Existing Traffic Conditions

An Existing conditions analysis of the current traffic conditions was prepared for several roadway segments within the study area. The Circulation Element focuses on level of service analysis of roadway segments which is the most appropriate level of detail for General Plan level analysis. The following is a description of the Existing circulation system operation:

Existing Circulation Element Map

The current City of Arvin Circulation Element was adopted as part of the 1988 General Plan. Figure 2-1 shows the current circulation map adopted as part of the 1988 General Plan.

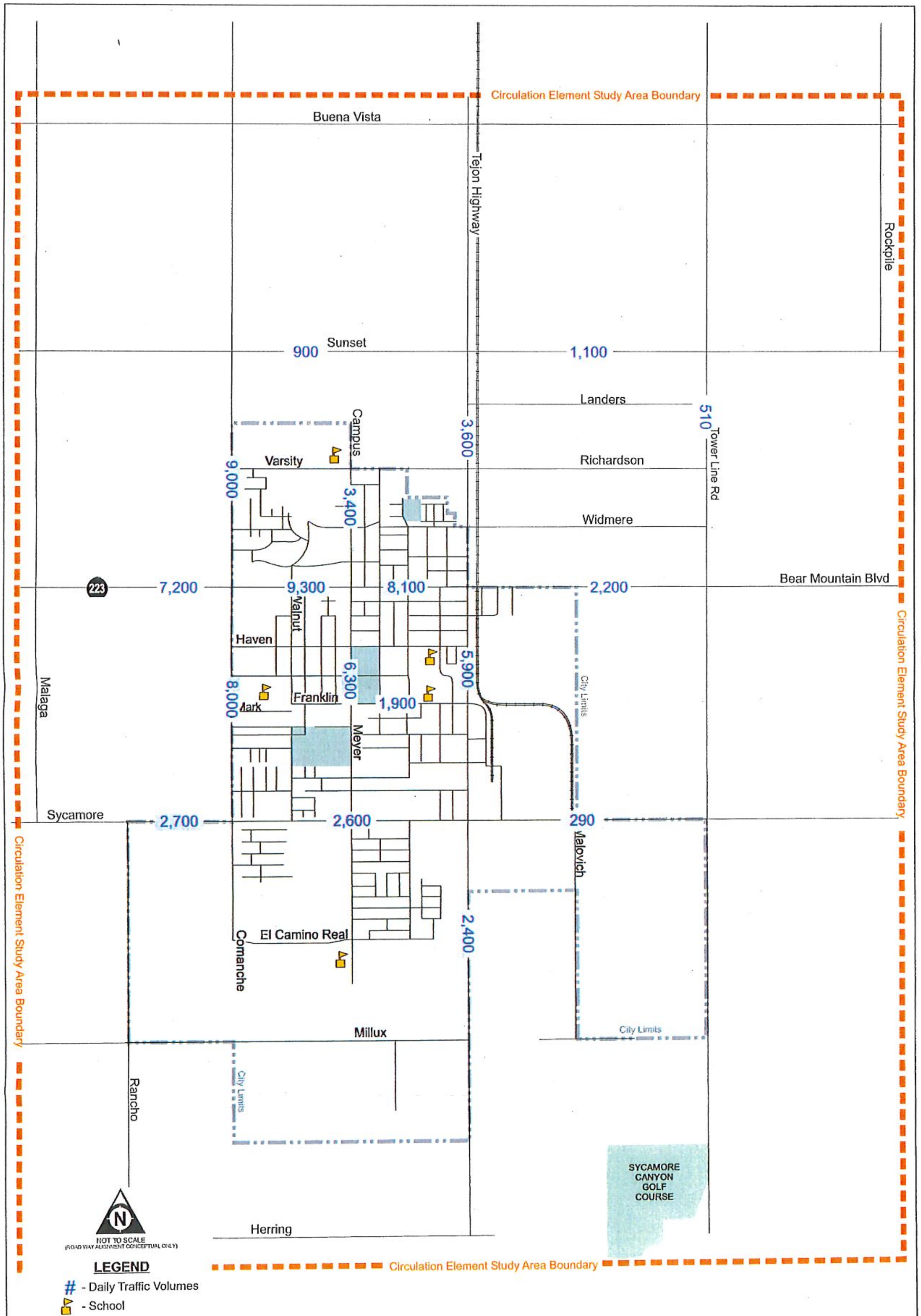
Existing Traffic Volumes

Existing traffic volumes for several roadway segments in the study area were taken from Annual Average Daily Traffic (AADT) counts taken in 2006 and 2007 and published by Kern County and Caltrans. Additional 24-hour weekday roadway counts were taken at six (6) locations in 2008. The traffic volumes used in the Existing conditions analysis are shown on Figure 2-2. The following locations were surveyed in 2008:

- Sunset Boulevard between Comanche Drive and Tejon Highway
- Sycamore Road between Comanche Drive and Tejon Highway
- Meyer Street between Sycamore Road and Bear Mountain Road
- Campus Drive between Bear Mountain Boulevard and Varsity Road
- Tejon Highway between Millux Road and Sycamore Road
- Tejon Highway between Sycamore Road and Bear Mountain Road

Existing Levels of Service

The level of service methodology used for the Circulation Element is discussed in Chapter 1. Table 2-1 shows the levels of service for the study roadway segments using the traffic volumes shown on Figure 2-2 and the level of service criteria shown in Tables 1-1 and 1-2. As shown in Table 2-1, all of the study roadway segments are currently operating at acceptable levels of service.



TPG Consulting

EXISTING DAILY TRAFFIC VOLUMES

Arvin Circulation Element
Kern County, CA

Figure 2-2

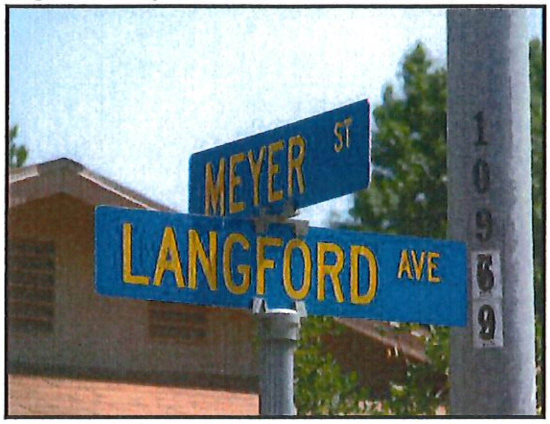
08-1158

TABLE 2-1:
SUMMARY OF EXISTING LEVELS OF SERVICE

Roadway	Boundaries	Number of Lanes	Median	Daily Traffic	Level of Service
Sunset Boulevard	Comanche Drive to Tejon Highway	2	Undivided	900	C
	Tejon Highway to Tower Line Road	2	Undivided	1,100	C
Bear Mountain Boulevard / SR 223	Rancho Drive to Comanche Drive	2	Undivided	7,200	C
	Comanche Drive to Campus Drive	4	Divided	9,300	C
	Campus Drive to Tejon Highway	4	Divided	8,100	C
	Tejon Highway to Tower Line Road	2	Undivided	2,200	C
Franklin Street	Walnut Drive to Tejon Highway	4	Undivided	1,900	C
Sycamore Road	Rancho Drive to Comanche Drive	2	Undivided	2,700	C
	Comanche Drive to Tejon Highway	2	Undivided	2,600	C
	Tejon Highway to Tower Line Road	2	Undivided	290	C
Comanche Drive	Sycamore Road to Bear Mountain Boulevard	2	Undivided	8,000	D
	Bear Mountain Boulevard to Sunset Boulevard	2	Undivided	9,000	D
Campus Drive / Meyer Street	Sycamore Road to Bear Mountain Boulevard	4	Undivided	6,300	C
	Bear Mountain Boulevard to Sunset Boulevard	2-4	Undivided	3,400	C
Tejon Highway / Derby Street	Millux Road to Sycamore Road	2	Undivided	2,400	C
	Sycamore Road to Bear Mountain Boulevard	2	Undivided	5,900	C
	Bear Mountain Boulevard to Sunset Boulevard	2	Undivided	3,600	C
Tower Line Road	Bear Mountain Boulevard to Sunset Boulevard	2	Undivided	510	C

Existing Classified System Pattern

The current circulation system was developed based on the plans for the City of Arvin in 1988. The Existing classifications (e.g. Arterial, Collector, etc.) remain valid, however the roadways network is compressed based on the limited development of Arvin at the time. The City of Arvin's Land Use Plan has since expanded to cover significantly more area. As such, the circulation system must expand to account for the growth that has occurred since the adoption of the Circulation Element and the growth projected to occur as the city builds out.



Connectivity

The effectiveness of a city's street system depends partly on the concept of connectivity. As a city develops, the connectivity of the street system can be disrupted by missing links. The circulation map developed in the 1988 Circulation Element, as shown in Figure 2-1, has several roadways that experience connectivity issues. Varsity Road, Fifth Avenue, Franklin Street, Walnut Drive, A Street, and Stockton Avenue are all identified as collectors or arterials in the 1988 Circulation Element, but do not provide necessary connectivity. Many of these connectivity issues have resulted as individual neighborhoods or even single buildings have been built without regard to the continuation of streets. Connectivity issues are discussed further in Chapter 3.

Plan Lines

The City of Arvin has adopted several street standards including standard street sections, driveway approaches, parking stalls, etc. As roadway capacity improvements are identified in the Circulation Element, the adopted standard street sections provide necessary right-of-way requirements for new roads or help to identify areas where right-of-way will restrict roadway improvements.

Transit

Public transportation services within the Arvin area include both local and intercity buses. Service is provided through Arvin Transit and Kern Regional Transit (KRT). Arvin Transit is a City-operated public transit system. Arvin Transit has been serving the transit needs of Arvin residents, and neighboring communities since 1979. Arvin Transit's service area includes the city

ArvinTransit

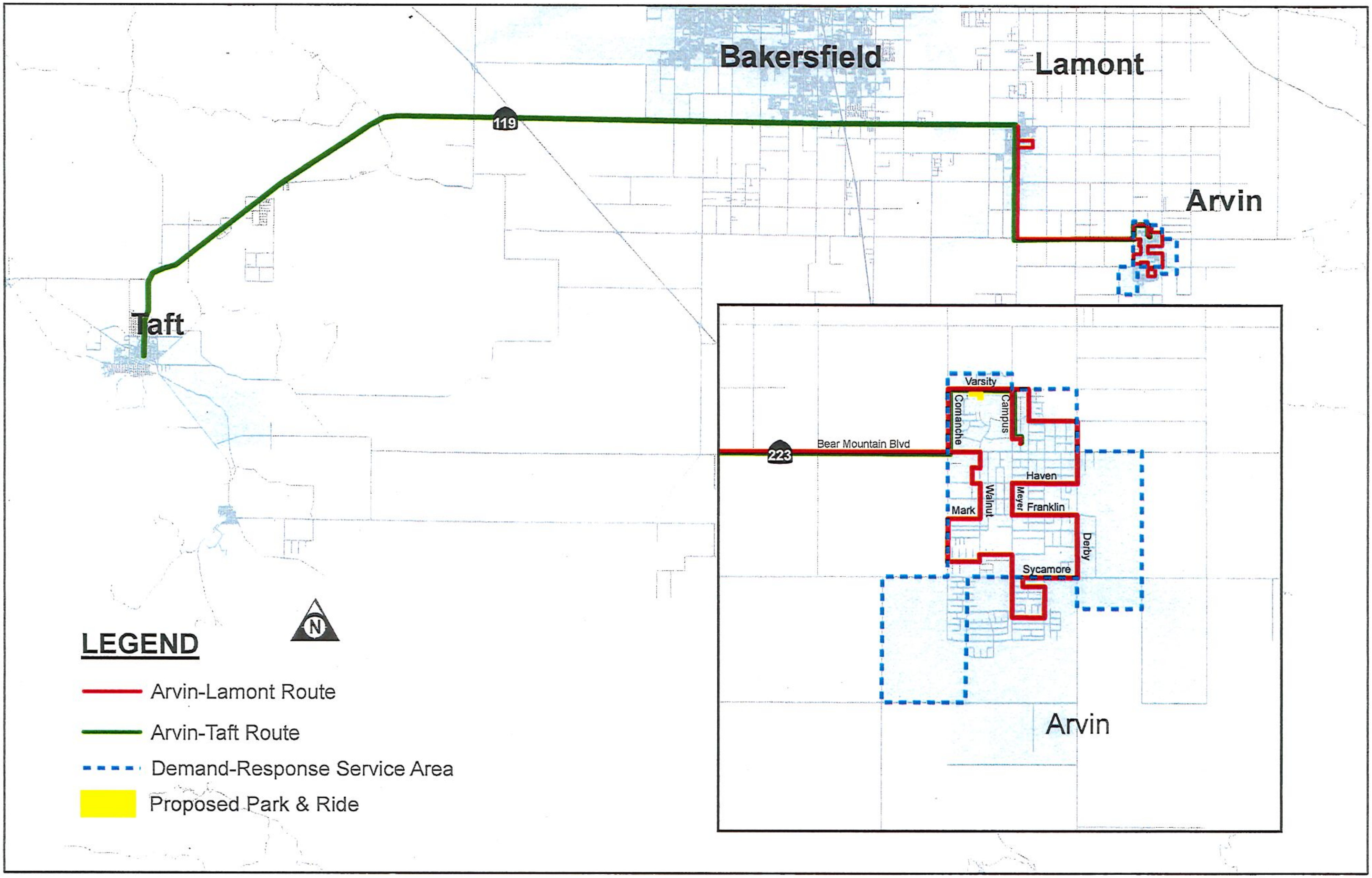
of Arvin, the unincorporated communities of Weedpatch and Lamont, and Taft Junior College located in the city of Taft. Planning and management of the system is guided by the *City of Arvin - Transit Development Plan (TDP)*, developed through the Kern Council of Governments (KCOG). The current Arvin TDP was completed earlier this year (2008). Arvin Transit offers both demand-response and deviated fixed-route service. Figure 2-3 depicts Arvin Transit services.

The City of Arvin offers a Dial-A-Ride (door to door) demand-response service to the residents and visitors of Arvin within the city limits. The service operates Monday through Friday between 7:00 am and 3:30 pm, except on designated holidays. All rides can be scheduled within 30 minutes of the desired pick up time within regular service hours. Regular general public fares are $1.00 per one-way trip. A reduced fare of 50¢ is available for seniors (age 62 and over), disabled patrons, and children (age 8 and under).

Arvin Transit also operates two deviated fixed-route services, transporting Arvin area residents to Lamont and Taft respectively. The service to Lamont provides five daily round trips from Arvin, Monday through Friday between approximately 7:00 am and 2:30 pm. The service provides regularly scheduled stops in Arvin, but passengers must call in advance to schedule a pick-up in Lamont for all but the first trip of the day. Arvin-Lamont service fares range from $1.25 for the general public, to 75¢ for seniors (age 62 and over), disabled patrons, and children (age 8 and under).

The second deviated fixed-route provides evening transit service between Arvin and Taft Junior College. This route, which began in January of 2006, makes one evening run from Arvin to Taft College and back, every Monday through Thursday during the school year. The service departs Arvin at approximately 4:40 pm and returns between 10:15 and 10:30 pm. The service is available to Taft College students only, and is subsidized by the College; Taft College pays five dollars per student ride.

Arvin residents wishing to travel to and from Bakersfield can do so via Kern Regional Transit's (KRT) Arvin-Lamont-Bakersfield intercity route, which provides round-trip service through the City of Arvin. KRT, operated by First Transit, is Kern County's designated transit system. The Arvin-Lamont-Bakersfield service operates seven daily round-trips, Monday through Saturday, and six round-trips on Sunday. The route services Arvin via a stop located behind Arvin City Hall. The service costs $2.50 per one-way trip between Arvin and Bakersfield, and $1.25 between Arvin and Lamont or Weedpatch. Discounted fares are available for seniors (age 62 and over), disabled patrons, and children (age 5-15). Passengers may transfer to other regional carriers (including the Kern Regional Transit Medical Dial-A-Ride) and Golden Empire Transit (metropolitan Bakersfield transit) in Bakersfield.



TPG Consulting Incorporated

EXISTING TRANSIT ROUTES

Arvin Circulation Element
Kern County, CA

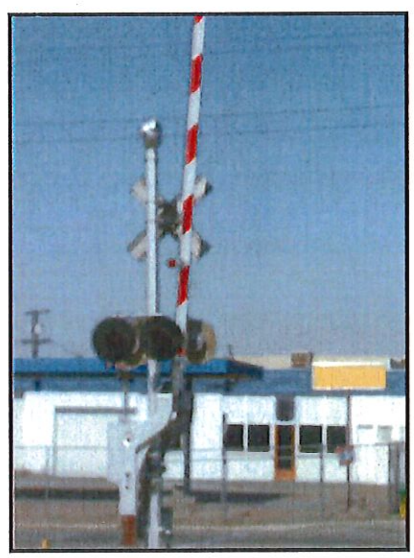
08-1158

Figure 2-3

Current ridership trends, based upon data provided within the *2008 City of Arvin – Transit Development Plan* for fiscal years 2003/04 through 2006/07, indicate that demand for transit services within Arvin has remained relatively constant. Approximately 24,000 riders utilized Arvin Transit's fixed route services during fiscal year 2006/07. In addition, the City's Dial-A-Ride service assisted approximately 81,000 patrons during that same fiscal year.

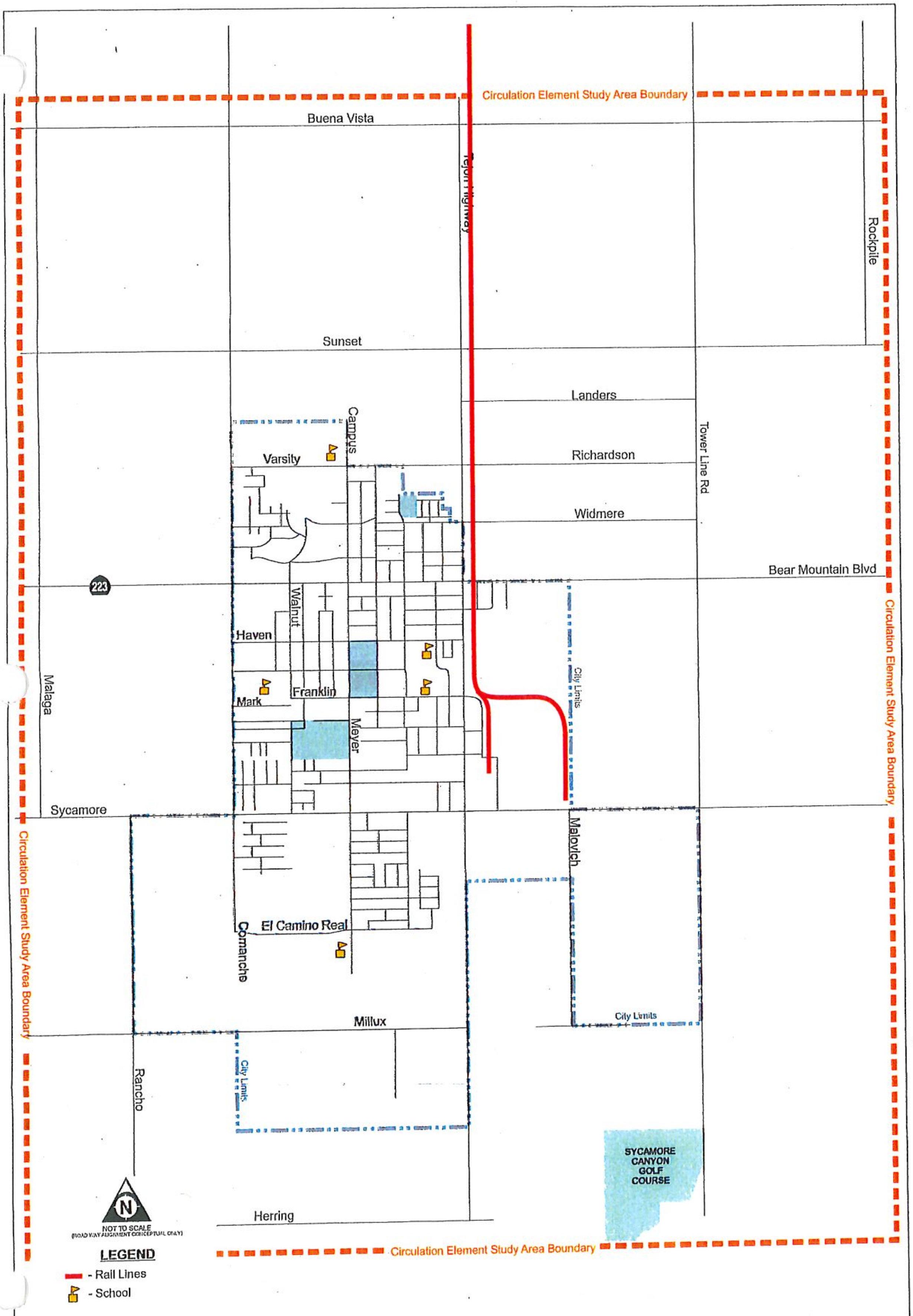
The City of Arvin has unsuccessfully pursued a grant from San Joaquin Valley Air Pollution Control District (SJVAPCD) to construct a park-and-ride lot. The park-and-ride lot would incorporate a transit stop on-site and would operate as the transit center for all routes operating in Arvin. The location of the center will be located on Varsity Road across from Arvin High School and is shown on Figure 2-3. The city intends to pursue further funding opportunities for this facility.

Rail



One rail line currently operates in the City of Arvin. The San Joaquin Valley Railroad (SJVR) maintains a rail spur which travels from its junction with a Union Pacific rail line, paralleling SR 58, south to Lamont and Arvin. The SJVR rail line travels south from SR 58 along the west side of SR 184, east along the north side of Di Giorgio Road, and south along the east side of Tejon Highway to its terminus just north of Sycamore Road. Figure 2-4 shows that current rail system in the Arvin area.

SJVR currently operates freight shipment for two facilities in Arvin, both of which are agricultural based. These shipments occur intermittently year-round and can run on any day of the week, but no more than once per day.



TPG Consulting

EXISTING RAIL SYSTEM

Arvin Circulation Element
Kern County, CA

Figure 2-4

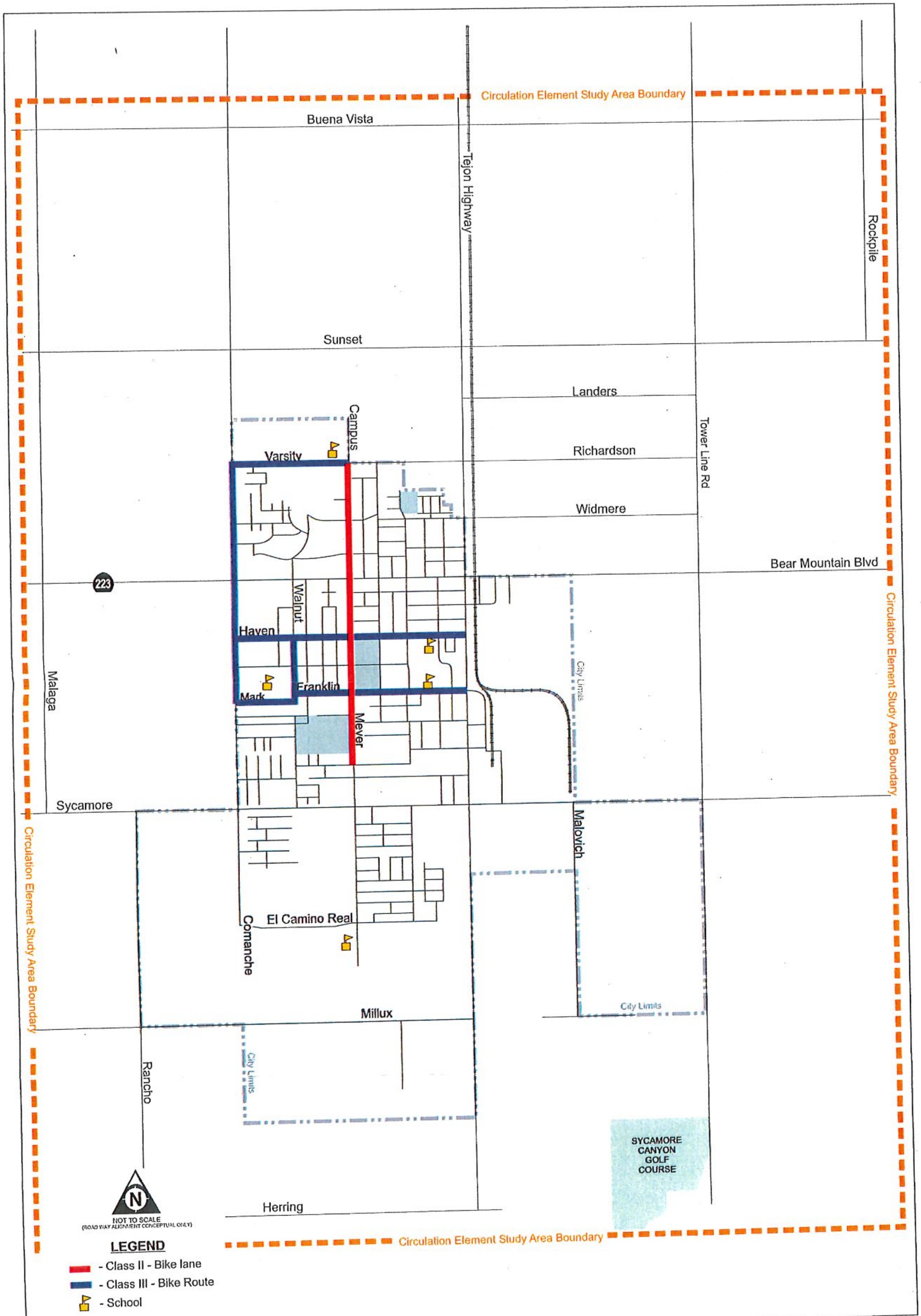
08-1158

Bicycle, Pedestrian, and Trails

Arvin's current non-motorized circulation alternatives consist of bicycle lanes and routes, as well as roadway-adjacent sidewalks. The City does not currently have an adopted bicycle or pedestrian plan.

Bikeways in Arvin can be classified as Class II (bike lane) and Class III (bike route) facilities as specified in the Caltrans Highway Design Manual Standards. Class II facilities, or on-street bike lanes, provide appropriate pavement striping and markings to delineate bicyclist right-of-way along streets or highways. Class III routes are provided within the street right-of-way and are shared with both motorists and pedestrians. Bike routes are required by Caltrans to be marked with the appropriate bike route signage, but no pavement stripes or bicycle land designation markers are required. Figure 2-5 and Table 2-2 delineate Arvin's existing bicycle facilities. Arvin does not currently have any Class I (bike path) bicycle facilities. Class I facilities provide a paved path separated from vehicular traffic for use by bicyclists and pedestrians. The Highway Design Manual provides standard criteria for each of the bicycle facility classifications. These standards are included in the Appendix.

Arvin's pedestrian circulation system is comprised of sidewalks, mostly in the vicinity of downtown and school zones. Pedestrian circulation facilities have been implemented in areas of recent development to enhance pedestrian safety. In addition, pedestrian enhancements to existing street sections with discontinuous or no existing sidewalks have been implemented over the last decade. These improvements include the addition or upgrading of sidewalks to sections of Tucker Street, A Street, Plumtree Drive, and Santa Rosa Street.



TPG Consulting

EXISTING BICYCLE FACILITIES

Arvin Circulation Element
Kern County, CA

Figure 2-5

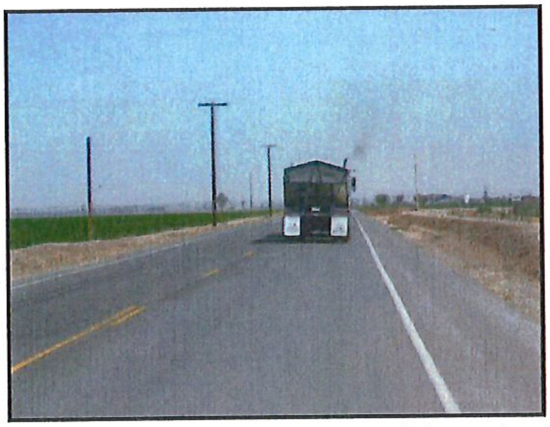
08-1158

TABLE 2-2:
EXISTING BICYCLE FACILITIES

Roadway	Boundaries	Route Direction	Type
Comanche Drive	Varsity Road to Mark Road	North-South	Class III - route
Walnut Street	Haven Avenue to Mark Road	North-South	Class III - route
Campus Drive	Varsity Road to SR223/Bear Mountain Boulevard	North-South	Class II - lane
Meyer Street	SR223/Bear Mountain Boulevard to Olsen Way	North-South	Class II - lane
Varsity Street	Comanche Drive to Campus Drive	East-West	Class III - route
Haven Drive	Comanche Drive to Tejon Highway/Derby Street	East-West	Class III - route
Franklin Street	Walnut Drive to Tejon Highway/Derby Street	East-West	Class III - route
Mark Street	Comanche Drive to Walnut Drive	East-West	Class III - route

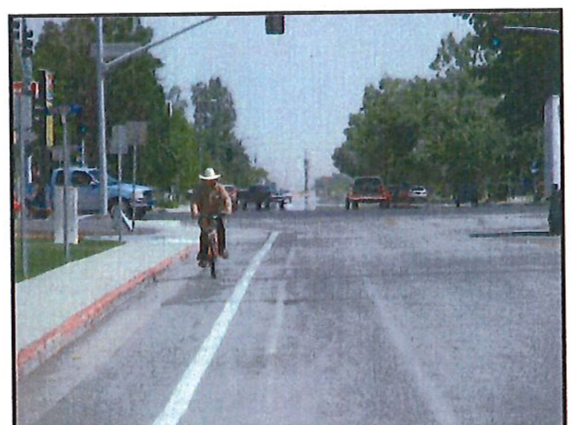
2001 Kern County Bicycle Facilities Plan

Truck Routes and Goods Movement



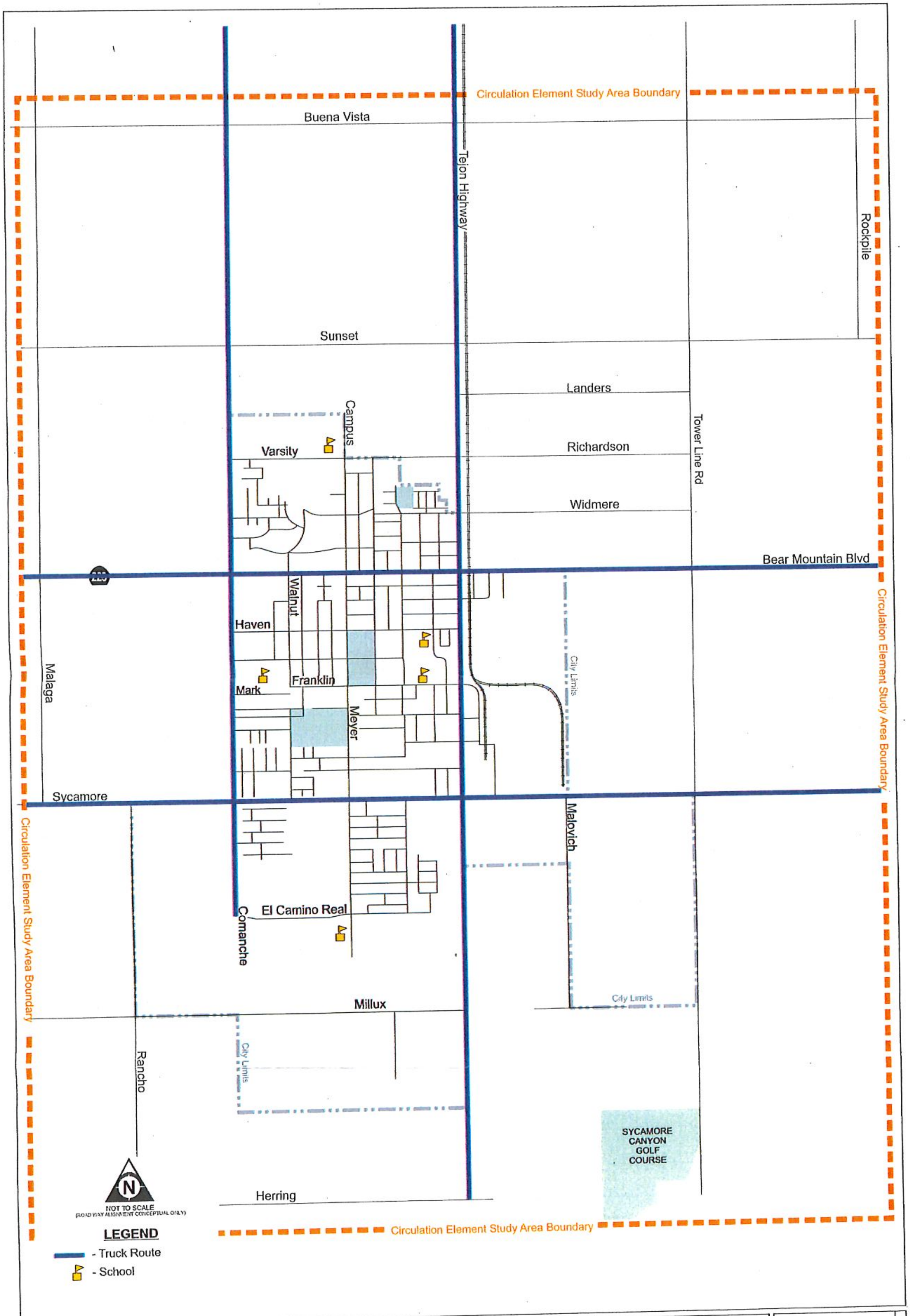
The City of Arvin has a large agricultural industry, which requires a large amount of goods movement via truck and trailer. As discussed in the rail section, only two operations in Arvin ship by rail. The remainder of product shipping occurs via truck and trailer. As shown in Figure 2-6, the following heavily used truck routes in Arvin include SR 223/Bear Mountain Boulevard, Sycamore Road, Comanche Drive, and Tejon Highway/Derby Street. These roadways contain the majority of the existing commercial, industrial, and agricultural development in Arvin and provide through traffic in and out of Arvin. Additional roadways in Arvin experience limited truck traffic for deliveries, but do not typically carry through truck traffic.

Transportation System Management and Transportation Demand Management



Transportation System Management (TSM) involves techniques that maximize the use of the existing roadways without significant increases the roadway physical capacity. Transportation Demand Management (TDM) involves programs to reduce vehicle miles traveled and encouraging travel mode changes. Examples of TSM and TDM strategies are coordinating/optimizing traffic signals, adding turn lanes, development of carpool programs, implementing flexible work schedules, and using public transit.

The largest source of employment in the Arvin area is agriculture which, by nature, employs certain TDM strategies. Agricultural workers are more likely to carpool and travel to and from work outside the typical commute hours. Arvin has few traffic signals, but periodic evaluation of the signal timing and cycle lengths can significantly improve traffic flow. As discussed previously, the proposed park-and-ride lot will provide another TDM measure. The City has also employed a 9/80 work schedule for all City Hall employees. Flexible work schedules are an emerging method of TDM which should be encouraged for businesses within Arvin. Other TSM and TDM strategies have been discussed in previous sections, including transit, pedestrian, and bicycle facilities.



TPG Consulting

EXISTING TRUCK ROUTES

Arvin Circulation Element
Kern County, CA

08-1158

Figure 2-6

CHAPTER 3

CIRCULATION ISSUES

This chapter focuses on the issues that affect the circulation system in the Arvin area both now and in the future. Understanding how the circulation system works today will help to determine necessary improvements for the future.

Issues are covered by specific areas of concern: streets and highways, transit, rail, bicycle, pedestrian and trails, goods movement, and TSM/TDM. Issues affecting the circulation system are discussed in a State context, regional context, and from a local perspective.

Statewide Issues

The following statewide issues are current and are projected to shape the development of the circulation system:

- Increasing population
- Out-of-date/deteriorating roadway infrastructure
- Environmental impacts (e.g. air quality)
- Goods movement
- Alternative modes of transportation
- Funding sources

The state of California is projected to double in population by the year 2040. The incredible amount of growth that will occur in California will present significant challenges to the current transportation system. In many areas, the current transportation infrastructure needs to be improved simply to keep pace with current conditions. As alternative modes of travel are introduced and/or increase in use, new infrastructure will be needed to provide for these modes of travel. Alternative modes of travel will be necessary to provide reductions in environmental impacts for personal travel as well as goods movement. This presents significant challenges for the state to provide funding for the ever-increasing list of transportation related projects.

Regional Issues

Many of the issues affecting the statewide circulation system are magnified in the regional context. Like the state, the issue of population growth will be a significant factor for Kern County. Kern County is projected to grow at a rate comparable to the statewide average. As population spills over from southern California, Kern County will absorb much of this excess in addition to growth attributed to normal development of the County's land plan(s).

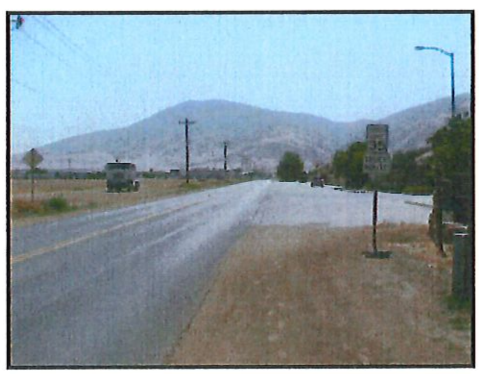
Environmental impacts, specifically air quality, present significant issues in Kern County. As federal and state air quality requirements increase, Kern County must focus on ways to improve air quality. Many of the funding sources for transportation capacity improvements may be in jeopardy if air quality standards are not met.

There are also significant issues concerning goods movement in Kern County. In Kern County, heavy vehicles represent approximately 24% of all vehicle miles traveled (VMT) through the County. This is the fourth highest percentage for counties throughout California. This is largely due to the fact that I-5 and SR 99, two of the major north-south corridors through the state, meet and travel through Kern County.

Local Issues

Locally, the City of Arvin feels the effects of the regional and statewide issues to varying degrees. The City of Arvin is projected to experience the second fastest rate of growth (behind Shafter) of all cities located in Kern County. As the population within Arvin grows, the creation of jobs will follow suit. The placement of these employment centers plays a key role in the development of the circulation system. In conjunction with the creation of employment centers is the development of commercial growth. Commercial growth within the community represents travel opportunities for the entire population, not just employees. It is the interaction between homes, jobs, and attractions that will drive the development of the circulation system.

Air quality is a high priority in the Arvin area. In 2007 Arvin was described by the EPA as having the highest level of air pollution of any city in the United States. Due to its geographic location, up against the foothills at the southern end of the San Joaquin Valley, smog funnels from the rest of the valley down to Arvin. Although the majority of this air pollution is caused by outside sources, the development of Arvin's circulation system should focus on ways to limit local pollution sources as much as possible.



Part of the development of the Circulation Element involves public input on the issues associated with the local circulation system. A community meeting and workshop was planned and held at Arvin City Hall to educate the public about the nature of the Circulation Element. The goal was also to allow the public to provide their individual goals and issues for the future of Arvin's circulation system. A copy of the public workshop presentation is included in the Appendix.

Street and Highway Issues

Arvin's streets experience typical issues for a small rural city that developed with limited planning for future development of the circulation system. Closely spaced streets, lack of connectivity, inadequate property setbacks, undeveloped sidewalks, and other issues are common in central Arvin.

Many of Arvin's roads were originally developed as rural two-lane roads without standards. As Arvin continues to grow, many of these roads are enveloped by urban development but are not completely reconstructed to current standards. This creates discontinuity in the roadway where the outside lanes are newly constructed, but the center lanes, actual traveled way, are in poor condition. Sycamore Road, for instance, was originally constructed as a two-lane rural road with unimproved shoulders. As urban development occurs on the north and south side of Sycamore Road, new pavement is constructed from the original edge of pavement to a standard curb, gutter, and sidewalk. However the original two-lane section remains unimproved. Other streets in and around Arvin have been constructed in a similar fashion. Correction of these old segments should be addressed in the traffic impact fee schedule.

Along the same lines as the above issue, several roads within Arvin have been constructed without proper setback requirements. Due to their locations, many of these roads are required as collectors and/or arterials. Meyer Street, for instance, has been fully developed between SR 223/Bear Mountain Road and Sycamore Road without proper setbacks in some locations. This limits future development of the roadway to necessary width and accommodations (bike lanes, sidewalk, etc.).

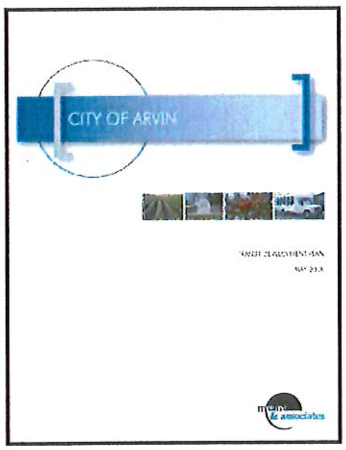
The lack of adherence to a roadway classification system has led to improperly balanced roadways. SR 223/Bear Mountain Boulevard is a good example of an improperly balanced arterial roadway. SR 223/Bear Mountain Boulevard between Comanche Road and Tejon Highway is the highest volume roadway in Arvin, but it also has a disproportionate amount of commercial driveways and access points. The close spacing of access points create vehicle conflicts on a roadway that is needed for through travel. Efforts should be made to consolidate driveways or divert access points so that they are not immediately adjacent to SR 223/Bear Mountain Road.

Street Maintenance

In 2001, the City of Arvin developed a Pavement Management System (PMS) to identify a maintenance schedule and budget. The 2001 PMS identified improvements to be made from 2002 to 2006 to upgrade and maintain the quality of Arvin's roads. Many of those improvements have not been completed, whether due to budgetary issues, additional development, or other reasons. Development of a city-wide traffic impact fee schedule will encompass maintenance and provide a larger system from which to draw maintenance funds.

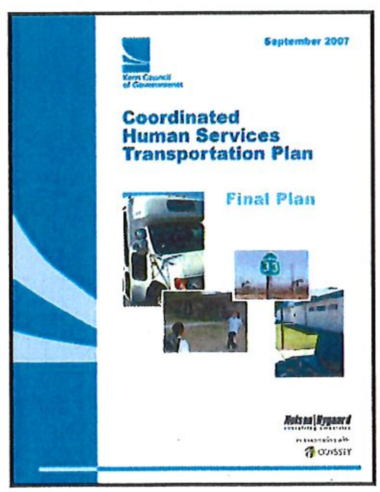
Connectivity

The connectivity of Arvin's arterials and collectors is very important to developing a good circulation system. Many roads that function as collectors are discontinuous or otherwise terminate, requiring the use of local streets and/or alleys to provide access through the community. Arvin's roads have developed on a ½ mile to 1 mile grid pattern. Most of the roads on the ¼ mile lines do not provide connectivity or consistent centerlines. In many places, separate developments have not built roads consistently to provide for future connectivity. Correcting many of these discontinuous roads is impractical due to existing development. Efforts by the City to require new development to conform to the typical grid pattern will help to improve connectivity issues.



Transit Issues

Arvin's current Transit Development Plan (2008) cites the need for a fixed route service within city limits to better accommodate the travel needs of choice riders, while balancing the benefits of the system in favor of Arvin residents (as opposed to non-residents who use the system). However, many of Arvin's aforementioned street issues preclude the expansion of transit services within Arvin. Discontinuous roads would require the use of local streets to provide access through the community, creating unsafe conditions for all users of the roadway, and poorly maintained through lanes lead to costly wear and tear on public transit vehicles.



From a regional perspective, Arvin Transit is experiencing issues typical of a small rural system. Through stakeholder outreach efforts the _Kern Council of Governments – Coordinated Human Services Transportation Plan (2007)_ identified key transportation gaps and unmet needs within Kern County. Many of these issues were relevant to the Arvin Transit system, including the need for increased service (hours and days) to insure return transportation services for commuters, and limited accessibility of comprehensive service information.

Rail Issues

The San Joaquin Valley Railroad spur in Arvin is located parallel to Tejon Highway/Derby Street on the east side of the road from the north city limits to Sycamore Road. The tracks are located close to Tejon Highway/Derby Street, creating hazards at crossing points (i.e. SR 223/Bear Mountain Road, Widmere Road, Richardson Road). As Arvin continues to develop to the north and east, these rail crossings may cause issues with potential traffic signals, widening of Tejon Highway/Derby Street, and access across Arvin. In general, railroad crossings located immediately adjacent to intersections tend to create vehicle dilemmas, decrease sight distance, and complicate movement of all modes of travel at the intersection.

There are also several private railroad crossings located between Sycamore Road and SR 223/Bear Mountain Road. These crossings provide access to the industrial development located east of the railroad tracks. A north-south road should be constructed to provide alternate access to these businesses and the private railroad crossings should be eliminated. This will eliminate certain safety hazards and provide better access control on Tejon Highway/Derby Street.

Although the placement of the rail line in Arvin presents geometric issues, it provides potential contribution to the circulation system. The ability to utilize existing infrastructure for future expansion of the rail system will be a benefit to the community. However, the decline in rail shipment may lead to the deterioration or termination of service to Arvin. Efforts should be made to maintain and increase the use of rail as a source of goods movement and potentially for future use as public transportation.

Bicycle, Pedestrian, and Trail Issues

Arvin's non-motorized modes of travel are inhibited by Arvin's aforementioned street issues, including a lack of connectivity, inadequate property setbacks, undeveloped sidewalks, and closely spaces access points (driveways). The lack of a City bicycle/pedestrian plan has led to a fragmented non-motorized circulation system that creates an unsafe and unwelcoming environment for both pedestrians and bicyclists. All current and future roadway planning efforts by the City should take into consideration the needs of non-motorized as well as motorized users.

Truck Route and Good Movement Issues

With Arvin's agricultural industry located on the east side of town, heavy truck movement through the community is commonplace. Heavy trucks frequently travel along SR 223/Bear Mountain Boulevard and Sycamore Avenue providing travel from the agricultural industry and SR 99 to the west. Comanche Drive and Tejon

Highway/Derby Street are also heavily traveled by trucks traveling to and from the surrounding agricultural fields to the packing and processing centers in located in Arvin. Truck travel on SR 223/Bear Mountain Boulevard is also required for deliveries to the commercial businesses located along its frontage.

The City of Arvin's agricultural industry requires a large amount of goods movement via truck and trailer. As discussed in the rail section, only two facilities in Arvin ship by rail. The remainder of product shipping occurs via truck and trailer. Heavily used truck routes in Arvin include SR 223/Bear Mountain Boulevard, Sycamore Road, Comanche Drive, and Tejon Highway/Derby Street. These roadways contain the majority of the existing commercial, industrial, and agricultural development in Arvin and provide through traffic in and out of Arvin. Additional roadways in Arvin experience limited truck traffic for deliveries, but do not typically carry through truck traffic.

Transportation System Management and Transportation Demand Management Issues

The use of TSM and TDM strategies in Arvin will play an important role in the development of the circulation system. As discussed in previous sections, many roadways in Arvin experience deficiencies that can be remedied by TSM and TDM measures. Especially where the ability to increase physical capacity is restricted, these programs and strategies may be the most practical solution.

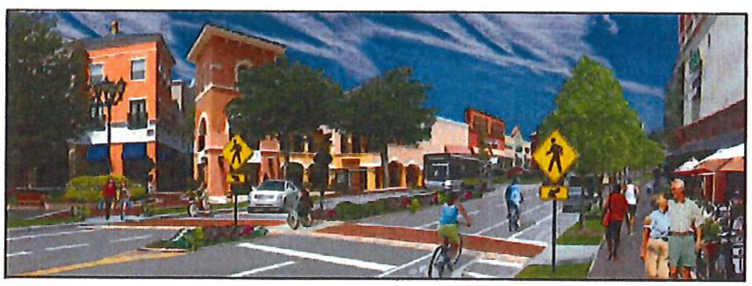
Complete Streets

In 2008, Assembly Bill 1358, the Complete Streets Act, became law and requires cities and counties, when updating the part of a local general plan that addresses roadways and traffic flows, to ensure that those plans account for the needs of all roadway users. In December 2010, the Governor's Office of Planning & Research, with substantial input from the CBC and its allies, issued general plan update guidelines for implementing the provisions of AB 1358. At the same time, the California Department of Transportation unveiled a revised version of Deputy Directive 64, an internal policy document that now explicitly embraces Complete Streets as the policy covering all phases of state highway projects, from planning to construction to maintenance and repair. As the result, California became the second—and by far the largest—state to implement Complete Streets policies covering every public street, road and highway. CBC continues to work with local bicycle advocacy organizations, air quality management agencies and other Complete Streets allies to ensure that guidelines implemented for AB 1358 serve as a national model.

Most of the current activity around "Complete Streets" is to retrofit existing roadways into facilities that are designed to be equally safe for drivers, bicyclists, transit vehicles and users, and pedestrians of all ages and abilities. In new development, this type of facility should be required by the jurisdiction's public works development standards and commonly implemented.

> The American Planning Association describes complete streets as follows:
> *Complete streets serve everyone – pedestrians, bicyclists, transit riders, and drivers – and they take into account the needs of people with disabilities, older people, and children. The complete streets movement seeks to change the way transportation agencies and communities approach every street project and ensure safety, convenience, and accessibility for all.*

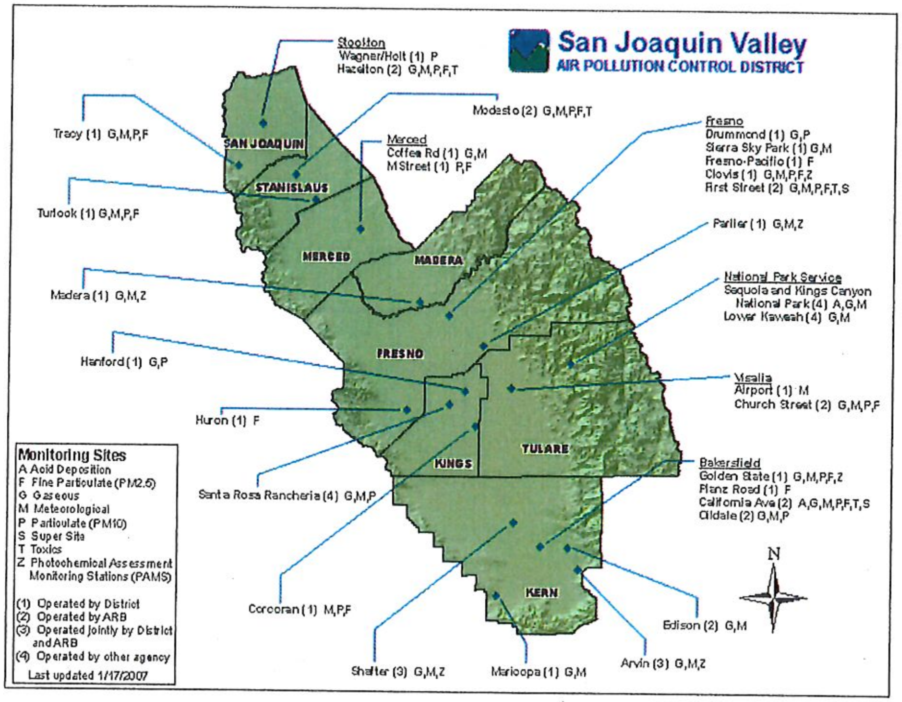
Ingredients that may be found on a complete street include ample sidewalks, pedestrian amenities, bike lanes (or wide paved shoulders), special bus lanes, comfortable and accessible transit stops, frequent crossing opportunities, median islands, accessible pedestrian signals, curb extensions, and more. Compliance with ADA is a given. A complete street in a rural area will look quite different from a complete street in a highly urban area. However, both are designed to balance safety and convenience for everyone using the road. Other techniques such as "road diets" and "traffic calming" are common components of Complete Streets.



The City of Arvin will endeavor to implement a complete streets strategy consistent with the State Requirements and Guidelines. This will include the multi-modal approach outlined in this Element of the General Plan as well as further integration of the Land Use and Circulation Elements.

Air Quality Issues

Arvin is located in the San Joaquin Valley Air Basin (SJVAB), which includes the western part of Kern County and most of the counties of Kings, Tulare, Fresno, Madera, Merced, Stanislaus and San Joaquin. The SJVAB is one of 15 State-designated air basins. According to the SJVAPCD, the air basin is approximately 250 miles long and averages 35 miles wide and is the second largest air basin in the state. This essentially flat valley is surrounded by the Sierra Nevada mountains in the east (8,000 to 14,000 feet in elevation), the Coast Ranges in the west (averaging 3,000 feet in elevation), and the Tehachapi mountains in the south (6,000 to 8,000 feet in elevation). Although marine air flows into the basin from the north, these mountain ranges restrict air movement through and out of the basin. The result is wind patterns that are usually calm and air masses that become trapped under inversion layers (warmer air on top of cooler air) typically below 3,000 feet in elevation. This is the primary reason the SJVAB is more vulnerable to air pollution problems than most other air basins in the State. It is certainly the most extensive area of the State subject to these conditions.



The SJVAPCD is required to monitor air pollutant levels to assure that applicable air quality standards are met, and if they are not met, to develop strategies together with State and Federal agencies to meet the standards. Depending on whether the standards are met or exceeded, the air basin is classified as being in "attainment" or as "non-attainment".

Local Issues

The SJVAB is a designated non-attainment area under both Federal and State standards for ozone concentrations. Ozone (O3) is a pollutant formed in the air through chemical reactions driven by sunlight of precursor compounds, mainly nitrogen oxides (NOx) and reactive organic gases (ROG). Ozone is highly reactive and corrosive and is a severe respiratory irritant. Ozone also attacks synthetic rubber, textiles, plants, and other materials. The Arvin area, due mainly to air flow characteristics within the basin and the city's location near the "bottom of the well" formed by the surrounding mountain ranges, tends to experience even higher ozone concentrations than the average for the SJVAB.

Another important class of criteria pollutants in the SJVAB is fine particulate matter. Particulate matter pollution consists of very small liquid and solid particles floating in the air. (PM10 refers to particles less than or equal to 10 microns in diameter. PM2.5 refers to particles less than or equal to 2.5 microns in diameter.) Particulate matter is a mixture of materials that can include smoke, soot, dust, salt, acids, and metals. Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates can damage human health and retard plant growth. Particulates also reduce visibility and corrode materials.

The U.S. EPA recently, September 25, 2008, changed the SJVAB's designation to "attainment" under the Federal PM10 standard. This is reflective of improvement in particulate matter pollution levels in the basin over the last two decades. However, the basin remains in non-attainment status for the State PM10 standard and Federal and State PM2.5 standards.

The California Air Resources Board (ARB) maintains a monitoring station on Bear Mountain Boulevard about two miles east of the Arvin city limits. This station monitors local ozone levels. Table 3-1 summarizes annual ozone data for the local area.

TABLE 3-1:
AIR QUALITY DATA AT ARVIN - OZONE

Pollutant	2009	2010	2011
Ozone (ppm) – Expected Peak Concentration	0.139	0.140	N/A
Number of days of State exceedances (>0.09 ppm)	54	36	N/A
Ozone (ppm) – Expected Peak Concentration	0.120	0.120	N/A
Number of days of State exceedances (>0.070 ppm)	104	90	N/A
Number of days of Federal exceedances (>0.075 ppm)	88	66	N/A

Source: California ARB *N/A= data not available or not found*

The Bear Mountain Boulevard station does not monitor particulate matter. The nearest such data is from the SJVAPCD's monitoring station at 5556 California Avenue in Bakersfield. Table 3-2 summarizes annual PM10 and PM2.5 data for the local area.

TABLE 3-2:
AIR QUALITY DATA AT BAKERSFIELD – PARTICULATE MATTER

Pollutant	2009	2010	2011
PM10 (µg/m^3) – Expected Peak Concentration	172.5	161.9	124.1
Number of days of State exceedances (>50 µg/m^3)	83.6	47.1	116.4
Number of days of Federal exceedances (>150 µg/m^3)	0	0	0
PM2.5 (µg/m^3) – "National Annual Average" (exceeded when >15 µg/m^3)	19	14.1	16.2
PM2.5 (µg/m^3) – "State Annual Average" (exceeded when >12 µg/m^3)	21.2	17.1	18.0
PM2.5 Estimated number of days of Federal exceedances (>35 µg/m^3 annual arithmetic mean)	45.5	28.7	N/A

Source: California ARB *N/A= data not available or not found*
** State and Federal data based on different samplers*

Relationship to Circulation Element

There is not requirement for an air quality element in the General Plan. However, because the General Plan sets the basis for all local planning and development, cities and counties have a unique opportunity and responsibility to consider the General Plan as a tool to implement policies and strategies beneficial to air quality. The Circulation Element, especially in conjunction with the Land Use Element, can have a profound impact on the potential level for mobile source (transportation) air emissions produced by a community by guiding the type and location of streets and other transportation facilities.

Air Quality Policy Considerations

Policy considerations related to air quality that might be directly treated in the Circulation Element include:

- *Cooperation with other agencies in developing plans and policies designed to foster attainment of Federal and State air quality standards. In terms of developing a local and regional transportation system that enhances service while reducing mobile source emissions, coordination with the SJVAPCD, Kern County, local school districts and Kern Council of Governments (Kern COG) is especially important.*

- *Implement transportation policies and capital improvements that facilitate development located, designed and constructed in a way that will minimize cumulative air quality impacts.*
- *Coordinate and provide support for Transportation Demand Management Programs with other public and private agencies, including those developed by the SJVAPCD and Kern COG.*
- *The City of Arvin shall work with Kern COG to comprehensively study methods of transportation which may contribute to a reduction in air pollution in the city. Some possible alternatives that should be studied are:*
- *Public transportation such as buses and light rail, to serve between communities of the valley, publicly subsidized if feasible.*
- *Intermodal public transit such as buses provided with bicycle racks, bicycle parking at bus stations, and park and ride facilities.*
- *Community bus or other public transportation systems, such as cycling or walking trails, with particular attention to high-density areas.*
- *Promote street design that provides an environment which encourages transit use, biking, and pedestrian movements.*

Global Climate Change Issues

Climate change refers to a significant change in measurable climate characteristics such as average temperature, rainfall or wind speed, continuing over a long period, such as a decade or more. Climate change can result from natural factors, such as fluctuations in the sun's intensity, volcanic activity or changes in ocean currents. It can also result from human activities, such as deforestation or burning fossil fuels.

The term global warming is often used interchangeably with climate change. However, global warming more properly refers to the observed increase in the average temperature of the Earth's atmosphere and oceans in recent decades.

Greenhouse Gases

Global warming is a term used to refer to the observed increase in the average temperature of the Earth's atmosphere and oceans in recent decades. Science is not unanimous about the cause of global warming. There is some science that suggests this is a cyclical phenomenon that has repeated itself over history (counteracted by periods of global cooling) and is therefore related to many naturally occurring events. However, there is other science that suggests that global warming may be related to increasing greenhouse gas concentrations in the atmosphere. Greenhouse gases absorb a certain amount of the solar energy reaching the Earth that would otherwise be reflected back into space. Global climate change may result in significant adverse effects to the environment that will be experienced worldwide, with some specific effects felt in California. Assembly Bill 32 (Statues of 2006), the California Global Warming Solutions Act of 2006, which was signed into law on September 27, 2006, requires statewide greenhouse gas (GHG) emissions reductions to 1990 levels by 2020.

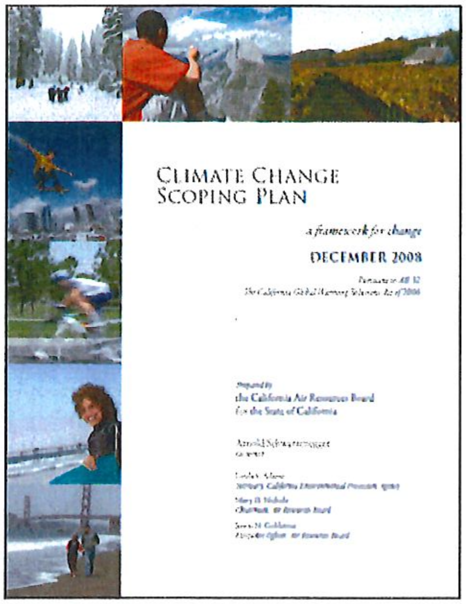
Greenhouse gases (GHGs) are those gases that trap heat that would otherwise radiate into space. Without the natural heat trapping effect of GHGs, the earth's surface would be about 34° C cooler (CAT, 2006). Some greenhouse gases occur naturally in the atmosphere, while others result from or are concentrated by activities including the burning of fossil fuels such as oil, natural gas, and coal. Although carbon dioxide is the largest contributor to climate change, approximately 81 percent, six greenhouse gases are regulated in California: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Carbon dioxide is the primary target for reducing GHG and addressing global climate change as this is more effectively regulated than some of the other greenhouse gases. The table below breaks down the percent contribution from anthropogenic sources of greenhouse gases by criteria pollutant.

GHGs are emitted by both natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Emissions of CO_2 are largely by-products of fossil fuel combustion, whereas CH_4 results from off-gassing associated with agricultural practices and the decomposition of organic materials within landfills. Man-made GHGs, which have a much greater heat-absorption potential than CO_2, include fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6), which are byproducts of certain industrial processes. Plants use carbon dioxide and water in photosynthesis and releases oxygen as a waste product. Humans use this oxygen to breathe and produce CO2 as a byproduct of respiration.

Health Effects

The U.S. EPA summarizes the potential for health effects resulting from climate change as follows:

> *Throughout the world, the prevalence of some diseases and other threats to human health depend largely on local climate. Extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems, such as changes in the range of infective parasites, can indirectly impact the incidence of serious infectious diseases. In addition, warm temperatures can increase air and water pollution, which in turn harm human health.*
>
> *Human health is strongly affected by social, political, economic, environmental and technological factors, including urbanization, affluence,*



scientific developments, individual behavior and individual vulnerability (e.g., genetic makeup, nutritional status, emotional well-being, age, gender and economic status). The extent and nature of climate change impacts on human health vary by region, by relative vulnerability of population groups, by the extent and duration of exposure to climate change itself and by society's ability to adapt to or cope with the change.

Local Context

According to the Climate Change Scoping Report approved in 2008 by the California Air Resources Board (the lead agency for implementing AB 32), in order to reach the AB 32 emission requirement, approximately 30 percent must be cut from business-as-usual emission levels projected for 2020, or about 15 percent from current GHG inventory emission levels.

On a per-capita basis, meeting AB 32's target levels means reducing the annual emissions from 14 tons of carbon dioxide for every man, woman and child in California to about 10 tons per person by 2020. Although carbon dioxide is the largest contributor to climate change, AB 32 references six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). This report, as with many climate change analyses, focuses on carbon emissions, as the contribution from other GHGs is relatively very small.

The Air Resources Board's preliminary recommendations in the Climate Change Scoping Plan for reducing greenhouse gas emissions in California to 1990 levels by 2020 include:

- *Expansion and strengthening of existing energy efficiency programs and building and appliance standards.*
- *Expansion of the State's investments in renewable fuels portfolios to 33 percent.*
- *Development of a California cap and trade program that links with other Western Climate Initiative Partner programs to create a regional market system.*
- *Implementation of existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard.*

- *Targeted fees to fund the State's long-term commitment to AB 32.*

The Climate Change Scoping Plan identifies the amount that each sector contributes to California's greenhouse gas emissions. The largest contributor is the Transportation sector, which contributes 38 percent of the state's total greenhouse gas emissions. The Transportation sector is largely made up of the cars and trucks that move goods and people. Advances in car technology and increases in fuel efficiency are expected to move this sector toward meeting the 1990 emissions standard and reducing overall carbon emissions.

The Electricity and Commercial/Residential Energy sector is the next largest contributor with over 30 percent of the greenhouse gas emissions. Although electricity imported into California accounts for only about 22 percent of our electricity, imports contribute nearly half of the greenhouse gas emissions from electricity because much of the imported electricity is generated at coal-fired power plants. AB 32 specifically requires ARB to address emissions from electricity sources both inside and outside of the state. The amount of carbon dioxide created for a unit of energy combusted is dependent upon how that energy was created. Certain energy providers and sources produce cleaner energy than others.

California's Industrial sector includes refineries, oil and gas production, food processors, and other large industrial sources. This sector contributes approximately 20 percent of California's greenhouse gas emissions, but the sector's emissions are not projected to grow significantly in the future

A November 16, 2007 staff report from the Air Resource Board titled "California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Level" breaks up the commercial and residential emissions by attributing 3 percent to the commercial sector and 6 percent to the residential sector.

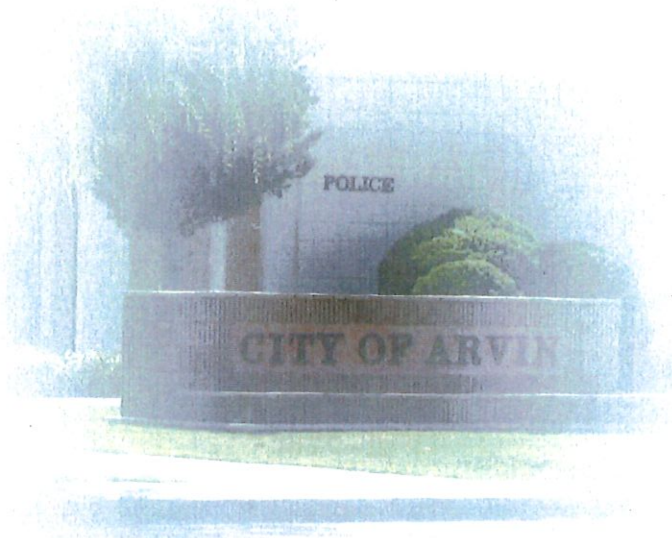
Relationship to Circulation Element

Policy considerations for reduction of criteria air pollutants such as ozone and particulate matter, as discussed above, also tend to be relevant for reduction of greenhouse gas emissions. Note also the fourth bulleted recommendation quoted above from the ARB's Climate Change Scoping Plan. It indicates impending state-wide efforts to require "implementation of existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard." Circulations Elements not designed to be responsive to such laws and policies will likely have to be amended to be so. That would not be a straightforward amendment. It would necessitate coordinating changes throughout the General Plan and have implications for development standards and capital projects.

Finally, SB 375, signed into law on September 30, 2008, is follow up legislation to AB 32 which creates an explicit link between greenhouse gas emissions reductions and the regional transportation planning process. There are already existing legal connections between the regional transportation planning and funding process and local General Plans/Circulation Elements. The combination creates complex policy interactions that have yet to be fully defined.

CHAPTER 4

POLICIES



This chapter of the Circulation Element establishes the framework for the implementation of the planned circulation system. The policies as outlined in this section support the development of a circulation system which is consistent with the other elements of the Arvin General Plan, as well as regional and State plans and programs. Care was taken to make sure that the goals and policies presented in the Circulation Element coincide with the policies adopted in the Final *Kern Regional Blueprint Program*. The City of Arvin has established several policies affecting transportation and this document expands on them in order to provide a cohesive set of policies governing the development of the City's transportation system.

This chapter presents specific goals and policies to guide the future development of the circulation system. Many of the goals and policies are available in the 1988 Circulation Element, but remain valid even now.

This chapter also includes discussion of air quality and global climate change. Although State guidelines do not require a specific element for air quality, the policies and goals for the Circulation Element play a key role in the community's air quality and the potential for climate change.

Definitions

The following table shows the goals, objectives, and policies have been established for the development and maintenance of Arvin's circulation system. For the purposes of this Circulation Element, the following definitions are provided for the goals, objectives, and policies:

Goal

A goal is a general expression of community values; it is general and is not time-constrained.

Policy

A policy is a course of action selected for a given situation to accomplish an objective; a policy is used to guide decision making.

TABLE 4-1: GOALS AND POLICIES
Streets and Highways
The following goal and policies govern the development of the roadway system in Arvin. The streets and highways are the key component to the circulation system

TABLE 4-1: GOALS AND POLICIES	
and lay the foundation for the development of all transportation modes.	
Goal: *A safe, efficient, and organized roadway system that meets the current and future needs of the community.*	
Constraint	**Mitigating Policy**
A) Substandard roadways	1) The City shall use the circulation system diagram to designate all arterials and collectors in the study area. 2) All future City streets shall be built to the adopted street standards as defined by the City Engineer and according to the roadway classification identified in the Circulation Diagram. 3) The City shall establish a level of service standard of "D" or better for all roadways and intersections for traffic analysis purposes. 4) Upgrade existing roadways to current standards wherever right-of-way permits. 5) Consolidate existing driveways along arterial roadways wherever feasible.
B) Roadway consistency with surrounding area	6) Ensure that the circulation system coordinates with the adopted land plan. 7) Ensure that the circulation system coordinates with regional transportation plans. 8) Provide adequate parking facilities for new development so as not to impact adjacent roadways. 9) Traffic signals shall be placed at arterial and collector intersections as warranted. 10) The city shall encourage developers to design local streets to discourage use

TABLE 4-1: GOALS AND POLICIES	
	as alternatives to collectors and arterials.
C) Roadway funding	11) Establish a developer impact fee program to provide funds for necessary transportation system improvements. 12) Developers shall construct roadways along their frontage from centerline to edge of right of way according to the adopted street standards and as identified in the Circulation Element.
D) Completed Streets	13) The City is committed to the implementation of a complete streets system and will integrate a multi-modal approach into the network.

Transit

The following goal and policies govern the transit system in Arvin. Maintaining and improving the transit system will greatly benefit the travel opportunities within the community of Arvin as well as to adjacent cities.

Goal:

Encourage the use of public transportation to replace vehicle trips.

Constraint:	Mitigating Policies
A) Transit service and accessibility	1) Develop an efficient city-wide transit system servicing the entire community. 2) Develop a multi-modal transit center linking local and regional transit systems with other modes of travel. 3) Work with adjacent jurisdictions to maintain and expand the inter-regional transit system. 4) Encourage new development, as necessary, to provide transit facilities (bus turnouts, bus stop shelters, etc.). 5) Provide transit opportunities near large trip generating areas (high density residential, commercial centers, etc.).

TABLE 4-1:
GOALS AND POLICIES

Rail

The following goal and policies drive the development of the rail system in Arvin. Rail transportation has the opportunity to provide needed goods movement and reductions in heavy vehicle trips.

Goal:

Continuation and improvement of rail service in the City of Arvin.

Constraint:	Mitigating Policies
A) Decline in rail use	1) Protect and maintain existing rail lines to serve existing and future industrial development in the community. 2) Buffer rail lines from future residential and commercial development. 3) Provide safe crossings for vehicular, pedestrian, and bicycle circulation across rail lines. 4) Encourage development of a freight receiving station to service industrial uses in and around Arvin. 5) Encourage or participate in regional projects exploring passenger rail service.

Bicycle, Pedestrian, and Trails

The following goal and policies govern the non-vehicular transportation system in Arvin. The development of bicycle and pedestrian facilities in Arvin are crucial to the future of Arvin's circulation system.

Goal:

A safe and inviting non-vehicular circulation system in Arvin.

Constraint:	Mitigating Policies
A) Limited bicycle facilities	1) Establish a bicycle route map to determine proper designation of recommended bicycle facilities. 2) Provide sidewalks and pedestrian facilities for major thoroughfares

TABLE 4-1: GOALS AND POLICIES	
	connecting attractions, including: schools, parks, commercial development, etc. 3) The city shall attempt to install sidewalks through developed areas that were built without pedestrian facilities. 4) Encourage future developers to implement pedestrian and bicycle facilities within the development. 5) Provide pedestrian connectivity through areas where vehicular connectivity is limited.

Truck Routes and Goods Movement

The following goal and policies govern the movement of truck traffic. Goods movement is a key component of Arvin's agriculture industry, but should be buffered from residential areas.

Goal:

A heavy vehicle routing system that provides efficient movement of goods in and around Arvin.

Constraint:	Mitigating Policies
A) Routing heavy vehicles through designated areas	1) Establish a truck route map identifying appropriate routes for truck travel to and from Arvin's industrial areas. 2) Install appropriate signage to mark truck routes and appropriate truck loading and parking areas. 3) Provide necessary truck access for commercial and industrial development.

Transportation System Management and Transportation Demand Management

The following goal and policies govern the transportation system and demand management strategies used to improve the circulation system. TSM and TDM are vital for improving roadways where existing development imposes physical

TABLE 4-1:
GOALS AND POLICIES

limitations, which is common in Arvin.

Goal:

Incorporate methods for improving the transportation system where typical capacity improvements are restricted.

Constraint:	Mitigating Policies
A) Typical capacity increasing improvements are not feasible	1) The city shall encourage the use of alternative modes of transportation. 2) The city shall consider "road diets" for certain collector roadways to balance through and turning capacity. 3) Establish coordination with Caltrans for periodic review of signal timing along SR 223/Bear Mountain Boulevard. 4) The city shall encourage reduction in congestion and vehicle-miles-traveled through various employer sponsored programs. 5) Develop a park-and-ride lot, potentially incorporated into a multi-modal facility.

Utilities

The following goal and policies govern the transit system in Arvin. The planning of public utilities systems is necessary to the continued development of the community.

Goal:

Public utilities facilities to provide for the entire community.

Constraint:	Mitigating Policies
A) Proper capacity for utility transmission	1) Preserve the integrity of major transmission and pipeline facilities through the city. 2) Plan for necessary public utility right-of-way with the development of the future street system.

TABLE 4-1: GOALS AND POLICIES	
Air Quality The streets and highways are the key component to the circulation system and lay the foundation for the development of all transportation modes. Therefore, the following goal and policies govern the improvement of air quality in the San Joaquin Valley Air Basin in general, and in Arvin specifically, primarily through the reduction of vehicle miles traveled.	
Goal: ***An improved quality of life through better air quality to transportation and circulation within the City.***	
Constraint:	**Mitigating Policies**
A) Poor Air Quality	1) Cooperate with other agencies in developing plans and policies designed to foster attainment of Federal and State air quality standards. Coordinate jointly with SJVAPCD, Kern County, local school districts and Kern Council of Governments (Kern COG) to develop a local and regional transportation system that enhances service while reducing mobile source emissions from vehicle trips.
	2) Implement capital improvements that facilitate development located, designed and constructed in a way that will minimize cumulative air quality impacts, such as through design and construction that qualifies for LEED certification. 3) Coordinate and provide support for Congestion Management and Transportation Demand Management (trip reduction) Programs with other public and private agencies, including those developed by the SJVAPCD and Kern COG.

TABLE 4-1: GOALS AND POLICIES	
	4) The City of Arvin shall work with Kern COG to comprehensively study methods of sustainable multi-modal transportation which may contribute to a reduction in air pollution in the city. Some methods that should be studied are: ♦ Public transportation such as buses and light rail, to serve between communities of the valley. ♦ Intermodal public transit such as buses provided with bicycle racks, bicycle parking at bus stations, and park and ride facilities. ♦ Community bus or other public transportation systems, such as cycling or walking trails, with particular attention to high-density areas. ♦ Promote street design and commercial development that provides amenities which encourages transit use, biking (riding and storage), and pedestrian movements. ♦ Establishment of a Transit Center with car-pool parking and in a location supported by higher density residential land use and commercial designations nearby. 5) Ensure that the circulation system coordinates with regional transportation plans. 6) Provide adequate parking facilities for new development so as not to impact adjacent roadways.

TABLE 4-1: GOALS AND POLICIES	
Greenhouse Gas (GHG) Reduction The streets and highways are the key component to the circulation system and lay the foundation for the development of all modes of transportation. Carbon Dioxide (CO2) is the greatest contributor by volume to GHG. Internal combustion engines from vehicles are one of the greatest contributors to CO2 pollution. Therefore, the following goal and policies govern the reduction of GHG in the San Joaquin Valley Air Basin in general, and in Arvin specifically, primarily through the reduction of vehicle miles traveled and utilization of alternative fuels.	
Goal: ***Reduce GHG emissions by reducing vehicle miles traveled and by increasing or encouraging the use of alternative fuels and transportation technologies.***	
Constraint:	**Mitigating Policies**
A) Global Warming	1) Adopt development standards that will require improvements to the transit system and infrastructure, and other measures that increase rider safety and accessibility and other incentives. 2) Ensure transportation centers are multi-modal and allow transportation modes to intersect and that they incorporate vehicle and bicycle park-and-ride facilities. 3) Provide safe and convenient access for pedestrians and bicyclists to, across, and along major transit priority streets. Prohibit projects that impede or make difficult bicycle and pedestrian access or that block through access on existing or potential bicycle and pedestrian routes. 4) City will monitor traffic safety and congestion to determine when and where modifications are necessary to increase efficiency and access, including such solutions as signal priority/preemption and

TABLE 4-1: GOALS AND POLICIES	
	synchronization, bus lanes, new Class 1 or Class 2 bike lanes, and enhanced pedestrian crossings. 5) Participate in and support public, private, and public/private partner programs that encourage ride-sharing, employer-based trip reductions, and bicycle safety education programs for drivers and riders. 6) Consider amendments to Zoning Codes that will allow for live-work sites, shared parking opportunities, commercial parking reductions in trade for bicycle parking and storage amenities. 7) Enforce state idling laws for commercial vehicles, including delivery and construction vehicles through standard conditions of approval on discretionary land use entitlements.

CHAPTER 5

FUTURE CIRCULATION SYSTEM

This Chapter describes the City of Arvin's circulation system through the year 2030. This future analysis includes discussions of the City's streets and highways, transit, rail, pedestrian and bicycle facilities, goods movement and transportation system management. The results of this analysis will identify the needs of the circulation system to provide for the future of Arvin.

While the rate of direction of the city's growth cannot be fully anticipated, it is necessary to estimate the socio-economic development for the future. This projection is used to develop future traffic volumes and identify the needs of the circulation system, thus guiding the planning and development process. The projection of the future circulation development is used to establish a program of necessary improvements for the future. The estimate of the future socio-economic development according to the land use plan is also needed to provide consistency between the Land Use Element and the Circulation Element as required by the State of California.

Regional Travel Demand Model

The Kern Council of Governments, with input from its member agencies, has developed and maintains a regional travel demand model, or "traffic model", which is used to project future traffic volumes, among other things. The future year 2030 population, housing, employment, and other socio-economic data currently included in the traffic model were adjusted to reflect the current land plan and roadway network. Population and employment growth were added to additional traffic analysis zones (TAZ) based on Arvin's current land plan. Additional population was added to the current multi-family zoned areas to increase density within the downtown area. Additional roadways were added to the model network to account for more discrete analysis of the added TAZs.

Using the changes described above, Kern COG prepared a revised 2030 model run. The revised 2030 model was compared to the most recently approved "existing" (2006) conditions model to develop the growth increments for Arvin's roadways. These increments were then added to the Existing traffic volumes to develop the 2030 traffic volumes used in the future analysis.

2030 Traffic Conditions

An analysis of the proposed future (2030) conditions was prepared for the roadway segments previously identified in the existing conditions analysis. The Circulation Element focuses on level of service analysis of roadway segments which is the most appropriate level of detail for General Plan level analysis. The following is a description of the proposed future circulation system operation:

Future Traffic Volumes

Future traffic volumes for several roadway segments in the study area were developed using the Kern COG traffic model(s), as discussed previously, and the existing traffic counts. The future traffic volumes reflect expansion of the city based on the currently adopted Land Use Map. The traffic volumes used in the existing conditions analysis are shown on Figure 5-1.

Future Levels of Service

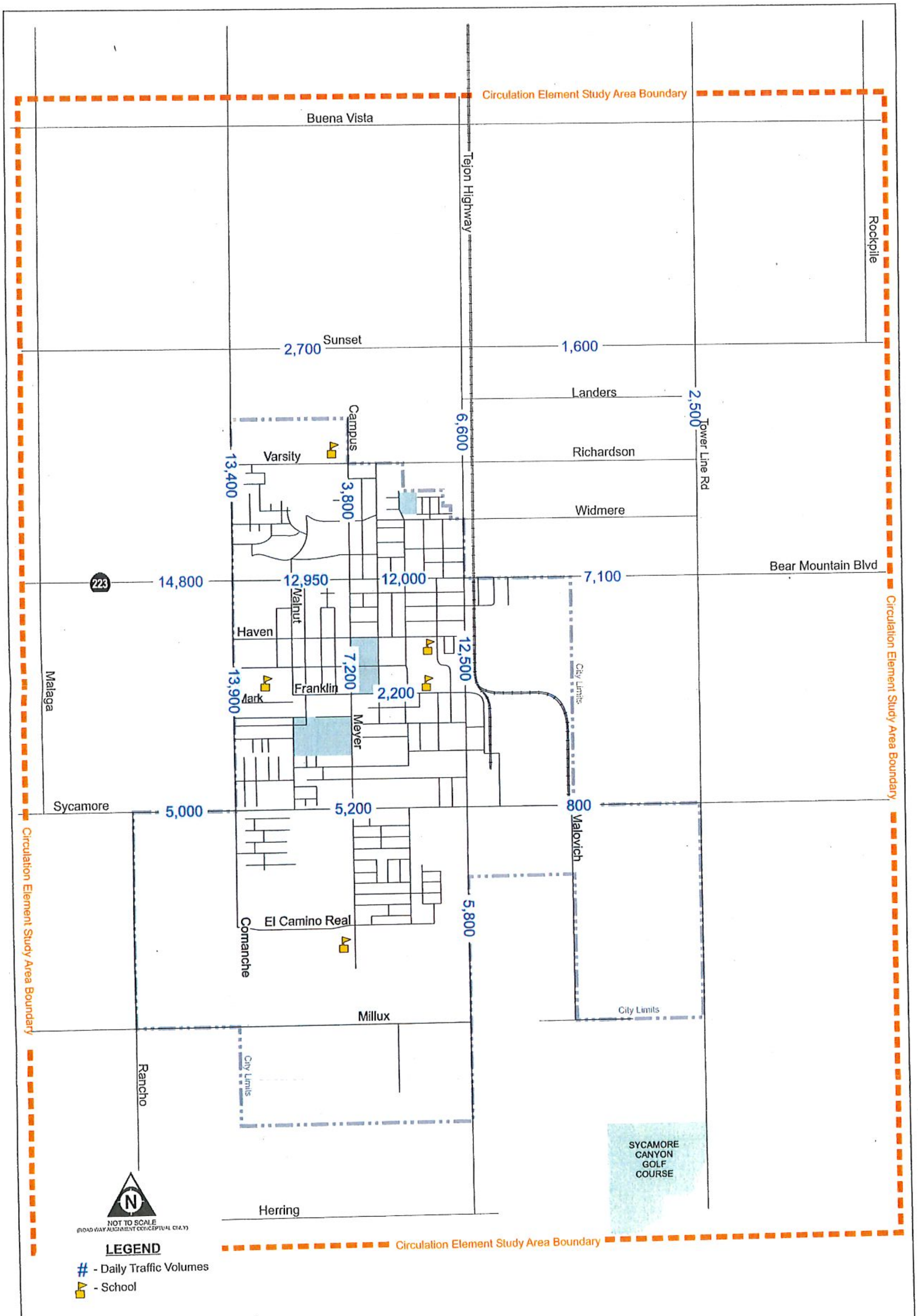
The level of service methodology used for future conditions analysis of the Circulation Element is discussed in Chapter 1 and is the same as the existing conditions analysis. Table 5-1 shows the projected levels of service for the study roadway segments using the traffic volumes shown on Figure 5-1 and the level of service criteria shown in Tables 1-1 and 1-2. As shown in Table 2-1, all of the study roadway segments are projected to operate at acceptable levels of service.

Streets and Highways

This section of the Circulation Element identifies the roadway classifications that will be designated to the roadways within the study area. The Circulation Element deals with areas within the existing urbanized area and in the rural/proposed development areas located in the study area.

Within the existing urban area, the Circulation Element serves to identify classifications for roadways already in existence. Some of these roads have been built to the identified standards, but others will require improvements to meet current or future development.

Roadways identified in the Circulation Element that are outside existing urban area serve to lay the foundation for the future roadway system. Based on the adopted land plan, significant development will occur in currently undeveloped areas. Setting classifications and standards for these roadways helps the city identify how development will occur in the future and preserve necessary right-of-way for the circulation system.



TPG Consulting

FUTURE DAILY TRAFFIC VOLUMES

Arvin Circulation Element
Kern County, CA

08-1158

Figure 5-1

TABLE 5-1:
SUMMARY OF FUTURE (2030) LEVELS OF SERVICE

Roadway	Boundaries	Number of Lanes	Median	Daily Traffic	Level of Service
Sunset Boulevard	Comanche Drive to Tejon Highway	4	Undivided	2,700	C
	Tejon Highway to Tower Line Road	4	Undivided	1,600	C
Bear Mountain Boulevard / SR 223	Rancho Drive to Comanche Drive	4	Divided	14,800	C
	Comanche Drive to Campus Drive	4	Divided	12,900	C
	Campus Drive to Tejon Highway	4	Divided	12,000	C
	Tejon Highway to Tower Line Road	4	Divided	7,100	C
Franklin Street	Walnut Drive to Tejon Highway	4	Undivided	2,200	C
Sycamore Road	Rancho Drive to Comanche Drive	4	Divided	5,000	C
	Comanche Drive to Tejon Highway	4	Divided	5,200	C
	Tejon Highway to Tower Line Road	4	Divided	800	C
Comanche Drive	Sycamore Road to Bear Mountain Boulevard	4	Divided	13,900	C
	Bear Mountain Boulevard to Sunset Boulevard	4	Divided	13,400	C
Campus Drive / Meyer Street	Sycamore Road to Bear Mountain Boulevard	4	Undivided	7,200	C
	Bear Mountain Boulevard to Sunset Boulevard	4	Undivided	3,800	C
Tejon Highway / Derby Street	Millux Road to Sycamore Road	4	Divided	5,800	C
	Sycamore Road to Bear Mountain Boulevard	4	Divided	12.500	C
	Bear Mountain Boulevard to Sunset Boulevard	4	Divided	6,600	C
Tower Line Road	Bear Mountain Boulevard to Sunset Boulevard	2	Undivided	2,500	C

AADT = Annual Average Daily Traffic *LOS = Level of Service*

Future Circulation Element Map

Figure 5-2 shows the proposed circulation map for the City of Arvin. The proposed circulation map was developed, with some exceptions, to accommodate the projected traffic conditions within the study area of this Circulation Element. The list of proposed changes to the circulation system is included below.

Future Classified System Pattern

As shown in Figure 5-2, the proposed future circulation system will retain the roadway classifications previously used in the 1988 Circulation Element. Based on the significant expansion of the city projected by the adopted land plan, the circulation system must expand to account for this growth. As such, several roadways will be extended or constructed in areas that are currently undeveloped. These roadways should be built to the adopted standards based on the roadway classification specified in the proposed circulation map. As specified in Chapter 2, the roadways, by classification, should be built as follows:

- **Principal Arterials** should be constructed with right-of-way widths of 110 feet to 146 feet. Principal arterials should have 4 through lanes of travel. Where feasible, principal arterials should have medians and channelized turn lanes at intersections with minor arterials and collectors.

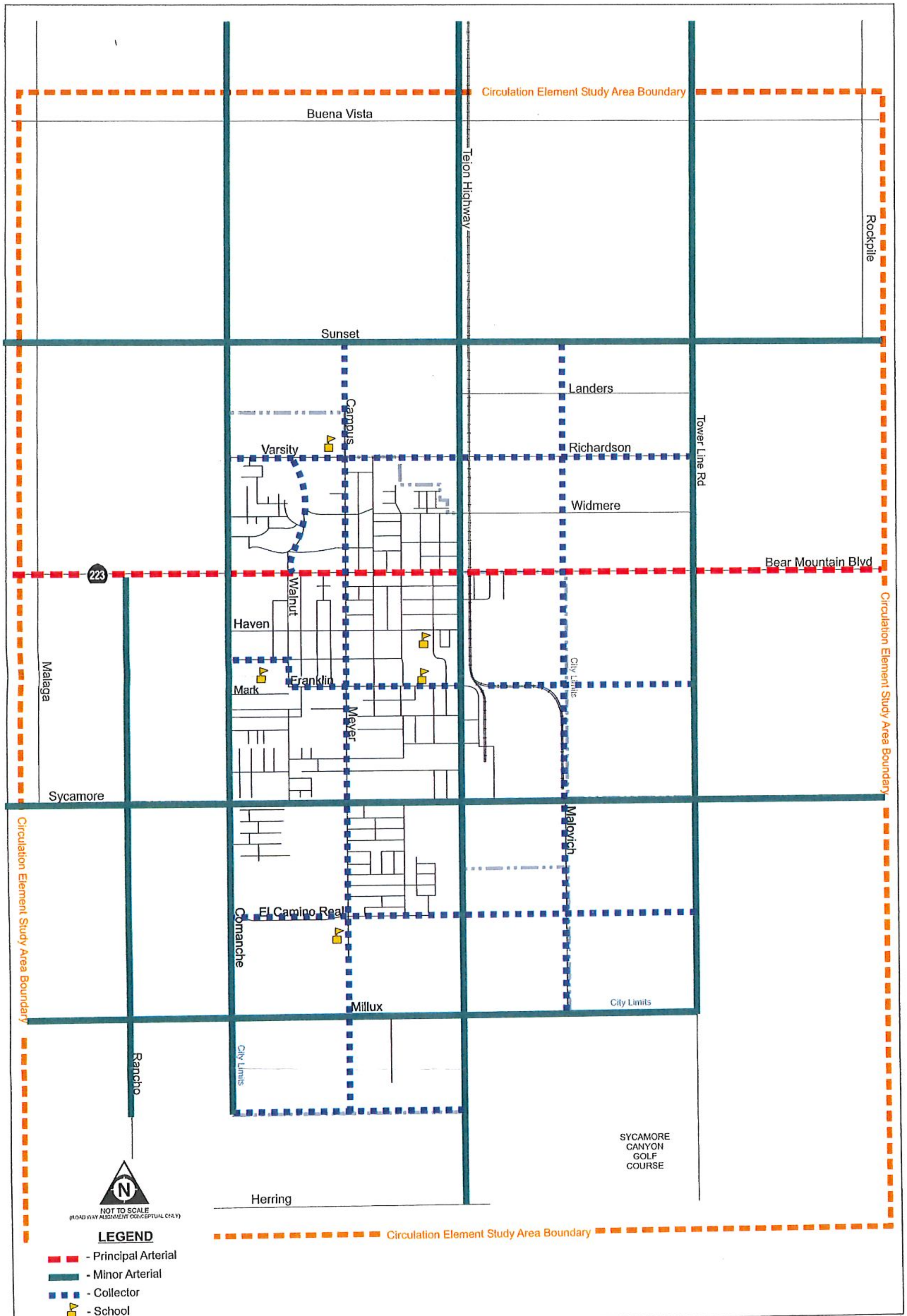
  Principal arterials include: SR 223/Bear Mountain Boulevard

- **Minor Arterials** should be constructed with right-of-way widths of 110 feet to 146 feet. Minor arterials should have 4 through lanes of travel. Where feasible, minor arterials should have medians and channelized turn lanes at intersections with minor arterials and collectors.

  Minor arterials include: Sunset Boulevard, Sycamore Road, Millux Road, Comanche Drive, Tejon Highway/Derby Street, and Tower Line Road

- **Collectors** should be constructed with right-of-way widths of 90 feet. Collectors should have 2 through lanes of travel. Collectors do not typically need medians to buffer traffic and turn lanes should be provided at intersections with arterials.

  Collectors include Varsity Road, Franklin Street (including portions of Walnut Drive and Hood Street), El Camino Real, Burkett Boulevard, Rancho Drive, Campus Drive/Meyer Street and Malovich Road



TPG Consulting

FUTURE CIRCULATION MAP

Arvin Circulation Element
Kern County, CA

08-1158

Figure 5-2

- **Local** roadways are constructed with right-of-way widths between 50 and 60 feet. Local roads at typically 2-lane roads without medians or turn lanes.

  All roadways not identified above fall under the local street category.

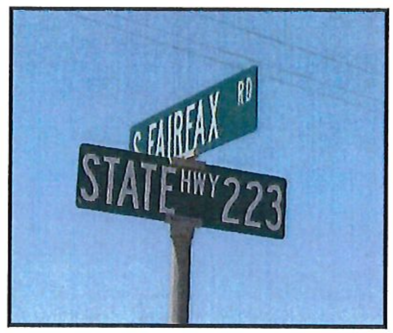
Projects List

In order for the street and highway system to develop as shown in the proposed circulation map, maintain level of service standards, and function with the surrounding land uses, the following circulation improvements are proposed:

Roadway Improvements

- *Sunset Boulevard between Malaga Road and Tower Line Road – modify from a 2 lane undivided roadway to a 4 lane undivided arterial standard*
- *Varsity Road/Richardson Road between Hill Street and Tower Line Road – improve/construct a 2 lane undivided collector standard*
- *SR 223/Bear Mountain Boulevard between Malaga Road and Comanche Drive – modify from a 2 lane undivided roadway to a 4 lane divided arterial standard*
- *SR 223/Bear Mountain Boulevard between Tejon Highway/Derby Street and Tower Line Road – modify from a 2 lane undivided roadway to a 4 lane divided arterial standard*
- *Hood Street – Comanche Drive to Meyer Street – improve 2 undivided lane collector/local road standard*
- *Franklin Street between Tejon Highway/Derby Street and Tower Line Road – construct a 2 lane undivided collector standard*
- *Sycamore Road between Rancho Drive and Tower Line Road – modify/improve from a 2 lane undivided roadway to a 4 lane divided arterial standard*
- *El Camino Real between Rancho Drive and Comanche Drive – construct a 2 lane undivided collector standard*
- *El Camino Real between Tejon Highway/Derby Street and Tower Line Road – construct a 2 lane undivided collector standard*
- *Millux Road between Rancho Drive and Tejon Highway/Derby Street – modify from a 2 lane undivided roadway to a 4 lane divided arterial standard*
- *Millux Road between Tejon Highway/Derby Street and Tower Line Road – construct a 4 lane divided arterial standard*
- *Burkett Boulevard between Comanche Drive and Tejon Highway/Derby Street – construct a 2 lane undivided collector standard*
- *Rancho Drive between Millux Road and Sycamore Road – improve to a 2 lane undivided collector standard*

- *Comanche Drive – between Burkett Boulevard and Sunset Boulevard – improve from a 2 lane undivided roadway to a 4 lane divided arterial standard*
- *Campus Drive/Meyer Street between Burkett Boulevard and Sycamore Road – construct a 2 lane undivided collector standard*
- *Campus Drive/Meyer Street between Varsity Road and Sunset Boulevard – construct a 2 lane undivided collector standard*
- *Tejon Highway/Derby Street between Burkett Boulevard and Sunset Boulevard – improve the 2 lane undivided roadway to a 4 lane divided arterial standard*
- *Malovich Road between Millux Road and Sunset Boulevard – construct a 2 lane undivided collector standard*
- *Tower Line Road between Millux Road and Sycamore Road – modify/construct a 4 lane divided arterial standard*
- *Tower Line Road between SR 223/Bear Mountain Boulevard and Sunset Boulevard – modify a 2 lane undivided roadway to a 4 lane divided arterial standard*



The widening of SR 223/Bear Mountain Boulevard is included on the list of unconstrained projects in the Kern County RTP. Since this improvement is on the unconstrained list of projects, it is not anticipated that this project will be funded by the State and/or the County by 2030.

Intersection Improvements

- *SR 223/Bear Mountain Boulevard at Comanche Drive – potential installation of a traffic signal*
- *SR 223/Bear Mountain Boulevard at Tejon Highway/Derby Street – potential installation of a traffic signal*
- *Existing and future arterial-arterial intersections should be monitored for installation of traffic signals*
- *Existing traffic signals should be monitored for addition of protected left-turn phases*

Improvement Limitations

The roadway geometrics described above should be applied to current and future roadways. In many places, existing development (land use or other physical barriers) presents limitations to implementation of the above improvements as follows:

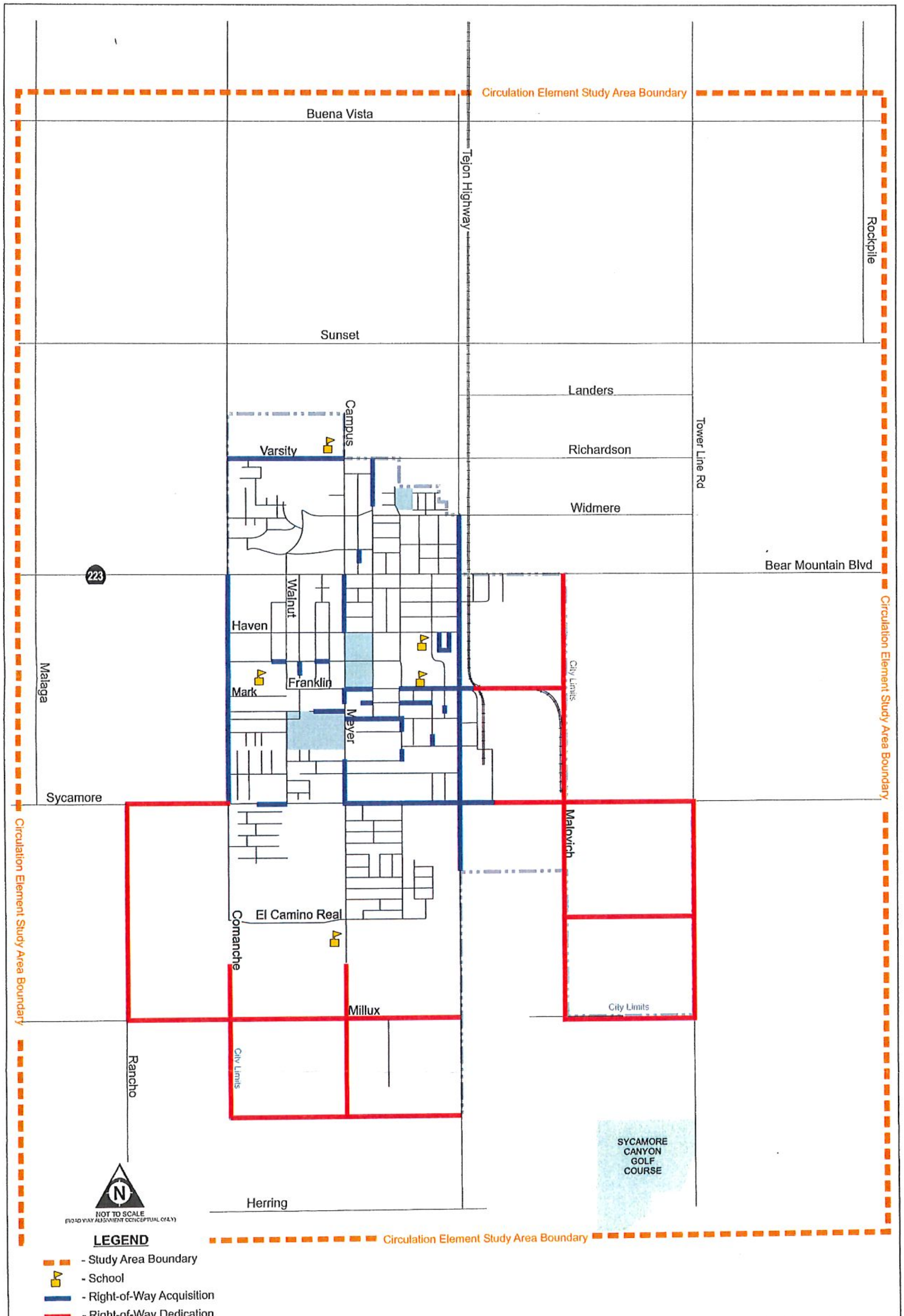
- *Hood Street between Comanche Drive and Walnut Drive – Existing residential development on the north side of the road may restrict full collector width. This segment is vital to the proposed circulation system and the right-of-way will need to be purchased by the city.*
- *Franklin Street east of Tejon Highway/Derby Street – Existing railroad tracks are located on the future alignment of this segment. An offset alignment will be required to provide the necessary connectivity of this future collector roadway.*
- *Sycamore Road near Meyer Street – Existing residential development on the northwest and southeast corners may restrict full arterial width. This development should be purchased by the City to provide necessary intersection improvements. This intersection will play a crucial role in the future circulation system.*
- *Comanche Drive between Schipper Street and SR 223/Bear Mountain Boulevard – Existing residential development on the east side of the road may restrict full arterial width. This sawtooth development should be purchased by the City as necessary to provide a consistent roadway section.*
- *Meyer Street between Sycamore Road and Olsen Street – Existing residential development on the west side of the road may restrict full collector width. The City should purchase this development to provide sufficient right-of-way. Meyer Street north and south of this location has already been widened to full width.*
- *Meyer Street between Haven Street and SR 223/Bear Mountain Boulevard – Existing residential development on the east and west sides of the road may restrict full collector width. Additional right-of-way immediately south of SR 223/Bear Mountain Boulevard will be crucial to the development of the signalized intersection. Existing residential development fronting Meyer Street on the east side of the street will be required to dedicate further right-of-way to allow full collector width. Newer development along the west side of this segment has already dedicated necessary right-of-way for a portion of this segment.*
- *Tejon Highway/Derby Street between Sycamore Road and Franklin Street – Existing residential and agricultural/industrial development on the east and west sides of the road may restrict full arterial width. This roadway serves as a boundary between industrial and residential uses. Development of the full arterial roadway, with median, is vital to providing a proper buffer and sufficient access control. The City should purchase the necessary right-of-way to construct this roadway to full width.*
- *Tejon Highway/Derby Street between Franklin Street and Varsity Road/Richardson Road – Existing residential and commercial development on the west side and the railroad tracks on the east side of the road may restrict full arterial width. A substandard roadway section may be needed along this segment due to the proximity to the railroad tracks. Limiting access along this segment will be crucial to the successful operation as an arterial roadway.*

- *Malovich Road between Sycamore Road and Franklin Street – The railroad tracks on the west side of the roadway alignment may restrict full collector width. As this roadway is constructed, sufficient right-of-way will need to be provided to allow development of the roadway to the full width. Although this roadway will not be a high volume road, it will be vital to heavy vehicle circulation.*

Figure 5-3 shows several locations that require additional right-of-way to be acquired and/or dedicated in order to fully develop the necessary roadways. This map was developed from input by City staff and the improvements recommended above. In developed areas of Arvin, this map represents locations that the City will need to acquire right-of-way to develop the planned street system. In the relatively undeveloped areas, right-of-way should be preserved in undeveloped areas in anticipation of the planned circulation needs of the community according to the Circulation Map. These locations will need to be dedicated for the roadway right-of-way as development occurs. The right-of-way acquisition and dedication locations shown in Figure 5-3 are approximate and may only be necessary for portions of the segments shown. Additional right-of-way may be necessary as further development occurs.

Figure 5-4 shows locations of alleys and streets within Arvin that are unpaved or have substandard paving. These locations are mostly located within older development. In some locations, the alleys provide the only source of access to adjacent development. Where alleys are the only source of access, they should be improved to local street standards or additional access should be provided from the established street system.

Another issue that should be addressed is the potential for "road diets" on some existing roadways. For instance, Franklin Street is currently a 4-lane undivided roadway. This configuration provides more than adequate through capacity, but does not provide for turning traffic. As a collector, this roadway serves as a balance between access and through travel. An example of a road diet for this type of roadway would be to remove 1 through lane in each direction and provide a two-way left-turn lane and bike lanes in each direction. The addition of the two-way left-turn lane provides additional capacity for turning movements, while the bike lanes provide additional facilities for non-vehicular travel.



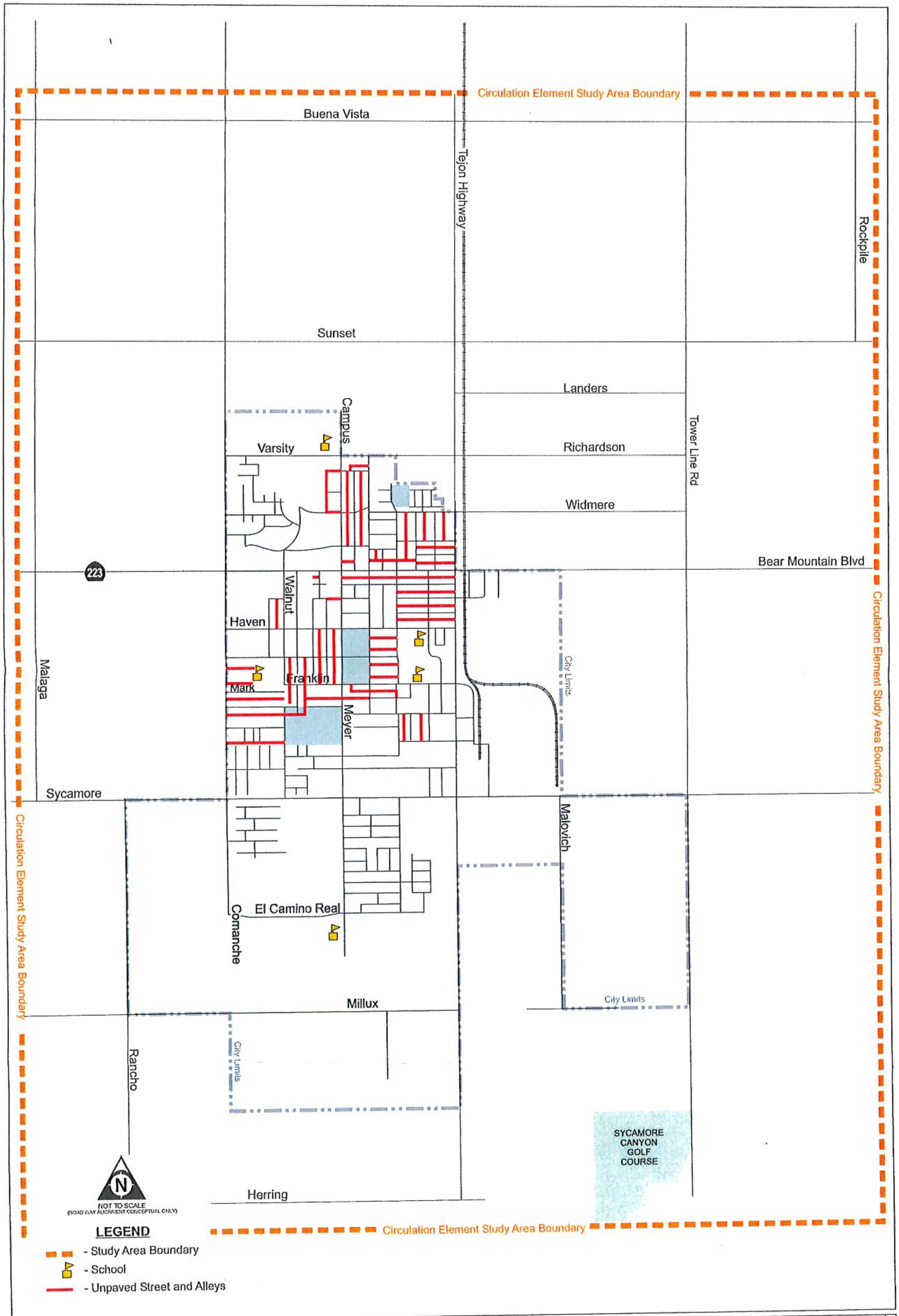
TPG Consulting

RIGHT - OF - WAY ACQUISITION/DEDICATION MAP

Arvin Circulation Element
Kern County, CA

Figure 5-3

08-1158



UNPAVED STREETS AND ALLEYS

Arvin Circulation Element
Kern County, CA

Figure 5-4

08-1158

Transit

As the community grows, demand for public transit services will increase. Historical trends in other Valley communities suggest that this increase in transit demand will actually be higher than the increase in population. Coupled with increased requirements brought about by development and air quality issues, demand for increased public transit service is expected over the period covered by this Circulation Element. All future transit growth should develop within the boundaries of the City's adopted public transit mission statement.

The City will continue to operate both demand-response and fixed route services. Based upon existing evaluations and plans the City should establish a distinct fixed route service along the City's periphery to better facilitate the intracity travel needs of their residents, and to free up the use of the Dial-A-Ride service for seniors and disabled patrons who are in need of door-to-door transportation services. Service hours for both services should be extended when possible to facilitate work to home travel, and the cost-effectiveness of providing service to outlying areas should be continually evaluated as Arvin expands.

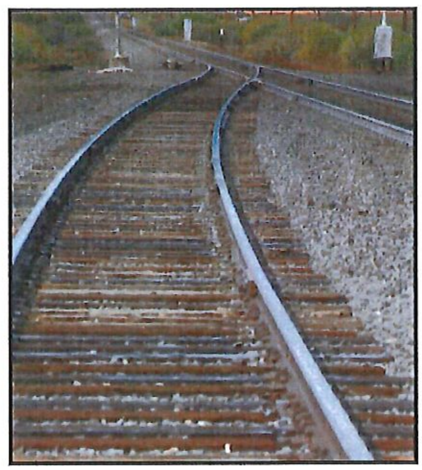
Specific service changes will be implemented through the City's most recent Transit Development Plan (TDP). This Plan, updated every 3-5 years by the Kern Council of Governments in association with the City, provides system recommendations based on current service conditions. The system will continue to be funded through Federal Transit Administration (FTA) Section 5311 Capital and Operating Assistance grants, State Transportation Development Act (TDA) funds, and other available federal, state, and local funds.

A transfer station should be established within the timeline of this Circulation Element in order to facilitate better coordination between Arvin Transit and Kern Regional Transit. This transfer site should be located at the City Hall complex, or another central downtown location, and include a park-and-ride lot to accommodate intercity transit use.

Arvin's transit system should be promoted as a way to limit local pollution sources. All Arvin Transit buses should include bike racks to expand opportunities for multi-modal travel, and the City should continue conversion of its transit fleet to compressed natural gas (CNG). The *2007 Destination 2030 Regional Transportation Plan* for Kern County calls for the replacement of all full- and mid-size diesel buses with alternative fuel buses within both metropolitan Bakersfield and rural communities, as funding becomes available.

As identified in the *Coordinated Human Services Transportation Plan (2007)*, all future land use planning should focus on transit-oriented "smart growth" development that supports public transit and walkable communities. Opportunities for infill and retrofitting of existing developments should also include a transit component within their planning process.

Rail



Future railroad service may present significant opportunities to the community of Arvin. As industrial development continues to fill out on the east side of Arvin, the potential to ship freight by rail should be promoted. The ability to remove heavy truck trips from the roads will benefit the circulation system as a whole, from roadway capacity to air quality benefits. As development occurs along the existing railroad tracks, sufficient buffers should be placed from residential and commercial uses and proper access should be developed for industrial uses. Construction of a freight receiving station should be considered for industrial uses without direct access to the railroad tracks.

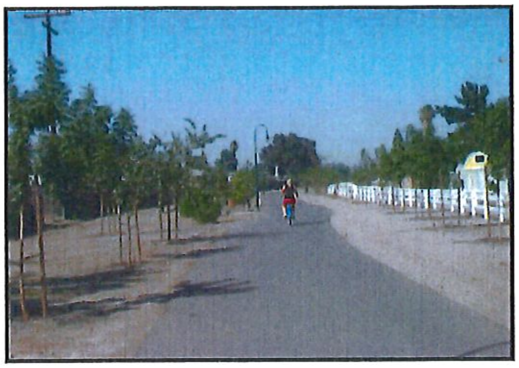
Based on the Arvin town hall meeting for the Kern Regional Blueprint Program, some participants indicated the desire for a commuter rail system. Should the County pursue a potential county-wide light-rail system at some point in the future, the City of Arvin should encourage and/or participate in the development of this system. However, a light-rail system is not something that the City of Arvin is capable of developing on its own.

Bicycle, Pedestrian, and Trails

Arvin's climate and topography are well suited to alternative modes of travel such as bicycling and walking. These inexpensive, energy-efficient modes of travel result in decreased parking demand, less automobile congestion, and help to reduce point-source levels of air pollution, and as such, should be promoted as viable modes of travel within Arvin. Future enhancements to both modes of travel should focus on providing safe and convenient routes throughout the city.

Future bikeways in Arvin will be classified as Class I (bike path) and Class II (bike lane) facilities as specified in the Caltrans Highway Design Manual Standards.

Class I facilities, or bike paths, are typically multi-use paths that occur along a separate right-of-way. Class II facilities, or on-street bike lanes, provide appropriate pavement striping and markings to delineate bicyclist right-of-way along streets or highways Bike lanes will be delineated along all proposed collectors. The following table (Table 5-2) and Figure 5-5 delineate Arvin's proposed bicycle facilities.



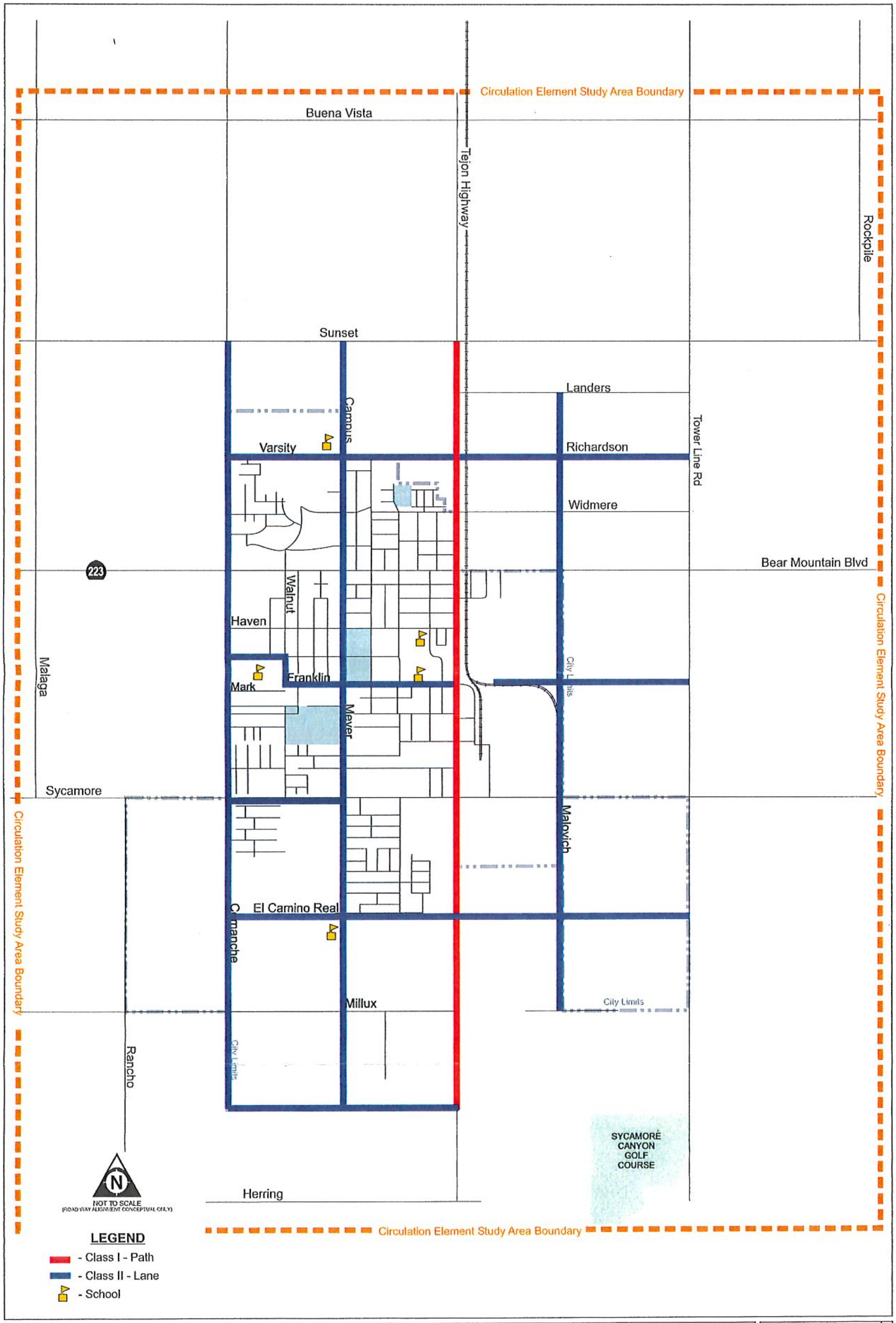
The Class I bike path located along Tejon Highway/Derby Street will provide a recreational trail for bicyclists, pedestrians, joggers, dog walkers, etc. The path will consist of a separate paved facility along the east side of Tejon Highway/Derby Street and the existing railroad tracks. This alignment may require the acquisition of additional right of way from the railroad, but will provide the best possible linkage between existing and planned residential neighborhoods in the north and south sections of town. The path design should include pathway amenities such as lighting, fencing, signage, and landscaping to ensure user safety and enhance the path's appeal.

Arvin's current bikeway facilities will be expanded and/or modified in conjunction with the proposed street circulation improvements. Bicycle use should be considered in all phases of transportation planning regarding new roadways, roadway redevelopment, and capacity improvements. Bicycle safety should be a key factor in the design and implementation of all future bicycle facilities projects, and all projects should include the designation of secure bicycle storage lockers and/or parking adjacent to key destination points within the City.

Pedestrian circulation within Arvin will be provided for by the system of street sidewalks. Arvin's pedestrian facilities will be expanded and/or modified in conjunction with the proposed street circulation improvements. The implementation of all future road projects and developments should include pedestrian facilities aimed at enhancing and improving pedestrian access and safety within the city; Lighting, signage, and street markings help to encourage pedestrian use and provide a greater perception of safety. Priority should be given to pedestrian projects involving areas of the City which currently have no or inadequate sidewalks, and new developments (both residential and commercial) should be designed to be pedestrian-friendly.

TABLE 5-2:
FUTURE (2030) BICYCLE FACILITIES

Roadway	Boundaries	Route Direction	Type
Walnut Drive	Hood Street to Mark Street	North-South	Class II - lane
Campus Drive	Sunset Boulevard to SR223/Bear Mountain Boulevard	North-South	Class II - lane
Meyer Street	SR 223/Bear Mountain Boulevard to South City Limits	North-South	Class II - lane
Tejon Highway/Derby Street	Varsity Street to Millux Road	North-South	Class I - path
Malovich Road	Sunset Boulevard to Millux Road	North-South	Class II - lane
Varsity Road	Comanche Drive to Tejon Highway/Derby Street	East-West	Class II - lane
Richardson Road	Tejon Highway/Derby Street to Tower Line Road	East-West	Class II - lane
Hood Street	Comanche Drive to Walnut Drive	East-West	Class II - lane
Franklin Street	Walnut Drive to Tower Line Road	East-West	Class II - lane
El Camino Real	Comanche Drive to Tower Line Road	East-West	Class II - lane
South City Limits	Comanche Drive to Tejon Highway/Derby Street	East-West	Class II - lane



TPG Consulting

FUTURE BICYCLE FACILITIES

Arvin Circulation Element
Kern County, CA

Figure 5-5

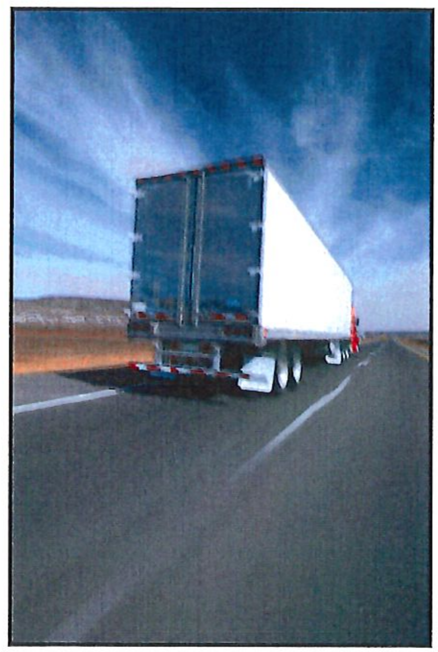
08-1158

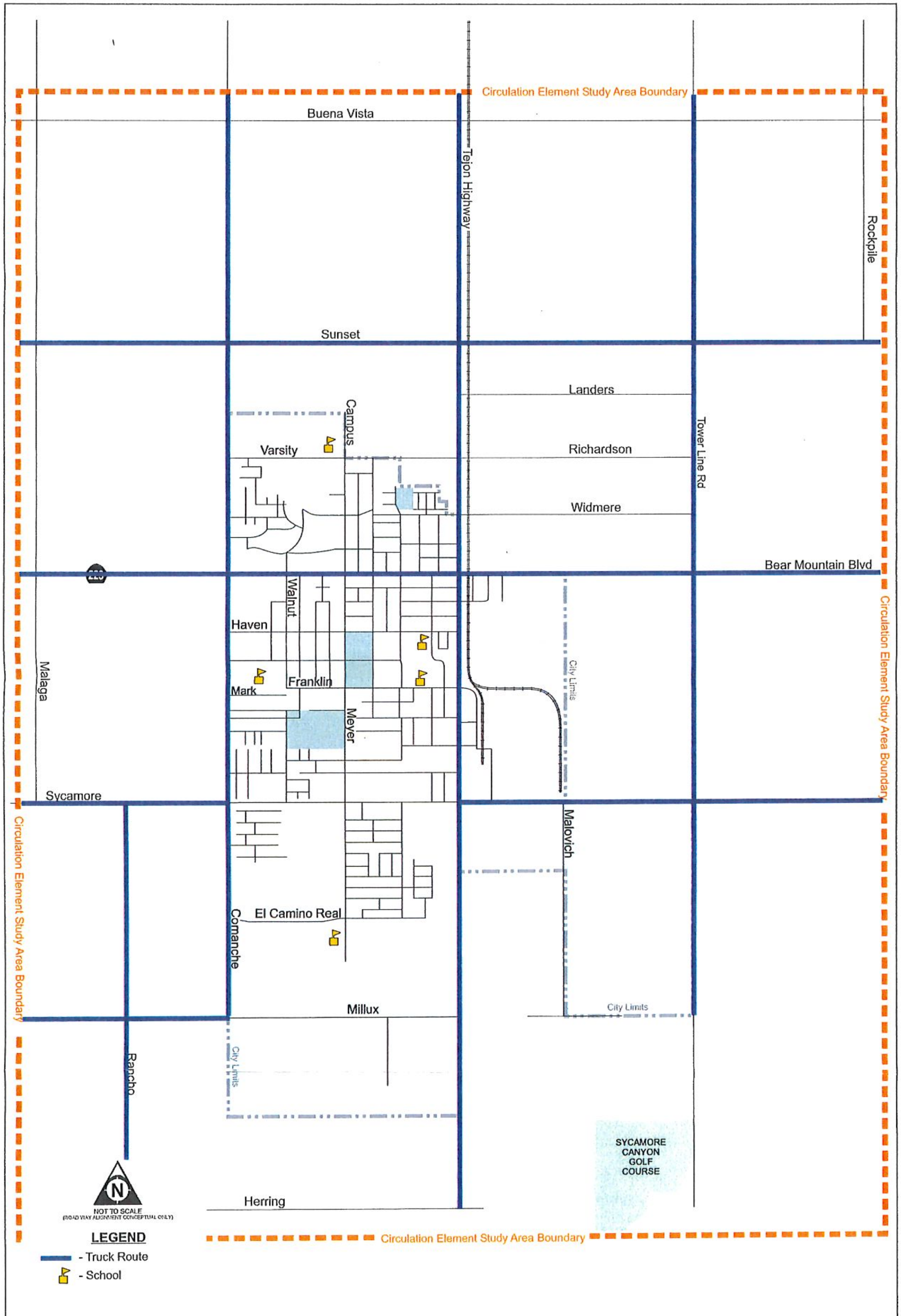
All future commercial and residential centers within Arvin should be designed to accommodate both bicyclists and pedestrians. New subdivisions should improve "walkability" by providing ingress and egress points to surrounding areas, and incorporating multi-use trails within their site plans. These residential trails should be designed to provide linkage to the Tejon Highway/Derby Street path where possible.

Truck Routes and Goods Movement

Based on the currently adopted land plan, the City of Arvin will experience an increase in the amount of industrial commercial development. This will lead to a significant increase in goods movement. Even with the potential increase in rail transport, the movement of goods by truck and trailer will still be an integral part of Arvin's industrial and commercial uses. As such, the truck routes within the City will need to change to reflect the increase in development. Figure 5-6 shows the proposed future truck routes in the study area. The city should encourage heavy vehicles to use truck routes and avoid traveling through residential areas.

Special consideration needs to be given to the proposed truck routes. Turn lane lengths, turn width requirements, sight distance, truck loading areas, and other physical requirements of the roadways need to be considered in the design of specified truck routes. Trucks should also be discouraged from parking on-street except where necessary to load/unload in commercial areas. Industrial development should provide sufficient on-site loading area to accommodate their freight loading needs without impacting the adjacent roadways.





TPG Consulting

FUTURE TRUCK ROUTES

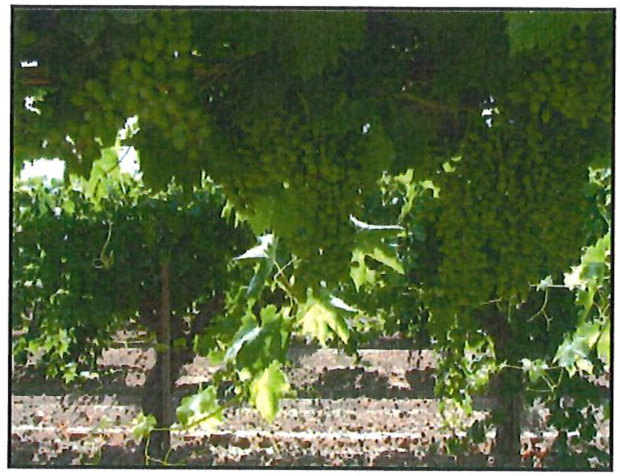
Arvin Circulation Element
Kern County, CA

Figure 5-6

08-1158

Transportation System Management and Transportation Demand Management

The use of TSM and TDM measures can greatly affect the future of Arvin's circulation system. Development of the TSM and TDM measures will coincide with the development of all aspects of the circulation system (roads, transit, bicycle, etc.). The city should implement strategies to reduce vehicle trips and increase the efficiency of the roadway system. Periodic review of traffic signal timing throughout the city will increase the efficiency of the roadways as development occurs and travel patterns change. The development of a multi-modal facility and park-and-ride lot will provide opportunities to remove vehicular trips from the roadways. Encouraging flexible work schedules and telecommuting will reduce peak congestion periods. By incorporating these strategies and others like them, TSM and TDM will provide for a better circulation system in Arvin.



Appendix A:
Technical Paper #1 - Level of Service Methodology

Arvin Circulation Element Update
Technical Paper #1 – Level of Service Methodology

April 22, 2008

Prepared for the
City of Arvin
200 Campus Drive
Arvin, Ca. 93203
661.854.3134

Prepared by:
TPG Consulting, Inc.
222 N. Garden St., Suite 100
Visalia, Ca. 93291
559.739.8072

Arvin Circulation Element Update
Technical Paper #1
Level of Service Methodology

TPG Consulting was retained by the City of Arvin and Kern County Council of Governments to update the City's Circulation Element. This update will provide the framework and methodology for identifying the existing and future roadway system.

Level of Service Methodologies

In determining the criteria and methodology for the formulation of the segment analysis procedure and level of service standard in the City of Arvin three (3) different approached were considered: the *2000 Highway Capacity Manual (HCM)*, the *2002 Florida Tables*, and the City of Bakersfield Segment Tables (Bakersfield Tables). The following discussion briefly explains the different methodologies.

2000 HCM

The methodology for determining the level of service along a roadway segment shown in Chapter 15, Urban Streets, of the *2000 HCM*, is based on the following inputs and calculations:

- Classification of roadway segment
- Length of roadway segment
- Number of intersections along the roadway segment
- Free-flow speed
- Running time
- Signalized intersection delay

The above inputs and calculations are based on field collected data.

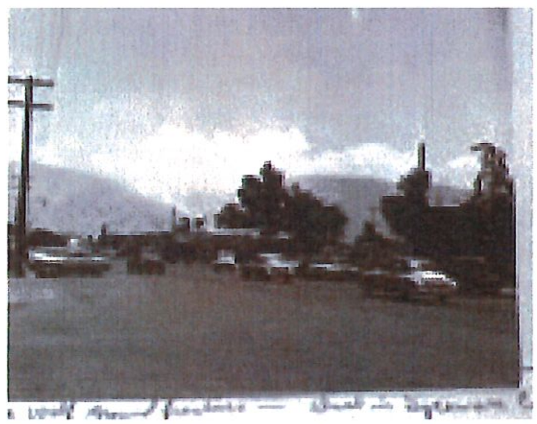
For analysis purposes, the *HCM 2000* defines six levels of service for various facility types. The six levels are given letter designations ranging from "A" to "F", with "A" representing the best operating conditions and "F" the worst. Quantifiable measures of effectiveness that best describe the quality of operation on the subject facility type are used to determine the facilities level of service. For segments, the quantifiable measure of effectiveness is volume to capacity measurements.

2002 Florida Tables

The *Florida Tables* are generalized planning tables based on the definitions and measurement techniques of the *HCM 2000*. This methodology incorporates both signalization characteristics (number of signals per mile) and roadway characteristics (number of lanes, left-turn pockets, divided/undivided) into the level of service determination. The *Florida Tables* separate facility types into freeways, state arterials with both interrupted (signalized) and uninterrupted (non-signalized) flow, and non-state roadways. Within these various classifications, the facilities are separated by number of lanes and divided versus undivided. There are also adjustments for facility types not given in the tables. For each facility type under each classification are levels of service "A" through "F" with corresponding traffic volumes. These volumes are the maximum amount of traffic that a given facility with given characteristics can carry and maintain a given level of service. This maximum volume per level of service is also called the capacity of the facility.

Bakersfield Tables

The City of Bakersfield has developed tables defining the roadway level of service, based on the volume of a roadway versus the capacity by roadway facility type. These tables are based on the *1985 Highway Capacity Manual*, *Transportation Research Board (TRB) Special Report 209*, and *TRB Circular 212*. It should be noted that the *1985 Highway Capacity Manual* has been reviewed and updated and any updates to calculations and/or methodologies are shown in the *2000 HCM*. A copy of the tables is attached.



Level of Service Analysis Methods

For purposes of the City of Arvin Circulation Element update, TPG has chosen to use the methodologies from *2002 Florida Tables*, as amended in May 2007. Segment analysis was deemed the most appropriate analysis technique for General Plan detail and a modified *Florida Table* technique was used to yield the best results for a community like Arvin. Using this methodology TPG customized a series of segment volumes specifically for Arvin. This process developed the daily *Arvin Segment Tables*, which will be used to determine the levels of service for the study segments shown in the Circulation Element update. Table 1 shows the levels or service for the roadway segments based on the number of lanes, median type and annual average daily volumes. Table 2 shows the adjustment factors to be applied to Table 1 based on number of lanes, median types and the presence/absence of left-turn lanes.

TABLE 1:
CITY OF ARVIN
ANNUAL AVERAGE DAILY VOLUMES
SEGMENT LEVEL OF SERVICE DESCRIPTION

Number of Lanes	Median (Divided/Undivided)	Level of Service A	B	C	D	E
Major City Arterials/Regionally Significant County Roadways						
2	Undivided	***	***	7,000	13,600	14,600
4	Divided	***	***	16,400	29,300	30,900
6	Divided	***	***	25,700	44,100	46,400
City Collector signalized intersection analysis						
2	Undivided	***	***	4,400	9,400	12,000
4	Divided	***	***	10,300	20,200	24,000
State Route 223 Two-Way Arterials						
Class I (0.00 to 1.99 signalized intersections per mile)						
2	Undivided	***	4,000	13,100	15,500	16,300
4	Divided	4,600	27,900	32,800	34,200	***
6	Divided	6,900	42,800	49,300	51,400	***
Class II (2.00 to 4.50 signalized intersections per mile)						
2	Undivided	***	***	10,500	14,500	15,300
4	Divided	***	3,700	24,400	30,600	32,200
6	Divided	***	6,000	38,000	46,100	48,400
Class III (more than 4.50 signalized intersections per mile)						
2	Undivided	***	***	5,000	11,800	14,600
4	Divided	***	***	11,700	27,200	30,800
6	Divided	***	***	18,400	42,100	46,300

Source: Florida Department of Transportation Systems Planning Office, May 17, 2007
www.dot.state.fl.us/planning/systems/sm/los/default.htm

**** = no level of service report for these volumes*

TABLE 2:
CITY OF ARVIN
ARTERIAL/NON-STATE ROADWAY ADJUSTMENTS
(CORRESPONDING VOLUMES ALTERED BY INDICATED PERCENTAGE)

Number of Lanes	Median (Divided/Undivided)	Left-turn lanes	Adjustment Factors
2	Divided	Yes	+5%
2	Undivided	No	-20%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

One-way facilities – multiply the corresponding two-directional volumes in table by 0.6

As can be seen in Table 1, higher level of service values may not be achieved on some roadway facilities even with extremely low traffic volumes. These higher quality levels of service cannot be achieved primarily because the roadway characteristics will not allow vehicles to attain relatively high average travel speeds. Therefore these study roadways will never attain LOS “A” or “B”.

For example, Caltrans 2006 traffic count data showed an average two-way daily volume of 8,900 for the segment between Comanche Drive and A Street along State Route 223. Using the Class II, 4-lane divided designation for State Route 223 shown in Table 1 the level of service for this roadway segment would be level of service "C".

Traffic Impact Study/Intersection Analysis

For the purpose of the preparation of individual traffic impact studies or intersection analysis, TPG recommends methodologies shown in the *2000 HCM*. This analysis method should be employed when a major project is proposed or an intersection is experiencing traffic operational problems.

For signalized intersections, "the average control delay per vehicle is estimated for each lane group and aggregated for each approach and for the intersections as a whole".[1] Level of service for the signalized intersection is then based on the aggregated intersection delay. All-way stop-controlled (AWSC) intersections, which have stop signs on all corners of the intersection and are considered unsignalized, function similarly to a signalized intersection in that control delay per vehicle is estimated for each lane group and aggregated for each approach and for the intersection as a whole. Level of service for the AWSC intersection is likewise based on the aggregated intersection delay. Control delay for two-way stop-controlled (TWSC) intersections, which have stop signs on only the minor street approaches, is also per vehicle but is computed for the stop-controlled or minor street movements only since theoretically the through movements on the major street are not experiencing any delay. Since there is no aggregation of delay for a TWSC intersection, there is no intersection level of service as a whole, only levels of service for the individual minor movements. The minor movements generally consist of separate lefts on the major street approaches and all movements on both minor street approaches.

Table 3 shows the six levels of service and their corresponding ranges of average control delay for both signalized and unsignalized intersections. Table 3 also contains a brief traffic flow description for signalized intersections for each level of service category. The level of service diagrams provided throughout the report show the levels of service for the study intersections. The levels of service shown for signalized and AWSC intersections are representative of the overall level of service for that intersection. For TWSC intersections, the level of service shown on the maps is the level of service for the worst operating movement at that intersection as opposed to the overall intersection level of service.

[1] *2000 HCM*, page 16-2.

TABLE 3: INTERSECTION LEVEL OF SERVICE DESCRIPTION			**Intersections**	
			Signalized	**Unsignalized**[1]
Level of Service	**Conditions**	**Signalized Intersection Description**	**Delay (secs/veh)**	**Delay (secs/veh)**
"A"	Free Flow	*Users experience very low delay. Progression is favorable and most vehicles do not stop at all.*	≤ 10.0	≤ 10.0
"B"	Stable Operations	*Vehicles travel with good progression. Some vehicles stop, causing slight delay.*	> 10.0 to 20.0	> 10.0 to 15.0
"C"	Stable Operations	*Higher delays result from fair progression. A significant number of vehicles stop, although many continue to pass through the intersection without stopping.*	> 20.0 to 35.0	> 15.0 to 25.0
"D"	Approaching Unstable	*Congestion is noticeable. Progression is unfavorable, with more vehicles stopping rather than passing through the intersection.*	> 35.0 to 55.0	> 25.0 to 35.0
"E"	Unstable Operations	*Traffic volumes are at capacity. Users experience poor progression and long delays.*	> 55.0 to 80.0	> 35.0 to 50.0
"F"	Forced Flow	*Intersection's capacity is oversaturated, causing poor progression and unusually long delays.*	> 80.0	> 50.0

Source: 2000 Highway Capacity Manual, Transportation Research Board.
[1] Unsignalized intersections include TWSC and AWSC

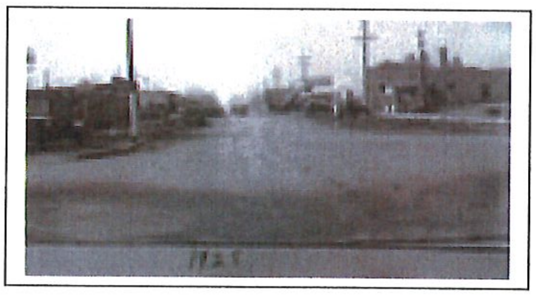
Level of Service Standards

The City of Arvin has adopted a LOS "D" as their standard for the Circulation Element Update and for subsequent traffic impact study purposes.

Sources

This technical paper was prepared using information taken from the following sources:

- *2000 Highway Capacity Manual (HCM 2000)*, Transportation Research Board, 2000.
- *2007 Generalized Quality/Level of Service Tables*, Florida Department of Transportation, May 2007.



Appendix B:
Highway Design Manual, Chapter 1000 - Bikeway Planning and Design

CHAPTER 1000 BIKEWAY PLANNING AND DESIGN

Topic 1001 - General Criteria

Index 1001.1 - Introduction

The needs of non-motorized transportation are an essential part of all highway projects. Topic 105 discusses Pedestrian Facilities with Index 105.3 addressing accessibility needs. This chapter discusses bicycle travel. All city, county, regional and other local agencies responsible for bikeways or roads where bicycle travel is permitted must follow the minimum bicycle planning and design criteria contained in this and other chapters of this manual (See Streets and Highways Code Section 891).

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, it is important to provide a uniform surface for bicyclists and pedestrians. See Index 625.1(1) and 635.1(1) for guidance in accommodating bicyclist and pedestrian needs on resurfacing projects. **When adding lanes or turn pockets, a minimum 4-foot shoulder shall be provided (see Topic 405 and Table 302.1).** When feasible, a wider shoulder should be considered. When placing a roadway edge line, sufficient room outside the line 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 use by bicyclists, can enhance motorist and bicyclist safety and mobility.

1001.2 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.

1001.3 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.

1001.4 Definitions

The Streets and Highway Code Section 890.4 defines a "Bikeway" as a facility that is provided 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 by motorists 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.

1001.5 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 bikeway 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.

1001.6 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 21717 -- Requires a motorist to drive in a bike lane prior to making a turn.

(k) Section 21960 -- Use of freeways by bicyclists.

Topic 1002 - Bikeway Facilities

1002.1 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 pavement marking for bicycle use may be unnecessary. In other cases, prior to designation as a bikeway, routes may need improvements for bicycle travel.

Many rural highways are used by touring bicyclists for intercity and recreational travel. It might 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 4-foot paved roadway shoulders with a standard 4 inch edge line 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, reducing lane width, 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, pavement markings 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 8 feet. The minimum paved width for a one-way bike path shall be 5 feet. A minimum 2-foot wide graded area shall be provided adjacent to the pavement (see Figure 1003.1A).** A 3-foot 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 8-feet, preferably 12 feet 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 12 feet 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 2-foot horizontal clearance to obstructions shall be provided adjacent to the pavement (see Figure 1003.1A).** A 3-foot 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 4-inch white edge line, 2 feet 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 8 feet.** It is desirable that the clear width of structures be equal to the minimum clear width of the path (i.e., 12 feet).

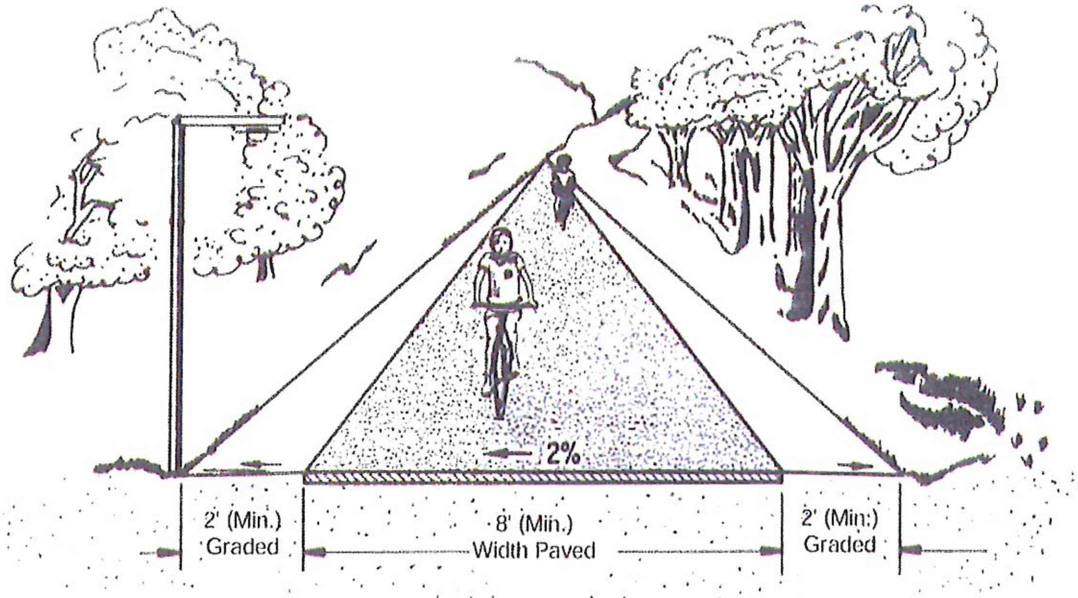
    The vertical clearance to obstructions across the clear width of the path shall be a minimum of 8 feet. Where practical, a vertical clearance of 10 feet is desirable.

(3) *Signing and Delineation.* For application and placement of signs, see the Manual on Uniform Traffic Control Devices (MUTCD), Section 9B.01 and the MUTCD and California Supplement Section 9B.01 and Figure 9B-101. For pavement marking guidance, see the MUTCD, Section 9C.03.

(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.

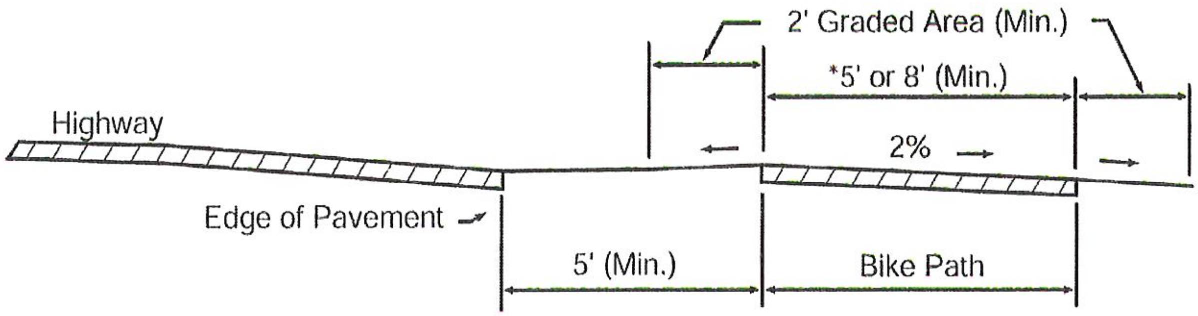
Figure 1003.1A

Two-Way Bike Path on Separate Right of Way



Note: For sign clearances, see MUTCD, Figure 9B-1.

Figure 1003.1B
Typical Cross Section of Bike Path Along Highway



NOTE: See Index 1003.1(5)

*One - Way: 5' Minimum Width
Two - Way: 8' Minimum Width

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 5 feet 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 25 miles per hour except as noted in Table 1003.1.**

Table 1003.1

Bike Path Design Speeds

Type of Facility	Design Speed (mph)
Bike Paths with Mopeds Prohibited	25
Bike Paths with Mopeds Permitted	30
Bike Paths on Long Downgrades (steeper than 4%, and longer than 500')	30

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 percent cross slope is recommended on tangent sections. The minimum superelevation rate of 2 percent 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 12 miles per hour to 0.21 at 30 miles per hour. 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.

Figures 1003.1D and 1003.1E indicate 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.

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

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

Figure 1003.1C

Curve Radii & Superelevations

$$R = \frac{V^2}{15(0.01e + f)}$$

where,

R = Minimum radius of curvature (ft)

V = Design Speed (mph)

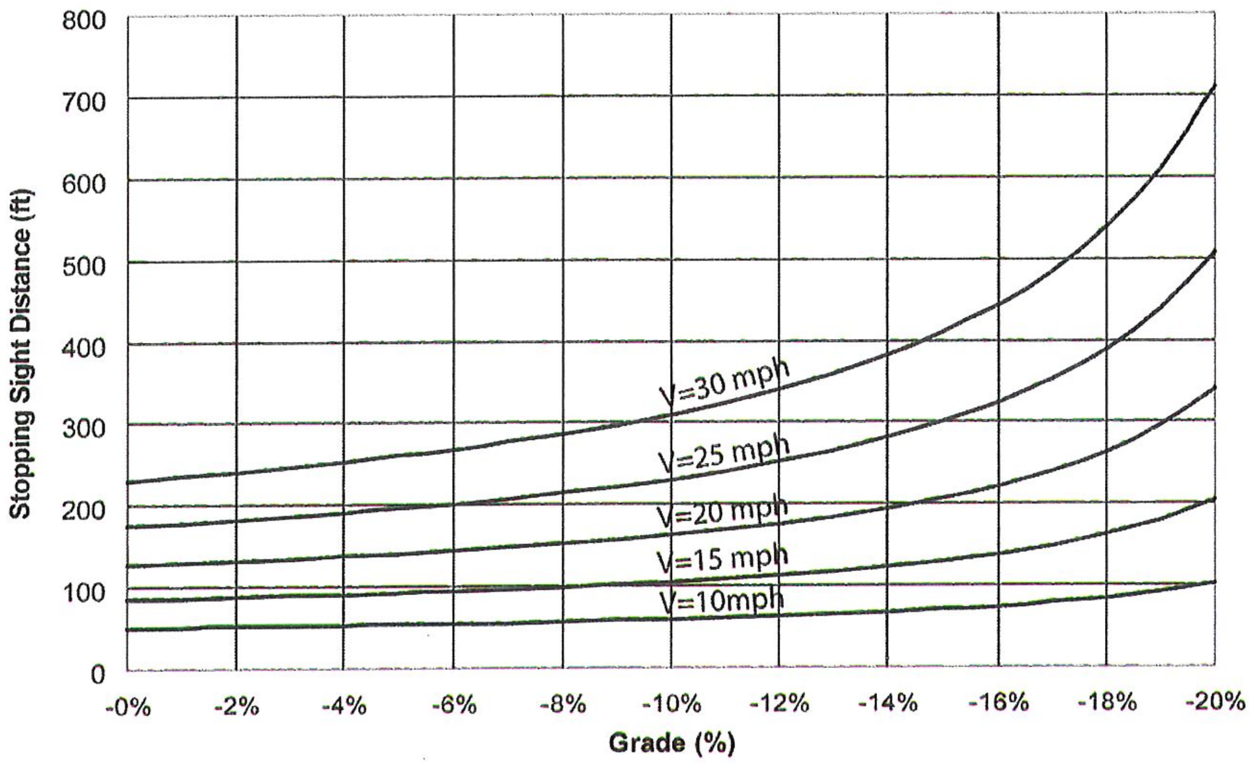
e = Rate of bikeway superelevation, percent

f = Coefficient of friction

Design Speed-V (mph)	Friction Factor-f	Superelevation-e (%)	Minimum Radius-R (ft)
15	0.31	2	46
20	0.28	2	89
25	0.25	2	155
30	0.21	2	261
15	0.31	3	45
20	0.28	3	86
25	0.25	3	149
30	0.21	3	250
15	0.31	4	43
20	0.28	4	84
25	0.25	4	144
30	0.21	4	240
15	0.31	5	42
20	0.28	5	81
25	0.25	5	139
30	0.21	5	231

Figure 1003.1D

Stopping Sight Distance – Descending Grade



$$S = \frac{V^2}{30(f - G)} + 3.67V$$

Where : S = Stopping sight distance (ft)

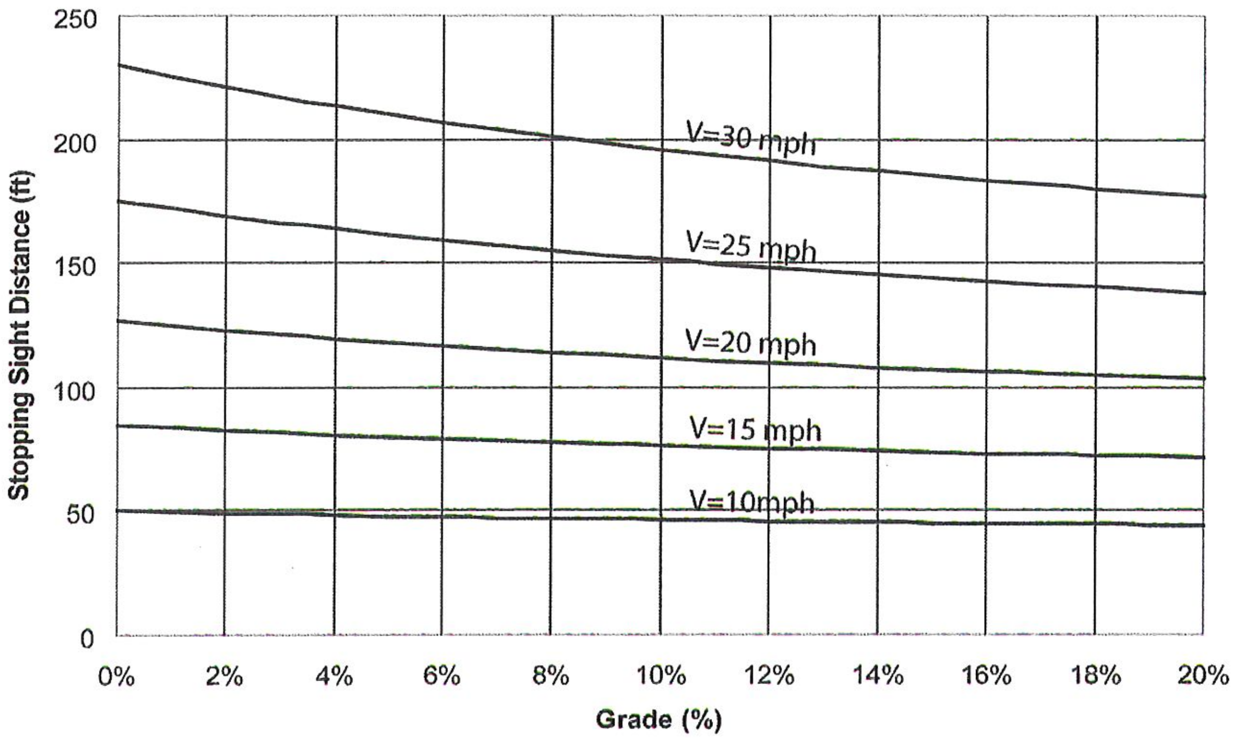
V = Velocity (mph)

f = Coefficient of friction (use 0.25)

G = Grade (ft/ft) rise/run

Figure 1003.1E

Stopping Sight Distance – Ascending Grade



$$S = \frac{V^2}{30(f+G)} + 3.67V$$

Where : S = Stopping sight distance (ft)

V = Velocity (mph)

f = Coefficient of friction (use 0.25)

G = Grade (ft/ft) rise/run

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 line, installing a curve 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 percent. It is desirable that sustained grades be limited to 2 percent if a wide range of riders is to be accommodated. Steeper grades can be tolerated for short segments (e.g., up to about 500 feet). Where steeper grades are necessitated, the design speed should be increased and additional width should be provided for maneuverability.

(13) Pavement Structure. The pavement structure 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 pavement structure. A minimum pavement thickness of 2 inches of Hot Mix Asphalt (HMA) is recommended. HMA (as described in Department of Transportation Standard Specifications), with ½ inch 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 10 feet 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 percent. 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.

(15) Barrier Posts. It may be necessary to install barrier posts at entrances to bike paths to prevent motor vehicles from entering. For barrier post placement, visibility marking, and pavement markings, see the MUTCD and California Supplement, Section 9C.101.

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 1003.1F

Minimum Length of Crest Vertical Curve (L) Based on Stopping Sight Distance (S)

$L = 2S - \frac{1456}{A}$ when S > L

$L = \frac{AS^2}{1456}$ when S < L

Double line represents S = L

L = Minimum length of vertical curve – feet

A = Algebraic grade difference - %

S = Stopping sight distance – feet

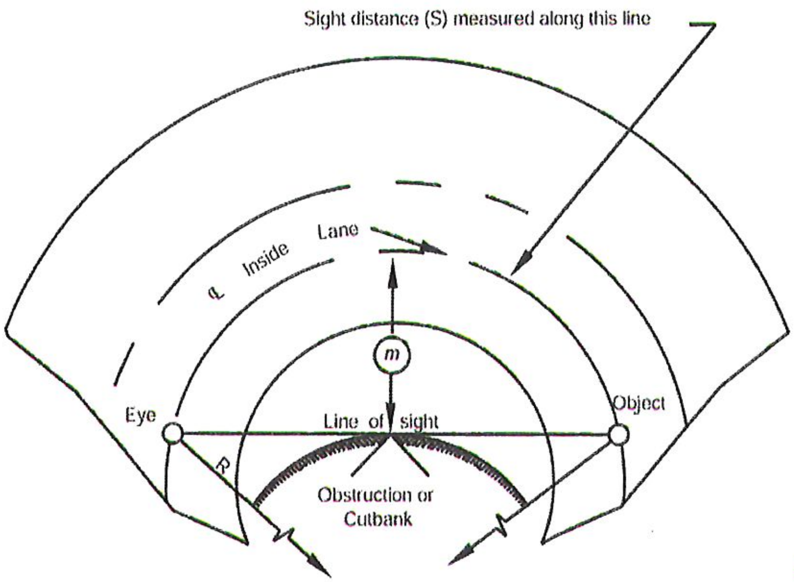
Refer to Figure 1003.1D to determine "S", for a given design speed "V"

Height of cyclist eye = 4½ feet

Height of object = 4 inches

A	S = Stopping Sight Distance (ft)													
(%)	30	50	70	90	110	130	150	170	190	210	230	250	270	290	
3												15	55	95	
4									16	56	96	136	176	216	
5							9	49	89	129	169	209	249	289	
6		S > L				17	57	97	137	177	217	258	300	347	
7					12	52	92	132	172	212	254	300	350	404	
8					38	78	118	158	198	242	291	343	401	462	
9				18	58	98	138	179	223	273	327	386	451	520	
10				34	74	114	155	198	248	303	363	429	501	578	
11			8	48	88	128	170	218	273	333	400	472	551	635	
12			19	59	99	139	185	238	298	363	436	515	601	693	
13			28	68	108	151	201	258	322	394	472	558	651	751	
14			36	76	116	163	216	278	347	424	509	601	701	809	
15		3	43	83	125	174	232	298	372	454	545	644	751	866	
16		9	49	89	133	186	247	318	397	485	581	687	801	924	
17		14	54	95	141	197	263	337	421	515	618	730	851	982	
18		19	59	100	150	209	278	357	446	545	654	773	901	1040	
19		23	63	106	158	221	294	377	471	575	690	816	951	1097	S < L
20		27	67	111	166	232	309	397	496	606	727	859	1001	1155	
21		31	71	117	175	244	325	417	521	636	763	901	1051	1213	
22		34	74	122	183	255	340	437	545	666	799	944	1102	1271	
23		37	77	128	191	267	355	457	570	697	836	987	1152	1329	
24		39	81	134	199	279	371	476	595	727	872	1030	1202	1386	
25	2	42	84	139	208	290	386	496	620	757	908	1073	1252	1444	

Figure 1003.1G
Minimum Lateral Clearance (*m*) on Horizontal Curves



S = Sight distance in feet.
R = Radius of ℄ of lane in feet.
m = Distance from ℄ of lane in feet.

See Figure 1003.1D to determine "S" for a given design speed "V".

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 28" above ℄ inside lane at point of obstruction.

R (ft)	S = Stopping Sight Distance (ft)														
	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
25	2.0	7.6	15.9												
50	1.0	3.9	8.7	15.2	23.0	31.9	41.5								
75	0.7	2.7	5.9	10.4	16.1	22.8	30.4	38.8	47.8	57.4	67.2				
95	0.5	2.1	4.7	8.3	12.9	18.3	24.7	31.8	39.5	48.0	56.9	66.3	75.9	85.8	
125	0.4	1.6	3.6	6.3	9.9	14.1	19.1	24.7	31.0	37.9	45.4	53.3	61.7	70.6	79.7
155	0.3	1.3	2.9	5.1	8.0	11.5	15.5	20.2	25.4	31.2	37.4	44.2	51.4	59.1	67.1
175	0.3	1.1	2.6	4.6	7.1	10.2	13.8	18.0	22.6	27.8	33.5	39.6	46.1	53.1	60.5
200	0.3	1.0	2.2	4.0	6.2	8.9	12.1	15.8	19.9	24.5	29.5	34.9	40.8	47.0	53.7
225	0.2	0.9	2.0	3.5	5.5	8.0	10.8	14.1	17.8	21.9	26.4	31.3	36.5	42.2	48.2
250	0.2	0.8	1.8	3.2	5.0	7.2	9.7	12.7	16.0	19.7	23.8	28.3	33.1	38.2	43.7
275	0.2	0.7	1.6	2.9	4.5	6.5	8.9	11.6	14.6	18.0	21.7	25.8	30.2	34.9	39.9
300	0.2	0.7	1.5	2.7	4.2	6.0	8.1	10.6	13.4	16.5	19.9	23.7	27.7	32.1	36.7
350	0.1	0.6	1.3	2.3	3.6	5.1	7.0	9.1	11.5	14.2	17.1	20.4	23.9	27.6	31.7
390	0.1	0.5	1.2	2.1	3.2	4.6	6.3	8.2	10.3	12.8	15.4	18.3	21.5	24.9	28.5
500	0.1	0.4	0.9	1.6	2.5	3.6	4.9	6.4	8.1	10.0	12.1	14.3	16.8	19.5	22.3
565		0.4	0.8	1.4	2.2	3.2	4.3	5.7	7.2	8.8	10.7	12.7	14.9	17.3	19.8
600		0.3	0.8	1.3	2.1	3.0	4.1	5.3	6.7	8.3	10.1	12.0	14.0	16.3	18.7
700		0.3	0.6	1.1	1.8	2.6	3.5	4.6	5.8	7.1	8.6	10.3	12.0	14.0	16.0
800		0.3	0.6	1.0	1.6	2.2	3.1	4.0	5.1	6.2	7.6	9.0	10.5	12.2	14.4
900		0.2	0.5	0.9	1.4	2.0	2.7	3.6	4.5	5.6	6.7	8.0	9.4	10.9	12.5
1000		0.2	0.5	0.8	1.3	1.8	2.4	3.2	4.0	5.0	6.0	7.2	8.4	9.8	11.2

(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 pavement markings 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 pavement markings 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, 5 feet shall be the minimum width of bike lane where parking stalls are marked.** If parking volume is substantial or turnover high, an additional 1 foot to 2-foot 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, 11 feet or 12 feet (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 35 miles per hour, 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 4 feet. With a normal 2-foot gutter, the minimum bike lane width shall be 5 feet.** The intent is to provide a minimum 4 feet wide bike lane, but with at least 3 feet 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, 4 feet), an additional 3 feet must be provided because bicyclists should not be expected to ride in the gutter. Wherever possible, the width of bike lanes should be increased 6 feet to 8 feet to provide for greater safety. Eight-foot 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 35 miles per hour

Per Topic 301, the minimum lane width standard is 12 feet. There are situations where it may be desirable to reduce the width of the traffic lanes in order to add or widen bicycle lanes or shoulders. In determining the appropriateness of narrower traffic lanes, consideration should be given to factors such as motor vehicle speeds, truck volumes, alignment, bicycle lane width, sight distance, and the presence of on-street vehicle parking. When vehicle parking is permitted adjacent to a bicycle lane, or on a shoulder where bicycling is not prohibited, reducing the width of the adjacent traffic lane may allow for wider bicycle lanes or shoulders, to provide greater clearance between bicyclists and driver-side doors when opened. Where favorable conditions exist, traffic lanes of 11 feet may be feasible but must be approved per Topic 301.

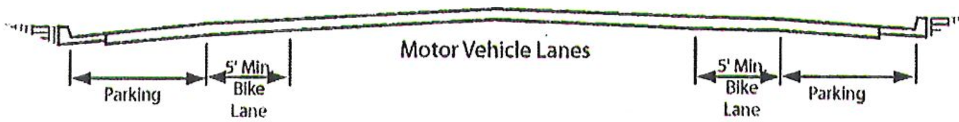
Bike lanes are not advisable on long, steep downgrades, where bicycle speeds greater than 30 miles per hour are expected. As grades increase, downhill bicycle speeds will increase, which increases the problem of riding near the edge of the roadway. In such situations, bicycle speeds can approach those 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 marked, 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) *Signing and Pavement Markings*. Details for signing and pavement marking of Class II bikeways are found in the MUTCD and California Supplement, Section 9C.04.

(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.

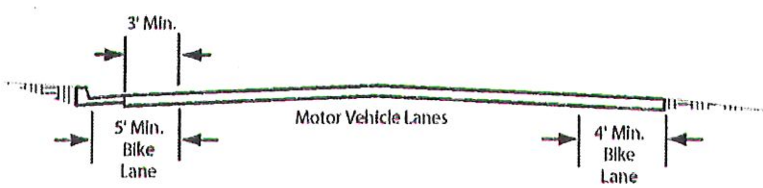
Figure 1003.2A
Typical Bike Lane Cross Sections
(On 2-lane or Multilane Highways)



(1) MARKED PARKING

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

(2) PARKING PERMITTED WITHOUT MARKED PARKING OR STALL



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

(4) TYPICAL ROADWAY IN OUTLYING AREAS PARKING RESTRICTED

Note: For pavement marking guidance, see the MUTCD and California Supplement, Section 9C.04

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.

(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.

For Class II bikeway signing and lane markings, see the MUTCD and California Supplement, Section 9C.04.

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 4 feet or 5 feet 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 1003.2D should also be used for multilane ramp intersections. Additionally, the outside through lane should be widened to 14 feet 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.

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 designate the route as a bikeway 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.

Figure 1003.2B

Typical Bicycle/Auto Movements at Intersections of Multilane Streets

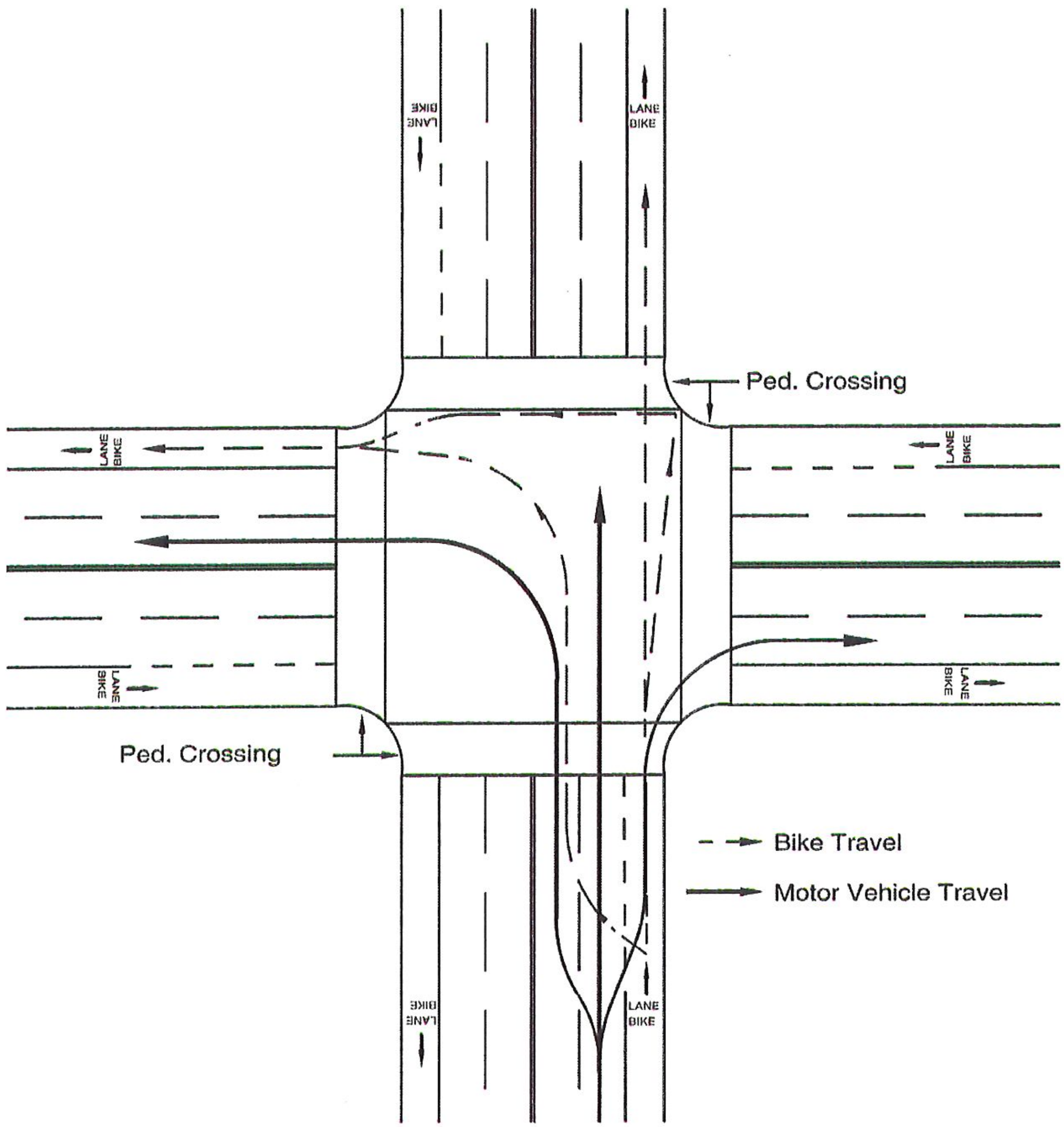
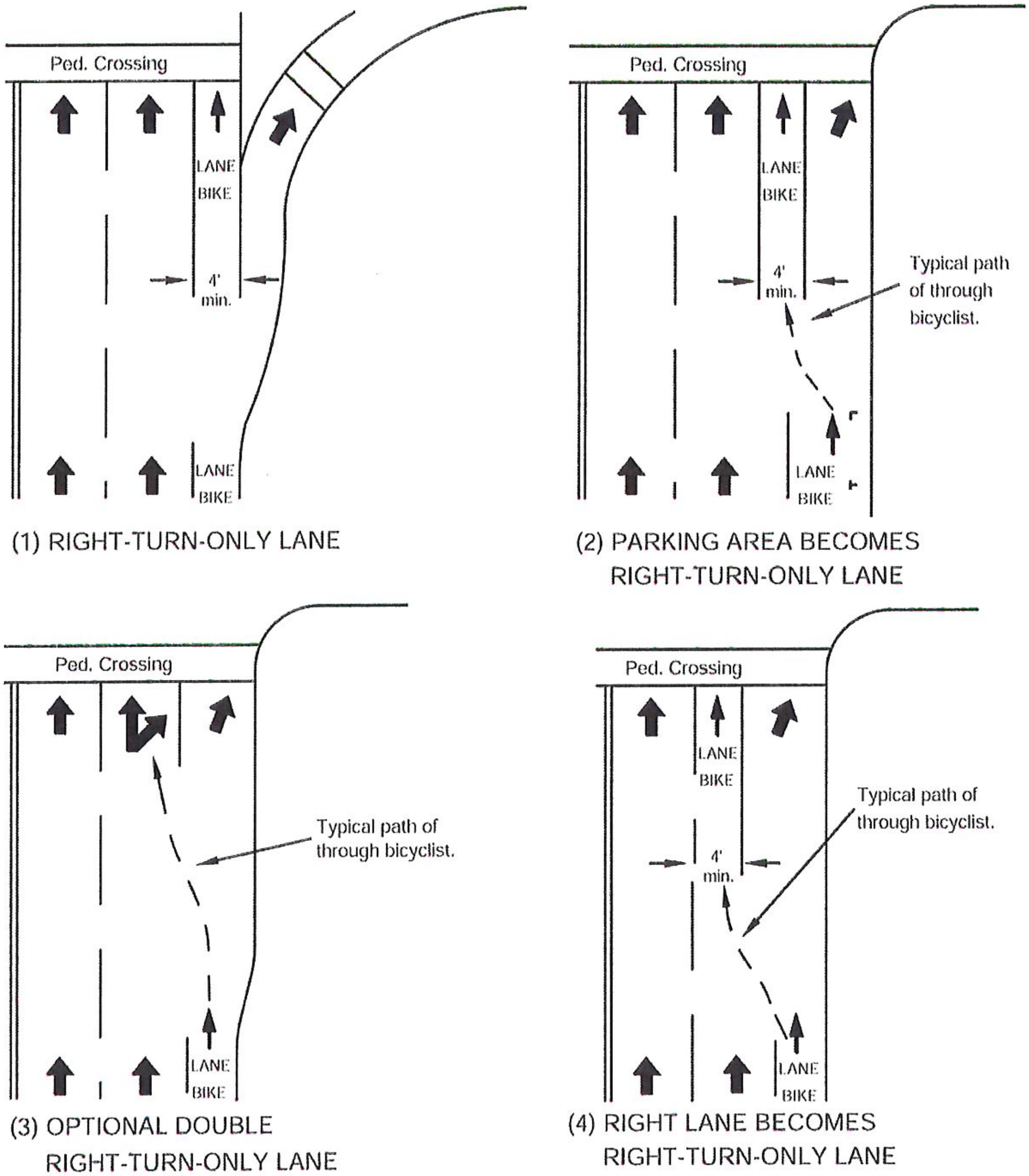
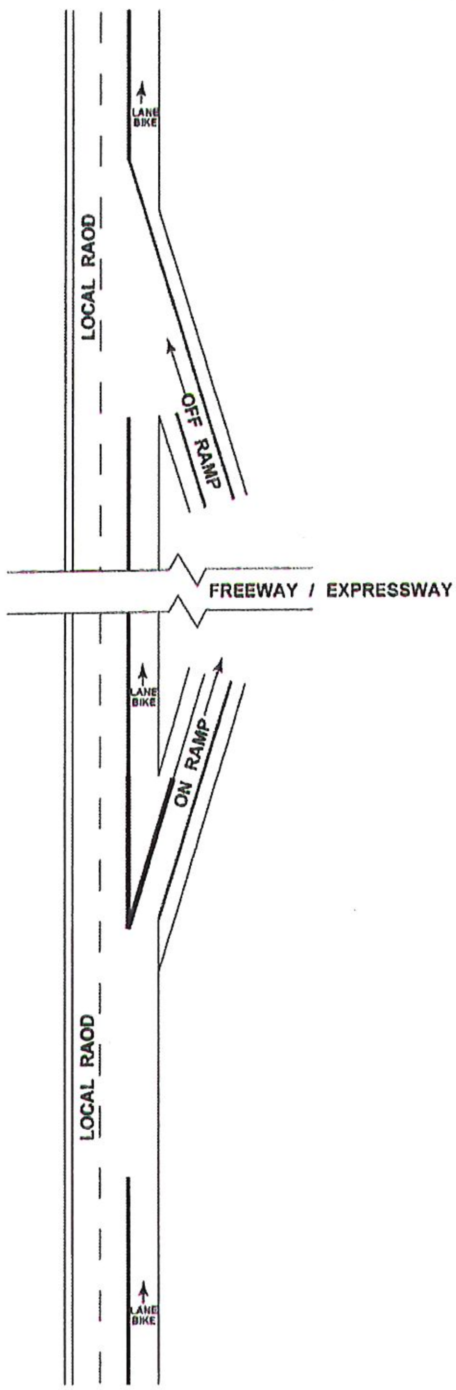


Figure 1003.2C
Bike Lanes Approaching Motorist Right-turn-only Lane



Note: For bicycle lane markings, see the MUTCD and California Supplement, Section 9C.04.

Figure 1003.2D
Bike Lanes Through Interchanges



Notes:

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

2.) 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 4 feet or 5 feet if a gutter exists. If the shoulder width is not available, the designated bike lane shall end at the previous local raod intersection.

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

(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. 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. For typical signing, see the MUTCD and California Supplement, Figures 9B-5 and 9B-6.

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.

Within the Interchange area the bike route shall require either an outside lane width of 16-foot or a 12-foot lane and a 4-foot 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 designated 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 Design 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
- Bridge Railing height

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 the MUTCD and California Supplement, Section 9B.101.

Where no reasonable alternate route exists within a freeway corridor, the Department should coordinate 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 pavement markings 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 pavement markings 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 54 inches high to minimize the likelihood of bicyclists falling over the railings. Standard bridge railings which are lower than 46 inches can be retrofitted with lightweight upper railings or chain link fence suitable to restrain bicyclists. See Index 208.10(6) for guidance regarding bicycle railing on bridges.

Separate highway overcrossing structures for bikeway traffic shall conform to Department standard pedestrian overcrossing design loading. The minimum clear width shall be the paved width of the approach bikeway but not less than 8 feet. 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 ¼ inch from the lower edge of an 8-foot long straight edge when laid on the surface in any direction.

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 the MUTCD and California Supplement, Chapter 3B 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.

Table 1003.6
Bikeway Surface Tolerances

Direction of Travel	Grooves [1]	Steps [2]
Parallel to travel	No more than ½" wide	No more than ⅜" high
Perpendicular to travel	---	No more than ¾" high

Notes:

(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.

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, 1" x ¼" steel cross straps should be welded to the grates at a spacing of 6 inches to 8 inches 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 ½ inch.

(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.

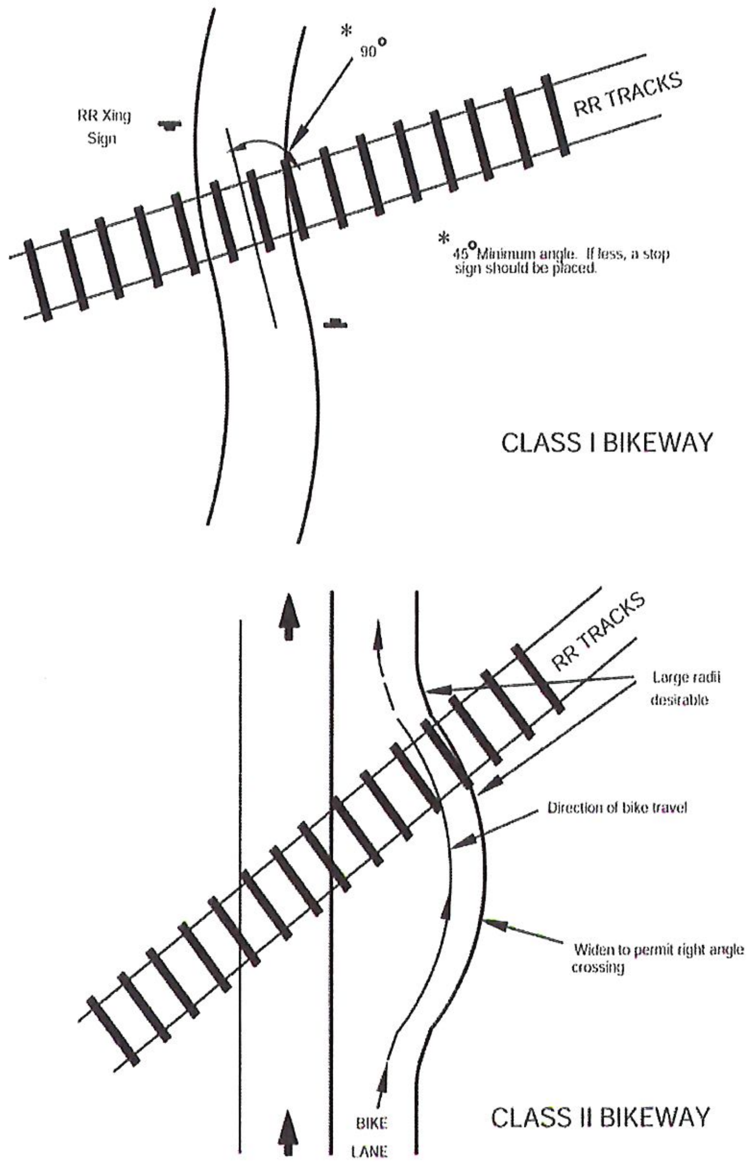
Pavement should be maintained so ridge buildup does not occur next to the rails. In some cases, timber plank crossings can be justified and can provide for a smoother crossing. Where hazards to bicyclist cannot be avoided, appropriate signs should be installed to warn bicyclists of the danger.

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. See the MUTCD, Section 9C.06.

Figure 1003.6A
Railroad Crossings



Appendix C:
Community Workshop Presentation

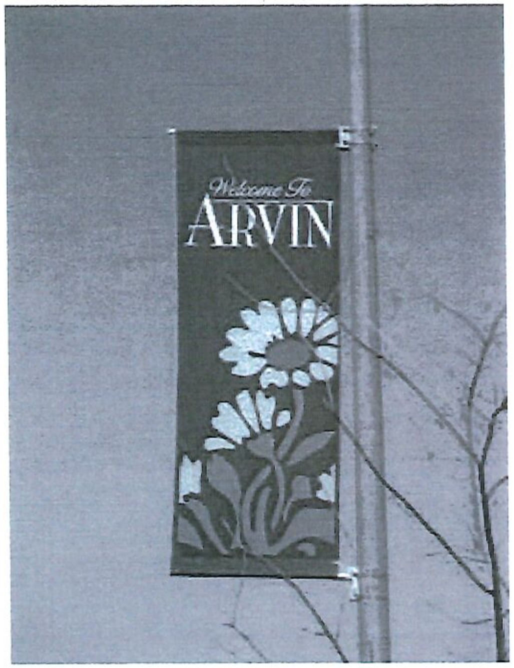
TPG Consulting Incorporated

Exceeding expectations in
Engineering, Planning & Transportation

City of Arvin Circulation Element Update
&
Impact Fee Study

Community Workshop Meeting Agenda
Wednesday, July 9, 2008
6:00 – 8:00 pm

1. Sign-in Sheet
2. Welcome/Introductions
3. Circulation Elements
4. Transportation Components
5. Keys to Success
6. Current Conditions
7. Key Issues/Challenges
8. Exercise
9. Schedule
10. Closing Questions/Comments



Arvin Circulation Element Update

Community Workshop Presentation

July 9, 2008

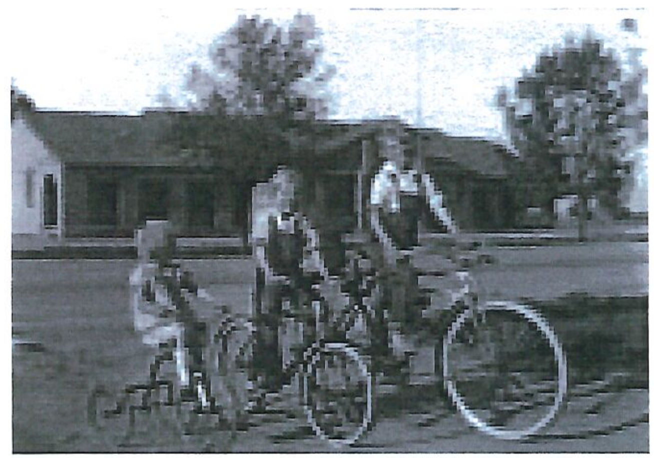
IPG Consulting 2007

Exceeding Expectations

Introduction

- The City and Kern COG intend to:
  - Update the Current Circulation Element
  - Based on Public Participation Program
  - Reflective of Regional Plans
  - Impact Fee Program to Support Development
  - Prepare a Multi-Modal Plan

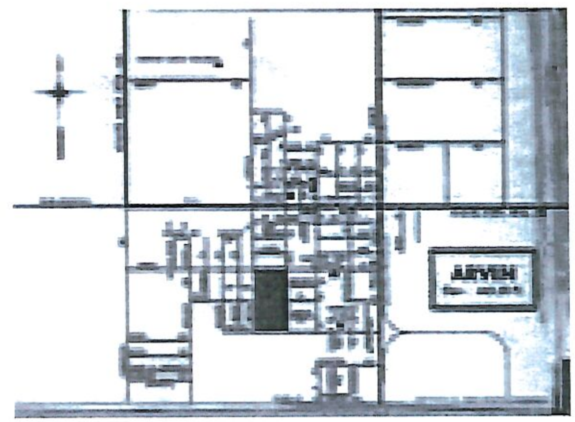
- Agenda
  - Circulation Elements
  - Transportation Components
  - Keys to Success
  - Current Conditions
  - Key Issues/Challenges
  - Exercise
  - Schedule



TPG Consulting 2007 Small Business of the Year

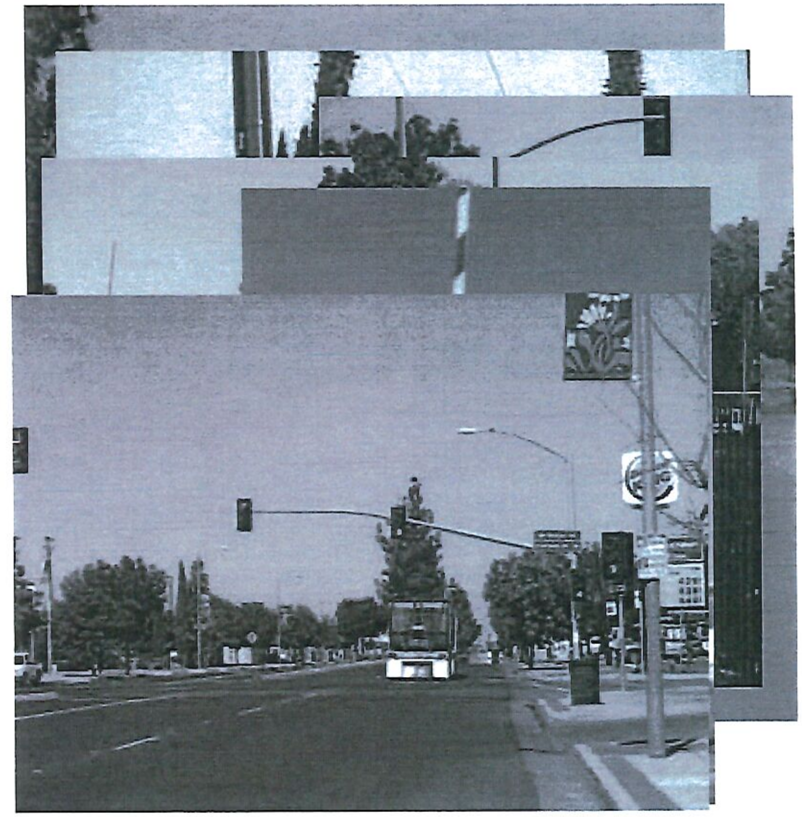
Circulation Elements

- Required by State Law as part of the General Plan
- Defines the policies, plans and goals relevant to the current and future circulation requirements
- Multi-modal systems
- Creates a plan to meet the transportation demands of the future
- Supports
  - Planned land uses
  - Economic development



Transportation Components

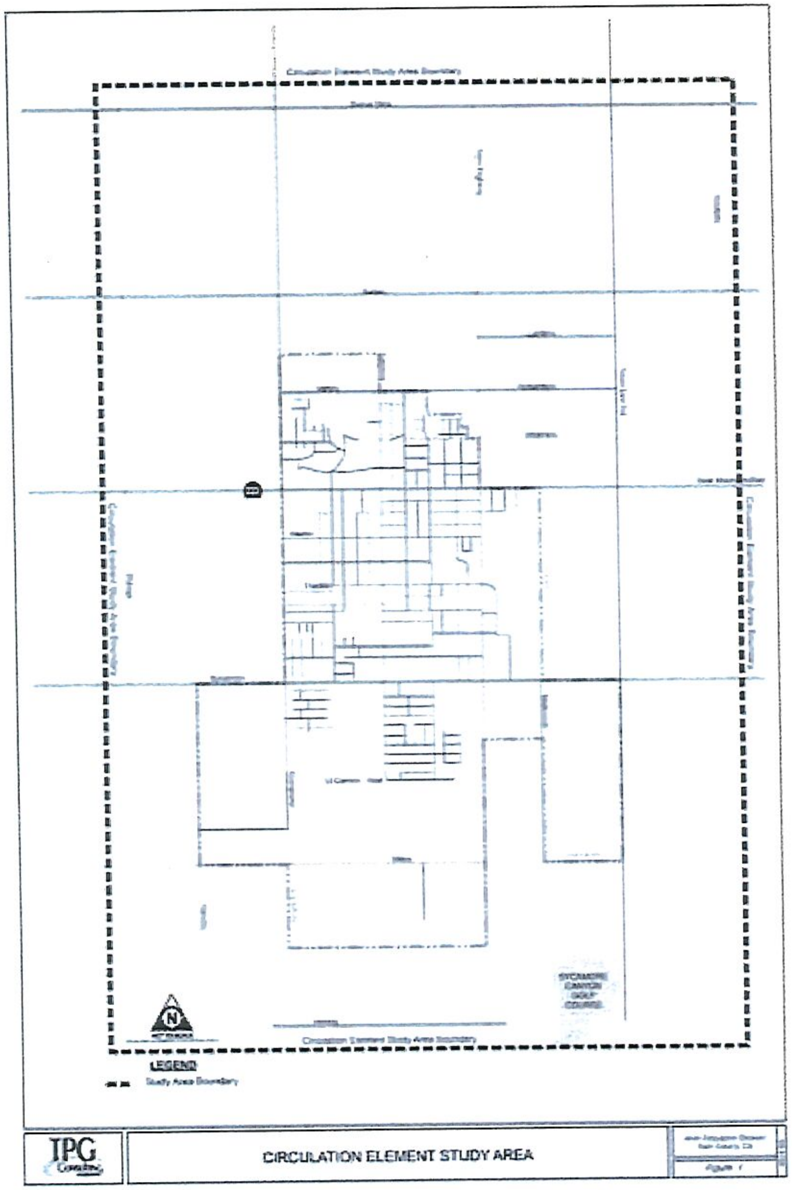
- Streets and Highways
- Transit
- Bicycles
- Pedestrians/Trails
- Rail
- Truck Routes/Goods Movement
- Park-N-Ride



Keys to Success

- Comprehensive Transportation Plan
- Impact Fee Methodology
- Public Participation Process
- Consensus Building Through Education

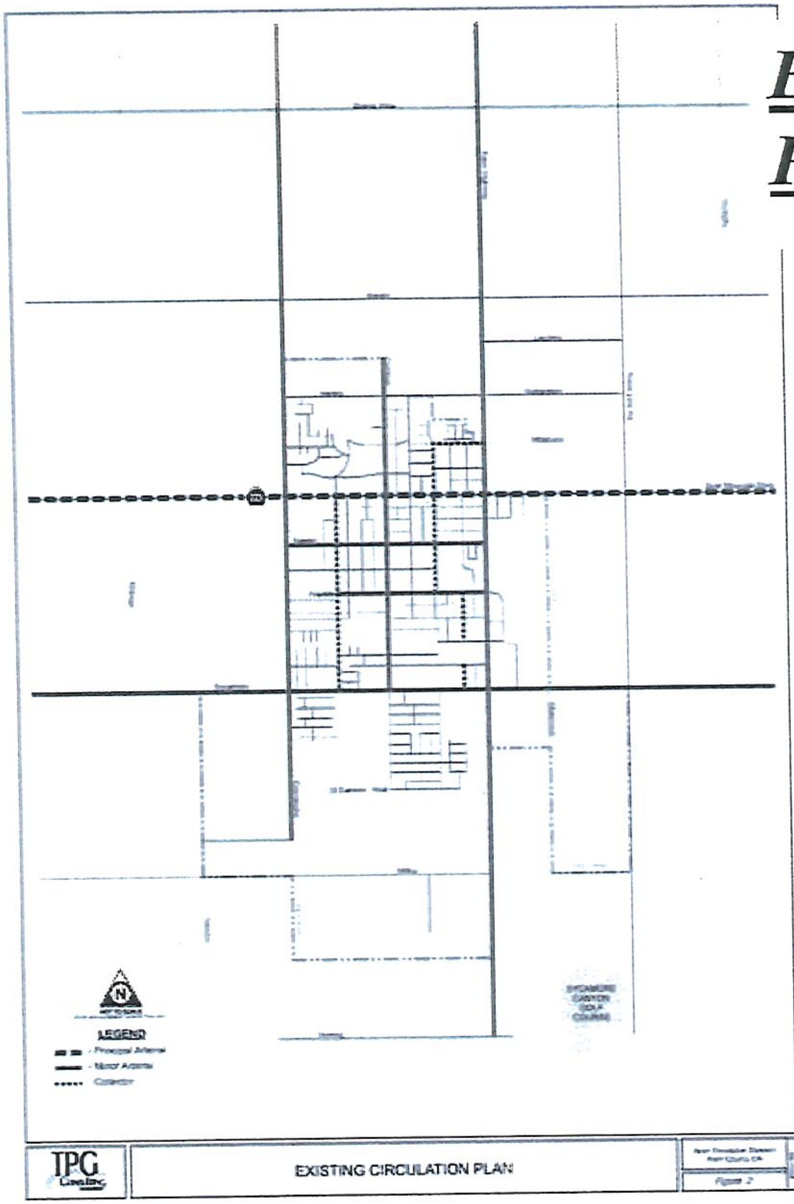
Study Area



IPG Consulting
2007 Small Business of the Year

Exceeding Expectations

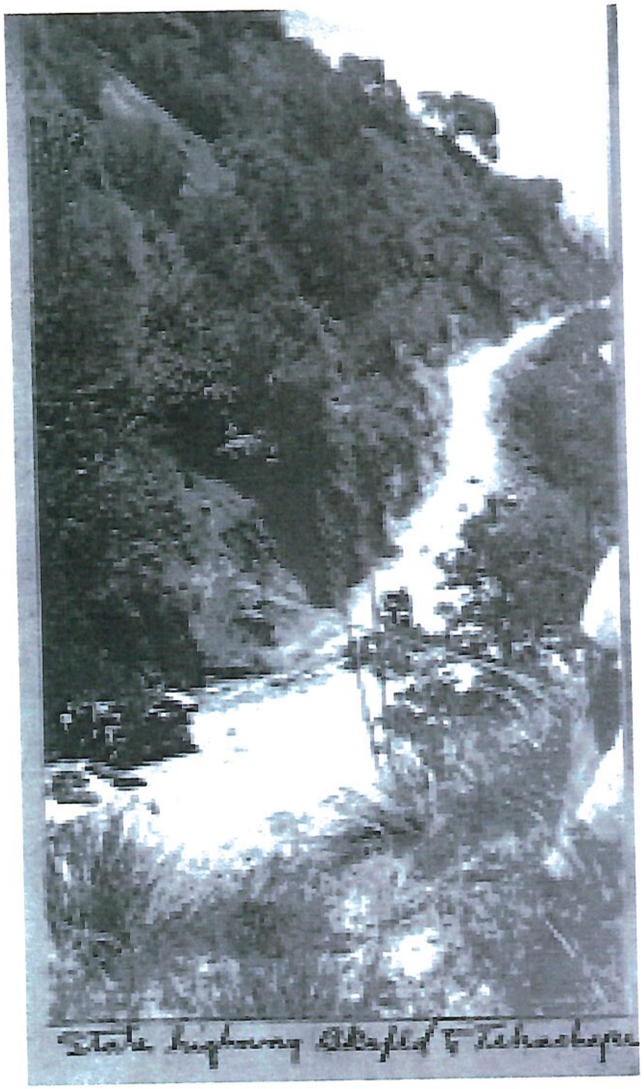
Existing Circulation Plan (1988)



IPG Consulting 2007

Existing Conditions

Roadway	Segment	Number of Lanes	Median	AADT	LOS
Sunset Boulevard	Comanche Drive to Tejon Highway	2	Undivided	900	C
	Tejon Highway to Tower Line Road	2	Undivided	1,100	C
Bear Mountain Road	Rancho Drive to Comanche Drive	2	Undivided	7,200	C
	Comanche Drive to Campus Drive	4	Divided	9,300	C
	Campus Drive to Tejon Highway	4	Divided	8,100	C
	Tejon Highway to Tower Line Road	2	Undivided	2,200	C
Franklin Street	Walnut Drive to Tejon Highway	2	Undivided	1,900	C
Sycamore Road	Rancho Drive to Comanche Drive	2	Undivided	2,700	C
	Comanche Drive to Tejon Highway	2	Undivided	2,600	C
	Tejon Highway to Tower Line Road	2	Undivided	290	C
Comanche Drive	Sycamore Road to Bear Mountain Road	2	Undivided	8,000	D
	Bear Mountain Road to Sunset Boulevard	2	Undivided	9,000	D
Campus Drive	Sycamore Road to Bear Mountain Road	2-4	Undivided	6,300	C
	Bear Mountain Road to Sunset Boulevard	4	Undivided	3,400	C
Tejon Highway	Millux Road to Sycamore Road	2	Undivided	2,400	C
	Sycamore Road to Bear Mountain Road	2	Undivided	5,900	C
	Bear Mountain Road to Sunset Boulevard	2	Undivided	4,200	C
Tower Line Road	Bear Mountain Road to Sunset Boulevard	2	Undivided	510	C



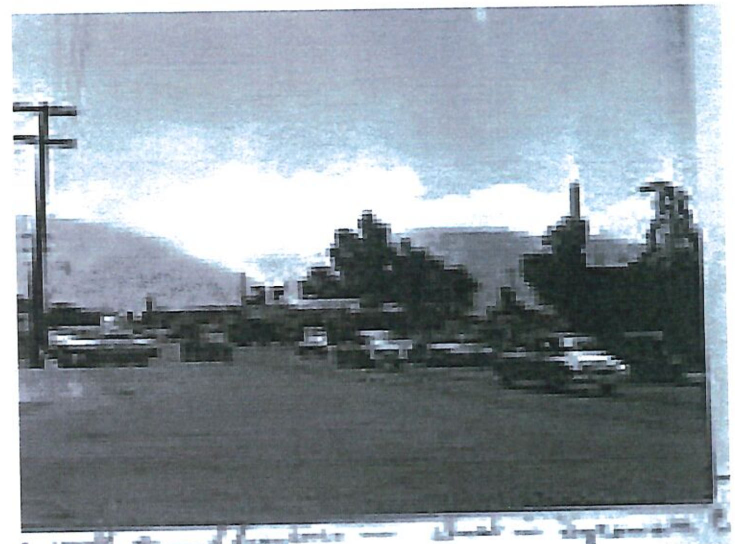
Key Issues/Challenges

- ☐ Updating the 1988 Circulation Element
- ☐ Tying the Land Use Plan to the Circulation Plan
- ☐ Development of a comprehensive funding program
- ☐ Updating the Traffic Impact Fee
- ☐ Interpreting the community's needs
  - Maintenance of streets
  - Alternative Modes of Transportation
- ☐ Public Participation Program
- ☐ Reflective of regional plans

IPG Consulting 2007

Exercise

- *Community Values*
- *Vision of Arvin's Future*
- *Transportation Modes*
  - *Streets and Highways*
  - *Transit*
  - *Bicycles*
  - *Pedestrians/Trails*
  - *Rail*
  - *Truck Routes/Goods Movement*
  - *Park-N-Ride*

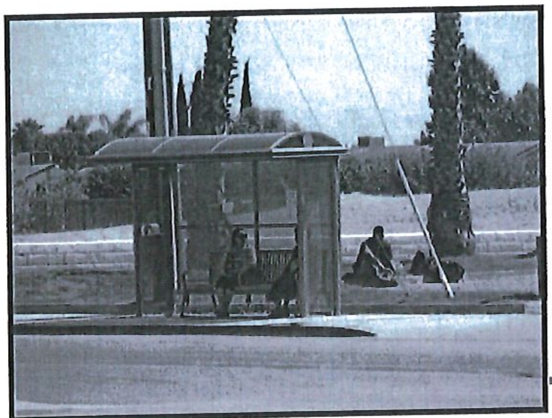


Wrap Up

- Next Steps
  - Public Workshop - *July 9, 2009* –
  - Draft Arvin Circulation Element and Impact Fee Report - August 2008
  - Final Arvin Circulation Element and Impact Fee Report - September 2008
- Summary of Exercise

❖ "THANKS FOR YOUR ASSISTANCE"

HELP US PLAN THE FUTURE OF ARVIN'S TRANSPORTATION SYSTEM!



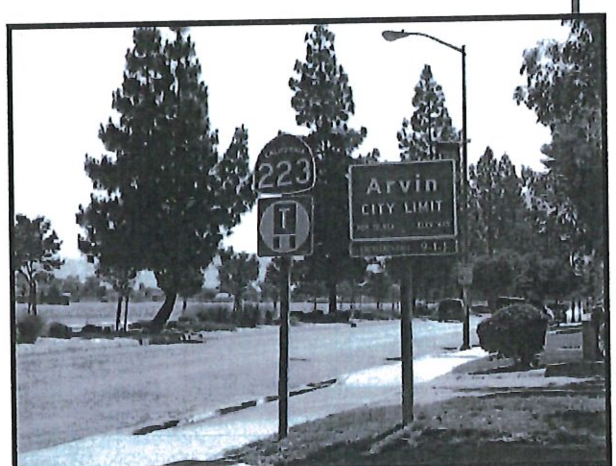
Let Your Voice Be Heard!

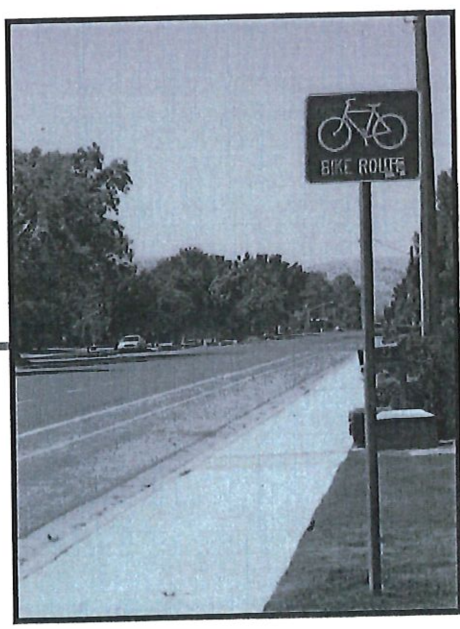
The City of Arvin, in conjunction with the Kern Council of Governments, is preparing a transportation plan for the City of Arvin. We need input from community members like you to identify transportation concerns, including streets, bike, pedestrian, rail, public transit, trails and truck routes/goods movement.

Please come to the community workshop and help plan the future of Arvin.

- **What: Community Workshop**
- **When: Wednesday, July 9th, 6:00 p.m. - 8:00 p.m.**
- **Where: City Council Chambers, City Hall, 200 Campus Drive, Arvin**

Refreshments will be served



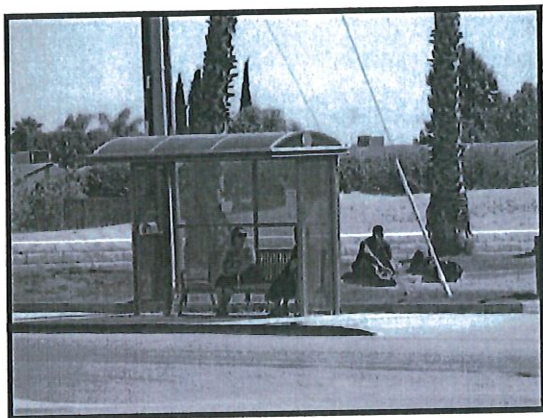


For more information, please call

TPG Consulting Incorporated
Exceeding expectations in Engineering, Planning & Transportation

(559) 739-8072

¡ATENCION! NECESITAMOS SU AYUDA PARA PLANEAR EL FUTURO DEL SISTEMA DE TRANSPORTACION PARA ARVIN!



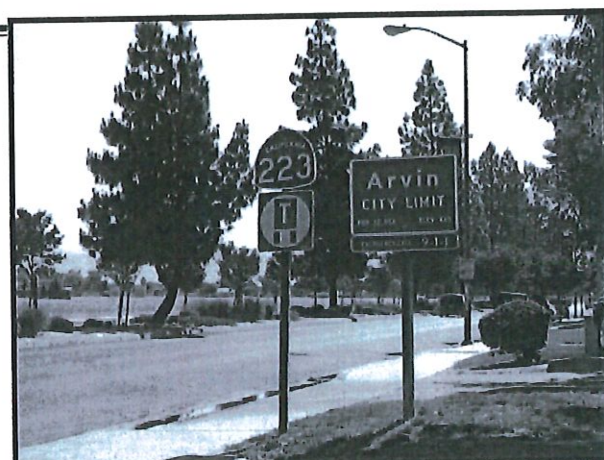
¡Que Su Voz Sea Escuchada!

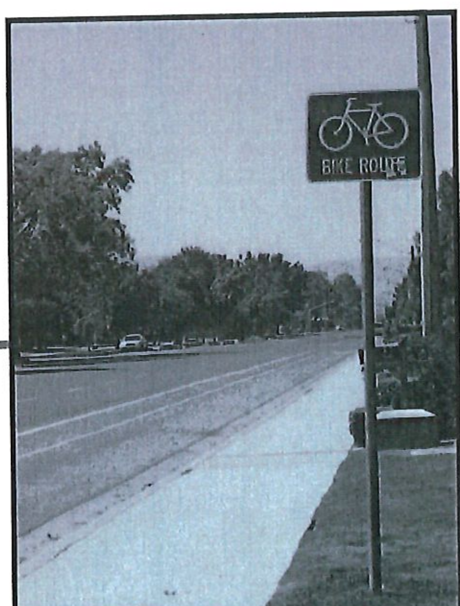
La Ciudad de Arvin, en conjunto con el Consejote Governamiento de Kern, esta preparando un plan de transportación para la Ciudad. Necesitamos su participación como miembro de la comunidad para identificar las preocupaciones de transportación, incluyendo las rutas de las calles, bicicletas, pateones, transportación pública, de autobuses, las tracas del tren, y otras rutas de troces pesados.

Favor de venir al taller de la comunidad para ayudar con el plan del futuro de Arvin.

- **Que: Taller de Comunidad**
- **Cuando: Miércoles, Julio 9, de las 6:00 p.m. - 8:00 p.m.**
- **Donde: 200 Campus Drive, Arvin, el edificio del concilio de la ciudad**

Se servirá refrescantes





Para más información, favor de comunicarse:

TPG Consulting Incorporated

Exceeding expectations in Engineering, Planning & Transportation

(559) 739-8072

¡ATENCION! NECESITAMOS SU AYUDA PARA PLANEAR EL FUTURO DEL SISTEMA DE TRANSPORTACION PARA ARVIN!

¡Que Su Voz Sea Escuchada!

La Ciudad de Arvin, en conjunto con el Consejote Governamiento de Kern, esta preparando un plan de transportación para la Ciudad. Necesitamos su participación como miembro de la comunidad para identificar las preocupaciones de transportación, incluyendo las rutas de las calles, bicicletas, pateones, transportación pública, de autobuses, las tracas del tren, y otras rutas de troces pesados.

Favor de venir al taller de la comunidad para ayudar con el plan del futuro de Arvin.

Que:	Taller de Comunidad
Cuando:	Miércoles, Julio 9, de las 6:00 p.m. - 8:00 p.m.
Donde:	200 Campus Drive, Arvin, el edificio del concilio de la ciudad

Se servirá refrescantes!

Para más información, favor de comunicarse:
(559) 739-8072

HELP US PLAN THE FUTURE OF ARVIN'S TRANSPORTATION SYSTEM!

Let Your Voice Be Heard!

The City of Arvin, in conjunction with the Kern Council of Governments, is preparing a transportation plan for the City of Arvin. We need input from community members like you to identify transportation concerns, including streets, bike, pedestrian, rail, public transit, trails and truck routes/goods movement.

Please come to the community workshop and help plan the future of Arvin.

What:	Community Workshop
When:	Wednesday, July 9th, 6:00 p.m. - 8:00 p.m.
Where:	City Council Chambers, City Hall, 200 Campus Drive, Arvin

Refreshments will be served

For more information, please call

TPG Consulting Incorporated

Exceeding expectations in Engineering, Planning & Transportation

(559) 739-8072