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Estimating Bicycle and Pedestrian Demand in San Diego

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ABSTRACT

This paper introduces the concepts behind estimating bicycle and pedestrian demand and provides an example of the development of a sketch-plan method for estimating bicycle and pedestrian demand from land use in San Diego County. The paper describes the methodology involved in collecting counts for the currently ongoing Seamless Travel project. The Seamless Travel project intends to develop a model for estimating bicycle and pedestrian demand within San Diego County. The project methodology includes conducting bicycle and pedestrian counts and intercept surveys over a two-year period throughout the County and evaluating the effects that socio-demographic factors and physical factors have on walking and biking rates within the County. The project is funded by Caltrans Division of Innovation and Research and is being conducted by the Traffic Safety Center of University of California Berkeley and Alta Planning + Design.

INTRODUCTION

The interest in bicycle and pedestrian modes as a small but important component of our multi-modal transportation system has been growing, since the adoption of the Intermodal Surface Transportation Efficiency Act (ISTEA) in the early 1990s. A combination of increased interest in resolving traffic congestion, constructing livable communities and streets, supporting more active and healthy lifestyles, enhancing pedestrian and bicyclist safety, and encouraging Safe Routes to Schools, has resulted in a desire and need to accurately measure bicycling and walking rates, collision rates, and to understand why, when, and where people walk or bicycle.

In 2006, Caltrans secured the Traffic Safety Center of University of California Berkeley and Alta Planning + Design to develop a model for estimating bicycle and pedestrian demand within San Diego County. The project methodology includes conducting bicycle and pedestrian counts and intercept surveys over a two-year period throughout the County and evaluating the effects that socio-demographic factors and physical factors have on walking and biking rates within the County. The project is funded by Caltrans Division of Innovation and Research.

At the completion of the project the research team will identify trends in walking and bicycling; evaluate the relationship between usage and as facility quality, physical factors, and social factors; and review the potential for using land use and infrastructure improvements to increase walking and bicycling. The product of this research will provide Caltrans staff, local agency staff, advocates, elected officials, and others with the information and tools needed to understand walking and bicycling rates, patterns, relationships, and trends within San Diego, and may be applicable to other areas of the state and country.

The Seamless Travel Project is the first large scale test of count and survey methodology outlined by the National Bicycle and Pedestrian Documentation Project (NDP). The NDP is an annual bicycle and pedestrian count and survey effort sponsored by the Institute of Transportation Engineers Pedestrian and Bicycle Council. The goals of the NDP are to establish a consistent national bicycle and pedestrian count and survey methodology, to establish a national database of bicycle and pedestrian count information generated by these consistent methods and practices and to use the count and survey information to begin analysis on the correlations between various factors and bicycle and pedestrian activity.

This paper addresses the following topics:

- ▲ Bicycle and Pedestrian Data
- ▲ Travel Modeling and Estimating Bicycle and Pedestrian Demand
- ▲ Walking Versus Bicycling
- ▲ An Overview of the San Diego Seamless Travel Research Project

BICYCLE AND PEDESTRIAN DATA

Consistent data on bicycling and walking is limited, and is probably the single greatest impediment to being able to understand these modes. In 2000, the Bureau of Transportation Statistics published a report summarizing the existing bicycle and pedestrian data sources and the

importance, quality and usefulness of this data. According to the report, *Bicycle and Pedestrian Data: Sources, Needs & Gaps*, national data is commonly available, but state, regional and local data is not. The report notes that data quality ranges from fair to poor (Bureau of Transportation Statistics 2000).

On a state and regional level, the U.S. Census and the National Household Travel Survey provide the only readily available, consistent bicycle and pedestrian count and survey information. However, several limitations make these data sources less than ideal for estimating regional and local bicycling and walking rates. Due to data collection methodology, the Census often undercounts the actual number of walking and biking trips made in a locality. The Census data only includes commute trips, leaving out the significant number of people who bicycle or walk for recreation, to conduct personal business or to socialize. Additionally, the Census long-form, which is used to gather journey to work information, requires that respondents choose only one mode. As a result, multi-modal trips, such as walking to transit, are not counted as a walking trip (California Department of Transportation May 2002).

The National Household Travel Survey provides more useful information. The NHTS selects a random sample of U.S. households and asks each to complete a travel diary. All types of trips are collected, not just commute trips, and every component of a multi-modal trip is captured. However, the NHTS uses a smaller sample size than the U.S. Census, and is only useful at a national level. Recently, the NHTS has expanded its add-on program, which allows states and metropolitan planning organizations to purchase additional sample surveys for their area.

As with any survey that relies on a subset of a population, sampling error may affect the accuracy of the Census and the NHTS. Both the Census Long Form (which collects the journey-to-work data) and the NHTS use samples of the population, and may under-represent or omit subgroups of the population. This is especially pertinent for bicycle commuting data, for which the mode share is usually less than 1%.ⁱ

The quantity and quality of regional and local bicycle and pedestrian data varies. State, regional and local data collection efforts are generally tailored to suit specific needs of the community or project being evaluated (Greene-Roesel et al. 2007). The Bureau of Transportation Statistics notes that, "While a few cities and metropolitan planning organizations routinely conduct pedestrian and bicycle counts, most collect them only sporadically for specific studies or do not collect them at all," (Bureau of Transportation Statistics 2000). In California, it is common for metropolitan planning organizations or regional transportation planning agencies to collect regional travel surveys. Though these surveys generally focus on motor vehicle trips, most have a mode share component.

A bill that would require Metropolitan Planning Organizations to conduct bicycle and pedestrian counts is currently under consideration by the California State Legislature. If passed, the data collected by regional MPOs will be a valuable addition to nonmotorized planning, engineering and research. Ultimately, the usefulness of this data to estimating bicycle and pedestrian demand depends on the way in which the data is collected and disseminated. The data will be most useful if they are collected in a unified format and made readily available.

The Seamless Travel project will address the limited data availability in several ways. First, by conducting an extensive series of counts using the same methodology (80 locations, four count periods over two years) the project will provide San Diego County with up-to date, comparable bicycle and pedestrian data. Second, by evaluating the land use/socio-demographic connection,

the project will develop a sketch plan modeling method that can be used to estimate bicycle and pedestrian activity levels in other parts of the County. Third, as the first large-scale test of methodology outlined in the National Documentation Project, the Seamless Travel project will be used to inform and refine the National Documentation Project Methodology.

TRAVEL MODELING AND ESTIMATING BICYCLE AND PEDESTRIAN DEMAND

Transportation models fall under two groups: aggregate models or disaggregate models. Aggregate studies model travel behavior based on the characteristics of an area (e.g. population density, employment density, household income, facility type). Disaggregate studies model travel behavior from the perspective of individual travel choices. These models apply individual characteristics and preferences (e.g. attitudes, trends related to gender or age) to a population with known characteristics to predict travel behavior.

Aggregate and disaggregate models differ in their ease of use and predictive abilities. Aggregate models can be developed using readily available data and methods. Disaggregate models are more complicated to develop and require custom data and survey collection, but are more effective at predicting travel behavior (Federal Highway Administration 1999).

Regional transportation modeling and forecasting began in the 1950's with the increasing need to predict and plan for expected increases in population, vehicle ownership and vehicle miles traveled. The passage of the 1963 Federal Aid Highway Act institutionalized regional transportation planning by requiring that urban areas employ a "continuing, comprehensive and cooperative" transportation planning process. Since these beginnings, institutionalized transportation models have been modified to reflect changing social patterns and new environmental regulations and conformance requirements. The model commonly used today, is the four-step Urban Transportation Model System (UTMS) (Pas 1995).

The UTMS takes transportation system characteristics and land use system characteristics as inputs, uses four sub-models to determine trip generation, trip distribution, trip mode choice and trip assignment, and produces an estimate of the volume and speed of traffic on the transportation network. The four steps represent a sequential decision making process:

Step 1: Trip Generation: Should I make a trip?

Step 2: Trip Distribution: Where should I go?

Step 3: Mode Share: Should I drive, walk, bike, or take the bus?

Step 4: Route Choice: What route should I take?

This process has been criticized as a "highly unrealistic representation of traveler's decision making," but the intention of the four-step model is not to model individual trip decisions, but to provide a "pragmatic approach to reducing the extremely complex phenomenon of travel behavior into analytically manageable components," (Meyer and Miller 2001). Some four-step models switch the order of steps two and three, performing the modal split before distributing the trips.

Historically, transportation modeling has been focused on highway or transit networks, and considers just two modes: private vehicles and public transportation (Sheppard 1995; Meyer

and Miller 2001). Factors that could influence the decision to walk or bike are not usually included in the traditional four-step travel model process. When developing a non-motorized transportation model, or when incorporating non-motorized transportation into a traditional four-step model, several factors should be considered, as outlined in Table 1.

TABLE 1: Factors Influencing Non-Motorized Travel

Variable	Description
Link Characteristics	Measurable characteristics of a link in a road or path network (e.g., traffic volume, lane width, or pavement quality)
Link "Friendliness"	The overall acceptability of a link as a bicycle or pedestrian route – a function of link characteristics. Also varies by user characteristics (e.g., experiences vs. novice bicyclist.)
Network Characteristics	Characteristics of a network of links (e.g., connectivity) which determine its overall acceptability or "friendliness" to the user.
Network "Friendliness"	A general measure of how acceptable the local road/path network is for bicycling or walking.
Supporting Policies	Other programs, policies, facilities, etc., which affect the acceptability of bicycling or walking (e.g. bicycle parking, showers/lockers, and educational programs).
Population Characteristics	Characteristics of the local population which relate to likelihood of bicycling or walking (e.g. socioeconomic characteristics or attitudes)
Climate/Weather	General propensity to walk or bicycle, as a function of climate/weather. This might be considered a constant for a given area/region.
Characteristics of Other Modes	Relative travel times and costs of bicycling or walking vs. other modes, as well as safety, comfort, or other factors which influence choice of mode. Policy variables might include parking pricing, transit service improvements, etc.
Land Use	Density and distribution characteristics of population, employment, shopping, and other activities which affect where people travel, how many trips are generated, trip length, etc.

Source: (Federal Highway Administration 1999).

Methods for modeling non-motorized travel are not as institutionalized as those for modeling motor vehicle and transit trips, and therefore vary more. Methods to model non-motorized trips range from comparative studies to incorporation into regional four-step demand models. Several common types of models are described in Table 2

TABLE 2: Methods for Modeling Nonmotorized Travel Demand

Purpose/Method	Description
Demand Estimation	Methods that can be used to derive quantitative estimates of demand
Comparison Studies	Methods that predict non-motorized travel on a facility by comparing it to usage and to surrounding population and land-use characteristics
Aggregate Behavior Studies	Methods that relate non-motorized travel in an area to its local population, land use, and other characteristics, usually through regression analysis
Sketch Plan Methods	Methods that predict non-motorized travel on a facility or in an area based on simple calculations and rules of thumb about trip lengths, mode shares, and other aspects of travel behavior
Discrete Choice	Models that predict an individual's travel decisions based on characteristics of the

Models	alternatives available to them
Regional Travel Models	Models that predict total trips by trip purpose, mode, and origin/destination, and distribute these trips across a network of transportation facilities, based on land-use characteristics such as population and employment and on characteristics of the transportation network.

Sources: Federal Highway Administration 1999

The Seamless Travel study will compare peak hour bicycle and pedestrian counts to local land use, demographic and other factors and will evaluate whether correlations can be made between these factors and local nonmotorized activity levels. If correlations can be made, the study will develop a sketch plan model to estimate bicycle and pedestrian demand within a neighborhood based on these physical and social factors.

Recently, with increased agency interest in using integrated land use-transportation models, nonmotorized travel has been incorporated more fully into the modeling process, specifically within integrated land use-transportation models. Integrated land-use-transportation models relate the interactions between two separate but parallel markets: the land use and the transportation markets. These models have been used in Honolulu, Hawaii, Eugene, Oregon, and are being tested in Sacramento and San Diego (Johnston 2006). Caltrans is also considering the feasibility of using an integrated land-use model. (Caltrans has a statewide travel model, but it is not currently an integrated land-use model.)

Some integrated land use models can include inputs on local accessibility and, as a result, more accurately integrate bicycle and pedestrian travel into the system. UrbanSim is one such model. It includes measurements for “local accessibility—within a 1/3 of a mile—in addition to regional accessibility. These accessibility values serve as inputs for the economic and land use modules of the model.

The findings from the Seamless Travel study will be shared with San Diego Council of Governments so that the agency can integrate these findings into its integrated land use-transportation model, and may be incorporated into a future statewide integrated land use-transportation model.

WALKING VERSUS BICYCLING

Though walking and bicycling are often lumped together, there are significant differences between the two modes. Most models that are developed for forecasting non-motorized transportation are developed specifically for bicyclists or pedestrians. Three of the most significant differences between the two modes are:

1. *Walking trips are generally shorter than bicycling trips.* This may affect the spatial scale of analysis.
2. *A large percentage of walking trips are trips to access other modes, including the automobile or transit.* Bicycle trips are generally stand-alone trips. Modeling should consider the fact that pedestrian trips may not replace automobile trips, but may result from those trips. Conversely, the quality of the walking environment may need to be considered in predicting transit mode shares.

3. *The decision to ride a bicycle involves a greater conceptual leap than the decision to walk.* Public health and social marketing fields have shown that the decision to even consider riding a bicycle is a multi-staged process involving a variety of interacting personal social and environmental factors. Attitudinal research is important for modeling and understanding pedestrian travel, but is perhaps most significant for bicycle travel (Federal Highway Administration 1999).

It is important to understand these differences when evaluating how that land use, demographics, policy, and facility type influences the decision to walk or bike. Count location selection and the analysis techniques used in the Seamless Travel project reflect these differences between walking and biking. Count locations have been selected to include areas that favor bicycling and areas that favor walking. The geographic analysis will use smaller buffer sizes to analyze characteristics that are likely to affect walking and larger buffer sizes to analyze those that are likely to affect biking.

SAN DIEGO COUNTY SEAMLESS TRAVEL RESEARCH PROJECT

Note: As of submittal date, the results of the first count and survey efforts in San Diego County had not yet been compiled. A summary and analysis of these preliminary counts will be presented at the TRB National Conference in 2008.

The Seamless Travel is a two-year research effort to conduct bicycle and pedestrian counts in San Diego County and evaluate the effects of socio-demographic and physical characteristics on walking and biking activity levels. This research effort seeks to enhance the existing sources of bicycle and pedestrian data collection effort within the San Diego region. The data collected through this effort will be documented so that it can be incorporated into San Diego's integrated land use-transportation model.

The key goals of the Seamless Travel project are 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 Projectⁱⁱ as a template,
- (c) Conduct counts and surveys using San Diego County as a model community,
- (d) Analyze how bicycle and pedestrian activity levels relate to facility quality, 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 can be improved.

At the completion of this project the research team will be able to report on several trends in walking and bicycling; how usage relates to items such as facility quality, physical factors, and social factors; and the potential for using land use and infrastructure improvements to increase walking and bicycling. The research is intended to 1) develop methods to allow practitioners to estimate bicycle and pedestrian activity based on local physical and social factors and to 2) develop methods to allow practitioners to evaluate how land use modifications may affect bicycle and pedestrian activity levels. Eventually, the research findings may be used to develop a method for estimating bicycle and pedestrian exposure rates that can be integrated into Caltrans statewide Transportation System Network, thereby institutionalizing the consideration of bicyclists and pedestrians in statewide traffic modeling.

Why San Diego County?

San Diego County was chosen as a model community for two reasons. First, regular bicycle counts were conducted throughout the county between 1981 and 1997. Count locations remained the same from year-to-year, with the exception that several new count locations were added to the list each year. The original set of count locations was randomly selected from the existing and proposed county bicycle network. This historic bicycle count data can be used to test and evaluate the counts and correlations identified by the Seamless Travel project. Second, San Diego County has an extensive, frequently updated countywide GIS database that is freely available. Historic GIS information is also available, allowing us to compare historic bicycle counts to historic land uses.

The research team is to working closely with local agencies, staff, and organizations to maximize the efficiency of the data collection and analysis process. Representatives from several local agencies have been invited to participate on a local stakeholder team. This team provides input into methods and provides valuable local expertise. The following agencies are represented: San Diego Council of Governments, City of San Diego, San Diego County, WalkSanDiego, San Diego Bicycle Coalition, Caltrans District 11 (San Diego District) and Caltrans Headquarters.

Methodology Overview

The methodology of the Seamless Travel project is outlined below. To date, the research team has completed the first three tasks, is in the process of collecting its first round of bicycle and pedestrian count information and has begun background data collection. The remainder of this paper details the count methodology used in Task 4 and briefly summarizes the methodology for Tasks 5 through 8.

Task 1. Form an Advisory Committee - completed

Task 2. Project Objectives - completed

Task 3. Literature Review - completed

Task 4. Primary Data Collection - in progress

Task 4.1 Review and Select Methods for Counts and Surveys.

Task 4.2 Select Count and Survey Locations

Task 4.3 Choose Dates for Counts and Surveys

Task 4.4 Count and Survey Training and Quality Control

Task 4.5 Review and Refinement of Data Collection Methods (test cases)

Task 4.6 Surveys

Task 4.7 Conduct Counts and Surveys

Task 5. Database Development

Task 5.1 Summarize Count and Survey Results

Task 5.2 Background Data – in progress

Task 6. Research Findings

Task 6.1 Compare to Local, State, and National Findings

Task 6.2 Identify Factors with High Correlation Rates

Task 6.3 Elements with State or National Implications

Task 7. Recommendations/Deployment

Task 7.1 Accessible Database for Future Research

Task 7.2 Summary Report of Findings

Task 7.3 Presentation Materials

Task 7.4 Model Development

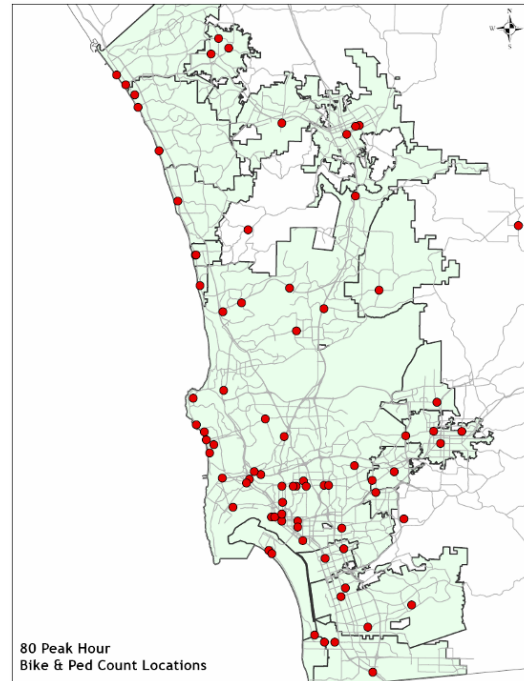
Task 8. Prepare and Disseminate Final Reports and Materials

Figure 1

Peak Hour Count Locations in San Diego County

Count Methodology

The Seamless Travel Study includes manual peak counts at 80 locations throughout San Diego County and automated 24-hour counts at four locations. Manual peak counts will be conducted four times throughout the 2-year study and automated counts will be collected throughout the length of the study.

It was determined that a random sample, while more likely to produce statistically significant results, would require many more count locations than were possible given the project budget. Instead, count locations were selected to ensure that a variety of demographic and physical characteristics were represented. The list of historic bicycle count locations were used as a jumping off point for selecting counts. Using GIS analysis and input from local stakeholders, a final set of 80 count locations (40 historic bicycle counts, 40 new counts) was established. Count locations were chosen to represent:

- ▲ Various types of bicycle facilities, including no bicycle facility

- ▲ High pedestrian crash areas
- ▲ Areas identified for future smart growth
- ▲ Locations near transit stops (trolley, bus, ferry)
- ▲ Locations near planned or recently completed bicycle and pedestrian projects
- ▲ Various land uses

All 18 jurisdictions within the County and unincorporated county are represented in the count locations. The count locations focus on the more populated, western half of the county. A map of count locations is shown in Figure 1.

Peak hour counts will be conducted during the AM weekday peak (7am-9am) and the midday weekend peak (noon-2pm) at all 80 count locations. Additional PM peak (4pm-6pm) counts will be conducted at 20 locations each count cycle, with all 80 locations counted at the conclusion of the study. The choice to count only one peak hour was due to budgetary constraints. The AM peak was chosen based counts from the National Household Travel Survey, Bay Area Travel Survey and southern California counts conducted by Alta that shows bicycle and pedestrian travel peaks at the same time during the AM peak, but during the PM peak, pedestrian travel peaks earlier than bicycle travel. (The earlier peaking is likely due to students leaving school in the early afternoon.)

A traffic counting firm has been hired to conduct peak hour counts. In addition to collecting bicycle and pedestrian counts, the traffic firm will collect site specific data to be used in the final analysis. The researchers worked with the traffic firm to develop a methodology that will allow counters to collect the following items:

- ▲ Presence of curb/gutter/sidewalk
- ▲ Presence of bike facilities
- ▲ Intersection geometry
- ▲ Pedestrian phasing if signalized intersection
- ▲ Weather

Automated Count Methodology

In addition to peak hour counts, the Seamless Travel project is collecting automated year-long counts to establish trends in biking and walking. After evaluating the various automated counting tools available on the market, the research team decided to use a combination of passive infrared counters and active infrared counters. Both count tools collect time-stamped data, contain their own power source, and allow data to be downloaded. Active infrared counters allow bicyclists and pedestrians to be classified, but are more challenging to install (two units as opposed to one), and are more expensive than passive infrared. Passive infrared counters do not classify bicyclists and pedestrians, but only require one unit per installation.

Active infrared counters can be calibrated to classify bicyclists and pedestrians. Two units should be installed along one corridor. One unit is calibrated to trigger a count at a low speed, while the other unit is calibrated to trigger a count at a higher speed. The low-speed unit counts all pedestrians and bicyclists while the higher speed unit counts only bicyclists. Mode split can be determined by subtracting the bicyclist count from the combined count. To date, the count devices have been installed in the field, but have not been calibrated. The research team will

experiment in the field to determine the appropriate speed at which the two units will need to be calibrated, however it has been suggested by the California Bicycle Advisory Committee that 8 mph is a good speed at which to start counting bicyclists.

Infrared counters have been shown to consistently undercount pedestrians. Pedestrians that walk side-by-side are generally counted as one pedestrian. Undercounts range from 5 to 10 percent, but are generally consistent at a location. (Greene-Roesel et al. 2007). The researchers will compare manual counts to automated counts to establish a correction factor for each site.

Count locations for the year-long automated counts were more restricted than those for the peak hour manual counts. Due to the count technology chosen, only off-street areas could be used. Infrared cannot easily be used to monitor on-street bikeways, as vehicles will trip the sensor. It was determined that using a pneumatic tube counter for on-street bikeways may pose safety concerns, and may be affected by buses and vehicles rolling over the tube.

Count locations for year-long automated counts were chosen at five sites, and reflect locations that are expected to receive a variety of recreational, commuter and bicycle and pedestrian traffic. A map of count locations is shown in Figure 2.

Information collected from the year-long automated counts will be used to evaluate hourly, daily, monthly and seasonal trends in biking and walking. The four locations will also include manual peak hour counts, which will be used to establish a factor for estimating 24-hour bicycle and pedestrian counts based on peak-hour counts.

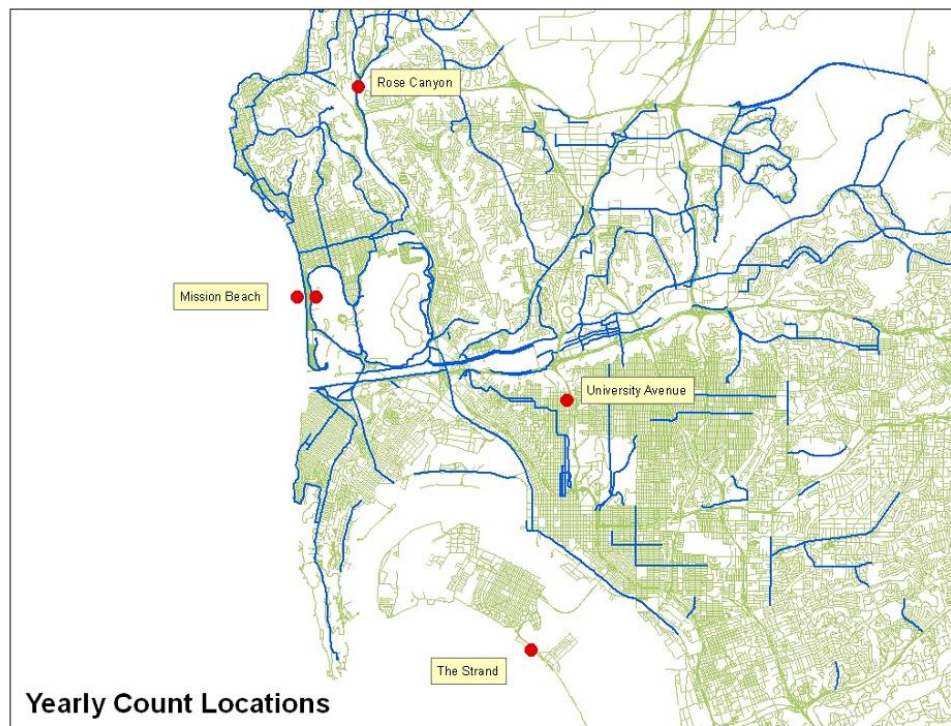


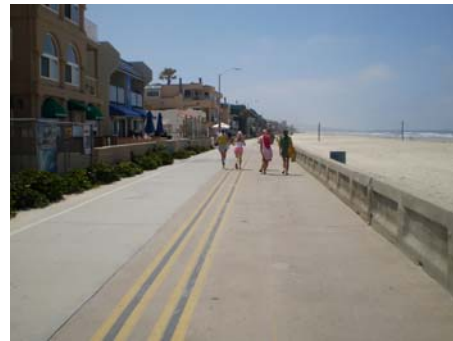
Figure 2

Yearly Count Locations in San Diego County



Rose Canyon Bike Path

Moderately high activity, bike commuters/
recreational walkers and bikers, bike/ped split



Mission Beach (Boardwalk)

High activity area, mainly recreational, no
mode split info

**Mission Beach (Bayside Boardwalk) (not
shown)**

Moderately high activity, mainly
recreational, bike/ped split

Figure 3

Rose Canyon Bike Path and Mission Beach Year-long Automated Count Locations



University Avenue (sidewalk)

High pedestrian activity area, mainly
utilitarian urban travel, no mode split info



The Strand

Moderate activity levels, mainly recreational
walkers and bikers, bike/ped split

Figure 4

University Avenue and The Strand Year-long Automated Count Locations

Survey Methodology

In addition to conducting counts, the Seamless Travel project will collect user surveys from in the field intercept surveys. A survey firm that specializes in travel behavior data collection has been hired for this process. Surveys will be collected after each of the four count periods. Each survey effort will be conducted at twenty of the count locations, with all eighty count locations surveyed at the end of the two-year project. We will collect a total of 2000 completed surveys. Survey information will be used to understand count trends seen at each of the count locations.

The survey instrument is currently under development. It will be designed to gather the following information:

- ▲ Residence
- ▲ Origin and destination of trip
- ▲ Purpose of trip
- ▲ Desired places to walk or bike
- ▲ Frequency of walking and biking
- ▲ Challenges to walking and biking
- ▲ Socio-economic factors

Database Development

All data collected from the counts and surveys will be reviewed for quality and completeness, coded for location, day, week, year, and then entered into a centralized database via an interactive website or other portal. This method will allow for external updating of information, and ultimately, for the program to be used by Caltrans and local agencies in the future.

Background data will be entered into the database to allow comparison to the count and survey. Correlations between background data and pedestrian and bicycle activity levels will be evaluated and tested for statistical correlations. Factors that appear highly correlated will be studied in greater detail, as will combinations of factors that appear linked. The research team has already begun collecting the background factors identified in Table 3.

Table 3: Background Factors to Be Collected

Background Factors Assessed	Examples
Social factors	Income, age, location of residence
Weather factors	Temperature, precipitation
Physical factors	Land use type/mix, density, topography, population density
User characteristics	Trip purpose, trip frequency, seasonal frequency, trip origin and destination, facility access mode, facility preference, requested improvements
Transportation factors	Roadway volumes-speeds, crossings, transit linkages, mode share
Facility factors	Facility type, quality, access, length, aesthetics, connections, length, network quality, destinations, maintenance condition, users by type

Research Deliverables

One of the major objectives of this research project is to ensure that it can be continued, maintained, and updated by local agencies and Caltrans over time. The use of a web-based interactive database is a key feature of this accessibility. The research team will develop a web-based interactive database so that approved agencies and staff will be able to conduct counts and surveys according to standard instructions, and then upload the data directly into a centralized database. This will simplify the collection and tabulation process, and make the database available to Caltrans staff and researchers.

The research team intends to develop a model using the database and analysis from this research that can be used to estimate existing and future walking and bicycling rates at specific locations, areas, and corridors. This model can be used by Caltrans and local agencies to estimate future need, modal split assumptions, exposure rates, capacity and access requirements, measure benefits, and other needs. The model development will be contingent on a number of factors, including the results of the correlation analysis

In addition to the database and model, the research team will develop a Summary Report of Findings to highlight the trends, patterns, and relationships from the counts and surveys. The report will focus on:

- Implications for planning, design, policies, and funding: designed for public agency staff, non-profits, and elected officials, this section will focus on how the results of the research may influence everything from land use zoning to the design of transit centers.
- Implications for bikeway planning and allocation of funding based on demonstrated user preferences for specific types of facilities (such as a Class I bike path), and recommendations for addressing this preference.
- Implications for meeting the California Blueprint for Bicycling and Walking performance measures including (a) volumes, (b) traffic safety, (c) local participation, (d) connectivity, and (e) infrastructure.ⁱⁱⁱ
- Training and count/survey materials: designed to be used primarily by Caltrans and local agency staff desiring to conduct local counts or surveys.
- Potential for increases in bicycle/walk commute trips; regional modeling applications: designed for Caltrans, local agency staff, advocates, non-profits, and the general public, focusing on how the research results allow for further research into the role of walking/bicycling as a transportation mode, and use as a modal factor in transportation modeling.
- Measuring benefits and impacts: designed to be used by technical and non-technical users to understand the impacts and benefits of the results, including need for enhanced facilities, health and economic benefits, and reductions in vehicle trips.
- Applications for multi-modal planning: to be used by Caltrans and local agency staff to understand the relationship between transit, rail, highway, and other projects with potential bicycle and pedestrian demand.

CONCLUSION

With the increased interest in developing communities that complement bicycle and pedestrian modes, in resolving traffic congestion, in promoting more active and healthy lifestyles, and enhancing safety, more people have the desire to accurately measure and understand why, when, and where people walk or bicycle.

It is the researcher team's hope that the results of this research will provide researchers, Caltrans and local agency staff, elected officials, advocates, and many others the tools they need to help answer these and other questions. With better information, decisions on how funding is allocated, how projects are developed, designed, and prioritized, how safety improvements are developed and assigned, and even the extent of general support for pedestrian and bikeway programs and improvements will be enhanced. Research from this project will be of interest throughout the state and country, impacting policies, planning documents, design standards and guidelines, collision analysis, and many other efforts.

ACKNOWLEDGEMENTS

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REFERENCES

- Bureau of Transportation Statistics (2000). *Bicycle and Pedestrian Data: Sources, Needs & Gaps*. Department of Transportation, Washington DC. BTS00-02.
- California Department of Transportation (May 2002). *California Blueprint for Bicycling and Walking*.
- Federal Highway Administration (1999). *Guidebook on Methods to Estimate Non-Motorized Travel: Overview of Methods*. U. S. Department of Transportation, Research, Development, and Technology. Publication No. FHWA-RD-98-165.
- Greene-Roesel, R., M. C. Diogenes, et al. (2007). *Estimating Pedestrian Accident Exposure: Protocol Report*, University of California Traffic Safety Center.
- Johnston, R. A. and M. C. McCoy (2006). *Assessment of Integrated Transportation/Land Use Models*, Information Center for the Environment, Department of Environmental Science and Policy, University of California Davis.
- Meyer, M. and E. Miller (2001). *Demand Analysis*. Urban Transportation Planning: A Decision-Oriented Approach. New York, McGraw-Hill.
- Pas, E. (1995). *The Urban Transportation Planning Process*. The Geography of Urban Transportation. S. Hanson. New York, The Guilford Press: 53-79.
- Sheppard, E. (1995). *Modeling and Predicting Aggregate Flows*. The Geography of Urban Transportation. S. Hanson. New York, The Guilford Press.

ENDNOTES

ⁱ Using Journey to Work data from the U.S. Census 2000, the bicycle mode share for the United States is 0.40% and the bicycle mode share for California is 0.80%.

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

ⁱⁱⁱ *California Blueprint for Bicycling and Walking: Report to Legislature*, California Department of Transportation, May 2002, p. 4