

8 CORRIDOR DEMAND

This chapter presents results of a cell-phone data analysis to determine where people are traveling both within Stanislaus County and across county boundaries. The data source and methodology are presented first, followed by the analysis. The results from this analysis will be used to identify travel patterns in the region that can be used to improve service and create new transit priority corridors.

DATA SOURCE

One of the most dramatic changes to occur in public transit planning and forecasting over the last few years has been the introduction of “Big Data” and the rollout of dynamic US Census data. Big Data refers to data sets that are both current and massive that require new ways of analyzing and displaying information that were unfathomable a decade ago. One of these Big Data sets is the information collected from Global Positioning System (GPS) equipped cellular communication devices.

Today in the US, approximately 97% of people own a cellular telephone, and over 85% own a smartphone equipped with GPS tracking services.⁶ Compare this with 2011, when Pew Research completed its first survey of cellphone ownership and found that only 35% of US citizens owned a smartphone. This distribution of cellular devices means it is now possible to track the real-time movement of people, all day, every day, around the country, regardless of what mode they use to move about. GPS mobility data is generated not just by smartphones but also by any vehicle equipped with navigation software.

⁶ <https://www.pewresearch.org/internet/fact-sheet/mobile/>

StreetLight Analytics

GPS data is collected by cellular service companies such as T-Mobile, AT&T, and Verizon, who then resell it to data aggregation/analysis services. One of the leaders in that field is StreetLight Analytics (www.StreetLightdata.com). Every month, StreetLight compiles, aggregates, indexes, and processes over 40 billion anonymized location records collected from smartphones, tablets, and navigation devices in connected cars and trucks. It then adds context from numerous other sources, like parcel data and digital road network data, to develop a comprehensive view of mobility across North America's vast network of roads, bike lanes, and sidewalks. Fehr & Peers has been a trusted partner of StreetLight for several years. For this project, Fehr & Peers worked closely with StreetLight to obtain travel data for trips by day of week and time of day for the entire Ride the S service area.

Data was collected for the months of May 2019 and May 2021, representing time periods both before and during the COVID-19 pandemic. The data was condensed down to create "typical days and time periods" as noted in the following paragraphs.⁷

METHODOLOGY

The first step in this analysis involved defining and selecting the appropriate zones to examine, and then selecting the relevant date ranges. That process was done collaboratively with Ride the S staff. Next, data records were cleaned so that mobility movements⁸ for freight and delivery vehicles could be removed from the data set.

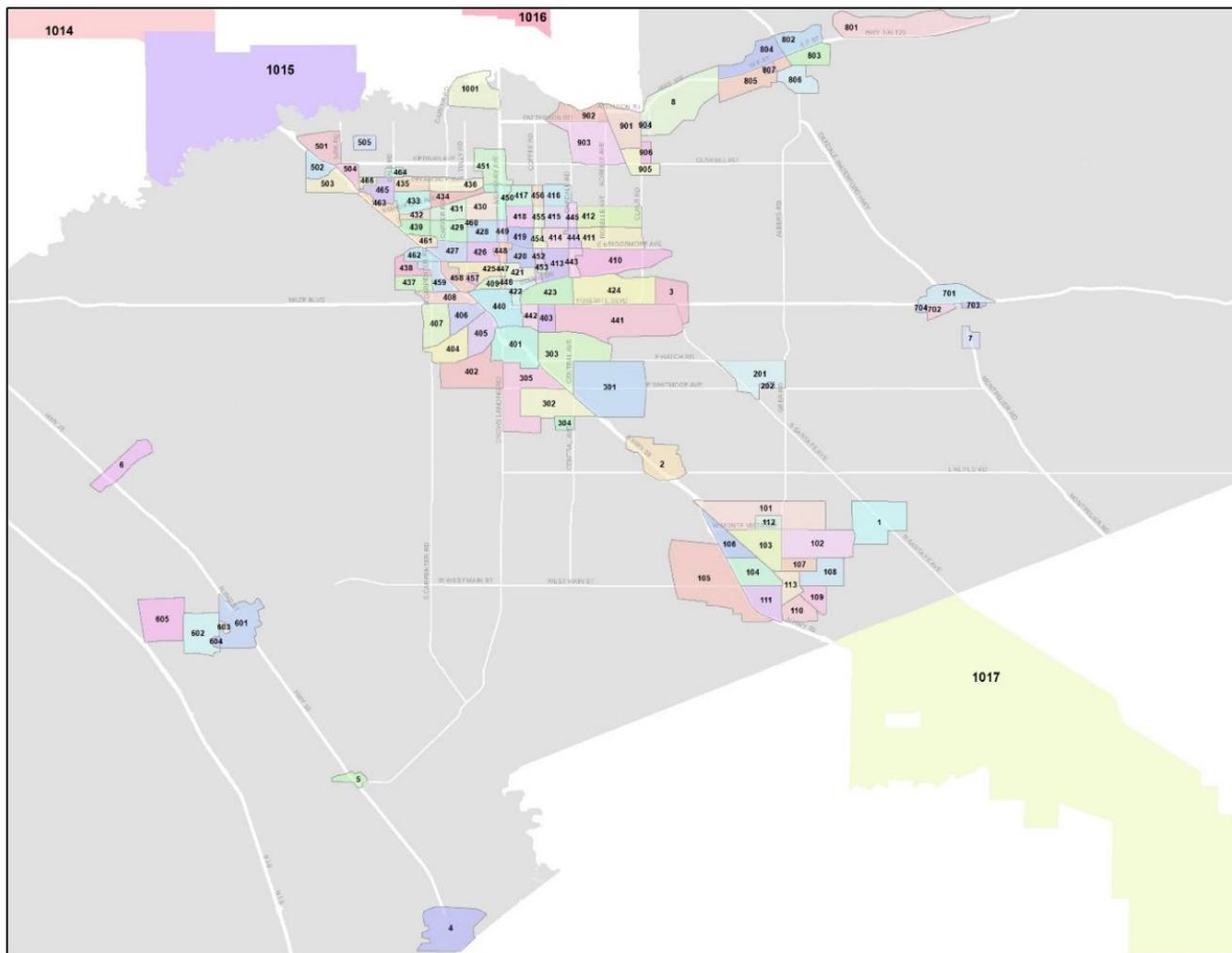
The county was further divided into 40 "analysis" zones to facilitate planning activities. The zone sizes and boundaries were based on factors such as the geography of cities, the roadway network, the presence of key trip generators such as hospitals or schools, and natural and manmade landmarks that divide neighborhoods (such as Highway 99). These zones are shown in Figure 92. Several zones were also created outside Stanislaus County so that it would be possible to explore regional travel in addition to local travel (Figure 93).

⁷ 2019 was used as the baseline because it was the last full year of data prior to the onset of COVID-19. We wanted to see what travel was like—all travel, not just transit travel—in the last full period of normalcy prior to the pandemic.

⁸ Mobility movements include all travel activity, including both freight and people. Freight and delivery movements are removed from StreetLight using a set of algorithms.

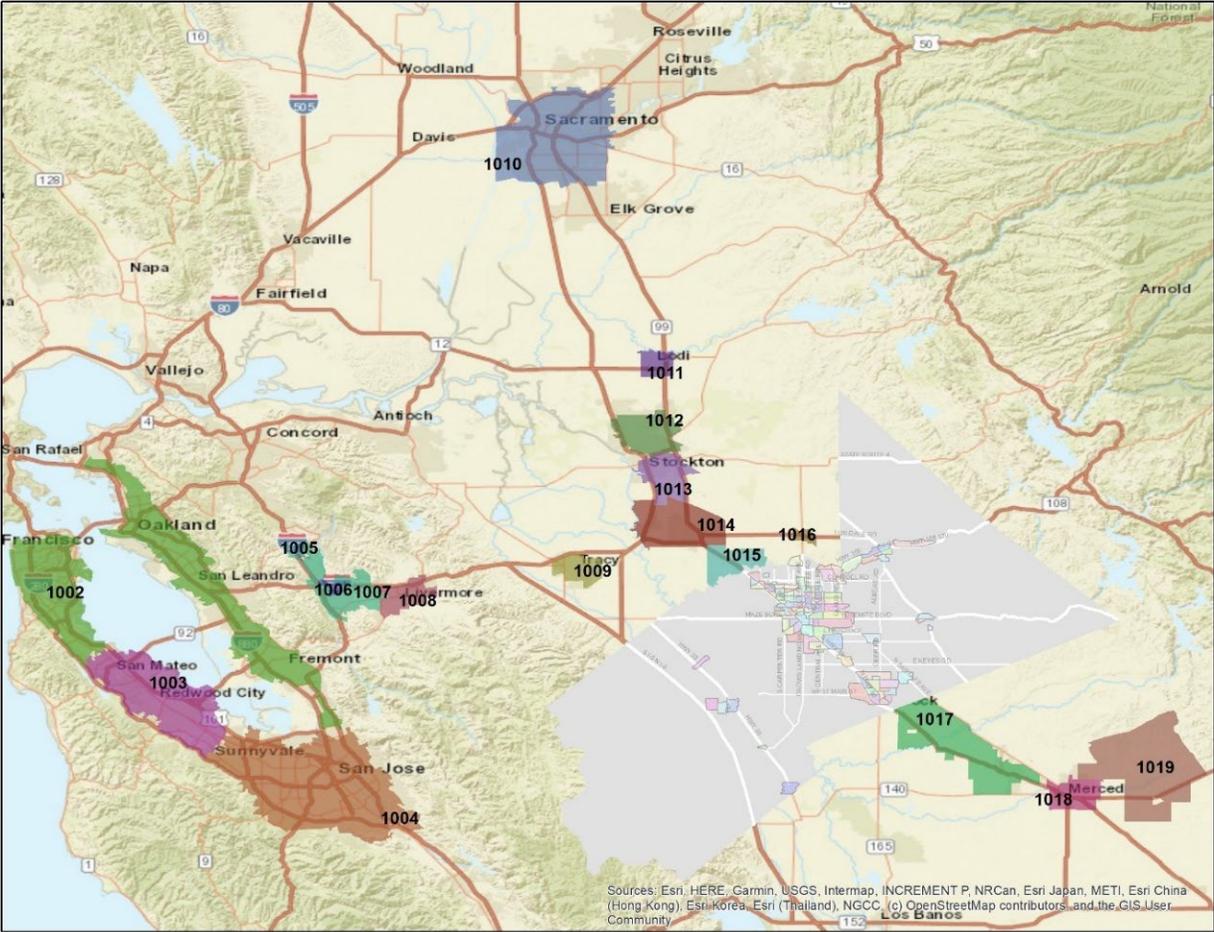
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Figure 92 StreetLight Analysis Zones within Stanislaus County



Source: Fehr & Peers

Figure 93 StreetLight Analysis Zones Outside of Stanislaus County



Source: Fehr & Peers

Data was captured and placed in an Origin-Destination (O/D) Microsoft Excel Matrix. The matrix displays the “To” and “From” for each zone. After creating the matrix, both the pre-COVID and COVID timeframe datasets were aggregated into the following seven time periods that Fehr & Peers believes would be the most useful for service planning later in this project:

1. All day, weekday travel
2. Weekday AM peak period travel (8 AM to 9 AM)
3. Weekday midday travel (11 AM to 1 PM)
4. Weekday PM peak period travel (4 PM to 6 PM)
5. Weekday evening travel (7 PM to 9 PM)
6. All day, weekend travel
7. Weekend midday travel (11 AM to 1 PM)

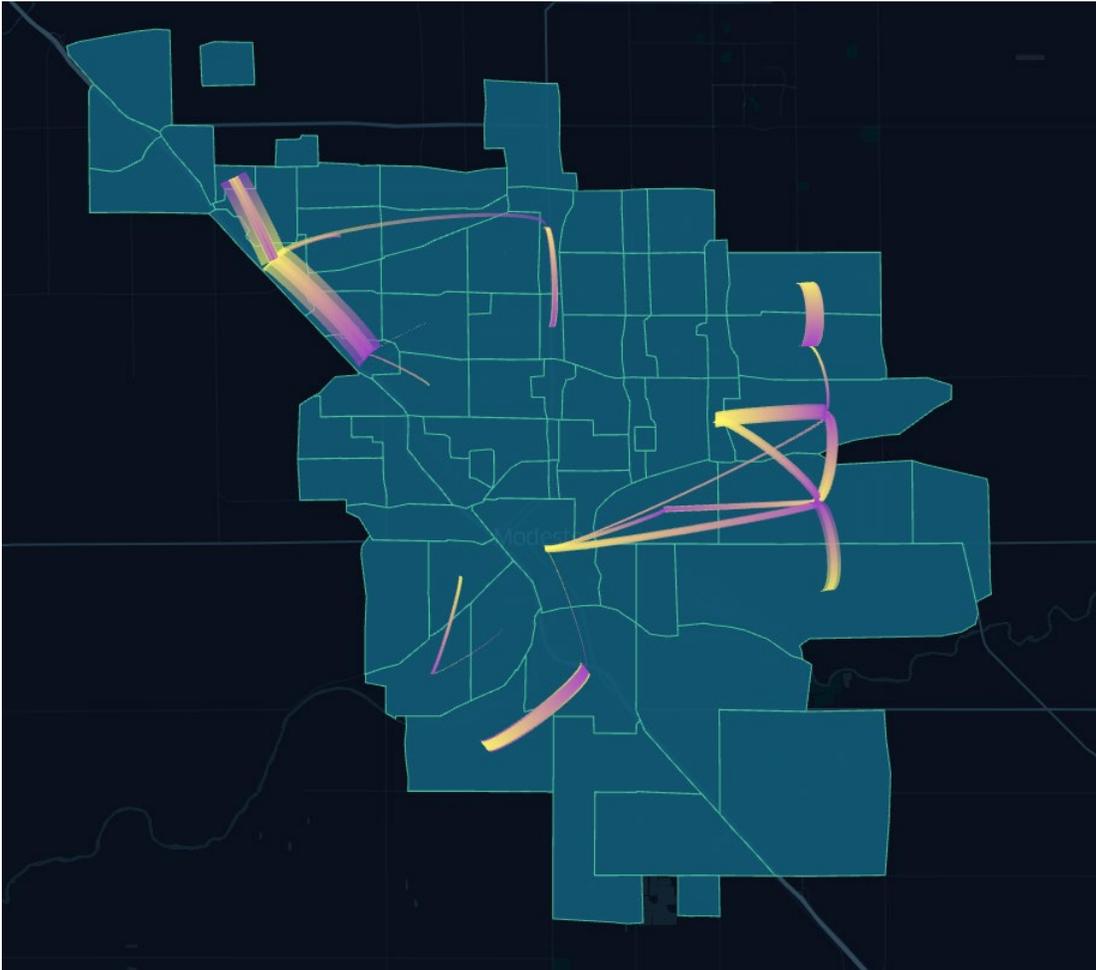
An extensive set of Excel tables that show the origins and destinations of the seven analysis time frames and datasets for the Pre-COVID and COVID origin/destination data are housed here: https://fehrandpeers-my.sharepoint.com/:x/p/k_mcnickle/EUhk9AOK6FJPgHxRaPgQmD8BkVIQTbdwD4RyCzRXmZOp0g?e=OuFvsL.

The last step in the process involved moving the data into a visualization software designed for geospatial data analysis. Kepler software⁹ allows technical and non-technical audiences to manipulate a large data set using a web browser and play back the geo-temporal trends over time.¹⁰ The end result is a visual view of travel patterns and flows to and from each zone. The most useful application of the Kepler visualization will be during the service planning work when the planning team might wish to focus on a single zone and explore the travel activity into and out of specific zones. An example of a visualization for the top origin-destination pairs is shown in Figure 94.

⁹ www.kepler.gl

¹⁰ The Kepler database has been provided to Ride the S staff as a separate file. The database with all visual materials may be accessed via this link: https://fehrandpeers-my.sharepoint.com/:f:/r/personal/k_mcnickle_fehrandpeers_com/Documents/StanRTA%20Demand%20Analysis?csf=1&web=1&e=nm5Lxs

Figure 94 Example of Kepler Visualization



Source: StreetLight Data

ANALYSIS

The Origin/Destination Zone table covering the 141 zones creates a matrix with 19,881 trip pairs (141 zones x 141 zones). The activity in any one zone on any particular day ranges from a low of 0 trips to a high of more than 22,000 trips. While it is possible to spend a lot of time analyzing data between zones or groups of zones at a micro level, that detailed trip analysis will be saved for the service planning portion of this project.

For now, the focus is on more macroscopic levels of movement and identifying predominant patterns of travel, or conversely, a lack of pattern where one was thought to have existed.

Figure 95 through Figure 100 shows countywide, inter-county and single zone trips, respectively, before and during COVID-19.

The analysis has been categorized to match the way most transit agencies, and specifically operations staff, think about demand markets:

Local: These are all types of trips that occur within the main urban areas of Modesto, Ceres, Turlock, Riverbank and Oakdale.

Intercity: Commute and non-commute trips that occur between cities within the county.

Regional: Primarily long-distance commute trips that cross county lines

Summary tables showing the changes between May 2019 (Pre-COVID) and May 2021 (COVID) are included in Figure 94 and Figure 96. Note that travel within the same zone is also captured in the “In County” column as a percentage of total in-county trips. Analysis of this data follows.

In Figure 97, total trip activity for all days and time periods for trips that started and ended within Stanislaus County, declined during COVID-19 by a range of 15 to 21%. This is consistent with similar areas throughout California. Also worth noting is that there is almost as much daily activity on weekends as there is on weekdays. This will be an important consideration during the service planning process when decisions are made on how much service to provide on weekends versus weekdays.

In Figure 98, one surprising finding is that the total weekday movement across the county line barely changed from Pre-COVID to during COVID. More surprising is that the amount of movement on weekday evenings and on weekends increased by a few percentage points.

Trips that stayed within a zone are considered the most “local” of all trips (Figure 99). These trips declined by anywhere from 15 to 27%. With most schools closed during the pandemic and substituted with remote learning, it should be no surprise that there was a significant drop off in local travel activity. In addition, the decrease in weekend activity might be linked to the shutdown of various social/recreational locations.

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Figure 95 Travel Patterns by Day of Week

Time Period	Same Zone	In County	Regional	% In County	% Regional
Pre-COVID, Weekday, All Day	194,323	1,396,562	177,807	89%	11%
COVID, Weekday, All Day	147,086	1,105,276	170,433	87%	13%
Pre-COVID, Weekend, All Day	153,039	1,116,239	155,492	88%	12%
COVID, Weekend, All Day	123,539	948,603	162,432	85%	15%

Source: StreetLight Data

Figure 96 Travel Pattern by Peak Commute Hours

Time Period	Same Zone	In County	Regional	% In County	% Regional
Pre-COVID, Weekday, Morning Peak (8am-9am)	9,151	64,149	10,100	86%	14%
COVID, Weekday, Morning Peak (8am-9am)	7,381	52,911	8,755	86%	14%
Pre-COVID, Weekday, Evening Peak (4pm-6pm)	27,308	217,037	29,185	88%	12%
COVID, Weekday, Evening Peak (4pm-6pm)	19,938	173,003	27,313	86%	14%
Pre-COVID, Weekday, Evening (7pm-9pm)	20,263	134,912	15,481	90%	10%
COVID, Weekday, Evening (7pm-9pm)	17,305	111,991	15,664	88%	12%

Source: StreetLight Data

Figure 97 Travel Patterns by Day of Week, Midday

Time Period	Same Zone	In County	Regional	% In County	% Regional
Pre-COVID, Weekday, Midday (11am-1pm)	25,533	177,670	17,050	91%	9%
COVID, Weekday, Midday (11am-1pm)	21,541	146,131	16,785	90%	10%
Pre-COVID, Weekend, Midday (11am-1pm)	24,205	178,772	21,363	89%	11%
COVID, Weekend, Midday (11am-1pm)	18,871	152,727	23,618	87%	13%

Source: StreetLight Data

Figure 98 Total Movements within Stanislaus County

	Pre-Covid (2019)	During Covid (2021)	% Change
Weekday, All Day	1,396,562	1,105,276	-21%
Weekday, Morning Peak (8am-9am)	64,149	52,911	-18%
Weekday, Midday (11am-1pm)	177,670	146,131	-18%
Weekday, Evening Peak (4pm-6pm)	217,037	173,003	-20%
Weekday, Evening (7pm-9pm)	134,912	111,991	-17%
Weekend, All Day	1,116,239	948,603	-15%
Weekend, Midday (11am-1pm)	178,772	152,727	-15%

Source: StreetLight Data

Figure 99 Total Movements Between Stanislaus County and Other Counties

	Pre-Covid (2019)	During Covid (2021)	% Change
Weekday, All Day	177,807	170,433	-4%
Weekday, Morning Peak (8am-9am)	10,100	8,755	-13%
Weekday, Midday (11am-1pm)	17,050	16,785	-2%
Weekday, Evening Peak (4pm-6pm)	29,185	27,313	-6%
Weekday, Evening (7pm-9pm)	15,481	15,664	+1%
Weekend, All Day	155,492	162,432	+4%
Weekend, Midday (11am-1pm)	21,363	23,618	+11%

Source: StreetLight Data

Figure 100 Total Movements that Stayed within a Stanislaus Zone

	Pre-Covid (2019)	During Covid (2021)	% Change
Weekday, All Day	194,323	147,086	-24%
Weekday, Morning Peak (8am-9am)	9,151	7,381	-19%
Weekday, Midday (11am-1pm)	25,533	21,541	-16%
Weekday, Evening Peak (4pm-6pm)	27,308	19,938	-27%
Weekday, Evening (7pm-9pm)	20,263	17,305	-15%
Weekend, All Day	153,039	123,539	-19%
Weekend, Midday (11am-1pm)	24,205	18,871	-22%

Source: StreetLight Data

Top Ten Origin/Destination Pair Analysis

To explore the travel patterns in more detail, the top local, intercity, and regional pairs for 16 Stanislaus County communities.

The following guiding questions were used to identify significant pairs:

Local: Is there enough local travel to warrant some level of local public transit service?

Intercity: For travel within Stanislaus County, what are the top three to five trip pairs?

Regional: For travel that crosses the county line, is there a significant amount of activity compared to other markets? If yes, what are the top destinations?

Local Demand

Figure 101 looks at the number of trips that start and end within each community. Communities with higher levels of travel are those most likely to be able to support some

level of transit service. This data is one piece of the overall travel flows within and out of the county. Although there is no true cutoff point for when local service is likely to be effective, there is a natural cutoff point for amount of internal traffic flow with Hughson at almost 8,000 daily weekday trips, and Denair's 1,800.

Within Modesto, the analysis showed there are several local origin/destination pairs of interest:

- Downtown is a major destination from almost everywhere in the city
- Southwest Modesto has a strong connection with Cost Less Shopping (Carpenter/Kansas), the Vintage Faire Mall and Modesto Junior College East
- East Modesto (bordered by Scenic, Claus, Floyd and Lakewood) has a strong connection to the Highway 132 Corridor and downtown Modesto
- The Vintage Faire Mall is still a very important destination for most zones in Modesto
- The McHenry Avenue Corridor between downtown to Kiernan Avenue is strong

Figure 101 Demand for Local Transit Service

Trip Origin and Destination	Potential Local Transit Demand	Weekday Daily Vehicle Trips
Modesto	✓	847,212
Turlock	✓	265,329
Ceres	✓	94,983
Oakdale	✓	82,539
Patterson	✓	59,343
Riverbank	✓	32,137
Salida	✓	13,090
Newman	✓	13,041
Waterford	✓	9,579
Hughson	✓	7,980
Denair	✗	1,832
Keyes	✗	829
Empire	✗	617
Westley/Grayson	✗	280
Crows Landing	✗	<100
Hickman	✗	<100

Source: Streetlight Data, 2021

Intercity Demand

Figure 102 Top Intercity Destinations

City of Origin	Destination 1	Destination 2	Destination 3	Destination 4	Destination 5
Ceres	Turlock (west of Hwy 99)	Hughson	SW Modesto	Downtown Modesto	Modesto - Highway 132 (north side)
Crows Landing	Newman	Patterson	--	--	--
Denair	Turlock (mostly north of West Main St)	--	--	--	--
Empire	Modesto – N/S of Hwy 132 between Empire and Downtown Modesto	Downtown Modesto	Ceres	--	--
Keyes	Turlock (mostly north of West Main St)	Hughson	Ceres	--	--
Hickman	Waterford	--	--	--	--
Hughson	Turlock	Ceres	Modesto, N/S of Hwy 132 between Empire and Downtown	Downtown Modesto	--
Modesto	Ceres (especially from SW Modesto)	Lathrop/Manteca	--	--	--
Newman	Patterson	Crows Landing	Turlock (north of West Main St)	--	--
Oakdale	Riverbank	Lathrop/Manteca	Escalon	--	--
Patterson	Newman	Turlock (west of Hwy 99/Costco)	--	--	--
Riverbank	Oakdale	Escalon	Lathrop/Manteca	Modesto (Oakdale Rd Corridor)	Modesto (McHenry Rd Corridor)
Salida	Modesto (Vintage Faire Mall)	Modesto (Misc. areas along Hwy 99 north of Vintage Faire mall)	--	--	--
Turlock	Denair	Keyes	Hughson	Ceres	Modesto (Downtown)
Waterford	Hickman	Hughson	Ceres	--	--
Westley/Grayson	Patterson	--	--	--	--

Source: StreetLight Data, Fehr & Peers, 2021

Regional

Regional demand among Stanislaus County cities with at least 2,500 daily weekday trips is shown in Figure 103. On a typical weekday, in a 24-hour period 99% of travel is between the County and:

- Stockton/Lathrop/Manteca: 46%
- Highway 99 corridor to Merced: 22%
- Inner San Francisco Bay Area: 11%
- Tracy: 6%
- Escalon: 6%
- Tri-Valley Area (Livermore, Pleasanton, etc.): 6%
- Sacramento: 2%

Figure 103 Regional Demand Patterns

Origin	Regional Demand (weekday trips)	Destination (Weekday Trips)
Ceres	12,700	1. Stockton/Lathrop/Manteca (44%) 2. Hwy 99 Corridor to Merced (22%)
Modesto	83,000	1. Stockton/Lathrop/Manteca (57%)
Newman	2,500	1. SF Bay Area (28%) (Livermore, San Jose) 2. Stockton/Lathrop/Manteca (20%)
Oakdale	9,200	1. Stockton/Lathrop/Manteca (49%) 2. Escalon (23%)
Patterson	8,900	1. SF Bay Area (31%) (Livermore, San Jose) 2. Stockton/Lathrop/Manteca (24%)
Riverbank	7,200	1. Stockton/Lathrop/Manteca (46%) 2. Escalon (29%)
Salida	11,500	1. Stockton/Lathrop/Manteca (74%)
Turlock	29,100	1. Hwy 99 Corridor to Merced (70%)
Crows Landing	< 2,500	
Denair	< 2,500	
Empire	< 2,500	
Keyes	< 2,500	
Hickman	< 2,500	

Hughson	< 2,500	
Waterford	< 2,500	
Westley/Grayson	< 2,500	

Source: StreetLight Data, 2021

Transit Corridors Analysis

In fixed-route transit planning, there will always be a mix of routes that cover less densely populated areas, with an objective to supply a lifeline service throughout the network, as well as routes in more populated areas that consistently carry a lot of people day in and day out.

The analysis in this report is intended to provide a starting point for identifying priorities for allocating resources. At a corridor level, there are three worth discussing based on our review of the data: McHenry Avenue, Paradise Road, and Highway 99.

McHenry Avenue/SR 108

McHenry Avenue is the backbone of the Ride the S system and is the highest ridership corridor in the system. Routes 22, 23, 37, 35, and 60 serve some or all of McHenry Avenue at varying frequencies and hours. In the service planning phase of this project, we will need to examine whether there is an opportunity to make alignment changes to reduce duplication of service or to make schedule adjustments to ensure consistent frequencies.

Paradise Road

The Paradise Road corridor is also served by several routes that operate either on it or adjacent to it. Routes 21, 26, 33 and 36 all provide some service on the corridor, although schedules could be better coordinated. Interestingly, StreetLight data indicated people in that area generally travel within that area, which is worth keeping in mind as service improvements are identified for that area.

Highway 99 Corridor between Modesto and Turlock

The Highway 99 corridor is the most direct route between the two biggest cities in Stanislaus County: Modesto and Turlock. There are several different transit options to travel between the two cities but they may be hard for riders to understand.

Routes 10 and 15 both connect the two cities, with Route 10 being the more direct of the two routes, staying predominantly on Highway 99. However, Route 10 does not operate on Saturdays so riders must take Route 15 instead.

The Turlock-Modesto Shuttle also provides service between the two cities and operates six days a week. The service can pick up and drop off passengers anywhere in the designated zone; however, there is a published schedule so there is a limit to the number of pickups and drop-offs that can be accommodated. The limited number of trips

(four roundtrips on weekdays, three roundtrips on weekends) coupled with the need to make a reservation further limits the utility of the service.

In addition to Ride the S offering duplicative services within its own network, Routes 10 and 15 duplicate parts of the Turlock Transit system. The other challenge with providing service along this corridor is that Highway 99 continues to get more congested, and for longer spans of time, which have an impact on bus travel time reliability. All these things will be important considerations as we think about how to best serve the corridor.

PRELIMINARY CORRIDOR DEMAND FINDINGS

Local Travel

One of the most interesting findings from the StreetLight data is that downtown Modesto remains a very important destination for almost all zones within the City of Modesto. The combination of civic, retail, and commercial buildings, combined with the on-going redevelopment efforts appear to be maintaining downtown's role as an important hub of activity. This supports justification for keeping the downtown as the center of a hub and spoke transit network.

Opportunities include:

- Consider growing transit demand in Southwest Modesto where the city is embarking on several redevelopment studies. There is already some potential from existing travel between the southwest Paradise corridor and destinations on the west side of the city including Cost for Less Super Market and the Modesto Junior College West Campus.
- Potential viability of dedicated transit priority projects in corridors such as Paradise/McHenry/Pelandale, or similar efforts utilizing Oakdale Road.
- Exploring the role of the mall in the transit network and creating more direct services to the mall. Unlike most suburban shopping malls throughout the US, the Vintage Faire Mall remains remarkably viable and is an important destination for trips throughout the City of Modesto and from locations around the County.

Intercity Travel

From city-to-city travel within Stanislaus County, opportunities include:

- Enhanced level of transit service that goes beyond the existing Dial-A-Ride and Route 45W operations due to the level of travel activity stays entirely within the westside communities of Patterson/Newman/Westly/Grayson.
- The travel connection between Riverbank and the eastside of Modesto, specifically the areas along both sides of Oakdale Road is potentially a viable corridor for future transit priority project connecting Downtown Modesto with Riverbank. Oakdale Road is an area designated by the City of Modesto for future development.

- Improving Route 61. Empire exhibits strong travel connections with Modesto, specifically the areas just north and south of Highway 132 as well as Downtown Modesto. Currently Route 61 only travels in a one-way loop that requires a person in Empire to travel to Waterford, Hickman, Hughston, and Ceres to get to Modesto.
- Waterford and Hickman might be better served with service connecting directly with Ceres and Turlock rather than just having the existing single route into downtown Modesto. There are no fixed-routes that make this connection today.
- Making Route 28 more efficient. Salida’s most important travel connections are the Vintage Faire Mall and other destinations along Highway 99 between Salida and the Mall. The travel time along the current route is not competitive with travel time by car.

Regional Travel

Based on StreetLight data approximately 178,000 trips cross the county line during a typical weekday. This pales in comparison to the 1.3 million weekday trips that occur within the county lines.

Opportunities include:

- Establish Ride the S’s role in providing regional trips.
- Revisit Route C, which connects Turlock, and Patterson with the Dublin Pleasanton BART Station. The StreetLight data shows fairly small amounts of travel between Turlock and the Inner San Francisco Bay Area.
- Examine whether the current regional network is meeting the commute needs of Newman and Patterson. They both show strong connections to the Livermore and San Jose areas. This isn’t surprising given their geographic proximity to the two areas.
- Potential new service between Patterson and Tracy (including the proposed Golden West Logistics Center).
- Explore a joint service “reconfiguration” effort with Merced County to explore ways of better meeting travel demand. There may be enough demand to justify a new service or coordination with Merced’s The Bus to connect the South part of the County along Highway 99 between Turlock and Ceres with the communities to Merced. Merced County currently operates an hourly service between Merced and Turlock.