State Smart Transportation Initiative

Connecting Sacramento:
A Trip-Making and Accessibility Study

Study Overview and Highlights July 2017

Purpose of this study

Local governments and transportation agencies often make challenging decisions about how best to use their limited resources to ensure they are meeting people's travel needs. These decisions typically depend on reliable data and metrics, which help explain where issues exist, come up with logical solutions, evaluate of the impacts of potential projects, and weigh the relative benefits of different options.

Decision-makers have long relied on a limited set of tools. Facility-level metrics such as road delay and on-time transit arrival provide some sense of how well different pieces of a transportation system are performing; costly travel surveys shed light on people's actual travel behaviors; and travel demand models let us simulate travel patterns throughout a region and forecast travel behavior into the future. Unfortunately, these tools fall short in easily answering fundamental transportation-related questions: where are people going and how easily can they get there? This is particularly true regarding transit riders and potential transit users.

Newer data sources and more advanced analytic tools can potentially change that drastically, but they are not well understood and rarely applied in practice. This study incorporates several of those new tools and data sources to understand how useful they are and how they can inform smarter transportation investments and more impactful improvements – particularly related to improving people's access to existing transit and increasing transit ridership.

Novel tools and data sources

Accessibility metrics

Accessibility metrics incorporate everything we know about existing transportation networks and land uses to explain how easily people can reach essential destinations by different modes. By measuring accessibility in terms of travel time, we can begin to answer the following questions for any given location in a region:

- How accessible are transit stations by walking?
- How many jobs are reasonably accessible by transit?
- How easily can people access their essential daily needs?

To make these calculations, this study relies on the Sugar Access package provided by Citilabs. While other methods exist, Sugar Access provides all the necessary data and computing power to make reasonable accessibility calculations without any prior effort.

Trip-making data

Passive trip-making data lets us understand people's precise travel patterns without models or costly surveys. Various anonymous data sources offer information about origin-destination flows, route choices, and trip characteristics by different modes of travel. This study incorporates two such data sources:

- Teralytics provides information on light rail trips based on cellular location data combined with transit routes and schedules from General Transit Feed Specification (GTFS) data.
- StreetLight Data provides information on vehicle trips, bicycle trips, and pedestrian trips based on passive GPS data from in-vehicle units and mobile devices.

Applications

Using these tools and data sources, this study demonstrates meaningful ways to understand people's current travel patterns, identify clusters of potential transit users, identify substantial gaps in transit accessibility, and quantify the impacts of potential improvements. Example applications and concepts are described below.

Vehicle trips

Using StreetLight Data, this study identifies personal vehicle trips that run along the light rail lines, many of which could be made by transit instead. Many of those trips begin Downtown, just south of Downtown along the Blue Line, and near several stations along the Gold Line. The data also reveal where those trips end. For example, of the 7,400 vehicle trips beginning near Iron Point station each weekday, roughly 2,800 end within two to three stations and another 1,700 end elsewhere along the Gold Line, including Downtown.

Light rail trips and mode share

Using data from Teralytics, this study reveals the origins, destinations, and mode share of light rail trips. As with StreetLight Data, this study only considers trips that begin and end near transit stations (precluding many park-and-ride trips). The main use of these data is to identify areas near stations with exceptionally low light rail mode shares. For example, only 1.4% of trips beginning just south of Butterfield station are made by light rail (compared to 5% in other nearby areas). This area includes several large office buildings served by abundant parking, which likely encourages driving and makes walking to the station less appealing.

Pedestrian trips

Using StreetLight Data, this study reveals the origins and destinations of walking trips to and from light rail stations. Methods for classifying observed GPS traces by mode are an essential outcome of this project. Previously, the data only let us understand vehicle movements based mainly on observations from in-vehicle GPS units. However, using data from handheld GPS-

enabled devices and machine learning techniques, StreetLight Data has developed methods that can accurately identify vehicle, bicycle, and pedestrian trips. At the time of this study these methods were still in a trial phase, but trip metrics based on those methods are incorporated into the study on that basis.

Transit accessibility metrics

To evaluate transit accessibility, we measure the number of jobs accessible by transit during the morning period (7-10 AM) based on the existing transit schedules. In this case, the reported number of jobs is decay-weighted, meaning that nearby jobs are assigned more utility than jobs further away, based on decay functions derived from the 2009 National Household Travel Survey (NHTS) in the state of California. For example, a job within 10 minutes counts 100 percent; a job within 30 minutes counts 70 percent; and a job within 60 minutes counts 40 percent. This measure lets us evaluate existing accessibility and quantify the impacts of accessibility improvements.

Accessibility impact scores

Accessibility impact scores are developed to identify blocks that could benefit the most from improved connections to existing transit stations. These metrics account for: A) the actual walking time to light rail stations from nearby blocks using the existing network, B) the potential time reduction caused by a direct (straight-line) connection to the station, and C) the number of people in a block that would be affected by an improved connection. This measure suggests that impactful connections could be added near Zinfandel station, Swanston station, Meadowview station, and others. A direct connection is not always possible, so the actual achievable travel time reduction must be calculated separately, based on project-specific details.

Other applications

Several other important applications are highlighted in this study, including:

- Using StreetLight Data to analyze vehicle trips to and from light rail parking lots. In many cases, people drive short distances suggesting they might be able to walk or bike. In other cases, shuttles and ridesharing services might be reasonable alternatives.
- Using accessibility metrics identify transportation equity issues.

Case study: Accessibility improvements near Swanston station

The following case study of Swanston station illustrates many of the various uses of accessibility metrics and trip-making data outlined in this study, including: vehicle and transit trip-making patterns, accessibility impact scores, and accessibility metrics for project evaluation.

The second highest accessibility impact score occurs in a block just east of Swanston station (Figure 1). The ideal (straight-line) walk time from that block to Swanston station is two minutes, but the actual walking time is 16 minutes, due to rail lines that limit access. There are few households in the block, but approximately 800 jobs.

Figure 1. Impact scores (0 to 100) around Swanston station

Teralytics data reveals that only three percent of trips beginning near that block and ending somewhere else along the light rail lines are made by light rail. This is lower than many areas along the rail line, but similar to other nearby areas. Of those trips (approximately 130 on a typical weekday), many end downtown (Figure 2).

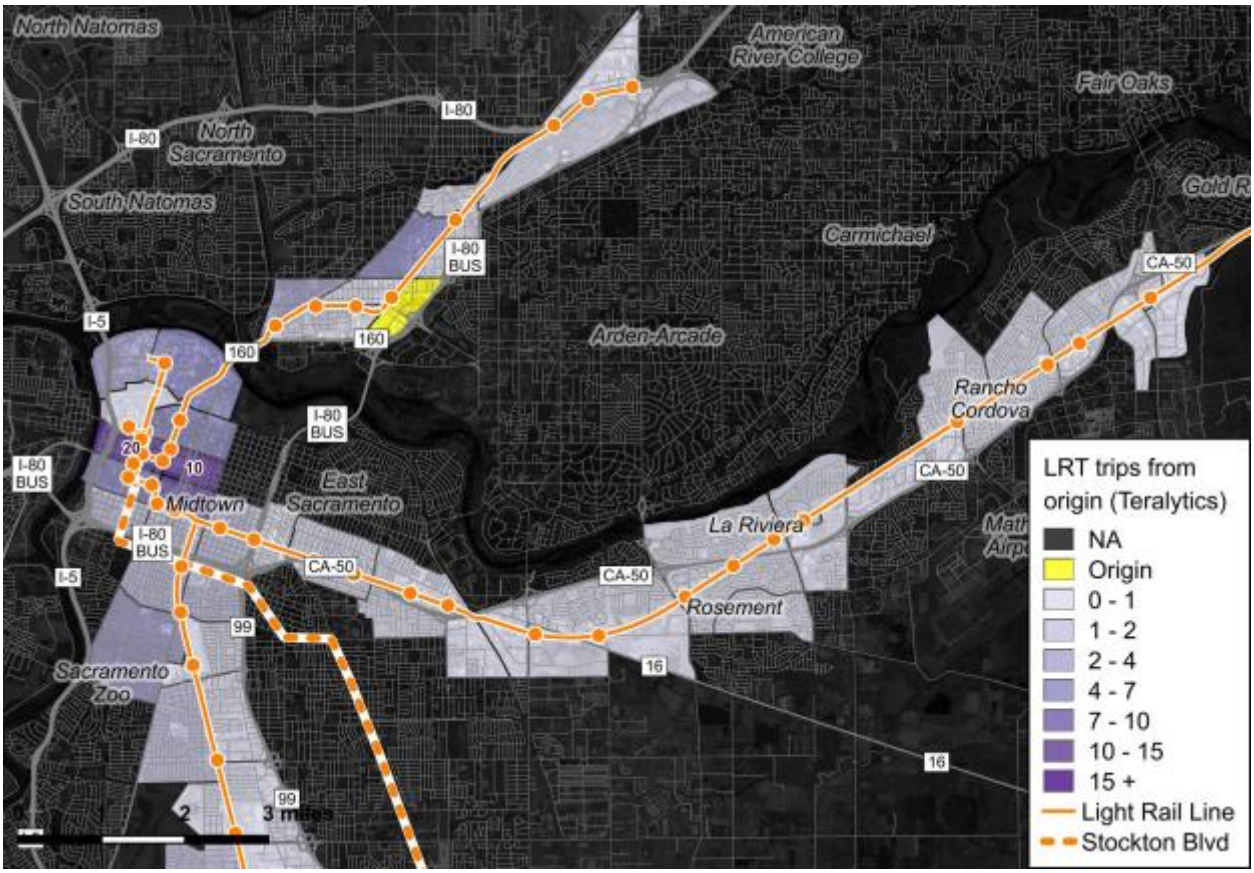

Figure 2. LRT trip destinations from east of Swanston station (Teralytics)

StreetLight Data reveals approximately 1,500 vehicle trips beginning near the block and ending somewhere along the light rail lines are made by personal vehicles. This is higher than other nearby areas. Of those trips, many end Downtown and elsewhere along the Blue line north of Downtown (Figure 3). Many of these trips represent potential transit trips.

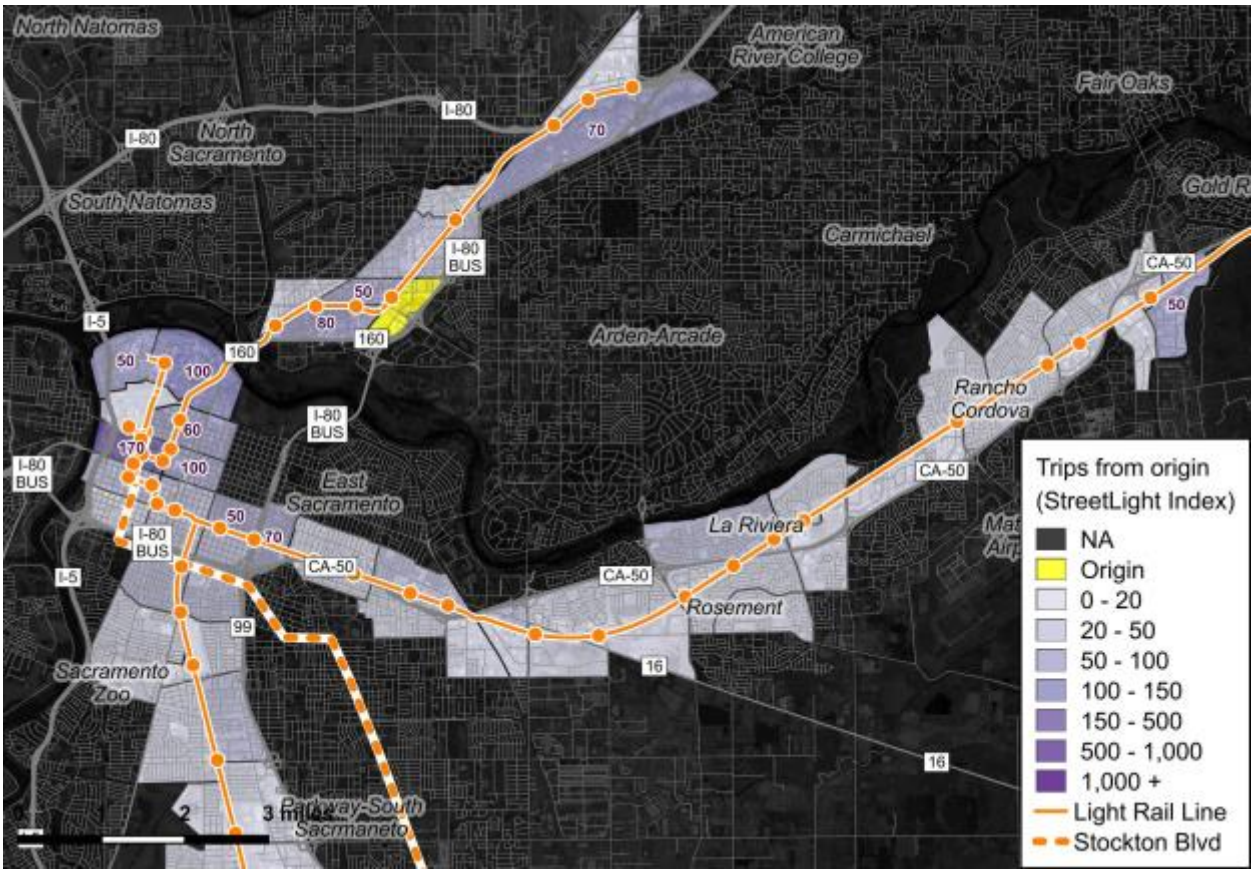

Figure 3. Vehicle trip destinations from east of Swanston station (StreetLight Data); multiply StreetLight Index (shown) by 0.85 for approximate number of vehicle trips

Recognizing the accessibility issues around Swanston station, the City of Sacramento proposed new connections to the east in a Transit Village Specific Plan from 2007. The plan, developed through a series of public workshops, is meant to enhance the area around the station as a highly-connected transit oriented development and maximize development potential. The plan proposes a dense network of bicycle and pedestrian connections including a bridge across the existing freight line to the east (Figure 4).

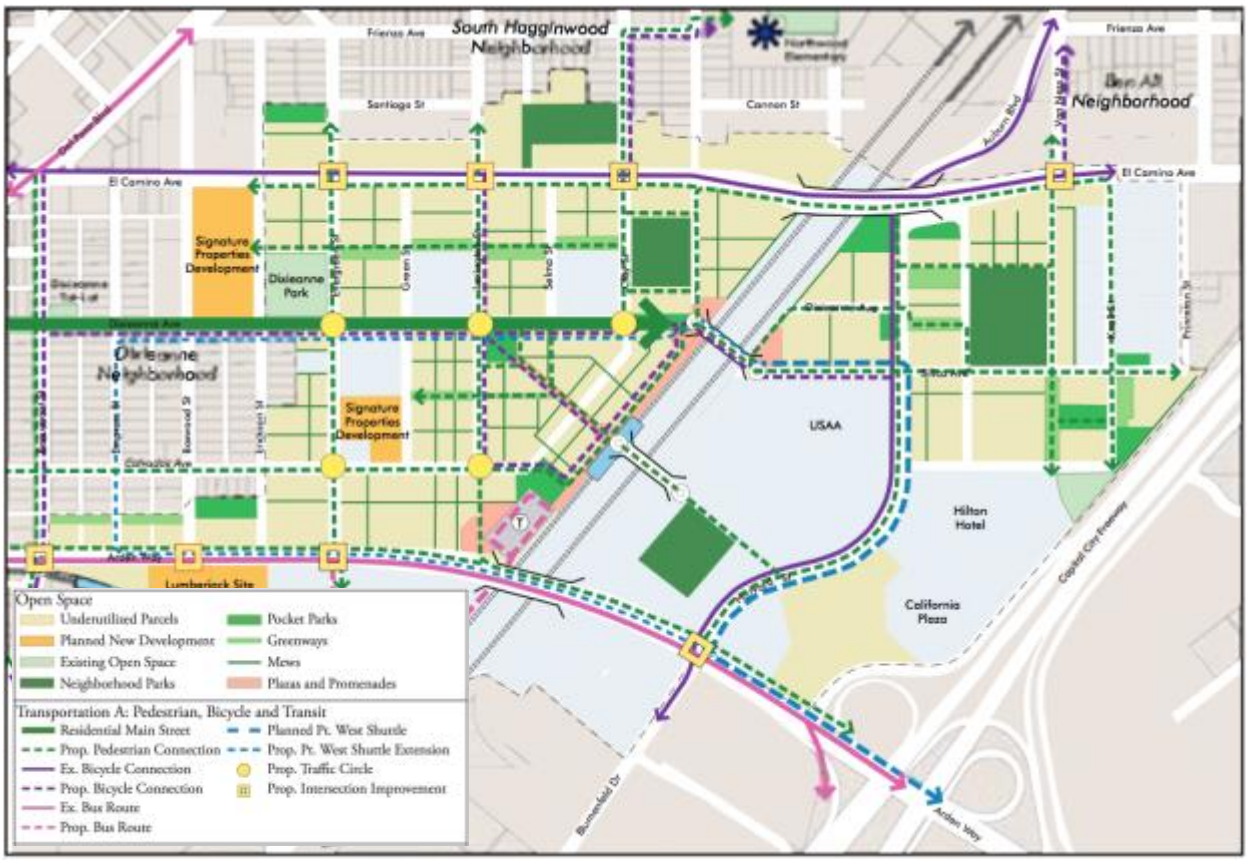

Figure 4. Proposed bicycle and pedestrian connections around Swanston station (source: City of Sacramento)

Figure 5 shows how the proposed connections would improve travel times for those walking to the station. From the neighborhood immediately to the east, travel time to the station decreases by 10 minutes. From neighborhoods further east, travel times decrease by around five minutes. Additional connections west of Swanston station also reduce travel times in the vicinity.

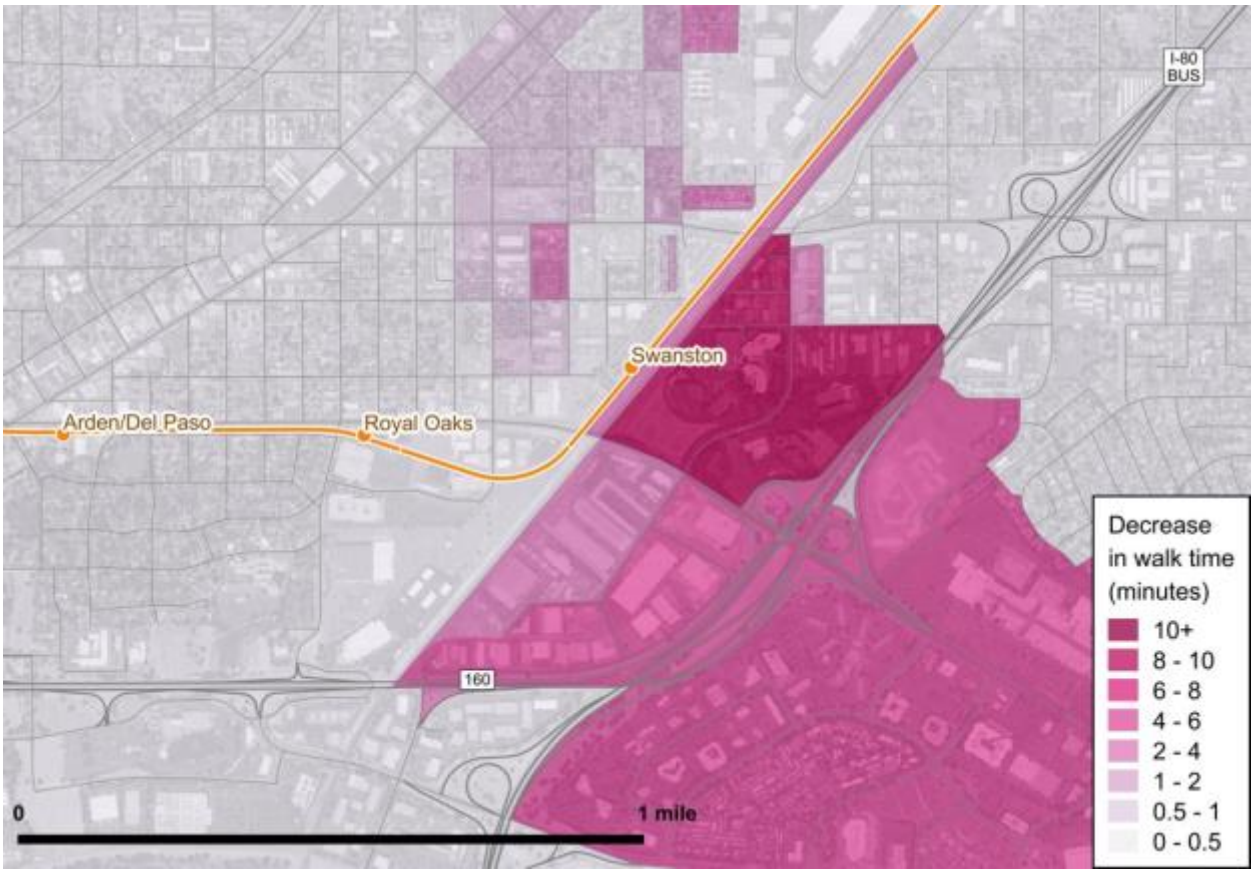

Figure 5. Walk time improvements due to proposed connections to Swanston station

We can further evaluate the impacts of these proposed improvements by comparing before and after conditions using the transit accessibility measure described above. As shown in Figure 6, the improved connections to Swanston station have a pronounced impact throughout the transit system. Those living immediately to the east gain access to an additional 15,000 to 30,000 jobs by transit from the improvements. Within a half-mile of the station, the average increase is 1,600 jobs. Because the connections also improve access to jobs near the station, the impacts spread citywide. In total, roughly 33,000 households gain access to an additional 250 jobs or more.

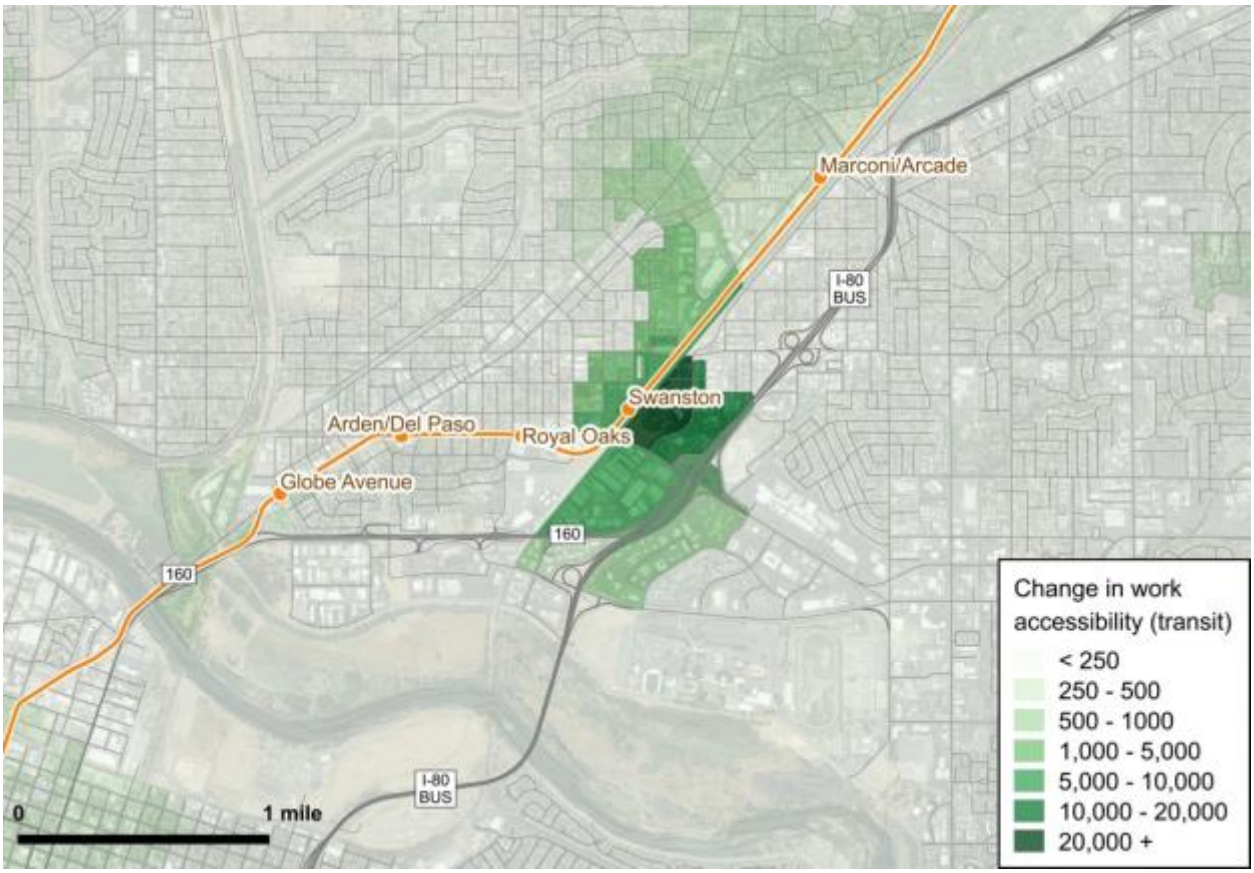

Figure 6. Improvements in access to jobs by transit due to proposed connections to Swanston station

Case study: Walking trips to and from Zinfandel station

The following case study of Zinfandel station illustrates how pedestrian trip-making data from StreetLight Data can be used to understand where people walking to the station begin their trips and where few people walk, highlighting potential accessibility issues that should be addressed. The following analysis focuses on the origins and destinations of pedestrian trips passing through the Zinfandel station platform.

As shown in Figure 7, most of those trips (35%) begin or end just north of the station in an area that includes some residences and a Walmart shopping center. Many (28%) also begin or end just east of the station at the Rancho Cordova shopping center. Some trips (19%) begin or end in residential neighborhoods to the west and few trips (5%) begin or end in neighborhoods to the northeast. The data also show that northeastern neighborhoods favor Cordova Town Center station, the next station to the east.

The most relevant finding regarding last-mile connections is that 15% of trips begin or end in a large cluster of office buildings just southeast of the station, across the Lincoln Highway (US-50). This is somewhat surprising given the abundant parking that serves the buildings, the sparse pedestrian network, and the single access point across the Lincoln Freeway on Zinfandel Drive.

This finding suggests that some attention should be paid to improving pedestrian connections across the freeway, both to improve conditions for people making those trips and to attract more transit commuters.

Figure 7. Origins and destinations of walking trips to and from Zinfandel station (StreetLight Data)

More information on the *Connecting Sacramento* study, including the full technical report, can be found at www.ssti.us/2017/07/connecting-sacramento.

This study, led by the State Smart Transportation Initiative with the Lincoln Institute of Land Policy, was sponsored by TransitCenter with additional support from the Barr Foundation and Planet Bike. Partners include the Sacramento Council of Governments, the City of Sacramento, Sacramento Regional Transit, Caltrans, the Sacramento Downtown Partnership, Citilabs, StreetLight Data, and Teralytics.