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Seamless Travel:
Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type

(Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type)

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Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type

Abstract

This paper provides the data collection and research results for the Seamless Travel project. The Seamless Travel Project is a research project funded by Caltrans and managed by the University of California Safe Transportation Research & Education Center, with David Ragland, PhD., as the Principal Investigator and Michael Jones as the Project Manager. The project is funded by Caltrans Division of Innovation and Research and is being conducted by the Safe Transportation Research & Education Center of University of California Berkeley and Alta Planning + Design.

Measuring bicycle and pedestrian activity is a key element to achieving the goals of the California Blueprint for Bicycling and Walking (the Blueprint)[7]. Meeting these goals, which include a 50% increase in bicycling and walking and a 50% decrease in bicycle and pedestrian fatality rates by 2010, and increases in funding for both programs, will require a quantifiable and defensible base of knowledge. This research helps meet two of the Blueprint's major strategic objectives: (1) collecting data on volumes and facilities, and (2) determining the most cost-effective methods of estimating bicycle and pedestrian collision rates.

Understanding why people walk or ride bicycles, how the type and quality of facility influences these trips, and how adjacent land uses, density, access, roadway traffic volumes, and other items impact walking or bicycling, are all critical to meeting the goals of the Blueprint. Good baseline information on walking and bicycling is important to answer questions like that posed in the title of this research: are Class I bike paths so attractive to potential commuters that they should be given priority over Class II bike lanes, Class III bike routes, or other facilities?

Counts and surveys conducted throughout California since 2000 consistently show a substantially higher demand for and use of Class I bike paths than on-street facilities.[8] Is this due to inconsistent on-street systems, a lack of riding expertise by the public, perceived or real safety concerns, recreational versus commuter use, high roadway traffic volumes and speeds, and/or other factors?

[7] California Blueprint for Bicycling and Walking: Report to Legislature, California Department of Transportation, May 2002

[8] Alta Planning + Design, staff experience on 62 bicycle and pedestrian plans in California since 1990

This research is designed to (a) evaluate existing bicycle and pedestrian data sources and collection methods, (b) conduct comprehensive counts and surveys of bicyclists and pedestrians in a consistent manner using the National Bicycle & Pedestrian Documentation Project (NBPD) as a template [9], (c) conduct counts and surveys using San Diego County (with extensive historical count information) as a model community, (d) analyze how bicycle and pedestrian activity levels relate to facility quality and factors such as land use and demographics, (e) identify factors that are highly correlated with increased bicycling and walking, (e) provide methods for quantifying usage and demand that will enhance research on benefits and exposure, and (f) evaluate how the transit-linkage (bicycle and pedestrian connections to transit) can be improved.

This Report presents materials developed including a literature review, advisory committee meeting input, project objectives, data collection methodology, results from the data collection effort, analysis of correlations, trends, and patterns, conclusions on the accuracy and applicability of the data, and recommendations on increasing walking and bicycling in California.

[9] *National Bicycle and Pedestrian Documentation Project*, Jones, M., Buckland, L., Cheng, A., Transportation Research Board, Aug. 2005

FINAL REPORT

SEAMLESS TRAVEL:

Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type

PREPARED FOR

Task Order 6117

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EXECUTIVE SUMMARY

The National Bicycle & Pedestrian Documentation Project is the largest and longest combined count and survey effort in the United States focusing only on bicyclists and pedestrians. Using San Diego County as a case study to apply the National Bicycle & Pedestrian Documentation Project methodology, the Seamless Travel Project is one of the first initiatives of its type to develop an extensive database of count and survey data for use in analyzing and identifying factors that influence bicycling and walking. While the bicycle and walk modes are studied together, it is recognized that they are distinct from one another and they are always counted, surveyed, and analyzed separately. This Final Report provides a review of the methodology along with count and survey results, development of predictive models, model results, and information on how the count/survey results and models can be used by public agencies and transportation professionals.

Key findings include:

The Seamless Travel Project represents a significant advance in the non-motorized field of research. Current and past research efforts have been limited by the lack of adequate data to test and verify theories. The Seamless Travel Project is one of the largest studies of bicyclist and pedestrian behavior in the United States. It includes a large number of manual count locations (80), it is the first study to incorporate data from the National Bicycle & Pedestrian Documentation Project in comparing results from around the country, it is one of the first to use automatic count data collected over a 365-day period to adjust manual counts, and it is one of the first to incorporate extensive survey results with manual counts. This effort also adds to the small number of studies that have created predictive pedestrian and bicycle volume models from actual count data.

California should develop and implement a systematic bicyclist/pedestrian count and survey program. A systematic count and survey of bicyclists and pedestrians by Caltrans and local agencies is an important step meeting the goals of the California Blueprint for Bicycling and Walking (the Blueprint)[10], Complete Streets policies, and other goals. The Seamless Travel study provides specific materials (Training Manual and Powerpoint) for how to conduct manual and automatic machine counts, surveys, use of the data, and recommendations on how counts could be institutionalized and funded. In order to gather reliable data over time, it will be important to adopt consistent count and survey methods, such as those provided by the National Bicycle & Pedestrian Documentation Project.

Annual use should be the standard measurement for the bicycle and pedestrian modes. Given the day to day and seasonal variability at many locations, and the fact that determining peak hour capacity is not an overriding need, the use of annualized figures will allow a more accurate comparison between locations.

Methods and conclusions based on data from San Diego County and the National Bicycle & Pedestrian Documentation Project should be applicable to many community

[10] California Blueprint for Bicycling and Walking: Report to Legislature, California Department of Transportation, May 2002

types and locations. Compared to other modes where methods (such as the ITE Trip Generation Manual) and data collected from limited locations nationwide are accepted by all agencies, there is no existing similar acceptance for the bicycle/pedestrian field. The Seamless Travel project and National Bicycle & Pedestrian Documentation Project represent a significant accumulation of data, and the data and methods should be applicable to a broad range of communities nationwide. However, seasonal and other local variables do exist that require additional efforts, especially year long machine counts.

Where peak hour volumes are needed to evaluate capacity, the standard 'Design Period and Design Day' on Class I and multi-use pathways should be as follows:

Maximum design load:	11am-1pm, July, 4th
Weekday:	11am-1pm, Mid-July, Tuesday, Wednesday, or Thursday (non-holiday)
Weekend day:	11am-1pm, Mid-July, Saturday (non-holiday)

Class I and Multi use pathway capacity ranges between 15 and 270 persons per hour per foot of pathway width. Free flow conditions suitable for higher bicycle commuting speeds are represented at the lower end, while the maximum capacity range would require bicyclists to dismount or ride very slowly. Both ends of the range require adequate separation between directional flow, and preferably modes as well**.**

For planning purposes, the use of 120 persons per hour per foot of path width as the maximum capacity is recommended to maintain adequate flows. Centerline separation and supporting pathway management techniques (signing, enforcement etc) on any pathway with design day volumes over 10 persons per hour per foot of path width and pedestrian mode split over 20%, or over 15 persons per hour per foot of path width and under 20% pedestrian mode split are recommended. Design hour or day pedestrian volumes on sidewalks should conform with the Highway Capacity Manual pedestrian level of service methodology, which is also used to determine crosswalk capacities.

Bicycle and pedestrian volumes can be classified in ranges to facilitate mapping and analysis. The recommended classification range is as follows:

<u>Bicycle Volumes</u>	
Low	0-20 per hour
Moderate	21-60
High	over 61
<u>Pedestrian Volumes</u>	
Low	0-40 per hour
Moderate	41-100
High	Over 100

The perception of the walk and bicycle trip making as recreational or discretionary is unfounded. The walk and bicycle modes have significant (and often the same) percentages of work, school, or utilitarian trip making as household travel in general, and private vehicle trips (see **Table 1** and **Figure 1**). While funding for pedestrian and bicycle facilities is typically limited to 'transportation' functions only, funding for roadways, transit, and other systems make no such distinction. The result is a potential funding bias against non-motorized facilities, as well as a

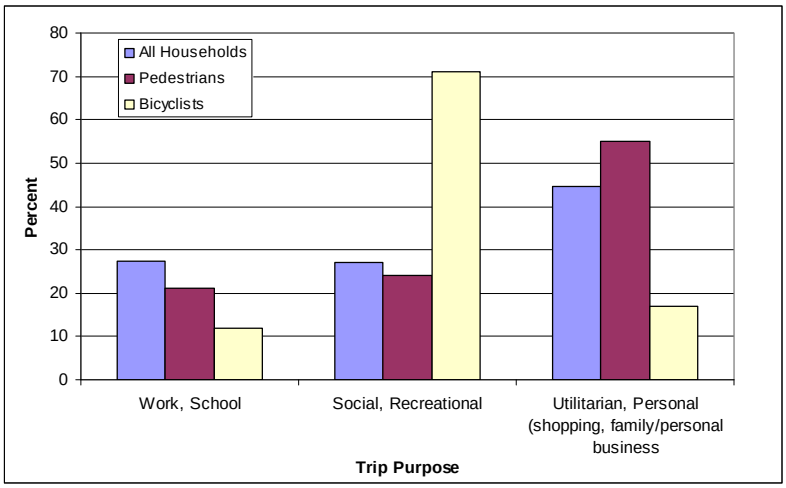
potential resistance to accommodate non-motorized modes in new projects despite adoption of Complete Streets and other similar policies.

Table 1: Comparison of Trip Purpose

	All Households (Percent)[1]	Pedestrians[2] (Percent)	Bicyclists[2] (Percent)
Work, School, Utilitarian	27.5	21	12
Social, Recreational	27.1	24	71
Utilitarian, Personal (shopping, family/personal business)	44.6	55	17

1. Bureau of Transportation Statistics, National Household Travel Survey, Fig 7, 2001
2. San Diego County survey results

Figure 1: Comparison of Trip Purpose



Class I bike paths and multi-use paths in general serve as important transportation facilities. The surveys of trip purpose combined with the year-long counts of four (4) bike paths in San Diego County show (see **Table 2**) these pathways alone are used by an estimated 691,969 bicyclists on work/school/utilitarian trips. This volume is 90% higher than the total estimated annual volumes of all on-street bicycle trips counted at 69 of the 80 manual count locations. It is likely that paths serve as important incubators for bicyclists learning or re-learning how to ride bicycles as a transportation vehicle for short trips.

Table 2: Comparison of Pathway and On-Street Bicycling by Trip Purpose

Location	Total Annual Use	Transportation Trips[1]
Bayside Path	513,558	133,525
Gilman Path/ Rose Canyon	164,638	42,805
Strand Path	148,109	38,508
Boardwalk	1,835,426	477,131
Subtotal	2,661,426	691,969
On-Street Locations[2]	1,401,837	364,477

1. Defined as school, work, utilitarian trips
2. 69 of the 80 count locations, normalized to annual counts

Bike lanes are not an indicator of bicycle use. Bicycle use on streets with bike lanes is similar as streets without bike lanes. This does not mean that bike lanes do not attract or serve bicyclists. Firstly, bike lanes have traditionally been installed where they are feasible rather than where the highest existing uses are located. Secondly, all things being equal, bicyclists will choose the best, most direct route with the best combination of topography, lane width, and traffic volumes speeds available.

Location Determines Data. The location of the five (5) automatic counters drives the pattern of data collected. Bicycle and pedestrian activity is affected by facility type (pathways, sidewalks), surrounding land use, weather, time of year, and many other factors. The data therefore provides a 'snapshot' of a limited range of possible activity patterns in San Diego County or in any community. However, this data along with other year round data from around the country starts to provide a picture of activity trends that can be used to frame parameters of activity.

Bicycle use in San Diego County based on historical counts back to 1987 has generally been stable, and is increasing in the past year. Various agencies in San Diego including SANDAG and Caltrans have conducted bicycle counts since 1985. Twelve (12) locations were consistently counted between 1985 and 2008 (13 years). Initially the figures indicated a steep decline in use at these 12 locations between 1985 and 1990. However, an in-depth analysis of the figures shows that almost all of the decline was due to one location (Site #16: College/Montezuma). This location is next to the LRT station near San Diego State University, which was completed during the count period, and may have impacted or changed bicycling patterns in the area. **Table 3** shows how, if this site is removed, volumes at the remaining 11 locations were stable from 1985-2007. In all cases, volumes in the most recent count (2008) have jumped between 40-85%. The last column on **Table 3** and **Figure 2** shows the average percent change of all 12 locations from 1985-2008, showing a consistent increase during this period except between 1990 and 1993.

Table 3: Historic Bicycle Counts San Diego County 1985-2008

Year	AM Counts[1]	Average %[2]	AM Counts	Average %[3]	Average % Change[4]
1985	1,022		414		
1987	913	-10	396	-4	+27
1990	659	-28	395	0	-2
1993	701	+6	440	+11	+12
1997	541	-33	410	-7	+12
2007	586	+8	386	-6	+12
2008	823	+40	713	+85	+30

1. AM Counts, weekdays 7am-9am, adjusted seasonally, 12 locations
2. Count locations increased from 12 in 1985 to 80 in 2008
3. AM Counts, weekdays 7am-9am, adjusted seasonally, 11 locations excluding College/Montezuma
4. Average % change of all 12 locations from year to year

Figure 2: Historic Counts

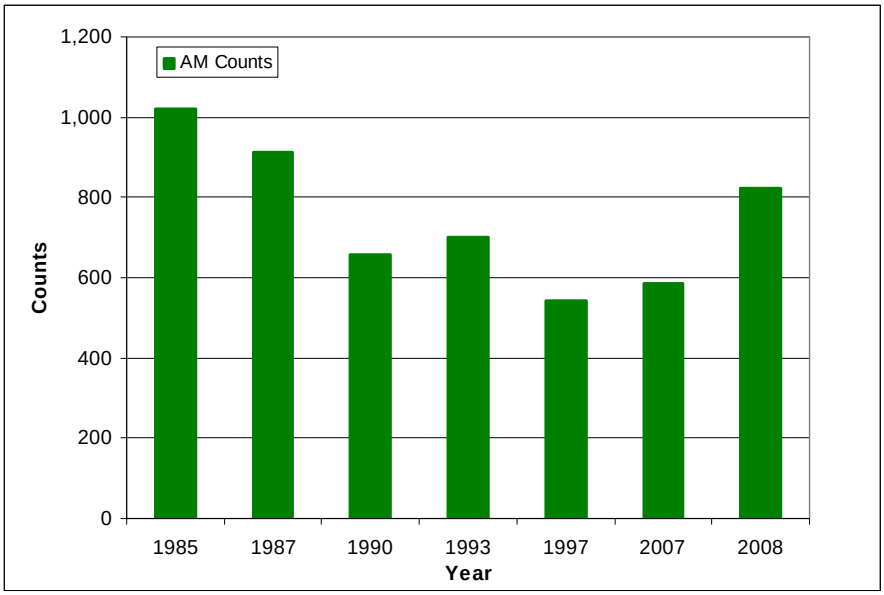
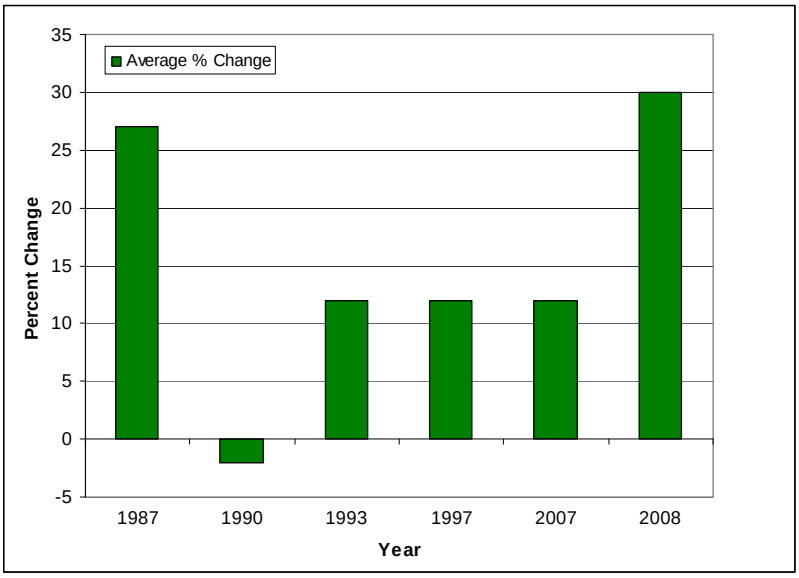


Figure 3: Historic Percent Change



Mode split on Class I and multi-use pathways is highly related to regional and local patterns, with bicycle mode splits ranging from 30% to 90% and pedestrian mode splits from 10% to 70%. Predictive models should be able to identify a general mode split based on adjacent demographics and land uses. Commuter paths located next to some kinds of land uses may require the development of alternative routes, special delineation and/or management to preserve the ability to be used by bicyclists for commuting.

Multi-use paths in San Diego County, such as the one above in Chula Vista, are mostly used by bicyclists

Class I and multi-use paths in San Diego County are used mostly by bicycles. While this varies by location and facility, bicyclists are the primary users of the pathways counted in San Diego County. Nationally, pedestrians outnumber bicyclists on pathways 75% to 20% on average. Mode split appears to be correlated with adjacent land uses, regional bicycling patterns, and quality of the bikeway network

Over the course of a year, there are no distinct daily peak periods for pedestrians and bicyclists. Unlike motor vehicle traffic patterns, there is no sharp commute pattern for either bicycle or pedestrian mode regardless of facility type. Activity is evenly spread throughout the day, with minor peaking patterns. This is likely due to the mix of recreational and utility/work/school trips, and also an indication of the low proportion of commute trips overall. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Actual day-to-day variability at many count locations may make forecasting difficult. Actual day to day variability is largely related to the volumes (higher volumes = less day to day variability) and trip types (recreational trips = higher variability). With many count locations having very low volumes, any predictive model will need to accept a relatively high margin of error. Also, validation counts would need to be conducted over a longer period of time during the same month of year, or, adjusted using local automatic count machine data.

The 6am – 9pm period accounts for a consistent 95% of the total volumes. Bicycle and pedestrian volumes gently taper off from about 6pm to 12 midnight. From 12 midnight to 6am there is very little activity. Focusing on the 6am to 9pm period will capture a consistent snapshot of the vast majority (95%) of activity. The exception may be count locations near large entertainment centers or districts.

Bicyclists and pedestrians have nearly an identical daily pattern of use on multi-use pathways. While bicyclists accounted for 55% of all users on the five (5) pathways, peaking patterns were proportional with pedestrian volumes. This indicates trip purpose on pathways, regardless of mode, is similar between bicyclists and pedestrians, and that the combined modes can be used to analyze patterns.

Pedestrian volumes on sidewalks in some areas are highly consistent and spread evenly throughout the day and evening, with little discernable peaking. The hourly pedestrian volumes on University Avenue in the Hillcrest neighborhood of San Diego (a higher density, older neighborhood with good transit service) was extremely even on both weekdays and weekdays, with virtually no change between about 10am and 12 midnight. This reflects the fact

a neighborhood with a mix of residential and commercial uses produces nearly constant and consistent walking volumes for most of the day. This will allow manual counts conducted during any time of the year to be adjusted to an annual total figure. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Peak periods on Class I and multi-use paths have a consistent annual peak period of 11am-1pm, with minor variations. This will allow manual counts conducted during any time of the year to be adjusted to an annual total figure. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Pedestrian volumes on sidewalks, while generally consistent, will have seasonal changes in peak periods depending on the adjacent land uses. Peak periods on sidewalks for pedestrians range from 1-3pm on weekdays in the Fall/Winter/Spring to 9-11pm in the Summer. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Given the consistency in peaking patterns on Class I bike paths and multi-use paths and sidewalks in the locations described, manual counts can be used to extrapolate annual data. This assumes the count location has a moderate to high volume, is not predominately recreational, and can be validated with counts conducted during the same period for at least two (2) days, or, validated with a local automatic count machine.

Bicycle and pedestrian count results can yield some unusual, unexpected results, reflecting highly localized conditions. For example, the second highest month of activity on the four (4) pathways was March, possibly due to the college and university break schedules. Other unexpected results could be caused by events such as marathons or races, construction, special events, pulses of patrons from nearby rail, transit or ferry operations, and sporting events.

Day of week volumes are consistent between modes and locations, both in San Diego County and nationally. Over the course of a year, bicycle and pedestrian volumes by day of week are nearly identical, with Saturday being the day with the highest activity, and weekends being higher than weekdays. This breakdown is very consistent with national counts.

Monthly volumes appear to be highly related to regional conditions, especially weather. The monthly pattern in San Diego County had both intuitive results (July with the highest volumes) and unusual results (March had the second highest with 12%). Compared to other locations in the country with more severe winters, use is relatively even over 12-months in San Diego County. The need for automatic counters in different regions is apparent in order to establish local monthly adjustment factors.

The correlation between actual counts and variables is complex. An analysis of over 30 variables with the 80 bicycle and pedestrian count locations shows that while there are some distinct patterns (especially with pedestrian volumes), most variables are highly correlated with each other (and therefore not helpful) and there are significant numbers of 'outliers' that cannot be easily explained.

Population density and transit ridership are not the strongest indicators of walking. Some variables commonly thought to be highly correlated to walking, such as population density and transit ridership, turned out to be only mild indicators and much less effective than others (such as employment density). If an agency's goal is to create neighborhoods or corridors with higher levels of walking, a mixture of employment and residential uses is critical.

A model with refinement factors is a useful forecasting tool. Using multiple regression modeling as a starting point, a refinement model with variables triggered by specific thresholds of volumes helps to improve the forecasting accuracy of the bicycle and pedestrian models. The models should be accurate enough with local adjustments (especially for monthly changes) to allow for estimates of use by location, exposure analysis, and other uses. These refinements can be modified and expanded as more data is collected over time.

Peak Periods and Hours

Finding #8: Over the course of a year, there are no distinct daily peak periods for pedestrians and bicyclists. Unlike motor vehicle traffic patterns, there is no sharp commute pattern for either bicycle or pedestrian mode regardless of facility type. Activity is evenly spread throughout the day, with minor peaking patterns. This is likely due to the mix of recreational and utility/work/school trips, and also an indication of the low proportion of commute trips overall. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Finding #9: Actual day-to-day variability at many count locations may make forecasting difficult at some locations. Actual day to day variability is largely related to the volumes (higher volumes = less day to day variability) and trip types (recreational trips = higher variability). With many count locations having very low volumes, any predictive model will need to accept a relatively high margin of error. Also, validation counts would need to be conducted over a longer period of time during the same month of year, or, adjusted using local automatic count machine data.

Finding #10: The 6am – 9pm period accounts for a consistent 95% of the total volumes. Bicycle and pedestrian volumes gently taper off from about 6pm to 12 midnight. From 12 midnight to 6am there is very little activity. Focusing on the 6am to 9pm period will capture a consistent snapshot of the vast majority (95%) of activity. The exception may be count locations near large entertainment centers or districts.

Finding #11: Bicyclists and pedestrians have nearly an identical use pattern on multi-use pathways. While bicyclists accounted for 55% of all users on the five (5) pathways, the peaking patterns were proportional with pedestrian volumes. This indicates that trip purpose on pathways, regardless of mode, is similar between bicyclists and pedestrians, and that the combined modes can be used to analyze patterns.

Finding #12: Pedestrian volumes on sidewalks in some areas are highly consistent and spread evenly throughout the day and evening, with little discernable peaking. The hourly pedestrian volumes on University Avenue in the Hillcrest neighborhood of San Diego (a higher density, older neighborhood with good transit service) was extremely even on both weekdays and weekdays, with virtually no change between about 10am and 12 midnight. This reflects the fact that walking in a neighborhood with a mix of residential and commercial uses produces nearly constant and consistent volumes for most of the day. This will allow manual counts conducted during any time of the year to be adjusted to an annual total figure. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Finding #13: Peak periods on multi-use paths have a consistent annual peak period of 11am-1pm, with minor variations. This will allow manual counts conducted during any time of the year to be adjusted to an annual total figure. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage.

This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Finding #14: Pedestrian volumes on sidewalks, while generally consistent, will have seasonal changes in peak periods depending on the adjacent land uses. Peak periods on sidewalks for pedestrians range from 1-3pm on weekdays in the Fall/Winter/Spring to 9-11pm in the Summer. This finding is true for locations with (a) connections to mixed land uses (residential, commercial, office), (b) recreational trips and destinations, and/or (c) visitor usage. This finding would not apply to locations such as large employment centers with little/no retail or restaurant uses, or near major transportation hubs.

Finding #15: Given the consistency in peaking patterns on pathways and sidewalks in the locations described, manual counts can be used to extrapolate annual data. This assumes the count location has a moderate to high volume, is not predominately recreational, and can be validated with counts conducted during the same period for at least two (2) days, or, validated with a local automatic count machine.

Finding #16: Bicycle and pedestrian count results can yield some unusual, unexpected results, reflecting highly localized conditions. For example, the second highest month of activity on the four (4) pathways was March, possibly due to the college and university break schedules. Other unexpected results could be caused by events such as marathons or races, construction, special events, pulses of patrons from nearby rail, transit or ferry operations, and sporting events.

Standard Measurements

Finding #17: Annual use should be the standard measurement for the bicycle and pedestrian modes. Given the day to day and seasonal variability at many locations, and the fact that determining peak hour capacity is not an overriding need, the use of annualized figures will allow a more accurate comparison between locations and areas.

Finding #18: Where peak hour volumes are needed to evaluate capacity, the standard 'Design Period and Design Day' on multi-use pathways should be as follows:

Maximum design load:	11am-1pm, July, 4th
Weekday:	11am-1pm, Mid-July, Tuesday, Wednesday, or Thursday (non-holiday)
Weekend day:	11am-1pm, Mid-July, Saturday (non-holiday)

Finding #19: Pathway capacity ranges between 15 and 270 persons per hour per foot of pathway width. Free flow conditions suitable for higher bicycle commuting speeds are represented at the lower end, while the maximum capacity range would require bicyclists to dismount or ride very slowly. Both ends of the range require adequate separation between directional flow, and preferably modes as well.

Finding #20: For planning purposes, we recommend the use of 120 persons per hour per foot of path width as the maximum capacity. We also recommend centerline separation and supporting pathway management techniques (signing, enforcement etc) on any pathway with design day volumes over 10 persons per hour per foot of path width and pedestrian mode split over 20%, or over 15 persons

per hour per foot of path width and under 20% pedestrian mode split. Design hour or day pedestrian volumes on sidewalks should conform with the Highway Capacity Manual pedestrian level of service methodology, which is also used to determine crosswalk capacities.

Finding #21: Bicycle and pedestrian volumes can be classified to facilitate mapping and analysis. The recommended classification scheme is as follows:

Bicycle Volumes	
Low	0-20 per hour
Moderate	21-60
High	over 61
Pedestrian Volumes	
Low	0-40 per hour
Moderate	41-100
High	Over 100

Additional categories can be created as needed.

Days of the Week

Finding #22: Day of week volumes are consistent between modes and locations, both in San Diego County and nationally. Over the course of a year, bicycle and pedestrian volumes by day of week are nearly identical, with Saturday being the day with the highest activity, and weekends being higher than weekdays. This breakdown is very consistent with national counts.

Months of the Year

Finding #23: Monthly volumes appear to be highly related to regional conditions, especially weather. The monthly pattern in San Diego County had both intuitive results (July with the highest volumes) and unusual results (March had the second highest with 12%). Compared to other locations in the country with more severe winters, use is relatively even over 12-months in San Diego County. The need for automatic counters in different regions is apparent in order to establish local monthly adjustment factors.

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