

Toward a Walkable El Camino Real: An Analysis of Opportunities and Barriers

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Senior Capstone, March 2018



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EXECUTIVE SUMMARY

The City of Santa Clara is developing a plan to transform El Camino Real into a “tree-lined, pedestrian and transit-oriented corridor with a mix of residential and retail uses.” The city is considering improvements related to bicycle lanes, street trees, landscaping, and mixed-use development. To contribute to this plan, a senior capstone team at Santa Clara University collected and analyzed data, and created recommendations for improving the pedestrian experience along El Camino Real. This team focused on the section of El Camino Real between Lafayette Street and Scott Boulevard.

This senior capstone project involved three main components to study the barriers and facilitators to the walkability of El Camino Real: (1) a public perception survey aimed at local Santa Clara residents, (2) a walk audit that analyzed each block along the study area, as well as several side streets, and (3) a GIS analysis of destinations and pedestrian safety.

The results were organized in terms of a hierarchy of walkability adapted from the scholarly literature. The four levels in this walkability hierarchy were *accessibility*, *safety*, *comfort*, and *pleasurability*. This hierarchy formed the crux of the analysis and was the basis to identify the most important areas for the City of Santa Clara to focus its policy changes and investments.

Our results show that El Camino Real has many destinations along the corridor, satisfying the first hierarchy level of accessibility. There are opportunities to improve the safety of the corridor, particularly through **sidewalk lighting, additional crosswalks and traffic controls**, and **increasing pedestrian activity along the street**. Additionally, the city could improve the comfort and pleasurability of the corridor by **converting the parking lanes** along El Camino Real into **wider sidewalks and a landscaped buffer with street trees**. This would provide a buffer between pedestrians and vehicles, street trees for shade, and additional greenery. We recommend a **reduction in the speed limit** to 30 miles per hour. Lastly, the city should continue to **encourage mixed-use residential development** with limited setbacks.

INTRODUCTION

The City of Santa Clara envisions an El Camino Real that is appealing and safe to people walking or riding a bicycle. This project supports the city’s planning process and creates recommendations, based off a hierarchy of walking needs, to promote a walkable El Camino Real. The senior capstone team worked with the City of Santa Clara Community Development Department to recommend improvements to the 0.9 mile portion of El Camino Real extending from Lafayette Street to Scott Boulevard. This report identifies barriers to walking in the study area, and includes recommendations to the City based on research and best practices. The main issues that we address are the walkability of this section of El Camino Real and the effect of walkability on the sustainability and health of the residents in the surrounding neighborhood. This project answers the following research questions:

- What are the biggest barriers to walking along El Camino Real?
- How do residents perceive opportunities and constraints for a walkable street?
- How can the city improve the streetscape along El Camino Real to encourage more people to walk, bike, or ride transit?

Cities and urban areas are comprised of many features that can encourage or discourage people from walking to their destinations, and the most successful or walkable places do not have many barriers. Additionally the successful urban areas contain many factors that encourage walking such as efficient land uses with many destinations for walking to, low and moderate vehicle travel speeds, greenery, and extra lighting to make people feel safer. Barriers to walkability include long distances between destinations, minimal safety from traffic and small sidewalks that discourage people from walking. It is therefore important to address both potential areas for increasing encouraging factors and decreasing potential barriers.

This report includes a GIS analysis of the walkability of El Camino Real using established criteria from past research; the results of a survey of public perceptions about opportunities and constraints for a walkable El Camino Real; and short- and medium-term recommendations for improving the walkability of the corridor.



Figure 1: City of Santa Clara General Plan diagram of El Camino Real focus area

LITERATURE REVIEW

Environmental benefits of reducing transportation emissions and energy usage

Efforts performed to increase the walkability and general aesthetics of El Camino Real can have significant impacts upon the sustainability of the area. The two main routes that smarter development can take to increase sustainability come by reducing transportation emissions and decreasing energy usage in residences and businesses.

The research on how urban design and planning can be used to reduce transportation emissions commonly measures vehicle miles traveled (VMT). VMT refers to the amount of miles that vehicles are traveling, and therefore when individuals carpool, or take public transport, they are reducing overall VMT by splitting their miles with others. Studies show that more compact development can decrease VMT by concentrating people around downtown areas, increasing household density, increasing nearby job accessibility, and improving street connectivity (Stevens, 2017). While the exact extent to which compact development can decrease VMT is debated, one meta-analysis estimated that doubling housing density can reduce VMT by 5 to 12 percent (National Resource Council, 2010). An example of a more compact development can be seen in Figure 2.

The types of urban form associated with walkable neighborhoods are also associated with lower residential energy use. Urban low density development uses up to 1.8 times more energy per capita than high density urban development (Norman et al., 2006). These perceived benefits



Figure 2: Compact Development Example from Menlo Park's El Camino Specific Plan (City of Menlo Park, 2012)

are most likely accounted for by the increased heating and cooling benefits from smaller spaces with less exposed exterior walls (Norman et al., 2006). It is also important to note that the study found decreased energy usage and lessened environmental impact in the construction process due to increased efficiency of building complexes over single family residences (Norman et al., 2006). Another study looked at development across the nation

confirmed these results by showing that compact county residences use an average of 1.4 million less BTU units than homes in sprawling counties (Ewing and Rong, 2008).

Health benefits of walkable neighborhood design

Increasing the walkability and general beauty of El Camino could have multiple positive effects on the health of the road's patrons. Through promoting active lifestyles and encouraging pedestrian and neighborhood safety, this project can contribute to better health outcomes for users of El Camino Real.

Studies have shown that single-use, low-density land development, in combination with disconnected street networks and long blocks, are negatively correlated with walking and use of public transportation (Powe, Mabry, Talen, & Mahmoudi, 2016). For years, public health organizations have taken urban planning approaches to reversing these trends, as can be seen in that one of the five overarching principles of *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity* is to encourage environmental changes that help prevent overweight and obesity (Office of the Surgeon General, 2001). In addition to increasing awareness of overweight and obesity in the home, school and health care settings, this call to action encourages partnerships between community organizations to increase walkability, ultimately promoting beneficial health activities. For instance, Frank's King County study in Washington found that as little as a 5 percent increase in walkability of a neighborhood has been associated with 32.1 percent increase in time spent engaging in physically active travel, per capita (Frank et al., 2006). In turn, this has been associated with a 0.23-point reduction in body mass index, a common measure of overweight and obesity (Frank et al., 2006).

Additionally, increased walkability has also been associated with increased social cohesion and benefiting pedestrian safety. Physical connectivity, as promoted through more walkable neighborhoods, have shown to have a significant effect on social cohesion due to the fact that the existence of commonly used walking routes allow pedestrians to meet on foot (Cooper, Fone, & Chiaradia, 2014). This finding has been supported by additional research that has found that improved walkability can facilitate social interactions in outdoor settings, and thus encourage community cohesion and decrease (Zhu et al., 2014). Further, reduced vehicle traffic can increase pedestrian safety and comfort, which in turn encourages walking habits and general sentiments of safety within the community (Litman, 2017).

Economic benefits of walkability

Increasing the walkability and aesthetics of El Camino Real also has the potential to help the economic vitality of the area. Consumers who spend less money on transportation can spend these dollars elsewhere; one study showed how consumers in automobile-dependent communities spend an average of 50 percent more on transportation than consumers in multi-modal transportation communities (McCann, 2000). The benefits to businesses can also be large in some contexts. The mechanisms connecting these improvements with retail sales are the higher frequency of visits associated with walkers and bikers and the connection between attractive streetscape design and consumer retail perception (Tolley, 2011).

Walkable neighborhoods have been connected with higher home values. Although not peer-reviewed, one study that analyzed over 90,000 nationwide real-estate transactions showed

that just a one point increase in a 100 point walkability scale was associated with \$700 to \$3,000 higher home values (Cortright, 2009). Besides showing the potential of walkability to bring value to homeowners, his undeniably shows that people truly do value more walkable, mixed-use, accessible neighborhoods. However, it is also important to consider that the increased home values can contribute to the problem of gentrification and therefore needs to be considered as well in any economic analysis of walkability benefits (Immergluck & Balan, 2017).

Components of walkability

Alfonzo (2005) proposes a hierarchy of walkability to assist in prioritizing these needs and we used this as a framework in guiding our study. People’s motivation to walk is influenced by a wide range of needs ranging from basic to complex, thus the more basic needs must be satisfied before the more complex needs are considered. Alfonzo’s hierarchy of factors that affect a person’s choice and ability to walk as a five-level pyramid with the most basic needs on

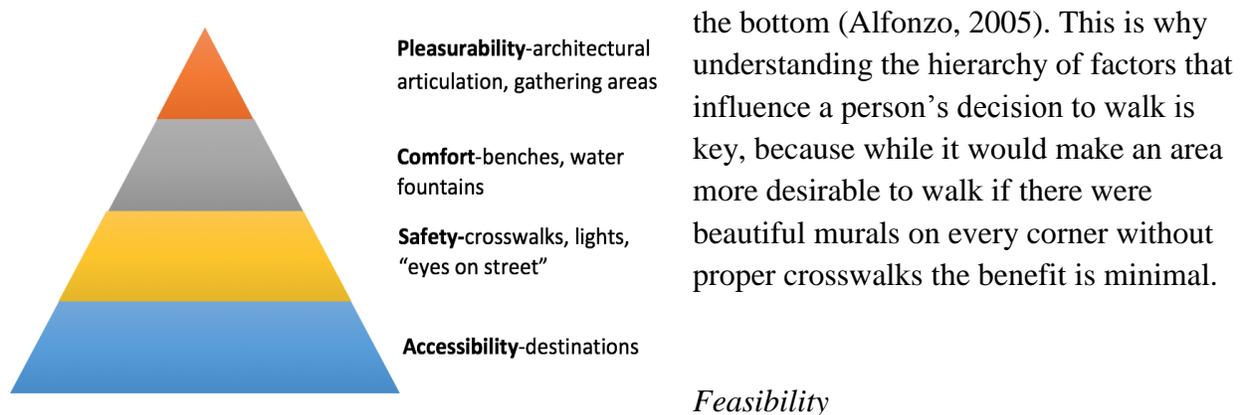


Figure 3: Hierarchy of Walkability Needs (Adapted from Alfonzo, 2005)

Alfonzo’s hierarchy of walking needs starts with the feasibility of walking. This concerns how practical is it to walk

when compared to the alternatives, and this is considered the most basic need of walkability (Alfonzo, 2005). If one’s destination is too distant or one’s ability to walk is hindered (i.e. unable to cross the street due to disability, can’t leave kids at home to walk) “walking will typically not occur” (Alfonzo, 2005). Feasibility is less concerned with the urban form of the area than other hierarchy levels and therefore has less bearing on this study of the El Camino walking environment.

Accessibility

One step above is accessibility which incorporates the “quantity, quality, variety and proximity of activities present” as well as how they are all connected (Alfonzo, 2005). Connectivity is highly associated with walkable neighborhoods revolving around the density of an area, distance/ routes to destinations and the “diversity of land uses within walking distance” (Adriana et al., 2017). Dealing with similar features another component used to analyze

walkability is the land use of an area such as the number of mixed use areas or high density housing.

Safety

Safety, both from traffic and crime, is important when walking. Studies show that the safety of an area greatly impacts walkability, therefore improving people's perceptions of being safe from crime as well as traffic encourages walking (Adriana et al., 2017). Some key factors to consider regarding the components of safety include the amount of pedestrian lighting, buffers protecting pedestrians from road traffic, traffic lights, traffic control measures, the speed limit on the street, the presence of crosswalks, the presence of medium/high traffic driveways, and "eyes on the street" (a measure of the presence of multiple family housing and high-trafficked businesses that give pedestrians the perception of surveillance).

Comfort

Once those needs have been met a person can assess the degree of comfort associated with walking, this is the second highest need (Alfonzo, 2005). Comfort is associated with the ease of walking and the satisfaction felt doing so, features like canopies for shade and rain protection or benches can help improve the comfort factor (Alfonzo, 2005). Another important aspect to look at is the streetscape and the pedestrian experience, things like greenspace (i.e. trees, flowers), and activity space or "spaces that encourage social interaction" are all significant influencers (Adriana et al., 2017; Samarasekara et al., 2011).

Pleasurability

The top of the pyramid is pleasurability, this is the last stage of considerations when a person is deciding to walk and it deals with features that appeal to the walking experience (Alfonzo, 2005). Another way to interpret pleasurability is to ask how enjoyable or interesting it is to walk in an area. There are numerous features that when incorporated can make an area more enjoyable to walk including street trees, attractive architecture, outdoor dining, and even the presence of other people is associated with a more pleasurable environment (Alfonzo, 2005). With this information we can not only make exciting and practical suggestions but recommendations that will also have the greatest impact on improving walkability along El Camino.

Measuring the attributes of walkable neighborhoods

The key urban design elements of walkable streets are green spaces, landscaping, and public areas. Ameli et al. (2015) wrote of improving the functionality of street sidewalks by taking aesthetic quality and beautification into consideration. The variables that were measured in this study were "imageability, enclosure, human scale, transparency and complexity" (Ameli et al. 2015). The most important quality that was determined in this study was transparency, which means the level at which people can perceive what lies ahead of them when walking on a

street. Ameli further discusses that “transparency, as it was measured, incorporates three operational variables: the proportion of first floor facades with windows; the proportion of active uses at street level; and the proportion of street walls along the frontage” (Ameli et al. 2015). An example of an active use at the street level would be street shops that people can walk by and observe.

Another quality that has the potential to improve walkability is the incorporation of green spaces on streets. Creating unique streetscapes can help enhance the quality of living in some neighborhoods while giving people opportunities to venture out and explore. In Allan Jacobs’s “*Great Streets*”, the author talks about the different ways to improve the aesthetic and functionality of sidewalks. He writes that “green streetscapes incorporate existing trees to the largest extent possible, facilitate natural infiltration and have less impervious surfaces such as concrete and asphalt” (Allan Jacobs, 1993). A reduction in the amount of concrete surfaces can improve the visual appearance of sidewalks as well as offer many ecosystem services to surrounding neighborhoods. By offering ecosystem services to nearby neighborhoods, the overall health of a community could potentially improve.

METHODS

For this project we conducted a background interview with the City’s Associate Planner and El Camino Real Project Manager; a GIS analysis focused on how the walkability needs of the community are currently being met; a public perception survey to gain understanding of community opinions of the road; and identification of best practices to provide a wider context for potential interventions. Throughout our analysis, we have organized our data around the hierarchy of walkability needs (Table 1).

Table 1: Methods Framework, Adapted from Alfonzo (2005)

Hierarchy Level	Example(s)	Data Source
Accessibility	Distance to resources, variety of resources available	Walk audit
Safety	Light posts, sidewalk setback, available “eyes on the street”	Walk audit, Yelp business directory
Comfort	Benches, wider sidewalks, lower speed limits	Walk audit
Pleasurability	Street trees, public art, outdoor dining, appealing architecture	Walk audit

Walk Audit

To collect the necessary data, such as street lights, abandoned buildings, speed limit, etc. for our GIS analysis we conducted a Pedestrian Environmental Data Scan (PEDS) walking audit. The PEDS walking audit, was developed to measure the environmental features that affect walking (Clifton et. al, 2007). Specifically for identifying environmental features of an area that influence walking and therefore has a high utility for our study’s purposes (Clifton et. al, 2007). Before conducting the audit, we identified 24 blocks in our study area to be audited by splitting up El Camino Real and four of the major side streets (Lafayette, Monroe, Lincoln, Scott) into its natural street blocks (Figure 4).

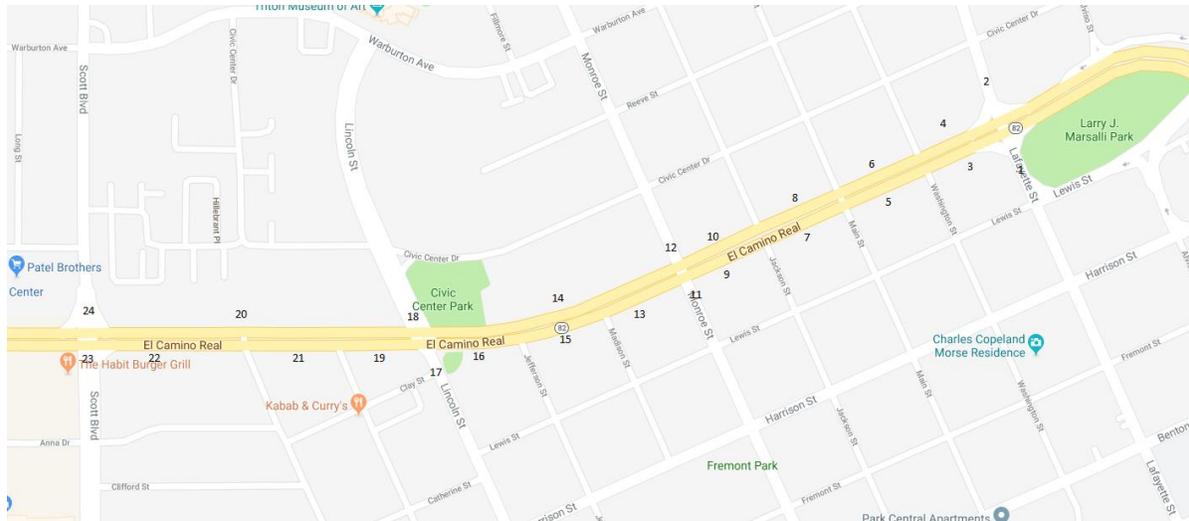


Figure 4: Identified blocks in study area for PEDS walking audit analysis

Additionally, we included major side streets in the audit to give a better idea of the walking conditions of areas that lead to the El Camino. We performed an audit for each side of El Camino Real because of its high volume and performed just one audit for each the side streets. The design of the PEDS audit is such that we only needed to write numbers or checks for all the aspects covered and this allowed us to gather the necessary information in a quick and accurate fashion. After we performed the audit, we identified 11 key variables to separate the data into for later analysis in GIS (Table 2). In analyzing our data we used Geographic Information Systems (GIS).

Table 2: Key Variables for GIS Analysis

Variable	Scoring System
Presence of “Eyes on Street”	0 = Not present 1 = Present
Path Obstructions/ Sidewalk Width	One point for obstructions, medium/ high volume driveways, and narrow paths. A score of 3 indicates that it is very difficult to walk.
Protection from Road	0 = None 1 = Not at edge 2 = Not at edge plus some sort of buffer like hedges or landscaping
Pedestrian Lighting	0 = Not present
Speed Limit	MPH limit on section
Traffic Controls	0 = No traffic controls 1 = Not at edge 2 = Not at edge plus some sort of buffer like hedges or landscaping

Variable	Scoring System
Amenities	0 = None 1 = Any
Crosswalks to number of connections	#(crosswalks) / #(connections)
Fulfilled Resource Categories	# of categories (grocery, service/ retail, transit, recreation/ open space, medical)
Abandoned Buildings/ Undeveloped Lots	0 = None 1 = 1 or more
Cleanliness and Building Maintenance	0 = Poor 1 = Fair 2 = Good

GIS Analysis

In our discussions with the City, a spatial analysis was identified as a useful contribution to the project. For our analysis, we focused on *accessibility*, *safety*, *comfort* and *pleasurability*.

1. Accessibility

Accessibility included factors such as resources available within a walking distance and the variety of resources available within walking distance. This analysis included any resources within $\frac{1}{8}$ mile of either side of the El Camino and walkable was defined as being within the standard distances of a $\frac{1}{4}$ mile and $\frac{1}{2}$ mile, used in Alfonzo's 2005 and Duncan et. al's 2012 papers. The resources are split into the following categories: service/retail (clothing stores, bike shops, banks, restaurants, laundromats etc.), grocery stores, transit stops and open spaces (parks). These categories were partially inspired by walkability studies by Duncan et. al and Krizek (2012; 2003). The data for the service/retail, grocery stores and recreational resources were sourced from Yelp and business websites. After we sourced the data, we then created buffers of a quarter mile around the grocery stores, as they are a major daily destination, to determine the presence of walkable resources within reach of a given area. Areas with high degrees of overlap will be considered to have higher levels of accessibility while areas devoid of much overlap will be considered to have low levels of accessibility.

2. Safety

Safety factors include abandoned buildings, number of lights, the speed limit of the nearby road, and planting strips (Alfonzo, 2005). Our GIS work regarding safety focused on two types, namely from traffic and crime, and the built environment qualities that play into people's safety perceptions. For traffic safety we incorporated data on all crosswalk locations as well as the history of traffic accidents involving pedestrians along the El Camino. For crime safety we looked at the available light posts, the "eyes on the street" factor and the presence of miscellaneous elements like abandoned buildings and barred windows. To collect the necessary data for speed limit, street setback, light posts, and abandoned buildings we performed a PEDS walking audit along the section of the El Camino and down one block on the perpendicular intersecting streets on either side of the El Camino, such as Lafayette, Scott, and Monroe.

For the "eyes on the street" factor, we used business hours, found on Yelp, and presence of housing as indicators for this factor. After we collected this data, we then assigned point values to each safety factor. Positive safety factors, like lower speed limits, significant street setback, and lighting were given positive values, while negative safety factors were given negative point values. Each block, separated by the side of the road, then received a score based on the sum of its factors and displayed on a final map with either green (for safe), orange (for neutral) or red (for unsafe). The division of the groups was governed by natural breaks in the data as indicated in the GIS analytics tool.

Public Perception Survey

We surveyed 9 people along El Camino Real between Lafayette and Scott (Santa Clara Town Centre) to assess current perceptions about El Camino Real. We asked the survey respondents:

- Age range (options: 18 - 25 years old; 26 - 35 years old; 36 - 45 years old; 46 - 55 years old; 55 and over; I prefer not to say)
- Race/ethnicity (options: White; Hispanic or Latino; Black or African American; Native American or American Indian; Asian / Pacific Islander; Other)
- Gender: (open ended)
- How often do you walk along or near El Camino Real?
- When you are walking down this corridor, what are some of the strengths of this area? (Prompts: walkability, trees/planters, useful businesses)
- What are weaknesses of El Camino Real as you are walking? (Prompts: safety, traffic, noise, inconvenient, traffic lights, sidewalk hazards)
- Opinion on a visual survey showing different developmental options for El Camino Real, i.e. bus lane, light rail, widened sidewalk, bike lane (Figure 5)

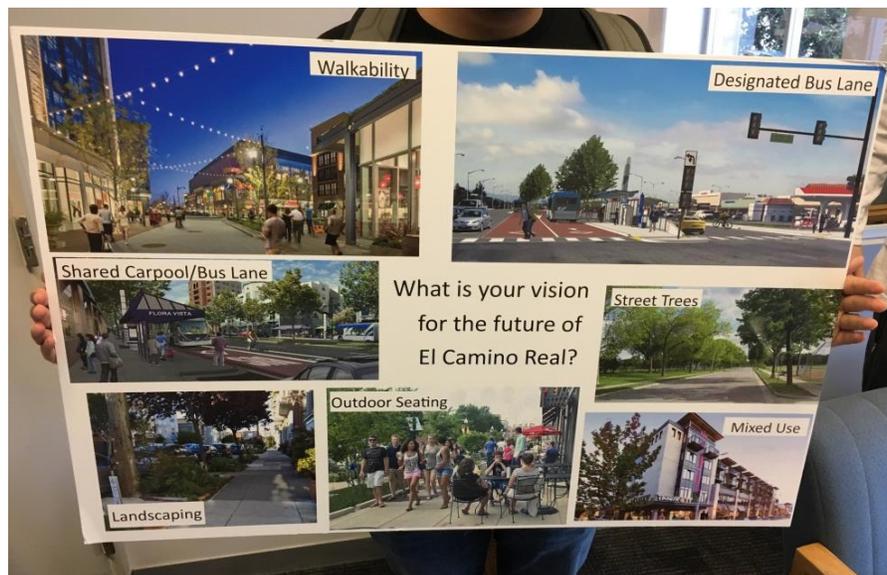


Figure 5: City of Santa Clara Visual Survey from Pop-Up Outreach Event at Santa Clara University.

- Would you walk along El Camino Real more if you saw your preferred proposed change?
- If so, can you estimate how much more? (Options: as once more a month or less, once more a week, 2-3 times more per week, more than 2-3 times per week)

The demographics of our participants were 77 percent male and 23 percent female. 44 percent of our respondents were between 18 and 25 years of age, 33 percent were between 26

and 35, 11 percent were between 46 and 55, and 11 percent were 55 and over. 44 percent of the respondents identified as Asian/Pacific Islander while 33 percent and 22 percent identified as Hispanic or Latino and White, respectively. Additionally, we considered survey information collected by the City of Santa Clara in their outreach session at Santa Clara University. They collected data using their visual surveys (see example above) about what changes people would like to see along El Camino Real. This data was included to incorporate a diversity of experiences in respondents. Because the respondents walking on El Camino Real were already current patrons of the road, analyzing SCU students allowed us to consider the opinions of prospective patrons as well.

RESULTS

Visually representing the results of the walk audit allowed us to analyze our study area from multiple perspectives (Figure 6). This helped us gain a more thorough understanding of the current walkability on El Camino Real.



Figure 6: ArcGIS spatial analysis of El Camino Real destinations and grocery availability

Accessibility

Destinations for daily life:

Our walk audit results show that El Camino Real has 47 walkable destinations and 10 transit stops along the corridor (Figure 6). Twenty-eight of the destinations were classified as retail/service, 14 as restaurants, two as grocery stores, and three as open spaces. The vast majority of these destinations, except the three located on Scott Boulevard and Santa Clara Town Centre destinations are located directly on the El Camino.

Along the corridor, we identified two grocery stores, Sprouts and Target (located in the Southwestern portion of Figure 6). Neither Sprouts nor Target are full-service grocery stores. The ¼ and ½ mile buffers surrounding these grocery stores serve to show the lack of very close grocery options for the vast majority of the study section. However, it would take a considerable increase in residential density to justify a grocery store within a ½ mile of all the residents in the area. If more housing development continues down the road, it would be more conducive to a full-service grocery store.

Retail/services was the largest category of destinations observed in the study area. This destination type was distributed mainly on the eastern and western extremes of the map, with only two falling in between Monroe and Scott Boulevard (Figure 6). The types of retail/service appear to be fairly diverse and included options such as banks, a pharmacy, a dentistry, a shoe stores, and flower shop--the only notable exception to this being the three hair and nail salons that fall within the study region.

The 14 restaurants in the study region are mainly located on the western portion of the corridor (Figure 6). Eleven of the restaurants are located west of Lincoln St, leaving only three to the rest of the study area. This is also notable given the lack of grocery stores also observed in the eastern portion of the study region, forcing residents in this area to take transit or personal vehicles to get groceries. Moreover, eight of the restaurants were fast food chains, leaving fewer options for fresh foods for local residents all along the study area.

There are three parks or open spaces located along El Camino Real: Larry J. Massali Park on the far eastern edge of the study area, and Civic Center Park and Geof Goodfellow Sesquicentennial park on opposite ends of the street at the intersection of Lincoln and El Camino.



Figure 7: Typical transit stop

Transit

The transit stops along El Camino Real, all bus stops, are mostly uniform and evenly dispersed. Five are located east of Monroe street and five are located west of Monroe. An example of a typical bus stop along the route can be seen in Figure 7. The only transit stop observed to have a shelter was on the southeastern corner of El Camino Real and Scott Blvd.

Sidewalk Obstructions

There are many sidewalk obstructions along El Camino Real. Every block studied but one (Block 1, Figure 4), contained either signs, poles or several medium/high volume driveways that blocked part of the sidewalk.



Figure 8: Example of pole obstruction and narrowed sidewalk

Signs/poles were the main obstruction observed, 22 of the 24 blocks studied contained this sort of obstruction. The only blocks not containing these signs or poles were the side streets of Lafayette and Lincoln. These shortened the effective width of the sidewalk by about 1-2 feet (Figure 8). Other examples of obstructions included benches, overgrown greenery, and garbage cans, but only existed on 25 percent of the blocks and did not appear to be very consistent obstructions in the study area.

Medium/high volume driveways were the other major obstruction we identified along the study area. While not physical obstructions themselves, the semi-frequent presence of car traffic presents the potential for obstructing pedestrian traffic. Seventy-five percent of the blocks studied had at least one medium/high volume driveway. These driveways also present a pedestrian safety issue by essentially creating another intersection for walkers to cross.

Public Perceptions of Accessibility

Our survey focused on participants' opinions of the current state of the El Camino and potential future developments asking questions about demographics, how often they walk along El Camino Real, their perceived strengths and weaknesses of El Camino Real and their opinions on proposed changes to the road. Again, we surveyed 9 users of El Camino Real. Three of our survey respondents said that they had trouble with reaching the attractions along El Camino Real. They said that they had to walk about half a mile before reaching any restaurants and stores. However, six respondents said that they had no problem with walking along El Camino Real, and thought that the sidewalks and crosswalks were wide enough to walk through. It is unknown whether the respondents we surveyed were residents living near El Camino Real or if they were just frequent visitors from different communities. One of the biggest strengths that they stated was that there were many restaurants and stores to visit along El Camino Real. seven respondents didn't have a problem with the amount of shops/stores along the street. Figure 6 shows that there are multiple restaurants within our targeted one mile radius from Lafayette Street to Scott Boulevard.

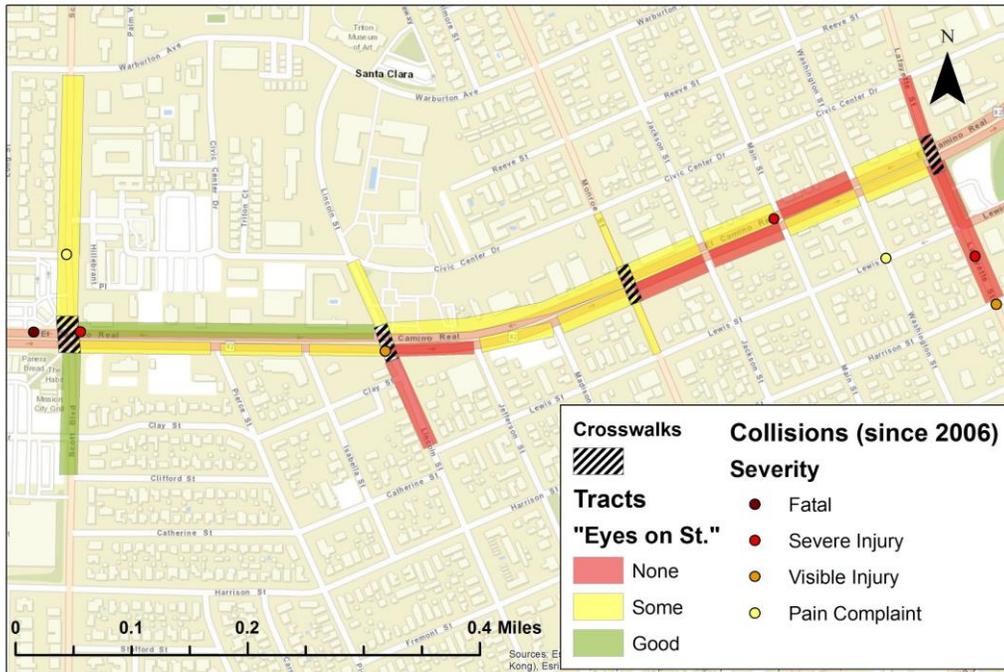


Figure 9: El Camino Real safety concerns and pedestrian collisions

Safety

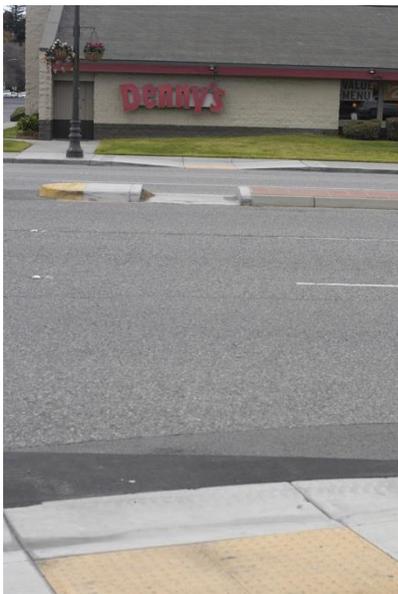


Figure 10: Example of 8 lane crossing with no crosswalk

Crosswalks

One of the major safety related observations along El Camino concerned the amount of protected crosswalks for pedestrians. The only crosswalks available for pedestrians to cross the El Camino were at the major side streets of Lafayette, Monroe, Lincoln and Scott (Figure 10). One area observed even had curb cuts through the median to suggest that it was a route for pedestrians, but contained no other crossing aids or traffic controls for pedestrians to make it across the six lanes of high speed traffic.



Figure 11: El Camino crosswalk with curb cut but no crosswalk

El Camino also lacked crosswalks for the side street crossings for pedestrians walking along the El Camino corridor (Figure 11). While all of the side street crossings along El Camino Real had curb cuts, the only side street crossings with painted crosswalks were once again for the major side streets of Lafayette, Monroe, Lincoln and Scott. This ends up encouraging people to jaywalk as it is a more much direct alternative to walking up to an extra quarter mile.

Buffers

Buffers between pedestrians and traffic were nonexistent along the El Camino itself. Once again, only the side streets studied along the corridor contained any sort of barrier or buffer – usually landscaping (Figure 12) – between pedestrians and the road.



Figure 12: Madison St. with landscaping buffer between road and sidewalk

Traffic Lights and Signage

Every block studied along the corridor contained at least some sort of traffic control, either stop sign or traffic light. Seven traffic lights were observed in the study area, four along El Camino Real corridor, and three on the side streets of Lafayette, Lincoln and Scott. Interestingly, all three of the side street traffic lights were located on the south side of the El Camino. Eighteen of the 24 blocks studied contained a stop sign to control traffic. The blocks without stop signs were all the major side streets, which contained traffic lights to control traffic. One area that the

El Camino was significantly lacking in this area were pedestrian warning signs to alert traffic to the presence of pedestrians. None of the blocks studied contained any sort of these signs.

Speed Limits

The speed limit along the El Camino itself was 40 mph the entire length of the study region. The side streets studied, however, varied between 25-35 mph. Monroe and Lincoln both had the relatively low speed limit of 25 mph. Lafayette was slightly higher at 30 mph and and Scott was even higher at 35 mph.

Pedestrian/sidewalk lighting

While the entire study area had road-oriented lighting (Figure 13), there was very little pedestrian-scale lighting along the corridor or on the side streets. The only areas observed to have this sort of lighting included blocks 20, 23 and 24. However, this pedestrian lighting was not constant throughout the blocks and was only observed in small sections of the blocks, such as the section of block 22 near the corner of Scott and the El Camino (Figure 14).



Figure 14: Pedestrian-oriented lighting

“Eyes on the Street”



Figure 15: Multi-family housing along El Camino Real

There were two factors we identified for measuring the eyes on street factor along the corridor. The first was the presence of multi-family housing and the second was trafficked businesses (such as restaurants and grocery) open past 5 p.m. Nine of the 24 blocks either contained multiple family housing, or had multiple family housing construction projects in progress (blocks 7 & 22, Figure 4). Ten of the 24 blocks had businesses open late. Together, this resulted in 18 of the blocks having some sort of eyes

on the street surveillance factor (Figure 15). The blocks with the worst eyes on the street level were concentrated on the east side of the corridor, with four of the blocks containing no surveillance located on the east side of Monroe (Figure 15).

Vacant Lots and Buildings

Five blocks along the study corridor contained vacant lots and/or abandoned buildings. They were also concentrated on the east side of the corridor--all but one were located east of Monroe St. One example of a vacant lot identified can be seen on block 10 on the corner of



Figure 16: Vacant lot along El Camino Real

Monroe and El Camino Real on the southeastern corner of the intersection (Figure 16). The front of the lot is completely vacant and the back appears to be a storage facility for RVs, but the space is mainly unused. Block 14 had the highest number of abandoned buildings in our study with three businesses (Civil Auto Pro, Tires Unlimited and M.B. transmissions) that all appear to be abandoned.

Comfort

Street furniture and other amenities

One of the key aspects for comfort is street amenities. We found that 10 of the 24 blocks studied contained some sort of amenity, which in the case of the El Camino only consisted of benches or water fountains. Benches were located at 10 of the blocks along the El Camino, but seven of these were due to bus stops having public benches (Figure 7). Two of the other blocks with benches were park benches and only one was a dedicated pedestrian amenity.

Drinking Fountains

Only one drinking fountain was located along the study region, on block 18 (Figure 4). It was located within Civic Center Park, and not very visible to pedestrians along the corridor.

Sidewalk Condition

Most of the sidewalks along the corridor were actually in fairly good condition, and we did not rate a single block as having poor sidewalk maintenance (defined as many bumps/cracks/holes). Fifteen out of the 24 blocks were rated as fair (defined as: some bumps/cracks/holes) and the remaining 9 as good (defined as: very few bumps, cracks or holes). The distribution of the fair-rated sidewalks are fairly evenly distributed throughout the study area, the only exception being a stretch of five straight poor ratings from blocks 10-14, which includes two blocks on Monroe boulevard (Figure 4).

Street Trees and Landscaping

Nine of the 24 blocks had some street trees that provide shading for pedestrians. However, all of these blocks had only minimal street tree coverage, and do not provide adequate shading for pedestrians (Figure 17). Further, 2/3 of these blocks were side streets, despite the fact that side streets only made up 1/3 of the studied blocks. This is most likely to do with the decision of the city to place utilities underneath the sidewalk along the corridor, therefore constricting the placement of trees so that they do not interfere with the placing of the cables.



Figure 17: Street trees along El Camino Real

Only one in six blocks studied contained any sort of street landscaping (Figure 17). All of these blocks were located on side streets, leaving the main corridor with no street landscaping to improve the walking experience.

Pleasurability

Articulation and Other Building Design Characteristics

Given the shortcomings in more basic walkability needs, pleasurability was not extensively studied in our analysis. However, articulation in building design was one aspect of the PEDS walk audit that contributes to this hierarchical factor. None of the blocks studied were measured to have highly articulated building design, and five were identified to have some articulation in design. There not appear to be any significant patterns in the distribution of these blocks throughout the study region. Based off of the results from our public perception survey, we can conclude that the people walking along El Camino Real found the street to be uncomfortable at times due to the amount of noise caused by traffic and construction projects. Also, some respondents mentioned that it takes them a while to walk before they reach any stores and restaurants, which causes some discomfort.

Other results

Public Perceptions

Three survey respondents said that they rarely walk along or near El Camino Real with the most common response being one or two times per month. Three respondents said they walked along the street once per week while two respondents said they walked two or more times per week. There seemed to be more people walking around their neighborhood when we were conducting our survey, and we think that the reason for this might be that neighborhood blocks tend to have more street trees and less noisy traffic than the main street does.

DISCUSSION

Accessibility

Our results from the walk audit and GIS analysis show that there are an adequate amount of resources along El Camino Real, with the notable exception of grocery stores that only existed along the western portion of the study area. The results from the survey supported this finding and showed that sixty-six percent of survey respondents reported that they thought that the El Camino had a good amount of resources within walking distance. However, these results are somewhat limited due to the respondents being made entirely of people who already walk along El Camino Real, and therefore have a better perception of the walkability conditions along the El Camino. Given this, we believe that accessibility is not likely to be the major reason that the El Camino has not yet reached is walkability potential. However, there is always room for improvement and we would like to emphasize that efforts to improve access to a diverse set of resources along the El Camino, especially to grocery stores, should be continued.

Safety

Safety appears to be the most crucial area of focus for future development projects along the El Camino given its high importance on the hierarchy of walkability and the poor safety conditions along El Camino currently based on our results from the walk audit, GIS analysis, traffic safety data, and survey results.

No block along El Camino Real had any sort of buffer between pedestrians and the roadway. El Camino Real also had poor lighting and a lack of the “eyes on street.” Only two blocks in the study region had any sort of pedestrian lighting, and even these sections of lighting were not for the entire block. This could be improved through better street lighting, and more housing and businesses that improve pedestrians’ comfort.

The lack of protected crosswalks for the El Camino were also observed to be a major area of concern for the safety of the corridor. There were only four crosswalks across the El Camino in the study region, forcing pedestrians to potentially travel much further in order to get to a crosswalk in order to traverse the busy road. This ends up encouraging people to jaywalk as it is a much faster alternative. Jaywalking, although a social construct pushed by the auto industry, is still an inherently dangerous activity, and the lack of crosswalks is almost certainly contributing to this behavior (Stromberg, 2015). We witnessed numerous jaywalkers attempting to cross to El Camino Real during our walk audit, despite the general lack of pedestrians along the street. Further, there were no crosswalks for the side street crosswalks lining the El Camino, potentially increasing the likelihood for pedestrian related accidents.

Comfort

Our analysis of the comfort of El Camino Real showed that is also an area of concern. Its lack of street amenities, such as benches and drinking fountains, were very apparent and street trees were almost non-existent along the main corridor--most likely due to the placement of the utilities underneath the sidewalk that makes it difficult to plant trees. One promising aspect of comfort that we did observe was the sidewalk condition along the corridor. We rated none of the blocks in the study area as having poor sidewalk maintenance, 15 as having fair maintenance and 9 as having good maintenance.

Pleasurability

We observed a few characteristics associated with pleasurable walking. The only factor applicable from our analysis was the architectural articulation of the building design and only five blocks were observed to have any architectural articulation and none were observed to highly articulated building design. Once more important hierarchical levels are satisfied, other contributing elements to pleasurability, such as outdoor dining areas, street art, and landscaping, could be considered in future studies in order to determine how to satisfy this last level of the hierarchy.

CONCLUSIONS AND RECOMMENDATIONS

El Camino Real has great potential to become a more walkable, bikeable, economically productive, safe, and sustainable corridor for the City of Santa Clara. Using the hierarchy adapted from Alfonzo's 2005 paper, we identified that the most significant current barrier to accomplishing this goal was in the realm of safety. El Camino Real appears to meet the most basic need of accessibility by having an adequate amount of destinations. Safety, the next need on the hierarchy, however, has numerous pitfalls that are likely preventing the corridor from becoming more walkable. The most notable aspects of safety that we recommend be improved:

- Incorporate landscaped road buffers to separate pedestrians from vehicle traffic and to provide shade.
- Eliminate the parking lane, and potentially one traffic lane, and convert space into a wider sidewalk and bike lane to allow for a more complete street environment.
- Add pedestrian-oriented lighting to improve safety at night.
- Add crosswalks, especially across El Camino Real, to increase pedestrian safety and decrease walking times.
- Decrease speed limit to 30 mph to improve pedestrian experience and safety.
- Incorporate more mixed-used, pedestrian-oriented development and remove the storefront parking and driveways that currently pose a threat to pedestrians and create a more car-oriented environment.

Based on our analysis, comfort and pleasurability were lacking along El Camino Real, however, the city needs to make major safety improvements first before addressing the comfort and pleasurability of El Camino Real:

- Increase the amount of amenities to improve the pedestrian experience through benches, drinking fountains, (Figure 18), and transit shelters.
- Add street trees to shade pedestrians and make for a more comfortable, pleasurable experience. The city s
- Add outdoor dining and gathering areas in addition to the Santa Clara Town Centre.
- Increase architectural articulation, courtyard development, and add public art to make for a more interesting walking experience.



Figure 18: Water fountain and bench, comfort feature recommendations

Our recommendations are inspired by the complete streets design concept by the California Department of Transportation illustrating how a six-lane corridor, similar to the El

Camino, can be converted into a tree-lined, well-lit, mixed-use, pedestrian, bike, car and transit-oriented space for all. This example gets at most aspects of the walkability hierarchy that we have mentioned. Safety is better met through improved crosswalks, better lighting, buffers between the road and pedestrians, and mixed-use housing that provides multiple family housing and businesses to help increase the “eyes on the street.” Comfort and pleasurability are also met through street trees and landscaping that provide shade and an interesting streetscape to travel through, and increased amenities such as benches, bike racks, and outdoor seating improve the pedestrian experience.

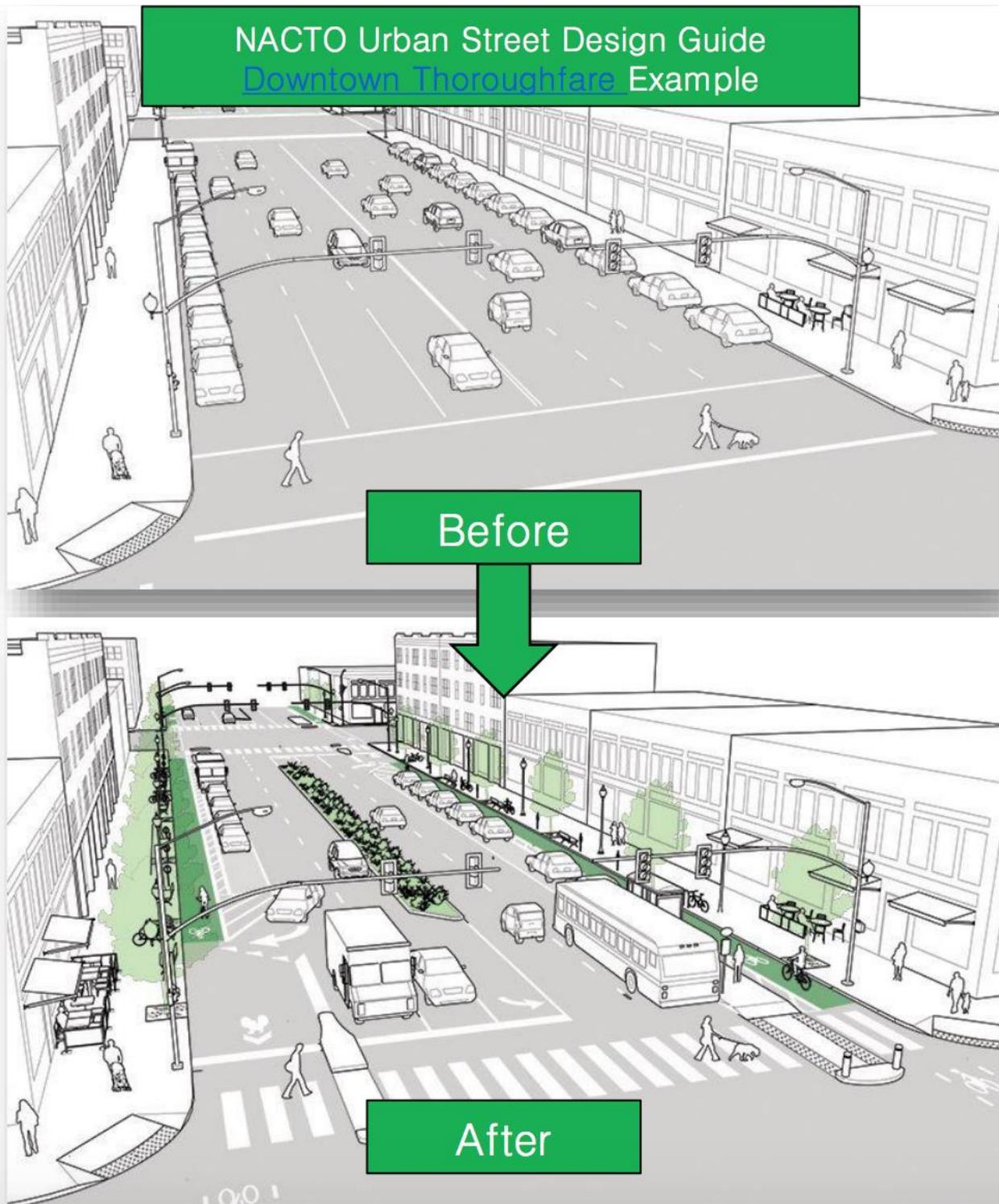


Figure 19: Potential vision for El Camino Real (Guide, 2011).

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