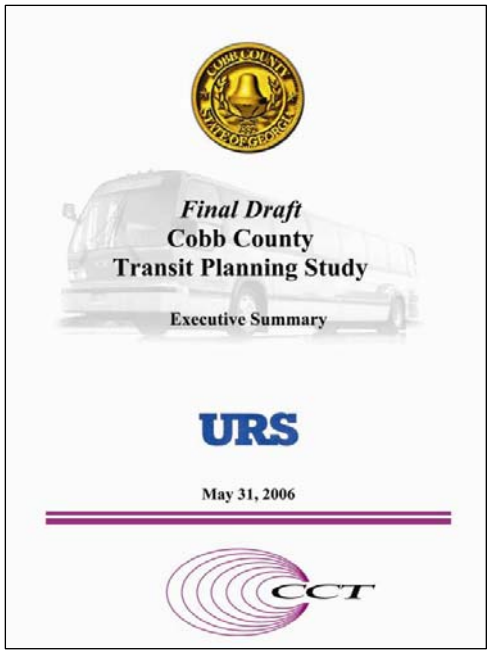


Figure 3.5: Cover of the Cobb County Transit Planning Study

Cobb County Transit Planning Study (2006)

The Transit Planning Study included a Bus Stop Inventory and Improvement Plan, which examined issues of user experience, accessibility and provision of amenities at Cobb Community Transit stops. As part of this inventory, sidewalk conditions around bus stops were evaluated and rated as "good," "fair," or "none." Other characteristics of the bus stop environment were also recorded including:

- width of sidewalk;
- if sidewalk connects to an intersection, a crosswalk, and/or adjacent land use;
- presence of a concrete pad at stop location;
- presence and description of any nearby obstructions to access;
- presence of a crosswalk;
- presence of a curb ramp; and
- presence of a bike rack.

The plan recommended that Cobb Community Transit coordinate with local jurisdictions to repair or install sidewalks where necessary, with priority assigned according to the number of boardings at subject stops. The plan also recommends crosswalk marking improvements for three intersections near bus stops. The existing conditions phase of the *Bicycle and Pedestrian Improvement Plan* supplements the *Transit Planning Study's* findings about the immediate vicinity of transit stops with broader findings about the level of accommodation for both pedestrians and bicyclists along the Major

Thoroughfares leading to those transit stops.

Cobb County Access to Jobs Plan (2001)

This study focuses primarily on the ability of Cobb County residents receiving Temporary Aid to Needy Families (TANF) to travel from their homes to employment centers in the County via public transit. The plan's methodology determined that families who live outside of a walkable distance—which this study set as within the boundaries of a 1000' x 1000' square—of a Cobb Community Transit stop that can get them to an employment center in a timely manner to be unserved by the transit system. The study found that 58% of the County's TANF recipients had job access as defined by the study. This percentage indicates that a "suitable" number of families are being served, but that basic access is still a major barrier.

The recommendations are focused on things that Cobb Community Transit, employers, and social service agencies can do to better coordinate meeting the transportation needs of TANF recipients and other candidates for low-skill jobs. The study's methodology does not account for walking conditions as it assumed the 1000 foot squares to be uniformly walkable terrain; there are likely squares that have few or poor sidewalks, for example. The existing conditions portion of the *Bicycle and Pedestrian Improvement Plan* will provide the County with information about walking conditions along the County's major thoroughfares, which may be useful if the *Access to Jobs Plan* is updated.

The *Access to Jobs Plan* is also focused on transit service as the principal alternative to private automobiles. The study focuses on trips that consist of walking from home to transit and then from transit to work, a similar study could be done considering bikeable distances to transit and employment centers. The *Bicycle and Pedestrian Improvement Plan* provides information about bicycling accommodation on the County's Major Thoroughfares, which could be used in a revision to the *Access to Jobs Plan*.

Cobb County Major Thoroughfares Plan (2006)

This plan is the document by which Cobb County classifies roadways as Arterials, Major Collectors, or Minor Collectors. The document defines the functions of the various classifications with regard to their service of carrying longer-distance through traffic versus more local traffic and serving land access.

The roadways identified in this plan are the roadways evaluated for bicycle and pedestrian accommodation later in this chapter.

3.1.3 CORRIDOR/LOCAL STUDIES

Austell Road Corridor LCI Study (2007)

The Austell Road Corridor Study examines an area centered upon a four mile stretch of Austell Road, from just south of Clay Road to just north of Milford Church Road. The roadway is a four-lane divided highway that carries close to 40,000 vehicles per day over most of its length. Austell Road's intersection with the East-West Connector, which is about in the middle of the study area, has one of the highest accident rates in the State of Georgia, according to the study.[2] The study area is home to a major community institution and employer, WellStar Hospital, and intersects the Silver Comet Trail. The commercial properties along the corridor are in a general state of decline, but the study notes that residential neighborhoods nearby are stable and well maintained. Sidewalks are present on both sides of Austell Road north of theEast-West Connector, although at the far north end of the corridor there are stretches that are narrow or in disrepair. South of the East –West Connector, sidewalks are only present on one or the other side of the road, depending on the exact location. (Cobb County has initiated design on new sidewalks to be constructed along an eastern segment of Austell Road from Seayes Road to Anderson Mill Road, south of the East-West Connector.) Sidewalk coverage is inconsistent on intersecting roadways. The study makes no mention of on-street bicycle facilities; the Silver Comet Trail is the only existing shared use path in the area, and it runs perpendicular to the corridor. Austell Road crosses the trail on a bridge so there is no direct access from the corridor to the trail; the nearest access point is about one-half mile west on Anderson Mill Road.

The study recommends a number of roadway widening and intersection improvements, including new turn lanes. The study also proposes access management and traffic calming strategies, which should lessen conflicts between motorists and pedestrians. The study proposes filling sidewalk gaps as well as pedestrian crossing and signalization upgrades at several intersections to improve pedestrian accommodation. The study's recommendations for bicycle improvements focus on providing more access points to the Silver Comet Trail from the corridor. A proposed streetscape redesign for Austell Road includes sidewalks widened to 12 feet—including planting areas—and maintaining four 12-foot travel lanes on the roadway with no on-street bicycle facility.

The filling of sidewalk gaps and careful intersection upgrades should be beneficial to pedestrian mobility. Improved access to the trail will improve recreational opportunities and bicycle commutes to destinations outside the study area. There is little mention of on-street bicycling conditions in the study area.

[2] Cobb County, "Austell Road LCI Study," 2007, p.2

Austell Road is a Major Thoroughfare and was subject to analysis and recommendations described in later portions of this Plan.

Six Flags Drive Corridor Study (2007)

This 2007 study was performed by the Planning Department of the Cobb County Community Development Agency. The study area was a 1.1 mile section of Six Flags Drive, between Factory Shoals Road and Interstate 20. There are no signalized intersections other than at the terminal points of the study area. This 40 mph roadway is configured with four travel lanes and a two-way left turn lane. There are sidewalks on the north side of the road only. The corridor is served by Cobb Community Transit's Route 30 Bus; there are eight transit stops on the corridor, three of which are not situated on sidewalks. The study cites both demographic and land use reasons why demand for transit access and bicycle and pedestrian accommodation may be high in the study area.

The study recommends a number of projects to improve bicycle and pedestrian accommodation. Short term objectives include the following:

- installation of five foot sidewalks along the south side of the road; and
- development of six crosswalks with refuge islands and intersection safety improvements.

Longer term objectives include:

- development of a shared use path along the north side of the roadway;
- development of a second, connecting path from the path described above northeast towards where Mableton Parkway crosses the Chattahoochee River;
- construction of a landscaped median to replace the two-way left turn lane;
- "decorative" street light upgrades; and
- intersection "improvements" including an "optional right turn lane at the Factory Shoals Road at Six Flags Drive intersection, going eastbound."

The study also recommends land-use changes, including increasing housing density, promoting mixed-use development and the development of a library in the area.

The study recommendations can all be conducive to the improvement of conditions for bicycling and walking. The desire lines—trails worn by pedestrians walking where no sidewalk currently exists—found on the south side of the road are evidence of the demand for new sidewalks there. The shared use path proposed by the corridor study is of the type commonly known as a "sidepath," which is to say it is located parallel to a roadway. The AASHTO *Guide for the Development of Bicycle Facilities* cautions against the construction of such facilities, due to numerous operational problems associated with them. There are design

practices that can mitigate some of these operational concerns, however, and a well-designed sidepath on the north side can greatly increase bicycle and pedestrian mobility in corridors like Six Flags Drive. (The design guidelines in Chapter 6 of the *Bicycle and Pedestrian Improvement Plan* address these issues and other guidance from the AASHTO *Guide,* as well as research and best practices developed since its last revision.) Appropriate crossing treatments would also be beneficial, especially to bicycle mobility, if the sidepath is on the north side only. The plan did not make any mention of on-street bicycling conditions; Six Flags Drive is a Major Thoroughfare and was subject to analysis and recommendations described in later portions of this Plan.

Plans to alter intersections should carefully consider the needs of crossing pedestrians, as additional lanes and large radii can greatly increase crossing distances, thereby increasing pedestrians' exposure to conflict with motor vehicles. The land uses changes recommended for the study area, if implemented, could greatly increase the amount of pedestrian and bicycle activity in the area; facility improvements will have to be carefully designed to ensure that that increased activity is safely accommodated.

Macland Road Corridor Study (2007)

This 2007 Study was performed by the Planning Department of the Cobb County Community Development Agency. The study area was the entire seven mile length of Macland Road from the Paulding County line to Powder Springs Road. Macland Road is classified as an arterial roadway by Cobb County; from the Paulding County line to State Route 76 (approximately three miles) it is a two-lane undivided roadway with very limited shoulders, while from SR 76 to Powder Springs Road (four miles) it is a four-lane divided highway.

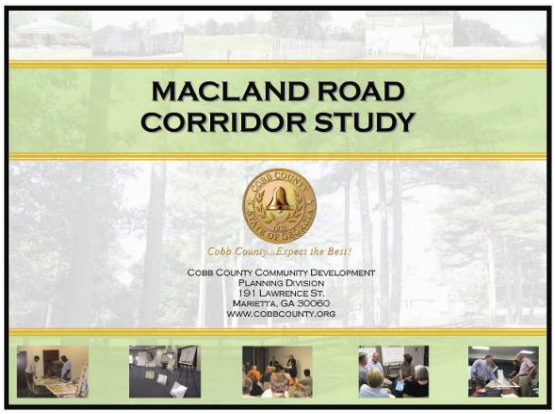


Figure 3.6: Cover of the Macland Road Corridor Study

Sidewalks are limited to two short stretches near intersections with SR 76 and Old Lost Mountain Road. Traffic volumes range from 16,000 to 24,500 vehicles per day, depending on the count location. The study notes that the County's crash reports do not distinguish bike or pedestrian crashes, but that on Macland Road there were 33 crashes classified as "other" between 2004 and 2007. Due to a pending Georgia Department of Transportation project to widen the two-lane portion Macland Road to four lanes, the Corridor Plan does not make a specific recommendation regarding Macland Road, but instead focused on changes at intersections and adjacent roadways.

The study recommends "creating opportunities for walking and/or bicycling to destinations within the corridor."[3] These recommendations include sidewalks and shared use paths along Macland Road, which are to connect with sidewalks within adjacent developments. The study also recommends standard inclusion of sidewalks in future residential developments in the study area, and the prohibition of "unfinished" backs of structures from facing Macland Road, which, the study maintains, "does not welcome pedestrian access."[4] The study cites strong public feedback for improved walkability in the study area, and recommends three new shared use paths for the study area.

Due to the pending widening of Macland Road, the study recommendations are very general in nature. Additional sidewalks and well-designed paths would undoubtedly improve pedestrian and bicycle mobility in this area where such facilities are very limited. Again, no mention is made of on-street bicycle accommodation; Austell Road is a Major Thoroughfare and was subject to analysis and recommendations described in later portions of this Plan. Routine accommodation practices, which are recommended in this plan and consistent with the County's Complete Streets policy, would help Cobb County coordinate with GDOT to provide appropriate bicycle accommodation in GDOT widening projects.

[3] Cobb County Community Development Agency, "Macland Road Corridor Study," 2007, p. 42.
[4] Ibid.

Canton Road Corridor Study (2005)

This study examines the portion of Canton Road from the Sandy Plains Connector to the Cherokee County line (approximately five miles). The roadway is a Major Thoroughfare connecting Interstate 75 to southern Cherokee County; it is four lanes wide with a two-way left turn lane. The study deals with many land use and aesthetic issues, but transportation issues are integral as well. Participants in public involvement sessions complained of high vehicle speeds and misuse of the two-way left turn lane as a passing or through lane during peak times. Access management was also a major concern due to numerous driveway cuts for commercial properties along the entire corridor. Business opposition at the outset of the project took any median proposals off the table, so alternative access management strategies had to be developed. The perception of "pedestrian friendliness," or lack thereof, was considered a problem for the corridor. Challenges to pedestrian friendliness included discontinuous sidewalks, inadequate crosswalk treatments—including some with no marking whatsoever—at intersections, un-authorized midblock crossings (using the two-way left turn lane as a refuge), as well as the general high-speed, high volume character of the roadway.

Traffic calming and access management are the primary foci of this study. Because of public opposition to constructing a median, planners instead proposed a strategy of driveway consolidation, inter-parcel circulation, and the construction of parallel access roads, possibly to be implemented in

redevelopment projects. Traffic calming was addressed by a proposal to apply textured and/or colored paving to sections of the two-way left turn lane, with the hope that the rumble-strip like effect of the textured surface would discourage continuous travel in the lane.[5] Traffic calming was also identified as a benefit of a proposed narrowing of the vehicular travel lanes to 11 feet, which could "provide a less comfortable driving experience at higher rates of speed,"[6] with the remaining pavement given over to a "bicycle friendly shoulder." Recommendations also include a 12-foot wide shared use path through the corridor, intersection improvements such as crosswalk markings, turn lane channelization islands, signal improvements and ramp improvements.

Many of the recommended projects should improve pedestrian and bicycle mobility. Access management not only benefits motorists, but reduces the number of conflict points where turning motorists cross the paths of bicyclists and pedestrians. Enhanced crossing treatments at intersections and channelization islands can be especially helpful for pedestrians attempting to cross such a fast and busy corridor. Well-designed shared use paths can also enhance mobility for bicyclists and pedestrians. It is a wise strategy to coordinate the median treatment and lane narrowing with the Local Area Road Program (LARP) Resurfacing schedule, as this greatly minimizes the cost of these changes, compared to implementing them independently. It would be good to study the effectiveness of the median treatments at reducing the undesirable behaviors, as there are no well-known studies on the subject; it would be important then to gather some data on the occurrence of the offending behaviors before the changes, so that the expected reduction can be measured. It is also important to note that narrowing lane widths to 11 feet, independent of other traffic calming measures, has not been shown to reduce motorist speeds, according to recent studies. Additionally, while it is true that shoulders narrower than the AASHTO-recommended four-foot bike lanes are useful to certain types of bicyclists, it is not recommended that those shoulders not be narrower than three feet, and should present a smooth, rideable surface that is free from incursions by drain inlets. Also, concrete gutter pans are not considered part of the usable width of the shoulder in cases where there is less than five feet between the curb face and the edge stripe. The report made mention of difficulties related to mid-block crossings, but no improvements of this type were recommended. The report's transportation analysis mentions that a raised median could improve pedestrian accessibility by providing safer opportunities for crossing, whether at intersections or mid-block locations. Medians and access management strategies can also improve safety for motorists. Whatever the resolution of the median issue, the county may wish to study the corridor in more detail to identify appropriate opportunities for mid-block crossing treatments that will

[5] Cobb County Community Development Agency, "Canton Road Corridor 'Main Street' Design Principles Plan and Recommendations," 2005, p. 31
[6] Ibid., p.10.

improve the safety of crossings many people are already making.

Delk Road Transit Oriented Development Study (2004)

This study examined the potential for redevelopment associated with a proposed Bus Rapid Transit (BRT) Station near the Delk Road interchange with I-75. The study area is roughly bounded by Marietta Parkway on the north, Powers Ferry Road on the east, Terrell Mill Road on the south and Cobb Parkway and Wylie Road on the west. The study area is bisected along a north-south axis by Interstate 75, and there are only three crossings of the I-75 corridor in the 2.5 mile length of the study area. The presence of the interstate limits pedestrian connectivity, especially from residential areas east of the highway to the area of the proposed BRT station on the west side of the highway. The study was conducted under the auspices of ARC's LCI program, which seeks to direct development towards areas with land use and infrastructure conducive to slowing sprawl and reducing vehicle miles traveled. Mobility for bicycles and pedestrians is a key concern of many LCI studies, and is especially important in this one which is centered on a major new transit facility.

The vision for the study area includes a "series of walkable, mixed-use Town and Neighborhood Centers."[7] Among the goals serving this vision is an interconnected street pattern in the area west of I-75, with wide sidewalks for east-west connectivity. Goals also included general encouragement of pedestrian and bicycle mobility. It was noted in the study that while many of the existing roadways in the area are functioning fairly well for motor vehicles, they are not accommodating non-motorized modes in any significant way. Sidewalks in the area are limited and discontinuous, crosswalks are seldom marked or served by pedestrian signals, and intersections crossings are often very wide. Un-met pedestrian demand in the area is made obvious by the presence of desire lines along some roadways. The study notes neither on-street bicycle facilities nor shared use paths were found in the area at the time of the study. The study notes that with the existing density of development in the area, there is a strong potential for pedestrian activity, which would likely increase with the introduction of the BRT facility.

The study recommends programs, policies and projects to move the area toward the vision. Program recommendations include lighting, pedestrian signal and streetscape improvements. Policy recommendations include balanced investment in all transportation modes, provision of new sidewalks to be timed with the BRT development, adherence to GDOT pedestrian facility design guidelines, and developer requirements to improve sidewalks. Project recommendations include sidewalk construction where facilities are lacking, including design guidance on the different requirements for locating of street trees and other amenities on state roads versus local

[7] Basil Baumann Prost & Associates, "The City of Marietta Delk TOD LCI Study Final Report" Final Report, p. 14.

roads. The study also recommends improving bicycle accommodation in a number of ways. First, it states that the development of new, interconnected, low-speed, low-volume roads in the area will benefit bicycle mobility. The plan also calls for new shared use paths through the study area, as well as a designated bike route along a low volume roadway to link several of the proposed paths. Typical sections (based on GDOT standards) shown in the study for recommended improvements to Franklin Road and for the proposed BRT station access road, both include four-foot bike lanes on each side of the roadway.

The Delk Road TOD Study is very comprehensive and makes recommendations that will likely improve bicycle accommodation. Well designed sidewalks and pathways, greater interconnectivity and intersection improvements can be highly beneficial to bicyclists and pedestrians. If the development of the area proceeds according to the vision described in this study, utilization of both modes may well increase. The report does not deal with on-street bicycling conditions on the higher volume roads in the area; several of the roads in the Delk Road TOD Study area are Major Thoroughfares and are subject to analysis and recommendations described in later portions of this Plan.

Historic Downtown Mableton Study (2001)

This study examined the possibilities for redevelopment of the historic community of Mableton in South Cobb County. The study area is centered on the area if the

Figure 3.7: Historic Downtown Mableton Study (2001)

original nine-block plat for Mableton, just northwest of the intersection of Clay Road and Veterans Memorial Highway. The study focuses on redevelopment opportunities associated with Mableton's historic character and proximity to a proposed commuter rail station, which would connect it to downtown Atlanta. The core study area is very compact and could become a pedestrian oriented, walkable-scale activity center with the proposed redevelopment.

The study notes that several of the original platted streets are in disrepair or undeveloped, and many are lacking sidewalks on both sides. The study recommendations include the following:

- repairing streets in disrepair and connecting any discontinuous sections;

- installing sidewalks where necessary, and making ADA-required upgrades for curb ramps where needed;
- development of a "bicycle-corridor" through the center of the historic district, along the rights-of-way of two very narrow and undeveloped platted streets; and
- traffic calming and crossing improvements for some of the higher speed roadways at the edges of the district, as well as the provision of bike lanes on these busier roadways, to allow access between the district and surrounding areas and destinations, including the Silver Comet Trail, which is approximately two miles to the north along Floyd Road.

The study recommendations are fairly comprehensive and should all improve bicycle and pedestrian mobility in the area. The possibility of developing bike lanes on the nearby arterials will be evaluated in later portions of this Plan.

ARC Connect Six (State Route 6) Corridor Study (2008)

State Route 6 is a major regional roadway that cuts through the southwest corner of Cobb County, passing close to the communities of Powder Springs and Austell. Known locally as C.H. James Parkway, SR 6 in Cobb County is a four-lane divided highway that extends seven miles through Cobb County. The overall length of the study corridor is 32.5 miles, through Paulding, Cobb, Douglas and Fulton Counties. This study predicts the State Route 6 Corridor will continue to be an area of significant growth through 2030, including a 52 percent increase in population and a 45 percent increase in employment. Most of Cobb County's section of State Route 6 is in the study's "Segment 1," which runs from the Paulding County Line to Westside Road, at the south end of the Norfolk Southern Intermodal Terminal. Segment 1 is characterized in the study as "exurban in nature," presently at the beginning of the cycle of intense residential and retail development. Nevertheless the study identifies the Cobb County portion of Segment 1 as both a major origin and a major destination for trips on the total corridor. The study notes that the corridor is currently lacking in bicycle and pedestrian accommodation. Sidewalks are very limited, but desire lines show that pedestrians are present. Crossing improvements are rare and crosswalks are frequently unmarked. Transit stops generally do not have sidewalk access. There are no designated bicycle facilities on the corridor roadways. The Silver Comet Trail does intersect the corridor just northwest of Powder Springs, but there are limited points of connection.

The study recommends the development of a parkway along Hiram-Lithia Springs Road to serve as an alternate route parallel to State Route 6; the proposed cross section includes "eight- to ten-foot wide multiuse side paths" on both sides of the road.[8] This facility is seen as a possible link to connect the Silver Comet Trail with Sweetwater Creek State Park in

[8] Atlanta Regional Commission, *"Connect Six: State Route 6 Corridor Study, Final Report,"* March 2008, pp. 3-13.

Douglas County. Recommendations for State Route 6 itself include an access management plan, with special attention to access by developing parcels on the north side of Powder Springs, near Florence Road. The study also recommends the general improvement of pedestrian access to transit stops. The study recommends against developing new pedestrian and bicycle infrastructure directly on State Route 6, and instead focuses on providing facilities on "connecting and parallel roadway network and between developments." Specifically, the study recommends developing a connection between the Silver Comet Trail and Sweetwater Creek State Park, either via a greenway alignment or via sidepaths along Hiram-Lithia Springs Road, providing sidewalks and bicycle lanes along frontage or backage roads associated with new development, and developing facilities to allow access between the Silver Comet Trail and the State Route 6 Corridor.

The study deals with providing accommodation for bicycles and pedestrians in an environment that is often understood to be inhospitable to their needs, and consequently where little demand is assumed. In such an environment, it is prudent to concentrate on providing facilities in coordination with development, and the provision of facilities on access roads and streets that intersect State Route 6 will improve mobility for bicyclists and pedestrians. It should be noted, however, that certain cyclists will use the main corridor for longer trips and for access between destinations. State Route 6 is a Major Thoroughfare and was subject to analysis and recommendations described in later portions of this Plan.

The proposed trail connections should benefit both bicycle and pedestrian mobility. The proposed parkway sidepath for Hiram-Lithia Springs Road should, if properly designed, also benefit non-motorized mobility and draw on the qualities of two regional attractors for outdoor recreation. It should be noted, however that many bicyclists prefer riding in the roadway over using sidepaths, so shoulders or bike lanes may be useful on such roadways as well.

Cobb County Rail to Trail Master Plan (1997)

This document outlined the steps necessary to develop the Silver Comet Trail, including the use of design criteria from the AASHTO *Guide for the Development of Bicycle Facilities*, which it identifies as the "legally defensible design manual for bicycle facilities."[9] The extent of the trail proposed in the Master Plan is from Florence Road to Mavell Road. This portion was built including a connection further westward from Florence road into Paulding County.

[9] Cobb Land Trust Inc., "Cobb County Rail Trail Master Plan," 1997, p.

Alternatives for the extension of the trail eastward into Fulton County from Mavell Road are considered in Chapter 7A of this plan.

3.1.4 OTHER DOCUMENTS

Cobb County Multi-Use Systems Trail Plan (2008)

This map depicts the network of existing Cobb County Trails and National Park Service Trails in the Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park. The map also depicts selected programmed and proposed trails. The map also indentifies Cobb Community Transit lines that provide access to existing trails.

CCT Shelter and Bus Stop Inventory

See Transit Planning Study (above).

Cobb County Code of Ordinances

The Cobb County Code of Ordinances addresses bicycle and pedestrian concerns in a number of specific ordinances. In numeric sequence these include the following:

- Section 30-1, a local amendment to the Georgia Constitution, which authorizes the County to provide for the construction and maintenance of sidewalks and to assess the costs to owners of abutting property;
- Section 6-22, which allows for the creation of community improvement districts for the provision of governmental services and facilities, including sidewalks and bicycle and pedestrian facilities;
- Sections 106-91 through 106-98, which require the construction of

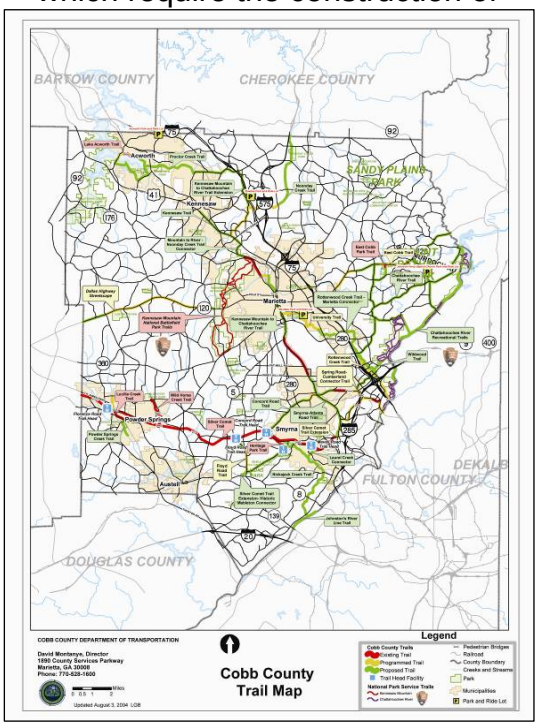


Figure 3.8: Cobb County Trail Map

sidewalks along certain roads in new developments;
- Sections 106-112 and 106-113, which allow for the creation of sidewalk districts and describe the funding thereof;
- Sections 106-155 through 106-168, which allow for the creation of pedestrian lighting districts by local property owners and describes the funding and operation standards thereof;
- Section 118-33, which authorizes officers of the police department "or such officers as are assigned by the director of public safety, including school crossing guards," to direct traffic in certain

situations, including the safeguarding of pedestrians;

- Section 118-49, which authorizes the County's traffic engineer to designate and maintain crosswalks at intersections where there is "particular danger to pedestrians crossing the roadway and at other such places as he may deem necessary," and also directs the traffic engineer to study existing crosswalks not at intersections and to "abolish those which he deems unnecessary;"
- Section 118-50, which authorizes the County traffic engineer to establish, designate, and maintain safety zones for the protection of pedestrians;
- Section 118-54, which directs the traffic engineer to place pedestrian control signals at places designated by the code or "any other law or ordinance," and declares drivers of vehicles subject to rules prescribed in the Official Code of Georgia Annotated (O.C.G.A.) when signals are placed;
- Section 118-87, which prohibits human powered and animal powered vehicles, including bicycles and tricycles, from operating on the limited access highways of the County;
- Section 118-89, which regulates the operation of bicycles on a specific roadway known as Columns Drive, and allows for violators of these regulations to be banned from Columns Drive until the following day.

Section 110-1, which defines terms relevant to subdivision development regulations, includes a definition of crosswalk, which reads as follows:

> *Crosswalk* means a right-of-way within a block dedicated to public use, ten feet or more in width, intended primarily for pedestrians and from which motor-propelled vehicles are excluded. It is designed to improve or provide access to adjacent roads and lots.

This definition is a variance with the definition in O.C.G.A., which is as follows:

> (10) "Crosswalk" means:
>
> (A) That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or in the absence of curbs, from the edges of the traversable roadway; or
>
> (B) Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface.

In the summer of 2008, the Cobb County Commission adopted a revision to the Official Code of Cobb County, which defines a type of zoning district known as a Continuing Care Retirement Community. Included in the regulations

for such districts is section 134-202.1 (6) which regulates the design of sidewalks in such districts. The regulation stipulates that in addition to being ADA compliant, sidewalks should "generally be wide enough to accommodate passing wheelchairs," run along any public road frontage, and connect to nearby networks. The regulation also stipulates that any "joint use path (i.e. golf cart and pedestrian) must be at least 10 feet wide."

Official Code of Georgia

The Official Code of Georgia contains numerous regulations pertaining to bicycle and pedestrian facilities.

Georgia code generally prohibits the operation of bicycles on sidewalks, though not directly: all vehicles are prohibited from sidewalks (except when crossing them in a driveway), vehicles are defined as any devices which people and property are transported, and bicycles are defined as devices. Bicycles are defined in Section 40-1-1

(6) as "every device propelled by human power upon which any person may ride, having only two wheels which are in tandem and either of which is more than 13 inches in diameter." Section 40-6-144, as amended in 2009, requires that every vehicle

> emerging from an alley, building, private road, or driveway within a business or residential district shall stop such vehicle immediately prior to driving onto a sidewalk or onto the sidewalk area extending across such alley, building entrance, road, or driveway or, in the event there is no sidewalk area, shall stop at the point nearest the street to be entered where the driver has a view of approaching traffic thereon. The driver of a vehicle shall yield the right of way to any pedestrian on a sidewalk. Except as provided by resolution or ordinance of a local government for sidewalks within the jurisdiction of such local government authorizing the operation of bicycles on sidewalks by persons 12 years of age or younger, no person shall drive any vehicle upon a sidewalk or sidewalk area except upon a permanent or duly authorized driveway.

The definition of a vehicle is in Section 40-6-144 (75), and includes "every device in, upon, or by which any person or property is or may be transported or drawn upon a highway, excepting devices used exclusively upon stationary rails or tracks."

Georgia Code defines a sidewalk in Section 40-6-144 (57), as

> "that portion of a street between the curb lines, or the lateral lines of a railway, and the adjacent property lines, intended for use by pedestrians."

A 2009 amendment to the code allowed for the local option of permitting sidewalk riding by children 12 years old and under. On July 14, 2009, the Cobb

County Board of Commissioners voted unanimously to authorize sidewalk riding on roadways by persons 12 years old and younger in unincorporated Cobb County.

Georgia law does not define a shared use path. Georgia law does, however, in Section 40-6-294 (d), give local governments the option to require bicyclists to use a path adjacent to a roadway and not use the roadway. If the local authorities choose to make such a requirement, the designated path must meet the guidelines for such facilities

> "as set forth by the American Association of State Highway and Transportation Officials" (AASHTO), which publishes such guidance in its *Guide for the Development of Bicycle Facilities.*

Georgia Code defines an "Electric personal assistive mobility device" or "EPAMD"

> as a self-balancing, two nontandem wheeled device designed to transport only one person and having an electric propulsion system with average power of 750 watts (1 horsepower) and a maximum speed of less than 20 miles per hour on a paved level surface when powered solely by such propulsion system and ridden by an operator who weighs 170 pounds.

Section 40-6-320 (a) states that'

> such devices may be operated on highways and on sidewalks where a 48 inch clear path is maintained for access for persons with disabilities, provided that any person operating such a device shall have the same rights and duties as prescribed for pedestrians.

It goes on to say that no person shall operate any electric personal assistive mobility device on the roadway of any highway unless:

> The maximum speed limit of the roadway is 35 miles per hour or less; or the roadway has a separately striped bicycle lane and the device is operated within the bicycle lane, when traveling on any roadway of a highway, a person operating an electric personal assistive mobility device shall travel in the same direction authorized for motor vehicle traffic on such roadway.

Georgia Code defines a "Motorized cart" as

> "every motor vehicle having no less than three wheels and an unladen weight of 1,300 pounds or less and which cannot operate at more than 20 miles per hour."

Section 40-6-331 allows a local governing authority to designate certain public streets or portions thereof to be used by motorized carts and regular vehicular traffic but goes on to say that the ordinances shall not be effective unless appropriate signage is posted:

> Motorized carts may cross streets and highways that are part of the state highway system only at crossings or intersections designated for that purpose by the Department of Transportation. Motorized carts may cross streets and highways that are part of a municipal street system

> or county road system and used by other types of motor vehicles only at crossings or intersections designated for that purpose by the local governing authority having jurisdiction over such system.

Georgia code defines a "Moped" as:

> a motor driven cycle equipped with two or three wheels, with or without foot pedals to permit muscular propulsion, and an independent power source providing a maximum of two brake horsepower. If a combustion engine is used, the maximum piston or rotor displacement shall be 3.05 cubic inches (50 cubic centimeters) regardless of the number of chambers in such power source. The power source shall be capable of propelling the vehicle, unassisted, at a speed not to exceed 30 miles per hour (48.28 kilometers per hour) on level road surface and shall be equipped with a power drive system that functions directly or automatically only, not requiring clutching or shifting by the operator after the drive system is engaged.

Per Section 40-6-350, drivers of mopeds are subject to the same rules as drivers of any vehicle.

3.1.5 CONCLUSIONS

The purpose of this section is to provide context of the existing plans, studies and ordinances in effect in and around Cobb County. This review reveals that bicycling and walking have been addressed at many different levels in several of these studies and ordinances. Some are very comprehensive, while others have only tangential relevance. Some studies may benefit by being amended to deal with bicycle and pedestrian needs more directly. Recommended amendments to these studies are described in Chapter 2, after the discussion of recommended policies.

3.2 EXISTING INFRASTRUCTURE

3.2.1 EXISTING ACCOMMODATION OF BICYCLING AND WALKING

For the County and its residents to understand the progress of this plan as it is implemented, it is important to have a clear understanding of the conditions for biking and walking as they existed at the time the plan was developed. Any attempt to describe such conditions needs to be done in a manner that allows for continual monitoring, so that improvements recommended by the plan can be observed as they take effect and that measurable progress towards the plan's objectives can be reported to Commissioners and taxpayers alike. This section of the plan reports on conditions for walking and bicycling observed on the County's Major Thoroughfares between November 2008 and February 2009. The methods of evaluation are two statistical tools that assign "grades" to roadway segments, using a pseudo-academic scale (A-F), based on how well each of those roadway segments accommodates the needs of pedestrians and bicyclists. These methods, the Pedestrian Level of Service model and the Bicycle Level of Service model, have been used by counties and cities across the nation as well as regional, state and federal agencies, to evaluate in excess of 200,000 miles of roadway. These methods were adopted by the national Highway Capacity and Quality of Service Committee as its official measures of pedestrian and bicycle accommodation. These methods were the same methods used by the Atlanta Regional Commission in its 2007 *Bicycle Transportation and Pedestrian Walkways Plan*, which includes results of these methods in its prioritization of member agency requests for funding assistance.

The Pedestrian Level of Service and Bicycle Level of Service models are described in detail in Appendix A-1[10] of this plan. This section of the plan will discuss their results for Cobb County's Major Thoroughfares as well as the general conditions that contributed to those results. The findings of this section of the plan are descriptive; they make no attempt to determine an appropriate level of accommodation or facility treatments on a given roadway. These issues will be addressed in Chapter 4, "Infrastructure Needs".

In order to apply these models, various types of data were gathered for input to the models. These data were field-gathered by the consultant team, culled from existing records, or, in limited cases, estimated based on analogous observations. Field gathered data included geometric data such as widths of lanes, roadways, gutters, buffers and sidewalks, as well as observed roadway characteristics including lane counts, configuration (one-way, undivided, divided, or use of a two-way left turn lane) posted speed limit, roadside profile, pavement condition, and cross-section type (curbed or open shoulder).

[10] Previously submitted as "Evaluation Methodology," ultimately to be included as an appendix in the final plan.

Traffic conditions were applied from outside sources: traffic counts were provided by the County, and heavy vehicle percentages were estimated using a lookup table. In certain cases, where traffic counts were unavailable, volumes were estimated by applying the average count of other roadways in the study network of the same functional class (arterial, major collector, minor collector) having the same configuration and number of lanes.

Figure 3.9: The consultant team collected data regarding roadway geometry and configuration as well as data regarding sidewalk presence, width and separation from the roadway

The relevant data were collected for the County's network of Major Thoroughfares (as of October 2008), which includes roadways classified as arterials, major collectors, and minor collectors. This network totaled approximately 790 centerline miles, but each segment was evaluated directionally, so that results are reported for each direction of travel in the roadway (for bicycling) and alongside both sides of the road (for walking), yielding a total of over 1550 directional miles evaluated. The distance-weighted average results for the study network are similar for bicycling and walking. The average mile of Cobb County roadway has a Bicycle Level of Service score of 4.13, equal to a grade of "D", and a Pedestrian Level of Service Score of 4.20, also equal to a grade of "D".

The Bicycle Level of Service and Pedestrian Level of Service results for the Cobb County's Major Thoroughfares are mapped in figures 3.10 and 3.11, respectively.

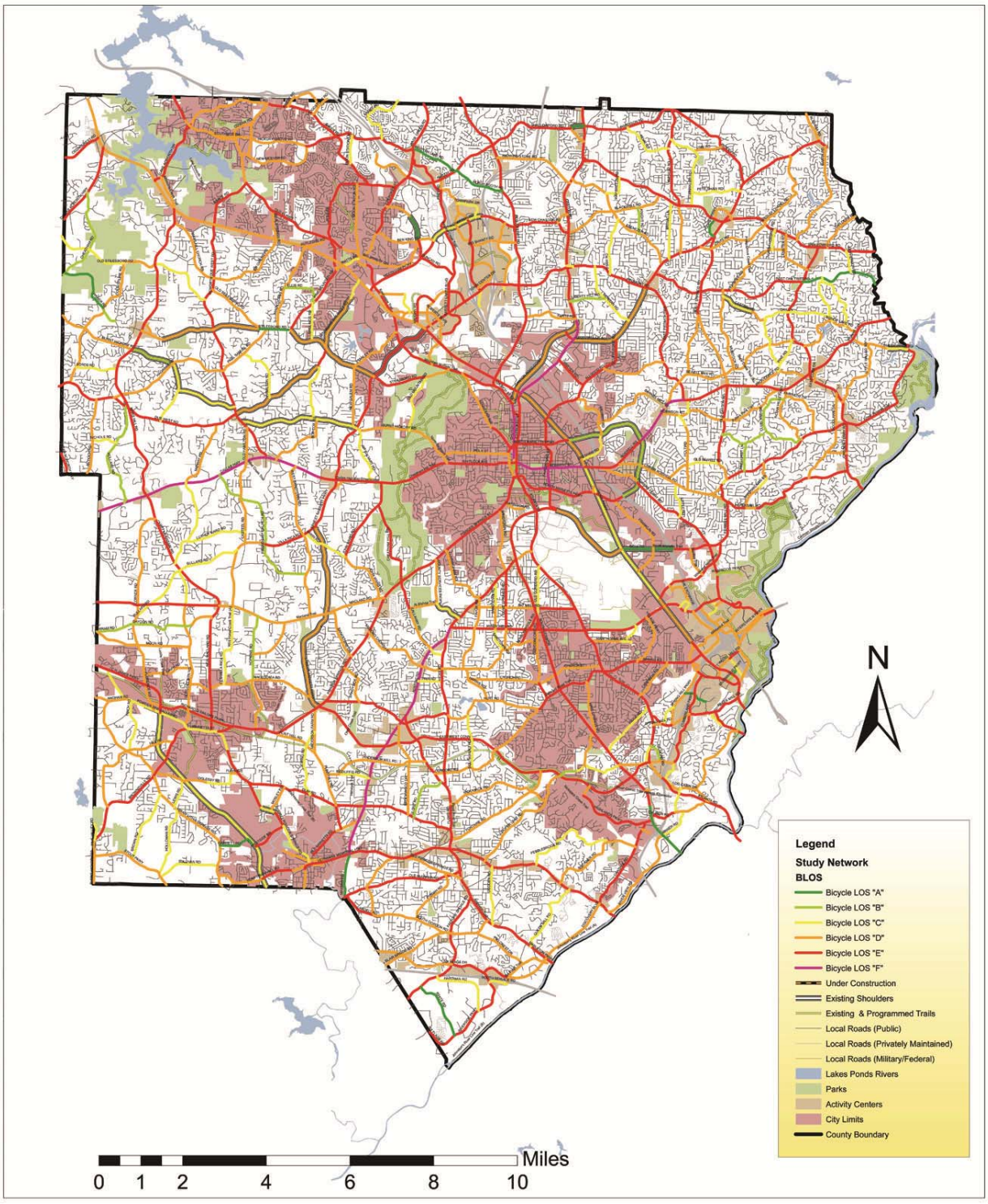


Figure 3.10: Cobb County Bicycle Level of Service Results Map

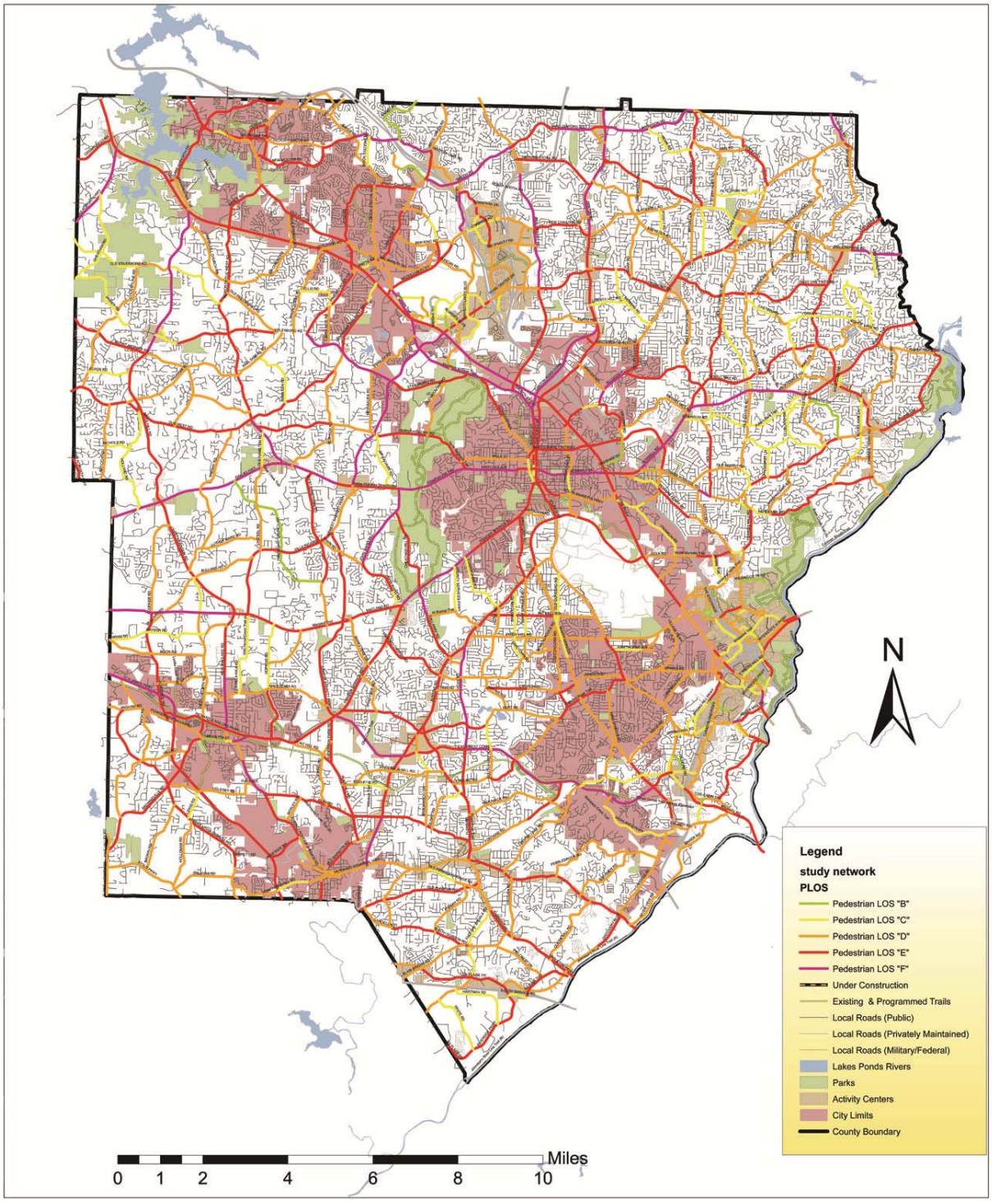


Figure 3.11: Cobb County Pedestrian Level of Service Results Map

Level of Service	LOS Score
A	≤ 1.50
B	1.51—2.50
C	2.51—3.50
D	3.51—4.50
E	4.51—5.50
F	> 5.50

Table 3.1: Bicycle Level of Service and Pedestrian Level of Service strata and corresponding scores

While every community has different expectations regarding accommodations for biking and walking, as a general observation these results describe a challenging situation for biking or walking along a typical Cobb County road. This is not an unusual result for urbanized areas in the United States, however. Similar evaluations of roadway networks have been performed in metropolitan areas around the country. A sample of these results for bicycling conditions, including the result for Cobb County, is shown in Figure 3.12. Communities whose networks earned a Bicycle Level of Service grade of "C" include Lexington, KY (1999), Philadelphia, PA (1996), Gainesville, FL (2000), and San Antonio, TX (2000). Communities whose networks scored a grade of "D," like Cobb County, include Baltimore, MD (1998), Jacksonville, FL (2004), Chicago, IL (2001), and Orlando, FL, (2001). The study network for the entire Atlanta region (comprised of roadways from the Atlanta Regional Commission's Regionally Strategic Transportation System) scored a grade of "E" in 2006, as did the roadways of Collier County, FL (Naples metropolitan area) in 2004.
A similar comparison of Cobb County's Pedestrian Level of Service results with other study areas is shown in Figure 3.13.

As might be inferred from from the distance weighted averages (located on the next page), the distribution of mileage also reflects very challenging conditions for both bicycling and walking, with "E" being the grade for the greatest number of bicycle miles and "D" being the grade for the greatest number of pedestrian miles. The distribution of mileage for bicycling are shown in Figure 3.14, while the distribution of mileage for walking is shown in Figure 3.15.

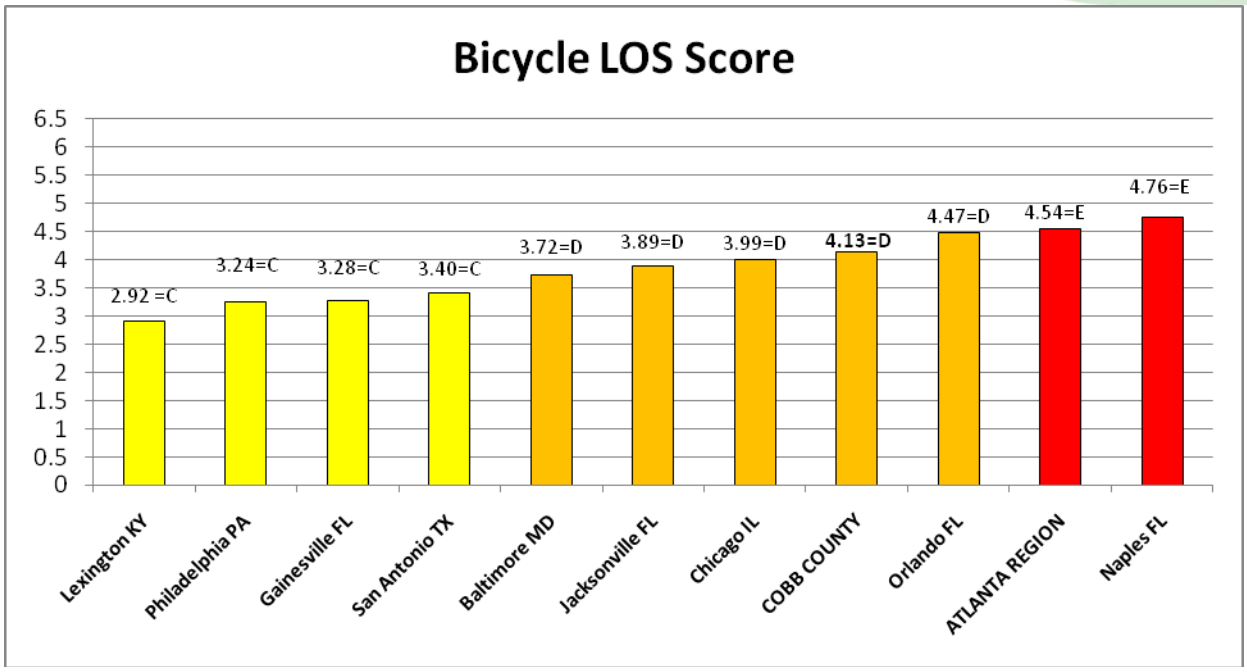


Figure 3.12: Distance Weighted Averages for Area-wide Evaluations of Bicycling Conditions with Bicycle Level of Service Model. *Source: Sprinkle Consulting Archives*

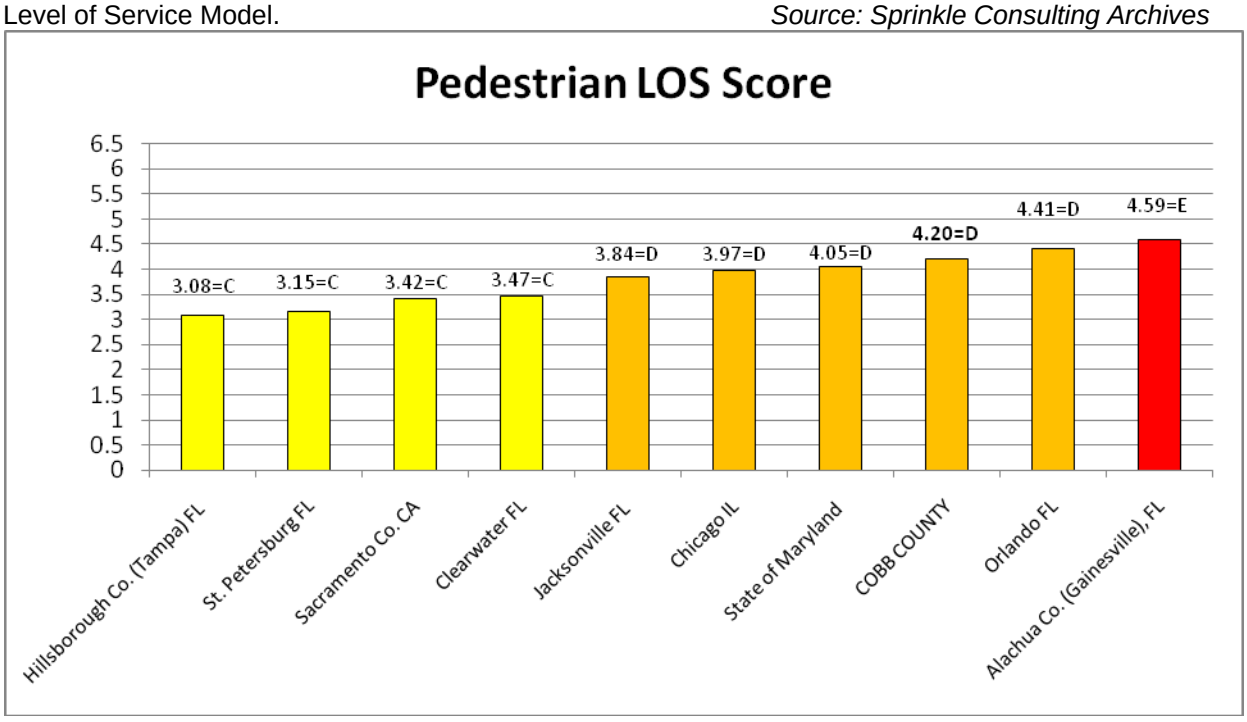


Figure 3.13: Distance Weighted Averages for Area-wide Evaluations of Walking Conditions with Pedestrian Level of Service Model. *Source: Sprinkle Consulting Archives*

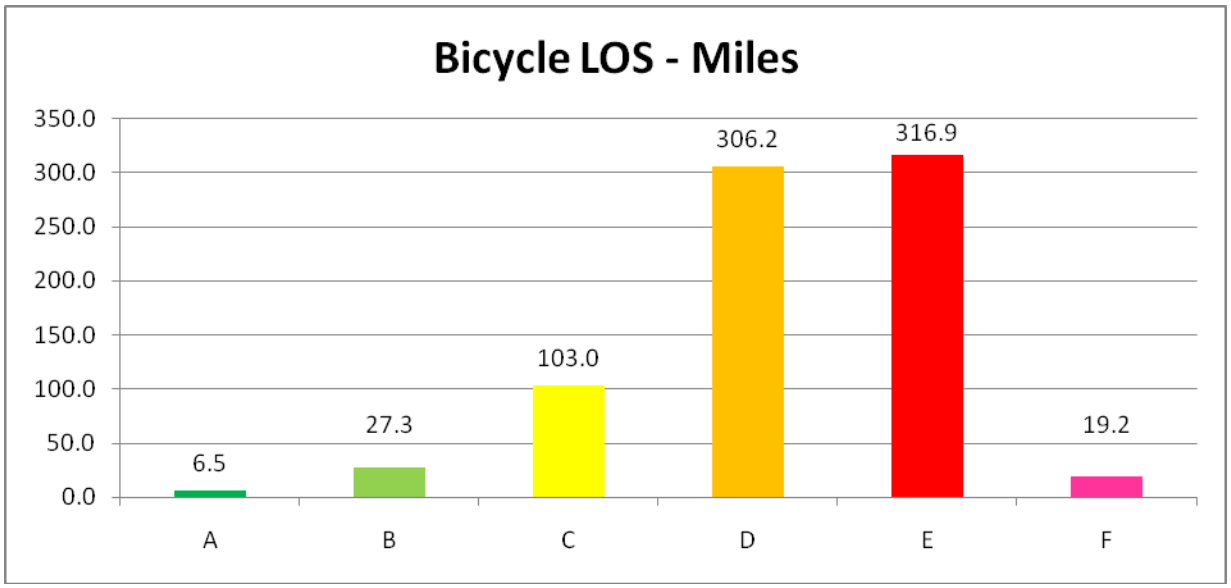


Figure 3.14: Distribution of Study Network Miles by Bicycle Level of Service Grade

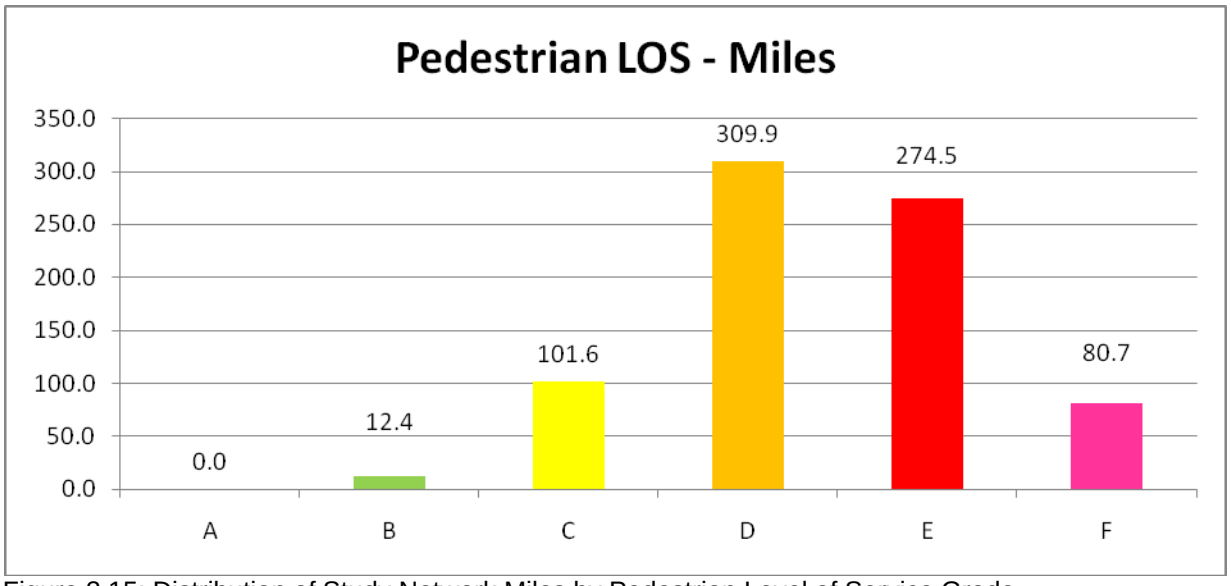


Figure 3.15: Distribution of Study Network Miles by Pedestrian Level of Service Grade

Some general observations may be made about factors that contribute to the challenging character of bicycling and walking conditions along Cobb County's Major Thoroughfares. It is important to note, however, that the Bicycle Level of Service and Pedestrian Level of Service models each consider a complicated interplay of contributing factors as they model a bicyclist's or pedestrian's perception of comfort and safety on a given roadway. No one factor is likely responsible for a segment's result, and later sections of this plan will make recommendations about how to mitigate the existing conditions to improve

Figure 3.16: Bicyclists can feel well accommodated on higher speed, higher volume roadways if they have a wide shoulder area to use

accommodation where needed. But certain factors can be identified as contributing to the overall environment to provide some context beyond the numbers. First, traffic volumes on county roadways can be very high. Of the 787 centerline miles surveyed, over half reported volumes in excess of 10,000 vehicles per day, a volume that can be translated into an experience for a bicyclist or pedestrian of being passed by a car approximately every six and one-half seconds.

The County's roadways do not typically feature shoulders or bike lanes which represent separate space in the roadway cross section which bicyclists can claim as their own operating space; only 50 miles of the study network feature shoulders three feet wide or greater on both sides of the road.

Figure 3.17: Sharing roadways with higher traffic becomes very stressful for bicyclists

On the remaining 730+ miles network, the average width between the edge of pavement and the stripe demarcating the outside lane is 11.7 feet, leaving a tight squeeze for bicyclists who try to share the road with cars.

Only 43% of the network miles surveyed have full sidewalk coverage along at least one side of the roadway, and of all the sidewalks surveyed the average buffer separating that sidewalk from the roadway is just under two feet. Alongside those roadways without sidewalks or shoulders, it is not uncommon for the roadsides to fall quickly into ditches, leaving little room

for those who might choose to walk alongside them anyway, or little room to escape for those who choose to walk or ride a bike in the narrow roadway. Taken all together, these characteristics describe an environment which can be very stressful for those who attempt to walk or ride a bicycle along Cobb County's roadways, limiting the viability of these modes to be experienced as real transportation options in the County.

3.2.2 CHALLENGES TO BICYCLING CONDITIONS DUE TO RESURFACING PRACTICES

In addition to the measurable characteristics that are used as data for the Bicycle and Pedestrian Level of Service models, the consultant team noticed several other common characteristics of the Cobb County's Major Thoroughfares that also contribute to the challenging environments for bicycling and walking in the county. These include differing outside lane widths in the opposing directions of the same roadway segment and resurfacing practices that do not result in a smooth longitudinal joint between the gutter pan and the paved travel way.

Lane Width Variations

Along with any shoulder that might be present, the outside lane is the primary space utilized by bicyclists who choose to ride on the roadway. The width of the outside lane is an important data input for the Bicycle Level of Service Model's evaluation of how well a roadway accommodates bicyclists. The data collectors found quite often that there was a considerable discrepancy between the outside lane widths on the two directions of the roadway. The center stripe was frequently not at the actual center of the pavement and the outside lanes of the same roadway often had considerably different amounts of space to offer bicyclists. For example, the two lane roadways of the study network were divided in to 492 roadway

Figure 3.18: Bicyclists can feel well accommodated sharing a roadway with very low volumes

segments. Of these, 218 segments (44%) had discrepancies of half a foot or greater between the two lane widths, and of those, 112 segments had differences of a foot or greater. In the example of a one-foot difference, bicycles traveling westbound are sharing 11 feet with the motorized traffic, while their counterparts traveling westbound are sharing 12 feet. The impact of this difference on bicycle level of service is varies—as lane width is not the only significant factor in the model—but such a significant difference might cause a cyclist to choose different routes depending upon his or her direction of travel, an inconvenient and undesirable outcome.

Resurfacing Without Milling

Another apparent resurfacing practice that impacts the bicycling experience is the finishing of the edge of pavement relative to the gutter pan. It appears that in some instances, the existing pavement was not milled prior to resurfacing, so that successive layers of pavement have been deposited one on top of another. In some cases, the new pavement forms a high lip along the joint with the gutter pan (see Figure 3.19). In other cases the new pavement has covered the gutter pan entirely and the pavement runs all the way to the face of the curb. The situation of leaving a lip is undesirable for a couple of reasons. First, it requires bicyclists to track a tighter line as they travel. If they notice the lip, they will be concentrating on avoiding the change in level and possibly ride farther out into the lane as a result. If they don't notice it, they may well ride over it, dropping down onto the level of the gutter, and possibly have a difficult time getting out.

Figure 3.19: Paving that does not leave a smooth joint with the gutter pan

This practice also has the potential of taking away some opportunities for bike lanes. *The AASHTO Guide for the Development of Bicycle Facilities*, recommends that a bike lane be 5 feet from the face of curb on roadways with curb-and –gutter cross sections. Within this dimension is an assumed 1-2 foot wide gutter and at least 3 feet of rideable surface on the pavement. Five feet apportioned between these two surfaces is recommended only if "the longitudinal joint between the gutter pan and the pavement surface is smooth." The recommended 3 foot minimum width of paved area for this type of bike lane is less than the 4 feet recommended for an open shouldered roadway. In practice, a bike lane of 3 feet could be placed along a two foot gutter pan, or a bike lane of 3.5 feet could be placed next to a 1.5 foot gutter. Assuming minimum lane widths of 11 feet, careful resurfacing and maintenance of the seam between the pavement of the gutter pan could allow for bike lanes on 28 and 29 foot wide two-lane roadways, where otherwise 30 feet would be needed for a full 4 foot bike lane.

A paved-over gutter can create a false impression of a shoulder, if an edge stripe is placed on the road at the position of the joint (if the joint were visible). The appearance of pavement outside the white line is sometimes misunderstood by motorists and bicyclists as a shoulder intended for bicycle travel; such areas are too narrow

to function effectively as rideable space. Those who attempt to ride in this zone may strike their pedals on the curb face. Also, those who ride in space suggested by this may suddenly have to swerve to avoid inlets that drain the gutter they are riding over (see Figure 3.20). Lastly, paving over the gutter can also lead to cracking of the pavement over the gutter edge, degrading the surface condition in the portion of the road most used by bicyclists.

Figure 3.20: A paved over gutter suddenly drops into an inlet

3.3 POTENTIAL FOR BICYCLING AND WALKING IN COBB COUNTY

The Latent Demand method was employed to identify and quantify potential bicycle and pedestrian trip activity on a study network consisting of Cobb County's "Major Thoroughfares" (Arterials, Major Collectors and Minor Collectors identified in the County's Major Thoroughfare Plan), supplemented by proposed trails from the County's Multi-Use Trail Systems plan. The Latent Demand Method is described in detail in the Evaluation

Methodology document (and will be included as a technical appendix in the final plan document). The results of Latent Demand Analyses for both bicycling and walking are shown in the maps here, full data results are found in Appendix C. Certain characteristics of Cobb County required some custom tailoring of the methodology to reflect local circumstances. These elements are discussed below.

3.3.1 TRIP PURPOSES, GENERATORS, ATTRACTORS, AND THEIR RESPECTIVE BUFFERS

The trip purposes for which potential demand was identified in this analysis include:

- home-to-work;
- shopping and errands (home- and work-based);

- home-to-school (elementary and middle schools);
- higher education (Life University, Kennesaw State University, Southern Polytechnic State University and Chattahoochee Technical College);
- as well as trips to transit; and
- social/recreational trips.

Using the study network, the County-provided year 2030 Traffic Analysis Zone (TAZ) demographic and employment data, and the provided and GIS-mapped *key* trip attractors and/or generators (schools, colleges, transit routes, parks), all corridor segments were analyzed according to detailed methodology described in the Appendix A. Locally specific calibrations were made to the methodology in the following ways:

- The potential for elementary and middle school trips was measured out to 1.5 miles from school locations, which equals Georgia's pupil transportation exclusion zone, the distance under which the State Department of Education does not subsidize school bus costs. Potential trips were estimated based on an average number of students in elementary and middle schools in the Cobb County School District and Marietta City Schools, per the Georgia Department of Education Full-time Equivalent (FTE) Data Collection System (October 2008 Data).
- The potentials for shopping and work trips were estimated out to two miles (in half-mile increments) from each study network segment. In previous applications of the Latent Demand Method, trip potentials have been estimated to distances roughly twice the average trip length. However, due to the large scale of this study area, the number of intersections between the study network segments (and their incremental travel-shed buffers) and the TAZs (which provide data on population and employment) grew rapidly into the hundreds of thousands exceeding the computational capabilities of Microsoft Excel. As such, potentials were estimated in half-mile increments up to two miles, the same distance for social/recreational and transit trips. The potential for trips to higher-education destinations were also estimated up to two miles, due to the similarity of higher education trips
- to work trips, as described in the technical Appendix It is not believed that this limitation will influence the overall results, due to the fact that the calculated probabilities drop off sharply as they approach average trip length. Results were spot-checked by adding potential increased demand in the affected categories and found minimal

changes in the raw scores, and negligible changes in the relative rankings among segments.

- Parks were stratified into five types for which there are per acre trip rates in the calculated in the Institute of Transportation Engineers' *Trip Generation I (7th* Edition). These types and their Trip Generation land use types (in parentheses) are: City Park (411), County Park (412), Regional Park (417), State Park (413), and National Monument (418). The categories of City and County Parks represent lower intensity-of-use parks of these respective jurisdictions, while Regional Parks represent higher intensity-of-use parks of either jurisdiction. Assignments of parks to these categories were made with the input of County Staff.

- Trails were assigned the trip rate used for regional parks, calculated on an area derived from the average length of existing and programmed trails and an assumed right-of-way of 100 feet.

3.3.2 TRIP LENGTHS AND PROBABILITIES

Once the potential "markets" for bicycling and walking trips were estimated, probabilities for making trips at various lengths were applied. These probabilities were calculated from average bicycling and walking trip lengths for various purposes as reported in the 2001 National Household Travel Survey. The trip lengths and probabilities for the various purposes are shown in Table 3.2.

The full results for the Latent Demand Analysis of bicycling and walking in the Cobb County are listed in the accompanying databases. The results are displayed in the six trip-purpose-specific columns, showing the potential market for each trip purpose on each network segment. These market numbers reflect the prevalence, proximity, and magnitude of the surrounding trip generators or attractors. The results are then normalized on a 100-point scale (i.e., individual scores are calculated as a percentage of the highest score for that trip purpose). The last column displays the highest purpose-specific score for each study network segment. These relative ranking results are depicted graphically on the accompanying maps (Figure 3.21 for bicycling and Figure 3.22 for walking), with results stratified into five tiers according to their scores for bicycling and walking. These quintile groupings are shown in Table 3.3.

The Latent Demand Score values will be used in the prioritization of projects, as one term in the calculation of a project's benefit to the county, namely, the likelihood of that project being used by local residents if it were to be developed. The tier assignments are for map representation purposes only.

Trip Lengths and Probabilities for Modes and Purposes										
	Work/Higher Ed.		School		Shopping		Social/Rec		Transit*	
	WALK	BIKE	WALK	BIKE	WALK	BIKE	WALK	BIKE	WALK	BIKE
Avg. Trip Length (miles)	0.85	2.93	0.62	1.2	0.55	0.88	0.95	1.9	0.43	1.57
Probability @ distance										
0.5 miles	0.981	0.996	0.960	0.990	0.945	0.982	0.985	0.995	0.890	0.992
1 mile	0.635	0.985	0.269	0.864	0.143	0.667	0.731	0.962	0.015	0.924
1.5 miles	0.084	0.954	0.001	0.451	0.000	0.109	0.177	0.842	0.000	0.669
2 miles	0.001	0.881	0.000	0.000	0.000	0.002	0.007	0.591	0.000	0.288

Table 3.2: Cobb County Trip Lengths and Probabilities for Modes and Purposes

Ranges and Counts of Map Tiers for Bicycling and Walking Latent Demand				
	Bicycling		Walking	
Map Tier	LDS Range	Segment Count	LDS Range	Segment Count
1	57-100	158	45-100	159
2	43-56	156	32-44	166
3	30-55	163	23-31	158
4	20-29	174	14-22	158
5	1-19	122	1-13	134

Table 3.3: Cobb County Ranges and Counts of Map Tiers for Bicycling and Walking Latent Demand

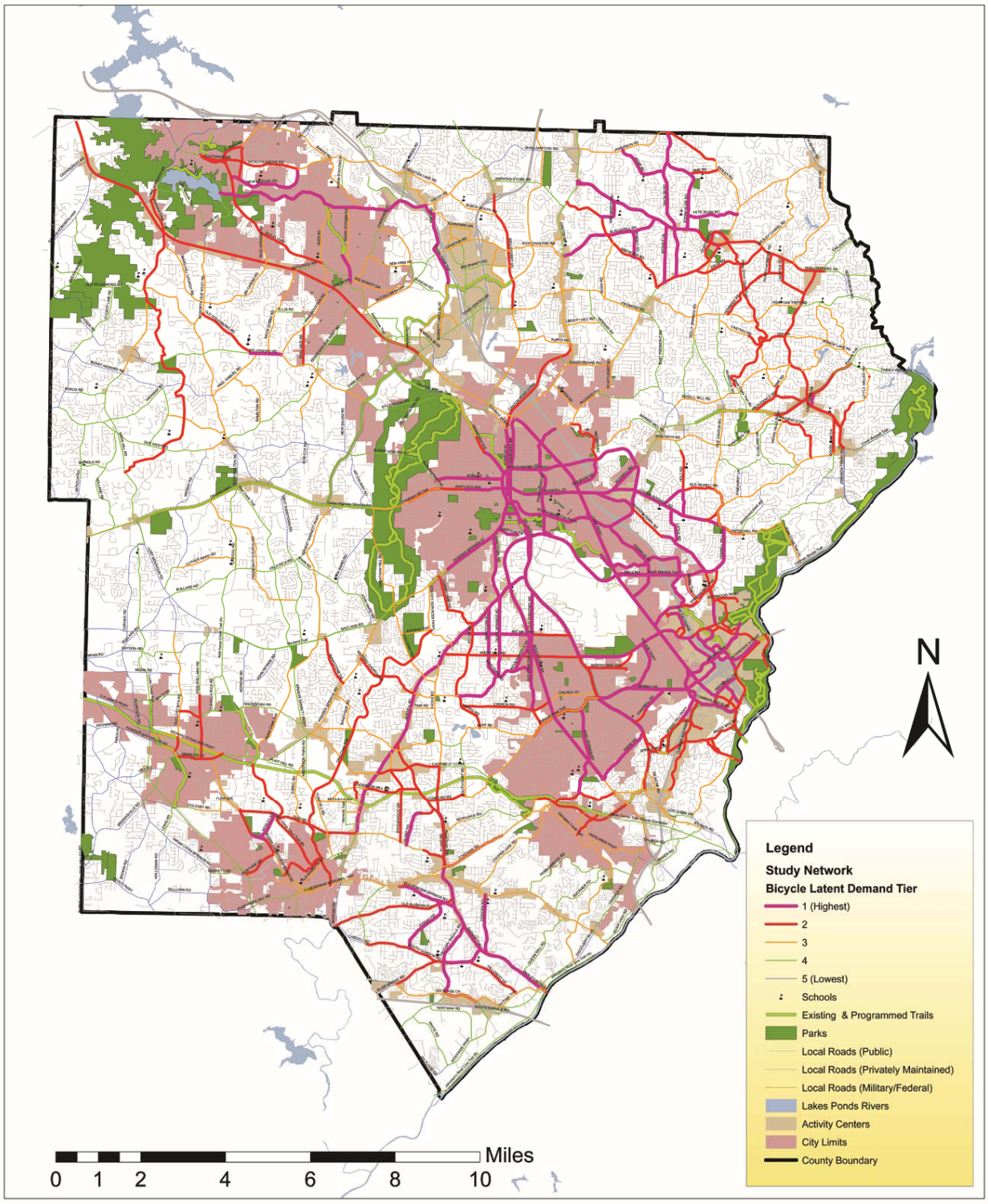


Figure 3.21: Cobb County Bicycle Latent Demand Results Map

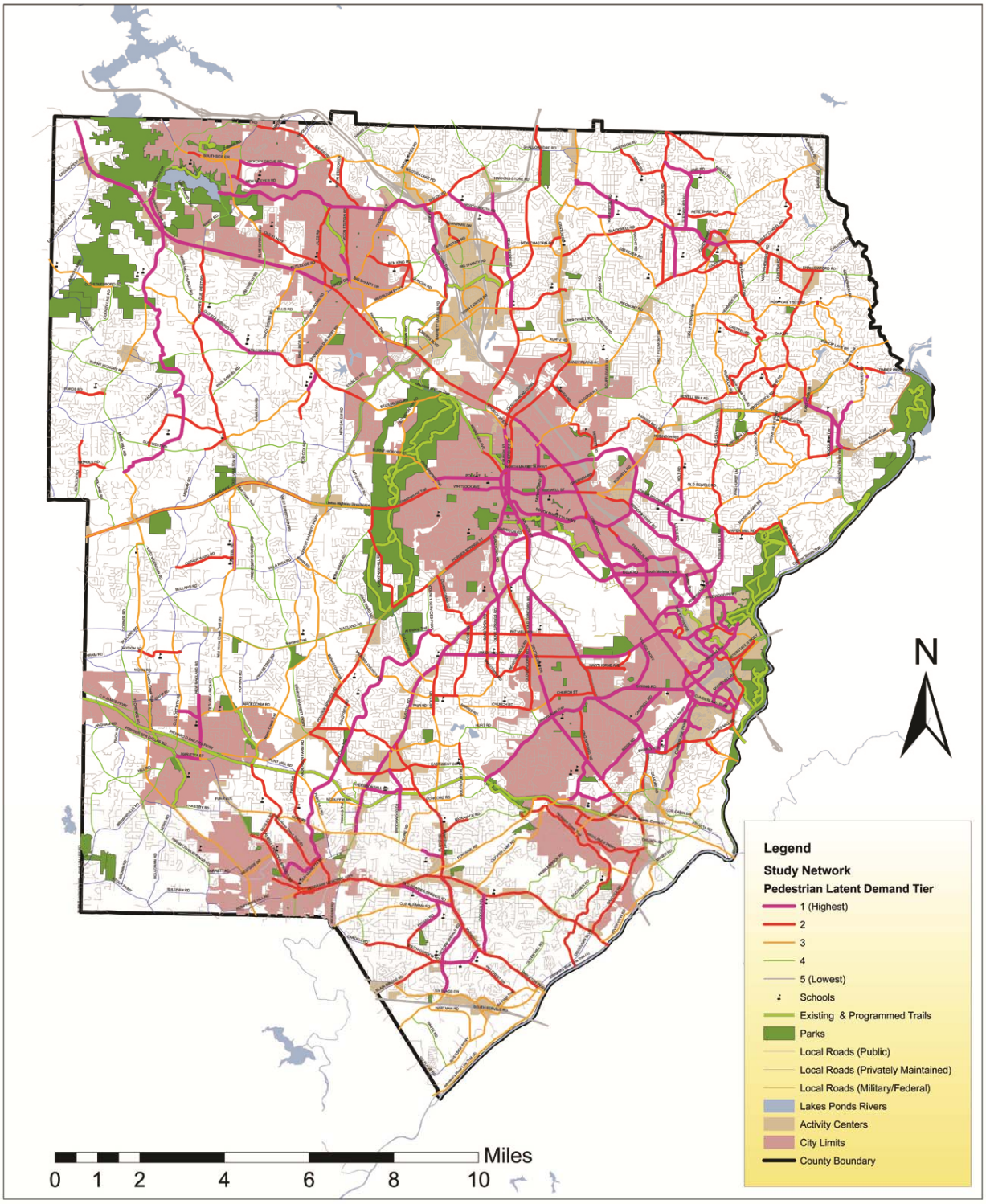


Figure 3.22: Cobb County Pedestrian Latent Demand Results Map

Chapter 4:

Infrastructure Needs

Introduction

The previous chapter described various ways in which the existing conditions for bicycling and walking have been analyzed, by reviewing the documents and ordinances that pertain to bicycling and walking, by describing the level of accommodation provided on the County's roadways—as measured with the Bicycle level of Service and Pedestrian Level of Service models—and by examining the potential market for bicycling and walking with the Latent Demand Method. This chapter progresses from that description of the current situation to identifying specific needs for improvement to the bicycling and walking infrastructure in the county. This section explains the process by which needs for individual corridors were identified and the process of recommending infrastructure improvements to meet those needs.

4.1 FOCUSING THE NETWORK

The first step towards identifying needs was to focus on a study network that would be the primary focus of the County's efforts to improve bicycling and walking conditions. The network of roadways that were studied for the existing conditions report consisted of all roadways designated as major thoroughfares (arterials, major collectors, and minor collectors) as of October 2008. These roadways totaled approximately 790 miles in length. In addition, approximately 160 miles of proposed trails were included in the Latent Demand Analysis, bringing the total network to approximately 950 miles. Based on collaboration among the Project Management Team, the Key Stakeholder Group and the consultant team, a process was developed by which the a more focused study network was designated. The County's 1993 *Bicycle/Transportation Plan* identified a network of roadways and proposed trails that could serve as a core network for bicycling in the County (see Figure 4.1). This network was augmented by those roads and proposed trails that showed the highest potential for bicycling and walking according to the Latent Demand analysis (the highest scoring 20% of miles for each mode, see Figure 4.2), and by those roadways and proposed trails which received two or more votes from the public in via one of the methods of input used in the plan process (see Figure 4.3, and see Appendix D for details on the public involvement methods). These three selections were combined and the resulting network was reviewed by County Staff, who then augmented this network with a few more roadways selected to provide connectivity to any portions of the County that were not covered by the selection criteria. The resulting study network (Figure 4.4) includes approximately 656 miles of roadway and approximately 110 miles of trails, for a total of just over 675 miles.

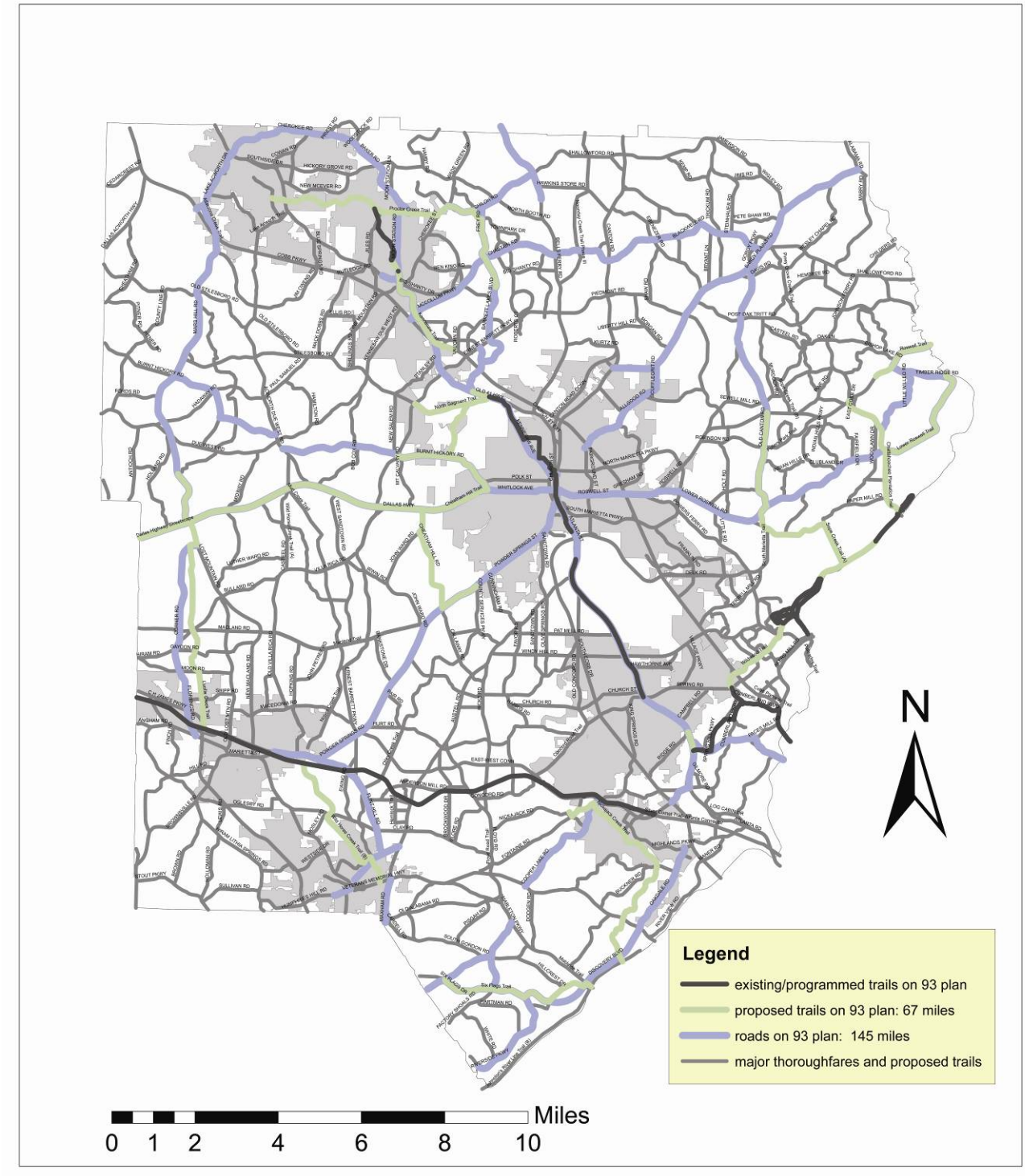


Figure 4.1: Roads and Trails outlined as the core bicycling network in 1993

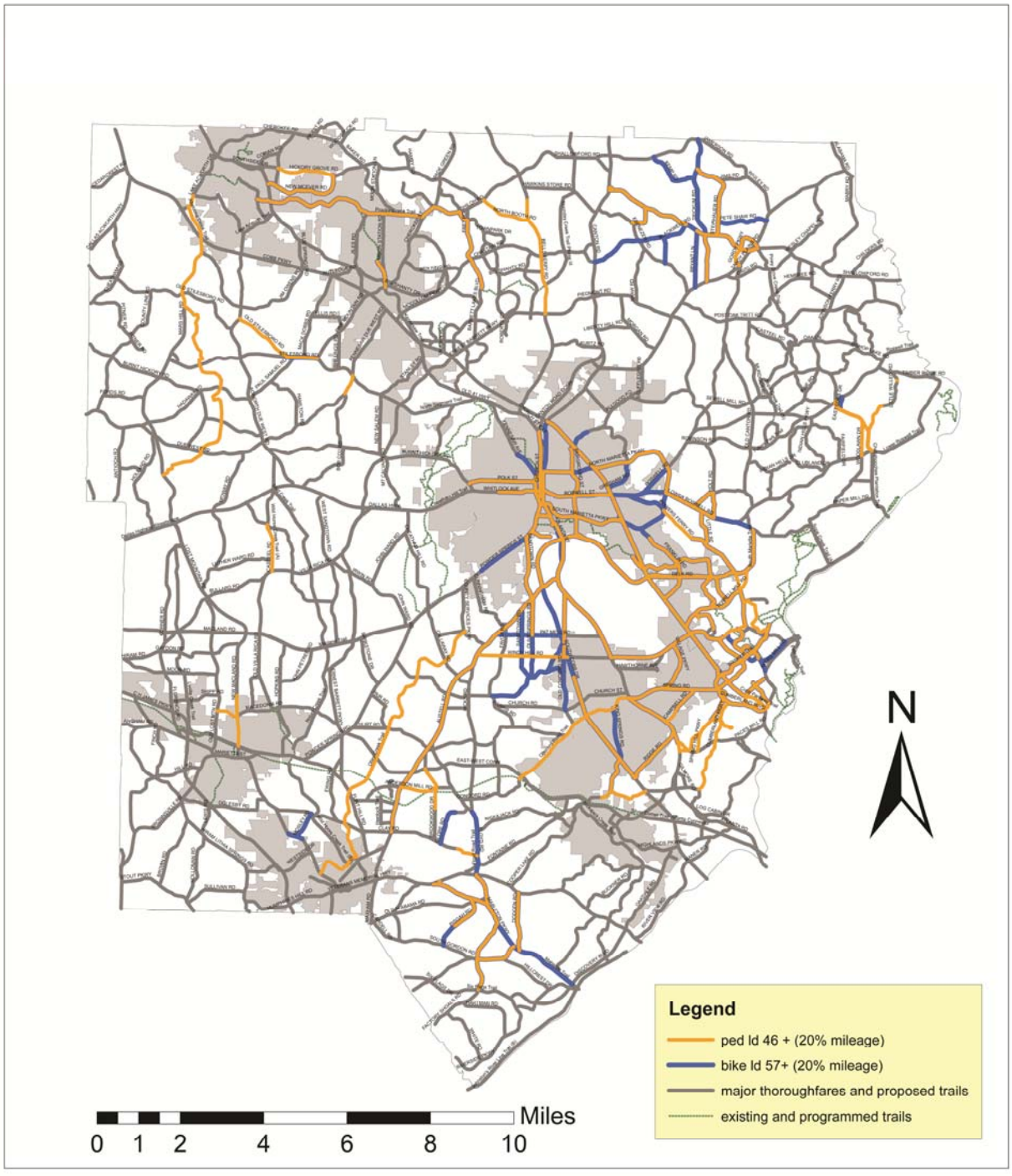


Figure 4.2: Roads and trails in the highest scoring 20% of mileage for bicycle and pedestrian modes

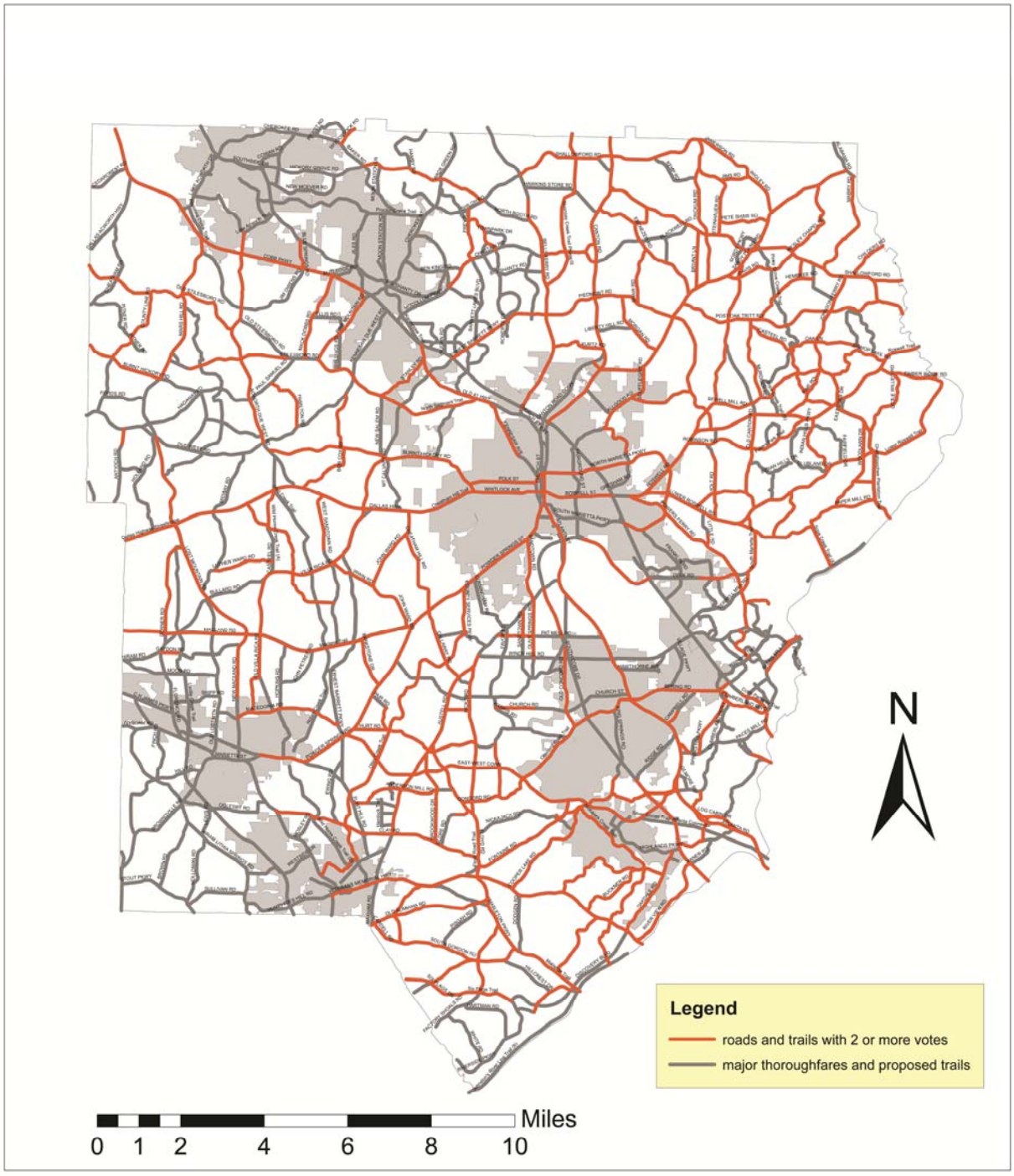


Figure 4.3: Roads and trails receiving more than two votes from the public

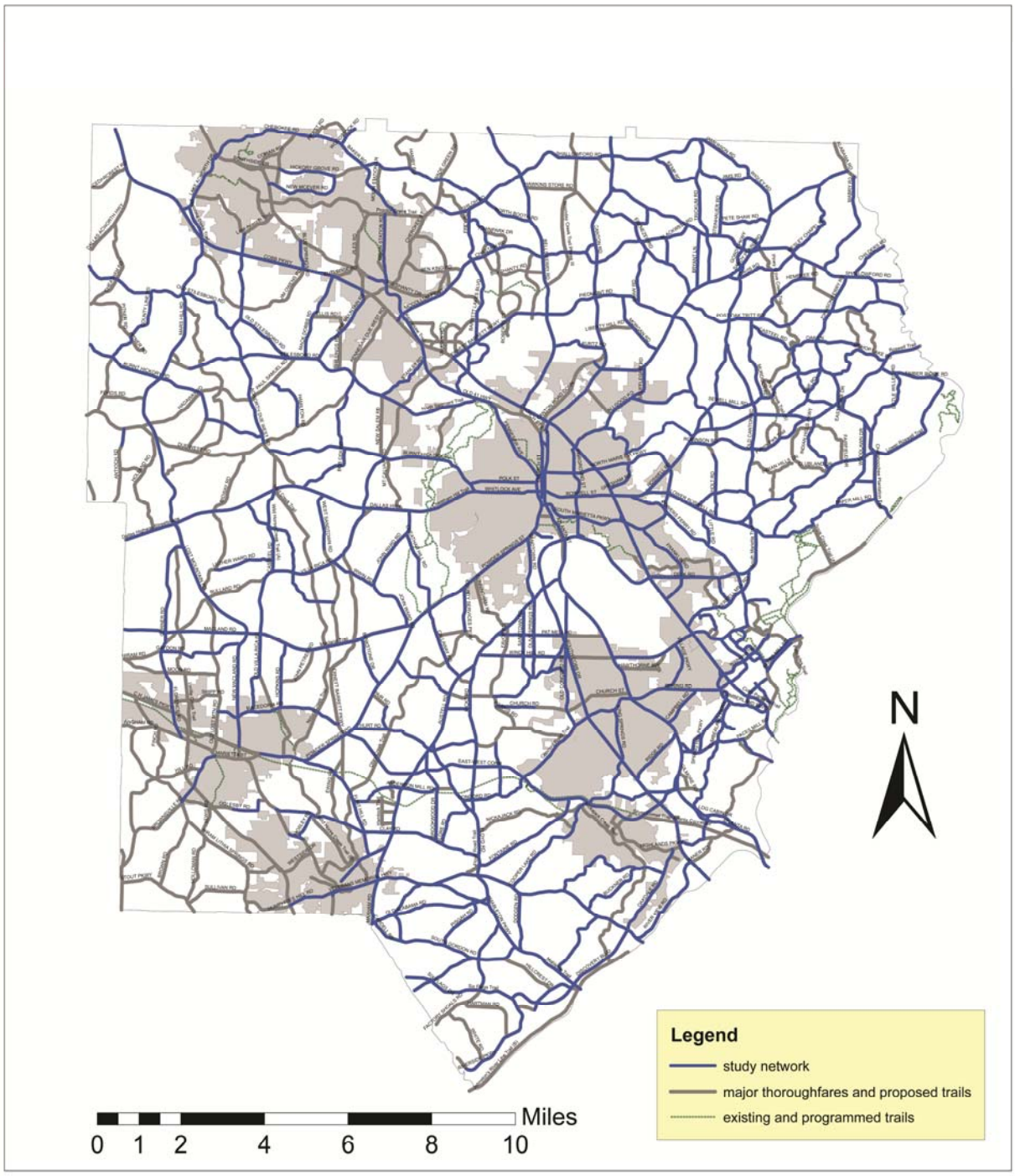


Figure 4.4: Project study network

4.2 EXPECTED PERFORMANCE THRESHOLDS AND NEEDS

Based on input from the public at the Community Open House Workshops held in January 2009 and the guidance of the Key Stakeholder Committee, it was decided that Bicycle Level of Service "C" and Pedestrian Level of Service "C" would be adopted as thresholds representing acceptable levels of accommodation on the roadways of the Study Network. It was also decided that Bicycle Level of Service "D" and Pedestrian Level of Service "D" would be adopted as thresholds representing actable levels of accommodation on the remaining Major Thoroughfares of the County. With these expected performance thresholds established, a need for improvement can be identified on any roadway segment that fails to meet the appropriate threshold for accommodating either bicycling or walking. For the Study Network roadways, just over 80 miles of roadway are already performing at Bicycle Level of Service "C" or better, leaving approximately 485 miles of roadway with need for improvement. Similarly, approximately 75 miles of study network roadway are operating at Pedestrian Level of Service "C" or better, leaving just over 490 miles of roadway in need of improvement. For the other major thoroughfares, there are currently just over 170 miles of roadway performing at Bicycle Level of Service "D" or better, leaving approximately 50 miles of roadway with need for improved bicycling conditions, while nearly 150 miles of roadway are achieving Pedestrian Level of Service "D" or better, and so just over 70 miles of roadway need improved pedestrian conditions. For an illustrative view of the distribution of needed improvements, see Figure 4.5.

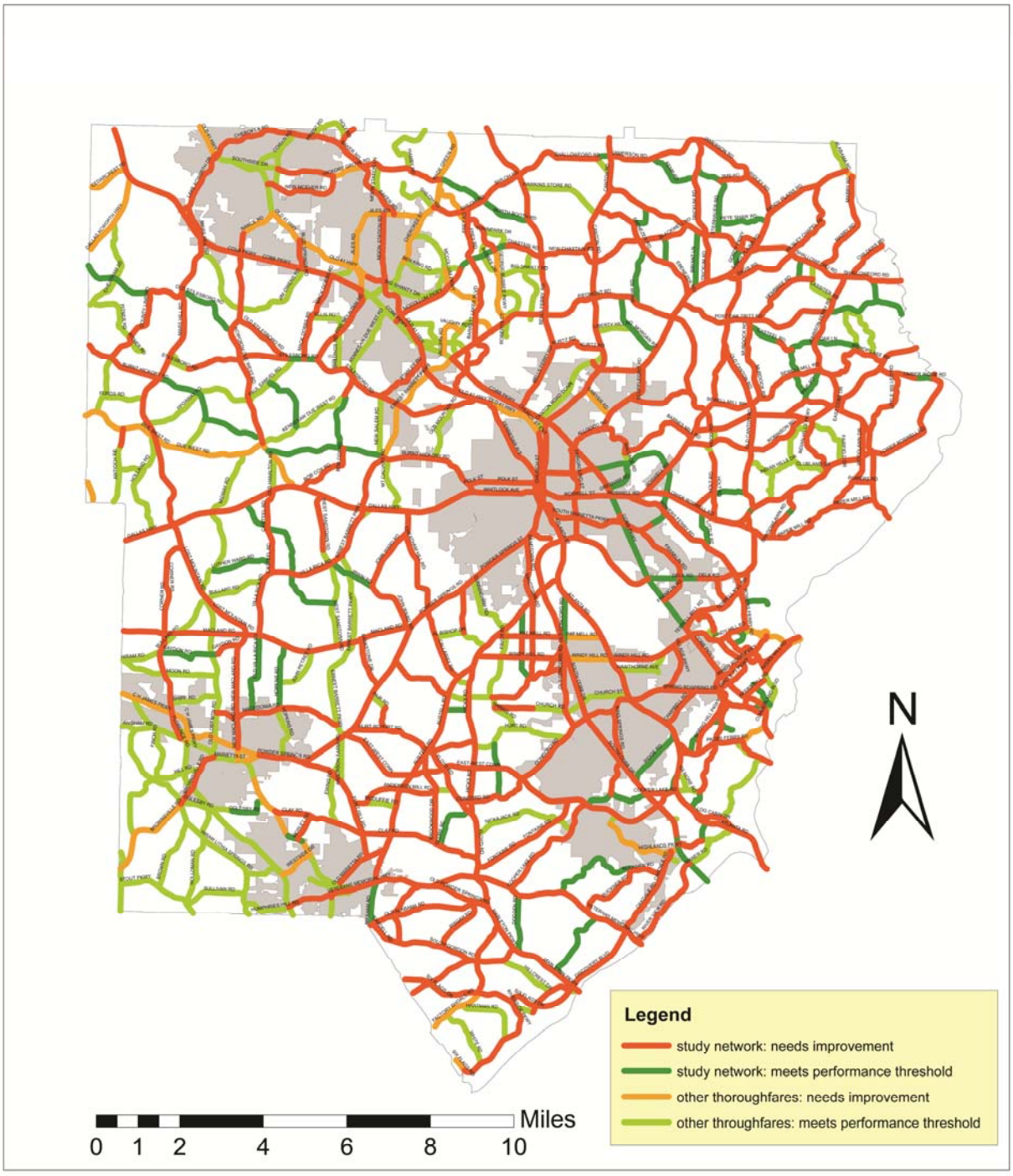


Figure 4. 5: Needs on Study Network and Other Major Thoroughfares

4.3 FACILITY RECOMMENDATION IN RESPONSE TO NEEDS

After establishing which segments have need for improvement, the consultant team identified facility types that could bring the facility's performance to the desired threshold. There are three general facility types recommended for improving bicycling conditions and two general facility improvement types for improving walking conditions. More specific applications of each general type are indicated in the implementation tables in Chapter 5, based on the characteristics of each individual corridor. The general types for improving bicycling conditions are re-striping for bike lanes, constructing paved shoulders, and detailed corridor studies.

These improvement strategies were considered in ascending order of cost per mile. The least expensive facility improvement is re-striping the existing roadway surface with bike lanes or shoulders. This approach requires no new construction, only the placement of the appropriate pavement markings and spot maintenance or repair of the roadway surface as needed. While these costs are relatively small, they can effectively be reduced to zero if such projects are coordinated with the county's regular schedule of roadway resurfacing; then the facility change is a design modification of a project for which the county has already allocated a budget. The next type considered was addition of a paved shoulder,(or the widening of an existing one) which typically includes some substantial construction cost, due to the installation of "new" asphalt and some minor regrading. Finally, the option presumed to be most expensive is identified as "detailed corridor study needed", these are segments for which the previously mentioned strategies are not likely feasible, and will require more detailed individual study to determine an effective strategy for accommodating bicyclists. Further study may reveal a range of solutions, up to the development of a trail facility (which is the basis for the higher presumed cost).

Pedestrian needs can be met either by the addition of sidewalk or by better buffering along an existing sidewalk if full coverage is already present.

4.3.1 BICYCLE FACILITY RECOMMENDATIONS

Re-striping for bike lanes was recommended for roadways where the width of the existing pavement is sufficient for the inclusion of four-to-six foot wide bike lanes alongside 11 foot (or wider) through travel lanes. Four feet is the minimum width recommended for a designated bike lane on open shouldered roadways. The Cobb County Department of Transportation employs a minimum 11-foot lane width. Widths of turn lanes were not considered or modified in the consideration of bike lane candidates.

Once candidate roadways were identified from among the roadways with need for improvement, the Bicycle Level of Service Score was re-calculated based on the proposed lane widths. The study network roadways which can achieve Bicycle Level of Service "C" are identified in the implementation tables, along with the recommended width of the bike and travel lanes that will bring the roadway to the desired performance threshold. Roadways which have sufficient pavement width for bike lanes but which would still not perform at Bicycle Level of Service "C" are also identified, as "interim re-stripe" candidates; these roadways will still need further study to determine the solution that will bring their performance to the desired threshold and the implementation database indicates recommended second steps for them. Segments of the remaining major thoroughfares which have sufficient existing pavement width for a four foot bike lane next to 11-foot travel lanes are also identified, and a minimum facility width is recommended for them.

Building or widening paved shoulders was recommended for roadways which have a predominantly open-shouldered cross section. As was the case with the re-striping candidates, segments were recommended for shoulders between four and six feet wide next to travel lanes of no less than 11 feet. The implementation tables differentiate further between paved shoulder candidates based upon the current profile of the roadside and the amount of grading that will be required to construct a paved shoulder.

Segments which are predominantly lined with curb and gutter do not allow for construction of paved shoulders, and so have been indicated with a label of **Detailed Corridor Study Needed.** Bike lanes or additional shoulder space are not feasible for these segments and a more substantial facility improvement may be required. Quite often, it will be necessary to construct a shared use pathway along the roadway (also known as a "sidepath"). It may be possible on some corridors to divert users to a parallel roadway that serves the same destination, to add shoulders along any undeveloped portions found within the larger segment, or some other approach to accommodate users; only a more detailed study of each corridor will provide the ultimate solution to sufficiently accommodate bicycle traffic. The implementation tables in Chapter 5 use costs based on the assumption that a construction of a sidepath is necessary, and differentiates between segments based on the current profile of the roadside and the amount of grading that will be required to construct a sidepath.

4.3.2 PEDESTRIAN FACILITY RECOMMENDATIONS

For improving pedestrian facilities, the approaches to improvement include either adding sidewalks or buffering improvements. Segments of the Study Network which already have full sidewalk coverage, but which are still

not meeting the desired performance threshold of Pedestrian Level of Service “C”, will require a detailed study to investigate possibilities for **improved buffering** of the existing sidewalks from the roadway. Those roadways which do not have full sidewalk coverage are recommended for **adding sidewalks to** provide full connectivity for pedestrians.

Chapter 5: Implementation Opportunities

Introduction

This *Cobb County Bicycle and Pedestrian Improvement Plan* has a stated goal of improving the performance of Cobb County's networks of bicycle and pedestrian facilities. Chapter 3 explained how such performance can be measured and describes the existing performance of the County's Major Thoroughfares according to the adopted metrics: Bicycle Level of Service and Pedestrian Level of Service. Chapter 4 described needs that can be identified with regard to community expectations of system performance and how facility improvement types that should help meet those needs have been identified for the roadways of the Study Network and other Major Thoroughfares. This section will briefly discuss approaches to implementing facility improvements to help the County meet its goal of improving system performance for bicycle and pedestrian travel.

5.1 OPPORTUNITIES THROUGH ROUTINE ACCOMMODATION

The strategies identified in Chapter 4 are based on what would be necessary to retrofit the existing cross section as a stand-alone project intended primarily to improve bicycling or walking conditions. Given a network the size of Cobb County's Major Thoroughfares, however, such improvements would take a very long time—and be very expensive—if independently undertaken. An important element of any implementation plan is to coordinate the meeting of bicycle and pedestrian needs with other projects scheduled by the County, GDOT, one of the municipalities, or private developers. If careful steps are taken to insure the needs of bicyclists and pedestrians are met in all phases of projects, from planning to construction documents, the goals of improving system performance for these modes will be more quickly achieved. Such an approach is known as "Routine Accommodation" and is in keeping with the Complete Streets Policy adopted by the Board of County Commissioners in January of 2009 which states:

> Cobb County will implement the Complete Streets Concept by considering safe access for all users, to include motorists, bicyclists, pedestrians and transit users, including individuals with physical disabilities and senior citizens, in the planning, design, construction and operations of streets within its jurisdiction.

Project types which can present opportunities for improving bicycle and

pedestrian conditions are listed in the following pages.

5.1.1 RESURFACING

The retrofitting project lists in this chapter identify roadways where bike lanes or shoulders will fit in combination with the existing through lanes being reduced to a minimum of 11 feet. Those roadways have been identified under the assumption that other elements of the cross section—such as the number of through lanes and the presence of turn lanes—will not change. Every resurfacing project should include a careful review of all lane assignments and assess their necessity and dimensions with respect to capacity and turning movements of the particular segment. Any unnecessary lanes or excessively wide lanes could yield space in the cross section which could be used by bicyclists or, in the case of a shoulder along a rural roadway without sidewalks, pedestrians. Resurfacing practices have other positive impacts for bicyclists as well. The surface condition of a roadway is a contributing data point to the Bicycle Level of Service Model and improving pavement condition can improve the performance of the roadway for bicycles. For example, a two lane, undivided, 24-foot wide roadway that carries 4,000 vehicles a day at 35 miles per hour receives a Bicycle Level of Service score of 3.97 if its pavement is rated a “3” on the FHWA five-point scale, which is classified as a grade of “D”. That same roadway, however, receives a Bicycle Level of Service Score of 3.49, classified as a grade of “C”, if it is resurfaced and its new pavement is rated as a “5” on the FHWA scale. Finally, resurfacing practices can also benefit bicyclists if they include the milling of existing pavement so that the new surface is flush with the gutter pan at the edge of the roadway. Such careful practices can allow for narrower bike lanes adjacent to wider gutter pans provided that the distance to the curb is at least 5 feet and the rideable surface is at least 3 feet as specified in the Design Guidelines (Chapter 6).

5.1.2 RECONSTRUCTION PROJECTS

When the County is undertaking a project to totally reconstruct a roadway, careful consideration of the needs of bicyclists and pedestrians should be taken into account at all phases of the project. The projects identified in the retrofit lists in this chapter are all constrained by the assumption that existing curb lines are not likely to be moved for the sake of improving bicycling conditions alone. Many roadways have been recommended for detailed corridor studies and/or sidepaths based on the constraint of the existing roadway width. If the roadway is being reconstructed, however, opportunities for better accommodating bicyclists are no longer constrained and only minimally contribute to the cost of such projects. The Design Guidelines (Chapter 6) should be consulted on such projects and the consideration of multiple user types should be considered. If right-of-way allows, sidepaths may still meet the needs of

many users, provided that they are well-designed. It should be remembered that many users do prefer riding in the roadway over riding on trails. Reconstruction plans should carefully consider the option of including both bike lanes and sidepaths if right-of-way allows.

5.1.3 Rezoning, Redevelopment, and New Developments

Frequently, a change in zoning or the development of a parcel or parcels offers opportunities to improve bicycling and walking conditions. This can take the form of adding a new facility or amenity, or it may mean improving an existing facility to achieve a higher level of service. Any rezoning or redevelopment that occurs should include a condition requiring the construction of a segment of sidewalk or bicycle facility if one does not already exist. This is one way agencies can work to complete sections of sidewalk that they might otherwise be required to prioritize and fund.

Simply having such a requirement as a condition may yield the result Cobb County is seeking, but even if not a condition of approval, developers can be incentivized to incorporate facilities that actually help Cobb County meet or even exceed its goals for pedestrian and bicycle accommodation. The upgrade of an existing facility should be encouraged. Examples of incentives include a reduction in open space requirements, reduced fees or the expedited approval of development plans.

Non-facility amenities such as showers and secure bicycle parking should also be encouraged in redevelopment, rezoning and new development plans. The inclusion of these items, while less common, may be encouraged by offering any number of incentives such as a reduction in the number of parking spaces, the allowance for more compact spaces, or an expedited approval process. Please see Chapter 2, section 2.2 for additional policy suggestions.

5.1.4 New Roadway Construction

When the County is planning new roadways, bicycle and pedestrian accommodation should be considered in accordance with the Complete Streets Policy and this project's Design Guidelines. The appropriate facilities can be identified with the same methods used for existing roadways in this study, using the assumed or design values for the various data inputs to the Bicycle and Pedestrian Level of Service Models.

Each one of these Routine Accommodation strategies, if followed, will make significant contributions towards the goal of improving the performance of Cobb County's Major Thoroughfares with respect to the needs of bicyclists and pedestrians.

5.2 OPPORTUNITIES FOR IMPLEMENTATION THROUGH RETROFITS

Facility improvement recommendations for all major roadways which are not currently meeting the appropriate performance criteria are described in Chapter 4. Any one of these roadways could coincide with one of the "routine accommodation" practices described in section 5.1 above. There are several options available to the county for scheduling the implementation of standalone projects as funding and budgets allow. The County can consider identified project types individually, compare them for the benefit they provide, or prioritize them according to the benefit they return relative to their implementation costs. The various retrofit strategies are discussed in the following sections.

5.2.1 Sidewalk Construction

The vast majority of roadways in the study network have some need for sidewalk construction. Over 400 miles of roadway are indicated as not meeting the performance standard and not having full sidewalk coverage. When reviewing these potential projects for implementation, it will be important to also consider the recommended bicycle facility for a given segment. If a roadway is identified as likely needing a sidepath trail to accommodate bicyclists, then the trail will serve the function of a sidewalk on one side of the road. Such segments have been identified in the facility recommendation maps and the databases found in Appendix F. County planners should consider the timeframe for implementation of the trail project when planning and designing the sidewalk project to determine if a sidewalk is needed on both sides and also which side is best suited for the trail facility. Roadways needing a sidewalk on both sides are also identified on the Facility Recommendation Map and in the databases included in Appendix F.

5.2.2 Re-striping

Approximately 39 miles of roadway are identified as having potential for the inclusion of bike lanes with the re-positioning of lane stripes within the existing cross section. These fall into three different categories. The first are Study Network roadways which could achieve the desired performance standard (Bicycle Level of Service "C") if their surface were re-allocated to include a bike lane at least 4 feet wide and travel lanes no less than 11 feet wide. There are 10 such segments, which add up to just over 20 miles of roadway. These recommended re-stripings were calculated to reach the performance threshold, and so have different specified lane widths depending upon other characteristics

Segment ID	Roadway	Beginning Intersection	Ending Intersection	Length (mi)	Recommended Bike Lane Width	Recommended Outside Lane Width
96.0	Cobb Pkwy	Pine Mtn	Bartow Co	7.6	6.0	11.4
96.1	Cobb Pkwy	Roswell St	Canton Rd	2.4	5.0	11.3
120.0	Dallas Hwy	John Ward Rd	Garrison Commons	1.7	6.0	11.2
165.0	Frey Rd	Campus Loop	Chastain Rd	0.3	4.0	11.0
220.0	Interstate N Pkwy	Powers Ferry Rd	Fulton Co	0.3	5.0	11.1
266.0	Macland Rd	John Ward	Villa Rica	3.7	6.0	11.1
285.0.	Macland Rd	Villa Rica	Lost Mountain	0.3	6.0	11.1
367.0	Moon Station Rd	Old 41 Hwy	Jiles Rd	1.7	4.0	11.3
433.0	Polk St	Burnt Hickory Rd	North Marietta Pkwy	1.6	4.0	11.0
433.5	South Marietta Pkwy	Cobb Parkway	I-75	0.7	6.0	11.0

Table 5.1: Bike lane projects that will assist in achieving the performance standard (study networks segments)

of each segment. These segments are shown in Table 5.1 and are illustrated in Figure 5.1. Full details on the segments can be found in Appendix F.

The second category consists of roadways that would not meet the performance threshold with installation of a bike lane, but nonetheless have room for such a facility in their existing cross section. These roadways are recommended for “interim re-striping,” which will provide a basic, inexpensive facility until such time as a more accommodating facility can be developed for the segment (the database in Appendix F contains second-step facility recommendations for these segments). There are 9 of these segments which total approximately 17 miles. These segments are shown in Table 5.2 and illustrated in Figure 5.1.

Segment ID	Roadway	Beginning Intersection	Ending Intersection	Length (mi)	Recommended Bike Lane Width	Recommended Outside Lane Width
80.0	Cherokee St	North Park Square Rd	North Marietta Pkwy	0.4	4.6	11.0
80.1	Cherokee St	North Marietta Pkwy	Chicopee	0.5	5.3	11.0
95.0	Cobb Pkwy	Paces Mill	Fulton Co	0.3	4.5	11.0
96.2	Cobb Pkwy	Canton Rd	Barrett Pkwy	2.8	6.0	11.9
120.1	Dallas Hwy	Garrison Commons	Paulding Co	5.8	6.0	11.4
399.0	Roswell Rd	Timber Ridge	Fulton Co Line	1.1	4.0	11.0
399.4	Roswell Rd	Old Canton	E. Piedmont Rd	1.1	4.4	11.0
445.1	Stilesboro Rd	Rose Hedge Way	Old Stilesboro	2.4	4.1	11.0
445.3	Stilesboro Rd	Pine Mountain	Barrett Pkwy	2.4	4.5	11.1

Table 5.2: Interim bike lane projects

The final type of bike lane projects are found on non-study network roadways ("Other Major Thoroughfares"). These are not intended to meet a particular performance threshold, but were found to have room for a bike lane within the existing cross section.

There are two such segments, both along Barrett Parkway, totaling about two miles. These are shown in Table 5.3 and illustrated in Figure 5.1.

Segment ID	Roadway	Beginning Intersection	Ending Intersection	Length (mi)	Recommended Bike Lane Width	Recommended Outside Lane Width
145.0	Ernest Barrett Pkwy	North Cobb Pkwy	Old 41 Hwy	0.7	4.0	11.7
146.0	Ernest Barrett Pkwy	Old 41 Hwy	Stilesboro Rd	1.0	4.0	11.7

Table 5.3: Interim bike lane projects (Other Major Thoroughfares)

Bicycle & Pedestrian Improvement Plan: Potential Bike Lanes

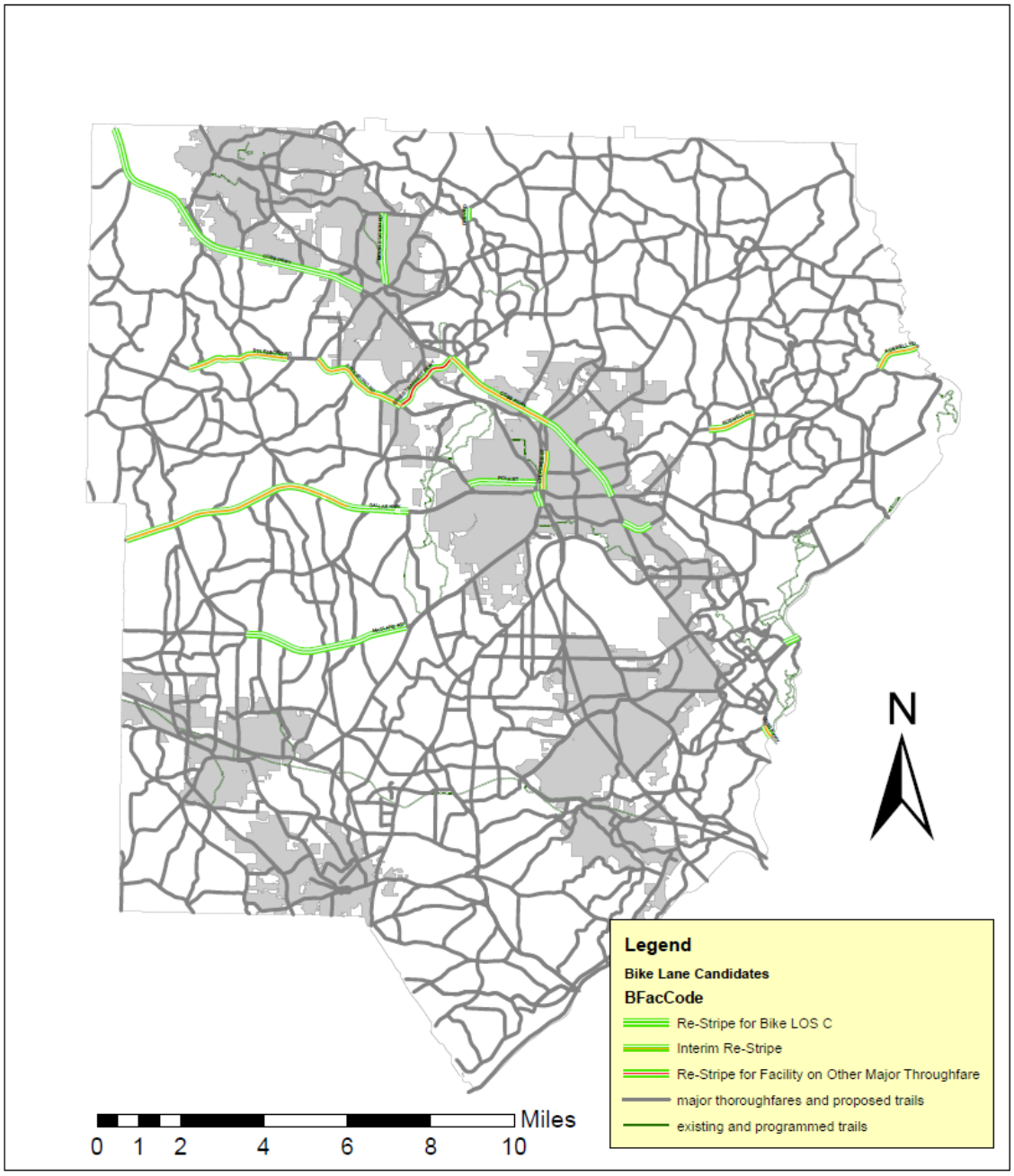


Figure 5.1: Map of Potential Bicycle Lane Candidates

5.2.3 SHOULDER WIDENING

Some roadways could be improved by the addition of pavement to accommodate a designated bike lane or shoulder. These roadways are currently too narrow for such a facility, but have open-shouldered cross sections that could be widened without too much difficulty. As was the case with bike lane re-stripe projects, these roadways were examined for the potential of a cross section that included a shoulder between 4 and 6 feet wide and travel lanes a minimum of 11 feet wide, if such a cross section would allow the roadway to meet the performance standard. Projects were differentiated between those which will likely be easily constructed due to a reasonably flat and graded roadside profile (Roadside Condition 1 as described in the methodology description in Appendix A) and those which will likely require some regrading work and possible drainage engineering due to the presence of swales and ditches in close proximity to the existing roadside (Roadside Condition 2 in the methodology description). The 12 segments (equaling about 17 miles) which can have shoulders added with minimal grading are shown in Table 5.4, while the 33 segments (equaling about 39 miles) which will require more substantial re-grading are shown in Table 5.5; both are illustrated in Figure 5.2. Full details for these segments are found in the database included in Appendix F.

Segment ID	Roadway	Beginning Intersection	Ending Intersection	Length (mi)	Recommended Bike Lane Width	Recommended Outside Lane Width
9.0	Allgood Rd	Scufflegrit Rd	Merritt Rd	1.0	16.0	5.0
23.0	Baker Rd	Jiles Rd	Cowan Rd	3.4	15.0	4.0
66.2	Canton Rd	Cobb Prkwy	Cherokee St	0.6	15.0	4.0
137.0	East-West Conn	Fontaine Rd	South Cobb Dr	2.4	16.5	5.5
138.0	East-West Conn	Hicks Rd	Fontaine Rd	2.5	15.5	4.5
162.0	Fontaine Rd	Nickajack	East West Conn	0.6	15.0	4.0
162.1	Roswell Rd	Old Canton	E. Piedmont Rd	1.1	4.4	11.0
179.0	Greers Chapel Rd	North Cobb Pkwy	Barrett Pkwy	0.6	15.0	4.0
224.1	Jamerson Rd	Trickum Rd	Wigley Rd	1.3	15.0	4.0
318.0	Old 41 Hwy	Kennesaw Ave	Barrett Pkwy	1.6	16.0	5.0
417.0	Shallowford Rd	Childers Rd	Fulton Co	1.1	16.5	5.5
424.0	Six Flags Dr	Blair Bridge Rd	Factory Shoals Rd	1.3	15.0	4.0

Table 5.4: Potential shoulder widening projects with minimal regrading

Segment ID	Roadway	Beginning Intersection	Ending Intersection	Length (mi)	Recommended Bike Lane Width	Recommended Outside Lane Width
13.1	Anderson Mill Rd	Mc Duffie	Austell Rd	1.0	15.0	4.0
24.6	Barnes Mill Rd	Soaring Dr	Millview	0.8	15.0	4.0
31.0	Bells Ferry Rd	Piedmont	I-575 SB	2.8	17.0	6.0
33.0	Benson Poole Rd	Smyrna Powder Springs Rd	South Cobb Dr	0.8	16.0	5.0
43.0	Blue Springs Rd	North Cobb Pkwy	Old 41 Hwy	0.7	15.0	4.0
44.1	Bob Cox Rd	Ivy Manor	Burnt Hickory	0.9	15.0	4.0
62.0	Callaway Rd	Austell Rd	Al Bishop	1.1	15.5	4.5
84.1	Church Rd	Harris Rd	Foxwood	0.9	15.0	4.0
139.0	East-West Conn	Powder Springs Rd	Austell Rd	2.0	17.0	6.0
162.0	Fontaine Rd	Nickajack	East West Conn	0.6	15.0	4.0
162.1	Roswell Rd	Old Canton	E. Piedmont Rd	1.1	4.4	11.0
171.2	Gaydon Rd	Brand	New Macland Rd	0.6	15.0	4.0
228.0	Jims Rd	Steinhauer Rd	Wigley Rd	0.7	15.0	4.0
262.1	Mableton Pkwy	Factory Shoals Rd	Fulton Co	2.6	16.5	5.0
264.1	Macedonia Rd	New Macland Rd	Old Lost Mountain Rd	0.5	15.0	4.0
266.3	Macland Rd	Barrett Pkwy	John Ward	0.1	17.9	4.0
296.0	New McEver Rd	Old 41 Hwy	Hickory Grove Rd	2.0	15.0	4.0
316.0	Old 41 Hwy	Barrett Pkwy	North Cobb Pkwy	0.7	16.5	5.5
320.0	Old 41 Hwy	North Cobb Pkwy	Mccollum Pkwy	0.9	16.0	5.0
325.0	Old Concord Rd	Concord Rd	Church Rd	0.4	15.0	4.0

Table 5.5: Potential shoulder widening projects with moderate regrading

Segment ID	Roadway	Beginning Intersection	Ending Intersection	Length (mi)	Recommended Bike Lane Width	Recommended Outside Lane Width
343.0	Olive Springs Rd	Pat Mell	Austell Rd	0.9	16.5	5.5
343.2	Olive Springs Rd	Windy Hill	Smyrna Powder Springs Rd	0.5	15.0	4.0
373.0	Powder Springs Rd	Macland Rd	Bellemeade Dr	2.2	16.6	5.5
382.0	Powers Rd	Woodlawn Dr	Johnson Ferry Rd	0.5	15.0	4.0
391.0	River View Rd	Veterans Memorial Hwy	South Cobb Dr	2.5	15.0	4.0
410.0	Scufflegrit Rd	Allgood Rd	Sandy Plains Rd	0.9	16.0	5.0
411.0	Sewell Mill Rd	East Piedmont Rd	Johnson Ferry Rd	3.2	15.0	4.0
426.0	Six Flags Dr	Riverside Pkwy	Six Flags Pkwy	0.7	16.5	5.5
462.1	Villa Rica Rd	Friendship Church	Barrett Pkwy	1.3	16.5	5.5
470.0	Wesley Chapel Rd	Shallowford Rd	Sandy Plains Rd	2.1	15.0	4.0
473.1	West Sandtown Rd	Dallas Hwy	Hoyle Farm	1.4	15.0	4.0
478.3	Whitlock Ave	Windsor	John Ward	0.9	16.5	5.5
489.0	Woodstock Rd	Baker Rd	Cherokee Co	0.5	15.0	4.0

Table 5.5 continued: Potential shoulder widening projects with moderate regrading

Bicycle & Pedestrian Improvement Plan: Potential Widened Shoulders

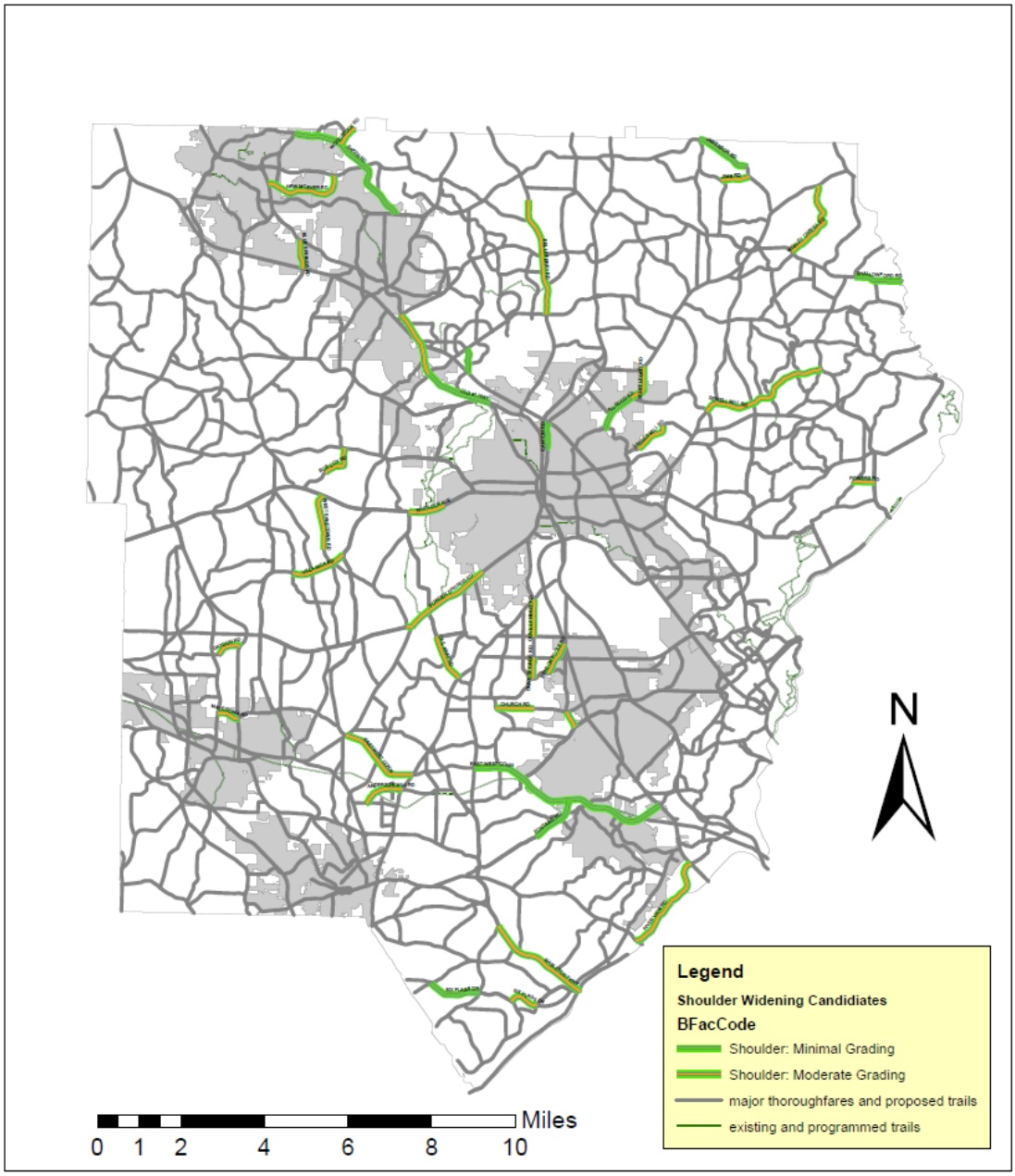


Figure 5.2: Map of Shoulder Widening Candidates

5.2.4. Detailed Corridor Studies

The remainder of the Study Network segments will require more detailed study to determine what sort of facility improvements will be required to improve their performance for bicyclists and pedestrians. Because their current cross sections are too narrow for addition of bike lanes and they are lined with curb-and-gutter (precluding the widening of their shoulders) these roadways may well require construction of a sidepath trail in order to accommodate bicycle traffic. Given that this is the most frequent facility recommendation and the fact that they are the most expensive project type, their implementation is best considered using a comparative analysis of some sort. Two such approaches are discussed in the following section.

5.3 PRIORITY GROUPINGS FOR INDEPENDENTLY FUNDED BICYCLE AND PEDESTRIAN IMPROVEMENTS

In order to choose which projects to develop first, the County can look for ways to compare the relative merits of the projects identified in the database included in Appendix F. These databases provide two separate approaches: considering the relative benefits of the projects, and considering the relative cost-effectiveness of the projects via a neo traditional cost to benefit ratio.

5.3.1 Benefit Scores

There are three classes of benefits that have been quantified in the course of this study: Improvement, Latent Demand, and Public Votes. An improvement score can be calculated as the difference between the Bicycle or Pedestrian Level of Service Score for a given segment, and the score that represents the performance threshold for segment (3.5, or Level of Service “C” for Study Network Roadways, 4.5, or Level of Service “D” for other Major Thoroughfares). This figure is then multiplied by the length of the project (in miles) to allow for comparison between projects of different scales. Latent Demand scores represent potential for biking and walking based on the surrounding land use; the methodology is explained more fully in Chapter 3 and in Appendix A. Public Votes are compiled from input at this plan’s public workshops (including responses submitted in writing or electronically) and historical requests to the Cobb County DOT; additional “Bonus Votes” were applied to segments that have been the subject of previous study by the County or other planning agencies, including the Atlanta Regional Commission. These benefit inputs have been assigned weights based on input from the stakeholder committee and County staff, and can be tabulated into an aggregate benefit score as shown below:

30% (improvement x length)
+ 50% (latent demand)
+ 20%(votes)
100% (total benefit score)

Benefit scores have been calculated for each segment and tables sorted in order of benefit score for both modes are included in Appendix F.

5.3.2 Neo Traditional Benefit/Cost Index:

The segments can also be compared with respect to the benefit they provide in return for the level of investment required to implement them. Such a benefit to cost comparison would help the County select those projects which provide the best "bang for the buck". This can be done by dividing the benefit scores described above by the estimated project cost. Typical project costs (per mile) were developed for the various facility types, which when multiplied by the project length can provide an estimated project cost. The formula for calculating the benefit to cost index is shown below. This number is reported as a "Priority Score" in the tables included in Appendix F, two of which are sorted by this priority score, one for the bicycle mode and one for the pedestrian mode.

A note about the Atlanta Regional Commission's *Bicycle Transportation and Pedestrian Walkways Plan*

In 2007, the Atlanta Regional Commission approved the *Bicycle Transportation and Pedestrian Walkways Plan* which identified a regional-scale network of bicycle facilities connecting major centers across the entire Atlanta Region. This network is comprised mostly of roadways of ARC's Regionally Significant Transportation System (RSTS); the plan included evaluation and facility recommendations for its study network, which included numerous major roadways through Cobb County. While the ARC plan is more concerned with regional mobility than this current Cobb County *Bicycle and Pedestrian Improvement Plan*, there is a certain degree of overlap between the two plans' objectives. In recognition of this common purpose, the corridors that were included in the ARC plan's network are given the same "bonus weighting" (equivalent to 20 votes) as segments that were the subject of more localized planning studies. A map illustrating the ARC's network in Cobb County is shown in Figure 5.3.

$$\text{Benefit/Cost Index} = \frac{30\%\ (\text{improvement} \times \text{length}) + 50\%\ (\text{latent demand}) + 20\%\ (\text{votes})}{(\text{length} \times \text{unit cost})}$$

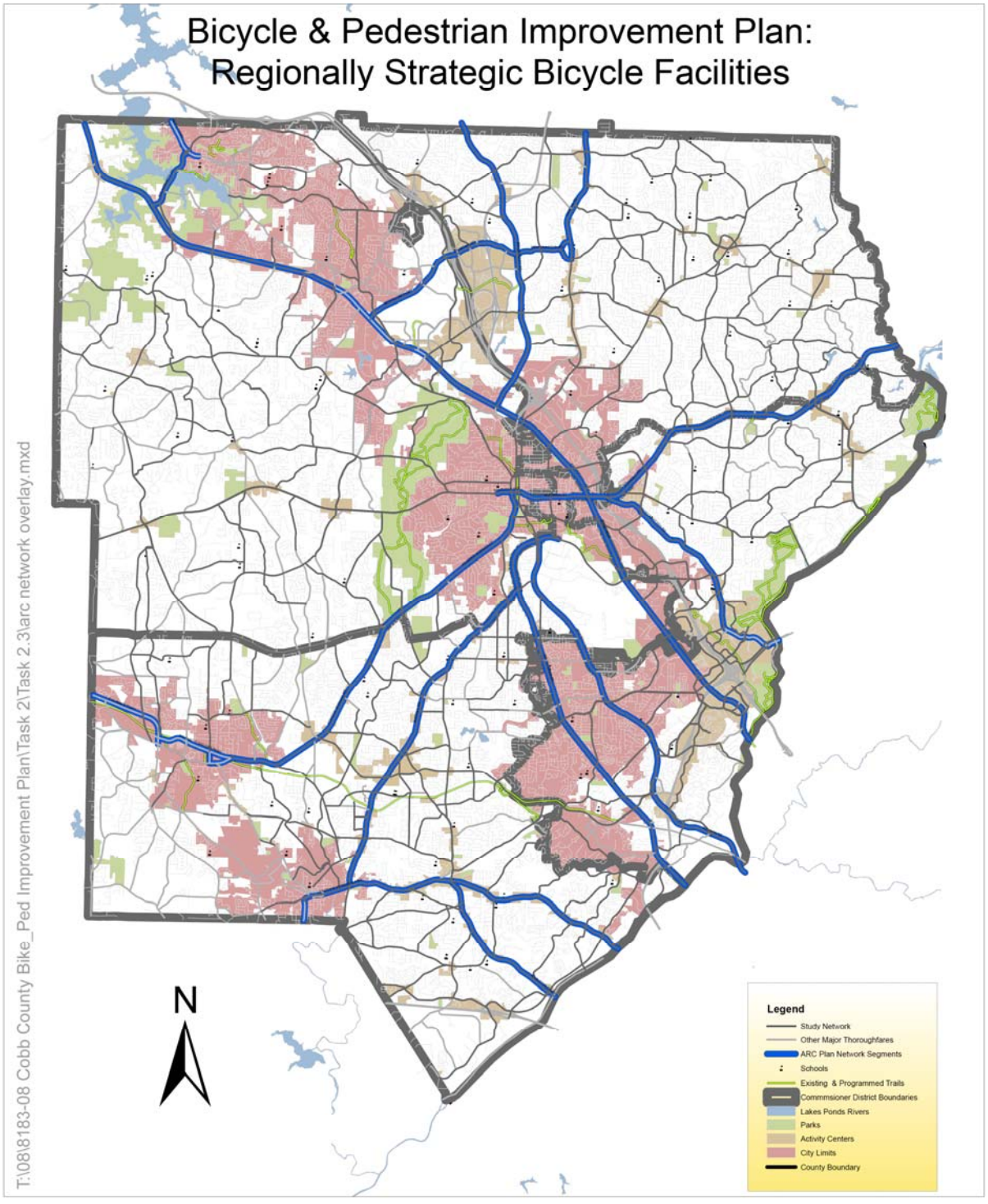
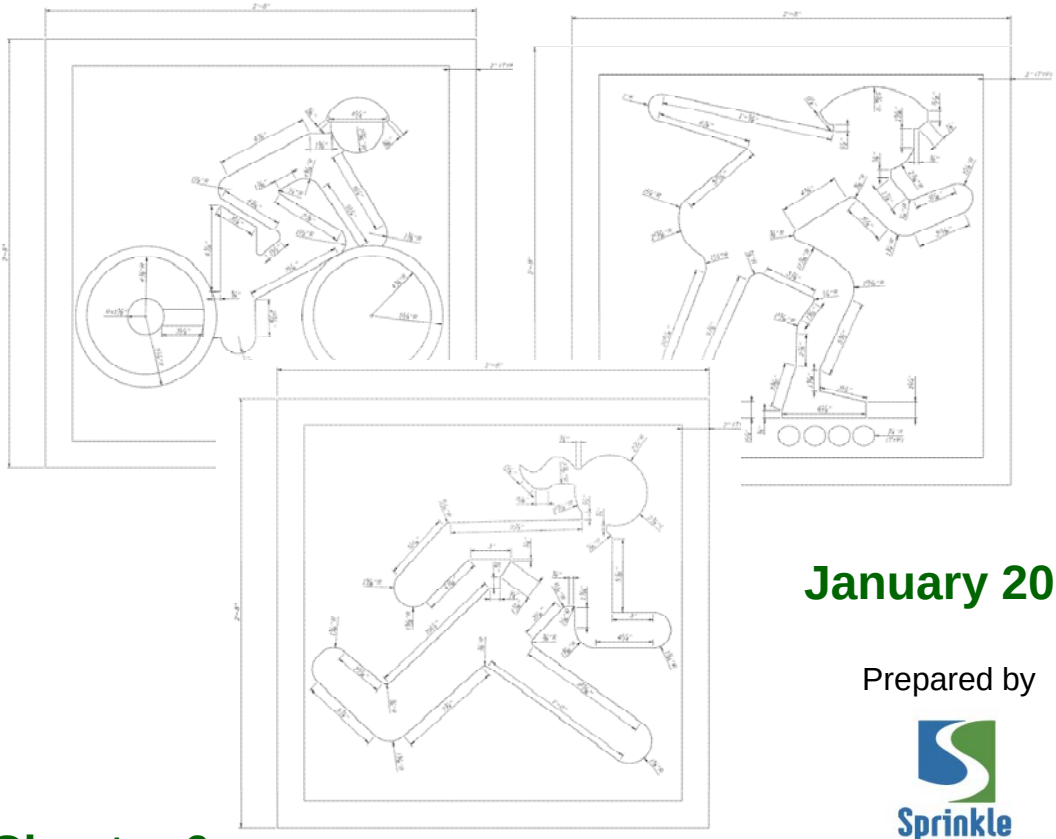


Figure 5.3: Map of Cobb County Portion of ARC Regionally Strategic Bicycle Network

Cobb County Bicycle and Pedestrian Improvement Plan



Chapter 6
Design Guidelines

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RS&H, PEQ, & PEDS

Table of Contents

CHAPTER 6: DESIGN GUIDELINES

Chapter 6:

Design Guidelines

6.1 INTRODUCTION

This document provides guidelines and criteria for the design and operation of bicycle facilities. This document is a ***guidance*** document and does not create standards.

While not intended to create standards, this guidance document does cite national criteria or practices that may be considered standards. Design standards reviewed during this document's development include:

- Cobb County Standard Details, Cobb County DOT
- Cobb County Development Standards, Cobb County DOT
- Georgia DOT Bike/Ped Design Policy
- *2009 Manual on Uniform Traffic Control Devices,* FHWA
- *A Policy on the Geometric Design of Streets and Highways,* AASHTO
- *Guide for the Development of Bicycle Facilities,* AASHTO
- *Guide for the Planning, Design, and Operations of Pedestrian Facilities, AASHTO*

Additional primary materials serving as reference for this document include:

- *Characteristics of Emerging Road and Trail Users and Their Safety,* FHWA
- *Americans with Disabilities Act Architectural Guidelines,* U.S. Access Board

6.2 IN-STREET BIKEWAYS

6.2.1 ROADWAY CROSS SECTION

The *Cobb County Bicycle and Pedestrian Master Plan* includes desirable minimum level accommodations for bicyclists. Achieving this minimum level of accommodation needed on any given roadway may not necessarily require the provision of bicycle lanes or paved shoulders. Several design considerations, including facilities, pavement markings and signage are described below.

Shared Roadways

Bicyclists will, to varying extents, ride on nearly all of the roadways of Cobb County. Generally, roadways do not need any special geometric improvements to accommodate cyclists. However some roadway design components should be given consideration with respect to cyclists. Examples of these include bicycle safe drainage grates and expansion joints on bridges.

Wide curb lanes are a special example of a shared roadway facility. Fourteen feet is the recommended minimum width for a wide curb lane.

(Note: While the AASHTO Bike Guide currently defines a *Shared Roadway* as "A roadway which is open to bicycle and motor vehicle travel."[1] The *Manual on Uniform Traffic Control Devices* (*MUTCD*) defines *Shared Roadway* as "a roadway that is officially designated as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated."[2] In this document, *shared roadways* will be considered as per the AASHTO definition.)

Paved Shoulders

Adding paved shoulders to an existing roadway without curb and gutter, or restriping a roadway to obtain a paved shoulder outside the travel lane can be an effective and relatively inexpensive way to improve a roadway for bicyclists. To accommodate cyclists, paved shoulders should be at least 4 feet wide and paved. See Figure 6.1.

Bike Lanes

A *Bicycle Lane* or *Bike Lane,* is a portion of a roadway that has been designated for preferential or exclusive use by bicyclists by pavement markings and, if used, signs. They have very specific design, signing and striping criteria described in the AASHTO *Bike Guide* and the *Manual on Uniform Traffic Control Devices*. The following information on bike lanes is adapted from those documents unless otherwise stated.

Width

In sections with curb and gutter, bike lanes should be at least 5-feet wide measured from the face of curb. This 5-foot width assumes a minimum of a 3-foot wide rideable surface; the gutter pan is not included as part of the rideable surface. On sections of roadway without curb and gutter, a minimum width of 4-feet should be provided for a bike lane. Where a bike lane is striped next to striped on-street parking a minimum bike lane width of 5 feet is recommended. Where the parking lane is not separately striped, 11 feet clear from the bike lane stripe and the face of curb is recommended. See Figure 6.2.

Additional width (for a total of 6 or even 8 feet) is desirable for roadways where substantial truck traffic is anticipated.

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[1] *Guide for the Development of Bicycle Facilities*, American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 1999, pg. 3.
[2] *MUTCD*, FHWA, Washington, DC, 2009, P 20.

Figure 6.1: In-Street Bikeway Design – Paved Shoulder

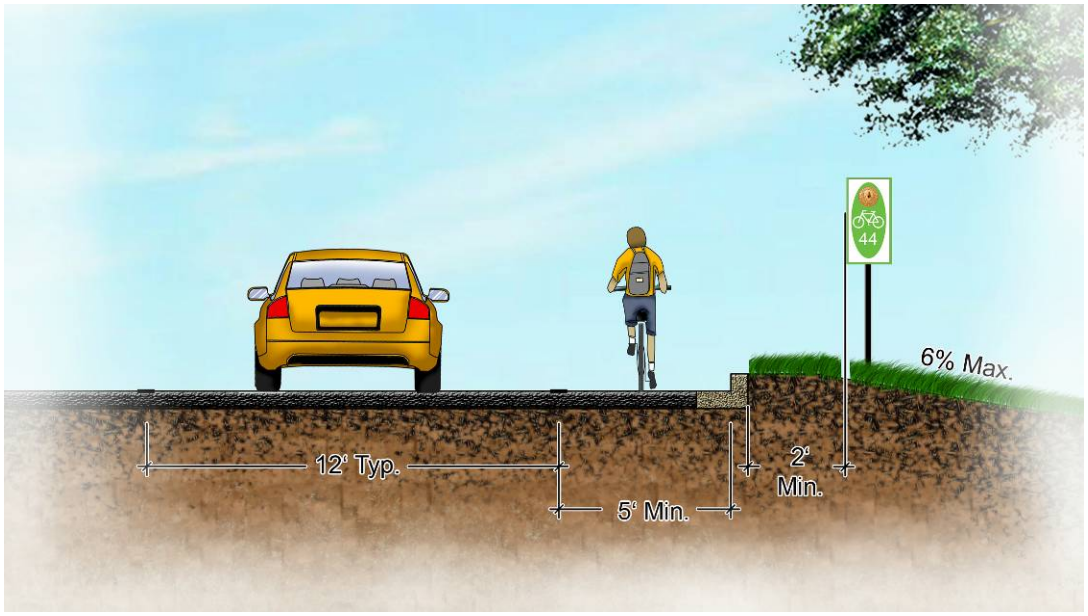


Figure 6.2: In-Street Bikeway Design – Bike Lane

Striping and Marking

A bike lane should be separated from the general travel lane by a 6-inch white stripe.

Bicycle lanes must be designated with pavement markings and signage.[3] In Georgia, the predominant bike lane symbol used is the bicycle with a rider symbol shown in Figure 6.3. Where bike lanes are to be designated, the bike lane symbol should be placed after every intersection and at regular intervals as needed. A maximum spacing of 600 feet in urban areas and one every ¼ mile in rural areas is recommended.

Figure 6.3: Bike Lane Symbol

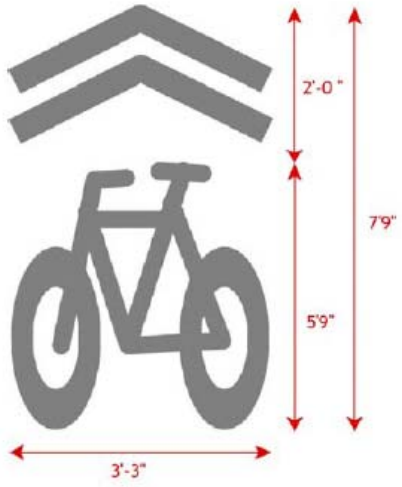
Shared Lane Markings

A variation of the experimental shared lane symbol shown in Figure 6.4[4] has been shown to reduce bicyclists riding on the sidewalk and increase riding with traffic. More recent research has shown this symbol to be more understandable to motorists and bicyclists. Consequently, this treatment may help reduce bicycle crashes at intersections along a marked roadway. When used, it is often placed next to on-street parallel parking to help bicyclists the appropriate location within the lane to ride and reduce the potential for "dooring" crashes.

This *Shared Lane Marking* is included in the 2009 *MUTCD*. It states that if used on a street with on-street parallel parking, the shared lane marking is to be placed at least 11 feet from the face of the curb (or edge of pavement if there is no curb). Where there is no on-street parking, it should be placed at least 4 feet from the face or curb (or edge of pavement if there is no curb). The marking should be placed after each intersection and otherwise periodically, not less than every 250 feet.

[3] The 2009 *MUTCD* has eliminated the requirement for signage.

[4] Florida Department of Transportation and UNC-HSRC, *Evaluation of the Shared Lane Arrow*, December, 1999.



Bike-and-chevron marking

Figure 6.4: Shared Lane Marking

Share the Road Signs

In limited circumstances where a roadway cannot be improved to provide full width shoulders or bike lanes, it may be appropriate to install Share the Road signs (the W11-1 Bicycle Warning sign with a W16-1 *Share the Road* supplemental plaque).[5] See Figure 6.5.

Figure 6.5: Share the Road Sign

Overuse of any sign can adversely impact its effectiveness. Consequently, roadway and traffic conditions should be carefully considered prior to installing Share the Road signs. Share the Road signs can be appropriate where:

- a relatively high number of cyclists can be expected on the roadway;
- the roadway cannot be improved for cyclists;
- a courtesy problem exists (such as where a shared use path parallels the roadway and motorist harass those cyclists using the roadway);
- when a bike lane ends; and
- to warn motorists that bicyclists will be entering the main travel lane at a sudden narrowing of the roadway.

Bicycle May Use Full Lane Sign

In some locations, such as narrow streets, or on severe downgrades, it may be advisable for cyclists to "claim the lane" on a roadway. This behavior is consistent with the Official Code of Georgia Annotated;[6] however, some bicyclists and motorists may be unaware of this. Consequently, in locations where cyclists may benefit from "claiming the lane," consideration should be given to installing a Bicycle May Use Full Lane sign. This sign is included in the 2009 *MUTCD.*

[5] *MUTCD*, Section 2C.50 ,FHWA, 2009.

[6] O.C.G.A. § 40-6-294

Figure 6.6: Bikes May Use Full Lane Sign

The associated text from the *MUTCD* follows:

> **Section 9B.06 Bicycles May Use Full Lane Sign (R4-11)**
> Option:
> The Bicycles May Use Full Lane (R4-11) sign (see Figure 6.6) may be used on roadways where no bicycle lanes or adjacent shoulders usable by bicyclists are present and where travel lanes are too narrow for bicyclists and motor vehicles to operate side by side.
>
> The Bicycles May Use Full Lane sign may be used in locations where it is important to inform road users that bicyclists might occupy the travel lane.
>
> Section 9C.07 describes a Shared Lane Marking that may be used in addition to or instead of the Bicycles May Use Full Lane sign to inform road users that bicyclists might occupy the travel lane.
>
> Support:
> The Uniform Vehicle Code (UVC) defines a "substandard width lane" as a "lane that is too narrow for a bicycle and a vehicle to travel safely side by side within the same lane."

On steep hills it may be advisable to widen the uphill bike lane, remove the downhill bike lane and install the R4-11.

6.2.2 INTERSECTION TREATMENTS

Intersections have numerous configurations, ranging from the very simple to complex intersections with on-street parking on the approaches and turn lanes. The design of in-street bikeways at various intersection configurations should include specific treatments to preserve the safe circulation of motor vehicles and cyclists.

Even though paved shoulders are not required to have intersection treatments, it is recommended that when intersection improvements or modifications are planned, intersection treatments for bike lanes should be incorporated to accommodate cyclists riding on paved shoulders. Several intersection treatment options are described below.

Roadways without right turn lanes

The continuous stripe that separates the bike lane and the regular travel lane should become a skip stripe (2ft – 4ft), at least 50 feet before the intersection (stop bar or radius point). The skip stripe will allow right-turn motorists to cross the designated bike lane to make a turn on the right edge

of the roadway. The skip stripe also alerts motorists they are crossing a designated bike lane. Examples are shown in Figures 6.7 and 6.8.

Roadways with right turn lanes

A through bike lane (5ft minimum width) should be provided between the right-turn lane and the regular travel lane to accommodate the cyclist traveling through the intersection. The solid striped through bike lane should have the same length as the right turn lane. At the beginning of the right turn lane taper, the bike lane stripes should be dotted (2ft – 4ft). These skipped stripes provide a transition area (during the right-turn taper) for right-turning motorists to cross the bike lane. At the end of the right-turn taper the skipped stripes become the solid stripes of the through bike lane. Before the transition area (right-turn taper) pavement markings can be used to warn the cyclist to yield to motorists.

Similar striping approaches should be used at 'T' intersections to accommodate left-turning cyclists. Examples of bike lanes at intersections with right lanes are shown on Figures 6.9, 6.10, and 6.11.

Roadways with right turn drop lanes

As with roadways with tapered right turn lanes, a through bike lane (5ft minimum width) should be provided to accommodate the cyclist traveling through the intersection. To accommodate a right lane drop, the bike lane needs to be shifted to the left. See Figure 6.12.

To provide a transition area for cyclists to shift left to the through bike lane the following treatment is recommended:

- In general, a minimum 80 ft area should be provided to allow cyclists to transition left to the shifted bike lane.
    - The first 50ft of the transition area should separate the travel lane and bike lane with a dotted white stripe (2ft – 4ft skip pattern).
    - The last 30ft of the transition area should remain unstriped.
- The shifted through bike lane should begin at least 100ft before the right turn drop lane. For this 100ft the regular travel lane should be separated from the shifted bike lane by a dotted white stripe (2ft – 4ft).

Before the cyclist transition area, pavement markings can be used to warn cyclists to yield to motorists. A similar treatment should be used at 'T' intersections to accommodate left-tuning cyclists. An example is shown in Figure 6.13.

Roadways with on-street parking

In the space between the end of on-street parking and the intersection's

stop bar the bike lane should be delineated by dotted stripes on both sides (2ft – 4ft skip pattern). A typical example is shown in 6.14.

Roadways with right turn lanes and a shared through/right turn

Designers should consider the confusion created for cyclists and motorists before using this type of intersection treatment. In roadways with designated bike lanes, it is recommended to avoid marking a through/right turn lane next to a right turn lane.

Interchange areas

Typical interchange areas in Cobb County have large radii on/off ramps. The large radii and long diverge and merge lanes associated with these intersection configurations are problematic for bicyclists as they create weaving areas with high speed motor vehicle traffic. To accommodate cyclists in these types of interchanges the treatment shown on Figure 6.15 is recommended. This treatment provides cyclists with an option to continue parallel to the direction of motorist traffic or to cross the on/off ramp traffic at a right angle.

For the development of new interchanges in urban type areas, a more compact design with smaller radii, in accordance to AASHTO guidelines, is recommended. To accommodate cyclists within the more compact interchanges implement the treatment shown in Figure 6.16.

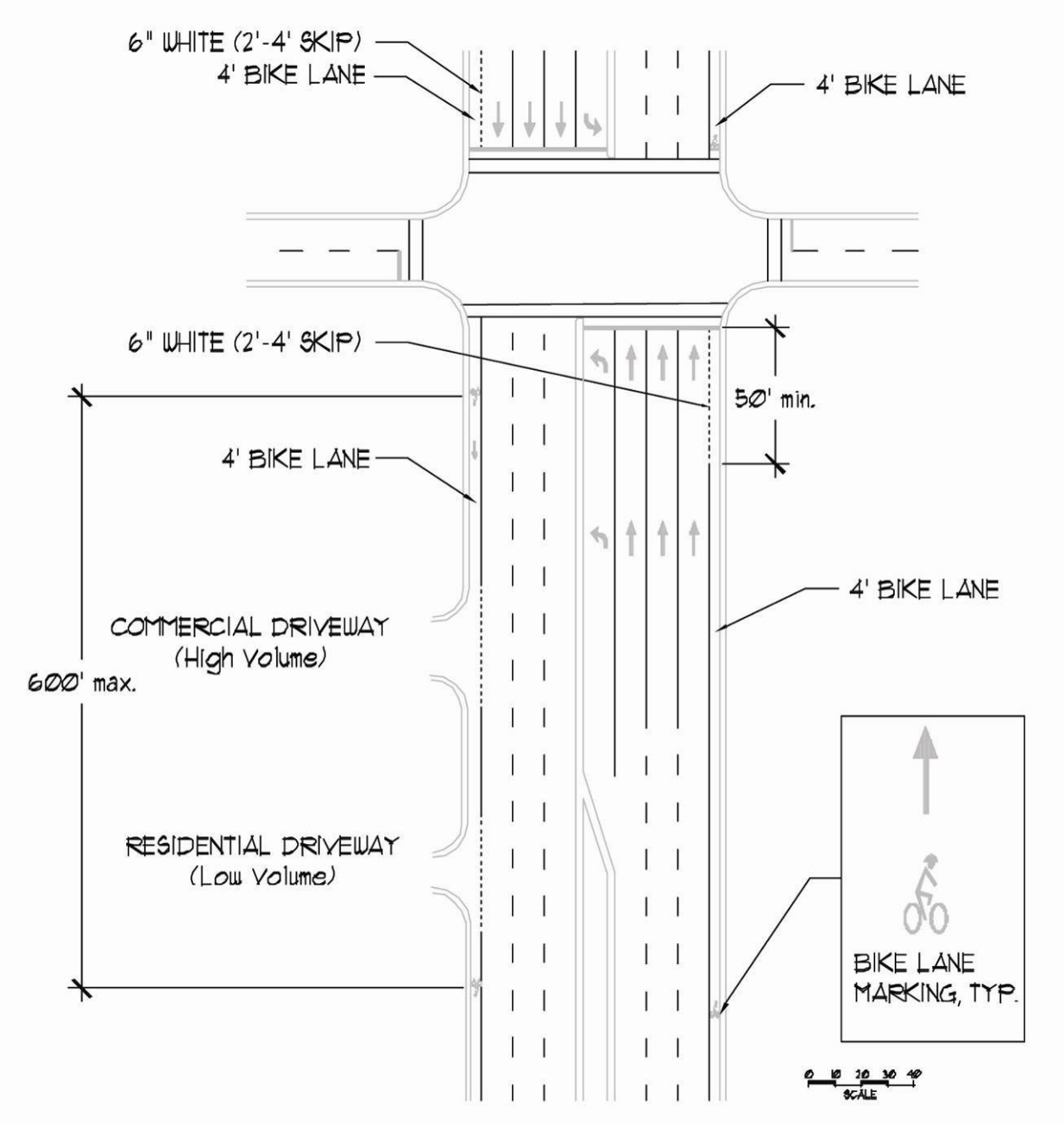


Figure 6.7: Major Intersection – No Right Turn Lane – Curb & Gutter

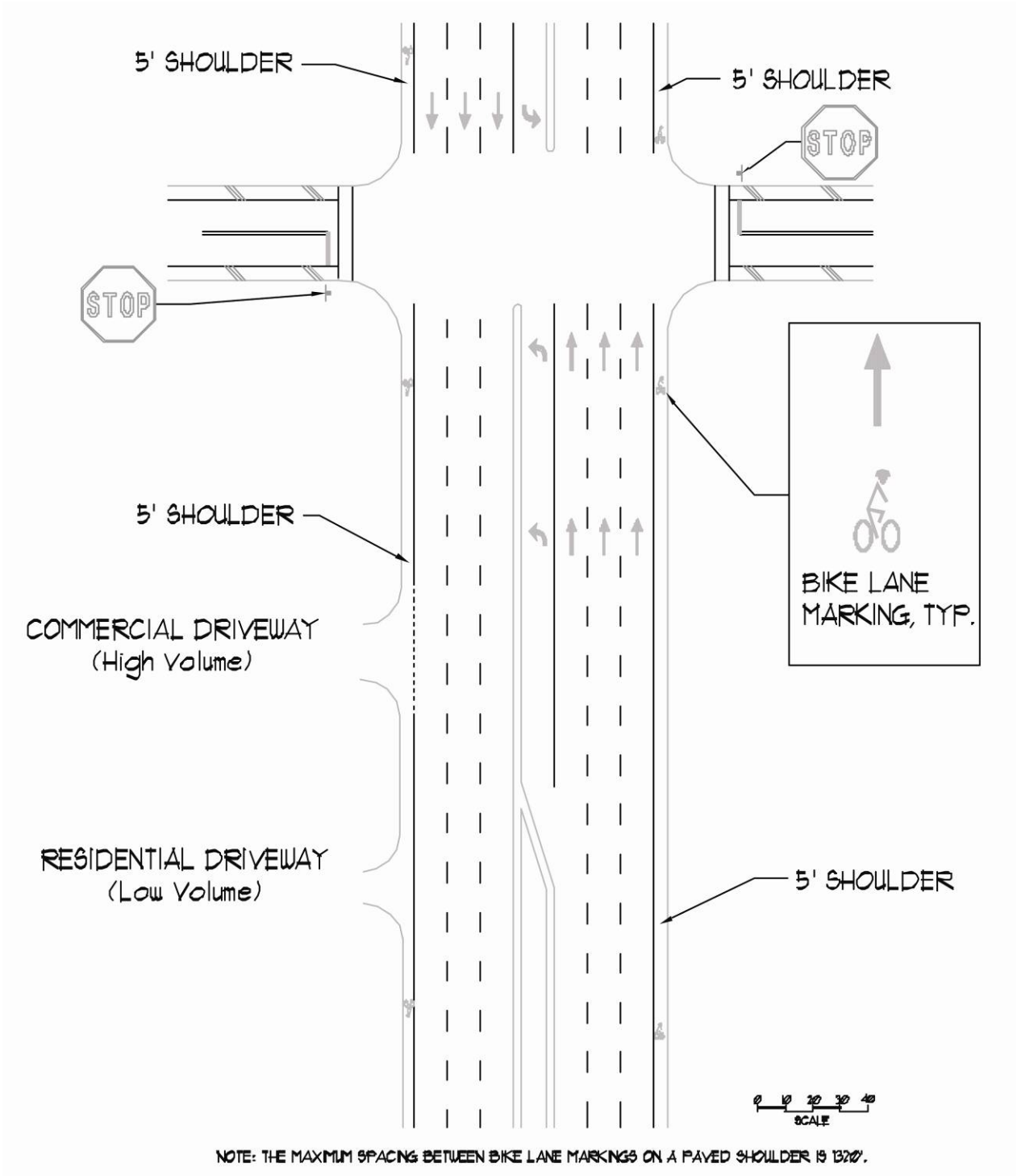


Figure 6.8: Major with Local Street Intersection – No Right Turn Lane – Paved Shoulder

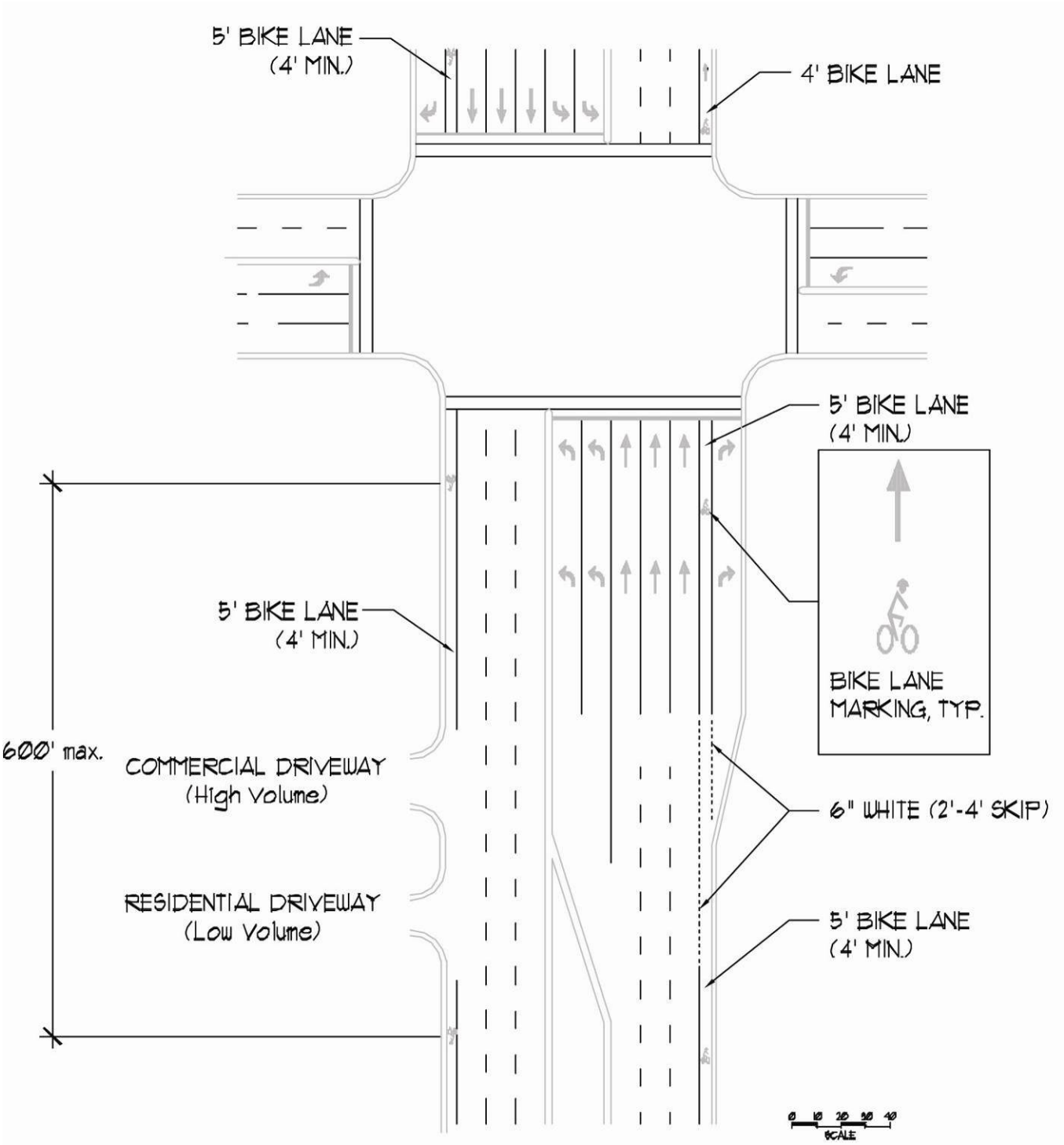


Figure 6.9: Major Intersection – Right Turn Lane – Curb & Gutter

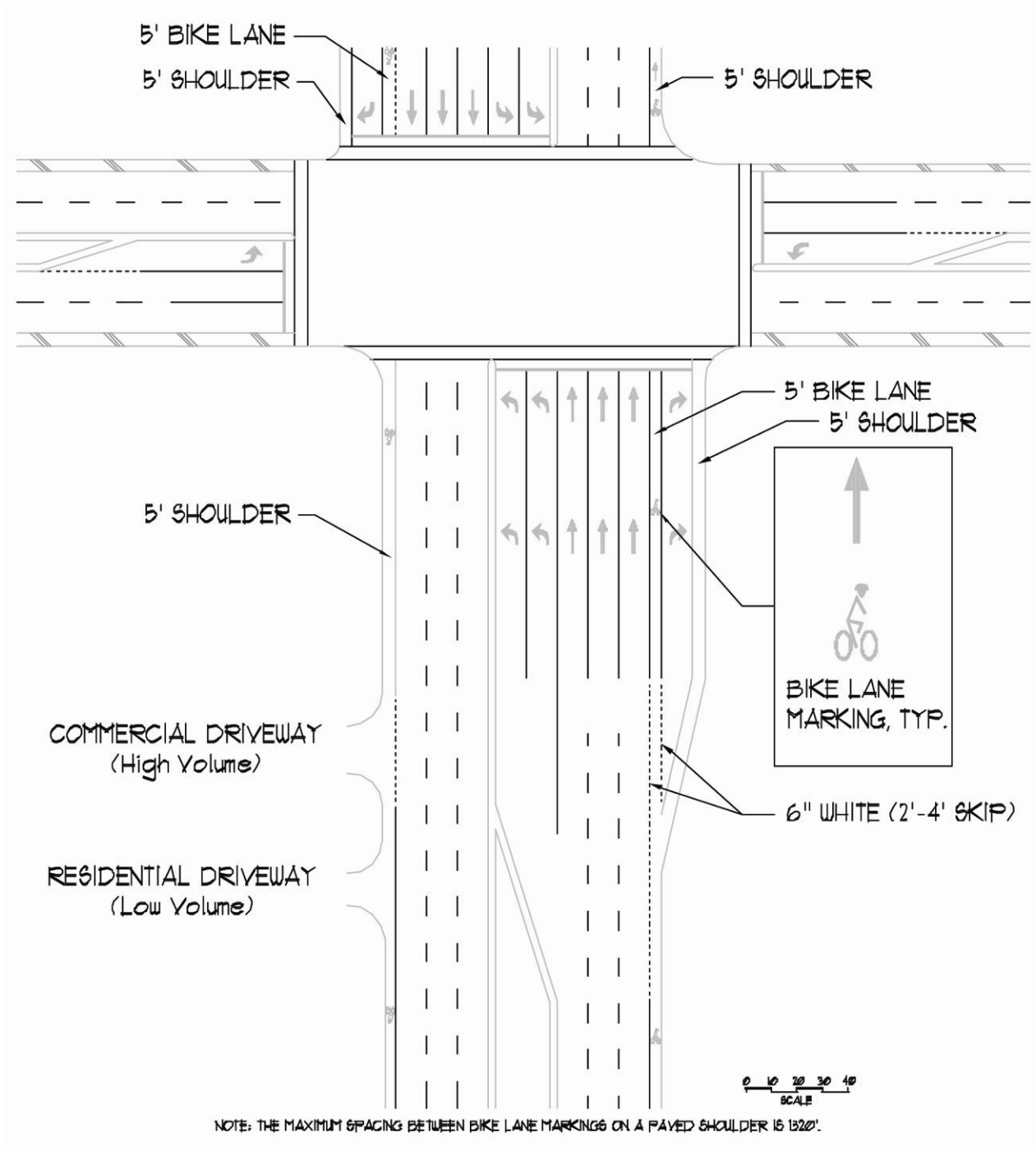


Figure 6.10: Major Intersection – Right Turn Lane – Paved Shoulder

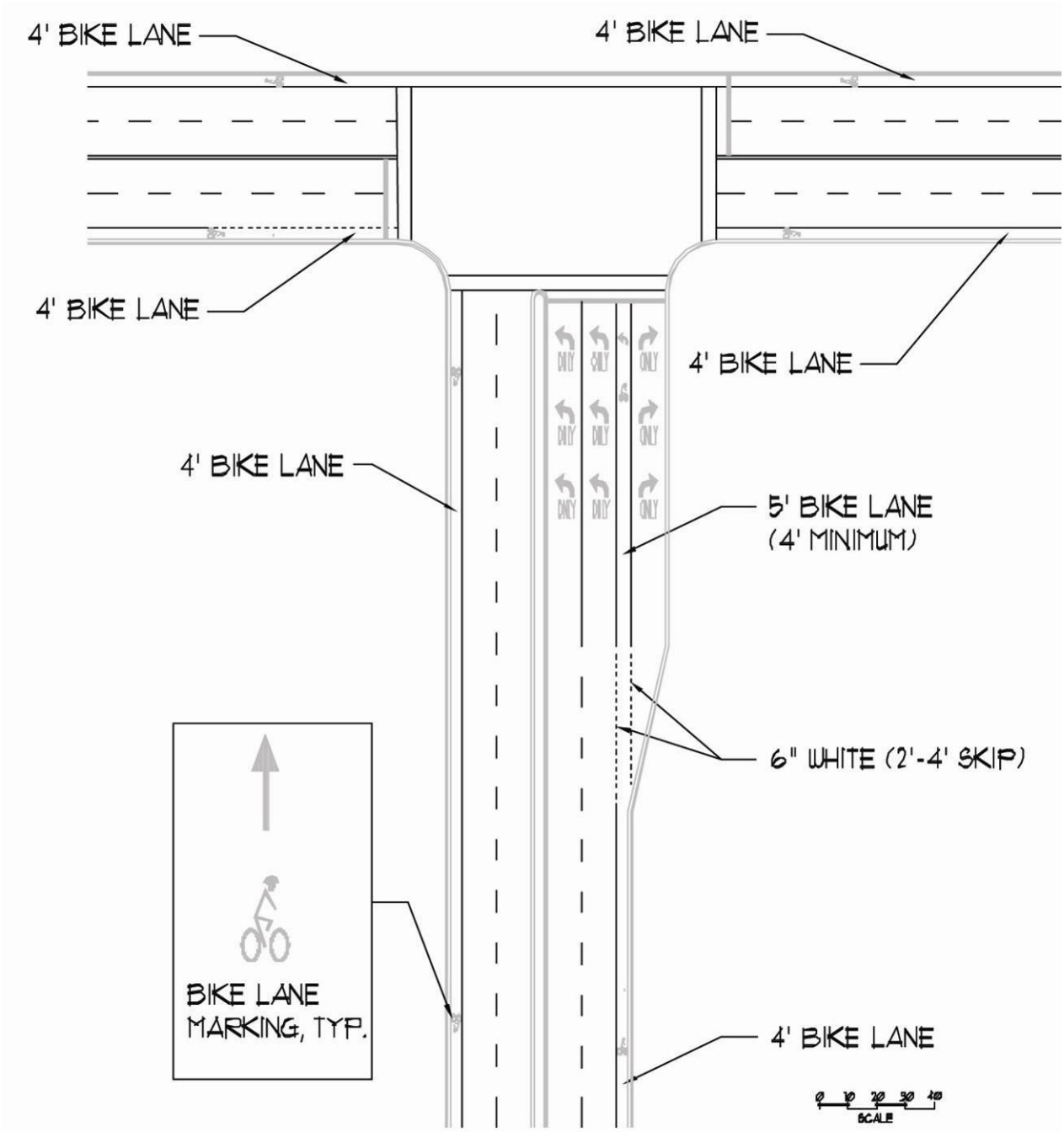


Figure 6.11: 'T' Intersection – Right Turn Lane – Curb & Gutter

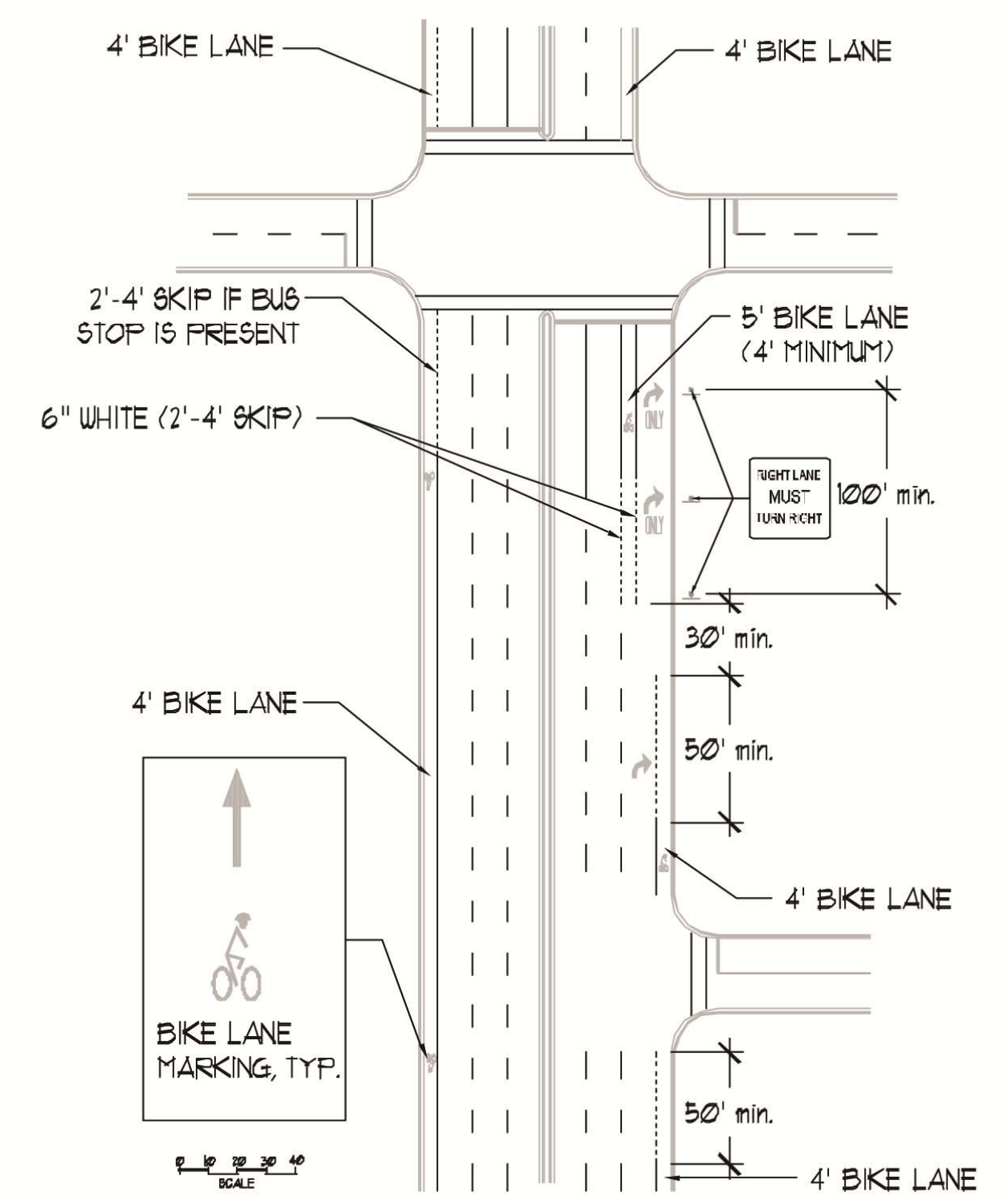


Figure 6.12: Major Intersection – Right Turn Drop Lane – Curb & Gutter

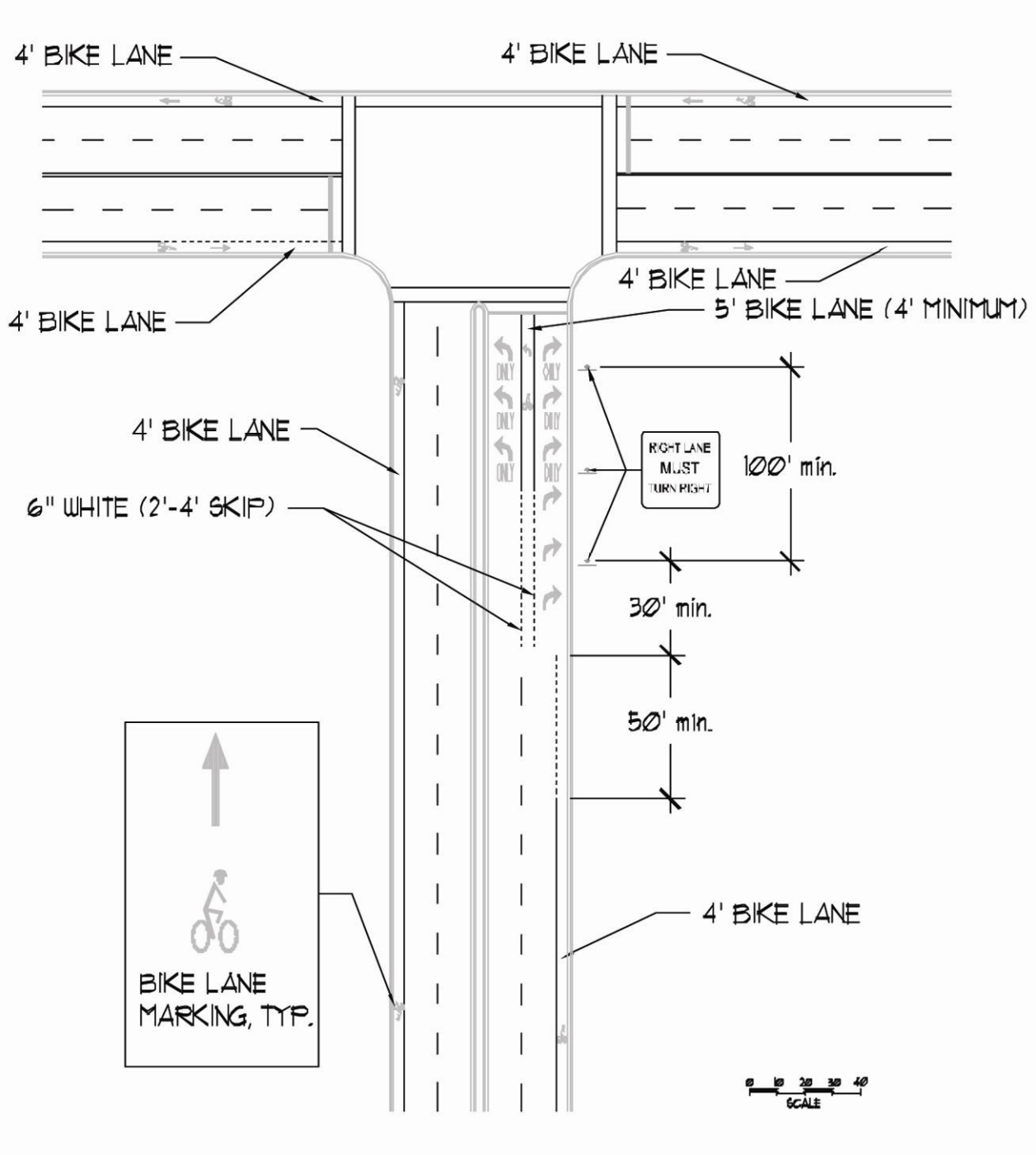


Figure 6.13: 'T' Intersection – Right Turn Drop Lane – Curb & Gutter

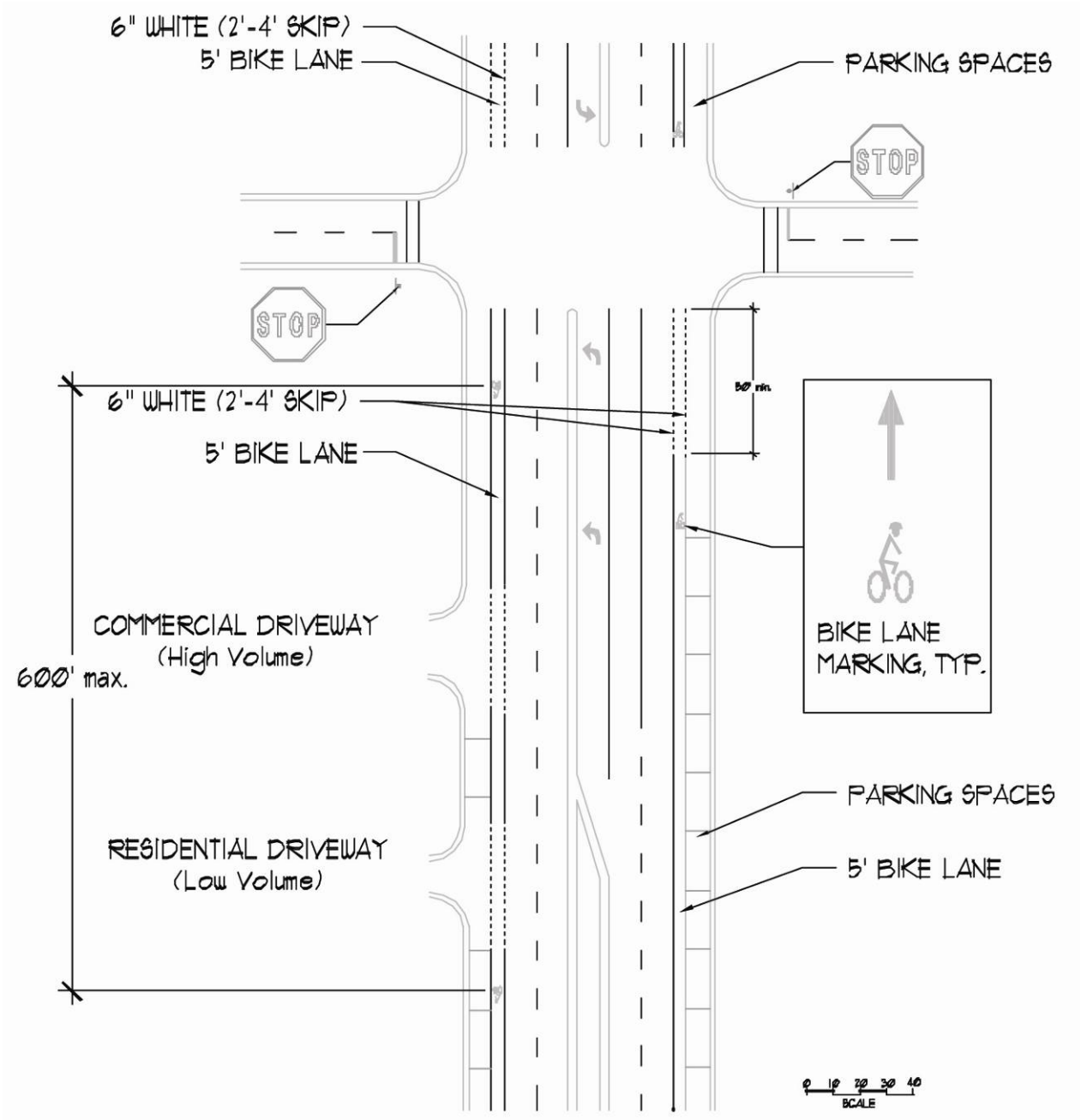


Figure 6.14: Major with Local Street Intersection – On-Street Parking– Curb & Gutter

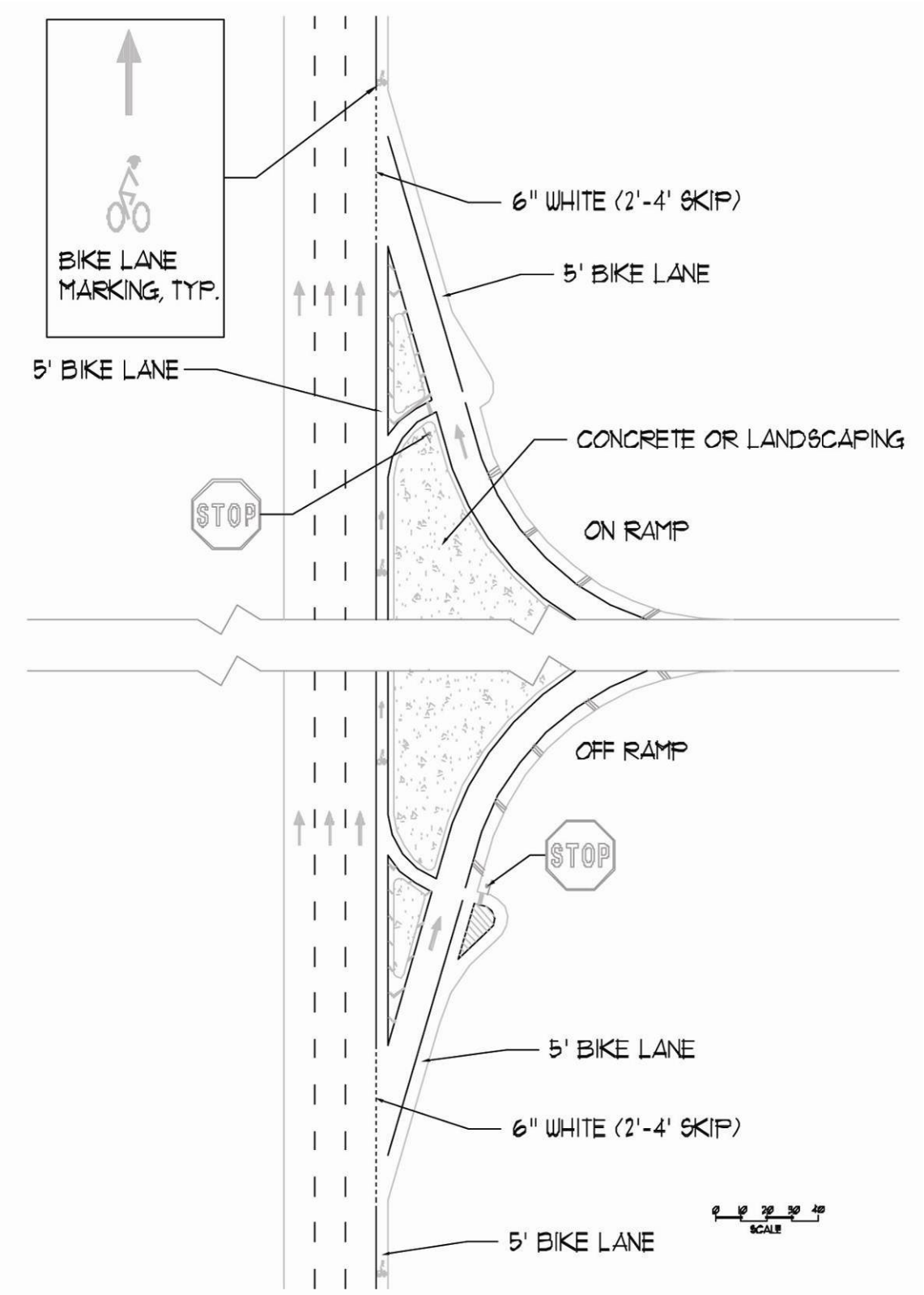


Figure 6.15: Typical Treatment for Existing Interchange Ramps

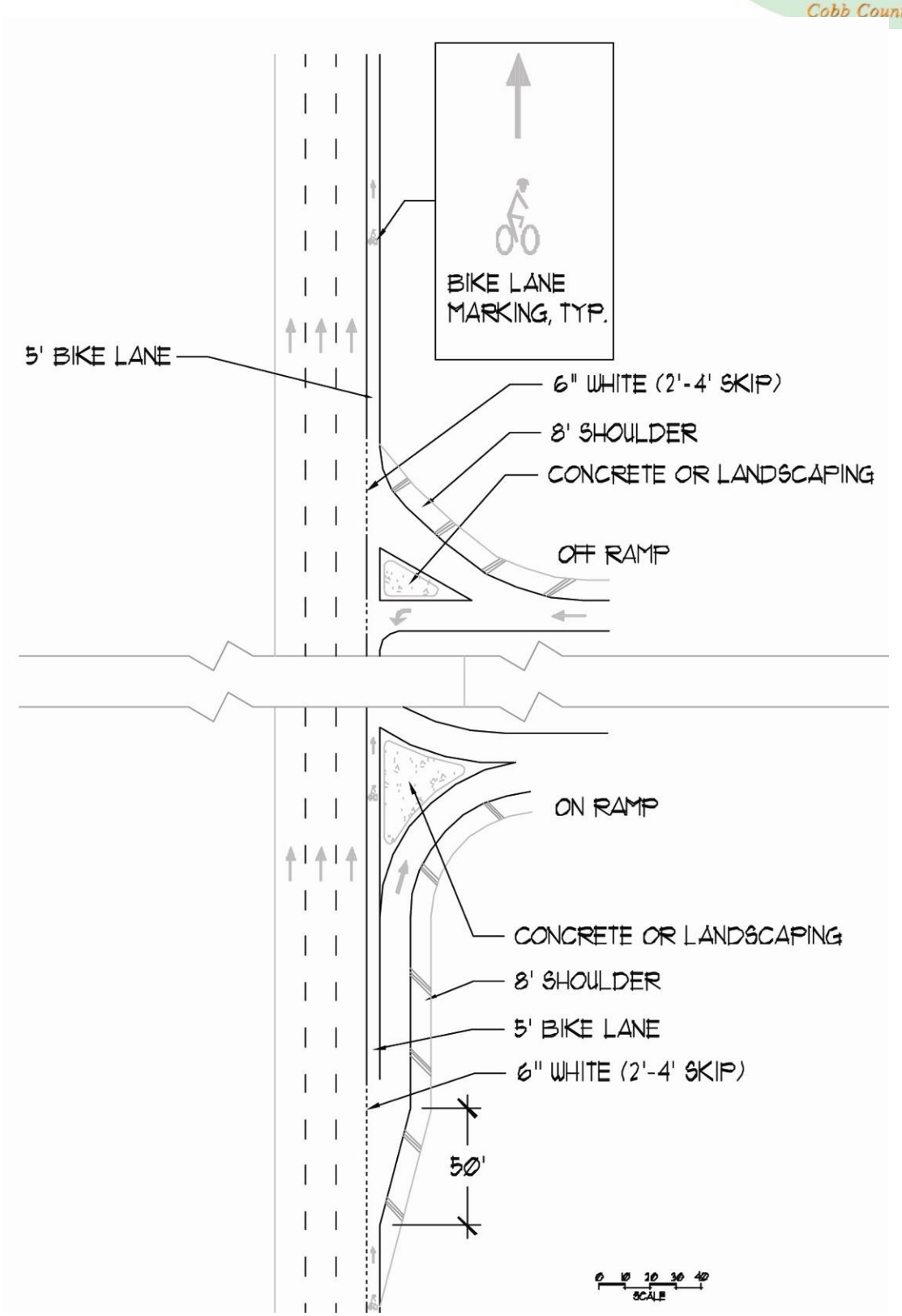


Figure 6.16: Typical Treatment for New Interchange Ramps

6.2.3 TRAFFIC SIGNALS

On most roadways, cyclists can cross intersections under the same signal phase as motorists. However, on occasion, modified signal timing or additional traffic control devices may be appropriate.

Timing of traffic signals

Cyclists are at the greatest risk during periods of low traffic flow and clearance intervals. Signals should be designed to provide an adequate clearance interval for bicyclists who enter at the end of the green signal phase and a total crossing time long enough to accommodate cyclists starting up on a new green signal phase. Yellow change intervals adequate for motorists are usually adequate for cyclists. The *AASHTO Greenbook*[7] provides the following equation to calculate the total clearance interval (yellow change interval plus red clearance interval):

$$y + r_{cleaer} \geq t_r + \frac{v}{2b} + \frac{w + l}{v}$$

y = yellow interval, sec
r_{clear} = red clearance interval, sec
t_r = reaction time (1.0 sec)
v = bicyclist speed, fps[8]
b = bicycle braking deceleration (4 to 8 ft/s^2)
w = width of crossing, ft
l = length of bicycle, 6 ft

[7] A Policy on the Geometric Design of Highways and Streets, 2004, AASHTO.
[8] The AASHTO *Bike Guide*, P 65, has a typographical error stating speeds are in mph

Detection of bicycles at signalized intersections

Just as with detection for motor vehicles, the detection of bicyclists at intersections is an important aspect of intersection design. This section describes the importance of providing detection that works for all vehicles (motor vehicles and bikes) in the roadway and strategies for making signals responsive to the presence of bicycles. Approximately 98% of cyclists should be able to clear signals timed for a cyclist speed of 6 mph. If this interval is longer than the allowed by local
code, the longest available clearance interval should be used.

A bicyclist needs enough time to react, accelerate and cross the intersection when approaching a green signal. The *AASHTO Greenbook* (P 65) provides an equation to determine the minimum green time; however, this equation does not accurately represent the required minimum time for bicyclists to clear an intersection. A more accurate equation for intersections up to 144 feet wide is provided below:

$$g + y + r_{clear} \geq t_r + \sqrt{\frac{2(w+l)}{a}}$$

g = minimum green
y = yellow interval, sec
r_{clear} = red clearance interval, sec
t_r = reaction time (2.5 sec)
w = width of crossing, ft
l = length of bicycle, 6 ft
a = bicycle acceleration (1.5 – 3 ft/s^2)

Actual field observations should be taken prior to making any adjustments to the minimum green or clearance intervals. Acute angle intersections require longer crossing times for cyclists.

For compliance with traffic laws and cyclist's safety, bicycles should be detected at traffic-actuated signals. Efforts should be made to ensure that signal detection devices are capable of detecting bicycles. Even though detectors that have been placed for vehicular traffic can usually detect bicycles, it is recommended to mark the road surface to indicate to cyclists the optimum location for bicycle detection.

Figure 6.17 shows a standard pavement symbol which should be placed at the location of the loop detector to notify the cyclist where to stop.

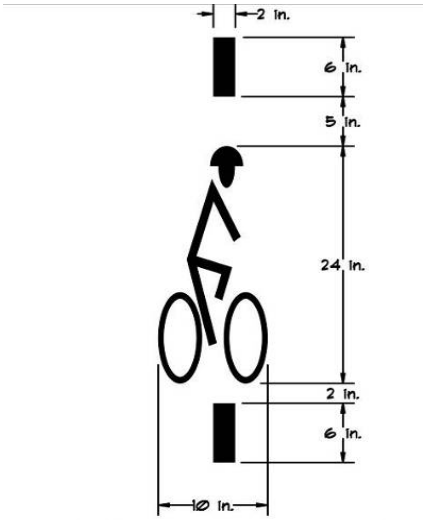


Figure 6.17: Bicycle Detector Pavement Marking

The *MUTC* requires traffic signals be adjusted to consider the needs of bicycles.[9] Of equal importance is the fact that signals which cannot detect bicyclists impact both the safety of cyclists and the attitudes of motorists.

The MUTCD states:

Standard:
At installations where visibility-limited signal faces are used, signal faces shall be adjusted so bicyclists for whom the indications are intended can see the signal indications. If the visibility-limited signal faces cannot be aimed to serve the bicyclist, then separate signal faces shall be provided for the bicyclist.

On bikeways, signal timing and actuation shall be reviewed and adjusted to consider the needs of bicyclists.

It is important that bicyclists riding on roadways should be able to see the traffic signals for their approaches. This discussion, however, focuses on the second part of the MUTCD standard, the requirement to review and adjust signal actuation in consideration of the needs of bicyclists.

Non-responsive signals, at which cyclists cannot get a green signal indication, can cause unsafe behaviors

[9] *MUTCD,* Section 9D.02 Signal Operations for Bicycles, FHWA, Washington, D.C., 2009.

by cyclists. Bicyclists can be frustrated by traffic signals which will not detect their bicycles. Non-responsive signals can cause significant delays, and when delayed long enough bicyclists will typically ride through the red signal. While this is not an illegal behavior,[10] it can contribute to cyclists choosing to disregard other signals which might actually be responsive to their presence. This conditioned disregard for signals can lead to crashes. Signals which do not respond to the presence of bicycles can also adversely affect motorists' attitudes toward bicyclists. Motorists' observation of cyclists proceeding through red signals reinforces the oft-held belief that most cyclists are scofflaws with no regard for the rules of the road and/or even that cycling is not a legitimate mode of transportation on the roadway.

Traffic signals are usually installed because there are relatively high traffic volumes on both the main road and Side Street. This means that throughout most of the day, and most of the week, there is an adequate volume of motor vehicles on any particular approach to call the green signal. However, at some intersections, or during off-peak times (i.e., at night, in the early morning, on weekends) this may not be the case. In these situations, the signal detection hardware should be configured so that bicyclists can be detected. The following section identifies situations where the detection of bicyclists is an important consideration, how signal loops detect bicyclists, and how signalized intersections can be improved to consider the needs of bicyclists.

Important locations for bicyclist detection

Just as detection of motor vehicles is not necessary for all movement approaches to signalized intersections, the same is true for the detection of bicycles. A discussion of which approaches may or may not need to be able to detect bicycles is provided below:

Through movements: Typically, signals along arterial roadways are programmed to "rest on green" for the arterial roadway. This means that if the signal hardware does not detect a vehicle on a side street approach, the signal facing the arterial roadway will remain green indefinitely. At other roadway intersections, however, signals are programmed for "automatic recall," which gives each approach through movement a green signal every cycle, whether a vehicle is detected or not. On arterial roadways employing either if these two approaches to signal timing, it is

[10] 316.1235 (FS) Vehicle approaching intersection in which traffic lights are inoperative.--The driver of a vehicle approaching an intersection in which the traffic lights are inoperative shall stop in the manner indicated in s. 316.123(2) for approaching a stop intersection. In the event that only some of the traffic lights within an intersection are inoperative, the driver of a vehicle approaching an inoperative light shall stop in the above-prescribed manner.

frequently not necessary to be able detect a bicycle (or any other vehicle) on some through movement approaches for the purposes of providing a green signal. Travelers on non-arterial side streets do not often enjoy the benefit of automatic recall. Consequently, if through-moving cyclists on a side street are not detected by the signal hardware, they will not receive a green light and will then likely treat the signal like a STOP sign type control. Therefore, on signalized intersections without automatic recall, the signal hardware should be adjusted to detect cyclists.

Right turn movements: In right turn lanes it may not be necessary to detect bicyclists; the ability to perform a right turn on red (RTOR) provides ample opportunity for bicyclists to turn. As was described earlier, during those time periods when traffic volumes on the cross street are so high as to prevent an RTOR, there is also likely to be detectable motor vehicle traffic on the approach the cyclist is using, sufficient to call the green light for that approach. If, however, there is a prohibition against RTOR, then the detection of bicyclists once again becomes an important consideration.

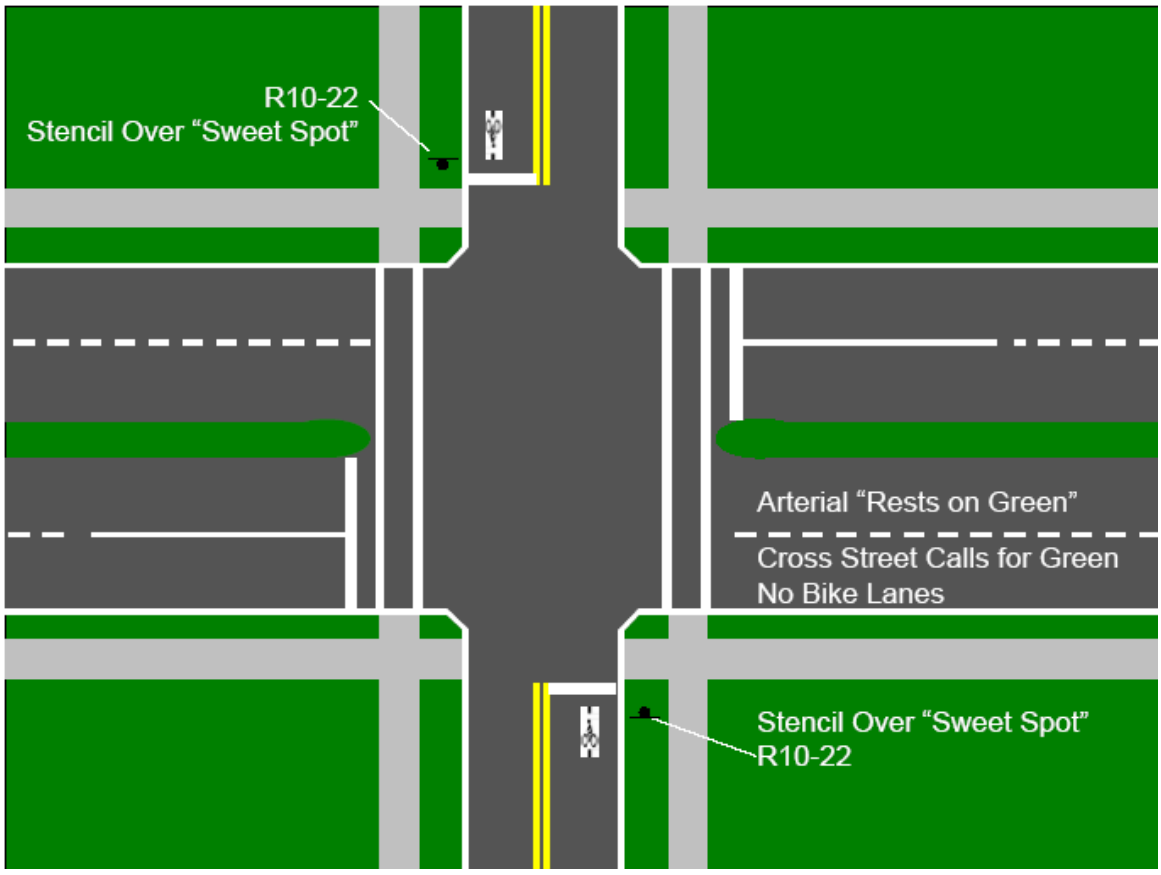


Figure 6.18: Bicycle Detector Pavement Marking for Through Movement

Left turn movements: On roadways with automatic recall, it may not be necessary for hardware to be able to detect bicyclists in left turn lanes that have a permitted or protected/permitted operation. This is for the same reasons as stated for the right turn lanes: under low volume conditions, the permitted left turn should provide adequate opportunities to turn and under higher volume conditions motor vehicles will likely be present to call the signal.

In those left turn lanes that provide for protected-only left turns the signal hardware should be able to detect bicycles; the same is true for left turn lanes on roadway approaches that are not set up for automatic recall.

Figures 6.18 (previous page) and 6.19 (below) show those movements where the detection of bicycles is an important consideration.

Methods for the detection of bicycles

For traffic signals to operate efficiently they must be able to detect when vehicles are present on approaches to the intersection. In response to detecting the presence (and consequently the absence) of vehicles, traffic signal hardware can adjust signal phasing and timing plans to accommodate fluctuating traffic conditions throughout the day and

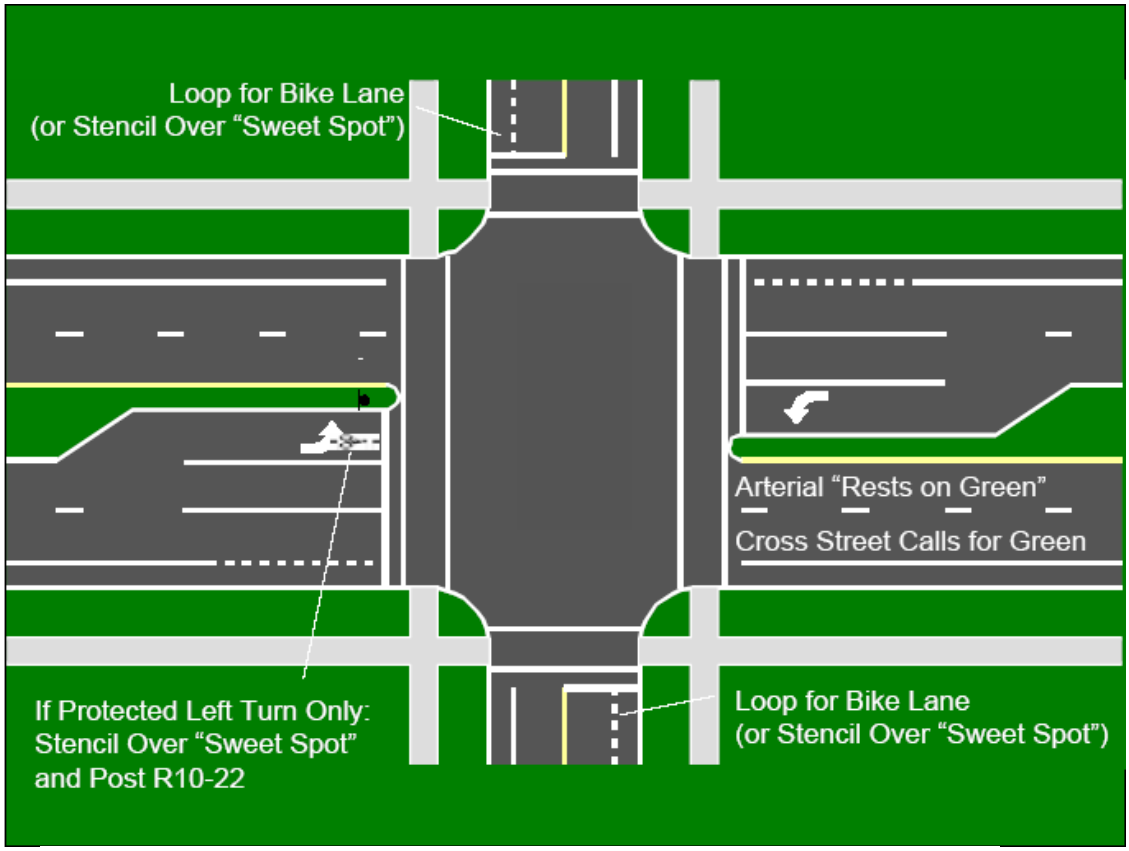


Figure 6.19: Bicycle Detector Pavement Marking for Left-turn Movement

week. Inefficient signal operations can arise when vehicle detection hardware is not operating optimally, such as when a loop fails. When this happens, the detector hardware will usually compensate by providing an automatic recall to the movement formerly monitored by the failed detector; this means that the lane over the failed loop will receive a green light during every cycle, whether a vehicle is there or not. Alternatively, there are some signal loop installations which may detect cars, but do not detect some trucks, motorcycles or bicycles. If they are not detected, these vehicles may not receive a green light. This section describes common detector types and how their detection of bicycles can be optimized.

Inductive loops: The most common type of vehicle detection hardware is the inductive loop. The loop consists of a wire (or several wires) embedded into the roadway. A very low voltage current runs continuously through the loop; whenever a conductive object enters the electrical field around the loop, the loop's inductance is altered. The detector hardware senses this change in inductance and interprets it as a vehicle over the loop.[11]

Loop sensitivity is also an important aspect to consider with regard to bicycle detection. Sensitivity is affected by several factors, the three most important of which are: the amount of metal in the vehicle; the proportion of the loop covered by the vehicle; and the distance between the roadway surface and the metal in the vehicle. Ideally, a loop would be able to detect any vehicle placed over the loop but not detect vehicles in any adjacent lanes.

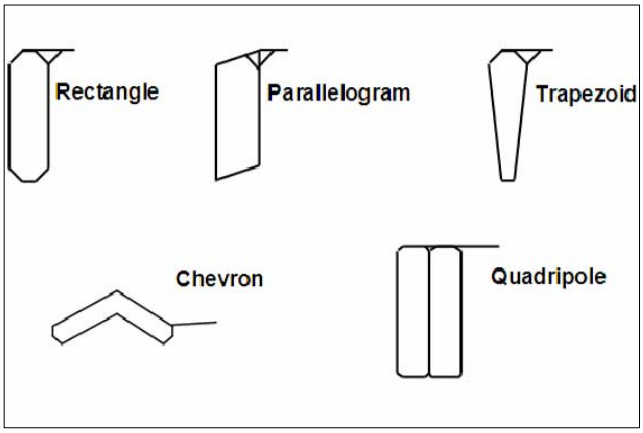


Figure 6.20: Types of Inductive Loops

Calibrating loops sensitively to do so is a principal challenge of signal hardware design, which has led to the development of numerous loop configuration solutions. Some of the more common configurations are shown in Figure 6.20 (above). Each of these configurations is widely used across the country and each is capable of detecting bicycles in their fields.

There is a perception among many cyclists and roadway engineers that inductive loops do not detect the presence of bicycles; this perception is

[11] It is important to note that induction loops do not detect changes in the magnetic field and therefore a bicycle need not be made of steel to be detected. Because aluminum is a better conductor than steel, aluminum bikes are actually are more easily detected by inductive loops than steel bikes.

often based on cyclists not waiting in an optimal spot for detection. Research has shown that inductive loops are highly reliable at detecting steel and aluminum bicycles when bicycles are in the proper position.[12] There are two basic strategies to improve detection of bicycles: to direct bicyclists to the area of optimal loop sensitivity ("marking the sweet spot") or to place new loops in spots where cyclists are likely to be waiting, such as in the bike lane or at the right edge of the pavement. It recommended that these strategies for optimizing loop detection of bicyclists be employed before investigating a substantial investment of new technology; the technology already in place around many local intersections is likely quite capable of detecting bicyclists. The following sections describe these two strategies.

Marking the Sweet Spot: One of the simplest ways to facilitate the detection of bicyclists at traffic signals is to mark that spot on the roadway where a given loop will detect a bicycle. The MUTCD provides for a symbol that may be placed on the pavement to indicate the optimum position for a bicyclist to actuate the signal.[13] Used in conjunction with the BICYCLE SIGNAL ACTUATION sign (R10-22)[14], this symbol can eliminate the problem of bicycle detection for any intersection movement where the loops can detect bicyclists.

This sweet spot can be located by two people in the field using the following process. First, have one person open the controller cabinet and note the light indicating detection for the lane of interest. Next, place a bicycle at the right edge of the lane with the front tire overhanging the stop line. Then move the bicycle slowly to the left in the lane until the controller indicates the bike is detected by the signal loop (see Figure 6.21).

Figure 6.21: Finding the "Sweet Spot"

[12] See for example the FHWA report "Bicycle and Pedestrian Transportation," prepared by SRF consulting in 2003, available on line at http://ntl.bts.gov/lib/23000/23300/23330/BikePedDetFinalReport.pdf

[13] *MUTCD*, Section 9C.05 Bicycle Detector Symbol, FHWA, Washington, D.C., 2009.

[14] *MUTCD*, Section 9B.13, Bicycle Signal Actuation Sign, FHWA, Washington, D.C., 2009.

Continue moving the bike until the bicycle can no longer be detected. Finally, mark the pavement at the middle of this range of detection. In many cases an entire bicycle is not needed to locate the sweet spot, just a bicycle wheel may do. However, until it can be determined if a single wheel will be detected by local loops, an entire bike – and initially both a mountain bike and a road bike – may be appropriate for experimentation.

Loops for Bike Lanes

Placement of signal loops within bike lanes is not always necessary. As stated above, frequently bicycles only need to be detected in situations where no motor vehicle is present; in those situations, bicyclists could exit the bike lane and wait to be detected over the standard signal loop. Even so, changing lanes at an intersection to call for a signal change is not a normal vehicular behavior. Consequently, in the interest of providing consistent treatments and promoting consistent vehicular behavior, bike lane detection should still be considered at locations where signal change is unlikely without detection.

The most commonly recommended loop type for bike lanes is a quadripole loop of reduced size. These loops are highly sensitive to objects in the area immediately above them, but detection falls off rapidly outside of this sensitivity field; this means that cars in adjacent lanes will not be detected. Quadripole loops, when placed in a bike lane, typically detect within an area two feet wide by 10 feet long.

6.2.4 OBSTRUCTION MARKINGS

Where obstructions are unavoidable a special treatment should be used to gain the attention of the approaching cyclists. Signs, reflectors, diagonal yellow markings or other treatments may be appropriate to alert bicyclists to potential obstructions. Figure 6.22 shows an example of an obstruction marking.

6.3 SHARED USE PATH DESIGN

6.3.1 DESIGN SPEED

The design speed for a shared use path dictates numerous other design criteria values. Consequently, it is important to use the appropriate design speed – one that accommodates the design user, but does not needlessly constrain the designer – when designing shared use paths.

According to the AASHTO *Guide for the Development of Bicycle Facilities* (referred to as the *Bike Guide*), shared use paths should be designed for a bicycle traveling at 20 mph.[15]

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[15] *Guide for the development of Bicycle Facilities,* pg. 36, American Association of State Highway and Transportation Officials, 1999.

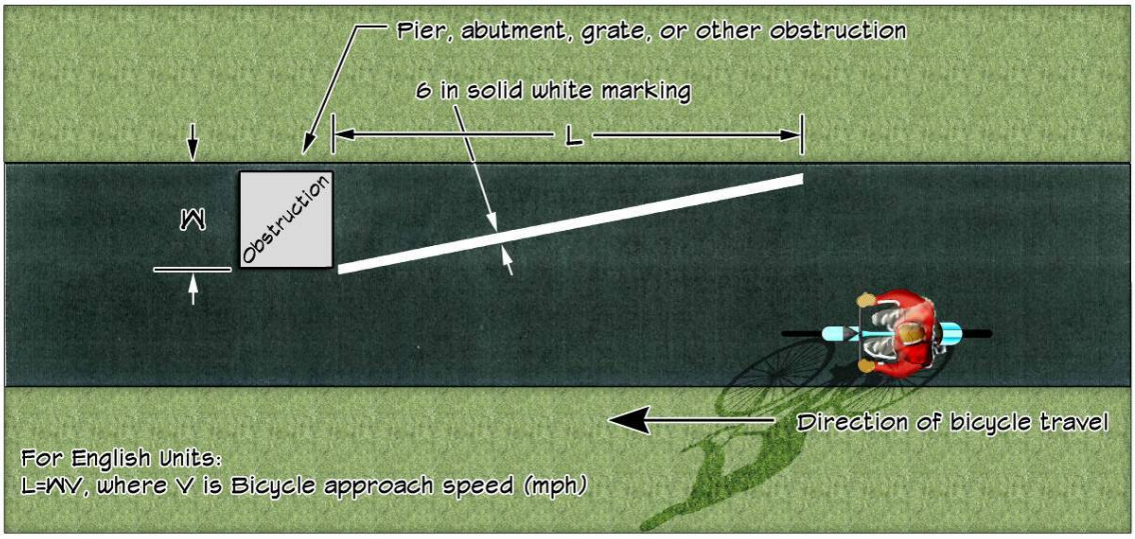


Figure 6.22: Obstruction Marking Illustration

This design speed is based upon the idea that the occasional bicyclists can and will travel at 20 mph. Research performed subsequent to the adoption of the *Bike Guide* has established that these high speed cyclists represent a small proportion of the cyclists using shared use paths. These studies found that the 85 percentile speed for bicyclists using shared use paths ranges from 12.5 to 13.6 mph.[16,17]

Based upon the cited research, lower design speeds (than 20 mph) could be considered for some shared use paths or portions thereof. On regional trails, such as rail trails, it is appropriate to design to accommodate the higher speed cyclists. However, on trails specifically serving lower speed users reduced design speeds may be appropriate and provide some benefits. These conditions are described in more detail in the following subsection.

There are several conditions for which a reduced design speed would be appropriate and enhance a shared use path facility. On paths primarily serving school children, higher-speed cyclists may pose a hazard to the primary users. High speed cycling may not be appropriate on some "family friendly" routes. Commuter routes serving downtown areas should not be required to provide for high-speed cyclists.

Path serving schools/local connections

Paths serving elementary schools should not be designed to encourage high-speed cycling. Elementary school students, whether walking or bicycling, do not travel at high-speeds. They often do not ride bikes in straight lines; they tend to weave. They may be

[16] *Characteristics of Emerging Road and Trail Users and Their Safety*, FHWA, 2005.
[17] *Operations of Shared Use Paths*, FHWA, 2005.

unstable on bikes. Their behaviors are often unpredictable. Paths for elementary school students need not be designed to accommodate high-speed cyclist.

Other pre-college students (middle, high school) riding to school also represent a class of shared use path that user could benefit from a reduced design speed. They tend to travel in groups and often do not ride in predictable ways. Whereas some cyclists will ride in uniform packs, students tend to be more fluid. They may shift positions within their groups considering only the other individuals in their groups without consistent scanning for other cyclists or pathway users. Student cyclists are more likely to be riding mountain bikes than road bikes, resulting in lower speeds. Consequently, a pathway serving students need not be designed to encourage high-speed cycling.

Paths serving urbanized areas

Just as urban and suburban roadways are designed to accommodate lower speed users than rural roads, it may be appropriate to allow for lower design speeds on paths in urbanized areas. In urbanized areas, the number of conflicts along pathways increases. Congestion, along the pathway often increases as well. Additionally, increased signal frequency tends to reduce the potential for high speed travel along pathways. Furthermore, as development becomes denser, the number of pedestrians using a pathway may increase causing additional potential conflicts. These factors suggest that lower operating speeds, and thus design speeds, should be encouraged on pathways in urbanized areas.

Recommended design speeds

Table 6.1 provides recommended design speeds for shared use paths in Cobb County:

Facility type	Recommended Design Speed
Rural path, independent alignment	20 mph
Elementary school path	10 mph
Middle/high school path	15 mph
Local connectors	15 mph
Urban pathway	15 mph

Table 6.1: Recommended Design Speeds for Shared Used Paths

On paths with significant downgrades exceeding 4% a design speed 10 mph higher than that shown in the above table should be used.

6.3.2 STOPPING SIGHT DISTANCE

Path users, particularly bicyclists and inline skaters, must be provided adequate sight distance along a path to allow them to stop safely at intersections or to avoid hazards. Because of the nature of bicycle handling, potential hazards can include surface irregularities.

Recommended stopping sight distance

Table 6.2 provides recommended design speeds for shared use paths in Cobb County:

Design Speed	Stopping Sight Distance
10 mph	50 feet
15 mph	85 feet
20 mph	127 feet
30 mph @ 4% grade	253 feet
30 mph @ 6% grade	268 feet
30 mph @ 8% grade	287 feet

Table 6.2: Recommended Stopping Sight Distance for Shared Used Paths

6.3.3 PATH WIDTH

Shared use path width needs, at a minimum, to accommodate two design users to pass each other in opposing directions. The *Bike Guide* recommends a minimum width for shared use paths of 10 feet. The Characteristics of Emerging Road and Trail Users and Their Safety Report supports this minimum width. In this study bicyclists were found to have a "sweep" width of approximately 40 inches. This means two bicyclists could pass each other with approximately 16 inches of separation and still maintain a foot of clearance to the outside of the path. The *Bike Guide* also recommends considering increasing the width of shared use paths to 12 feet or more if there substantial use by not only cyclists, but joggers, in-line skaters, and/or pedestrians as well. The Characteristics research found in-line skaters to have a sweep width of 5 feet, further supporting the *Bike Guide* recommendations.

The AASHTO *Bike Guide* acknowledges that under certain conditions it may be necessary or desirable to increase the width of a shared use path to 12 feet, or even 14 feet, due to substantial use by bicycles, joggers, skaters and pedestrians, use by large maintenance vehicles, and/or steep grades.

The volume (or expected volume) of users on a shared use path should also be considered when selecting the appropriate width for a shared use

path. The FHWA report *Evaluation of Safety, Design, and Operation of Shared use Paths—Final Report*[18] provides a methodology for calculating the level of service for shared use paths based upon the number and type of users and the width of the path.

The *Bike Guide* also recognizes that under some conditions it may be necessary to reduce a shared use path's width to a minimum of 8 feet. According to AASHTO, this reduced should only be used where –

- Bicycle traffic is expected to be low, even on peak days or during peak hours,
- Pedestrian use of the facility is not expected to be more than occasional,
- There will be good horizontal and vertical alignment providing safe and frequent passing opportunities, and
- During normal maintenance activities the path will not be subjected to maintenance vehicle loading conditions that would cause pavement edge damage.

Some research suggests that the width of a path also influences the speed of the users on the path. Narrower paths appear to result in reduced travel speeds.

While it is understood that there will be instances in which the minimum widths stated below cannot be achieved, the following recommended widths should be provided whenever possible.

Independent alignment shared use paths

An independent alignment shared use path is one which does not closely parallel a roadway. Rail-trails are the most frequently thought of type of independent alignment shared use path, but these facilities may be located along utility easements, undeveloped platted roadways, or other exclusive rights of way.

Independent shared use paths are typically quite long and well used by a myriad of user types – cyclists, skaters, joggers with dogs, adults on tricycles, kids, etc. Often they experience high volumes during peak activity periods. Users tend to be a mix of lower and higher speed users making it important to provide passing opportunities. Adequate width should be provided on these facilities to accommodate the various user types and speeds.

To accommodate higher design speeds, multiple user types and higher volumes of users, the recommended minimum width for an independent alignment shared use path in Cobb County is 12 feet. A sketch of a typical cross section is shown in Figure 6.24 on page 6-33.

[18] *Evaluation of Safety, Design, and Operation of Shared use Paths—Final Report*, FHWA, 2006.

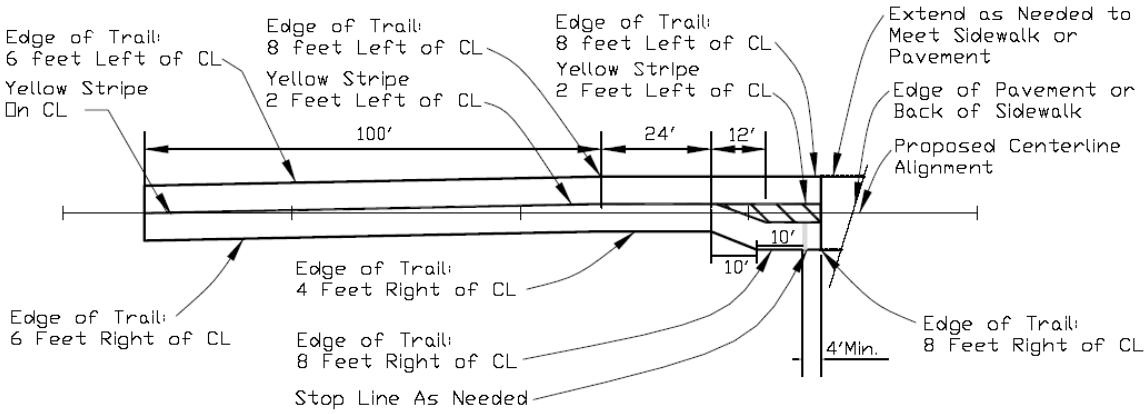


Figure 6.23: Pathway offset diversion treatment for slowing shared use path traffic on the approach to intersections

School paths/local connectors

A subset of the independent alignment shared use path is the local connector. Local connectors make short linkages between other facilities. Often these are represented by "short-cut" paths to schools or between neighborhoods. They may serve a limited number of users. School paths often function as (essentially) one-way facilities under peak volume conditions. School paths and local connectors should be a minimum of 8 feet wide, with 10 feet preferred when higher volumes are expected (see *Evaluation of Safety, Design, and Operation of Shared use Paths—Final Report*).

Shared use paths adjacent to a roadway

According to the AASHTO *Guide for the Development of Bicycle Facilities*, "when shared use paths are located immediately adjacent to a roadway, some operational problems are likely to occur." These include the following:

- They require one direction of bicycle traffic to ride against motor vehicle traffic. This is contrary to motorists' expectations and may result in motorists not noticing the "against traffic" cyclists until it is too late to prevent a crash.
- Traffic exiting side streets or driveways may block the path.
- Signs posted for motorists are facing away from cyclists riding against traffic.
- The proximity of a path to a roadway may require barriers to keep cyclists from falling into the roadway or errant motor vehicles from running onto the path.

A further explanation of these and other points is provided in the

AASHTO Bike Guide on pages 34 and 35.[19]

More recent research suggests there may be ways to mitigate some of these operational problems.[20] Chief among the potential methods for reducing the operational problems of pathways adjacent to the roadways is reducing speeds along the facilities, particularly at intersections.

A minimum width of 8 feet should be used for shared use paths adjacent to a roadway. A sketch of a typical cross section is shown in Figure 6.25 on page 6-33. For shared use paths adjacent to a roadway that serve as connectors for regional trails a minimum of 10 feet width is desirable; however, offsets (kinks) and neck-downs to slow down users may be appropriate on intersection approaches. A graphical example of such a treatment is shown in Figure 6.23.

Where a pathway is located adjacent to a roadway, the path should be located a minimum of 5 feet from the edge of the shoulder or face of curb. If 5 feet cannot be obtained, a suitable barrier at least 42 inches high should be provided. However care must be taken that this barrier does not preclude visibility for any approach to intersections or driveways.

Recommended path widths

Table 6.3 provides recommended path widths for shared use paths in Cobb County.

Facility type	Minimum Width
Independent alignment	12 feet
School paths / connectors	8 feet[a]
Paths adjacent to a roadway	8 feet[b]

[a]10 feet for higher volume facilities
[b]10 feet for regional trail connectors

Table 6.3: Recommended Shared Used Path Widths

6.3.4 CLEARANCES

Maintaining safe horizontal and vertical clearances to obstruction are important considerations of shared use path design.

Minimum horizontal clearance to obstructions

Shared use path users should be provided a horizontal clearance to obstructions. AASHTO recommends a minimum 2 foot graded shoulder with a maximum slope of 1:6 should be maintained adjacent to the path. AASHTO recommends 3 feet of

[19] AASHTO *Guide for the Development of Bicycle Facilities*, 1999, pp. 33-35.
[20] Petritsch, Landis, Huang, and Challa. "Sidepath Safety Model - Bicycle Sidepath Design Factors Affecting Crash Rates", *Transportation Research Record 1982*, Transportation Research Board, 2006.

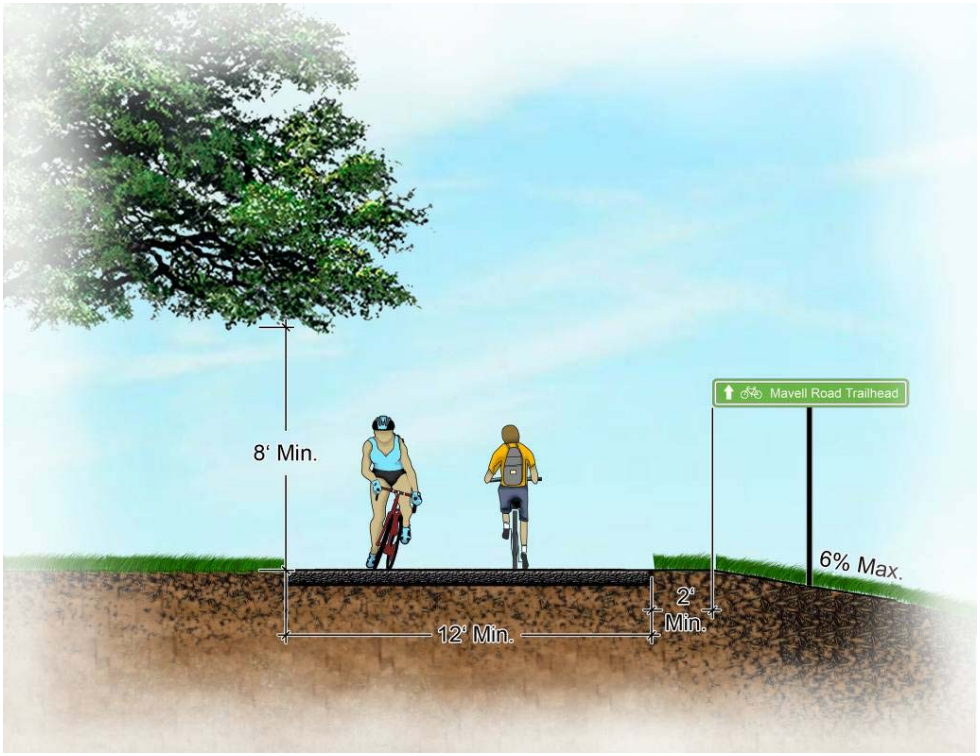


Figure 6.24: Independent Alignment Shared Used Path

Figure 6.25: Shared Used Path Adjacent to a Roadway

separation to vertical obstructions. A minimum of 5 feet should be maintained between shared use paths and embankments with greater than 3:1 slope. If this spacing cannot be maintained some sort of barrier should be considered. At a minimum, if an embankment with a slope greater than 3:1 is within 2 feet of the path and the drop-off exceeds 30 inches, an appropriate barrier should be installed. If a greater than 10-inch drop-off is located within 2 feet of the path it should be shielded.

Minimum vertical clearance to obstructions

A minimum vertical clearance of 8 feet above the surface of the shared use path should be maintained to overhead obstructions. A 10-foot vertical clearance is desirable.

6.3.5 HORIZONTAL ALIGNMENT

The horizontal alignment of shared use paths is dependent upon the facility design speeds. Maximum radii for paths are determined using the equation given on the bottom of page 37 in the AASHTO *Bike Guide*.

Recommended minimum turning path radii

Table 6.4 provides recommended minimum radii for shared use paths in Cobb County.

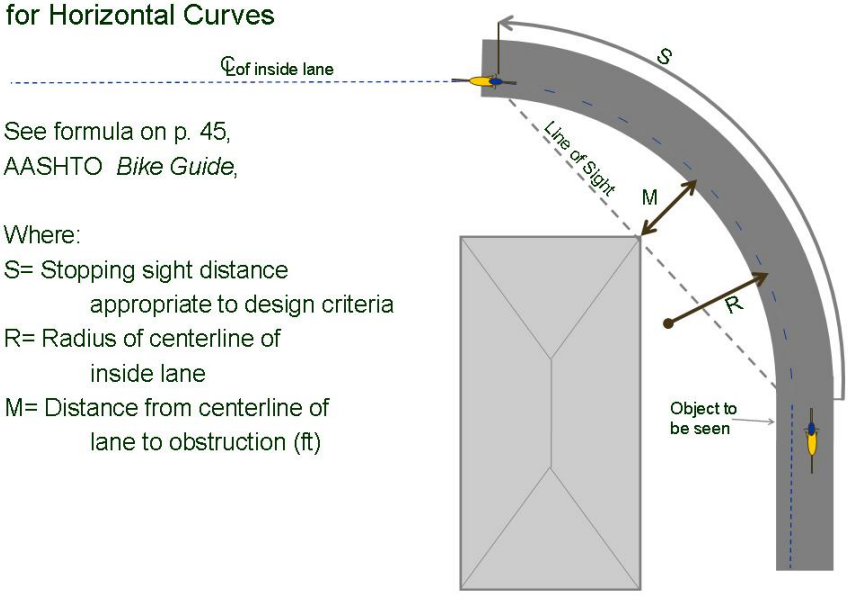
Design Speed	Radius
10 mph	23 feet (20 feet)
15 mph	55 feet (49 feet)
20 mph	102 feet (89 feet)
30 mph	316 feet (260 feet)
The above dimensions assume a cross slope of 2% to the outside of the curve. The reduced values shown in parentheses may be used with a 2% cross slope to the inside of the curve.	

Table 6.4: Recommended Minimum Radii for Shared Used Path

Minimum offset to visual obstructions

When a visual obstruction is adjacent to a pathway, curves must be designed to maintain adequate sight distances around the obstructions. To do this, a minimum separation of the curved path to the potential visual obstruction must be maintained. Calculation of this minimum obstruction distance is calculated as shown in the graphic (Figure 6.26) and with the equations provided. A table of values is also provided.

Minimum Lateral Clearance for Horizontal Curves



See formula on p. 45, AASHTO *Bike Guide*,

Where:
S= Stopping sight distance appropriate to design criteria
R= Radius of centerline of inside lane
M= Distance from centerline of lane to obstruction (ft)

$$M = R\left[1 - \cos\left(\frac{28.65S}{R}\right)\right]$$

$$S = \frac{R}{28.65}\left[\cos^{-1}\left(\frac{R-M}{R}\right)\right]$$

Stopping Sight Distance

Radius	50	75	100	125	150	175	200	225	250	275	300
20	13.7										
40	7.6	16.3	27.4	39.7							
60	5.1	11.3	19.7	29.7	41.1	53.3					
80	3.9	8.6	15.1	23.2	32.7	43.3	54.8	66.9	79.3		
100	3.1	7.0	12.2	18.9	26.8	35.9	46.0	56.9	68.5	80.6	92.9
125	2.5	5.6	9.9	15.3	21.8	29.4	37.9	47.3	57.5	68.3	79.7
150	2.1	4.7	8.3	12.8	18.4	24.8	32.1	40.3	49.1	58.7	69.0
200	1.6	3.5	6.2	9.7	13.9	18.8	24.5	30.8	37.8	45.4	53.7
250	1.2	2.8	5.0	7.8	11.2	15.2	19.7	24.9	30.6	36.9	43.7
300	1.0	2.3	4.2	6.5	9.3	12.7	16.5	20.9	25.7	31.0	36.7
350	0.9	2.0	3.6	5.6	8.0	10.9	14.2	17.9	22.1	26.7	31.7
400	0.8	1.8	3.1	4.9	7.0	9.5	12.4	15.7	19.4	23.4	27.8
500	0.6	1.4	2.5	3.9	5.6	7.6	10.0	12.6	15.5	18.8	22.3
600	0.5	1.2	2.1	3.3	4.7	6.4	8.3	10.5	13.0	15.7	18.7
700	0.4	1.0	1.8	2.8	4.0	5.5	7.1	9.0	11.1	13.5	16.0
800	0.4	0.9	1.6	2.4	3.5	4.8	6.2	7.9	9.7	11.8	14.0
900	0.3	0.8	1.4	2.2	3.1	4.3	5.6	7.0	8.7	10.5	12.5
1000	0.3	0.7	1.2	2.0	2.8	3.8	5.0	6.3	7.8	9.4	11.2

Figure 6.26: Minimum Lateral Clearance for Horizontal Curves

6.3.6 VERTICAL ALIGNMENT

Grade

Cobb County has many areas where grades may play a significant role in the planning and design of shared use paths. For bicyclists, significant uphill grades can influence decisions in what routes they will ride or even if they will ride a bike at all. Consequently, whenever possible grades should be kept to a minimum.

The AASHTO *Bike Guide* notes that grades greater than 5% are undesirable because the ascents are difficult for many bicyclists and the descents may cause some cyclists to exceed speeds at which they are competent. Additionally, the Americans with Disabilities Act Architectural Guidelines (ADAAG) state the maximum longitudinal grade for an accessible route is 5%; shared use paths must meet this criterion.[21]

In some instances, a greater than 5% grade cannot be avoided. The AASHTO *Bike Guide* provides desirable maximum lengths for grades steeper than 5%, these are shown in Table 6.5.

Grade	Desired Maximum Length
5-6%	800 ft
7%	400 ft
8%	300 ft
9%	200 ft
10%	100 ft
≥11%	50 ft

Table 6.5: Recommended Minimum Lengths for Grades on Shared Used Paths

Where steeper than 5% grades are used the following design measures should be considered:

- Increase clear recovery areas next to the path by providing wider shoulders and greater clearances to obstructions and embankments steeper than 3:1.
- Increase the width of the path above the required minimum to provide additional “wobble” space for cyclists.
- Use greater than the minimum allowable stopping sight distances.
- Install rest areas 5 feet long at the desired maximum distances described above; these should be full width of the path and have a maximum of 5% slope in any direction.

[21]The ADAAG has a provision for *conditions of infeasibility.* If the existing grade of a right-of-way exceeds 5%, following the existing grade is still allowed.

- Install a Hill warning sign (W7-5) no less than 50 feet in advance of the slope.
- Install centerline striping to better delineate the sides of the path.
- At trailheads or informational kiosks, provide information (such as a profile under a map) of the grades on the trail.

Vertical curves

Crest vertical curves must be long enough to allow bicyclists to see over the crest to any surface irregularities that may exist on the path surface. The AASHTO *Greenbook*[22] provides the following equations for the minimum length of vertical curves.

When $S > L$ $$L = 2S - \frac{200\left(\sqrt{h_1} + \sqrt{h_2}\right)^2}{A}$$

When $S < L$ $$L = \frac{AS^2}{100\left(\sqrt{2h_1} + \sqrt{2h_2}\right)^2}$$

Where

L = minimum length of vertical curve (ft)
A = algebraic grade difference (percent)
S = stopping sight distance (ft)
h_1 = driver's eye height (ft)
H_2 = object height (ft)

when S > L $L = 2S - \frac{900}{A}$

when S < L $L = \frac{AS^2}{900}$

Height of cyclist's eye – 4 1/2 ft
Height of object – 0 ft

For bicyclists the driver's eye height is considered 4.5 feet and the object height is considered 0 feet. The AASHTO *Bike Guide uses* these values to obtain the following simplified equations.

Figure 6.27 on the following page is taken directly from the AASHTO *Bike Guide* (pg. 44) and provides minimum lengths of vertical curves for given algebraic differences in grade.

[22] A Policy on the Geometric Design of Highways and Streets, 2004, AASHTO.

A	S = Stopping Sight Distance (ft)														
(%)	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
2												30	70	110	150
3								20	60	100	140	180	220	260	300
4						15	55	95	135	175	215	256	300	348	400
5					20	60	100	140	180	222	269	320	376	436	500
6				10	50	90	130	171	216	267	323	384	451	523	600
7				31	71	111	152	199	252	311	376	448	526	610	700
8			8	48	88	128	174	228	288	356	430	512	601	697	800
9			20	60	100	144	196	256	324	400	484	576	676	784	900
10			30	70	111	160	218	284	360	444	538	640	751	871	1000
11			38	78	122	176	240	313	396	489	592	704	826	958	1100
12		5	45	85	133	192	261	341	432	533	645	768	901	1045	1200
13		11	51	92	144	208	283	370	468	578	699	832	976	1132	1300
14		16	56	100	156	224	305	398	504	622	753	896	1052	1220	1400
15		20	60	107	167	240	327	427	540	667	807	960	1127	1307	1500
16		24	64	114	178	256	348	455	576	711	860	1024	1202	1394	1600
17		27	68	121	189	272	370	484	612	756	914	1088	1277	1481	1700
18		30	72	128	200	288	392	512	648	800	968	1152	1352	1568	1800
19		33	76	135	211	304	414	540	684	844	1022	1216	1427	1655	1900
20		35	80	142	222	320	436	569	720	889	1076	1280	1502	1742	2000
21		37	84	149	233	336	457	597	756	933	1129	1344	1577	1829	2100
22		39	88	156	244	352	479	626	792	978	1183	1408	1652	1916	2200
23		41	92	164	256	368	501	654	828	1022	1237	1472	1728	2004	2300
24	3	43	96	171	267	384	523	683	864	1067	1291	1536	1803	2091	2400
25	4	44	100	177	278	400	544	711	900	1111	1344	1600	1878	2178	2500

Shaded area represents S = L

L = Minimum Length of Vertical Curve (ft)
A = Algebraic Grade Difference (%)
S = Stopping Sight Distance (ft)

Minimum Length of Vertical Curve = 3 ft.

Figure 6.27: Minimum Length of Crest Vertical Curve (L) Based on Stopping Sight Distance
A Policy on the Geometric Design of Highways and Streets, 2004, AASHTO

6.3.7 INTERSECTIONS OF SHARED USE PATHS AND ROADWAYS

When at grade crossings occur between a shared use path and a roadway an intersection is created. Just as with any other intersection, several questions must be addressed when deciding upon how the intersection is to be designed. In particular, what specific traffic controls should be installed:

- Which facility, road or path, should be the priority facility?
- What is the least restrictive form of control that can be used (none, yield, stop, or signal)?
- What treatments should be installed?

The following sections of these design guidelines address these questions.

Assigning priority

Assigning priority at an intersection between a path and roadway will be decided differently for a path adjacent to a roadway and an independently aligned path.

Paths Adjacent to a Roadway

When a shared use path is built adjacent to a roadway, a sidepath, the sidepath should be given the same priority at intersections as the road it parallels.[23] Therefore, if the path parallels an arterial roadway and all side streets are STOP sign controlled to provide priority to the arterial, then the stop signs should be placed so that users of the path also have priority and are not required to stop.

Paths on Independent Alignments

When a shared use path intersects a roadway, a decision must be made as to which facility will a have priority and which will have to yield or stop. It should not be assumed that a roadway will always receive priority over a shared use path. According to the MUTCD –

> *Speed should not be the sole factor used to determine priority, as it is sometimes appropriate to give priority to a high-volume shared use path crossing a low-volume street, or to a regional shared use path crossing a minor collector street.*
>
> *When placement of STOP or YIELD signs is considered, priority at a shared use path/roadway intersection should be assigned with consideration of the following:*
> *A. Relative speeds of shared use path and roadway users;*
> *B. Relative volumes of shared use path and roadway traffic; and*
> *C. Relative importance of shared use path and roadway.*
>
> *When priority is assigned, the least restrictive control that is appropriate should be placed on the lower priority*

[23] AASHTO *Guide for Development of Bicycle Facilities,* pg. 34.

approaches. STOP signs should not be used where YIELD signs would be acceptable. [Provided adequate geometry exists for the needed visibility of approaching vehicles/users.]

Given the above, the fact that a roadway may have higher speeds might be offset by the volume of the pathway being much higher than that of the roadway. A local roadway might also be considered a lower priority than a regional pathway.

For two lane roadways, using the volumes and speeds of the pathway and its intersecting roadways is recommended to determine which facility should get priority. Figure 6.28 on the following page shows how this would be applied. Enter the graph with the roadway and path volumes, if the intercept is above the sloped line corresponding to the speed limit of the roadway, the roadway should receive the priority at the crossing. (Essentially the slope of each line is adjusted to reflect the proportionate speeds of the intersecting facilities.)

Least Restrictive Form of Traffic Control

The type of traffic control (Stop or Yield signs) required at an intersection is dependent upon intersection sight distances. Where possible Yield signs should be used as they are less restrictive than Stop signs and more representative of how path users are likely to behave. Overuse of Stop signs can lead to a lack of respect for the signs and unsafe assumptions by pathway users. This can further lead to the necessity for more authoritative traffic control devices where the cyclists really must stop to be safe.

Available sight distances are the primary determining factor in deciding whether Yield sign or Stop sign is appropriate at an intersection. The criteria in AASHTO's *Green Book* [24] should be used to determine if Yield control is acceptable. (Note, however, that significant clear right-of-way is needed and must be maintained for the use of "yield" control.) Examples of required sight distances are provided on pages 6-42 through 6-43.

[24] *A Policy on the Geometric Design of Highways and Streets*, AASHTO, 2004, pp. 666-669

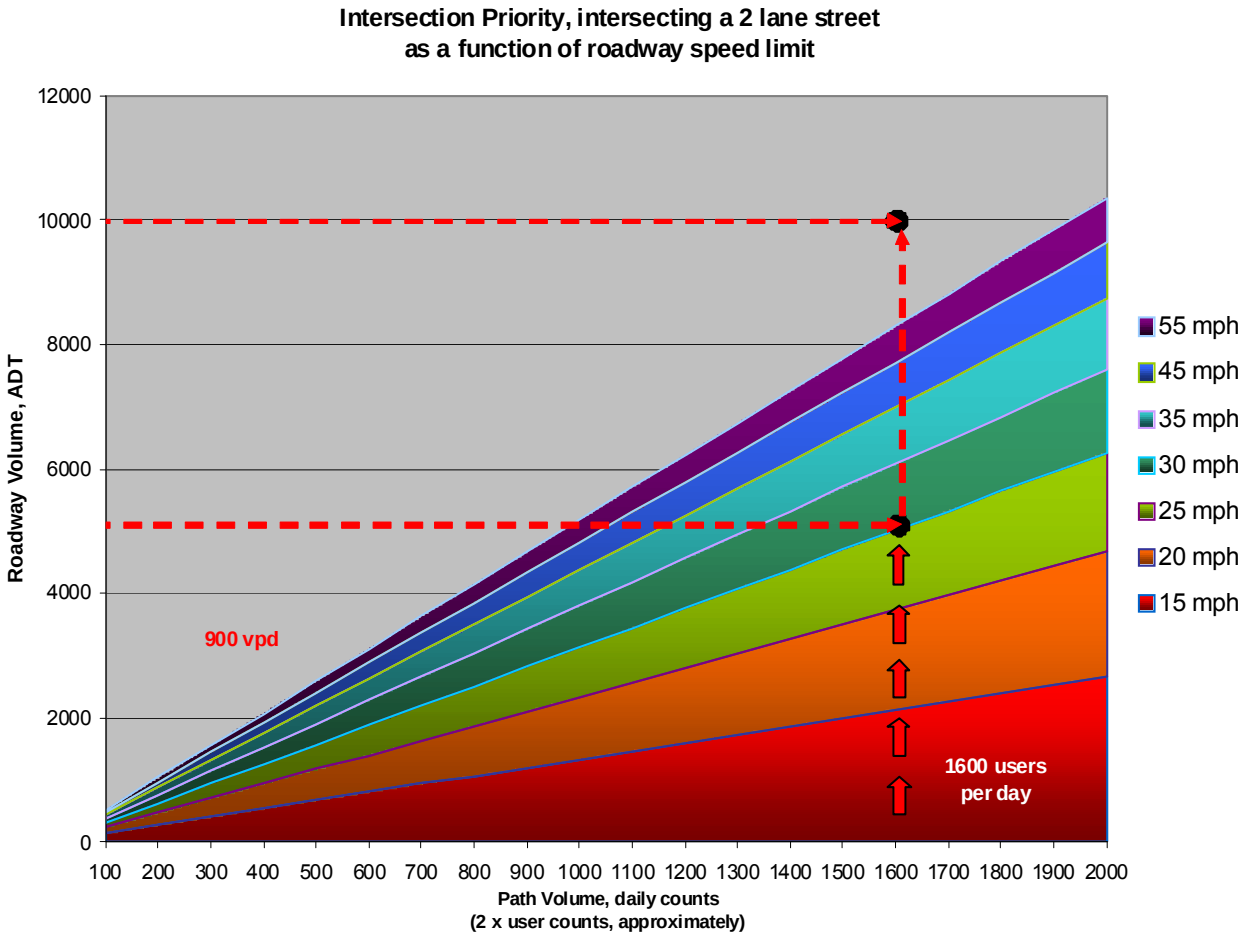


Figure 6.28: Proposed priority based upon facility speeds and volumes

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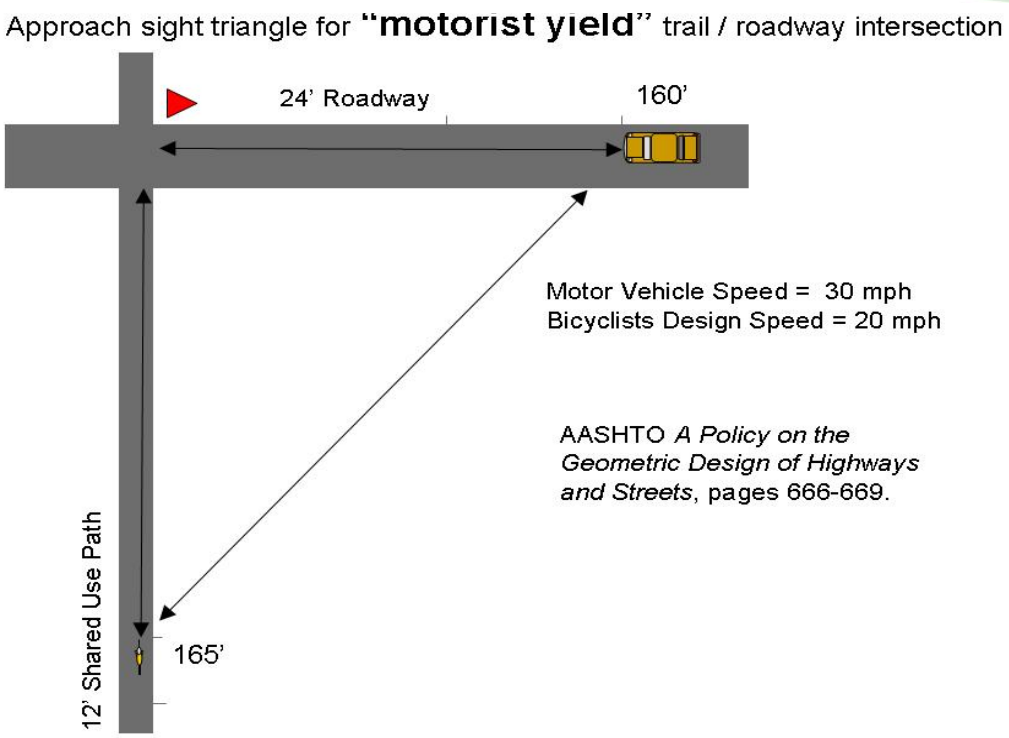

Figure 6.29: Proposed sight triangle for "motorist yield"

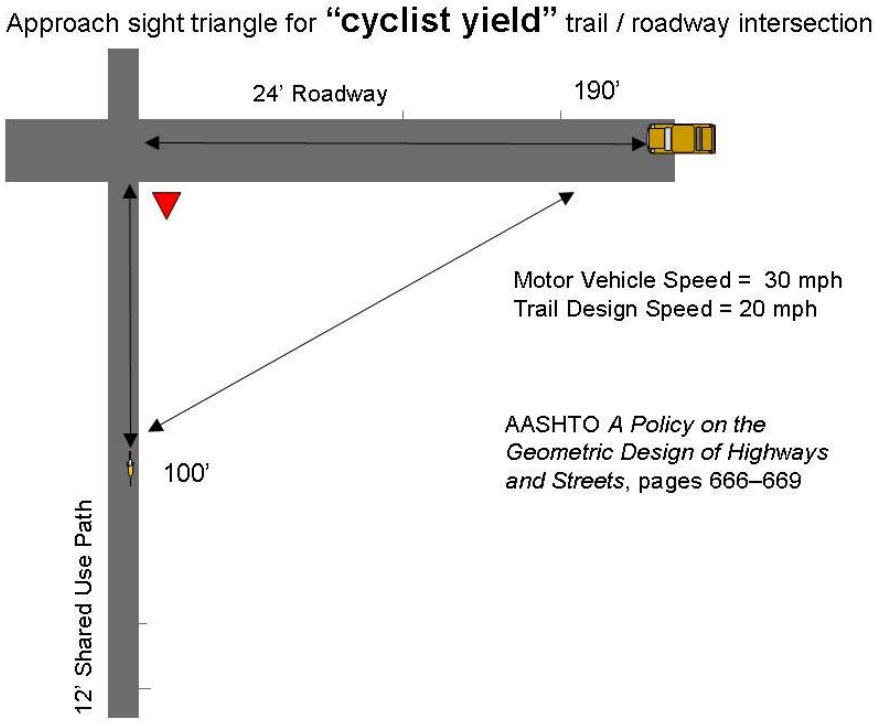

Figure 6.30: Proposed sight triangle for "cyclist yield"

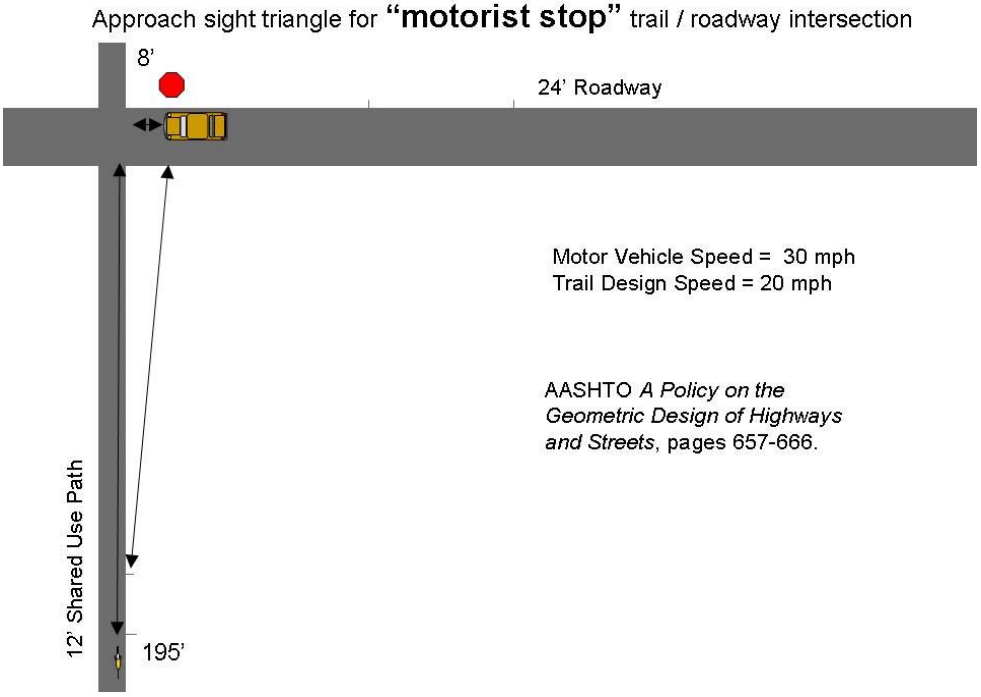

Figure 6.31: Proposed sight triangle for "motorist stop"

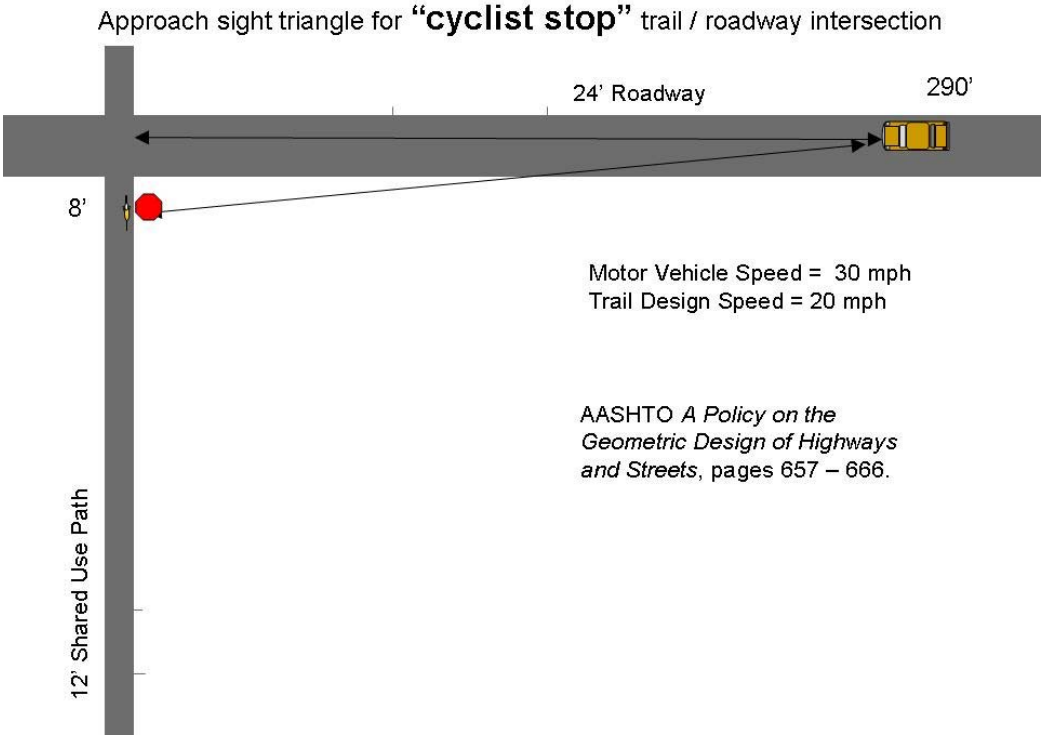

Figure 6.32: Proposed sight triangle for "cyclist stop"

Supplemental Traffic Control Devices at Unsignalized Path Crossings

Unsignalized Crossings

The MUTCD provides information on what type of traffic control devices may be used at shared use path crossings. However, other than requiring crosswalk markings and Bicycle or Pedestrian Warning signs it provides no clear guidance about what conditions any particular traffic control devices are recommended to be used. The Atlanta Regional Commission *Bicycle Transportation and Pedestrian Pathways Plan* includes an appendix which makes specific recommendations with regard to what traffic control devices should be used for particular roadway/pathway conditions. While this document provides good guidance, recent developments on the national level with regard to FHWA acceptance of particular traffic control devices make it appropriate make some minor revisions to that document. The revised guidelines are provided below:

For these guidelines, roadways were stratified into low-, medium-, and high-volume. The threshold volume for low- to medium-volume is determined using the amount of time a pedestrian can expect to wait for an adequate gap in traffic to cross the street. The medium- to high-volume threshold is based upon a midblock crossing safety study prepared by the University of North Carolina's Highway Safety Research Center.[25] Depending on whether the street being crossed is low medium or high volume, the corresponding table, 6.6, would be referenced to determine the recommended traffic control devices for the crossing.

In the application, one would determine the volume of traffic in the lanes being crossed and use Table 6.6 below to determine which table in the traffic control matrices to use.

Traffic Volume in Lanes Being Crossed	
> 6,700 vpd	Table 6.7
6,700 – 12,000 vpd	Table 6.8
>12,000 vpd	Table 6.9

vpd = vehicles per day

Table 6.6: Volume Thresholds for the Crossing Treatments Guidelines

The proposed traffic control matrices of appropriate treatments are shown on the following pages.

[25] For a detailed discussion of how the low-, medium-, and high-volume roadway thresholds were obtained, please see *2007 Atlanta Region Bicycle Transportation & Pedestrian Walkways Plan (adopted September 26, 2007)*

General notes for applying the Crossing Treatment Guidelines Matrices

1. Each column in the table represents a package of traffic control devices recommended for the specific crossing condition.
2. The designation of "YES" for the median assumes there is potential for installing a raised median at the crossing location and that one will be installed. Raised medians that can be used as pedestrian refuges (6 feet wide or wider in the direction of the roadway cross-section) will allow for less restrictive motor vehicle traffic controls to be used in conjunction with the midblock crossings. Wider refuge islands, 10 feet or more, should be considered to accommodate bicycle with trailers and recumbent bicycles.
3. On multi-lane roadways with medians on the approach, crossing signage for motorists should be placed in the medians as well as on the side of the roadway.
4. The use of Danish offsets (angled cuts through the median) should be considered at all crossings with raised medians for two reasons. First, the offset through the median directs the path users' attention toward the traffic about to be crossed. Secondly, by providing an angled cut through the median, longer users (tandems, bicycles with trailers) may be better accommodated in a narrower median. Cattle-gate style crossings which require two 90 degree turns in a short distance can restrict the passage of longer users; if used they should be carefully designed.
5. When advance yield lines are used on the approach roadways they should be used in conjunction with solid lane lines extending back the stopping sight distance from yield lines. This is to enable law enforcement officers to determine when a motorist fails to yield when he could have done so.
6. On six-lane, undivided roadways, strong consideration should be given to providing a grade-separated crossing of the roadway for pathway users. Until such time as this can be achieved, aggressive channelization should be used to divert pathway users to the nearest safe crossing.
7. This guidance assumes that lighting will be considered and provided where needed for crossings that are used at night.
8. Priority for low volume crossings (whether the road or path must yield) should be set considering the relative speeds, volumes, and the relative importance of the road or path. Sight distance should also be considered.
9. Yellow centerlines should be considered on the path approaches to crossings for a distance equal to the design stopping sight distance for the path. YIELD/STOP signs should be installed as appropriate, as should yield markings or stop bars.

Table 7: Roadway Volume less than 650 vehicles per hour, vph (6,700 vehicles per day[1], vpd)												
Lanes	2 – lanes						4 - lanes					
Median	No			Yes			No			Yes		
Speed	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph
Marked Crosswalks	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
COMBINED BICYCLE/PEDESTRIAN CROSSING Sign (W11-15) w/ Arrow (W16-7p)[2] 	✓			✓	✓					✓	✓	
Advance Ped Xing Sign[2] (W1-2)	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Yield Here to Ped Signs (R1-5)[3] 		✓	✓			✓	✓			✓	✓	✓
Advance yield lines[4]		✓	✓			✓	✓	✓	✓	✓	✓	✓
On demand crossing[5]			✓					✓	✓			✓

[1] Assumes a K factor of 0.097

[2] *The COMBINED BICYCLE/PEDESTRIAN CROSSING warning sign is in the 2009 MUTCD. Strong Yellow Green may be used for this sign. If these guidelines are used for midblock PEDESTRIAN crossings, the W11-2 Pedestrian warning signs should be used.*

[3] *MUTCD* 2B.11

[4] Placed 20 -50 feet in advance of the crosswalk (Section 3B.16)

[5] See attached discussion on Page 49.

Table 8 : Roadway Volume greater than 650[1] vph (6,700 vpd) and less than 1,150 vph (12,000 vpd)

Lanes	2 - lanes						4 - lanes						6 - lanes					
Median	No			Yes			No			Yes			No			Yes		
Speed	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph
Marked Crosswalks	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
COMBINED BICYCLE/PEDESTRIAN CROSSING Sign (W11-15) w/ Arrow (W16-7p)[2] 	✓	✓		✓						✓								
Ped Xing Sign (advance)[2]	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yield Here to Ped Signs (R1-5)[3] 		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓						
Advance Yield lines[4]		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓						
Stop Lines[5]													✓	✓	✓	✓	✓	✓
On demand crossing[6]			✓			✓	✓	✓	✓		✓	✓						
Special considerations[7]													✓	✓	✓	✓	✓	✓

[1] Assumes a K factor of 0.097

[2] *The COMBINED BICYCLE/PEDESTRIAN CROSSING warning sign is in the 2009 MUTCD. Strong Yellow Green may be used for this sign. If these guidelines are used for midblock PEDESTRIAN crossings, the W11-2 Pedestrian warning signs should be used.*

[3] Placed 20 -50 feet in advance of the crosswalk (Section 3B.16)

[5] *MUTCD* Section 3B.16

[6] See attached discussion on Page 49.

[7] See attached discussion on Page 51.

Table 9: Roadway Volume greater than 1,150 vph[1] (12,000 vpd)

Lanes	2 - lanes						4 - lanes						6 - lanes					
Median	No			Yes			No			Yes			No			Yes		
Speed	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph	≤ 30 mph	35–40 mph	≥ 45 mph
Marked Crosswalks	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
COMBINED BICYCLE/PEDESTRIAN CROSSING Sign (W11-15) w/ Arrow (W16-7p)[2] 	✓	✓		✓	✓					✓	✓	✓						
Ped Xing Sign (advance)[2]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yield Here to Ped Signs (R1-5)[3] 		✓	✓		✓	✓	✓			✓	✓	✓						
Advance yield Lines[4]		✓	✓		✓	✓	✓			✓	✓	✓						
Stop Lines[5]								✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
On demand crossing[6]			✓			✓	✓											
Special consideration[7]								✓	✓				✓	✓	✓	✓	✓	✓

[1] Assumes a K factor of 0.097

[2] *The COMBINED BICYCLE/PEDESTRIAN CROSSING warning sign is in the 2009 MUTCD. Strong Yellow Green may be used for this sign. If these guidelines are used for midblock PEDESTRIAN crossings, the W11-2 crossings – because of bicyclists higher speeds as opposed to pedestrians. If these guidelines are used for midblock PEDESTRIAN crossings, the W11-2 Pedestrian warning signs should be used.*

[3] Placed 20 -50 feet in advance of the crosswalk (Section 3B.16)

[5] *MUTCD* Section 3B.16

[6] See attached discussion on Page 49.

[7] See attached discussion on Page 51.

Activated Pedestrian Treatments: Traffic control devices on the approach to a crossing must inform roadway users (and the non-motorized users) of the fact that a conflict may occur, make them aware of their responsibilities on the approach to the crossing, and provide adequate time/space for everyone to behave accordingly. Research has shown that many of the standard, static traffic control devices used to warn motorists of crossings do not result in motorist compliance with the rules to stop for pedestrians in crosswalks. Whether it is because of ignorance of the rules, lack of courtesy, or unawareness of the crossing; the failure of motorists to yield/stop for pedestrians/pathway users in crosswalks results in numerous problems. At best, motorist failure to yield can prevent pedestrians from crossing the roadway and create excessive delays for those who wish to use the crossing. At worst, by failing to yield, motorists place crossing users at risk and create an unsafe condition for all users.

As a result of the inadequacy of static traffic control devices to result in motorist yielding behaviors, several types of active treatments are being/have been tested around the United States to increase motorist yielding. The most basic of these is a continuous flashing beacon at the crosswalk. These can be supplemented with beacons mounted on the W11-15 Combined Bicycle/Pedestrian Crossing warning signs. Research on these types of continuous flashing beacons has shown there to be minimal improvement in driver behaviors where they have been placed.

On demand crossings go beyond the constant flashing beacon by providing a real time, pedestrian activated warning to motorists. These treatments include flashing beacons such as those described above, but only flash when activated by a pedestrian/pathway user. In-pavement lights[26] are another example of this type of activated traffic control device. Research has shown such treatments to be of variable value. At most installations, the motorist yielding rates show a temporary increase, then the improvement effect tapers off, resulting in only a minimal improvement over the long term.

Another type of activated crossing, referred to as the Rapid Rectangular Flashing Beacon, is showing a great deal of promise in test applications. Research suggests motorist yield rates are ranging from 80 to 97 percent six months after deployment. To date this appears to be the most effective combination of traffic control devices that do not actually require the motorist to stop.[27] While not yet in the *MUTCD*, this treatment has obtained an Interim Approval from the FHWA

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[26] *Manual on Uniform Traffic Control Devices*, Chapter 4L

[27] At crosswalks, it is not the warning device (sign, marking) that requires the motorists stop. These devices merely warn the driver of the potential presence of a pedestrian. It is the pedestrian in or approaching the crosswalk that creates the requirement to yield or stop.

for application. It is described in greater detail below.

Rapid Rectangular Flashing Beacon (RRFB): The *RRFB* treatment is a combination of signage markings and pedestrian activated strobe and feedback devices. Signage for the RRFB typically includes advance warning signs (W11-15 would be appropriate for a path crossing of a roadway) with AHEAD supplemental plaques (W16-9p), and YIELD HERE TO PEDS signs (R1-5). Pavement markings include yield markings and solid white lane lines (on divided multi-lane roads); the length of these lines is dependent upon the design stopping sight distance for the roadway. The pedestrian activated treatments would be W11-15 signs with built in rectangular strobe flashers. Additionally, pedestrian visible strobes and a recorded message inform pedestrians when the crossing is activated and instruct them to wait for motorists to yield.

High visibility crosswalks are typically used with the RRFB crossing treatment, as seen in Figure 6.33 below. This treatment has an Interim Approval for use from FHWA. It is provided as an appendix.

Special considerations: At some locations, traffic conditions may be so severe that even the activated treatments described above may not adequately alert motorists to the presence of a crossing or result in acceptable yielding behavior. These locations, if a signal is not warranted (see next section), pose a particular challenge to jurisdictions wishing to promote walking or bicycling. The jurisdictions must choose whether the mobility of the non-motorized user merits more restrictive traffic control of motorists.

Figure 6.33: Rapid Rectangular Flashing Beacon (RRFB): marking plan and view of installed device

Geometric modifications such as raised medians, curb extensions, choke points, or even lane reductions may be considered to improve the crossing environment for crossing users. Used alone or in tandem, these calming treatments can reduce the speeds along the roadway, thereby providing greater sight distances and increasing the propensity for motorists to yield.

There are also some traffic control device treatments which may be considered at these locations. One such treatment, the Pedestrian Hybrid Signal, has been included in the *2009 MUTCD*. The *MUTCD* text is included in an appendix to this document. The Pedestrian Hybrid Signal beacon includes a solid then flashing red requiring motorists to stop. A description of the Pedestrian Hybrid Signal phasing is provided in Figure 6.34 and a photo of an installed device is shown in Figure 6.35.

Figure 6.35: Pedestrian Hybrid Signal: view of installed device

Signalized Pathway Intersections

At shared use path/roadway intersections with a high number of conflicts, it may be advisable to install traffic signals. It must be noted that while traffic signals can reduce delays for pathway users and reduce the potential for some types of crashes, other types of crashes (rear end collisions for example) are likely to increase.

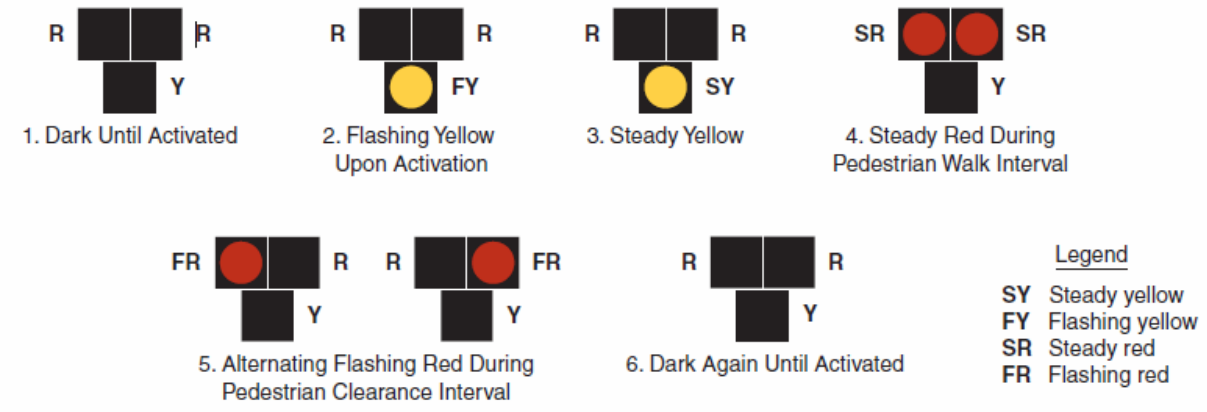


Figure 6.34: Pedestrian Hybrid Signal Phasing

Consequently, a traffic engineering study should be performed prior to the installation of any traffic signal.

One of the basic methods for determining if a traffic signal may be considered at an intersection is a signal warrant study. The MUTCD provides eight different warrants for analyzing intersections:

Warrant 1, Eight-Hour Vehicular Volume
Warrant 2, Four-Hour Vehicular Volume
Warrant 3, Peak Hour Vehicular Volume
Warrant 4, Pedestrian Volume
Warrant 5, School Crossing
Warrant 6, Coordinated Signal System
Warrant 7, Crash Experience
Warrant 8, Roadway Network

For shared use paths, any of these warrants may be applied. For the Pedestrian Volume and School Crossing warrants, both bicyclists and pedestrians may be counted to obtain crossing volumes. For the vehicular volume based warrants (1-3) only bicyclists may be counted.[28]

The Pedestrian Volume warrant has been revised in the 2009 MUTCD, the revised warrant is provided in an appendix of this document.

6.4 BIKE ROUTES

Bike routes can be defined as the links between origins and destinations that have been improved for, or are for some reason considered preferable for, bicycle travel. Bike route wayfinding signage should provide the following basic information:

- Destination of the route
- Distance to the route's destination
- Direction of the route

Bike routes can be divided into the two following categories: General Routes and Number Routes. General Routes are links with a single origin and a single destination. Number Routes form a network of Bike routes that connect several origins to several destinations.

6.4.1 GENERAL ROUTES

General Routes connect users to a single destination. Typical single destinations include:

- Attraction Areas (i.e. stadiums, parks, etc.)
- Neighborhood Areas (i.e. downtown, historic neighborhoods, etc.)
- Trail Networks (i.e. Silver Comet Trail)

[28] *MUTCD*, FHWA, 2009, pg. 9D-1.

A typical sign that conveys the basic wayfinding information for General Routes is shown below in Figure 6.36.

Figure 6.36: Typical General Route Signage

6.4.2 NUMBER ROUTES

Number Routes give users access to a network of routes that connects them to multiple destinations. In addition to the typical wayfinding information, signage for Number Routes should also provide the location of the current network link and the distance to the next network link connections. Information provided by Number Routes' wayfinding signage is similar to the information provided by highway signage to motorists. Figure 6.37 shows a typical sign that conveys wayfinding information for Number Routes.

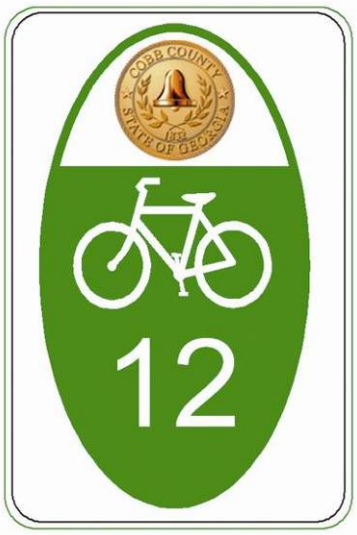


Figure 6.37: Typical Number Route Signage

6.4.3 ADDITIONAL WAYFINDING

Beyond (distance, direction and destination) wayfinding signage, route users find other types of signs useful. Regulatory (Stop, Yield, No Motor Vehicles, etc.) and warning (Intersection Ahead, Path Narrows, etc.) signs are important as well. Informational signage can turn a good day on the path into a great day. Similar to rest areas in interstate highways, kiosks at key locations with "You Are Here" maps that show the Route Network and nearby amenities should be included to provide users with the information needed for a complete and enjoyable use of the route system.

Signs near water fountains telling path users how far it is to the next water fountain, interpretive markers for culturally or environmentally significant sites, and other amenity signs should be used to improve users' experiences. Example amenity wayfinding signs are shown in Figure 6.38.

Figure 6.38: Typical Amenity Wayfinding Signage

6.5 OTHER DESIGN CONSIDERATIONS

There are several specific items that should be considered when designing In-street Bikeways and Shared Used Paths. Following are some typical roadway and roadside design elements that should be designed so as to accommodate bicycle travel.

6.5.1 DRAINAGE INLETS AND UTILITY COVERS

Placement of drainage inlet grates should be avoided within an In-street Bikeway. If this is not possible, drainage inlet grates should be bicycle-safe. The construction of new roadway facilities should consider the use of a curb inlet, instead of a drainage inlet within an In-street Bikeway. Utility covers and drainage grates should be installed to be flush with the pavement.

Drainage inlet grates with slots or gaps parallel to the roadway can trap a bicycle's front wheel and seriously damage the bicycle and harm the cyclist. These types of grates should be replaced with bicycle-safe grates that maintain the required hydraulic capacity for the inlet. A bicycle-safe grate should have at a minimum, bars perpendicular to the travel direction at a 4 inch center-to-center spacing.

For safety considerations, any utility cover or drainage inlet located within an In-Street Bikeway that has been identified to have a gap/opening parallel to the roadway, should be replaced/corrected as soon as practicable.

6.5.2 RAILROAD CROSSINGS

Ideally railroad crossings at roadway grades should be perpendicular to the travel way. The more the railroad crossing deviates from a right angle, the greater the potential for a cyclist's front wheel to be trapped in the tracks, causing the loss of steering control.

A special treatment should be considered for railroad crossings with angles less than 45 degrees. It is recommended a special path is provided for cyclists to cross the tracks at a right angle. The approach and departure shoulder for the special

crossing path should be paved and have sufficient length to allow cyclists to merge into a gap in traffic. Furthermore, warning signs and pavement markings should be installed in accordance with the MUTCD that guide cyclists towards the best crossing angle. Figure 6.39 shows detail of a special railroad crossing treatment.

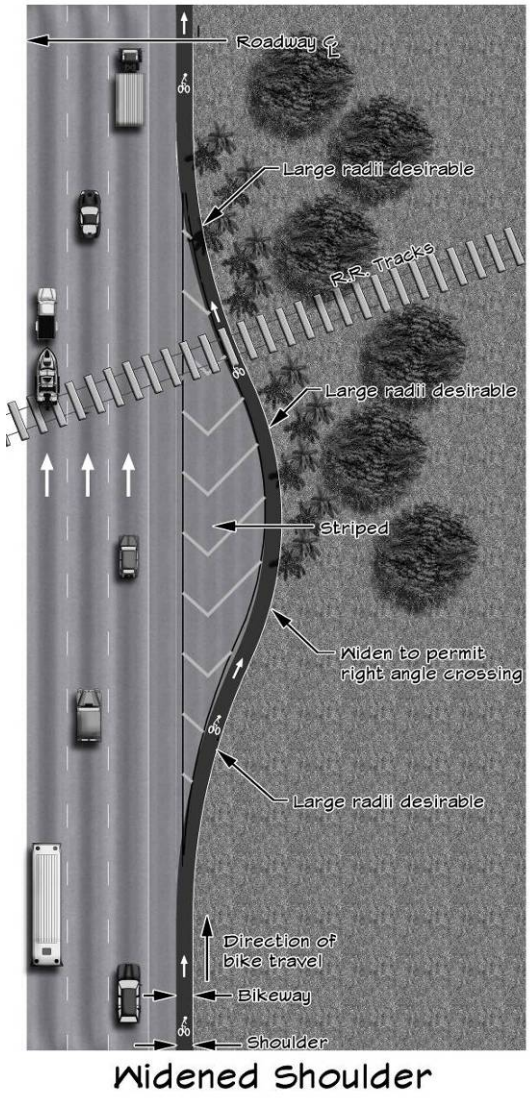


Figure 6.39: Railroad Crossing Treatment

6.5.3 ON-STREET PARKING

On urban roadways with on-street parking, the most common travel path used by cyclists is the area between parked cars and vehicular travel lanes. This area is constricted by opening car doors, extended mirrors which narrow the cyclists' space, and limited views of intersecting traffic.

6.5.4 PAVEMENT SURFACE QUALITY

Bicyclists' (and inline skaters') safety, comfort and speed are affected by the stability and smoothness of the pavement surface. Cracks, joints or drop-offs parallel to the direction of travel can trap cyclists' wheels and cause loss of control. Irregular surfaces, holes or bumps can cause cyclists to encroach into motor vehicle traffic. Additionally, surface obstructions can reduce the cyclists' speed and cause loss of stability. Consequently, maintenance schedules for roadways and paths should consider the needs of these users.

6.5.5 BICYCLE PARKING FACILITIES

Bicycle parking facilities should be provided at trip destinations, and should offer protection from theft and damage. Bicycle parking devices can be divided into two classes, short-term and long-term. The minimum needs for each differ in their placement and protection.

Long-term parking facilities should provide a high degree of security and protection from the weather. Apartment complexes, schools, employment centers, and transit stops are typical places where long-term parking facilities are needed. These facilities are usually lockers, cages or rooms inside buildings.

Short-term facilities should be provided in decentralized parking areas, where the bicycle is left for a short period of time and is visible and convenient to the building entrances. Retail centers, restaurants, and parks are typical places where short-term parking facilities are needed.

Both short-term and long-term parking facilities should be capable of accommodating various types of bicycles, and should be easy to operate. If possible, signs depicting how to operate the facility should be posted.

6.5.6 BICYCLE AMENITIES

Providing supplemental improvements should be considered to enhance and/or promote the use of bikeways. For long continuous paths, rest areas with water fountains are desirable. Improvements that promote a smooth interconnection between bikeways and other transit facilities should also be considered. For example, consider adding racks to buses, connecting bikeways with “park-n-ride” mass-transit facilities or allowing bicycles in rapid rails.

Informational maps showing bike route networks, and their connection to other transit facilities, are economical and highly successful ways to improve the public’s awareness of bicycle facilities. Furthermore, maps can help deter cyclists from using high-speed/volume roadways and other facilities identified as less favorable for bikeways.

6.6 PEDESTRIAN FACILITIES

The planning, design and operation of pedestrian facilities share a main goal: the safety of pedestrians. Special attention to pedestrian safety is needed, because pedestrians are the most vulnerable of all transportation facility users. Pedestrian facilities should also accommodate pedestrians of all abilities. For this reason accessibility is another key factor in the planning, design and operation of pedestrian facilities.

6.6.1 SIDEWALK DESIGN

Routes intended for pedestrian use should include a walkway that meets ADA requirements. Construction of new pedestrian facilities or improvement of existing facilities should meet ADA requirements. Various types of walkways can be used to accommodate pedestrians in the public right-of-way. The most common type is a sidewalk parallel to the roadway. Off-road paths could also be used in rural areas and shared used paths can be used to

accommodate cyclists and pedestrians.

Sidewalk widths

The minimum clear width for a sidewalk should be 4 feet, not including attached curbs. Where sidewalks are less than 5 feet in width, passing spaces at least 5 feet in width, are required (by ADA) to be provided at reasonable intervals not to exceed 200 feet. The 5feet width is needed for wheelchair users to pass another or turn around. Along areas with high pedestrian traffic (i.e. central business district) sidewalk widths greater than 5feet should be included. For example, on sidewalks adjacent to store fronts an additional 2 feet should be provided to accommodate shy distance from walls, shoppers stopping to look into windows, and to avoid conflicts with opening doors and pedestrian traffic.

There are planning tools which can help designers select appropriate sidewalk widths. First, the capacity based sidewalk Level of Service from the current *Highway Capacity Manual*. This methodology provides a way to determine sidewalk widths based upon acceptable levels of congestion on the sidewalk. A second method, which will be included in the 2010 update to the *Highway Capacity Manual* is the same Pedestrian Level of Service used by Cobb County for the *Bicycle and Pedestrian Improvement Plan*. This method ties sidewalk widths to pedestrians' perceptions of safety and comfort.

Buffer widths

To improve pedestrian safety, buffers should be considered along collector and arterial roadways. Buffer area plantings and amenities aid in creating an inviting social setting for the pedestrians. On-street parking and bike lanes can also act as a sidewalk buffer. Buffer widths are measured from the edge of the traveled way. In areas without on-street parking or bike lanes a planting strip is recommended. Local and collector streets should have planting strips from 2 to 4 feet in width. Arterial and major streets should include planting strips from 5 to 6feet in width. Where planting strips are not provided the desirable width for a curb-attached sidewalk should be 6 feet on residential streets and 8 feet on commercial streets.

Bus stops separated from sidewalks by a landscape buffer area should include 60" x 80" paved areas for the loading unloading busses. The bus stop connections also need to meet the requirements of the ADA.

Grade and cross slope

Maximum cross-slope permitted by ADA requirements is 2 percent on any accessible route. When sidewalks are adjacent to a roadway the longitudinal grades are not limited as long as the sidewalk follows the adjacent street's grade. If the sidewalk does not follow the street's grade, the maximum grade allowed by ADA requirements is 5 percent and up to an 8.3 percent ramp

with handrails and landings at reasonable intervals.

Driveway design

Abrupt changes in cross-sectional slopes and warped surfaces disrupt the accessibility of sidewalks. Cross-slopes in new construction or reconstructions should not exceed 2 percent, per ADA requirements. There are several design alternatives to construct driveways that maintain ADA requirements in sidewalks. The two main goals achieved by these alternatives included maintaining a minimum 4 feet wide path with cross-slopes less than 2 percent.

The use of audible and visible signals requiring pedestrians to yield to vehicles at driveways is inappropriate and confusing. This practice should be prohibited.

Driveways at high traffic volume generators should be designed as intersections.

Lighting

To improve visibility, comfort and safety, good street lighting should be promoted at least at intersections and other pedestrian crossing areas. Lighting is also strongly recommended in areas where there is a high concentration of pedestrian activity at dusk or nighttime.

For areas with sidewalk or sidepaths, these facilities should be lit to the same level as the roadway. In shopping districts or downtown areas

Figure 6.40: Lighting for Midblock Crossings

landscaping, awning, or signs may create dark spots along the pedestrian route. In these locations it is desirable to include pedestrian level lighting in addition to street lighting, to improve the security and comfort of pedestrians. At midblock crossings pedestrians should be front-lit, not back-lit. See Figure 6.40 on the previous page.

Protruding Objects and Obstacles

Just like motorists and cyclists, pedestrians have a clearance envelope that should be maintained to prevent conflicts and promote safety. At a minimum an envelope 7 feet in height and 4 feet in width should be kept free of obstacles. However, on wider urban sidewalks the 4-foot wide path cannot be clearly defined. For this reason the following guidelines should be followed to prevent the intrusion of objects and obstacles within the pedestrian clearance envelope.

Wall mounted objects: Objects should not protrude more than 4 inches from a wall when located between 27 inches and 7 feet above the sidewalk.

Single-post mounted objects: Objects should not overhang more than 4 inches per side of post when located between 27 inches and 80 inches above the sidewalk.

Multiple-Post Mounted Objects: The lowest edge of an object mounted on multiple posts having a clear distance between adjacent posts greater than 1feet shall be no higher than 27 inches or no lower than 7feet above the sidewalk.

Drainage grates and utility covers: Manhole covers, hatches and other utility grates, if possible, should be placed outside the pedestrian travel way. However, when present in the walking surface, grates and covers should be mounted flush with the surface. To prevent trapping canes or wheelchairs grate openings should not exceed 5 inches in the direction of travel. If grates in the walking surface have elongated openings, they must be placed so that the long dimension is perpendicular to the predominant direction of travel.

Street trees and buffer plantings: Care should be taken to avoid planting trees or large shrubs that will obstruct the visibility (at planting and maturity height) of pedestrians attempting to cross the street or motorists attempting to enter a driveway. Trees with large canopies planted between the sidewalk and street should generally be trimmed in a manner that provides at least 7feet of clearance between the branches and sidewalk. Tree wells and grates should follow the same criteria described for drainage grates and utility covers described above.

6.6.2 PEDESTRIAN ROADWAY CROSSING DESIGN

Roadways may have excellent sidewalk facilities, but if the street

crossing treatments are uncomfortable to use few pedestrians will use the sidewalks. Following are some typical guidelines and treatments that can be used at pedestrian crossings to enhance safety and functionality.

Intersection/roadway design

Intersections are the most practical and common crossings for pedestrians. Consequently, where pedestrians are anticipated, they should be considered a design user of the intersection. Fortunately, the AASHTO *Greenbook* guidance on intersection design provides for intersections that work for all users.[29] Specifically, it states intersections should be designed to:

- provide for conflicts at right angles;
- provide for one decision/conflict at a time;
- provide protection for pedestrians;
- channelize intersections; and
- minimize conflict areas.

Turning radii

Intersection corner radii should be designed based upon a design vehicle. The type of design vehicle considered is dependent upon the types of roadways intersecting. Turning radius templates should be used during design to ensure that adequate, but not excessive, space is provided for the appropriate design vehicle.

Local streets: Passenger vehicles can be accommodated with 10- to 15-foot street corner radii. Utility vehicles can encroach into adjacent lanes of traffic to make turns if the conflicting approaches are required to stop. In these, typically local street/local street intersections, these small curb radii may be acceptable. This is particularly true when on street parking is allowed on the roadway and provides additional "effective radii" for turning motor vehicles. Twenty-five-foot radii may be more appropriate for new construction depending on the roadway receiving width and design vehicle.

Collector streets: On collector roadway intersections, more frequent turning truck traffic should be anticipated. Thirty-foot radii should be provided so that an occasional truck can turn without too much encroachment**.**

Arterial streets: On arterial roadways where truck traffic is likely, designing with turning templates or truck turning simulation software is very important. This allows for the turning vehicles to be accommodated while minimizing conflict areas. To accommodate turning buses, or large truck combinations, 40-foot radii, or preferably three centered curves, should be provided. Alternatively, right turn channelization islands can

[29] *A Policy on the Geometric Design of Highways and Streets*, Chapter 9, 2004, AASHTO.

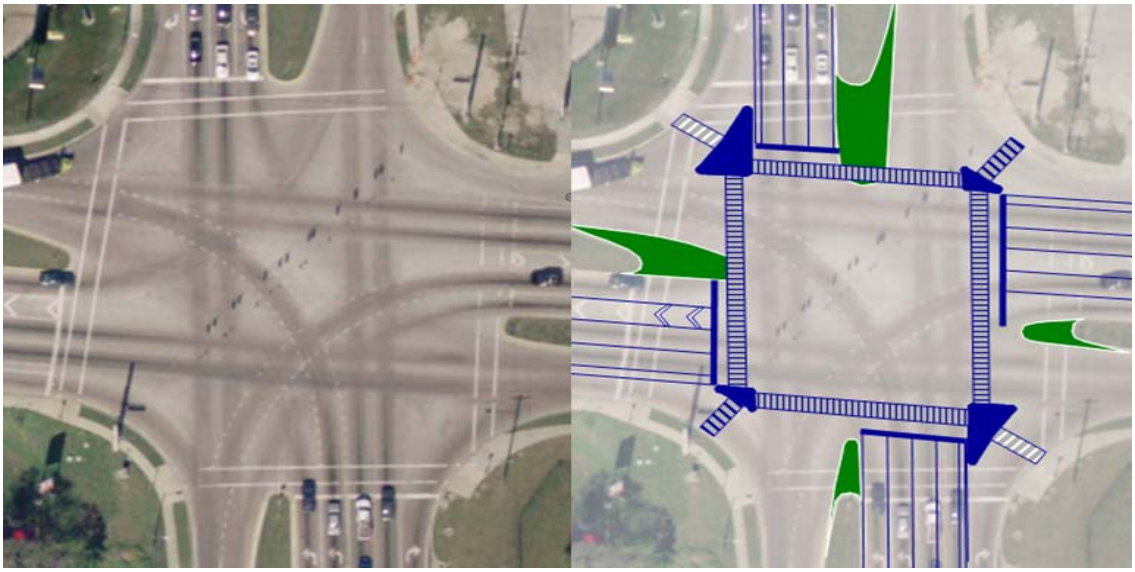


Figure 6.41: Intersection examples

facilitate turning trucks while minimizing crossing distances for pedestrians. Again, where stop control is provided for conflicting vehicles, intersections may be designed to allow trucks to use the entire receiving width of an intersection.

Figure 6.41 shows the same intersection with two different design concepts. Both accommodate a large tractor trailer truck (WB -67 design vehicle). However, the design on the right provides increased storage for turning vehicles. It also allows vehicles to clear the intersection more quickly, thus reducing required yellow-plus-all-red signal phase time at the intersection and increasing capacity. If mast arm signals are used, placing the poles within the channelization island (the northeast corner may be a bit small for this) can dramatically reduce construction costs.

For pedestrians this design dramatically reduces the pedestrian crossing distances (and therefore the clearance intervals – another benefit for motorists). With curb modifications it could also reduce the speed of right turning motor vehicles. It allows the pedestrians to negotiate the right turn separately from the rest of the intersections; pedestrians have been found to prefer these multi-step crossing approach at large intersections.) [30]

Pedestrian Treatments

Curb ramps should follow ADA to provide an accessible route for all types of pedestrian users.

[30] Petritsch, Landis, Huang, McLeod, Challa, Guttenplan. “Level-of-Service Model for Pedestrians at Signalized Intersections”, TRR 1939, TRB 2005.

Intersections with on-street parking need special attention with regard to pedestrian and motorist sight visibility. Parked cars can hinder visibility between pedestrians and motorists. For example, a parked car 20 feet away from the crosswalk can visually screen children or people in wheelchairs from oncoming motorist traffic. If the parked vehicle is a van or a sport utility vehicle, no pedestrians may be visible to the approaching motorists. For this reason curb extensions should be used as an intersection treatment to increase sight distance. In general, curb extensions should extend the width of the on-street parking lane, approximately 6feet from the curb. If a curb extension would interfere with a bike lane, a further setback from the crosswalk for the on-street parked car should be required.

Existing raised medians 6 feet or more in width can be used as crossing islands to provide a storage area for pedestrians in long intersections. New intersections, where crossing distances exceed 60 feet should include a crossing island at least 6feet in width. The 6-foot width provides space for one wheelchair user or more than one pedestrian to wait. The cut-through area in crossing medians can be angled to increase the pedestrians' visibility of incoming traffic; this is particularly useful in mid-block crossings. In constrained conditions, travel lanes can be narrowed to 10 feet to provide space for a crossing island. Two-foot detectable warnings strips should be placed on both sides of median refuge islands six or more feet in width.
The width of marked crosswalks should not be less than 6 feet. Stop and Yield line setbacks should be used with marked crosswalks. When used at controlled intersections, stop lines should be placed approximately 10 feet and no less than 4 feet in advance and in a parallel direction to the crosswalk. At uncontrolled intersections on multilane roads setbacks of 20 to 50 feet are desirable for yield lines to provide improved visibility of and for motorists approaching in any lane.

Midblock crossings

The previous section on traffic control for shared use path crossings of roadways is also applicable to midblock pedestrian crossings. At midblock pedestrian crossings, however, all signs should be pedestrian oriented (the PEDESTRIAN CROSSING sign should be used instead of the COMBINED BICYCLE/PEDESTRIAN CROSSING sign).

Pedestrian signals

When installed correctly, traffic signals benefit pedestrians by interrupting heavy volumes of motor vehicles where there are insufficient gaps to cross safely at intersections or midblock crossings (see the Shared Use Path discussion above for warrant information). Traffic signals are required to take into consideration the

needs of pedestrian traffic.[31] Pedestrian signal heads are recommended at all signals were pedestrian treatments are provided along the approach roadways or corners. According the *MUTCD* pedestrian signal heads must be installed –

> *A. If a traffic control signal is justified by an engineering study and meets either Warrant 4, Pedestrian Volume or Warrant 5, School Crossing (see Chapter 4C);*
> *B. If an exclusive signal phase is provided or made available for pedestrian movements in one or more directions, with all conflicting vehicular movements being stopped; or*
> *C. At an established school crossing at any signalized location.*
> *D. Where engineering judgment determines that multiphase signal indications (as with split-phase timing) would tend to confuse or cause conflicts with pedestrians using a crosswalk guided only by vehicular signal indications.*[32]

The *MUTCD* recommends that traffic signal timing for pedestrians be based on an assumed speed of 4ft/sec. However, this speed should vary based on the individual characteristics of pedestrians. For example, a design crossing speed of 3ft/sec should be used at intersections where older pedestrians are expected.

Pedestrian signal heads provide signal directions exclusively intended for pedestrian traffic. These indications consist of a *Walking Person* (symbolizing *Walk*) and an *Upraised Hand* (symbolizing *Do not Walk*). The 2009 *MUTCD* requires countdown displays be provided for all but the shortest of pedestrian crossings.[33]

Pedestrian clearance intervals should be calculated upon an assumed walking speed of 3.5 feet per second. A walking speed of up to 4 feet per second may be used to if some technique such as extended push button press or passive pedestrian detection is being used to provide an option for the longer clearance interval when needed.

Accessible Pedestrian Signals

When crossing a street at a signalized location, pedestrians who have visual disabilities initiate their crossing when they hear the traffic in front of them stop and the traffic alongside them begin to move; this usually corresponds with the onset of the green interval. In an increasing number of locations – at complex intersections, or intersections with unusual signal timing plans - the intersection environment does not

[31] MUTCD, FHWA, 2009, P 450.
[32] MUTCD, FHWA, 2009, P 495.

[33] The 2009 *MUTCD* has no compliance date. All traffic control devices that are currently in place may remain in place for the duration of their useful lives. However, all new traffic control devices are to be compliant with the 2009 *MUTCD*. The state of Georgia has until January 2012 to adopt the 2009 *MUTCD*.

provide the information pedestrians with visual disabilities need to make an accurate judgment on when it is safe to cross the street.

Accessible Pedestrian Signals (APS) are devices that provide audible and tactile information for pedestrians with vision and/or hearing impairments. APS treatments include a locator tone that assists pedestrians with visual disabilities in finding the pedestrian push button. The push button is large, 2-inch diameter minimum, and is easy to press. An arrow raised in relief is located on the pedestrian push button to direct the pedestrian toward the crossing. Some APS devices have raised intersection “maps” to let pedestrians know how many lanes they will be crossing and the lane configurations.

The *MUTCD* provides guidance on where APS signals should be installed. At a minimum, if a request for an APS is received by Cobb County; the request should be forwarded to an Orientation and Mobility Specialist in the Georgia Department of Labor - Rehabilitation Services, for an assessment. If this agency decides an APS should be installed, then the County should install the treatments.

Complete requirements for APS can be found in Section 4E.06 of the *MUTCD*.

APPENDIX 6.A RAPID RECTANGULAR FLASHING BEACON

FHWA INTERIM APPROVAL

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Sent via Electronic Mail

Subject: **INFORMATION**: MUTCD – Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11)

Date: July 16, 2008

From: Anthony T. Furst
Acting Associate Administrator
for Operations

Reply to
Attn. of: HOTO-1

To: Associate Administrators
Chief Counsel
Acting Chief Financial Officer
Directors of Field Services
Federal Lands Highway Division Engineers
Resource Center Director
Division Administrators

Purpose: The purpose of this memorandum is to issue an Interim Approval for the optional use of Rectangular Rapid Flashing Beacons (RRFB) as warning beacons under certain limited conditions. Interim Approval allows interim use, pending official rulemaking, of a new traffic control device, a revision to the application or manner of use of an existing traffic control device, or a provision not specifically described in the Manual on Uniform Traffic Control Devices (MUTCD).

Background: The Florida Department of Transportation, in conjunction with the city of St. Petersburg, has requested that the Federal Highway Administration (FHWA) issue an Interim Approval to allow the use of RRFBs as warning beacons to supplement standard pedestrian crossing and school crossing warning signs at crossings across uncontrolled approaches. The RRFB does not meet the current standards for flashing warning beacons as contained in the 2003 edition of the MUTCD, Chapter 4K which requires a warning beacon to be round in shape and either 8 or 12 inches in diameter, to flash at a rate of approximately once per second, and to be located no less than 12 inches outside the nearest edge of the warning sign it supplements. The RRFB uses rectangular-shaped high-intensity LED-based indications, flashes rapidly in a wig-wag "flickering" flash pattern, and is mounted immediately between the crossing sign and the sign's supplemental arrow plaque.

MOVING THE AMERICAN ECONOMY

Research on the RRFB: The city of St. Petersburg has completed experimentation with the RRFB at 18 pedestrian crosswalks across uncontrolled approaches and has submitted their final report. In addition to "before" data, the city collected "after" data at intervals for 1 year at all sites and for 2 years at the first 2 implemented sites. For the first 2 sites, the city collected data for overhead and ground-mounted pedestrian crossing signs supplemented with standard round yellow flashing beacons, for comparison purposes, before the RRFBs were installed. The data show very high rates of motorist "yield to pedestrians" compliance, mostly in the high 80s to close to 100 percent, in comparison to far lower rates (in the 15 to 20 percent range) for standard beacons. The very high yielding rates are sustained even after 2 years in operation, and no identifiable negative effects have been found. The RRFB's very high compliance rates are previously unheard of for any device other than a full traffic signal and a "HAWK" hybrid signal, both of which stop traffic with steady red signal indications. The St. Petersburg data also shows that drivers exhibit yielding behavior much further in advance of the crosswalk with RRFB than with standard round yellow flashing beacons. These data clearly document very successful and impressive positive experience with the RRFBs at crosswalks in that city.

In addition to the St. Petersburg locations, experimentation is underway at 3 sites in Miami-Dade County, FL, 4 sites in Largo, FL, and 2 sites in Las Cruces, NM, and RRFBs are being installed at 3 sites in northern Illinois. Additionally, the District of Columbia has installed RRFBs at one crosswalk and plans to request experimentation with RRFB at several sites. Data from locations other than St. Petersburg is limited but does show results very similar to those found in St. Petersburg. A study of 2 RRFB locations in Miami-Dade County, FL, reported in a TRB paper, found that evasive conflicts between drivers and pedestrians and the percentage of pedestrians trapped in the center of an undivided road because of a non-yielding driver in the second half of the roadway were both significantly reduced to negligible levels. Data so far from the one RRFB site in DC shows driver yielding compliance rates increased from 26 percent to 74 percent after 30 days in operation and advance yielding distances also increased comparable to the St. Petersburg results.

FHWA Evaluation of Results: The Office of Transportation Operations has reviewed the available data and considers the RRFB to be highly successful for the applications tested (uncontrolled crosswalks). The RRFB offers significant potential safety and cost benefits, because it achieves very high rates of compliance at a very low relative cost in comparison to other more restrictive devices that provide comparable results, such as full midblock signalization. The components of RRFB are not proprietary and can be assembled by any jurisdiction with off-the-shelf hardware. The FHWA believes that the RRFB has a low risk of safety or operational concerns. However, because proliferation of RRFBs in the roadway environment to the point that they become ubiquitous could decrease their effectiveness, use of RRFBs should be limited to locations with the most critical safety concerns, such as pedestrian and school crosswalks across uncontrolled approaches, as tested in the experimentation.

At a recent meeting of the National Committee on Uniform Traffic Control Devices, the Signals Technical Committee voted to endorse the future inclusion of the RRFB for uncontrolled crosswalks into the MUTCD and recommended that FHWA issue an Interim Approval for RRFB. The FHWA believes this indicates a consensus in the practitioner community in support of optional use of RRFB. This Interim Approval does not create a new mandate compelling installation of RRFB but will allow agencies to install this type of flashing beacon, pending official MUTCD rulemaking, to provide a degree of enhanced pedestrian safety at uncontrolled crosswalks that has been previously unattainable without costly and delay-producing full traffic signalization.

Conditions of Interim Approval: The FHWA will grant Interim Approval for the optional use of the RRFB as a warning beacon to supplement standard pedestrian crossing or school crossing signs at crosswalks across uncontrolled approaches to any jurisdiction that submits a written request to the Office of Transportation Operations. A State may request Interim Approval for all jurisdictions in that State. Jurisdictions using RRFB under this Interim Approval must agree to comply with the technical conditions detailed below, to maintain an inventory list of all locations where the devices are placed, and to comply with Item F at the bottom of Page 1A-6 of the 2003 MUTCD, Section 1A.10 which requires:

> "An agreement to restore the site(s) of the Interim Approval to a condition that complies with the provisions in this Manual within 3 months following the issuance of a Final Rule on this traffic control device. This agreement must also provide that the agency sponsoring the Interim Approval will terminate use of the device or application installed under the Interim Approval at any time that it determines significant safety concerns are directly or indirectly attributable to the device or application. The FHWA's Office of Transportation Operations has the right to terminate the interim approval at any time if there is an indication of safety concerns."

1. General Conditions:

   a. An RRFB shall consist of two rapidly and alternately flashed rectangular yellow indications having LED-array based pulsing light sources, and shall be designed, located, and operated in accordance with the detailed requirements specified below.

   b. The use of RRFBs is optional. However, if an agency opts to use an RRFB under this Interim Approval, the following design and operational requirements shall apply, and shall take precedence over any conflicting provisions of the MUTCD for the approach on which RRFBs are used:

2. Allowable Uses:

a. An RRFB shall only be installed to function as a Warning Beacon (see 2003 MUTCD Section 4K.03).

b. An RRFB shall only be used to supplement a W11-2 (Pedestrian) or S1-1 (School) crossing warning sign with a diagonal downward arrow (W16-7p) plaque, located at or immediately adjacent to a marked crosswalk.

c. An RRFB shall not be used for crosswalks across approaches controlled by YIELD signs, STOP signs, or traffic control signals. This prohibition is not applicable to a crosswalk across the approach to and/or egress from a roundabout.

d. In the event sight distance approaching the crosswalk at which RRFBs are used is less than deemed necessary by the engineer, an additional RRFB may be installed on that approach in advance of the crosswalk, as a Warning Beacon to supplement a W11-2 (Pedestrian) or S1-1 (School) crossing warning sign with an AHEAD: (W16-9p) plaque. This additional RRFB shall be supplemental to and not a replacement for RRFBs at the crosswalk itself.

3. Sign/Beacon Assembly Locations:

a. For any approach on which RRFBs are used, two W11-2 or S1-1 crossing warning signs (each with RRFB and W16-7p plaque) shall be installed at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided highway, the left-hand side assembly should be installed on the median, if practical, rather than on the far left side of the highway.

b. An RRFB shall not be installed independent of the crossing signs for the approach the RRFB faces. The RRFB shall be installed on the same support as the associated W11-2 (Pedestrian) or S1-1 (School) crossing warning sign and plaque.

4. Beacon Dimensions and Placement in Sign Assembly:

a. Each RRFB shall consist of two rectangular-shaped yellow indications, each with an LED-array based light source. Each RRFB indication shall be a minimum of approximately 5 inches wide by approximately 2 inches high.

b. The two RRFB indications shall be aligned horizontally, with the longer dimension horizontal and with a minimum space between the two indications of approximately seven inches (7 in), measured from inside edge of one indication to inside edge of the other indication.

c. The outside edges of the RRFB indications, including any housings, shall not project beyond the outside edges of the W11-2 or S1-1 sign.

d. As a specific exception to 2003 MUTCD Section 4K.01 guidance, the RRFB shall be located between the bottom of the crossing warning sign and the top of the supplemental downward diagonal arrow plaque (or, in the case of a supplemental advance sign, the AHEAD plaque), rather than 12 inches above or below the sign assembly. (See attached example photo.)

5. Beacon Flashing Requirements:

a. When activated, the two yellow indications in each RRFB shall flash in a rapidly alternating "wig-wag" flashing sequence (left light on, then right light on).

b. As a specific exception to 2003 MUTCD Section 4K.01 requirements for the flash rate of beacons, RRFBs shall use a much faster flash rate. Each of the two yellow indications of an RRFB shall have 70 to 80 periods of flashing per minute and shall have alternating but approximately equal periods of rapid pulsing light emissions and dark operation. During each of its 70 to 80 flashing periods per minute, one of the yellow indications shall emit two rapid pulses of light and the other yellow indication shall emit three rapid pulses of light.

c. The flash rate of each individual yellow indication, as applied over the full on-off sequence of a flashing period of the indication, shall not be between 5 and 30 flashes per second, to avoid frequencies that might cause seizures.

d. The light intensity of the yellow indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005.

6. Beacon Operation:

a. The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation at a predetermined time after the pedestrian actuation or, with passive detection, after the pedestrian clears the crosswalk.

b. All RRFBs associated with a given crosswalk (including those with an advance crossing sign, if used) shall, when activated, simultaneously commence operation of their alternating rapid flashing indications and shall cease operation simultaneously.

c. If pedestrian pushbuttons (rather than passive detection) are used to actuate the RRFBs, a pedestrian instruction sign with the legend PUSH BUTTON TO TURN ON WARNING LIGHTS should be mounted adjacent to or integral with each pedestrian pushbutton.

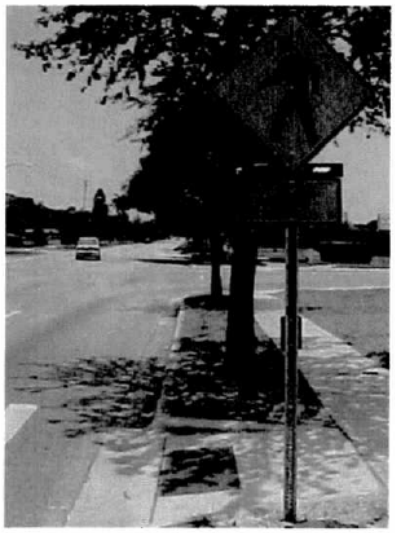
d. The duration of a predetermined period of operation of the RRFBs following each actuation should be based on the MUTCD procedures for timing of pedestrian clearance times for pedestrian signals.

e. A small light directed at and visible to pedestrians in the crosswalk may be installed integral to the RRFB or push button to give confirmation that the RRFB is in operation.

7. Other:

a. Except as otherwise provided above, all other provisions of the MUTCD applicable to Warning Beacons shall apply to RRFBs.

Any questions concerning this Interim Approval should be directed to Mr. Scott Wainwright at **scott.wainwright@dot.gov** or by telephone at 202-366-0857.



Example of RRFB with W1-2 sign and W16-7p plaque at crosswalk across uncontrolled approach. [Photo courtesy of City of St. Petersburg, Florida]

APPENDIX 6.B PEDESTRIAN HYBRID SIGNALS

2009 MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES

CHAPTER 4F. PEDESTRIAN HYBRID BEACONS

Section 4F.01 Application of Pedestrian Hybrid Beacons

Support:

01 A pedestrian hybrid beacon is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.

Option:

02 A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C), or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal.

Standard:

03 **If used, pedestrian hybrid beacons shall be used in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians enter or cross a street or highway. A pedestrian hybrid beacon shall only be installed at a marked crosswalk.**

Guidance:

04 *If one of the signal warrants of Chapter 4C is met and a traffic control signal is justified by an engineering study, and if a decision is made to install a traffic control signal, it should be installed based upon the provisions of Chapters 4D and 4E.*

05 *If a traffic control signal is not justified under the signal warrants of Chapter 4C and if gaps in traffic are not adequate to permit pedestrians to cross, or if the speed for vehicles approaching on the major street is too high to permit pedestrians to cross, or if pedestrian delay is excessive, the need for a pedestrian hybrid beacon should be considered on the basis of an engineering study that considers major-street volumes, speeds, widths, and gaps in conjunction with pedestrian volumes, walking speeds, and delay.*

06 *For a major street where the posted or statutory speed limit or the 85th-percentile speed is 35 mph or less, the need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-1 for the length of the crosswalk.*

07 *For a major street where the posted or statutory speed limit or the 85th-percentile speed exceeds 35 mph, the need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-2 for the length of the crosswalk.*

08 *For crosswalks that have lengths other than the four that are specifically shown in Figures 4F-1 and 4F-2, the values should be interpolated between the curves.*

Section 4F.02 Design of Pedestrian Hybrid Beacons

Standard:

01 **Except as otherwise provided in this Section, a pedestrian hybrid beacon shall meet the provisions of Chapters 4D and 4E.**

02 **A pedestrian hybrid beacon face shall consist of three signal sections, with a CIRCULAR YELLOW signal indication centered below two horizontally aligned CIRCULAR RED signal indications (see Figure 4F-3).**

03 **When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:**

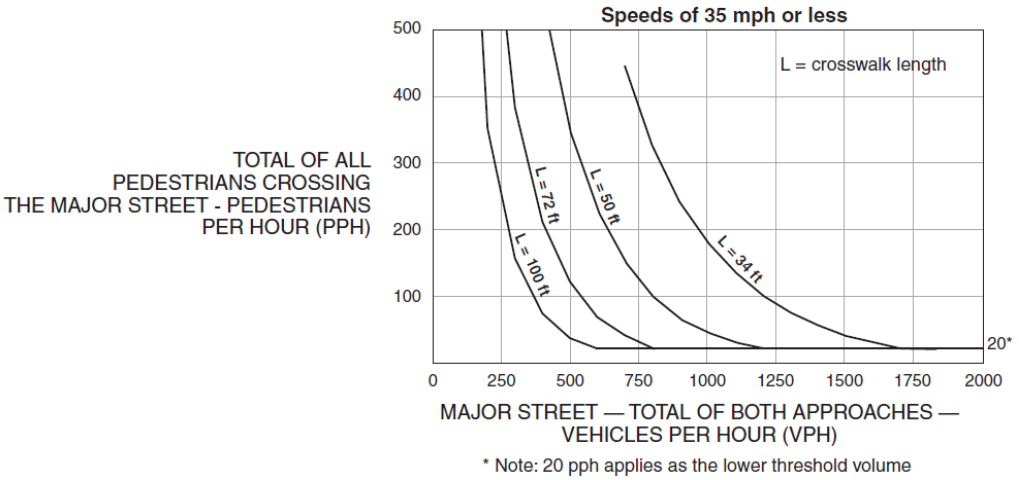
- **A. At least two pedestrian hybrid beacon faces shall be installed for each approach of the major street,**
- **B. A stop line shall be installed for each approach to the crosswalk,**
- **C. A pedestrian signal head conforming to the provisions set forth in Chapter 4E shall be installed at each end of the marked crosswalk, and**
- **D. The pedestrian hybrid beacon shall be pedestrian actuated.**

Guidance:

04 *When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:*

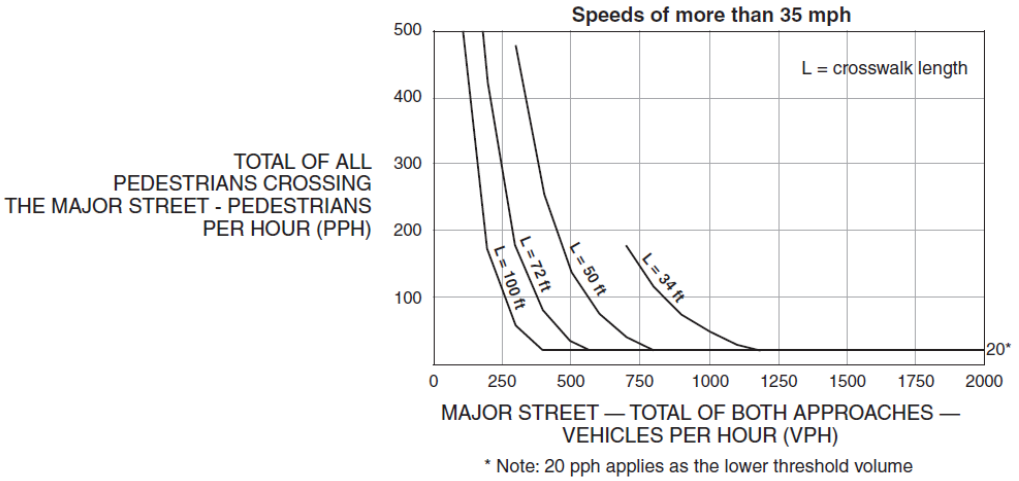
- *A. The pedestrian hybrid beacon should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs,*

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways



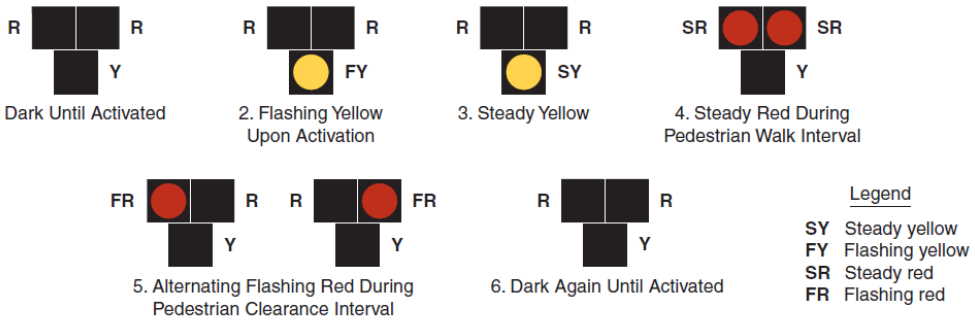
* Note: 20 pph applies as the lower threshold volume

Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways



* Note: 20 pph applies as the lower threshold volume

Figure 4F-3. Sequence for a Pedestrian Hybrid Beacon



B. Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance,

C. The installation should include suitable standard signs and pavement markings, and

D. If installed within a signal system, the pedestrian hybrid beacon should be coordinated.

05 *On approaches having posted or statutory speed limits or 85th-percentile speeds in excess of 35 mph and on approaches having traffic or operating conditions that would tend to obscure visibility of roadside hybrid beacon face locations, both of the minimum of two pedestrian hybrid beacon faces should be installed over the roadway.*

06 *On multi-lane approaches having a posted or statutory speed limits or 85th-percentile speeds of 35 mph or less, either a pedestrian hybrid beacon face should be installed on each side of the approach (if a median of sufficient width exists) or at least one of the pedestrian hybrid beacon faces should be installed over the roadway.*

07 *A pedestrian hybrid beacon should comply with the signal face location provisions described in Sections 4D.11 through 4D.16.*

Standard:

08 **A CROSSWALK STOP ON RED (symbolic circular red) (R10-23) sign (see Section 2B.53) shall be mounted adjacent to a pedestrian hybrid beacon face on each major street approach. If an overhead pedestrian hybrid beacon face is provided, the sign shall be mounted adjacent to the overhead signal face.**

Option:

09 A Pedestrian (W11-2) warning sign (see Section 2C.50) with an AHEAD (W16-9P) supplemental plaque may be placed in advance of a pedestrian hybrid beacon. A warning beacon may be installed to supplement the W11-2 sign.

Guidance:

10 *If a warning beacon supplements a W11-2 sign in advance of a pedestrian hybrid beacon, it should be programmed to flash only when the pedestrian hybrid beacon is not in the dark mode.*

Standard:

11 **If a warning beacon is installed to supplement the W11-2 sign, the design and location of the warning beacon shall comply with the provisions of Sections 4L.01 and 4L.03.**

Section 4F.03 Operation of Pedestrian Hybrid Beacons

Standard:

01 **Pedestrian hybrid beacon indications shall be dark (not illuminated) during periods between actuations.**

02 **Upon actuation by a pedestrian, a pedestrian hybrid beacon face shall display a flashing CIRCULAR yellow signal indication, followed by a steady CIRCULAR yellow signal indication, followed by both steady CIRCULAR RED signal indications during the pedestrian walk interval, followed by alternating flashing CIRCULAR RED signal indications during the pedestrian clearance interval (see Figure 4F-3). Upon termination of the pedestrian clearance interval, the pedestrian hybrid beacon faces shall revert to a dark (not illuminated) condition.**

03 **Except as provided in Paragraph 4, the pedestrian signal heads shall continue to display a steady UPRAISED HAND (symbolizing DONT WALK) signal indication when the pedestrian hybrid beacon faces are either dark or displaying flashing or steady CIRCULAR yellow signal indications. The pedestrian signal heads shall display a WALKING PERSON (symbolizing WALK) signal indication when the pedestrian hybrid beacon faces are displaying steady CIRCULAR RED signal indications. The pedestrian signal heads shall display a flashing UPRAISED HAND (symbolizing DONT WALK) signal indication when the pedestrian hybrid beacon faces are displaying alternating flashing CIRCULAR RED signal indications. Upon termination of the pedestrian clearance interval, the pedestrian signal heads shall revert to a steady UPRAISED HAND (symbolizing DONT WALK) signal indication.**

Option:

04 Where the pedestrian hybrid beacon is installed adjacent to a roundabout to facilitate crossings by pedestrians with visual disabilities and an engineering study determines that pedestrians without visual disabilities can be allowed to cross the roadway without actuating the pedestrian hybrid beacon, the pedestrian signal heads may be dark (not illuminated) when the pedestrian hybrid beacon faces are dark.

Guidance:

05 *The duration of the flashing yellow interval should be determined by engineering judgment.*

Standard:

06 **The duration of the steady yellow change interval shall be determined using engineering practices.**

Guidance:

07 *The steady yellow interval should have a minimum duration of 3 seconds and a maximum duration of 6 seconds (see Section 4D.26). The longer intervals should be reserved for use on approaches with higher speeds.*

APPENDIX 6.C PEDESTRIAN SIGNAL WARRANTS

2009 MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

02 **The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:**

- **A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or**
- **B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Standard:

04 **The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.**

Guidance:

06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

- *A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.*
- *B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.*
- *C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.*

Option:

07 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

Section 4C.06 Warrant 5, School Crossing

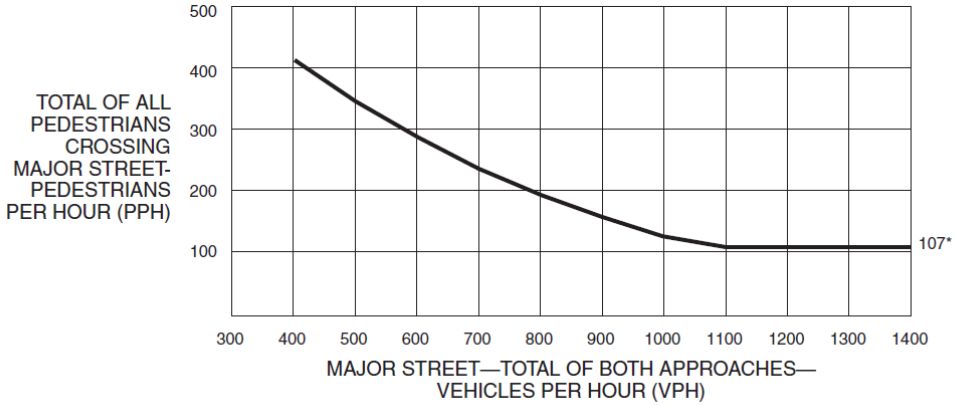
Support:

01 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.

Standard:

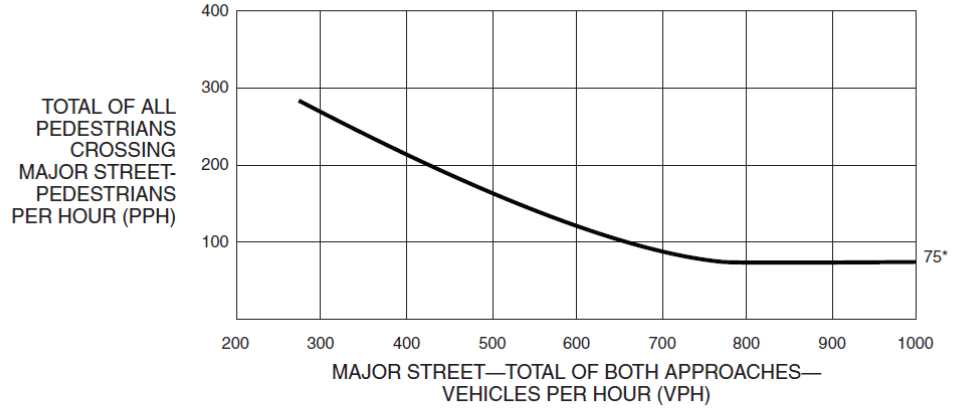
02 **The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number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

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume



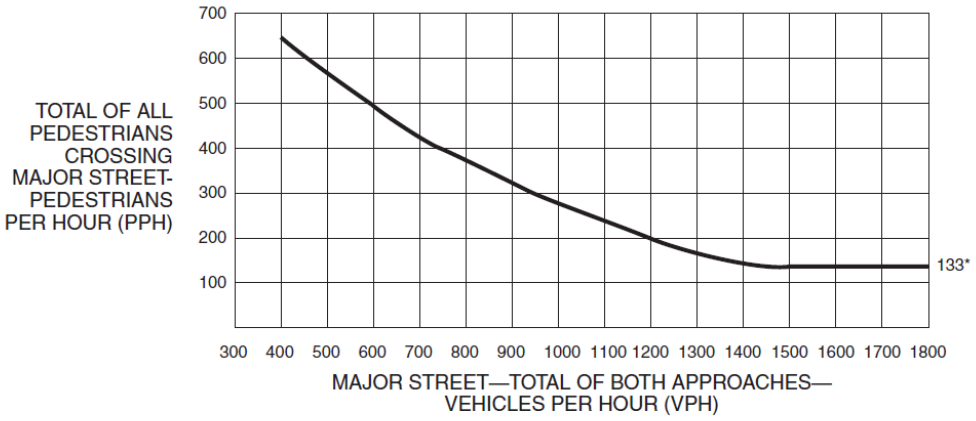
*Note: 107 pph applies as the lower threshold volume.

Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



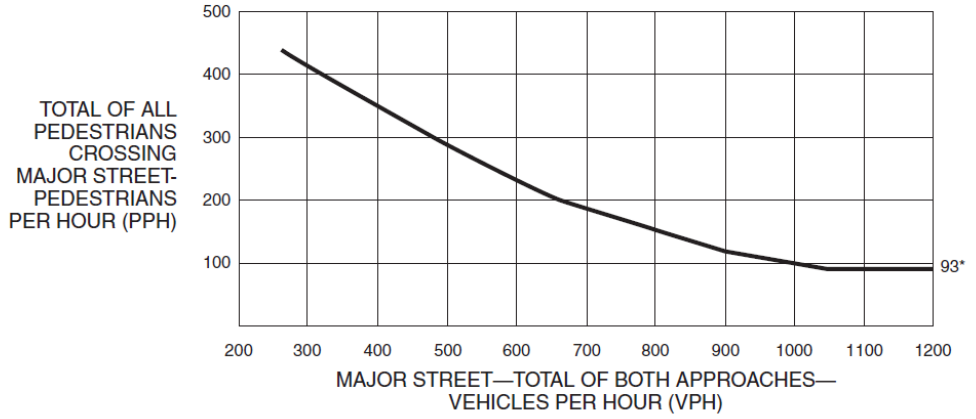
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

03 **Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.**

04 **The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

Guidance:

05 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. *If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.*

B. *If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.*

C. *Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.*