Drivers, Pedestrians, and Cyclists in California Want Complete Streets
A Comparison of Results from Roadway Design Surveys of Pedestrians, Drivers, Bicyclists,
and Transit Users in Northern and Southern California

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ABSTRACT
This paper compares findings from two recent surveys on roadway design preferences among pedestrians, drivers, bicyclists, and public transit users along major urban corridors in the metro areas of San Francisco and Los Angeles. Sponsored by the California DOT, the research explored design preferences that could increase perceived traffic safety, walkability, bikability, and economic vitality along urban arterials.

Results from intercept surveys showed that roadway users desire similar design features along the test corridors, which carry 25,000-40,000 motorists bi-directionally and have comprehensive sidewalk coverage, but little to no on-street bicycle facilities. In response to an open-ended question about street improvements to enhance perceived traffic safety, Bay Area respondents ranked bicycle lanes and improved pedestrian crossings first and second overall, while respondents in the LA area ranked them in reverse order. Decreased speed was ranked third in the Bay Area, and 5th in the LA area. Other top suggestions included increasing street lighting, traffic signals, and stop signs in the Bay Area, and better maintained roads and increased travel space in the LA area.

These findings add to the growing body of evidence that design features generally deemed beneficial to one user group, such as pedestrian crossings for pedestrians, may also benefit other users. Moreover, these results suggest that roadway planning can implement a few key design interventions to enhance the travel experience of multiple user groups. Overall, the findings support the continued implementation of complete streets principles and policies.
INTRODUCTION
In the last decade, walking and bicycling trips have increased across the U.S. – in some places, such as Lexington, Kentucky, and Portland, Oregon, tripling data reported in 2001 (1, 2). While this is great news for cities that have worked for years to encourage walking and bicycling, it comes with the consequence that motorists, bus traffic, bicyclists, and pedestrians often share space and interact on major roadways. In many cities, roadway design has not kept pace with the changing roadway demographics, and may not provide environments conducive to bicycling or walking. In some cases, such as where prevailing speeds are high, but no separated facilities exist for cyclists, these roadways may inadvertently be designed to contribute to—rather than mitigate—conflict. This paper presents results from recent pedestrian and bicyclist intercept surveys conducted to understand how landscaping and street design features currently or could potentially affect perceived traffic safety, economic vitality, and general satisfaction along major urban arterials in the eastern part of San Francisco Bay Area and the metro Los Angeles area.

Recent research on roadway design preferences has tended to focus on bicyclists and, to a lesser extent, pedestrians, with little examination of how motorists view roadway design. Despite—or perhaps because of—this lack of knowledge about roadway design preferences among a diversity of users, popular news stories suggest that certain roadway design features benefit only a subset of road users. For instance, efforts to install bicycle lanes in New York City and San Francisco were opposed in part because they were seen to benefit a minority of users, while negatively impacting the majority (3, 4). The findings in this paper suggest that this portrayal may be misleading, and that roadway design features typically considered user-specific may benefit a much broader segment of roadway users.

This research was conducted along San Pablo Avenue, a State route acting as an arterial in six Bay Area cities, and Santa Monica Boulevard, a major arterial running through the metro Los Angeles area, as part of a larger project to develop performance measures for pedestrian and bicyclist safety and mobility for the California Department of Transportation (Caltrans). The findings may be applicable to urban arterials in general.

Literature Review
A comprehensive literature review of research examining design interventions and their effects on pedestrian, bicyclist, and driver safety and mobility undergirded this study, and is described in detail elsewhere (5). The review found that studies on walkability have analyzed the relationship between neighborhood and street characteristics and reported mobility and safety trends, while research on bicycling has tended to focus on stated preferences in an attempt to understand how to encourage more bicycling. This discrepancy seems to be due in part to a historical lack of revealed preference data for bicyclists, who generally comprise a much smaller percentage of roadway users. While studies have investigated driver preferences for roadway design elements such as pavement and landscaping treatments, little research has examined preferences for features traditionally viewed as specific to pedestrians and bicyclists (6). The research highlighted here is excerpted from the broader literature review, and focuses on revealed and stated preferences for roadway design features along arterial roadways.

Numerous studies suggest that urban form and traffic patterns influence whether or not a community is considered walkable. In their review of the literature, Saelens and Handy found that walking was positively associated with sidewalks, network connectivity, mixed land uses, and higher density; findings linking aesthetics and walking were less clear (7). Lee and Moudon found that approximately 40% of pedestrians and bicyclists viewed “too much traffic” as the top
barrier to more walking and bicycling near Seattle, Washington (8). Dangerous street-crossing
conditions were also top barriers for pedestrians, while a lack of bike lanes, trails, and nearby
safe places to cycle were top barriers for bicyclists. Respondents suggested that good street
lighting and more street trees would encourage walking and bicycling, as would benches (for
pedestrians) and bike lanes/trails and bike parking (for cyclists).

Schlossberg, Agrawal, et al. surveyed people walking to transit stops in the Bay Area of
California and Portland, Oregon. They found that perceived safety (from both crime and traffic)
and route directness were key factors in route choice. Nearly half of respondents prioritized
sidewalks in route choice, while over one-third prioritized aesthetic factors such as landscaping.
The street sections considered least walkable by respondents were concentrated along arterials
and collectors (9). Research by Petritsch et al. on pedestrian level of service (LOS) at signalized
intersections and along arterials in Florida indicates that conflicts with turning vehicles, the
volume and speed of perpendicular traffic, and width of driveway and intersections crossings
have the most negative effect on pedestrians’ perceptions of comfort (10). In their study of the
areas surrounding transit stops in Portland, Oregon, Schlossberg and Brown found that streets
with high traffic volumes and multiple lanes may act as barriers to pedestrians attempting to
cross the street (11).

Research on bicycling tends to find strong stated preferences for on-road bicycle
facilities. In their survey of residents in King County, Washington, Moudon, Lee, et al. found
that nearly 50% of respondents (cyclists and non-cyclists) wanted more bike lanes and trails to
courage them to bicycle more (12). Wardman et al. found that cyclists in the United Kingdom
lacked access to developed, convenient bicycle networks, and that an increase in on-road
bicycling facilities would encourage them to bicycle more (13). In their random-sample survey
of Portland, Oregon, residents, Dill and Voros found that nearly 40% of people who wanted to
bicycle more cited a lack of bike lanes or trails (14). Research by Petritsch, Landis, et al. on
bicycle LOS in Florida found that the presence or absence of a bicycle lane was the most
commonly cited reason for giving a roadway a high or low score, respectively (15). In their
analysis of perceived cycling risk and route acceptability, Parkin et al. found that bicycle lanes
could mitigate the perceived risk of bicycling near high amounts of auto traffic (16).

Stated preference research is limited in that the preferences are generally not verified
through longitudinal analysis examining whether and how survey respondents’ behavior changed
when their preferred facilities were built. However, trends within revealed preference research,
detected by reviewing the results from multiple studies conducted across neighborhoods or
communities, seem to corroborate findings from stated preference studies. For example, using
GPS data from 166 cyclists in Portland, Oregon, Dill and Gliebe found that cyclists riding for
utilitarian purposes rode mainly on streets with bicycle infrastructure. Nearly 30% of the travel
occurred on streets with bicycle lanes and bicycle boulevards—even though only 24% of
shortest-path trips would have occurred on those streets (17). Correspondingly, Winters,
Teschke, et al. found that frequent and infrequent cyclists in Vancouver, British Columbia, go
out of their way to use routes with bicycle facilities. An analysis of recorded bike trips for 74
cyclists indicated that 49% of the total trip distance took place on designated bike routes, as
compared to 21% in a shortest-path scenario (18).

Research examining how various roadside design features affect driver safety and
behavior is fairly robust, although recent studies have challenged accepted design strategies for
urban roadways (particularly arterials), arguing that recommendations about sight lines for street
trees and parking, speed limits, lane widths, and configurations may increase crash risk for
drivers and other roadway users. For example, Fitzpatrick et al. found that higher posted speed limits and increased lane widths were associated with significantly increased driver speed on multi-lane arterial roadway sections in Texas (19). In his comparison of roadway segments in Florida with and without “livability” treatments such as on-street parking, trees, sidewalks, and buildings close to the right-of-way, Dumbaugh found that drivers drove more slowly through the livable area and that the livable street sections had fewer roadside and mid-block crashes after controlling for ADT, posted speed, lane and median widths, and related factors (20). Naderi found that landscaping improvements along arterials in Toronto, Canada, were positively associated with reduced mid-block crash rates (21). Using computer modeling to evaluate sightlines for drivers in various scenarios, Macdonald found that on-street parking was much more likely to block drivers’ views of oncoming traffic than were street trees, which are more tightly regulated (22). Despite these and related studies, relatively little research has investigated driver preferences for roadway design in urban areas. The few studies that exist have been small and qualitative in nature, precluding general conclusions.

SURVEY METHODOLOGY
The survey included questions about trip purpose, frequency of visits to the area, perceptions of traffic safety under various conditions, and preferences for various design amenities. After obtaining a human subjects exemption from the UC Berkeley Office of Human Subjects Protection, the researchers worked with a survey firm to randomly intercept participants on foot or bicycle at eight sites along San Pablo Avenue and nine sites along Santa Monica Boulevard. In the Bay Area, the survey was only conducted in English; in the LA area, it was conducted in English and Spanish. Surveyors included men and women, working alone, divided between the different sites. They intercepted participants aged 18 and older in a variety of locations along the street, including at intersections and bus stops, while entering or leaving local businesses, and mid-block. In the Bay Area, approximately 25% of people refused to participate, for a total of 537 respondents. In the LA area, the refusal rate was 38%, resulting in 567 respondents.

The data was entered into Microsoft Excel™, and then analyzed using the statistical software package STATA 12 (StataCorp, College Station, TX). Findings presented in this paper are statistically significant through Chi Square and Kruskal-Wallis tests at the level of $p \leq 0.10$.

Area Information & Survey Sites

San Pablo Avenue
San Pablo Avenue is officially under Caltrans’ jurisdiction as State Route 123, but the roadside design features found in various sections are influenced by the six cities (Richmond, El Cerrito, Albany, Berkeley, Emeryville, and Oakland) and two counties (Alameda and Contra Costa) through which the urban arterial passes. State Route 123 has 181 intersections along its 9.5-mile (15.3 km) length, and the character of the street ranges from traditional “main street” with small buildings built to the lot line, to big box superstores with large building footprints separated from the roadway by parking lots. The entirety of the street carries bidirectional traffic with at least two lanes in each direction. It also has nearly 100% bidirectional sidewalk coverage, but no on-street bicycle facilities.

The eight survey locations represented a variety of street design amenities, land uses, pedestrian crash rates, and amounts and presence of pedestrian-friendly design elements, such as street trees, median trees, a raised median island, landscaping, public seating, and trash cans.
Pedestrian crash rates and context sensitivity ratings were calculated for each intersection and then divided into thirds, representing low, medium, and high values. Intersections were chosen from the low and high areas in order to provide maximum possible differentiation between the locations.

Figure 1 shows the eight locations where surveys were conducted along the corridor. In one case, the survey team experienced harassment at the site and therefore moved to another site similar in design and crash rate. Data from the two sites were combined and analyzed as one.

**FIGURE 1 Survey Locations along San Pablo Avenue.**

To capture a wide variety of participants, the survey team visited the sites from 9 am – 6 pm over a two-week period (including five weekdays and three weekend days) in September, 2010. There was no rain during the survey period, and the temperature was slightly above average for the Bay Area (approximately 75 degrees Fahrenheit or 24 degrees Celsius).

*Santa Monica Boulevard*

Santa Monica Boulevard (“SMB”), also known as State Route 2, is part of the historic national Route 66 and runs through four cities (Los Angeles, West Hollywood, Santa Monica, and
Beverly Hills) in Los Angeles County. This research focused on the 5-mile (8-km) segment beginning at the west entrance to West Hollywood and ending at Highway 101 in west Los Angeles. Since 1999, the portion of SMB in West Hollywood has been under local control, whereas the portion in Los Angeles is still under Caltrans’ control. The roadside design features found in various sections reflect these different jurisdictions. The portion of SMB in this study has 91 intersections, and, like San Pablo Ave, the character of the street ranges widely—from traditional “main street” with small buildings built to the lot line, to industrial uses with large building footprints. The entirety of the street carries bidirectional traffic with at least two lanes in each direction. It also has 100% bidirectional sidewalk coverage, with a few blocks of bicycle lane in West Hollywood.

The nine survey sites, five of which were located in West Hollywood with the remaining in Los Angeles, represented a variety of street design amenities, land uses, pedestrian crash rates, and amounts and presence of pedestrian-friendly design elements, as in the case of San Pablo Avenue. Figure 2 shows the nine locations where surveys were conducted along the corridor.

**FIGURE 2 Survey Locations along Santa Monica Boulevard.**

The survey team visited the survey sites along Santa Monica Boulevard from 8 am – 8 pm over a three-week period (including thirteen weekdays and six weekend days) in June 2012. There was no rain during the survey period, and the temperature approximated average temperatures for the survey area during the time period.

**Area Information**

Table 1 presents data for the survey sites along San Pablo Avenue. In order to obtain enough responses to facilitate analysis, the survey sites encompassed two blocks on either side of the selected intersection. Asking respondents about survey areas, rather than just single intersections, was also thought to better reflect how contiguous intersections and segments interact to influence people traveling along the corridor. In one case (54th-59th), a mostly residential area where the average block size was short and several intersections were offset, the survey area was extended two more blocks on each side to increase the number of respondents. Table 1 also presents the average and standard deviation of data from the intersections in each survey area, in addition to traffic injury data from 2001-2010, the most recent years for which
data was available when this survey was conducted. The injury data is from the California Statewide Integrated Traffic Records System (SWITRS). One pedestrian and three motor vehicle fatalities were reported in the project’s eight survey areas during this time period.

## TABLE 1 Pedestrian, Driver, and Bicyclist Injury, Volume, and Speed Information for the San Pablo Avenue Survey Areas

<table>
<thead>
<tr>
<th>Intersection Boundaries of the San Pablo Avenue Survey Areas</th>
<th>Stockton-Fresno</th>
<th>Castro-Kains</th>
<th>Solano-Castro</th>
<th>Gilman-Cedar</th>
<th>Ashby-Haskell</th>
<th>54th-59th</th>
<th>40th-45th</th>
<th>65th-Alcatraz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment length in miles (km)</td>
<td>0.1 (0.16)</td>
<td>0.3 (0.48)</td>
<td>0.3 (0.48)</td>
<td>0.4 (0.64)</td>
<td>0.1 (0.16)</td>
<td>0.4 (0.64)</td>
<td>0.3 (0.48)</td>
<td>0.1 (0.16)</td>
</tr>
<tr>
<td># intersections on west side of street</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>% of signalized intersections in area</td>
<td>33%</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
<td>20%</td>
<td>11%</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Average ped injuries(^1) (std dev)</td>
<td>0 (1)</td>
<td>2 (3)</td>
<td>3 (5)</td>
<td>1(^f) (2)</td>
<td>2 (3)</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Average bike injuries(^1) (std dev)</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td>2 (1)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Average motor vehicle injuries(^1) (std dev)</td>
<td>1 (2)</td>
<td>8 (6)</td>
<td>9 (6)</td>
<td>10 (9)</td>
<td>7(^2f) (10)</td>
<td>3(^f) (3)</td>
<td>3 (2)</td>
<td>5 (4)</td>
</tr>
<tr>
<td>Average weekly ped crossings(^2) (std dev)</td>
<td>7,590 (146)</td>
<td>9,354 (841)</td>
<td>10,533 (820)</td>
<td>6,189 (185)</td>
<td>5,875 (294)</td>
<td>8,466 (119)</td>
<td>10,322 (217)</td>
<td>7,576 (230)</td>
</tr>
<tr>
<td>Average AADT(^3) (std dev)</td>
<td>28,765 (31)</td>
<td>28,583 (932)</td>
<td>28,850 (335)</td>
<td>27,990 (422)</td>
<td>26,685 (391)</td>
<td>26,518 (3,720)</td>
<td>30,397 (425)</td>
<td>24,407 (277)</td>
</tr>
<tr>
<td>*Average speed (std dev) in mph [kph]</td>
<td>29 (4) [47 (6)]</td>
<td>26 (4) [42 (6)]</td>
<td>27 (4) [43 (6)]</td>
<td>29 (4) [47 (6)]</td>
<td>29 (4) [47 (6)]</td>
<td>27 (5) [43 (8)]</td>
<td>27 (4) [43 (6)]</td>
<td>25 (4) [40 (6)]</td>
</tr>
</tbody>
</table>

\(^1\)California Statewide Integrated Traffic Records System (SWITRS), 2001-2010  
\(^2\)Indicates fatality in the survey area during the time period 2001-2010.  
\(^3\)Estimated using Schneider, et al., (2009) pedestrian volume model  
\(*\)Average weekly pedestrian crossings were estimated using a model by Schneider et al., and developed for the East San Francisco Bay Area (23). Average annual daily traffic was obtained through the Caltrans Traffic Accident Surveillance and Analysis System (TASAS). Speed data was gathered through the researchers’ observations of at least 100 vehicles in free-flow traffic at an intersection in the middle of each survey area.
All survey areas had 100% bi-directional sidewalk coverage that was at least five feet in width. The roadway carried motorized traffic in two lanes in both directions, and all survey areas except Castro-Kains and Solano-Castro had raised, landscaped medians measuring approximately 10 feet. There was also parallel, on-street parking the length of each survey area, but there were no on-road bicycle facilities.

Table 2 presents equivalent data for the survey sites along Santa Monica Boulevard, including traffic injury data from 2001-2010. There were two pedestrian and one driver fatalities reported in the project’s nine survey areas during this time period.

TABLE 2 Pedestrian, Driver, and Bicyclist Injury, Volume, and Speed Information for the Santa Monica Boulevard Survey Areas

<table>
<thead>
<tr>
<th>Intersection Boundaries of the Santa Monica Boulevard Survey Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment length in miles (km)</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>(std dev)</td>
</tr>
<tr>
<td># intersections on west side of street</td>
</tr>
<tr>
<td>% of signalized intersections in area</td>
</tr>
<tr>
<td>Average ped injuries1 (std dev)</td>
</tr>
<tr>
<td>Average bike injuries1 (std dev)</td>
</tr>
<tr>
<td>Average motor vehicle injuries1 (std dev)</td>
</tr>
<tr>
<td>Average weekly ped crossings2 (std dev)</td>
</tr>
<tr>
<td>Average AADT3 (std dev)</td>
</tr>
<tr>
<td>Average speed (std dev) in mph [kph]</td>
</tr>
<tr>
<td>85th % speed in mph [kph]</td>
</tr>
</tbody>
</table>

*The posted speed limit is 25 mph along the corridor
1 California Statewide Integrated Traffic Records System (SWITRS), 2001-2010
2 Indicates one fatality in the survey area during the time period 2001-2010.
3 Estimated using Schneider, et al., (2009) pedestrian volume model???
FINDINGS AND DISCUSSION

Survey Population
This section describes the basic data from the survey, including socio-demographic data, overall trip purpose, travel mode, and visit frequency.

Sociodemographic Characteristics
The data show that the survey population for both areas is slightly younger, more male, and more educated than would be expected given the data of the surrounding Census tracts and larger region. In the Bay Area, the survey population is also less racially and ethnically diverse than would be expected; this was not the case in the LA area. These differences between the survey population and the area population may bias the survey findings, although more research would be necessary to understand the extent of the bias. Additional information about the survey populations may be found in the full report (24).

Trip Characteristics
Along San Pablo Avenue, the majority of respondents arrived at the survey areas either by car (39%) or by foot (35%). Public transit users comprised another 16% of the sample, while 9% of respondents were bicyclists. Along Santa Monica Boulevard, 35% of people arrived to the site by foot, while 28% drove and 34% arrived by public transit. Only 3% of people arrived to SMB by bicycle. The mode of arrival was significantly related \( (p \leq 0.001) \) to the respondent’s age for San Pablo Avenue, but not Santa Monica Boulevard.

Respondents along both corridors were asked about their “typical” activities while visiting the area. For both San Pablo Avenue and Santa Monica Boulevard, the most common activities were shopping, living in the area, and working or running errands. For San Pablo Ave, a high percentage of respondents also reported dining and drinking, while respondents along Santa Monica Boulevard were more likely to be “passing through.” Along both corridors, pedestrians, bicyclists, and transit users made at least 50% of the trips in each category except entertainment. Furthermore, while nearly 75% of respondents along both corridors reported visiting “all the time” or “fairly often”, pedestrians were the mostly likely to visit frequently for both surveys, while drivers were the least likely. These percentages suggest that catering to the needs of non-motorized users would serve the business interests along the corridors. In addition, the high visit frequency implies that most respondents were familiar with the areas.

Perceived Traffic Safety along the Corridors
The survey participants were also questioned about how safe they feel while walking and bicycling on and across San Pablo Avenue and Santa Monica Boulevard. Over 80% of respondents along both corridors feel “somewhat” or “very” safe walking on the sidewalk—compared to approximately 50% who feel at least somewhat safe walking across the street. Even fewer respondents – only about 15% – reported feeling at least somewhat safe bicycling across the street, and less than 10% felt somewhat safe bicycling along either major arterial. In addition, over 50% and nearly 40% of respondents from San Pablo Avenue and Santa Monica Boulevard, respectively, answered “not applicable” to the question about bicycling, which may
include respondents with no desire to bicycle as well as people who would like to bicycle but do
not because of perceived danger.

Perceived safety while walking or bicycling along San Pablo Avenue was not
significantly related to arrival mode or survey area, although there were clearly some areas
where respondents felt safer than others. Along Santa Monica Boulevard, perceived safety while
bicycling was significantly related to survey area, and perceived safety while walking was
significantly related to arrival mode.

Street Improvements that Would Increase Perceived Traffic Safety
Respondents were then asked to name the various types of street improvements they thought
would improve traffic safety. The question was open-response, so respondents could list as
many improvements as they wanted, and many respondents named more than one. As Figure 3
shows, there was clear alignment between user groups along San Pablo Avenue in terms of the
most requested street improvements, and the alignment persisted between survey areas. A high
percentage of drivers and pedestrians (both intercepted on foot) did not request any traffic safety
elements—a not-unreasonable finding given the high percentage of people who feel safe walking
along the corridor. However, among the over 70% of respondents who suggested improvements,
a bicycle lane was the most requested (by 18% of respondents), followed by elements that could
improve pedestrian crossings, such as lighted crosswalks and longer crossing times (by 14% of
respondents).

* “Other” includes 14 requested improvements, such as traffic signal timing, landscaping, larger parking spaces, and
dedicated turn signals. Each suggestion in the “other” category was requested by less than 2% of the sample.

Similar results were found for Santa Monica Boulevard, although to a slightly lesser extent than
along San Pablo Avenue. In this case, 56% of respondents requested traffic safety
improvements. Among those who did not request any improvements, 54% and 27% reported feeling “very safe” walking along and across the street, respectively. Among those who requested improvements, better crosswalks were the most requested (by 13% of users), followed by bicycle lanes/improvements (by 11% of roadway users). As Figure 4 shows, improved crossings were requested by similar numbers of drivers, pedestrians, and transit users, while bicycle lanes/improvements were requested by similar numbers of all user groups.

FIGURE 4 Street Improvements Requested to Increase Perceived Traffic Safety along Santa Monica Boulevard, by Arrival Mode (N=567).

The responses to this question were not significantly related to the survey area for San Pablo Avenue, except in the case of bicycle lanes ($p \leq 0.05$). Whether someone requested a bicycle lane or improved pedestrian crossings was significantly related to arrival mode ($p \leq 0.000$ and $p \leq 0.05$, respectively). Whether someone requested increased traffic signals or stop signs was significantly related to visit frequency ($p \leq 0.01$), with those visiting the most often requesting this improvement. For Santa Monica Boulevard, a request for improved pedestrian crossings was significantly ($p \leq 0.01$) related to survey area, while a request for bicycle lanes or improvements was significantly ($p \leq 0.001$) related to arrival mode. No significant connection between improvements and visit frequency was found for Santa Monica Boulevard.

Tables 3 and 4 show how each user group ranked the five most-requested improvements, as well as the percentage of the group requesting “nothing.” The overall preference order was the same when weighted by individual response and mode. It is impossible to precisely interpret these results without further research. However, findings from other studies may give clues as to why some users requested street improvements not typically deemed as benefiting them (such as drivers requesting bicycle lanes and improved pedestrian crossings). First, individuals use multiple modes at different times, and the drivers, pedestrians, and transit users who requested a
bicycle lane may appreciate it for other trips. These preferences may also reflect benefits to pedestrians and drivers who share space with bicyclists. Evidence of this is found in a recent survey of Bay Area drivers, who overwhelmingly agreed that bicycle lanes “make bicyclists more predictable” and “give bicyclists their own space” (25). Bicycle lanes may also encourage bicyclists to ride on the roadway instead of the sidewalk, thus improving pedestrian comfort and safety on the sidewalk.

TABLE 3 Respondents’ Top Five Street Improvements to Increase Perceived Traffic Safety along San Pablo Avenue, by Arrival Mode

<table>
<thead>
<tr>
<th>Improvement</th>
<th>All Users (N=531)</th>
<th>Driver (n=208)</th>
<th>Pedestrian (n=190)</th>
<th>Transit User (n=84)</th>
<th>Bicyclist (n=49)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of responses</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>1. Bike lane</td>
<td>18</td>
<td>14</td>
<td>16</td>
<td>6</td>
<td>63</td>
</tr>
<tr>
<td>2. Improve pedestrian crossings</td>
<td>14</td>
<td>13</td>
<td>15</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>3. Slow traffic/Improve driver behavior</td>
<td>11</td>
<td>10</td>
<td>12</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>4. Street lighting</td>
<td>9</td>
<td>13</td>
<td>5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5. More traffic signals and stop signs</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>- Nothing</td>
<td>28</td>
<td>31</td>
<td>27</td>
<td>25</td>
<td>14</td>
</tr>
</tbody>
</table>

* The survey respondents themselves combined traffic signals and stop signs and/or indicated a desire for more stops along the corridor. When users wanted other features typically associated with traffic signals, such as turn arrows or timed signals, these were classified differently.

TABLE 4 Respondents’ Top Five Street Improvements to Increase Perceived Traffic Safety along Santa Monica Boulevard, by Arrival Mode

<table>
<thead>
<tr>
<th>Improvement</th>
<th>All Users (N=567)</th>
<th>Driver (n=159)</th>
<th>Pedestrian (n=195)</th>
<th>Transit User (n=192)</th>
<th>Bicyclist (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of responses</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>1. Improve pedestrian crossings</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>2. Bicycle lane/improvements</td>
<td>11</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>3. Road maintenance/clean streets</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>4. More/wider traffic lanes</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>5. Reduce speeding</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>- Nothing/skip question</td>
<td>45</td>
<td>41</td>
<td>43</td>
<td>49</td>
<td>20</td>
</tr>
</tbody>
</table>

Improved pedestrian crossings may also benefit multiple user groups—not just by increasing the predictability and visibility of people when they cross as pedestrians, but also by providing more awareness to the drivers and bicyclists who may conflict with crossing pedestrians. Street lighting may similarly benefit all user groups by improving visibility. Slowing traffic and adding traffic signals and stop signs may benefit safety through increased and more predictable stopping, while road maintenance and keeping the area clean can benefit all users. The request...
for more and/or wider traffic lanes likely reflects some desire to move faster, particularly for
drivers and transit users along congested Santa Monica Boulevard, but the high percentage of
cyclists requesting more space may be related to perceived risk resulting from riding between
moving traffic and parked cars on a street with 12-foot lanes. Additional research into this topic
could help clarify these findings.

**Limitations**

These findings are subject to a few limitations. First, 27% and 45% of respondents along San
Pablo Avenue and Santa Monica Boulevard, respectively, either had no answer or said that
“nothing” could improve perceived traffic safety. This may be partially explained by the fact
that 60% and 54% of those who did not answer or answered “nothing” already feel “very safe”
walking along San Pablo Avenue and Santa Monica Boulevard, respectively, while just a
fraction of respondents who felt “very unsafe” walking answered “nothing.” The same cannot be
said for bicyclists: a large majority of those who arrived by bike requested traffic safety
improvements along both corridors. And overall, nearly 75% of the San Pablo Avenue
respondents and 55% of the Santa Monica Boulevard respondents think traffic safety could be
improved. This strongly suggests that perceived traffic safety is an important subject area to be
addressed in the future.

Second, all survey respondents were intercepted on foot or bicycle, regardless of their
mode of arrival to the corridor. Their answers may therefore have reflected their preferences as a
pedestrian more than their preferences as a driver or transit user. Third, while intercept surveys
tend to have a high response rate, they are also by nature short in order to improve the odds that
the respondent completes the survey. Fourth, this survey explores roadway design preferences of
traffic that has stopped at some point along this corridor and thus cannot be said to represent the
preferences of people who use this corridor solely for traveling through these locations. Finally,
the open-response questions such as the one about traffic safety improvements did not give users
a choice set from which to select responses. While this has the benefit of not leading the
respondent to a certain answer, all users may not have the same knowledge of or familiarity with
what street improvements are possible.

**CONCLUSIONS**

The research presented in this paper provides further evidence that road users who stop at some
point along a multi-use corridor—including drivers, pedestrians, transit users, and bicyclists—
want similar things to improve traffic safety and encourage visits. While the users requested
scores of traffic safety improvements, improved pedestrian crossings and bicycle lanes were the
two categories that were consistently named by all user groups and in both survey areas. These
findings underscore that a multi-modal “Complete Streets” approach may provide opportunities
to create an urban street environment that can benefit all users. Priorities for throughput,
walkability, bikability, and economic activity may be more compatible than traditionally thought.

These findings are based on two surveys along major corridors in different geographic
regions of California. More research should be conducted to further explore preferences for
roadway design and how they may change depending on whether one is stopping along a
corridor, or only using the corridor to travel through a city. Future research should also include
cities outside of the major metropolitan regions examined here. However, the findings presented
in this paper are potentially applicable to any place with multi-modal traffic, particularly where
issues of sharing right-of-way exist in a similar manner to San Pablo Avenue and Santa Monica Boulevard. Based on these findings, transportation officials may have opportunities to broadly benefit users and communities while focusing limited resources on a few select design elements. Because of the potential synergistic benefits of certain roadway features, roadway design does not have to be a zero-sum game.

Transportation agencies throughout the U.S. must balance the need to decrease congestion, steward their resources, increase road user safety, and strive toward policy goals such as increasing active transportation. They are also often expected to partner with communities to bring economic vitality through transportation improvements. The findings from this survey suggest that certain roadway elements that have the potential to meet multiple goals and serve multiple user groups. This research suggests that synergistic roadway design considerations—particularly designs fitting with complete streets principles—will offer transportation agencies an opportunity to simultaneously work toward goals of lowering costs, encouraging safety and mobility, and promoting economic vitality, while better partnering with the communities they serve.

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REFERENCES


