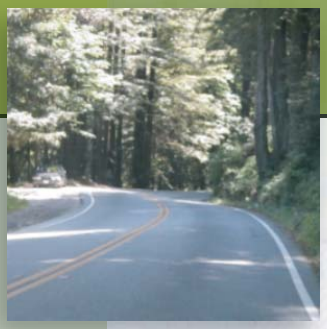

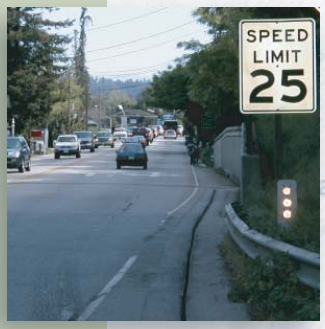

FINAL REPORT:

SAN LORENZO VALLEY TRAIL FEASIBILITY STUDY

June 2006

LandPeople

PREPARED FOR COUNTY OF SANTA CRUZ
DEPARTMENT OF PUBLIC WORKS

Final Report
San Lorenzo Valley Trail Feasibility Study

Prepared for:

County of Santa Cruz, Department of Public Works
Jack Sohriakoff, Senior Civil Engineer
Greg Martin, Civil Engineer

June 2006

Prepared by:

landscape planners and architects
Randy Anderson, Principal
Matt Lamborn, Associate Planner
John Seagrave, Assistant Planner
Kara Lucca, Planning Assistant

In association with:

Frederik Venter, Higgins Associates, *Traffic and Civil Engineers*
Tripat Mangat, Ifland Engineers, Inc., *Civil Engineers*
Kim Tschantz, Cypress Environmental and Land Use Planning
Timothy C. Best, *Certified Engineering Geologist*
Kathleen Lyons, Biotic Resources Group, *Botanist*
Dana Bland, *Wildlife Biologist*
Matthew Clark, Holman & Associates, *Consulting Archaeologists*
Bill Cameron, Rails-to-Trails Conservancy

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1.0 Introduction

1.1 Project Background and Objectives

Improved bicycle and pedestrian routes have been discussed in the San Lorenzo Valley for many years. In the past few years, the San Lorenzo Valley (SLV) Trail Committee formed and conducted field studies to focus on this objective. In 2001 the Santa Cruz County Public Works Department and the Rails-to-Trails Conservancy collaborated on an application for a Caltrans Community-Based Transportation Planning Grant. In May 2002 Caltrans approved the grant to conduct a feasibility study of a trail along the San Lorenzo Valley/Highway 9 corridor between Santa Cruz and Boulder Creek (approximately 15 miles), including an assessment of the potential to use the Big Trees/Roaring Camp Railroad line as part of the trail (see Figure 1.1: Project Location Map).

The planning firm LandPeople was selected in January 2004 to conduct the feasibility study for the trail, working closely with the San Lorenzo Valley Trail Committee and other interested parties and stakeholders. The Rails-to-Trails Conservancy, a private non-profit organization, was contracted separately to the County to provide the railroad portion of the study.

The objectives of this study were to: 1) provide a thorough evaluation of the conditions, opportunities and constraints of constructing a continuous bicycle and pedestrian trail, or separate facilities, along the main study routes, or any identified alternative routes; 2) prepare conceptual improvement plans and cost estimates for the most feasible routes; and, 3) with public and agency input, prepare recommendations for trail improvements.

1.2 Summary of Study Process

The first phase of the study was focused on the feasibility of improving Highway 9 and/or the Big Trees/Roaring Camp Railroad line for bicycle and pedestrian access. In addition to the Santa Cruz to Boulder Creek regional connection, the study examined needs and opportunities to create local bicycle and pedestrian enhancements within communities. Along each primary corridor, parallel and alternative routes were evaluated. Connections to each possible route from communities, schools, and other resources were considered as well. The evaluation considered County and City bike route plans, and the Town Plans of Felton, Ben Lomond and Boulder Creek. Concept designs and cost estimates were prepared for the main routes and for parallel and connecting routes that were determined to be worthy of further study.

After extensive efforts to solicit participation and comments on the study, and County staff and stakeholder review of preliminary study results, a Community Meeting was held on June 2, 2004 to present the findings of the preliminary trail route assessment. During the first study phase the Railroad Route and the southern portion of Highway 9 from Santa Cruz to Felton were deemed by the County Public Works Department, as the responsible local agency, to be economically impractical for the department to improve as connecting bicycle and pedestrian routes. The extremely high costs of the improvements are associated with the severe physical, operational and environmental constraints, including potential impact on natural resources in Henry Cowell Redwoods State Park. In addition to the design, environmental review and construction costs accounted for in the cost estimates, use of the railroad right-of-way would entail access acquisition costs that could potentially be significant. The pursuit of improvements to the rail trail corridor and the lower Highway 9 segment are more suited to other agencies such as the Santa Cruz County Regional Transportation Commission and the California Department of Transportation.

Based on comments at the Community Meeting, additional alternative routes were added to the study for the portion between Santa Cruz and Felton. These routes were assessed for feasibility in the same manner as the routes assessed initially:

- Graham Hill Road from Ocean Street in Santa Cruz to Highway 9 in Felton;
- Pipeline Road in Henry Cowell Redwoods State Park, which connects to Graham Hill Road at the County Equestrian Park via Big Trees Road/Entrance Road and/or River Trail or Meadow Trail. This route was determined to be infeasible due to steep grades, environmental issues, and land use conflict with the Park's purposes.
- Conference Drive, Mt. Hermon Road, and Lockewood Lane from north Graham Hill Road to central Graham Hill Road. This route bypasses the northern portion of Graham Hill Road. This alternative was determined to be infeasible due to a long narrow bridge, a major landslide zone, and a long circuitous route.
- Plymouth Street, El Rancho Drive, La Madrona Drive, and Sims Road from Ocean Street to Graham Hill Road, which bypasses the southern portion of Graham Hill Road. (the Plymouth – Sims Route).

Several shorter alternative connections or bypasses to Highway 9 and other routes were examined. Four of these were eliminated from further consideration due to physical, land use, and environmental constraints:

- Trails connecting through UCSC or the upper portions of the City of Santa Cruz Pogonip property;
- Ocean Street Extension to Graham Hill Road via the equestrian trail through Woods Cove subdivision or City water property;
- A bypass of a portion of Highway 9 from Felton to Ben Lomond via Glen Arbor Road;
- A bypass of Highway 9 between Brookdale and Boulder Creek using Alta Via, a local road to the west.

Three other short Highway 9 bypass alignments were determined to be potentially desirable as trail routes. Design concepts and cost estimates are included with the related Highway 9 segment evaluations:

- A bypass of Highway 9 segment 7 along Cooper Street north of Felton Empire Road;
- A bypass of Highway 9 along Gushee Street south of Felton Empire Road may be desirable as a local transportation improvement for bicycles and pedestrians;
- A bypass of Highway 9 segment 8 via El Solyo Heights Drive and Hacienda Way north of San Lorenzo Valley Elementary School may be desirable as an improvement to serve students.

The study ultimately evaluated over 45 miles of potential trail routes. Conceptual plans and cost estimates were prepared for 29 miles, of which any particular segment can be fully improved if desired, and if sufficient funding can be acquired. It is not the intention of this report to recommend elimination or restriction of any particular route from interim transportation improvements.

1.3 Summary of Study Results

The study conclusions are based on technical evaluation of engineering, environmental and economic feasibility factors, and on public comments regarding community preferences. These factors do not coincide in the southern portion of the Study Area, resulting in publicly preferred routes that are different from the most technically feasible route.

Extensive public comments were received through the four Community Meetings held during the study, and in email and written comments received primarily during review of the draft report. Appendix F contains a summary of the comments, and copies of the emails, letters, and meeting notes for each of the Community Meetings.

Felton to Boulder Creek Recommended Route

The study determined that the recommended trail route from Felton north to Boulder Creek is the Highway 9 right-of-way, with the exception of one short bypass section in central Felton. Though it is seriously constrained in many locations, the Highway right-of-way is the only viable option. The recommended route follows Cooper Street north parallel to Highway 9 in Felton, and then along the right-of-way of Highway 9 north to the terminus in Boulder Creek. The estimated cost to complete the potential bicycle and pedestrian access improvements is high: $21.1 million, or $2.8 million per mile over the 7.48 mile route. In addition to addressing severe physical constraints in a number of locations, these improvements would require addressing Caltrans design standards and securing approval for bicycle and pedestrian facilities in the state right-of-way. This would include addressing the policy that any significant modification of the highway should also strive to bring the roadway facility up to current standards, which are typically much higher than the current roadway configuration.

Public comments supported the conclusion that Highway 9 is the only alternative from Felton to Boulder Creek, and generally placed a higher priority on improvements along this northern portion of the overall route than on the Santa Cruz to Felton portion because the northern portion serves a more densely developed and populated corridor.

Santa Cruz to Felton Route

There are three alternative routes from Santa Cruz to Felton, plus a fourth route that provides an alternative to the southern half of this connection:

- Big Trees and Roaring Camp Railroad right-of-way (the Railroad Route);
- Highway 9 right-of-way;
- Graham Hill Road right-of-way;
- The Plymouth-Sims Route bypassing the southern portion of Graham Hill Road.

The preliminary study conclusions were that the most feasible route between Santa Cruz and Felton from an engineering and economic standpoint extends from Ocean Street in Santa Cruz north along Plymouth Street, El Rancho Drive, La Madrona Drive, and Sims Road (the Plymouth-Sims Route), bypassing the steep and winding southern portion of Graham Hill Road. From the intersection of Sims Road and Graham Hill Road the route runs north along Graham Hill Road to Highway 9 in Felton. However, this route was not supported by public comments during the public comment and review period of the last draft report.

Publicly Preferred Routes. Most of the comments received later in the study process supported pursuing the improvement of the Railroad Route, or alternatively the southern portion of Highway 9, in preference to Graham Hill Road or the Plymouth-Sims Route. The public comments supporting these preferred alternatives were mainly from bicycle riders and activists. This eventually led to a writing campaign supporting this position. Based on these comments, the public's Preferred Route is the Railroad Route, along the Big Trees and Roaring Camp Railroad from Santa Cruz to Felton, with an Alternative Preferred Route along Highway 9.

Due to severe physical constraints, the estimated cost of improving either route is very high. The Railroad Route improvements are estimated to cost $25.6 million, plus unknown costs for acquiring public access rights along the right-of-way. This equates to $4.9 million per mile along the 5.5 mile route. Using the Railroad Route would require addressing significant design and operational constraints and securing PUC approval for placing a trail adjacent to, and in some cases crossing, an active rail line. The Highway 9 Route improvements are estimated to cost $23.4 million to improve, or $3.6 million per mile over the 6.44 mile route. These improvements would require addressing Caltrans requirements and securing approval for bicycle and

pedestrian facilities in the state right-of-way. This would include addressing the policy that any significant modification of the highway should also strive to bring the roadway facility up to current standards, which are typically much higher than the current roadway configuration.

The public comments supporting these preferred alternatives typically acknowledged the significant engineering and economic challenges of implementing either route, but stated that this is outweighed by several factors:

- The aesthetic and recreational value of these two scenic routes would be high;
- The even gradients from Santa Cruz to Felton are much more suitable for bicycle travel;
- The real and perceived safety of users would be significantly greater than the Graham Hill Road or the Plymouth-Sims route due to lower traffic volumes and speeds on Highway 9, and the low volume of rail traffic on the Railroad Route
- Interim or limited improvements along Highway 9 could go a long way toward improving safety for bicyclists.

Many comments stated that the study should have examined the complete or partial closing of Highway 9 to vehicles, and making Graham Hill Road the state highway, so that the current Highway 9 corridor could be completely or partially closed to motor vehicles, and function as a bicycle route. As explained by County Public Works staff at the last two Community Meetings, study of the closure and/or transfer of Highway 9 to Graham Hill Road is far beyond the scope of the study assignment or the Caltrans grant that provided most of the project funding. It would require a separate, different type of study. The closure of Highway 9 (or even constraints on speed or temporary closures) has inter-agency legal, political, and operational issues that are beyond the scope of a trail alignment study. This is not to say that the concept should not be studied or has no merit. It is simply not feasible to address in the current study.

The Most Feasible Route. The identification of the most feasible route is based on practical engineering and funding factors, and judgment about how to provide the most benefit to most citizens for the least dollars. The Graham Hill Road/Plymouth-Sims Route is identified as the most feasible route to connect bicyclists and pedestrians from Santa Cruz to Felton due to the factors outlined below. The Railroad Route is acknowledged to be the best route for bicyclists to travel from Santa Cruz to Felton, assuming the funding was available to acquire the right to use it and to construct the improvements, and the railroad operations and safety concerns can be addressed. However, the anticipated level of bicycle commuting use along the railroad route is likely to be low relative to recreational use. There is only one neighborhood (Paradise Park) along the route, and it is situated at a lower elevation than the rail line. The southern Highway 9 Route has similar issues.

The Graham Hill Road Route, and the Plymouth-Sims Route that bypasses the southern portion of Graham Hill Road, are both designated bike routes in the County and City bike route plans. Both have many neighborhoods, as well as schools and places of employment, along the route. These roads are under the County's jurisdiction, and do not entail the right-of way acquisition issues and costs associated with using the Big Trees and Roaring Camp Railroad line, which are not included in the cost estimates. Significant portions of the route are already fully improved for bikes and pedestrians, and two portions of the route have preliminary plans for improvements that would serve bikes and pedestrians. The Plymouth-Sims route was identified because the vehicle volumes and speeds on these roads would be much less than on Graham Hill Road. In addition, the gradient is less steep on the Plymouth-Sims Route. The route along Graham Hill Road north of Sims is also desirable because it will have opportunities for a path separated from the road in the vicinity of Henry Cowell Redwoods State Park, especially if the California Department of Parks and Recreation would eventually cooperate in the development of a shared trail where informal trails currently exist. While the separated path could not continue to Felton without involving private property, which is beyond the scope of the current study, there are existing

parallel roads and paths on private property along part of this alignment that are extensively used by the public. In the future there may be opportunities to create a separated bicycle and pedestrian pathway bypassing the northern "S curve" portion of Graham Hill Road.

Though the estimated construction cost of the trail improvements for the Graham Hill and Plymouth-Sims routes approach the cost of improving the Railroad or southern Highway 9, the actual net cost is likely to be far less because there would be no right-of-way acquisition cost, there would be no need to obtain encroachment permits from Caltrans, and the improvements can be done in conjunction with road improvement projects that are warranted for traffic safety in any case. Improvement of these roads to better accommodate bicycles and pedestrians will have secondary benefits for automobile drivers. The improvements along County roads can be incrementally funded and can also be incorporated into private development that occurs along the routes. It is acknowledged that making the roadway wider and safer for cars can lead to higher speeds, which in turn deters bicyclists. However, there are options for design of "traffic calming" features into the road improvements to constrain traffic speed and help protect bicyclists and pedestrians. This should be considered in formulating the final design of any improvements.

Although Graham Hill Road is no longer part of the Preferred Route, the Department of Public Works has indicated it will continue to design and construct projects accommodating all modes of travel through this corridor without using bicycle account funds, as requested by the local advocates.

1.4 Estimated Improvement Costs

Table 1.1 provides a summary of the estimated cost for constructing continuous bicycle and pedestrian facilities along each of the alternative study routes. These planning-level cost estimates are based on preliminary investigations of site conditions and requirements, and concept-level design. The construction costs vary significantly among segments along the route, as detailed in report Section 2.0, and the Appendices. The cost estimates include a factor of 10% for environmental documents and review, 15% for design, 15% for plan review and construction inspection, and 15% for contingencies. Overall, constructing any of the potential improvements would be expensive projects that would be phased over a long period, and potentially completed in conjunction with other roadway improvement and private development projects.

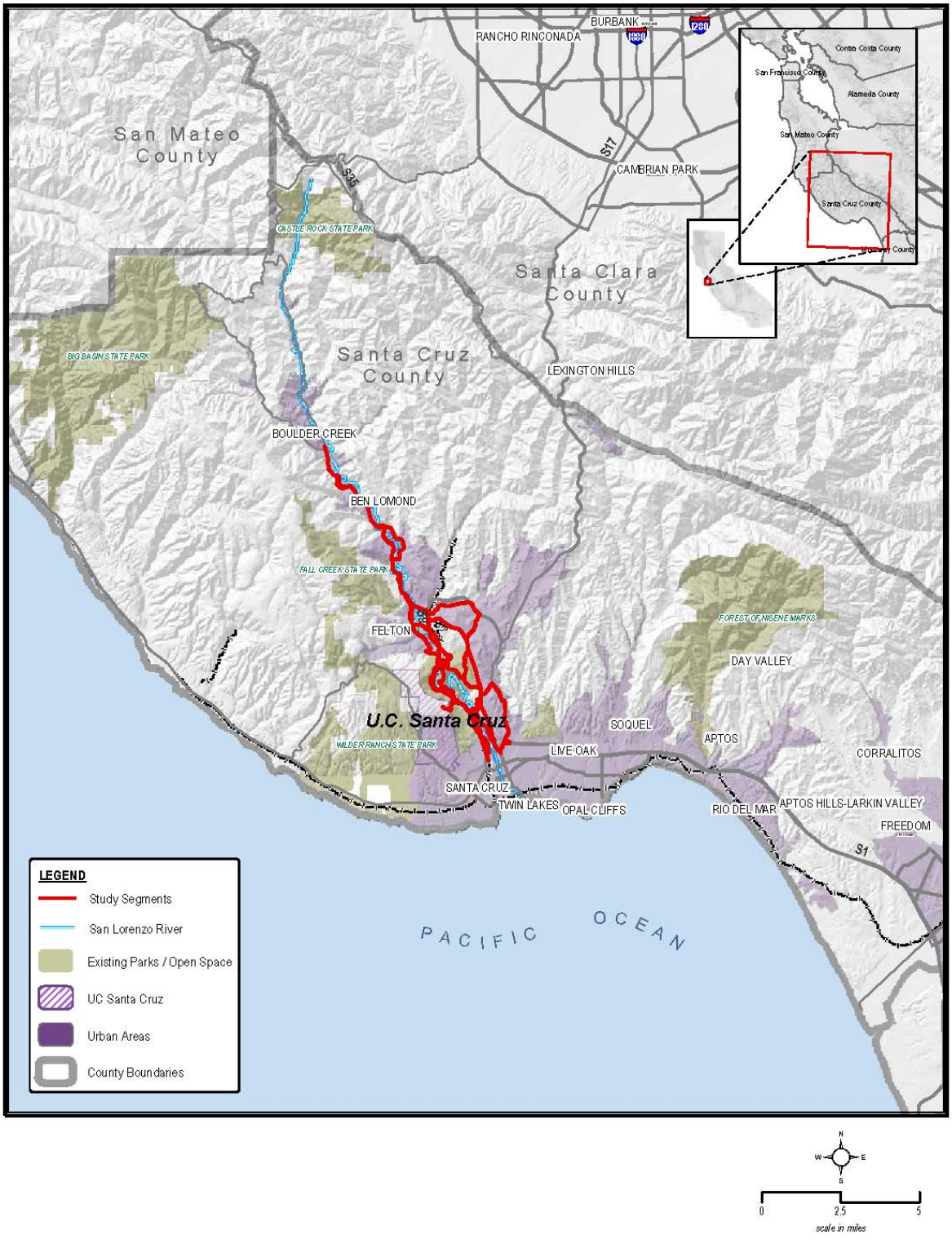
Table 1.1: Improvement Cost Summary

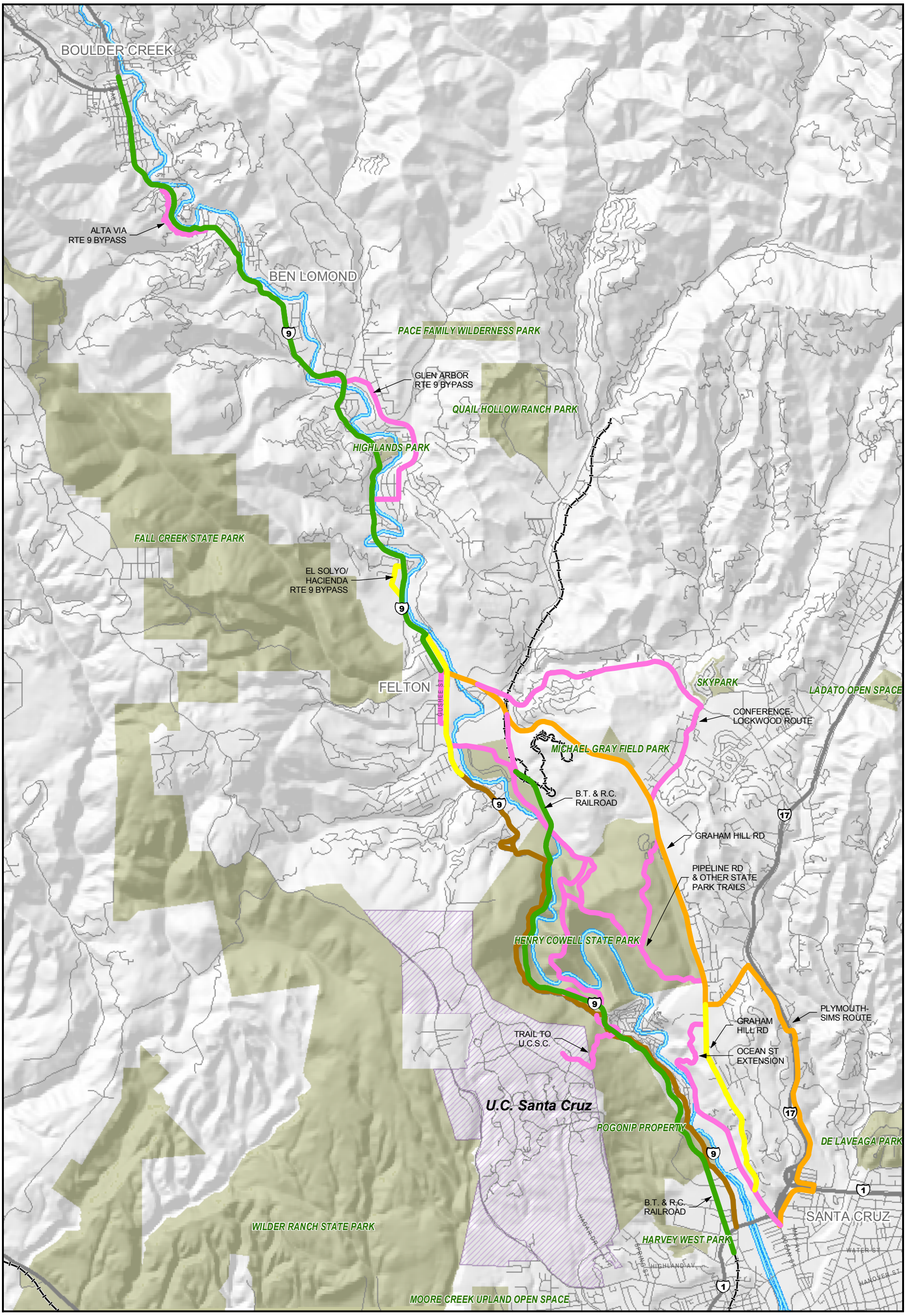
Santa Cruz to Felton Alternatives			
Route	**Length in Miles**	**Cost**	**Cost/mile**
Railroad (Publicly Preferred Route)	5.25	$25,562,107	$4,868,973
Highway 9, south corridor (Alt. Publicly Preferred Route)	6.44	$23,390,291	$3,631,734
Graham Hill Road, entire corridor	6.08	$16,166,076	$2,658,894
Plymouth-Sims/Graham Hill Road North (Most Feasible Route)	7.65	$20,521,421	$2,682,539

Felton to Boulder Creek Alternatives			
Route	**Length in Miles**	**Total Cost**	**Cost/mile**
Highway 9, north corridor	7.48	$23,369,481	$3,125,639
Highway 9, north corridor w/ Cooper Street Alternative (Recommended Route)	7.48	$21,116,323	$2,823,038

(note: railroad corridor improvement costs do not include right-of-way acquisition)

Figure 1.1: Project Location Map





LEGEND

Study Segment Findings

- Recommended Route north of Felton (Highway 9) and Publicly Preferred Route south of Felton (Railroad)
- Alternative Publicly Preferred Route
- Most Feasible Route South of Felton
- Desirable Long Term Trail Improvements
- Studied & eliminated

- Existing Parks / Open Space
- UC Santa Cruz
- San Lorenzo River

N W E S

0 0.25 0.5 0.75 1

scale in miles

FIGURE 1.2: Recommended Route Overview

SAN LORENZO VALLEY TRAIL FEASIBILITY STUDY

LandPeople

1.5 Summary of Trail Bypass and Connections Evaluated

In addition to the three main corridors, several shorter alternative connections to the Highway 9 and Railroad routes were examined. Four of these are recommended for elimination from further consideration due to physical, land use, and environmental constraints:

- Trails connecting through UCSC or the upper portions of the City of Santa Cruz Pogonip property;
- Ocean Street Extension to Graham Hill Road via the equestrian trail through Woods Cove subdivision or City water property;
- A bypass of Highway 9 segments 9, 10, and part of 11 from Felton to Boulder Creek via Glen Arbor Road;
- A bypass of Highway 9 segment 14 using Alta Via, a local road to the west.

Three other short Highway 9 bypass alignments are recommended for further consideration as trail routes. Design concepts and cost estimates are included with the related Highway 9 segment evaluations:

- A bypass of Highway 9 segment 8 via El Solyo Heights Drive and Hacienda Way north of San Lorenzo Valley Elementary School;
- A bypass of Highway 9 segment 7 along Cooper Street north of Felton Empire Road (part of the Preferred Route);
- Connecting to the above, a bypass of Highway 9 segment 6 along Gushee Street south of Felton Empire Road (part of the Preferred Route).

In addition to the above shorter bypasses and connections, three major alternative routes were studied. These routes would bypass some or all of the constrained southern portion of Highway 9 and the railroad alignment:

- Pipeline Road in Henry Cowell Redwoods State Park, which connects to Graham Hill Road at the County Equestrian Park via Big Trees Road/Entrance Road and/or River Trail or Meadow Trail. This route was determined to be infeasible due to steep grades, environmental issues, and land use conflict with the park's purposes.
- Plymouth Street, El Rancho Drive, La Madrona Drive, and Sims Road from Ocean Street to Graham Hill Road (the Plymouth – Sims Route, part of the Recommended Route), which bypasses the southern portion of Graham Hill Road. Evaluation of this route includes design concepts and cost estimates, contained in Appendix A, B and C;
- Conference Drive, Mt. Hermon Road, and Lockewood Lane from north Graham Hill Road to central Graham Hill Road. This route bypasses the northern portion of Graham Hill Road. This alternative was determined to be infeasible due to a long narrow bridge, a major landslide zone, and a long circuitous route.

A more detailed analysis of results and recommendations is provided in Section 1.7.

1.6 Study Methods and Process

The Trail Feasibility Study was initiated with a public Trail Advisory Committee meeting on February 12, 2004 at Highlands Community Park in Felton. This meeting provided an overview of the project, and allowed County staff and the consultants the opportunity to hear public ideas and concerns.

A series of geographic information system (GIS) based maps was prepared to cover the study area. These maps were prepared from data supplied by Santa Cruz County and augmented with information collected from Caltrans, other public domain sources, and field studies. LandPeople, Landscape Architects and Planners, and Higgins Associates, Traffic Engineers, collaborated on the Highway 9 route assessment. The Rails-to-Trails Conservancy staff prepared the Big Trees/Roaring Camp Railroad route assessment. The environmental resource consultants each characterized the conditions and issues associated with their area of expertise.

The major study corridors were broken down into a series of segments for more detailed evaluation. Figures 1.3 and 1.4 show the study segments and the resulting recommended priorities for improvement. Green lines indicate the highest priority for improvement along the route. Some portions of the Preferred Route are already improved, or are to be improved by other projects, or are very expensive to improve and are thus indicated as a secondary priority for improvements (yellow lines). The pink and orange colored routes are alternatives for improvement for regional and recreational bicycle or pedestrian access, but not the highest priority for improvement for local transportation purposes.

Detailed route maps for Highway 9 are contained in Appendix B, and cost estimates are contained in Appendix C. The Railroad route maps and cost estimates are contained in Appendix E. As a means of indicating the relative feasibility for constructing a trail, a set of typical condition ratings from A to F was developed, including some adaptations for the railroad route. A is the most feasible condition, while F is the least feasible condition. These ratings systems are described in detail in Section 2.1. The condition percentages presented in the evaluations indicate how constrained the alternative routes are. Detailed descriptions of the conditions along the routes are provided in Appendix A. Detailed maps of the conditions along the routes are provided in Appendix B.

After extensive efforts to solicit participation and comments on the study, and County staff and stakeholder review of preliminary concepts, a Community Meeting was held on June 2, 2004 to present the findings of the preliminary trail route assessment. Based on comments at this meeting, additional alternative routes were added to the study for the portion between Santa Cruz and Felton. These routes were assessed for feasibility in the same manner as the routes assessed initially.

Due to the great extent, variability, and complexity of the routes under study, graphic symbols were developed to indicate the type of trail improvements proposed along the routes. Improvement concepts, preliminary cost estimates, and comparative analyses of features and benefits were then developed for all the major alternatives, and preliminary recommendations were formulated. This information was published on the consultant's website on February 28, 2006 and presented at a community meeting on March 14, 2006. Articles in the Santa Cruz Sentinel and San Jose Mercury News highlighted the study and the availability of the study information. Following the March meeting a draft report was prepared and presented at a Community Meeting on May 16, 2006. Based on comments received at the meeting or within a week thereafter, the report was revised to final form.

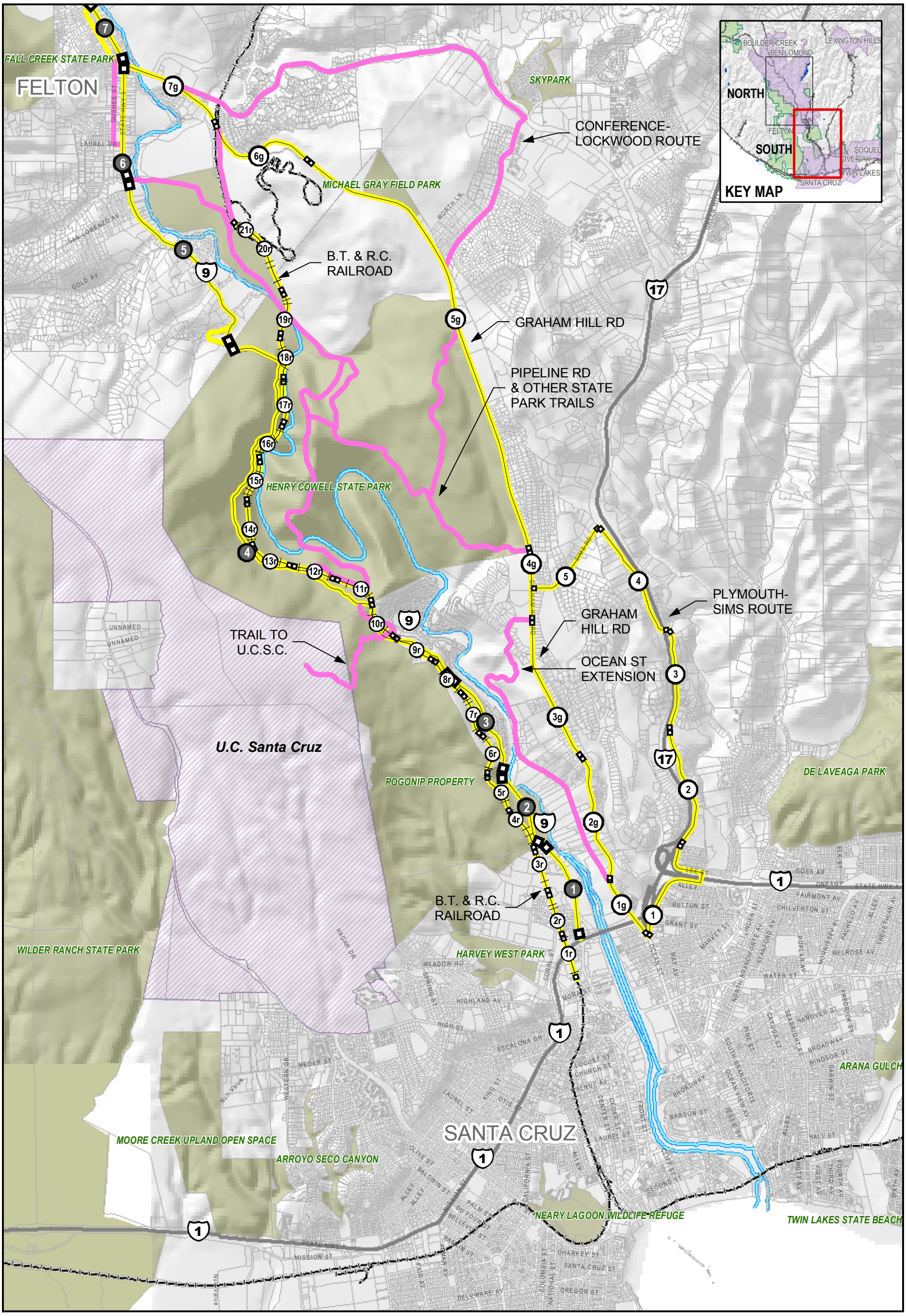


FIGURE 1.3: Study Segments Overview South

SAN LORENZO VALLEY TRAIL FEASIBILITY STUDY

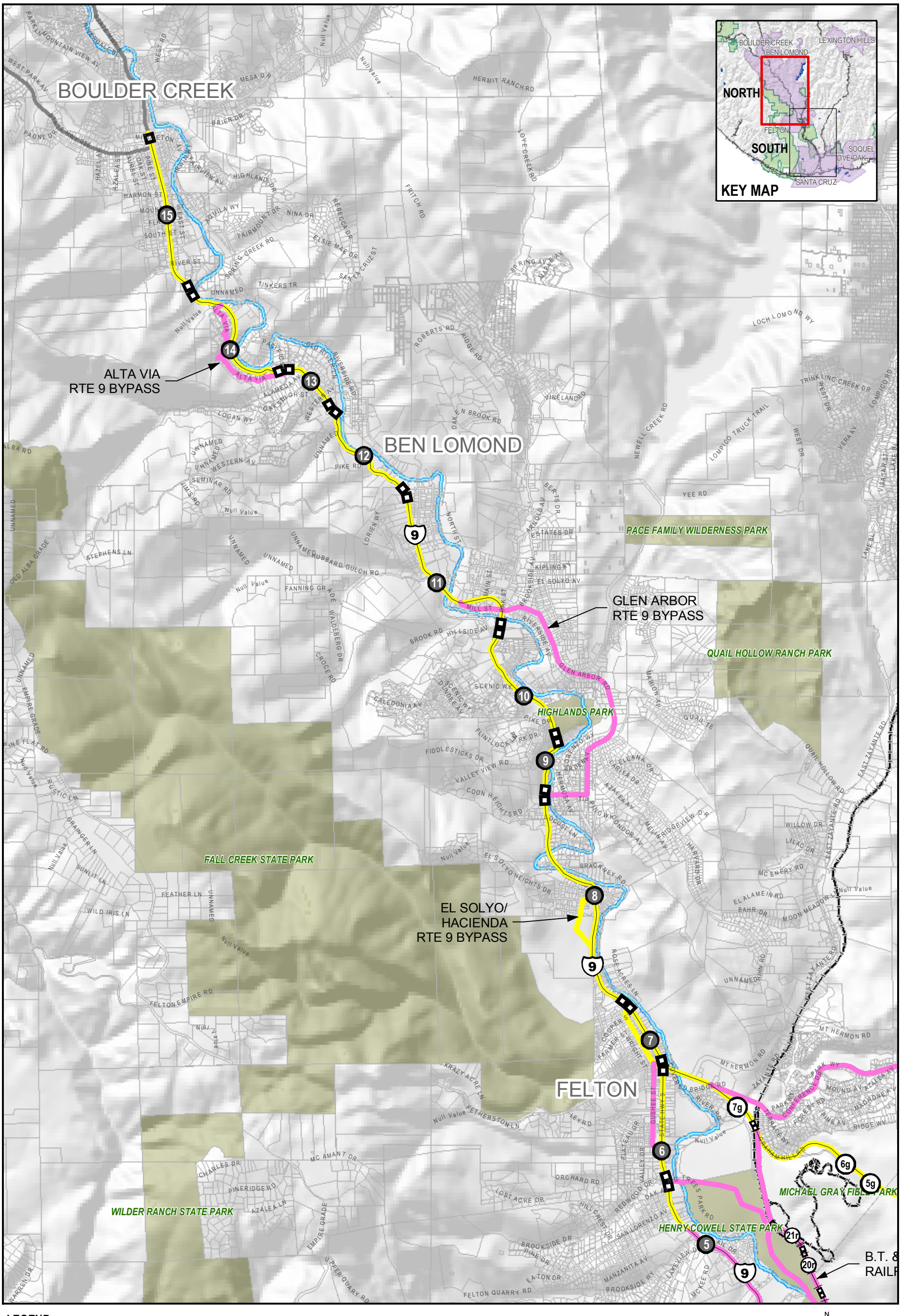


FIGURE 1.4: Study Segments Overview North

SAN LORENZO VALLEY TRAIL FEASIBILITY STUDY

1.7 Overview of Route Alternative Findings

Overall, constructing bicycle or pedestrian trail improvements in this study area will be extremely expensive due to steep, often unstable slopes, dense trees, and adjacent development that has occupied most areas of buildable land. Constructing trail facilities in some portions of the study area, especially along Highway 9, could result in major changes to the appearance of the highway corridor, though not necessarily significant environmental impacts.

Tables 2.1 and 2.2 provide a summary of the cost, conditions, and features of the alternative trail routes. Conclusions of the study are presented below. The study routes and segments are shown in Figures 1.3 and 1.4:

1. A continuous bicycle and pedestrian trail along Highway 9 from Santa Cruz to the south boundary of Felton would be extremely expensive due to constraints of steep unstable slopes, including many that are already supported by massive retaining walls, dense redwoods that are protected in a State Park, and adjacent residential development at Paradise Park.[1]
2. A trail along the Big Trees and Roaring Camp Railroad line would also be extremely expensive because the line passes through the same highly constrained terrain as the Highway.
3. Graham Hill Road is a more practical route to improve for bikes and pedestrians from Santa Cruz to Felton, as the central portion already has some paths, wide shoulders, and formal bike and pedestrian facilities. However, the north and south ends of Graham Hill Road have steep curving segments that are more difficult to improve, have some environmental or land use constraints, and are less suitable for bike and pedestrian use than the central portion.
4. A route combining Plymouth Street, El Rancho Drive, La Madrona Drive and Sims Road provides a bypass of lower Graham Hill Road that has lower traffic volumes, less steep grades, and more neighborhood connections, but it would be more expensive to improve than the portion of Graham Hill Road that it would bypass.
5. A route following Conference Drive, Mt. Hermon Road and Lockewood Lane would provide a bypass of the northern "S curve" portion of Graham Hill Road, however this route would be circuitous, passes through a massive unstable landslide area, and is constrained by dense residential development that limits the ability to widen Lockewood Lane. Designs and estimates were not prepared for this alternative.
6. Segments of Highway 9 from south Felton to Boulder Creek have varying levels of feasibility: some already have space for bikes and pedestrians and require minimal improvement, and some are nearly as constrained as the worst segments of Highway 9 between Felton and Santa Cruz. The segments that have the greatest benefit-to-cost ratios for improvement are:
    - Segment 6 Alternative – the Gushee Street Bypass of Highway 9 from Laurel Drive to Felton Empire Road.
    - Segment 7 Alternative – the Cooper Street Bypass of Highway 9 from Felton Empire Road to Highway 9.
    - Segment 8 – North Felton at SLV Schools
    - Segment 10 – Highway 9 in Central Ben Lomond.
    - Segment 10 – Highway 9 in North Ben Lomond.

[1] The idea was suggested in the public workshop of negotiating an agreement to transfer ownership of the current portion of Highway 9 between Santa Cruz and Felton from Caltrans to the County, and to designate Graham Hill Road as the new Highway 9. Old Highway 9 would be closed to vehicles at the north and south boundaries of the State Park. While an interesting concept, this is beyond the scope of the current study to evaluate.

- Segment 15 – Highway 9 in Central Boulder Creek.

Other Highway 9 bypass routes were studied but found to be infeasible due to steep rugged slopes, dense trees, dense adjacent development, and stream or river crossings.

7. Existing unpaved and paved recreational trail routes west and east of Highway 9 and Graham Hill Road are infeasible for use as major bike and pedestrian connections due to steep grades, sensitive habitat, and lack of established public access rights.

Although many segments of Highway 9 and the railroad are highly constrained, this report evaluates the requirements and cost for improvement of these entire routes on a segment-by-segment basis so that the public, stakeholders, and decision-makers can be informed about the challenges and opportunities along each part. Though not the objective of the current study, it may be desirable and feasible to improve portions of the overall route on the highway or the railroad to serve more localized transportation needs.

1.8 Report Organization

This report is organized to summarize the study scope and results first, and to cover the study details and background information in subsequent sections and appendices.

Section 2.0 summarizes the route evaluations, including existing conditions and specific trail improvement concepts and costs. It includes Table 2.1, a matrix comparing all the major alternative trail routes, and Table 2.2, with segment-by-segment descriptions of conditions, improvement concepts and costs.

Section 3.0 contains general standards and specific criteria and assumptions used for the trail concepts. This includes a series of concept sketches illustrating trail improvements in typical settings.

Appendix A presents detailed written evaluations of each alternative route on a segment-by-segment basis, except for the Railroad route, which is contained in the stand-alone **Appendix E**.

Detailed existing conditions and improvement concepts maps and tables are contained in **Appendix B**. Cost estimates for the alternative trail routes are contained in **Appendix C**.

Appendix D contains planning and environmental information used to develop or evaluate the trail improvement concepts. Detailed environmental analysis is beyond the scope of the current study. This background information indicates the issues that may be faced in planning and constructing trail improvements.

Appendix E is a stand-alone report on the Railroad route, including evaluation, improvement concepts, cost estimates, and findings.

Appendix F is a compilation of meeting notes and public comments on the draft report.

2.0 Route Evaluation and Improvement Concepts Summary

This section summarizes the evaluation methods, and results, design concepts and cost estimates. Detailed route evaluations are contained in Appendix A. Detailed improvement concepts and cost estimates are contained in Appendix B and Appendix C, respectively.

2.1 Route Alternatives Evaluation Summary

This trail feasibility study encompasses an extensive series of routes, shown in Figures 1.2 and 1.3. A brief segment-by-segment summary of the findings is provided below.

Highway 9 South (Santa Cruz to Felton) (see Figure 1.2 and Appendix A)

- Segments 1 and 2 are in the City of Santa Cruz – they are provided for reference purposes only, and would primarily serve the nearby Paradise Park residential area.
- Segment 3 would serve eastern Paradise Park and connect to southern Henry Cowell Redwoods State Park. It has a very high cost due to steep slopes and existing retaining walls.
- Segments 4 and 5 would make the connection from Central Felton to the south boundary of the Park. These segments include portions that are highly constrained, but also some portions that are relatively easy to improve with a trail. Overall, the cost to complete the connection would be very high.
- Segment 6, in central Felton is essentially a commercial district improvement project, with the associated high costs and changes to private improvements. Segment 6 Alt., the Gushee Street bypass, would be a much lower cost bike and pedestrian route, but it is indirect and doesn't serve the Highway 9 businesses and destination most people will want to access.

Highway 9 North (Felton to Boulder Creek) (see Figure 1.3 and Appendix A)

- Generally these segments are comparable in cost to the Highway 9 south segments. While most of these segments have fewer physical constraints than Highway 9 south, they have more conflicts with land use and improvements that will raise the cost.
- This route serves local bicycle and pedestrian destinations as well as regional through traffic. It provides a greater safety benefit than Highway 9 south trail improvements because the traffic levels are 2 to 3 times higher than Highway 9 south.
- Segment 7, north of Graham Hill Road is very expensive due to adjacent slopes on the east, and structures and major retaining walls on the west.
- Segment 7 Alt., the Cooper Street Bypass would be much less expensive, but has a serious constraint/land use conflict for constructing a connection to Highway 9 at a reasonable grade.
- Segment 8 has particular significance because it includes the frontages of the SLV schools, and proposes trail improvements on school property. The appropriate improvements should be carefully resolved working with the School District.
- Segments 8 through 15 have varying price tags due to constraints, and due to the fact that some bike and pedestrian facilities already exist in the towns.

Santa Cruz Big Trees Railroad (Santa Cruz to Felton) (see Figure 1.2 and Appendix E)

- The 21 individual ¼ mile segments identified for the railroad study were too numerous to detail in the matrix, therefore there are no numerical scores.
- This route is even more expensive than the Highway 9 South route because there is no option to use existing Highway shoulders or create sidewalks – the entire route would be a Class I multi-use path. The need for a new bridge over the San Lorenzo River also adds significant cost.

- The constraints, advantages, and disadvantages of this route are otherwise similar to Highway 9 South.

Graham Hill Road (see Figure 1.2 and Appendix A)

- Completing this connection would be far less expensive overall and per mile than the Highway 9 South route or the Railroad route.
- Part of the reason this route is less expensive is that portions of it are already improved for bikes and pedestrians.
- This route has far more traffic at much higher speeds, and serves more local neighborhoods and bike and pedestrian destinations, than Highway 9 South or the Railroad route.
- Significant parts of the route have physical constraints and land use conflicts similar to Highway 9 South or North, specifically segments 2g, 3g, and 6g.
- Segment 5g, north of Henry Cowell State Park, probably has the most serious environmental constraints of any portion of any of the routes in that it passes through federally-protected special status species habitat.
- The improvement concepts and estimates assume the completion of 2 major County road improvement projects – a new traffic signal at Lockewood Lane and a traffic signal modification at Mt. Hermon Road. If budget constraints prevent the completion of those projects, the trail project costs would be increased.

Plymouth – Sims Route (Santa Cruz to central Graham Hill Road) (see Figure 1.2 and Appendix A)

- The Plymouth Street/El Rancho/La Madrona/Sims route from Ocean Street to Graham Hill Road is an alternative to the lower portion (segments 1g through 3g) of the Graham Hill Road Route. It would bypass some steep, constrained segments of Graham Hill Road, allowing bicyclists and pedestrians to connect from the central City of Santa Cruz bike route and sidewalk system to central Graham Hill Road and adjacent neighborhoods.
- Segment 1, from Ocean Street to the Santa Cruz City Limits on North Plymouth Street, features existing bike lanes on the portion south of Highway 1, and discontinuous segments of sidewalk. Completing the bike lanes would require mainly parking restrictions in a residential neighborhood, but little construction. Completing the sidewalks would require some retaining walls and modification of private improvements.
- Segment 2, from the Santa Cruz City Limits to the Highway 17 Pasatiempo Drive on-ramp at El Rancho Drive would be relatively straightforward to widen and continue a sidewalk or path on the east. There are approximately 3' wide existing shoulder and one section with sidewalk and pavement for bike lanes exists. Retaining walls may be required in some locations to provide wider bike lanes and a sidewalk or pedestrian path on the east side.
- Segment 3, on El Rancho Drive from the Highway 17 on-ramp at Pasatiempo Drive to La Madrona Drive has embankments or ditches on one or both sides, constraining the available shoulder from 0 to 1'. Widening to continue bike lanes, and ideally to provide a sidewalk or path on the east side, would require construction of a series of significant retaining walls.
- Segment 4, La Madrona Drive to Sims Road follows La Madrona Drive along an undercrossing of Highway 17, and then parallels Highway 17 on the west side. There is no existing paved shoulder, pathway or sidewalk. There is room to widen the roadway on the east shoulder in some locations, but others have steep slopes. Widening would require construction of retaining walls along approximately half the portion of the route that drops off steeply to the Highway 17 right-of-way.
- Segment 5 follows Sims Road to Graham Hill Road. Sims Road has adequate room to construct bike lanes if curbside parking is restricted. The grades are relatively level and the main obstacles are some private fences, driveway columns, and trees located in the right-of-way. Santa Cruz County Public

Works Department has prepared a conceptual plan and estimate to improve Sims Road from Graham Hill Road to Brook Knoll Drive with bike lanes and sidewalks. This included concrete sidewalk, curb, and gutter on the north side, and A.C. (asphalt) dike on the south side, bike lanes on both sides, and drainage improvements in several locations. Parking would be prohibited on both sides of the road.

Conference Drive/Mt. Hermon Road/Lockewood Lane Route (north Graham Hill Road to central Graham Hill Road) (see Appendix A)
Improvement concepts and estimates were not developed for this route due to its indirect connection, potential land use conflicts with the Mt. Hermon Conference Center, major constraints of constructing a trail through a huge landslide that severed Conference Drive, and private residential improvements and narrow right-of-way that constrain bike lane or trail development along southern Lockewood Lane. This alternative is not recommended for further study as part of the San Lorenzo Valley Trail Study, though it may warrant study for other regional bike and pedestrian circulation purposes – e.g. a Felton to Scotts Valley connection, and a Scotts Valley to Santa Cruz connection.

2.2 Route Alternatives Evaluation Matrix

The matrix in Table 2.1 provides an overview and comparison of the various trail alternatives and segments on a very simplified basis. This matrix does not include some alternatives that were eliminated from further study, such as the Alta Via route, the Pipeline Road route and the Conference Drive-Lockewood Lane route. These conclusions are discussed in Appendix A. The matrix includes the Highway 9 South route and the Railroad route for comparison purposes.

In the matrix, a segment that has more darkened circles is generally more feasible/desirable than a segment with lighter circles, and the overall scores reflect the results – a higher score being more feasible/desirable. Again, this matrix is generalized and subjective, and should be used as a guide to help focus consideration of the study, and not as a direct basis for feasibility decisions.

Overall, the cost for these trail improvements is very high. This is due to the major physical constraints along most of the route, the high improvement standards for a public trail, especially in the Caltrans right-of-way; and the very preliminary nature of the plans and estimates, which increases uncertainty and thus requires a more conservative estimate.

Table 2.1: Route Alternatives Evaluation Matrix

Scoring: 10 = high (supports trail) 5 = medium 0 = low (does not support trail)

Cost 10 = (0 - $2,999,999/mi.) 5 = ($3,000,000 - 4,999,999/mi.) 0 = ($5,000,000+/mi.)

	Length	Estimated Cost	Cost/Mi.	Safety Need/Benefit	Prospective Use Level	Land Use/Existing Improvements Compatibility	Environmental Compatibility	Total Score
HIGHWAY 9 SOUTH								
Segment 1 - in City of Santa Cruz, for ref. Only	2991	$822,484	$1,451,928	High, but some facilities exist	Heavy use			45
Segment 2 - in City of Santa Cruz, for ref. only	2429	$1,230,898	$2,675,645			Pogonip property	Some tree removal, 2 creek crossings	20
Segment 3 - Paradise Park	3301	$3,849,754	$6,157,740		Connects Paradise Park to Santa Cruz	Paradise Park, some Pogonip[	Tree removal	25
Segment 4 - Henry Cowell State Park	15,054	$10,720,006	$3,759,906	No shoulder or path in many portions	Connectors to State Park trails	State Park land	Tree removal, bridges	20
Segment 5 - South Felton	6898	$4,608,427	$3,527,471	Wide shoulders exist on part	Connects north to town	Existing private drives, improvements	Tree removal	25
Segment 6 - Downtown Felton	3333	$2,158,722	$3,419,758	Wide shoulders exist	Serves busy commercial area	Sidewalks needed on private land		40
Segment 6 Alt. - Gushee Street bypass	2376	$221,923	$493,162	Doesn't address access to stores	Many will still use Highway 9			40
Hwy 9 South Summary - Santa Cruz to Felton Segments	34006 total feet	$23,390,291 total est. cost	**6.4** avg. score	$3,069,373 avg. cost/mi.	**7.1** avg. score Contains very busy traffic	**6.4** avg. score Recreational destinations, but not as high demand as local segments	**5.0** avg. score Some significant conflicts - State Park, Paradise Park, Pogonip Preserve	**5.7** avg. score Significant impacts (trees, scenery) especially in State Park	**30.7** avg. score
HIGHWAY 9 NORTH								
Segment 7 - North of Graham Hill Road	2049	$2,389,947	$6,158,575	Contains very busy traffic	A major route to schools, shopping	Conflicts with existing residences	Related to slopes, walls, land use	20
Segment 7 Alt. - Cooper Street bypass	2049	$136,789	$352,487	Contains very busy traffic	Bikes would still use Highway 9	Generally none but conflicts with residence		35
Segment 8 - North Felton, SLV schools	7107	$4,959,673	$3,684,687	Heavy fast traffic near schools	Major route to schools, shopping	School property, private improvements	Some tree removal, new bridges	35
Segment 9 - South Ben Lomond	1792	$1,694,105	$4,991,559	Winding, narrow segment	Connectors to Highlands Park		Steep slopes, above creek, tree removal	35
Segment 10 - Central Ben Lomond	3978	$1,991,008	$2,642,665		Connects from central Ben Lomond to Highlands Park	Private improvements	Some tree removal	35
Segment 11 - North Ben Lomond	5595	$2,546,349	$2,402,989	Most parts have shoulders	Lower density area	Private improvements	Some tree removal, new bridges	35

Table 2.1: Route Alternatives Evaluation Matrix (cont'd)

Scoring: 10 = high (supports trail) 5 = medium 0 = low (does not support trail)

Cost 10 = (0 - $2,999,999/mi.) 5 = ($3,000,000 - 4,999,999/mi.) 0 = ($5,000,000+/mi.)

	Length	Estimated Cost	Cost/Mi.	Safety Need/Benefit	Prospective Use Level	Land Use/Existing Improvements Compatibility	Environmental Compatibility	Total Score
HIGHWAY 9 NORTH (cont'd)								
Segment 14 - South Boulder Creek	4373	$3,041,548	$3,672,393	Narrow, winding	Connection between Brookdale and Boulder Creek	Private driveways	Tree removal	30
Segment 15 - Boulder Creek	4250	$204,234	$253,731	Part already improved, most has wide shoulder	Urbanized area	Private driveways, improvements	Some tree removal	40
Hwy 9 North Summary - Felton to Boulder Creek Segments	34552 total feet	$21,347,558 total est. cost	**6.0** avg. score; $3,309,507 avg. cost/mi.	**7.5** avg. score; Contains heavy fast traffic, narrow, winding segments	**8.0** avg. score; Includes many popular bike & ped destinations (schools, towns, parks)	**4.0** avg. score; Many conflicts with existing improvements	**6.5** avg. score; Some conflicts with trees, rural scenery	**32** avg. score
RAILROAD ROUTE								
Railroad Route Summary	27720 total feet	$25,559,107 total est. constr. cost (not incl. ROW acquisition)	$4,868,401 avg. cost/mi. (Severe physical constraints, SLR Bridge)	Bypasses very busy, hwy portions addresses informal/unsafe use of RR as trail	High, at least seasonally, for local connections, moderate for regional connection	Similar to Highway 9 - conflicts with State Park, Paradise Park	Similar to south Highway 9 - trees, scenery	
GRAHAM HILL ROAD								
Segment 1g - City of S. Cruz, for ref. only	1980	already improved	N/A	High, but facilities exist				45
Segment 2g - Part in City of Santa Cruz	3752	$2,729,783	$3,841,486	Steep, narrow, fast, winding segment	An important connection, but steepness may deter use	Assuming adequate ROW	Some tree removal, visibility	40
Segment 3g	4224	$2,122,856	$2,653,570	Narrow, fast segment	Important connection	Many conflicting private drives, improvements	Tree removal	35
Segment 4g	1992	already improved	N/A	High, but facilities exist				45
Segment 5g	13518	$7,294,068	$2,848,992	Heavy, fast traffic but wide shoulders, parallel path exist	Would serve recreational, local, regional users	Potential conflict with State Park	Tree removal, sensitive habitat north of State Park	30
Segment 6g	3460	$3,127,988	$4,773,346	Steep, narrow, winding, fast traffic	Connects to neighborhoods, parks, central Felton		Tree removal, steep slopes	40
Segment 7g	3199	$379,161	$625,811	Narrow, heavy, fast traffic	Connects neighborhoods to central Felton	Some driveways and improvements		45
Graham Hill Route Summary	32125 total feet	$15,653,856 total est. cost	**8.6** avg. score; $2,106,172 avg. cost/mi. (Segments 2g, 3g and 6g have similar constraints to Highway 9)	**7.1** avg. score; Provides safer bike & ped access on fast, busy route; connects more regional & local destinations than Hwy 9 south	**10.0** avg. score; High to moderate, depending on location - more likely regional traffic than Highway 9 south	**7.9** avg. score; Fewer conflicts than Highway 9 south, except in Segment 3g	**6.4** avg. score; Generally better than Highway 9 south, but significant potential conflicts in Segment 5g	**40** avg. score

Table 2.1: Route Alternatives Evaluation Matrix (cont'd)

Scoring: 10 = high (supports trail) 5 = medium 0 = low (does not support trail)

Cost 10 = (0 - $2,999,999/mi.) 5 = ($3,000,000 - 4,999,999/mi.) 0 = ($5,000,000+/mi.)

	Length	Estimated Cost	Cost/Mi.	Safety Need/Benefit	Prospective Use Level	Land Use/Existing Improvements Compatibility	Environmental Compatibility	Total Score
PLYMOUTH-SIMS ROUTE								
Segment 1 - Ocean St. to Santa Cruz city limits	4340	$703,830	$856,272	Some facilities exist	Relatively high			45
Segment 2 - Santa Cruz city limits to Hwy 1 @ El Rancho Dr.	3506	$2,205,444	$3,321,376		High - County Health Complex generates use			50
Segment 3 - El Rancho Dr. to La Madrona Dr.	2920	$2,713,652	$4,906,878			Embankments, trees, driveways		40
Segment 4 - La Madrona Dr., El Rancho to Sims	3675	$2,581,976	$3,709,614					45
Segment 5 - Sims Road	2774	$1,003,182	$1,909,445	Already under study by County	Serves elementary school	Adjacent residential improvements		45
Plymouth-Sims Route Summary	17215 total feet	$9,208,084 total est. cost	**7.1** $1,978,188 avg. score	**9.0** avg. score	**8.0** avg. score	**8.0** avg. score	**10.0** avg. score	**45** avg. score

2.3 Existing Conditions and Improvement Concepts

Detailed evaluations of conditions are contained in Appendix A. Detailed existing conditions and improvement concept maps and tables are contained in Appendix B. They cover the alternative routes, segment-by-segment, typically moving south to north, consistent with the direction of the post miles on the highway and railroad. Where deemed worthy of consideration, concepts for some short bypass routes are included in the maps and tables along with the description of the parallel highway segment.

Note that improvements within the City of Santa Cruz are technically not a part of the study, but are identified for consideration as part of the total requirement to create a complete regional connection.

The cost estimates for the highway and roadway portions of the study are presented in detail in Appendix C. The scope and budget for this study dictates a very "broad brush" approach to design and estimation, based on many generalizations and assumptions. The maps, tables and estimates are organized to provide as much specific and accurate information as possible, to provide the basis for informed decisions on the relative merits of various segments and alternative routes, and to provide a clear starting point for more detailed plans and estimates.

Table 2.2 summarizes the existing conditions and route improvement concepts and costs for each major alternative route. This table is designed as a series of center-spreads. The portion of the table on the left shows the existing conditions. The portion on the right shows the proposed improvements. The "west side" is typically the southbound side of the route, which could actually be on the north or south depending on twists in the route. The "east side" is similarly the northbound side.

The A-F existing conditions types, the 1-4 improvement types, and the concept design examples are detailed in Section 3.0.

Table 2.2: Route Conditions and Improvement Concepts

HIGHWAY 9 EXISTING CONDITIONS					
Current Condition: A, B, C, D, E, F (Best to worst, see Section 3.3, for descriptions of typical conditions.)					
Seg.	**Location, Existing Conditions**	**Current Bike and Ped Access**	**Condition in l.f. West Side**	**Condition in l.f. East Side**	**Notes**
1	Highway 1 to Pogonip boundary, Santa Cruz commercial area, flat, relatively straight	Sidewalks and bike lanes on W, some on E	A 595 B 2396	A 311 B 1669 C 826 D 186	Within City of Santa Cruz
2	Pogonip Open Space, Santa Cruz gently winding road through open space, gentle terrain at S end; gets steep at N	2 – 4' shoulders, disappear after PM .8	C 1015 D 1414	B 1339 C 490 D 599	Within City of Santa Cruz/Pogonip Open Space
3	Southern Paradise park Area. Highly constrained by slopes and trees, sharp curves – about 2/3 is condition E, 1/3 F (retaining walls)	None, except 2-4' shoulder around PM 1.4	D 368 E 1795 F 1138	D 382 E 1745 F 1174	South end within City of Santa Cruz /Pogonip Open Space
4	Northern Paradise Park area through Cowell Redwoods S.P. Highly constrained by slopes and trees – almost 1/3 is condition D and E, 1/3 F (retaining walls)	Generally little or no shoulder, but some wider, flatter portions	C 1915 D 545 E 11589 F 1005	C 1193 D 2462 E 2321 F 4628	Primarily w/in Henry Cowell State Park, portion is w/in Pogonip Open Space
5	South Felton to State Park Entrance. Rural/ suburban with more gentle slopes than Segment 4. Some large trees	None. Shoulder width varies	B 1892 C 1294 E 3712	B 2978 C 1235 D 356 E 2329	Low density residential use doesn't warrant major alteration to adjacent private improvements
6	Central Felton – State Park Entrance to Graham Hill Road. Generally flat and straight. South half is suburban residential, some commercial; church. Northern half is Felton commercial district	Wide shoulders generally in place. Short segment of sidewalk on E. at Fire Station	A 280 B 2590 C 463	B 2189 C 1144	See Section 3.4 for considerations regarding improving access on commercial frontages
6 Alt.	Gushee Street Bypass Laurel Drive to Felton Empire Rd. Mixed residential and rear of commercial uses, fire station. Low traffic.	Some sidewalk/ path; mostly paved parking driveway areas			Potential bypass for northern part of segment 6 – an interim solution
7	Cooper Street Bypass Felton Empire Road to Highway 9	None, but low traffic volume, speed	A 124 B 462 C 237	C 1087 E 963	Steep slopes, 1 driveway constrain improvement at N end
8	North Felton – Cooper Street to Glen Arbor Road Generally has fewer slopes, walls, sharp curves and other constraints, very heavy traffic; Hacienda Way Bypass route features moderate slope in undeveloped area of school grounds	Shoulders vary 3-6', major ret. walls at Glen Arbor have 4' walk, 1' shoulder on W, 3' shoulder on E, Informal path and wooden footbridge at small drainage on school grounds at Hacienda Way bypasses F section on Highway 9	B 1481 C 3801 D 640 E 618 F 567	A 953 B 2189 C 1786 D 1164 E 685 F 330	Includes frontage of SLV elementary, middle and high schools

HIGHWAY 9 IMPROVEMENT CONCEPTS

Proposed Improvement: ❶ Bike lanes/wide shoulders ❷ Sidewalk or path ❸ Class I multi-use path/bike trail ❹ Sign as a bike/pedestrian route

Seg.	Improvement Concepts	Improvement Types, l.f. West Side	Improvement Types, l.f. East Side	Improve Bridges & Major Drainage Structures	Concept Design Examples See Section 3.5	Estimated Segment Cost
1	Complete shoulder/bike lane widening/striping to 4' on both sides (addt'l 20% of length), complete sidewalk on both sides, extend 1 large culvert.	❶662 ❷662 ❸0 ❹0	❶2668 ❷2668 ❸0 ❹0	Culvert at PM 0.2	1, 3	$822,484
2	Provide Class I path/bike trail on east, extend 2 large culverts/bridges	❶2428 ❷0 ❸0 ❹0	❶2428 ❷0 ❸1492 ❹0	Creek/large culvert at PM .75, Creek/large culvert at PM 1.06	2, 6, 7	$1,230,898
3	Class I path/bike trail along east side	❶0 ❷0 ❸0 ❹0	❶0 ❷0 ❸3301 ❹0	None	8, 11, 14, 15	$3,849,754
4	Class I path/bike trail along east side, bike/ped bridge at PM 1.97, extend large culvert/bridge at PM 3.45	❶0 ❷0 ❸0 ❹0	❶0 ❷0 ❸15,055 ❹0	Concrete girder bridge (Rincon Creek) PM 1.97 161'Lx24'W; Sidehill Viaduct (SV) PM 2.11 162'Lx29'W; culvert crossing PM 3.45; SV PM 3.67 62'Lx21'W; SV PM 3.87 163'Lx20'W; SV PM 4.27 82'Lx18'W	11, 14, 15	$10,720,006
5	Limited shoulder widening to 4' on both sides; Class I path/bike trail on east with bike/ped bridge at PM 4.75 to crosswalk at Old Big Trees Road, then sidewalk/path on east to end; extend large box culverts/bridges, PM 5.55, 5.8	❶4874 ❷0 ❸1157 ❹0	❶4869 ❷0 ❸0 ❹0	Creeks/large culverts at PM 4.75, PM 5.55, narrow box culvert at PM 5.8; Provide trail bridge at creek to west of 4.75	1, 2, 4, 7, 8, 11, 12	$4,608,427
6	Complete sidewalk along both sides, stripe and sign bike lanes on existing shoulders, improve/provide landscaping on commercial frontages	❶0 ❷3140 ❸0 ❹0	❶0 ❷3333 ❸0 ❹0	None	Figure 3-1, 1, 3, 4	$2,158,722
6 Alt.	Sidewalk/pathway improvements both sides, stripe and sign bike/ped route	❶0 ❷0 ❸0 ❹2601	❶0 ❷0 ❸0 ❹0	None	-	$221,923
7	Limited shoulder widening to 5' on both sides, provide sidewalk/ped path along west side; redo landscaping on some frontages, west side	❶2050 ❷1858 ❸0 ❹0	❶2050 ❷0 ❸0 ❹0	None	3, 12, 13	$2,389,947
7 Alt.	Minor pavement improvements both sides, sidewalk/ramps at Hwy 9 connection, stripe and sign bike/ped route	❶0 ❷0 ❸0 ❹1945	❶0 ❷0 ❸0 ❹0	None	-	$136,789
8	Complete shoulder widening to 5' on both sides, sidewalk/ped path along west side to north end of school property; improved ped bridge at north side of school property; signed ped route on Hacienda and El Solyo Heights Dr.; Class I bike path/trail from El Solyo Heights Dr. to Willowbrook; new bike/ped bridges on west side of existing "Twin Bridges'; sidewalk/ped path on west from Willowbrook to Glen Arbor Rd.	❶7106 ❷6314 ❸0 ❹0	❶7106 ❷0 ❸0 ❹0	Fall Creek Bridge PM 7.01 92'Lx23'W, has 6' sidewalks. Pre-fab trail bridge over intermittent creek on school property. Twin Bridges at PM 7.76 (307'Lx21'W), PM 7.87 (151'Lx24'W) require parallel trail bridges	5, 6, 7	$4,959,673

Table 2.2: Route Conditions and Improvement Concepts (cont'd)

HIGHWAY 9 EXISTING CONDITIONS					
Current Condition: A, B, C, D, E, F (Best to worst, see Section 3.3, for descriptions of typical conditions.)					
Seg.	**Location, Existing Conditions**	**Current Bike and Ped Access**	**Condition in l.f. West Side**	**Condition in l.f. East Side**	**Notes**
9	South Ben Lomond Glen Arbor Road to Highlands Park – very steep wooded slopes, many curves, close to SL River on E side. No adjacent structures due to steep slopes. Existing major ret. wall on E around PM 8.3	Shoulders vary 0' to 3-4'	E 1682 F 110	D 483 E 849 F 461	A desirable connection to due to relationship to Highlands Park
10	South Ben Lomond Highlands Park to Hillside Ave. Moderate slopes on E, steeper slope on W. Some flat areas w/turnouts. Many curves in central portion.	2-3' shoulders	B 1604 C 2015 D 359	B 1162 C 2817	Improved connection to Highlands Park mentioned as a priority in community meetings
11	Central Ben Lomond Hillside Ave. to opposite California Ave. relatively flat to gently sloping terrain. Straight road or sweeping curves. Generally ample room to improve.	Initially 5-6' shoulders, then 2' until after bridge at PM 9.8, 0' shoulder at end. Sidewalks in commercial district from Glen Arbor to Mill St., incl. improvement project currently underway	A 408 B 1873 C 1595 D 1720	A 1477 B 3860 C 259	New downtown improvements include curbside parking, no bike lanes. Mill St. is intended bypass. N of central Ben Lomond, low residential densities, rural character don't warrant formal pathway improvements.
12	South Brookdale Steep wooded terrain with sharp curves, very close proximity to SL River. Recent slope failures S of existing house close to road on E. Few adjacent structures or roads due to steep slopes	Initially 2-3' shoulder, then no shoulder except wide spot around PM 10.7	B 206 C 402 D 2890	B 218 C 280 E 2050 F 948	A very narrow segment for bikes and pedestrians. May warrant construction of path.
13	Central Brookdale To Pacific St. relatively straight road and moderate slopes, but many cross-streets, driveways, close structures & embankments	2-3' shoulder	B 1102 C 809	B 1119 C 792	A higher density residential area and busy tourist/commercial zone warrant improvements
14	North Brookdale Pacific St. to S Boulder Creek. Similar to Segment 12 – steep wooded slopes, sharp curves, close proximity to SL River	Little or no shoulder. Turnouts around PM 11.4, 11.5	C 1544 D 1718 E 1111	C 1525 D 1440 E 852 F 557	A very narrow segment for bikes and peds. Alta Via bypass deemed infeasible due to narrow width, sharp curves, drives and structures
15	Boulder Creek Relatively flat terrain, straight road through residential village area, commercial district	Approx. 3' shoulders in S residential area. Wider shoulders, sidewalks in CBD.	A 1833 B 1454 C 1201 D 262	A 1146 B 2155 C 1003 D 445	Generally easy to improve to conform with downtown area improvements.

HIGHWAY 9 IMPROVEMENT CONCEPTS						
Proposed Improvement: ❶ Bike lanes/wide shoulders ❷ Sidewalk or path ❸ Class I multi-use path/bike trail ❹ Sign as a bike/pedestrian route						
Seg.	**Improvement Concepts**	**Improvement Types, l.f. West Side**	**Improvement Types, l.f. East Side**	**Improve Bridges & Major Drainage Structures**	**Concept Design Examples** See Section 3.5	**Estimated Segment Cost**
9	Limited shoulder widening to 4' on both sides, sidewalk/path on east side outside guardrail	❶1792 ❷0 ❸0 ❹0	❶1792 ❷1792 ❸0 ❹0	None	8, 11	$1,694,105
10	Shoulder widening to 5' on both sides, Class I bike path/trail on east side in Highlands Park, sidewalk/path on east side to Grace Street (end)	❶3978 ❷0 ❸0 ❹0	❶3978 ❷0 ❸1020 ❹0	Concrete box girder bridge PM 9.33 has 3-4' shoulders, 4-5' sidewalks – 168'Lx45'W	1, 2, 6, 7	$1,991,008
11	Complete sidewalk/path along both sides from Hillside Ave. to S. Mill St.; stripe and sign bike lanes to S. Mill St./Glen Arbor Road; from N. Mill St. widen shoulders to 5"; provide sidewalk/path on east side to Middle Rd.; provide ped bridge on west at Hubbard Gulch; provide crosswalk at Middle Rd., then Class I bike path/trail	❶5596 ❷370 ❸1002 ❹0	❶5596 ❷394 ❸0 ❹0	Marshal Creek Bridge PM 9.71 has 5-6' shoulders, 4' sidewalks, (161'Lx23'W); Hubbard Gulch Bridge PM 9.85 concrete girder (26'Lx28'W)	1, 6, 7	$2,546,349
12	Provide Class I bike path/trail on west side, extend large culvert/bridge at PM 10.87	❶0 ❷0 ❸3497 ❹0	❶0 ❷0 ❸0 ❹0	Extend large culvert at Alba Creek, PM 10.87	7, 8	$2,534,969
13	Limited shoulder widening to 4' on both sides, Class I bike trail/path on W. to crosswalk at Larkspur, from crosswalk at Alameda; sidewalk/path elsewhere on both sides; extend large culvert/bridge at PM 11.4; redo landscaping along some frontages	❶1911 ❷1911 ❸0 ❹0	❶1911 ❷1911 ❸0 ❹0	Clear Creek Bridge (culvert w/K-rails) at PM 11.4	1, 3, 6, 7, 12, 13	$1,848,936
14	Provide Class I bike path/trail on west side	❶0 ❷0 ❸4373 ❹0	❶0 ❷0 ❸0 ❹0	None	7, 8, 11	$3,041,548
15	Complete shoulder widening to 5' along south end of segment; shoulder striping and signing for bike lane and parking on both sides, provide Class I bike trail path to new crosswalk at Grove St.; complete sidewalk/path on both sides in south end; extend large culvert/bridge at PM 12.22	❶0 ❷1465 ❸1467 ❹0	❶637 ❷2128 ❸0 ❹0	Creek/culvert at PM 12.22 Malosky Creek; Boulder Creek Bridge PM 13.11 has 2-3' shoulder and 3-4' sidewalk (marginal); 95'Lx30'W	1, 2, 4, 6, 7, 8	$2,004,234

Table 2.2: Route Conditions and Improvement Concepts (cont'd)

GRAHAM HILL ROAD EXISTING CONDITIONS					
Current Condition: A, B, C, D, E, F (Best to worst, see Section 3.3, for descriptions of typical conditions.)					
Seg.	**Location, Existing Conditions**	**Current Bike and Ped Access**	**Condition in l.f. West Side**	**Condition in l.f. East Side**	**Notes**
1g	Ocean St. at Plymouth St. to Ocean St. Extension/Cemetery urban setting	Bike lanes & sidewalks	A 1980	A 1980	Within City of Santa Cruz
2g	Ocean St. Extension/ Cemetery to Michael Ln. steep terrain, steep grade, embankments, retaining walls on east	Shoulders 0-3'	D 3752	D 3752	Leaves Santa Cruz city limits above Tanner Heights Dr.
3g	Michael Ln. to Woods Cove Subdivision relatively level terrain, but many res. driveways, util. poles, oaks, planters, low walls & ditches constrain improvements	From Mosswood Dr. to Woods Cove entrance, road narrows, embankments on both sides	C 4224	C 4224	
4g	Woods Cove Subdivision to Equestrian Park Relatively flat terrain made improvements easy	3-4' shoulders; signal & crosswalk at Sims; Class I path on W & bike lanes	A 1992	A 1992	A prototype for other areas
5g	Equestrian Park to Bear Mountain Picnic Area Access Road Initially wide & straight, constrained by few trees and util. poles, then increasing embankments and trees. Beyond State Park enters sensitive habitat area	Shoulders widest near south boundary of State Park.	B 3456 C 9691 D 372	B 4316 C 9159	Construction of path would require significant tree removal and grading. Signal planned at Lockwood Lane in other project
6g	Bear Mountain Picnic Area Access Rd. to Roaring Camp Rd. "Tunnel" segment w/downhill "S" curve, steep terrain, many redwoods & util. Poles. Existing trails on Big Trees Roaring Camp property extensively used by public, incl. base rock surface road to picnic area, unpaved old roads and informal trails parallel G.H. Rd.	2 – 3 ' shoulders, turnout on S side near middle of segment. Old Graham Hill Road still a county-owned r.o.w.?	C 1191 D 2269	D 3460	Separate trail is an option.
7g	Highway 9 to Roaring Camp Rd. relatively flat terrain, 2 bridges are major constraints	Wide 5' shoulders/bike lanes and sidewalks exist from Zayante Rd. to Hwy 9	A 2452 C 747	A 2442 C 757	Mt. Hermon signal to be improved

Table 2.2: Route Conditions and Improvement Concepts (cont'd)

GRAHAM HILL ROAD IMPROVEMENT CONCEPTS						
Proposed Improvement: ❶ Bike lanes/wide shoulders ❷ Sidewalk or path ❸ Class I multi-use path/bike trail ❹ Sign as a bike/pedestrian route						
Seg.	**Improvement Concepts**	**Improvement Types, l.f. West Side**	**Improvement Types, l.f. East Side**	**Improve Bridges & Major Drainage Structures**	**Concept Design Examples** See Section 3.5	**Estimated Segment Cost**
1g	None required - sidewalks and bike lanes exist	❶0 ❷0 ❸0 ❹0	❶0 ❷0 ❸0 ❹0	none	Not Applicable	$0
2g	Class I path/bike trail on west - some tree removal required (acacia and eucalyptus). Provide crosswalk at each end.	❶0 ❷0 ❸3751 ❹0	❶0 ❷0 ❸0 ❹0	none	8	$2,729,783
3g	Limited shoulder widening up to 4 feet each side (minimize tree removal & modification of private improvements), provide sidewalk/path on west side.	❶4223 ❷0 ❸0 ❹0	❶4223 ❷0 ❸0 ❹0	none	6, 7	$2,122,956
4g	None required: Class I path/bike trail exists along east side, bike lanes/wide shoulders in place	❶0 ❷0 ❸0 ❹0	❶0 ❷0 ❸0 ❹0	none	Not Applicable	$0
5g	Widen shoulder to 5' on both sides; use existing parallel road on west, then provide ped path/sidewalk in r.o.w. Widening, signal and crosswalk to be provided at Lockwood Ln. by separate Co. project. Alternative to above: Improve multi-use path in State Park (S.P.) on alignment of existing unpaved trail and connecting to paved road – requires S.P. approval.	❶12017 ❷0 ❸12017 ❹0	❶13514 ❷0 ❸0 ❹0	none	1, 2, 6, 7, 8, 9	$7,294,068
6g	Widen shoulders to 5' to provide bike lanes; provide Class I multi-use path/bike trail by additional widening on south side, providing K rail barrier at edge of roadway.	❶3458 ❷0 ❸3458 ❹0	❶3458 ❷0 ❸0 ❹0	none	9	$3,127,988
7g	Widen shoulders to 5' on both sides; provide Class I path/bike trail on south side to Bean Creek; provide pre-fab bike/ped bridge at Bean Creek (alt. to reconstruct Zayante intersection and bridge); sidewalk and bike lanes exist from Bean Creek Bridge to Hwy 9.	❶722 ❷722 ❸0 ❹0	❶734 ❷734 ❸0 ❹0	new parallel bike/ped bridge or Bean Creek Bridge to be replaced	6, 7	$891,281

Table 2.2: Route Conditions and Improvement Concepts (cont'd)

PLYMOUTH-SIMS EXISTING CONDITIONS					
Current Condition: A, B, C, D, E, F (Best to worst, see Section 3.3, for descriptions of typical conditions.)					
Seg.	**Location, Existing Conditions**	**Current Bike and Ped Access**	**Condition in l.f. West Side**	**Condition in l.f. East Side**	**Notes**
1	**1. Plymouth Street - Ocean Street to Santa Cruz City Limits.** Relatively light traffic, flat to gentle grades.	Existing bike lanes S. of Hwy 1. Bike lanes not striped near Ocean St. and on-ramps, Only short sections of sidewalk. No crosswalks at Emeline.	A 2027 B 2272	A 844 A/B 860 B 2483 C 153	Not a part of formal study area - comments for reference only. Consistent with City Bike Plan.
2	**2. N. Plymouth Street - Santa Cruz City Limits to Highway 17 on-ramp at El Rancho Drive.** Relatively light traffic. Flat to gentle grades.	Minimal striped shoulders 3' to 4' except at Co. Health Services. Sidewalk for 1 block adjacent to Co. Health Services.	A 663 B 836 C 902 D 1119	A 591 B 249 C 1649 D 375 D/C 642	Pedestrian traffic on narrow shoulder originating from Heath Services complex.
3	**3. El Rancho Drive - Highway 17 on ramp to La Madrona Drive.** Gently climbing grade, some flat shoulders but mostly embankments and drop-offs.	Little or no paved shoulder, sidewalk or path for 1 block north of Carbonara on east side.	B 222 B/D 422 C 147 D 2130	B 741 C 383 D 1795	Steep embankment w/ large eucalyptus trees NW of Carbonara
4	**4. La Madrona Drive - El Rancho to Sims Road.** Steep grade initially then gently climbing. Significant cross-slope. Numerous driveways on W., intermittent flat shoulder or drop-offs on E.	Little or no paved shoulder, no path or sidewalk. Some room to walk on parts of unpaved E shoulder. Crosswalks at south and west sides of La Madrona/Sims intersection.	B 244 C 1581 D 1852	B 1783 D 1892	Room to widen at Hwy 17 undercrossing; would involve Caltrans encroachment permit. Also potentially for improvements adjacent to Hwy 17 row on E.
5	**5. Sims Road - La Madrona to Graham Hill Road.** Relatively flat gradient and level terrain. A heavily used connector to/from Hwy 17.	Paved shoulder width varies from 5' to 1'; no path or sidewalk. Crosswalks at Brook Knoll and near Pied Piper Lane. Signal w/ bike/ped activation and crosswalks at Graham Hill Road.	B 2774	B 2774	Brookknoll Drive at NE end leads to Brook Knoll Elementary School. SC Co has prelim plan for G.H. Rd. to Brook Knoll improvements

PLYMOUTH SIMS IMPROVEMENT CONCEPTS						
Proposed Improvement: ❶ Bike lanes/wide shoulders ❷ Sidewalk or path ❸ Class I multi-use path/bike trail ❹ Sign as a bike/pedestrian route						
Seg.	**Improvement Concepts**	**Improvement Types, l.f. West Side**	**Improvement Types, l.f. East Side**	**Improve Bridges & Major Drainage Structures**	**Concept Design Examples** See Section 3.5	**Estimated Segment Cost**
1	Complete sidewalks on Fernside, Lee, and Plymouth. Stripe crosswalks at Emeline/ Fernside and Emeline/Lee. Stripe bike lanes on Emeline, Lee, and N. Plymouth. Convert 2-way stop at Fernside/Emeline to 4-way.	❶817 ❷0 ❸0	❶2272 ❷1721 ❸0	none	1, 3, 6	$703,830
2	Widen shoulders to provide at least 5' wide bike lanes and complete sidewalk or pathway on E. side of N. Plymouth St.	❶2982 ❷0 ❸0	❶2664 ❷2915 ❸0	none, but some culvert extension	1, 6, 7, 9	$2,205,444
3	Widen shoulders to provide at least 5' wide bike lanes and to complete sidewalk or pathway on E. side of El Rancho Dr.	❶2920 ❷0 ❸0	❶2920 ❷2398 ❸0	none, but some culvert extension	9	$2,713,652
4	Install crosswalks at El Rancho/La Madrona intersection. Widen/realign road to construct bike lanes and informal path on N.or E. to Sims Rd.	❶3677 ❷0 ❸0	❶3675 ❷3675 ❸0	none, but some culvert extension	10	$2,581,976
5	Widen to provide bike lanes and sidewalk on N. side of Sims Rd. Provide crosswalk at north side La Madrona/Sims intersection.	❶2774 ❷0 ❸0	❶2774 ❷2774 ❸0	none	1, 3, 6	$1,003,182

3.0 Trail Design Standards and Criteria

Working Paper No. 1, in Section 2.0 and Table 2.1, provided an overview of trail types and standards. The sections below provide more detail on these standards and related design criteria used for paths, trails and sidewalks, and on specific design concepts, standards, and assumptions used for this study.

3.1 Public Trail Standards

Caltrans Standards. The California Department of Transportation (Caltrans) has adopted standards for bikeways, which are considered multi-use facilities to be shared with pedestrians, although separate facilities for pedestrians are desirable.

Bicycle Facilities. Chapter 1000 of the Caltrans Highway Design Manual contains detailed standards for bikeways. This chapter defines three types of bikeways:

> (1) Class I Bikeway (Bike Path). Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow minimized.
> (2) Class II Bikeway (Bike Lane). Provides a striped lane for one-way bike travel on a street or highway.
> (3) Class III Bikeway (Bike Route). Provides for shared use with pedestrian or motor vehicle traffic.

Class I Bike Paths must be paved and a minimum of 8 feet (2.4 meters) wide. There are many other details contained in the standards. The most significant of these are shown in Figure 4.1. There are also minimum standards for the radius of curves. The Highway Design Manual recommends a maximum gradient of 5% for new Class I paths. Caltrans Design Information Bulletin 82 (2001) provides design guidelines for facilities that accommodate people with disabilities, such as multi-use Class I paths. The Bulletin states:

> Pedestrian facilities that are part of nonmotorized transportation facilities must be designed in accordance with the Highway Design Manual for the appropriate bikeway classification, and the (Federal) Designing Sidewalks and Trails for Access for trails and equestrian design. Designers of pedestrian-shared facilities must consider the geometric requirements that are most critical for the intended users. In some cases designing for pedestrians may govern the geometric features.

Based on state and federal standards, the maximum grade of paths that include pedestrian access can be as steep as 12:1 (8.33%) if 5' by 5' level resting areas are provided at intervals of no more than 200 feet.

Class II Bike Lanes must be a minimum of 4 feet wide, or 5 feet wide where adjacent to curbside parking, as shown in Figure 4.2. Class II Bike Lanes must be one-way on each side of the roadway. There are many standards for marking, alignment through intersections, and other factors detailed in the Highway Design Manual.

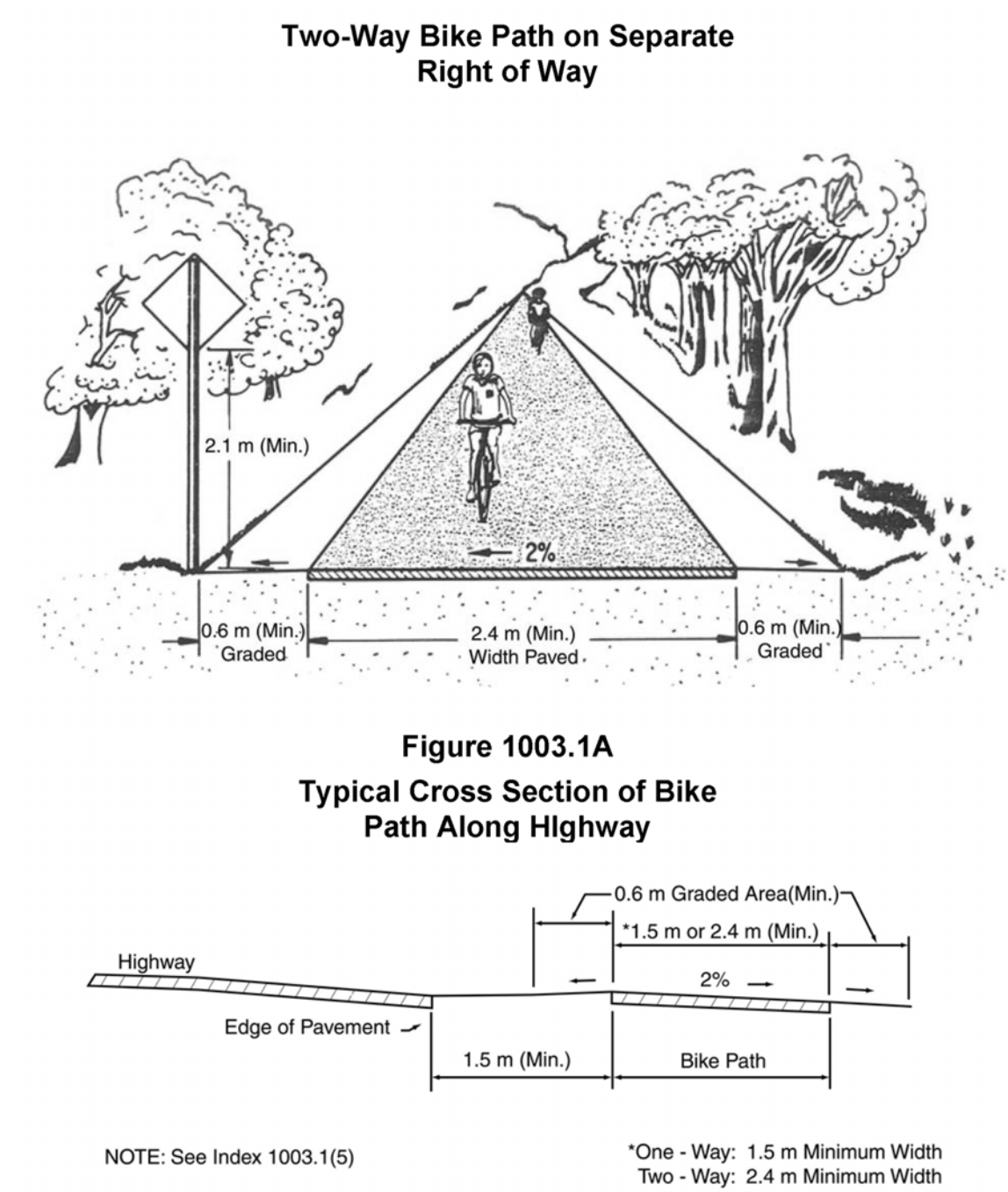
Class III Bike Routes are designated by route signs placed at all changes of direction and periodically along the route.

Pedestrian Facilities**.** Caltrans standards for pedestrian sidewalks and paths are much less detailed than bikeway standards. The Highway Design Manual addresses pedestrian facilities in Topic 105.1. Sidewalks and

paths must be paved and a minimum of 5 feet wide, excluding curbs. Regarding the gradient of pedestrian facilities, Caltrans' Design Information Bulletin 82, "Pedestrian Accessibility Guidelines for Highway Projects", states:

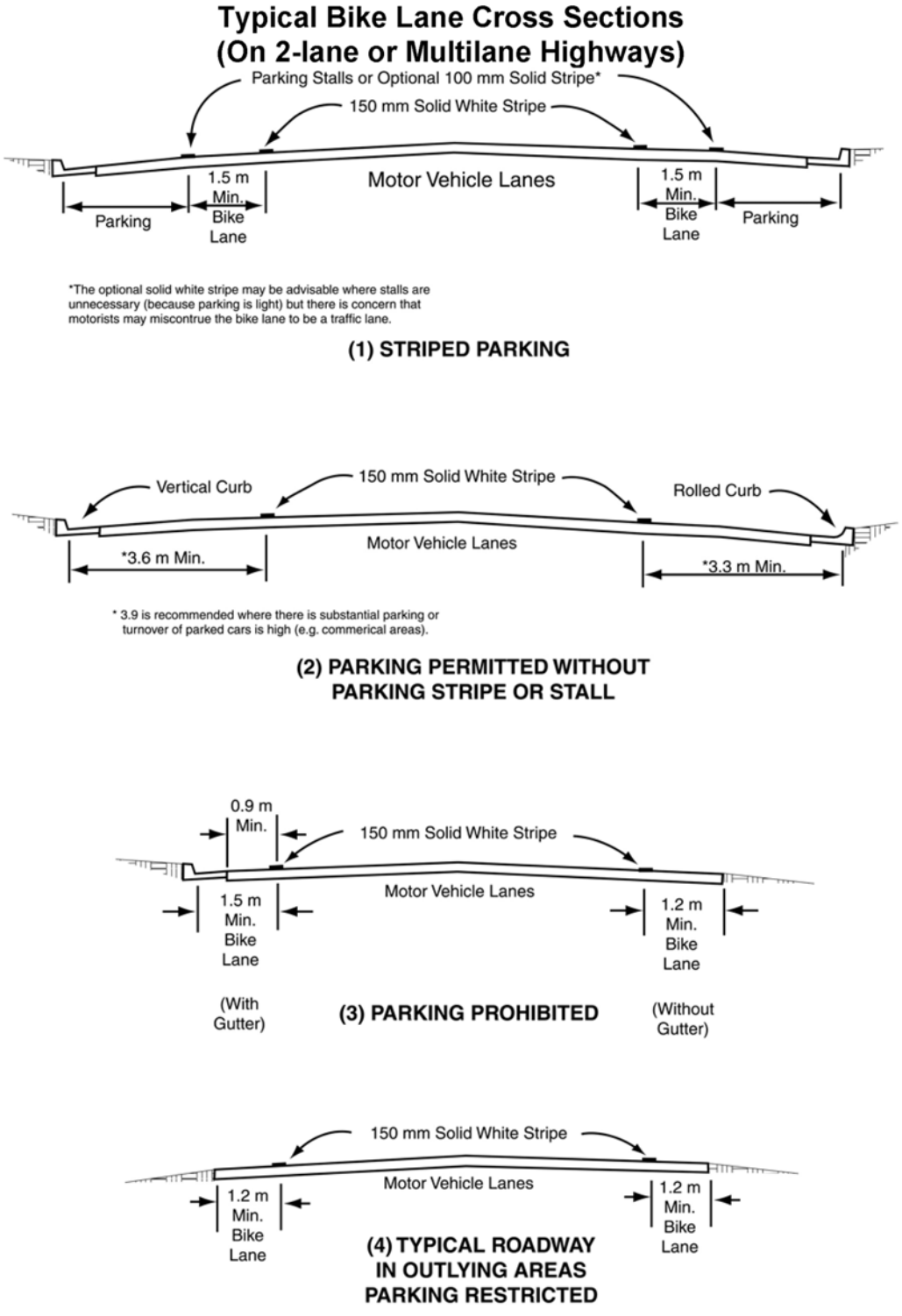
> The grade or slope of an accessible route should be as flat as possible. Any part of an accessible route with a slope greater than 1:20 (5%) shall be considered a ramp, and must comply with the standards of a ramp (Federal).
>
> All walks with continuous gradients (up to 5%) shall have level areas at least 1.5 m [5 feet] in length at intervals of at least every 122-m [400 feet] (State).

Figure 3.1: Class I Bike Paths (Multi-Use Facilities)



from Caltrans *Highway Design Manual*, Chapter 1000

Figure 3.2: Class II Bike Lanes



from Caltrans Highway Design Manual, Chapter 1000

Exceptions to Standards. Caltrans has the authority to grant exceptions to standards provided there is thorough documentation and justification that the exception is necessary and the facility will be safe. However, exceptions to pedestrian facility standards, or to accessibility factors such as maximum grade on multi-use facilities, requires approval from the Division of State Architect, which administers Title 24, the State's laws concerning access for people with disabilities. Title 24 must be at least as stringent as the federal Americans with Disabilities Act (ADA) standards.

Other Agency Standards. Outside the Caltrans right-of-way, such as in the County road right-of-way or along the railroad, standards for multi-use paths, bike lanes, sidewalks, and trails or paths may vary from Caltrans standards, although most agencies try to meet Caltrans standards, at minimum. If a project is funded with money from the State Highway Improvement Program (STIP), it may be required to comply with Caltrans standards even if it is not within the state right-of-way.

The California Department of Parks and Recreation (DPR) has its own adopted standards for trails, which may include multi-use trails, in State Parks. These standards are more flexible than the Caltrans standards. The DPR standards in turn reference federal guidelines for Outdoor Developed Areas that are slated to be formally adopted as part of ADA law in the next few years. In the interim, these guidelines are used by federal agencies and many state and local agencies to guide the design of trails in parks and rural settings. The Federal Highway Administration (FHWA) publishes an excellent reference to these guidelines: Designing Sidewalks and Trails for Access, Part 2 – Best Practices Design Guide, September, 2001 (publication No. FHWA-EP-01-027).

3.2 Alternative Trail Improvement Types

Study of the feasibility of a trail in the San Lorenzo Valley entails identifying the basic types of trails that are desirable, acceptable levels of change to, or impact on, existing site conditions, the elements of design and construction that will be required to create the trail in a given setting, and finally, the cost of the improvements. The most practical form of trail changes along the route due to physical conditions, adjoining land use, and demand for bicycle or pedestrian access in that vicinity. There are four basic types of trail improvement that may be appropriate, as outlined below:

1. **Bike lanes/wide shoulders**

   It is always desirable to provide bike lanes (a Caltrans Class II bike facility), or at least wide paved shoulders, with separate pedestrian facilities if possible.[2] The estimates in this study include allowances for striping and signing of bike lanes, though in some cases it may not be physically feasible to create bike lanes due to constraints such as steep embankments or adjacent trees.

   In some cases, the improvement concepts and estimates identify "limited shoulder widening." This includes situations where constraints such as slopes, walls, driveways and trees may make it infeasible to create a full minimum 4 foot wide shoulder, and some cases where the shoulder is already 4 feet wide or more through much of the segment, and only minor additional widening is necessary in order to meet the bike lane standard.

2. **Sidewalk or path**

[2] Many bicyclists feel that the marking and signing of bike lanes provides a false sense of security to bicyclists, because motorists do not recognize or respect the bicyclist's space. They would prefer to have the space without the markings. However, formal designation and marking of bike lanes is typically preferred by transportation agencies, and may be necessary if the route is to be identified in transportation plans and maps, and includes state/federal funding.

In urbanized areas, especially with retail commercial uses, most of the road frontage is densely developed with parking, driveways, signs, landscaping, planters, and walls. In many cases wide shoulders for bikes already exist in these locations. Sidewalks or paths are needed only to accommodate pedestrians. Typically they are 4 to 5 feet wide with concrete or asphalt pavement. Typically they would occur on both sides of the road, but in some cases they may be needed only on one side.

3. Class I multi-use path

A Caltrans Class I bikeway, also known as a multi-use path or trail, is a separate facility from the roadway. These facilities are paved and a minimum of 8 feet wide, with 12 feet a desirable width in unconstrained settings.

4. Signed bike/pedestrian route

This improvement concept primarily involves posting signs identifying a bicycle and/or pedestrian route. In Caltrans terms this is a Class III bicycle route, but the concept could apply to pedestrians on low-traffic streets. Some minor improvements along the route may also be entailed, such as paving, trimming of encroaching vegetation, and potentially parking restrictions and traffic control measures.

3.3 Typical Existing Conditions

Physical conditions occurring along the study routes are quite variable and complex. For the purpose of this planning-level study, typical conditions were defined to generally categorize existing conditions along the routes. Similar to traffic level-of-service descriptions, they are organized A to F, A being the least constrained condition, and F being the most constrained condition. A somewhat different series of A-F conditions was defined for the Railroad Route Evaluation, presented in Appendix E.

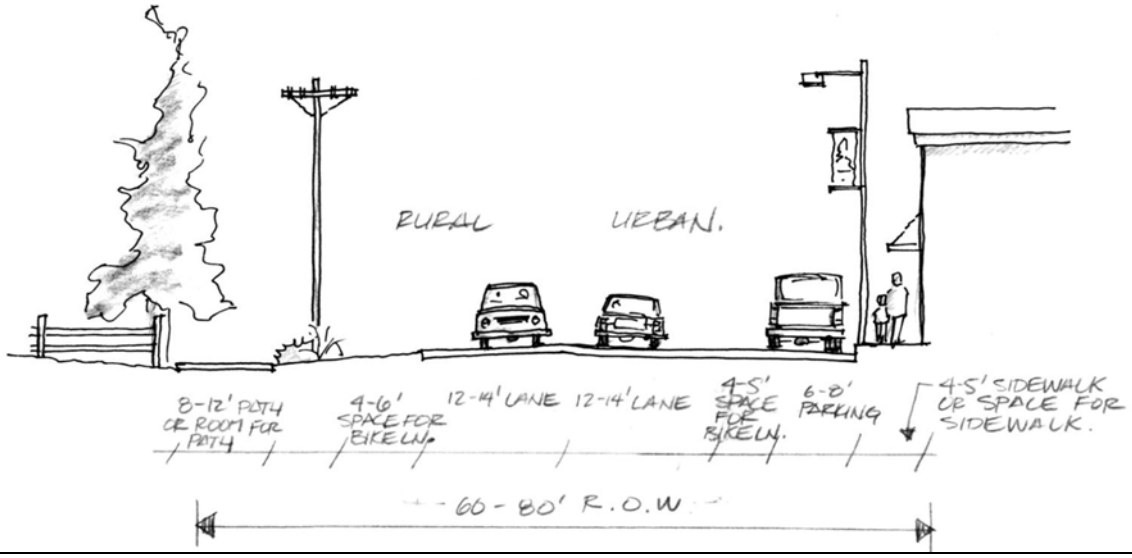
A – Areas with existing bike and pedestrian access

These areas have shoulders wide enough to be designated as Class 2 bike lanes (4' to 6') and existing sidewalk or paved pedestrian path. Some barriers such as utility poles, trees, signs, and driveways would have to be addressed to complete or formalize these improvements. This condition often occurs in or near the center of the business districts.

South Felton, looking south

Boulder Creek looking north

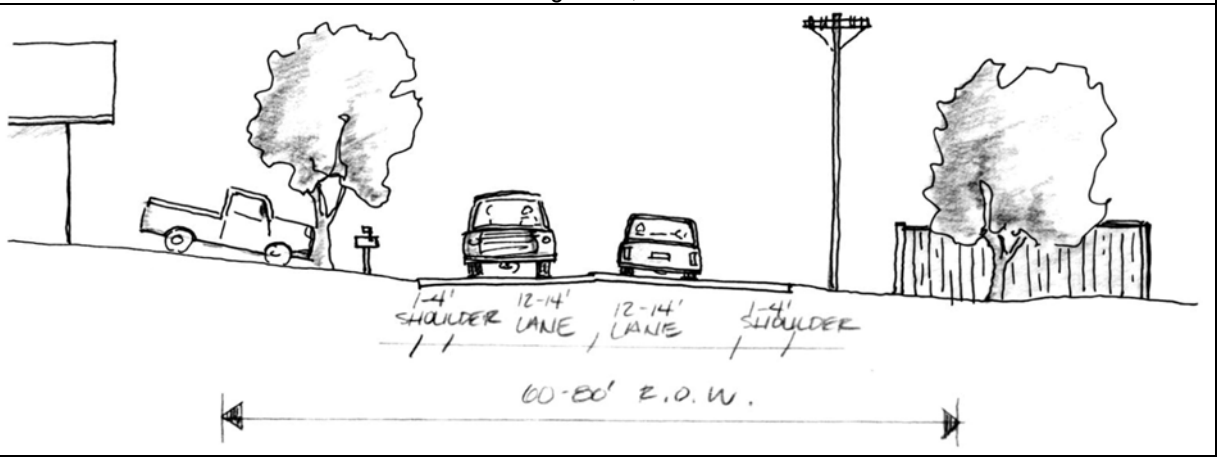
Graham Hill Rd. looking north



B – Areas with relatively level topography, few barriers to creating/improving bike and pedestrian access

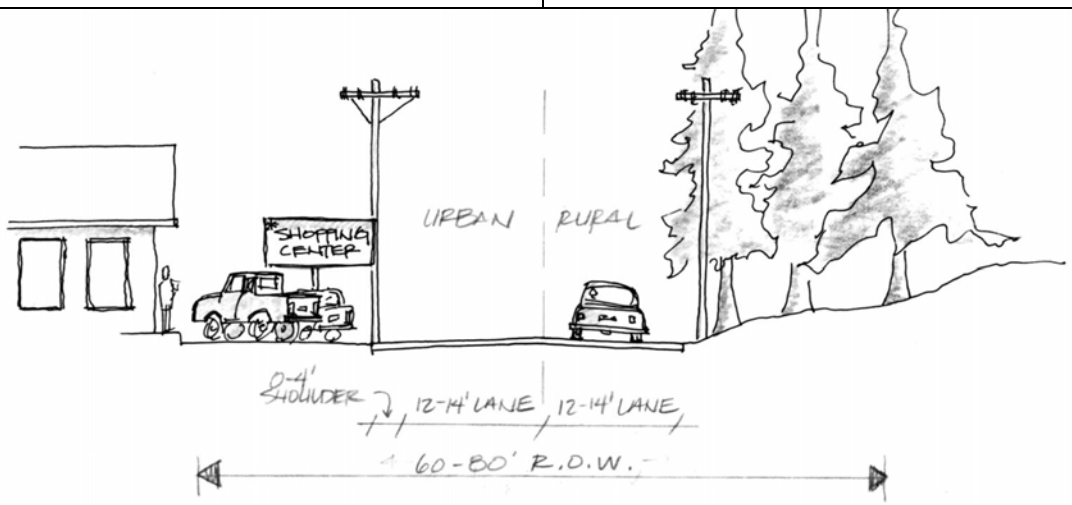
Typically, on at least one side, there is room to widen the highway and/or construct a separate pedestrian path with some minor grading and drainage structure addition/improvement, though some barriers such as utility poles, drainage ditches, trees, and driveways would have to be addressed. This condition generally occurs on the outskirts of the towns.

Looking north, PM 4.3



C – Areas with gentle topography, smaller embankments, or adjacent relatively level terrain, but significant adjacent trees, and/or private use and improvement barriers

This type includes residential or commercial areas where the structures, parking, and improvements have been established close to the roadway, or State Park or other areas where mature trees (typically redwoods) are adjacent to the roadway, so that widening the highway, providing a separate Class 1 trail, or providing a sidewalk or path would require redesign or re-arrangement of the site. A common condition is conflict with residential, or more commonly commercial parking that uses the highway right-of-way for head-in and pull-out.



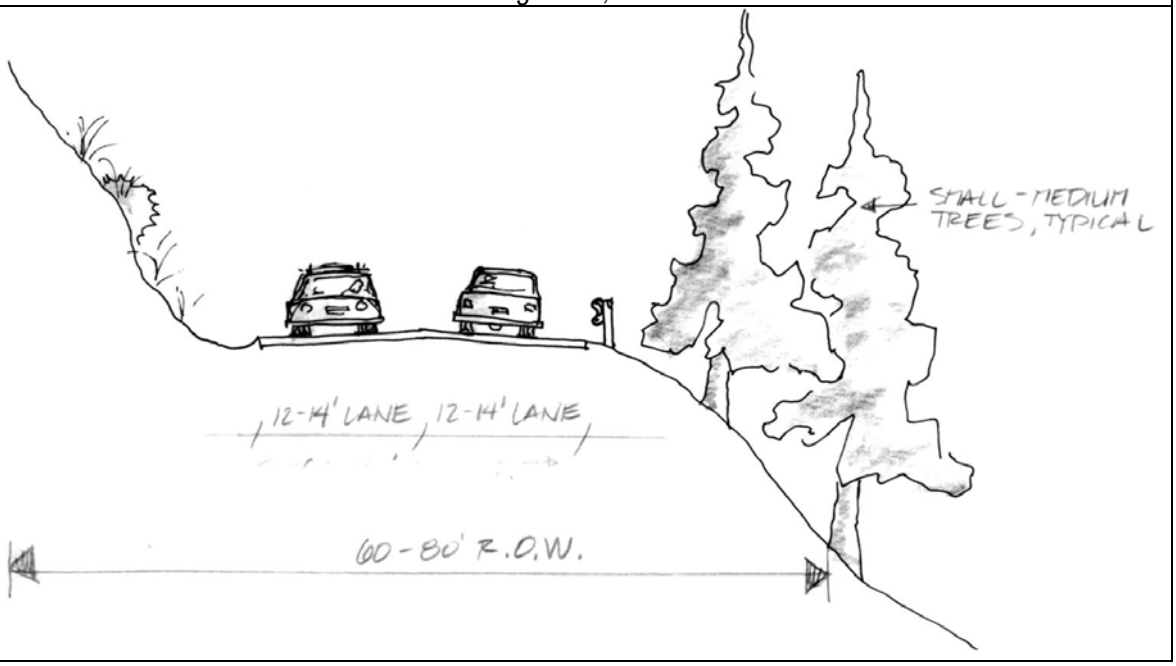
D – Areas with steep topography immediately adjacent to the roadway

This condition is typical of much of the section through the State Park and in a number of other segments. There is no flat ground upon which to widen or create a parallel trail. Retaining walls or some type of cantilevered structure would be necessary to create the needed room.

Looking north, near PM 4.8

View to Fall Creek Road

Looking south, PM 4.3



E – Area with steep topography immediately adjacent to the roadway and adjacent trees, and/or private use and improvement barriers

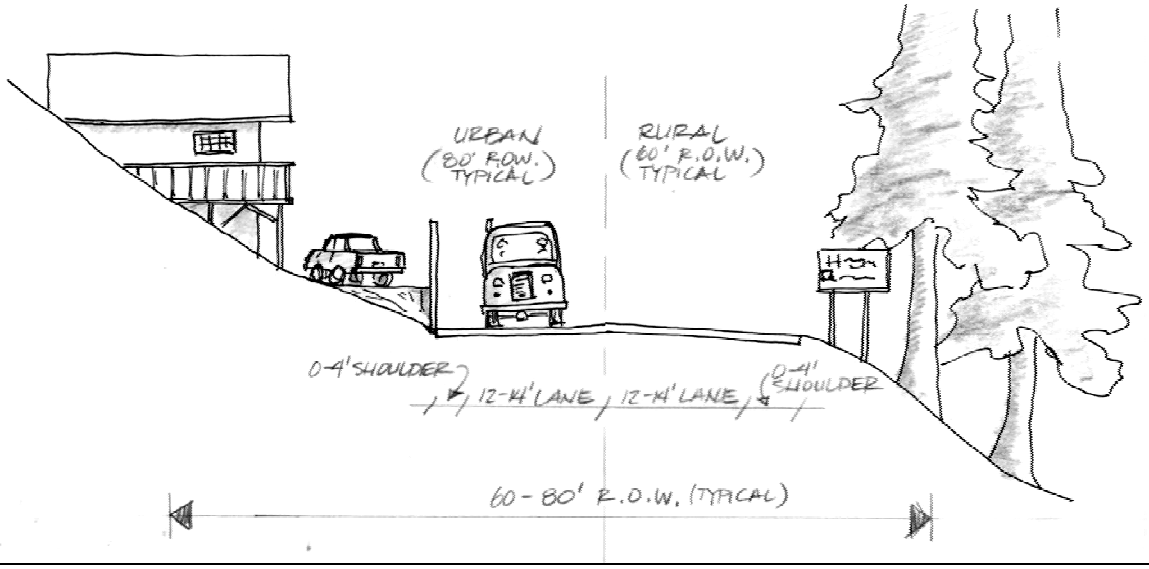
Typically this condition occurs in residential areas on the fringe of the developed towns, except in segment 7 north of Graham Hill Road. Here there are significant construction requirements, such as new or added retaining walls, plus significant potential impact on adjacent structures, trees, driveway access, etc. that would constrain widening or adding a trail.

Hwy 9 north of Graham Hill Road, looking north

Graham Hill Road, looking south

Hwy 9 north of Graham Hill Road, looking south

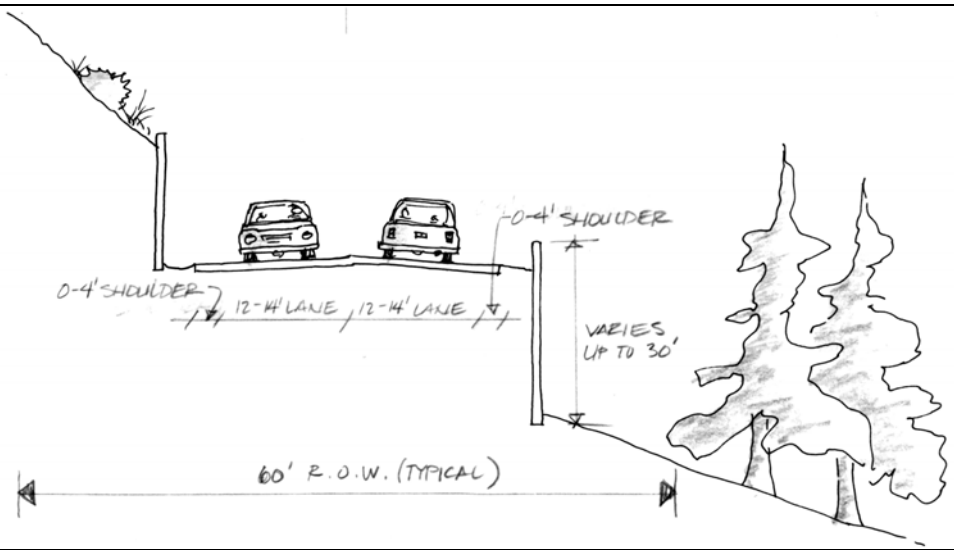
Hwy 9 north of Graham Hill Road, looking north



F – Areas with existing major retaining walls

In these areas the highway surface is many feet above or below the top of the adjacent slope. Creation of additional room to widen or add a trail would require the complete reconstruction of the wall or addition of a parallel structure to support the trail.

Hwy 9 at lower Glen Arbor Road, looking north



3.4 Priority Trail Improvement Types for this Study

The basic objective of this study is to accommodate bicyclists and pedestrians with a safe, continuous route from Boulder Creek to Santa Cruz. The type and combination of facilities that are most feasible and desirable along the route will vary based on physical conditions, demand by bicyclists and pedestrians, and interests of local property owners, residents and businesses. Safety and connectivity of travel along the route is a primary consideration. The overall plan should not create a route that leads bicyclists or pedestrians into a situation where they are unsafe. Therefore, the improvement concepts include a continuous route for pedestrian and bicyclists to existing or proposed crosswalks to allow safe crossing of the road where the route switches to the other side due to constraints or opportunities. Aside from variations required due to site constraints, connectivity requirements and neighbor interests, the preferred trail types to meet the basic objectives of the Study are listed below in priority order:

Bike lanes/wide shoulders on both sides with multi-use path on one side. Generally, for rural and suburban conditions, this is the most desirable configuration. Bike lanes or wide shoulders are preferred by serious bicyclists over shared use paths or more circuitous off-street routes that avoid congested roads. However, separate multi-use paths are preferable for pedestrians and may be preferred by people who place priority on safety and/or enjoyment over rapid transportation, such as children, older persons, people with disabilities, and casual recreational bicyclists.

Although a minimum of 4 foot wide shoulders is the standard, **i**n some highway or road sections with significant physical constraints (e.g. Conditions C and D) the most practical level of improvement may be to widen the shoulder as much as possible without creating the need for major grading, retaining walls, alteration of private improvements, or destruction of trees and vegetation. This could result in modest increases to current narrow shoulders – i.e. 1 to 2 foot increase for a net of 2 to 3 feet. In very constrained conditions (E and F) there may be minimal potential for shoulder widening due to guardrails, walls, and steep embankments immediately adjacent to the roadway. In these cases a separate Class I shared facility for bicyclists and pedestrians may be the only improvement option.

Bike lanes/shoulders with sidewalks or paths on both sides. In urbanized areas, especially with retail commercial uses, most of the road frontage is already densely developed with parking, driveways, signs, landscaping, planters, and walls (improvement types C 1, 2, and 3 typify these conditions). In other cases there is insufficient additional right-of-way to construct a Class I path. The most practical form of bicycle and pedestrian access in these locations is bike lanes (or at least adequate shoulders for bike use) and sidewalks or paths – typically 4 to 5 feet wide with concrete or asphalt pavement. In some cases this condition already exists in town commercial centers.

Bike lanes/shoulders with sidewalk or path on one side. If there are adequate bike lanes/shoulders, and in areas with lower density development, or concentration of uses and demand on one side of the highway (such as at the schools) it may be practical to provide a pedestrian-only sidewalk or path facility on one side of the highway or road. Especially in physically constrained settings, the cost and disturbance caused by constructing a 5 foot wide sidewalk will be far less than constructing an 8 foot + Class I multi-use path.

Class I multi-use path on one side – no shoulder improvements. Widening the roadway to create room for a path is preferred. However in some locations highway shoulder widening is severely constrained by steep slopes, and particularly by existing retaining walls on the downhill, east side. In some cases it may be more

feasible and less expensive to construct a separate multi-use path outside of the existing guardrails and walls on the east, or create new walls on the slopes to the west, than to reconstruct or replace the existing retaining walls, or add new walls, in order to widen the highway enough for bike lanes and sidewalks, or a multi-use path. A major reason for this is that a multi-use path can generally be built down-slope, below the level of the highway, which reduces the height of the walls required, and may also improve safety and aesthetics for trail users due to the separation from traffic.

Another case where a multi-use path may be a preferable option to standard width bike lanes/shoulders is in more suburban areas, with encroaching embankments, driveways, parking, fences, walls, and other private improvements. There may be room to construct a multi-use path on one side of the road, but not room to provide both the path and full bike lanes/shoulders. In this case the path may be preferable because it provides a safe bicycle and pedestrian route in both directions, and involves less disturbance to private improvements, in part because it can vary somewhat in horizontal and vertical alignment to avoid obstacles such as mature trees, while a widened road cannot.

With this improvement type a problem is presented as to how to connect across the highway or road where the trail changes to bike and/or pedestrian facilities on both sides of the road. For this reason transitions must occur where there are safe crossing, ideally where there is a traffic signal, or at locations where safe crossings can be established.

Signed bike/pedestrian route. Signing as a bicycle and/or pedestrian route in absence of wide shoulders or designated paths or walks is feasible only on very low traffic streets, and is a "last resort" alternative to providing an improved trail, or could be offered as an alternative route. In some cases there are intermittent sidewalks or paths in place that should be extended (as on Gushee Street). In other cases there are no sidewalks or room for such, and they are not necessary due to very low traffic speeds and volumes.

3.5 Typical Trail Improvement Examples

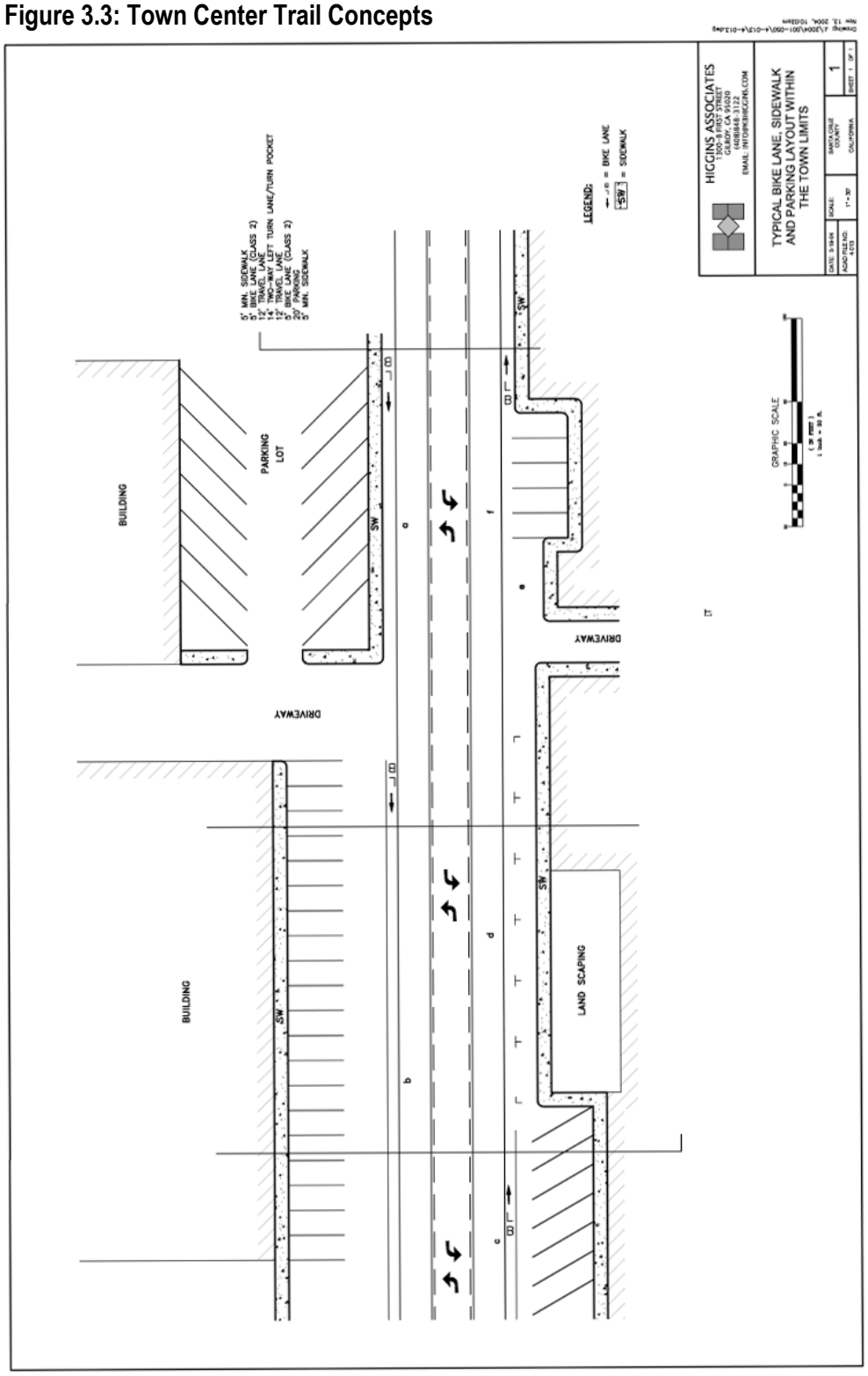
A range of current conditions along the trail routes classified and mapped to document varying degrees of difficulty for constructing a trail. These range from A to F, A being a situation where an acceptable access condition exists, and F being the most constrained condition, where a cliff or major retaining wall precludes road widening. There are many variations within these A though F definitions. In this section conceptual trail improvement examples are presented for each of the B through F conditions (Condition A already is improved, or only requires signing and striping), including as many as 4 sub-types of improvements to respond to variation in the physical conditions or settings. These concepts provide the basis for estimating the number of lineal feet of that condition/improvement type along each segment (presented in Tables 2.2 and 2.3), and for cost estimates for each trail segment and overall route (presented in Appendix C).

Solutions in Commercial Areas. Planning for trails through the town centers requires special attention. As discussed in Appendix D, the town plans ultimately call for the creation of bike lanes and continuous sidewalks in the town centers where they do not already exist. As demonstrated by the fact that the recently constructed Ben Lomond frontage improvements include curbside parking rather than bike lanes, the wishes of local merchants often conflict with these objectives. It will require a long and involved planning and design process to implement these long-term visions for bicycle and pedestrian access in the town centers. Additional financing mechanisms and agreements such as parking assessment districts may be required.

Felton town center has the greatest need and least progress toward improving bicycle and pedestrian access conditions, but portions of Ben Lomond and Boulder Creek, and Brookdale could also benefit from further improvements. Generally there are adequate shoulders for bicycles in these locations. Multiple driveways and head-in parking directly off the highway interfere with the path of bike travel, but these are problems that can only be addressed through major long-term urban planning efforts outlined above. The greatest current need and opportunity is for safer and more convenient pedestrian circulation. This would benefit many businesses as well as the pedestrians, because it could make it easier for visitors to patronize several nearby businesses.

This study presents some interim concepts for improving pedestrian circulation by linking and improving pedestrian routes along existing business frontages, as illustrated for a hypothetical commercial area in Figure 3.3. Creating more continuous sidewalks would entail creating striped or special pavement crossings of driveways, making openings in intervening fences and walls, re-design or relocation of planters, signs, and parking, and construction of sidewalks either along the building frontage where the parking is directly off the highway, or along the road frontage where there is a separate parking area. Cross sections for these concepts are providing in Trail Concept Examples 3 and 4, in the following pages.

Figure 3.3: Town Center Trail Concepts



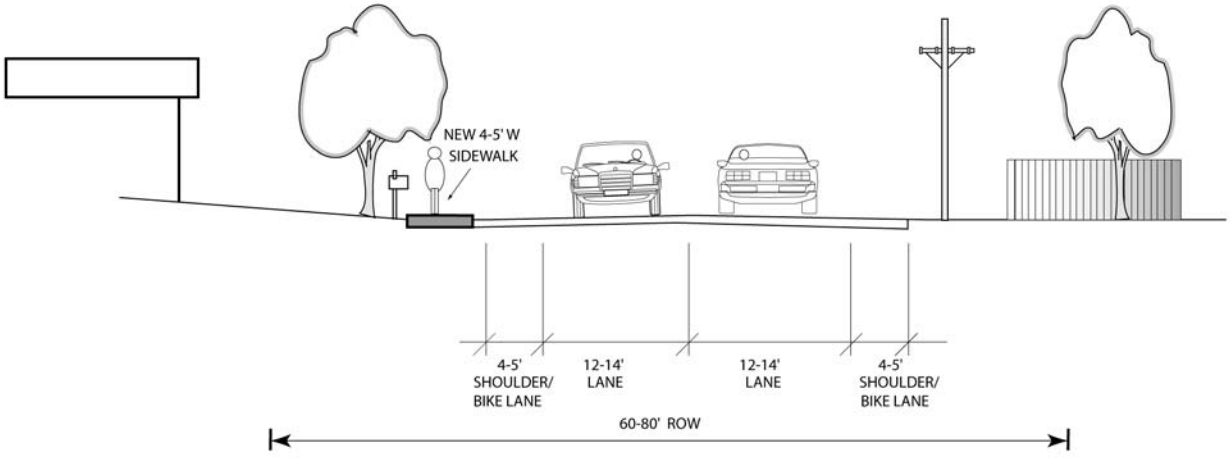
Trail Concept Example 1:

Bike Lanes/Shoulders with Sidewalks/Paths
Condition B – Areas with relatively level topography, few barriers to creating/improving bike and pedestrian access

This example generally occurs on the outskirts of the towns, and other rural settings. Improvement requirements will include demo of existing features, some minor grading and drainage structure addition/improvement. Barriers such as utility poles, signs drainage ditches, trees, and driveways would have to be addressed.

South Felton looking north

Looking north near State Park



Example - Typical suburban frontages of Highway 9

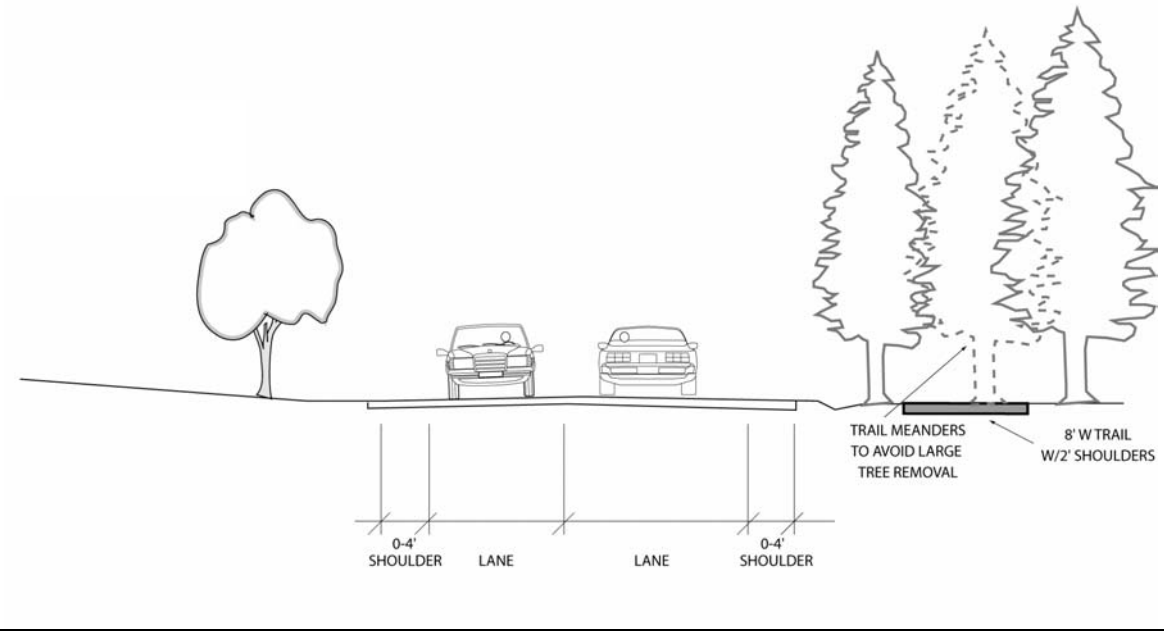
Trail Concept Example 2:

Multi-Use Path
Condition B – Areas with relatively level topography, scattered large trees, few other barriers to creating/improving bike and pedestrian access

This example is typical of some areas of the State Park that have wide turnouts, and other rural areas along Highway 9 with wide, flat adjacent land. Requirements for constructing a multi-use path are relatively straightforward, given that the alignment can be routed around the trees.

Looking north, PM 4.3

Looking north



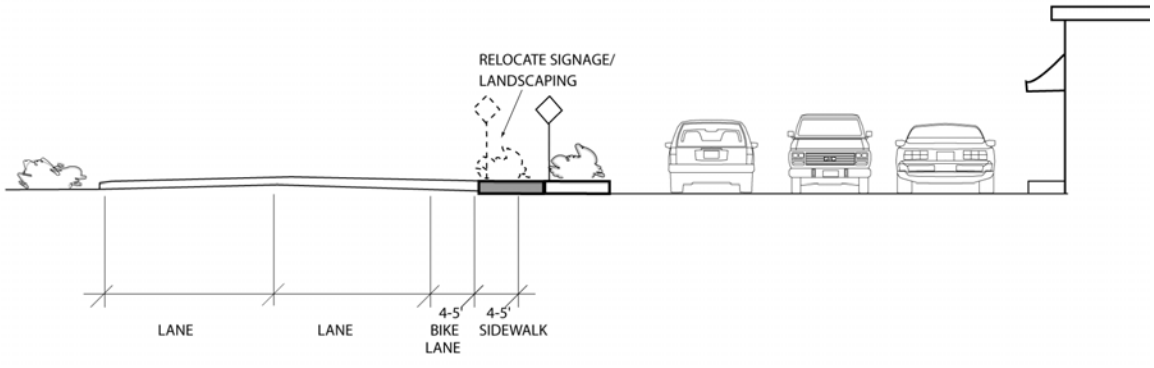
Example - Portions of Highway 9 in State Park

Trail Concept Example 3:

Bike Lanes/Shoulders with Sidewalks/Paths
Condition C – Areas with gentle topography, smaller embankments, or adjacent relatively level terrain, but significant adjacent trees, and/or private use and improvement barriers

This example shows a commercial area with a parking lot off a driveway from the highway or road. Often room for a bike lane exists but there is no provision for pedestrians. Relocation or re-design of parking, landscaping, signs, and low walls, relocation of utilities, and modification of drainage facilities may be required to provide space for a bike lane and sidewalk along the frontage.

South Felton looking north



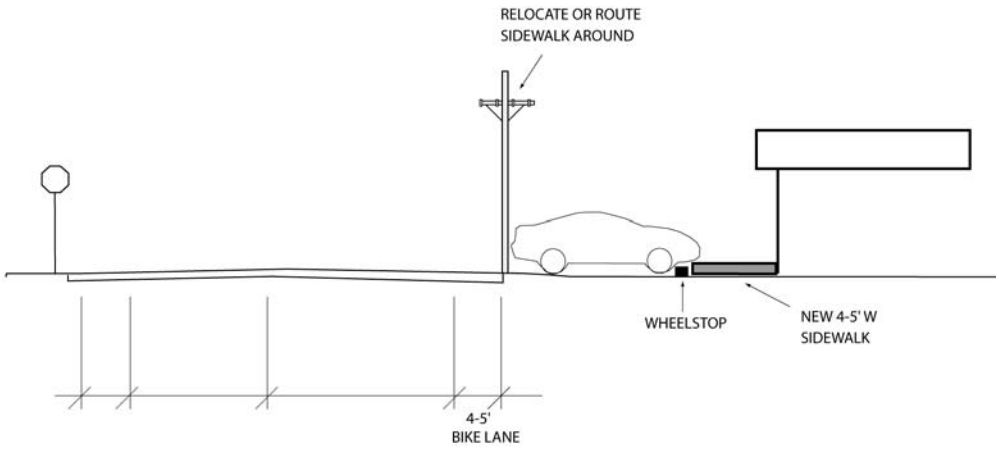
Example - Commercial district with separate parking area from highway

Trail Concept Example 4:

Bike Lanes/Shoulders with Sidewalks/Paths
Condition C – Areas with gentle topography, smaller embankments, or adjacent relatively level terrain, but significant adjacent trees, and/or private use and improvement barriers

Parking that uses the highway right-of-way for head-in and pull-out is a particular problem, typically in commercial areas, but a similar condition occurs in dense residential areas where the structures, parking, and improvements have been established close to the roadway, and often in the right-of-way. In commercial areas a solution may be to work with the property and business owners to provide sidewalks adjacent to the buildings, if they do not already exist. This may require re-arrangement of parking and site improvements, as well as coordination of improvements on adjacent properties so that there is a continuous path of travel.

Central Felton looking north



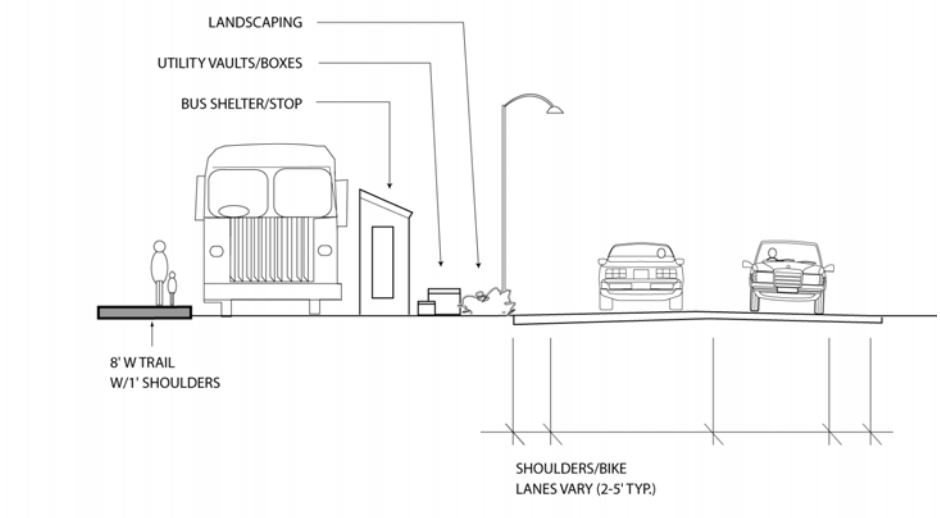
Example - Commercial district with parking directly off highway

Trail Concept Example 5:

Bike Lanes/Shoulders with Pedestrian or Multi-Use Path on One Side
Condition C – Areas with gentle topography, smaller embankments, or adjacent relatively level terrain, but significant adjacent trees, and/or private use and improvement barriers

This condition occurs at the frontage to the San Lorenzo Valley schools, though it is similar to issues on some commercial frontages. In addition to additional shoulder widening for bikes, a 5' wide pedestrian path is envisioned along the frontage, which would necessitate reorganization of some structures, as well as vehicular and pedestrian access to the site.

Hwy 9 at High School frontage, looking north



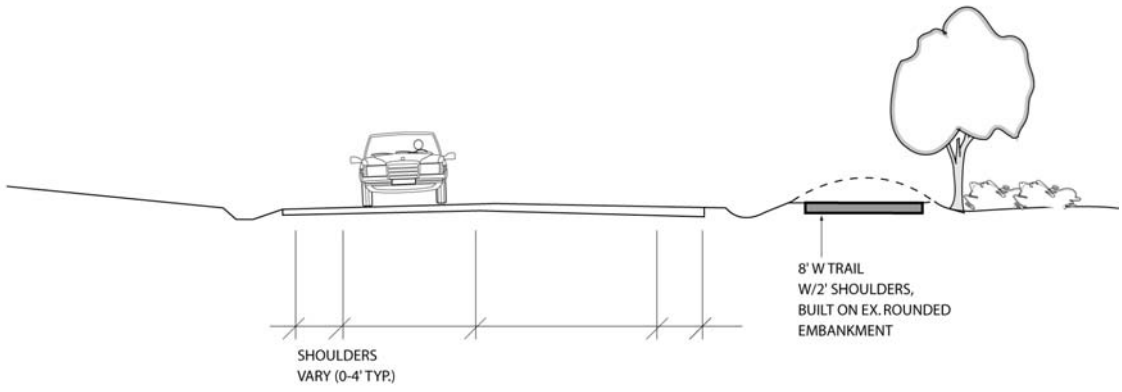
Example - School frontage area

Trail Concept Example 6:

Bike Lanes/Shoulders with Multi-Use Path on One Side
Condition C – Areas with gentle topography, smaller embankments, or adjacent relatively level terrain, but significant adjacent trees, and/or private use and improvement barriers

This condition occurs on long stretches of Graham Hill Road, and in some locations along Highway 9. Rather than a steep slope, an embankment exists that was presumably created during grading for the road. In some cases there are utilities and/or mature trees on the embankment. To create room for a multi-use path, the embankment would have to be removed and the material deposited at another location (potentially used on a portion of trail using retaining walls that required backfill).

Graham Hill Road looking south near State Park entrance



Example - Portions of Highway 9 and Graham Hill Road w/ fill embankments

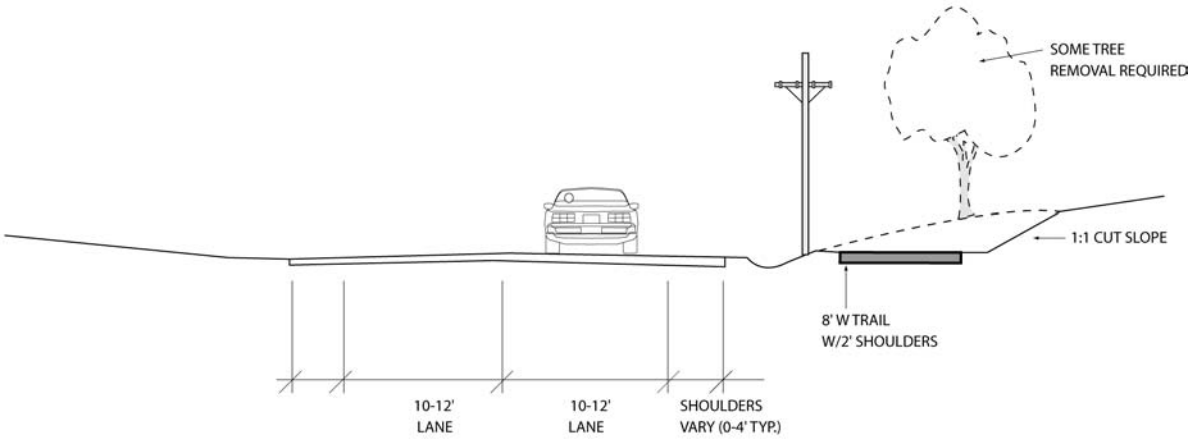
Trail Concept Example 7:

Bike Lanes/Shoulders with Multi-Use Path on One Side
Condition C – Areas with gentle topography, smaller embankments, or adjacent relatively level terrain, but significant adjacent trees, and/or private use and improvement barriers

This is very similar to the previous example except that there is a moderate continuous slope adjacent to the road, requiring a cut to create space for a trail. The example shows a 1:1 cut slope, which could be used on Graham Hill Road. However, Caltrans standards allow a maximum of 2:1 slopes, meaning more space would be required for the trail, or a retaining wall would be needed. Depending on the right-of-way width and adjacent or conflicting features such as walls, structures and trees, a trail could be simple to construct, or very complicated. Transitions at driveways that cross the trail alignment are particularly tricky, to avoid making either the driveway or the trail too steep or slanted.

Graham Hill Road looking south

Highway 9 looking south, north of Ben Lomond



Example - Portions of Highway 9 and Graham Hill Road

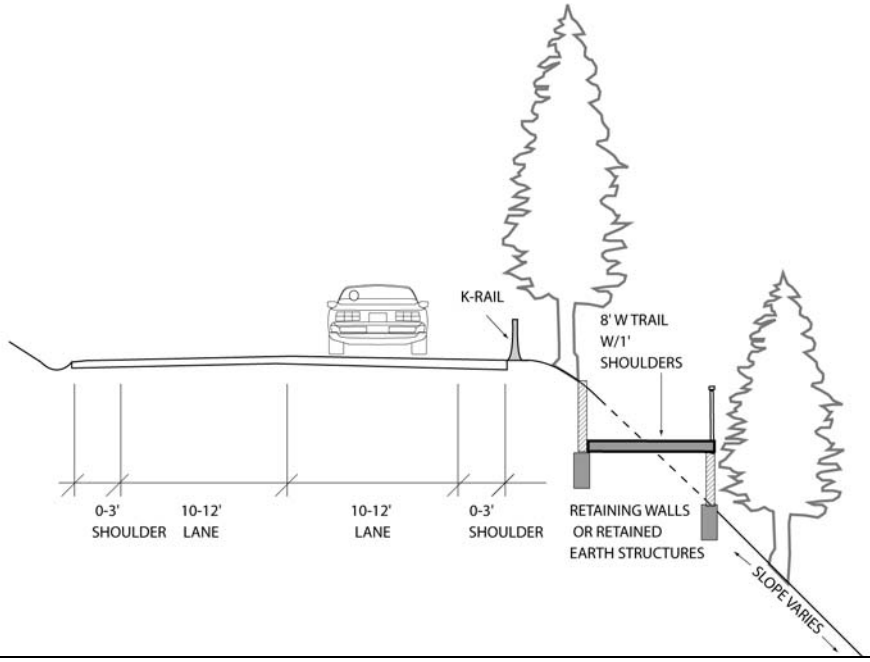
Trail Concept Example 8:

No Shoulder Widening, Multi-Use Path on One Side
Condition D – Areas with steep topography immediately adjacent to the roadway

In this example the road is already constructed as wide as possible without using retaining walls, or major retaining walls exist that would have to be reconstructed to widen the road to provide wider shoulders and/or an adjacent trail. In this case the most feasible and safest alternative may be to construct a separate multi-use path below, or in some cases above, the level of the roadway. Many of these segments have many small to medium trees that would have to be cut to construct the trail.

Highway 9, looking south, PM 4.3

Graham Hill Road, southern end, looking south



Example - Portions of Highway 9 and Graham Hill Road

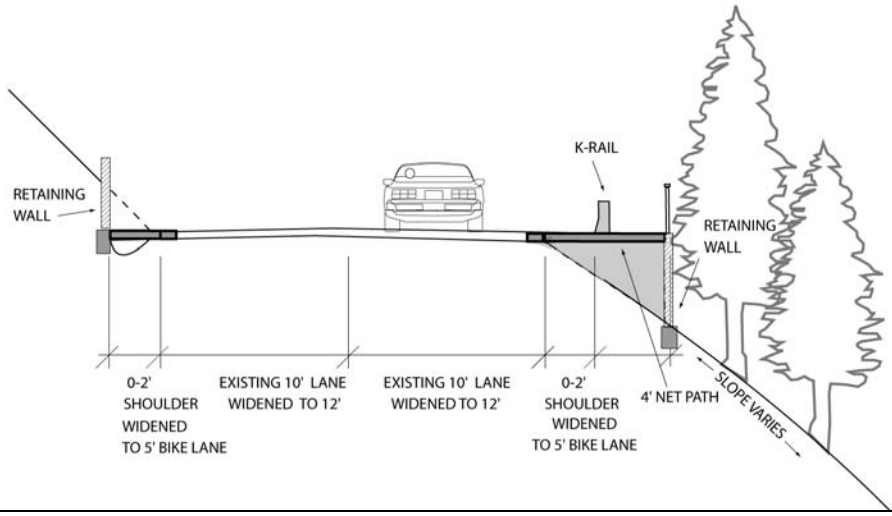
Trail Concept Example 9:

Shoulder Widening for Bike Lanes, Sidewalk, or Path on One Side
Condition D – Areas with steep topography near the roadway

In this example the road is already constructed as wide as possible without using retaining walls. The road would need to be widened to provide bike lanes and a sidewalk or path. Many of these segments have many small to medium trees that would have to be cut to construct the trail, and some have driveways that present grading conform challenges.

El Rancho Drive

El Rancho Drive



Example - Portions of El Rancho Drive

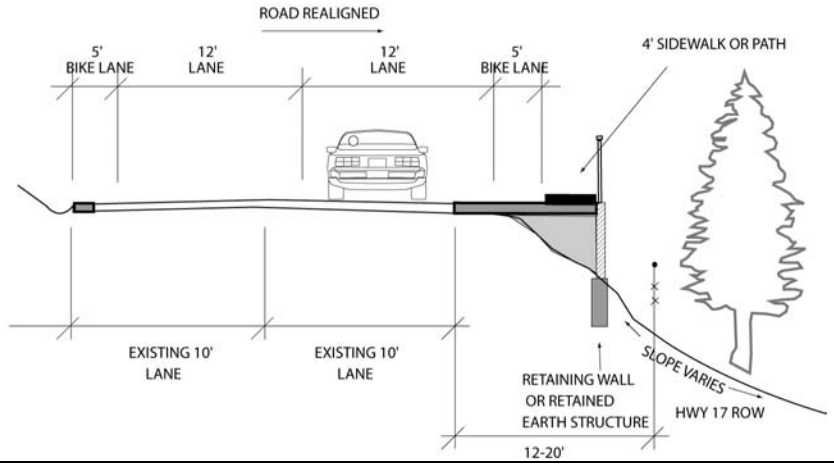
Trail Concept Example 10:

No Shoulder Widening, Multi-Use Path on One Side
Condition D – Areas with steep topography near the roadway

In this example the road is already constructed as wide as possible without using retaining walls, or major retaining walls exist that would have to be reconstructed to widen the road to provide wider shoulders and/or an adjacent trail. In this case the most feasible and safest alternative may be to construct a separate multi-use path, in some cases below the level of the roadway.

La Madrona Drive, view north

La Madrona Drive



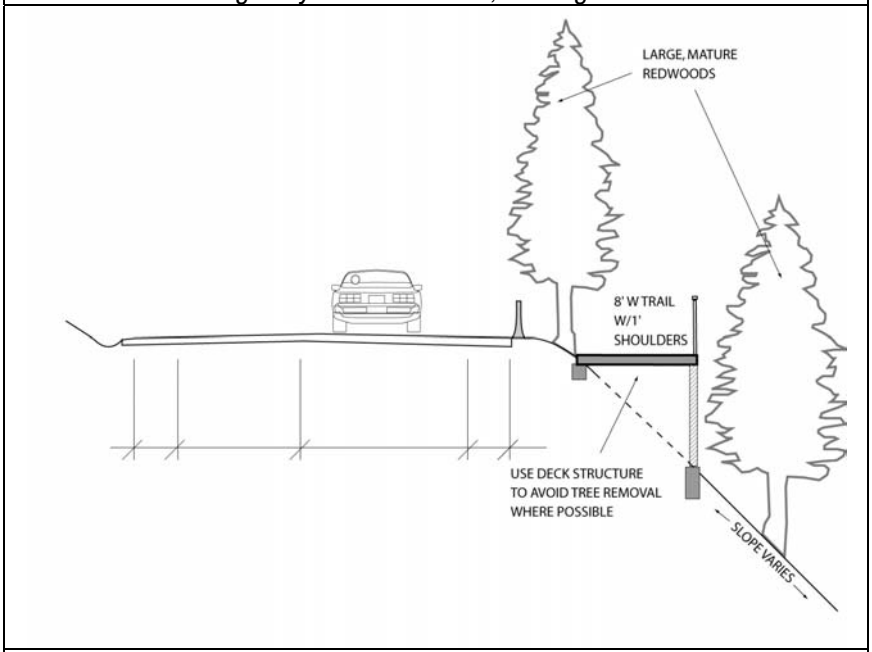
Example - Portions of La Madrona Road

Trail Concept Example 11:

No Shoulder Widening, Multi-Use Path on One Side on Deck Structure
Condition E – Areas with steep topography immediately adjacent to the roadway and adjacent trees, and/or private use and improvement barriers

This example shows a typical condition that occurs primarily in the State Park along Highway 9, where mature redwoods are located on steep slopes near the roadway. Typically there is no room to widen the roadway without removing the trees. Constructing a trail with conventional retaining walls would also destroy or adversely impact the trees. Constructing a trail on a deck or cantilevered structure as shown could avoid grading and wall construction near the trees. This is an expensive approach, but may be the only option in steep location with large trees that are desirable to save.

Highway 9 in State Park, looking south



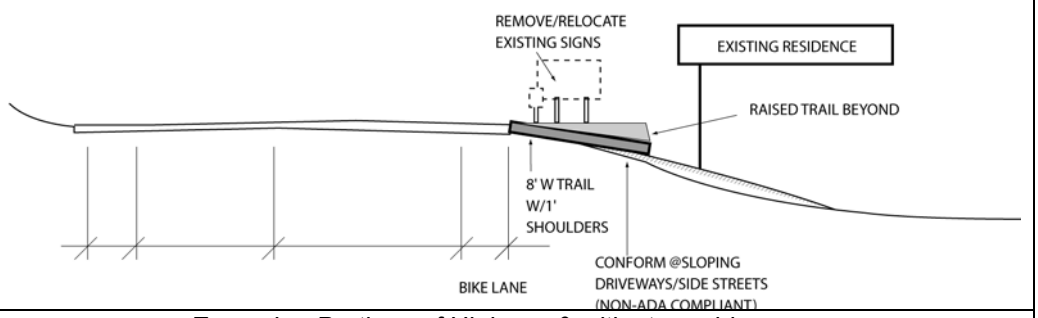
Example - Portions of Highway 9 in State Park

Trail Concept Example 12:

Multi-Use or Pedestrian Path on One Side
Condition E – Areas with steep topography immediately adjacent to the roadway and adjacent trees, and/or private use and improvement barriers

This example occurs on Highway 9 north of Graham Hill Road on the east side, and in some other locations. This segment has very heavy vehicular traffic, as well as many bicycles and pedestrians. The only space available to bike or walk is an approximately 3 foot wide shoulder. Driveways to businesses and residences extend down steep slopes directly from the roadway, and signs, fences, walls and other structures are located immediately adjacent to the roadway. Widening is precluded by the slopes and driveways. Construction of a separate path would require relocating the signs and other structures, and resolving careful transitions between the trail and the driveways, probably requiring portions of each to be steeper and more warped than standards would otherwise allow.

Hwy 9 north of Graham Hill Rd. looking north



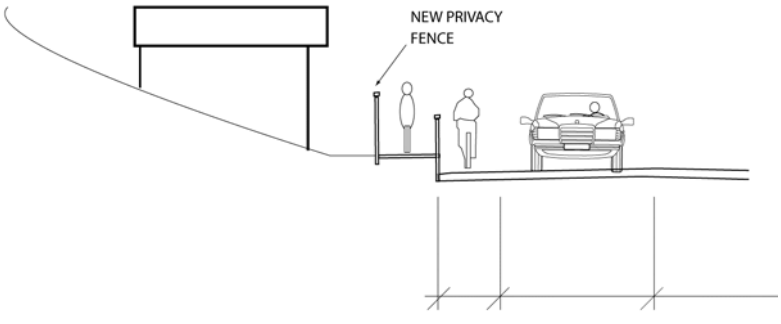
Example - Portions of Highway 9 with steep driveways

Trail Concept Example 13:

Multi-Use or Pedestrian Path on One Side
Condition E – Areas with steep topography immediately adjacent to the roadway and adjacent trees, and/or private use and improvement barriers

This example occurs on Highway 9 north of Graham Hill Road on the west side, and in some other locations. This segment also has very heavy vehicular traffic, as well as many bicycles and pedestrians. Again, the only space available to bike or walk is an approximately 3 foot wide shoulder. A series of residences are constructed on steep slopes very close to the roadway, and fences, walls and other structures are located immediately adjacent to the roadway. These properties are already highly constrained in terms of space. In at least on case, closest to Graham Hill Road, a large retaining wall supporting a residence is located immediately adjacent to the roadway. Widening or construction of a separate path would require reorganization and further reduction in the space for parking, and yard. In some cases it may not be feasible to provide an improved trail without removing the house and associated walls.

Hwy 9 north of Graham Hill Rd. looking north



Example - Portions of Highway 9 with adjacent structures

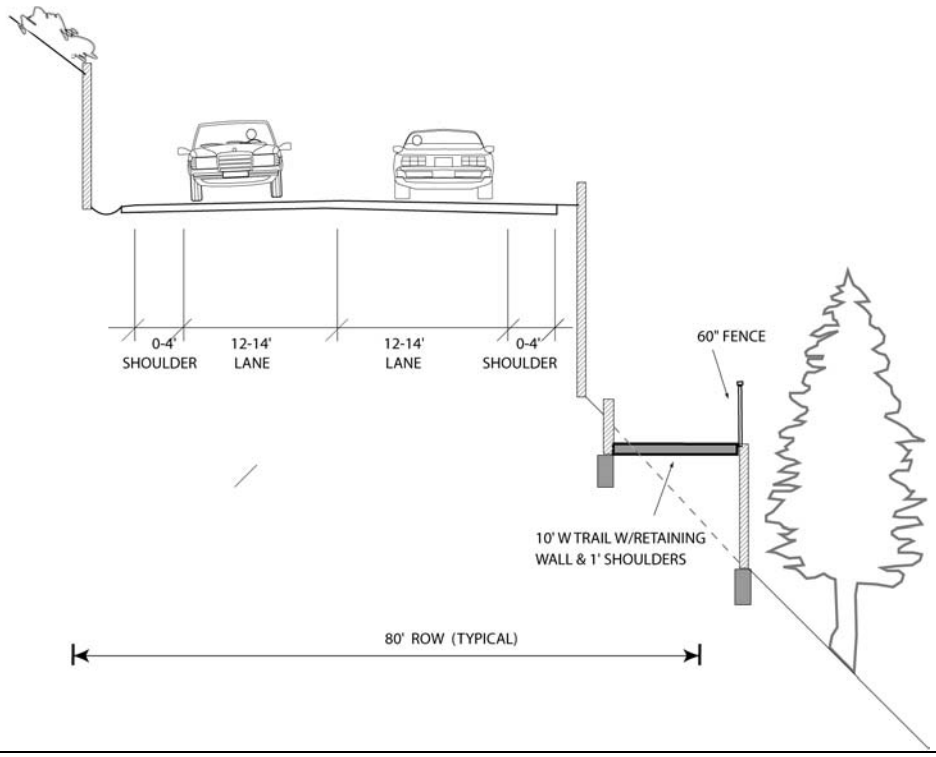
Trail Concept Example 14:

Multi-Use or Pedestrian Path on One Side
Condition F – Areas with existing major retaining walls

In these areas the highway surface is many feet above or below the adjacent slope. Widening the roadway would require the complete reconstruction of the wall. The most feasible alternative to provide a trail in these locations may be to construct a separate path above or below the existing wall. This will require separate retaining walls and involve careful engineering to ensure that the new structure does not interfere with the existing wall. If the length and height of the existing wall allows the grades of the trail connections to meet standards, the trail could be constructed at the base of the wall using retaining walls as shown.

Highway 9 in State Park looking south

Highway 9 south of Cooper Street, looking south

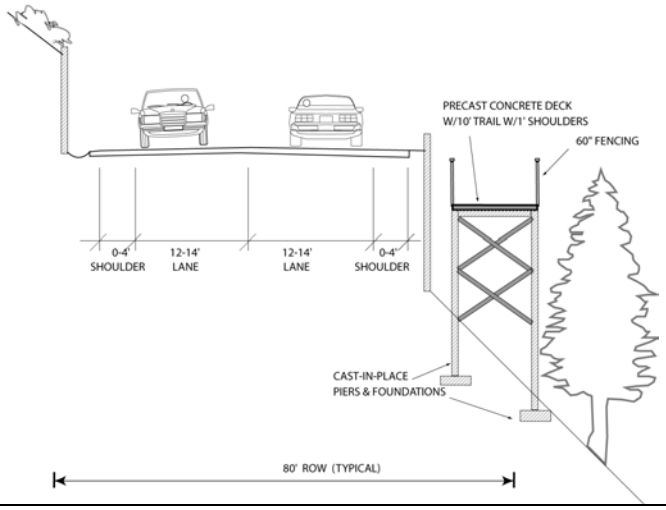


Trail Concept Example 15:

Multi-Use or Pedestrian Path on One Side
Condition F – Areas with existing major retaining walls

This example is a similar condition to Example 12 except the difference between the highway elevation and the slope at the bottom of the existing wall is too great to allow a trail connection at a reasonable grade. The trail would need to be elevated on a causeway structure through this section. This also may help to preserve trees in the area. In these areas the highway surface is many feet above or below the adjacent slope.

Highway 9 in State Park looking south



3.6 Specific Trail Design Details and Assumptions

In addition to the basic features such as width, surface and gradient, many other trail design features and fixtures are specified by Caltrans and other standards. There are many choices to be made in the design of a regional trail system such as the San Lorenzo Valley Trail. Ideally there would be a uniform set of standards for design throughout the system, regardless of ownership of the trail right-of-way. Preliminary concepts for trail improvement standards are outlined below.

Bridges and Drainage Structures. The project traverses through mountainous terrain. As such there is a proliferation of pipe culverts, box culverts and bridges and sidehill viaducts that accommodate storm water, creeks and rivers, or traverse steep slopes. Table 4.1 is a summary of major bridges and box culverts along Highway 9 within the study area. The Improvement Concepts maps and tables indicate the location and configuration of the major box culverts and bridges along Highway 9. Improvements to these structures have been identified based on the improvement detail at that specific location (e.g. where a path would be constructed the widening of the drainage structure would accommodate a path). Where the roadway is widened, the structure would also be widened to accommodate the new cross section of the road, shoulders/bike lane and sidewalk

For smaller pipe culverts the following assumptions have been made. It is assumed that there would be ten pipe culverts per mile that are smaller than three feet in diameter. For estimating improvement costs is was assumed that fifty percent of the pipe culverts are one-and-a-half feet in diameter and the other fifty percent are three feet in diameter.

Box culverts and pipe culverts larger than three feet in diameter are indicated on the Improvement Concepts maps. Existing dimensions of these culverts have been used to calculate quantities for widening and subsequent improvement costs.

The following approach was taken in deciding where structures would be widened versus a separate bridge provided:

- Where Class II bike lanes and sidewalk would be provided across box culverts, the culverts and bridges would have to be extended to accommodate the new cross section. In general, a bridge that does not have a significant clearance above the mean water level, and thus acts like a box culvert, would be widened.
- Where a Class I path would be provided across a smaller box culvert, the path would be a structure with supporting columns and a bridge span.
- Where a Class I path would be provided across a creek/river and the adjacent street crossing is a bridge structure, the path would be a separate bridge structure, with its own supporting foundations, columns and a bridge span.

Table 3.1: Highway 9 Bridges and Box Culverts

Segment	Post Mile(s)	Feature	Dimensions
1	0.20	culvert	
2	0.75	creek/box culvert	
2	1.06	creek/box culvert	
4	1.97	Rincon Creek Bridge (concrete girder; 2' ped space)	161'Lx24'W
4	2.11	sidehill viaduct	162'Lx29'W
4	3.45	box culvert crossing w/guardrails	
4	3.67	sidehill viaduct	62'Lx21'W
4	3.87	sidehill viaduct	163'Lx20'W
4	4.00	box culvert	
4	4.27	sidehill viaduct	82'Lx18'W
5	4.75	new pedestrian bridge at creek/large culvert	
5	5.55	Gold Gulch Bridge (narrow bridge w/guardrails at box culvert)	
5	5.80	narrow box culvert at Shingle Mill Creek	
8	7.01	Fall Creek Bridge (6' sidewalk both sides)	92'L
8	7.76	San Lorenzo River Bridge	307'Lx21'W
8	7.87	San Lorenzo River Bridge	151'Lx24'W
9	8.30	box culvert w/K-rails	
10	9.33	concrete box girder bridge (3-4' shoulders and 4-5' sidewalk)	168'Lx45'W
11	9.65	creek bridge	
11	9.71	Hubbard Gulch Bridge (6' shoulder and 4' sidewalks)	161'Lx23'W
11	9.75	San Lorenzo River Bridge	
11	9.85	Marshal Creek Bridge (concrete girder)	26'Lx28'W
12	10.87	large culvert at Alba Creek	
13	11.34	Clear Creek Bridge	
13	11.40	box culvert w/K-rails across Clear Creek	
14	12.22	box culvert across Malosky Creek	
15	12.44	creek w/guardrails	
15	13.11	Boulder Creek Bridge (2-3' shoulders, 3-4' sidewalk)	95'Lx30'W

In some cases bridges could not be widened and a new trail bridges would be provided, as noted on the Improvement Concepts maps and tables. The general nature of the cost estimates, and the relatively high cost of alternative approaches, covers a range of options in the widening or replacement of bridges and drainage structures.

Crosswalks, Signals, and Crossings. Existing and proposed crosswalks are indicated on the Trail Improvement Concepts maps.

New crosswalks are recommended as part of the conceptual design for the project. Typically, where the Class I path would start/end and where the sidewalk would be provided on both sides of Highway 9, a crosswalk would be provided. Thus, where pedestrian or cyclists would have to cross Highway 9 to continue on the path, a cross walk would be required. However, in some cases bike lanes and sidewalks may continue to provide access to the trail to only local residents along Highway 9. In these cases, signage would be provided along the trail to indicate where Highway 9 would have to be crossed to continue either north or south, and that continuing on the present side is not a through route.

Along Segment 4 at post mile 2.25 the Class I path would cross the Santa Cruz Big Trees railway line. Highway 9 crosses the tracks at a skewed angle. The path would have to cross the railway tracks at a right angle and special treatment would be required across the tracks to ensure safe crossing of trail users and that no ridge buildup should occur next to the tracks. Thus the path would not be located alongside Highway 9 at this location, but at an offset from the edge of the pavement to accommodate the right angle crossing. The crossing should be at least as wide as the path approaches.

Proper road signs and striping would be provided at all crossings, in accordance with the *Manual on Uniform Traffic Control Devices (MUTCD),* FHWA November 3003 Chapter 9 and the *MUTCD 2003 California Supplement,* Caltrans, May 20, 2004, Chapter 8. The MUTCD indicates the appropriate regulatory signs, guidance signs, warning signs and markings, as well as location for placement of these signs at the railroad crossing.

Trail Signage and Striping. The trail would consist of Class I, II and III bike and pedestrian facilities and would also include the provision of pedestrian-only sidewalks or paths in some sections along Highway 9 and Graham Hill Road and along the alternative alignments. To ensure safety of trail users and continuous operations along the trail, appropriate road traffic signs and road markings would be required along the trail. Special details will be needed where transitions occurs between Class I, II and III facilities, and where trail users would be required to cross streets. Especially where there is mixed use it is important to use center stripes, pavement markings and signage to separate the direction of bike travel. Crossings at roads, railroads, and major driveways also require special design consideration and markings. This standard and special traffic control signage should including speed limits for bikes when on the same trail as pedestrians. In addition, there should be unique and consistent signage that identifies the route, and gives directions to users. This is especially important given the orientation of the San Lorenzo Valley region to tourism, and the potential for popularity of the trail with tourists.

Road traffic signs and striping would be provided according to the *Manual on Uniform Traffic Control Devices (MUTCD),* FHWA November 3003 Chapter 9 and the *MUTCD 2003 California Supplement,* Caltrans, May 20, 2004, Chapter 8. The MUTCD indicates the appropriate regulatory signs, guidance signs, warning signs and markings, as well as location for placement of these signs. Caltrans and other agencies and organizations provide standards and guidelines for striping, signing, and marking bicycle and pedestrian facilities.

Structures and Materials. High quality, suitability to the setting, and consistency in design appearance are desirable attributes for retaining walls, bridges, railings, and fences used for the trail. Caltrans has its own specific design details for most structures within its right-of-way, but there is always room for creativity in terms of colors, textures and materials. Aesthetics of the trail are of primary importance, especially in village core areas, where special materials and features may be justified, such as colored concrete or special pavers.

Street Furniture and Fixtures. Existing portions of the trail route feature bus shelters, benches, bike racks, trash receptacles, light fixtures and other amenities for trail users. The trail should include these amenities where they are not already provided, especially in urban or activity centers. Except where this would conflict with standards in a Town Plan or other specific document, there should be a consistent design theme and standard for the type and location of these fixtures.

Private Improvements and Landscaping. The concepts and cost estimates in this study presume that there would be sensitive treatment of existing privately built or maintained features such as trees, landscaping, fencing, and walls located in the highway or county road right-of-way so there is a minimum of disturbance, and/or features are carefully modified or replaced in-kind. Treatments for driveways where the road is widened and/or a path is constructed require careful attention so that both the trail and the driveway are fully functional and meet access standards. In the village cores, allowances for landscaping are provided in the cost estimates and design concepts to allow for a consistent design theme that unifies and beautifies the trail route.

Tree and Vegetation Removal and Replacement. The cost estimates include per-mile factors for removal of trees that are conservatively high in number and cost. However the trail design concepts are intended to minimize the need to remove trees while providing a functional trail. The cost estimates do not necessarily represent the number of trees that actually would need to be removed. Replacement trees and native vegetation should be carefully selected to be consistent with the original habitat and to match or exceed what was removed.

Environmental Compliance. Allowances for general environmental process and mitigations and mitigations in the form of private improvement modifications and replacements are built into the cost estimates, as are erosion control Storm Water Pollution Prevention Program (SWPPP).

Trail Information and Maps. Clear maps of the trail should be available to the public and to visitors, including posted maps at major trailheads and destinations, printed maps, and availability on web sites that would be sources of transportation and tourism information.

Trail Maintenance. The cost and responsibilities for ongoing operation and maintenance of the trail are major considerations for determining feasibility and for future planning. Generally pedestrian and bike facilities in the Caltrans right-of-way would be Caltrans' responsibility to maintain. The County would be responsible for facilities in its own right-of-way, the State Department of Parks and Recreation would be responsible for portions on its land, if any, and private property owners would be responsible for portions on their property, which are limited to sidewalks in commercial areas in this study. However, as a special project, maintenance responsibilities for the trail might be subject to negotiation. Caltrans might not be willing to allow the facilities to be built in its right-of-way, or State Parks on its land, for example, unless the County or other entity took responsibility for maintenance.

Specific responsibilities and costs for trail maintenance can vary significantly depending on the type of facility, the setting, and who is doing the work. Cost for maintenance of wide shoulders or bike lanes would typically be borne by the agency with responsibility for road maintenance, and would reflect a relatively small incremental increase in the cost of road maintenance. The responsibility for maintenance of separate trails, sidewalks or paths is more negotiable and the costs and requirements more variable. Table 3.2 below is a "placeholder" example of tasks and cost per mile for a Class I multi-use trail, which in this example costs approximately $8,400 per mile annually. In addition to these routine and ongoing costs, there would be major costs for

resurfacing and major repairs and replacements, constituting on the order of half the original construction cost, plus inflation, approximately every 20 years.

Table 3.2: "Placeholder" Maintenance Cost Per Mile of Multi-Use Trail

	Task	Specification	Unit	Quantity	Unit Cost	Subtotal	Annual interval	Multiplier	Annual Cost
1	Administration and coordination	Maintenance Supervisor	Labor hours	4	$80	$320	Annually	1	$320
2	Routine maintenance, trash cleanup	Foot or ATV	Labor hours	2	$30	$60	Every 2 weeks	26	$1,560
3	Spray pre-emergent herbicides at trail edge	Backpack, ATV, or truck-mounted sprayer	Labor hours	8	$70	$560	2X per year	2	$1,120
4	Repair/replace signs, lights, fences and gates	Includes materials	Allowance	Lump Sum		$500	Annually	1	$500
6	Thin brush and limb trees	8' clearance vertical, 3' horizontal from trail	Labor hours	16	$30	$480	Bi-Annually	0.5	$240
7	Maintain trail surface and minor work on banks, walls culverts	Hand work, seal cracks on pavement	Labor hours	72	$30	$2,160	Bi-Annually	0.5	$1,080
8	Repair/replace barrier and retaining walls	Contracts based on damage by vehicles, natural conditions	Allowance	Lump Sum		$50,000	Over 20 years	0.05	$2,500
9	Misc. materials and supplies		Allowance	Lump Sum		$200	Annually	1	$200
							Subtotal Annual Cost		$7,520
							Contingency: 20%		$1,504
							Total Annual Cost		**$9,024**

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