Analysis of Santa Cruz County Greenway Capacity and Usage

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Introduction

This paper examines the capacity of trails based on width and separation of bicycle and pedestrian groups. It also examines the difference in projected usage of the Santa Cruz County Greenway—built on a continuous, level, railroad corridor—versus a rail-with-trail option that detours onto local streets where there are constraints as shown in the Monterey Bay Sanctuary Scenic Trail Plan (2014).

Greenway Capacity Based on Width

Greenway (sometimes called a multi-use trail, or shared use path) capacity in terms of the maximum number of pedestrians (including runners, skateboarders) and bicyclists has been studied extensively.

The primary sources for this research are:

/1 Highway Capacity Manual (HCM), Transportation Research Board (TRB), 2010
/2 Seamless Travel Study, UC Berkeley Traffic Safety Center, Caltrans, 2008
/3 Shared Use Path Level of Service Calculator, Federal Highway Administration, 2006
/4 NCHRP 552 Guidelines for Analysis of Investments in Bicycle Facilities, Transportation Research Board, 2006

Any study of capacity must first acknowledge the subjective meaning of being 'at capacity.' In general, it refers to the maximum volume of users (or vehicles) that could be accommodated in free-flow conditions. Many factors contribute to the complexity of this subject, including the mix of users, width of facility, striping/delineation, travel speed, lateral clearance, sight distance, gradient, and horizontal curvature.

For the purposes of this analysis, all factors are assumed to be the same for each trail width scenario. This includes the mix of users (60% bicyclists, 40% pedestrians), centerline and shoulder striping, travel speeds, lateral clearance (minimum 2-foot clearance on both sides), sight distance and horizontal curvature (assume tangent, level section with no cross traffic).

The table below provides the maximum free flow capacities for each width scenario. Note that level-of-service (LOS) E is considered the maximum free flow capacity. LOS E is described as "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." /3

Table 1
Capacity Comparison by Greenway Width /3

Width	Type	LOS E Capacity (1 hour) /1/3
8’	Shared use	330
10’	Shared use	420
12’	Shared Use	650
15’	Shared Use	850
21’ (14’ bikes, 7’ pedestrians	Separated bicycle and pedestrian use	3,100 bikes, 644 pedestrians, 3,744 total

We can see from Table 1 that there is a **dramatic difference in the capacity of a trail based on its width and separation of slow and fast-moving traffic**. A 21’ Greenway which separates bikes and pedestrians has 11.3 times the capacity of an 8’ multiuse trail and 5.8 times the capacity of a 12’ multiuse trail.

Estimated Trail Usage: Impacts of Continuity

Two terms are used to estimate future activity on a trail: (a) usage, and (b) demand. Usage is the actual number of bicyclists, pedestrians, and others who end up using a facility. ‘Demand’ refers to the potential number of users who would use a facility if there were no constraints. The difference between demand and usage could include, for example, limited capacity of the facility or constrained access.

Usage of any specific trail is based on a number of factors, including:

1. Adjacent and nearby population base
2. Scenic quality of the trail
3. Width, length, gradient, quality of the trail
4. Length of trail
5. Consistency of experience
6. Connectivity and directness
7. Access to major destinations
8. Existing walk/bike levels in the community
9. Level of tourism
10. Comparable facilities nearby

Alta's trail forecasting model takes these and other factors into account, and is calibrated with actual trail counts from around the country through the National Bicycle and Pedestrian Documentation Project and other sources.

Alta's Trail Demand Model uses five criteria:

(a) Quality of completed pathway
(b) Area climate
(c) Population directly served by trail (+/- 5 miles)
(d) Population within region (20 miles)
(e) Annual tourists to area

The potential demand for a *continuous*, high quality Greenway in Santa Cruz County **from the western end of Santa Cruz to Aptos is 2,311,672 users per year**, according to the Alta Trail Demand Model. It is estimated that 54% of the Santa Cruz County Greenway users would be bicyclists (1,248,302) and 46% (1,063,369) would be pedestrians/runners (/2). Of these total trips, it is estimated that 996,329 (43% of the total) would be utilitarian or work related (/2). Economic and transportation benefits of the Greenway can be developed, based on these numbers.

The table below breaks the annual usage figure down to an estimated peak and average daily use based on the Seamless Travel Study.

Table 2
Breakdown of Projected Annual Bicycle Usage of Santa Cruz County Greenway Central Reach

Period	Figures
Annual Usage (all users)	2,311,672
Average Total Daily Use /1	6,333
Annual Usage (bicyclists) /2	1,248,302
Peak Month (July /3)	174,762
Peak day (Saturday /4)	34,952
Average Saturdays/Month /5	8,072
Peak Hour (11-12 noon) /6	888

/1 This number takes the annual usage and divides by 365 days. It does not represent any specific day, time period, or location.
/2 Seamless Travel Study, 54% Table 36, p. 73 (similar to Monterey Recreational Trail)
/3 Seamless Travel Study, 14% July, Table 34, p. 69
/4 Seamless Travel Study, 20% Saturday, Table 33, p. 69
/5 4.33

/6 Seamless Travel Study, 11% 10-11am, Table 30, p. 65. Note: actual peak usage is dependent on locational factors.

In order to verify the accuracy of these numbers, forecasts from a completely independent approach are compared in Table 3 below.

Table 3
Comparison of Alta Trail Demand Model and Other Projections: Central Reach/Bicycles Only

Period	Source	Figures
Average Saturday/July	Alta Trail Demand Model/Seamless Travel Study	8,072
Potential Daily Use	GSCTS Low Estimate Demand Model (NCHRP 552)	3,861
Potential Daily Use	GSCTS Mid-Point Estimate Demand Model (NCHRP 552)	15,770

As seen, the Alta Trail Demand Forecast falls in between the two forecasts based on the Great Santa Cruz Trail Study (GSCTS / NCHRP 552). The locational and temporal aspects of these projections likely account for the differences. In other words, if the count was taken at a peak location on a peak day (e.g. July 4th), the count figures would be closer to the highest projection.

Impacts of a Discontinuous Greenway

Greenways attract users specifically because they offer a place to walk or ride **away from traffic**. Greenways that are located on old railroad corridors also offer gentle gradients and (usually) direct connections between major activity areas. Greenways that bisect and are accessible by residential areas and connect to schools, shops, and commercial businesses attract utilitarian riders and commuters, and also serve as places of recreation and exercise. Greenways that traverse scenic areas, connect to major visitor destinations and are in a major tourism area will also be heavily used by this group. Greenways that are wide enough to handle demands will be used by a multitude of different user types, including runners, skateboarders, and others.

Trails that have numerous detours and disconnected sections, especially that involve the use of high traffic arterials, congested areas, and major grade changes, will cease to function as one greenway, but instead would act independently as separate trails. The vast majority of trail users will not use high traffic streets or negotiate circuitous routes including steep gradients. For example, the Greenway through Capitola using the railroad trestle would have virtually no grade change, while the proposed rail-with-trail detour through the village of Capitola would involve a grade change of over 200 feet—plus the use of congested and narrow

streets. Greenway users will use short (under half mile) connectors that are direct, well signed, and protected from traffic and busy intersections.

The impact of a discontinuous trail can be determined as follows:

1. Any segment of a trail 'corridor' that is located on-street, is not protected with bike lanes, has travel volumes over 10,000 ADT (average daily traffic), is over 0.5 mile, is not a relatively direct connection, and/or involves a gradient change of over 200 feet total, would be subtracted from the total usage figure. For example, if Segment B was an on-street connector that met the criteria above, its percentage of the total length would be used to reduce total annual usage.

2. Any remaining off-street trail segment that is under 3.8 miles in length (the average bicycle trip length), would have its bicycle usage reduced proportionally. Any segment under 1.0 miles would have its pedestrian usage proportionally reduced.

3. Any off-street trail segment that has insufficient width will also limit annual usage.

An example on the Santa Cruz rail corridor of the impact of a discontinuous facility is Segment 10, the 17th Avenue-Jade Street Park segment, which the Monterey Bay Sanctuary Scenic Trail FEIR describes as being 'narrow (approximately 30 feet wide) through this segment, posing a constraint to multi-use trail development. Existing surface streets, bike lanes and pedestrian sidewalks through this segment would serve as alternate access until design solutions are identified.' In other words, **while the Master Plan and FEIR show a continuous facility, the reality is that large segments (like Segment 10) would be on-street rather than off-street segments without moving the tracks—which would be very costly.**

With Segment 10 being on-street on Opal Cliff Drive, and then through the heart of Capitola on Stockton Ave. and Monterey Ave—both involving total gradient changes of 200+ feet and high traffic congestion—the concept of a 'greenway' is eliminated in this area. This also means that rather than one, continuous 7.57-mile greenway from the Santa Cruz Beach Boardwalk (San Lorenzo River) to Aptos (Segments 9, 10, 11), there are instead a 1.73-mile trail segment on the west end and a 4.14-mile trail segment on the east end. **This would result in an estimated 35% reduction in bicycle trips alone.**

The impact on potential usage of a discontinuous trail versus a continuous level greenway is shown below.

Table 4
Estimate of Impact to Usage with Discontinuous Corridor, Segments 9-10-11

Percent of total potential usage allocated to Segments 9-10-11 /1	75%
Segments 9-10-11 Annual Continuous Greenway Usage	1,733,754
Segments 9-10-11 Annual Discontinuous Trail Usage	1,126,940
Reduced potential trips	606,814

/1 Estimate based on connectivity to major destinations, adjacent land uses, level of visitors