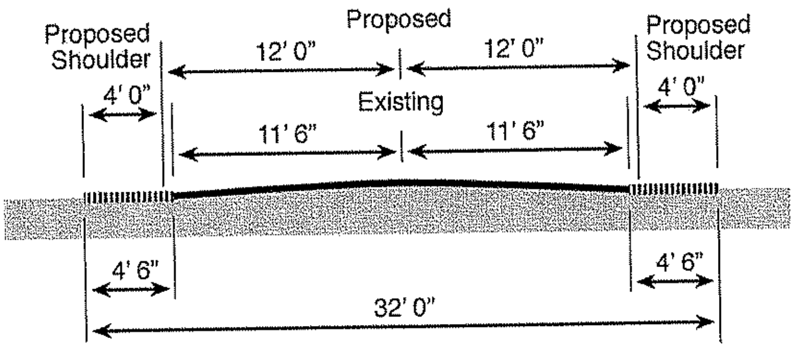
Davis-Woodland Bikeway Feasibility Study



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EXECUTIVE SUMMARY

The Davis-Woodland Bikeway Feasibility Study is the result of an agreement between Yolo County, the City of Davis, the City of Woodland, and the Yolo-Solano Air Quality Management District to fund the analysis of alternative bicycle routes between Davis and Woodland. A total of six routes were evaluated that included Class I (bike path), Class II (on street bike lanes), and Class III (on street shared facility) components that could serve commute and recreational purposes.

The Study incorporates comments and recommendations from the Yolo County Transportation District Technical Advisory Committee Subcommittee (TAC Subcommittee) for the Bikeway Feasibility Study, and the public, submitted either in direct communication with project staff or submitted during the Public Workshop held for the project on September 14, 1999. The TAC Subcommittee consisted of representatives from each jurisdiction funding the study, and the Davis Bike Club.

The alternatives were then analyzed and prioritized according to a set of ranking criteria developed for the project by the TAC Subcommittee. A new option (Option 1) emerged out of the review and workshop process, while one of the original six options (CR 102) was eliminated because the corridor already has a Class II bicycle route.

Factors in the analysis of the alternatives included right of way costs, construction costs, maintenance costs, accessibility of the route to existing and future activity centers, environmental impacts, agricultural impacts, recreation/aesthetic value, time to implement, and the prospects for increased growth and development in Woodland and Davis. Currently, UC Davis represents the destination for a significant number of Woodland residents – residents who have the potential to bicycle to work, class, or other utility destinations, and who are included in a region that currently commutes by bicycle at rates higher than the national average, although not at the high levels found in the City of Davis. Increased growth adjacent to either Woodland or Davis generates additional demand for improved bicycle facilities between the two cities, a demand that will continue to grow as more developments are built in the future.

In the short term, there is a need to improve bicycling conditions for those residents who commute between Davis and Woodland on County roads. Many of these improvements can be made within the context of general roadway improvements and maintenance, and can significantly improve the

safety and attractiveness of the connecting roadway system for those who currently cycle between Davis and Woodland. The most feasible alternative in the short term is a modified Option 1, adding four foot bike lanes to roadways that presently do not have shoulders (see Fig 25): the section of CR 99 between CR 27 and CR 29, and the section of CR 29 between CR 99 and State Route (SR) 113. The estimated cost of this option is approximately $1.2 million.

In the longer term, to address the expressed desire by many residents for a bicycle route between the two cities with more recreational and aesthetic values, the next most feasible alternative is Option 5. In general, Option 5 connects a series of three dead end frontage roads on the west side of SR 113 to provide a more centralized connection between the two cities (see Fig. 22). The estimated cost of this option is approximately $2.9 million. The first phase of Option 5 would be the improvements to shoulders on CR 99D to connect Option 1-modified to Davis.

It is also recommended that in the event that the California Northern Railroad/Union Pacific Railroad tracks are abandoned in the future, that the right-of-way be preserved for use as a non-motorized multi-use pathway connecting the cities of Woodland and Davis (see Fig. 2A).

1.0 INTRODUCTION

The Davis-Woodland Bikeway Feasibility Study was initiated by the Yolo-Solano Air Quality Management District as part of an effort to investigate the feasibility of various bikeway options connecting Davis and Woodland. In general, the routes investigated include combinations of Class I (off road) bike paths, Class II (on road) bike lanes, and Class III (on road) bike routes. The City of Davis, the City of Woodland, the County of Yolo, and the Yolo-Solano Air Quality Management District have each committed funds to investigate the feasibility of alternative routes.

At present one Class II bikeway along County Road (CR) 102 connects the eastern portions of Woodland and Davis. The Yolo County Bicycle Transportation Plan identifies a second connection of the westerly portions of the two cities along CR 99. Widening and shoulder striping of 4 miles of CR 99 south of CR 27 would complete this connection.

This feasibility study includes the analysis of the original six (6) options included in the Request for Proposal for the study. Out of this feasibility process, Option 6 (CR 102) was deleted, and a new option (Option 1) was added, which is a consolidated alternative incorporating features from several of the six original alternatives.

This report presents a description of needs (Chapter 2) including a discussion of the difference between commuter and recreational needs, and the projected growth in the area. Chapter 3 discusses different types of potential bikeway improvements. Chapter 4 briefly describes the evaluation criteria considered in the ranking of alternatives. Chapter 5 discusses individual sections of the alternative alignments, and the physical conditions along them. Chapter 6 describes each alternative and provides a brief discussion of each evaluation criteria. Chapter 7 summarizes the information presented in the report, and ranks the alternatives based on a weighted ranking developed by the TAC Subcommittee. Appendices include a detailed presentation of cost estimates, a discussion of maintenance issues, and design guidelines.

1.1 Project Purpose and Goals

The primary purpose of this Project Report is to:

- provide background on the project history, goals, and relationship to existing plans and other relevant documents;
- identify the future Davis-Woodland Bikeway users and their needs. Solicit public and agency input through workshops and review of this document;
- identify constraints and proposed solutions including grade crossings, environmental conditions, project costs, property ownership, and railroad operations;
- develop conceptual alternative alignments where constraints can be overcome in either the short or long-term;
- provide implementation details on schedule, cost, funding, liability, safety, landscaping, maintenance, legal agreements, program development, environmental permitting, and other items; and
- identify a recommended phasing plan for the short, mid, and long term.

The Study also provides a forum for discussion of the planning and design issues prior to seeking funding for developing construction documents.

Project Goals

The Project Scope provides specific goals, objectives, and requirements for the proposed Bikeway. In addition to those expressly stated goals is the goal of orienting projects towards available funding sources. It is expected that much of the project funding will be derived from regional, state, or Federal sources that are primarily oriented towards bicycle commuter projects (rather than recreation). By linking neighborhoods directly to transit stations and employment centers, the Davis-Woodland Bikeway Project will serve a direct function of encouraging commuters to ride or walk to their destinations rather than drive. Even recreational trips, if they replace trips otherwise made by a vehicle, would meet the intent of the transportation funding programs such as TEA-21 (Transportation Equity Act for the 21st century). A summary of project goals is presented below.

The project should:

Goal 1: be a continuous, integrated facility from Davis to Woodland, utilizing separate right of ways wherever feasible or appropriate.

Goal 2: be designed to serve both the needs of commuter and recreational bicyclists, as well as provide facilities usable by pedestrians and other non-motorized travelers.

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Goal 3: be a functional facility in that it enhances access to major and minor destinations, provides a relatively direct connection in the County, and follows routes already used by bicyclists, pedestrians, and others.

Goal 4: build upon and connect to existing infrastructure and existing/planned bikeways wherever possible.

Goal 5: maximize safety and security by organizing and managing bicycling activity and improving safety between vehicles and bicyclists. This can be accomplished by appropriate design and operation of the facility.

Goal 6: minimize impacts to adjacent property owners by appropriate design and operation of the facility. This may include fencing, landscaping, and other appropriate improvements.

Goal 7: represent the most cost-effective solution possible, with special attention paid to estimated capital, right-of-way, and maintenance costs.

Goal 8: be designed to meet state and Federal standards, including the American with Disabilities Act.

Goal 9: recognize that pedestrians, joggers, and others will also be using any pathway segments of the project. Any pathway segments should be managed through signs, pathway width, striping, and other measures to organize users so that commuting bicyclists can proceed unimpeded by others. Off-road pathways should utilize scenic resources while protecting environmentally sensitive areas and agricultural areas.

Goal 10: be relatively straightforward so that it can be implemented in rational phases within a reasonable time frame.

1.2 Summary of Existing Relevant Plans

Information used in this Project Report includes existing general plans, bikeway master plans, environmental documents, demographic and land use data, traffic volumes, and other reports and plans. A summary of each of those relevant plans is presented below.

City of Woodland Bikeway Master Plan (1997)

The 1997 City of Woodland Bikeway Master Plan contains a strong set of goals and policies designed to improve conditions for cyclists in Woodland. The plan recognizes to the need for improved bicycle facilities. The primary recommendations of the plan include developing safe functional facilities that meet the needs of both commuter and recreational cyclists. Bike facilities are proposed for CR 102, CR 101, CR 25A, CR 24C, and East Street to the City limits. Policy five recognizes the need to maintain consistency with the routing and geometrics of Yolo County's Bicycle Transportation Plan, and the need for a major recreational bicycling connection to Davis.

City of Woodland Year 2000 California Department of Finance (DOF) Population estimate: 46,300.

City of Davis Bikeway Plan (1993)

The 1993 City of Davis Bikeway Plan is currently undergoing an update. The plan specifically identifies the need to coordinate and cooperate with surrounding jurisdictions such as the University of California at Davis, the City of Woodland, and Yolo and Solano Counties to create an internal bikeway network, and assure safe and convenient bicycle access to all areas of the City. The 1993 plan does not target specific corridors linking Davis to Woodland for improvements; however, it does mention the need to develop criteria for bicycle access to open space areas preserved outside the city limits, as well as recreational bicycling corridors leading to the north.

City of Davis Year 2000 California DOF Population estimate: 58,600.

Draft City of Davis General Plan (1999)

The City of Davis is currently in the process of updating its General Plan. This document outlines major policy and project initiatives in a number of areas, including bicycle transportation. Policy MOB 3.1.d addresses bicycle connections to other adjacent communities:

> "Plan bicycle route connections to neighboring communities. Coordinate planning of these facilities with Yolo and Solano counties, the City of Woodland and their (respective) bicycle plans"

County of Yolo Bicycle Transportation Plan (1999)

The 1999 Yolo County Bicycle Transportation Plan is a comprehensive plan that includes goals, policies, actions, and financial strategies to provide for the development of an integrated system of bikeway facilities that will provide for safe and convenient travel for bicyclists throughout the county. The Plan shows CR 102 as the only existing continuous bicycle pathway between the eastern portion of two cities, with 6-foot shoulders along most of the route. The Plan identifies CR 99 as a proposed high priority bicycle connection between the western portions of the cities of Woodland and Davis.

1.3 Project Setting and History

The project study area is located in Yolo County, between the communities of Davis and Woodland.

Need and Purpose

The geography of the area consists of flatlands primarily used for agriculture. The Study Area is home to the two respective cities with a combined population totaling about 100,000 people. The area is largely undeveloped outside the municipalities. The City of Davis is well known internationally for the quantity and quality of its accommodations for bicycles, an accommodation facilitated by the presence of a large University of California at Davis campus, flat terrain, and a climate well suited to bicycling.

1.4 Project Methodology

The methodology used in this report is based on standard planning, design, and engineering principals. These include:

(a) a analysis of existing conditions and constraints,
(b) a needs analysis,
(c) input from the public and relevant agencies and departments,
(d) close coordination with County staff and the YCTD TAC Subcommittee
(e) analysis of the proposed alternative corridors to ensure that the project is integrated, continuous, and safe,
(f) recognition of the physical, operational, and cost constraints along the proposed corridors, and
(g) development of a phased approach which will allow an orderly implementation of the project.

The evaluation methodology behind the alternative alignments is clearly identified in the text descriptions, which identifies the various advantages and disadvantages according to the goals and criteria developed by the TAC Subcommittee .

2.0 NEED AND PURPOSE

The need for a facility connecting Woodland and Davis is called out specifically in the Yolo County and Woodland Bicycle Plans, but can also be seen as a natural extension of the demand created by years of developing bicycle facilities in the region, a high number of commuters to UC Davis, and a climate and topography that lends itself well to bicycling. Davis in particular has been used to illustrate that those areas that invest in and promote a high standard of accommodation for bicyclists can achieve significant increase in bicycle trip volumes. Bicycle commuting represents almost 25% of overall commute trips in Davis – a number that is likely unmatched anywhere else in the United States.

Surveys such as the 1991 Lou Harris Poll indicate that there is a large reservoir of latent demand for these facilities. While more than 50% of Americans own bicycles and want to bicycle at least occasionally, many people simply have little confidence in their own abilities or the provision of consistent facilities on which to ride in their communities. The proof of this theory is evident in any community (such as Davis) that has made an effort to provide a significant level of bicycle facilities; bicycle usage increases dramatically. Based on the success of bikeway projects in Davis and around the region, it is safe to assume that a similar facility between Davis and Woodland in Yolo County would enjoy similar success.

Each user group has specific needs that will directly affect the planning and design of the Davis-Woodland Bikeway. For example, many less experienced bicycle riders prefer to use multi-use trails (also known as Class I bike paths) or lower-traffic side streets rather than busy arterials or rural roads with no shoulders. Experienced bicyclists are often willing to trade more traffic and higher traffic speeds for a more direct route to their destination. This project should be designed for the user group most likely to be found in this corridor: commuter cyclists of moderate to good abilities, who are willing to ride on roads but would prefer lower traffic volumes and speeds, along with shoulders or bike lanes. This group might use a Class I bike path if it provided a direct connection.

Current bicycling activities can be categorized into the following groups:

Commuters Commuters in this case will consist of employed adults and adult students. Adult commuters are typically seasoned bicyclists, who can move at above average speeds and maneuver across busy roadways. Often these commuters prefer to ride on-street rather than on a bike path: the Davis-Woodland Bikeway should be designed to be attractive to both the casual and serious bicyclist. There are not projected to be many (if any) school children commuting to school on this corridor, since the attendance areas do not overlap, however families with young children would have the potential to use the corridor. Access points from the project to schools, neighborhoods, and employment centers must also be provided for the project to serve as an effective commuter corridor. Utilitarian trips such as shopping can also be included in this category.

Recreation The Davis-Woodland Bikeway, depending on the type of facility selected, may attract users who simply desire a linear corridor for exercise and recreation. This includes families with young children, club bicyclists, and long distance bicyclists. While the project is intended primarily for bicyclists, it must also be recognized that off-street bike paths will also be used by pedestrians, joggers, in-line skaters, and others. All of these groups have unique characteristics, many of which conflict with one another. For example, experienced bicyclists may be traveling at speeds in excess of 20 mph. Roller skaters/bladers often consume the entire trail width as part of their skating motion. Families and pets often travel in the wrong direction, stand in the middle of pathways, or otherwise obstructing through traffic. Joggers typically prefer the unpaved shoulder to run on rather than asphalt. Benches, drinking fountains, signing, and waste receptacles are just a few of the items typically required for recreational and commuter trail users alike. Because of this multiplicity of needs, the Davis-Woodland Bikeway should be designed to separate different user groups as much as possible by providing unpaved shoulders on each side of any pathway and other devices.

2.1 Demand for Bikeway Improvements

While there is not an accurate model available to project the number of future bicycle commuters who would use a new bikeway, the demand can be identified through other means. For example,

Types of Improvements

Figure 1 shows the future growth areas in both Woodland and Davis (source: Davis General Plan). As seen, Woodland is expected to develop southward towards CR 25 in the future, while most of the Davis growth will occur in the southwest part of the City on the University of California at Davis (UCD) campus.

The need and demand for an enhanced bikeway linkage between Woodland and Davis, especially on the western side of the corridor, is best indicated by the number of students, faculty, and staff who live in Woodland. According to UCD (source: letter from Robert Grey for Larry Vanderhoef, July 30, 1999), there are about 200 UCD students and about 1,000 faculty and staff living in Woodland. The trend from 1989 to 1997 shows an increase of 7% in this pattern, indicating that over time there will be an increasing commute pattern between the two cities.

The recreational demand for a bicycle route between the two cities is dependent on the type of facility constructed, and is also difficult to predict. It is expected that the recreational use of a Class I (off road) route would be higher than that of the Russell Boulevard path west of Davis, since two population centers would have access to it. The Russell Boulevard path is a very popular route for recreational cyclists.

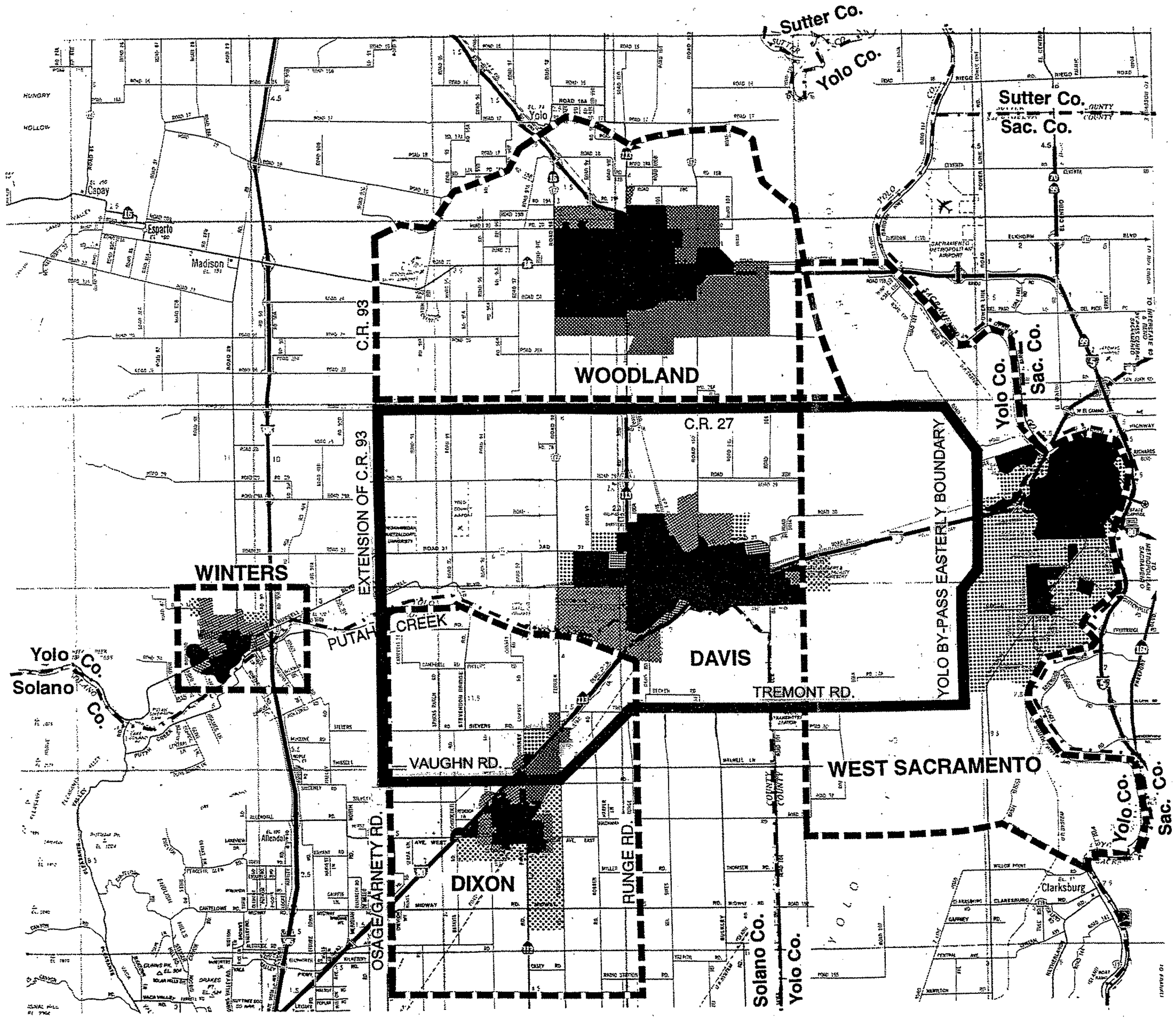
At the public workshop held in Woodland in September 1999, approximately 25 people attended to express their interest in improved bicycle facilities between the two cities. Attendees at the workshop were about evenly split in their preferences, some preferring improved shoulders on existing county roads, others preferring completely separated pathways.

3.0 TYPES OF POTENTIAL IMPROVEMENTS

An important element in the alternatives analysis is the basic types of bikeway treatments being considered. The alternatives include new shoulders, bike lanes, bike routes, and bike paths. Different types of bicyclists have differing preferences on the types of facilities they choose to use. More experienced bicyclists tend to chose direct routes, and are more tolerant of heavier traffic volumes and speeds than are children or novice bicyclists. Parallel pathways and on-road facilities both have advantages and limitations, as described below:

Rural Roads

Many of the proposed alternatives between Davis and Woodland would follow rural county roads for all or part of their length. Many of these roads have two travel lanes within a limited pavement width between 20 and 24 feet wide, and no shoulders. While these roads often carry light to moderate traffic volumes, the travel speeds on most of these roads, given their long tangents and limited traffic control, is well over 50 miles per hour (based on observation). Therefore, while some of the rural roads offer a direct connection between Davis and Woodland, and may traverse scenic farmland, they cannot be considered 'bike-friendly' for all but the most experienced bicyclist. Bicyclists are forced to ride in the travel lanes on these roads, which is fine until there are two vehicles coming towards each other at the same time, forcing the bicyclist to leave the pavement. This becomes more of a problem for bicyclists considering the prevalence of adjacent ditches and



Surrounding Planning Areas and Spheres of Influence

- Davis Planning Area
- Other Planning Area
- Existing Development
- Planned Development
- Sphere of Influence
- County Boundary

NOTES
1. This map is intended to show general boundaries for regional context. The boundaries are not precise and are subject to amendments by the jurisdictions.
2. The Planned Development area and the Sphere of Influence area are the same for the City of West Sacramento.

Fig. 1: Future Growth Areas

Davis General Plan

4 sq mi
1

0 1 3 5 mi

narrow bridges.

On other rural roads, especially the dead end roads such as Rose Lane, travel volumes and speeds are so low that riding in the roadway would be acceptable for a broad range of bicyclists.

Given these issues, it is recommended that any rural road with moderate to high traffic speeds or volumes be re-constructed with a minimum of four (4) foot shoulders with striping, and be identified as a Class II bike lane if used as part of a Davis-Woodland Bikeway. If the route is a dead-end roadway with very low traffic volumes and speeds, additional shoulders are preferred but not required.

Shoulders and Bike Lanes

Shoulder facilities, which can range from 2 up to 12 feet, are typically identified as Class III bike routes in rural areas. Class II bike lanes are often not appropriate in rural areas given the number of signs and stencils, although they may be easier to fund. The width of shoulders is related to several items, including (a) traffic speed and volumes, (b) availability of right of way, and (c) expense of widening due to adjacent constraints.

Shoulders are generally considered to be more easily developed than parallel or separated pathways, and are popular with experienced bicyclists. The Yolo County Department of Planning and Public Works has pointed out that many of the rural roads in this study will require full re-construction in order to provide shoulders, due to the condition of existing pavements and structural issues attendant with road widening. In most cases, adding shoulders to the roadway will also require the purchase of additional property.

Properly designed, shoulders encourage legal on-road bicycling, and allow stronger cyclists to cover greater distances without affecting other bicyclists. They do not provide significant separation from motorized traffic, however, and less-experienced bicyclists might find these facilities intimidating, depending upon the characteristics (speed, volume) of adjacent motorized traffic. They also offer an important safety benefit to motorists in the form of a break down lane, offering vehicles a chance to pull off the roadway when needed. They can also be easier and less expensive to implement, since they are typically within an existing public right of way and can be funded with both roadway and bikeway funding.

Proposed shoulders or bike lanes in this study are assumed to be a minimum four (4) feet wide, which is a compromise between providing the maximum width possible while minimizing cost and agricultural impacts.

Bike Paths

Separated trails and pathways (Class I bike paths) when well designed can become very popular facilities for a wide range of recreation and transportation activities. Users will cite the absence of motorized traffic as a major advantage of these facilities, although by no means should the presence of a trail or path be interpreted as meaning the elimination of conflict or risk. Overall, a separated Class I bike path will attract a much higher number of bicyclists and pedestrians, both recreational users and commuters, than a parallel on-road facility with any significant volume of traffic.

Commuters often find that the number of users of different types in a confined right of way creates a conflict situation that significantly affects commute trip length in terms of time traveled. Trail intersections with roads and highways must be very carefully designed, as often both trail users and motorists alike may be unaware of the potential for conflict at these intersections. In any case, most trail trips involve at least some on-road bicycling, either to access the facility or to overcome barriers in the physical environment in which the trail is located.

Parallel Bike Paths versus Bike Lanes/Shoulders

Class I pathways parallel and adjacent to existing roadways offer a significantly different situation then other Class I paths. Chapter 1000 of the Highway Design Manual specifically states: "Bike paths immediately adjacent to streets and highways are not recommended because they require movements contrary to the normal rules of the road" (p.1000-6). Many of the problems cited by Caltrans in Chapter 1000 are related to bicycle movements through intersections and across driveways. Where there are few intersections or driveways, these problems may be ameliorated. However, as a general rule on-street improvements are considered preferable to parallel pathways except under unusual conditions.

It is also true that a parallel bike path might attract more users than shoulder or bike lane improvement, depending on traffic volumes and speeds. However, it is likely that most of these additional users will be making recreational versus commuting trips.

Frontage Roads

The Woodland-Davis corridor offers another option that can be used in conjunction with off-road and shoulder facilities. Frontage roads often provide the same direct service as the highways that they serve, but with a fraction of the traffic volumes that make the highways less attractive (or illegal) locations for many bicyclists to ride. Many frontage roads have such low volumes that they can serve as a "surrogate trail", providing direct access and the ability to ride at an efficient speed without the concerns of either trail user conflict or excessive motorized conflict.

In addition, when frontage roads dead-end near each other (as they do adjacent to SR113 at Willow Slough and at the California Northern Railroad (CNRR) tracks south of CR 25A), the development of a bike/pedestrian bridge to close the gap can open up extensive corridors with minimal motorized traffic for essentially just the cost of the bridge itself. This can greatly extend the ability of a jurisdiction to address other facility concerns in an area while providing commuters with the direct service they need and the conditions that less-experienced bicyclists appreciate.

Evaluation Criteria

4.0 EVALUATION CRITERIA

Preliminary analysis of the corridors and potential alternatives has been conducted through field reviews, interviews, surveys, workshops, and reviews of available mapping, plans, and aerial photographs. The criteria used to evaluate each of the six (6) alternatives are briefly described below, in order of importance as determined by the TAC Subcommittee.

Right-of-Way and Construction Costs

The cost to acquire right-of-way and the construction cost of a proposed option is considered an important evaluation criteria. While there are numerous sources of outside funding available for bikeways, it is more difficult to obtain large competitive grants, they require more local matching moneys, and they would probably compete with other bikeway projects in Yolo County. As determined by the Yolo County Department of Planning and Public Works, virtually all of the options require the acquisition of additional land for improvements. Even shoulder widening projects require additional land in many cases. Construction costs of shoulder/bike lane projects are also greatly affected by the need to re-construct the entire roadway in many cases, rather than simply adding a shoulder. This greatly increases the cost of the project, and is addressed in more detail in the Appendix A "Cost Estimates". Finally, some options include a bridge crossing over sensitive riparian habitats or the railroad, which are typically expensive features.

Detailed construction and right of way costs are provided in Appendix A.

Maintenance Costs

Unlike capital costs, maintenance costs for bikeways almost always are borne by local agencies that are already strapped for maintenance funds. Adding a new facility that would require a significant amount of additional maintenance effort is an important evaluation criteria. Typically, off-street pathways are more difficult and expensive to maintain than on-road improvements since they are a new facility requiring special equipment. For example, new shoulders or bike lanes on a road are often swept and maintained as part of normal roadway maintenance operations, while a new pathway might require a new sweeper, fence repairs, graffiti and weed abatement, and other activities. As such, Class I bike paths have a higher maintenance cost (estimated at $8,500 per mile per year) than on-street options.

For further discussion of maintenance and operations issues, refer to Appendix C.

Accessibility of the Route to Existing and Future Activity Centers

Alternatives are evaluated on the proximity of the proposed route to potential users, and by the extent to which each option serves major existing and future activity centers. Routes that provide good access and direct connections to destinations such as downtown Woodland, University of California at Davis, and other activity centers will rate higher than routes which provide poor or circuitous connections and access. This criteria is directly related to expected usage or benefit of each option.

Routes that provide good access and connectivity are expected to attract and benefit a higher number of users. With CR 102 already providing a bikeway connection on the eastern side of Davis and Woodland, options that serve central and especially western Woodland and Davis rate higher since they are addressing an un-served population base.

Environmental Impact

While the overall environmental impact of bicycle facilities is generally considered beneficial, the alternatives need to be considered in the context of impact to agricultural lands and operations, impact on streams and waterways, and also for their impact to adjacent residential uses where applicable. The draft Habitat Conservation Plan (EIP Associates, 1996) for Yolo County identifies a number of endangered species in the area including a concentration of Swainson's Hawks nests along Willow Slough. Options that include new bridges across Willow Slough or new alignments along that waterway will require permits from the U.S. Fish & Game Department and U.S. Corps of Engineers, as well as California Environmental Quality Act (CEQA) and possibly National Environmental Protection Act (NEPA) review. It is not possible at this level of evaluation to determine if there will be significant impacts, but in most cases new bridges can be constructed with the proper mitigations to potential impacts. The environmental review process and the mitigations do add time and cost to the project.

Agricultural Impacts

While Woodland and Davis are growing cities, the alternative bikeway corridors are all located in an agricultural area that is intended to be preserved. Impacts on agricultural uses, including acquisition of easements through farmland, impacts to spraying, or other impacts on farming operations, is an important criteria. The Yolo County Right to Farm Ordinance is relevant to this criterion, because it is essentially a nuisance ordinance that prevents neighbors (including a bikeway user) from complaining about legal farm operations such as crop dusting. However, this does not eliminate the ability of people to complain about farm operations, or sue a farmer or bikeway manager, especially if they try to prove negligence.

The Yolo County Farm Bureau has gone on record (Duane Chamberlain, November 3, 1999) as being opposed to off-road bikepaths between Davis and Woodland. The reasons cited are (a) the recreational nature of the demand, (b) available money should be spent on roadway (not bikeway) improvements, (c) landowners will not be willing to sell easements, (d) bicyclists on County roads prevent aerial spraying, and (e) County roads are used by farm machinery, and bicyclists do not pay attention to this or ride single file.

Both the on-road and off-road options will be immediately adjacent to agricultural operations, and will often require the relocation of drainage ditches and acquisition of property. New Class I pathways along the railroad or Willow Slough do represent a new impact to those adjacent agricultural areas, and could be considered more significant. While agricultural impacts must be addressed in more detail in the CEQA and/or NEPA process, bikeways have been constructed and operated successfully in a wide variety of agricultural environments for many years around the country.

Use of Existing Infrastructure

Alternatives that capitalize on existing public infrastructure, whether that is a roadway or publicly-owned easements, are considered a positive evaluation criteria. Options that require the purchase of or easements on private property are considered more problematic from a cost, timeliness, privacy, and security perspective. Both on-road and off-road options require the acquisition of right of way, although some more than others.

Recreation/Aesthetic Value

Bikeway options that provide recreational and/or aesthetic values could serve to enhance the recreational opportunities available to the adjacent communities. Multi-use trails located away from roadways attract a much broader variety of recreational users than do on-street or parallel bikeways. Bikeways along scenic corridors such as Willow Slough would offer an additional attraction to users. Since the primary users of the bikeway are expected to be commuters, recreational and aesthetic attributes are weighted with less importance than other criteria.

Ease and Time to Implement

Some proposals are more difficult and time consuming to implement, especially those options that require extensive multi-agency coordination, easements, permits, right-of-way acquisition, and other items. For example, it is likely to be more time consuming to conduct environmental review and approvals on a creek pathway than adding shoulders or bike lanes to an existing roadway. The ability of a project to be completed in a reasonable time frame is an important criteria.

Safety

All of the options under consideration would be designed with safety in mind, in accordance with available design standards. For this reason, safety was not used as a ranking criteria for the purpose of comparing the alternatives.

Concerns about safety are the most common reason stated by the public for not bicycling or bicycling more often. While no activity is completely safe, and no assurance of safety is made with this report, past research has shown that bicycling accident rates are the same or lower than automobile rates on a per trip basis. Studies have shown that most bicycle accidents involve younger persons, often riding on the wrong side of road (often on sidewalks) on a late weekday afternoon (between 3 and 5pm). This leads to the conclusion that the single most effective means of addressing safety concerns is by providing higher quality bicycle education to younger students.

There is some disagreement as to whether Class I bike paths offer any greater level of safety than on-street routes. Accident statistics are not a good source for study because they are biased towards incidents involving injury or property damage to an insured object, typically an automobile. It is a reasonable conclusion that, while there may in some cases be more incidents on a busy bike path than on a street, the incidents are likely to be less serious than a conflict with a car or truck. Studies conducted by the Rails-to-Trails Conservancy (RTC) of over 1,000 existing multi-use trails or bike paths have shown that safety is not a significant problem. The conclusion of this extensive research is that bike paths typically have the same or slightly less safety and security problems as the surrounding neighborhoods.

By way of comparison, bicyclists and pedestrians in the corridor must now ride or walk within several feet of up to 3,000 vehicles per day traveling upwards of 50 or 60 miles per hour. By this measurement, people's exposure to potential injury will be greatly reduced if any improvements for bicyclists were made in the Davis-Woodland corridor.

Safety should be addressed on the Davis-Woodland Bikeway in the following manner:

1. Adhere to the established design, operation, and maintenance standards provided for by the Caltrans Highway Design Manual, and those presented in this document.
2. Supplement these standards with the sound judgement of professional engineers
3. Maintain adequate recording and response mechanisms for reported safety and maintenance problems
4. Thoroughly research the causes of each reported accident. Respond to accident investigations by appropriate design or operation improvements.
5. Provide mileposts on the trail so that emergency response can be directed.
6. Design the trail, its structures, and access points to be accessible by emergency vehicles. Bollards at the entrance to each trail segment should be removable by the appropriate fire, ambulance, and police agencies. Constrained segments of the trail that cannot accommodate emergency vehicles should not be longer than 500 feet, and identified in advance by the appropriate police, fire, and ambulance services
7. Provide regular police patrols to the extent needed.

Special Safety Features

Special features which may enhance the safety on the Class I sections of the Davis-Woodland Bikeway include the use of solar-powered cell phones and panic buttons. No conclusive proof exists that these devices are effective at reducing crime or improving response time. In the few instances where they have been installed, vandalism has often been a problem. More importantly, these features may represent an additional liability hazard if they are not properly maintained and monitored. A panic button, for example, would need to be monitored 24 hours per day in order to be effective and not represent a liability to the local jurisdiction.

Cell phones connected to local sheriffs department, similar to those being installed by Caltrans along highways, may offer a more cost effective approach that may appropriate to certain sections of the Davis-Woodland Bikeway. They are not intended, however, to be a primary response mechanism for emergencies but rather a support feature.

Alternatives and Components

5.0 ALTERNATIVES AND SUB-COMPONENTS

The study setting and existing bike lanes are presented in Figure 2A. Each of the six (6) options are evaluated according to the criteria described previously (see Figure 2B). As will be seen, each of the alternatives consists of several distinct components, some of which are shared with other alternatives. To simplify the review process, descriptions of these component pieces are presented first. Cross sections show the facilities at their most constrained locations.

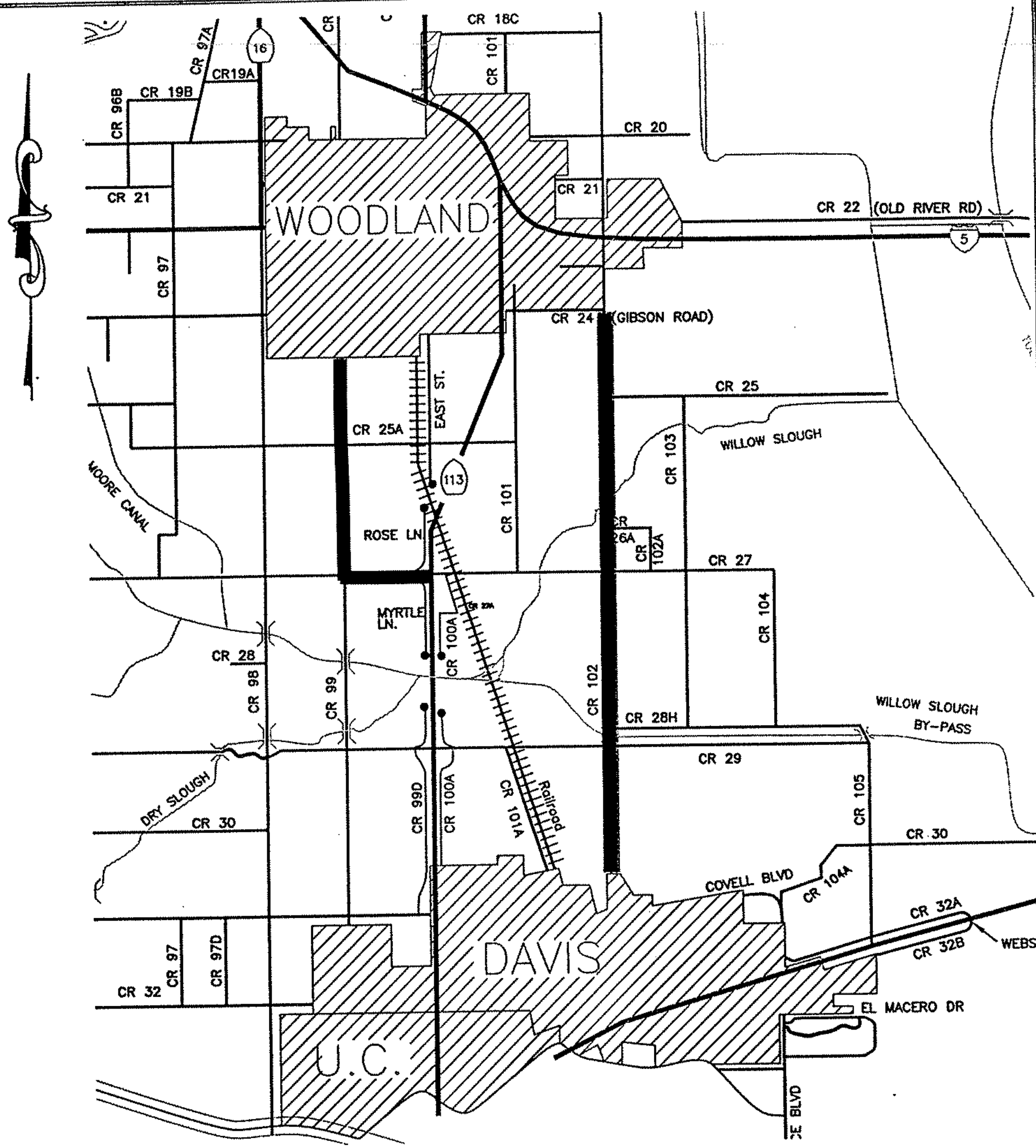
California Northern Railroad (CNRR)

The CNRR leases trackage from the Union Pacific Railroad (UPRR) through the study area. The railroad is part of a branch line (the West Valley Subdivision) extending from Davis northward to Woodland and beyond. Depending on the season, the tracks have several trains per day at lower speeds. While the UPRR is the property owner, they typically defer to their lessee on allowing other uses on the right of way. The CNRR has indicated in a letter (John Speight, November 2, 1999) that they are willing to consider public access to the right of way under the following conditions:

a. 25 feet minimum setback from track centerline
b. fencing or other positive separation
c. liability borne by trail manager
d. monitoring or law enforcement borne by the trail manager
e. at grade crossings require automatic protection
f. clean up of property responsibility of trail manager

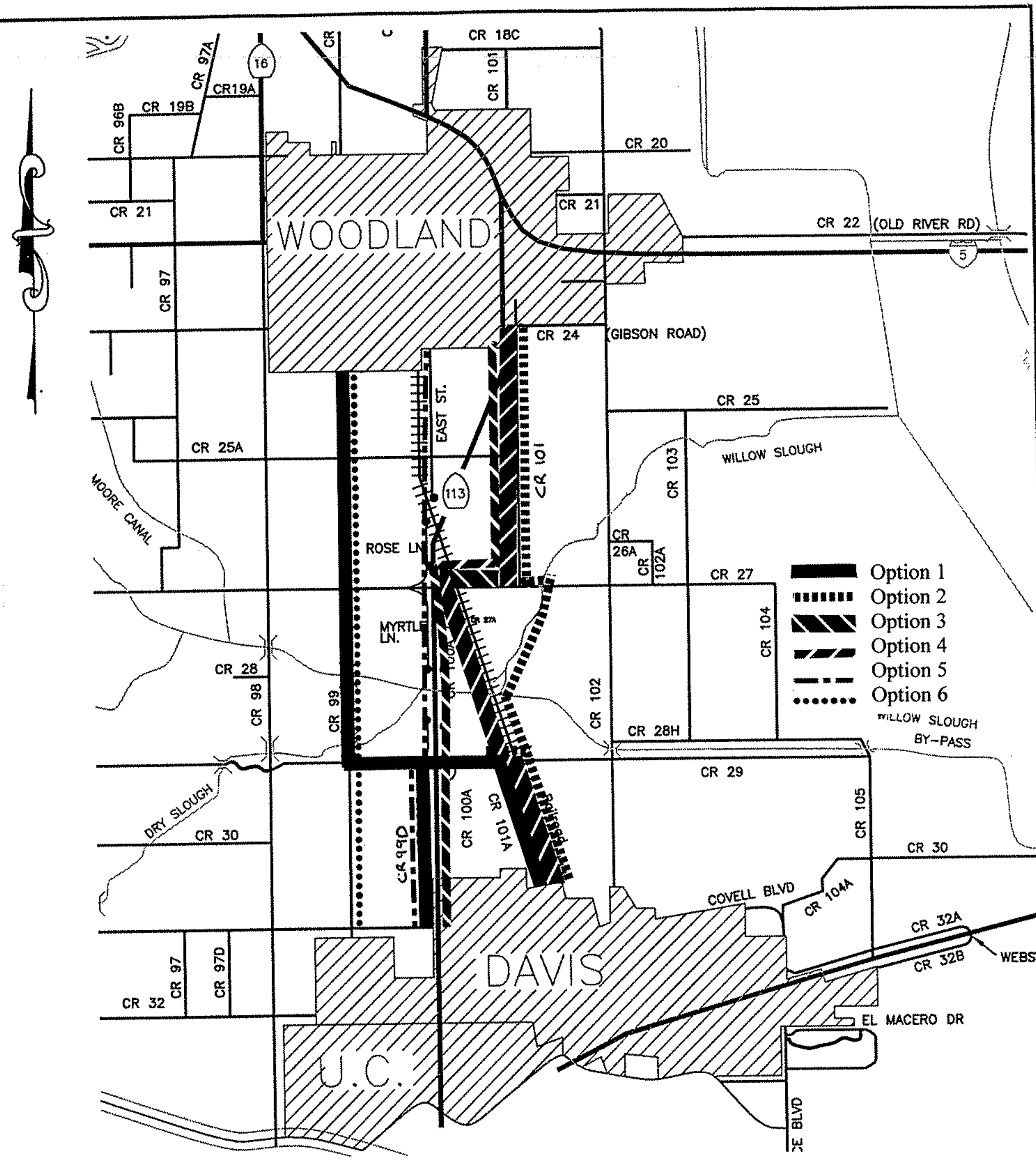
The CNRR right of way between Woodland and Davis varies in width, from 60 feet to 100 feet. Between the City of Davis and CR 27 it is 60 feet in width. From CR 27 to approximately the SR 113 under crossing, the right of way is 70 feet wide. North of this point the right of way is 100 feet wide. Along East Street the right of way is 80 feet wide. The CNRR has stated that they would consider allowing a pathway as long as it was not within 25 feet of the centerline of their tracks. With a 60 feet wide right of way, this means that any new pathway would need to be located within a 10-15 feet wide easement on private property adjacent to the railroad right of way (see Figure 3). With a 70 feet right of way, about 5 feet of additional private property would be required. A pathway could fit within an 80 or 100 feet right of way and require no additional land. Even after meeting CNRR setback requirements, a pathway would require UPRR approval. The UPRR has a general policy against allowing such facilities, although they have made exceptions in the past. At a minimum, past experience on more than 10 similar projects around the country by Alta Consulting has shown that rail-with-trail projects are extremely time consuming.

The property adjacent to the CNRR is active farmland. Often, there is an access road within 21 to 30 feet from the railroad tracks, along with a drainage swale. Depending on which side of the tracks the bike path was located, the access road would need to be moved between 20 and 25 feet, which would impact existing drainage, utility poles, and planted cropland. Another potential constraint is the presence of utilities along the CNRR corridor, although bike paths are commonly constructed over



EXISTING BIKE LANES

WO. #: 2004		YOLO COUNTY DEPARTMENT OF *PLANNING AND PUBLIC WORKS* 292 WEST BEAMER STREET, WOODLAND, CALIFORNIA	DATE: 01/20/99
SHEET # 6			DRAWN BY: BJ
OF 6		**Figure 2A: Vicinity Map**	DESIGNED BY:



VICINITY MAP (NO SCALE)

). #: 2004	VICINITY MAP PROPOSED BIKE PATH BETWEEN WOODLAND AND DAVIS	YOLO COUNTY DEPARTMENT OF *PLANNING AND PUBLIC WORKS* 292 WEST BEAMER STREET, WOODLAND, CALIFORNIA	DATE: 01/20/99
IEET #			DRAWN BY: BJ
OF		**Figure 2B: Proposed Options**	DESIGNED BY:

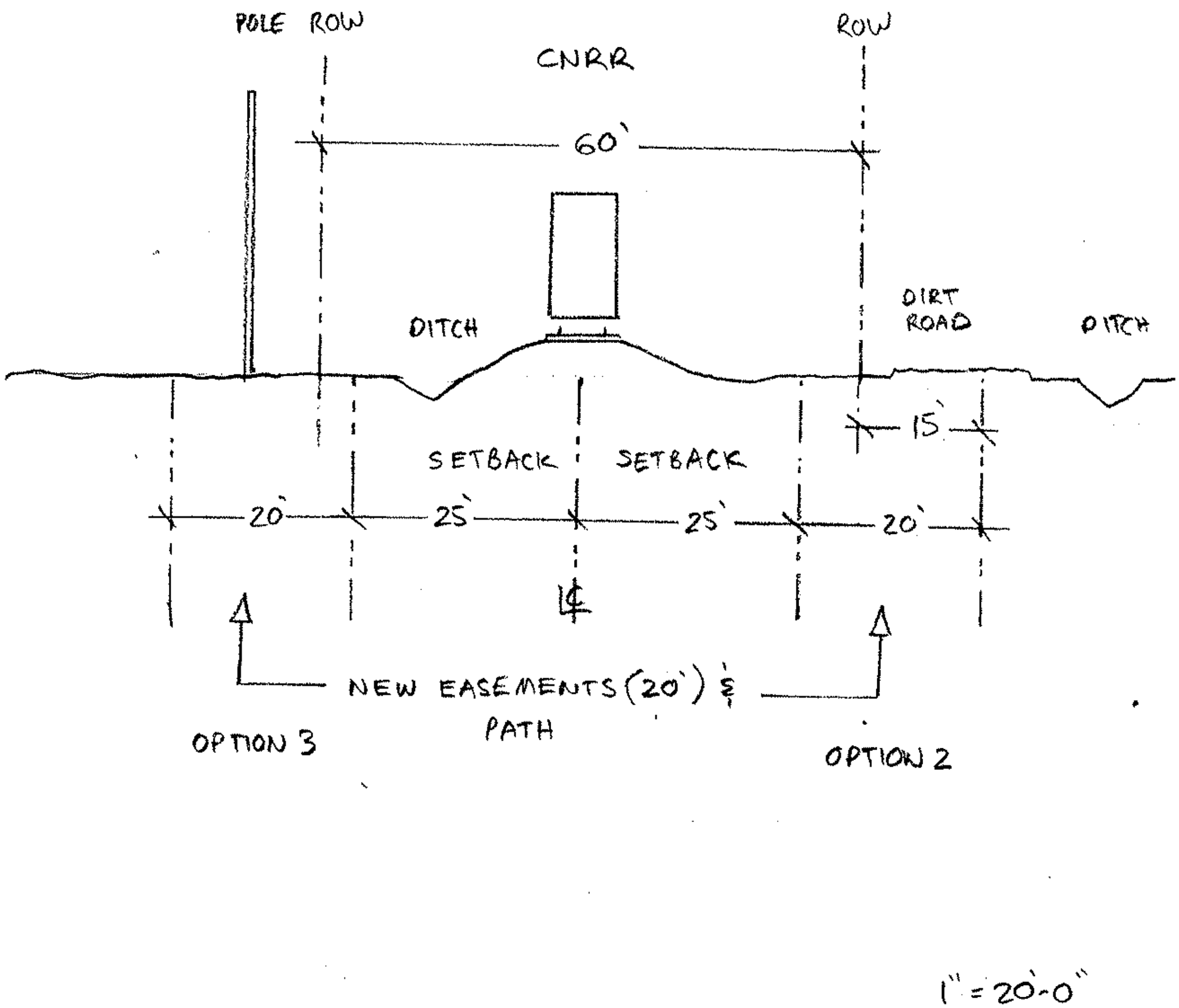


Fig. 3	CNRR (north of CR 29)	alta

utilities in other areas. Preliminary engineering would provide more information on this as needed.

Because the railroad right of way is not wide enough in most of the study area to allow for co-usage with a bicycle path, the cost estimates for a bicycle path along the railroad include the cost of acquiring the necessary 20 feet wide right of way from adjacent property owners.

One of the bikeway options considered (Option 5) would require a new at-grade crossing, bridge, or underpass of the CNRR tracks, connecting East Street and Rose Lane (see Figure 4). This crossing is known as Mullen's crossing. This would require approval of the CNRR, UPRR, and California Public Utilities Commission (CPUC). The CPUC has a policy of no new at-grade crossings in California. While there are examples of the CPUC granting exceptions to this policy, there is no guarantee they would grant one here. According to the CPUC (source: conversation with Tom Enderle, CPUC, November 30, 1999), the application for a new at-grade crossing must include data indicating why a bridge or tunnel (or other solution) was not considered feasible. Additional factors that play into the CPUC decision include geometry of the crossing, site distance, train traffic, and bicycle traffic. The fact that the tracks are on a curve at the Mullen's crossing would be a strike against an at-grade crossing here. The CPUC review time would be about 3-4 months, however the County would need to develop preliminary engineering designs for the proposed crossing.

The County conducted a cost comparison between a new separated-grade crossing and re-routing a pathway on the west side of the CNRR tracks from Rose Lane up to CR 25A. It costs about $312,000 less ($184,000 for bikeway-related items only) to avoid the separated-grade crossing and build a new pathway up to CR 25A than try and construct a grade separated crossing.

CR 27

CR 27 in the vicinity of Willow Slough has a paved surface of 23 feet with two travel lanes and no shoulders. The speed limit is not posted on this segment of roadway, actual traffic speed is over 55 MPH, and traffic volumes are at 1345 ADT, which is approximately half the volume of the same road west of SR 113 (2725 ADT). Parallel ditches on both sides of the road are set back about 16 feet from the pavement, allowing for lower cost implementation of shoulders. Given the traffic speeds on this roadway, any proposed route on CR 27 would require new shoulders and signage as a Class II bike lane or Class III bike route. No new right of way is required on this roadway to provide shoulders (see Figure 5).

CR 29

CR 29 is a two-lane road with between 26 and 29 feet of pavement, very small shoulders, and a traffic level of 3800ADT. Between SR113 and CR102, the road has recently be reconstructed and the pavement condition is good. The presence of irrigation and drainage ditches within 2 to 6 feet from the edge of pavement makes either shoulder paving or pathway development technically more complicated and more expensive. If selected as a bikeway, CR 29 would require new shoulders and signage as a Class II bike lane or a Class III bike route. Additional right of way would need to be

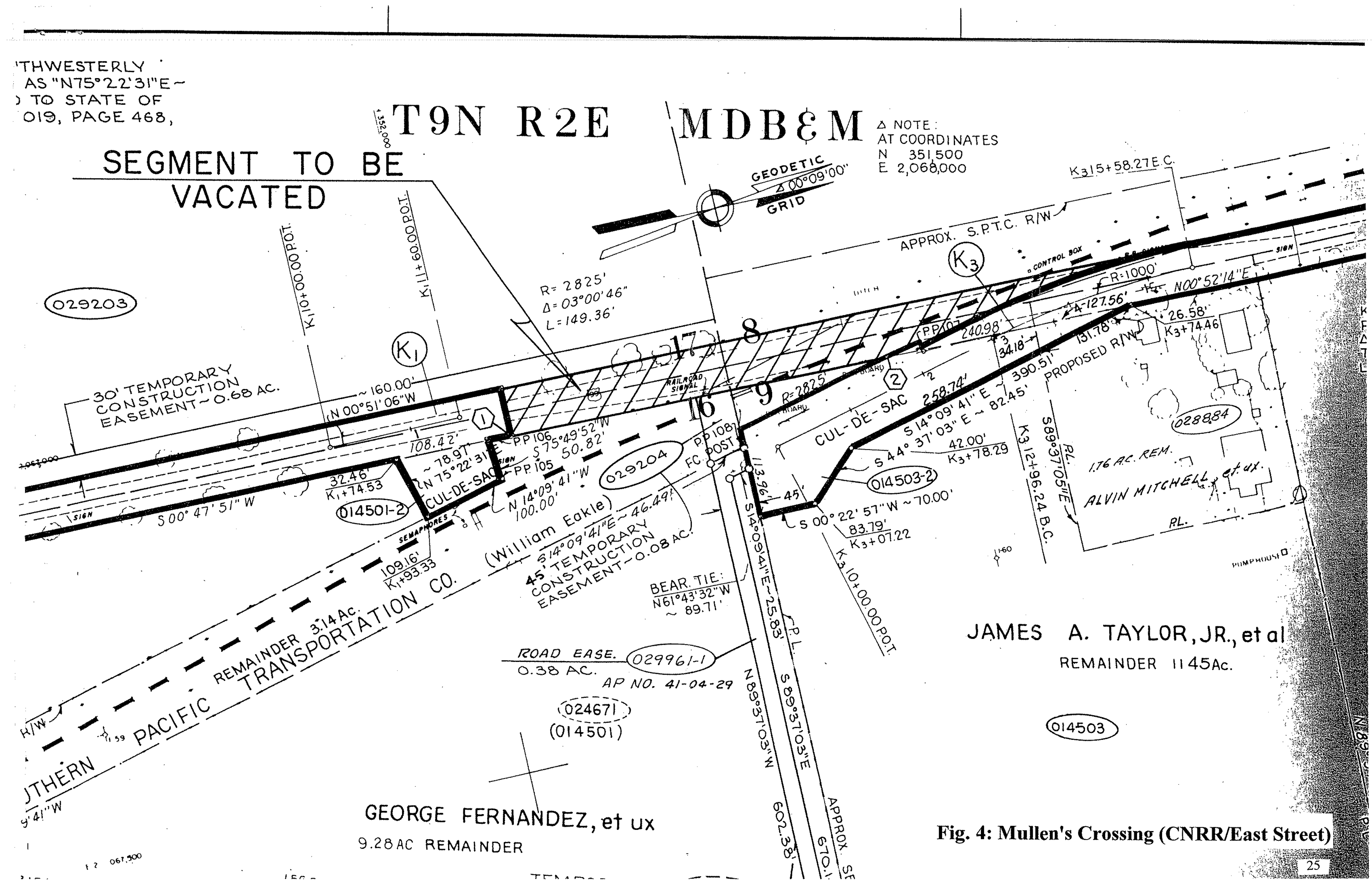


Fig. 4: Mullen's Crossing (CNRR/East Street)

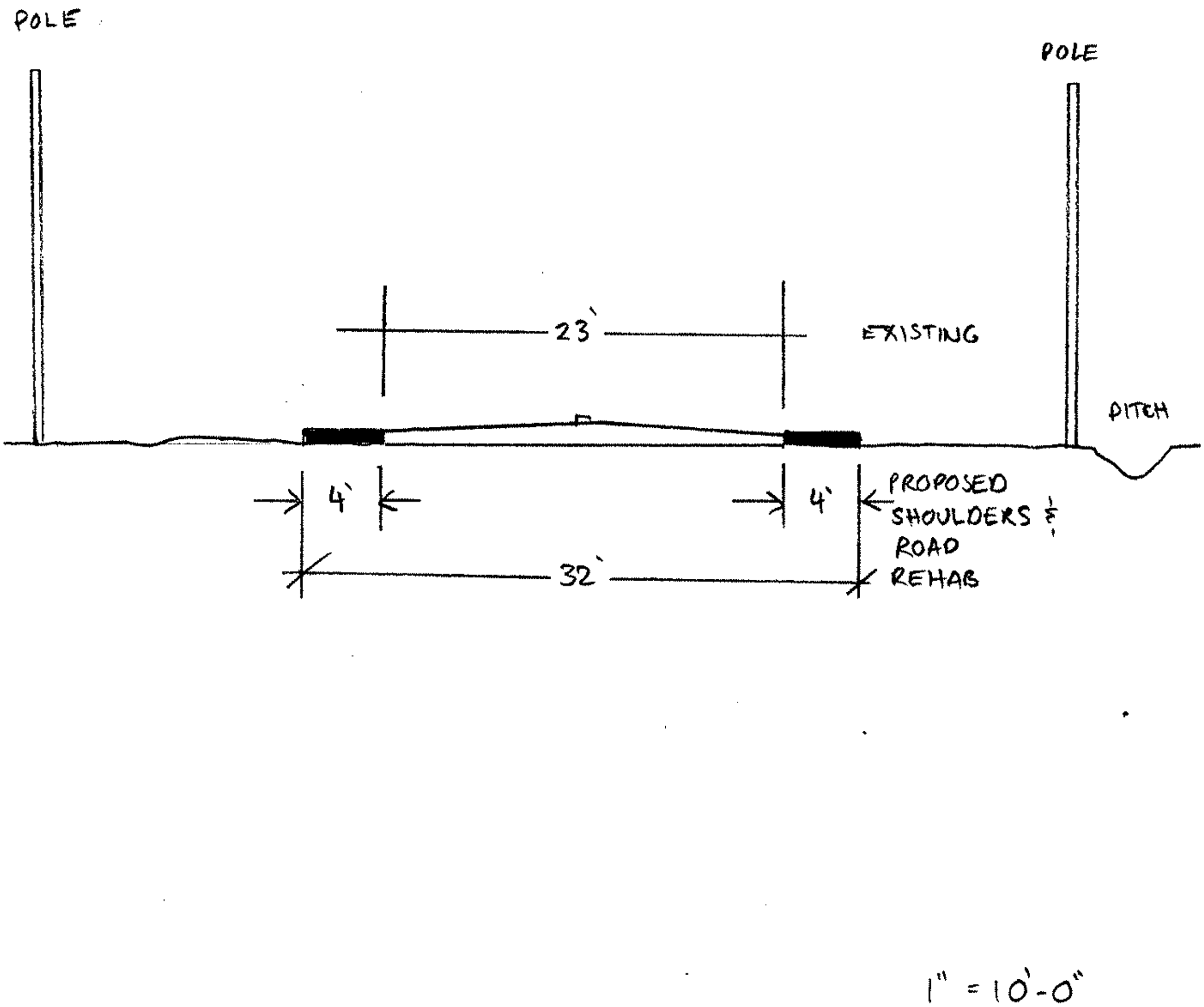


Fig. 5	CR 27 (east of SR 113)	alta PLANNING • DESIGN • ECONOMICS

acquired to provide shoulders on CR 29 (see Figure 6).

CR 99

CR 99 is a north-south route serving the western sides of both Woodland and Davis, with volumes ranging from 1200 ADT south of CR 29 to about 1800 ADT between CR 27 and Woodland. From Davis northward to CR 29, the road has two travel lanes within 24 feet of pavement, and no shoulders. A combination of irrigation/drainage ditches, trees, and utility poles located as close as 3 feet from the pavement edge would need to be addressed prior to widening this section (see Figure 7). North of CR 29 to CR 27, the roadway pavement narrows to 21 feet (33 feet at the two bridges) within a 50' right of way. Ditches and a row of mature olive trees on the East Side of this road section prevent easy widening of this portion of roadway. North of CR 27 into Woodland, CR 99 has between 31 and 34 feet of pavement including two travel lanes and 4 feet shoulders. CR 99 would be identified as a Class II bike lane or a Class III bike route once shoulders were completed and the route completed as a bikeway. Additional right of way (about 2.4 acres) is required to provide shoulders on CR 99 due to the desire to avoid removing existing olive trees.

CR 99D

CR 99D is a western frontage road allowing limited access to SR 113. This road consists of a 30 feet wide paved surface (two twelve-foot travel lanes, 3 feet wide shoulders) from Davis to CR 29, and carries low traffic volumes (see Figure 8). South of CR 29, the road would be identified as a Class II bike lanes or III bike route and provide shoulders. North of CR 29, CR 99D continues with a 25 feet wide paved surface and two travel lanes. The road dead-ends south of Willow Slough, and accordingly has one of the lowest traffic volumes of any of the streets included in the analysis of alternatives. This segment of CR 99D would be identified as a Class III bike route, and would not necessarily require shoulders given the low traffic volumes and speeds. A new pathway and bike-pedestrian bridge would need to be built north of CR 99D to connect to Myrtle Lane, requiring an easement from Caltrans or adjacent property owners.

As part of the approval of the City of Davis Community Golf Course Expansion project and Residential Subdivision (North Davis Meadows II) in the mid-1990's, the County Board of Supervisors adopted the following condition relevant to possible bike lanes on County Road 99D.

> "55. a. The City of Davis shall cooperate with the County of Yolo to provide widening and restriping improvements on Co. Rd. 99D sufficient to provide a minimum 4 foot wide paved shoulder striped for bike lanes on both sides from the northern end of the Sutter-Davis Hospital site (Phase I and II) to the secondary access route connecting the clubhouse to Co. Rd. 99D. This improvement shall be installed to the satisfaction of the Public Works Director."

The basis for this condition was Mitigation Monitoring Measure 3.3B-3 in the Environmental Impact Report for the project. Although the subdivision has been constructed, the Davis Golf Course Expansion Project does not appear to be a viable project at this time, so it is uncertain what effect

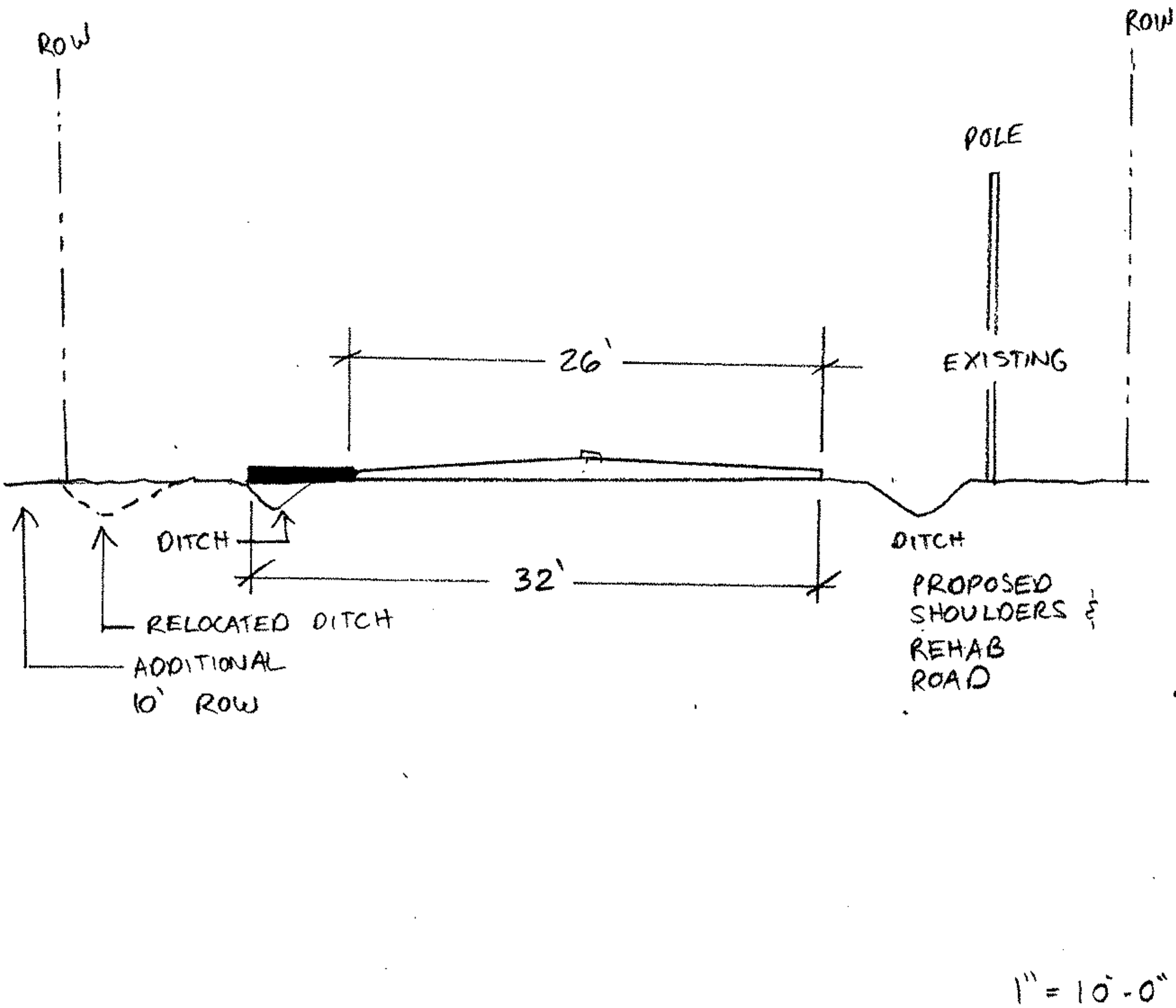
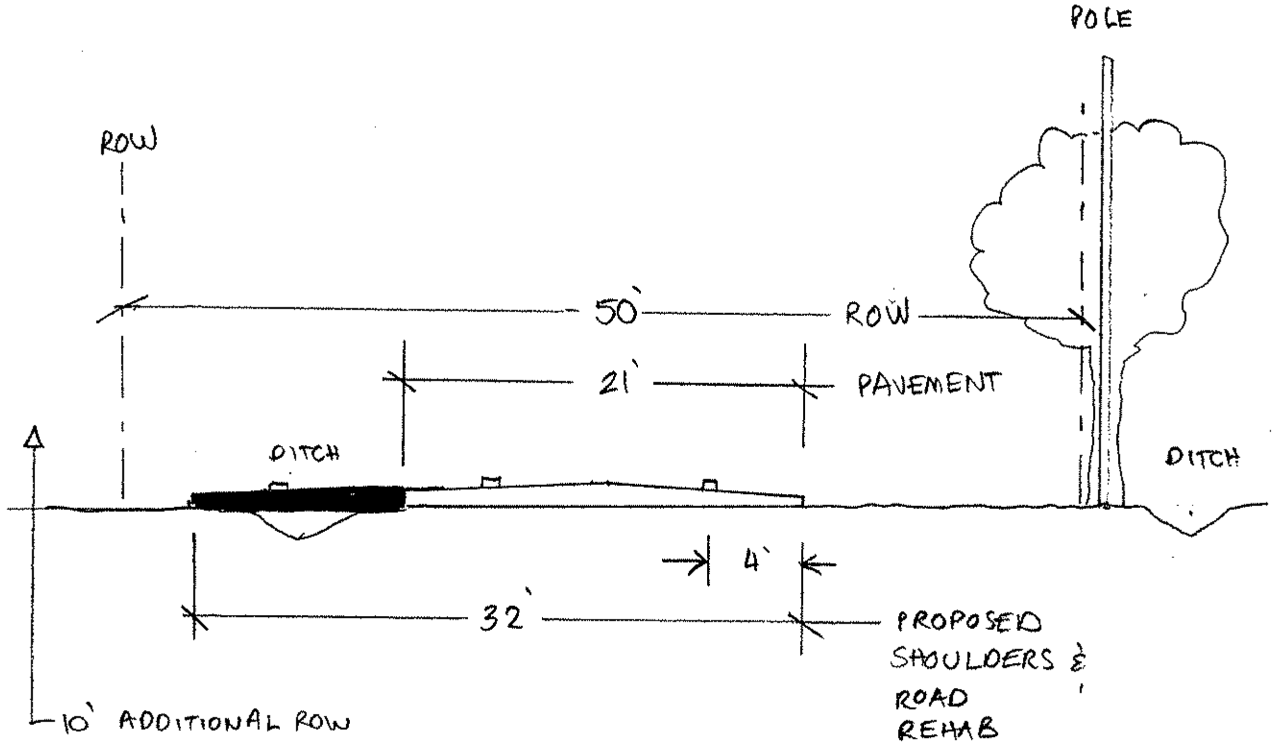


Fig. 6 | **CR 29 (east of CR 99)**



1" = 10'-0"

Fig. 7	**CR 99 (south of CR 27)**	alta

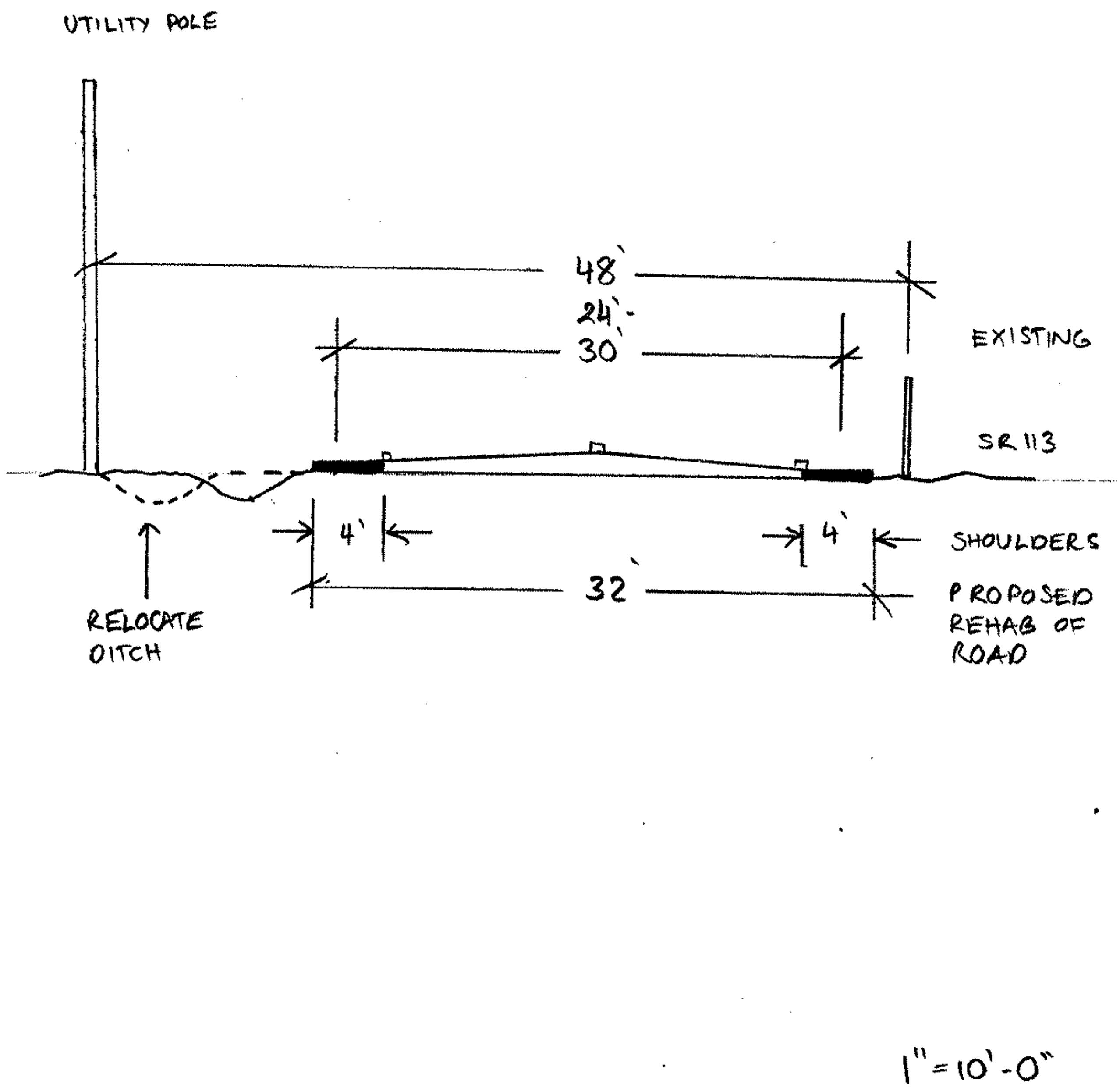


Fig. 8	**CR 99D (south of CR 29)**	alta

this condition of approval may have on the improvement of County Road 99D.

CR 100A

CR 100A is a bifurcated roadway, with disconnected sections north and south of Willow Slough. From the City of Davis (Sycamore Lane), CR 100A is a frontage road on the east side of SR 113 with 25 feet of pavement and two 12.5 foot lanes, occasional 5 foot paved shoulders in poor condition, and low traffic volumes. If selected as a bikeway, this section should be identified as a Class II bike route and provided with consistent 4 feet shoulders up to CR 29 (see Figure 9). North of CR 29, 100A is a dead-end street, and could be identified as a Class III bike route with no shoulder improvements. However, the cost estimates reflect standard 4 feet wide bike lanes or shoulders on this section. The road is separated from its northern partner by Willow Slough. The construction of a pathway and bridge over the slough between the cul-de-sacs would provide a route with very low motorized traffic volumes between CR 29 and CR 27, and would require an easement from Caltrans or adjacent private property owners. The northern section of CR 100A to CR 27 has two travel lanes within a 22 feet wide paved surface, and no shoulder. While this could be signed as Class III bike route with no shoulders the cost estimates reflect the provision of shoulders or bike lanes, representing the optimal improvement.

CR 101

This is a two-lane paved road with no shoulders from CR 25A northward to the City of Woodland. South of CR25A, the road is a gravel roadway with accordingly very low (125ADT) traffic volumes. The right of way varies from 50 to 60 feet, with the paved roadway portion between 23 and 25 feet wide (no shoulders) and the unpaved roadway 22 to 23 feet wide. Irrigation ditches line both sides of the roadway for much of its length. North of CR 25A, this road would be re-constructed to provide access for bicycles as part of the Springlake development in Woodland. South of CR 25A, the road would need to be paved with shoulders to provide a Class II bike lane or Class III bike route (see Figure 10). However, the later is not included as part of the Springlake plan.

CR 101A

CR 101A is a moderately traveled road (2100 ADT) with two 10.5-foot lanes without paved shoulders. The public right of way is 70 feet, with a ditch located on the western side of the road. Shoulders could be implemented along this section without major relocations or improvements, or right of way acquisition. (see Figure 11) A pathway could be located on either side of the roadway, although the west side provides more room. As it approaches the Davis city limits, the road has been developed with curb and gutter and 40 feet of paved surface. Class II bike lanes are the preferred type of treatment on CR 101A due to the fact there are existing Class II bike lanes on the City of Davis section. Bike lanes on CR 101A would in effect continue these facilities northward to CR 29.

CR 102

The main north-south roadway connecting the east sides of both Woodland and Davis, CR 102 has

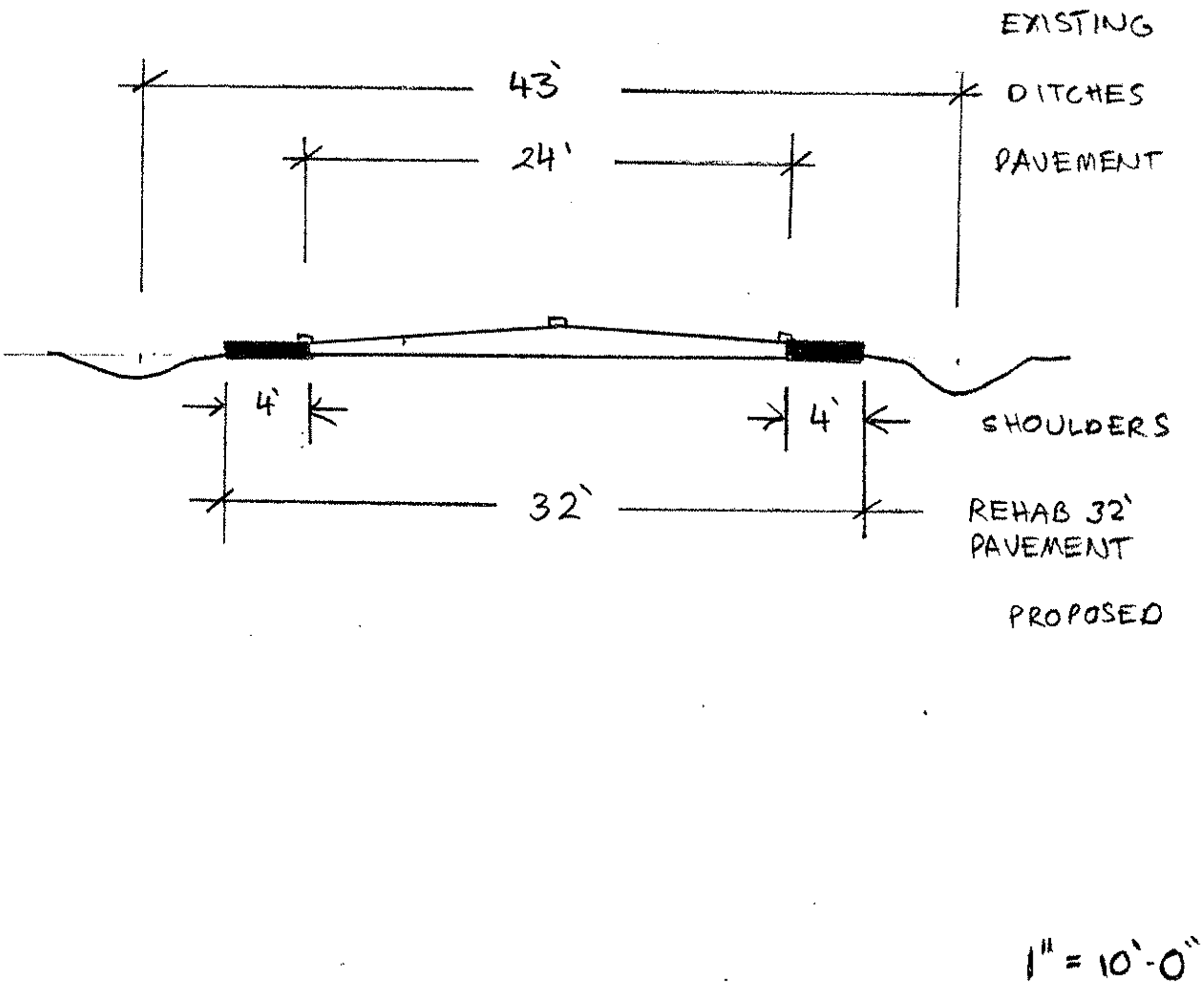


Fig. 9	**CR100A**	alta

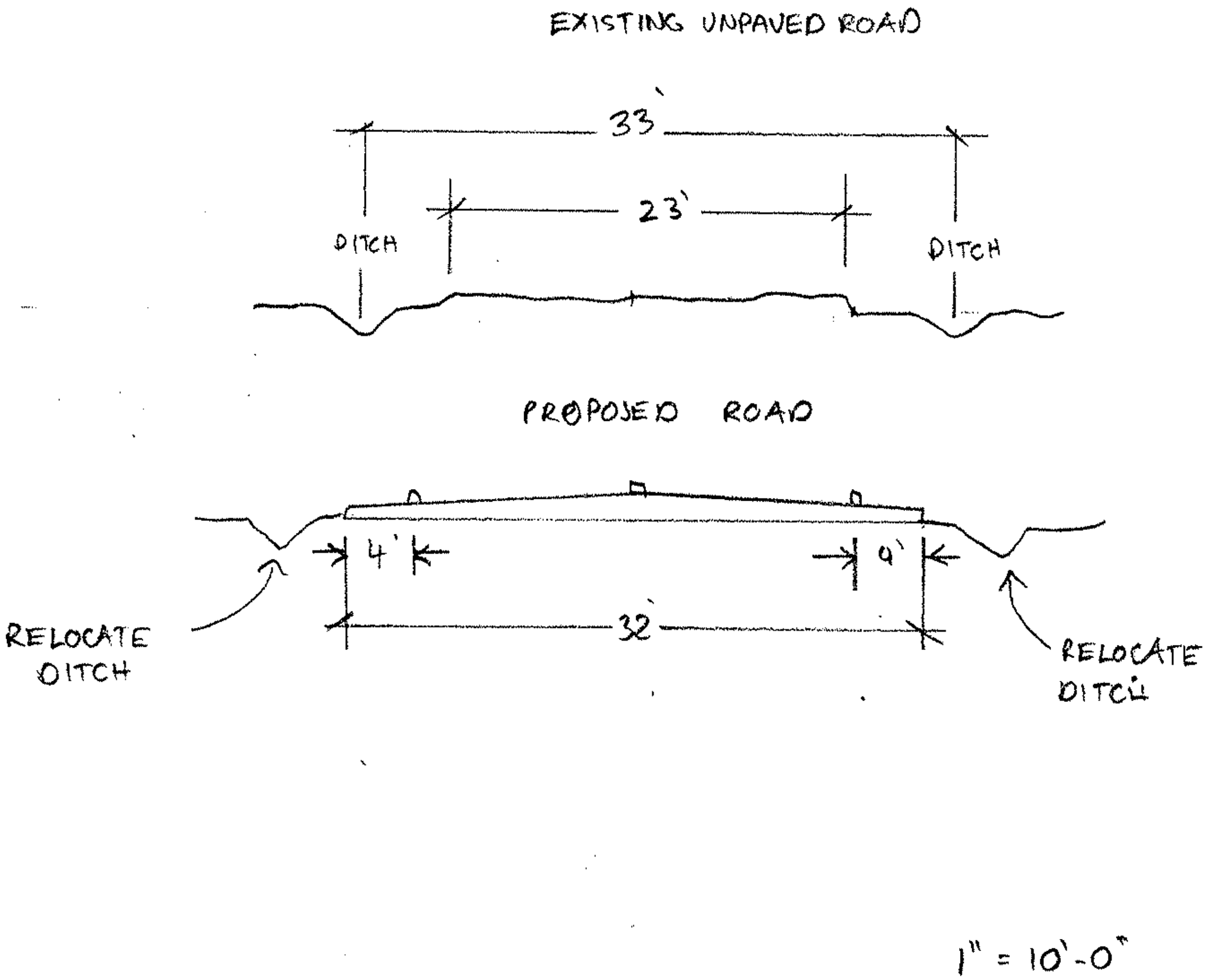


Fig. 10	CR 101 (south of CR 25A)	alta

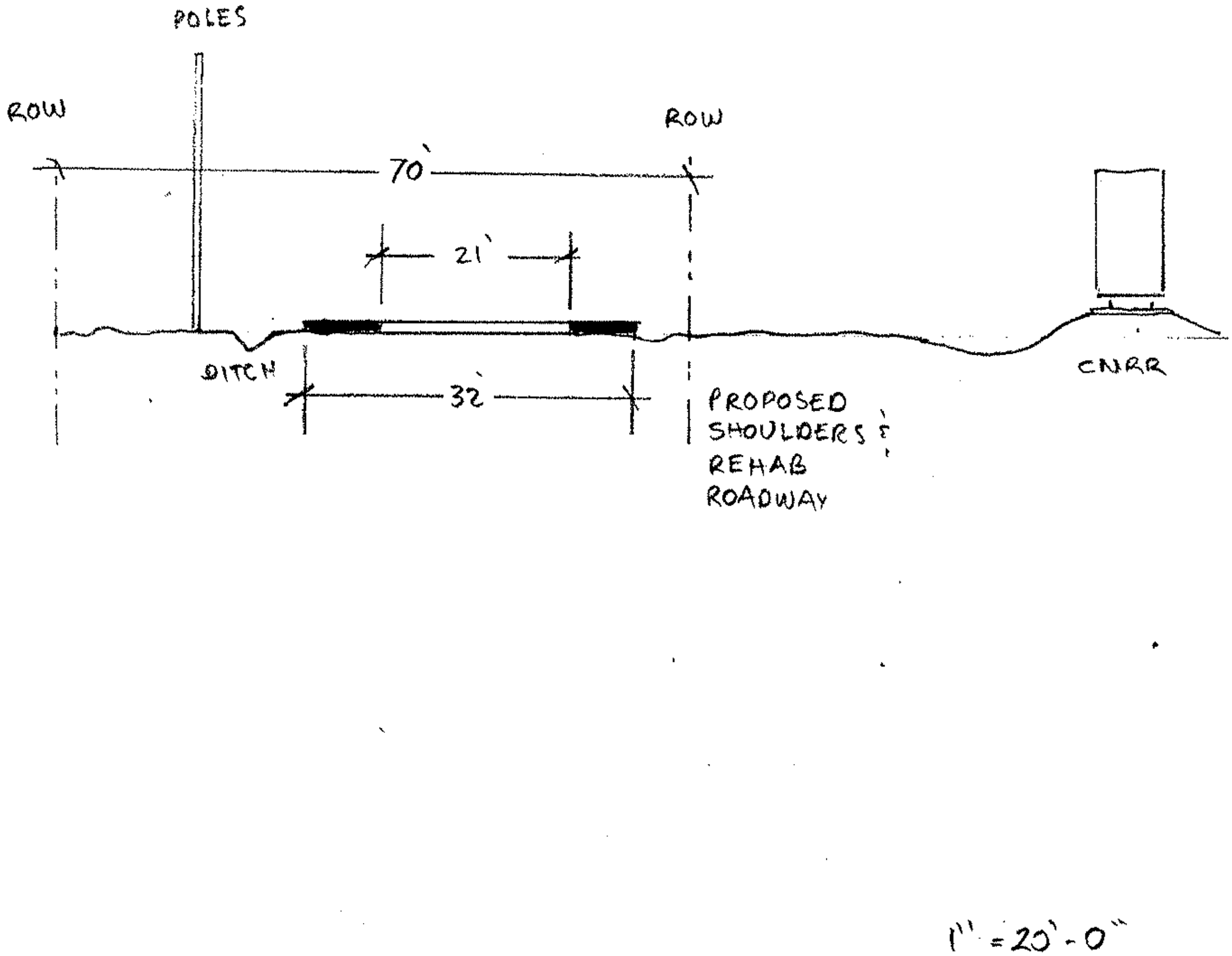


Fig. 11	CR 101A (south of CR 29)	alta

moderate traffic volumes, high traffic speeds, a right of way between 90 and 100 feet wide, and two travel lanes and shoulders within 40 to 42 feet of pavement. With 6 feet shoulders along most of the route, this is already a Class II bicycle route between the Woodland and Davis area.

East Street

East Street is a major north-south street in Woodland, and extends southward until it dead-ends at the CNRR. Once SR 113 was constructed, the railroad crossing on East Street was abandoned, although bicyclists still cross illegally from Rose Lane. East Street has a 33 feet wide paved surface, two travel lanes, and shoulders south of CR 25A. North of CR 25A, the roadway is only 29 feet wide, with utility poles and black walnut trees on both sides preventing an easy addition of shoulders (see Figure 12).

Myrtle Lane

Myrtle Lane is a 24 feet wide dead end local street. To be an effective bicycle route, it would need to be connected to CR 99D immediately to the south, separated by about 2,000 feet. The Myrtle Lane right of way is adjacent to the Caltrans right of way for SR 113. This road would be identified as a Class III bike route, and does not necessarily require shoulders. The cost estimates reflect the provision of new 4 feet wide shoulders/bike lanes, representing the optimal improvement that could be provided in later phases of the bikeway development.

Rose Lane

Rose Lane is a 33 feet wide dead end local street, with very low traffic volumes. Rose Lane terminates at the CNRR tracks. There is no existing legal crossing of the track at this location. A new crossing would be required including the approval of the UPRR, CNRR, and the CPUC. The road would be identified as a Class III bike route, with no shoulders necessarily required. The cost estimates reflect the provision of new 4 feet wide shoulders/bike lanes, representing the optimal improvement that could be provided in later phases of the bikeway development.

State Route 113

While bicycle and pedestrian use of SR 113 is legally allowed between CR 29 and CR 27, it is not considered a viable alternative to attract additional people to the freeway shoulders in the future. However, in order to connect CR 99D and Myrtle Lane, or both sections of CR 100A, portions of the Caltrans right of way might be utilized to construct a bike path. Caltrans survey maps show a 240 feet wide Caltrans right of way in the vicinity of Willow Slough, of which 138 feet is consumed by the roadway, shoulders, and median (source: Caltrans Willow Slough Bridge Construction drawing.) Approximately 51 feet of Caltrans right of way on each side of the highway pavement is available for vehicle recovery, drainage, and possibly a bikeway. Because the response from Caltrans to a County request for State right of way to accommodate a bikeway is unknown, the assumption has been made that right of way would need to be acquired from adjacent property owners to provide a pathway on either side of SR 113. The cost estimates reflect the acquisition of a 20 feet wide

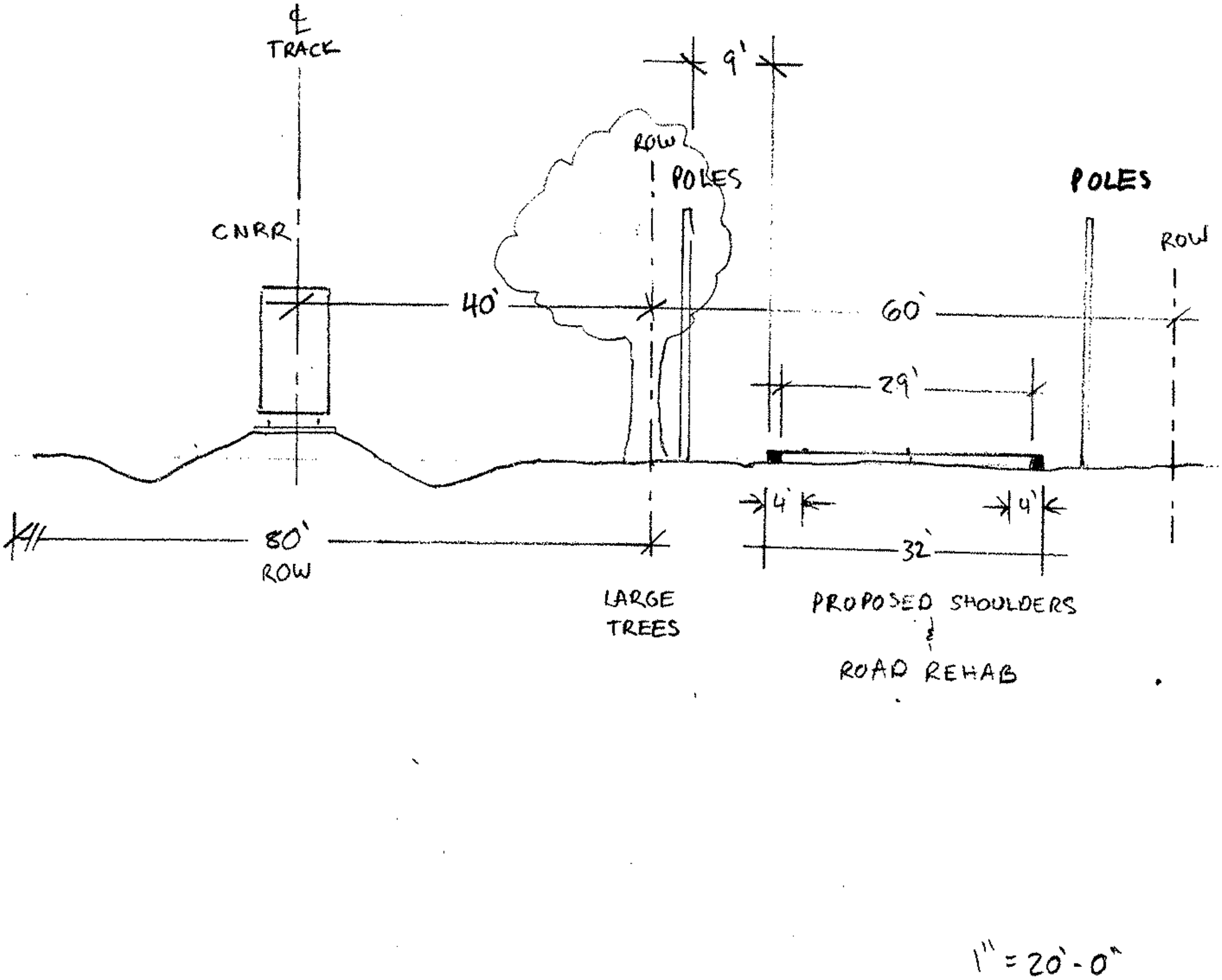


Fig. 12 | **East Street (north of CR 25A)**

Evaluation of Alternatives

OPTION 1

easement through this area (see Figure 13).

It is not possible to tell whether Caltrans would grant an encroachment permit to construct a pathway within State right of way until after going through an extensive review process. Correspondence from Caltrans (Tadj Ratajczak, June 8, 2000) indicates a willingness to review the project proposal, although typically the review process will require preliminary engineering drawings beyond the scope of this project. Based on experience elsewhere in California, Caltrans has generally allowed these types of facilities within or adjacent to their right of way, assuming Highway Design Manual requirements such as minimum set backs, and recovery zones for errant vehicles, can be met.

Willow Slough

The Willow Slough corridor is on private property, without a dedicated public easement or right of way (see Figure 14). A new bridge structure would need to be built north of CR 29 at the Willow Slough by-pass to bring the proposed path north to CR 27. Any pathway along Willow Slough would impact adjacent farming operations by opening up areas now closed to public access. A pathway along the slough would also result in moving farm access roads and drainage/irrigation ditches, thereby eliminating some farmland. In addition, it would be necessary to address safety, security, and privacy issues in the bikeway design

6.0 EVALUATION OF ALTERNATIVE ALIGNMENTS

This section presents a description and evaluation of each of the six options according to the overall project goals (chapter 1), needs and purpose (chapter 2), types of potential improvements (chapter 3), evaluation criteria (chapter 4), and physical conditions on each segment (chapter 5). In Section 7, a summary of how each alternative scored according to the evaluation criteria is presented, along with estimated costs of each alternative.

OPTION 1: BIKE ROUTE (Shoulder Improvements CR 99/CR 29/CR 101A/CR 99D)

Description:

Option 1, shown in Figure 15, is a hybrid of Options 2 and 6. It was identified by the public and TAC Subcommittee as a possible way to enhance the six (6) original options presented, and especially to provide a more central connection into Davis for Option 6. Essentially, Option 1 includes new shoulders on CR 99 as in Option 6, except that it is only between CR 27 and CR 29. To provide a better connection into central Davis, new shoulders are placed on CR 29 between CR 99 and CR 101A. New connections are then placed on both CR 99D (new Class II bike lanes or Class III shoulders) and CR 101A (new Class II bike lanes).

A parallel Class I bike path was not considered along CR 99 in this option (or Option 5) for the following reasons, some of which have been discussed before.

1. Caltrans specifically discourages parallel bike paths.

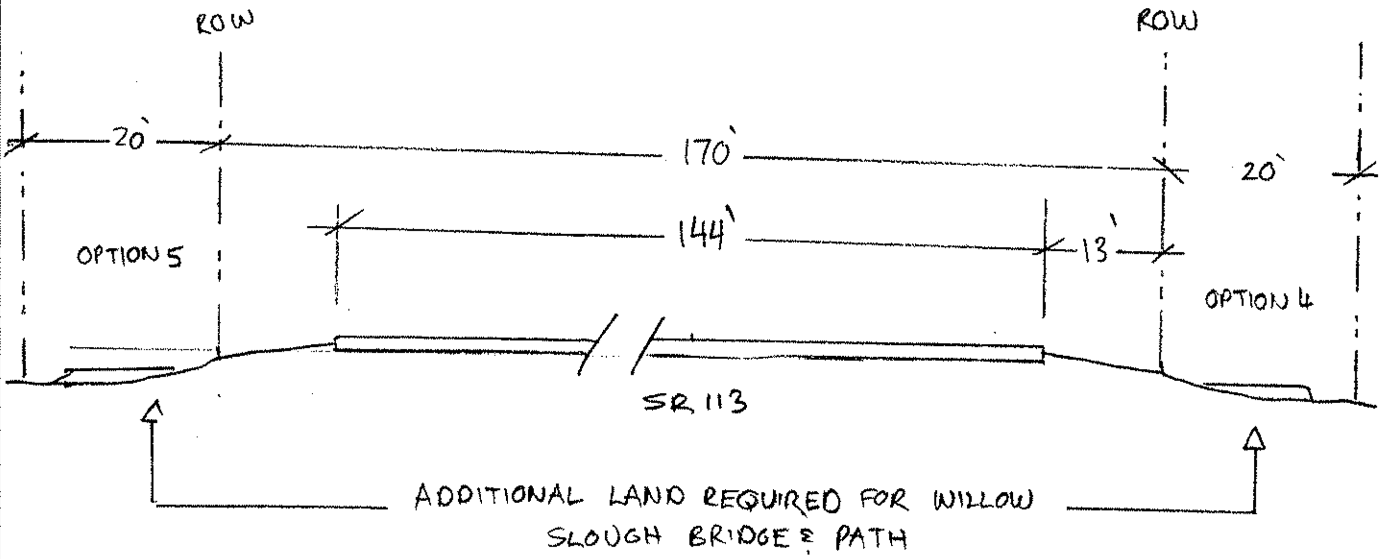


Fig. 13	State Highway 113 (near Willow Slough)	alta

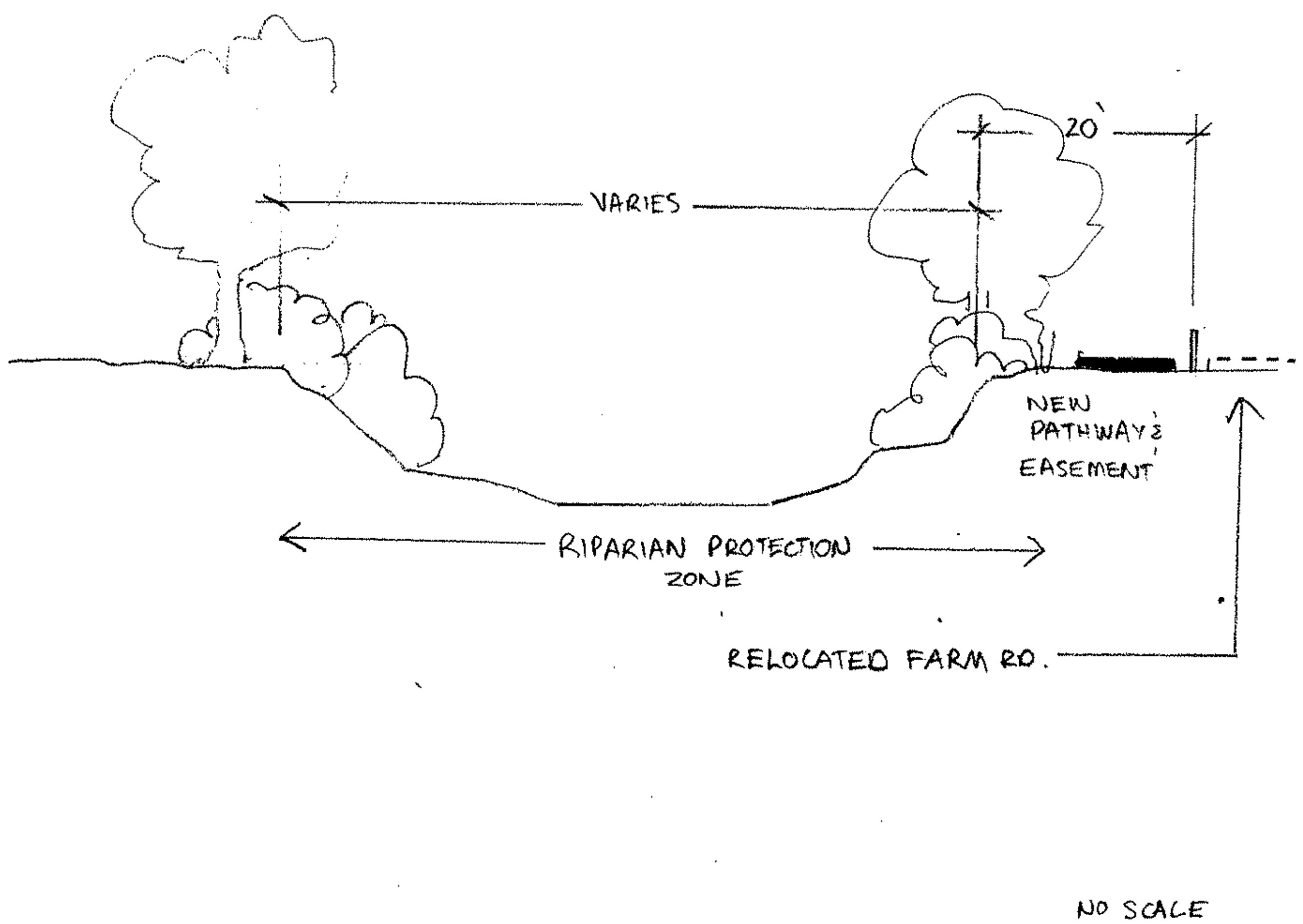


Fig. 14	**Willow Slough (east of CNRR)**	alta

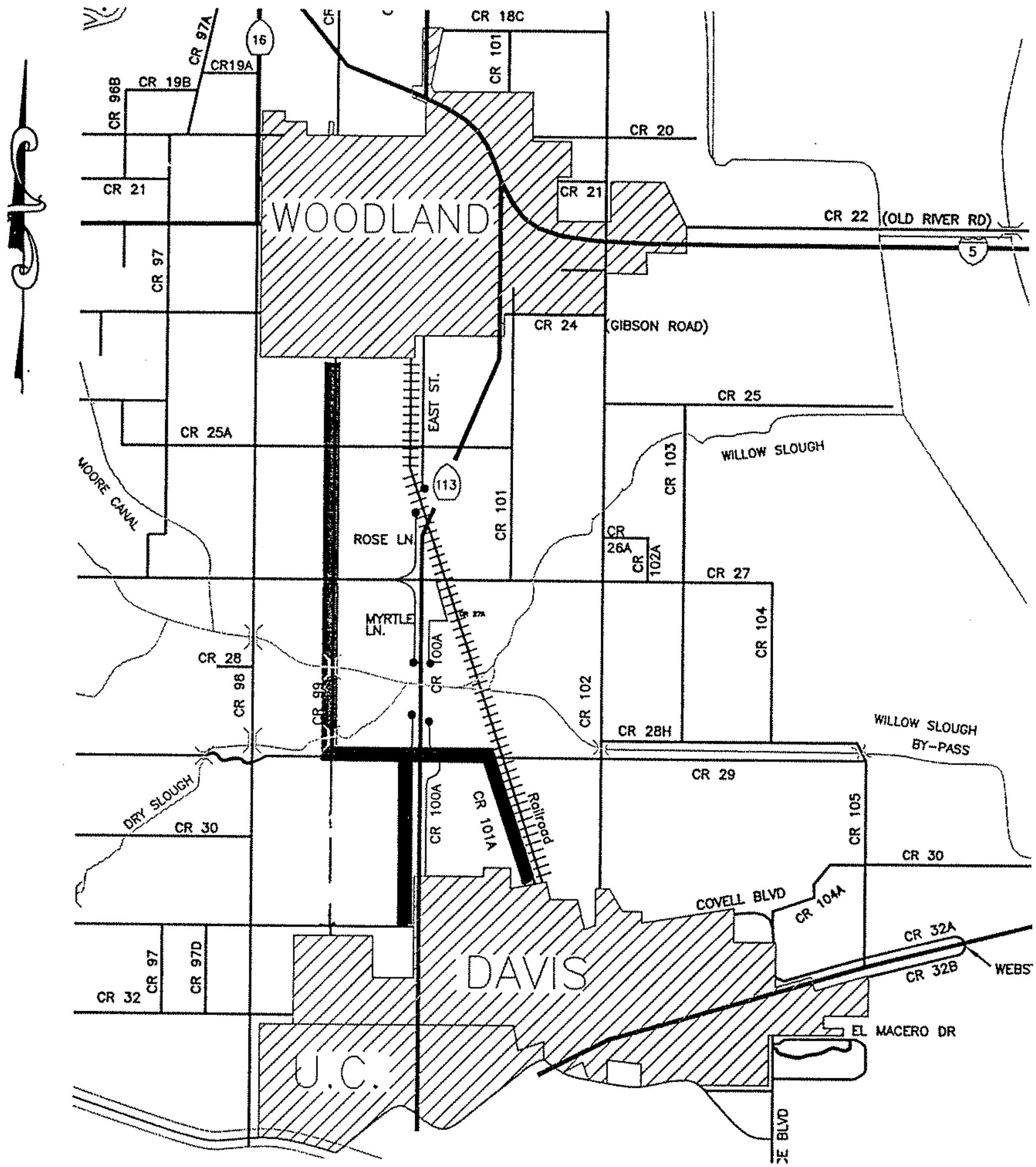


Fig. 15 | **Option 1**

alta

2. Class II bike lanes already exist from Woodland south to CR 27.
3. a Class I path would require additional right of way and expense, and would be particularly difficult with respect to right of way acquisition in the area between CR 27 and CR25A due to the number of homes adjacent to the road.
4. shoulders offer both an important motor vehicle safety benefit and bicycle commute benefit.
5. there are numerous driveways along CR 99 that pose a safety concern for a Class I facility.

Right-of-Way and Construction Costs

This option would require the acquisition of some private property (approximately 3.53 acres) in order to provide shoulders/bike lanes, and avoid removing existing olive trees. Shoulders on CR 99 would require fairly extensive drainage and utility pole relocation. Shoulders on CR 29, CR 99D, and CR 101A would require drainage ditch and utility pole relocation. Due to the need to reconstruct CR 99, CR 29, CR 101A, and CR 99D to provide shoulders, the total cost of this project is quite high (over $2.5 million), while the bikeway components total $766,000.

Maintenance Costs

On-road bicycle facilities in the County typically do not receive special treatment.

Accessibility of the route to Existing and Future Activity Centers

This option offers very excellent accessibility to bicyclists in western and central Davis and Woodland. In combination with the CR 102 shoulders, bicyclists would have four connection points into Davis and two into Woodland.

Environmental Impact

This option would have very limited environmental impacts, since the new shoulders would replace adjacent ditches and there would be no new improvements to the slough crossings.

Agricultural Impacts

This option could impact agricultural operations and result in some loss of agricultural land, depending on the extent of drainage ditch relocation and land purchase. Wider shoulders would be a benefit for slow moving farm machinery.

Use of Existing Infrastructure

This option requires some new infrastructure, including new shoulders. It does use and improve the existing County roads, which offer a direct connection between the two cities.

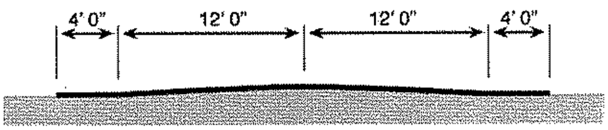
Recreation/Aesthetic Value

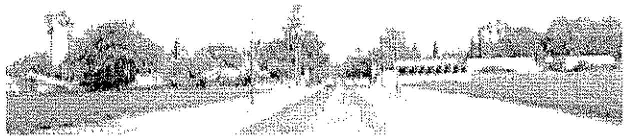
This option would be located next to high speed and relatively high traffic roadways, which is not particularly aesthetic. It is likely that recreational users would not use this route in high numbers, nor would less experienced bicyclists.

Ease and Time to Implement

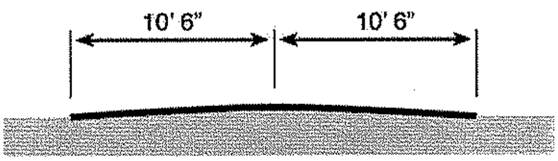
This option would involve the purchase of land to provide shoulders. Since the right of way is adjacent to existing roadways, the process would be less time consuming and difficult than with off-road routes.

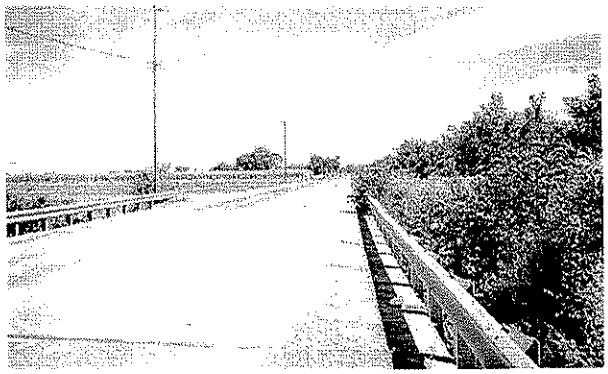
County Road 99
South of Woodland Looking North



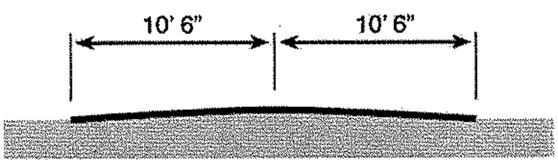


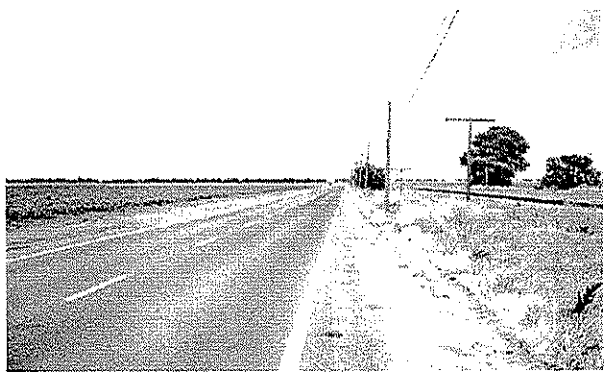
County Road 99
Near Willow Slough Crossing
Looking North

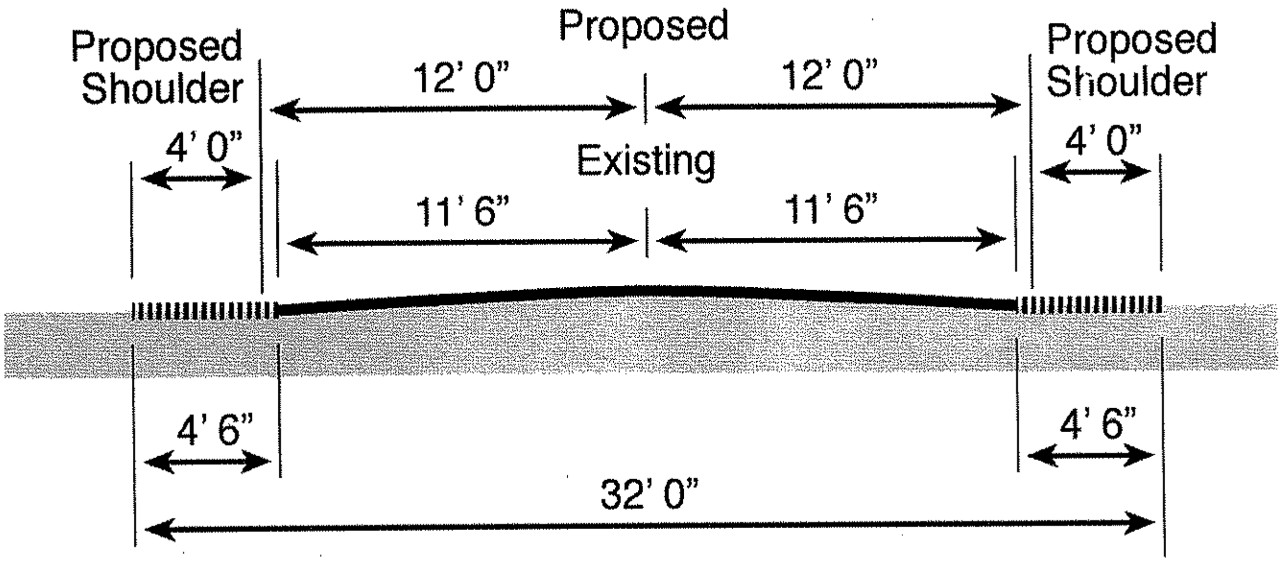




County Road 101A
South of CR 29
Looking North

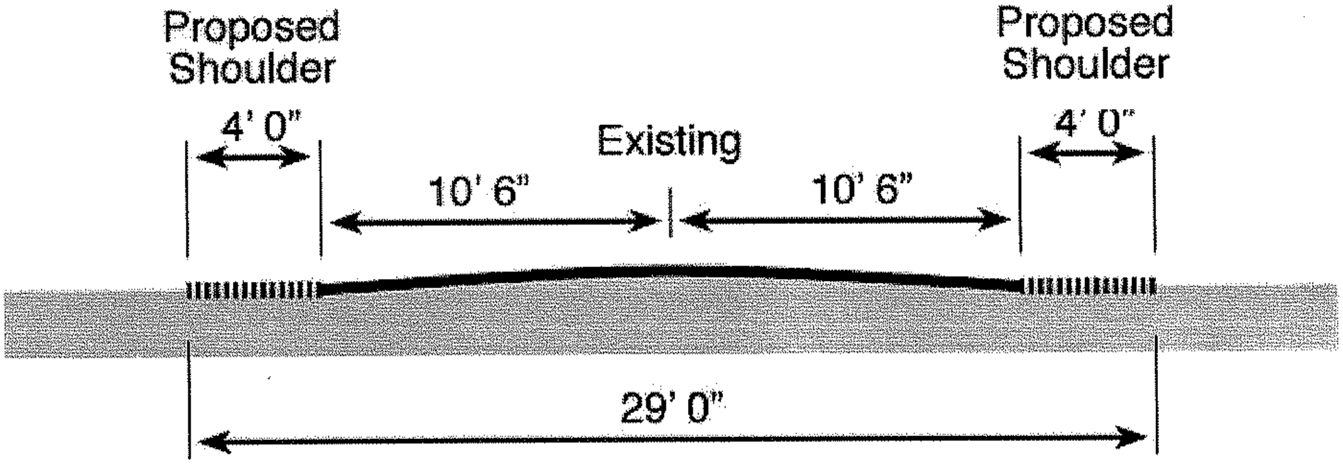






Typical Cross Section

Figure 16	Proposed Improvement County Road 99 between CR 27 and CR 29	alta



Typical Cross Section

Figure 17	Proposed Improvement County Road 29 (CR 99 to CR 101A)	alta PLANNING • DESIGN • ECONOMICS

OPTION 2

OPTION 2: BIKE ROUTE (CR 101A/CR 29/CN Railroad Path/Willow Slough Path/CR 27/CR 101)

Description:

From the City of Davis, Option 2 (see Figure 18) follows CR 101A to the northwest and on the western side of the railway, where a 70 feet wide County right-of-way will allow for either shoulders or a parallel pathway. The route crosses CR 29 and follows beside the CNRR right-of-way as a bike path until it reaches Willow Slough. From there, a bike path follows the Slough to the northeast until it meets CR 27. The route then crosses the slough eastbound on CR 27, and turns north on CR101. The route then follows CR 101 north to CR 24 and the City of Woodland as an on-street bike route.

Evaluation:

Right-of-Way and Construction Costs

This option has major right-of-way issues and high construction costs. The option requires the purchase of 6.01 acres of land. The CNRR right-of-way north of CR 29 is not wide enough to accommodate a bike path. New right-of-way would need to be acquired from adjacent farms along the railroad and along Willow Slough. Construction costs would be high due to the need to construct a new bridge over Willow Slough, and relocate farmland drainage and utilities. CR 101A would need to be reconstructed to provide shoulders or bike lanes, while CR 101 would need to be paved. Total cost for this project is estimated to be over $3 million, with $1.7 million bikeway-related.

Maintenance Costs

As with any off-street facility, the new bike path portions of the route would require regular maintenance including sweeping, weed abatement, trash removal, and re-surfacing. The annual maintenance cost for the pathway segment totals about $21,000 per year.

Accessibility of the route to Existing and Future Activity Centers

This option offers very good accessibility to bicyclists. At the southern end, CR 101A links into Central Davis, while at the northern end the route connects to central/east Woodland. Since the termini of this route are relatively close to the existing bikeway on CR 102, the net enhancement to connectivity gained with this alignment is less than it might be with alignments located farther west.

Environmental Impact

This option would include a new bridge over and a new pathway along Willow Slough. While the impacts to that sensitive area are not known and might be mitigated, it does represent a potential environmental impact. An EIR could be required for the project. Permits would most likely be required from the U.S. Corps of Engineers, U.S. Fish & and Wildlife Service and/or the California Department of Fish and Game, and the Department of Water Resources (DWR).

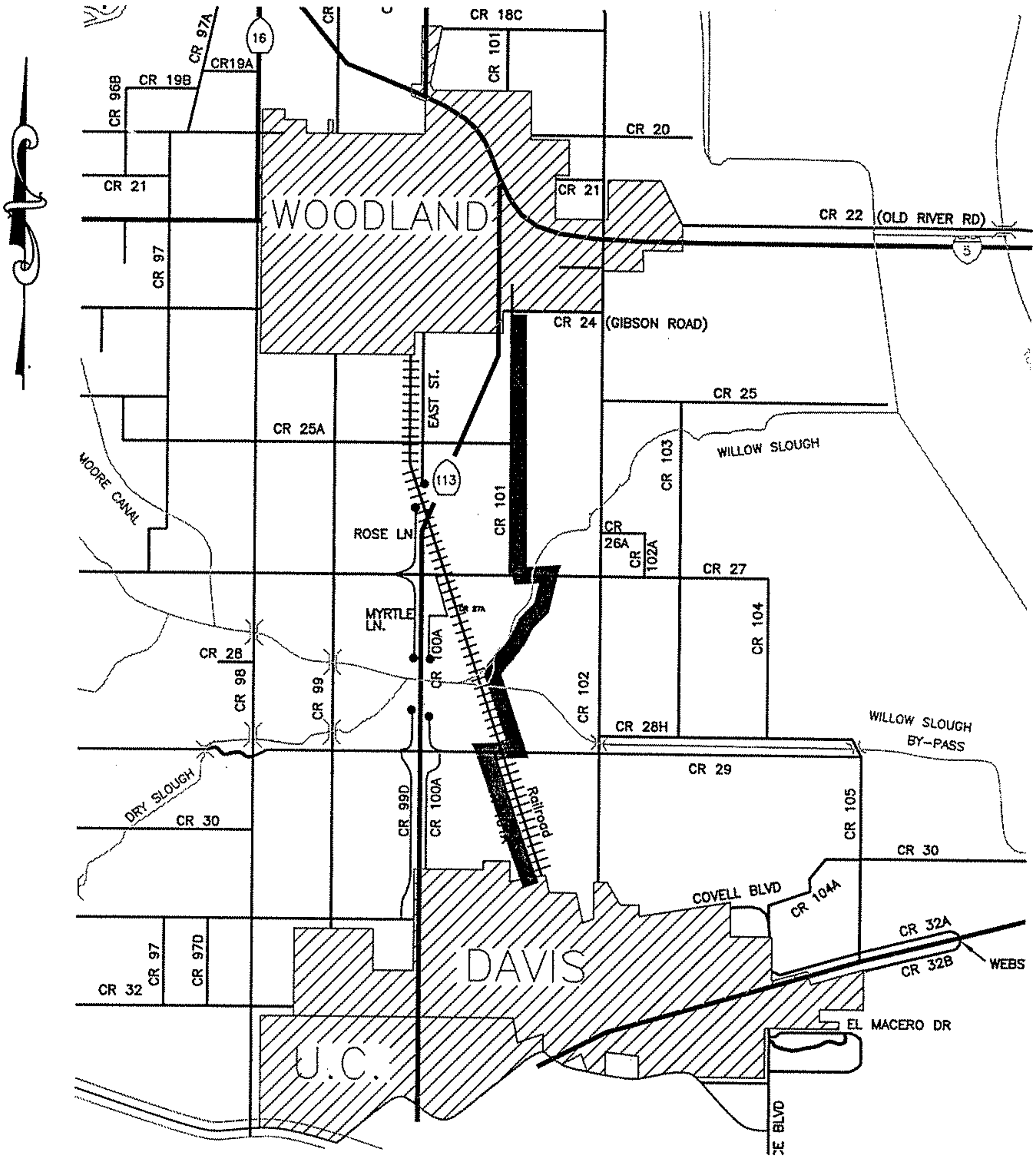


Fig. 18 | **Option 2**

alta

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Agricultural Impacts

This option would impact agricultural operations, including the need to acquire farmland, and relocate drainage and service roads. The pathway segments would intrude on agricultural lands not presently accessible to the public, with possible impacts to aerial and ground spraying operations for the immediate farmland.

Use of Existing Infrastructure

This option requires substantial new infrastructure, especially between CR 29 and CR 27.

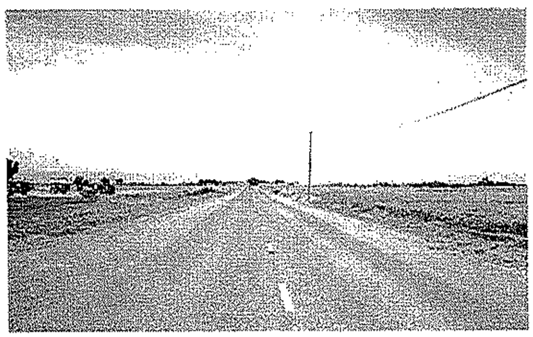
Recreation/Aesthetic Value

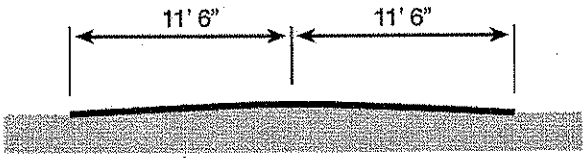
This option would offer a very pleasing aesthetic experience for users, being removed from vehicle traffic for about one to two thirds of its length and being located next to Willow Slough. The pathway segments would attract a substantial number of recreational users who might never use an on-street facility.

Ease and Time to Implement

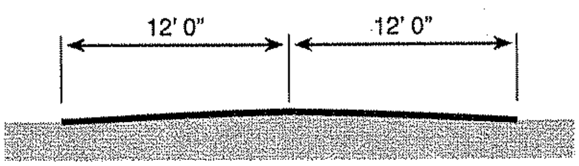
This option could be difficult and time-consuming to implement, given the need to acquire private farmland and environmental and agricultural impacts. It is possible that the right-of-way would require time-consuming condemnation proceedings. The project would require CEQA review that could result in the need for an environmental impact report (EIR), requiring funds and time.

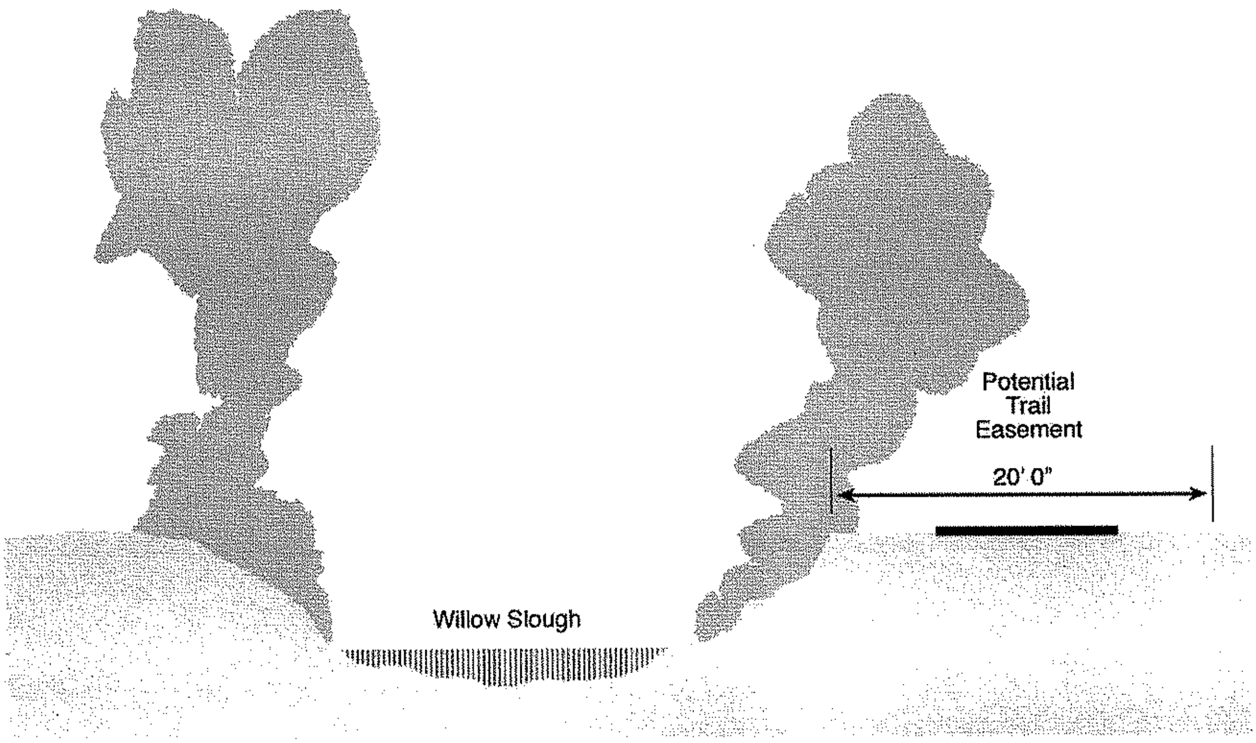
County Road 27
Near CR 101 Looking West
(East similar)





County Road 101
North of CR 25A
Looking North





Typical Cross Section

Figure 19	Potential Willow Slough Bike Path	alta PLANNING • DESIGN • ECONOMICS

OPTION 3

OPTION 3: BIKE ROUTE (CR 101A/CN Railroad Path/CR 100A/CR 27/CR 101)

Description:

From the City of Davis, Option 3 follows CR 101A from Davis to CR 29 as either improved shoulders or a parallel pathway (see Figure 20). Once across CR 29, a bike path would follow adjacent to the CNRR right of way to CR 100A and then on to CR 27. At CR 27, the project would include improved shoulders to CR 101, and then follow CR 101 into Woodland.

Evaluation:

Right-of-Way and Construction Costs

This option has major right-of-way issues and high construction costs. The CNRR right-of-way north of CR 29 is not wide enough to accommodate a bike path. Approximately 6.25 acres of land would need to be acquired from adjacent farms along the railroad and along CR 100A. Construction costs would be high due to the need to construct a new bridge over Willow Slough, and relocate farmland drainage and utilities. Shoulder improvements would be required on CR 27, and CR 101 would need to be paved. Total project cost is estimated at $3.2 million, with $1.6 million bikeway-related.

Maintenance Costs

As with any off-street facility, the new bike path portions of the route would require regular maintenance including sweeping, weed abatement, trash removal, and re-surfacing. The annual maintenance cost for the pathway segment totals about $16,000 per year.

Accessibility of the route to Existing and Future Activity Centers

This option offers very good accessibility to bicyclists. At the southern end, CR 101A links into Central Davis, while at the northern end the route connects to central/east Woodland. Since the termini of this route are relatively close to the existing bikeway on CR 102, the net enhancement to connectivity gained with this alignment is less than it might be with alignments located farther west.

Environmental Impact

This option would include a new bridge over, and a new pathway along, Willow Slough. While the impacts to that sensitive area are not known and might be mitigated, it does represent a potential environmental impact. Permits would be required from the U.S. Corps of Engineers, U.S. Fish & Wildlife Service and/or California Department of Fish and Game, and the Department of Water Resources (DWR).

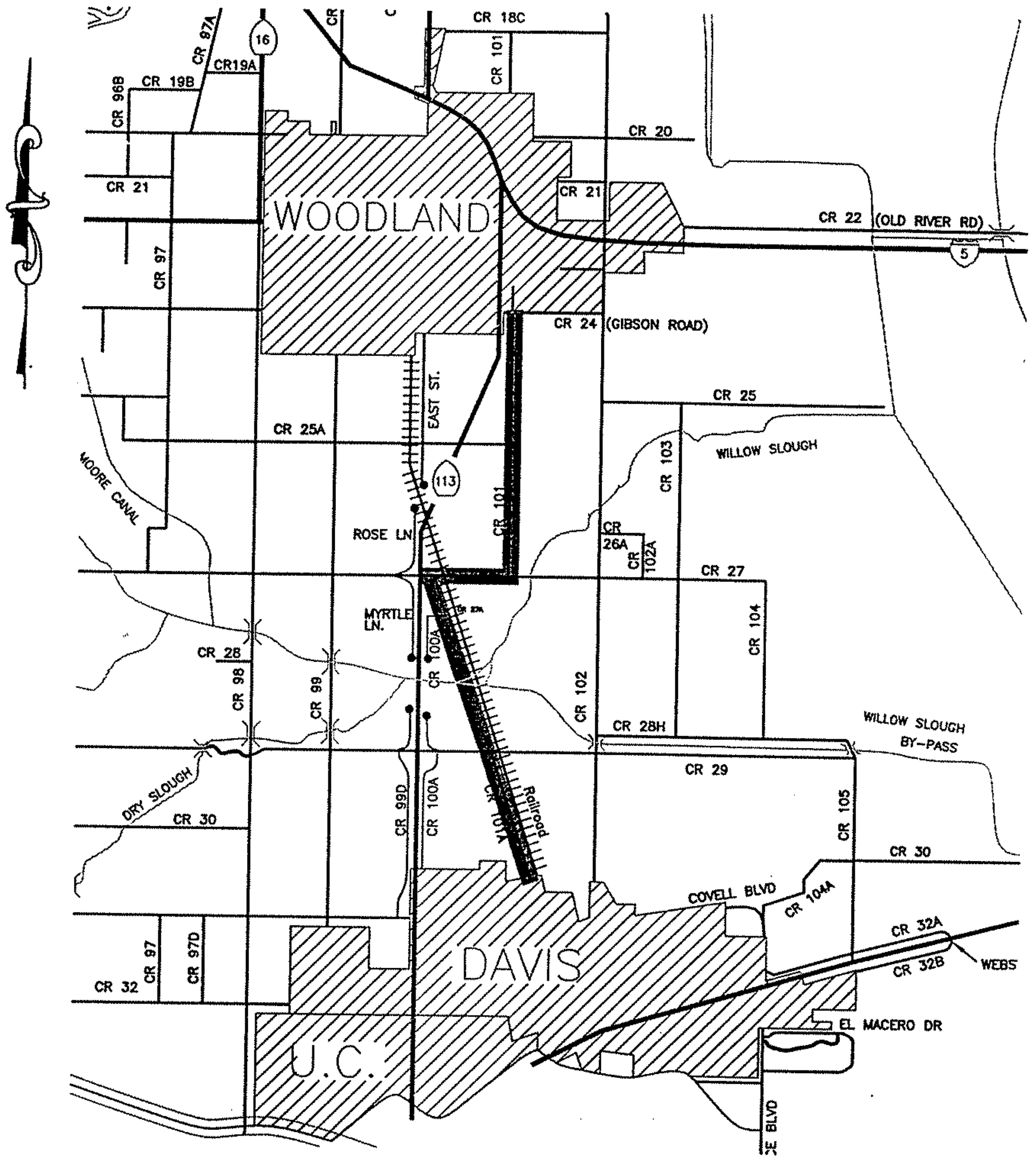


Fig. 20	Option 3	alta

Agricultural Impacts

This option would impact agricultural operations, including the need to acquire farmland, and relocate drainage and service roads. The pathway segments would intrude on agricultural lands not presently accessible to the public, with possible impacts to aerial and ground spraying operations for the immediate farmland.

Use of Existing Infrastructure

This option requires substantial new infrastructure, especially between CR 29 and CR 27.

Recreation/Aesthetic Value

This option would offer a very pleasing aesthetic experience for users, being removed from vehicle traffic for over one half of its length. The pathway segments would attract a substantial number of recreational users who would probably not use an on-street facility.

Ease and Time to Implement

This option could be difficult and time-consuming to implement, given the need to acquire private farmland and environmental and agricultural impacts. It is possible that the right-of-way would require time-consuming condemnation proceedings, along with CEQA and NEPA review and approval.

OPTION 4

OPTION 4: BIKE ROUTE (CR 100A/Willow Slough Bridge-Path/CR 100A/CR 27/CR 101)

Description:

From the City of Davis, Option 4 follows CR 100A northward crossing CR 29 and continuing to where the road dead ends (see Figure 21). A new pathway adjacent to SR 113 would connect the two sections of CR 100A, requiring the acquisition of right of way, and a new bridge across Willow Slough. The route would re-connect with CR 100A and continue to CR 27 as a Class III bike route. At CR 27, the route would turn east and continue to CR 101, requiring new shoulders on CR 27. The route would continue on CR 101 northward into Woodland, requiring paving of CR 101 with 4 foot shoulders.

Evaluation:

Right-of-Way and Construction Costs

This option has right-of-way issues and some significant construction costs. Additional right of way would be required to connect the two sections of CR 100A through adjacent farmland, if Caltrans right of way cannot be utilized. A new bridge would be required over Willow Slough. Shoulder improvements would be required on CR 27, and CR 101 would need to be paved. This option requires the purchase of 1.84 acres of land, and has a total project cost of $3.5 million with $1.4 million being bikeway-related.

Maintenance Costs

As with any off-street facility, the new bike path segment across Willow Slough would require regular maintenance including sweeping, weed abatement, trash removal, and re-surfacing. The estimated annual cost for this would be about $7,000.

Accessibility of the route to Existing and Future Activity Centers

This option offers very good accessibility to bicyclists. At the southern end, CR 100A links into Central Davis at Sycamore Lane, while at the northern end the route connects to central/east Woodland. However, the north end of the route is relatively close to the existing bikeway on CR 102, leaving the west side of Woodland without a good connection to Davis.

Environmental Impact

This option would include a new bridge over Willow Slough. While the impacts to that sensitive area are not known and might be mitigated, it does represent a potential environmental impact. Permits would be required from the U.S. Corps of Engineers, U.S. Fish & Wildlife Service and/or California Department of Fish and Game, and the Department of Water Resources (DWR).

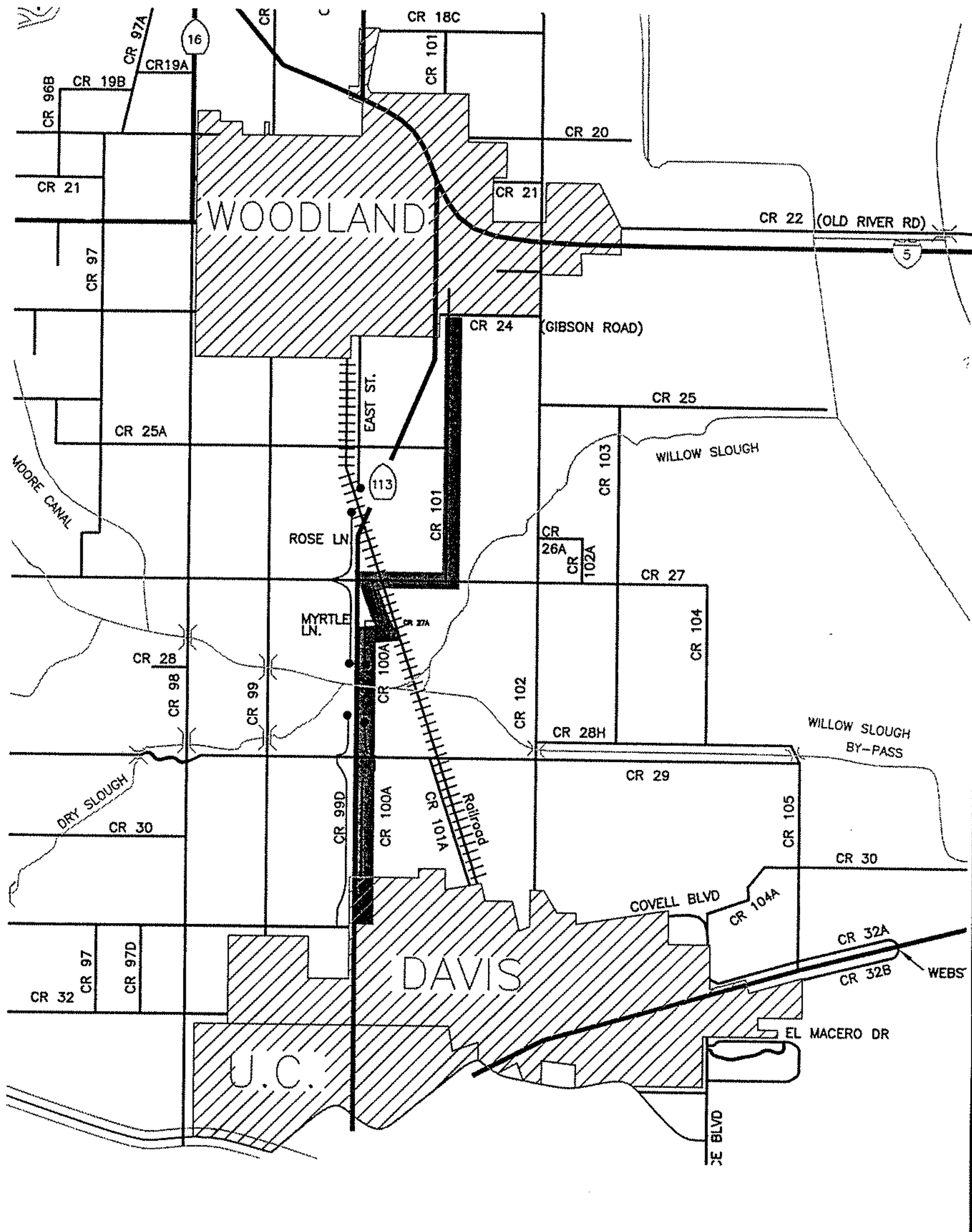


Fig. 21	Option 4	alta

Agricultural Impacts

This option would involve the purchase of 1.8 acres of land. Since the pathway would be located adjacent to existing roads, the impact to agricultural operations is not considered to be significantly more than those from the existing roads.

Use of Existing Infrastructure

This option requires some new infrastructure, including new shoulders, a pathway, and a bridge. It does use the existing frontage roads, which offer relatively low traffic volumes and speeds.

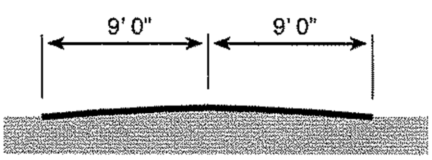
Recreation/Aesthetic Value

This option would be located next to SR 113 for about half of its length, which is not particularly aesthetic. However, the route would be mostly on low traffic/speed roadways, include a creek crossing, and traverse scenic farmlands on a quiet rural road (CR 101).

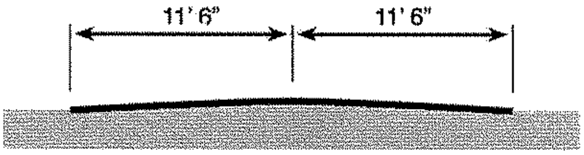
Ease and Time to Implement

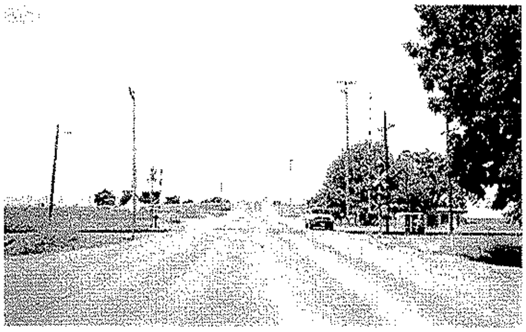
This option could be difficult and time-consuming to implement, given the probable need to acquire right of way from adjacent property owner(s). It is possible that the right-of-way would require time-consuming condemnation proceedings, along with CEQA, NEPA, and Caltrans review and approval.

County Road 100A
Near CR 27 Looking North

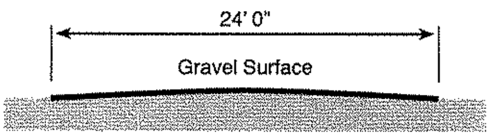


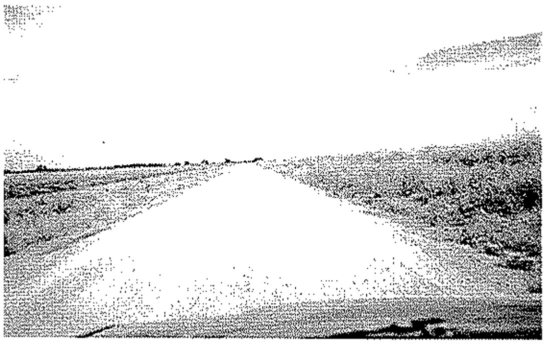
Road 27
Near CNNR)
Looking West





County Road 101
Near CR 27
Looking North





OPTION 5

OPTION 5: BIKE ROUTE (CR 99D/Willow Slough- Path/Myrtle Lane/Rose Lane/East Street)

Description:

From the City of Davis, Option 5 follows CR 99D as a Class II bike lane northward on a frontage road on the west side of SR 113, crossing CR 29 and continuing to where the road dead ends. (see Figure 22). A new Class I pathway adjacent to SR 113 would connect CR99D north to Myrtle Lane, requiring the acquisition of right of way and new bridge across Willow Slough. (Once Option 5 was completed to the intersection of Myrtle Lane and CR27, this phase of Option 5 would provide continuity for bicyclists travelling to or from western Woodland, since CR27 currently has a 4-foot shoulder from Myrtle Lane to CR 99, and County Road 99 has 4-foot shoulders between CR 27 and the Woodland City limits.) A Class II bike lane would continue from Myrtle Lane across CR 27 to Rose Lane, and northward to the termination of Rose Lane at the CNRR tracks. The old railroad crossing at this point has been vacated. There are two sub-options at this location. The project could cross the tracks here with a separated crossing to East Street, requiring a new CPUC crossing permit, and easement rights from the CNRR. It is the CPUC policy not to allow any new at-grade crossings in California. It is not possible to determine at this juncture whether an at-grade crossing permit is possible, although the CPUC will determine if a reasonable alternative to a proposed at-grade crossing exists. The assumption has been made that a separated grade crossing would be required at this location.

A reasonable alternative to a new separated-grade crossing is to construct a pathway on the west side of the CNRR tracks, continuing northward to CR 25A, at which point people would be directed to East Street, or a path continuing northward on the west side of the CNRR tracks. The CNRR right of way is 80 feet wide along East Street, but the tracks are located in the western portion of the right of way in the vicinity of the curve in the railroad tracks, meaning that there is not sufficient room to provide a 15 feet wide easement within the CNRR right of way and still maintain the minimum 25 feet setback required by the CNRR. It is likely that right of way adjacent to the CNRR right of way would need to be purchased for a path in this location. North of CR25A, development of a pathway east of the CNRR tracks in the planned development area shown in Figure 1 should be considered as development occurs.

Shoulder improvements to East Street are limited by the presence of mature black walnut trees. To avoid removing trees it would be necessary to install shoulders with less than a 4-foot width. Since traffic volumes are very low on the dead-end portion of East Street south of CR25A, the existing shoulders and a Class III bike route treatment are acceptable alternatives to full widening on this section of roadway. Cost estimates assume 4 feet shoulders on East Street from Woodland south to CR 25A to allow for the uncertainty involved in the cost of shoulder improvements in this area.

Evaluation:

Right-of-Way and Construction Costs

This option has right-of-way issues and significant construction costs. A total of 1.9 acres of land

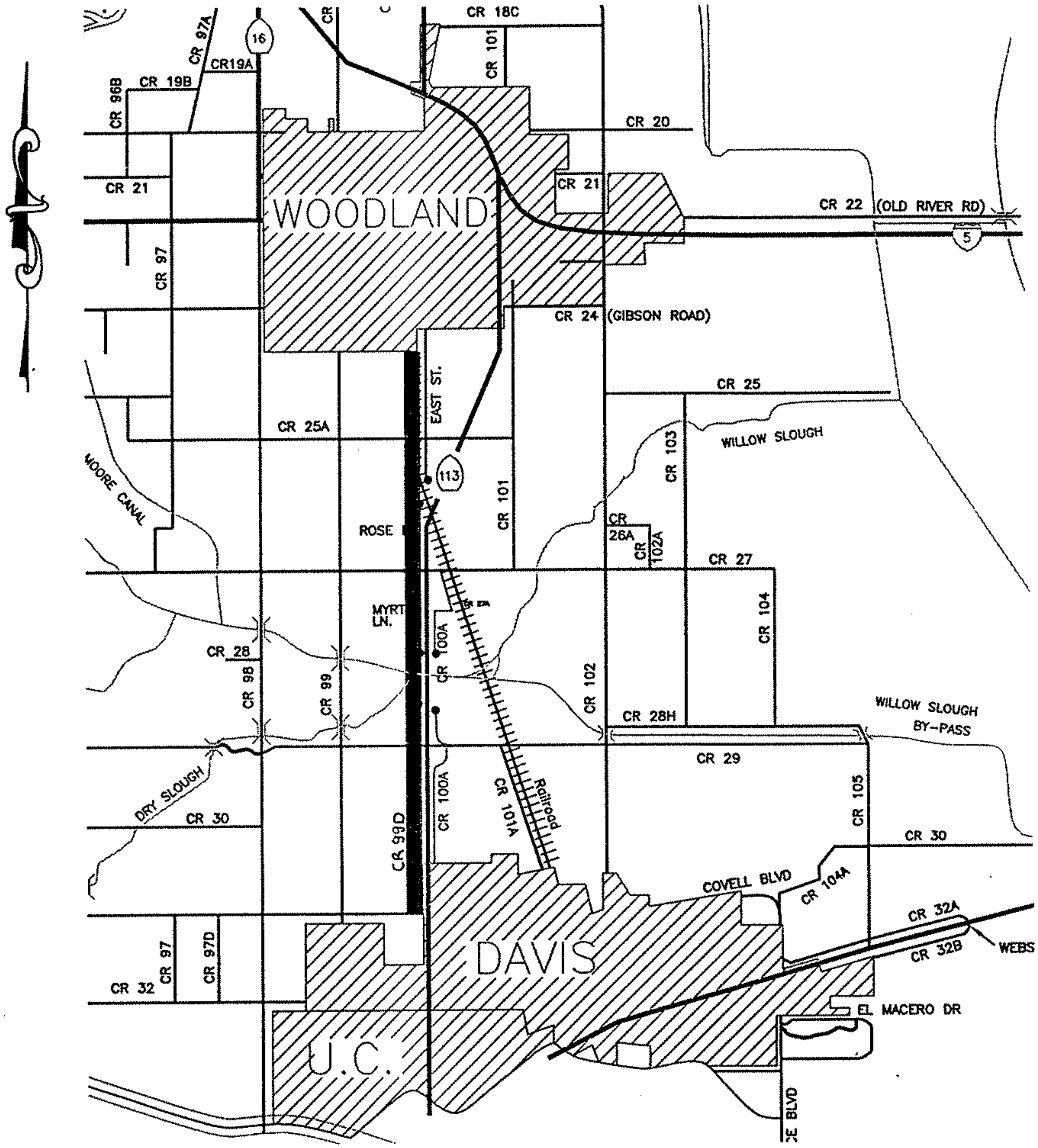


Fig. 22	Option 5	alta

would need to be acquired to connect CR99D and Myrtle Lane, and to circumnavigate or cross the CNRR tracks at the north end of Rose Lane (depending on which sub-option is selected). A new bridge would be required over Willow Slough. Shoulder improvements would be required on CR 99D, and East Street. Depending on which sub-option is selected, an easement may be required from the CNRR north of Rose Lane and a new permit required from the CPUC (with CNRR and UPRR approval). Total project cost is estimated at about \$2.9 to \$3.2 million, with \$1.2 to \$1.5 million being bikeway related, depending on the sub-option selected.

Maintenance Costs

As with any off-street facility, the new bike path segments would require regular maintenance including sweeping, weed abatement, trash removal, and re-surfacing. The estimated annual cost for this would be about \$9,000.

Accessibility of the route to Existing and Future Activity Centers

This option offers very good accessibility to bicyclists. At the southern end, CR 99D links into West Davis, while at the northern end the route connects to central Woodland.

Environmental Impact

This option would include a new bridge over Willow Slough. While the impacts to that sensitive area are not known and might be mitigated, it does represent a potential environmental impact. Permits would be required from the U.S. Corps of Engineers, U.S. Fish & Wildlife Service and/or the California Department of Fish and Game, and the Department of Water Resources (DWR). New shoulders or bike lanes on East Street north of CR 25A could result in the removal of some trees to accommodate additional pavement.

Agricultural Impacts

Since the pathway would be located adjacent to existing roads, the impact to agricultural operations is not considered to be significantly more than those from shoulder improvements. If the suboption involving a path west of the CNRR tracks between CR 25A and Rose Lane is selected, the adjacent farmland could be affected.

Use of Existing Infrastructure

This option requires some new infrastructure, including new shoulders, a pathway, and a bridge. It does use the existing frontage roads, which offer relatively low traffic volumes and speeds.

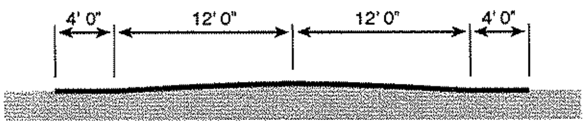
Recreation/Aesthetic Value

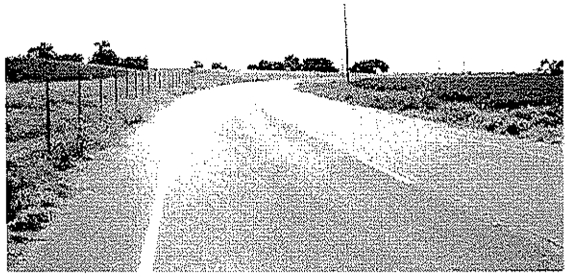
This option would be located next to SR 113 for about 2/3rds of its length, which is not particularly aesthetic. However, the route would be mostly on low traffic/speed roadways, include a creek crossing, and traverse scenic farmlands. Also, since the prevailing winds in the region are from the west, cyclists on this route would be more likely to be upwind of vehicle exhaust from SR 113, as compared to the alignment in Option 4 on the east side of SR 113.

Ease and Time to Implement

This option could be difficult and time-consuming to implement, given the need to acquire an easement from an adjacent property owner(s). It is possible that the right-of-way would require time-consuming condemnation proceedings, along with CEQA, NEPA, CNRR, UPRR, and Caltrans review and approval. Obtaining a permit from the CPUC to construct a new grade crossing would be time consuming, with an uncertain outcome.

Rose Lane
Near CR 27
Looking South





Myrtle Lane
Near CR 27
Looking South

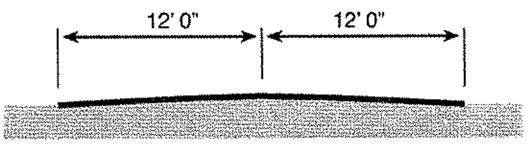


Figure 23	California Northern Railroad Tracks in Woodland With East Street on Right	alta PLANNING • DESIGN • ECONOMICS

OPTION 6

OPTION 6: BIKE ROUTE (CR 99 Bike Lanes)

Description:

From the City of Davis (CR 31), Option 6 is CR 99 between Davis and Woodland improved with 4 foot shoulders between CR 27 and Covell Blvd. (CR 31) in Davis (see Figure 24). Presently, CR 99 has 4-foot shoulders from Woodland south to CR 27.

Evaluation:

Right-of-Way and Construction Costs

This option would require the acquisition of 4.85 acres of private land to provide shoulders and avoid impacting existing olive trees. Shoulders would require fairly extensive drainage and utility pole relocation. The total project cost is estimated at $1.5 million, with $425,000 being bikeway related.

Maintenance Costs

As with any on-road facility, the shoulders would need to swept on a regular basis as part of regular roadway maintenance activities.

Accessibility of the route to Existing and Future Activity Centers

This option offers very good accessibility to bicyclists. At the southern end, CR 99 links into west Davis, while at the northern end the route connects to west-central Woodland. While the route offers a good balance with the existing bikeway on CR 102, it is probably inconvenient for people coming from central Davis. Option 1 was devised to address this situation.

Environmental Impact

This option would have very limited environmental impacts, since the new shoulders would replace adjacent ditches and there would be no new improvements to the creek crossings.

Agricultural Impacts

This option could impact agricultural operations since 4.8 acres of additional right of way would be needed. The added road width afforded by 4-foot bicycle lanes would provide a benefit for slow moving farm vehicles.

Use of Existing Infrastructure

This option requires some new infrastructure, including new shoulders. It does use the existing County road, which offers a direct connection between the two cities.

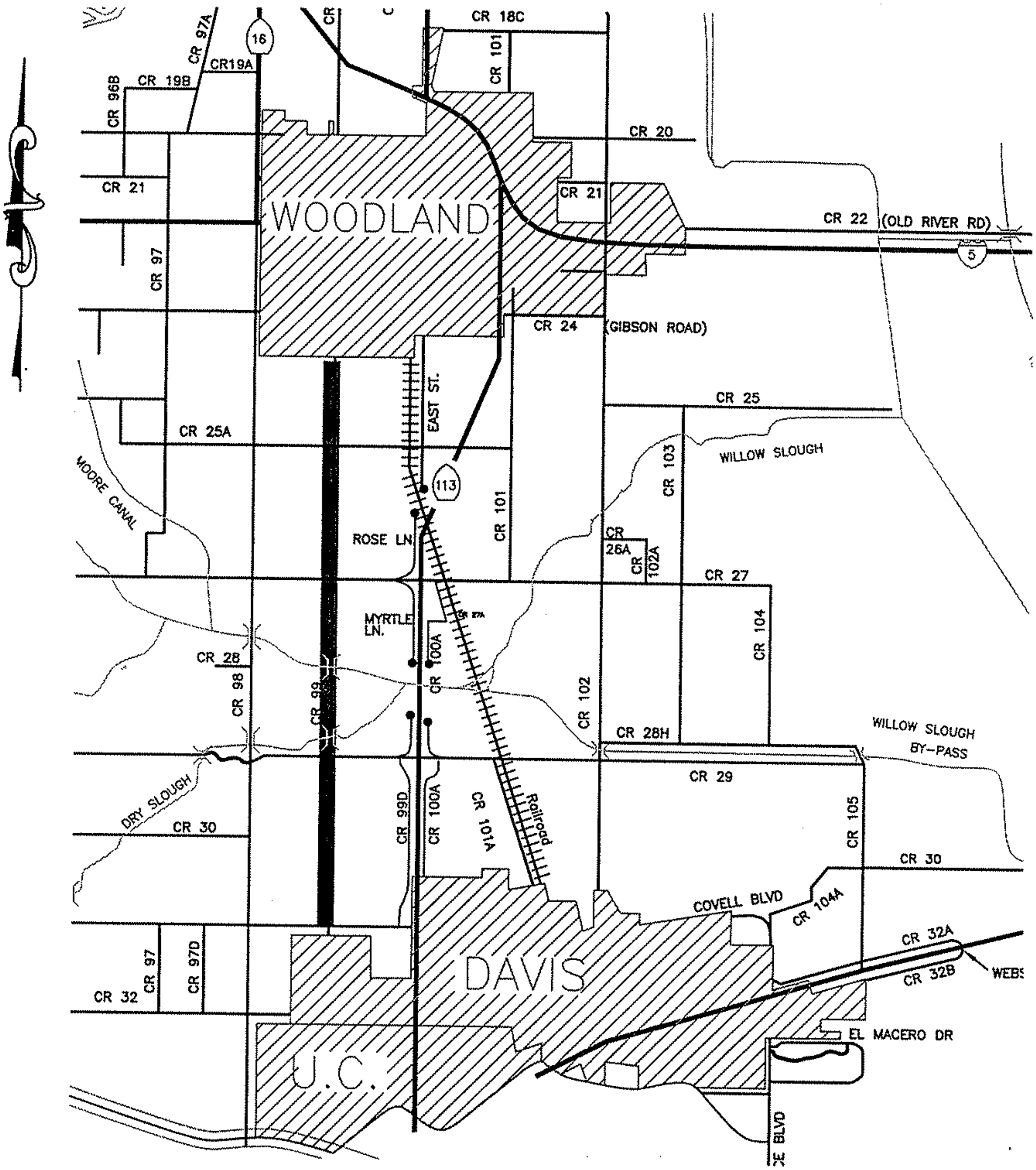


Fig. 24	Option 6	alta

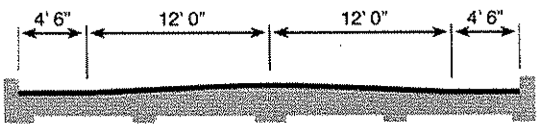
Recreation/Aesthetic Value

This option would be located next to a high speed and relatively high traffic roadway, which is not particularly aesthetic. It is likely that recreational users would not use this route in high numbers, nor would less experienced bicyclists.

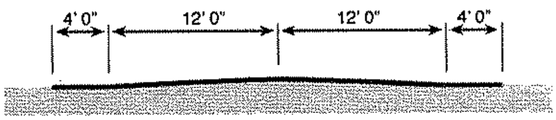
Ease and Time to Implement

This option would be relatively straightforward to design and implement, although the drainage relocation would need to be coordinated with adjacent property owners. The purchase of additional road right of way would be relatively easy compared to acquiring right of way for options that are not adjacent to County roadways.

County Road 99
Near Willow Slough Crossing
Looking North (4' shoulder only at bridges)



County Road 99
Near CR 27
Looking North



Alternatives Analysis

7.0 ALTERNATIVES ANALYSIS

Table 1 presents a summary of the key aspects of each of the options, including cost, length, acreage required, and other information. To develop a meaningful comparison and evaluation of these options, a decision matrix was developed to evaluate each of the bikeway alternatives, with each option rated according to set criteria that have been weighted by the TAC Subcommittee by their relative importance. At this preliminary level of analysis, the matrix is kept relatively simple to clarify the strengths and liabilities of each alternative.

Table 1
Summary of Proposed Options

Features:	Option 1: CR99/29/101A/99D	Option 2: CR101A/29/CNRR/Willow Sl/27/101	Option 3: CR101A, CNNR/100A/27/101	Option 4: CR100A/Willow Sl/100A/27/101	Option 5: 99D/Myrtle Ln Rose Ln/(cross CNRR @ CR25A)/East St	Option 6: CR99
Total Length of new construction (miles):	6.38	6.78	7.19	7.46	6.19	4
Length by Classification:						
Class I- Fully Separated	0	2.48	1.9	0.76	1.01	0
Class II-Shoulders	6.38	4.3	5.29	6.7	5.18	4
Project Cost*	$2,563,382	$3,085,307	$3,282,265	$ 3,533,885	$2,945,635	$1,554,485
Bikeway Cost**	$ 766,792	$1,757,977	$1,653,645	$ 1,473,685	$1,325,055	$ 424,985
Acreage Required	3.53	6.01	5.25	1.84	1.86	4.85
Annual Maintenance Cost	$ -	$ 21,080	$ 16,150	$ 6,375	$ 8,670	$ -
Caltrans permit	no	no	no	perhaps	perhaps	no
US F&G permit	no	yes	yes	yes	yes	no
US Army Corps permit	no	yes	yes	yes	yes	no
CPUC permit	no	perhaps	perhaps	no	perhaps	no
CNRR/UPRR approval	no	perhaps	perhaps	no	perhaps	no

* Assumes full road reconstruction for Class II sections of route, representing the optimal improvement.
** That portion of the Project Cost, assuming Class II bikeway improvements are constructed concurrent with road improvements.

A description of the evaluation criteria was presented in Section 4. The relative importance of each criterion was developed by the TAC Subcommittee. That weighting is as follows, in order from most important to least important:

1. Right of Way and Construction Costs — 10 points
2. Maintenance Costs — 9 points
3. Access of the Route for Bicyclists to Existing and Future Activity Centers — 8 points
4. Environmental Impact — 7 points
5. Agricultural Impacts — 6 points
6. Use of Existing Infrastructure — 6 points
7. Recreational/Aesthetic Value — 4 points
8. Ease and Time to Implement — 3 points

The evaluation criteria are applied to each of the six options below in Table 2. The higher the score within each criteria's maximum points, the more effective the option is at meeting the objectives of that criteria (i.e. lower cost, higher score, or lower impact, higher score).

Table 2
Evaluation of Options

	Option					
Criteria	**1** CR99/29/ 101A/ 99D	**2** CR101A/29/ CNRR/ Willow Sl/ 27/101	**3** CR101A/ CNNR/ 100A/27/ 101	**4** CR100A/ Willow Sl/ 100A/27/101	**5** 99D/ Myrtle Lane/ Rose Lane/ East St	**6** CR99
Right of Way & Construction Costs (10 points)	8	3	3	4	5	10
Maintenance Costs (9 points)	9	3	3	7	6	9
Accessibility of the Route to Existing and Future Activity Centers (8 points)	8	5	5	5	7	5
Environmental Impact (7 points)	7	3	3	3	3	7
Agricultural Impacts (6 points)	6	3	3	5	6	6
Use of Existing Infrastructure (6 points)	6	3	3	4	4	6
Recreation/ AestheticValue (4 points)	1	4	3	2	3	1
Ease and Time to Implement (3 points)	2	1	1	2	2	2
TOTAL (53 points)	**47**	**25**	**24**	**32**	**36**	**46**

7.1 Route Scoring Results, Recommendations, and Phasing

As seen in Table 2, Options 1 and 6 score significantly higher than the other options due to the emphasis in the criteria weighting on projects that are functional, cost effective, provide connections to central or western Woodland, and that can be implemented within a reasonable amount of time.

Obviously, if criteria such as recreational/aesthetic benefits were weighted as more important criteria, the options with off-road bike path components would score higher. It must be recognized that such a scoring system yields a range of scores that are useful for comparisons, but which are not necessarily exact in their result. In general terms, the six options can be divided into two categories: on-road routes that are commute routes with limited recreational appeal, and on-road/off-road combinations that have varying degrees of recreational appeal.

In the short term, there is a need to improve bicycling conditions for those residents who commute between Davis and Woodland on County roads. Many of these improvements can be made within the context of general roadway improvements and maintenance, and can significantly improve the safety and attractiveness of the connecting roadway system for those who currently cycle between Davis and Woodland. The recommended order of implementation of the preferred alternatives is described below.

Preferred Alternatives

1) Option 1- Modified:

As indicated in Table 2, Option 1 ranks the highest of the six options mainly due to the option's use of existing infrastructure, connectivity to activity centers, low maintenance cost and low environmental impact and low impact to private property. However, it is recommended that only a portion of Option 1 be developed in the short term to reduce the overall project cost and time to implement, without significantly reducing the connectivity it provides between Woodland and central Davis. It is recommended that the initial phase of Option 1 improvements consist of adding 4-foot bike lanes on CR 99 between CR 27 and 29, and 4-foot bike lanes on CR 29 between CR 99 and SR 113 (see Fig. 25). This would allow access to and from the existing frontage roads that parallel SR 113 south of CR 29 (CR 99D and CR 100A) which have variable shoulder widths yet low vehicle traffic volumes. The estimated cost of the modified Option 1 as described above is **$1,206,567** with the portion of the cost directly related to the added right-of-way and bike lanes to be **$336,300.**

2) Option 5:

Although Option 6 scored the second highest, much of Option 6 is included in the modified Option 1, and does not provide the connectivity to central Davis and the core area of UC Davis as does the modified Option 1.

In the longer term, to address the expressed desire by many residents for a centralized bicycle route between the two cities with more recreational and aesthetic values, it is recommended that Option 5 be implemented next. In general, Option 5 connects a series of three dead end frontage roads on the west side of SR 113 (see Fig. 23). The two connections involving the crossing of Willow Slough and the CNRR tracks will likely be time consuming and require phasing to implement. The estimated cost for this option is $2.9 million, the least costly of the routes with recreational components. Option 5 also provides a centralized connection between the two cities, complementing the CR 102

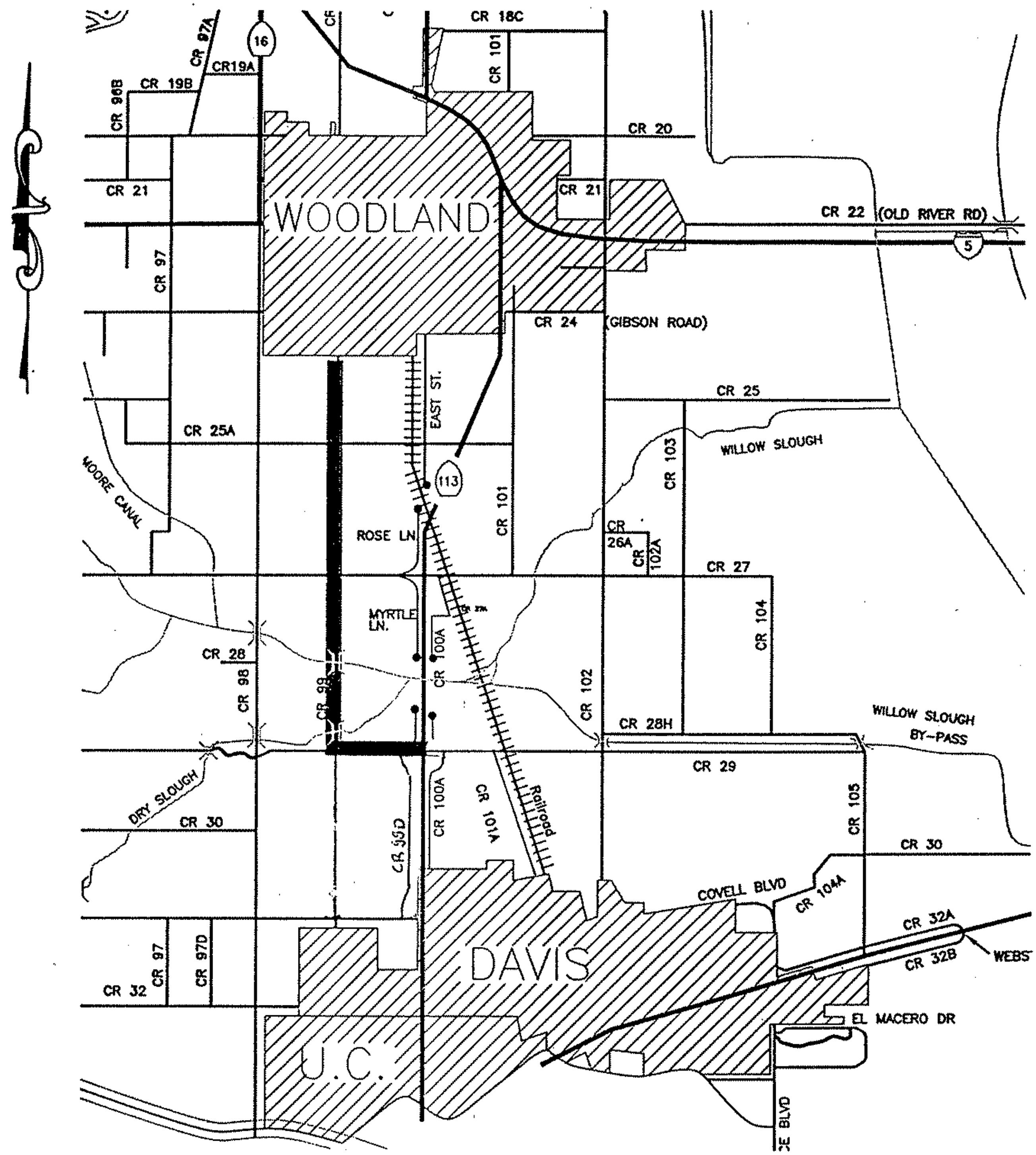


Fig. 25	Option 1 - Modified	alta

and CR 99 corridors. The segments of Option 4 between CR27 and CR29 should be considered if insurmountable constraints are discovered during the preliminary engineering phase of this segment of Option 5 (see Fig. 21).

3) Remaining Segments of Options 1 and 6:

The segments of Option 1 east of SR 113 (CR 29 and CR 101A) and the segment of Option 6 south of CR 29 (CR 99 between CR 29 and Covell Blvd.) should be improved with bike lanes once Option 5 is completed above to provide enhanced connections to and from downtown/central Davis, the core area of UC Davis, and western Davis (see Figures 15 and 24). These improvements should be considered at an earlier time if the existing road pavement conditions result in road reconstruction activities before Option 5 is fully implemented.

Options 2 and 3:

Because a significant portion of these options would be in the form of separated pathways through agricultural and open land and/or along and over creeks with riparian vegetation, Options 2 and 3 have high aesthetic value, recreational potential and potential to appeal to a broader level of user groups than the on-road options (see Figures 18 and 20). Due to their linear nature and relative low numbers of intersections with roadways and cross traffic, Options 2 and 3 could also serve well as commute corridors.

However, Options 2 and 3 received low rankings due to factors such as cost of construction, right-of-way acquisition, time to implement and their potential environmental impacts, potential impacts to agricultural operations and private property concerns.

Because of the high level of constraints as noted above, implementation of either of these options would most likely require a significant level of commitment and resources by all interested stakeholders including elected officials, private property owners, farmers, bicycle and trial users, local agency staff, and the railroad.

California Northern Railroad/Union Pacific Railroad Tracks:

In the event that the CNRR/UPRR tracks are abandoned anytime in the future, it is recommended that all feasible measures be taken to preserve the right-of-way for use as a non-motorized multiple-use pathway connecting the cities of Woodland and Davis (see Fig. 2B).

Phasing of the Preferred Alternatives

Phasing of Option 1-Modified, Option 5 and the Remaining Segments of Options 1 and 6:

Due to the desire to provide a continuous bikeway link between Davis and Woodland, it is essential that the selected options be developed in a manner that will provide as much continuity as possible for bicyclists given the constraints of available funding. Although completion of an Option as a whole is preferred, projects will most likely be done in phases.

For bikeway facilities requiring roadway rehabilitation such as with Option 1 and sections of Option 5, the project and bikeway funding needs to be coordinated with the larger roadway project. It is recommended that the first phase of Option 1- Modified consist of the construction of 4-foot bike lanes on CR 99 between CR 27 and CR 29, and that the second phase consist of the construction of 4-foot bike lanes on CR 29 between CR 99 and SR 113 (see Fig. 25).

It is recommended that the first phase of Option 5 consist of the construction of 4-foot bike lanes on CR 99D, and that the section of the route between CR 27 and CR 29 should be constructed as the second phase. This includes connecting CR 99D and Myrtle Lane with a separated pathway and bridge over Willow Slough. Once this second phase was completed, bicyclists would have access northward to western Woodland on existing 4-foot shoulders via CR27 and CR99. Phase 3 would complete the northern section between central Woodland and CR27 consisting of 1) a separate pathway along the west side of the CNRR tracks, or 2) a grade crossing at the CNRR tracks between Rose Lane and East Street in combination with the construction of 4- foot bike lanes on East Street between CR 25A and the Woodland city limits (see Fig. 22). It is recommended that the CNRR grade crossing be approached in the following order: 1) formally request CNRR and CPUC permission for a new at-grade crossing with security devices to maximize safety, 2) request CNRR and CPUC permission for a new separated-grade crossing, and depending on the responses received and costs of this alternative, 3) pursue the alternative alignment to the west of the CNRR tracks north to CR25A.

Remaining Segments of Options 1 and 6:

The segments of Option 1 east of SR 113 (CR 29 and CR 101A) and the segment of Option 6 south of CR 29 (CR 99 between CR 29 and Covell Blvd.) should be improved once Option 5 is completed above to provide enhanced connections to and from downtown/central Davis, the core area of UC Davis, and western Davis (see Figures 15 and 24). The phasing of these segments will be determined once Option 5 is completed. The phasing will also be influenced by the need for general roadway improvements to the segments.

Appendices

A.0 COST ESTIMATE

Cost estimates for construction have been developed to reflect the proposed alignment and alternatives envisioned in this feasibility report. Because the estimates have been developed without the benefit of specific design drawings, they are to be considered preliminary and subject to change.

A.1 Costs

The basic cost assumptions have been developed by the Yolo County Public Works Department based on their recent experience on similar types of projects. Some of the basic cost assumptions are identified in Table 3.

Table 3
Cost Assumptions

Item	Unit	Cost
Right of way	Acre	$ 10,000
Grind/AB/AC (4' shoulders only)	Mile	$ 85,000
Grind/AB/AC (32' roadway)	Mile	$ 340,000
Ditch Relocation	Mile	$ 48,000
Class I bike path (10' wide)	Lf	$ 30
Fencing	Lf	$ 10
Bike path bridge (200')	Ea	$ 360,000
Railroad crossing (separated)	Ea	$ 250,000
Environmental	Project	$10,000-$110,000
Engineering/Bid Documents	% of construction cost	10%
Contract Admin + QA/QC	% of construction cost	10%

Source: Yolo County Planning & Public Works Department

The Yolo County Department of Planning and Public Works has stated that some of the proposed shoulders/bike lanes will require concurrent reconstruction of the roadway, in order to avoid investing in new bikeway shoulders along sections of roadway that will need to be torn up for roadway reconstruction in the near future, to provide for adequate drainage, and to provide a stable structural section. To facilitate comparison, all roadways to be designated bikeways were estimated to include 4-foot shoulders, although due to funding constraints it may be warranted to construct the shoulders on some sections of the low volume frontage roads adjacent to SR 113 as part of later phases of the improvement. As such, the cost estimates by option presented on the following pages (Table 4) have two cost estimates, a construction cost for the total project including full road rehabilitation, and a construction cost for the bikeway portion of the project. Right of way costs are also presented separately.

Table 4
Summary of Costs by Option

Option 1 - CR99/CR29/CR101A /CR99D
Class II facility
Note: In this alignment, all roads to which 4' shoulders are to be added need to be rehabilitated prior to adding bikelanes. Two estimates are provided, 1 estimate of the portion of the rehabilitation cost attributable to added width for shoulders, the other estimate for the total rehabilitation

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	3.53	$2,289,200	$35,262	$662,300
Environmental: Should be relatively easy, neg dec for road rehab:		$10,000		$3,000
Engineering/Bid documents @ 5%		$114,460		$33,115
Contract Admin + QA/QC tests @ 5%		$114,460		$33,115
Total Project Estimated Cost (with ROW cost included):		$2,563,382		$766,792

Option 2: CR101/CR27/Willow Slough/Railroad/CR29/CR101A
Class I & II facility
Note: In this alignment, all roads to which 4' shoulders are to be added need to be rehabilitated prior to adding bikelanes. Two estimates are provided, 1 estimate of the portion of the rehabilitation cost attributable to added width for shoulders, the other estimate for the total rehabilitation

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	6.01	$2,429,300	$60,147	$1,331,525
Environmental: Will be difficult for willow slough portion, EIR:		$110,000		$100,000
Engineering/Bid documents @10%		$242,930		$133,153
Contract Admin + QA/QC tests @ 10%		$242,930		$133,153
Total Project Estimated Cost (with ROW cost included):		$3,085,307		$1,757,977

Option 3: CR101/CR27/CR100A/Railroad/CR101A
Class I & II facility

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	4.61	$2,641,480	$52,489	$1,292,630
Environmental: Will be difficult for ROW near railroad- ES + neg dec:		$60,000		$50,000
Engineering/Bid documents @10%		$264,148		$129,263
Contract Admin + QA/QC tests @ 10%		$264,148		$129,263
Total Project Estimated Cost (with ROW cost included):		$3,282,265		$1,653,645

Option 4: CR101/CR27/CR100A/New Bridge over Willow Slough/CR100A
Class I & II facility
Note: In this alignment, all roads to which 4' shoulders are to be added are assumed to need rehabilitation prior to adding bikelanes. Due to low traffic volumes, CR100A improvements could be postponed.

	Acres	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway portion
ESTIMATED CONSTRUCTION COSTS:	1.84	$2,879,600	$18,365	$1,171,100
Environmental: Will be difficult for ROW near slough - ES + neg dec:		$60,000		$50,000
Engineering/Bid documents @10%		$287,960		$117,110
Contract Admin + QA/QC tests @ 10%		$287,960		$117,110
Total Project Estimated Cost (with ROW cost included):		$3,533,885		$1,473,685
Delete if dead end frontage roads not improved:		$571,200		$142,800
Adjusted total project if dead end frontage roads not improved:		$2,962,685		$1,330,885

Option 5: East Street/Railroad crossing(alt Cl I w/o RR)/
Rose Ln/Myrtle Lane/Willow Slough/CR99D
Class I & II facility
Note: In this alignment, all roads to which 4' shoulders are to be added are assumed to need rehabilitation prior to adding bikelanes. Due to low traffic volumes, improvements to dead end frontage streets could be postponed. Alternate Class I route to the west of railroad tracks could be used to avoid railroad grade crossing.

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	1.24	$2,649,200	$27,397	$1,200,800
Environmental: Will be difficult for ROW near slough - ES + neg dec:		$60,000		$50,000
Engineering/Bid documents @10%		$264,920		$120,080
Contract Admin + QA/QC tests @ 10%		$264,920		$120,080
Total Project Estimated Cost (with ROW cost included):		$3,266,437		$1,518,357
	Added acres:			
Delete if Alternate Class I route is used to avoid RR crossing:	0.62	$312,000	$8,802	$184,500
Adjusted total project (with ROW cost included):		$2,945,635		$1,325,055
Delete if dead end frontage roads not improved:		$880,600		$220,150
Adjusted total project if dead end frontage roads not improved:		$2,065,035		$1,104,905

Option 6 - CR99
Class II facility

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	4.85	$1,360,000	$48,485	$340,000
Environmental: Should be relatively easy, neg dec for road rehab:		$10,000		$2,500
Engineering/Bid documents @ 5%		$68,000		$17,000
Contract Admin + QA/QC tests @ 5%		$68,000		$17,000
Total Project Estimated Cost (with ROW cost included):		$1,554,485		$424,985

Table 4 (cont'd)
Option 1

Construction + ROW Costs: CR99 from CR27 toCR29:

Notes:
Existing ROW 50'.
Existing Pavement width = 21'/22'
Desired Pavement with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction
Additional right of way needed to avoid removal of olive trees
Some power poles will need to be relocated.
Bridges w/ 4/5' shoulders assumed adequate, no upgrade needed

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	10560	10	2.42	$10,000		$24,242	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	2	$85,000					$170,000
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	2	$340,000			$680,000		

99

Construction + ROW Costs: CR29 from CR99 to CR99D:

Notes:
Existing ROW 60' typ. (30'+42' adjacent to subdivision).
Existing Pavement width = 26
Desired Pavement width with 4' shoulders for bikelane: 32'
Ditches on each side of road need to be relocated
Some Class I path already exists on north side of golf course & NDMI

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	1100	10	0.25	$10,000		$2,525	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1	$85,000					$85,000
Ditch relocate	1	$48,000					$48,000
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1	$340,000			$340,000		
Ditch relocate	1	48000			$48,000		

29

Construction + ROW Costs: CR29 from CR99D to CR101A:

Notes:
Existing ROW 60'.
Existing Pavement width = 29
Desired Pavement width with 4' shoulders for bikelane: 32'
Ditches on both side of road need to be relocated
Need ROW on north to avoid utility poles on south
No improvements in Caltrans ROW

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	3700	10	0.85	$10,000		$8,494	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	0.75	$85,000					$63,750
Ditch relocate	1.5	$48,000					$72,000
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	0.75	$340,000			$255,000		
Ditch relocate	1.5	48000			$72,000		

Construction + ROW Costs: CR101A from CR29 to Davis City Limits:

Notes:
Existing ROW: 5485' @ 70'
Existing Pavement width = 24
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction
Adequate ROW for separated facility along this route.

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.04	$85,000					$88,400
Ditch relocate	0	$48,000					$0
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.04	$340,000			$353,600		
Ditch relocate	0	48000			$0		

CR99D from CR29 to Davis City limit

Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Length = 8396 per Caltrans plans
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair

					Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.59	$85,000					$135,150
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.59	$340,000			$540,600		

	Acres	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
ESTIMATED CONSTRUCTION COSTS:	3.53	$2,289,200	$35,262	$562,300
Environmental: Should be relatively easy, neg dec for road rehab:		$10,000		$3,000
Engineering/Bid documents @ 5%		$114,460		$33,115
Contract Admin + QA/QC tests @ 5%		$114,460		$33,115
Total Project Estimated Cost (with ROW cost included):		$2,583,382		$766,792

Table 4 (cont'd)

Option 2

CR101 from existing Woodland city limits to CR25A:

Notes:
Existing ROW 50'.
Existing Pavement width = 23/25'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction
Improvements may be able to be required of Springlake development

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$85,000					$110,500
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$340,000			$442,000		

CR101 from CR25A to CR27:

Notes:
Existing ROW 60', 50' indicated on one record of survey.
Existing Pavement width = none, 23' gravel road
Desired Pavement width with 4' shoulders for bikelane: 32'
Road section needs to be surfaced, use same cost as rehab
Ditch adjacent to road needs to be relocated
Unpaved road would need to be paved to allow bikepaths to be feasible.
Class 1 path would require right of way

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (entire road needs paving if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	1.7	$85,000					$144,500
Ditch relocate	1.7	$48,000					$81,600
CONSTRUCTION COST: (road needs rehabilitation if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	1.7	$340,000			$578,000		
Ditch relocate	1.7	$48,000			$81,600		

CR27 from CR101 to Willow slough:

Notes:
Existing ROW 60'
Existing Pavement width = 24'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	0.265	$85,000 need to pave whole road					$22,525
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	0.265	$340,000			$90,100		

Willow Slough from CR 27 to CR29 .

Notes:
Existing ROW - none, need 20'
Existing Pavement width = none, need 10'
Pavement: 10' paved path, 10316' +2776' = 13092'
Will need permits from DWR, Fish & Game for bridge over Willow Slough Bypass
ROW/env clearance will be more difficult to obtain, as route does not parallel existing transportation route.

					Const. Cost Bikepath	Cost ROW	Const. Cost Bikepath
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	13100	20	6.01	$10,000		$60,147	
CONSTRUCTION COST: 10' paved path	Length (feet)	Cost per unit					
Clear/grub	13100	$10			$131,000		$131,000
Earthwork	13100	$5			$65,500		$65,500
AB/AC section	13100	$15			$196,500		$196,500
WM fencing	13100	$10			$131,000		$131,000
Bridge at bypass	1	$360,000			$360,000		$360,000

Construction + ROW Costs: CR101A from CR29 to Davis City Limits:

Notes:
Existing ROW: 5485' @ 70'
Existing Pavement width = 24
Pavement condition: poor, needs rehab concurrent with lane construction
Desired Pavement width with 4' shoulders for bikelane: 32'
Adequate ROW for separated facility along this route.

					Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.04	$85,000					$88,400
Ditch relocate	0	$48,000					$0
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.04	$340,000			$353,600		
Ditch relocate	0	48000			$0		

	Acres	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
ESTIMATED CONSTRUCTION COSTS:	6.01	$2,429,300	$60,147	$1,331,525
Environmental: Will be difficult for willow slough portion. EIR:		$110,000		$100,000
Engineering/Bid documents @10%		$242,930		$133,153
Contract Admin + QA/QC tests @ 10%		$242,930		$133,153
Total Project Estimated Cost (with ROW cost included):		$3,085,307		$1,757,977

Table 4 (cont'd)
Option 3

CR101 from existing Woodland city limits to CR25A:

Notes:
Existing ROW 50'.
Existing Pavement width = 23/25'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction
Improvements may be able to be required of Springlake development

RIGHT OF WAY:	Length (feet)	Right of way width road (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$85,000					$110,500
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$340,000			$442,000		

CR101 from CR25A to CR27:

Notes:
Existing ROW 60', 50' indicated on one record of survey.
Existing Pavement width = none, 23' gravel road
Desired Pavement width with 4' shoulders for bikelane: 32'
Road section needs to be surfaced, use same cost as rehab
Ditch adjacent to road needs to be relocated
Unpaved road would need to be paved to allow bikepaths to be feasible.
Class 1 path would require right of way

RIGHT OF WAY:	Length (feet)	Right of way width road (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (entire road needs paving if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	1.7	$85,000					$144,500
Ditch relocate	1.7	$48,000					$81,600
CONSTRUCTION COST: (road needs rehabilitation if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	1.7	$340,000			$578,000		
Ditch relocate	1.7	$48,000			$81,600		

CR27 from CR101 to 100A

Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Desired Pavement width with 4' shoulders for bikelane: 32'

RIGHT OF WAY:	Length (feet)	Right of way width road (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (entire road needs paving if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	0.72	$85,000					$61,200
CONSTRUCTION COST: (road needs rehabilitation if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	0.72	$340,000			$244,800		

CR100A from CR 27 to 2800' South

Notes:
Existing ROW 50'
Existing Pavement width = 22'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: Poor

RIGHT OF WAY:	Length (feet)	Right of way width road (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	2800	10	0.64	$10,000		$6,426	
CONSTRUCTION COST: (entire road needs paving if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	0.53	$85,000					$45,050
CONSTRUCTION COST: (road needs rehabilitation if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	0.53	$340,000			$180,200		

Railroad from 2800' south of CR 27 to CR29

Notes:
Existing ROW - none, need 20'
Existing Pavement width = none, need 10'
Pavement: 10' paved path, 1.9 miles
Will need permit from Fish & Game for bridge over Willow Slough
ROW/env clearance will be difficult to obtain, as route does not parallel existing road right of way, just RR.

RIGHT OF WAY:	Length (feet)	Right of way width road (ft)	Acres	Cost/acre	Const. Cost Bikepath	Cost ROW	Const. Cost Bikepath
	10032	20	4.61	$10,000		$46,061	
CONSTRUCTION COST: 10' paved path	Length (feet)	Cost per unit					
Clear/grub	10032	$10			$100,320		$100,320
Earthwork	10032	$5			$50,160		$50,160
AB/AC section	10032	$15			$150,480		$150,480
WM fencing	10032	$10			$100,320		$100,320
Bridge at slough	1	$360,000			$360,000		$360,000

Construction + ROW Costs: CR101A from CR29 to Davis City Limits:

Notes:
Existing ROW: 5465' @ 70'
Existing Pavement width = 24
Pavement condition: poor, needs rehab concurrent with lane construction
Desired Pavement width with 4' shoulders for bikelane: 32'
Adequate ROW for separated facility along this route.

RIGHT OF WAY:	Length (feet)	Right of way width road (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.04	$85,000					$88,400
Ditch relocate	0	$48,000					$0
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.04	$340,000			$353,600		
Ditch relocate	0	48000			$0		

	Acres	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway portion
ESTIMATED CONSTRUCTION COSTS:	6.25	$2,641,480	$52,489	$1,292,630
Environmental: Will be difficult for ROW near railroad- ES + neg dec:		$60,000		$50,000
Engineering/Bid documents @10%		$264,148		$129,253
Contract Admin + QA/QC tests @ 10%		$264,148		$129,253
Total Project Estimated Cost (with ROW cost included):		$3,287,285		$1,653,625

Table 4 (cont'd)
Option 4

CR101 from existing Woodland city limits to CR25A:
Notes:
Existing ROW 50'.
Existing Pavement width = 23/25'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction
Improvements may be able to be required of Springlake development

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$85,000					$110,500
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$340,000			$442,000		

CR101 from CR25A to CR27:
Notes:
Existing ROW 60', 50' indicated on one record of survey.
Existing Pavement width = none, 23' gravel road
Desired Pavement width with 4' shoulders for bikelane: 32'
Road section needs to be surfaced, use same cost as rehab
Ditch adjacent to road needs to be relocated
Unpaved road would need to be paved to allow bikepaths to be feasible.
Class 1 path would require right of way

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (entire road needs paving if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	1.7	$85,000					$144,500
Ditch relocate	1.7	$48,000					$81,600
CONSTRUCTION COST: (road needs rehabilitation if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	1.7	$340,000			$578,000		
Ditch relocate	1.7	$48,000			$81,600		

CR27 from CR101 to 100A
Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Desired Pavement width with 4' shoulders for bikelane: 32'

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (entire road needs paving if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	0.72	$85,000					$61,200
CONSTRUCTION COST: (road needs rehabilitation if to be used as bikeway)	Length (mile)	Cost per mile					
Grind/AB/AC	0.72	$340,000			$244,800		

CR100A from CR27 to 2800' south
Notes:
Existing ROW 50'
Existing Pavement width = 22'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction

	Length	Right of way width reqd (ft) / Cost	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done **in conjunction** w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	0.53	$85,000					$45,050
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	0.53	$340,000			$180,200		

CR27A/Frontage road/bridge/frontage road/ to CR29

Notes:
Existing ROW: CR27A = 50', frontage rd north = 60', gap= 0', frontage rd south=60'
Lengths: CR27A = 1783', frontage rd north = 2580', gap= 4000', frontage rd south=1700'
Pavement widths: CR27A = 21', frontage rd north = 24', gap= 0', frontage rd south=24'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: varies/frontage roads better than 27A and east.

	Length	Right of way width reqd (ft) / Cost	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	4000	20	1.84	$10,000		$18,365	
CONSTRUCTION COST: (assume 4' shoulders done **in conjunction** w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.15	$85,000					$97,750
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.15	$340,000			$391,000		
CONSTRUCTION COST: 10' paved path	Length (feet)	Cost per unit					
Clear/grub	4000	$10			$40,000		$40,000
Earthwork	4000	$5			$20,000		$20,000
AB/AC section	4000	$15			$60,000		$60,000
WM fencing	4000	$10			$40,000		$40,000
Bridge at slough	1	$360,000			$360,000		$360,000

CR100A from CR29 to Davis City limits

Notes:
Existing ROW: 5485' @ 60'
Existing Pavement width = 30'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: shoulders need attention, weeds.

	Length	Right of way width reqd (ft) / Cost	Acres	Cost/acre	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway Portion
RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre			
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done **in conjunction** w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$85,000					$110,500
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.3	$340,000			$442,000		

	Acres	Const. Cost Full rehabilitation	Cost ROW	Const. Cost Bikeway portion
ESTIMATED CONSTRUCTION COSTS:	**1.84**	**$2,879,600**	**$18,365**	**$1,171,100**
Environmental: Will be difficult for ROW near slough - ES + neg dec:		$60,000		$50,000
Engineering/Bid documents @10%		$287,960		$117,110
Contract Admin + QA/QC tests @ 10%		$287,960		$117,110
Total Project Estimated Cost (with ROW cost included):		$3,533,885		$1,473,685

Table 4 (cont'd)
Option 5

East St from Woodland City limits (CR24A) to CR 25A
Notes:
Existing ROW 60'.
Existing Pavement width = 29'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair
Large black walnuts are 6 to 16' from EOP, difficult to widen road much
Not enough room between tracks and trees to fit path and drainage.

	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
RIGHT OF WAY:	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1	$85,000					$85,000
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1	$340,000			$340,000		

East St from CR 25A to Rose Lane
Notes:
Existing ROW 60'.
Existing Pavement width = 29'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair
Large black walnuts are 6 to 16' from EOP, difficult to widen road much
Not enough room between tracks and trees to fit path and drainage.

	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
RIGHT OF WAY:	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	0.5	$85,000					$42,500
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	0.5	$340,000			$170,000		
Separated Grade Crosssing at RR:							
Right of Way						$15,000	
Culvert Underpass					$250,000		$250,000

Rose Lane from RR to CR27
Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair

	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
RIGHT OF WAY:	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1	$85,000					$85,000
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1	$340,000			$340,000		

Myrtle Lane from CR27 south to end
Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Length = 5558' per Caltrans plans
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair

	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
RIGHT OF WAY:	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.05	$85,000					$89,250
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.05	$340,000			$357,000		

Myrtle Lane to CR99D over Willow Slough
Notes:

Existing ROW: 0'., need 20
Existing Pavement width = 0'
Length = 2700" per Caltrans plans
Pavement: 10' paved path

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
	2700	20	1.24	$10,000		$12,397	
CONSTRUCTION COST: 10' paved path	Length (feet)	Cost per unit					
Clear/grub	2700	$10			$27,000		$27,000
Earthwork	2700	$5			$13,500		$13,500
AB/AC section	2700	$15			$40,500		$40,500
WM fencing	2700	$10			$27,000		$27,000
Bridge at bypass	1	$360,000			$360,000		$360,000

CR99D from end south to CR29
Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Length = 2850' per Caltrans plans
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	0.54	$85,000					$45,900
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	0.54	$340,000			$183,600		

CR99D from CR29 to Davis City limit
Notes:
Existing ROW 60'.
Existing Pavement width = 24'
Length = 8396 per Caltrans plans
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: fair

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
	0	10	0.00	$10,000		$0	
CONSTRUCTION COST: (assume 4' shoulders done in conjunction w/ road rehab)	Length (mile)	Cost per mile					
Grind/AB/AC	1.59	$85,000					$135,150
CONSTRUCTION COST: (assume entire road rehabilitated)	Length (mile)	Cost per mile					
Grind/AB/AC	1.59	$340,000			$540,600		

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	1.24	$2,649,200	$27,397	$1,200,800
Environmental: Will be difficult for ROW near slough - ES + neg dec:		$60,000		$50,000
Engineering/Bid documents @10%		$264,920		$120,080
Contract Admin + QA/QC tests @ 10%		$264,920		$120,080
Total Project Estimated Cost (with ROW cost included):		$3,266,437		$1,518,357

Alternate for Class I from north end of Rose Ln to west of RR to CR25A
Notes: This section would eliminate RR separated grade crossing.
Existing ROW: 0'., need 20'
Existing Pavement width = 0', need 10
Length = 2700' per Caltrans plans
Pavement: 10' paved path

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
	2700	10	0.62	$10,000		$6,198	
CONSTRUCTION COST: 10' paved path	Length (feet)	Cost per unit					
Clear/grub	2700	$10			$27,000		$27,000
Earthwork	2700	$5			$13,500		$13,500
AB/AC section	2700	$15			$40,500		$40,500
WM fencing	2700	$10			$27,000		$27,000
Alternate Total:					$108,000	$6,198	$108,000
Cost of RR crossing+improvements on East Street to 25A					$420,000	$15,000	$292,500
Savings by going around tracks to 25A					$312,000	$8,802	$184,500

Table 4 (cont'd)
Option 6

Construction + ROW Costs: CR99 from CR27 toCR31

Notes:
Existing ROW 50'.
Existing Pavement width = 21'/22'
Desired Pavement width with 4' shoulders for bikelane: 32'
Pavement condition: poor, needs rehab concurrent with lane construction
Additional right of way needed to avoid removal of olive trees
Some power poles will need to be relocated.
Bridges w/ 4/5' shoulders assumed adequate, no upgrade needed

RIGHT OF WAY:	Length (feet)	Right of way width reqd (ft)	Acres	Cost/acre	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
	21120	10	4.85	$10,000		$48,485	
CONSTRUCTION COST: (assume 4' shoulders done **in conjunction w/** road rehab)							
	Length (mile)	Cost per mile					
Grind/AB/AC	4	$85,000					$340,000
CONSTRUCTION COST: (assume entire road rehabilitated)							
	Length (mile)	Cost per mile					
Grind/AB/AC	4	$340,000			$1,360,000		

	Acres	Const. Cost Full rehab	Cost ROW	Const. Cost Bikeway only
ESTIMATED CONSTRUCTION COSTS:	**4.85**	**$1,360,000**	**$48,485**	**$340,000**
Environmental: Should be relatively easy, neg dec for road rehab:		$10,000		$2,500
Engineering/Bid documents @ 5%		$68,000		$17,000
Contract Admin + QA/QC tests @ 5%		$68,000		$17,000
Total Project Estimated Cost (with ROW cost included):		$1,554,485		$424,985

A.2 Right of way Easement Strategies

There are two basic strategies for gaining legal access to and control of the right of-way needed for the project. First, the County could negotiate with the relevant property owners individually to gain an easement or license agreement that is clearly described and delineated. The second strategy is to attempt to purchase private property and, if needed, condemn the property.

At a minimum, all easements or licenses should be wide enough to accommodate the bike path, setbacks, and required areas for construction. The minimum easement for a separated pathway would need to be at least 16 feet wide (25 feet is preferred) to accommodate the bike path and its required setbacks. The easement boundaries would need to be surveyed and field marked for the construction phase and future maintenance.

The amount of new right of way required for shoulder improvements varies depending on the existing width of the right of way, and will need to be in the form of road easement purchased from affected landowners.

Key issues that need to be resolved as part of any easement or license agreement include:

- Definition of geographic boundaries
- Cost
- Term of agreement
- Primary use of property
- Suspension or limitation of use
- Revocation conditions
- Maintenance and litter
- Insurance requirements
- Approval and inspection of work
- Monitoring and enforcement
- Damage to property
- Signs, fencing, vandalism, graffiti, drainage
- Encroachment permits

A.3 Funding

Funding for planning, design, and construction of the project has not yet been identified. Funding for projects of this type can come from a variety of local, state, and federal funding sources, with TEA (Transportation Equity Act for the 21st Century) program being a major source of funding. TEA-21 contains two major programs, STP (Surface Transportation Program) and CMAQ (Congestion Mitigation and Air Quality Improvements) along with other programs such as the National Recreational Trails Fund, Section 402 (Safety) funds, Scenic Byways funds, and Federal Lands Highway funds. TEA-21 funding for pedestrian and bicycle projects has increased significantly over the previous ISTEA program.

Transportation Enhancement Act for the 21st Century (TEA- 21): TEA-21 funding is administered through the state (California Transportation Commission) and regional governments (SACOG). Most, but not all, of the funding programs are transportation oriented, not recreation oriented, with an emphasis on (a) reducing auto trips and (b) providing an inter-modal connection. Funding criteria includes completion and adoption of a bicycle master plan, quantification of the costs and benefits of the system (including saved vehicle trips, reduced air pollution), proof of public involvement and support, CEQA compliance, access to right of way, and commitment of local resources.

The following state sources provide funding that is applicable to bikeway or pedestrian facilities.

TDA Article III (SB 821): Transportation Development Act (TDA) Article III funds are state block grants awarded annually to local jurisdictions for bicycle and pedestrian projects in California. These funds originate from the state sales tax and are distributed through the Congestion Management Agency to local jurisdictions based on tax revenue generation.

AB 434: AB 434 funds are available to clean air transportation projects, including bicycle projects, in California.

Bicycle Transportation Account: The State Bicycle Transportation Account (BTA) is an annual program that is available for funding bicycle projects. Available as grants to local jurisdictions, the emphasis is on projects that benefit bicycling for commuting purposes. As a result of SB 1772, effective July 1, 2001, this program will have $7.2 million in funding for Fiscal Years 2001/02 through 2005/06. After 2005/06, annual BTA funding will be $5 million. The grant funds require a 10% local match.

A variety of local sources are available for funding bikeway and pedestrian improvements, however their use is often dependent on local political support and budgetary conditions.

New Construction: Future roadway widening and construction projects are one means of providing bike lanes. To ensure that roadway construction projects include bike lanes where identified as part of the local master plan and this project study report, a formal review process of all roadway projects in the corridor must be instituted by all affected jurisdictions.

Development Impact Fees and Requirements: Another potential source of funding for completion of parts of the bikeway system are fees and requirements assigned to new development. Impact fees and requirements must show a direct nexus between the use of the fee or the required improvement, and impacts from the proposed development. Impacts are typically measured by trip generation and local intersection levels of service. The bikeway or trail improvement must be shown to reduce potential impacts of the development by encouraging people to walk or bicycle rather than drive.

DESIGN GUIDELINES

B.0 Recommended Planning and Design Standards

This section provides specific design and implementation guidelines and standards to ensure that the Davis-Woodland Bike Route is constructed to a consistent set of the highest and best standards currently available in the United States. Planning, design, and implementation standards and guidelines are derived from the following sources:

Caltrans: Highway Design Manual (Chapter 1000: Bikeway Planning and Design)
AASHTO: A Policy on Geometric Design of Highways and Streets
AASHTO: Guide for the Development of Bicycle Facilities
State of Florida: Trail Intersection Design Guidelines
Manual of Uniform Traffic Control Devices
USDOT, FHWA: Selecting Roadway Design Treatments to Accommodate Bicycles
BFA: Selecting and Designing Bicycle Routes
USDOT/FHWA: Conflicts on Multiple-Use Trails
RTC: Rails-with-Trails, Sharing Corridors for Transportation and Recreation

The sources listed above provide details on many aspects of a bikeway project, but (a) may contain recommendations that conflict with each other, (b) are not, in most cases, officially recognized "requirements", and (c) do not cover all of conditions on most bikeway projects. Except for the Caltrans guidelines, all design guidelines must be considered as simply design resources for route, to be supplemented by the reasonable judgements of professionals.

B.1 Bikeway Classifications

While Project Scope specifically refers to a "Bike Path" project, it also mentions that the final alignment may be off the railroad right-of-way and on nearby public streets. Bikeways are described by Caltrans in Chapter 1000 of the Highway Design Manual as being one of three basic types (see Figure B1).

- **Class I Bike Path** A paved bikeway physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way.

- **Class II Bike Lane** Any portion of a roadway designated for bicycle use and defined by pavement marking (stripes and stencils), curbs, signs or other traffic-control devices.

- **Class III Bike Route** A designated route through high demand corridors on existing streets that is shared with motor vehicles, indicated by periodic signs and not requiring pavement markings.

All of the proposed route segments fall into one of these three categories.

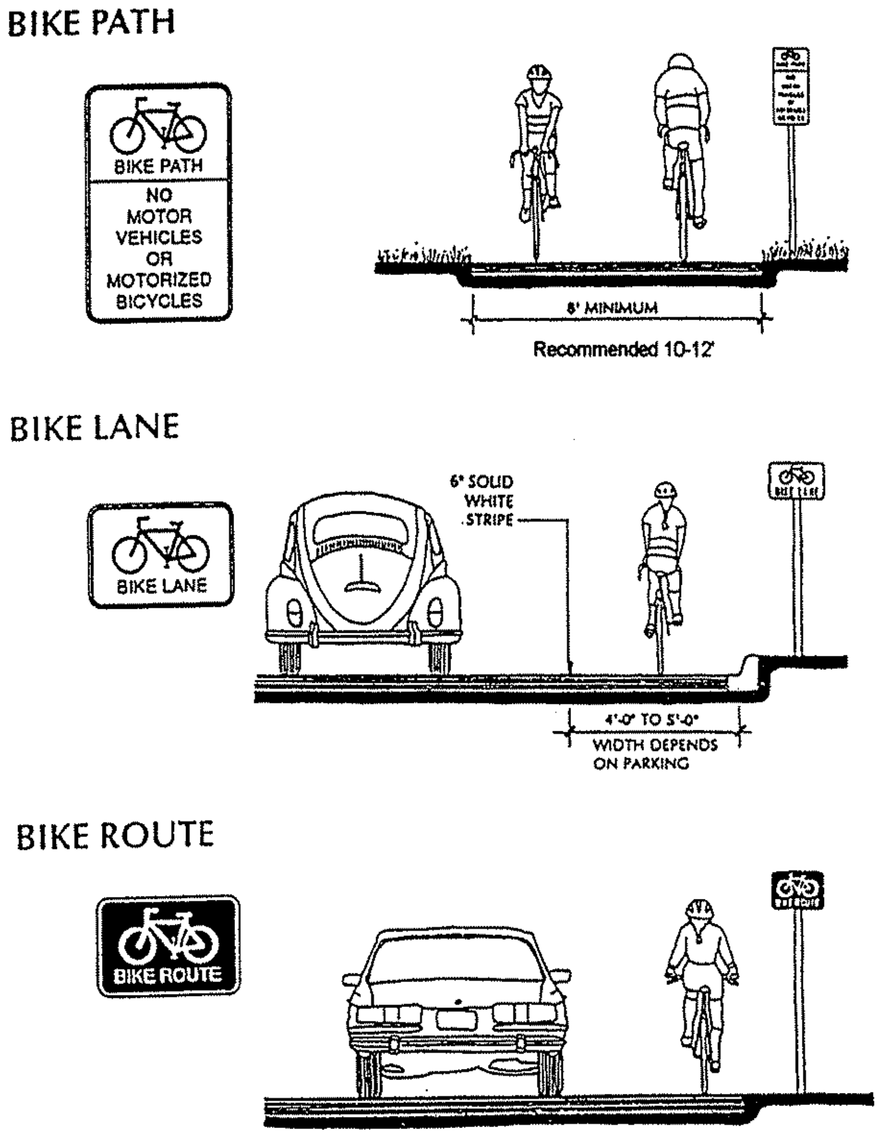


Figure B-1	Class Bike I Path, Class Bike II Lanes, Class III Routes	alta PLANNING • DESIGN • ECONOMICS

B.2 Application of Standards

The California Department of Transportation (Caltrans) has developed specific design guidelines in the Highway Design Manual for Class I bike paths. Off-road portions of the route will be designed to Class I standards wherever possible. These standards are intended to be a guide to engineers in their exercise of sound judgement in the design of projects. Design standards should meet or exceed the Caltrans standards to the maximum extent feasible. Lower standards may be used when such use best satisfies the concerns of a given situation. Mandatory design standards are those considered most essential to achievement of overall design objectives. Many pertain to requirements of law or regulations such as those embodied in the FHWA's controlling criteria. Mandatory standards are identified in Chapter 1000 of the Highway Design Manual with the word "shall".

Advisory standards are important but allow for greater flexibility and are identified by the word "should". Permissive standards are identified by the words "should" or "may" and can be applied at the discretion of the project engineer. Controlling Criteria, as defined by the FHWA, consists of 13 specific criteria to be used in the selection of design standards. They are: (1) design speed, (2) lane width, (3) shoulder width, (4) bridge width, (5) horizontal alignment, (6) vertical alignment, (7) grade, (8) stopping sight distance, (9) cross slope, (10) super elevation, (11) horizontal clearance, (12) vertical clearance, and (13) bridge structural capacity.

Designs which deviate from the mandatory Caltrans design standards *shall* be approved by the Chief, Office of Project Planning and Design, or to delegated Project Development Coordinators.

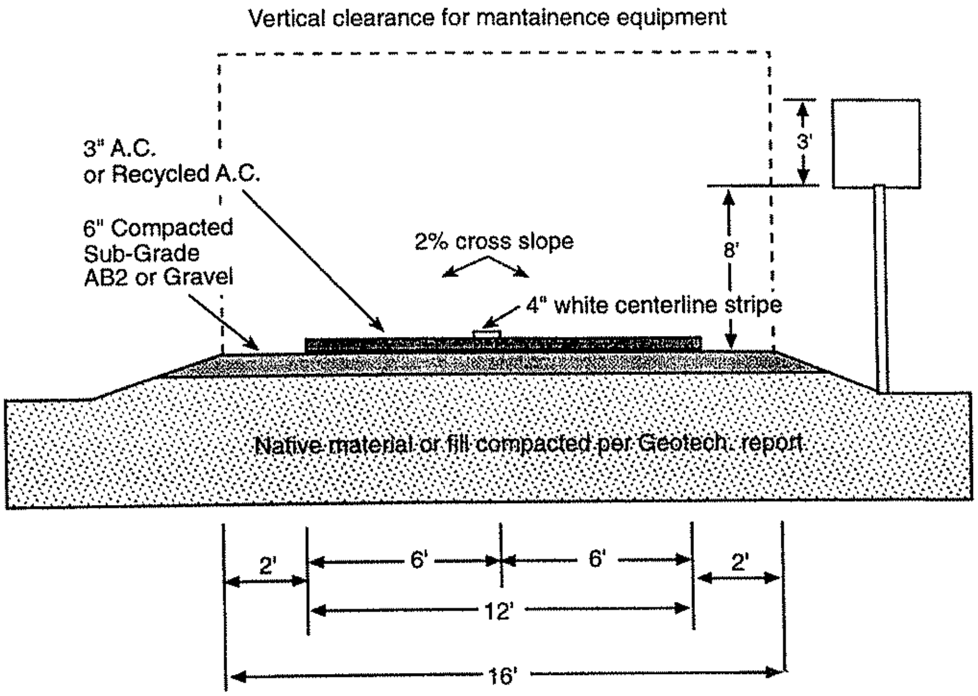
These standards represent the basic guidelines set forth by Caltrans. There are many conditions that are not explicitly covered in the Caltrans or AASHTO guidelines (such as fencing) which are also discussed in the following sections. Presentation of these standards in this report does not release the project designer or engineer from reviewing and using the original source material.

B.3 Class I Bike Path Design Standards and Recommendations

In addition to the published resources listed in Section B.0, recommended designs and practices are based on the experiences of other bikeway projects from around California and the United States. The following sections establish the basic design parameters as developed by Caltrans. Mandatory standards are shown in italics along with recommendations for this project.

Recommended Width

The required minimum width for paved Class I bike paths in California is 2.4 meters (7.9 feet), with .6 meters (2 feet) of lateral clearance and 2.1 meters (6.9-feet) of vertical clearance (see Figure B2). If the project is projected to have higher volumes of bicyclists and others, or if maintenance vehicles will be using the bike path on a regular basis, a minimum width of 10-feet is recommended with the same lateral and vertical clearances. Typically, 3-feet wide unpaved shoulders with a compacted surface (often decomposed granite) are located on each side of the paved surface to accommodate



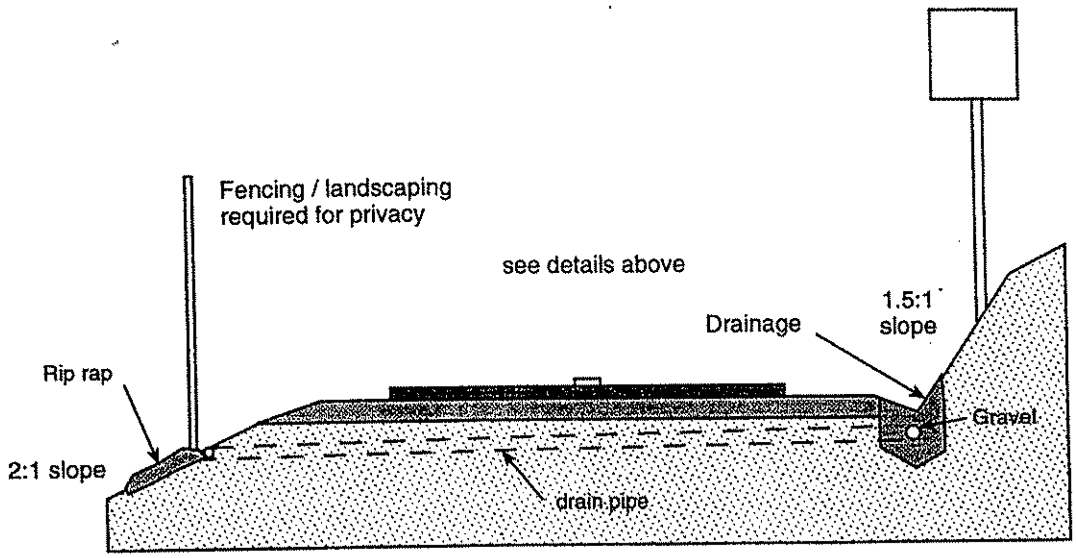


Figure B-2	Class I Bike Path Cross Section

joggers and others who prefer a softer surface. A 2% cross slope for drainage should be provided on all trails.

Recommendation: Provide a 10-feet wide paved surface on Class I portions of the trail, with 2 feet minimum unpaved shoulders for a total path width of 14 feet. Where use of the trail is expected to be high, a 12 feet wide paved surface may be appropriate. Where the right-of-way is constricted, an 8-feet wide paved surface may be provided for short distances (200 feet maximum).

Signing and Striping

A yellow centerline stripe may be desirable (but is not required) on sections of the bike path that have heavy usage, curves with restricted sight lines, at approaches to intersections, and/or where nighttime riding is expected.

Recommendation: Provide a yellow centerline in locations described above.

Intersections and Crossings

The bike path segments should take into consideration the frequency and condition of grade crossings of roadways. Grade separations, such as bridges or under crossings, are recommended if traffic volumes are heavy. If grade separation is not feasible, traffic signals may suffice. Stop or Yield signs for bicyclists will suffice where traffic volumes are not heavy.

Trail crossings should occur at established pedestrian crossings wherever possible, or at locations completely out of the influence of intersections. Mid-block crossings should address right of way for the motorist and trail user through use of Yield, Stop, or traffic signals that can be activated by trail users. Trail approaches at intersections should always have Stop or Yield signs to minimize conflicts with autos (see Figure B3). Bike Crossings may be placed in advance of trail crossings to alert motorists. Ramps should be placed on sidewalk curbs for bicyclists.

Recommendation: Design bike path crossings in accordance with the design standards described above.

Separation of Pathways

Bikeways or trails parallel to roadways should be located no closer than 1.5 meters (5-feet) from the edge of the roadway, unless a positive physical barrier is provided. Generally, bikeways are not recommended directly parallel to roadways as most bicyclists will find it less usable than the street itself, assuming there is adequate width.

Recommendation: Avoid bike paths with this configuration.

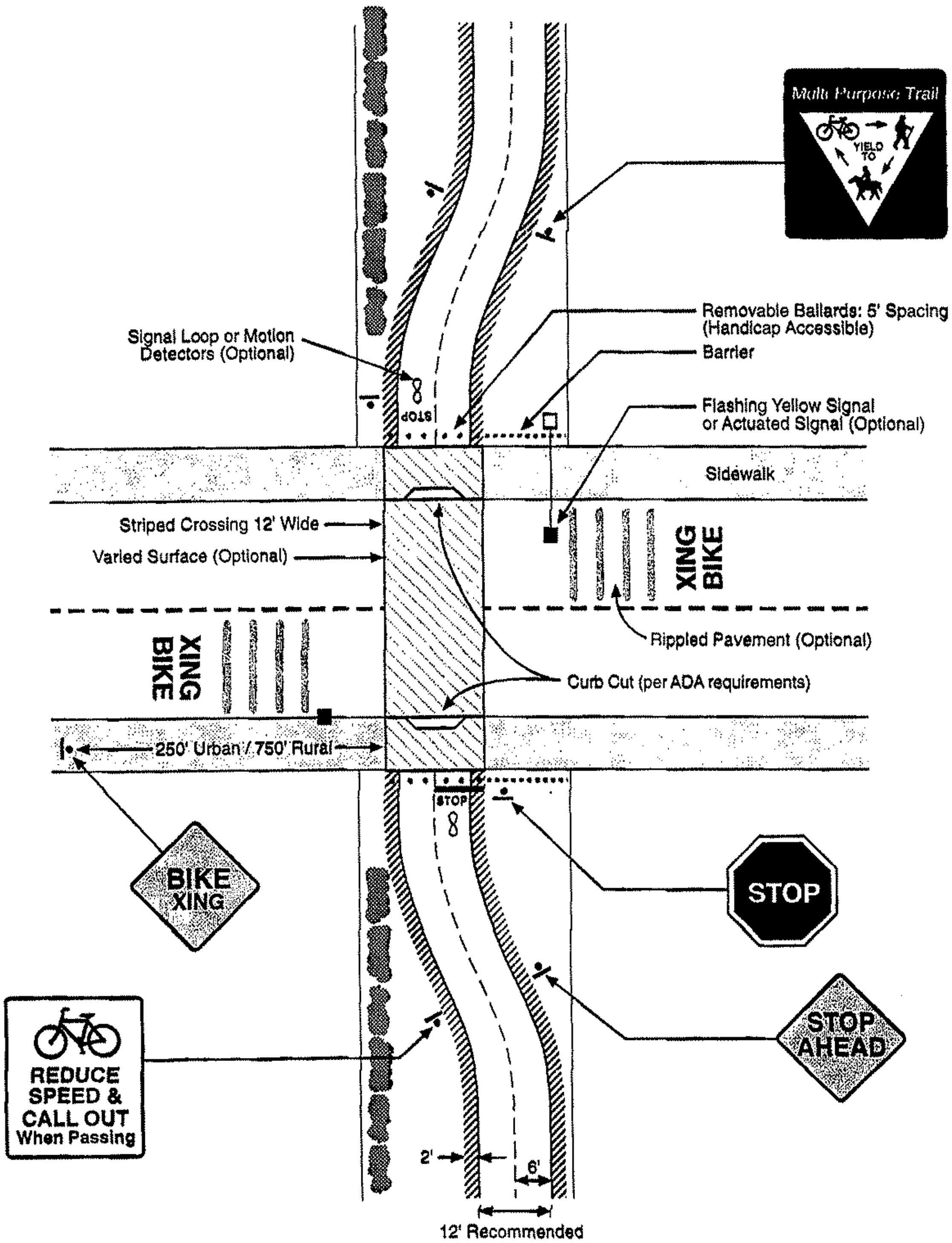


Figure B-3	Class I Multi-Use Trail Crossing Prototype	alta PLANNING • DESIGN • ECONOMICS

Design Speed

The minimum design speed for bike paths is 40 km/hour (25 miles per hour), except on sections where there are long downgrades (steeper than 4%, and longer than 500-feet). *Speed bumps or other surface irregularities should never be used to slow bicycles.*

Recommendation: Adopt and post these standards.

Horizontal and Vertical Alignments

Recommended vertical curves and stopping sight distances are shown in Figure B4. Recommended horizontal curve radii, sight distances, and super elevations are shown in Figure B5. A 2% cross slope is recommended for drainage, and should generally not be exceeded.

Recommendation: Adopt and use these standards in final design and construction.

Lateral Clearance on Horizontal Curves

The minimum clearance to line of sight obstructions on horizontal curves can be calculated by taking the 2 feet lateral clearance requirement, the required stopping sight distance from Figure B3, and the proposed horizontal curve radius from Figure B4.

Recommendation: Adopt and use these standards in final design and construction.

Gradients

Steep grades should be avoided on any bike path or multi-use trail, with 5% the recommended maximum gradient. Steeper grades can be tolerated for short distances (up to about 500 feet).

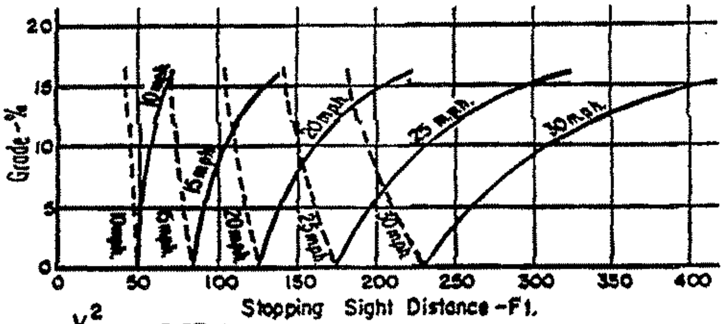
Recommendation: Adopt and use these standards in final design and construction. The bike path will be relatively level terrain for its entire length.

Structural Section

Bike path construction should be conducted in a similar manner as roadway construction, with sub-base thickness to be determined by soils condition and expansive soil types requiring special structural sections. Minimum asphalt thickness should be 50 mm (3 inches) of Type A or Type B as described by Caltrans Standard Specifications, with 12.5mm (one half inch) maximum aggregate and medium grading.

Recommendation: Adopt and use these standards in final design and construction. The unpaved shoulders should be constructed of compacted decomposed granite over an aggregate base.

Stopping Sight Distance

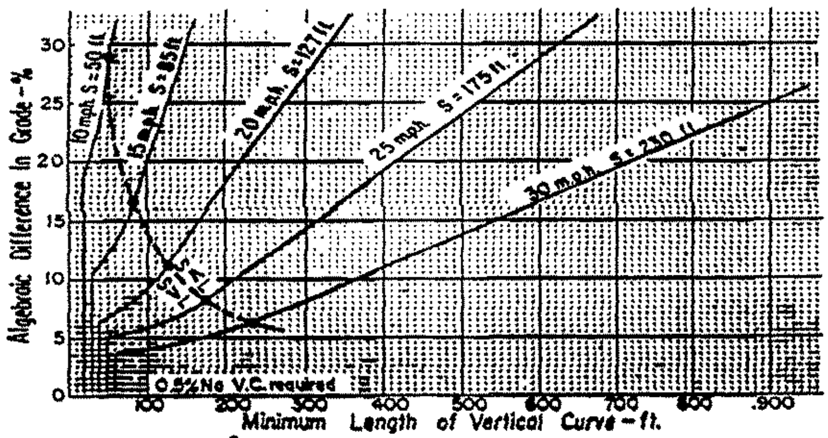


$$S = \frac{V^2}{30(f \pm G)} + 3.67\,V$$

where: S = stopping sight distance, ft.
V = velocity, mph.
f = coefficient of friction (use 0.25)
G = grade ft./ft. (rise/run)

Descend ————
Ascend - - - - - -

Sight Distances for Crest Vertical Curves

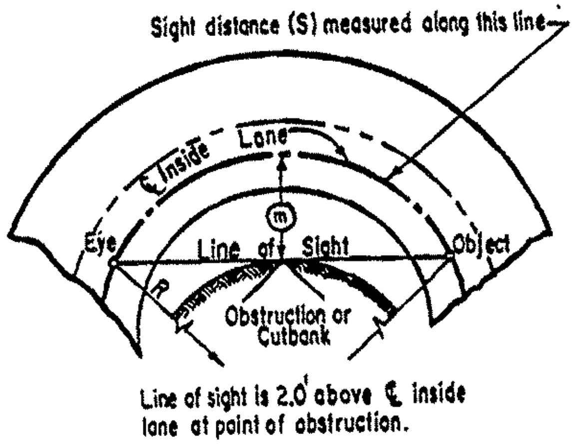


$$L = 2S - \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A} \quad \text{when } S > L$$

$$L = \frac{AS^2}{100(\sqrt{2h_1} + \sqrt{2h_2})^2} \quad \text{when } S < L$$

where: S = Stopping sight distance.
A = Algebraic difference in grade.
h_1 = 4 1/2 ft. - eye height of cyclist.
h_2 = 1/3 ft. - height of object.
L = Minimum vertical curve length.

Figure B-4	Class I Vertical Curves and Sight Distances	alta PLANNING • DESIGN • ECONOMICS



S = Sight distance in feet.
R = Radius of ℄ inside lane in feet.
M = Distance from ℄ inside lane in feet.
V = Design speed for S in M.P.H.

Angle is expressed in degrees

$$m = R\left[\text{vers}\left(\frac{28.65S}{R}\right)\right]$$

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

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

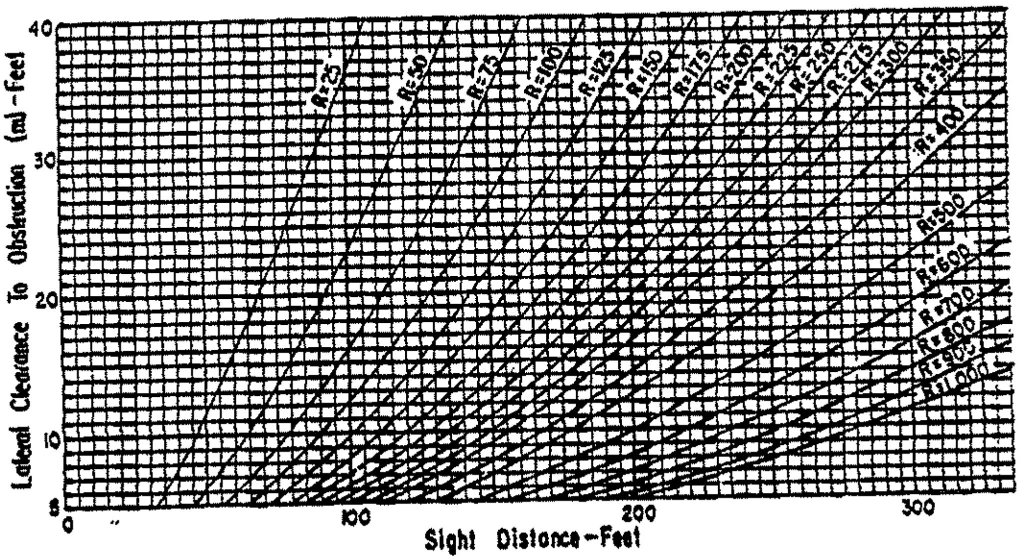


Figure B-5	Class I Horizontal Curves and Sight Distances	alta PLANNING • DESIGN • ECONOMICS

Drainage

The 2% cross slope will resolve most drainage issues on a bike path, except along cut sections where uphill water must be collected in a ditch and directed to a catch basin, where the water can be directed in a drainage pipe of suitable dimensions.

Recommendation: Adopt and use these standards in final design and construction. Coordinate all drainage designs with existing County construction documents.

Barrier Posts

Posts at trail intersections and entrances may be necessary to keep vehicles from entering. Posts should be designed to be visible to bicyclists and others, especially at night, with reflective materials and appropriate striping. Posts should be designed to be moveable by emergency vehicles.

Recommendation: Adopt and use these standards in final design and construction. Coordinate all barrier post designs with local maintenance, police, and fire departments.

Other Non-Caltrans Standards

Trail Setbacks from Railroad Tracks

The CPUC has specific minimum setbacks for any structures or improvements (including any sidewalk or trail that parallels active railroad tracks). These standards are typically applied to the minimum distance that crossing guard equipment is located from tracks. Minimum distances from the centerline of an active railroad to the outside edge of a trail or bikeway is 8'6" on tangent and 9'6" on curved track (General Order No. 26-D). Wherever possible, it is recommended that the trail be set back at least 25 feet from the centerline of the tracks, or at least 15 feet when there is a vertical separation of more than 10 feet. Experience working with the CNRR in Woodland indicates that at least 25 feet from centerline is needed for an acceptable separation from the tracks to any bicycle facility paralleling the railroad.

Recommendation: Adopt and use these standards in final design and construction. These sections will include a minimum 25-feet setback with a safety fence.

B4 Class II and III Bike Lane and Route Design Standards and Recommendations

All proposed Class II bike lane and Class III bike route standards listed below are recommended to be adopted and used in the design and construction of the project. As a general rule, Class II bike lanes should be installed wherever feasible except on residential and collector streets where average daily traffic volumes (ADT) are under 5,000 vehicles and 85th percentile speeds under 30 miles per hour. Bike lanes are optional on these streets and may not be necessary. The final design, approval, and implementation for all on-street facilities lies with Caltrans or local city public works departments.

Class II Bike Lanes and Class III Bike Routes

Portions of the proposed route will be located on-street and classified as either bike lanes or bike routes. Standards for Class II bike lanes and Class III bike routes are presented below, with Mandatory Standards in *italics*.

A. *Bike lanes shall be one-way facilities*, and located on both sides of two-way streets.
B. *Bike lanes shall not be placed between parking areas and the curb.*
C. *Bike lanes shall be a minimum of 1.5 meters (5-feet) wide when adjacent to marked on-street parking. Where there is no on-street parking permitted, bike lanes may be a minimum of 1.2 meters (4-feet) wide where there is no gutter and 1.5 meters (5 feet) including a normal 600mm gutter. Combination parking/bike lanes may be used that have one outside stripe that are 3.3 to 3.6 meters (10.8 to 11.8-feet) wide, depending on the type of curb.*
D. 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.
E. *Raised barriers or raised pavement markers shall not be used to delineate bike lanes.*
F. All striping should be continuous 6" solid white, except for the line between the lane and parking, which may be 4" solid white.
G. Typical traffic lanes next to bike lanes are 3.6 meters (11.8 feet). Lane widths narrower than 3.6 meters must receive approval as discussed in the Highway Capacity Manual Index 82.2. There are situations where it may be necessary to reduce the width of traffic lanes in order to stripe bike lanes. In determining the appropriateness of narrower traffic lanes, consideration should be given to factors such as motor vehicle speeds, truck volumes, alignment, and sight distance. Where favorable conditions exist, traffic lanes of 3.3 meters (10.8 feet) may be feasible.
H. Intersection design should be accomplished according to the designs presented in Figure A5 to the extent feasible.
I. Class III bike routes are un-striped shared facilities with motorists or pedestrians that should provide continuity to the bikeway system, and provide the bicyclist with a higher degree of service than alternative routes. A higher degree of service includes directness, adjusted traffic control devices giving priority to bicyclists, removal of on-street parking when possible, surface imperfections corrected, and/or a higher standard of maintenance than other comparable routes.
J. Sidewalks should generally not be used as a bike route, except under special circumstances.

Bridge and Grate Standards

Bicycles on bridges are best accommodated by bike lanes. Bikeway approaches to a two-way bikeway on one side of a bridge should be by way of a two-way bike path (not bike lane). *A physical separation (such as a fence or railing) shall be provided between a two-way bike path directly adjacent to travel lanes on a bridge. Separate highway over crossing structures for bicycles should conform to Caltrans standard design loading of 85 pounds per square foot, with the minimum* *clear width the same as the approach bikeway. Drainage inlet grates on bikeways shall have openings narrow enough and short enough to assure bicycle tires will not drop into the grates.*

Signing, Markings, and Traffic Control Devices

Uniform signs, markings, and traffic control devices shall be used per section 891 of the Streets and Highways Code. An optional 100 mm (4 inch) yellow centerline stripe may be used to separate users on a Class I bike path. *Bike lane signs (R81) shall be placed at the beginning of all bike lanes, on the far side of every arterial street intersection, at all major changes in direction, and at maximum half-mile intervals. Bike lane pavement markings shall be placed on the far side of each intersection.*

Bike path, bike lane, and bike route signing and markings should follow the guidelines as developed by Caltrans and the Manual on Uniform Traffic Control Devices. This includes advisory, warning, directional, and informational signs for both bicyclists, pedestrians, and motorists. The final striping, marking, and signing plan for the route should be reviewed and approved by a licensed traffic engineer and/or civil engineer.

B.5 Fencing and Barriers

Fencing and other barriers such as vegetation are typically used to separate Class I bike paths from adjacent land uses on either side of the right-of-way. Of the 37 trails-with-rails in the United States surveyed by RTC in 1996, 23 (62%) are located next to high-speed mainlines similar to the CNNR track. The median distance of all trails-with-rails from the edge of the trail to the centerline of the nearest railroad track was 55 feet, although 36% of the trails were located within 20 feet of the centerline of the railway tracks. Of all trails-with-rails, the majority (70%) had a barrier separating the railway tracks and trail, with the most common types of barriers being vegetation (32%), vertical separation (27%), and fencing (21%).

The need for and type of barriers between active railroad lines and bikeways or multi-use trails is currently being reviewed at the Federal level by the Federal Railroad Administration, Federal Highway Administration, the Institute of Transportation Engineers, Class I Railroads, and other interested parties. Research is being conducted to determine the "best practices" of existing trails-with-rails and specifically with regard to issues such as the need for fencing.

Research on the more than 1,000 existing multi-use trails throughout the United States has shown that crime and security are not major issues, and therefore no security fencing is proposed along the entire Class I bike path segments. Standard privacy fencing and/or vegetation could be provided where the bike path offers an unobstructed view into an adjacent back yard at the request of the property owner.

Recommendation: Fencing could be installed where the route is located adjacent to the railroad tracks, of a type, height, and location to be selected by railroad. Where there has been no history of trespassing across the railroad tracks, a 6-foot high chain link fence topped with three strands of barbed wire is recommended. Where there has been a history of trespassing at specific locations on the railroad tracks, a wrought iron or Israeli-type fence could be installed.

Recommendation: A new 52" chain link fence could be installed between the edge of the bike path clear zone and the flood channel (Willow Slough). This fence height offers protection for path users while not creating a closed-in effect that limits visibility.

Recommendation: New privacy fencing could be installed at the request of property owners directly adjacent to the path where the bike path offers a new unobstructed view into their back yards. The type, height, and other items could be negotiated with the property owner within a standard linear foot cost allowance.

B.6 Grade Crossings

When considering a proposed separated bike path and required crossings of roadways, it is important to remember two items: (1) bike path users will be enjoying an auto-free experience and may enter into an intersection unexpectedly, and (2) motorists will not expect to see bicyclists shooting out from an unmarked intersection into the roadway. In most cases, bikeway crossings at-grade can be properly designed to a reasonable degree of safety and to meet existing traffic and safety standards.

Evaluation of bikeway crossings involves analysis of traffic patterns of vehicles as well as trail users. This includes traffic speeds (85th percentile), street width, traffic volumes (average daily traffic, and peak hour), line of sight, and trail user profile (age distribution, destinations). A Traffic Safety study will need to be completed as part of the actual civil engineering design of the proposed crossings to determine the most appropriate final design features. This study identifies the most appropriate crossing options given available information, which must be verified and/or refined through the actual engineering and construction document stage.

The proposed systems approach in this report is based on established standards, published technical reports, and the experiences on existing facilities. Virtually all crossings fit into one of four basic categories, described in Table B-1.

Type 1 or uncontrolled crossings (unsignalized, but with other traffic control devices) are recommended for streets with 85th percentile travel speeds below 45 mph and ADTs below 10,000 vehicles.

Type 2 crossings within 250 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection for safety purposes. In order for this option to be effective barriers and signing would be needed to direct bike path users to the signalized crossings. In many cases the intersections are directly adjacent to the crossings and are not a significant problem for path users.

Table B-1	
Basic Crossing Prototypes	
Crossing Type	*Description*
1. Unprotected	Unprotected crossings include mid-block crossings of residential, collector, and sometimes major arterial streets.
2. Routed to Existing Intersection	Bikeways that emerge near existing intersections may be routed to these locations.
3. Signalized/Controlled	Bikeway crossings that require signals or other control measures due to traffic volumes, speeds, and trail usage.
4. Grade Separated	Bridges or under crossings provide the maximum level of safety but also generally are the most expensive and have right of way, maintenance, and other public safety considerations.

New signalized crossings (Type 3) are identified for crossings more than 250 feet from an existing signalized intersection and where 85th percentile travel speeds are 45 mph and above and/or ADTs 10,000 vehicles. Each crossing, regardless of traffic speeds or volumes, requires additional review by a registered engineer to identify sight line and other factors

Where required, new grade separated crossings of the major arterials have been recommended as a more permanent solution. Grade separated crossings are often warranted when roadway ADTs are in excess of 25,000 vehicles, and 85th percentile speeds in excess of 45 mph.

Standard Crossing Features

Signing. Crossing features for all roadways include warning signs both for vehicles and bike path users. The type, location, and other criteria are identified in the *Manual for Uniform Traffic Control Devices* (MUTCD) and the Caltrans *Highway Design Manual*. Consideration must be given for adequate warning distance based on vehicle speeds and line of sight, with visibility of any signing absolutely critical. Catching the attention of motorists jaded to roadway signs may require additional alerting devices such as a flashing light, roadway striping, or changes in pavement texture. Signing for bike path users must include a standard STOP sign and pavement marking, sometimes combined with other features such as bollards or a kink in the bike path (see Figure B3) to slow bicyclists. Care must be taken not to place too many signs at crossings lest they begin to lose their impact.

Directional signing may be useful for bikeway users and motorists alike. For motorists, a sign reading "Davis-Woodland Bike Path Project Xing" along with a bike path emblem or logo helps both warn and promote use of the bikeway itself. For bike path users, directional signs and street names at crossings help direct people to their destinations.

Striping

A number of striping patterns have emerged over the years to delineate bike path crossings. A median stripe on the bike path approach will help to organize and warn trail users. The actual crosswalk striping is a matter of local and state preference, and may be accompanied by pavement treatments to help warn and slow motorists. The effectiveness of crosswalk striping is highly related to local customs and regulations. In communities where motorists do not typically defer to pedestrians in crosswalks, additional measures may be required. While there is a trend to remove crosswalks at unprotected crossings, prudent design practice would be to install cross walks until there has been conclusive research proving that they are unsafe. Again, the final approval must be with the appropriate local or state roadway department.

Grades

Sustained down grades in excess of 5% should be treated with special caution at crossings. The higher speeds and braking capabilities of bicyclists poses a real safety hazard, and should be mitigated through the use of wide curves or barriers that force bicyclists to dismount and walk to the crossing.

Unprotected Crossings

An unprotected crossing consists of a crosswalk, signing, and often no other devices to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, bike path user volumes, use patterns, road type and width, and other safety issues such as nearby schools. The table below identifies the general thresholds below which unprotected crossings may be acceptable.

On residential and collector streets below 10,000 ADT, crosswalks and warning signs (Bike Xing) should be provided for motorists, and STOP signs and slowing techniques (bollards/geometry) used on the bike path approach. Care should be taken to keep vegetation and other obstacles out of the view line for motorists and trail users.

Collector streets up to 15,000 ADT require a higher level of treatment for crossings than residential streets. In addition to the features described for residential streets, signing locations may need to be moved further upstream and made more visible for motorists. A flashing yellow beacon costing between $15,000 and $30,000 may be used, preferably one that is activated by the bike path user rather than continuous. The East Bay Regional Park District is successfully using a flashing beacon that is activated by motion detectors on the trail, triggering the beacon as trail users approach the intersection. This equipment, while slightly more expensive, helps to keep motorists alert. Other new technologies include runway lights embedded in the pavement at cross walks, which flash a warning to oncoming motorists that the cross walk is in use. Research into the effectiveness of these devices is on-going at this juncture, although their effectiveness is most obvious at dusk.

Table B-2	
Unprotected Crossings	
Install Crosswalks	All locations[1]
Maximum Traffic Volumes:	10,000-15,000 (ADT), 1,000-1,500 peak hour
Maximum 85th Percentile Speeds:	35-45 mph
Maximum Trail User Volumes:	50-75 per hour, 300-400 per day
Maximum Street Width	60 feet (no median)
Minimum Line of Sight	25mph zone: 100 feet 35 mph zone: 200 feet 45 mph zone: 300 feet

Higher volume arterials over 15,000 ADT may be unprotected in some circumstances, for example if they are located near a signalized intersection and there are substantial gaps in the traffic, and/or there is a median island. This would not be appropriate if there were a significant number of school children using the bike path.

Existing Intersections

Bike paths that either parallel a roadway or emerge closer than 200 to 350 feet from a protected intersection, should be routed to that crossing in most cases. The reason is that motorists are not expecting to see pedestrians and bicyclists crossing so close to an intersection, traffic congestion may extend this distance, and the crossing may unnecessarily impact traffic capacity on a corridor.

Where the route does not emerge at the existing intersection a barrier and directional signing will be required to keep bicyclists and others from crossing at the unmarked location. At the existing intersection crosswalk, all bike path users will technically become pedestrians. Signs warning motorists of the presence of bicycles may be needed, as well as right turn on red prohibitions "when pedestrians and bicyclists present". High speed curve geometry and free right turns should be replaced with tighter radii to help slow vehicles.

[1] Some traffic design guidelines suggest that crosswalks are not required with ADT volumes below 7,000.

Table B-3	
Crossings at Existing Intersections	
Maximum Distance from Davis-Woodland Bikeway to Intersection:	Street Width 40 feet or less: 200 feet Street width over 40 feet: 350 feet
Length of barrier to prevent informal crossing	Street Width 40 feet or less: 50 feet Street width over 40 feet: 100 feet
Intersection Improvements	Warning Signs for Motorists Right turn on red prohibitions Elimination of high speed and free right turns Adequate crossing time Pedestrian activated signals

One of the key problems with using existing intersections is that it requires bicyclists to transition from a separated two-way facility to pedestrian facilities such as sidewalks and crosswalks, normally reserved for pedestrians. Widening and striping the sidewalk (if possible) between the path and intersection and adding a physical barrier may help to alleviate some of these concerns.

Table B4 presents a summary of crossings and crossing types for the Davis-Woodland Bikeway Project.

Table B-4	
Davis-Woodland Bikeway Crossings and Crossing Types (Class I segments only)	
Crossing	*Crossing Type*
CR 29	1. : crosswalk & warning signs
CR 27	1. : crosswalk & warning signs
CR 25A	2. : use existing signed intersection

B.7 Railroad Crossings

The Options generally do not include new grade crossings of the railroad tracks. Most routes will cross the railway tracks at established legal roadway crossings. It is useful to note that sidewalks are not provided at most legal street crossings of the railroad tracks. This presents a serious barrier to pedestrians, especially to senior citizens, handicapped individuals, and parents with strollers. New sidewalks with rubberized materials may need to be implemented over time to remedy this situation.

New pedestrian railroad crossing flashers are typically not required for sidewalk crossings at legal crossings because they are redundant with adjacent vehicle crossing warning equipment. However, new flashers should be provided where the trail crosses the tracks at legal crossings on the opposite side of the tracks as the vehicular warning devices.

B.8 Utilities and Lighting

Along with the railroad itself, surface and sub-surface utilities may be located within the railroad right of way, potentially impacting the location and construction of the bicycle routes. Utilities include active and abandoned communications cable, signal and communication boxes, fiber optic cable, water and sewer lines, and telephone lines. Bicycle routes should be designed to avoid having to move most active surface utilities, although utility poles no longer in use may be removed. The bike path may be located directly over existing sub-surface utilities assuming (a) adequate depth exists between the path surface and utility to prevent damage, and (b) agreements can be reached with the utility owner regarding access for repairs and impact to the bike path.

Enhanced lighting may be desirable at intersections and other locations. The Class I segments of the Davis-Woodland Bikeway are not proposed to have lighting at this juncture, due both to the cost and possible impacts to adjacent neighbors. Bicyclists riding at night are required by law to provide their own lighting. Individual cities may choose to light portions of the trail, especially where there is considerable evening pedestrian and bicycle commuter traffic.

B.9 Signing and Marking

Bicycle routes should be designed to include all of the required and recommended signing and marking standards developed by Caltrans in Chapter 1000 of the Highway Design Manual. In addition, all signs and markings should conform to the standards developed in the Manual of Uniform Traffic Control Devices (MUTCD). Each city may also have their own entrance signing features as well, which include regulations and other information.

In general, all signs should be located a minimum of 3 to 4 feet from the edge of the paved surface, have a minimum vertical clearance of 8.5 feet when located above the trail surface and be a minimum of 4 feet above the trail surface when located on the side of the trail. All signs should be oriented so as not to confuse motorists. The designs (though not necessarily the size) of signs and markings should be the same as used for motor vehicles.

Recommended pavement markings can be derived directly from the Caltrans Highway Design Manual (Chapter 1000) and the MUTCD.

Entrance Features

Entrances to the Class I portion of the Davis-Woodland Bikeway Project may contain a variety of support facilities and other items, depending on available resources and local support. Typical entrance features include:

1. **Trail Heads**. The trail may draw substantial numbers of users during peak times. Trail users could be directed to specific Trail heads where parking and other amenities are provided, helping to relieve some of the pressure on residential and commercial areas. Trail Heads may also contain drinking fountains, telephones, restrooms, bike lockers, and other features. Trail Heads should be accessible by transit and rail service.

2. **Bollards**. A single 48" wood or metal bollard (post) should be placed on the centerline of the trail at all entrances to prevent motor vehicles from entering the trail. The bollard should be designed with high reflective surfaces. The bollard should be locked to a ground plate and be easily removed by emergency vehicles.

3. **Entrance Features.** The trail alignment should have a sharp (20' or less radius) curve at all major roadway intersections wherever physically possible, to help slow bicycles. Entrance circles may be constructed with a 20' inside radius to help slow bicycles. Public art and/or entrance signs may be placed in the circle. Entrance signs should include regulations, hours of operation (if any), and trail speed limit. Entrance signs may also include sponsorships by local agencies, organizations, and/or corporations. Signs may be placed at the entrances or at appropriate locations along the trail that provide brief descriptions of historic events or natural features.

B.10 Landscaping

The basic scope of the project is to provide a transportation--rather than recreation--facility, and therefore landscaping is not considered an essential element in the planning and design of the facility. Individual cities may, however, decide to provide their own landscaping to enhance the linear corridor.

C.0 OPERATIONS AND MAINTENANCE

Operations and maintenance of the Davis-Woodland Bikeway is of utmost importance for the productive use of the facility, and the financial and liability resources of the local jurisdictions. It is assumed that each jurisdiction will perform their own operations and maintenance on their section of the Davis-Woodland Bikeway. In that case, this section presents a consistent set of standards that may be used by each local jurisdiction. There may be certain advantages to the forming of a joint powers authority or assigning that responsibility to an existing regional agency simply for the coordination and cost savings benefits. If such a regional agency is not assigned responsibility, it will be imperative that a coordinating framework between jurisdictions be established.

The following sections cover both off-road (Class I) and on-road (Class II and III) facilities, whichever is selected as the final alignment for this project.

C.1 Operations

Operation activities on the Davis-Woodland Bikeway will consist primarily of monitoring and security. Monitoring accidents including identifying the primary cause and rectifying any physical deficiencies must be accomplished by each jurisdiction. The local police department typically has the responsibility for collecting accident information identifying fault, while the public works department has the responsibility for setting up a system to receive calls on and respond to maintenance incidents and problems, and identifying and improving physical or operational conditions which may have contributed to the accident. The public works department typically also has the responsibility for making the determination to warn trail users of problems, and to close the Class I portions of the project when conditions warrant.

Security

Most multi-use trails in the United States do not have a dedicated police patrol of the facility. It is more common for local police to patrol sections of paved trails not visible from adjacent streets on an intermittent basis. As a rule of thumb, a multi-use trail such as the Davis-Woodland Bikeway Feasibility Project will require 1 man-hour per day for every 5 miles of Class I bike path. This translates into up to .5 man-hour/day for the Class I portion of the Davis-Woodland Bikeway Project based on Option 2. This figure would also vary by time of week and year. Off-peak weekdays may require only .25 man-hours/day, while peak weekends may require as much as 1 man-hours/day.

While each local police department is responsible for selecting the most appropriate means of patrolling their segment (if at all), it may be beneficial to patrol the Class I portions of the Davis-Woodland Bikeway using bicycle-mounted officers. Trail patrols may be supplemented by volunteers from local bicycling organizations, who could provide information to trail users and report problems to the authorities. Police or volunteer patrols are not required elements to a successful multi-use trail, however.

A summary of key security recommendations for the Class I portion of the project is presented below.

1. Make all segments of the Davis-Woodland Bikeway accessible to within 500 feet of emergency vehicles
2. Locate mile posts every mile or one half mile; identify markers on maps (start at southern trail head)
3. Illuminate all grade crossings and under crossings using photo-sensitive triggers
4. Locate all vegetation at least 10 feet from the Davis-Woodland Bikeway where possible
5. Provide bicycle racks and lockers at key destinations that allow for both frame and wheels to be locked.
6. Provide fire and police departments with a map of system, along with access points and keys/combinations to gates/bollards.
7. Enforce speed limits and other rules of the road.

Monitoring

Specific responsibilities should be assigned within each city to individuals responsible for monitoring the implementation of the Davis-Woodland Bikeway over time. This individual or Bike Path Coordinator would also be responsible that appropriate design and construction standards are used. The Coordinator could also be the clearinghouse for all reported maintenance and safety problems, collecting information from and dispersing information to the appropriate departments. The Coordinator would work with local public advocacy and advisory bodies in the design and operation of the trail. The Coordinator would also help identify and prepare funding applications to implement and maintain the trail over time.

C.2 Maintenance

Maintenance of the Davis-Woodland Bikeway could include the following regular activities, depending on the type of final landscaping treatment (if any) used on the Class I portions of the project:

Item	Frequency
Sign replacement/repair	1-3 years
Pavement marking replacement	1-3 years
Tree, Shrub, & grass trimming/fertilization	5 months- 1 year
Pavement sealing/potholes	5-15 years/30-40 years for concrete
Clean drainage system	1 year
Pavement sweeping	Monthly - annually as needed
Shoulder and grass mowing	as needed

Trash disposal	as needed
Lighting replacement/repair	1 year
Graffiti removal	Weekly - monthly as needed
Maintain furniture	1 year
Fountain/restroom cleaning/repair	Weekly - monthly as needed
Pruning	1-4 years
Remove fallen trees	As needed
Weed control	Monthly - as needed
Maintain emergency telephones	1 year
Maintain irrigation lines/replace sprinklers	1 year
Irrigate/water plants	Weekly - monthly as needed

Many of these maintenance items are dependent on the type and amount of landscaping and supporting infrastructure that is developed along the trail. It is recommended that a consistent maintenance procedure be developed for each jurisdiction along the Davis-Woodland Bikeway to ensure, at a minimum, that the facility is safe for trail users. Each jurisdiction should have a mechanism to identify, record, and respond to maintenance problems, and to keep written records of such actions.

Special maintenance equipment such as a sweeper may be purchased jointly by all local jurisdictions, thereby reducing costs. Typical maintenance vehicles for the Class I bike path segments will be light pick up trucks and occasionally heavy dump trucks and tractors. Care should be taken when operating heavier equipment on the Davis-Woodland Bikeway to warn trail users and to avoid breaking the edge of the trail surface.

If the Davis-Woodland Bikeway Project will serve as a maintenance access road for the railroad or other utilities, the trail width and pavement section should reflect the anticipated weight and frequency of vehicles. Agreements with these railroads and utilities regarding access to the bike path and methods of warning path users when track repair is in progress should be developed as part of the easement process.

C.3 Private Property Protection

The Class I portions of the Davis-Woodland Bikeway will be located directly adjacent to private properties along much of its proposed alignment. In some cases, private property would need to be purchased, further impacting neighboring land. Neighbor concerns typically include a loss of visual privacy, and concerns about increased crime, vandalism, noise, and fire. Wherever possible, the bike path should be located as far away as possible to protect the privacy of adjacent property owners. New privacy fencing is not be required as part of the project unless the project affords a new view into an adjacent parcels backyard or other private area. Fencing types, designs, and landscaping suggestions may be provided to property owners so that they can select the most appropriate type of fencing for their property within a reasonable linear foot cost allotment. Property owners may be permitted to install gates leading directly onto the bike path.

Studies conducted by Sonoma State University[2] and the Rails-to-Trails Conservancy have shown that new multi-use trails do not result in increases in crime to adjacent property owners. Criminal activity is not likely to occur along a bike path that is well planned, designed, operated, maintained, and used at essentially the same rate or slightly lower than the surrounding neighborhood. Fire concerns should be addressed in part by adequate weed abatement.

C.4 Transportation Management Plan

Bicyclists will need to be managed during construction and periodic maintenance of the Class I, II, and III portions of the project, when sections of the facility will be closed or unavailable to users. Users must be warned of impending closures, and given adequate detour information to bypass the closed or unfinished section of corridor. Users must be warned through the use of standard signing at the entrance to each affected section of the corridor (Bikeway Closed), including (but not limited to) information on alternate routes and dates of closure. Sections of the corridor that are closed must be gated or otherwise blockaded and clearly signed as closed to public use. Alternate routes should provide a reasonable level of directness and lower traffic volumes, and signed consistently. If no reasonable alternate routes are available, the corridor should have an 'End Bikeway'sign.

Maintenance operations and utility maintenance will occasionally require that a Class I bikeway be closed for extended periods. The easement agreement must stipulate that these agencies have the right to enter into the right-of-way at any time with at least 36 hours notice--except during emergencies--and that attempts will be made to not destroy the bike path surface or fencing.

C.5 Liability

Based on experiences of other jurisdictions as well as the case law in California, liability can become a problem under several conditions. A competent risk management program for the project will help assure that the local government is doing all that it can to be responsible stewards of the public treasury.

Use of Design Standards. The designers, builders, and inspectors of a facility should adhere to widely-accepted standards governing the design and construction of the bike path. A standard of conduct includes adherence to published documents such as safety codes, standards, or guidelines that are sponsored or issued by government agencies or voluntary associations, even though such documents lack the force and effect of law. Provisions of state laws related to transportation facilities, if mandatory, may provide the basis for a finding of negligence per se. Applicable California standards include the Uniform Building Code, and Caltrans Design Manual for Class I and II Bikeways. Other available design standards include AASHTO's <u>Guide for the Development of Bicycle Facilities</u>; Florida DOT's <u>Trail Intersection Design Guidelines</u>, Island Press's <u>Greenways: A Guide to Planning, Design, and Development</u>, and the Rail-to-Trails Conservancy's <u>Trails for the 21st Century: A Planning, Design, and Management Manual for Multi-Use Trails.</u> Careful

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[2] Brush Creek Trail Study, Sonoma State University, 1992.

compliance with applicable laws, regulations, route selection criteria, and design standards should greatly reduce the risk of injury to bicyclists using the bikeway, and also provide strong evidence that the agency used reasonable care.

Traffic signals and warning devices. Caltrans has adopted a Traffic Design Manual, which defines the circumstances under which traffic signals and warning devices are required. While California law limits the liability of public entities for failure to install regulatory traffic signals, signage and markings, non-regulatory warning signs must be installed where necessary to warn of a dangerous condition, such as an intersection. All signals and warning devices must be adequately maintained, so as not to invite reliance on a defective warning device.

Use of Professionals. Facilities that have been reviewed and approved by unregistered or unlicensed professionals may increase liability exposure.

Adhere to Maintenance Standards. Maintenance practices should be consistent along the entire rail/trail, and conform to recognized maintenance practices. The responsible maintenance agency(ies) should have a written procedure to follow to maintain all portions of the rail/trail, including pre-existing conditions such as drain grates.

Monitor Conditions. The responsible agency(ies) should have an internal mechanism to monitor and respond to actual operating conditions on the bikeway. This is typically done through the maintenance procedures, a record of field observations and public comments, and an annual accident analysis. Accidents should be reviewed to determine if physical conditions on the bikeway were a contributing cause.

Keep Written Records. Written records of all maintenance activities and procedures, responses to reports of safety hazards, and other regular activities must be recorded in order to be of use. Where a bike path travels through numerous jurisdictions, it may make sense to have one contact persons/department responsible for the entire facility, rather than risk confusion by incidents being reported to the wrong jurisdiction. Mileposts on the route may also help maintenance and enforcement personnel respond to problems.

Correct Hazards. Bike path managers should correct all hazards known by public officials in a timely fashion.

Warn of known hazards. Bike path users should be warned that the path is adjacent to an active railroad corridor or other potentially hazardous use through the use of appropriate signs such as "No Trespassing" and other warning signs.

Insurance. Proper insurance coverage or budgeting for self-insurance to cover potential liability will do much to alleviate concerns. Signage should conform to accepted standards.

Don't Call it Safe. Do not make any verbal or written comments that the project is "safe" or safer than a non-designated route. For example, this Project Feasibility Report makes a statement that the project reduces the number of intersections bicyclists and others must use in the corridor, and that most bicycle and pedestrian-related accidents occur at intersections. The report does not make any blanket claims that the project is safe or safer than comparable routes, however.

Don't Rush to Settle. Fear that juries will award a plaintiff large sums for damages has made many attorneys eager to settle cases before they come to court. One defender settled a case where a bicyclist was injured riding his bicycle on the shoulder of a roadway that was not a designated bikeway. The prosecution claimed that the local government had inferred some guarantee of safety by showing the route on an official map. The map itself made no explicit guarantee of safety, but did include "recommended" routes for bicyclists. The defender settled the case and forced the jurisdiction to remove all bicycle maps, which is now one of the few in the state that offer no such publication. The net effect of prematurely settling a case in this instance was to arbitrarily limit the types of services that could be offered by the local government. In other cases, settling cases prematurely may simply encourage legal action by others.