

BICYCLING

SMARTCODE MODULE

PREPARED BY MIKE LYDON, WITH ZACHARY ADELSON AND TONY GARCIA

*The bicycle is the most efficient machine ever created:
Converting calories into gas, a bicycle gets the equivalent of three thousand miles per gallon.*

Bill Strickland

BICYCLING STANDARDS

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- 3.7 THOROUGHFARE STANDARDS
- 5.9 PARKING AND DENSITY CALCULATIONS
- 5.10 PARKING LOCATION STANDARDS

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DEFINITIONS OF TERMS FOR ARTICLE 7

COMPLETE THOROUGHFARE ASSEMBLIES WITH BIKEWAYS FOR ARTICLE 6, TABLE 4C

SMARTCODE MODULE - BICYCLING

This Bicycling Module is transect-based. All or part of it may be adopted with a customized SmartCode as regulatory, advisory, or merely permissive ("shall," "should" or "may") or it may be provided as an auxiliary set of guidelines for developers and/or municipalities. Any mandatory regulations must be activated by the sections on the facing page or similar language. Even advisory or permissive standards are more likely to be used if they are activated by text within the code.

The Bicycle Tables may need further calibration with By Right and Warrant bullets, as local regulations, politics, and physical conditions require. While all Bikeways, Bicycle Parking Facilities, and Countermeasures require site-specific analysis and informed judgment for applicability, "By Right" shall mean that the proposed facility is applicable and permitted, while "Warrant" shall mean that further analysis is almost always appropriate. Spaces left blank in a table mean that a facility is generally not compatible with that Transect Zone in terms of habitat character.

The Bicycle Module tables may be appropriate in various places in Article 6, before the SmartCode Summary Table 14. As always, the insertion of new tables will require the renumbering of subsequent tables and a Find/Replace of those numbers throughout the code text. The Bikeway Assemblies should be included with other Thoroughfare Assemblies, found in the Complete Thoroughfares Module (formerly Table 4C).

If any part of this Module is used, the appropriate definitions should be added to Article 7 during calibration.

BICYCLING STANDARDS

ARTICLE 1. GENERAL TO ALL PLANS

1.3 INTENT

These goals may be added to the Intent section of the base SmartCode.

ARTICLE 3. NEW COMMUNITY PLANS

3.7 THOROUGHFARE STANDARDS

If any tables of this Module are to be mandatory or advisory for New Community Plans (the public realm), they should be activated using this or similar language in the code text. The word "shall" may be replaced with "should" if the tables are merely advisory.

Bicycle lanes and other bikeways that widen the right-of-way are not advised for new thoroughfares designed for the urban contexts of T-3, T-4, T-5, and T-6. They are, however, useful for retrofitting overwide existing thoroughfares.

The Existing Thoroughfares Module is helpful for codes that apply only to already urbanized areas, i.e., the G-4 Sector. For such codes, the sections here may be correlated to that Module, albeit with different numbering, and then into the final code.

ARTICLE 5. BUILDING SCALE PLANS

5.9 PARKING & DENSITY CALCULATIONS

5.10 PARKING LOCATION STANDARDS

If any tables of this Module are to be mandatory or advisory for the private realm, they should be activated using this or similar language in the code text.

ARTICLE 1. GENERAL TO ALL PLANS

1.3 INTENT

1.3.1 THE REGION

- i That development should provide contextual Bikeways for both short and long distance movement, as well as bicycle parking facilities for short and long term storage.
- j. That the regional Bikeway network should be well-integrated with the regional and local transit network.

1.3.2 THE COMMUNITY

- j. That Civic, institutional, and Commercial destinations should adapt their facilities to accommodate bicyclists.
- k. That bicycle parking types may correspond to the rural-to-urban Transect, but should be efficiently allocated by land use type, building size, and/or number of residents/employees.
- l. That bicycling should be recognized as an essential form of transportation and recreation within neighborhoods and throughout the region.
- m. That the local Bikeway network should be well-integrated with regional and local transit network.
- n. That new Thoroughfares in urban contexts should be designed to target speeds that are safe for bicyclists without dedicated Bicycle Lanes.

ARTICLE 3. NEW COMMUNITY PLANS

3.7 THOROUGHFARE STANDARDS

3.7.2 VEHICULAR LANES

- b. A Bikeway network consisting of shared use Bicycle Trails, shared use Bicycle Paths, Bicycle Routes, and/or Bicycle Lanes shall be provided throughout the community, as defined in Article 7 Definitions of Terms and allocated according to Table B2.
- c. All Thoroughfares shall permit bicycling, with the exception of limited-access Highways.
- d. All Bikeway and Countermeasure pavement markings and safety and wayfinding signing shall adhere to the same standards as automobile Vehicular Lane markings and signing.
- e. Bicycle Trails and Bicycle Paths shall be physically separated from motor vehicle Thoroughfares, except for intersection crossings.

3.7.3 PUBLIC FRONTAGES

A. SPECIFIC TO ZONES T4, T5, T6

- iv. Within the Public Frontages, the prescribed types of bicycle parking facilities shall be as shown in Table B4 and Table B5.

ARTICLE 5. BUILDING SCALE PLANS

5.9 PARKING AND DENSITY CALCULATIONS

5.9.3 BICYCLE PARKING REQUIREMENTS GENERAL TO ZONES T2, T3, T4, T5, T6

- a. The amount of bicycle parking required per lot shall be regulated by Table B3.

5.10 PARKING LOCATION STANDARDS

5.10.6 BICYCLE PARKING LOCATION STANDARDS SPECIFIC TO ZONES T4, T5, T6

- d. Location and type of bicycle parking shall be regulated by Table B4 and Table B5.

These annotations are advisory only. The SmartCode itself appears only on the right side of each spread.

TABLE B1. BIKEWAY & FACILITY TYPE SUMMARY

This table coordinates 18 types of Bikeways, Bicycle Parking Facilities, and Countermeasures (which mitigate unsafe or unappealing bicycling conditions) for constructing new thoroughfares or retrofitting existing ones. These techniques and measures are by no means comprehensive, as site specific design is encouraged and local calibration essential. Some known bicycling accommodations are intentionally omitted from this module because they compromise other aspects of urbanism. For example, Wide Curb Lanes unnecessarily expand roadway width, thereby encouraging automobile speeding, while not meaningfully attracting bicycle use - probably for that very reason.

Each of these 18 types is applied to one or more of the Transect Zones, yet existing conditions or other limitations may require one or more of them to be deleted, or other types added, in the calibration.

For example, the more intensive Bikeway design techniques, including bicycle lanes, are not necessary within the more urban zones of a greenfield site because urban thoroughfares based on the SmartCode are designed from the beginning to be safe for bicycling. However, in existing urbanism it is often advisable to convert excessive space dedicated to automobiles to space for pedestrians and bicyclists. Therefore some Bikeways are marked as suitable for retrofit only.

ADDITIONAL RESOURCES:

Bicycle Boulevard Planning and Design Guidebook, Initiative for Bicycle and Pedestrian Innovation <www.ibpi.usp.pdx.edu/guidebook.php>

Cycle Tracks: Lessons Learned, Alta Planning + Design <www.altaplanning.com/cycle+tracks.aspx>

FHWARails-With-Trails: Lessons Learned Report, Federal Highway Administration <www.fhwa.dot.gov/environment/rectrails/rwt/>

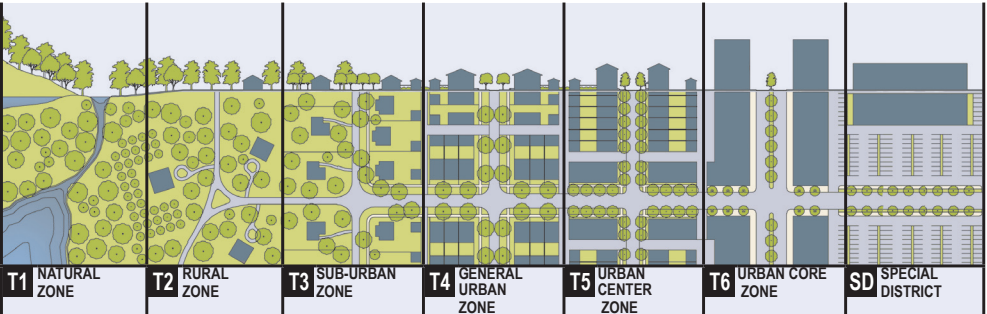
BIKESAFE: Bicycle Countermeasure Selection System <www.bicyclinginfo.org/bikesafe/>

Cities for Cycling, National Association of City Transportation Officials <www.nacto.org/workshops.html>

Municipality

Table B1: Bikeway & Facility Type Summary - This table prescribes opportunities for the placement of Bikeways, facilities, and Countermeasures across the Transect.

Note: All requirements in this Table are subject to calibration for local context.



a. Bikeway Types							
Shared Use Bicycle Trail	permitted	permitted	permitted				
Shared Use Bicycle Path			permitted	permitted	permitted	Warrant	Warrant
Bicycle Lane (Conventional)	permitted	permitted	permitted	retrofit by Warrant	retrofit by Warrant	retrofit by Warrant	Warrant
Shared Vehicular Lanes	permitted	permitted	permitted	permitted	permitted	permitted	Warrant
b. Bicycle Parking							
Bicycle Rack (standard)	Warrant	permitted	permitted	permitted	permitted	permitted	Warrant
Bicycle Rack (decorative, public art)	Warrant	Warrant	Warrant	Warrant	permitted	permitted	Warrant
Bicycle Shelter	Warrant	permitted	permitted	permitted	permitted	permitted	Warrant
Bicycle Locker	Warrant	permitted	Warrant	Warrant	permitted	permitted	Warrant
Bicycle Station					Warrant	permitted	Warrant
c. Bikeway Countermeasures							
Safety and Route Signing	permitted	permitted	permitted	permitted	permitted	permitted	Warrant
Peg-a-Track		Warrant	permitted	permitted	permitted	permitted	Warrant
Shared Vehicular Lane Marking (Sharrow)			permitted	permitted	permitted	permitted	Warrant
Bicycle Inductor Loop		Warrant	permitted	permitted	permitted	permitted	Warrant
Physically-Separated Bicycle Lane		Warrant	Warrant	retrofit by Warrant	retrofit by Warrant	retrofit by Warrant	Warrant
Contra-Flow Bicycle Lane			Warrant	retrofit by Warrant	retrofit by Warrant	retrofit by Warrant	Warrant
Buffered Bicycle Lane		Warrant	Warrant	retrofit by Warrant	retrofit by Warrant	retrofit by Warrant	Warrant
Bicycle Box			Warrant	retrofit by Warrant	retrofit by Warrant	retrofit by Warrant	Warrant
Shoulder	permitted	permitted	Warrant				Warrant

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BIKEWAY TYPES

This table prescribes placement of the basic types of Bikeways across the Transect. They may or may not be part of a marked Bicycle Route. They include: two types of shared use facilities to be used equitably with pedestrians, including runners, and other non-motorized transport, i.e., Bicycle Trails in more rural Transect Zones, and Bicycle Paths in more urban Transect Zones; various types of Bicycle Lanes (conventional, buffered, physically-separated, etc.), and all Shared Vehicular Lanes, including Bicycle Boulevards. Specific subtypes are shown in the Assemblies and Definitions sections of this Module. Bicycle Lanes are appropriate for the retrofit of existing overwide thoroughfares, but if added to new thoroughfares in urban contexts, they may have negative impacts on safety by increasing thoroughfare width and therefore automobile speed and pedestrian crossing distance, and by increasing intersection conflicts.

The language on the right side of this table is regulatory. Some localities may require or prefer that regulatory language appear in the main text.

As with the SmartCode's thoroughfares for motor vehicles, a Bikeway consists of the Riding Surface (the actual roadbed or pathway on which the bicycle travels) and its Public Frontage, if the latter is specific to the Bikeway. In the case of a Bicycle Lane, because it is already part of a multi-use thoroughfare, the Public Frontage specified in the Assemblies of this Module matches that for the associated Complete Thoroughfare for Table 4C. See also Table 4A of the base code. Calibrators must take care to reconcile the various options.

New Bikeways should provide identifiable and safe connections to an existing regional or community-scale Bike-way network, and should increase access to recreation, employment, education and commercial amenities. They should also connect to the existing transit network.

A complete Bikeway network includes a rich tapestry of types that accommodate the many skill levels and preferences of bicyclists. It is especially important to attract those who want to bicycle, but have been deterred by the perception - and reality - of unsafe conditions.

When selecting a Bikeway type, the existing vehicular thoroughfare width, traffic speed and volume, land use, urban form, etc. must be analyzed. Next, a communal vision for future urban character must be coordinated with thoroughfare type and vehicular movement to determine which Bikeway type is appropriate.

For example, a physically-separated bicycle lane (cycle track) provides a high level of service, but is only appropriate where intersections and curb cuts are limited and/or where turning conflicts can be mitigated with Countermeasures, like the two-stage signalized left-turn that includes bicycle queuing space, or other similar design techniques.

In this Module, Shared Use facilities may be either Bicycle Trails or Bicycle Paths. The two terms are often used interchangeably, but there are important distinctions in detailing and use that correspond to the Transect. A Bicycle Trail is more appropriate for rural environments where it is used mainly for recreational purposes, as fewer destinations exist along its trajectory. Bicycle Trails may follow more meandering, scenic routes, may use a wider variety of surface treatments (pavement or a more pervious material such as compact gravel or dirt), and typically intersect with fewer thoroughfares than their more urban counterparts. Bicycle Trails generally attract less use than Bicycle Paths, and may be as narrow as a single-track mountain bike trail.

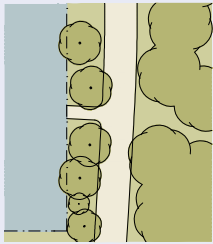
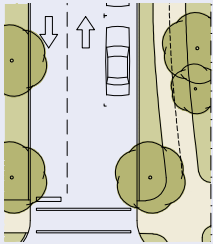
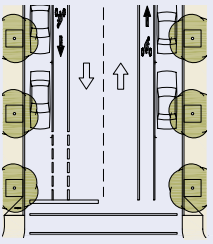
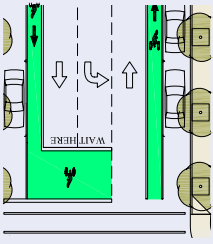
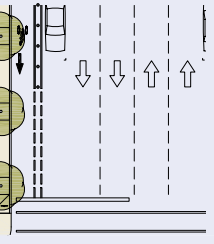
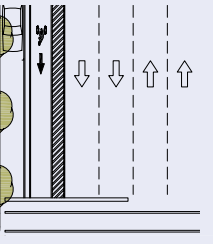
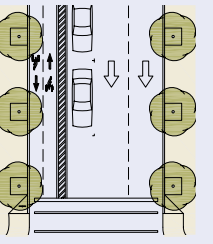
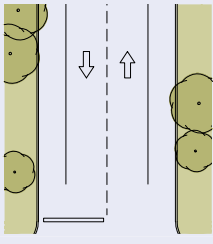
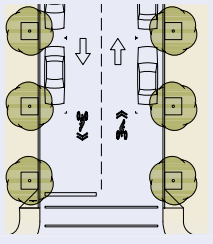
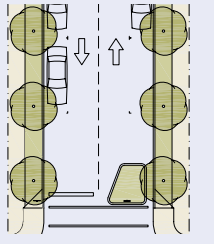
A Bicycle Path is more urban in character, is almost always paved with asphalt or concrete, and is used for utility and commuting as well as recreation. It typically requires more intensive stormwater considerations, lighting, and detailed pavement markings. Other SmartCode Modules are helpful in this regard, including Light Imprint, Sustainable Urbanism, Light Levels, Lighting Design, and Landscape.

Bicycle Paths are appropriate within greenways, parks, and waterfronts in urban Transect Zones, and alongside some urban rail right-of-ways. Thoroughfare crossings may occur, but should be unobtrusive so that movement may remain safe and as continuous as possible.

Although the conversion of underutilized railroad right-of-ways to shared use Bikeways is increasingly common due to the Rails-to-Trails movement, rail infrastructure should be preserved for future use as transit. The preferred "Rails-with-Trails" include their own design standards (See: *FHWA Rails-With-Trails: Lessons Learned Report*).

In North America, innovative Countermeasure applications, many inspired by success in Europe, are in various stages of experimentation. Shared Vehicular Lane Markings (Sharrows) were recently adopted into the 2009 Manual on Uniform Traffic Control Devices (MUTCD). Two new Countermeasures include bicycle boxes and colored bicycle lanes. A full understanding of these types should be achieved prior to their calibration and implementation, using the Resource list in this Module.

Table B2: Bikeway Types - This table describes opportunities for the placement of several Bikeway types across the Transect. A Bicycle Route may be comprised of any or all of these physical types. Bicycle Lanes should be used primarily for retrofit of existing overwide Thoroughfares.

a. (SHARED USE) BICYCLE TRAIL AND BICYCLE PATH	T1 T2 T3	T3 T4 T5			
					
	Bicycle Trail (BT)	Bicycle Path (BP)			
	8 - 12 ft dual direction signed rack, Bicycle Shelter	10 - 14 ft dual direction signed, signalized rack, Bicycle Shelter, Bicycle Locker			
b. BICYCLE LANE (in T4, T5, T6 recommended for retrofit only)	T2 T3 T4 T5 T6	T2 T3 T4 T5 T6	T2 T3 T4 T5 T6	T2 T3 T4 T5 T6	T2 T3 T4 T5 T6
					
	Conventional Bicycle Lane (BLC)	Bicycle Lane with Bicycle Box (BLX)	Physically Sep. Bicycle Lane (BLP)	Buffered Bicycle Lane (BLB)	2-way Buffered Bicycle Lane (BLB2)
	5 ft min. w/parking, 4ft min. w/o parking with traffic or Contra-flow signalized, dashed, Peg-a-Track, colored, Bicycle Box rack, Bicycle Shelter, Bicycle Station	5 ft min each way, box depth 14 ft with traffic signalized, dashed, Peg-a-Track, colored, Bicycle Box rack, Bicycle Shelter, Bicycle Station	5 ft min/2 ft min barrier with traffic or dual direction signalized, dashed, Peg-a-Track, colored, Bicycle Box rack, Bicycle Shelter, Bicycle Station	5 ft min each way/2 ft min striped buffer with traffic signalized, Peg-a-Track, colored, Bicycle Box rack, Bicycle Shelter, Bicycle Station	5 ft min each way/3 ft min striped buffer dual direction signalized, Peg-a-Track, colored, Bicycle Box rack, Bicycle Shelter, Bicycle Station
c. SHARED VEHICULAR LANES	T1 T2 T3	T3 T4 T5 T6	T3 T4		
					
	Shoulder (BLS)	Shared Vehicular Lane w/ Sharrow (SL)	Bicycle Boulevard (BB)		
	6 ft min with traffic signed, signalized opportunistic, rack, Bicycle Shelter	same as Vehicular Lane with traffic signed, signalized opportunistic, rack, Bicycle Shelter	same as Vehicular Lane with traffic signed, signalized opportunistic, rack, Bicycle Shelter		

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BICYCLE PARKING REQUIREMENTS

Bicycle Parking Requirements, as they are associated with Article 5 Building Scale Plans, are applicable to both New Communities and Infill/Retrofit.

This table may be locally calibrated and incorporated into the Building Function & Parking Calculations tables in the base code. The goal is to provide the adequate facility enhancement and the appropriate bicycle parking ratios for the general land uses in each Transect Zone.

Bicycle parking should not be calculated as a portion of automobile parking requirements because supply and demand for that mode are not an adequate indicator of actual bicycle parking need. Furthermore, if a municipality adopts automobile parking maximums, or later reduces such parking requirements, the amount of bicycle parking would also be reduced when the opposite may be necessary. Therefore, bicycle parking ratios should be based on Building Function (e.g., a gym needs more bicycle parking than a lumberyard) and quantifiable indicators like unit count, employee count, or building square footage. Table B3 coordinates these elements for common land use types across the Transect.

Transect Zones with higher densities and higher degrees of mixed-use generally require higher ratios of bicycle parking.

Civic Zones and some Special Districts, especially schools and universities, vary widely in their placement and function, and with their large populations of active young people, may attract heavy bicycle use. Therefore, the bicycle parking ratios in Table B3 for these areas is very general, and should be further calibrated to local conditions. The same is also true for Transit Stops and Industrial Uses.

For small scale lodging, office, and retail buildings, bicycle parking requirements may be waived if adequate and adjacent short and long term parking facilities are provided by the municipality within the public frontage. Thresholds should be locally calibrated.

While the provision of bicycle parking and shower facilities are included in the LEED and LEED-ND rating system, they are not required. Thus, municipalities with or without LEED regulations should consider incentivizing or rewriting land use codes to ensure that adequate bicycle parking facilities are included where appropriate.

In general, a good bicycle parking plan should specify the number of bicycle parking spaces by Building Function, require long-term parking for all workplaces, transit stations and multi-unit residential or mixed-use buildings, and require adequate short-term parking for almost all other land

uses. Such plans or codes should also provide site planning standards that include rack/locker design and placement requirements, especially within the public frontage. These details may be added to this Module as needed.

Because bicycling is not yet a popular mode of transportation in most North American contexts, Table B3 is geared towards cities with a bicycle mode share of 5% or less. (By comparison, as of late 2009 Copenhagen had a 37% bicycle mode share for commuting, and an even higher share among city residents.) In places demonstrating a higher mode share, higher bicycle parking ratios may be needed. Bicycle parking ratios should be reviewed in conjunction with bicycle master plan updates, or at least every five years, to ensure that supply meets demand.

Municipality

Table B3: Bicycle Parking Requirements - This table prescribes minimum parking ratios within each Transect Zone and assumes a bicycle mode share of 5% or less. Requirements may be met within the building, Private Frontage, Public Frontage, or a combination thereof.

SHORT TERM PARKING (See Table 10)			
	T2 T3	T4	T5 T6
RESIDENTIAL Single-Family	no spaces required	no spaces required	n/a
Multi-Family	n/a	Min. 2.0 spaces .05 spaces / bedroom	Min. 2.0 spaces .10 spaces / bedroom
OFFICE	no spaces required	Min. 2.0 spaces 1.0 / add. 20,000 sq. ft.	Min. 2.0 spaces 1.0 / add.15,000 sq. ft.
RETAIL	Min. 2.0 space, 1.0 / add.10,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 5,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 5,000 sq. ft.
INDUSTRIAL	TBD	TBD	TBD
CIVIC Non-Assembly	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.
Assembly	Min. 2.0 spaces 1.0 / add. 20,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 15,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.
SCHOOL Elementary/ High School	Min. 2.0 spaces 1.0 / add. 25 students	Min. 2.0 spaces 1.0 / add. 20 students	Min. 2.0 spaces 1.0 / add. 20 students
University	Min. 2.0 spaces 1.0 / add. 20 students	Min. 2.0 spaces 1.5 / add. 20 students	Min. 2.0 spaces 1.0 / add. 10 students
TRANSIT STATION	TBD	TBD	TBD

LONG TERM PARKING (See Table 10)			
	T2 T3	T4	T5 T6
RESIDENTIAL Single-Family	no spaces required	no spaces required	n/a
Multi-Family	n/a	Min. 2.0 spaces .15 spaces / bedroom	Min. 2.0 spaces .20 spaces / bedroom
OFFICE	no spaces required	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.	Min. 2.0 spaces 1.5 / add. 10,000 sq. ft.
RETAIL	Min. 2.0 space, 1.0 / add. 10,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.	Min. 2.0 spaces 1.0 / add. 10,000 sq. ft.
INDUSTRIAL	TBD	TBD	TBD
CIVIC Non-Assembly	Min. 2.0 spaces 1.0 / add.15 employees	Min. 2.0 spaces 1.0 / add.15 employees	Min. 2.0 spaces 1.0 / add.10 employees
Assembly	Min. 2.0 spaces 1.0 / add.20 employees	Min. 2.0 spaces 1.0 / add.20 employees	Min. 2.0 spaces 1.5 / add.10 employees
SCHOOL Elementary/ High School	Min. 2.0 spaces 1.0 / add. 20 students	Min. 2.0 spaces 1.0 / add. 20 students	Min. 2.0 spaces 1.0 / add. 20 students
University	Min. 2.0 spaces 1.0 / add.15 students	Min. 2.0 spaces 1.5 / add. 10 students	Min. 2.0 spaces 1.5 / add. 10 students
TRANSIT STATION	TBD	TBD	TBD

BICYCLE PARKING FACILITY TYPES

Bicycle Parking Facility Types are applicable to both New Communities and Infill/Retrofit. They may be associated with either the Public Frontage (see the Bikeway Assemblies of this Module) or private lots.

Bicycle Parking is often excluded or insufficiently addressed in the planning, urban design and development process. As a result, accessible, attractive, and lockable parking facilities for short and long term use are often undersupplied or poorly located. When done well, both private and public bicycle parking initiatives complement the Bikeway network by encouraging more people to bicycle. Decision makers must take bicycle parking into consideration during the initial planning and design process.

To be truly effective, bicycle parking solutions must take the needs, behaviors, and preferences of people who bicycle into account. Meeting these needs will encourage and increase bicycle use and avoid haphazard solutions that reinforce anarchic parking behavior, threaten bicycle security, and ultimately deter use.

Municipalities should create and oversee bicycle parking plans at the scale of the city and in conjunction with county and/or state and owned rights-of-way and the officials who oversee them. However, such plans should be implemented and maintained at the scale of the neighborhood. Certain Special Districts, areas of high activity, and neighborhoods of unique character may provide opportunities to make use of bicycle parking facility designs that reinforce an existing built or natural aesthetic, or help define a new one. So-called "decorative" racks must be be readily identifiable and built to the same standards as other bicycle racks so that their design does not compromise the intended function.

Once implemented, bicycle parking must be well maintained, so that all parking areas remain clean, orderly and free of abandoned or vandalized bicycles.

Bicycle parking is to be allocated across the Transect by type, but detailed in quantity and location by land use, demand, and building size. As an example, a civic space, a movie theatre, and a transit station may be in the same Transect Zone, but each requires its own bicycle parking solution. Regardless, bicycle parking must be placed as close as possible to the associated destination, at least as close as any related automobile parking.

Bicycle parking facility types and styles are numerous. Several common types are shown in Table B4.

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Bicycle Rack: The most simple, recognizable, and effective form for short term parking is the "inverted U-rack." A single rack provides two bicycle parking spaces and allows the bicycle's frame to be secured with at least two points of contact—a pre-requisite for all acceptable bicycle rack types.

Bicycle Shelter: Shelters provide all-weather protection, and are intended for longer term use within areas of higher intensity, like transit stops, fitness gyms, civic buildings and civic space, trail heads, and educational institutions. Shelters should be simple to use, well-lit, and highly recognizable. Shelters also provide an opportunity to display a map of the regional and local bicycle network, as well as any other relevant information.

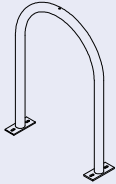
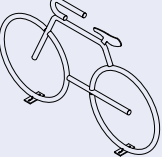
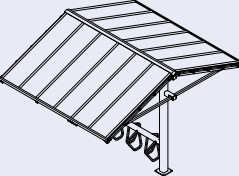
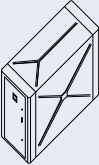
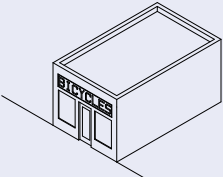
Bicycle Locker: Bicycle Lockers provide an all-weather, high-security, and long term parking solution. Lockers are ideal for transit stops, park and rides, civic buildings, educational institutions, and large apartment buildings/commercial towers. Bicycle Lockers should be well-maintained and monitored.

Bicycle Station: Stations provide the highest level of service for medium and long term parking. They are intended to be regional hubs of bicycling activity and are therefore ideal for the most urban Transect Zone, T-6. Bicycle Stations often include shower and changing facilities, bicycle repair and rental, attended or automated parking, and food and beverage services.

ADDITIONAL RESOURCES:
Bicycle Parking Guide, Association of Pedestrian and Bicycle Professionals, 2010 <www.apbp.org/?page=Publications>
Bicycle Parking Manual, Danish Cyclists Federation, 2008 <www.dcf.dk/composite-848.htm>
Bicycle Parking Guide, City of Cambridge, MA, 2008 <www.cambridgema.gov/cdd/et/bike/bike_pkng_brochure.pdf>

Municipality

TABLE B4: Bicycle Parking Types. This table shows five common types of Bicycle Parking facilities. Standards should be calibrated to the needs of each municipality.

	T1	T2	T3	T4	T5	T6	SD	Standards
Bicycle Rack (Inverted "U," post and ring, etc.) 	□	□	□	■	■	■	■	Racks shall be capable of securing bicycles with at least two points of contact. Simple, easily identifiable forms should be used. Racks may be placed in the Private Frontage, Public Frontage, or within buildings.
Bicycle Rack (decorative, public art) 			□	□	■	■	■	Decorative racks shall be recognizable as bicycle parking facilities and shall be held to the same performance standards as other bicycle racks. Such racks may be provided for Civic Buildings, Civic Spaces, and other locations of historic, social, or cultural importance.
Bicycle Shelter 	□	□	□	□	■	■	□	Shelters shall be highly recognizable and integrated with transit and/or related land uses requiring medium or long term bicycle parking needs. Each shelter shall include bicycle parking racks capable of securing bicycles with at least two points of contact.
Bicycle Locker 	□	□	□	□	■	■	□	Bicycle Lockers shall be placed in a highly visible and well-lit location, but shall not disrupt the function and order of the public realm. They should be monitored and maintained to discourage vandalism.
Bicycle Station 					□	■	□	Bicycle Stations should be located in highly visible locations, ideally near transit. They should offer a variety of services that may include repair, rental, cafe, lockers, showers, and storage facilities.

- By Right
- By Warrant

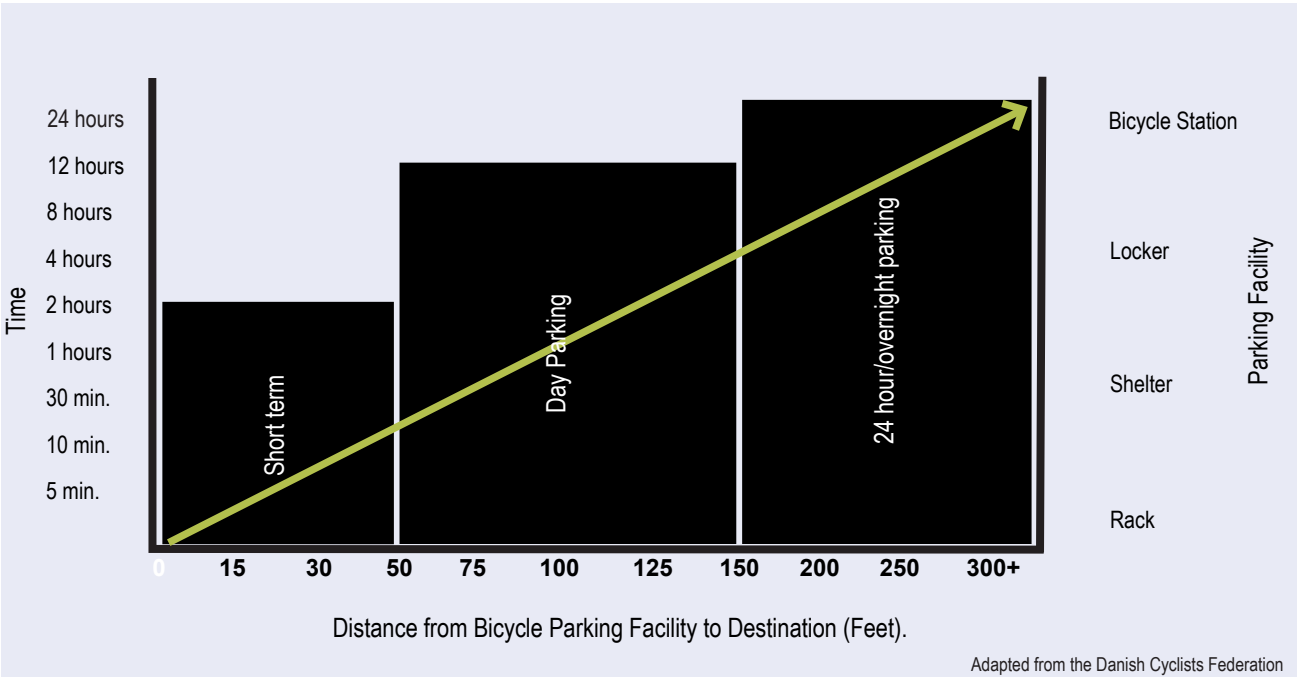
BICYCLE PARKING
GENERAL LOCATION STANDARDS

The placement and location of bicycle parking and other end-of-trip facilities is crucial in making bicycling more attractive and feasible. Bicyclists want to park as closely and conveniently to their destination as possible. In this regard, they are no different from motorists, as searching for bicycle parking can be equally frustrating as searching for motor vehicle parking. Short term facilities, like bicycle racks and shelters, should be located as close as possible to the destination(s) they serve. This is especially important for public spaces served by retail uses and transit stops.

Long term parking, such as bicycle lockers and stations, should also be as convenient as possible. However, the protection from inclement weather and the enhanced level of safety/service that long term facilities afford the user can make up for a less convenient location. Similarly, shower, changing rooms, and locker facilities need not be located inside the destination they serve.

Table B5, which was adapted from the Danish Cycling Federation's *Guide to Bicycle Parking*, demonstrates the general relationship between short term and long term parking, as well as the desired distance and level of service required to meet the needs of bicyclists.

Table B5: Bicycle Parking - General Location Standards - This table prescribes the general relationship among the distance from parking facility to destination, the parking duration, and the parking facility type provided.



DEFINITIONS OF TERMS

Any of these Bicycle Module terms used in a calibration of a SmartCode should be incorporated into Article 7 of the base code. Some definitions appear here for terms that are already in the base code (e.g., Bicycle Lane), but the definitions in this Module are more specific. Calibrators should modify any disparities according to local intent.

ARTICLE 7. DEFINITIONS OF TERMS
BICYCLE MODULE

- Bicycle Boulevard:** a Thoroughfare with shared Vehicular Lanes that introduces traffic calming and wayfinding solutions to give movement priority to bicyclists.
- Bicycle Box:** a section of pavement designed to give bicyclists using a Bicycle Lane a head start at signalized intersections. A Bicycle Box is often colored and includes a standard white bicycle pavement marking. It improves visibility between motorists turning right and cyclists traveling through the intersection. (Syn: advance stop line)
- Bicycle Inductor Loop:** a coil of wire embedded in a Thoroughfare surface that detects the presence of a bicycle and prioritizes an intersection signal for it.
- Bicycle Lane:** a lane reserved for bicycle travel within a vehicular Thoroughfare.
- Bicycle Locker:** an enclosed and secured locker that provides bicycle parking for long term use.
- Bicycle Path:** a dual-direction Bikeway that is physically separated from vehicular Thoroughfares, usually shared with pedestrians, runners, and rollerbladers and detailed for the more urban Transect Zones. (Var: shared use path)
- Bicycle Route:** a route marked with signs to be amenable to bicycling, often comprised of one or more types of Bikeways over its trajectory.
- Bicycle Shelter:** a roofed shelter that provides multiple bicycle racks for public use.
- Bicycle Station:** a building that provides self-service, attended indoor valet, or automated bicycle parking services, often accompanied by showers, lockers, bicycle repair and rental facilities.
- Bicycle Trail:** a dual-direction Bikeway that is physically separated from vehicular Thoroughfares, usually shared with pedestrians, runners, and rollerbladers and detailed for the more rural Transect Zones. (Var: shared use path)
- Bikeway:** a continuously designated segment of the Right of Way that provides exclusive, preferential, or equal priority for bicycle travel. It includes the Riding Surface and any Curbs, markings, and protective barriers, and any plantings, lighting, and furniture that are specific only to the Bikeway.
- Buffered Bicycle Lane:** a Bicycle Lane separated from vehicular travel and/or parking lanes by striped pavement markings which function as a buffer. (Syn: enhanced bicycle lane)
- Contra-Flow Bicycle Lane:** a designated Bicycle Lane marked to allow bicyclists to travel against the flow of traffic.
- Conventional Bicycle Lane:** a Bicycle Lane for which the only separation from vehicular traffic is pavement striping.
- Countermeasure:** a design technique or facility intended to mitigate unsafe or unappealing bicycling conditions.
- Diverter:** a design intervention that limits vehicular traffic from entering all or part of a Thoroughfare but that enables bicycles to pass through.
- Peg-a-Track:** parallel dashed pavement markings that continue a Bicycle Lane through an intersection. (Var. Peg-a-Trak)

These annotations are advisory only. The SmartCode itself appears only on the right side of each spread.

Municipality

- Physically-Separated Bicycle Lane:** a uni- or bi-directional Bicycle Lane separated from the motor vehicle travel lanes by Curbs, railings, plantings, parked cars, and/ or grade separation. (Var: cycle track, sidepath)
- Riding Surface:** the portion of a Bikeway used for cycling, the equivalent of the Vehicular Lanes or roadbed for motor traffic
- Shared Vehicular Lane Marking:** a pavement marking featuring a bicycle symbol and chevron, applied to a Thoroughfare too narrow to accommodate Bicycle Lanes and with vehicular target speeds slow enough to allow cyclists to move safely with motor vehicles. (Syn: **Sharrow**)
- Sharrow:** see **Shared Vehicular Lane Marking**.
- Shoulder:** a paved portion of a Thoroughfare that exists outside of its Vehicular Lanes.
- Shy Zone:** a painted buffer between parked cars and a Bicycle Lane.

These annotations are advisory only. The SmartCode itself appears only on the right side of each spread.

TABLE 4C. BIKEWAY ASSEMBLIES

Included here are ten assemblies with detailed Bikeway standards that may be added to the base SmartCode during local calibration, and others may be created as necessary using the same template. They replicate closely the thoroughfare standards of municipal public works manuals and are intended to supplement the Complete Thoroughfares Module (Table 4C). Assemblies in all SmartCode transportation modules have specific measurements because they are meant to refer to an exact place. They should be considered examples and may be calibrated.

The Bikeways drawn here are to scale and include supporting information below them. These assemblies combine a vehicular thoroughfare similar to those found in the SmartCode Complete Thoroughfares Module with a Bikeway type selected from this module. In the final calibrated code, the assembly may be extended to include one or more Transit types, if applicable. A complete thoroughfare designed from scratch would require all transportation provisions to be considered together, along with drainage, which also must be correlated to the Transect. (See LightImprint.org, the Natural Drainage Module, and the Landscape Module for techniques.)

The assemblies in this module that include bicycle lanes in the higher T-zones are intended only for retrofit of existing thoroughfares, as noted on the assembly table. Properly designed thoroughfares in New Urbanist communities have low target speeds so bicycle lanes are generally not necessary. In fact, they may be counter-productive to a safe pedestrian and bicycling realm, widening the curb-to-curb crossing distance as well as the sense of spatial enclosure that slows down motorists. When bicyclists are not present, bicycle lanes actually may cause motorists to feel safer driving faster (they are farther from parked cars and trees), which in turn makes bicyclists less likely to use that thoroughfare for bicycling. Sharing traffic lanes with very slow-moving traffic is safer. For example, the vehicular lanes for the Bicycle Path assembly are wider than advised for New Urbanist design in the T-zones shown, making the path a good solution for cycling.

While parking lanes in the Complete Thoroughfares Module may be 7' for narrower ROWs and therefore slower target speeds, restriping of an overwide thoroughfare may call for 8' parking lanes when placed between a conventional (striped only) bicycle lane and the curb. This helps reduce the likelihood of the motorist "dooring" the cyclist. A wider-than-minimum bicycle lane is also indicated in this case. Again, these are retrofit strategies only.

Standards for the separations on Physically-Separated Bicycle Lanes are not given because the materials and widths vary depending on context - curbs, planters, bollards, raised pavement or other tools may be used.

Bicycle Boulevards are a new and highly specific street type to be used for retrofitting corridors where primarily residential land uses abut the thoroughfare. The Bicycle Boulevard assembly drawn here shows a partial diverter and specific pavement markings to communicate the priority movement of bicyclists. In reality, diverters should be used sparingly, and are just one of many techniques used to articulate a Bicycle Boulevard. Other measures include wayfinding signs, reduced speed limits, medians designed for cyclists, neighborhood traffic circles, and the removal of stop signs along the corridors. Please refer to the *Bicycle Boulevard Planning and Design Guidebook* for further information on where this bikeway type is most applicable.

Municipality

KEY		ST-57-20-BL
Thoroughfare Type		
Right of Way Width		
Pavement Width		
Transportation		
THOROUGHFARE TYPES		
Highway:		HW
Road:		RD
Street:		ST
Drive:		DR
Avenue:		AV
Commercial Street:		CS
Boulevard:		BV
Rear Alley:		RA
Rear Lane:		RL
Path:		PT
Passage:		PS
BIKEWAY TYPES		
Bicycle Trail (Shared Use):		BT
Bicycle Path (Shared Use):		BP
Bicycle Lane:		BL
Conventional		BLC
Buffered		BLB
Buffered - Two-Way		BLB2
Physically Separated		BLP
Shoulder		BLS
With Bicycle Box		BLX
Shared Vehicular Lane:		SL
Bicycle Boulevard:		BB
TRANSITWAY TYPES		See TOD Module
ASSEMBLY DESIGNATION		
Thoroughfare Type		
Right-of-Way Width		
Pavement Width		
Transect Zone Assignment		
PUBLIC FRONTAGE		
Drainage Type		
Curb Radius		
Walkway Type		
Planter Type		
Landscape Type		
Median Width		
VEHICULAR LANES		
Traffic Lane Width		
Parking Lane Width		
Target Speed		
Pedestrian Crossing Time		
BIKEWAY TYPE		
Riding Surface Width		
Movement		
Intersection Treatment		
Bicycle Parking		
TRANSITWAY TYPE		

BT-V-10
Bicycle Trail (Shared Use)
varies
10 feet
T1, T2, T3
Swale
n/a
n/a
n/a
n/a
naturalistic
n/a
n/a
n/a
n/a
n/a
BT - Bicycle Trail (Shared Use)
10 feet
dual direction
signed
rack, Bicycle Shelter
n/a

BP-V-10
Bicycle Path (Shared Use)
varies
10 feet
T3, T4, T5
Swale, Curb
n/a
n/a
n/a
naturalistic, planted
n/a
11 feet
one side @8 feet marked
n/a
n/a
BP - Bicycle Path (Shared Use)
10 feet
dual direction
signed, signalized
rack, Bicycle Shelter, Bicycle Locker
n/a

TABLE 4C BIKEWAY ASSEMBLIES - NEW OR RETROFIT

KEY		ST-57-20-BL
Thoroughfare Type		
Right of Way Width		
Pavement Width		
Transportation		
THOROUGHFARE TYPES		
Highway:	HW	
Road:	RD	
Street:	ST	
Drive:	DR	
Avenue:	AV	
Commercial Street:	CS	
Boulevard:	BV	
Rear Alley:	RA	
Rear Lane:	RL	
Path:	PT	
Passage:	PS	
BIKEWAY TYPES		
Bicycle Trail (Shared Use):	BT	
Bicycle Path (Shared Use):	BP	
Bicycle Lane:	BL	
Conventional	BLC	
Buffered	BLB	
Buffered - Two-Way	BLB2	
Physically Separated	BLP	
Shoulder	BLS	
With Bicycle Box	BLX	
Shared Vehicular Lane:	SL	
Bicycle Boulevard:	BB	
TRANSITWAY TYPES		See TOD Module
ASSEMBLY DESIGNATION		
Thoroughfare Type		
Right-of-Way Width		
Pavement Width		
Transect Zone Assignment		
PUBLIC FRONTAGE		
Drainage Type		
Curb Radius		
Walkway Type		
Planter Type		
Landscape Type		
Median Width		
VEHICULAR LANES		
Traffic Lane Width		
Parking Lane Width		
Target Speed		
Pedestrian Crossing Time		
BIKEWAY TYPE		
Riding Surface Width		
Movement		
Intersection Treatment		
Bicycle Parking		
TRANSITWAY TYPE		

HW-66-40-BLS
Highway with Shoulder
66 feet
40 feet
T1, T2
Swale
15 feet
n/a
13 foot continuous Swale
naturalistic
n/a
12 feet
n/a
over 35 mph
12 seconds
BLS - Bicycle Lane / Shoulder
8 feet
with traffic
signed, signalized
opportunistic, rack, Bicycle Shelter
See Transit Module

CS-60-32-SL
Commercial Street w/ Shared Lane Marking (Sharrow)
60 feet
32 feet
T3, T4, T5, T6
4" raised Curb
10 feet
14 foot Sidewalk both sides
6 foot tree wells
trees at 30' o.c. avg.
n/a
9 feet
both sides @ 7 feet marked
25 mph
10 seconds
SL - Shared Vehicular Lane (Sharrow)
9 feet
with traffic
signed, signalized, Bicycle Inductor Loops
rack, Bicycle Shelter
See Transit Module

TABLE 4C BIKEWAY ASSEMBLIES - RETROFIT

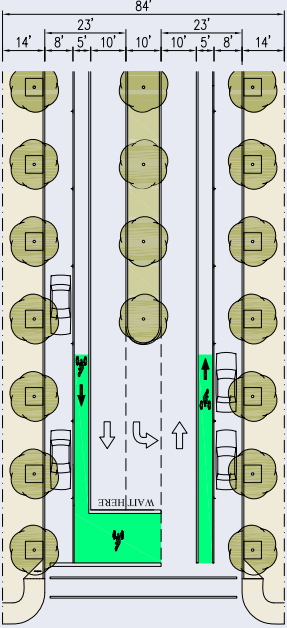
KEY		ST-57-20-BL
Thoroughfare Type		
Right of Way Width		
Pavement Width		
Transportation		
THOROUGHFARE TYPES		
Highway:	HW	
Road:	RD	
Street:	ST	
Drive:	DR	
Avenue:	AV	
Commercial Street:	CS	
Boulevard:	BV	
Rear Alley:	RA	
Rear Lane:	RL	
Path:	PT	
Passage:	PS	
BIKEWAY TYPES		
Bicycle Trail (Shared Use):	BT	
Bicycle Path (Shared Use):	BP	
Bicycle Lane:	BL	
Conventional	BLC	
Buffered	BLB	
Buffered - Two-Way	BLB2	
Physically Separated	BLP	
Shoulder	BLS	
With Bicycle Box	BLX	
Shared Vehicular Lane:	SL	
Bicycle Boulevard:	BB	
TRANSITWAY TYPES		See TOD Module
ASSEMBLY DESIGNATION		
Thoroughfare Type		
Right-of-Way Width		
Pavement Width		
Transect Zone Assignment		
PUBLIC FRONTAGE		
Drainage Type		
Curb Radius		
Walkway Type		
Planter Type		
Landscape Type		
Median Width		
VEHICULAR LANES		
Traffic Lane Width		
Parking Lane Width		
Target Speed		
Pedestrian Crossing Time		
BIKEWAY TYPE		
Riding Surface Width		
Movement		
Intersection Treatment		
Bicycle Parking		
TRANSITWAY TYPE		

CS-76-48-BLC
Commercial Street with Conventional Bicycle Lane
76 feet
48 feet
(retrofit) T3, T4, T5
4" raised Curb
10 feet
14 foot Sidewalk both sides
4 foot tree well
trees at 30' o.c. avg.
n/a
10 feet
both sides @ 8 feet
30 mph
13 seconds
BL - Bicycle Lane
6 feet
with traffic
signed, signalized, dashed, Peg-a-Trak, colored
rack, Bicycle Shelter, Bicycle Locker, Bicycle Station
See Transit Module

ST-52-32-BB
Street as Bicycle Boulevard
52 feet
32 feet
(retrofit) T3, T4
4" raised Curb
10 feet
5 foot Sidewalk both sides
5 foot continuous planter
trees at 30' o.c. avg.
n/a
9 feet
both sides @ 7 feet marked
20 mph
10 seconds
BB - Bicycle Boulevard
9 feet
with traffic
signed, signalized, Bicycle Inductor Loops, Diverter
rack, Bicycle Shelter
See Transit Module

TABLE 4C BIKEWAY ASSEMBLIES - RETROFIT

KEY		ST-57-20-BL
Thoroughfare Type		
Right of Way Width		
Pavement Width		
Transportation		
THOROUGHFARE TYPES		
Highway:	HW	
Road:	RD	
Street:	ST	
Drive:	DR	
Avenue:	AV	
Commercial Street:	CS	
Boulevard:	BV	
Rear Alley:	RA	
Rear Lane:	RL	
Path:	PT	
Passage:	PS	
BIKEWAY TYPES		
Bicycle Trail (Shared Use):	BT	
Bicycle Path (Shared Use):	BP	
Bicycle Lane:	BL	
Conventional	BLC	
Buffered	BLB	
Buffered - Two-Way	BLB2	
Physically Separated	BLP	
Shoulder	BLS	
With Bicycle Box	BLX	
Shared Vehicular Lane:	SL	
Bicycle Boulevard:	BB	
TRANSITWAY TYPES		See TOD Module
ASSEMBLY DESIGNATION		
Thoroughfare Type		
Right-of-Way Width		
Pavement Width		
Transect Zone Assignment		
PUBLIC FRONTAGE		
Drainage Type		
Curb Radius		
Walkway Type		
Planter Type		
Landscape Type		
Median Width		
VEHICULAR LANES		
Traffic Lane Width		
Parking Lane Width		
Target Speed		
Pedestrian Crossing Time		
BIKEWAY TYPE		
Riding Surface Width		
Movement		
Intersection Treatment		
Bicycle Parking		
TRANSITWAY TYPE		

	AV-84-56-BLX
Avenue with Bicycle Lane with Bicycle Box	
84 feet	
56 feet	
(retrofit) T3, T4, T5	
4" raised Curb	
10 feet.	
14 foot Sidewalk both sides	
6 foot tree wells	
trees at 30' o.c. avg.	
10 feet.	
10 feet, turn lane10 feet	
both sides @ 8 feet marked	
35 mph	
16 seconds	
BLX - Bicycle Lane with Bicycle Box	
5 feet with 14' deep box	
with traffic	
signalized, Bicycle Box	
rack, Bicycle Shelter, Bicycle Locker, Bicycle Station	
See Transit Module	

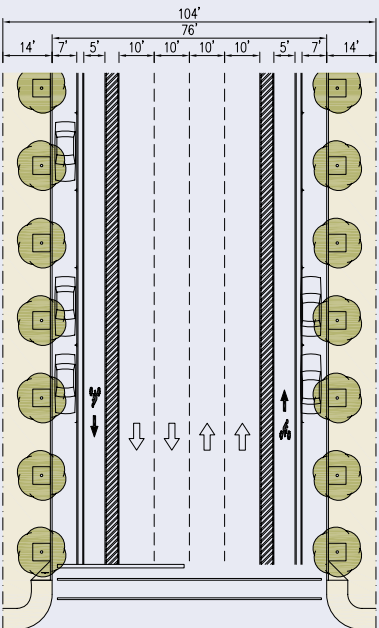
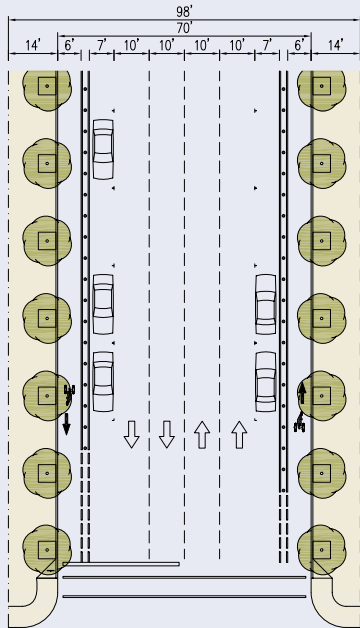
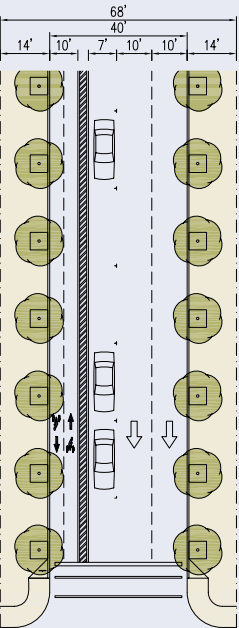
	CS-104-76-BLB
Commercial Street with Buffered Bicycle Lanes	
104 feet	
76 feet	
(retrofit) T5, T6	
4" raised Curb	
10 feet	
14 foot Sidewalk both sides	
6 foot tree wells	
tree wells 30' o.c. avg.	
n/a	
10 feet	
both sides @ 7 feet marked	
above 35 mph	
24 seconds	
BLB - Buffered Bicycle Lane	
5 feet with 4' striped buffer and 2' Shy Zone	
with traffic	
signalized, Peg-a-Track, colored, Bicycle Box, Bicycle Inductor Loops	
rack, Bicycle Shelter, Bicycle Locker, Bicycle Station	
See Transit Module	

TABLE 4C BIKEWAY ASSEMBLIES - RETROFIT

KEY		ST-57-20-BL
Thoroughfare Type		
Right of Way Width		
Pavement Width		
Transportation		
THOROUGHFARE TYPES		
Highway:	HW	
Road:	RD	
Street:	ST	
Drive:	DR	
Avenue:	AV	
Commercial Street:	CS	
Boulevard:	BV	
Rear Alley:	RA	
Rear Lane:	RL	
Path:	PT	
Passage:	PS	
BIKEWAY TYPES		
Bicycle Trail (Shared Use):	BT	
Bicycle Path (Shared Use):	BP	
Bicycle Lane:	BL	
Conventional	BLC	
Buffered	BLB	
Buffered - Two-Way	BLB2	
Physically Separated	BLP	
Shoulder	BLS	
With Bicycle Box	BLX	
Shared Vehicular Lane:	SL	
Bicycle Boulevard:	BB	
TRANSITWAY TYPES		See TOD Module
ASSEMBLY DESIGNATION		
Thoroughfare Type		
Right-of-Way Width		
Pavement Width		
Transect Zone Assignment		
PUBLIC FRONTAGE		
Drainage Type		
Curb Radius		
Walkway Type		
Planter Type		
Landscape Type		
Median Width		
VEHICULAR LANES		
Traffic Lane Width		
Parking Lane Width		
Target Speed		
Pedestrian Crossing Time		
BIKEWAY TYPE		
Riding Surface Width		
Movement		
Intersection Treatment		
Bicycle Parking		
TRANSITWAY TYPE		

	CS-98-70-BLP
Commercial Street with Physically-Sep. Bicycle Lane	
98 feet	
70 feet	
(retrofit) T5, T6	
4" raised Curb	
10 feet.	
14 foot Sidewalk both sides	
6 foot tree wells	
trees at 30' o.c. avg.	
n/a	
10 feet	
both sides @ 7 feet marked	
35 mph	
20 seconds	
BLP - Physically-Separated Bicycle Lane (Cycle Track)	
6 feet with 2 ft barrier	
with traffic	
signalized, Peg-a-Track, colored	
rack, Bicycle Shelter, Bicycle Locker, Bicycle Station	
See Transit Module	

	DR-68-40-BLB2
Drive with 2-Way Buffered Bicycle Lane	
68 feet	
40 feet	
(retrofit) T4, T5, T6	
4" raised Curb	
10 feet	
14 foot Sidewalk both sides	
6 foot tree wells	
tree wells 30' o.c. avg	
n/a	
10 feet	
one side @ 7 feet marked	
30 mph	
12 seconds	
BLB2 - Two-Way Buffered Bicycle Lane	
5 feet each way with 3 ft striped buffer	
dual direction	
signalized, Peg-a-Track, colored,Bicycle Box, Bicycle Inductor Loops	
rack, Bicycle Shelter, Bicycle Locker, Bicycle Station	
See Transit Module	