4. Bikeways

The *Highway Design Manual (HCM - Chapter 1000 (Bicycle Transportation Design))* recognizes mobility for all modes of travel as an essential element of the transportation system. The role of bikeways is one mode of travel to the transportation system and are one part of an effort to improve bicycling safety and convenience as a way to either help to accommodate motor vehicle and bicycle traffic on the roadway system, or as a complement to the road system to meet the needs of a bicyclists.

As part of the decision to develop bikeways, it is essential that the bikeway network be interconnected to improve safety for all users and access for bicycles. The decision to develop bikeways should be made in coordination with the local agencies.

The *City of Fresno's Active Transportation Plan (ATP)* is a comprehensive guide that outlines the vision for active transportation in the City of Fresno. The plan serves as a roadmap for achieving its goals superseding the existing *City of Fresno Bicycle, Pedestrian & Trails Master Plan* serving as the City's bicycle master plan and pedestrian master plan. The ATP attempts to improve the accessibility and connectivity of the bicycle and pedestrian network to promote active transportation while providing walking and bicycle facilities.

Additionally, *Fresno County Regional Bicycle and Recreational Trails Master Plan* is one component that outlines the continued efforts towards making bicycling an integral part of Fresno County. The plan provides a comprehensive view for long range development of an extensive bikeway and recreational trails network that connects cities and unincorporated areas countywide.

Furthermore the role of bikeways also complies with Complete Streets – Integrating the Transportation system. The California Complete Streets Act requires general plans to develop a plan for multi-modal transportation system. The goal, to encourage cities to reconsider policies emphasizing automobile circulation and highlight all modes of transportation, i.e. bicycle ridership. Bicycle ridership reduces traffic jams increasing the capacity of the transportation network and promotes greenhouse gas emissions improving air quality and the overall travel experience for road users.

All bicycle plans mentioned above intend to guide and influence bikeway, pedestrian, and recreational trails, policies, programs and development of standards within their jurisdictions. Successful implementation of these policies, programs and development standards requires coordination with appropriate agencies to provide consistency and continuity for promoting bicycling as an alternative with other forms of transportation.

4.1 Bikeway Facility Types

The HCM defines 5 facility types are listed and illustrated below:

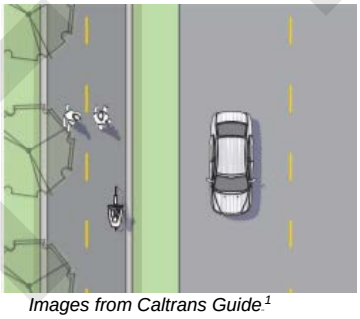
1. Shared Roadway (No Bikeway Designation)

- Not designated as bike way paths (no markings or signage posted), although most bicycle travel occurs on these streets and highways.

2. Class I Bikeway (Bike Path)

- Exclusive right of way, path completely separated from the roadway

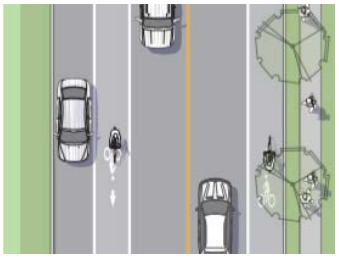
Fresno – Clovis Rail Trail (Shepard Avenue/Millbrook Avenue)



Images from Caltrans Guide[1]

3. Class II Bikeway (Bike Lane)

- Restricted right of way designated for bicycle use, designated by solid white striping



[1] Caltrans: A Guide to Bikeway Classification, July 2017

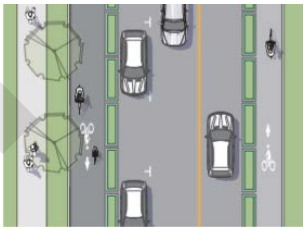
4. Class III Bikeway (Bike Route)

- Shared right of way for motor vehicles and bicycles

McKinley Avenue/Van Ness Avenue (near Fresno City College)

5. Class IV Bikeways (Separated Bikeways)

- Exclusive right of way with designated buffer zone from path of travel
- No Class IV bikeways current/planned within Fresno County jurisdiction



Division Street, San Francisco

Both City of Fresno and County of Fresno also follow the descriptions of the 5 facility types as noted in the HDM.

4.2 Study Area – Bicycle Facilities

The study area encompasses approximately 15 square miles serving two jurisdictions, City of Fresno (approximately 3 square miles) and Fresno County (approximately 12 square miles). Figure 4.1 illustrates the boundary limits for both jurisdictions.

The City of Fresno is the 5th largest city in California with an estimated population of 531,580 people in 2018 covering about 112 square miles. The City is located in central California (San Joaquin Valley).

Figure 4.1 – Project Area by Jurisdiction

Google Arial Image

As illustrated in Figure 4.1, the study area within the City of Fresno boundary limits encompasses approximately 3 square miles (approximately 20 percent) of the total study area.

The remaining vast area, approximately 12 square miles or 80 percent of the project area is considered rural Fresno County. According to the *Fresno County General Plan County wide Land Use Diagram* this area is mostly zoned agriculture, therefore bicycle facilities do not exist as described by Caltrans five facility types. That said, the area roadways infrastructure shares the road with bicyclists and can be considered mixed use of the roadway system. Therefore, bicycle movement along these rural county roads can inhibit ridership use base on the level of stress that the roadway presents (road width, traffic speed, the presence of parking lane, etc...). Level of Stress is discussed in a subsequent section.

4.2.1 Fresno City – Bicycle Facilities

Existing Facilities

The *City of Fresno ATP* identifies the existing networks of bike lanes and bike routes for both cyclist and pedestrians. A total of 491 miles of bikeway facility types have been constructed to date, a process that began with the adoption of the *1974 Fresno General Plan* and the City's first *Bicycle Master Plan*. Table 4.1 identifies the type and miles of bikeway for 2010 and 2016, a percentage change of 93% increase. This network of bike lanes and bike routes built over time may contain discontinuities or gaps within the network.

Table 4.1: Bicycle Network Facilities

Type	2010 Miles	2016 Miles
Class I Bike Paths	14	38
Class II Bike Lanes (one-direction)	226	431
Class III Bike Routes (one-direction)	14	22
Total(s)	**254**	**491**

Fresno ATP, December 2016

Within Study Area

Pertaining to the study area there currently exists Class II bike lanes. These Class II bike lane segments are located on:

- Church Avenue from Fig Avenue to Golden State Boulevard
- North Avenue from Cherry Avenue to Orange Avenue
- Central Avenue from Ulta Distribution Center frontage road section to East Avenue
- Amazon Distribution Center frontage road section to Orange Avenue
- Cherry Avenue from Valley Iron Inc. (frontage road – 1,300 ft south of North Avenue) to Cummins Pacific (frontage road – 675 ft north of Annadale Avenue)
- East Avenue from Central Avenue to Dorothy Avenue

- Orange Avenue from Central Avenue to Fresno Industrial Center driveway (just south of the overpass)

In total, the network of bike lanes within the study area make up approximately 5.5 miles or one percent of the total bike network as noted in Table 4.1. Figure 4.2 identifies the network of bike lanes within the study area as well as those surrounding the project limits. As illustrated in Figure 4.2, there are Class II bike lane facilities north of Central Avenue (within city limits). This area has seen design improvements that encompass complete street standards.

A challenge regarding the existing bikeway network is the connectivity of the system to nearby bikeway networks, Elm Avenue to the west and Church Avenue to the north. As mentioned earlier, one of the goals to promote bicycling is connectivity of the bicycle network. With continual growth of the area, implementation of policies, programs and development standards with appropriate agencies is a way to successfully complete connectivity of the bike network within the project area.

FIGURE 4.2

CITY OF FRESNO

99

41

Ventura St

Church Ave

Jensen Ave

Dorothy Ave

Annadale Ave

North Ave

Central Ave

CALWA

Muscat Ave

MALAGA

Malaga Ave

Minnewawa Ave

American Ave

Jefferson Ave

EASTON

Lincoln Ave

Clayton Ave

Adams Ave

Sumner Ave

Elm Ave

Cherry Ave

East Ave

Orange Ave

Cedar Ave

Maple Ave

Chestnut Ave

Willow Ave

Peach Ave

Villa Ave

Kenneth Ave

Clovis Ave

FOWLER

Fresno County

Study Area

- Class II - Bicycle Lane
- State Route (Freeway)
- Roads
- Rail
- Fresno County
- City of Fresno (city limits)
- Sphere of Influence Boundary
- Triangle Industrial Study Area
- HSR_Maintenance Facility
- Fire Station #89
- Cherry Avenue Auction
- Orange Elementary
- Ulta Distribution Center
- Amazon Distribution Center

N

0 0.25 0.5 0.75 1

Miles

REVERSE TRIANGLE
TRANSPORTATION AREA PLAN

Bikeways Map

Project No. 11192258

Date 6/12/2019

Fresno Council of Governments

GHD

L:\Prj\2618\G2618\Maps\Working\Bicycle Facilities.mxd
Print date: 30 Jul 2019 - 09:31

Paper Size ANSI B (portrait)

Data source: GHD 2019, Fresno County Public GIS data, City of Fresno Public GIS data, Caltrans Public GIS data. Created by: jramirez2

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California IV FIPS 0404 Feet

4.3 Bicycle Level of Stress – Base Line Condition

Overview

Existing bicycle conditions for the study area were analyzed based on the Mineta Transportation Institute's Bicycle Level of Traffic Stress (LTS) methodology, which can be obtained from the paper, *Low Stress Bicycling and Network Connectivity* (Report 11-19, Mineta Transportation Institute, May 2012). Bicycle LTS is a rating system of the safety, comfort, and convenience of transportation facilities from the perspective of the user. The approach outlined in the Mineta report uses roadway data, (i.e., posted speed limit, number of travel lanes, daily traffic levels, and presence and character of shoulder or bicycle lanes) to analyze bicyclist comfort level. The Bicycle LTS methodology breaks road segments into one of four classifications/ratings for measuring the effects of traffic-based stress on bicycle riders, with 1 being the lowest stress or most comfortable, and 4 being the highest stress or least comfortable. The greater the separation between the outside travel lane and bicyclist generally means less stress for users. Examples and descriptions for each level of traffic stress are shown in Figure 4.3.

Methodology

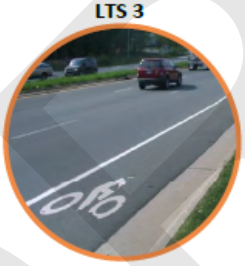
LTS 1 is assigned to roads that would be suitable for most children to ride, and to multi-use paths or cycle tracks separated from motorized traffic. LTS 2 is assigned to roads that could be comfortably ridden by the average adult population. For purposes of this analysis, road segments with LTS scores of 1 or 2 are characterized as "low-stress" bicycle connections. These low-stress LTS scores reflect bicycling conditions that 60 percent of the general population would consider favorable enough to consider traversing the roadway by bicycle. LTS 3 is the level assigned to roads that would be acceptable to an "enthused and confident" cyclists, while LTS 4 is assigned to segments that are only acceptable to "strong and fearless" bicyclists—those who will confidently tolerate riding on roadways characterized by minimal separation from high motor vehicle volumes and speeds. For purposes of this analysis, road segments with LTS scores of 3 or 4 are characterized as "high-stress" bicycle connections. Thus, even if bicycle infrastructure exists between two places, it would not be considered viable for biking to 60% or more of the general pollution if the connection is rated as high-stress.

The Bicycle LTS methodology is broken into three categories: segments (along), intersection approaches (turn lanes), and intersection crossings (unsignalized). Specific criteria are applied separately for each category. Dependent upon community context and the detail level desired, the overall methodology can usually be simplified based on the general consistency of facility types, as certain elements (i.e. no turn lanes, no bike lanes, limited speeds, etc.) may not exist in a particular community.

It is likely that the LTS scores show directional differences along a given route, due to potential differences in infrastructure characteristics. Therefore, both directions are reported for a given roadway segment. However, the methodology for the criteria aggregate (overall LTS) follows the weakest link principle: the dimension with the worst level of stress governs. For example, if the two directions of a roadway segment result in different scores, the worst of these two segments are

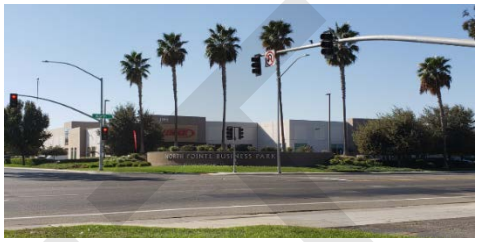
reported as the overall score. Moreover, if a segment is considered low stress, and there is a high stress intersection approach at the end of the segment, the whole segment is considered high stress. Figure 4.3 presents the LTS for the segments, approaches, and intersections for the roadways in the study area.

Figure 4.3 Level of Stress (LTS) Score Descriptions

LTS 1  Comfortable for all ages and abilities	Represents little traffic stress and requires less attention, so is suitable for all cyclists. This includes children that are trained to safely cross intersections (around 10 yrs. old/5th grade) alone and supervising riding parents of younger children. Generally, the age of 10 is the earliest age that children can adequately understand traffic and make safe decisions which is also the reason that many youth bike safety programs target this age level. Traffic speeds are low and there is no more than one lane in each direction. Intersections are easy to cross by children and adults. Typical locations include residential local streets and separated bike paths/cycle tracks.
LTS 2  Comfortable for most adults	Represents little traffic stress but requires more attention than young children can handle, so is suitable for teen and adult cyclists with adequate bike handling skills. Traffic speeds are slightly higher but speed differentials are still low and roadways can be up to three lanes wide in total for both directions. Intersections are not difficult to cross for most teenagers and adults. Typical locations include collector-level streets with bike lanes or a central business district.
LTS 3  Comfortable for confident bicyclists	Represents moderate stress and suitable for most observant adult cyclists. Traffic speeds are moderate but can be on roadways up to five lanes wide in both directions. Intersections are still perceived to be safe by most adults. Typical locations include low-speed arterials with bike lanes or moderate speed non-multilane roadways.
LTS 4  Uncomfortable for most	Represents high stress and suitable for experienced and skilled cyclists. Traffic speeds are moderate to high and can be on roadways from two to over five lanes wide in both directions. Intersections can be complex, wide, and or high volume/speed that can be perceived as unsafe by adults and are difficult to cross. Typical locations include high speed or multilane roadways with narrow or no bike lanes.

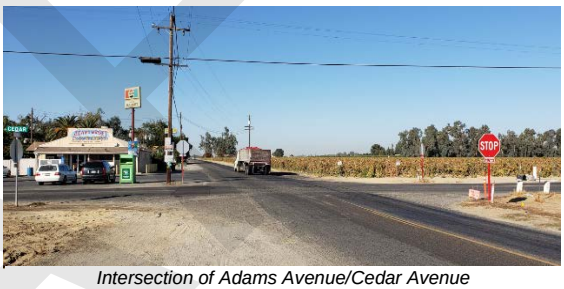
Source: "Low Stress Bicycling and Network Connectivity", Mineta Transportation Institute, Report 11-19, May 2012.

Existing Bicycle LTS Summary



North Point Business Park

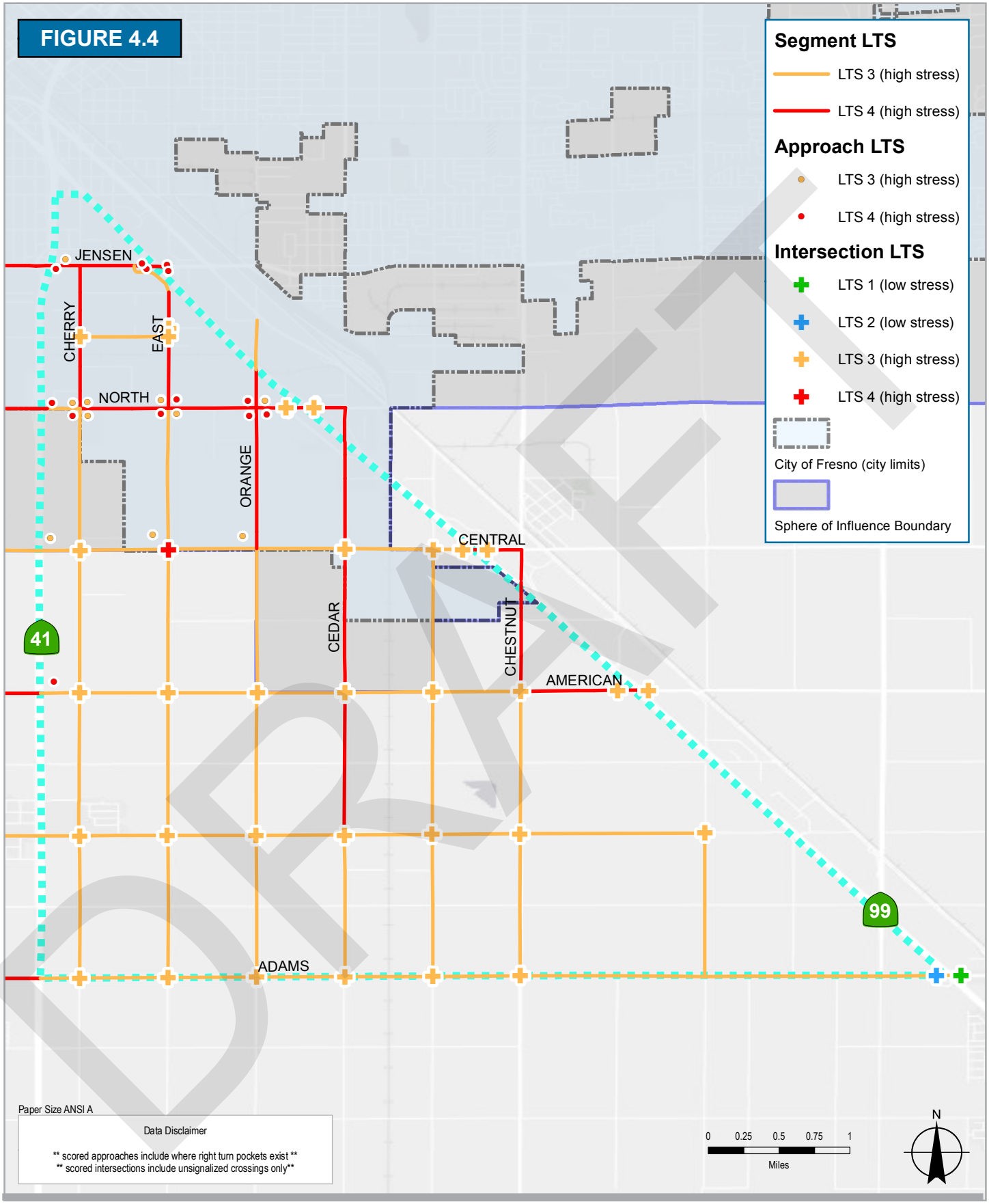
Figure 4.4 summarizes the Bicycle LTS results for the segments, crossings, and intersection approaches in the study area as applicable. As illustrated, areas with commercial development (area between Jensen Avenue and North Avenue) recorded high-stress due to the higher speeds and daily traffic volumes. As an example, North Avenue at the North Point Business Park (photo to the right) located at North Avenue/East Avenue is an arterial road that incorporates complete street characteristics such as dedicated class II bike lanes, two-thru lanes and a median/two-way left turn lane.



Intersection of Adams Avenue/Cedar Avenue

The southern portion of the study area also recorded high stress (south of Central Avenue). Similar to the northern portion of the study area; speed and lack of bicycle facilities contributed to high stress levels for the segments and intersections. Approaches were not mapped due to the absence of right turn lanes. The approaches would not be considered high stress, due to lower volumes and no right turn. As an example, the intersection of Adams Avenue/Cedar Avenue (photo above) is representative of intersection approaches within the southern portion of the area, most of which lacked dedicated right turn lanes.

FIGURE 4.4



REVERSE TRIANGLE
TRANSPORTATION AREA PLAN

Bicycle Level of Traffic Stress

Project No. **11192258**
Date **08/26/2019**

Fresno Council of Governments

GHD

K:\PRJ2618\G2618\Maps\Working\LTS_2_updated.mxd
Print date: 28 Aug 2019 - 11:17

Horizontal Datum: WGS 1984
Grid: GCS WGS 1984

Data source: Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community. Created by: jramirez2