Basis of Design Report for Trail Width

Humboldt Bay Trail: Eureka-to-Arcata Segment

	PREPARED BY
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1 INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to document the design basis for the trail width of the Humboldt Bay Trail segment located between the cities of Eureka and Arcata, around the east side of Humboldt Bay, along the U.S. Highway 101 and North Coast Railroad Authority (NCRA) railroad transportation corridor. This report is intended to provide supporting technical information for applications for coastal development permits from the California Coastal Commission.

1.2 Overview of Humboldt Bay Trail

The Humboldt Bay Trail is envisioned as a network of trails (shared-use paths) providing non-motorized access for transportation and recreational use throughout the Humboldt Bay region. The Humboldt Bay Trail will connect communities with multi-modal transportation facilities and connect people to the bay by enabling people of all ages and abilities to access and experience the bay's resources directly. In addition to serving the region's transportation needs, the Humboldt Bay Trail will achieve a critical link in the California Coastal Trail and enable a significant expansion of resource-dependent use around the bay.

The Humboldt Bay Trail is being developed as a collaborative effort between the Humboldt County Association of Governments (HCAOG), Humboldt County, City of Arcata, City of Eureka, California Department of Transportation (Caltrans), California State Coastal Conservancy, NCRA, Redwood Community Action Agency (RCAA), and other community groups. The current focus is to develop a continuous trail from central Arcata to the southern end of Eureka for a total length of nearly 13 miles. Planning for the near-term phases of the Humboldt Bay Trail has been subdivided into four project areas:

1. Arcata City Trail (led by City of Arcata) – 1.3-mile bike path from Foster Avenue to Samoa Boulevard (Highway 255). This project was constructed in 2015.

2. Humboldt Bay Trail North (led by City of Arcata) – 3.0-mile bike path from Samoa Boulevard (Highway 255) along the Highway 101/railroad corridor to a terminus located north of Bracut Industrial Center. Construction is scheduled to begin in 2017.

3. Humboldt Bay Trail South (led by County of Humboldt) – 4.0-mile bike path from the southern terminus of the Bay Trail North project south along the Highway 101/railroad corridor to the west side of Eureka Slough, connecting to the Eureka Waterfront Trail. The construction start-date for this project (currently unfunded) is projected to be 2020.

4. Eureka Waterfront Trail Phases A/B/C (led by City of Eureka) – A set of three projects totaling 3.7 miles to fill gaps between existing segments of the Waterfront Trail. Construction is scheduled to begin in 2016.

1.3 Eureka-to-Arcata Segment

The Humboldt Bay Trail between Eureka and Arcata is a proposed Class I bike path aligned generally parallel to U.S. Highway 101 and the NCRA railroad, with potential alternative alignments at two locations near private property (Bracut and Brainard). In addition to bicycle use, the trail will provide transportation, recreation, and coastal access opportunities for

pedestrians and other non-motorized users. One of the major goals of the Humboldt Bay Trail is to maximize the number and variety of user groups who will benefit from it.

2 PROJECT INFORMATION

2.1 Design Approach

The Humboldt Bay Trail projects currently in progress involve segments of paved trails that will function as non-motorized transportation facilities complementing the roadway network. Planning and design processes for trails of this type are similar to the processes for road infrastructure. The lead agencies have taken a context-based approach for trail design consistent with the following:

- Caltrans Highway Design Manual (Chapter 80 - Application of Design Standards)
- Caltrans Director's Policy on Context Sensitive Solutions (DP-22)
- American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities

According to the Highway Design Manual (page 80-1), "the context of a highway is a critical factor when developing the purpose and need statement for a project in addition to making fundamental design decisions such as its typical cross section…. Designers need to be aware of and sensitive to land use, community context and the associated user needs of the facility…." This approach is intended to minimize impacts on scenic, historic, archaeological, environmental, and other important resources and support the livability of the community while meeting transportation needs.

The Caltrans Context Sensitive Solutions policy (page 1) encourages "innovative and inclusive approaches that integrate and balance community, aesthetic, historic, and environmental values with transportation safety, maintenance, and performance goals." Flexibility in applying design standards is allowed but must be supported using sound engineering judgment.

According to the AASHTO bicycle facilities guide (page 2-14), "A core value of context sensitive solutions is to provide an effective facility for both the user and the surrounding community and a project built in harmony with adjacent land use, preserving important environmental, historic, and aesthetic features of the area…. Context sensitive designs should address the needs of bicyclists…." Factors to be considered include facility function, traffic volume, speed, traffic mix, expected users, conditions of adjacent and intersecting facilities, topography, sensitive resources, adjacent land uses, and cost.

This context-sensitive approach is consistent with the 2007 Humboldt Bay Trail Feasibility Study: Eureka to Arcata (Alta Planning + Design, *et al*), which states (page 8):

> "Identifying the needs of trail users is critical to providing appropriate trail alignments and design features that respond to the surrounding community and anticipates uses of the trail. It is important to understand who will be using the trail, how they will use it, and what types of amenities will be most effective in making this trail an asset to the surrounding community. The trail's design will need to respond directly to the needs of the trail users and managers."

2.2 Context

The Eureka-to-Arcata segment of the Humboldt Bay Trail is situated within the seven-mile linear transportation corridor connecting the two largest urban areas in Humboldt County. According to the 2010 census, the greater Eureka area has a population of 45,034 and Arcata area has a population of 17,231 (the total population of the adjacent urban areas is 62,265). The Eureka-to-Arcata corridor is largely surrounded by open space including Humboldt Bay to the west and agricultural land to the east.

U.S. Highway 101 is a principal arterial and provides one of three routes around northern Humboldt Bay. Within the project area, Highway 101 is a four-lane expressway with two travel lanes in each direction (south-bound and north-bound) separated by a vegetated drainage ditch. The roadway includes 11- to 12-foot wide travel lanes and ten-foot wide shoulders. This segment of Highway 101 has the highest highway traffic volume within Humboldt County with an average annual daily traffic of 36,300 (2011 data). In 2002, this highway segment was designated the Eureka-Arcata Route 101 Safety Corridor as part of a program to reduce collision rates at the at-grade intersections. Caltrans and HCAOG are in the process of implementing the Eureka-Arcata Route 101 Corridor Improvement Project, with construction anticipated to begin in 2019 or 2020.

The railroad around Humboldt Bay is part of the Northwest Pacific Railroad line which has been owned and managed by NCRA since 1992. The track embankment was constructed starting in 1900 along the margin of the bay. Commercial railroad operations ceased in 1998 following severe storm damage on the line within the Eel River canyon. In 2012, a common vision was established for utilizing a rail-with-trail framework to develop trails within the railroad corridor (NCRA, 2012).

Bicyclists and pedestrians currently have very limited options for traveling between Eureka and Arcata. Although the shoulders of Highway 101 were recently widened by reducing travel lane width and colorized, many people are uncomfortable with traveling in close proximity to high volumes of traffic traveling at high speeds (the posted speed limit ranges from 50 to 65 miles per hour). Therefore, Highway 101 currently sees limited non-motorized use, except by experienced adult cyclists. The other two routes around the bay, Highway 255 and Myrtle Avenue/Old Arcata Road, have lower traffic volumes but comparable vehicle speeds and narrower shoulder widths.

As a transportation connection between Arcata and Eureka, this segment of the Humboldt Bay Trail will have high commuter use. The corridor has limited road and driveway crossings, so the trail will accommodate relatively long, undisrupted reaches where cyclists can reach high speeds.

Humboldt Bay is an exceptional natural feature of the region that provides significant cultural, scenic, and natural resources. Recreational use near Humboldt Bay is highly desirable, and access within the Eureka-to-Arcata corridor is currently limited. The Humboldt Bay Trail between Eureka and Arcata is intended to provide high-quality recreational experiences along the bay shoreline. The trail is expected to be heavily used for bird-watching, nature study, exercise, and enjoyment. The trail will also enable additional interpretive trails in the future.

The Bay Trail North and Bay Trail South projects are both situated within the Highway 101/railroad corridor between Arcata and Eureka and thus share a common context. The Arcata City Trail and Eureka Waterfront Trail are each situated within the urban areas of the respective cities and have their own unique contexts and user profiles. The trail widths of the in-city portions of the Humboldt Bay Trail network, along with other regional trails, are developed based on their specific contexts and should not be interpreted as implying a precedent or fixed standard for trails situated in different contexts.

2.3 Purpose and Need

A non-motorized trail between Eureka and Arcata has been identified as a community priority for over fifteen years in multiple surveys, workshops, meetings, and planning documents. When complete, the trail will link the two largest cities in Humboldt County and provide a major step toward regional trail connectivity in and around Humboldt Bay. The primary purposes of the Humboldt Bay Trail are to provide a balanced, "complete street" transportation network and enhance public access to Humboldt Bay. The trail is needed because Highway 101 between Eureka and Arcata is an incomplete transportation facility that was designed primarily to support motorized vehicles. The Humboldt Bay Trail has been a longstanding priority of HCAOG and its member agencies. The total cost for the Eureka-to-Arcata segment is expected to exceed $20 million, with the majority of the funding coming from state and federal transportation funds. A continuous trail will have many complementary benefits, including:

- Improved safety (through separation of motorized and non-motorized travelers)
- Economic development (by supporting transportation mobility and regional tourism)
- Congestion relief
- Enhanced quality of life
- Community connectivity
- Reduced vehicle miles traveled, fuel consumption, and emissions
- Partial rehabilitation of the railroad prism

2.4 Plans and Studies

Humboldt Bay Trails Feasibility Study

This 2001 planning level study discussed the unique context of Humboldt Bay and evaluated opportunities to improve non-motorized access by expanding or creating trails around the entire bay. RCAA (2001) identified the Humboldt Bay segment of the California Coastal Trail as the backbone of a regional trail system that provides coastal access to the bay. The concept of a trail project between Arcata and Eureka separate from the Highway 101 corridor was identified as the highest priority project in the region because it would connect the two largest cities in the county, provide recreational access to the bay, and enable the broad use of bicycles as a mode of transportation on a heavily traveled highway segment. RCAA (2001) recommended "pathway design that facilitates access by multiple users (including pedestrians and runners, stroller-joggers, and in-line skaters) with an emphasis on serving bicycle traffic – a 10-14' wide paved surface with marked lanes and occasional 'pull-outs' is recommended to serve all users and remain functional for cyclists" (Page III-51).

Humboldt Bay Trail Feasibility Study: Eureka to Arcata

In 2006, local agencies and stakeholders initiated a cooperative planning process to perform a more detailed analysis of the feasibility of developing a Class I bikeway/multi-use trail between Arcata and Eureka. The highway/railroad corridor was divided into twelve segments based on topography and other features, and five options (four trail options and a no-project option) were developed and evaluated. The report (Alta Planning + Design *et al*, 2007) presented information regarding design concepts, opportunities and constraints, environmental impacts, magnitude of costs, projected benefits, and implementation recommendations. The minimum tread width was identified as eight feet, with an attempt to be 10 feet wherever possible (Page 17).

Humboldt County Coastal Trail Implementation Strategy

In 2009, RCAA initiated a coordinated planning effort with funding from the Coastal Conservancy to develop an implementation strategy for completing the California Coastal Trail within Humboldt County. The final report (RCAA *et al*, 2011) included alignment evaluation

and prioritization and trail demand projections for the approximately 158-mile-long segment within Humboldt County. Trail alignments were evaluated based on the goals of providing a scenic experience; maximum access for a variety of non-motorized uses; connectivity to destinations and amenities along the coast and local communities; separation from motorized traffic; minimum impacts to natural habitats and cultural and archeological resources; and respect for private property. For the segment between Arcata and Eureka, the report recommended a bike path with soft surface shoulders along the rail corridor around Humboldt Bay. The recommended design standard was a hard surface path of 12 feet where possible, 10 feet in constrained areas, along with four-feet natural surface shoulders (Page 44).

Initial Study and Mitigated Negative Declaration for Arcata Rail with Trail Connectivity Project
In 2011 the City of Arcata prepared an environmental document for the Arcata City Trail and Bay Trail North projects for compliance with the California Environmental Quality Act (CEQA). The proposed project analyzed in the CEQA document had a paved trail tread of ten feet with two two-foot unpaved shoulders (Appendix I – Design Plan Set).

Project Study Report and Initial Engineering Study for Humboldt Bay Trail South
Humboldt County prepared a Project Study Report (March 18, 2014) for the Humboldt Bay Trail South project to support the County's request for funding from the California Transportation Commission to perform technical studies, engineering design, and permitting. The Project Study Report identified the proposed project as a trail with a 10-foot-wide pave surface and two-foot-wide softer shoulders on each side (page 12). Following that report, Humboldt County retained GHD, Inc. to prepare an Initial Engineering Study (August 2014). The standard (non-bridge) cross-section in the Initial Engineering Study included a paved trail width of ten to twelve feet.

Other Plans
The Humboldt Bay Trail has been addressed in several other local plans (Humboldt Bay Harbor, Recreation and Conservation District, 2007; HCAOG, 2008; HCAOG, 2010a; HCAOG, 2010b; HCAOG, 2012; NCRA, 2012; HCAOG, 2013).

2.5 Nexus with Coastal Commission Consistency Determination for Corridor Improvement Project

A concurrent project within the study area is the Route 101 Eureka-Arcata Corridor Improvement Project which is being implemented by Caltrans and HCAOG. The Corridor Improvement Project addresses six at-grade crossings on Highway 101 situated between the Eureka Slough Bridge and the Route 101/255 separation in Arcata. The Humboldt Bay Trail is formally linked to Highway 101 and the Corridor Improvement Project through conditions established by the California Coastal Commission. The Revised Findings of Consistency Certification (Coastal Commission, 2013) includes Condition 1 (Coastal Trail Planning), which specifies:

> "Construction of the Route 101 Corridor Improvements will not commence until adequate commitments are in place to assure that a separate Class 1 bike and pedestrian trail, parallel to Route 101 from Arcata to the northern end of downtown Eureka, will be constructed and operational by the time the major project components are completed" (Page 7).

2.6 Trail User Profile

The Humboldt Bay Trail will serve as a transportation corridor between two large urban areas and as a major regional destination for recreation and outdoor activities. The trail will be used by a wide range of users for a variety of trip purposes using a variety of mobility modes. Trail users will range in ages, experience levels, and abilities. Trip purposes will include commuting (to

work, school, social events, commerce) and recreation (exercise, enjoyment, nature study). Modes of mobility will include bicycles (upright, recumbent, three-wheeled), wheelchairs, skates, scooters, and on foot. Pedestrians will include people with baby strollers and people walking dogs. The trail will be used by individuals as well as groups (e.g., up to 10 to 20 people). In addition, vehicles will need to access the trail periodically for maintenance, law enforcement, and emergency response.

Different trail users have different needs and preferences. Experienced users typically travel for longer distances and durations and at higher speeds (up to 20 to 25 miles per hour). Experienced users typically desire a continuous trip at a steady rate with few conflicts and will make passing movements around slower users. Novice and casual users will travel for shorter distances and durations with slower speeds and more frequent stoppages. Bicycle commuters may ride before dawn and after sunset, especially during the winter.

As a relatively long segment of trail separated from a roadway, the Humboldt Bay Trail will become a popular destination for children learning to ride bicycles, as well as seniors. Children are generally slower in recognizing and responding to rapidly changing situations and less able to accurately judge the speed and distance of approaching cyclists. Children are also generally less familiar with "rules of the road" and conventions for trail use (e.g., slower users staying to the right). Children are more likely to travel on an irregular course with frequent starts and stops. Seniors are another special type of user, who may ride at a slower pace and have longer reaction times when responding to sudden movements or objects in their path (AASHTO, 2012). Stoppages for resting will be common.

The Humboldt Bay Trail is expected to be a popular destination for walking, running, wildlife viewing, and other forms of nature study. Pedestrians slowing or stopping for birdwatching and similar activities will be common.

2.7 Trail Use Estimates

Overview

Existing conditions along the Highway 101 corridor between Eureka and Arcata are a significant deterrent for non-motorized travel. A large number of people don't ride bicycles on the corridor due to the perceived dangers of traveling on the shoulder of a major highway. Surveys, letters, and oral testimony over many years provide evidence of high latent demand.

Annual Use

The 2011 Humboldt County Coastal Trail Implementation Strategy report (RCAA *et al*, 2011) provided quantitative estimates for annual trail use of proposed trail segments by analyzing local and tourist demand (Appendix N). Local demand was forecasted using Alta Planning + Design's Seamless Travel Model, which was calibrated using data collected in San Diego. The model applies a predictive formula based on demographic data (employment density, population density), presence of retail activity, and trail length. Tourist demand was estimated at the county level based on county visitor data and applying use factors from studies of other trails across the country. Results were adjusted for seasonal factors to develop annual estimates. Based on the analysis in this report, the estimated annual usage of the Humboldt Bay Trail between Eureka and Arcata is approximately 80,000 to 100,000 trips per year.

Peak Hourly Use

For design purposes, rates of trail use are desired on a daily or hourly basis. The Seamless Travel Model used by RCAA *et al* (2011) is likely adequate to estimate annual usage but is not

considered a robust predictive tool for daily or hourly usage (Dana Dickman, Alta Planning + Design, personal communication).

Development of quantitative methods to forecast bicycle and pedestrian travel is an emerging field of study. Quantitative methods require a high level of demographic data, user and household surveys, and statistical analysis (AASHTO, 2012). However, these methods still require many assumptions and have limited reliability due to (1) the many site-specific causal factors involved in the decision to use a trail, and (2) the wide range of spatial scales (existing models have primarily been developed at a city-wide scale in large urban settings).

Due to the lack of a good-fit quantitative model and the absence of adequate local survey data for calibration, the best approach for non-motorized travel demand analysis within the project area is to develop a qualitative estimate based on a comparison study with an existing facility.

The Humboldt Bay Trail will be a major "showcase" regional trail for Humboldt County, comparable to the Sacramento River Trail in Redding, the American River Trail in Sacramento, and the Bear Creek Greenway in Medford/Ashland (Jackson County, Oregon). Based on demographics and setting, use of the Humboldt Bay Trail between Eureka and Arcata is expected to substantially exceed the Hammond Trail located in McKinleyville; however the Hammond Trail provides a local example of a Class I bike path, and existing trail use data can be used as a reference point to support an estimate for the Humboldt Bay Trail.

According to the 2010 census, McKinleyville has a population of 15,177. The Hammond Trail is used for both commuting and recreation but likely has a higher percentage of recreational use compared to the proposed Humboldt Bay Trail. In 2011, RCAA organized volunteers to conduct counts of trail usage on two summer days over a period of 12 hours each day (RCAA, 2011). Results from this survey (reflecting total two-way volumes) are summarized on Table 1.

Table 1 – Trail Use Counts (Two-way) for the Hammond Trail, August 2011 (RCAA, 2011)

Location	Paved Trail Width (feet)	Wednesday, August 17		Saturday, August 20	
		Daily total	Peak hourly	Daily total	Peak hourly
Clam Beach near Strawberry Creek	8.0 – 8.5	89	16	97	16
Murray Road	10.0 – 10.5	285	42	364	53
Hiller Park	8.0 – 8.5	335	36	387	47
Hammond Bridge at Mad River	8.0	163	23	256	38

Estimates for peak hourly usage of the proposed Humboldt Bay Trail between Eureka and Arcata are provided in Table 2. Count data for current non-motorized use on Highway 101 are not available (Kevin Tucker, Caltrans, personal communication), therefore estimates for existing conditions (without trail) are based on personal observations. Estimates for future with-trail conditions are provided for the first year after construction (assumed to be 2020) and also for a 20-year planning horizon. Future with-trail estimates were developed using professional judgment by considering the similarities and differences between the contexts for the Hammond Trail and the proposed Humboldt Bay Trail, with adjustments for the different physical settings and community contexts. In particular:

- Population of areas served: the Humboldt Bay Trail will directly serve two urban areas with a total population almost four times larger than the area directly served by the Hammond Trail.
- Physical setting: The Humboldt Bay Trail will be longer and provide a more continuous corridor with less flow interruption.
- User profile: The Humboldt Bay Trail will see higher commuter use and will serve as a more popular recreation destination.

The estimates in Table 2 are intended to reflect an 85th percentile rate (i.e., 85% of days will have peak hourly usage below, 15% of days will have peak hourly usage above). In other words, the peak hourly rate would be met or exceeded approximately 50 days per year.

Table 2 – Estimated Peak Hourly Non-Motorized User Trips for Eureka-to-Arcata Segment of Humboldt Bay Trail

Scenario	Commuting Bicyclists	Recreational Bicyclists	Pedestrians	Total (Two-way)	Total (One-way)
Existing without Trail	5-10	5-10	0-5	10-25	5-13
Future (2020) with Trail	50-60	50-60	30-40	130-160	65-80
Future (2040) with Trail	60-75	60-75	40-50	160-200	80-100

As a design basis, peak hourly trail use on the Humboldt Bay Trail between Eureka and Arcata is expected to be three to four times greater than the Hammond Trail.

3 DESIGN STANDARDS

3.1 Highway Design Manual (Caltrans, 2015)

Chapter 1000 of the Highway Design Manual contains planning and design criteria for "bikeways," defined as facilities provided primarily for bicycle travel (Streets and Highways Code Section 890.4). A Class I bike path provides a completely separated right of way for the exclusive use of bicycles and pedestrians with minimal crossflow by motorists. Chapter 1000 provides design criteria for geometrics, separations between bike paths and highways, drainage, and signing and delineation. Chapter 1000 establishes minimum safety design criteria which are to be applied by transportation professionals using engineering judgment in the development and operation of bikeways (Streets and Highways Code Section 891). Guidance for Class I bike paths relevant for this report includes the following:

- Section 1003.1 – Shared use of a Class I bike path by bicycles and pedestrians has the potential for conflicts; consideration of separate facilities for pedestrians may be beneficial to minimize conflicts.

- Section 1003.1(1) – Shoulders for bike paths and roads have similar functionality. "Experience has shown that paved paths less than 12 feet wide can break up along the edge as a result of loads from maintenance vehicles."

- Section 1003.1(1)(a) – "The minimum paved width of travel way for a two-way bike path shall be 8 feet, 10-foot preferred." This statement is qualified by the following: "Where heavy bicycle volumes are anticipated and/or significant pedestrian traffic is expected, the paved width of a two-way bike path should be greater than 10 feet, preferably 12 feet or more. Another important factor to consider in determining the appropriate width is that bicyclists will tend to ride side by side on bike paths, and bicyclists may need adequate passing clearance next to pedestrians and slower moving bicyclists."

- Section 1003.1(1)(b) – "A minimum 2-foot wide shoulder, composed of the same pavement material as the bike path or all weather surface material that is free of vegetation, shall be provided adjacent to the traveled way of the bike path when not on a structure. A shoulder width of 3 feet should be provided where feasible. A wider shoulder can reduce bicycle conflicts with pedestrians."

3.2 Guide for the Development of Bicycle Facilities (AASHTO, 2012)

AASHTO policies and standards are to be used in conjunction with the Highway Design Manual (HDM, Section 82.3). Guidance from AASHTO (2012) relevant for this report includes the following:

- Section 5.2.1 (Width and Clearance) – "The usable width and the horizontal clearance for a shared use path are primary design considerations. Figure 5-1 depicts the typical cross section of a shared use path. The appropriate paved width for a shared use path is dependent on the context, volume, and mix of users. The minimum paved width for a two-directional shared use path is 10 ft (3.0 m). Typically, widths range from 10 to 14 ft (3.0 to 4.3 m), with the wider values applicable to areas with high use and/or a wider variety of user groups.

  "In very rare circumstances, a reduced width of 8 ft (2.4 m) may be used where the following conditions prevail:

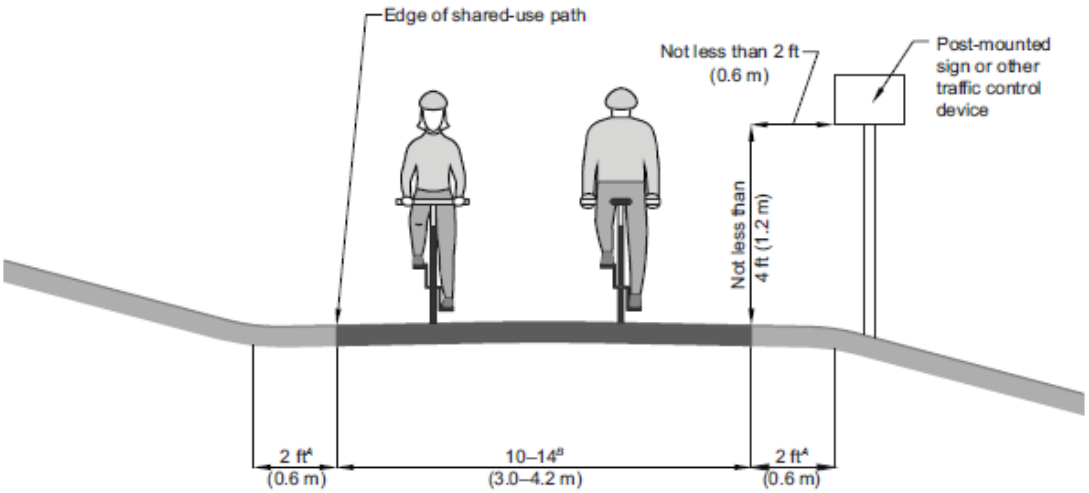
  - Bicycle traffic is expected to be low, even on peak days or during peak hours.
  - Pedestrian use of the facility is not expected to be more than occasional.
  - Horizontal and vertical alignments provide frequent, well-designed passing and resting opportunities.
  - The path will not be regularly subjected to maintenance vehicle loading conditions that would cause pavement edge damage.

  "In addition, a path width of 8 ft (2.4 m) may be used for a short distance due to a physical constraint such as an environmental feature, bridge abutment, utility structure, fence, and such. Warning signs that indicate the pathway narrows … should be considered at these locations.

  "A wider path is needed to provide an acceptable level of service on pathways that are frequently used by both pedestrians and wheeled users…. Wider pathways, 11 to 14 ft (3.4 to 4.2 m) are recommended in locations that are anticipated to serve a high percentage of pedestrians (30 percent or more of the total pathway volume) and high use volumes (more than 300 total users in the peak hour). Eleven foot (3.4 m) wide pathways are needed to enable a bicyclist to pass another path user going the same direction, at the same time a path user is approaching from the opposite direction (see Figure 5-2). Wider paths are also advisable in the following situations:

- Where there is significant use by inline skaters, adult tricycles, children, or other users that need more operating width;
- Where the path is used by larger maintenance vehicles;
- On steep grades to provide additional passing area; or
- Through curves to provide more operating space."

Typical Cross Sections of a Shared Use Path (AASHTO, 2012)



Notes:
[A] (1V:6H) Maximum slope (typ.)
[B] More if necessary to meet anticipated volumes and mix of users, per the *Shared Use Path Level of Service Calculator* (9)

Figure 5-1. Typical Cross Section of Two-Way, Shared Use Path on Independent Right-of-Way

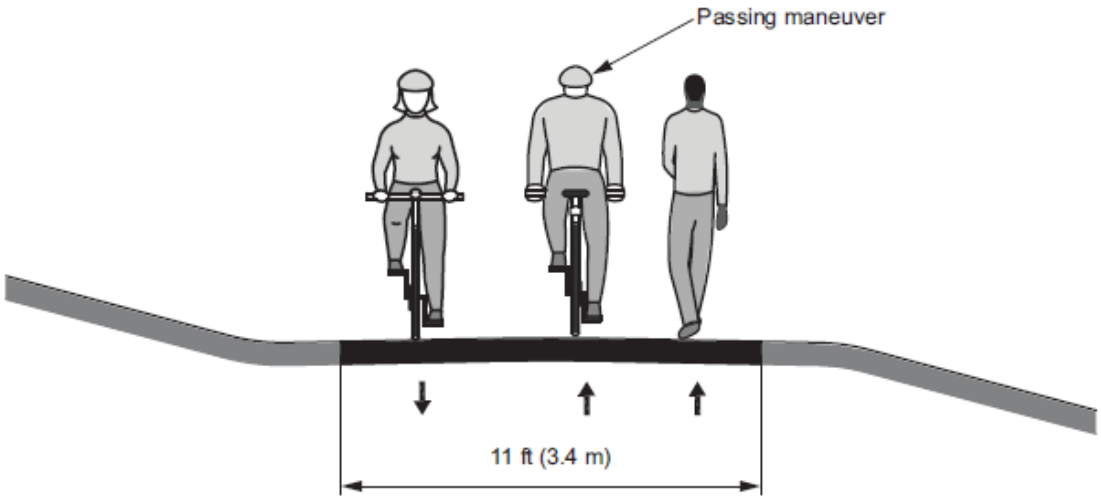


Figure 5-2. Minimum Width Needed to Facilitate Passing on a Shared Use Path

- Section 5.2.1 (Width and Clearance) – "Ideally, a graded shoulder area at least 3 to 5 ft (0.9 to 1.5 m) wide with a maximum cross-slope of 1V:6H, which should be recoverable in all weather conditions, should be maintained on each side of the pathway. At a minimum, a 2 ft (0.6 m) graded area with a maximum 1V:6H slope should be provided for clearance from lateral obstructions …."

3.3 Humboldt County Coastal Trail Implementation Strategy (RCAA *et al*, 2011)

RCAA *et al* (2011) noted that "The California Coastal Trail system through Humboldt County will require a number of trail types that respond to the context of each dynamic local landscape as well as a variety of trail users" (Page I-1). The report presents best practices for trail design guidelines for the multiple trail types needed to complete the network. For Class I bike paths, RCAA *et al* (2011) specified the following:

> "The anticipated range of users and forecast level of use by different user groups should dictate the design of each specific facility. Higher use, greater variety of use, and higher speed differentials all require greater width, increased separation of uses, and greater attention to regulation and education of bike path users. At a minimum, Class I bike paths require a minimum eight foot wide paved surface and a minimum of two foot wide clear, graded shoulders on both sides. This minimum standard is not appropriate for moderate to high-use segments accommodating mixed uses or high speed bicycle traffic. For moderate to high-use segments, a wider paved surface of ten to twelve feet (minimum) should be considered. In areas where a variety of users are expected, expanded unpaved shoulders should be included where possible. Where a path also doubles as an access route for maintenance or emergency vehicles, a minimum twelve foot wide path is recommended, as narrower paths tend to break up along the edges due to vehicle loads." (Page I-4).

3.4 Shared-Use Path Level of Service Calculator – A User's Guide (FHWA, 2006)

The Federal Highways Administration (FHWA) funded a study to assess the quality of service on 15 trails across the United States and develop an analytical tool to support the design of appropriate widths and cross sections for new trails. This study focused on measures for the quality of user experience on a trail and did not explicitly measure safety. FHWA (2006) determined that the quality of user experience on a trail is largely the result of being able to maintain an optimum speed and retaining freedom to maneuver. FHWA (2006) developed a model for trail Level of Service (LOS) that predicts the quality of user experience as a function of four variables: user volume, mode split, trail width, and presence of centerline. LOS categories are described in Table 3:

Table 3 –Trail Level of Service

Level of Service	Description from FHWA (2006)
A	**Excellent.** Trail has optimum conditions for individual bicyclists and retains ample space to absorb more users of all modes, while providing a high-quality user experience. Some newly built trails will provide grade-A service until they have been discovered or until their ridership builds up to projected levels.
B	**Good.** Trail has good bicycling conditions, and retains significant room to absorb more users, while maintaining an ability to provide a high-quality user experience.

C	**Fair.** Trail has at least minimum width to meet current demand and to provide basic service to bicyclists. A modest level of additional capacity is available for bicyclists and skaters; however more pedestrians, runners, or other slow-moving users will begin to diminish LOS for bicyclists.
D	**Poor.** Trail is nearing its functional capacity given its width, volume, and mode split. Peak-period travel speeds are likely to be reduced by levels of crowding. The addition of more users of any mode will result in significant service degradation. Some bicyclists and skaters are likely to adjust their experience expectations or to avoid peak-period use.
E	**Very Poor.** Given trail width, volume, and user mix, the trail has reached its functional capacity. Peak-period travel speeds are likely to be reduced by levels of crowding. The trail may enjoy strong community support because of its high usage rate; however, many bicyclists and skaters are likely to adjust their experience expectations, or to avoid peak-period use.
F	**Failing.** Trail significantly diminishes the experience for at least one, and most likely for all user groups. It does not effectively serve most bicyclists; significant user conflicts should be expected.

Grades A through C are generally considered acceptable levels of service, while Grades D through F can be considered degraded levels of service (FHWA, 2006).

Additional guidance from FHWA (2006) relevant for this report includes the following (all from Page 27):

- "Width is the key factor in determining LOS, and every additional foot of trail width has a positive impact on LOS."
- "Trails having 2.4-m (8.0-ft) width, which AASHTO recommends only in 'rare instances,' were found to have poor LOS, except at very low volumes or with user mixes that included few pedestrians and runners. The findings of this research support AASHTO's minimum 'recommended paved width for a two-directional shared-use path of [3.0 m] ten feet.'"
- "The study found that widths of 3.4-4.6 m (11.0-15.0 ft) provide improved LOS for higher volumes and more balanced user mixes than narrower widths. This is consistent with AASHTO recommendations that 'under certain conditions it may be necessary or desirable to increase the width of a shared-use path to 3.8 m (12.0 ft) or even to 4.3 m (14.0 ft), due to substantial use by bicycles, joggers, skaters and pedestrians….'"

Application of the LOS calculator for the Humboldt Bay Trail is discussed in Section 4.

4 RESULTS

4.1 Design Considerations

Overview

The Highway Design Manual and AASHTO (2012) provide standards that pertain to safety and operational effectiveness. The Humboldt Bay Trail must be designed to safely accommodate the expected volume and diversity of users, which includes a range of ages, experience levels, speeds, trip purposes, and mobility modes. The Humboldt Bay Trail is being designed to conform with the applicable standards to ensure that the trail meets the needs of the public and minimizes conflicts.

Safety

Trail width is a key design parameter for safety. A high rate of collisions or a perception of unsafe conditions will deter use and result in a failure to achieve the desired outcomes and benefits. Standards for trail width are intended to avoid or reduce the occurrence of collisions. The Humboldt Bay Trail will have a striped centerline delineating the opposite directions of travel, however in practice centerlines are fluid. With a range of speeds and a mix of bicycles and pedestrians, passing movements will be common. In addition, the presence of children, dogs, and people stopping to view wildlife will require cyclists to react to unexpected objects in their path. Users such as bicycle commuters will experience limited visibility during non-daylight hours. Shoulders are an essential feature of a trail surface by providing a recovery area if a trail user is forced to leave the path. Shoulders are also important for drainage and as a buffer from obstructions such as trees, signs, and fences.

Level of Service

Trail width is a key design parameter for operational effectiveness and the quality of the user experience. The calculator developed in FHWA (2006) was used to forecast the level of service for the Humboldt Bay Trail for trail widths ranging from 8.0 feet to 12.0 feet, using three scenarios for peak-hour one-way traffic volume: 65, 80, and 100. Each scenario assumed the same mode split (65% adult bicyclists, 5% child bicyclists, 20% pedestrians, 10% runners, 0% in-line skaters) with a centerline present. Results are provided in Attachment A and summarized on Table 4.

Table 4 – Forecasted Level of Service for Humboldt Bay Trail

Paved Trail Width (ft)	**Level of Service**		
	65 users/hr	80 users/hr	100 users/hr
12.0	B (Good)	B (Good)	B (Good)
11.0	B (Good)	B (Good)	C (Fair)
10.0	C (Fair)	C (Fair)	D (Poor)
9.0	C (Fair)	D (Poor)	D (Poor)
8.0	D (Poor)	D (Poor)	D (Poor)

A 12-foot trail would provide “Good” level of service for each scenario. An 8-foot trail would provide “Poor” level of service for each scenario. A 9- or 10-foot trail would provide “Fair” level of service trending to “Poor” with higher use, and an 11-foot trail would provide “Good” level of service trending to “Fair” with higher use.

Sensitive Resources / Environmental Factors

The majority of the trail between Eureka and Arcata will be constructed by widening the inboard side of the railroad fill prism. Widening the railroad prism will encroach on the drainage ditch situated between the railroad and highway. The drainage ditch has wetland characteristics and, although degraded, is considered by definition an Environmentally Sensitive Habitat Area (ESHA). One of the design goals for the Humboldt Bay Trail is to avoid and/or minimize impacts of ESHA and other natural resources to the extent feasible, while achieving the purpose and satisfying the need for the project. Alternative alignments that would avoid encroaching into the ditch have been determined to be infeasible.

Coastal Commission Guidance
During discussion at the hearing on September 12, 2013, Commissioners emphasized the need for the trail to accommodate pedestrians as well as cyclists. Some of the Commissioners comments suggested that a separate pedestrian path adjacent to the paved bike path was desired.

4.2 Specification of Trail Width

Four alternatives for trail cross-section and trail width were identified for consideration, as shown on Table 5:

Table 5 – Alternatives for Trail Type and Width

Attribute	**Alternatives**				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cross-section	Paved bike path and adjacent, unpaved pedestrian path	Paved bike path that allows all forms of non-motorized use (no adjacent pedestrian path)			
Tread width (bike path)	12 feet	12 feet	10 feet	9 feet	8 feet
Tread width (pedestrian path)	5 feet	n/a	n/a	n/a	n/a
Shoulder width	3 feet	3 feet	2 feet	2 feet	2 feet
Assessment:					
Conformance with Standards	Conforms	Conforms	Conforms	Does not conform	Does not conform
Consistency with previous plans and studies	Consistent	Consistent	Consistent	Inconsistent	Inconsistent
Consistency with Commission direction at 2013 hearing	Consistent	Consistent	Consistent	Inconsistent	Inconsistent
Level of benefits	Highest	Second highest	Meets minimum goals	Does not meet benefit goals	Does not meet benefit goals
Selection:	Not selected due to constraints	Not selected due to constraints	SELECTED ALTERNATIVE	Not selected due to non-conformance with standards and inconsistency with purpose/need	Not selected due to non-conformance with standards and inconsistency with purpose/need

Discussion
Alternative 1 provides a 12-foot paved bike path with a separate, adjacent 5-foot unpaved pedestrian path on one side and a 3-foot unpaved shoulder on the other side. This alternative conforms to standards and is consistent with previous plans and studies as well as direction from the Coastal Commissioners at the September 2013 hearing. This alternative has the highest level of benefits, but is considered infeasible due to multiple constraints, which include: limited available right-of-way; need to maintain ditch drainage capacity; proximity to sensitive resources; cost; and need for compatibility with railroad, highway, and private property.

Alternative 2 provides a 12-foot paved bike path with 3-foot unpaved shoulders. This alternative conforms to standards and meets all the consistency goals. This alternative would provide a level of service grade of "Good" for the 20-year planning horizon and would provide the various benefits discussed in Section 3. This alternative has the second highest level of benefits among the alternatives considered, but is considered infeasible due to the various constraints.

Alternative 3 provides a 10-foot paved bike path with 2-foot unpaved shoulders. Although providing fewer benefits than Alternatives 1 and 2, this alternative conforms with minimum safety and operational standards and is consistent with previous plans and studies as well as Coastal Commission direction from the September 2013 hearing. This alternative would provide an initial level of service grade of "Fair," transitioning to "Poor" at increasing levels of use.

Alternatives 4 and 5 provide a 9-foot and 8-foot paved bike path, respectively, with 2-foot unpaved shoulders. The Highway Design Manual and AASHTO (2012) provide allowances for a trail width less than 10 feet if certain conditions are met. The Highway Design Manual (Section 1003.1) specifies that selection of trail width must consider the volume of use, the presence of pedestrians along with bicyclists, and the need to accommodate passing movements. AASHTO (2012) provides a list (Section 5.2.1) of four conditions that must each be present to warrant a reduced width of 8 feet: low bicycle traffic, limited pedestrian use, frequent passing/resting opportunities, and infrequent use by maintenance vehicles. At least three of the four conditions cannot be met for the Humboldt Bay Trail; the third of these conditions (passing/resting opportunities) may be feasible. According to AASHTO (2012), 8-foot path widths are expected to be used for very short distances to accommodate significant constraints and should be posted with warning signs. Alternative 4 would provide an initial level of serve grade of "Fair" to "Poor," while Alternative 5 would provide an initial level of service grade of "Poor."

Alternatives 4 and 5 are deemed non-conforming with the Highway Design Manual and AASHTO (2012) and inconsistent with previous plans and studies. By not meeting the standards for adequately accommodating pedestrians as well as bicyclists, these alternatives are deemed inconsistent with Coastal Commission direction. Similarly, these alternatives would not meet the needs of the community and therefore would not fulfill the purpose of the project. Based on the discussion of standards in Section 3, a paved trail width of ten feet with two two-foot unpaved shoulders (Alternative 3) is considered the minimum acceptable alternative.

The City of Arcata analyzed the difference in wetland impacts between a 10-foot and 8-foot paved bike path (each with two 2-foot unpaved shoulders), corresponding to Alternatives 3 and 5, for the Bay Trail North project. Alternative 3 would encroach an additional two feet into the drainage ditch situated between the railroad and highway corridors. For the 3-mile Bay Trail North segment, Alternative 3 would have 0.15 acres more impacts compared to Alternative 5. Humboldt County has not performed this comparative analysis for the Bay Trail South project because the preliminary design has not been developed; however, the approximate differential impacts for Bay Trail South are likely to be similar in magnitude. Based on the limited encroachment into the ditch and the existing disturbed conditions of the ditch, the additional wetland impacts associated with Alternative 3 will not significantly disrupt the habitat values or degrade the ecological function of the ditch wetlands. All wetland impacts will be mitigated at the approved mitigation ratios.

4.3 Other Coastal Trails

Examples of trail projects located within the coastal zone include the following:

Project:	Morro Bay Harborwalk / Dune Restoration Project
Applicant:	City of Morro Bay
Permit No.:	3-05-071
Hearing date:	February 10, 2006
Project context:	Waterfront between highways and beach/dunes
Trail components:	8-foot boardwalk and 12-foot Class I bike path
Relevant information:	12-foot bike path was approved within ESHA.

Project:	Arana Gulch Master Plan
Applicant:	City of Santa Cruz
Permit No.:	3-11-074
Hearing date:	December 8, 2011
Project context:	68-acre open space area; Project area includes designated critical habitat for Santa Cruz tarplant (federally listed as threatened, state listed as endangered, CNPS List 1B)
Trail components:	8-foot trail
Relevant information:	Trail width was limited to 8 feet. Trail bisects the main meadow area which provides critical habitat for the federal- and state-listed plant.

Project:	Interstate-5 Improvements at San Elijo Lagoon
Applicant:	Caltrans and San Diego Association of Governments
Permit No.:	6-15-2092
Hearing date:	March 9, 2016
Project context:	Adjacent to Interstate-5
Trail components:	North Coast Bike Trail (3 miles of trail, 16-feet wide) and Manchester Avenue Trail
Relevant information:	Trail facilities have ESHA impacts.

5 REFERENCES

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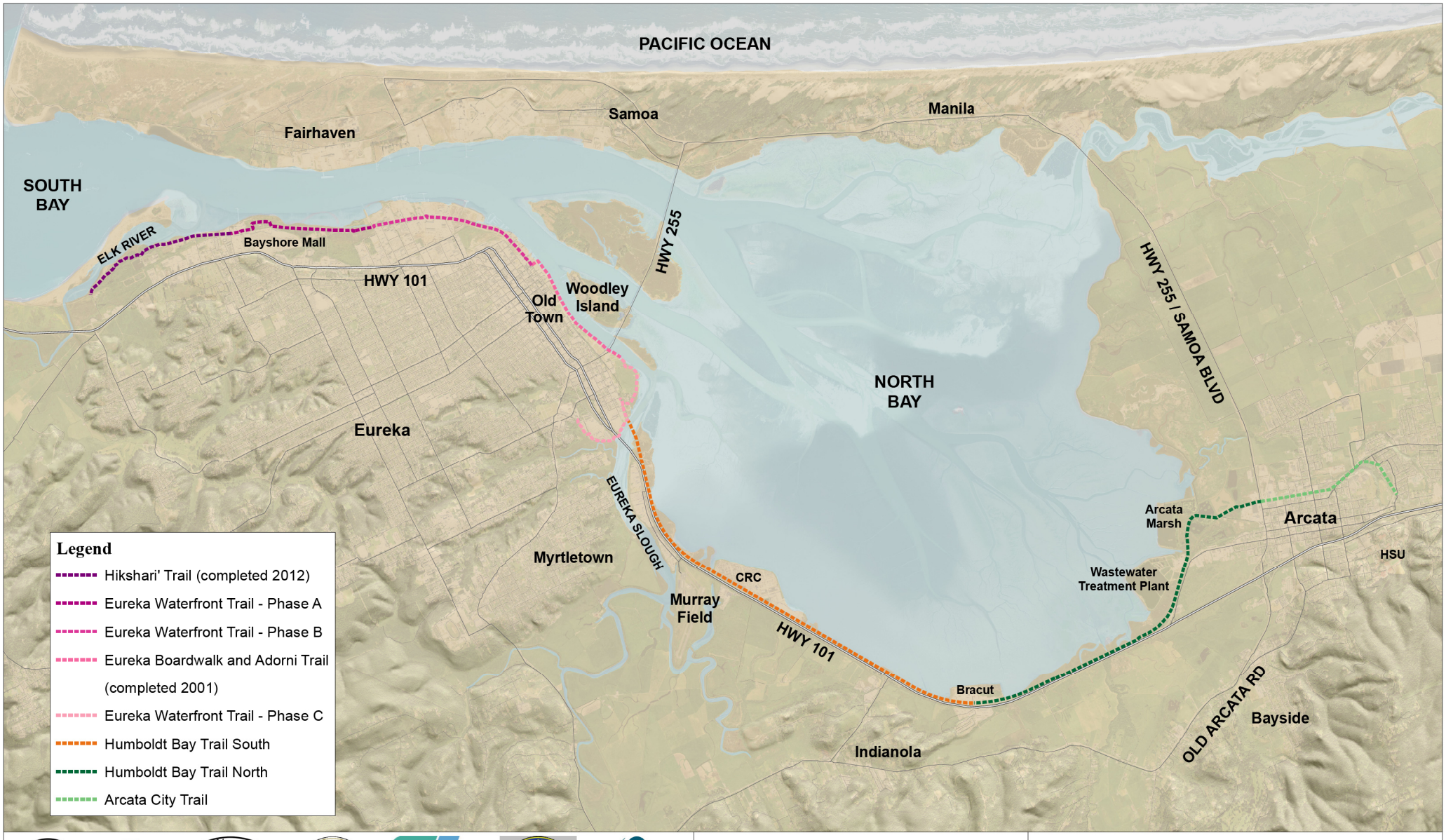

0 0.5 1 Miles

Date Prepared: September 26, 2014

Humboldt Bay Trail

Figure 1 - Site Map

Attachment A

Shared Use Path Flow Analysis Tool

Trail Level of Service (LOS) Calculator

Draft Spreadsheet Based on Federal Highway Administration Shared Use Path Study

North Carolina State University and Toole Design Group

Trail LOS Scale	
LOS Score	LOS Grade
X≥4.0	A
3.5≤X<4.0	B
3.0≤X<3.5	C
2.5≤X<3.0	D
2.0≤X<2.5	E
X<2.0	F

ROW #1

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 1	12.0	1	65.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.74	B	12.75%	6.21	0.05	0.05	3.69	3.69	B

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #2

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 2	11.0	1	65.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.62	B	12.75%	6.21	0.05	0.05	3.57	3.57	B

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #3

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 3	10.0	1	65.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.47	C	52.31%	25.49	0.21	0.21	3.26	3.26	C

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #4

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 4	9.0	1	65.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.30	C	52.31%	25.49	0.21	0.21	3.08	3.08	C

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #5

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 5	8.0	1	65.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.08	C	52.31%	25.49	0.21	0.21	2.86	2.86	D

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

MODEL ASSUMPTIONS

Trail volume represents the actual number of users counted in the field (the model adjusts this volume based on a peak hour factor of 0.85).

Bicyclists will pass all trail users that are traveling less than 12.8 miles per hour (average bicyclist speed)

Shared Use Path Flow Analysis Tool

Trail Level of Service (LOS) Calculator

Draft Spreadsheet Based on Federal Highway Administration Shared Use Path Study

North Carolina State University and Toole Design Group

Trail LOS Scale	
LOS Score	LOS Grade
X≥4.0	A
3.5≤X<4.0	B
3.0≤X<3.5	C
2.5≤X<3.0	D
2.0≤X<2.5	E
X<2.0	F

ROW #1

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 1	12.0	1	80.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.71	B	15.81%	9.48	0.08	0.08	3.63	3.63	B

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #2

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 2	11.0	1	80.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.59	B	15.81%	9.48	0.08	0.08	3.51	3.51	B

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #3

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 3	10.0	1	80.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.45	C	59.60%	35.75	0.30	0.30	3.15	3.15	C

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #4

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 4	9.0	1	80.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.27	C	59.60%	35.75	0.30	0.30	2.97	2.97	D

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #5

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 5	8.0	1	80.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.05	C	59.60%	35.75	0.30	0.30	2.75	2.75	D

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

MODEL ASSUMPTIONS

Trail volume represents the actual number of users counted in the field (the model adjusts this volume based on a peak hour factor of 0.85).

Bicyclists will pass all trail users that are traveling less than 12.8 miles per hour (average bicyclist speed)

Shared Use Path Flow Analysis Tool

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Draft Spreadsheet Based on Federal Highway Administration Shared Use Path Study

North Carolina State University and Toole Design Group

Trail LOS Scale	
LOS Score	LOS Grade
X≥4.0	A
3.5≤X<4.0	B
3.0≤X<3.5	C
2.5≤X<3.0	D
2.0≤X<2.5	E
X<2.0	F

ROW #1

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 1	12.0	1	100.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.68	B	19.89%	14.92	0.12	0.12	3.56	3.56	B

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #2

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 2	11.0	1	100.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.56	B	19.89%	14.92	0.12	0.12	3.44	3.44	C

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #3

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 3	10.0	1	100.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.42	C	67.53%	50.63	0.42	0.42	2.99	2.99	D

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #4

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 4	9.0	1	100.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.24	C	67.53%	50.63	0.42	0.42	2.82	2.82	D

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

ROW #5

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Prelim LOS Score	Trail Level of Service	
	Closest 0.5 ft.	0=No Centerline	*Volume*	*Mode Split (%)**								*Adj. Factor (subtract from User Percep. score)*						
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Prelim LOS Score	LOS Score	LOS Grade
Humboldt Bay Case 5	8.0	1	100.0	65.0%	20.0%	10.0%	0.0%	5.0%	100.0%	3.02	C	67.53%	50.63	0.42	0.42	2.60	2.60	D

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicylists.

Click Here for Default Mode Split

MODEL ASSUMPTIONS

Trail volume represents the actual number of users counted in the field (the model adjusts this volume based on a peak hour factor of 0.85).

Bicyclists will pass all trail users that are traveling less than 12.8 miles per hour (average bicyclist speed)