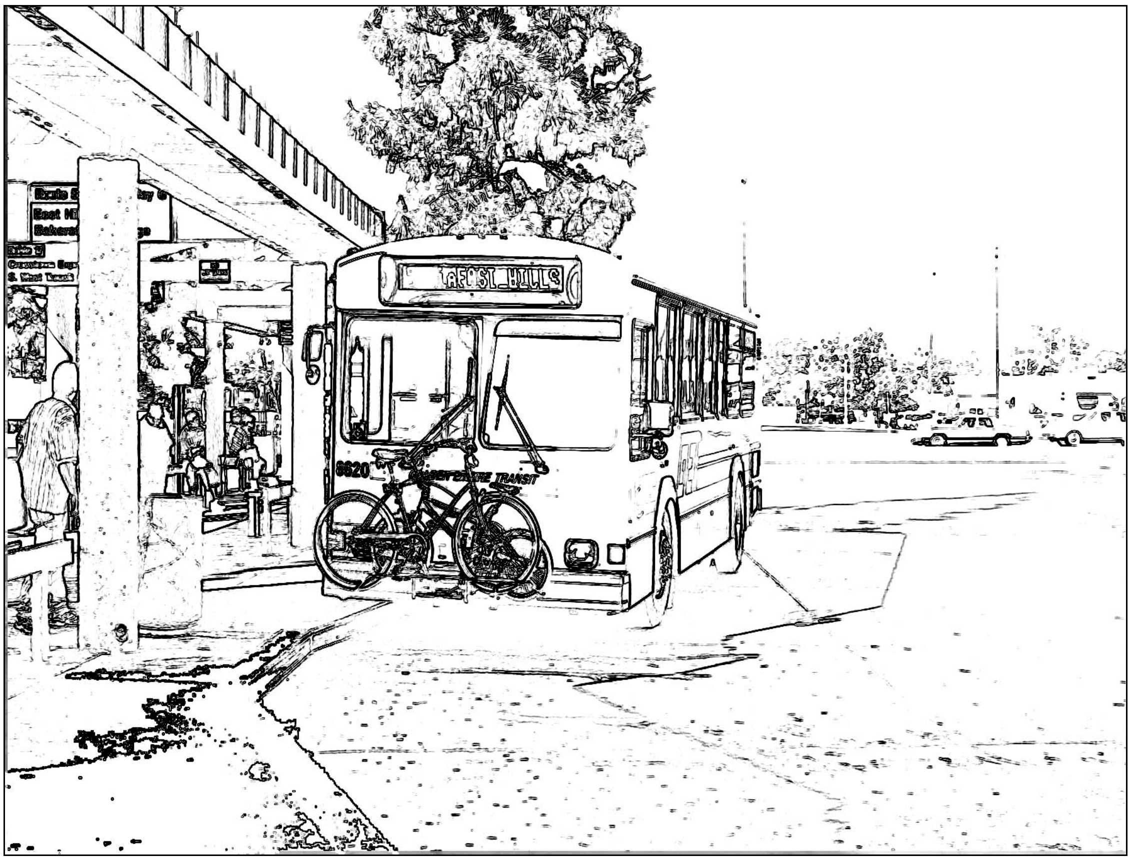
KERN COUNTY BICYCLE FACILITIES PLAN



2001

Kern Council of Governments
1401 –19th- Street, Suite 300
Bakersfield, California 93301

Adopted October 2001

Kern County Bicycle Plan-2001

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Executive Summary

This report is a compendium of bicycle transportation facilities, both constructed and planned, within Kern County. It is intended to serve as guide to developing bicycle transportation facilities in an orderly and timely fashion within the region.

In the transportation planning profession, more and more emphasis is being placed on soft solutions to traffic and traffic congestions problems. The trend towards solving traffic problems without resorting to expanding transportation (automobile) facilities has been evident over the last decade and there have been many notable success stories where more effective management of the existing transportation system reduces or eliminates the need for costly and disruptive expansions of existing travel corridors. Providing alternatives to personal transportation other than the private automobile is a central tenet of the new way of thinking about transportation systems.

The Kern County area is especially well suited for bicycle transportation facilities to make a significant and meaningful contribution to the overall transportation system. The climate of the region is favorable for bicycling, with many clear, dry days and moderate temperatures.

Introduction

The Kern County Bicycle Plan has been produced so that much of the information related to bicycling in the Kern region will be available in a single document. The purpose this serves is to simplify and clarify bicycle travel facilities planning and serve as a basis of understanding for existing facilities and identify where the system needs to be expanded.

The Kern region is very conducive to bicycle transportation. The weather is nearly frost-free and from mid-April through mid-October sunny, dry and warm conditions become almost monotonous. Combined with the nearly level terrain found in most of the region's urbanized areas, the potential for travel by bicycle is very high.

According to the fact sheet for the California Bicycle Summit, March 5-6, 1998:

Statewide, about 7 tons per day of smog-forming gases and almost a ton of inhalable particles are spared from the air we breathe due to use of bicycles rather than motor vehicles. People choosing to pedal rather than drive usually replace short automobile trips that are disproportionately high in pollutant emissions.

- More than half of commute trips, and three out of four shopping trips, are less than five miles in length -- ideal for bicycling. Forty percent of all trips are less than two miles.

- National polls have found that 17 to 20 percent of adults say they would sometimes bike to work if safe routes and workplace parking and changing facilities were provided. A comprehensive review of non-motorized travel data indicates, "Considerable latent demand for bicycling and walking will be released if infrastructural impediments to these modes are removed or mitigated."

- A 1985 study of the market for commute cycling found that as many as 200,000 to 800,000 more Californians "might be convinced to bicycle rather than drive to work, considering their suitability in terms of age, employment status, commute distance and bike availability."

- Bicycling is increasing in popularity. 105 million Americans rode a bicycle in 1997, a significant increase over 1991 levels.

The U.S. Department of Transportation's three-year National Bicycling and Walking Study, completed in 1994, identified strategies for doubling the percentage of total trips made by bicycling and walking, and identified scenarios for increasing bicycle trips by 3 to 5 times current levels. The 1991 Statewide Travel Survey found 1.3 percent of trips were made by bicycle. Here's the air pollution reduction that would result if Californians were to replace an additional 3 percent of car and light truck trips with bicycle trips by 2010:

Travel and Emission Reductions in 2010 if Bicycle Usage Replaces 3% of Projected Light Duty Vehicle Trips (tons/day)			
	Reduction in Vehicle Miles of Travel	Reductions in Smog-Forming Gases (ROG+NOx)	Reductions in Inhalable Particles (PM10)
South Coast region	3,289,000	5.7	1.6
Bay Area	1,674,000	2.9	0.8
San Joaquin Valley	**1,220,000**	**2.1**	**0.6**
Sacramento region	707,000	1.2	0.4
San Diego County	751,000	1.3	0.4
Southeast Desert region	**378,000**	**0.7**	**0.2**
Ventura County	216,000	0.4	0.1
Santa Barbara County	146,000	0.3	0.1
Monterey/Santa Cruz	173,000	0.3	0.1
Statewide	9,239,000	16.0	4.5

Source: California Air Resources Board – Fact Sheet – California Bicycle Summit dated March 27, 1998.

Many cities within the Kern region have adopted bicycle plans as a subsection of the Circulation Element. However, many have not been updated in several years. One of the purposes of this report is to describe the existing systems, the amount of planned systems that have been constructed and where additional funding may be utilized, on a regional basis, to improve and enhance the existing system and to make it more available to the general public to avail themselves for travel by bicycle.

GOALS

- **Goal:** Provide a balanced and efficient transportation system that maximizes the reduction of air pollution.
- **Goal:** Provide safe, accessible and convenient bicycling facilities.
- **Goal:** Support and encourage increased levels of bicycling and walking.
- **Goal:** Promote the use of bicycles as an integral component of the regional multi-modal transportation network.

OBJECTIVES

- **Objective:** Plan and provide a continuous and easily accessible bike path system within the region.
- **Objective:** Develop a region-wide cycling system that will minimize bicycle/automobile/pedestrian conflicts.
- **Objective:** Encourage maintenance of bicycle facilities.
- **Objective:** Provide adequate support facilities to encourage use of the bikeway system.
- **Objective:** Provide an information/education program for motorists and cyclists that identifies the proper role for each in the traffic environment.
- **Objective:** Non-motorized transport facilities should be provided as rapidly as possible whenever they have the potential to reduce motor vehicle use.
- **Objective:** Sources of revenue should be pursued for non-motorized transportation facilities, public transportation alternatives and infrastructure improvements for pedestrian and bicycle access.

POLICIES

- **Policy:** Recommend appropriate roadway standards to facilitate the use of alternative modes of travel, such as bus lanes, bike lanes and pedestrian access.

- **Policy:** Assist with coordination between local agency General Plan Circulation Elements.

- **Policy:** All developments and land use plans should be evaluated in terms of effects on the transportation system, including the bicycle system.

- **Policy:** Plans and development proposals for land adjacent to existing or proposed transportation projects should evaluate possible effects on the surrounding circulation network.

- **Policy:** The proposed transportation network shall be consistent with the region Air Quality Attainment Plans.

- **Policy:** Require the design of new bicycle facilities to be in compliance with the Highway Design Manual Chapter 1000-Bikeway Planning and Design.

- **Policy:** Encourage bikeway maintenance services to clear the facilities of loose material, broken glass and other materials hazardous to pedestrians and bicyclists.

- **Policy:** Implement a program to install bicycle-safe drain gratings

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- **Policy:** Encourage bicycle-friendly chip-seal maintenance projects.

- **Policy:** Encourage bicycle-friendly rumble strips.

- **Policy:** Encourage bicycle-friendly railway track crossings.

- **Policy:** Implement a program to provide proper bicycle route lighting.

- **Policy:** Encourage secure bicycle storage facilities at industrial, civic, commercial, recreational, educational and governmental locations.

- **Policy:** Give priority to projects that link existing sections of the bikeway system, thereby eliminating gaps.

- **Policy:** Install bikeway projects in conjunction with street improvement projects.

- **Policy:** Request that CALTRANS design bridges and freeway overpasses/underpasses to serve bicyclists in conjunction with the highways that are designated as portions of the bikeway system.

- **Policy:** Provide for bicycle storage at terminal facilities such as airports, train stations and bus stations to accommodate non-motorized users.

- **Policy:** Encourage transit operators to provide bicycle carriers so that bicycles can be an increasing part of a multi-modal transportation system.

- **Policy:** Encourage bicycle-parking facilities at destination centers such as shopping centers.

- **Policy:** Develop a clear, simple and recognizable bicycle system with clearly signed areas and boundaries.

- **Policy:** Develop bicycling safety pamphlets for distribution through schools, bicycle shops and civic organizations.

- **Policy:** Encourage the Department of Motor Vehicles to include bicycle rules and regulation on license tests.

- **Policy:** Encourage the use of multi-modal transport systems such as bicycle-bus-bicycle transfers.

- **Policy:** Highest priority in non-motorized funding allocations should be to transportation improvements that facilitate a jobs/housing balance, access to work sites, shopping areas, or intermodal linkages.

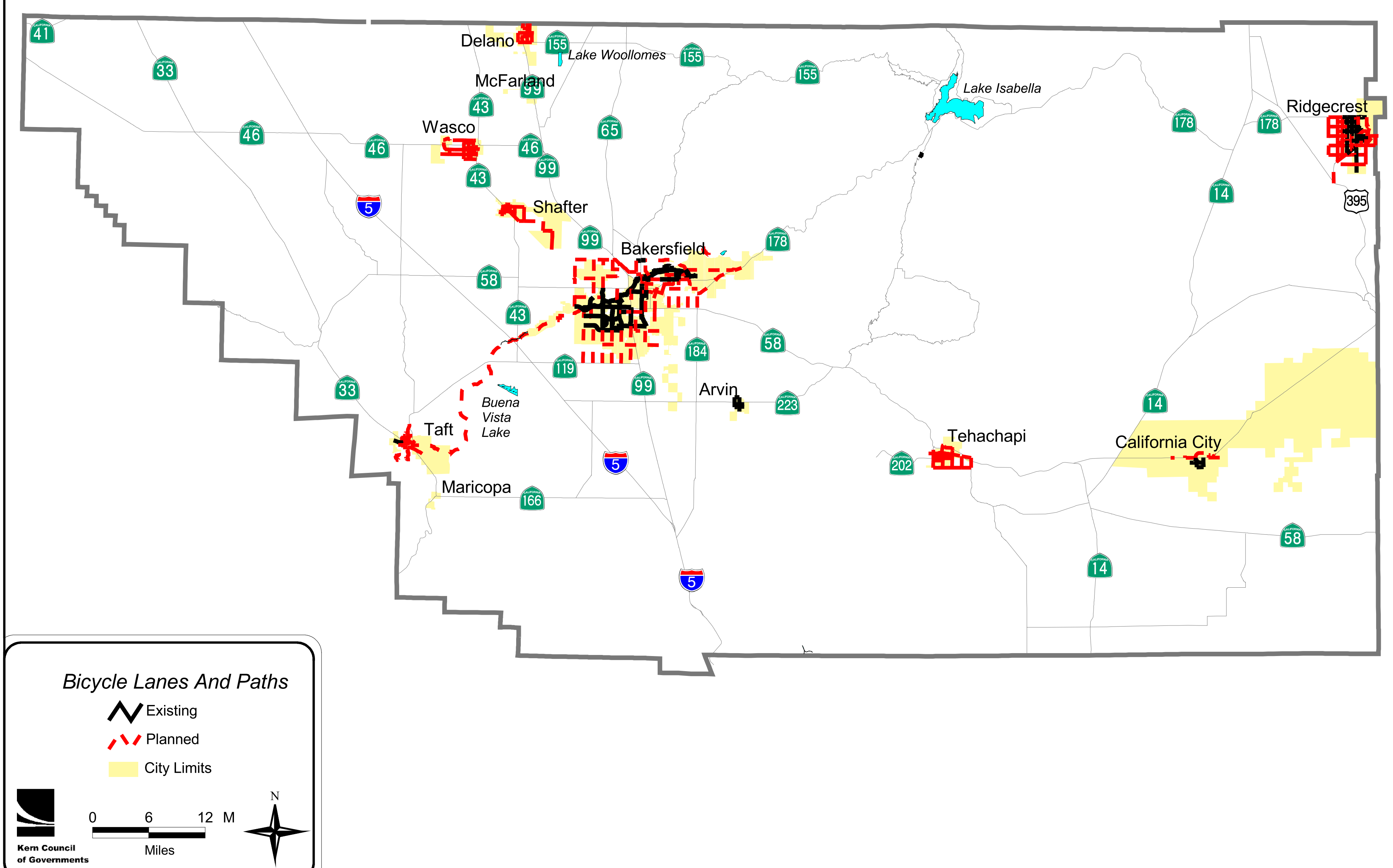
- **Policy**: Assure that the transportation system is balanced and integrated with existing and planned land use to ensure maximum air quality improvements.

- **Policy:** Support public information programs that inform the public about the causes and cures of air pollution and traffic congestion and how bicycles can help implement these programs.

Bikeways and Bikepaths

Existing and Planned

Kern County



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Delano
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Lake Woollomes
McFarland
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Wasco
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Lake Isabella
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Ridgecrest
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Shafter
Bakersfield
58
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184
Arvin
223
Buena Vista Lake
Taft
Maricopa
166
Tehachapi
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California City
Bicycle Lanes And Paths
Existing
Planned
City Limits
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Kern Council of Governments

Arvin

The City of Arvin is located at the base of the Tehachapi Mountains in the extreme southeastern part of the San Joaquin Valley. The terrain is generally flat and the climate conducive to bicycle travel. The 1990 Census reported that 73 persons commuted to work by bicycle out of a locally employed work force of 2,923. This was about 2.5% of commuter trips.

At the present time the city does not have an adopted bicycle plan. The 1988 General Plan mentions that several existing streets could accommodate bicycle lanes, including Meyer Street and Campus Drive and Bear Mountain Blvd. Several of these mentioned routes have been completed.

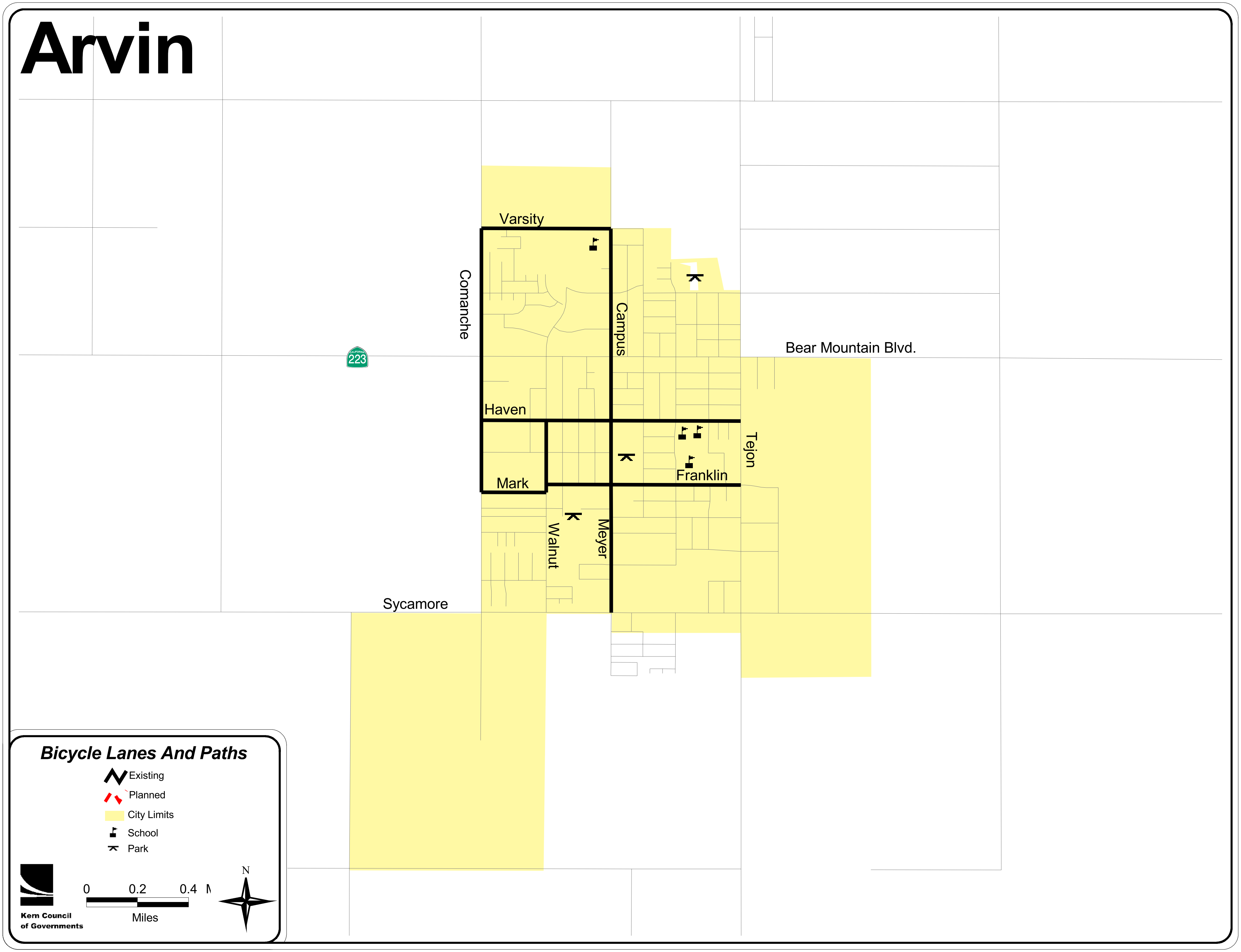
Existing Facilities

North-South Routes

-Meyer Street from Olsen Way to Bear Mountain Blvd.
-Campus Drive from Bear Mountain Blvd to Varsity Road
-Comanche Drive from Mark Road to Varsity Street
-Walnut Street from Mark Road to Haven Avenue

East-West Routes

-Franklin Street from Walnut Street to Derby Street
-Varsity Street from Comanche to Campus Avenue
-Haven from Campus Avenue to Derby Street
-Mark Road from Comanche Road to Walnut Street


Arvin
Varsity
Comanche
Campus
Bear Mountain Blvd.
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Haven
Tejon
Franklin
Mark
Walnut
Meyer
Sycamore
Bicycle Lanes And Paths
Existing
Planned
City Limits
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Kern Council of Governments

Metropolitan Bakersfield

The metropolitan Bakersfield area is home to about 406,196 people. Approximately 247,057 of these live in the City of Bakersfield and the remainder live in adjacent unincorporated areas. The area is generally flat with elevations generally from around 400 feet to 500 feet but with elevations rising to 900 feet in the northeast.

According to the 1990 Census, approximately 0.6 percent of commuters used bicycles for work related commutes. An additional 1.7percent walked while 1.2 percent rode buses.

In 1984 the Kern Council of Governments retained the consulting firm of TJKM Transportation Consultants to prepare a bicycle plan for the metropolitan Bakersfield Area. The result of this consultant contract was a planning document entitled "A Bikeway System Study for the Bakersfield Metropolitan Area." The City of Bakersfield the County of Kern have been incrementally funding the suggested route system for the past 15 years.

Many routes have been constructed since the 1984 report was published.

Existing Facilities

East-West Routes:

-Panorama Drive from Manor Street to Shiloh Ranch Road (Class II).
-Columbus Street from River Blvd. to Panorama Drive (Class II).
-University Street from Wenatchee Street to Columbus Street (Class II).
-21st Street from Oak Street to Chester Avenue (Class II).
-Planz Road from South Chester Avenue to Meadow view Drive (Class II).
-Stockdale Highway from Oak Street to Allen Road (Class II).
-Ming Avenue from New Stine Road to Buena Vista Road (Class II).
-White Lane from New Stine Road to Buena Vista Road (Class II).

North-South Routes:

-Fairfax Road from Auburn Street to Paladino Drive (Class II).
-Q Street from 4th Street to Golden State Highway (Class II).
-Chester Avenue / South Chester Avenue from Planz Road to 34th Street (Class II)
-Oak Street from Planz Road to Kern River Bikeway (Class II).
-New Stine Road from White Lane to Marella Way (Class II).
-Gosford / Coffee Road from White Lane to Stockdale Highway (Class II).
-Ashe Road from White Lane to Stockdale Highway (Class II).
-North Laurelglen Blvd. looping to South Laurelglen Blvd. (Class II).

Funded Facilities

-Fairfax Road from Alfred Harrell Highway to Paladino Drive
-Paladino Drive Extension from Fairfax Road to Morning Drive Extension
-Morning Drive Extension from Alfred Harrell Highway to Paladino Drive Extension
-Camino Media from California State University Bakersfield to Stockdale Highway

Proposed Facilities

East-West Routes:

-Brimhall Road from Allen Road to Coffee Road
-Hageman Road from Allen Road to Mohawk Avenue
-Snow Road form Allen Road to Fruitvale Road
-Olive Drive from Fruitvale to Victor Street
-Belle Terrace from New Stine Road to Madison Street
-White Lane from New Stine Road to Lakeview Avenue
-21st Street from Chester Avenue to Haley Street
-Kentucky Street from Alta Vista Street to Mt. Vernon Avenue
-34th Street from Chester Avenue to Union Avenue
-Bernard Street from Union Avenue to Oswell Street
-College Avenue from Mt. Vernon to Morning Drive
-Columbus Street from La Costa Street to Fairfax Road
-University Street from Wanatchee Street to Haley Street.
-China Grade Loop from McCray Street to Gordon’s Ferry Road
-Roberts Lane from North Chester Avenue to Oildale Drive

North-South Routes:

-Allen Road from Stockdale Highway to Snow Road
-Buena Vista Road from Panama Lane to Stockdale Highway
-Old River Road/Calloway Drive from Panama Lane to Snow Road
-Coffee Road from Rosedale Highway to Snow Road
-Gosford Road from Panama Lane to White Lane
-Ashe Road from Panama Lane to White Lane
-New Stine Road from Panama Lane to White Lane
-Oak Street from Panama Lane to Planz Road
-Hughes Lane from White Lane to Ming Avenue
-Fruitvale Avenue from Hageman to Snow Road
-Mohawk Street from Truxtun Avenue to Hageman Road
-South P Street from East Belle Terrace to 4th Street
-Q Street from Golden State Highway to Columbus Street

-Madison Street from Watts Drive to Brundage
-King Street from Brundage Lane to Panorama Drive
-Baker Street from East California Avenue to Bernard Street
-Haley Street from Kentucky Street to Panorama
-Mt. Vernon from Brundage Lane to Panorama Drive
-Oswell Street from Brundage Lane to Auburn Street
-Fairfax Road from Brundage Lane to Auburn Street
-Morning Drive from Brundage Lane to Niles Street
-Oildale Drive from Roberts Lane to China Grade Loop
-Manor Street from the Kern River Bridge to China Grade Loop

Proposed Bicycle Routes (signs only)

East-West Routes:
-Sundale Avenue from Ashe Road to New Stine Road
-Wilson Road from New Stine Road to Madison Street
-Pacheco Road from Hughes Lane to Cottonwood Road
-Brundage Lane from Oak Street to Edison Highway
-Breckenridge Road from Morning Drive to Comanche Road
-Palm Street from Real Road to South King Street
-Virginia Street from South King Street to Fairfax Road
-Center Street from Mt. Vernon Avenue to Oswell Street
-30th Street from Chester to Alta Vista Drive
-Easton Drive (and others) from California Avenue to Real Road

North-South Routes:
-Real Road from Stockdale Highway to Palm Street
-Alta Vista Drive from Kentucky to Panorama Drive
-South Sterling Road from Brundage Lane to College Avenue
-Manor Street/7th Standard Road

Kern River Bikeway

The most outstanding bicycling route in the Metropolitan Bakersfield area is the Kern River Bicycle Path. This Class I (separate right-of-way) bikeway stretches over 12.3 continuous miles through the center of the urbanized area of Bakersfield and is a central component of the Kern River Parkway.

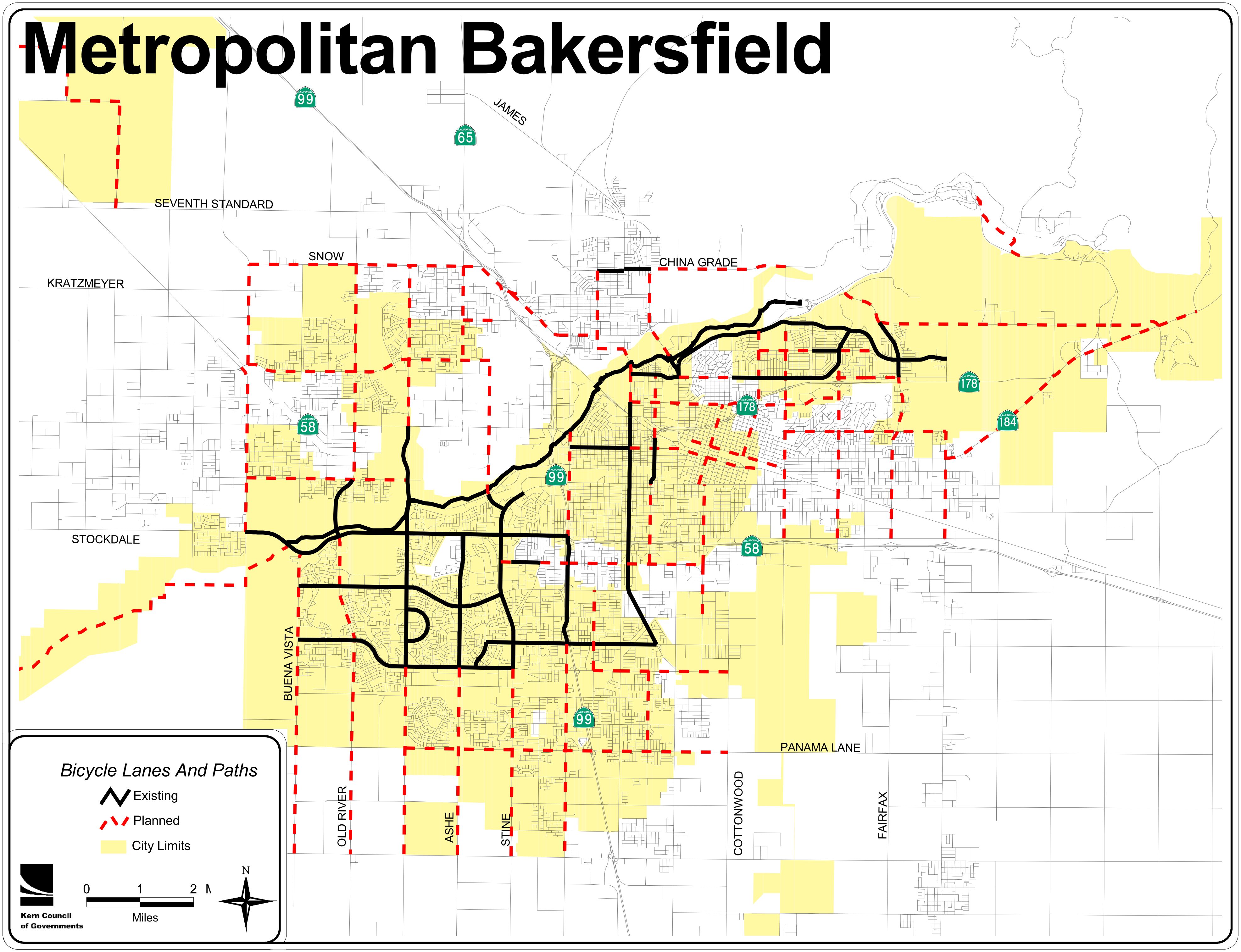
The initial section of the Kern River Bikeway was 3.2 miles in length from Beach Park to Manor Street. It was completed in 1976. The next 2.5-mile segment of bikeway was completed in 1982 between California State University-Bakersfield and Mohawk Avenue. In 1987 a 2-mile section was completed between Manor Street and Beach Park.

Another 2-mile section was completed in 1990 from California State University-Bakersfield to the Stockdale Highway Bridge. In 1996 another 2 miles of bikeway was built from Manor Street to the City Limits near China Grade Loop in Northeast Bakersfield. A short segment of bikeway was completed in 1997 that connected the Manor Street to the Bakersfield City Limits segment to China Grade Loop.

Also constructed in 1997 was a 2-mile long segment of the Kern River Bikeway from Hart Park to the California Living Museum (CALM). This segment of the bicycle path connects two very popular recreational attractions.

It is anticipated that the Kern River Bikeway will serve as the backbone of a regional bikeway system. Future expansions being discussed include a linkage to the City of Taft possibly using aqueduct and canal right of ways.

Metropolitan Bakersfield



California City

California City is located in the Mojave Desert area of Kern County and has a population of 8,385. The area flat terrain and is conducive to bicycle transportation.

Existing Routes

East-West Routes

-California City Blvd from Isabella Blvd to Proctor Blvd
-North Loop Road from California City Blvd to Randsburg-Mojave Road
-South Loop Blvd from California City Blvd to Hacienda Blvd
-Great Circle Blvd from Neuralia Blvd to South Loop Blvd
-Redwood Blvd from Airway to Hacienda Blvd

North-South Routes

-Hacienda Blvd from Redwood Blvd to California City Blvd
-Randburg-Mojave Road from North Loop to California City Blvd
-Airway from South Loop to Redwood

Proposed Facilities

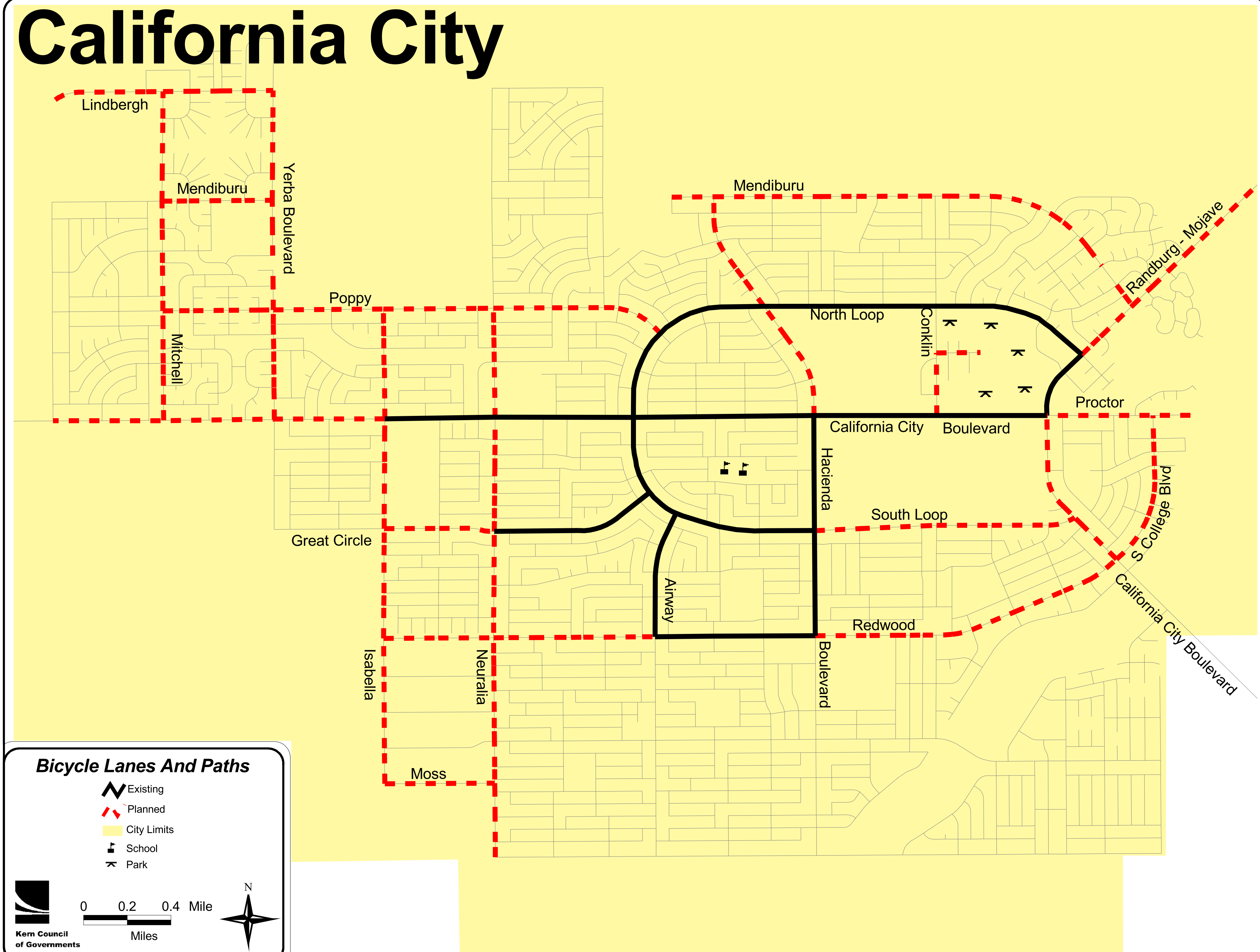
East-West Routes

-Lindberg from airport to Yerba Blvd
-Mendiburu from Mitchell to Yerba Blvd
-Mendiburu from 88th St to Randburg-Mojave Road
-Poppy from Mitchell to North Loop
-California City Blvd from Baron to Isabella
-Proctor from California City Blvd to Cambridge
-Great Circle from Isabella to Neuralia
-South Loop from Hacienda to California City Blvd
-Redwood Blvd from Isabella to Airway
-Redwood Blvd from Hacienda to California City Blvd
-Moss from Isabella to Neuralia

North-South Routes

-Mitchell from Lindbergh to California City Boulevard
-Yerba from Lindbergh to California City Boulevard
-Isabella from Poppy to Moss
-Neuralia from Poppy to Sequoia
-Hacienda from Mendiburu to California City Blvd
-California City Blvd from Proctor to Redwood
-South College from Proctor to California City Blvd
-Randsburg-Mojave Road from North Loop north

California City



Bicycle Lanes And Paths

Existing
Planned
City Limits
School
Park

Kern Council of Governments

0 0.2 0.4 Mile

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Delano

Delano is a rapidly growing community of 38,824 on the Kern County/Tulare County line. The terrain is nearly level and the climate very conducive to bicycle transportation. There is no current bicycle plan, but a study done in 1980 outlines a proposed bicycle travel network within the city of Delano. According to the 1990 Census 0.4 percent of the work force commuted by bicycle.

Proposed Facilities

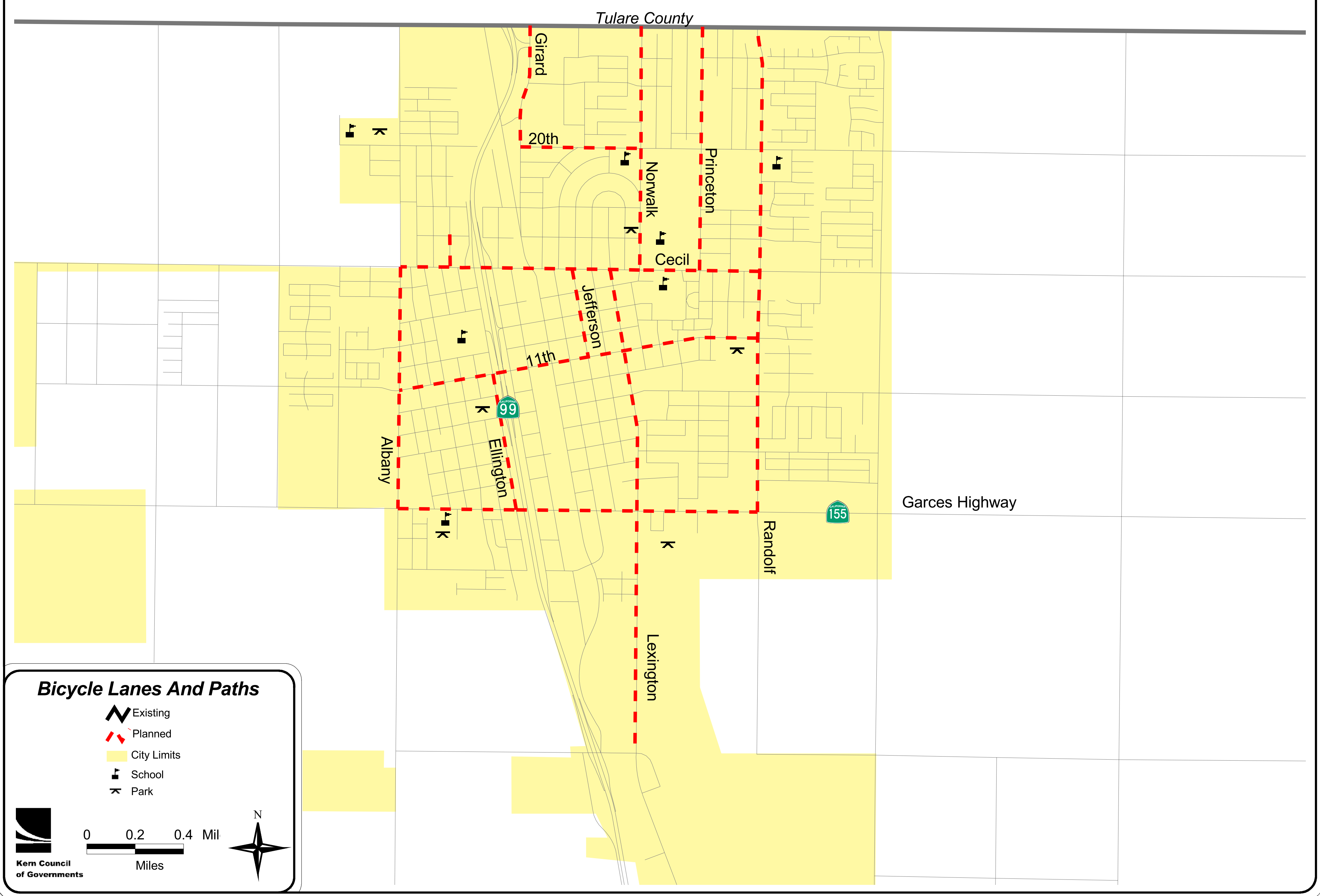
North-South Routes

-Albany Street from Garces Highway to Cecil Avenue
-Ellington Street from Garces Highway to Cecil Avenue
-Jefferson Street from 11th Avenue to Cecil Avenue
-Lexington Street from Airport Drive to Cecil Avenue
-Norwalk Street from Cecil Avenue to County Line Road
-Girard Street from 20th Street to County Line Road
-Princeton Street from Cecil Avenue to County Line Road
-Randolph Street from Garces Highway to County Line Road

East-West Routes

-Garces Highway from Albany to Randolph Street
-11th Avenue from Albany Street to Randolph Street
-Cecil Avenue from Albany Street to Randolph Street
-20th Street from Girard Avenue to Norwalk Street

Delano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Ellington
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Randolf
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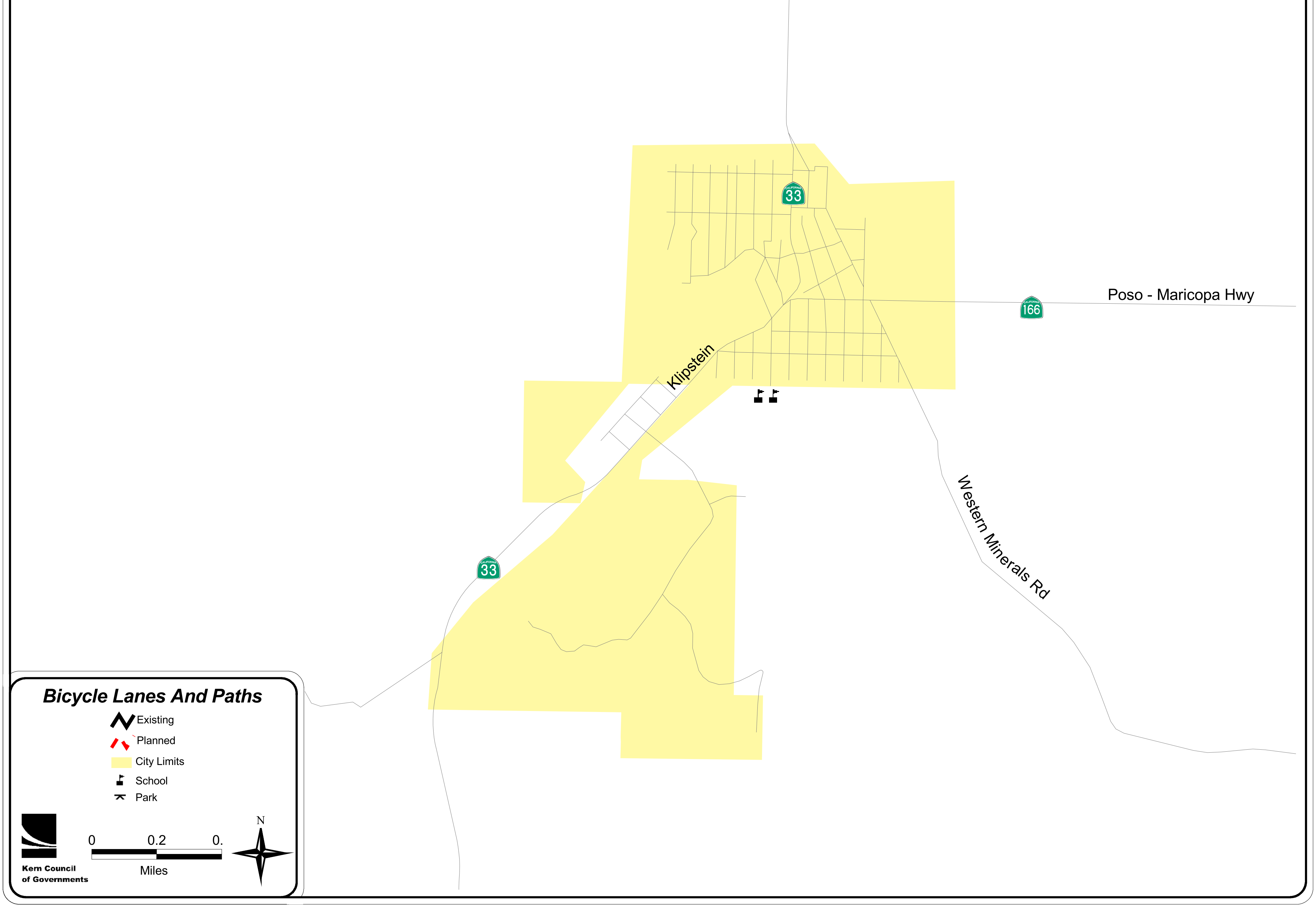
Maricopa

The City of Maricopa is located at the junction of SR 33 and SR 166. It has a population of 1,111 according to the 2000 Census. At the present time, there are no existing or proposed bike facilities.

Maricopa



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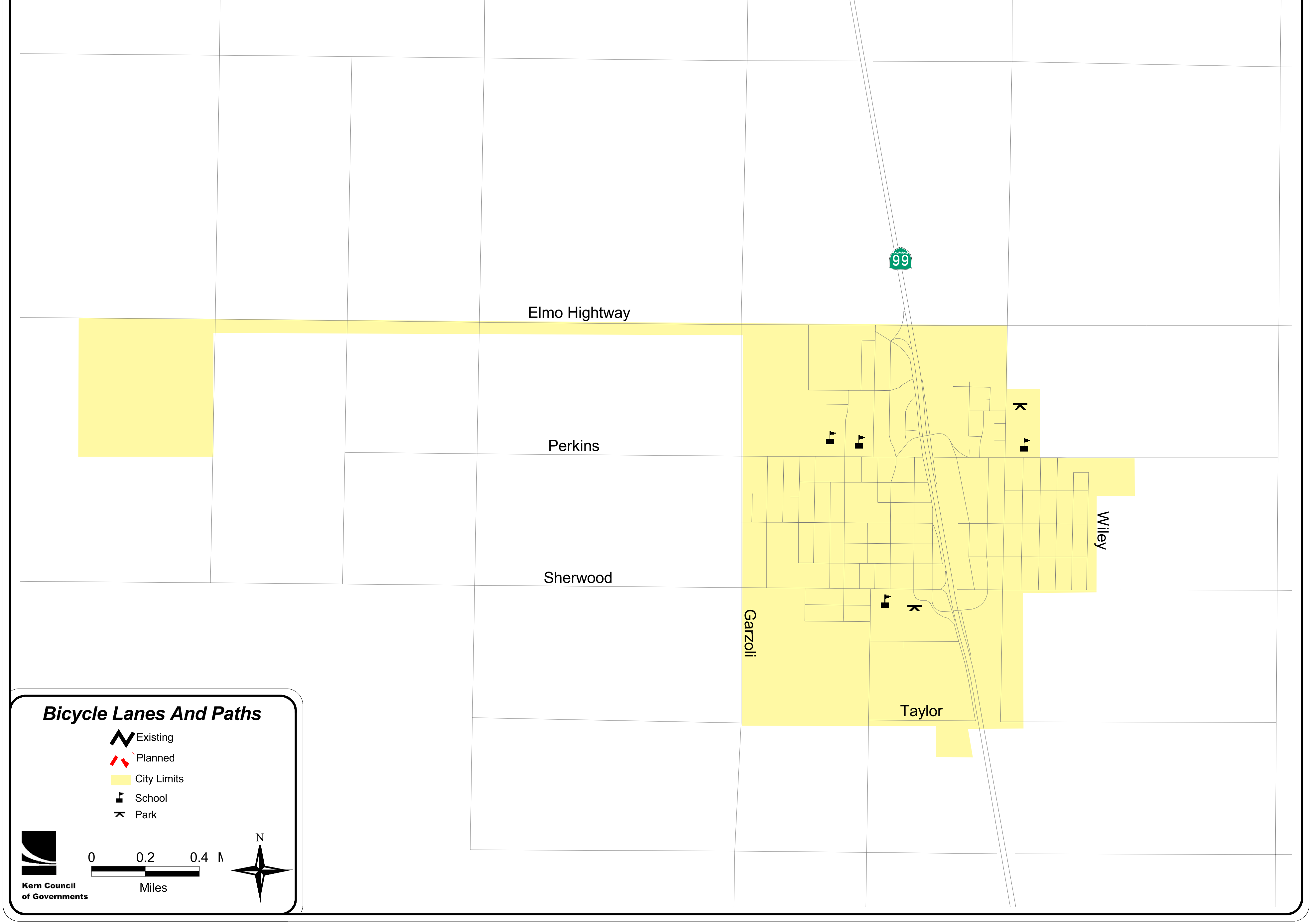
McFarland

The City of McFarland is located in the San Joaquin Valley on SR 99. The city had a population of 9,618 according to the 2000 Census. At the present time, there are no existing or proposed bike facilities.

McFarland


Elmo Hightway
Perkins
Sherwood
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Bicycle Lanes And Paths
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City Limits
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Kern Council
of Governments

Ridgecrest

Ridgecrest is located in the extreme northeastern corner of Kern County. The city had a 2000 population of 24,927. The city is relatively compact with relatively flat terrain and a mild and dry climate. More than 2.9% of work commute trips were made by bicycle according to the 1990 Census. The City of Ridgecrest has an adopted bicycle plan and has been steadily implementing the proposed plan over a number of years with funding from various sources, including the city's general fund.

Existing Facilities

North-South Routes

-Downs Street from China Lake Blvd to Inyokern Road
-Norma Street from Ridgecrest Blvd to Inyokern Road
-China Lake Blvd from intersection of Downs Street to Inyokern Blvd
-College Heights Blvd from Cerro Coso College to China Lake Blvd.
-Sunland Drive from East Upjohn Avenue to Ridgecrest Blvd
-French Avenue from China Lake Blvd to Drummond Avenue

East-West Routes

-Upjohn Avenue from Norma Street to Gateway Blvd
-California Avenue from City Hall to Richmond Street
-Ridgecrest Blvd from China Lake Blvd to Gateway Blvd
-Las Flores Avenue from Mahan to French Avenue
-Drummond Avenue from Downs Street to French Avenue
-Ward Avenue from Mahan to China Lake Blvd
-Inyokern Road from Mahan to Lauristen Road

Funded Facilities

North-South Routes

-South Norma Street from West Church Avenue to Ridgecrest Blvd
-Gateway Blvd from Ridgecrest Blvd to Gold Canyon Drive
-Chelsea Lane from Vieweg School to China Lake Blvd

East-West Routes

-Bowman Road from South Downs Street to China Lake Blvd
-Gold Canyon Drive from Pierce School to Gateway Blvd

Proposed Facilities

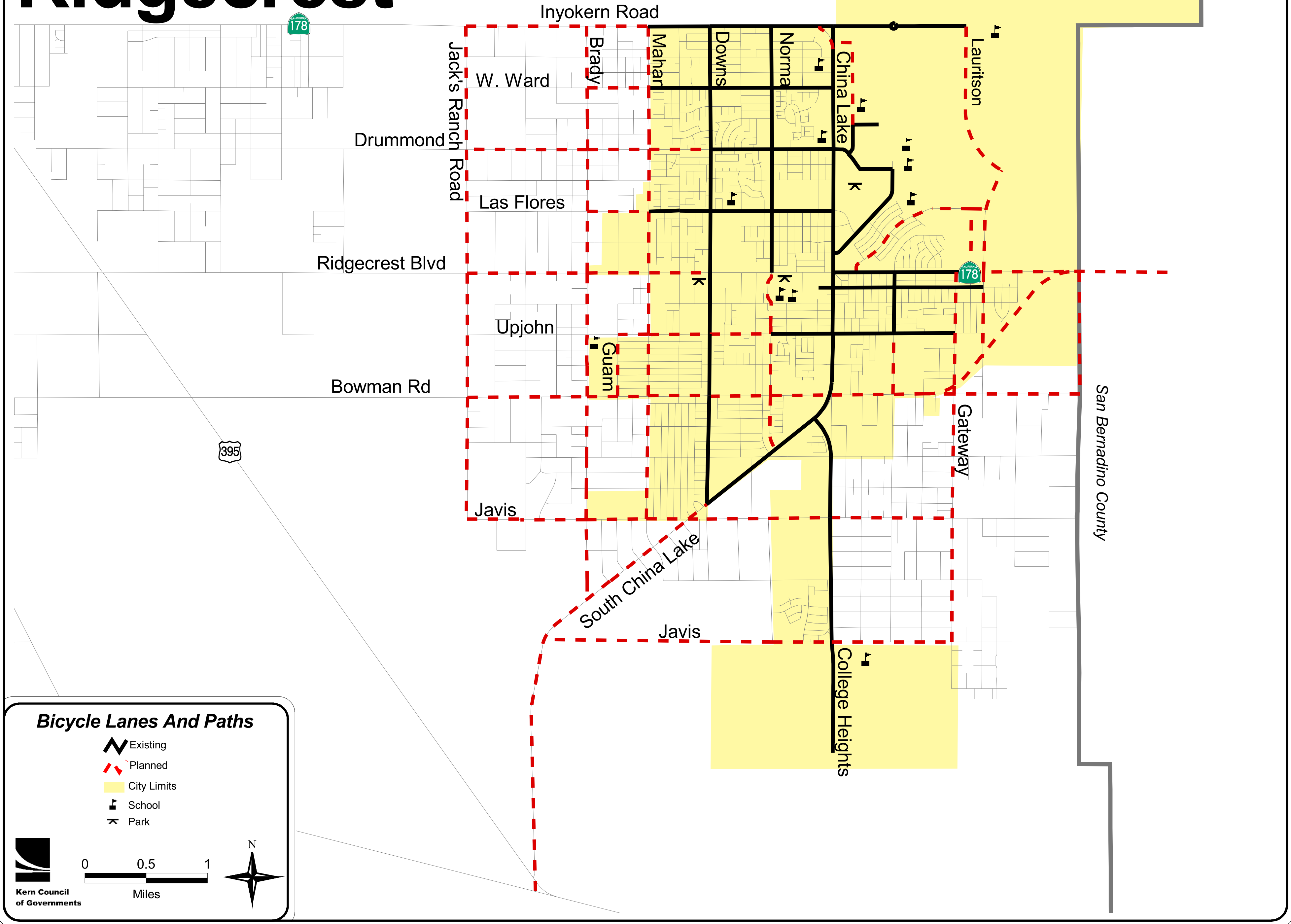
North-South Routes

-China Lake Blvd from US 395 to intersection of Downs Street
-Jack=s Ranch Road from Springer Avenue to Inyokern Road
-Brady Street from China Lake Blvd to Inyokern Road
-South Guam Avenue from West Bowman Road to West Upjohn Avenue
-Mahan Street from Springer Avenue to Inyokern Road
-Norma Street from China Lake Blvd to West Church Street
-Sunland from East Bowman Road to East Upjohn Avenue
-Gateway Blvd from Springer Avenue to Ridgecrest Blvd
-Richmond Street from Proposed Highway 178 alignment to Inyokern Road
-San Bernardino Blvd from East Bowman Road to Ridgecrest Blvd

East-West Routes

-Javis Avenue from China Lake Blvd to Gateway Blvd Extension
-Springer Avenue from Jack's Ranch Road to Gateway Blvd
-Bowman Road from Jack's Ranch Road to Downs Street
-Upjohn Avenue from Guam Street to Norma Street
-West Ridgecrest Blvd from Jack's Ranch Road to Downs Street
-West Drummond Avenue from Jack's Ranch Road to Downs Street
-Inyokern Road from Jack's Ranch Road to Mahan Street
-East Bowman Road from China Lake Blvd to San Bernardino Blvd
-Proposed Highway 178 from Bowman Road to Ridgecrest Blvd
-Ridgecrest Blvd from Gateway Blvd to San Bernardino Blvd
-Gold Canyon Drive from Ridgecrest Blvd to Pierce School

Ridgecrest



Inyokern Road
W. Ward
Drummond
Las Flores
Ridgecrest Blvd
Upjohn
Bowman Rd
Javis
South China Lake
Javis
Jack's Ranch Road
Brady
Mahan
Downs
Norma
China Lake
Lauritson
Guam
Gateway
College Heights
San Bernardino County
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Bicycle Lanes And Paths
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Shafter

Shafter is a community with a population of 12,736 according to the 2000 Census. Located in the San Joaquin Valley area of Kern County, the community had a bicycle commuting rate of 1.0% according to the 1990 Census. The terrain is generally flat and the climate conducive to bicycle transportation.

There is no adopted bicycle plan and there no bicycle travel facilities are provided in the community.

Proposed Bicycle Routes

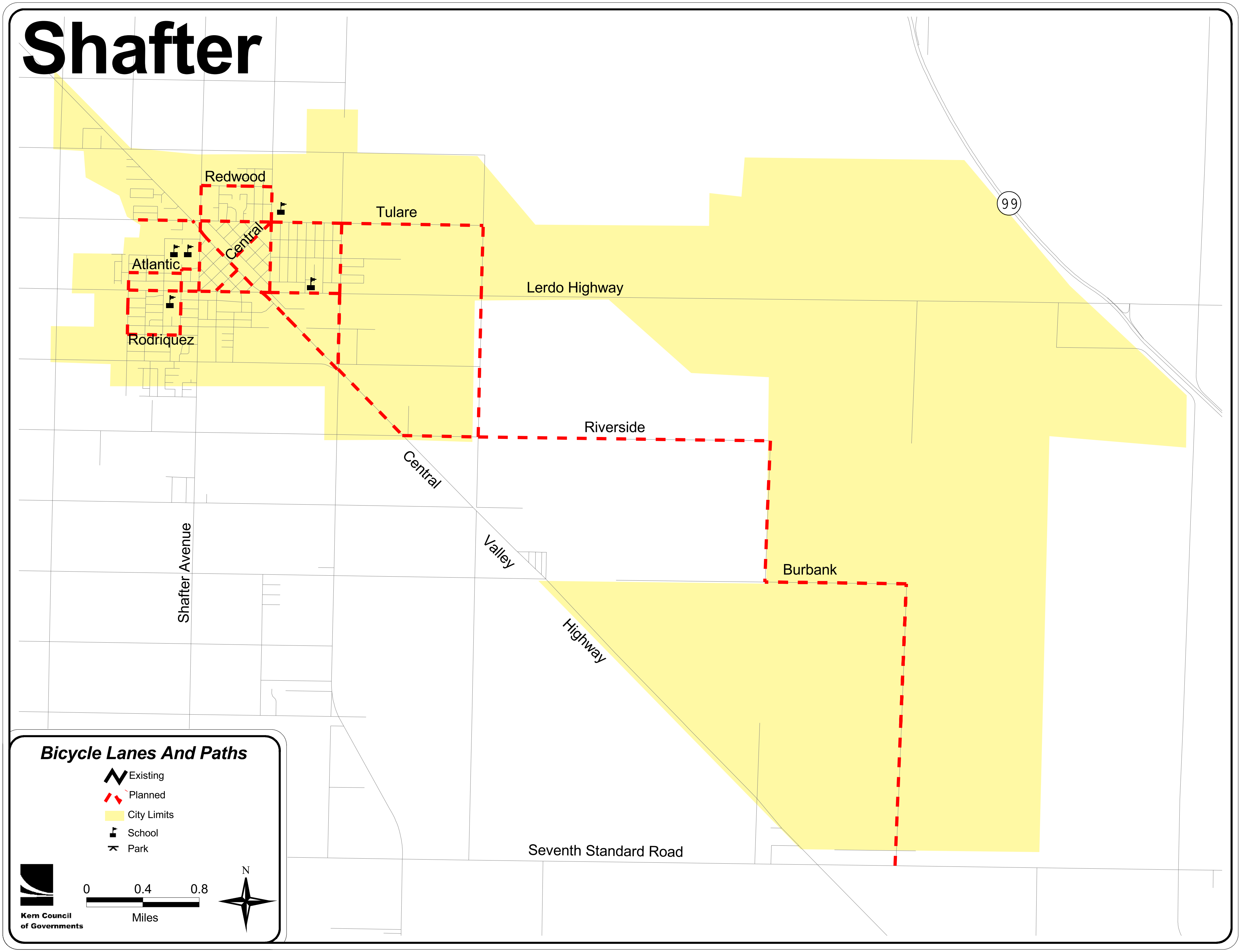
North-South Routes

-Schnaidt Street from Rodriguez Street to Atlantic Avenue
-Wall Street from Rodriquez Street to Munzer Street
-Mannel Street from Lerdo Highway to East Tulare Street
-Cherry Street from Riverside Street to East Tulare Street

East-West Routes

-Central Valley Highway from Riverside Street to Tulare Street
-Pacific Street from Lerdo Highway to Central Valley Highway
-Central Avenue from Central Valley Highway to East Tulare Street
-Rodriguez Street from Schnaidt Road to South Wall Street
-Lerdo Highway from Schnaidt Road to South Beech Street
-Atlantic Street from Schnaidt Road to South Wall Street
-Munzer Street from North Wall Street to North Shafter Street
-Tulare Street from Western Shafter City Limits to Cherry Street
-Redwood Street from North Shafter Street to Mannel Avenue

Shafter



Redwood
Tulare
Central
Atlantic
Lerdo Highway
Rodriquez
Riverside
Central
Valley
Highway
Burbank
Shafter Avenue
99
Seventh Standard Road
Bicycle Lanes And Paths
Existing
Planned
City Limits
School
Park
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Miles
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Kern Council
of Governments

Taft

The City of Taft is on the western edge of Kern County. With a 2000 population of 6,400, the city has no adopted bicycle plan. About 1.5% of work commute trips occurred by bicycle according to the 1990 Census. The only existing bicycle facility is a small segment of Class I bicycle/pedestrian way along a stretch of the Sunset Railway alignment that is being developed as a Rails-to-Trails project. The Greater Taft area includes the City of Taft and the unincorporated communities of Ford City, Taft Heights, and South Taft. The Greater Taft area has a combined population of 13,675 in 2000. Approximately 1.4 percent of work commutes are by bicycle.

Existing Bicycle Facilities

East-West Routes

-Sunset Railway Rails-to-Trails from Hillard Street to South 10th Street

Funded Facilities

East-West Routes

-Sunset Railway Rails to Trails from South 10th Street to 2nd Street

Proposed Facilities

Looped Routes

-25 Hill Road

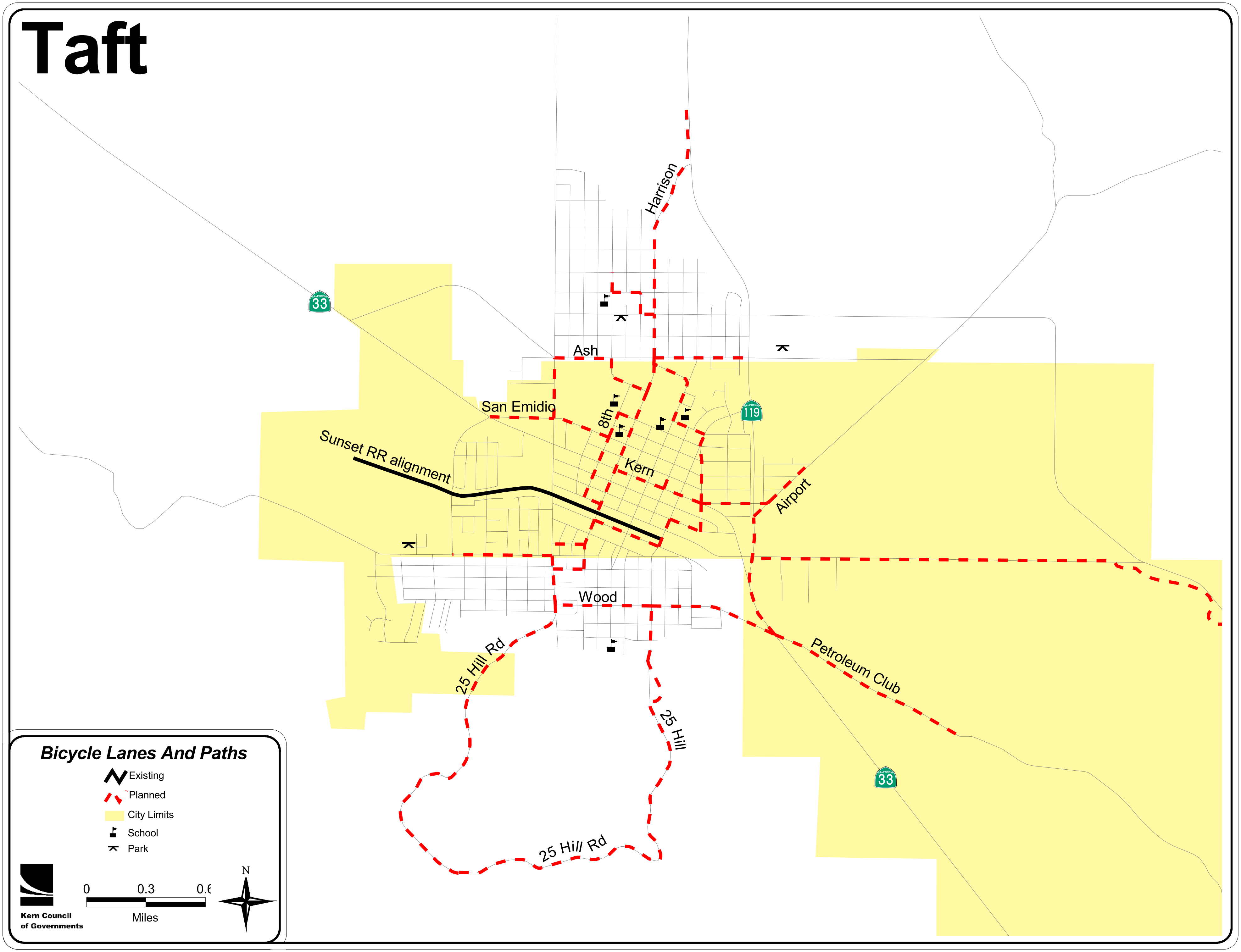
East-West Routes

-Wood Street from 10th Street to General Petroleum Street
-Petroleum Club Road from General Petroleum Street to city limits
-Pico Street from 10th Street to Lierly Avenue
-A Street from Hillard Avenue to 10th Street
-Hope Street from 10th Street to 6th Street
-Supply Row from 6th Street to 2nd Street
-Main Street from 6th Street to 7th Street
-Center Street from 2nd Street to 1st Street
-Kern Street from 6th Street to 1st Street
-Kern Street from 1st Street to Highway 119
-Airport Road from Highway 119 to Airport Terminal
-San Emido Street from cul-de-sac to 7th Street
-Ash Street from 10th Street to Emmons Park Drive
-Finaley Drive from 6th Street to 4th Street
-Calvin Street from 4th Street to 1st Street

-Emmons Park Drive from Ash Street to 6th Street
-Perimeter of Ford City Park

North-South Routes
-10th Street from 25 Hill Road to A Street
-6th Street from Pico Street to Ash Street
-Harrison Street from Ashe to Grevillea
-7th Street from Main Street to Emmons Park Drive
-4th Street from Calvin to Finely Drive

Taft



Harrison
Ash
San Emidio
8th
Kern
Sunset RR alignment
Airport
Wood
25 Hill Rd
25 Hill
25 Hill Rd
Petroleum Club
33
119
33
Bicycle Lanes And Paths
Existing
Planned
City Limits
School
Park
0
0.3
0.6
Miles
N
Kern Council of Governments

Tehachapi

The City of Tehachapi is located in the mountain region of Kern County at an elevation of nearly 4,000 feet. It had a 2000 population of 10,957. There is currently no bikeways plan for the city nor are any bikeways or bicycle facilities constructed. According to the 1990 Census, approximately one-percent of the workforce commuted by bicycle.

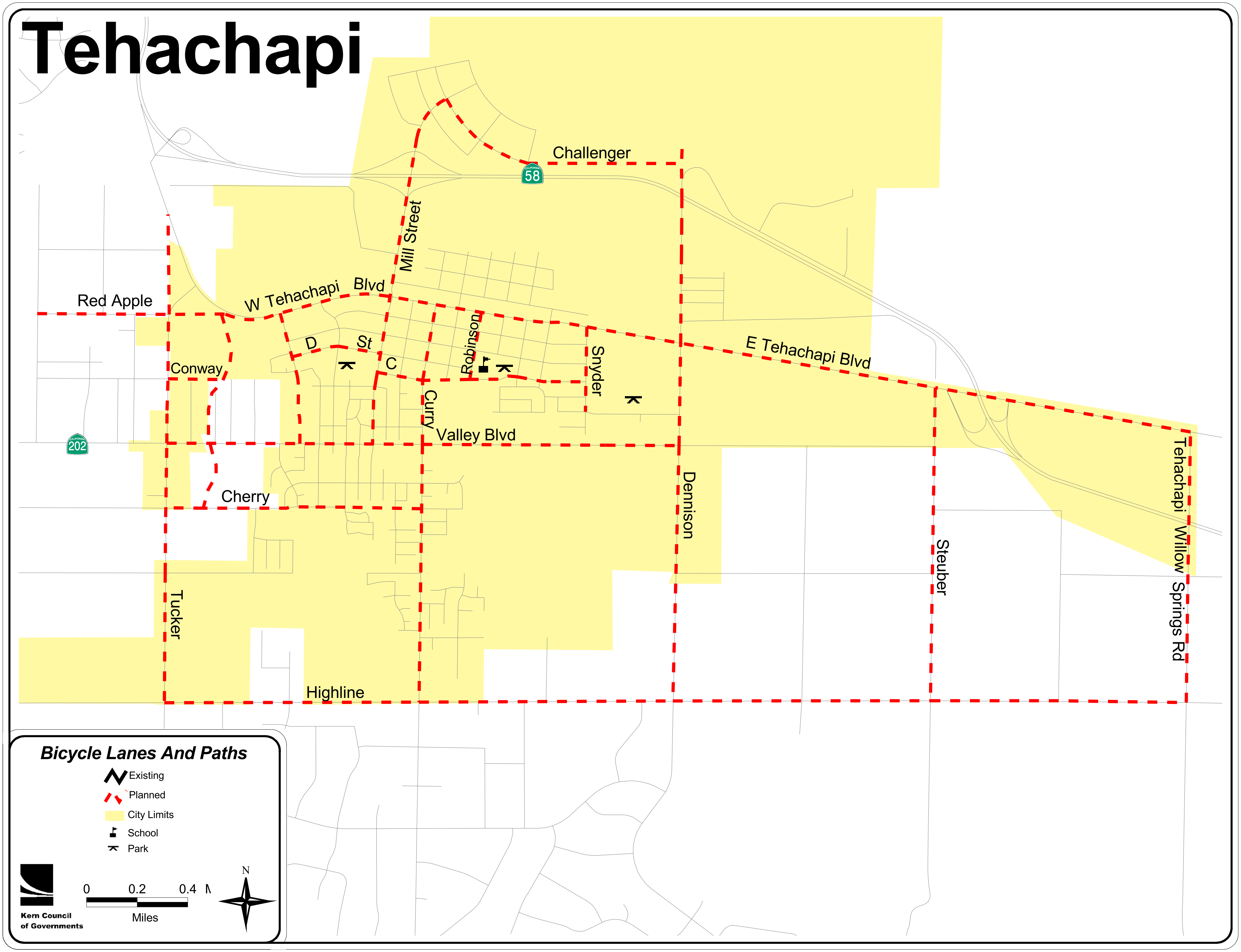
Proposed Facilities

North-South Routes

-Tucker Road from Highline Road to Tehachapi Blvd.
-Summit Road from Highline Road to Valley Blvd.
-Curry Street from Valley Blvd to Tehachapi Blvd.
-Mt. View Avenue from Valley Blvd to Tehachapi Blvd.
-Mill Street from Valley Blvd. To Capital Hills Drive
-Robinson Street from C Street to Tehachapi Blvd.
-Snyder Avenue from Anita Drive to Tehachapi Blvd.
-Dennison Road from Highline Road to Tehachapi Blvd.
-Stueber Road from Highline Road to Tehachapi Blvd.
-Tehachapi-Willow Springs Road from Highline Road to Tehachapi Blvd.

East-West Routes

-Highline Road from Tucker Road to Tehachapi-Willow Springs Road
-Cherry Lane from Tucker Road to Brentwood Street
-Valley Blvd. from Tucker Road to Summit Road
-D Street from Mt. View Road to Mill Street
-C Street from Robinson Street to Snyder Street
-Tehachapi Blvd. from Tucker Road to Tehachapi-Willow Springs Road
-Red Apple Avenue from Westwind Blvd. to Tucker Road



Tehachapi
Challenger
58
Mill Street
W Tehachapi Blvd
Red Apple
D St
C
Robinson
Snyder
E Tehachapi Blvd
Conway
Curry
Valley Blvd
202
Cherry
Dennison
Steuber
Tehachapi Willow Springs Rd
Tucker
Highline
Bicycle Lanes And Paths
Existing
Planned
City Limits
School
Park
0
0.2
0.4
Miles
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Kern Council of Governments

Wasco

The city of Wasco is located in the San Joaquin Valley portion of Kern County. The 2000 population was 21,263. According to the 1990 Census, 0.6 percent of the workforce commuted by bicycle. There is currently no bicycle facilities plan. A few segments of bikeways have been constructed.

Existing Facilities

-Looped Class I bike path around Westside Park
-Class 1 bike path south side of Barker Park from Maple to Birch

Proposed Class I Bikeways

North-South Routes
-East side of Central Avenue from Filburn to Eucalyptus
-West side of Central Avenue from Eucalyptus to Highway 46

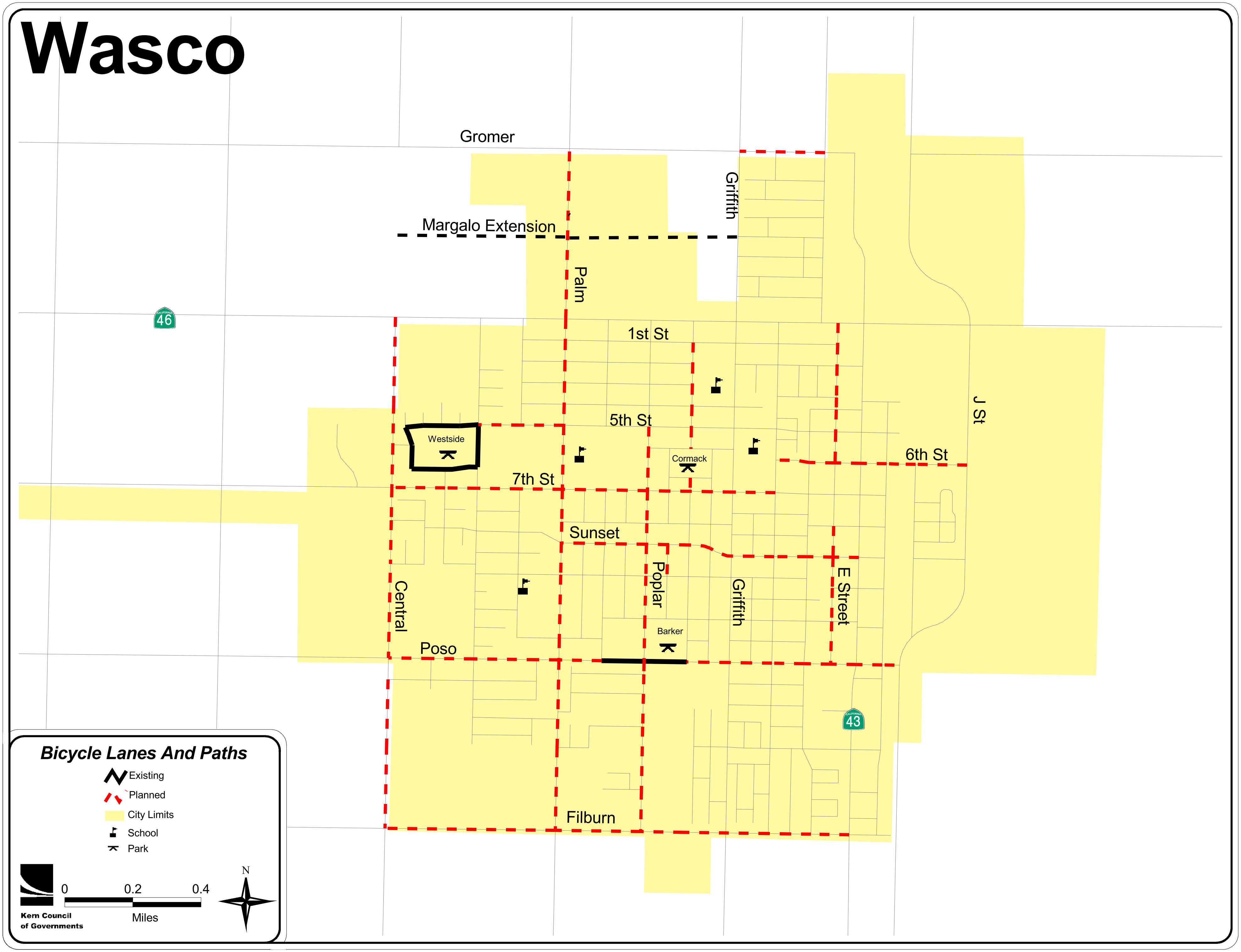
East-West Routes
-North side of Filburn from Central to Griffith
-South side of Filburn from Griffith Avenue to Highway 43
-Gromer Road from Griffith Avenue Extension to Annin Road

Proposed Class II Bikeways

North-South Routes
-Palm Avenue from Filburn Avenue to Margalo Road Extension
-Poplar Avenue from Filburn Avenue to 5th Street
-Birch Avenue from 7th Street to First Street
-E Street from 6th Street to Highway 46
-E Street from Poso Avenue to 8th Street

East-West Routes
-Poso Avenue from Central Avenue to 8th Street
-Sunset Avenue from Palm Avenue to Highway 43
-7th Street from Central Avenue to Broadway
-6th Street from Broadway to J Street
-South side of 5th Street from Beckes Avenue to Palm Avenue
-Margalo Road extension from Central Avenue to Griffith Avenue

Wasco


Gromer
Margalo Extension
Griffith
Palm
1st St
5th St
6th St
7th St
J St
Westside
Cormack
Sunset
Poplar
Griffith
E Street
Central
Poso
Barker
Filburn
46
43
Bicycle Lanes And Paths
Existing
Planned
City Limits
School
Park
0
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Miles
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Kern Council
of Governments

Unincorporated Kern County

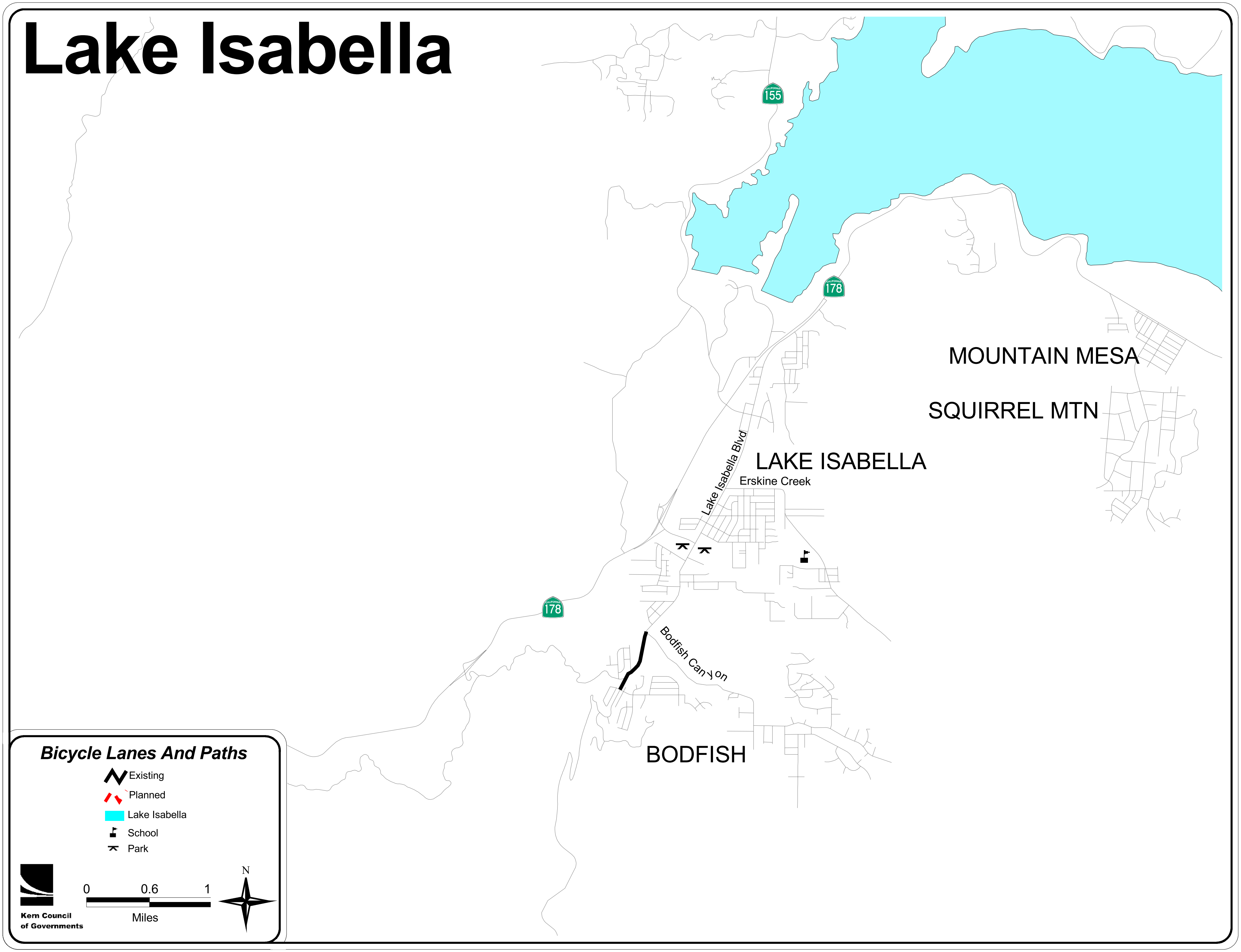
In addition to the Metropolitan Bakersfield bicycle facilities previously discussed, the County of Kern also owns and maintains a bikeway in Bodfish in the Lake Isabella area of the county.

Existing Facilities

North-South Routes

Lake Isabella Boulevard from Bodfish Canyon to Kern River Canyon Road (Bodfish Post Office location).

Lake Isabella



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CHAPTER 1000 BIKEWAY PLANNING AND DESIGN

Topic 1001 - General Information

Index 1001.1 - Definitions

"Bikeway" means all facilities that provide primarily for bicycle travel.

(1) Class I Bikeway (Bike Path). Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow minimized.

(2) Class II Bikeway (Bike Lane). Provides a striped lane for one-way bike travel on a street or highway.

(3) Class III Bikeway (Bike Route). Provides for shared use with pedestrian or motor vehicle traffic.

1001.2 Streets and Highways Code References - Chapter 8 - Nonmotorized Transportation

(a) Section 887 -- Definition of nonmotorized facility.

(b) Section 887.6 -- Agreements with local agencies to construct and maintain nonmotorized facilities.

(c) Section 887.8 -- Payment for construction and maintenance of nonmotorized facilities approximately paralleling state highways.

(d) Section 888 -- Severance of existing major nonmotorized route by freeway construction.

(e) Section 888.2 -- Incorporation of non-motorized facilities in the design of freeways.

(f) Section 888.4 -- Requires Caltrans to budget not less than $360,000 annually for nonmotorized facilities used in conjunction with the state highway system.

(g) Section 890.4 -- Class I, II, and III bike-way definitions.

(h) Section 890.6 - 890.8 -- Caltrans and local agencies to develop design criteria and symbols for signs, markers, and traffic control devices for bikeways and roadways where bicycle travel is permitted.

(i) Section 891 -- Local agencies must comply with design criteria and uniform symbols.

(j) Section 892 -- Use of abandoned right-of-way as a nonmotorized facility.

1001.3 Vehicle Code References - Bicycle Operation

(a) Section 21200 -- Bicyclist's rights and responsibilities for traveling on highways.

(b) Section 21202 -- Bicyclist's position on roadways when traveling slower than the normal traffic speed.

(c) Section 21206 -- Allows local agencies to regulate operation of bicycles on pedestrian or bicycle facilities.

(d) Section 21207 -- Allows local agencies to establish bike lanes on non-state highways.

(e) Section 21207.5 -- Prohibits motorized bicycles on bike paths or bike lanes.

(f) Section 21208 -- Specifies permitted movements by bicyclists from bike lanes.

(g) Section 21209 -- Specifies permitted movements by motorists in bike lanes.

(h) Section 21210 -- Prohibits bicycle parking on sidewalks unless pedestrians have an adequate path.

(i) Section 21211 -- Prohibits impeding or obstruction of bicyclists on bike paths.

(j) Section 21212 -- Requires a bicyclist under 18 years of age to wear an approved helmet.

(k) Section 21717 -- Requires a motorist to drive in a bike lane prior to making a turn.

(l) Section 21960 -- Use of freeway shoulders by bicyclists.

Topic 1002 - General Planning Criteria

1002.1 Introduction

The needs of non-motorized transportation must be considered on all highway projects. Topic 105 discusses Pedestrian Facilities with Index 105.3 addressing accessibility needs. This chapter discusses bicycle travel.

Bicycle travel can be enhanced by improved maintenance and by upgrading existing roads used regularly by bicyclists, regardless of whether or not bikeways are designated. This effort requires increased attention to the right-hand portion of roadways where bicyclists are expected to ride. On new construction, and major reconstruction projects, adequate width should be provided to permit shared use by motorists and bicyclists. **On resurfacing projects, the entire paved shoulder and traveled way shall be resurfaced. When adding lanes or turn pockets, a minimum 1.2 m shoulder shall be provided (see Topic 405 and Table 302.1).** When feasible, a wider shoulder should be considered. When placing a roadway edge stripe, sufficient room outside the stripe should be provided for bicyclists. When considering the restriping of roadways for more traffic lanes, the impact on bicycle travel should be assessed. Bicycle and pedestrian traffic through construction zones should be addressed in the project development process. These efforts, to preserve or improve an area for bicyclists to ride, can benefit motorists as well as bicyclists.

1002.2 The Role of Bikeways

Bikeways are one element of an effort to improve bicycling safety and convenience - either to help accommodate motor vehicle and bicycle traffic on shared roadways, or to complement the road system to meet needs not adequately met by roads.

Off-street bikeways in exclusive corridors can be effective in providing new recreational opportunities, or in some instances, desirable commuter routes. They can also be used to close gaps where barriers exist to bicycle travel (e.g., river crossing). On-street bikeways can serve to enhance safety and convenience, especially if other commitments are made in conjunction with establishment of bikeways, such as: elimination of parking or increasing roadway width, elimination of surface irregularities and roadway obstacles, frequent street sweeping, establishing intersection priority on the bike route street as compared with the majority of cross streets, and installation of bicycle-sensitive loop detectors at signalized intersections.

1002.3 The Decision to Develop Bikeways

The decision to develop bikeways should be made with the knowledge that bikeways are not the solution to all bicycle-related problems. Many of the common problems are related to improper bicyclist and motorist behavior and can only be corrected through effective education and enforcement programs. The development of well conceived bikeways can have a positive effect on bicyclist and motorist behavior. Conversely, poorly conceived bikeways can be counterproductive to education and enforcement programs.

1002.4 Selection of the Type of Facility

The type of facility to select in meeting the bicycle need is dependent on many factors, but the following applications are the most common for each type.

(1) *Shared Roadway (No Bikeway Designation).* Most bicycle travel in the State now occurs on streets and highways without bikeway designations. This probably will be true in the future as well. In some instances, entire street systems may be fully adequate for safe and efficient bicycle travel, and signing and striping for bicycle use may be unnecessary. In other cases, routes may be unsuitable for bicycle travel, and it would be inappropriate to encourage additional bicycle travel by designating the routes as bikeways. Finally, routes may not be along high bicycle demand corridors, and it would be inappropriate to designate bikeways regardless of roadway conditions (e.g., on minor residential streets).

Many rural highways are used by touring bicyclists for intercity and recreational travel.

In most cases, it would be inappropriate to designate the highways as bikeways because of the limited use and the lack of continuity with other bike routes. However, the development and maintenance of 1.2 m paved roadway shoulders with a standard 100 mm edge stripe can significantly improve the safety and convenience for bicyclists and motorists along such routes.

(2) Class I Bikeway (Bike Path). Generally, bike paths should be used to serve corridors not served by streets and highways or where wide right of way exists, permitting such facilities to be constructed away from the influence of parallel streets. Bike paths should offer opportunities not provided by the road system. They can either provide a recreational opportunity, or in some instances, can serve as direct high-speed commute routes if cross flow by motor vehicles and pedestrian conflicts can be minimized. The most common applications are along rivers, ocean fronts, canals, utility right of way, abandoned railroad right of way, within college campuses, or within and between parks. There may also be situations where such facilities can be provided as part of planned developments. Another common application of Class I facilities is to close gaps to bicycle travel caused by construction of freeways or because of the existence of natural barriers (rivers, mountains, etc.).

(3) Class II Bikeway (Bike Lane). Bike lanes are established along streets in corridors where there is significant bicycle demand, and where there are distinct needs that can be served by them. The purpose should be to improve conditions for bicyclists in the corridors. Bike lanes are intended to delineate the right of way assigned to bicyclists and motorists and to provide for more predictable movements by each. But a more important reason for constructing bike lanes is to better accommodate bicyclists through corridors where insufficient room exists for safe bicycling on existing streets. This can be accomplished by reducing the number of lanes, or prohibiting parking on given streets in order to delineate bike lanes. In addition, other things can be done on bike lane streets to improve the situation for bicyclists, that might not be possible on all streets (e.g., improvements to the surface, augmented sweeping programs, special signal facilities, etc.). Generally, stripes alone will not measurably enhance bicycling.

If bicycle travel is to be controlled by delineation, special efforts should be made to assure that high levels of service are provided with these lanes.

In selecting appropriate streets for bike lanes, location criteria discussed in the next section should be considered.

(4) Class III Bikeway (Bike Route). Bike routes are shared facilities which serve either to:

(a) Provide continuity to other bicycle facilities (usually Class II bikeways); or

(b) Designate preferred routes through high demand corridors.

As with bike lanes, designation of bike routes should indicate to bicyclists that there are particular advantages to using these routes as compared with alternative routes. This means that responsible agencies have taken actions to assure that these routes are suitable as shared routes and will be maintained in a manner consistent with the needs of bicyclists. Normally, bike routes are shared with motor vehicles. The use of sidewalks as Class III bikeways is strongly discouraged.

It is emphasized that the designation of bikeways as Class I, II and III should not be construed as a hierarchy of bikeways; that one is better than the other. Each class of bikeway has its appropriate application.

In selecting the proper facility, an overriding concern is to assure that the proposed facility will not encourage or require bicyclists or motorists to operate in a manner that is inconsistent with the rules of the road.

An important consideration in selecting the type of facility is continuity. Alternating segments of Class I and Class II (or Class III) bikeways along a route are generally incompatible, as street crossings by bicyclists are required when the route changes character. Also, wrong-way bicycle travel will occur on the street beyond the ends of bike paths because of the inconvenience of having to cross the street.

Topic 1003 - Design Criteria

1003.1 Class I Bikeways

Class I bikeways (bike paths) are facilities with exclusive right of way, with cross flows by motorists minimized. Section 890.4 of the Streets and Highways Code describes Class I bikeways as serving "the exclusive use of bicycles and pedestrians". However, experience has shown that if significant pedestrian use is anticipated, separate facilities for pedestrians are necessary to minimize conflicts. Dual use by pedestrians and bicycles is undesirable, and the two should be separated wherever possible.

Sidewalk facilities are not considered Class I facilities because they are primarily intended to serve pedestrians, generally cannot meet the design standards for Class I bikeways, and do not minimize motorist cross flows. See Index 1003.3 for discussion relative to sidewalk bikeways.

By State law, motorized bicycles ("mopeds") are prohibited on bike paths unless authorized by ordinance or approval of the agency having jurisdiction over the path. Likewise, all motor vehicles are prohibited from bike paths. These prohibitions can be strengthened by signing.

(1) *Widths.* **The minimum paved width for a two-way bike path shall be 2.4 m. The minimum paved width for a one-way bike path shall be 1.5 m. A minimum 0.6 m wide graded area shall be provided adjacent to the pavement (see Figure 1003.1A).** A 1.0 m graded area is recommended to provide clearance from poles, trees, walls, fences, guardrails, or other lateral obstructions. A wider graded area can also serve as a jogging path. Where the paved width is wider than the minimum required, the graded area may be reduced accordingly; however, the graded area is a desirable feature regardless of the paved width. Development of a one-way bike path should be undertaken only after careful consideration due to the problems of enforcing one-way operation and the difficulties in maintaining a path of restricted width.

Where heavy bicycle volumes are anticipated and/or significant pedestrian traffic is expected, the paved width of a two-way path should be greater than 2.4 m, preferably 3.6 m or more. Another important factor to consider in determining the appropriate width is that bicyclists will tend to ride side by side on bike paths, necessitating more width for safe use.

Experience has shown that paved paths less than 3.6 m wide sometimes break up along the edge as a result of loads from maintenance vehicles.

Where equestrians are expected, a separate facility should be provided.

(2) *Clearance to Obstructions.* **A minimum 0.6 m horizontal clearance to obstructions shall be provided adjacent to the pavement (see Figure 1003.1A).** A 1.0 m clearance is recommended. Where the paved width is wider than the minimum required, the clearance may be reduced accordingly; however, an adequate clearance is desirable regardless of the paved width. If a wide path is paved contiguous with a continuous fixed object (e.g., block wall), a 100 mm white edge stripe, 0.3 m from the fixed object, is recommended to minimize the likelihood of a bicyclist hitting it. **The clear width on structures between railings shall be not less than 2.4 m.** It is desirable that the clear width of structures be equal to the minimum clear width of the path (i.e., 3.6 m).

The vertical clearance to obstructions across the clear width of the path shall be a minimum of 2.5 m. Where practical, a vertical clearance of 3 m is desirable.

(3) *Striping and Signing.* A yellow centerline stripe may be used to separate opposing directions of travel. A centerline stripe is particularly beneficial in the following circumstances:

(a) Where there is heavy use;

(b) On curves with restricted sight distance; and,

Figure 1003.1A

Two-Way Bike Path on Separate Right of Way

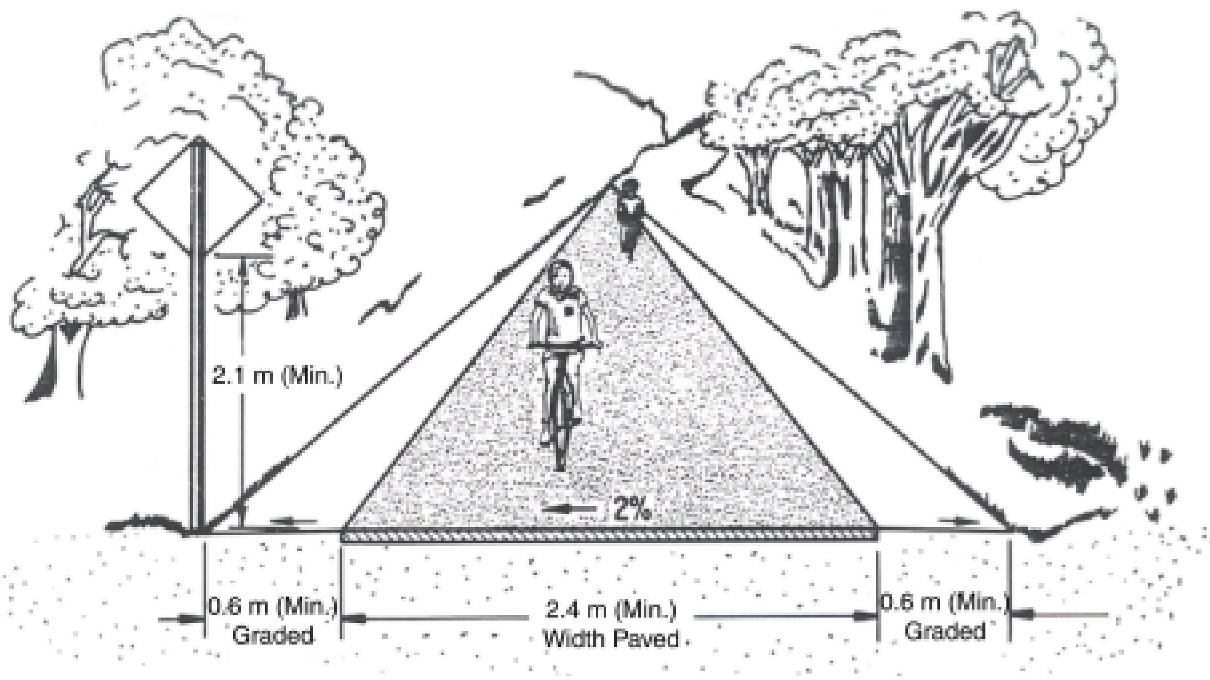
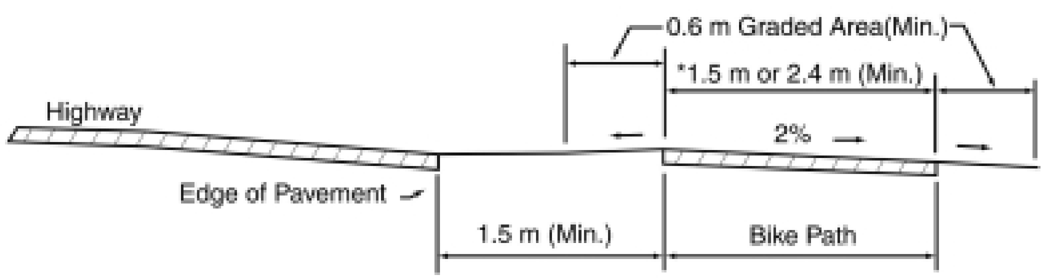


Figure 1003.1A

Typical Cross Section of Bike Path Along HIghway



NOTE: See Index 1003.1(5)

*One - Way: 1.5 m Minimum Width
Two - Way: 2.4 m Minimum Width

(c) Where the path is unlighted and nighttime riding is expected. (Refer to Topic 1004 for signing and striping details.)

(4) Intersections with Highways. Intersections are a prime consideration in bike path design. If alternate locations for a bike path are available, the one with the most favorable intersection conditions should be selected.

Where motor vehicle cross traffic and bicycle traffic is heavy, grade separations are desirable to eliminate intersection conflicts. Where grade separations are not feasible, assignment of right of way by traffic signals should be considered. Where traffic is not heavy, stop or yield signs for bicyclists may suffice.

Bicycle path intersections and approaches should be on relatively flat grades. Stopping sight distances at intersections should be checked and adequate warning should be given to permit bicyclists to stop before reaching the intersection, especially on downgrades.

When crossing an arterial street, the crossing should either occur at the pedestrian crossing, where motorists can be expected to stop, or at a location completely out of the influence of any intersection to permit adequate opportunity for bicyclists to see turning vehicles. When crossing at midblock locations, right of way should be assigned by devices such as yield signs, stop signs, or traffic signals which can be activated by bicyclists. Even when crossing within or adjacent to the pedestrian crossing, stop or yield signs for bicyclists should be placed to minimize potential for conflict resulting from turning autos. Where bike path stop or yield signs are visible to approaching motor vehicle traffic, they should be shielded to avoid confusion. In some cases, Bike Xing signs may be placed in advance of the crossing to alert motorists. Ramps should be installed in the curbs, to preserve the utility of the bike path. Ramps should be the same width as the bicycle paths. Curb cuts and ramps should provide a smooth transition between the bicycle paths and the roadway.

(5) Separation Between Bike Paths and Highways. A wide separation is recommended between bike paths and adjacent highways (see Figure 1003.1B). **Bike paths closer than 1.5 m from the edge of the shoulder shall include a physical barrier to prevent bicyclists from encroaching onto the highway. Bike paths within the clear recovery zone of freeways shall include a physical barrier separation.** Suitable barriers could include chain link fences or dense shrubs. Low barriers (e.g., dikes, raised traffic bars) next to a highway are not recommended because bicyclists could fall over them and into oncoming automobile traffic. In instances where there is danger of motorists encroaching into the bike path, a positive barrier (e.g., concrete barrier, steel guardrailing) should be provided. See Index 1003.6 for criteria relative to bike paths carried over highway bridges.

Bike paths immediately adjacent to streets and highways are not recommended. They should not be considered a substitute for the street, because many bicyclists will find it less convenient to ride on these types of facilities as compared with the streets, particularly for utility trips.

(6) Bike Paths in the Median of Highways. As a general rule, bike paths in the median of highways are not recommended because they require movements contrary to normal rules of the road. Specific problems with such facilities include:

(a) Bicyclist right turns from the center of roadways are unnatural for bicyclists and confusing to motorists.

(b) Proper bicyclist movements through intersections with signals are unclear.

(c) Left-turning motorists must cross one direction of motor vehicle traffic and two directions of bicycle traffic, which increases conflicts.

(d) Where intersections are infrequent, bicyclists will enter or exit bike paths at midblock.

(e) Where medians are landscaped, visual relationships between bicyclists and motorists at intersections are impaired.

For the above reasons, bike paths in the median of highways should be considered only when the above problems can be avoided. **Bike paths shall not be designed in the medians of freeways or expressways.**

(7) *Design Speed*. The proper design speed for a bike path is dependent on the expected type of use and on the terrain. **The minimum design speed for bike paths shall be 40 km/h except as noted in Table 1003.1.**

Table 1003.1

Bike Path Design Speeds

Type of Facility	Design Speed (km/h)
Bike Paths with Mopeds Prohibited	40
Bike Paths with Mopeds Permitted	50
Bike Paths on Long Downgrades (steeper than 4%, and longer than 150 m)	50

Installation of "speed bumps" or other similar surface obstructions, intended to cause bicyclists to slow down in advance of intersections or other geometric constraints, shall not be used. These devices cannot compensate for improper design.

(8) *Horizontal Alignment and Superelevation*. The minimum radius of curvature negotiable by a bicycle is a function of the superelevation rate of the bicycle path surface, the coefficient of friction between the bicycle tires and the bicycle path surface, and the speed of the bicycle.

For most bicycle path applications the superelevation rate will vary from a minimum of 2 percent (the minimum necessary to encourage adequate drainage) to a maximum of approximately 5 percent (beyond which maneuvering difficulties by slow bicyclists and adult tricyclists might be expected). A straight 2% cross slope is recommended on tangent sections. The minimum superelevation rate of 2% will be adequate for most conditions and will simplify construction. Superelevation rates steeper than 5 percent should be avoided on bike paths expected to have adult tricycle traffic.

The coefficient of friction depends upon speed; surface type, roughness, and condition; tire type and condition; and whether the surface is wet or dry. Friction factors used for design should be selected based upon the point at which centrifugal force causes the bicyclist to recognize a feeling of discomfort and instinctively act to avoid higher speed. Extrapolating from values used in highway design, design friction factors for paved bicycle paths can be assumed to vary from 0.31 at 20 km/h to 0.21 at 50 km/h. Although there is no data available for unpaved surfaces, it is suggested that friction factors be reduced by 50 percent to allow a sufficient margin of safety.

The minimum radius of curvature can be selected from Figure 1003.1C. When curve radii smaller than those shown in Figure 1003.1C must be used on bicycle paths because of right of way, topographical or other considerations, standard curve warning signs and supplemental pavement markings should be installed. The negative effects of nonstandard curves can also be partially offset by widening the pavement through the curves.

(9) *Stopping Sight Distance*. To provide bicyclists with an opportunity to see and react to the unexpected, a bicycle path should be designed with adequate stopping sight distances. The distance required to bring a bicycle to a full controlled stop is a function of the bicyclist’s perception and brake reaction time, the initial speed of the bicycle, the coefficient of friction between the tires and the pavement, and the braking ability of the bicycle.

Figure 1003.1D indicates the minimum stopping sight distances for various design speeds and grades. For two-way bike paths, the descending direction, that is, where “G” is negative, will control the design.

Figure 1003.1C

Curve Radii & Superelevations

$$R = \frac{V^2}{127\left(\frac{e}{100} + f\right)}$$

where,

R = Minimum radius of curvature (m),

V = Design Speed (km/h),

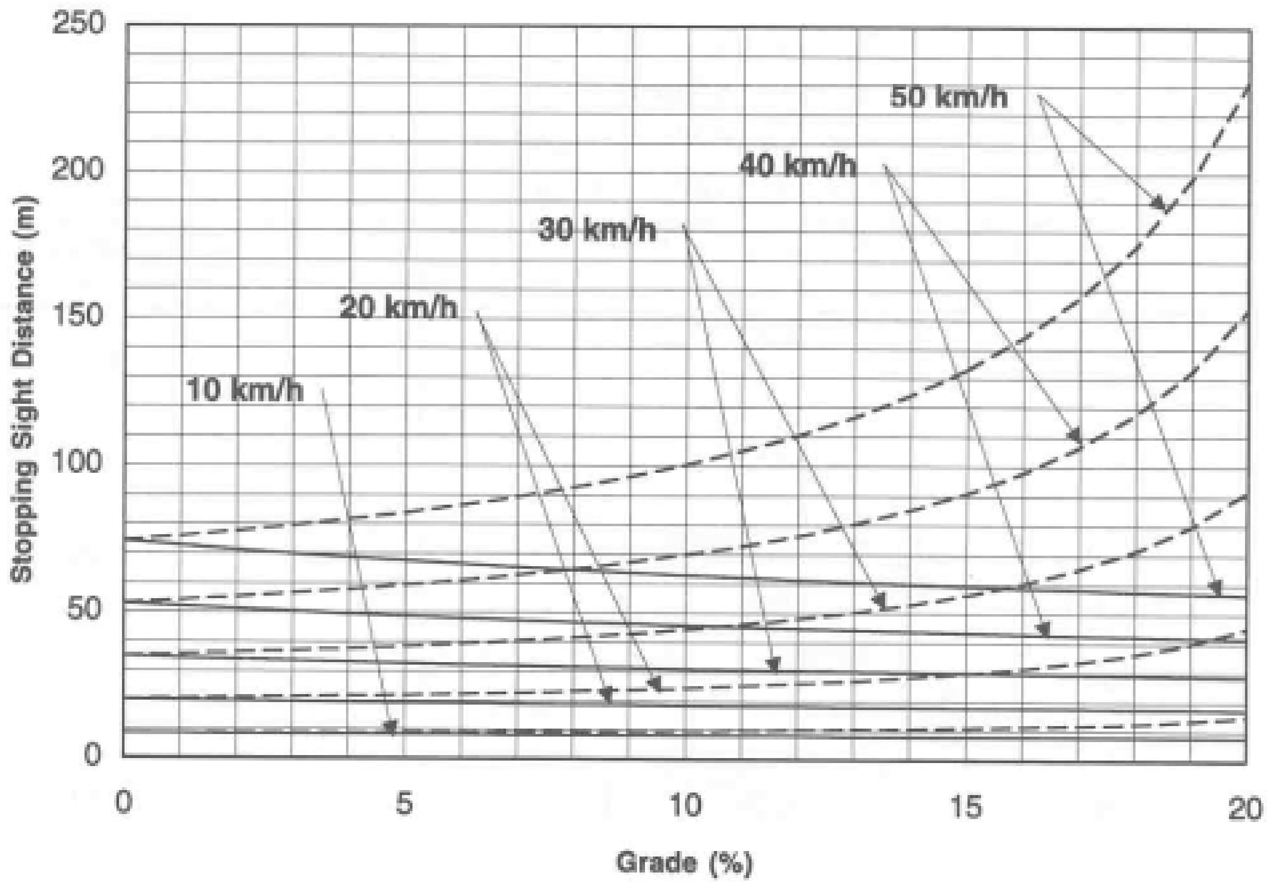
e = Rate of bikeway superelevation, percent

f = Coefficient of friction

Design Speed-V (km/h)	Friction Factor-f	Superelevation-e (%)	Minimum Radius-R (m)
20	0.31	2	10
30	0.28	2	24
40	0.25	2	47
50	0.21	2	86
20	0.31	3	9
30	0.28	3	23
40	0.25	3	45
50	0.21	3	82
20	0.31	4	9
30	0.28	4	22
40	0.25	4	43
50	0.21	4	79
20	0.31	5	9
30	0.28	5	21
40	0.25	5	42
50	0.21	5	76

Figure 1003.1D

Stopping Sight Distance



$$S = \frac{V^2}{254\,(f \pm G)} + \frac{V}{1.4}$$

Descend - - - - - -
Ascend ———

Where : S = stopping sight, m

V = velocity, km/h

f = coefficient of friction (use 0.25)

G = grade, m/m (rise/run)

(10) *Length of Crest Vertical Curves*. Figure 1003.1E indicates the minimum lengths of crest vertical curves for varying design speeds.

(11) *Lateral Clearance on Horizontal Curves*. Figure 1003.1F indicates the minimum clearances to line of sight obstructions for horizontal curves. The required lateral clearance is obtained by entering Figure 1003.1F with the stopping sight distance from Figure 1003.1D and the proposed horizontal curve radius.

Bicyclists frequently ride abreast of each other on bicycle paths, and on narrow bicycle paths, bicyclists have a tendency to ride near the middle of the path. For these reasons, and because of the serious consequences of a head on bicycle accident, lateral clearances on horizontal curves should be calculated based on the sum of the stopping sight distances for bicyclists traveling in opposite directions around the curve. Where this is not possible or feasible, consideration should be given to widening the path through the curve, installing a yellow center stripe, installing a curve ahead warning sign, or some combination of these alternatives.

(12) *Grades*. Bike paths generally attract less skilled bicyclists, so it is important to avoid steep grades in their design. Bicyclists not physically conditioned will be unable to negotiate long, steep uphill grades. Since novice bicyclists often ride poorly maintained bicycles, long downgrades can cause problems. For these reasons, bike paths with long, steep grades will generally receive very little use. The maximum grade rate recommended for bike paths is 5%. It is desirable that sustained grades be limited to 2% if a wide range of riders is to be accommodated. Steeper grades can be tolerated for short segments (e.g., up to about 150 m). Where steeper grades are necessitated, the design speed should be increased and additional width should be provided for maneuverability.

(13) *Structural Section*. The structural section of a bike path should be designed in the same manner as a highway, with consideration given to the quality of the basement soil and the anticipated loads the bikeway will experience. It is important to construct and maintain a smooth riding surface with skid resistant qualities. Principal loads will normally be from maintenance and emergency vehicles. Expansive soil should be given special consideration and will probably require a special structural section. A minimum pavement thickness of 50 mm of asphalt concrete is recommended. Type "A" or "B" asphalt concrete (as described in Department of Transportation Standard Specifications), with 12.5 mm maximum aggregate and medium grading is recommended. Consideration should be given to increasing the asphalt content to provide increased pavement life. Consideration should also be given to sterilization of basement soil to preclude possible weed growth through the pavement.

At unpaved highway or driveway crossings of bicycle paths, the highway or driveway should be paved a minimum of 3 m on each side of the crossing to reduce the amount of gravel being scattered along the path by motor vehicles. The pavement structure at the crossing should be adequate to sustain the expected loading at that location.

(14) *Drainage*. For proper drainage, the surface of a bike path should have a cross slope of 2%. Sloping in one direction usually simplifies longitudinal drainage design and surface construction, and accordingly is the preferred practice. Ordinarily, surface drainage from the path will be adequately dissipated as it flows down the gently sloping shoulder. However, when a bike path is constructed on the side of a hill, a drainage ditch of suitable dimensions may be necessary on the uphill side to intercept the hillside drainage. Where necessary, catch basins with drains should be provided to carry intercepted water across the path. Such ditches should be designed in such a way that no undue obstacle is presented to bicyclists.

Culverts or bridges are necessary where a bike path crosses a drainage channel.

Figure 1003.1E

Stopping Sight Distances for Crest Vertical Curves

$L = 2S - \frac{450}{A}$ when S > L

$L = \frac{AS^2}{450}$ when S < L

Height of cyclist eye - 1400 mm
Height of object - 100 mm

Double line represents S=L
L = Min. length of vertical curve - meters
A = Algebraic grade difference-%
S = Stopping sight distance - meters
V = Design speed km/h (Refer to Figure 1003.1D to determine "V", after "S" is determined.

GIVEN "A" AND "L"; FIND "S"

A (%)	L=50 m S (m)	L=100 m S (m)	L=150 m S (m)	L=200 m S (m)	L=250 m S (m)	L=300 m S (m)
4.5	75					
5	70	95				
5.5	66	90				
6	63	87				
6.5	60	83				
7	57	80	98			
7.5	55	77	95			
8	53	75	92			
8.5	51	73	89	103		
9	50	71	87	100		
9.5	49	69	84	97		
10	47	67	82	95		
10.5	46	65	80	93		
11	45	64	78	90		
11.5	44	63	77	88	99	
12	43	61	75	87	97	
12.5	42	60	73	85	95	
13	42	59	72	83	93	
13.5	41	58	71	82	91	
14	40	57	69	80	90	98
14.5	39	56	68	79	88	96
15	39	55	67	77	87	95

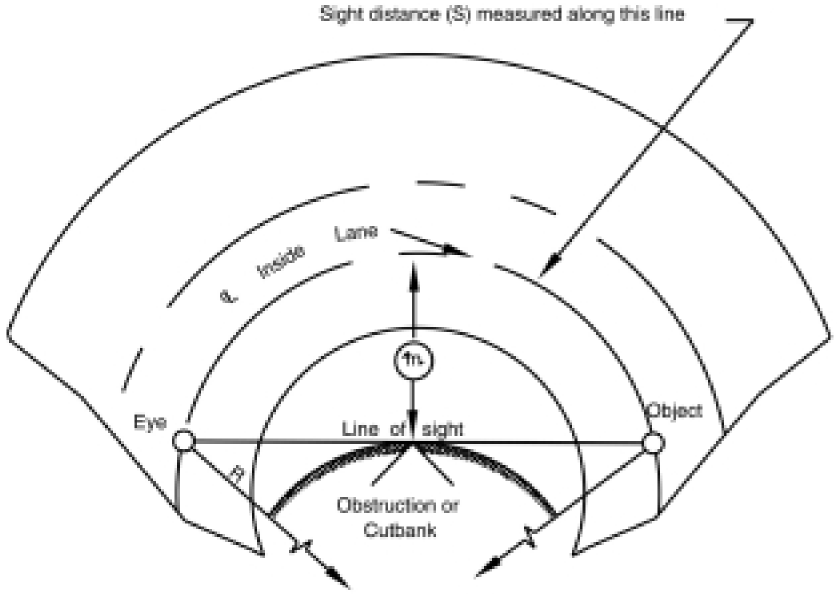
Figure 1003.1E

Stopping Sight Distances for Crest Vertical Curves (continued)

GIVEN "A" AND "S"; FIND "L"

A (%)	S=10 m L (m)	S=15 m L (m)	S=20 m L (m)	S=25 m L (m)	S=30 m L (m)	S=35 m L (m)	S=40 m L (m)	S=45 m L (m)	S=50 m L (m)
5									10.0
6							5.0	15.0	25.0
7						5.7	15.7	25.7	35.7
8					3.8	13.8	23.8	33.8	43.8
9					10.0	20.0	30.0	40.0	50.0
10				5.0	15.0	25.0	35.0	45.0	55.6
11				9.1	19.1	29.1	39.1	49.5	61.1
12			2.5	12.5	22.5	32.5	42.7	54.0	66.7
13			5.4	15.4	25.4	35.4	46.2	58.5	72.2
14			7.9	17.9	27.9	38.1	49.8	63.0	77.8
15			10.0	20.0	30.0	40.8	53.3	67.5	83.3
16		1.9	11.9	21.9	32.0	43.6	56.9	72.0	88.9
17		3.5	13.5	23.5	34.0	46.3	60.4	76.5	94.4
18		5.0	15.0	25.0	36.0	49.0	64.0	81.0	100.0
19		6.3	16.3	26.4	38.0	51.7	67.6	85.5	105.6
20		7.5	17.5	27.8	40.0	54.4	71.1	90.0	111.1
21		8.6	18.6	29.2	42.0	57.2	74.7	94.5	116.7
22		9.5	19.6	30.6	44.0	59.9	78.2	99.0	122.2
23		10.4	20.4	31.9	46.0	62.6	81.8	103.5	127.8
24		11.3	21.3	33.3	48.0	65.3	85.3	108.0	133.3
25		12.0	22.2	34.7	50.0	68.1	88.9	112.5	138.9
26		12.7	23.1	36.1	52.0	70.8	92.4	117.0	144.4
27		13.3	24.0	37.5	54.0	73.5	96.0	121.5	150.0
28	4	13.9	24.9	38.9	56.0	76.2	99.6	126.0	155.6
29	4	14.5	25.8	40.3	58.0	78.9	103.1	130.5	161.1
30	5	15.0	26.7	41.7	60.0	81.7	106.7	135.0	166.7

Figure 1003.1F
Lateral Clearances on Horizontal Curves



S = Sight distance in meters.
R = Radius of ℄ of lane in meters.
m = Distance from ℄ of lane in meters.
V = Design speed for S in km/h.
(Refer to Figure 1003.1D to determine "V", after "S" is determined.)

Angle is expressed in degrees

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

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

Formula applies only when S is equal to or less than length of curve.

Line of sight is 600 mm above ℄ inside lane at point of obstruction.

GIVEN "R" AND "S"; FIND "m"

R (m)	S=10 m *m* meters	S=20 m *m* meters	S=30 m *m* meters	S=40 m *m* meters	S=50 *m* meters	S=60 m *m* meters	S=70 m *m* meters	S=80 m *m* meters	S=90 m *m* meters	S=100 m *m* meters	S=110 m *m* meters
25	0.50	1.97	4.37	7.58	11.49	15.94	20.75	25.73	30.68	35.41	39.72
50	0.25	1.00	2.23	3.95	6.12	8.73	11.76	15.17	18.92	22.99	27.32
75	0.17	0.67	1.50	2.65	4.13	5.92	8.02	10.42	13.10	16.06	19.28
100	0.12	0.50	1.12	1.99	3.11	4.47	6.06	7.90	9.96	12.24	14.75
125	0.10	0.40	0.90	1.60	2.49	3.58	4.87	6.35	8.01	9.87	11.91
150	0.08	0.33	0.75	1.33	2.08	2.99	4.07	5.30	6.70	8.26	9.97
175	0.07	0.29	0.64	1.14	1.78	2.57	3.49	4.55	5.75	7.10	8.57
200	0.06	0.25	0.56	1.00	1.56	2.25	3.06	3.99	5.04	6.22	7.52
225	0.06	0.22	0.50	0.89	1.39	2.00	2.72	3.55	4.49	5.53	6.69
250	0.05	0.20	0.45	0.80	1.25	1.80	2.45	3.19	4.04	4.98	6.03
275	0.05	0.18	0.41	0.73	1.14	1.63	2.22	2.90	3.67	4.53	5.48
300	0.04	0.17	0.37	0.67	1.04	1.50	2.04	2.66	3.37	4.16	5.03
350	0.04	0.14	0.32	0.57	0.89	1.29	1.75	2.28	2.89	3.57	4.31
400	0.03	0.13	0.28	0.50	0.78	1.12	1.53	2.00	2.53	3.12	3.78
500	0.03	0.10	0.23	0.40	0.62	0.90	1.22	1.60	2.02	2.50	3.02
600	0.02	0.08	0.19	0.33	0.52	0.75	1.02	1.33	1.69	2.08	2.52
700	0.02	0.07	0.16	0.29	0.45	0.64	0.87	1.14	1.45	1.79	2.16
800	0.02	0.06	0.14	0.25	0.39	0.56	0.77	1.00	1.27	1.56	1.89
900	0.01	0.06	0.13	0.22	0.35	0.50	0.68	0.89	1.12	1.39	1.68
1000	0.01	0.05	0.11	0.20	0.31	0.45	0.61	0.80	1.01	1.25	1.51

Figure 1003.1F

Lateral Clearances on Horizontal Curves (continued)

GIVEN "R" AND "m"; FIND "S"

R (m)	***m*** **= 1 meter**	***m*** **= 2 meters**	***m*** **= 3 meters**	***m*** **= 4 meters**	***m*** **= 5 meters**	***m*** **= 6 meters**	***m*** **= 7 meters**	***m*** **= 8 meters**	***m*** **= 9 meters**	***m*** **= 10 meters**	***m*** **= 11 meters**
	S (m)	**S (m)**	**S (m)**	**S (m)**	**S (m)**	**S (m)**	**S (m)**	**S (m)**	**S (m)**	**S (m)**	**S (m)**
25	14.19	20.13	24.74	28.67	32.17	35.37	38.35	41.15	43.81	46.36	48.82
50	20.03	28.38	34.81	40.27	45.10	49.49	53.55	57.35	60.93	64.35	67.61
75	24.52	34.72	42.57	49.21	55.08	60.40	65.32	69.91	74.23	78.34	82.26
100	28.31	40.06	49.11	56.75	63.51	69.63	75.27	80.54	85.50	90.20	94.68
125	31.64	44.78	54.88	63.41	70.94	77.77	84.06	89.92	95.44	100.67	105.66
150	34.66	49.04	60.10	69.43	77.67	85.13	92.00	98.41	104.44	110.15	115.60
175	37.43	52.96	64.90	74.97	83.86	91.91	99.32	106.23	112.73	118.88	124.75
200	40.01	56.61	69.36	80.13	89.62	98.22	106.13	113.51	120.45	127.01	133.27
225	42.44	60.04	73.56	84.97	95.04	104.15	112.53	120.35	127.70	134.66	141.28
250	44.73	63.28	77.53	89.56	100.16	109.76	118.59	126.82	134.56	141.89	148.86
275	46.91	66.37	81.31	93.92	105.03	115.09	124.35	132.98	141.09	148.77	156.08
300	49.00	69.32	84.92	98.08	109.69	120.19	129.86	138.86	147.33	155.34	162.97
350	52.92	74.86	91.71	105.92	118.45	129.79	140.22	149.94	159.08	167.72	175.95
400	56.58	80.03	98.03	113.22	126.61	138.73	149.87	160.26	170.01	179.25	188.04
500	63.25	89.47	109.59	126.57	141.53	155.06	167.52	179.11	190.01	200.32	210.13
600	69.29	98.00	120.04	138.63	155.02	169.83	183.47	196.16	208.09	219.38	230.12
700	74.84	105.85	129.65	149.73	167.42	183.42	198.14	211.85	224.72	236.91	248.50
800	80.00	113.15	138.60	160.05	178.97	196.07	211.80	226.45	240.21	253.23	265.62
900	84.85	120.01	147.00	169.76	189.81	207.95	224.63	240.16	254.75	268.56	281.69
1000	89.44	126.50	154.95	178.93	200.07	219.18	236.76	253.13	268.51	283.06	296.90

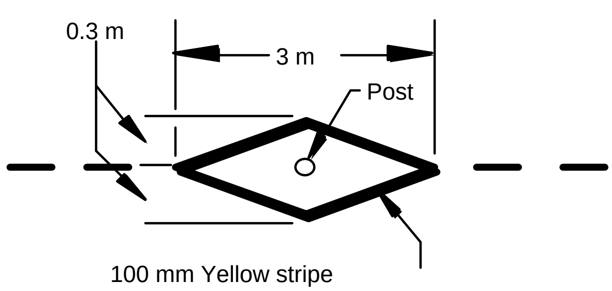
(15) *Barrier Posts*. It may be necessary to install barrier posts at entrances to bike paths to prevent motor vehicles from entering. When locating such installations, care should be taken to assure that barriers are well marked and visible to bicyclists, day or night (i.e., install reflectors or reflectorized tape).

Striping an envelope around the barriers is recommended (see Figure 1003.1G). If sight distance is limited, special advance warning signs or painted pavement warnings should be provided. Where more than one post is necessary, a 1.5 m spacing should be used to permit passage of bicycle-towed trailers, adult tricycles, and to assure adequate room for safe bicycle passage without dismounting. Barrier post installations should be designed so they are removable to permit entrance by emergency and service vehicles.

Generally, barrier configurations that preclude entry by motorcycles present safety and convenience problems for bicyclists. Such devices should be used only where extreme problems are encountered.

Figure 1003.1G

Barrier Post Striping



(16) *Lighting.* Fixed-source lighting reduces conflicts along paths and at intersections. In addition, lighting allows the bicyclist to see the bicycle path direction, surface conditions, and obstacles. Lighting for bicycle paths is important and should be considered where riding at night is expected, such as bicycle paths serving college students or commuters, and at highway intersections. Lighting should also be considered through underpasses or tunnels, and when nighttime security could be a problem.

Depending on the location, average maintained horizontal illumination levels of 5 lux to 22 lux should be considered. Where special security problems exist, higher illumination levels may be considered. Light standards (poles) should meet the recommended horizontal and vertical clearances. Luminaires and standards should be at a scale appropriate for a pedestrian or bicycle path.

1003.2 Class II Bikeways

Class II bikeways (bike lanes) for preferential use by bicycles are established within the paved area of highways. Bike lane stripes are intended to promote an orderly flow of traffic, by establishing specific lines of demarcation between areas reserved for bicycles and lanes to be occupied by motor vehicles. This effect is supported by bike lane signs and pavement markings. Bike lane stripes can increase bicyclists' confidence that motorists will not stray into their path of travel if they remain within the bike lane. Likewise, with more certainty as to where bicyclists will be, passing motorists are less apt to swerve toward opposing traffic in making certain they will not hit bicyclists.

Class II bike lanes shall be one-way facilities. Two-way bike lanes (or bike paths that are contiguous to the roadway) are not permitted, as such facilities have proved unsatisfactory and promote riding against the flow of motor vehicle traffic.

(1) *Widths*. Typical Class II bikeway configurations are illustrated in Figure 1003.2A and are described below:

(a) Figure 1003.2A-(1) depicts bike lanes on an urban type curbed street where parking stalls (or continuous parking stripes) are marked. Bike lanes are located between the parking area and the traffic lanes. **As indicated, 1.5 m shall be the minimum width of bike lane where parking stalls are marked.** If parking volume is substantial or turnover high, an additional 0.3 m to 0.6 m of width is desirable.

Bike lanes shall not be placed between the parking area and the curb. Such facilities increase the conflict between bicyclists and opening car doors and reduce visibility at intersections. Also, they prevent bicyclists from leaving the bike lane to turn left and cannot be effectively maintained.

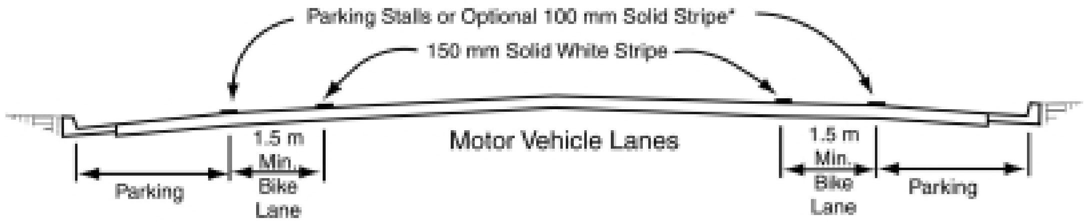
(b) Figure 1003.2A-(2) depicts bike lanes on an urban-type curbed street, where parking is permitted, but without parking stripe or stall marking. Bike lanes are established in conjunction with the parking areas**. As indicated, 3.3 m or 3.6 m (depending on the type of curb) shall be the minimum width of the bike lane where parking is permitted.** This type of lane is satisfacory where parking is not extensive and where turnover of parked cars is infrequent. However, if parking is substantial, turnover of parked cars is high, truck traffic is substantial, or if vehicle speeds exceed 55 km/h, additional width is recommended.

(c) Figure 1003.2A-(3) depicts bike lanes along the outer portions of an urban type curbed street, where parking is prohibited. This is generally the most desirable configuration for bike lanes, as it eliminates potential conflicts resulting from auto parking (e.g., opening car doors). **As indicated, if no gutter exists, the minimum bike lane width shall be 1.2 m. With a normal 600 mm gutter, the minimum bike lane width shall be 1.5 m.** The intent is to provide a minimum 1.2 m wide bike lane, but with at least 0.9 m between the traffic lane and the longitudinal joint at the concrete gutter, since the gutter reduces the effective width of the bike lane for two reasons. First, the longitudinal joint may not always be smooth, and may be difficult to ride along. Secondly, the gutter does not provide a suitable surface for bicycle travel. Where gutters are wide (say, 1.2 m), an additional 0.9 m must be provided because bicyclists should not be expected to ride in the gutter. Wherever possible, the width of bike lanes should be increased to 1.8 to 2.4 m to provide for greater safety. 2.4 m bike lanes can also serve as emergency parking areas for disabled vehicles.

Striping bike lanes next to curbs where parking is prohibited only during certain hours shall be done only in conjunction with special signing to designate the hours bike lanes are to be effective. Since the Vehicle Code requires bicyclists to ride in bike lanes where provided (except under certain conditions), proper signing is necessary to inform bicyclists that they are required to ride in bike lanes only during the course of the parking prohibition. This type of bike lane should be considered only if the vast majority of bicycle travel would occur during the hours of the parking prohibition, and only if there is a firm commitment to enforce the parking prohibition. Because of the obvious complications, this type of bike lane is not encouraged for general application.

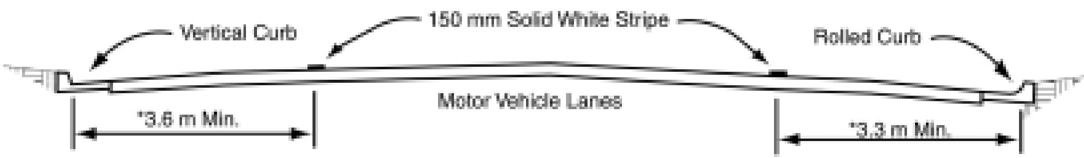
Figure 1003.2A(4) depicts bike lanes on a highway without curbs and gutters. This location is in an undeveloped area where infrequent parking is handled off the pavement. This can be accomplished by supplementing the bike lane signing with R25 (park off pavement) signs, or R26 (no parking) signs. **Minimum widths shall be as shown.** Additional width is desirable, particularly where motor vehicle speeds exceed 55 km/h.

Figure 1003.2A
Typical Bike Lane Cross Sections
(On 2-lane or Multilane Highways)



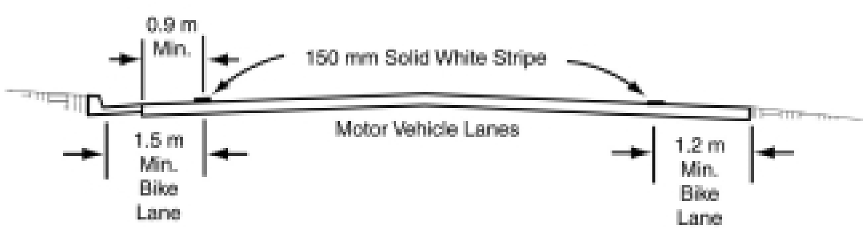
*The optional solid white stripe may be advisable where stalls are unnecessary (because parking is light) but there is concern that motorists may misconstrue the bike lane to be a traffic lane.

(1) STRIPED PARKING

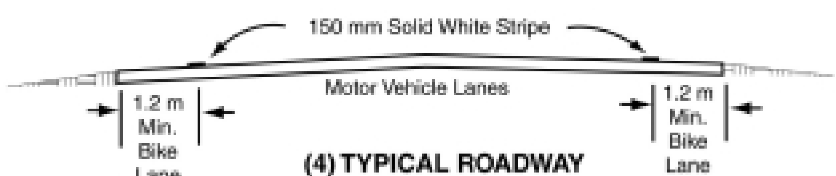


* 3.9 is recommended where there is substantial parking or turnover of parked cars is high (e.g. commerical areas).

(2) PARKING PERMITTED WITHOUT PARKING STRIPE OR STALL



(With Gutter) **(3) PARKING PROHIBITED** (Without Gutter)



(4) TYPICAL ROADWAY IN OUTLYING ARES PARKING RESTRICTED

The typical traffic lane width next to a bike lane is 3.6 m. Lane widths narrower than 3.6 m must receive approval as discussed in Index 82.2. There are situations where it may be necessary to reduce the width of the traffic lanes in order to stripe bike lanes. In determining the appropriateness of narrower traffic lanes, consideration should be given to factors such as motor vehicle speeds, truck volumes, alignment, and sight distance. Where favorable conditions exist, traffic lanes of 3.3 m may be feasible.

Bike lanes are not advisable on long, steep downgrades, where bicycle speeds greater than 50 km/h are expected. As grades increase, downhill bicycle speeds will increase, which increases the problem of riding near the edge of the roadway. In such situations, bicycle speeds can approach those of motor vehicles, and experienced bicyclists will generally move into the motor vehicle lanes to increase sight distance and maneuverability. If bike lanes are to be striped, additional width should be provided to accommodate higher bicycle speeds.

If the bike lanes are to be located on one-way streets, they should be placed on the right side of the street. Bike lanes on the left side would cause bicyclists and motorists to undertake crossing maneuvers in making left turns onto a two-way street.

(2) *Striping and Signing*. Details for striping and signing of bike lanes are included under Topic 1004.

Raised barriers (e.g., raised traffic bars and asphalt concrete dikes) or raised pavement markers shall not be used to delineate bike lanes. Raised barriers prevent motorists from merging into bike lanes before making right turns, as required by the Vehicle Code, and restrict the movement of bicyclists desiring to enter or exit bike lanes. They also impede routine maintenance. Raised pavement markers increase the difficulty for bicyclists when entering or exiting bike lanes, and discourage motorists from merging into bike lanes before making right turns.

Bike lane stripes should be placed a constant distance from the outside motor vehicle lane. Bike lanes with parking permitted (3.3 m to 3.9 m between the bike lane line and the curb) should not be directed toward the curb at intersections or localized areas where parking is prohibited. Such a practice prevents bicyclists from following a straight course. Where transitions from one type of bike lane to another are necessary, smooth tapers should be provided.

(3) *At-grade Intersection Design*. Most auto/bicycle accidents occur at intersections. For this reason, bikeway design at intersections should be accomplished in a manner that will minimize confusion by motorists and bicyclists, and will permit both to operate in accordance with the normal rules of the road.

Figure 1003.2B illustrates a typical at-grade intersection of multilane streets, with bike lanes on all approaches. Some common movements of motor vehicles and bicycles are shown. A prevalent type of accident involves straight-through bicycle traffic and right-turning motorists. Left-turning bicyclists also have problems, as the bike lane is on the right side of the street, and bicyclists have to cross the path of cars traveling in both directions. Some bicyclists are proficient enough to merge across one or more lanes of traffic, to use the inside lane or left-turn lane. However, there are many who do not feel comfortable making this maneuver. They have the option of making a two-legged left turn by riding along a course similar to that followed by pedestrians, as shown in the diagram. Young children will often prefer to dismount and change directions by walking their bike in the crosswalk.

Figure 1003.2C illustrates recommended striping patterns for bike lanes crossing a motorist right-turn-only lane. When confronted with such intersections, bicyclists will have to merge with right-turning motorists. Since bicyclists are typically traveling at speeds less than motorists, they should signal and merge where there is sufficient gap in right-turning traffic, rather than at any predetermined location. For this reason, it is recommended that all delineation be dropped at the approach of the right-turn lane. A pair of parallel lines (delineating a bike lane crossing) to channel the bike merge is not recommended, as bicyclists will be encouraged to cross at a predetermined location, rather than when there is a safe gap in right-turning traffic.

A dashed line across the right-turn-only lane is not recommended on extremely long lanes, or where there are double right-turn-only lanes. For these types of intersections, all striping should be dropped to permit judgment by the bicyclists to prevail. A Bike Xing sign may be used to warn motorists of the potential for bicyclists crossing their path.

At intersections where there is a bike lane and traffic-actuated signal, installation of bicycle-sensitive detectors within the bike lane is desirable. Push button detectors are not as satisfactory as those located in the pavement because the cyclist must stop to actuate the push button. It is also desirable that detectors in left-turn lanes be sensitive enough to detect bicycles (see Chapter 9 of the Traffic Manual and Standard Plans for bicycle-sensitive detector designs). See Figure 1003.2D for bicycle loop detector pavement marking.

At intersections (without bike lanes) with significant bicycle use and a traffic-actuated signal, it is desirable to install detectors that are sensitive enough to detect bicycles.

(4) *Interchange Design*. As with bikeway design through at-grade intersections, bikeway design through interchanges should be accomplished in a manner that will minimize confusion by motorists and bicyclists. Designers should work closely with the local agency in designing bicycle facilities through interchanges. Local Agencies should carefully select interchange locations which are most suitable for bikeway designations and where the crossing meets applicable design standards. The local agency may have special needs and desires for continuity through interchanges which should be considered in the design process.

When a bike lane approaches a ramp intersection that intersects the local facility at or close to 90° (typical of a compact or spread diamond configuration), then Figure 1003.2C may be the appropriate method of getting bike lanes through the interchange.

However, when a bike lane approaches one or more ramp intersections that intersect the local facility at various angles other than 90° (typically high-speed, skewed ramps), Figure 1003.2E should be considered.

Figure 1003.2E, shows a bike lane through a typical interchange. The 150 mm bike lane stripe should be dropped 30 m prior to the ramp intersection as shown in the figure to allow for adequate weaving distance. **The shoulder width shall not be reduced through the interchange area. The minimum shoulder width shall match the approach roadway shoulder width, but not less than 1.2 m or 1.5 m if a gutter exists. If the shoulder width is not available, the designated bike lane shall end at the previous local road intersection.**

Depending on the intersection angles, either Figure 1003.2C or 1003.2E should also be used for multilane ramp intersections. Additionally, the outside through lane should be widened to 4.2 m when feasible. This allows extra room for bicycles to share the through lane with vehicles. The outside shoulder width should not be reduced through the interchange area to accommodate this additional width.

1003.3 Class III Bikeways

Class III bikeways (bike routes) are intended to provide continuity to the bikeway system. Bike routes are established along through routes not served by Class I or II bikeways, or to connect discontinuous segments of bikeway (normally bike lanes). Class III facilities are shared facilities, either with motor vehicles on the street, or with pedestrians on sidewalks, and in either case bicycle usage is secondary. Class III facilities are established by placing Bike Route signs along roadways.

Figure 1003.2B

Typical Bicycle/Auto Movements at Intersections of Multilane Streets

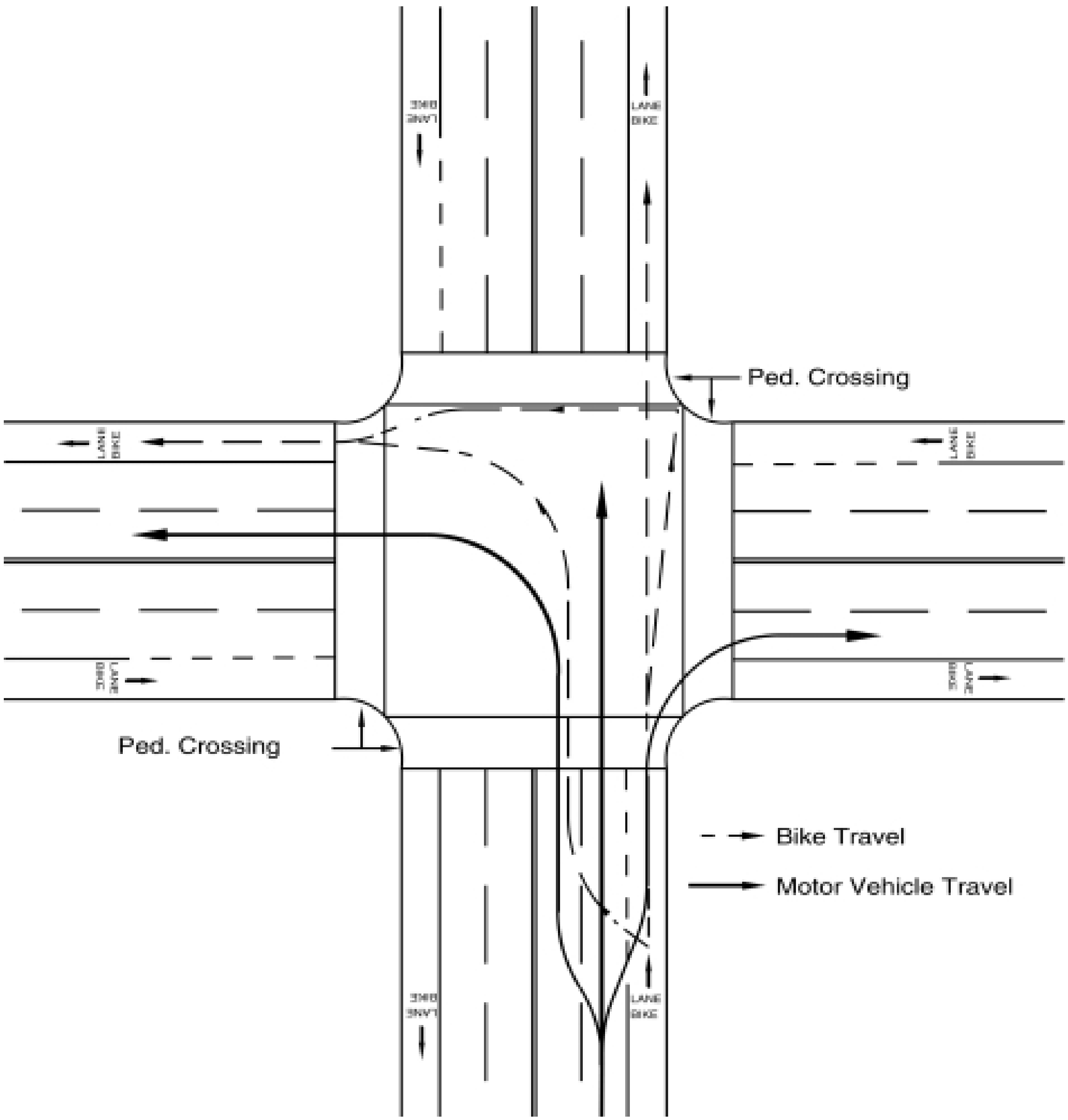


Figure 1003.2C
Bike Lanes Approaching Motorist Right-turn-only Lane

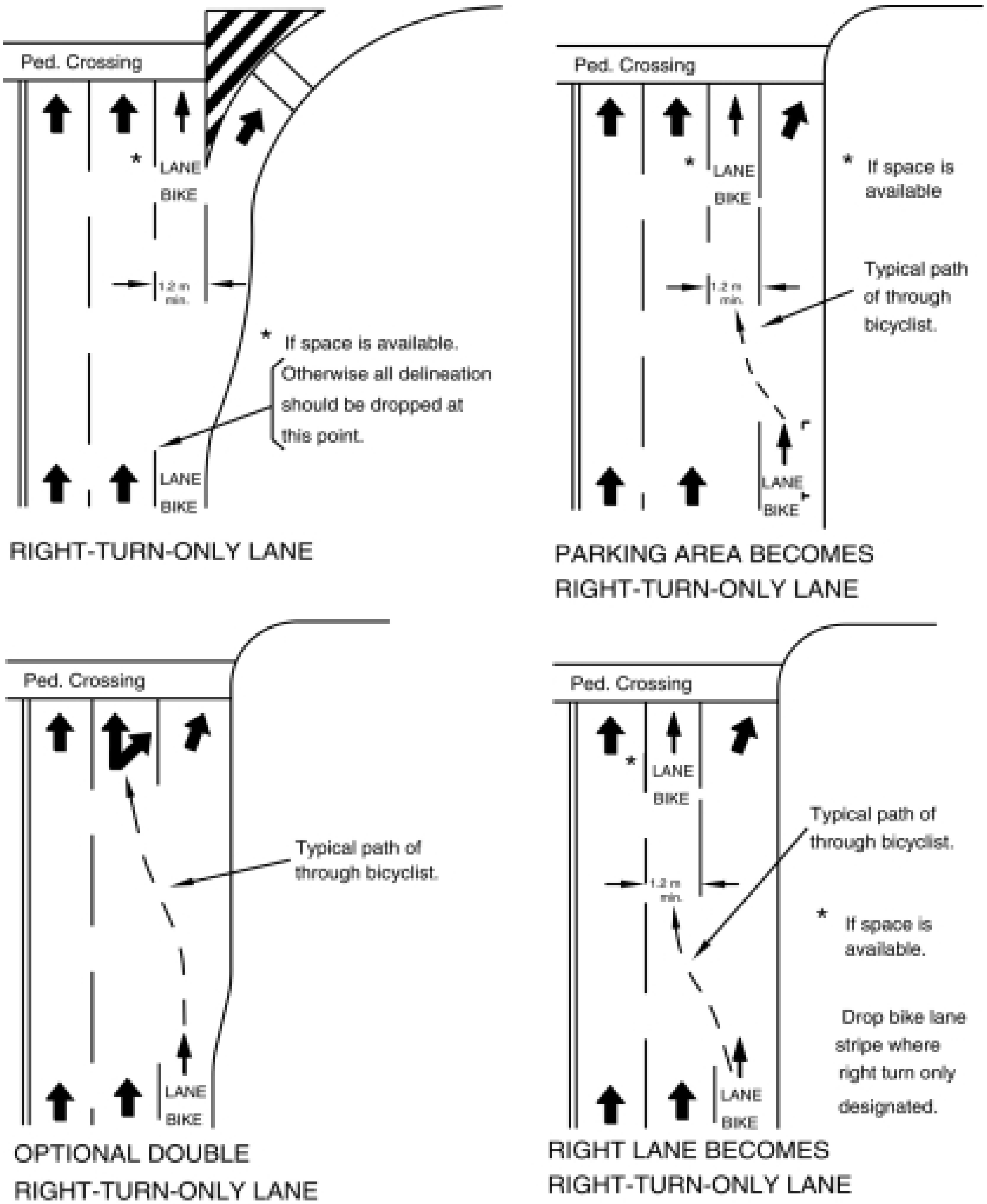


Figure 1003.2D
Bike Loop Detector Pavement Marking

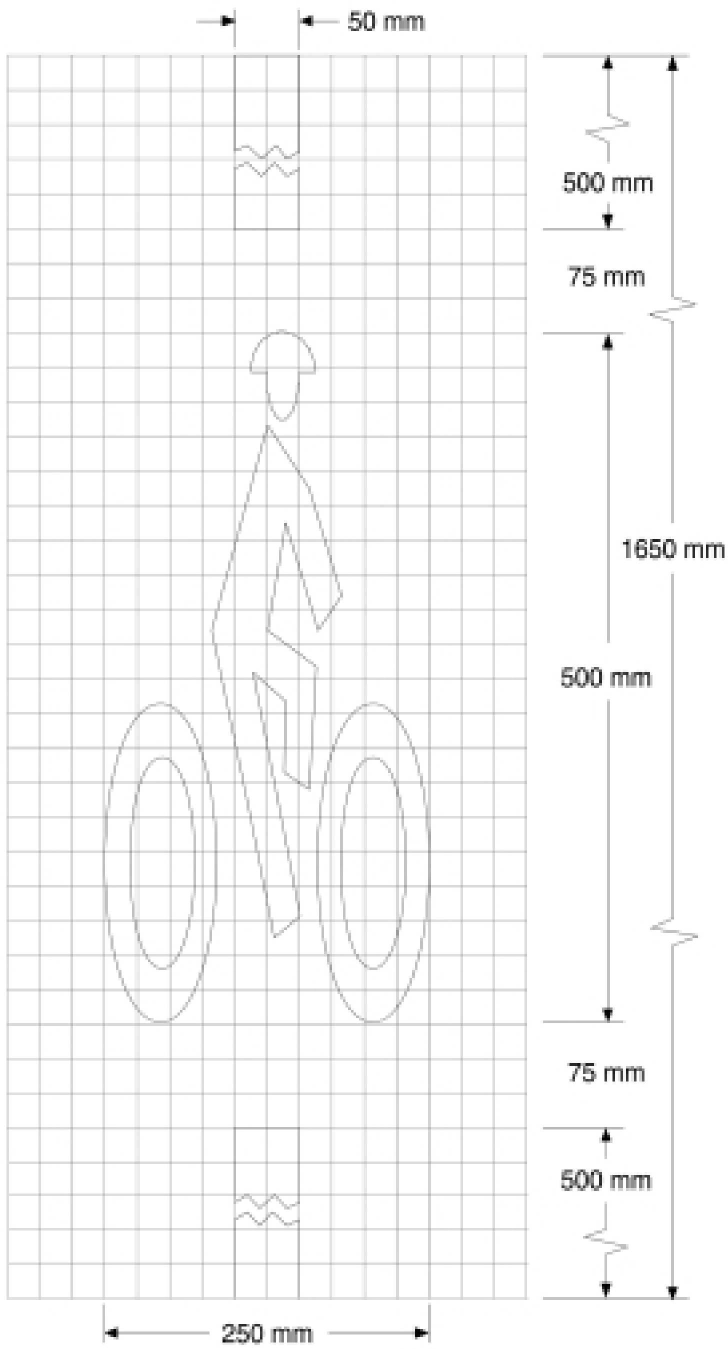
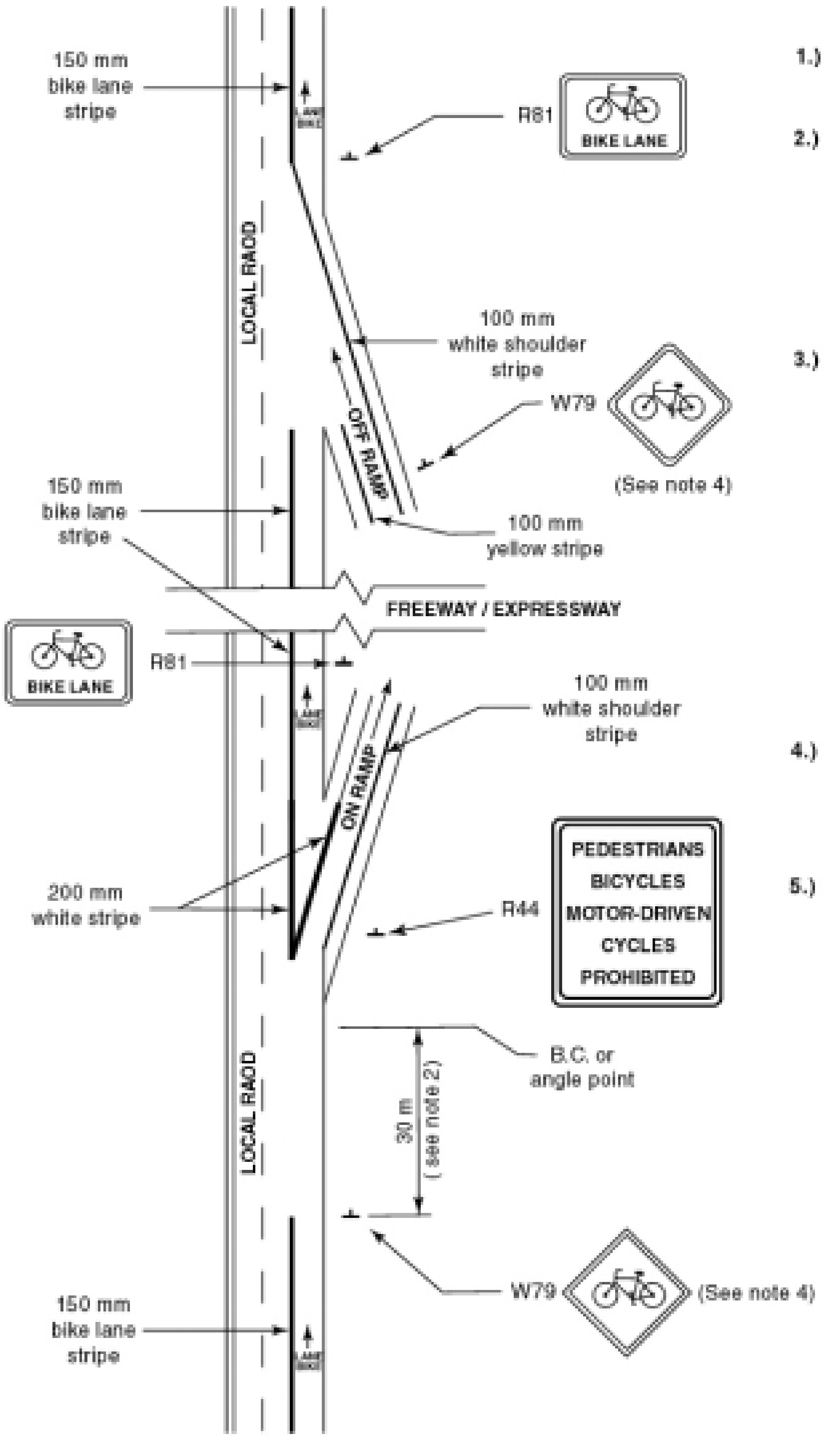


Figure 1003.2E

Bike Lanes Through Interchanges



Notes:

1.) See Index 1003.2 (4) for additional information.

2.) At additional on-ramps within the interchange the signing & striping as shown shall be repeated. Where the on-ramps intersect at the local road at or near 90 degrees, the striping should follow Figure 1003.2C.

3.) The shoulder width shall not be reduced through the interchange area. The minimum shoulder width shall match the approach roadway shoulder width, but not less than 1.2 m or 1.5 m if a gutter exists. If the shoulder width is not available, the designated bike lane shall end at the previous llocal raod inter-section.

4.) The W79 signs are optional and should be used only when determined appropriate by the Engineer.

5.) See Index 1003.3 (4) for information on Bike Routes Through Interchanges.

Minimum widths for Class III bikeways are not presented, as the acceptable width is dependent on many factors, including the volume and character of vehicular traffic on the road, typical speeds, vertical and horizontal alignment, sight distance, and parking conditions.

Since bicyclists are permitted on all highways (except prohibited freeways), the decision to sign the route should be based on the advisability of encouraging bicycle travel on the route and other factors listed below.

(1) On-street Bike Route Criteria. To be of benefit to bicyclists, bike routes should offer a higher degree of service than alternative streets. Routes should be signed only if some of the following apply:

(a) They provide for through and direct travel in bicycle-demand corridors.

(b) Connect discontinuous segments of bike lanes.

(c) An effort has been made to adjust traffic control devices (stop signs, signals) to give greater priority to bicyclists, as compared with alternative streets. This could include placement of bicycle-sensitive detectors on the right-hand portion of the road, where bicyclists are expected to ride.

(d) Street parking has been removed or restricted in areas of critical width to provide improved safety.

(e) Surface imperfections or irregularities have been corrected (e.g., utility covers adjusted to grade, potholes filled, etc.).

(f) Maintenance of the route will be at a higher standard than that of other comparable streets (e.g., more frequent street sweeping).

(2) Sidewalk Bikeway Criteria. In general, the designated use of sidewalks (as a Class III bikeway) for bicycle travel is unsatisfactory.

It is important to recognize that the development of extremely wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel, as wide sidewalks will encourage higher speed bicycle use and can increase potential for conflicts with motor vehicles at intersections, as well as with pedestrians and fixed objects.

Sidewalk bikeways should be considered only under special circumstances, such as:

(a) To provide bikeway continuity along high speed or heavily traveled roadways having inadequate space for bicyclists, and uninterrupted by driveways and intersections for long distances.

(b) On long, narrow bridges. In such cases, ramps should be installed at the sidewalk approaches. If approach bikeways are two-way, sidewalk facilities should also be two-way.

Whenever sidewalk bikeways are established, a special effort should be made to remove unnecessary obstacles. Whenever bicyclists are directed from bike lanes to sidewalks, curb cuts should be flush with the street to assure that bicyclists are not subjected to problems associated with crossing a vertical lip at a flat angle. Also curb cuts at each intersection are necessary, as well as bikeway yield or stop signs at uncontrolled intersections. Curb cuts should be wide enough to accommodate adult tricycles and two-wheel bicycle trailers.

In residential areas, sidewalk riding by young children too inexperienced to ride in the street is common. With lower bicycle speeds and lower auto speeds, potential conflicts are somewhat lessened, but still exist. Nevertheless, this type of sidewalk bicycle use is accepted. But it is inappropriate to sign these facilities as bikeways. Bicyclists should not be encouraged (through signing) to ride facilities that are not designed to accommodate bicycle travel.

(3) Destination Signing of Bike Routes. For Bike Route signs to be more functional, supplemental plates may be placed beneath them when located along routes leading to high demand destinations (e.g., "To Downtown"; "To State College"; etc.-- see Figure 1004.4 for typical signing).

There are instances where it is necessary to sign a route to direct bicyclists to a logical destination, but where the route does not offer any of the above listed bike route features. In such cases, the route should not be signed as a bike route; however, destination signing may be advisable. A typical application of destination signing would be where bicyclists are directed off a highway to bypass a section of freeway. Special signs would be placed to guide bicyclists to the next logical destination. The intent is to direct bicyclists in the same way as motorists would be directed if a highway detour was necessitated.

(4) *Interchange Design* As with bikeway design through at-grade intersections, bikeway design through interchanges should be accomplished in a manner that will minimize confusion by motorists and bicyclists. Designers should work closely with the local agency in designing bicycle facilities through interchanges. Local Agencies should carefully select interchange locations which are most suitable for bikeway designations and where the crossing meets applicable design standards. The local agency may have special needs and desires for continuity through interchanges which should be considered in the design process.

Figure 1003.2E may also be used where the preferred designation is a class III (bike route), with the R81 signs being replaced with G93 signs and the bike lane delineation eliminated. A 100 mm stripe may be used to delineate the shoulder through out the bike route designation**. Within the Interchange area the bike route shall require either an outside lane width of 4.8 m or a 3.6 m lane and a 1.2 m shoulder. If the above width is not available, the designated bike route shall end at the previous local road intersection.**

1003.4 Bicycles on Freeways

In some instances, bicyclists are permitted on freeways. Seldom would a freeway be signed or striped as a bikeway, but it can be opened for use if it meets certain criteria. Essentially, the criteria involve assessing the safety and convenience of the freeway as compared with available alternate routes. However, a freeway should not be opened to bicycle use if it is determined to be incompatible. The Headquarters Traffic Liaisons and the Project Development Coordinator must approve any proposals to open freeways to bicyclists.

If a suitable alternate route exists, it would normally be unnecessary to open the freeway. However, if the alternate route is unsuitable for bicycle travel the freeway may be a better alternative for bicyclists. In determining the suitability of an alternate route, safety should be the paramount consideration. The following factors should be considered:

- Number of intersections
- Shoulder widths
- Traffic volumes
- Vehicle speeds
- Bus, truck and recreational vehicle volumes
- Grades
- Travel time

When a suitable alternate route does not exist, a freeway shoulder may be considered for bicycle travel. Normally, freeways in urban areas will have characteristics that make it unfeasible to permit bicycle use. In determining if the freeway shoulder is suitable for bicycle travel, the following factors should be considered;

- Shoulder widths
- Bicycle hazards on shoulders (drainage grates, expansion joints, etc.)
- Number and location of entrance/exit ramps
- Traffic volumes on entrance/exit ramps

When bicyclists are permitted on segments of freeway, it will be necessary to modify and supplement freeway regulatory signs, particularly those at freeway ramp entrances and exits (see Chapter 4 of the Traffic Manual).

Where no reasonable alternate route exists within a freeway corridor, the Department should coordi-nate with local agencies to develop or improve existing routes or provide parallel bikeways within or adjacent to the freeway right of way.

The long term goal is to provide a safe and convenient non-freeway route for bicycle travel.

1003.5 Multipurpose Trails

In some instances, it may be appropriate for agencies to develop multipurpose trails - for hikers, joggers, equestrians, bicyclists, etc. Many of these trails will not be paved and will not meet the standards for Class I bikeways. As such, these facilities should not be signed as bikeways. Rather, they should be designated as multipurpose trails (or similar designation), along with regulatory signing to restrict motor vehicles, as appropriate.

If multipurpose trails are primarily to serve bicycle travel, they should be developed in accordance with standards for Class I bikeways. In general, multipurpose trails are not recommended as high speed transportation facilities for bicyclists because of conflicts between bicyclists and pedestrians. Wherever possible, separate bicycle and pedestrian paths should be provided. If this is not feasible, additional width, signing and striping should be used to minimize conflicts.

It is undesirable to mix mopeds and bicycles on the same facility. In general, mopeds should not be allowed on multipurpose trails because of conflicts with slower moving bicyclists and pedestrians. In some cases where an alternate route for mopeds does not exist, additional width, signing, and striping should be used to minimize conflicts. Increased patrolling by law enforcement personnel is also recommended to enforce speed limits and other rules of the road.

It is usually not desirable to mix horses and bicycle traffic on the same multipurpose trail. Bicyclists are often not aware of the need for slower speeds and additional operating space near horses. Horses can be startled easily and may be unpredictable if they perceive approaching bicyclists as a danger. In addition, pavement requirements for safe bicycle travel are not suitable for horses. For these reasons, a bridle trail separate from the multipurpose trail is recommended wherever possible.

1003.6 Miscellaneous Bikeway Criteria

The following are miscellaneous bikeway criteria which should be followed to the extent pertinent to Class I, II and III bikeways. Some, by their very nature, will not apply to all classes of bikeway. Many of the criteria are important to consider on any highway where bicycle travel is expected, without regard to whether or not bikeways are established.

(1) Bridges. Bikeways on highway bridges must be carefully coordinated with approach bikeways to make sure that all elements are compatible. For example, bicycle traffic bound in opposite directions is best accommodated by bike lanes on each side of a highway. In such cases, a two-way bike path on one side of a bridge would normally be inappropriate, as one direction of bicycle traffic would be required to cross the highway at grade twice to get to and from the bridge bike path. Because of the inconvenience, many bicyclists will be encouraged to ride on the wrong side of the highway beyond the bridge termini.

The following criteria apply to a two-way bike path on one side of a highway bridge:

(a) The bikeway approach to the bridge should be by way of a separate two-way facility for the reason explained above.

(b) **A physical separation, such as a chain link fence or railing, shall be provided to offset the adverse effects of having bicycles traveling against motor vehicle traffic.** The physical separation should be designed to minimize fixed end hazards to motor vehicles and if the bridge is an interchange structure, to minimize sight distance restrictions at ramp intersections.

It is recommended that bikeway bridge railings or fences placed between traffic lanes and bikeways be at least 1.4 m high to minimize the likelihood of bicyclists falling over the railings. Standard bridge railings which are lower than 1.4 m can be retrofitted with lightweight upper railings or chain link fence suitable to restrain bicyclists.

Separate highway overcrossing structures for bikeway traffic shall conform to Caltrans' standard pedestrian overcrossing design loading. The minimum clear width shall be the paved width of the approach bikeway but not less than 2.4 m. If pedestrians are to use the structure, additional width is recommended.

(2) *Surface Quality*. The surface to be used by bicyclists should be smooth, free of potholes, and the pavement edge uniform. For rideability on new construction, the finished surface of bikeways should not vary more than 6 mm from the lower edge of a 2.4 m long straight edge when laid on the surface in any direction.

Table 1003.6

Bikeway Surface Tolerances

Direction of Travel	Grooves(1)	Steps(2)
Parallel to travel	No more than 12 mm wide	No more than 10 mm high
Perpendicular to travel	---	No more than 20 mm high

(1) Groove--A narrow slot in the surface that could catch a bicycle wheel, such as a gap between two concrete slabs.

(2) Step--A ridge in the pavement, such as that which might exist between the pavement and a concrete gutter or manhole cover; or that might exist between two pavement blankets when the top level does not extend to the edge of the roadway.

Table 1003.6 indicates the recommended bikeway surface tolerances for Class II and III bikeways developed on existing streets to minimize the potential for causing bicyclists to lose control of their bicycle (Note: Stricter tolerances should be achieved on new bikeway construction.) Shoulder rumble strips are not suitable as a riding surface for bicycles. See Traffic Manual Section 6-03.2 for additional information regarding rumble strip design considerations for bicycles.

(3) *Drainage Grates, Manhole Covers, and Driveways*. Drainage inlet grates, manhole covers, etc., on bikeways should be designed and installed in a manner that provides an adequate surface for bicyclists. They should be maintained flush with the surface when resurfacing.

Drainage inlet grates on bikeways shall have openings narrow enough and short enough to assure bicycle tires will not drop into the grates (e.g., reticuline type), regardless of the direction of bicycle travel. Where it is not immediately feasible to replace existing grates with standard grates designed for bicycles, 25 mm x 6 mm steel cross straps should be welded to the grates at a spacing of 150 mm to 200 mm on centers to reduce the size of the openings adequately.

Corrective actions described above are recommended on all highways where bicycle travel is permitted, whether or not bikeways are designated.

Future driveway construction should avoid construction of a vertical lip from the driveway to the gutter, as the lip may create a problem for bicyclists when entering from the edge of the roadway at a flat angle. If a lip is deemed necessary, the height should be limited to 15 mm.

(4) *At-grade Railroad Crossings and Cattle Guards*. Whenever it is necessary to cross railroad tracks with a bikeway, special care must be taken to assure that the safety of bicyclists is protected. The bikeway crossing should be at least as wide as the approaches of the bikeway. Wherever possible, the crossing should be straight and at right angles to the rails. For on-street bikeways where a skew is unavoidable, the shoulder (or bike lane) should be widened, if possible, to permit bicyclists to cross at right angles (see Figure 1003.6A). If this is not possible, special construction and materials should be considered to keep the flangeway depth and width to a minimum.

Figure 1003.6A
Railroad Crossings

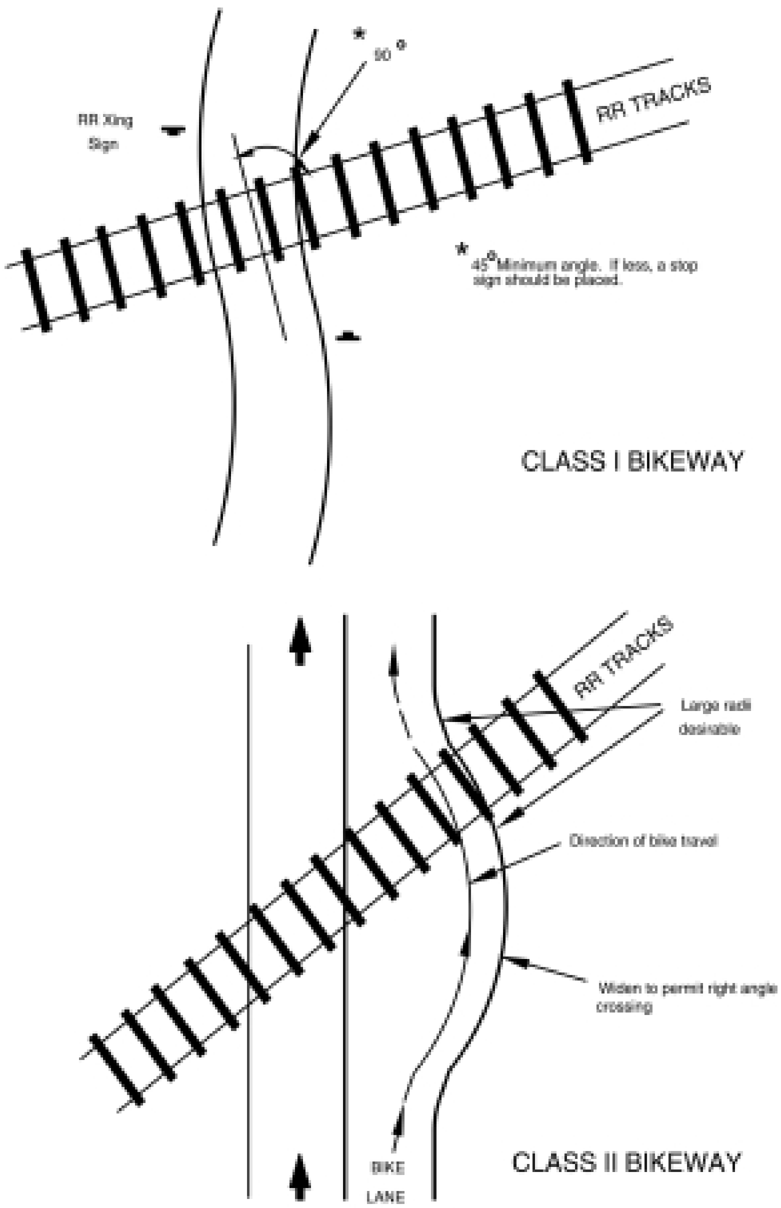
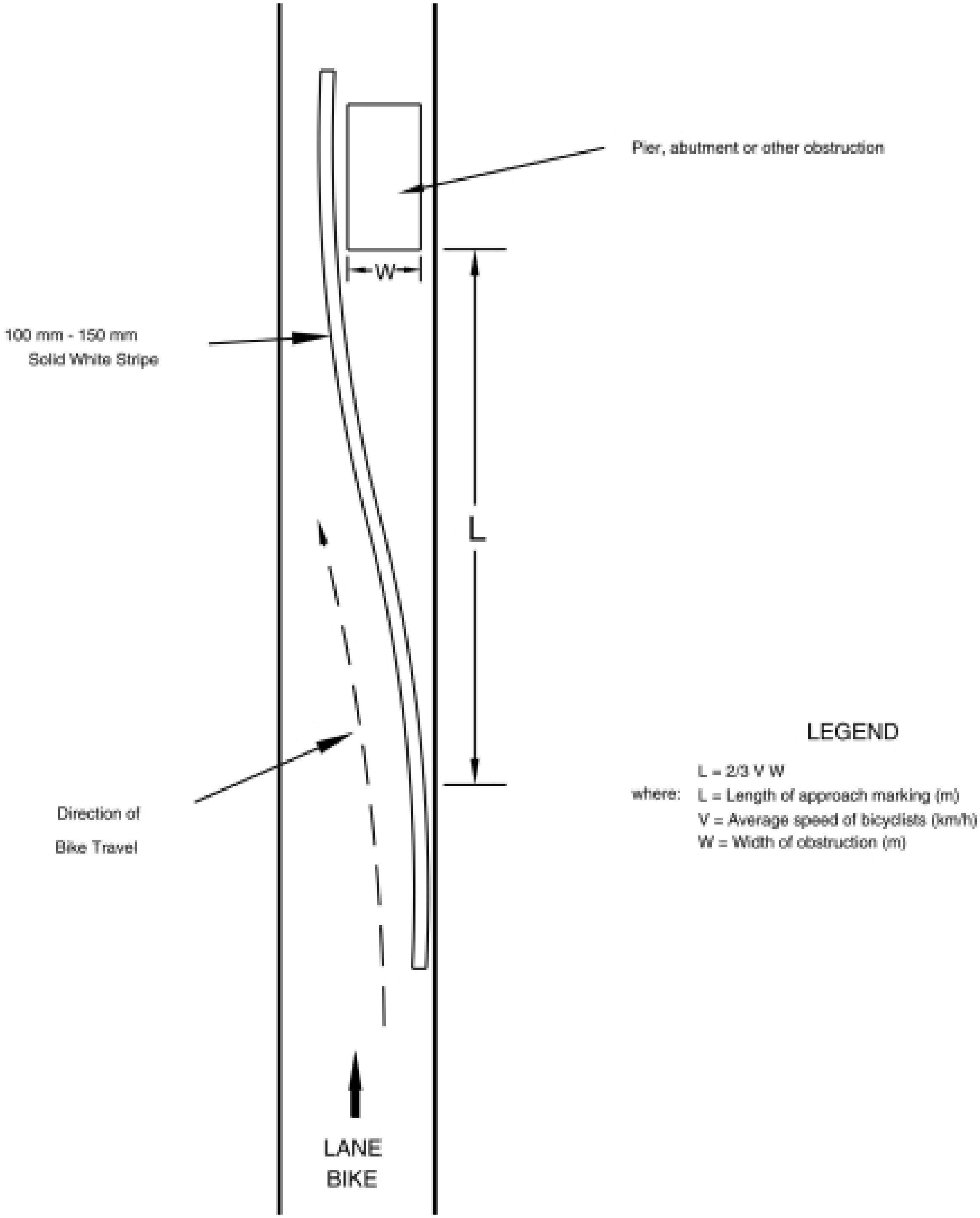


Figure 1003.6B

Obstruction Markings



Pavement should be maintained so ridge buildup does not occur next to the rails. In some cases, timber plank crossings can be justified and can provide for a smoother crossing. Where hazards to bicyclist cannot be avoided, appropriate signs should be installed to warn bicyclists of the danger.

All railroad crossings are regulated by the California Public Utilities Commission (CPUC). All new bike path railroad crossings must be approved by the CPUC. Necessary railroad protection will be determined based on a joint field review involving the applicant, the railroad company, and the CPUC.

The presence of cattle guards along any roadway where bicyclists are expected should be clearly marked with adequate advance warning.

(5) *Obstruction Markings*. Vertical barriers and obstructions, such as abutments, piers, and other features causing bikeway constriction, should be clearly marked to gain the attention of approaching bicyclists. This treatment should be used only where unavoidable, and is by no means a substitute for good bikeway design. An example of an obstruction marking is shown in Figure 1003.6B. Signs, reflectors, diagonal black and yellow markings, or other treatments will be appropriate in other instances to alert bicyclists to potential obstructions.

Topic 1004 - Uniform Signs, Markings and Traffic Control Devices

1004.1 Introduction

Per Section 891 of the Streets and Highways Code, uniform signs, markings, and traffic control devices shall be used. As such this section is mandatory, except where permissive language is used. See the Traffic Manual for detailed specifications.

1004.2 Bike Path (Class I)

An optional 100 mm yellow stripe may be placed to separate opposing directions of travel. (See Index 1003.1(3) for additional information.) A 0.9 m long stripe with a 2.7 m space is the recommended striping pattern, but may be revised, depending on the situation.

Standard regulatory, warning, and guide signs used on highways may be used on bike paths, as appropriate (and may be scaled down in size). Special regulatory, warning, and guide signs may also be used to meet specific needs.

White painted word (or symbol) warning markings on the pavement may be used as an effective means of alerting bicyclists to approaching hazards, such as sharp curves, barrier posts, etc.

1004.3 Bike Lanes (Class II)

Bike lanes require standard signing and pavement markings as shown on Figure 1004.3. This figure also depicts the proper method of striping bike lanes through intersections. Bike lane lines are not typically extended through intersections. Where motor vehicle right turns are not permitted, the solid bike lane stripe should extend to the edge of the intersection, and begin again on the far side. Where right turns are permitted, the solid stripe should terminate 30 m to 60 m prior to the intersection. A dashed line, as shown in Figure 1004.3, may be carried to, or near, the intersection. Where city blocks are short (less than 120 m), the length of dashed stripe is typically close to 30 m. Where blocks are longer or motor vehicle speeds are high (greater than 60 km/h), the length of dashed stripe should be increased to 60 m.

In addition to the required "Bike Lane" pavement marking, an optional bike lane symbol may be used as shown on Figure 1004.4 to supplement the word message.

The R81 bike lane sign shall be placed at the beginning of all bike lanes, on the far side of every arterial street intersection, at all major changes in direction, and at maximum 1 km intervals.

Bike lane pavement markings shall be placed on the far side of each intersection, and may be placed at other locations as desired.

Raised pavement markers or other raised barriers shall not be used to delineate bike lanes.

The G93 Bike Route sign may also be used along bike lanes, but its primary purpose should be to provide directional signing and destination signing where necessary. A proliferation of Bike Route signs along signed and striped bike lanes serves no useful purpose.

Many signs on the roadway also will apply to bicyclists in bike lanes. Standard regulatory, warning, and guide signs used specifically in conjunction with bike lanes are shown in Chapter 4 of the Traffic Manual.

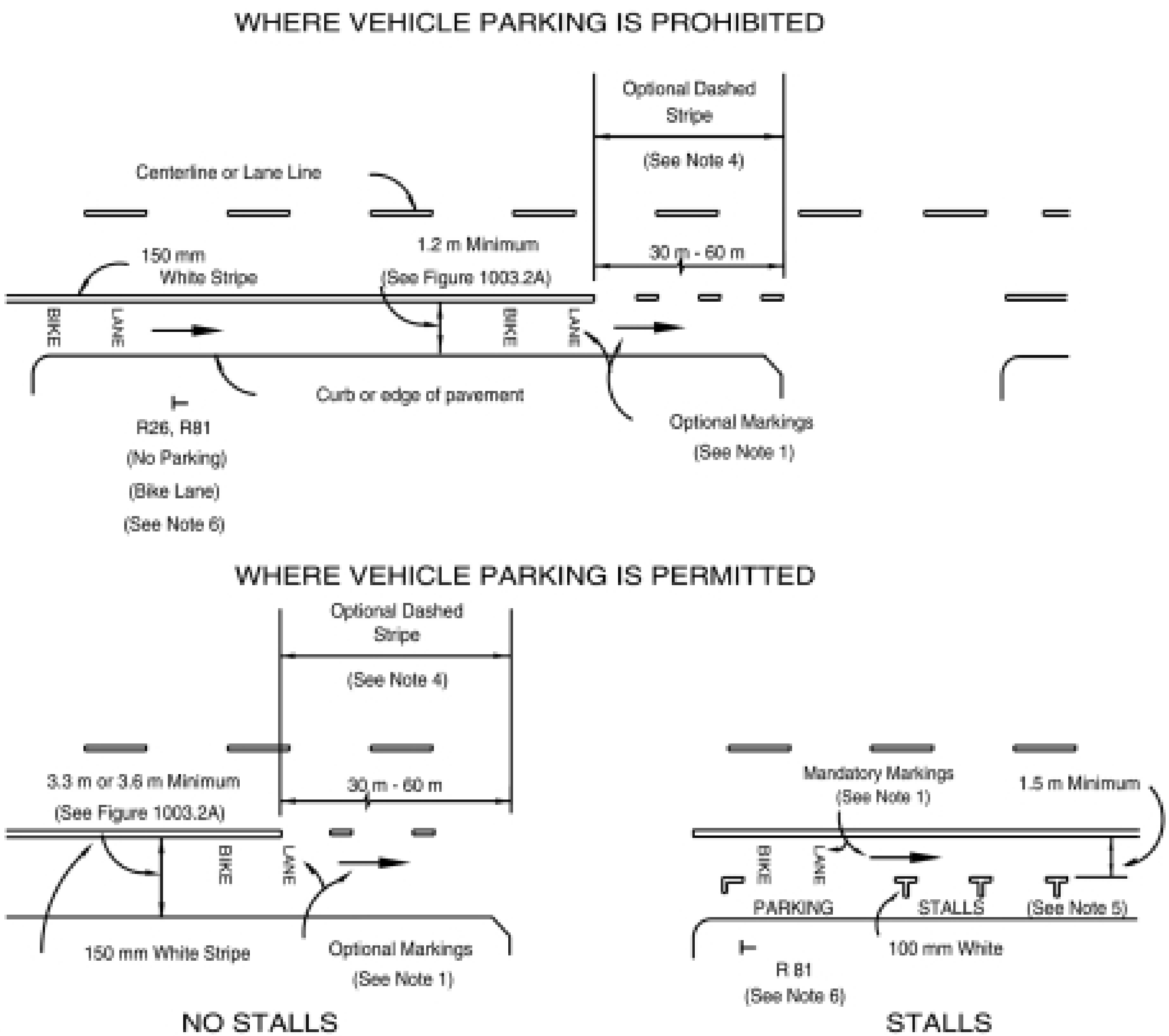
1004.4 Bike Routes (Class III)

Bike routes are shared routes and do not require pavement markings. In some instances, a 100 mm white edge stripe separating the traffic lanes from the shoulder can be helpful in providing for safer shared use. This practice is particularly applicable on rural highways, and on major arterials in urban areas where there is no vehicle parking.

Bike routes are established through placement of the G93 Bike Route sign. Bike route signs are to be placed periodically along the route. At changes in direction, the bike route signs are supplemented by G33 directional arrows. Typical bike route signing is shown on Figure 1004.5. The figure shows how destination signing, through application of a special plate, can make the Bike Route sign more functional for the bicyclist. This type of signing is recommended when a bike route leads to a high demand destination (e.g., downtown, college, etc.).

Many signs on the roadway also will apply to bicyclists. Standard warning and guide signs used specifically in conjunction with bike routes are shown in Chapter 4 of the Traffic Manual.

Figure 1004.3
Bike Lane Signs and Markings



NOTES:

1. The Bike Lane pavement markings shall be placed on the far side of each intersection, and may be placed at other locations as desired.
2. The use of the bicycle symbol pavement marking to supplement the word message is optional.
3. The G93 Bike Route sign may be placed intermittently along the bike lane if desired.
4. Where motorist right turns are permitted, the solid bike lane line shall either be dropped entirely, or dashed as shown, beginning at a point between 30 m and 60 m in advance of the intersection. Refer to Detail 39A in the Traffic Manual for striping pattern dimensions.
5. In areas where parking stalls are not necessary (because parking is light), it is permissible to paint a 100 mm solid white stripe to fully delineate the bike lane. This may be advisable where there is concern that motorists may misconstrue the bike lane to be a traffic lane.
6. The R81 bike lane sign shall be placed at the beginning of all bike lanes, on the far side of every arterial street intersection, at all major changes in direction, and at maximum 0.8 km intervals.

Figure 1004.4
Bike Lane Symbol

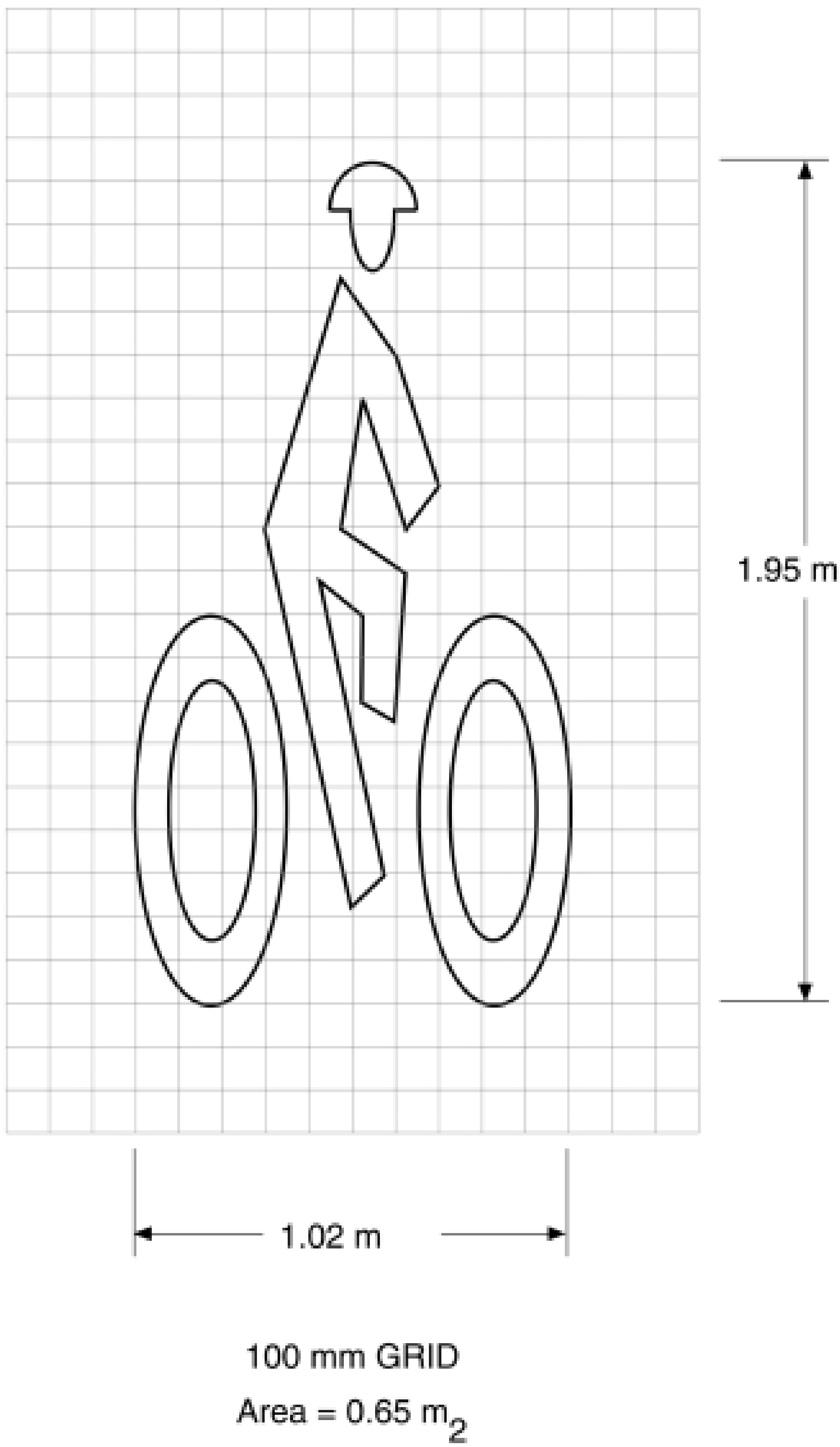
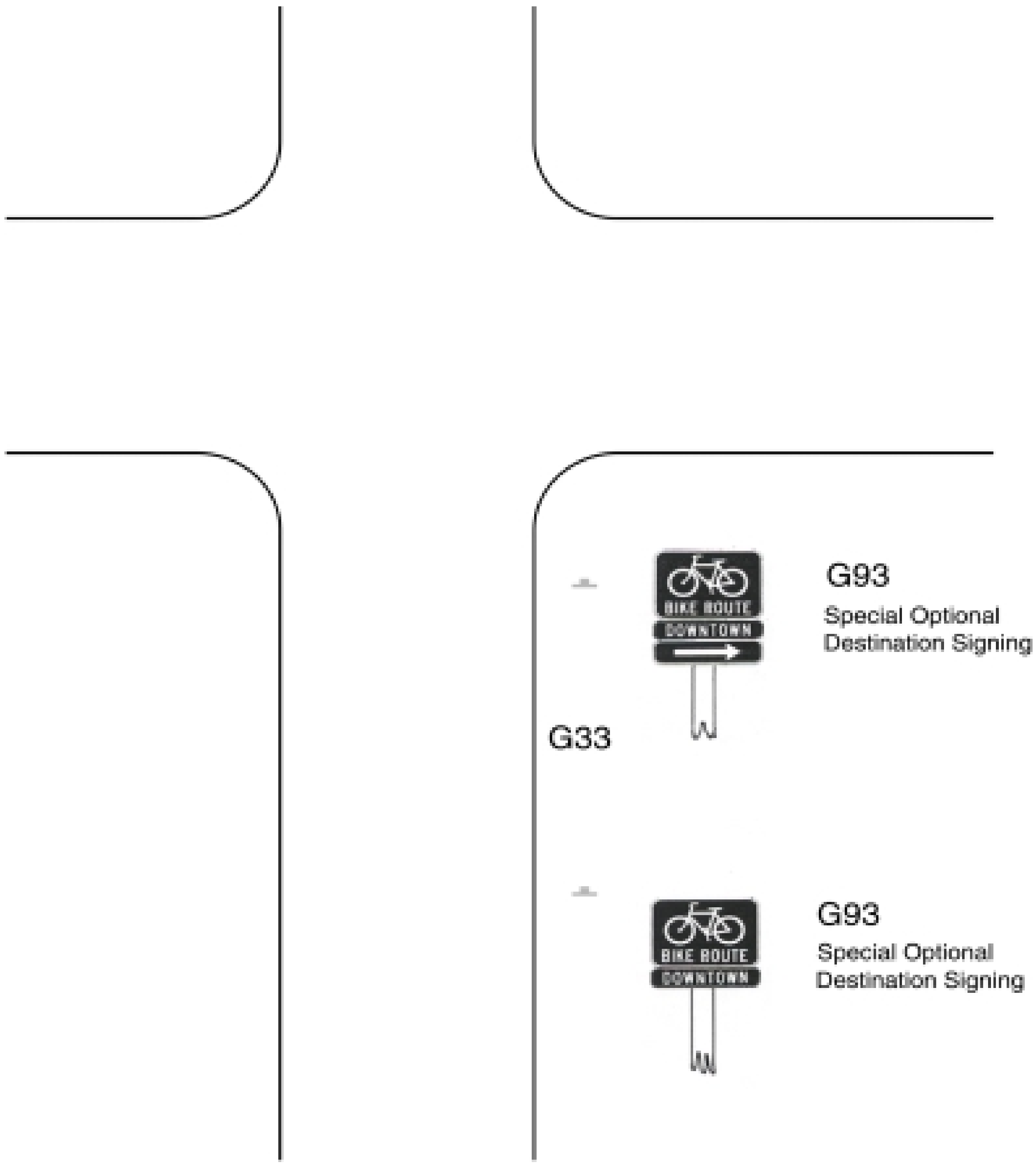


Figure 1004.5

Bike Route Signing



NOTES: The G93 Bike Route signs shall be placed at all points where the route changes direction and periodically as necessary.