Taking Health to the LA Great Streets
Measuring Walking, Biking and Safety

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A comprehensive project submitted in partial satisfaction of the requirements for the degree Master of Urban & Regional Planning

by

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Disclaimer:

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EXECUTIVE SUMMARY

Cities across the country are investing in their urban street infrastructure to make their roads safer, more accessible, and vibrant for their communities. Programs such as the Los Angeles Great Streets Initiative aim to increase the City’s quality of life by focusing on services and functions provided by streets other than efficiently moving automobiles. There are a total of 15 Great Street Corridors1 in the City of Los Angeles; one selected for each Council District. Each selection has unique characteristics such as the types of businesses available, a rich history in Los Angeles, serving as a destination for residents and visitors, and being or becoming a part of an integrated transportation network that supports more walking, bicycling, and public transportation.

At the macro level, these streets have the potential to contribute to the health and well-being of Los Angeles and local neighborhoods who depend on them. The City is collecting data to evaluate whether the program will stimulate economic activity, improve access and mobility, social cohesion, and neighborhood safety; an effective evaluation of such goals would allow the City to understand if the changes to the street are benefitting the community.

1 Los Angeles Mayor Eric Garcetti announced the Great Streets Initiative program in 2014 to invest in underutilized streets that serve as the economic, social and cultural centers of many neighborhoods in the City. The program aims to develop streets that activate public spaces, provide economic revitalization, increase personal safety, and enhance local culture.
Despite these efforts, we still don’t completely understand how these streets can create environments that encourage healthier lifestyles, physical activity, and ultimately improve public health. Metrics and tools used to evaluate existing conditions of a street such as vehicular, pedestrian, and bicycle counts, while sufficient, are often not developed for a public health perspective. This project focuses on compiling recommended metrics and evaluation tools for walking, biking and aspects of traffic and personal safety that will better inform street-level health analysis. Therefore, this research will answer, “What metrics best evaluate safe and healthy streets?”

I addressed this question by drawing from metrics recommended in the academic literature and from commonly used street-level assessment tools. I then conducted a baseline evaluation of the Cesar Chavez Avenue, which is one of the Great Streets Corridors in the City of Los Angeles. The tools included: 1) an audit of the physical streetscape using the Pedestrian Environmental Quality Index (PEQI) developed by the San Francisco Department of Public Health (SFDPH), 2) Non-Compliant Motorist Counts and Pedestrian Activity Scans developed by the Los Angeles Department of Transportation, (LADOT) and 3) the Pedestrian Behavior Observation Tool developed by the Los Angeles Department of Public Health (DPH). Together the evaluation tools collected an array of data on the corridor’s physical street amenities (and lack thereof), overall walkability, activities most commonly experienced on the sidewalks, and a glimpse of how motorists and pedestrians behave at an intersection.
From my baseline evaluation, the findings address the existing conditions of Cesar Chavez Avenue and the usefulness of the evaluation tool and its metrics. Cesar Chavez Avenue’s intersections and street segments received scores ranging from 12.5 to 71 out of 100 reflecting varying levels of walkability. New visible crosswalks and temporary curb extensions aim to improve traffic safety, but does not fully address the potential to increase personal safety and comfort along the street. Despite the liveliness of visitors and residents who come to eat, drink, shop and use the services at many of the businesses, most activities (especially waiting for transit) were done standing, leaning or informally sitting reflecting the need for more spaces to sit and socialize.

Evaluation tools in this study contained relevant metrics to examine walkability and traffic safety, but lacked adequate metrics to properly assess the full extent of bikability and personal safety. If the City or Client plans to conduct further evaluations on Cesar Chavez and other Great Streets Corridors, supplementing the tools with metrics to better inform health, physical activity, and safety are encouraged. While all methods varied by how difficult it was to initially learn, the observation-based tools (e.g., counts and scans) provided the most flexibility to add or remove variables of interest.

The report outlines the process for answering the research question with a review of academic literature, explanation of evaluation methods, analysis of data and in depth discussion on recommendations for evaluating healthy streets.
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# ACRONYMS, ABBREVIATIONS, AND RELEVANT TERMINOLOGY

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<th>Description</th>
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<tbody>
<tr>
<td>Caltrans</td>
<td>California Department of Transportation</td>
</tr>
<tr>
<td>City</td>
<td>City of Los Angeles</td>
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<tr>
<td>Client</td>
<td>Los Angeles Great Streets Initiative</td>
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<tr>
<td>DPH</td>
<td>Los Angeles County Department of Public Health</td>
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<td>LADOT</td>
<td>Los Angeles Department of Transportation</td>
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<tr>
<td>LOS</td>
<td>Level of Service</td>
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<td>Metro</td>
<td>Los Angeles County Metropolitan Transportation Authority</td>
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<td>PEQI</td>
<td>Pedestrian Environmental Quality Index</td>
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<tr>
<td>SFDPH</td>
<td>San Francisco Department of Public Health</td>
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<tr>
<td>SWITRS</td>
<td>California Statewide Integrated Traffic Records System</td>
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DEFINITIONS

**Built Environment**- Refers to the physical and human built spaces that ranges in scale from buildings and streets to neighborhood and cities.

**Ease of Implementation**- The ranges of difficulty in learning and conducting an evaluation tool.

**Indicator**- A quantitative or qualitative factor that provides a reliable means to measure achievement.

**Metric** - A standard of measurement by which progress or performance can be assessed. Can include one or more indicators (e.g., pedestrian fatalities per capita, percentage of drivers failing to yield).

**Evaluation Tool**- An established set of metrics with a protocol developed to allow community organizers or researchers to collect information on a specific policy, project, or program.

**Walkability**- A measurement of how ideal an environment (e.g., city, neighborhood, street) for walking.

**Street Audit**- An inspection of the types of services and amenities available along the street.

**Streetscape**- A term that describes the spaces in-between two sides of a street that includes the front of a private lot, sidewalk, street furniture, and public roadway.
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"The street is our plaza."

La calle es nuestra plaza.
“You have to design your streets for everyone. The cities that have safe streets, that are easy to get around, are the ones that will grow and thrive in the 21st century.”

-Janette Sadik-Khan, Former NYC Transportation Commissioner

A movement to change the way we design our streets within state and local policy is spreading throughout the U.S. Transportation engineering has traditionally prioritized the quick and efficient movement of automobiles through street networks dictated by a hierarchy of street types such as arterials, collectors and local roads. Further supplementing this auto-oriented system is the use of Level-of-Service (LOS) measures to assign grades to the quality of traffic service along a given street. The implementation of Complete Street policies aims to make roads easily accessible to people of all ages and abilities, whether they are pedestrians, bicyclists, transit riders, or motorists.²

Complete Street policies and programs come in different forms, as one type does not fit the need of every state and its cities³. At the state level, policies are implemented in Oregon, California,

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North Carolina, Minnesota, Connecticut and Florida; City level policies or ordinances similarly exist in major cities such as Seattle, New York, San Francisco, Chicago, and Minneapolis. Complete street policies ultimately vary across cities depending on how much or little they address improving safety, access, and mobility for all people. The City of Los Angeles as an example, does not have a citywide policy for Complete Streets, but efforts to change the way Angelenos think about and use streets reflect the broader movement.

Los Angeles Mayor Eric Garcetti’s Great Streets Initiative is a program addressing similar goals set by the Complete Streets movement, but also tackles issues beyond transportation access and mobility. Major goals include enhancing neighborhood character and safety, environmental resilience, economic activity, equity and improving public health. The program recognizes that streets are an integral part of a neighborhood as the place where people live, work, socialize and recreate. With the first 15 Great Streets selected, the City aims to evaluate whether community driven improvements along these corridors will benefit the communities that the program serves. As such, LOS alone measures are inadequate to capture the effects of proposed changes.

Despite current evaluation efforts, there are still gaps in evaluating how these streets can create environments that encourage healthier lifestyles, physical activity, and ultimately improve public health. Metrics and tools used to evaluate existing conditions of a street such as vehicular,
pedestrian, and bicycle counts, while sufficient, are often not developed from a public health perspective. This project focuses on compiling recommended metrics and evaluation tools for walking, biking and aspects of traffic and personal safety in order to begin a street-level health analysis. Therefore, this research will answer, “What are the best ways to evaluate safe and healthy streets?”

Zavetoski and Agyeman (2015) illustrate in their book *Incomplete Streets*, that the current discussions on Complete Streets “disconnects streets from their significant social, structural, symbolic, discursive and historical realities.” They highlight that planning streets as a physical space with a focus exclusively on technical aspects of Complete Streets design may be reproducing many of the social, spatial and health inequalities that have plagued cities in the past century. This project seeks to look at streets as a social and symbolic community space in order to make recommendations for effective health evaluation of LA Great Streets.
2. WORD ON THE STREET
2.1. BACKGROUND AND EXISTING CONDITIONS

Cesar Chavez Avenue is a thriving commercial corridor that traverses East-West through Downtown Los Angeles, Boyle Heights, and unincorporated East Los Angeles. In 2014, the Mayor designated the segment in Boyle Heights between St. Louis Street and Evergreen Avenue as a Los Angeles Great Street with its appealing neighborhood shops, restaurants, and services. The Great Streets Initiative plans to improve walking and bicycling options for residents travelling to and from the street by using existing amenities and services such as community oriented businesses and the Mariachi Plaza Metro Gold Line Station.

The street is characterized by older buildings not taller than 2 stories high, built in the 1920’s and 1930’s.\(^5\) On the edge of the sidewalks, large Indian Laurel Fig trees (also known as ficus trees) line the street to provide adequate shade for all who pass by. The form of the street begins to fragment heading eastward towards Fickett Street with the presence of vacant lots, fast food establishments, and automobile-oriented shops that place their parking lots towards Cesar Chavez. Additionally, the numbers of driveways that a pedestrian must cross along the sidewalk increases as the number of total businesses decreases heading towards the end of the Great Street segment. At Evergreen, a strip mall with parking sits on the Southwest corner and a gas

station is located on the Northwest end. Despite the contrast between the Western and Eastern portions of Cesar Chavez, the Great Street primarily serves the neighborhood with a good mix of retail types, restaurants, and services. The amount of pedestrian traffic reflects the street as an important neighborhood center.

Figure 1: Map of Cesar Chavez Ave. in Boyle Heights
Selecting a Great Street to examine walking, biking, and safety involved working with the Los Angeles Great Streets Initiative (the Client) and Los Angeles County Department of Public Health (DPH). Both parties took interest in a health-level evaluation of this Great Street for several reasons. First, the City implemented the second phase of traffic safety improvements along the street in February 2016. Evaluating the street before and after any new improvements may provide insight to how people’s walking and driving behavior may change. Second, an evaluation of Cesar Chavez Avenue is timely as community organizations in Boyle Heights are developing the vision for their re-imagined Great Street.

2.2. NEIGHBORHOOD HISTORY AND DEMOGRAPHICS

Cesar Chavez crosses a neighborhood that is as diverse in its demographics as its history. Boyle Heights was a segregated neighborhood along with most of the City of Los Angeles in the 1920’s. The area has shifted from being a Jewish enclave to a predominantly Mexican and Mexican American enclave following World War II. Overall, the communities in Boyle Heights have consisted of Jews, Blacks, Latinos, and Asians. Discrimination against these groups in local city politics encouraged the formation of multiracial political coalitions in the 1940’s and 1950’s.
that elected the first Latino to the City Council. Today, the population in Boyle Heights is 84,000 and is mostly young working class Latinos.

While cultural diversity is Boyle Height’s asset, the area faces many economic, environmental and health burdens compared to the City of Los Angeles as a whole. More than half of the population has less than a high school degree, lower than the City’s average of 74%. About 30% of the population is below the federal poverty level and the average per capita income is $11,709 compared to the City’s average of $27,620.

The Los Angeles County Department of Public Health 2011 Survey Data by health district shows that 64% of children and 72% of adults in the Northeast district (includes Boyle Heights) have not met recommended weekly physical activity guidelines. The Boyle Heights community has higher coronary heart disease and stroke mortality rates in addition to higher children and adult asthma emergency visits compared to the City. Crime is also an issue with higher homicide mortality rates and higher emergency department visit rates due to assault in one or more zip codes. Residents face higher exposures to toxins such as ozone, PM 2.5, diesel particulate, and pesticides with a

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pollution burden index of 68.1 (zip code 90033) and 65.3 (zip code 90063) compared to the City’s score of 51.4.

2.3. MOBILITY, TRAFFIC VOLUMES AND COLLISIONS IN BOYLE HEIGHTS

A snapshot of mobility in Boyle Heights shows that 13% of households have no access to a vehicle, and 19% of commuters rely on public transportation. Only 8% of the share of commuters are walking and bicycling according to 2010 U.S. Census data. The collision rates between 2001 and 2010 involving pedestrians in Boyle Heights was 7.8 per 10,000 residents, which is slightly higher than the City’s average of 6.6. Motor vehicle collision rates for pedestrians and bicyclists under 18 years of age within a half-mile radius of a school are even worse--14 per 10,000 residents.

The City of Los Angeles, Department of Transportation (LADOT) collected counts of Average Daily Traffic (ADT) volumes at major intersections along Cesar Chavez through 2012. While LADOT conducted the counts at different dates and times, they reflect general vehicle traffic on the street and help inform decisions about traffic safety and street design improvements.

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9 Data on collisions retrieved from the City of Los Angeles’ Health Element and the Statewide Integrated Traffic Records System (2001-2010).
Total 24 hour ADTs along the street ranged between 18,000-24,000 vehicles. Intersections at Cesar Chavez/St. Louis and Soto had higher volumes compared to smaller 3-way intersection at Cesar Chavez/Saratoga and Forest Ave. Additional data collected in 2015 by Fehr & Peers, a transportation consulting firm, showed volumes vehicles, pedestrian and bicycle counts at two different segments of the Great Street on a weekday compared to a weekend (Figure 2). Pedestrian counts on Cesar Chavez between Breed and Soto were higher than counts between Mott and Saratoga. Bicycle counts were significantly lower for both locations on a weekday and weekend. The higher numbers of pedestrians counted along the street match the general observations made in this research showing the number and types of activities along the street.
There were 36 collisions\textsuperscript{10} along Cesar Chavez between St. Louis and Evergreen from 2008-2013. 20 of the collisions involved a motor vehicle and pedestrian(s) and 16 involved bicyclists. While the collisions were distributed across the street, a cluster of collisions occurred on streets with higher ADT such as St. Louis, Soto and Evergreen. New efforts to improve traffic safety are timely.

\textsuperscript{10} California Statewide Integrated Traffic Records System (SWITRS) Data from 2008-2013 is managed by the California Highway Patrol
as Boyle Height’s Great Street falls within the Mayor’s Vision Zero policy that aims to significantly reduce pedestrian and bicycle injuries and fatalities.\textsuperscript{11}

\begin{figure}[h]
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\includegraphics[width=\textwidth]{figure3.png}
\caption{Pedestrian and Bicycle Collisions along Cesar Chavez Avenue from SWITRS Data}
\end{figure}

\textsuperscript{11} High injury streets are mapped as part of the High Injury Network. This approach shows that 65\% of the City’s pedestrian and bicycle injuries occur on 6\% of the entire street network.
2.4. PEDESTRIAN SAFETY AND COMMUNITY ENVISIONING

Since it’s designation as a Great Street, Cesar Chavez has undergone a series of pilot traffic safety improvements to address the high incidence of traffic injuries and fatalities along the corridor. Intersection improvements were installed in Summer 2015 such as temporary curb extensions and high visibility crosswalks. Community outreach conducted by groups such as the Multicultural Communities for Mobility (MCM), From Lot to Spot, CALO Youthbuild, and Councilmember Jose Huizar’s office helped to illustrate the ideas, inspiration, and concerns that the neighborhood had for the future of Cesar Chavez Avenue.
On March 12, 2016, MCM, as one of the winners for the inaugural Great Streets Challenge grant, hosted activities to educate the community about road design treatments and safety for...
pedestrians, bicyclists, transit riders and drivers as part of their *Nuestra Avenida* campaign. Pop-up parklets and street furniture were placed along the street to show the community ideas of what a space on the street or sidewalk could look like if design changes to the street prioritized pedestrians.

*Figure 5: Activities along Cesar Chavez Avenue during the Nuestra Avenida event in March 2016*
3: QUANTIFYING HEALTHY BEHAVIORS AND CONDITIONS IN THE BUILT ENVIRONMENT
Understanding the built environment effects on human health is a growing and evolving area of interest for urban planning and public health professionals in the U.S. Research has shown the increasing evidence of the association between designing environments that promote walking and biking with increases in physical activity, personal and traffic safety (Dannenberg et al. 2003; Perdue et al., 2003; Lawrence et. al., 2005). Metrics such as pedestrian and bicycle counts, observational audits of street amenities, and traffic safety data help public agencies and organizations evaluate the effectiveness of policies implemented to create healthier environments. The gap in research, however, lies in choosing metrics that are most effective for evaluating physical activities and healthy conditions at the urban street and corridor level. This review will highlight the strengths and limitations of existing active travel research and pedestrian safety metrics in order to provide recommendations for effective assessments on urban streets or street corridors.

3.1. WHY PHYSICAL ACTIVITY SUCH AS WALKING OR BIKING MATTERS?

The need for safe walking and biking whether for transportation or recreation is great in an urban landscape where motor vehicles are the dominant mode of transportation and rates of physical activity have been declining (Dannenburg et al. 2003). Policies set in place to design cities and communities around the motor vehicle travel have in turn influenced the built environment for walking and biking.
Research in the past decade on the built environment’s effect on levels of walking and biking has been fruitful for addressing public health issues related to physical inactivity. While national efforts to increase leisure-time physical activity have been largely unsuccessful, increasing physical activity through an active living lifestyle has been a priority in the urban planning profession (Handy, et al. 2002 and Saelens et al., 2003). Addressing traffic congestion in urban cities and finding sustainable forms of transportation are a few of the traditional reasons to encourage walking and biking. Research indicating new benefits of street-scale built environment features now include: increases in social cohesion, personal safety, and economic activity (Kuo, et al. 1998; Francis, et al. 2012; and Clifton et al. 2012). These factors help make a stronger case for creating cities, communities, neighborhoods, and streets that are conducive to physical activity.

3.2. WHAT ENCOURAGES PHYSICAL ACTIVITY ON THE STREETS?

Physical elements and perceptions of the built environment encourage physical activity. Perceptions include that of traffic safety (i.e., safety from vehicle), personal safety (i.e., fear of crime, presence of people, and streetlights), comfort of walking and biking (e.g., levelness of streets and sidewalks, aesthetics of street), availability of interesting destinations, and distance between origin and destination. Physical elements relate more to the design or characteristic of the streets such as the urban form, street conditions, presence of street furniture and infrastructure for walking and biking (e.g., wide sidewalks, crosswalks, and bike lanes, bus stops).
All of these factors collectively contribute to an overall result or score that can determine whether an individual will likely walk or bike whether for leisure physical activity or for transportation.

### 3.3. METRICS FOR HEALTHY BEHAVIOR AND CONDITIONS

Many state and local municipalities are developing programs and policies (e.g., Open Streets, Great Streets, Main Streets and Complete Streets) that aim to redefine the purpose of urban streets. While the functions for those streets have traditionally been for moving motor vehicles safely and efficiently, these programs aim to create public spaces for people, promoting alternative modes of transportation, increasing physical activity, personal safety and lowering risks for pedestrian traffic fatalities. Effective metrics are needed in order to assess whether the street level changes proposed by these various programs are benefiting the people who use them. Ideally they should be translatable to other organizations looking to do similar evaluations of a street improvement and serve to establish baseline information for future analyses on a project’s effectiveness.

### OVERVIEW OF MEASURES AND METRICS ACROSS DISCIPLINES

Metrics used today to evaluate physical activity in the built environment have resulted from a combination of interdisciplinary expertise from the health, behavioral sciences, city planning and transportation, leisure studies, and parks and recreation fields (Sallis, 2009). While these disciplines assess the built environment from different perspectives, they contribute to
quantitative and qualitative approaches at the community level with knowledge on aesthetic and recreational environments. Brownson (2009) categorized three types of data used by researchers to analyze the built environment and physical activity; they include perceived measures obtained by questionnaires and surveys, observational measures through audits, and geospatial measures such as Geographic Information Systems (GIS). Lin and Moudon (2010) reviewed the reliability of these data classified as subjective measures (e.g., survey data, questionnaires and self-report) and objective measures (e.g., audits, GIS) in order to assess its association to physical activity. While objective measures (such as measured distance of nearby destinations) appeared to have strong associations with walking, the combination with a subjective measure (such as perceived presence of neighborhood shops) resulted in a stronger association with physical activity and walking. Overall, objective measures in this study and others were strong predictors (Lee and Moudon 2010).

The literature addresses the positive associations between certain built environments features and walking, but only a handful of articles distinguish between walking for leisure/physical activity or walking for transportation. This separation is important in determining whether environmental characteristics influencing physical activity tend to differ between the two types of walking (Pikora et. al, 2003, Hoehner et al. 2005 and Boarnet et al., 2011). For example, sidewalk width as a metric was shown to correlate positively with walking for transportation more so than walking for leisure activity. Objective and perceived measures of land use, recreational facilities and transportation system features were shown to support physical activity, but not other
environmental measurements (Hoehner et al., 2005). Land use measures included the number and proximity of destinations to a person’s home; recreational facilities included the number of parks, trails, and fitness facilities; transportation features included the presence of sidewalks, bike lanes, and public transit stops. Overall, Hoehner et al. (2005) concluded that the built environment may affect transportation activity more so than recreational activity.

The past decade has seen a growth of extensive assessments and instruments to observe or audit the built environment (Pikora et al. 2002; Giles-Corti et al. 2005; Boarnet et al., 2011). Brownson (2009) evaluated roughly 40 peer-reviewed instruments that addressed perceptions and observations of the built environment on physical activity. There are hundreds of different metrics across these instruments that aim to inform healthy behaviors and conditions such as physical activity, traffic and personal safety. A trade-off for many of these audits and assessments, however, is that they are time consuming, require careful selection of street segments, lack detailed and accurate data on behavioral and objective measures of the environment, and are often not validated. (Moudon & Lee, 2003, Brownson et al., 2009).

**SAFETY AND PHYSICAL ACTIVITY**

Significant barriers to walking and biking are related to crime, traffic and personal safety (Wang et al., 2015). Common methods to evaluate safety include individual perceptions of crime and safety, assessing environmental factors such as lighting (Pena-Garcia, et al. 2015;), as well as an assessment of walking and biking infrastructure.
PERCEPTIONS OF SAFETY AND CRIME

Many studies show the association between perceived risk and fear and physical activity. Strengths of association however are generally mixed in the literature (Hong and Chen, 2014). Perceived safety and fear are complex and can be influenced by an individual’s personal experiences of the surrounding physical and social environments. Loukaitou-Sideris (2006) found that the mixed results in studies are explained by methodological weaknesses and inconsistencies. For example, certain studies do not distinguish between different sources of danger (e.g., crime, fall injuries), that are important in relating to different safety concerns. The author notes that in general, the associations have been stronger in studies focusing on women, children and the elderly.

STREETSCAPE ELEMENTS AND SAFETY

The presence, distribution and intensity of street lighting have been shown to decrease the perceptions of danger and promote pedestrian and bicyclist safety (Valentine, 1990; Trench et al., 1992, and Loukaitou-Sideris, 2006). In particular, well-illuminated streets had a greater association with personal safety when average illumination was greater (Pena-Garcia, et al., 2015). Harvey et al. (2015) identified other elements such as building and tree design to affect perceived safety of streetscapes. Tall, narrower streetscapes for example were perceived as safer than wide and short streetscapes.
A review of existing traffic engineering controls by Retting et al. (2003) highlighted single lane roundabouts, sidewalks, exclusive pedestrian signal phasing, pedestrian refuge islands and intensity of roadway lighting, and curb extensions as effective measures of pedestrian traffic safety. In addition, Fitzpatrick et al. (2011) recommended pedestrian-activate beacon systems that were shown to produce an increase in motorist yielding behavior in their selected sites of study. The authors note that while these measures are highly effective, prioritizing each item is necessary due to resource scarcity for road engineering.

Bicycle traffic safety is similar to pedestrian safety where street-level interventions designed for biking are effective for improving bicycle safety. A few of the measures that have been associated with the reduction of risk in bicycle injuries and collisions include the presence of on road marked bike lanes, off-road bike paths, shared lane markings to increase motorist awareness of bicyclists, proper street lighting, and bicycle route maintenance (Reynolds et al., 2009 and Lusk et al., 2011).

A factor that increases and improves both bicycle and pedestrian safety is the use of traffic calming measures on the streets. The goal of these measures is to address motor vehicle speeding in order to reduce the risk and severity of crashes to pedestrians and bicyclists. Measures that have shown significant association with reductions in traffic speeds and volume include: travel lane narrowing, speed humps/tables, traffic circles and roundabouts (Zein et al. 1997; Litman, 1999, and Rahmen et al., 2009).
THE VALUE OF NEIGHBORHOOD SCALE METRICS

Neighborhood-scale urban form factors primarily consist of urban form factors such as residential density (Saelens et al. 2003 and Lawrence et al. 2005), land use mix (Lawrence et al. 2005; Feng et al., 2010, McCormack and Shiell, 2011 and Grasser et al., 2013), and street network connectivity (Southworth; 2005; Marshall et al. 2011 and Marshall et al. 2014); they are traditionally used to examine the correlation with physical activity and walking. While limited in their ability to capture detailed street level built environment characteristics, they can be used in combination with street-level metrics to provide a broader scope for data collection. For example, Frank (2007) assessed the relationship among objectively measured urban form variables in youth and found that access to recreation or open space is an important factor for walking.

LAND USE

Studies showing land use association on physical activity are inconsistent. One general theme is that neighborhoods zoned for single use, low-density land development has been inhibitive of physical activity (Frank et al., 2005). The general measures of land use metrics consist of counting the number of nonresidential destinations and calculating the diversity of land uses in geographically defined areas (i.e., land-use mix) (Hoehner et al., 2005 and Duncan et al. 2010). Limitations for land use metrics is that they are more useful at the neighborhood scale and do not alone provide the details of street level urban form factors that influence physical activity. Sung et al. (2015) found that there were interactive effects between street-level physical environment and
zoning suggesting that efforts to improving street walkability should be combined with zoning regulations.

**Density**

In studies examining urban form factors on physical activity, density measures were divided into two categories, residential and intersection density (Saelens et al., 2003 and Frank et al., 2005). Residential density is a ratio of the number of households to residential land area and can be supplemented by Census data, while intersection density is a ratio of intersections per square kilometer. Both were found in studies to be good predictors of walking at the neighborhood scale. Intersection density additionally is a more significant variable than street connectivity as well connected streets with long blocks can still inhibit physical activity. Frank et al. (2005) found that people are more likely to meet recommendations of ≥30 minutes of moderate activity when they live in neighborhoods with nearby shops and services, with many street connections between residential and commercial districts.

**Street Connectivity**

Street networks are localized systems of streets and roads that provide planners and transportation analysts the foundation for providing better transportation and route services. Street connectivity is a related concept that refers to the directness of links and connections in a street network (Mecredy et al. 2011). Currently there is more empirical evidence for connectivity
and walking for transportation with the idea that more destinations are available in areas with well-connected street networks (Southworth, 2005 and Koohsari et al. 2014). Many studies note the lack of attention to street connectivity measures and its effects on health outcomes. Marshall et al. (2014) found that more compact street networks correlated with reduced rates of obesity, diabetes, high blood pressure and heart disease after controlling for the food environment, land uses, socioeconomic status and street design. Street connectivity metrics are often measured by the number of intersections per square kilometer and would require a scale larger than a single street segment (Frank, 2005).

**URBAN AIR QUALITY**

Reducing vehicular emissions and improving air quality in urban environments can reduce the risk for adverse health effects. While the air quality on urban streets is not directly associated with physical activity, understanding strategies for air quality management and its effects at the street level informs policies influencing the built environment and is a measure worth examining with the goal of increasing healthier conditions. For example, porous barriers and buildings, street trees, parked cars, and solid barriers serve as passive methods for improving air quality (Vranckx et al., 2015; Jeanjean et al., 2015 and Gallagher et al., 2015). The effectiveness of street trees in reducing emissions varies with factors such as urban street canyon depth, tree placement, and wind direction (Vranckx et al., 2015). Abhijith and Gokhale (2015) investigated combined effects
of tree canopy heights and angle of park cars and found that highly porous, medium-sized trees
together with parallel and perpendicular car parking act best in reducing pedestrian exposure.

STREET LEVEL URBAN FORM

Urban form characteristics at the street level consist of building and lot sizes, building types and
architectural details, and streetscape amenities. Built environments that minimizes lot-width and
building configuration to promote pedestrian and bicycling safety and comfort should be
considered in redevelopment policies or projects (Vojnovic et al., 2006).

RELIABILITY OF INDEXES AND MULTIMODAL LEVEL OF SERVICE

There are few available studies on the effectiveness of assessments that aggregate metrics into
ranges of scores for walking or biking. Included in these tools are Levels of Service (LOS), which
were traditionally used by transportation planners and engineers to assess the capacity of
roadways to carry vehicles. A push in the past two decades for multi-modal LOS to measure
walkability and bikability has led to indices such as the Bicycle Environmental Quality Index (BEQI)
and the Pedestrian Environmental Quality Index (PEQI) developed by the San Francisco
Department of Public Health.

Brozen et al. (2014) evaluated existing multi-modal level services and indices for their
effectiveness against streets selected in Santa Monica, CA. The study found that the tools
produced similar results when the streets performed well for biking and walking, but when street
quality declined, the scores significantly differed. A major limitation of aggregating data and using indexes is the informational detail loss during scoring and classification. For example, the authors saw a lack of sensitivity to sidewalk quality, trees, lighting and common traffic calming treatments.

*WHAT ARE EFFECTIVE STREET-LEVEL MEASURES AND METRICS FOR PHYSICAL ACTIVITY?*

Effective street level measures reflect both objective and subjective measures. While associations were generally stronger for objective measures of the built environment, subjective measures examining perceptions were valuable for traffic and personal safety. Objective measures across studies consistently demonstrated value in audits and assessment tools that evaluated the built environment (e.g., pedestrian and bike infrastructure, streetscape elements). While many urban form factors such as residential and intersection density are difficult for application at the street level, examining urban form in relationship to the streetscape elements is valuable. Detailing the types of buildings, lot sizes, heights and architectural details can inform the comfort and interest value of walking and bicycling on a street. From the review of the literature, eight categories of measures are recommended with their respective set of metrics used for a street level evaluation. While built environment metrics in existing research ranged from a spectrum of single variables to a host of tools and assessments, the most comprehensive are summarized in *Table 1*. 

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<table>
<thead>
<tr>
<th>Street Level Indicators</th>
<th>Metrics</th>
<th>Literature Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Walking Trips and Pedestrian Facilities</td>
<td>Number of pedestrians on a given segment, Sidewalk width (feet), Number of marked crosswalks, pedestrian islands, curb extension, countdown signals, accessible ramps</td>
<td>Retting et al., 2003; Hoehner et al., 2005; McCormack et al., 2012; Fitzpatrick et al., 2011</td>
</tr>
<tr>
<td>2. Bicycle Trips and Bicycle Facilities</td>
<td>Number of bicyclists on a given segment, presence of on-road bike lanes</td>
<td>Hoehner et al., 2005; Brownson et al., 2009; Reynolds et al., 2009 and Lusk et al. 2011;</td>
</tr>
<tr>
<td>3. Traffic Safety</td>
<td>Number of fatalities and injuries by mode, marked and unmarked crosswalks, traffic calming device (roundabouts, medians, speed humps) etc.)</td>
<td>Garder, 2004; Zegeer et al. 2005; Rahman et al., 2009; Quistberg et al. 2015; Chen et al., 2015</td>
</tr>
<tr>
<td>4. Personal Safety</td>
<td>Number of street lights, survey evaluation of safety perception, Number of reported neighborhood crimes</td>
<td>Tien et al. 1977; Painter and Farrigan, 1997, 1999; Marshall and Garrick, 2011; Pena-Garcia et al., 2015</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5. Public Space</td>
<td>Number of parks or public plazas, observations of user presence and activities</td>
<td>Cohen et al., 2006; Giles-Corti et al., 2005 and Pietila et al. 2005; Cohen et al., 2006; Sarkar et al., 2015 and Lovasi et al., 2013</td>
</tr>
<tr>
<td>6. Land Use and Urban Form</td>
<td>Land-use mix, intersection density, building characteristics (building type: café, grocery, liquor store)</td>
<td>Hoehner et al., 2005; Frank et al., 2005 and 2007; Duncan et al. 2010; Schilling and Linton, 2005; Sung et al., 2015; Sung and Lee, 2015; Harvey et al., 2015</td>
</tr>
<tr>
<td>7. Wayfinding and Placemaking</td>
<td>Street furniture (Number of bike racks, benches, bus shelters, street lighting, street trees), Number of signage, public art (structures, murals)</td>
<td>Sarkar et al., 2015; Lovasi et al., 2013; Cohen et al., 2006; Vojnovic et al., 2005; Lovasi et al., 2013</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8. Local Air Quality</td>
<td>Levels of particulate matter and other air pollutants</td>
<td>Vranckx et al., 2015; Jeanjean et al., 2015 and Gallagher et al., 2015</td>
</tr>
</tbody>
</table>

Table 1: Summary of street level metrics that best assess the built environment for physical activity, personal and traffic safety
4: EVALUATING CESAR CHAVEZ AVENUE
Identifying strategies for the evaluation of healthy behaviors and conditions on Great Streets corridors involved working with the Los Angeles Great Streets Initiative, who is the client organization, and the Los Angeles County Department of Public Health (DPH) who were similarly interested in assessing long-term health outcomes of the Great Streets Initiative. Metrics evaluated through academic literature provided a basis for collecting information at the street level. Additionally, I used assessment tools created by local government agencies to collect data on walking, bicycling and safety. The tools included: 1) an audit of the physical street, 2) street intersection behavior observations of pedestrians and motorists and 3) a pedestrian activity scan.

Cesar Chavez Avenue in Boyle Heights was selected as the street of study. This street was identified by the Mayor in 2014 as one of Los Angeles’ most active commercial corridors with many available restaurants and shops. Great Streets aims to improve how residents travel in and out of this corridor by improving pedestrian and bicycle infrastructure. The client representative and DPH were interested in a health focused analysis for this street following pilot installation of traffic safety improvements along the corridor in August 2015 and February 2016. Community planning and visioning for the installation of amenities along Cesar Chavez are currently in progress.

DPH coordinated data collection along Cesar Chavez Avenue from Wednesday January 6, 2016 through Saturday January 9, 2016 employing street audit tools and intersection counts. I
coordinated additional pedestrian activity scans on January 12th, 14th and 16th, selecting a comparable weekdays and weekend mid-day.

4.1. ASSESSMENT TOOLS

The street audit, intersection counts, and pedestrian scans tools were assessed for their breadth in collecting health related data and overall ease of implementation (e.g., learning difficulty, data entry and analysis, time commitment). Local government agencies developed these tools with the intention of collecting data to measure the levels of walking, bicycling and general behavior of people on a street before and after a design intervention (e.g., new bike lanes, visible crosswalks, and curb extensions). Additionally, these tools help gather information about the activities of people and the attributes of a place.

4.2. STREET AUDIT TOOL: THE PEDESTRIAN ENVIRONMENTAL QUALITY INDEX

The audit of the streetscape or street environment is an effective way of obtaining baseline conditions of the street before important changes or interventions take place. For this project I collected information on the pedestrian quality of Cesar Chavez Avenue using a tool called the Pedestrian Environmental Quality Index (PEQI) developed by the San Francisco Department of
Public Health and modified by the University of California at Los Angeles (UCLA). Metrics used for this tool consist of ones commonly evaluated in the academic literature and suitable for street level analysis.

The PEQI consists of street segment and intersection based metrics associated with pedestrian environmental quality and safety grouped across categories representing intersection safety, vehicle traffic, street design, land use, and perceived safety (Table 2 and 3). The San Francisco Department of Public Health compiled these metrics based on a review of public health, transportation and planning literature. Scores and weights were determined by survey input from academic institutions, planning practitioners and active transportation advocates.

The audit was conducted on Friday January 8, 2016 and took approximately four hours to complete. To prepare, a DPH staff member and I participated in a PEQI training that took approximately 2 hours where we received materials such as clipboards, count forms and measuring tape. On the day of the audit I collected observational data with the DPH staff.

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12 The PEQI was modified for use in Los Angeles by Malia Jones, MPH, an alumna of the UCLA Fielding School of Public Health. Key changes were made to the original instrument in order to make it applicable to the Los Angeles Environment.

member on the physical condition of each street intersection and segment on Cesar Chavez Avenue between St. Louis Street and Evergreen Avenue.

Following the audit, the data from the count forms were transferred to an excel sheet in order to calculate scores for each street segment and intersection. Various street features and amenities receive different scores that are weighted and multiplied to produce a final score that ranges from 0-100. Features that benefit the walkable environment of the street (e.g., street trees, wide sidewalks, and public seating) are weighted higher than features that potentially deter walking (e.g., trash, graffiti, lack of traffic calming). For street segments along Cesar Chavez Avenue, scores were calculated for each side of the street for a thorough comparison of conditions.

<table>
<thead>
<tr>
<th>Categories of Intersection Data</th>
<th>Specific Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Intersection Safety</td>
<td>Number and type of crosswalks, pedestrian signals in each direction, stop signs, curb cuts, No Turn on Red signals/signs, crossing speed, crossing distance, traffic calming features (e.g., pavement treatments, median, roundabouts, curb extensions, and speed bumps)</td>
</tr>
</tbody>
</table>

Table 2: Types of Data Collected for Street Intersections by the PEQI Tool
### Categories of Street Segment Data

<table>
<thead>
<tr>
<th>Categories of Street Segment Data</th>
<th>Specific Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vehicle Traffic</td>
<td>Number of lanes, speed limit posted, traffic calming features (e.g., Pavement treatments, median, bike lanes, and speed bumps)</td>
</tr>
<tr>
<td>• Street Design</td>
<td>Sidewalk width, quality and condition, public seating, street trees, planters</td>
</tr>
<tr>
<td>• Land Use</td>
<td>Number of storefronts, historical sites, public art</td>
</tr>
<tr>
<td>• Safety and Aesthetic Qualities</td>
<td>Graffiti, litter, pedestrian-scale lighting, vacant lots, abandoned buildings</td>
</tr>
<tr>
<td>• Perceived Walkability</td>
<td>Subjective rating questions on street conditions</td>
</tr>
</tbody>
</table>

Table 3: Types of data collected for street segments by the PEQI Tool
4.3. INTERSECTION BEHAVIOR COUNTS

The intersection counts consisted of two separate tools: 1) the **Non-Compliant Motorist Counts** and 2) the **Pedestrian Behavior Observation Tool**. Both are useful tools to examine how motorists and pedestrians behave at intersections, and can reveal traffic safety issues and necessary improvements at a given intersection. I collected data using both tools with a DPH staff member at the Southeast corner of Cesar Chavez Avenue intersection at St. Louis for the first shift and at Mott for the second.

The Los Angeles City, Department of Transportation (LADOT) developed the Non-Compliant Motorist Counts to document specific instances where motorists fail to yield to pedestrians along crosswalks. Intersections at Cesar Chavez/St. Louis and Cesar Chavez/Mott were selected to account for differences in intersections that have already received minor improvements (e.g., visible crosswalks and temporary curb extensions) compared to the ones that have not. The data collector assigned to conduct the counts noted motorist behavior along two of the four crosswalks. The counts were also dependent on the two phases of the traffic signal (e.g., when west and eastbound traffic has a red light and when north and southbound has a red light).
The Pedestrian Behavior Observation Tool, developed by DPH, examines how people crossing the street behave relative to the existing conditions of the intersection, particularly the crosswalk signals. The type of information collected for these observations is shown in Table 4 below.

The Non-Compliant Motorist Counts record the total number of vehicles failing to yield to pedestrians or encroaching along two intersection crosswalks. It is important to note that counts
for noncompliance do not take into account the total number of vehicles passing through the intersection during the count period.

Data for the noncompliance counts were collected only for one weekend mid-day while pedestrian behavior counts were conducted on one weekday morning/afternoon and one weekend day instead of multiple days due to limitations in scheduling data collection. The resulting data is very limited in showing a complete comparison across multiple count periods, but provides valuable qualitative information for the baseline evaluation of the street and the usability of the tool itself.

<table>
<thead>
<tr>
<th>Category of Data Collected</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Count Period(^{14})</td>
<td>7:00-9:15am for weekday morning shift&lt;br&gt;11:00am-1:15pm for weekday mid-day shift&lt;br&gt;11:00am-1:15pm for weekend shift</td>
</tr>
<tr>
<td>2. Days of the Week</td>
<td>Selected 1 Weekday and 1 Weekend (e.g., Thursday and Saturday)</td>
</tr>
</tbody>
</table>

\(^{14}\) The extra 15 minutes in the count period accounts for the time it took to walk from the first location at St. Louis to the second at Mott.
3. Location
Intersections at Cesar Chavez/ St. Louis and Cesar Chavez /Mott St.

4. Observational Period
15 minute observations, totaling of an hour at each intersection

5. Conditions
Indicated weather conditions

6. Type of Users
Individual vs. group, gender, age

7. Waiting Location
Recorded where users are standing: concrete curb, curb extension, in the street

8. Signal Status
Is the crosswalk signal showing: Walk signal on, flashing red, solid red, or is there light mismatch?

Table 4: Summary of Pedestrian Behavior Observation Tool used along Cesar Chavez

4.4. PEDESTRIAN ACTIVITY SCANS

The Pedestrian Activity Scans\textsuperscript{15} were conducted for each block (which includes both sides of the street segment between two intersections). Counts were done on a Tuesday, Thursday, and

\textsuperscript{15} LADOT also developed this tool as part of their People Street Evaluation Manual used to collect baseline data before installing parklets.
Saturday in January 2016 to show differences between weekday and weekend activities. The data collector began taking counts by walking slowly along the sidewalk and stopping to accurately record stationary or lingering people and their activities. According to the tool’s protocol, counts can take on average of 4-8 minutes per block. Due to the configuration of the Cesar Chavez, intersections consisted of 4-point intersections and 3-point intersections. To organize data collection, the collector labeled each segment on the form with a number and walked along the southern portion of each block along Cesar Chavez Avenue before looping back to the northern portion. Each north or south side of the street had its own count form which took about 2-8 minutes depending on amount of activity along the sidewalk.

<table>
<thead>
<tr>
<th>Data Collected</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Count Period</strong></td>
<td>8:00-9:00am for morning shift</td>
</tr>
<tr>
<td></td>
<td>2:00-3:00pm for afternoon shift</td>
</tr>
<tr>
<td></td>
<td>11:00-12:00pm for weekend shift</td>
</tr>
<tr>
<td><strong>2. Day of Week</strong></td>
<td>Selected 2 Weekdays and 1 Weekend (e.g., Tuesday, Thursday and Saturday)</td>
</tr>
<tr>
<td><strong>3. Observational Period</strong></td>
<td>Varies for activity scan (~4-8 minutes per block)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4. Conditions</td>
<td>Indicating rain/no rain</td>
</tr>
<tr>
<td>5. Type of Users</td>
<td>Individual vs. group, gender, and age</td>
</tr>
<tr>
<td>6. Type of Major Activity</td>
<td>Physical activity, stand/sit, waiting for transit, shopping, street-vending, crossing street, nuisance behaviors, etc.</td>
</tr>
<tr>
<td>7. Selected Blocks along Cesar Chavez Avenue</td>
<td>All blocks along Cesar Chavez between St. Louis and Evergreen.</td>
</tr>
</tbody>
</table>

Table 5: Summary of general guidelines for structured observation of selected Great Streets adapted from LADOT People Streets Manual

4.5. GENERAL LIMITATIONS

There are hosts of other measures that could have been used for the evaluation of healthy conditions and behaviors on the selected streets such as the food environment along Cesar Chavez Avenue or access to other health services. The focus of this research, however, is to specifically examine physical activity and safety outcomes.

The evaluation tools selected for study, while used by the LADOT and DPH, have not been extensively evaluated in the academic literature, but comprise of measures and metrics that have
been critiqued by Sallis, 2009; Brownson et al. 2009; Lin and Moudon, 2010 and others. Examples of those metrics includes auditing the conditions of a street and counting pedestrians and bicyclists. The PEQI tool similarly has not had received extensive evaluation in the literature compared to other tools, but provides a thorough assessment of the walkability of a neighborhood.

**STREET AUDIT TOOL**

While traffic safety was evaluated through counts, personal safety was limited by auditing the presence of pedestrian street lighting, rather than counting the number of lights that worked. Due to the concerns for safety of the data collectors, street lighting was audited during the daytime. PEQI addresses personal safety and comfort of walkability with a series of rating-style questions answered by the data collector. These questions however, may not reflect the views of safety and walkability for residents and community members who frequently walk along the street.

PEQI as addressed in the literature review has limitations regarding the specificity of the information collected in order to produce an aggregate score. For example, the number of trees on a street is not counted, but it is only noted whether there are no trees, sparsely or continuously-lined. Street amenities are assigned a higher score, but this doesn’t account for the specific quality of those existing amenities. Having bike parking for example increases a street segments score, but doesn’t detail between how many bike racks exists or the condition of the rack(s).
INTERSECTION COUNTS

Limitation with the intersection counts include not having observations done for all crosswalks even though there may be differences in yielding behavior for one crosswalk versus another. Two street intersections were chosen to account for differences along Cesar Chavez Avenue where recent intersection improvements were installed in comparison to the segment where improvements were not in place at the time of observations. One limitation is that there may be differences between two intersections with or without improvements due to other external factors of the street (e.g., types of businesses along that intersection and the amount of pedestrian traffic). Another limitation has to do with the selection of observation day and times. While ranges of count periods and count days were chosen, there are gaps in times such as night periods and non-peak hours.

In May 2016, DPH updated the protocol used for their Pedestrian Behavior Observation Tool and the Non-Compliant Motorist Counts developed by LADOT in order to improve the accuracy of the data collected. The observations collected from the same two tools in this study applied the protocols that were developed before the revisions. As such, the issues on the evaluation tools’ limitations and usability were partially resolved or addressed in the new protocols. Examples include the addition of another data collector for the two tools, the revision of the motorist counts to include all movements rather than just non-compliance, and the removal of the “group size” and “starting/ending corners” variable in the Pedestrian Behavior Observation Tool.
5.1. TYING TOGETHER THE METRICS FOR EVALUATION

The tools used to evaluate the existing physical activity and safety conditions of Cesar Chavez Avenue measure available traffic safety infrastructure, the conditions of the sidewalk, the number and type of activity along the sidewalk, and how motorists and pedestrians behave at intersections. They include: The Pedestrian Environmental Quality Index (PEQI) developed by the San Francisco Department of Public Health, the Non-Compliant Motorist Counts and Pedestrian Activity Scans developed by the Los Angeles Department of Transportation, and the Pedestrian Behavior Observation Tool developed by the Los Angeles County Depart of Public Health (DPH).

While these tools consist of a small sample of available metrics to examine health on the streets, they provide valuable information that will inform future evaluations of Cesar Chavez Avenue and other Great Streets Corridors. The following sections detail the conditions of walking, bicycling, and traffic safety along Cesar Chavez. The usefulness of the tools is then described and analyzed in terms of their ease of implementation, initial learning difficulty and relevance to collecting the desired information on health metrics. The tools were selected in consultation with DPH’s evaluation team of Cesar Chavez.
5.2. STREET AUDIT: PEDESTRIAN ENVIRONMENTAL QUALITY INDEX

Scores for the PEQI tool range from 0-100 with higher numbers indicating favorable levels of walkability. There are five tiers of walkability. Scores of 0-20 represent an unsuitable environment for pedestrians, scores 21-40 represent poor conditions, scores 41-60 represent basic conditions, 61-80 represent reasonable conditions, and 81-100 represent the most ideal walking environment.

Cesar Chavez Avenue between St. Louis and Evergreen received scores from the Pedestrian Environmental Quality Index (PEQI) ranging between 12.5-71.4 for intersections, and 48-68 for the street segments (Figure 7). The installation of permanent visible crosswalks that took place in the past year contributed to the higher intersection scores. Temporary curb extensions at the intersections of St. Louis, Matthews, Breed, Soto and Fickett Streets were not scored since the PEQI does not award points for temporary treatments.
The segments with the highest scores are located between St. Louis and Breed where more people are walking and more types of retail and storefronts are clustered together. The main intersections along this stretch include: St. Louis, Chicago (south-facing) and Breed, which all benefited by improved crosswalks, and is reflected in their scores. There were currently no
intersection or street segments that scored above 80, which would have moved them into the next scoring category of an ideal pedestrian environment.

Four of the fourteen intersections scored under 20, which indicates an unsuitable environment for people crossing a street. These four intersections in particular (e.g., north-facing Chicago, Cornwell, north-facing Fickett, and Savannah) are 3-way intersections where a small neighborhood street connects to Cesar Chavez Avenue. It is difficult as a pedestrian to cross the larger street at these locations, since they do not have marked crosswalks. While these intersections highlight areas for future improvement, they do not impact the overall walking experience of Cesar Chavez Avenue, as reflected in the combination of higher scoring segments and intersections surrounding them.

What the scores can’t articulate are the differences across segments that are in the mid-lower ranges (e.g., scores between 20-60 or the poor and basic conditions). Not all “basic conditions” segments/intersections are equal. For example, the north segment of Cesar Chavez between Fickett and Mott scored roughly 10 points higher than the north segment between Forest and Evergreen. Both scores reflect the lowest and highest scores received that fell into the “basic conditions” category.
The Forest-Evergreen segment includes less retail space, a gas station which contributes to this segment earning less points overall. This is contrasted with the Fickett-Mott segment where a public mural exists and there are less driveways overall (Figure 8).

Figure 8: An example of two street segments in the same score category with vastly different features

In general, negative qualities or features (e.g., graffiti, litter, and vacant lots) receive less points during scoring. In contrast, segments or intersections with positive features (e.g., striped crosswalks, bike lanes, and pedestrian-scale lighting) are weighted higher and awarded more points. If two intersection or segments have a positive feature such as public art, but one has more of that feature, than both will still be awarded the same amount of points. This makes it challenging to increase an intersection or segments score based on having more features in one type of category.
Graffiti and litter was a common feature along the entire 17 street segments, which affected the potential for higher scores. Similarly, the number of driveways along the street, poor sidewalk conditions and obstructions negatively affect scores.

Figure 9: A segment’s score can be affected negatively by vacant lots, driveways (left) and sidewalk obstructions (right)
Street features and amenities that promote a walkable and sociable environment can also impede walking if chosen, placed or distributed in manner that affects safety. Pedestrian lighting, for example, can be found at bus stops and businesses clustered along the western section of the street, but were scarcely distributed towards the eastern section. There are few elements available to slow down vehicular traffic along the street aside from the temporary curb extensions between St. Louis and Soto and include the presence of pavement treatment and dips at Soto and Mott intersections respectively. The amount of pedestrian traffic, density of storefronts, and clustering of tree canopies may play a role in slowing down car traffic by acting as visual traffic calming. The role of street trees is important to consider along Cesar Chavez; while the ficus trees provide shade along the street, they limit walkability because of sidewalk damage caused by large tree roots (Figure 9). Street trees can also influence perceptions of safety along areas with limited night lighting such as the section of the street between Soto and Evergreen.
The PEQI tool is an assessment of an area’s walkability using scores for street segments and intersections. The scores are derived from points assigned to specific amenities and characteristics of a street, which are weighted on its ability to improve a person’s walking experience. The tool is dynamic in its ability to serve as a street audit tool where scores can easily be mapped to visually represent the existing street and sidewalk conditions.
While the PEQI isn’t extensively evaluated in the academic literature in the same manner as other built environment quality tools, it provides an adequate assessment of an area’s walkability. The PEQI, as addressed in the literature review, has limitations as it does not account for how specific types of amenities and their quality can contribute to scoring.

For example, the total number of trees on a street and their quality are not counted. It is only noted on the count form whether there are no trees, sparsely-lined trees, or continuously-lined. Similarly, having bike parking increases a street segment’s score, but doesn’t inform about the actual number or capacity of biking parking spots available or the design of the rack. Another limitation of the tool is the last set of questions on the form used for scoring a street segment, which asks data collectors to subjectively assess the overall walking experience of a segment. Definitions should be elaborated to distinguish the differences between what it means for a street to be “safe,” “visually attractive,” or “walkable.”

Intersections along the western portion of Cesar Chavez Avenue received temporary curb extension in mid-2015 as part of the City’s effort to improve traffic safety for pedestrians along the street. The PEQI tool does not have a category for scoring temporary traffic calming features; therefore, points were not awarded for temporary extensions in this audit. Community organizers using the PEQI do however, have the flexibility to award partial points for a feature not listed in the scoring sheet.
The tool can be employed by one data collector, but it is preferable that two or more collectors conduct the evaluation, due to the amount of time it takes for auditing every street intersection and segment. The PEQI tool requires training and understanding of what available street amenities look like and how data collectors can differentiate between them. While the directions on the forms are simple, accurately recording all of the amenities at street intersections and street segments take time and practice. Overall, the difficulty of using the tool is medium-to-difficult due to the extensive training, time committed to doing the audit, and understanding the terminology on the count forms.

5.3 INTERSECTION BEHAVIOR OBSERVATION COUNTS

The data collected from intersection count tools demonstrates whether current traffic safety infrastructure is meeting the needs of people who visit the corridor. Quantitative observations such as the number of people crossing at the intersection and the walk signal status (e.g., walk signal on, flashing red hand, and solid red hand) at the time of each person’s cross informs whether pedestrians have enough time to cross, and if the signals are working properly. The Non-Compliant Motorist Counts help to highlight behaviors that put pedestrians at risk for collisions and include motor vehicle failing to yield to pedestrians and vehicles encroaching on the crosswalk when stopped at a red light. Definitive patterns are harder to draw from the data collected from these two tools due to limitations in the actual data collected due to scheduling
constraints. Nonetheless the data provides enough information to assess how useful the tool is at gauging traffic safety.

**PEDESTRIAN BEHAVIOR OBSERVATION TOOL**

Observations for people crossing the street were conducted at St. Louis and Mott Streets along Cesar Chavez Avenue. Data available for the counts were collected during one weekday morning and afternoon and one weekend at mid-day. During the counts, data collectors recorded individuals crossing the street along with their starting and ending direction, their approximate gender and age range, whether they were in a group, and their position on the curb before crossing. Individuals and groups who crossed the street more than once were recorded as new observations. The numbers recorded for people traveling as a pair (2 people) or group (3+ people) represent a raw count of observations and not the actual number of groups.

The Los Angeles County Department of Public Health (DPH) provided aggregate data for counts that their staff conducted on a Saturday in January 2016 in order to compare to weekday counts conducted in this study. Because the counts were aggregated, specific types of relationships cannot be inferred. For example, 174 of the 380 Saturday observations were of female pedestrians. This aggregated number would not be able to show how many of the 174 females were aged 16 to 65 or crossed from the northwest corner to the southwest corner of St. Louis.
**GENDER**

Of the 550 total observations on Thursday, 50% were female. 47% of the 380 total observations were female on Saturday. Broken down by intersections, there were more females observed crossing on Thursday at St. Louis and on Thursday and Saturday at Mott. Across the day and time, there were more females observed during the weekend mid-day compared to Thursday morning and mid-day.

**AGE AND GROUP SIZE\(^\text{16}\)**

The majority of people observed crossing St. Louis and Mott on Thursday and Saturday were aged 16 to 65 and crossing alone. The second most were children under 16 years of age, with the majority of these children walking with a parent in a group of two or more. Additionally, many of the observations recorded of females in a group primarily consisted of women pushing strollers that carried an infant or young child. Of the total observations on Thursday and Saturday, those aged >65 years made up less than 15%; the majority of older adults where crossing alone.

\(^{16}\) The group size variable was removed in the May 2016 update to the Pedestrian Behavior Observation Tool because it was difficult to analyze that data if the data collector was only able to capture 2 out of 3 people in a group.
DIFFERENCES ACROSS TIME OF DAY

Differences across count periods were difficult to infer given the few count periods and the differences in the total number of count periods for a weekday versus the weekend. Peak weekday hours were chosen for Thursday from 7:00am-9:15am and 11:00am-1:15pm and 11:00am-1:00pm on Saturday. On Thursday, there were more pedestrians observed during the morning compared to the afternoon. Saturday had the most observations per count period with 380 compared to 269 for Thursday morning and 281 for the afternoon, given that a full count period lasts 2 hours. Differences across the times of day are consistent with surrounding activities on the street. Weekday mornings are characteristic of a work and school day where a parent is seen crossing the street with their children to get to school, while the early afternoon is busy with people crossing during the lunch hour.

SIGNAL STATUSES AND CROSSING DIRECTIONS\textsuperscript{17}

The direction where people begin and end crossing the street and the crosswalk signal that they see may influence behaviors that affect safety. For example, a flashing red hand with a countdown

\textsuperscript{17} This variable was removed in the May 2016 update to the Pedestrian Behavior Observation Tool. The data were not useful for DPH’s specific analysis. In other evaluations, data collectors commented on this variable being the most challenging to record, which slowed the process.
timer tells a pedestrian to complete the remainder of their crossing, but can also denote a sense of urgency making pedestrians feel that there isn’t enough time to cross before cars start to turn.

The exact location of pedestrians before crossing (e.g., on the concrete curb or in the street) may also influence perceptions of safety and crossing times. The temporary painted curb extensions at the St. Louis intersection reduce the speed of cars turning onto Cesar Chavez Avenue by shortening their turn radius at the intersection. It also ideally reduces the amount of time it takes for a pedestrian to cross the street by making the distance shorter. Among the observations on Thursday and Saturday, 99% of them were made from the concrete curb rather than the curb extension. While observers noted that temporary curb extension were effective at slowing down cars and preventing them from turning too soon before a pedestrian finished crossing, its condition as a temporary feature may influence people to cross at the physical curb rather than the painted extension.

Across all observations at St. Louis (for weekday and weekend), 12% of observed pedestrians crossed either when the crosswalk signal was flashing red or there was a light mismatch where the crosswalk signal did not turn green during a pedestrian crossing (Figure 10). Of the mismatches observed, all occurred because a pedestrian didn’t press the crosswalk button. Similarly, about 13% of observations at Mott were made on flashing red and light mismatches, with a few observations on a solid red signal. Pedestrians wishing to cross north or south on Cesar Chavez Avenue have to wait longer to cross and have shorter crossing times due to the traffic signal
prioritizing east-west traffic. The movement of traffic along the larger street is prioritized; thus, pedestrians and motor vehicles will stop for a shorter amount of time compared to the pedestrians and motor vehicles on the smaller cross streets.

Figure 11: Percentage of observations by type of Walk Signal Status during crossing

While people crossed from every direction, most movement occurred between the Southwest and Southeast corner and the Northeast and Southeast corner (Figure 11). At the Cesar Chavez and St. Louis intersection, many destinations are located at each of the street corners including restaurants, convenience stores and family owned businesses. Total pedestrian crossings were fewer at Mott for both days, but patterns of crossing between the starting and ending direction
were similar to St. Louis. A possible explanation for this observation in addition to the businesses on each street corner serving as destinations, is the location of transit stops on the Northeast corner of both streets. People were observed crossing the street and waiting to catch a bus going west towards Downtown Los Angeles. Another possible explanation is the ease of crossing west or east on Cesar Chavez due to traffic signals prioritizing east-west traffic.

![Diagram of pedestrian crossings on Cesar Chavez and St. Louis]

Figure 12: Volume of observed pedestrian crossings for Cesar/Chavez St. Louis
USABILITY OF PEDESTRIAN BEHAVIOR OBSERVATION TOOL

The diversity of data from this tool allows a researcher to see relationships between variables such as age, gender, group size, crossing direction and location, and walk signal status. The tool developed by DPH was easy to learn and implement. The location where a data collector stands does not affect the observations as long as the observer has an unobstructed view of the intersection\textsuperscript{18}. An advantage of the tool is that the pedestrian behaviors observed can be organized by the crossing direction and walk signal status. This helps to show the number of people crossing on a flashing red light, solid light or light mismatch in the direction of the street where the walk signal is on for a shorter amount of time (e.g., crossing north and south on Cesar Chavez Avenue).

Qualitative data not listed on the count forms were observed such as the frequency of women with strollers or large groups of families during the afternoon count periods. The challenge of adding additional variables for observation at an intersection is that it increases the margin for error when recording and may take longer to do given that people are crossing in all directions. The count form addresses this issue by providing questions for the data collector to answer.

\textsuperscript{18} In the May 2016 update to the Pedestrian Behavior Observation Tool, DPH increased the staff from one to two data collectors. The collectors are instructed to stand on the southwest or northwest corner and observe only the crossings on the adjacent sidewalk to effectively split the work.
following a complete count period in order to reflect on issues not addressed during the observations. The Pedestrian Behavior Observation Tool overall provides an array of pedestrian safety metrics and can be paired with the Non-Compliant Motorist Counts to fully examine interactions at a street intersection.

### NON-COMPLIANT MOTORIST COUNTS

I conducted counts for the Non-Compliant Motorist Counts on Saturday January 9th with the help of DPH staff. No additional count periods were conducted for this project due to scheduling limitations. Data collectors recorded when a motorist failed to yield to pedestrians along the East and South sidewalks to correspond with the traffic light signal. This instance also occurs when the driver turns into the crosswalk before a pedestrian has made it to the other sidewalk. Encroachments\(^{19}\) are also recorded when a driver enters the crosswalk on a red light.

<table>
<thead>
<tr>
<th></th>
<th>Cesar Chavez/St. Louis</th>
<th>Cesar Chavez/Mott</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Drivers Failing to Yield</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td># of Drivers Encroaching</td>
<td>15</td>
<td>32</td>
</tr>
</tbody>
</table>

\(^{19}\) Encroachments are defined as the act of a motor vehicle entering the crosswalk at a red light when a pedestrian crosses the same crosswalk. Vehicles stopping at the limit line, then entering the crosswalk to make a right turn were not marked as encroaching.
Table 6: Number of vehicle yield failures and encroachments at St. Louis and Mott Streets

The total counts for Saturday show that motorist behaviors are different at St. Louis and Mott. There are nearly twice as many encroachments at Mott compared to St. Louis, with the latter having slightly higher number of drivers failing to yield. The presence of the temporary curb extensions was a factor at St. Louis where the continental crosswalks and curb extension take up more space and define the boundaries where drivers should not pass in the crosswalk area. At Mott, the crosswalk consists of two painted narrow white lines where drivers take most of the crosswalk space before making a left or a right turn onto Cesar Chavez.

The slightly higher number of yield failures is surprising at St. Louis given the presence of new curb extensions and crosswalks. 80% of the encroachments at St. Louis were made along the Southern crosswalk, while 63% of the encroachments at Mott were made along the Eastern crosswalk. Overall, differences among noncomplying motorists across the East vs. South crosswalk were not significant due to the low number of total counts. The higher frequency of pedestrian crossings and vehicle traffic at St. Louis, however, may play a role in driver behavior. Overall, the analysis is limited without more comparable counts across other days and times.

COUNT USABILITY

The Non-Compliant Motorist Counts are useful at showing motorist behavior when enough comparable data is collected across multiple count periods and intersections. Learning how to
use the tool may be more difficult due to the layout of the count form. Data collectors need to be aware of each red light cycle for accurate recordings. Additionally, recording the correct type of yield failure takes practice, when multiple cars may be making a turn\textsuperscript{20}. An advantage to the format of the counts is the ability to record observations by traffic signal cycle. This makes it easy to determine whether cars are failing to yield or encroaching on an east-west red light versus a north-south red light. To obtain a more complete number of yielding behavior during a count period, data collectors can be assigned to observed the other two crosswalk directions.

Currently, the tool is unable to determine the percentage of noncompliant vehicles where the denominator is the total number of vehicles that pass through an intersection during a count period. Doing additional vehicle counts will be time consuming and require additional data collectors. Any percentages of noncompliance observed are limited to the number of total counts observed (from failures to yield and encroachments).

In order to effectively evaluate conditions for traffic safety, these counts should be combined with the Pedestrian Behavior Observation Tool and conducted over a range of count periods where there may be differing patterns of encroachments and yield failures outside of typical peak hours. While the tools are currently independent, a possible consolidation of the two tools may give

\textsuperscript{20} DPH revised the protocol of the Non-Compliant Motorist Counts in May 2016 to include all turning movements of a motor vehicle, including non-compliance. The number of collectors assigned increased to two, where one observes the W/E red light cycles and the other the N/S red light cycle.
strength to the evaluation of safety behavior and relevant risks by examining and characterizing interactions between pedestrians and motorists. For example, looking at the number of motorist noncompliance during different pedestrian signal statuses can highlight when pedestrians are most vulnerable.

5.4. PEDESTRIAN ACTIVITY ALONG CESAR CHAVEZ AVENUE SIDEWALKS

An active and thriving commercial corridor is a description that does not completely capture the essence of sidewalk activity along Boyle Height’s very own Great Street. A variety of activities centered on eating, drinking, shopping and vending bring life to the street. What makes these activities different from a similar street with cafes, bakeries, and clothing apparel stores is the culture imbued in Boyle Heights. As a predominantly Latino neighborhood, the types of services and amenities along Cesar Chavez Avenue serve the needs of the Spanish speaking majority, but offer plenty of reasons for visitors from around Los Angeles to visit. Taco shops, specialty bakeries, convenience stores, barber shops, family restaurants, affordable mobile phone retails are a small sample of the available types of retails along this Great Street. Pedestrian activity is busiest along the western section of Cesar Chavez between St. Louis and Soto before tapering off towards Evergreen to the east where buildings and storefronts are more spread out.
Figure 13: Summary of observed activities that took place along Cesar Chavez Avenue

While pedestrian traffic was abundant during weekday and weekend observations, people walking or biking were not counted for this observation. Aggregate data for bicycle and pedestrian counts were provided by the client representative to give context to the levels of biking and walking along this street. The goal of the Pedestrian Activity Scans was to record and capture the number of people who were stationary or lingering and their corresponding activity (e.g., eating/drinking, shopping, mobile device, cultural, vending). A number of reasons may influence walking and bicycling along this street such as the types of retail stores available, aesthetics of the street, presence of other people, and perceived safety. As such, results from this
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Tool and field notes describing the use of this tool will inform ways to better capture the changes to street activity following any future intervention along Cesar Chavez Avenue.

**SIDEWALK ACTIVITY**

The activities along Cesar Chavez Ave are reflections of the existing street and character of the community. The cluster of businesses between St. Louis and Evergreen provides an array of services for local residents and visitors. The orientation and proximity of shop fronts to the sidewalks seem to attract the attention of people walking along the street and give business owners a space to promote their goods. People of all ages were present alone and in groups with the majority traveling on their own. Groups consisted of pairs and three or more people with families or women and children making up the largest share. Females made up slightly less than half of the observations on weekdays and weekend day. Prevalent activities involved food (whether eating, buying or vending), waiting for transit, engaging in small group conversations, and car-related activities (e.g., parking, loading and unloading). Transit related activities occurred mostly during the weekdays, with the majority of people standing compared to sitting.

**TIME OF DAY**

Activities across the different times of day did not differ too much with the exception of a few shop owners opening their businesses and parents walking their kids to school during the morning count periods. More activity was observed on weekday afternoons compared to
weekend days, with weekend days concentrating the most activities for one count period. Gender and group sizes remained relatively the same across times of the day while age only changed on Saturday with the presence of older adults.

**ACTIVITIES**

Most activities along Cesar Chavez concentrated along the western street segment between St. Louis and Fickett, which may be due to the decreasing number of businesses along the eastern stretch compared to the western. While eating/drinking, being on a mobile device, shopping and vending comprised the majority of activities, roughly a third was labeled “other.” In this category, half were the act of speaking or talking to another person and 16% were car related activities that included loading and unloading a car, parking, driving away or exiting from a car. Car-centric activities suggest the role that the car plays in the beginning and end of a person’s trip along the street. Activities were observed more frequently during the weekend compared to weekdays, with the presence of more families and children.
Figure 14: A street vending station commonly seen along the street
POSTURE

Among the total activities observed across the weekday and weekend, most occurred with people standing compared to sitting. This indicates a general lack of seating along the sidewalks. Street vendors and shop owners who were engaging with customers often used informal seating (e.g., small stools, foldable chairs, and crates) while people waiting for transit were standing or leaning. Formal seating along Cesar Chavez is located at specific bus stops and certain segments of the street. The benches that were not at bus stops were often in poor condition or marked with graffiti and litter, which may act as a deterrent to people wishing to sit. Data collectors did however note the presence of waist-high metal bars near bus stops along Cesar Chavez that were placed for people to lean against. Very little to no people were observed using the bars for that purpose, however.
THE USABILITY OF PEDESTRIAN SCANS

This tool’s main purpose is to observe and count the number of people along a sidewalk and their activities. It is useful because it allows a structured observation to be quantitative, which helps to provide a descriptive quality of the data observed. The scans vary in the amount of time it takes...
to complete and focus on one side of a street segment per count form. For example, walking along both sides of Cesar Chavez Avenue between St. Louis and Chicago provides data that allows for comparison between the sides of the street. Overall, it took about 2-8 minutes to walk along one side of the street segment depending on the presence of activity. The side of the street with bus stops tended to take longer due to the number of people waiting for transit. One challenge with conducting pedestrian scans using the count forms for Cesar Chavez Avenue was the inconsistencies with intersections being 3-way vs four-way, which made it difficult to compare because the North and South segments of the streets do not line up making some segments longer or shorter. A strategy here is to label the segments properly to avoid confusion. Even if one side cannot be directly compared with the other, it will still be useful to have data collected for the entire street length on each side.

One disadvantage of this tool is the limitations in describing the extent or specificity of activities. Some activities do not fall into the range of “mobile device (i.e., using cell phones), eating or drinking, cultural, or nuisance” and can a person paying for parking, loading their car with goods, opening a shop, pacing, and people watching. A preferable strategy is to record all activities that are not listed on the form and categorize by a common theme such as “car related activities other than driving or maintenance.”

Because this tool emphasizes recording raw numbers of activities for each side of the street, the details of the exact location where people are conducting the activity become lost. This makes it
difficult to capture territorial-like behaviors such as people frequently spending time in a specific location or space. For example, a group of men wearing traditional/cultural regalia and sombreros were often seen sitting and standing on the side of a building on the northwest corner of the Cesar Chavez and Chicago intersection. This information simply gives a better snapshot of who uses the street and for what purpose. Families or individuals were seen hosting informal yard sales along a section of sidewalk adjacent to a vacant lot near Fickett Street. Street vendors were popular and distributed along Cesar Chavez attracting customers by selling hotdogs, cut and whole fruit and varieties of snacks and household goods. Capturing these details would simply require a few additional questions for data collectors to answer either during or following the counts.
Observing pedestrian activity along one or more streets is a common way of collecting information before implementing any street changes that benefit pedestrians. The Pedestrian Activity Scan however, is more unconventional in how the activities are observed. It requires a
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data collector to spend a few minutes walking along each side of the street in order to record sidewalks activities that are occurring in front them. Community organizers wishing to accomplish this task may also want to structure the time and location spent counting at specific street segments or intersection and observe activity that occurs across an imaginary screen line. An advantage to the Pedestrian Activity Scan is the flexibility in capturing a wide range of activities across a defined area in a short amount of time compared to a traditional 10-15 minutes.

5.5. COMPARING EVALUATION TOOLS FOR CESAR CHAVEZ AVENUE

The four tools used in this evaluation are not meant to be compared to one another as competing evaluation methods to collect data on walking, bicycling and traffic safety. Rather, the metrics that they collect are meant to be complimentary in the process of evaluating street-level health. Summaries of the evaluation tools listed below show its assets, limitations and ease of implementation or difficulty to learn and use.

1. SUMMARY OF THE PEDESTRIAN ENVIRONMENTAL QUALITY INDEX (PEQI)

Assets: Thorough street audit; scores walkability; weighted scoring; scores accounts for traffic safety and aspects of land use; data can be easily mapped; questions and scoring methods can be adjusted to fit the relevancy of a neighborhood’s streetscape
Limitations: Quality vs. quantities of amenities; portion with subjective assessment for safety and walkability; bikability only assessed as it relates to walkability; temporary treatments can’t be scored; time consuming to accurately conduct audit

Ease of Implementation: Medium-to-difficult; proper training on terminology of various variables required; multiple forms for intersection and segments; time to complete intersection and segments varies

2. SUMMARY OF THE PEDESTRIAN BEHAVIOR OBSERVATION TOOL

Assets: Data sortable; multiple variables; collects general demographic info; walk signal status and waiting location variables helpful for understanding pedestrian traffic safety behavior

Limitations: Observations for pedestrians independent from motorist behavior; metric for adequate crossing time difficult to observe\(^{21}\); data doesn’t reflect true total number of people observed

Ease of Implementation: Easy; observer must pay attention to pedestrians crossing from all directions

\(^{21}\) The updated version of this tool resolves this issue by assigning a second data collector to observe adjacent crosswalks.
3. SUMMARY OF THE NON-COMPLIANT MOTORIST COUNTS

**Assets:** Data can be sorted by multiple variables; records noncompliant motorist behaviors (e.g., failure to yield and encroachments)\(^{22}\)

**Limitations:** Observations for yielding behavior independent from Pedestrian Behavior Observation Tool; cannot determine percentage of non-compliant motorist percentage from total number of motorists who passed through intersection

**Ease of Implementation:** *Medium difficulty*; observer must be attentive to traffic light cycles and different types of motorist yielding behaviors; requires more than 1 observer if the goal is to collect observations from all crosswalks\(^{23}\)

4. SUMMARY OF PEDESTRIAN ACTIVITY SCAN TOOL

**Assets:** Variety of data on pedestrian activity; data sortable by variables; collects general demographic information; observing activities can be done quickly and not restricted to traditional 15-minute count periods

\(^{22}\) The updated version of the tool includes yielding behaviors as well as non-compliance.

\(^{23}\) The updated version of the tool assigns a data collector for the N/S and E/W red light cycles in order to increase the accuracy of data collection.
Limitations: Counts for parked cars and bikes included, but difficult to do in addition to observing pedestrians; cultural activities category not defined; many activities do not fall under available categories; selecting count periods can be difficult due to variability in time to complete scans

Ease of Implementation: Easy; time to complete each street segment varies depending on amount of activity
6: FINDINGS AND RECOMMENDATIONS
6.1. FINDINGS FROM EVALUATING CESAR CHAVEZ AVENUE

The following are findings from evaluating baseline data for Cesar Chavez Avenue using four different types of evaluation tools that contain relevant metrics for examining the existing street, amenities for walking and biking, and safety.

1. **Of the pedestrians observed along Cesar Chavez Avenue, the highest percentage were male.**

   From using the *Pedestrian Activity Scans*, females aged 16-65 comprised of less than half of the people observed (~43% of all total observations). Data from the *pedestrian observation behavior tool* showed that females comprised of 50% of the Thursday observations and 47% of Saturday mid-day observations. Additionally, those aged 16-65 comprised of the majority of observations across female age groups. A third of the women observed using both evaluation tools were in pairs or groups, often times with young children. The street is bustling with life and interaction as people of all ages and abilities move about, socializing, and looking to buy food or goods. However, any amenities that aim to improve the pedestrian experience and safety have the potential to benefit the women along the street who walk their kids to school in the morning, push their young kids in strollers, sell goods as shop owners and street vendors, and wait for public transit.
2. Different segments of Cesar Chavez have different levels of walkability; the street will benefit from more pedestrian/bike amenities.

Street segments and intersection scores for the Great Street ranged as low as 12 (not suitable walkable environment) to as high as 76 (reasonable walking environment) using the Pedestrian Environmental Quality Index (PEQI). Intersections with high visibility crosswalks scored higher than intersections without these traffic safety improvements. The lowest intersection scores were the result of a few three-way intersections along the north and south side of Cesar Chavez Avenue with only a stop sign as the safety measure.

“Reasonably walkable” street segments were concentrated along sections with more businesses, public seating, public art, fewer driveways, continuously lined trees, and good sidewalk quality. Sidewalks also played a large role in scoring with priority given to street segments with wider widths and fewer obstructions. The entire stretch of the street is navigable by a person pushing a stroller despite a few obstructions such as raised sidewalks and business merchandise being placed in the walkway. There are relatively few traffic calming measures along the street segments aside from one pedestrian crosswalk and signage. While few amenities currently exist for bicyclists, improvements aimed at reducing overall motor vehicle speeds would bode well for pedestrian and bicyclists along the street.
3. Activities along the street reflect a need for more seating and social spaces.

A valuable asset of this thriving corridor is how it functions as a destination for residents and visitors, rather than only serving as a route to and from Downtown Los Angeles. The street features many businesses that draw the attention of passersby and locals. The sidewalks between St. Louis and Evergreen are full of people who are mostly eating or drinking, shopping, vending, waiting for transit, talking, using their mobile devices, and activities related to their cars. A crowd of people can be seen standing and leaning around the bus stops at Soto and Cesar Chavez with few spots on the existing bus bench. Similarly, individuals can be seen standing and leaning by old newspaper boxes as they eat food from street vendors between the St. Louis and Cesar Chavez. Despite the life on the street, there are few public seating areas and spaces where people can comfortably congregate away from crowded sidewalks that are frequented by the movement of people. Existing seating other than bus benches were often informal (i.e., placed by shop owners, in poor condition, or marked with graffiti). Opportunities exist for more seating or plaza space on existing sidewalks, parking lots fronting the shops, and vacant lots along the corridor.

4. Pedestrians have enough time to safely cross the street.

The majority of people observed at St. Louis and at Mott were crossing the intersection during the “walk signal on” status with no instances where they began crossing during the solid red hand phase of the walk signal status. Less than a third of people observed began
walking during the “flashing red hand” phase of the walk signal status. Where temporary curb extensions exist, most people stood on the concrete curb before starting their crossing. People waiting to cross Cesar Chavez from the St. Louis and Mott (the streets cross streets where counts took place) generally waited longer to cross the street and had less time to cross due to the signal prioritizing the movement of east-west traffic along the street. Despite this condition, pedestrians were able to finish their crossings before the solid red hand appeared on the walk signal. Additional data from the PEQI assessment showed that a person with a stride length of ~ 2.6 feet could adequately cross Cesar Chavez before the walk signal becomes a solid red hand.

6.2. FINDINGS FROM THE TOOLS, METRICS, AND EVALUATION METHODS

1. The PEQI is useful street audit tool that provides relevant data on a street’s walkability.

The PEQI collects information on existing conditions of a street (whether positive or negative) and provides a weighted score for street intersections and segments that can be easily compared. Scores can be easily mapped to show a visual representation of walkability. The tool not only serves as an audit tool that is needed to collect baseline information on a street, but also highlights areas that would benefit from traffic safety improvements and adding more amenities to better serve people whether walking or biking. Its weaknesses are its inability to highlight the differences between two similarly scored street segments or intersections, thus presenting the issue of quantity versus quality.
More public art, or higher quality trees do not equate to higher scores when using the PEQI.

2. **The Metrics for Traffic Safety are limited in observing interactions between pedestrians and motorists.**
Looking at the number of motorist failing to yield, encroachments and how pedestrians cross the street only provides surface information about traffic safety conditions on the street. Important factors that a future evaluation can use to supplement this safety analysis include: an average or percentage of pedestrians who cross during different traffic signal phases at the neighborhood or city-level, the percentage of pedestrian collisions that occur when people crossing have the right-of-way, and the relationship between driving behavior and collisions. Evaluation forms need to consider people’s crossing behavior and car activity together to provide more meaningful traffic safety data.

3. **Evaluation Tools varied in their ease of implementation and learning difficulty.**
Across all four tools, the Pedestrian Activity Scans and the Pedestrian Behavior Observation Tool were easier to conduct then the PEQI and Non-Compliant Motorist Counts. While the difficulty of using the tools are mostly subjective to the comfort of data collector(s), the PEQI require more time to be invested to be properly trained for the use of the tool. The motorist counts, while not difficult to implement, can confuse observers if they aren’t well-
oriented to the movement of cars during the traffic signals cycles at intersections. The Pedestrian Behavior Observation Tool similarly was easy to implement, required less investment in the time to train, but included multiple variables that could increase the risk for error in data collection.

6.3. RECOMMENDATIONS AND STRATEGIES FOR AN EFFECTIVE EVALUATION OF HEALTHY STREETS

1. Evaluate street-level health by looking at diverse metrics for walking, biking, safety, and land use types.

Existing objective metrics for the levels of walking and biking are helpful for showing whether people bike and walk along a street. Subjective data on personal levels of physical activity from questionnaires however, can also inform future evaluations of Cesar Chavez Avenue and other Great Streets Corridors. Evaluations should include metrics that capture the social elements of health and safety on a street. Additionally, future efforts should incorporate the types of land use, urban form, and environmental metrics that were not used in this study including intersection density, land-use mix, storefront characteristics and urban air quality. While these additional factors may be difficult to collect at the street level, they help to provide sufficient data on the effects of changing or improving an existing street network.
2. Incorporate metrics for traffic safety that takes into consideration the different perceptions of traffic safety and abilities of people crossing

Crossing time is an important traffic safety metric evaluated in both the PEQI and the Pedestrian Behavior Observation Tool. It assesses whether people crossing the street have enough time to do so and rewards higher scores to intersections with adequate countdown timers higher scores. The PEQI specifically compares calculated crossing times with a standard time developed by the Federal Highway Administration. The standard however may not be adequate for all people. Those with disabilities, children and elderly require longer times to cross; the added pressure of cars queuing to make a left or right turn during the pedestrian right-of-way may alter perceptions of safety when crossing. While counts showed that people crossing at St. Louis and Mott had adequate time, qualitative observations showed that people often walked faster when they noticed the countdown timer and flashing red hand. Subjective questionnaires on pedestrian traffic safety may help understand people’s perceptions of crossing times and safety on the street.
3. **Conduct future evaluations using tools that have relevant metrics, are user friendly and easy to implement.**

Street-level evaluation tools like the ones developed by the Los Angeles Department of Transportation (LADOT), San Francisco Department of Public Health, and Los Angeles County Department of Public Health (DPH) contain relevant metrics for examining street-level data (e.g., pedestrian and bicycle infrastructure and traffic safety behaviors), but differ from a host of other tools developed by government agencies and scholars alike. Evaluation for the Great Streets Corridors should consider the strengths and limitations of each tool and the data collected. For example, many street audit tools such as the PEQI are available, but vary in their difficulty to learn and the time necessary to train and conduct evaluations. A balance is necessary between the ease of implementing the tool and whether its metrics provide meaningful data. Evaluations can broaden a public health level analysis by looking at the correlation between existing community physical activity levels and walking and biking conditions. The food environment and existing land uses may also play important roles in creating healthy streets have the potential to become, economic, social and healthy spaces.
7: CONCLUSION

Volunteers from CALO Youthbuild repainting a public bench

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The Complete Streets Movement has inspired many cities across the U.S. to rethink how streets should be designed and planned. While the goal of promoting streets as a public space and thoroughfare for people of all ages and abilities is pivotal to reversing the century old mindset that automobiles should have priority, it often leaves communities without a strong political voice to become marginalized. As an unintended consequence of the Complete Streets ideology, planners, researchers, and urban experts make the risk of removing streets from their significant social, structural, symbolic, and historical contexts. The Los Angeles Great Streets Initiative aims to re-imagine key selected neighborhood streets with the help of the community they serve. In a broader perspective, the program aims to improve the Great Streets by focusing all aspects of how people interact with the space. Doing so requires the proper evaluation of streets before and after the implementation of proposed changes to assess that the changes are in fact benefitting the community. This research aimed to fill the gaps in evaluation methods for looking at a public health perspective of complete streets or in this case the “LA Great Streets.” Existing metrics and tools for evaluation while sufficient from a transportation and urban design perspective lack the social and public health component that is needed to achieve a “complete” street.

The focus on walking, biking, and safety, while limited in its representation of public health metrics, is intended to inform future evaluations of Cesar Chavez Avenue and other Great Streets Corridors undergoing change in the next few years. Evaluation tools used to collect baseline data along Cesar Chavez Avenue can help inform recommendations for future assessment of healthy streets and provided a comparison among the evaluation tools with strengths and limitations.
Findings and recommendations from this research do not necessarily require local agencies, community organizations or the Client to change and discard current evaluation methods, but rather build on the type of data collected and its usability to inform a broader scope of goals other than transportation access and mobility. In order to better understand and evaluate street environments that are safer for active transportation, we must plan with the consideration of the neighborhood’s culture, history and needs at the forefront of the process.
8: REFERENCES


http://dx.doi.org/10.1016/j.landurbplan.2015.05.007


Lovasi, G.S., Schwartz-Soicher, O., Neckerman, K.M., Konty, K., Kerker, B., Quinn, J., and Rundle,


Pietilä, M., Neuvonen, M., Borodulin, K., Korpela, K., Sievänen, T., and Tyrväinen, L. (2015). Relationships between exposure to urban green spaces, physical activity and self-rated...


### APPENDIX A: PEQI DATA

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Score</th>
<th>Walkability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesar Chavez/St. Louis</td>
<td>63.02</td>
<td>Reasonable pedestrian conditions exits</td>
</tr>
<tr>
<td>Cesar Chavez/Chicago</td>
<td>18.75</td>
<td>Environment not suitable for pedestrians</td>
</tr>
<tr>
<td>(facing north)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cesar Chavez/Chicago</td>
<td>50.42</td>
<td>Basic pedestrian conditions exits</td>
</tr>
<tr>
<td>(facing south)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cesar Chavez/Cornwell</td>
<td>12.5</td>
<td>Environment not suitable for pedestrians</td>
</tr>
<tr>
<td>Cesar Chavez/Breed</td>
<td>71.43</td>
<td>Reasonable pedestrian conditions exits</td>
</tr>
<tr>
<td>Cesar Chavez/Soto</td>
<td>45.38</td>
<td>Basic pedestrian conditions exits</td>
</tr>
<tr>
<td>Cesar Chavez/Matthews</td>
<td>47.06</td>
<td>Basic pedestrian conditions exits</td>
</tr>
<tr>
<td>Cesar Chavez/Fickett</td>
<td>18.75</td>
<td>Environment not suitable for pedestrians</td>
</tr>
<tr>
<td>(north)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cesar Chavez/Fickett</td>
<td>47.06</td>
<td>Basic pedestrian conditions exits</td>
</tr>
<tr>
<td>Street Segment</td>
<td>Side of Street</td>
<td>Score</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>Cesar Chavez/Mott</td>
<td></td>
<td>61.34</td>
</tr>
<tr>
<td>Cesar Chavez/Saratoga</td>
<td></td>
<td>23.96</td>
</tr>
<tr>
<td>Cesar Chavez/Forest</td>
<td></td>
<td>33.33</td>
</tr>
<tr>
<td>Cesar Chavez/Savannah</td>
<td></td>
<td>12.5</td>
</tr>
<tr>
<td>Cesar Chavez/Evergreen</td>
<td></td>
<td>57.14</td>
</tr>
</tbody>
</table>

PEQI scores for intersections along the Cesar Chavez Avenue Great Street
<table>
<thead>
<tr>
<th>Street Segments</th>
<th>Direction</th>
<th>PEQI Score</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mott-Saratoga</td>
<td>South</td>
<td>54.89</td>
<td>Basic</td>
</tr>
<tr>
<td>Saratoga-Savannah</td>
<td>South</td>
<td>54.89</td>
<td>Basic</td>
</tr>
<tr>
<td>Savannah-Evergreen</td>
<td>South</td>
<td>61.83</td>
<td>Reasonable</td>
</tr>
<tr>
<td>St.Louis-Chicago</td>
<td>North</td>
<td>55.84</td>
<td>Basic</td>
</tr>
<tr>
<td>Chicago-Cornwell</td>
<td>North</td>
<td>59.94</td>
<td>Basic</td>
</tr>
<tr>
<td>Cornell-Breed</td>
<td>North</td>
<td>64.67</td>
<td>Reasonable</td>
</tr>
<tr>
<td>Breed-Soto</td>
<td>North</td>
<td>55.21</td>
<td>Basic</td>
</tr>
<tr>
<td>Soto-Fickett</td>
<td>North</td>
<td>67.82</td>
<td>Reasonable</td>
</tr>
<tr>
<td>Fickett-Mott</td>
<td>North</td>
<td>60.25</td>
<td>Basic</td>
</tr>
<tr>
<td>Mott-Forest</td>
<td>North</td>
<td>56.47</td>
<td>Basic</td>
</tr>
<tr>
<td>Forest-Evergreen</td>
<td>North</td>
<td>50.47</td>
<td>Basic</td>
</tr>
</tbody>
</table>

PEQI scores for street segments along the Cesar Chavez Avenue Great Street
APPENDIX B: PEDESTRIAN BEHAVIOR OBSERVATION DATA

WEEKDAY-% BY GENDER

- Female: 48%
- Male: 50%
- Unknown: 2%

WEEKEND DAY-% BY GENDER

- Female: 53%
- Male: 46%
- Unknown: 1%
Taking Health to the LA Great Streets
Observations by Age @ St. Louis

Observations by Age @ Mott
Taking Health to the LA Great Streets

Volume of Pedestrian Crossings at Cesar Chavez/St. Louis during Thursday (morning & mid-day) observations

- NW
- St. Louis
- NE
- SW
- SE

1-15 pedestrian crossings
16-30
31+

Volume of Pedestrian Crossings at Cesar Chavez/Mott during Thursday (morning & mid-day) observations

- NW
- Mott
- NE
- SW
- SE

1-15 pedestrian crossings
16-30
31+
Volume of Pedestrian Crossings at Cesar Chavez/St. Louis during Saturday (mid-day) observations

Volume of Pedestrian Crossings at Cesar Chavez/Mott during Saturday (mid-day) observations

<table>
<thead>
<tr>
<th>1-15 pedestrian crossings</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-30</td>
</tr>
<tr>
<td>31+</td>
</tr>
</tbody>
</table>

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APPENDIX C: NON-COMPLIANT MOTORIST DATA

Non-compliant Motorist Counts conducted on Saturday January 9, 2016.

<table>
<thead>
<tr>
<th></th>
<th>Cesar Chavez/St. Louis</th>
<th>Cesar Chavez/Mott</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Drivers Failing to Yield</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td># of Drivers Encroaching</td>
<td>15</td>
<td>32</td>
</tr>
</tbody>
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Number of Vehicle Yield Failures and Encroachments at St. Louis and Mott Streets

<table>
<thead>
<tr>
<th></th>
<th>East crosswalk</th>
<th>South crosswalk</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Drivers Failing to Yield</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td># of Drivers Encroaching</td>
<td>3</td>
<td>12</td>
</tr>
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</table>

Number of Vehicle Yield Failures and Encroachments by Crosswalk at St. Louis

<table>
<thead>
<tr>
<th></th>
<th>East crosswalk</th>
<th>South crosswalk</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Drivers Failing to Yield</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td># of Drivers Encroaching</td>
<td>20</td>
<td>12</td>
</tr>
</tbody>
</table>

Number of Vehicle Yield Failures and Encroachments by Crosswalk at Mott
APPENDIX D: PEDESTRIAN ACTIVITY SCAN DATA

Total Users Observed
- 419 Total
- 313 Weekday (Tuesday-167 + Thursday-146)
- 106 Weekend (Saturday)

Females as % of Observed Users
- Tuesday: 44%
- Thursday: 45%
- Saturday: 40%
- Overall, most of the people observed were men. Women were often seen in groups or with family.
Most people during observed times were alone, while pairs were the second most frequent group size. “Group” category was defined as three or more persons.

**Age Distribution Percentage**

- **Tuesday**
  - Younger than 16: 10%
  - 16 to 65: 78%
  - Older than 65: 12%

- **Thursday**
  - Younger than 16: 3%
  - 16 to 65: 89%
  - Older than 65: 8%
• **Saturday**
  - Younger than 16: 3%
  - 16 to 65: 81%
  - Older than 65: 16%

• Age was more difficult to tell for three categories of (>16 years, 16-65, and >65). Not as many children under >16 years of age on Tuesday and Thursday possibly due to school day.
Taking Health to the LA Great Streets

Waiting

<table>
<thead>
<tr>
<th>Days</th>
<th>Tues</th>
<th>Thurs</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing Street</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transit</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Tues</th>
<th>Thurs</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating/Drink</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Vending</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
North Sidewalk Activity

Females as % of Observed Users

- Tuesday: 42%
- Thursday: 47%
- Saturday: 34%
Age Distribution Percentage

- **Tuesday**
  - Younger than 16: 1%
  - 16 to 65: 74%
  - Older than 65: 14%

- **Thursday**
  - Younger than 16: 3%
  - 16 to 65: 83%
  - Older than 65: 14%

- **Saturday**
- Younger than 16: 3%
- 16 to 65: 77%
- Older than 65: 20%
South Sidewalk Activity

Females as % of Observed Users

- Tuesday: 47%
- Thursday: 45%
- Saturday: 50%
- Overall, most of the people observed were men. Women were often in groups or with family.
Age Distribution Percentage

- **Tuesday**
  - Younger than 16: 7%
  - **16 to 65:** 84%
  - Older than 65: 9%

- **Thursday**
  - Younger than 16: 3%
  - **16 to 65:** 94%
  - Older than 65: 3%

- **Saturday**
  - Younger than 16: 2%
  - **16 to 65:** 88%
- Older than 65: 10%

<table>
<thead>
<tr>
<th>Posture-South Sidewalk</th>
<th>Tues</th>
<th>Thurs</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing</td>
<td>60</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Sitting Formally</td>
<td>30</td>
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<td>10</td>
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<tr>
<td>Sitting Informally</td>
<td>10</td>
<td>5</td>
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</tr>
<tr>
<td>Leaning</td>
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<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waiting-South Sidewalk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tues</td>
</tr>
<tr>
<td>Thurs</td>
</tr>
<tr>
<td>Sat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crossing Street</th>
<th>Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tues</td>
<td>16</td>
</tr>
<tr>
<td>Thurs</td>
<td>14</td>
</tr>
<tr>
<td>Sat</td>
<td>2</td>
</tr>
</tbody>
</table>
Taking Health to the LA Great Streets

Activities-South Sidewalk

Activity by Time of Day-South Sidewalk