System and Service Evaluation

January 2017

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Introduction

The San Diego Metropolitan Transit System (MTS) Transit Optimization Plan is a transit system study aimed at improving the service effectiveness and operational efficiency of current fixed-route services. The plan will recommend system revisions based on an assessment of existing and future market conditions and an evaluation of current transit ridership and service performance. The following system analysis will identify current successes and challenges within the MTS service area and opportunities for effectively utilizing agency resources, increasing transit-mode share, growing ridership, and identifying corridors and areas for improved service.

Since the first MTS system restructuring (Comprehensive Operational Analysis) conducted from 2004-2006, San Diego's population and its travel needs have evolved. The *System and Service Evaluation* provides a comprehensive analysis of MTS services by examining service at the system, service tier, and individual route level. The large and varying service area requires a more in-depth analysis than a system-wide assessment can provide. The MTS system has therefore been divided into service tiers for 'micro' analysis to allow for more detailed service evaluation within the context of the larger system. MTS categorizes six service tiers based on service type in MTS Policy 42:

- **Light Rail (Trolley)**: High-frequency service (15 minutes or better during the base weekday) operating on exclusive railroad right-of-way. Serves multiple trip purposes and generally experiences high turnover along the line.
- **Express:** High-speed and commute service geared toward linking major sub-regional residential, employment, and activity centers. Service is generally provided throughout the weekday and possibly on weekends. Operates primarily on freeways and major arterials.
- **Rapid Express:** High-speed, point-to-point service geared towards commute markets. Service provided during the weekday peak periods only and scheduled to meet primary work shift times. May use over-the-road coaches for maximum comfort and highway operations.
- **Rapid:** High-frequency bus service (15 minutes or better during the base weekday) operating in a combination of HOV lanes, mixed-traffic lanes, and/or exclusive right-of-way. Serves multiple trip purposes and generally experiences high turnover along the line. Offers Traffic Signal Priority, enhanced station stops, and "Rapid" or other distinct branding. Service is subsidized by TransNet.
- **Urban Frequent:** High-frequency service (15 minutes or better during the base weekday) primarily operating along major arterials in denser urban areas. Serves multiple trip purposes and generally experiences high turnover along the route. May be

operated as regular (all stops) or limited (stopping only at major transfer points and activity centers).

- **Urban Standard:** Basic transit service with base weekday frequencies generally between 30 and 60 minutes. Operates in less dense urban and suburban areas. Serves multiple trip purposes and provides access to all stops.
- **Circulator:** Neighborhood feeder/distributor to transfer stations or shuttle service to local destinations. Operates on arterials and local streets to provide access to residences, businesses, activity, and transfer centers.
- **Rural:** Lifeline service that provides a link between rural communities and the San Diego urban core. Very limited service levels; generally a few round-trips operating a few days per week given limited demand.

For the *System and Service Evaluation*, some service tiers were consolidated based on fare structure and service type in order to more accurately compare service performance. The service tiers are categorized and consolidated as such:

- **Trolley:** Light rail services including the Blue, Green, and Orange Trolley Lines. Fares are $2.50 per trip.
- **Freeway Rapid/Express:** Includes Express, Rapid Express, and Rapid Routes 235 and 237. These services are high-speed, limited stop services operating primarily on highways and major arterials. Fares for these services are $2.50 for Express and Rapid routes and $5.00 for Rapid Express routes.
- **Arterial Rapid/Urban Frequent:** Includes Urban Frequent routes and Rapid Routes 201/202, 204, and 215. These services are high-frequency, high-turnover routes primarily operating along major arterials in dense urban areas. Fares are $2.25 per trip.
- **Urban Standard:** Includes all Urban Standard routes operating within the MTS service area. Fares are $2.25 per trip.
- **Circulator:** Includes all Circulator routes operating within the MTS service area. Fares are $2.25 per trip, excluding the SVCC Shuttles (Routes 972, 973, 978, 979), which are partially subsidized by NCTD and are free to the public.
- **Rural:** Includes four Rural routes operating primarily in the East and South regions of the MTS service area. Zone boundaries for Rural routes are defined at Alpine, Tecate, and Ramona. Fares are $5.00 for trips within one zone and $10 for trips within two zones.

This evaluation identifies key findings with insight into ridership patterns, productivity, and financial effectiveness in the following sections:

- **Service Overview** – Provides context for historical ridership trends, describes the features of the existing transit system, its network structure, and the types of services it provides, and summarizes alternate services offered in San Diego.

- **Existing Fixed-Route Conditions** – Analyzes the existing network structure and ridership patterns by the whole system and by service tier.
- **System Efficiency and Effectiveness** – Analyzes system and route productivity, financial effectiveness, service quality and service availability.
- **Service Evaluation Key Findings** – Summarizes overall key findings from the *System and Service Evaluation*.

Service Overview

The San Diego Metropolitan Transit System (MTS) provides trolley, fixed-route bus, and paratransit services to the greater San Diego area from the U.S.-Mexico Border to Escondido in North San Diego County. Currently, MTS provides transit to over 90 million riders annually. The service area includes the cities of Chula Vista, Coronado, El Cajon, Imperial Beach, La Mesa, Lemon Grove, National City, Poway, San Diego, and Santee as well as unincorporated San Diego County communities (e.g., Lakeside, Alpine, Tecate, and Ramona).

Historical Context

The MTS system has experienced steady growth in ridership since the implementation of 2004 COA service changes with total growth of 23 percent from 2005 to 2016 despite the 2010 recession. MTS provides 92 million trips each year and has nearly 310,000 boardings each weekday. MTS made significant improvements to their system in 2006 and has maintained ridership growth until very recently. In 2015, about 58 percent of ridership was on MTS bus services, 0.5 percent on MTS Access Paratransit services, and the remaining 41 percent on trolley services. Trolley ridership proportionally carries more passengers on weekends, accounting for 49 percent of Saturday ridership and just over 50 percent of Sunday ridership. Historical productivity follows a similar trend with general growth from 2006 to 2015 and more recent declines, particularly for bus productivity.

Figure 1: Annual Historic Ridership[1]

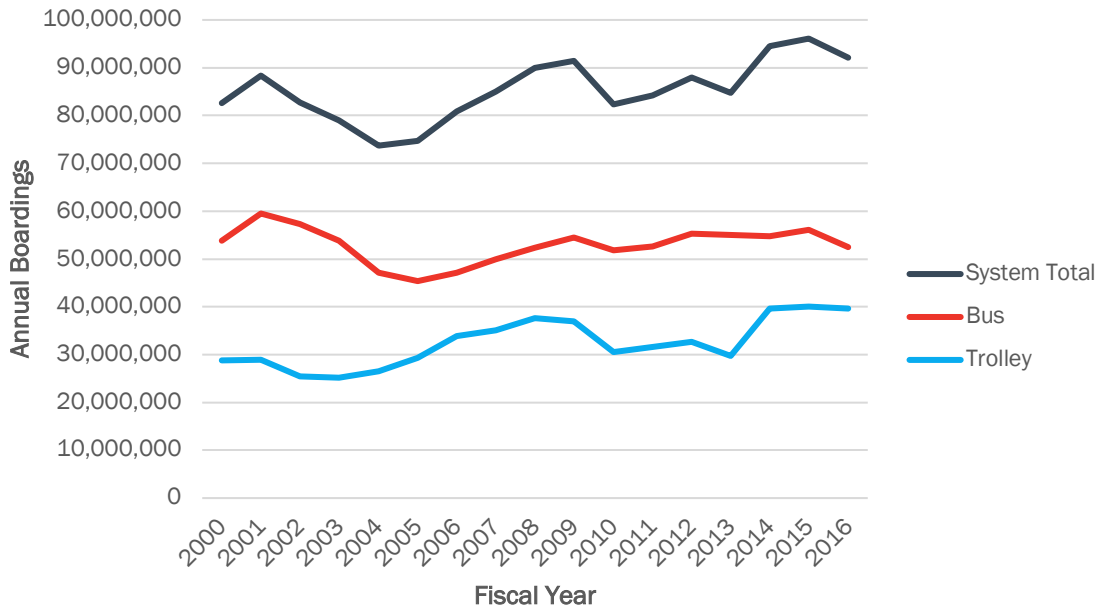
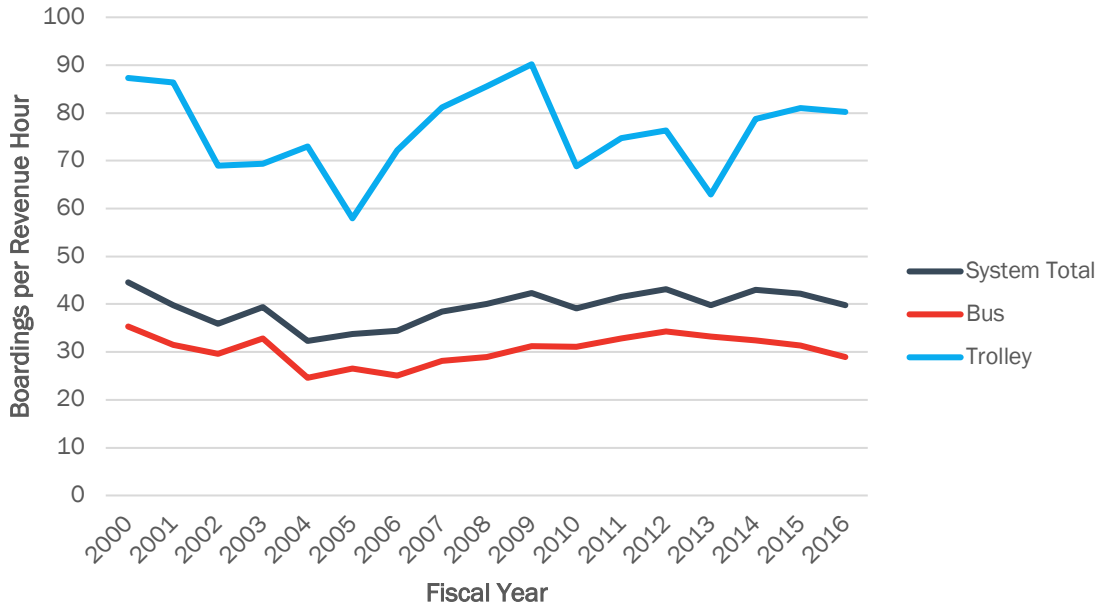


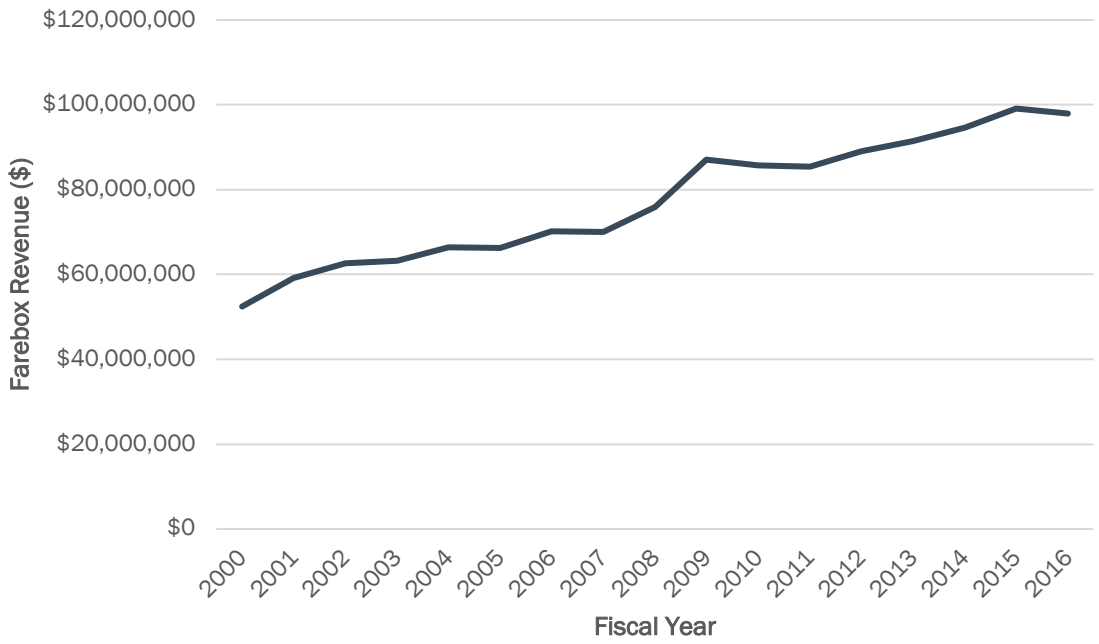
Figure 2: Annual Historic Productivity



[1] Ridership recording systems on trolleys were updated to automated systems in 2014. Thus, Trolley ridership may have been undercounted prior to 2014.

MTS fare revenues have steadily increased over the past 15 years, but as ridership growth stalled recently fare revenue fell 1.2 percent from 2015 to 2016 despite an increasing population and healthy job growth throughout San Diego. Part of the decline could be attributed to low gas prices and a recovering economy. Reversing these downward trends is a key focus of the *2016 Transit Optimization Plan*.

Figure 3: Historical Fare Revenue



System Changes

In 2004, MTS and TMD worked together to redesign the existing transit network, and MTS began implementing the resulting service changes in 2005 and 2006. Major changes as part of the COA included the consolidation and straightening of bus routes and the creation of a frequent all-day transit network. Bus and trolley services showed marked improvement after these changes were implemented, which boosted ridership throughout the overall network. Some of the major service changes that have occurred subsequent to the 2004 COA effort include:

- **Realignment of Trolley Services:** In September 2012, Trolley services were realigned to have all three services operate downtown. The Green Line Trolley was extended from Old Town to the 12th & Imperial Transit Center via the Convention Center. The Blue Line was shortened from Old Town back to America Plaza, while the Orange Line was shortened to Santa Fe Depot. Weekend frequency was increased on the Green and Orange Line Trolleys, and weekday peak frequency was increased on the Blue Line Trolley.

- **Introduction of the *Rapid* 201/202, *Rapid* 204 SuperLoop Services**: The Superloop West (*Rapid* 201/202) and East (*Rapid* 204) routes were designed and implemented as part of the final plan. SANDAG and MTS began installing bus stops along the route in 2008 and route operations began in 2009. Today, the SuperLoop *Rapid* 201/202 is the most productive Arterial Rapid/Urban Frequent route in the system with an average of 62 boardings per revenue hour during weekdays. However, the SuperLoop *Rapid* 204 East Loop is one of the least productive routes in the system, with an average of 19 boardings per revenue hour during weekdays.
- **I-15 Bus Rapid Transit (BRT)**: I-15 Express Lanes were completed in June 2014 and are now utilized by *Rapid* Express Routes 280 and 290 and *Rapid* Routes 235 and 237. These *Rapid* routes primarily serve the commuter population between downtown San Diego and Escondido. *Rapid* Route 235, which runs all day, performs well, carrying an average of 50 passengers per trip.
- **Mid-City Rapid**: In October 2014, MTS and SANDAG finished installing new bus shelters, completed roadwork along El Cajon Boulevard, and built new bus-only lanes on a portion of Park Boulevard for operation of the new *Rapid* Route 215. This route replaced an existing limited-stop service (Route 15) and provides service between downtown San Diego and San Diego State University (SDSU) through North Park, City Heights, and the College Area neighborhood surrounding SDSU.
- **Weekend service cuts**: In 2010, as a result of the Great Recession and a $7 million deficit in sales tax revenue, MTS cut over half of its Sunday services. At the time, cuts to Sunday services affected the least number of people in the most cost effective manner, but with a recovering economy and growing population, this analysis will consider the viability of restoring select weekend services.

Service Span and Frequencies

MTS follows industry best practice and defines “frequent” services as those which operate every 15 minutes or better during base periods. Increasing the number of core urban frequent routes was a key network goal of the 2004 COA. On weekdays, MTS currently operates 93 routes, 34 of which are frequent. On Saturdays, MTS operates 66 routes with nine running frequently. On Sundays, MTS operates 53 routes, eight of which are frequent. The routes most likely to operate only on weekdays are commuter express and circulator services. A total breakdown of operating requirements is summarized in the table below.

Table 1: Existing Service

	Routes		Vehicle Requirement		Service Span
	Total	Frequent	AM Peak	PM Peak	
Weekday	93	34	410	454	4:00 AM – 2:50 AM
Saturday	66	9	177	205	4:20 AM – 2:40 AM
Sunday	53	8	118	155	4:40 AM – 1:40 AM

Of the 34 frequent routes, 18 of them serve downtown San Diego. Routes that either run through or converge in downtown San Diego offer the most frequency and longest span of service during weekdays. The region south of the Orange Line Trolley, including communities near the border and Chula Vista, also have relatively frequent service with 11 of 19 routes running every 15 minutes or better. Similarly, several routes that run through and around the UCSD campus provide frequent service with three of 11 routes operating at 15 minutes or better. Lastly, of the 15 routes that operate in El Cajon, none of them offer frequent, 15-minute service. As populations in El Cajon increase, service enhancements in the eastern part of the County should be considered. Note that in some corridors, two routes are dovetailed to provide a 15-minute combined headway; these include Routes 815 and 816 along Main Street in El Cajon, Routes 962 and 963 along Plaza Boulevard in National City, and Routes 856 and 936 along College Avenue.

Access to Service

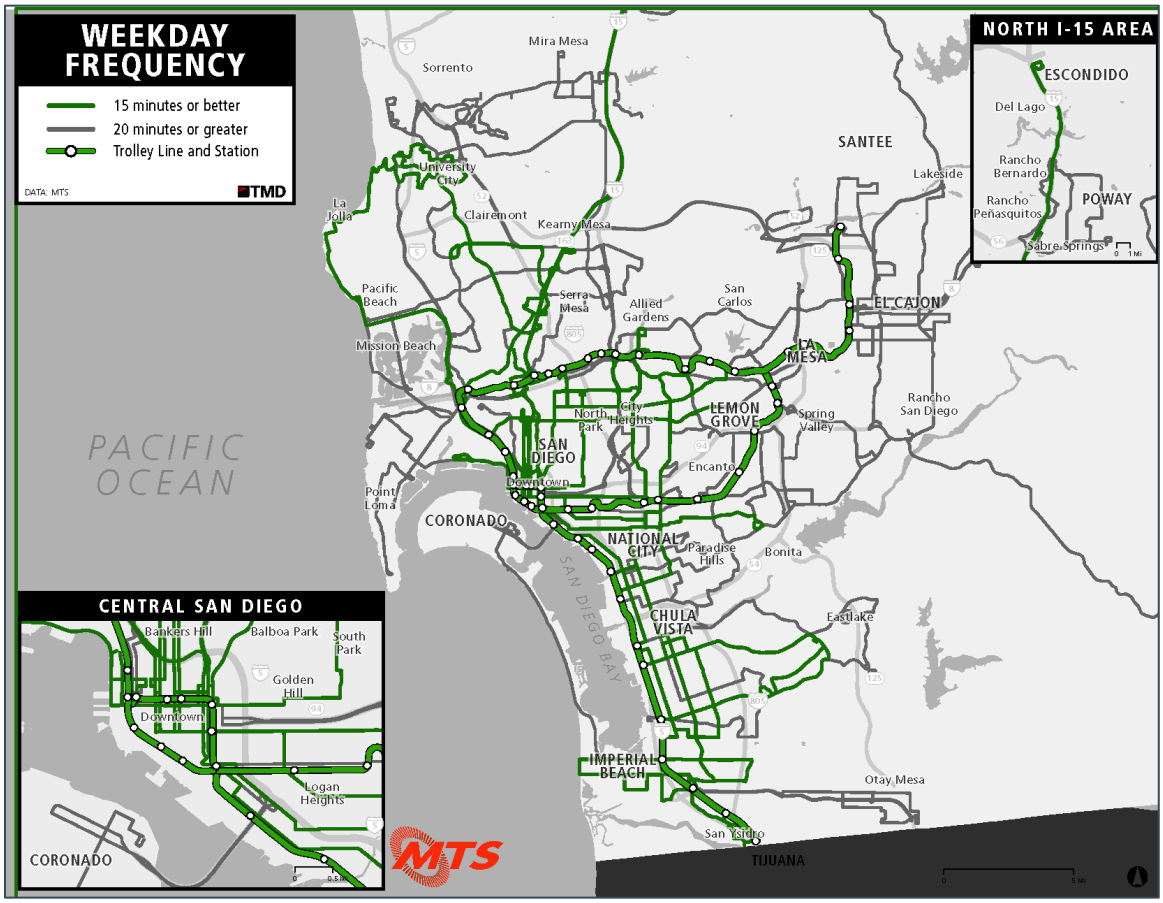
Currently, the majority of MTS frequent service is focused in the urban core and along major mixed use corridors. MTS operates 34 routes with frequent service during the weekdays. Data from the American Community Survey and SANDAG 2017 Projections was used to identify the number of people and jobs with access to both basic and frequent transit service. Access to the MTS network was measured by quarter-mile buffers (5-minute walk) around MTS bus stops and half-mile buffers (10-minute walk) around MTS Trolley and Rapid stations.

Almost 90 percent of population and 91 percent of jobs within the MTS service area have access to transit, while 72 percent of people and 81 percent of jobs have access to frequent network services – a key success story from the 2004 COA that helped drive ridership growth.

Table 2: Existing Transit Access

	Total	MTS Network		MTS Frequent Network	
		Number	Percent	Number	Percent
Population	2,293,000	2,061,000	**90%**	1,474,000	**72%**
Employment	1,137,000	1,034,000	**91%**	835,000	**81%**

Figure 4: Frequent Services within the MTS Network



Network Structure

The MTS transit network covers a vast geographical area of San Diego County. The County's unique topography of arroyos and mesa leads to a complicated and sometimes discontinuous roadway network for the bus system. MTS has developed the transit network to best advantage in meeting consumer mobility needs while maintaining cost-effective, efficient service. To accomplish this MTS has used the optimal network configuration for each region of the service area while linking the overall system together with high capacity regional transit.

- **Greater Downtown San Diego:** radial network design with mostly frequent routes that responds to both mobility needs and efficient operation. MTS linkage of routes through downtown is highly cost-effective and minimizes the need for route terminal bus storage for recovery and layover.
- **Urban Core East:** MTS utilizes an efficient grid of mostly frequent routes that converge on major nodes (e.g., SDSU) and key Trolley stations (e.g., Euclid).
- **East County:** primarily a radial network of "L-shaped" routes focused on El Cajon Transit Center (Green/Orange Line Trolley Station) that efficiently provide a partial grid structure augmented by community circulators. Limited amount of frequent service.
- **South County:** a network grid serving Trolley stations in the urban core west with linear lines serving the major mixed use corridors in the suburban eastern area with most routes operating frequent service.
- **Urban Core North:** a radial, crosstown network of both "L-shaped" and standalone routes on key mixed use corridors focusing on major hubs at Old Town, Fashion Valley, and Kearny Mesa Transit Centers. Frequent service only on major regional and sub-regional corridors.
- **UTC/UCSD:** isolated area due to topography served by radial and crosstown routes augmented by a frequent community BRT circulator.
- **San Diego North Inland:** suburban communities with frequent commuter oriented transit focused on major corridors (e.g., Mira Mesa, I-15) augmented by community circulators. Origin access emphasizes park-and-ride.

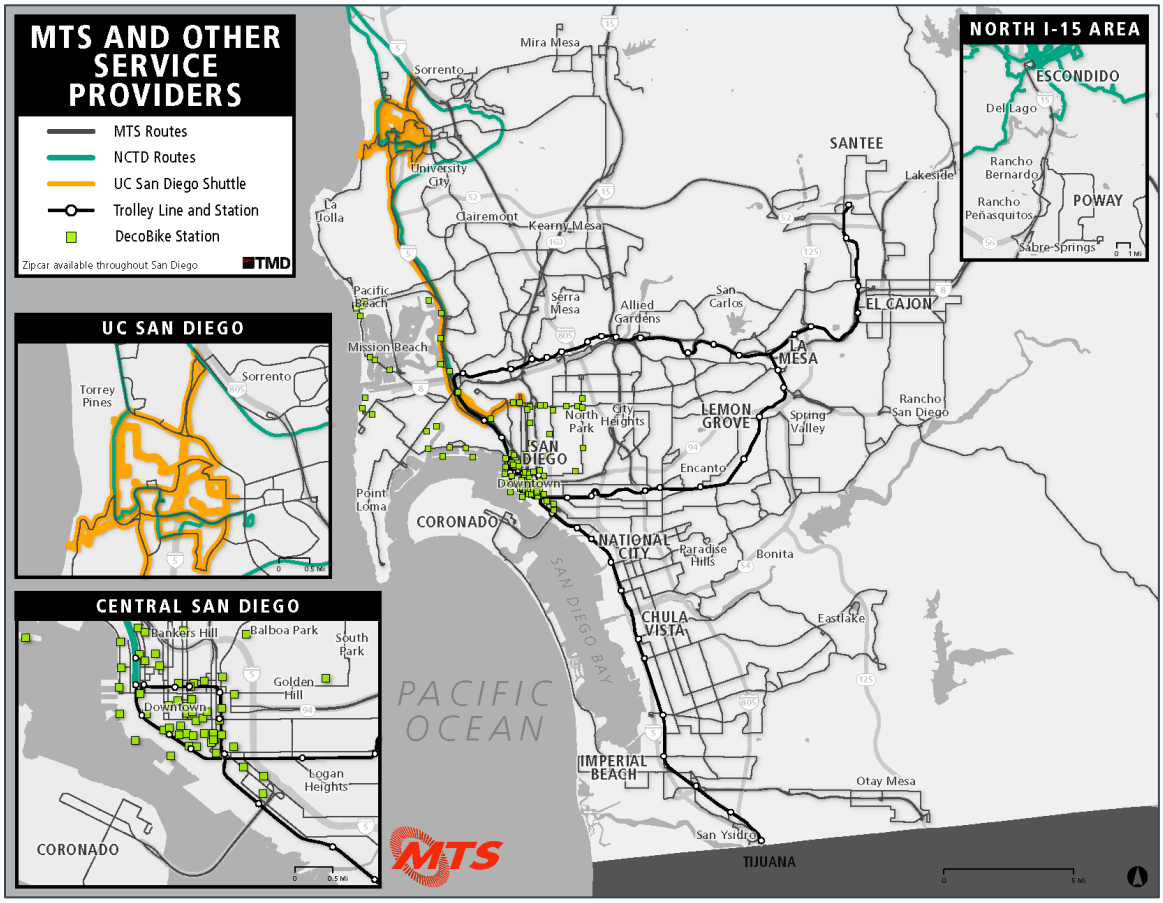
New Mid-Coast Trolley and South Bay Rapid will present new opportunities for network optimization in linking regional, community, and neighborhood travel cost-effectively.

Other Mobility Services

In addition to standard bus and trolley services, multimodal travel is possible in the MTS area through bike-sharing, car-sharing, and Transportation Network Companies (TNCs) that operate within the service area. These alternative modes of transportation have gained popularity with San Diego residents in recent years and can complement MTS services, operating near and

between transit centers to help the network of mobility options. By partnering with other mobility providers in the San Diego area, MTS can encourage a low car lifestyle which directly benefits the transit system.

Figure 5: Alternative Transportation Services in San Diego



DecoBike

DecoBike, San Diego's new shared bicycle system, operates a fleet of over 1,800 bicycles at 200 solar-powered bike stations in certain areas of San Diego. DecoBike stations are heavily concentrated in downtown San Diego, but are also located at or near MTS bus stops and/or Trolley stations in Barrio Logan, South Park, Golden Hill, and Mission Bay. Standard Membership annual passes for DecoBike cost $99. This option complements MTS in the urban core by offering short-distance travel options that extend the reach of the urban core transit network.

ZipCar

For trips that extend beyond the DecoBike service area or trips that necessitate a vehicle, ZipCar operates a car-sharing in San Diego. ZipCar members reserve a car online or on the mobile app up to seven days in advance. Renting a vehicle costs starts at $9.50 an hour and varies by class or $77 per day with a one-time application fee of $25 and monthly and yearly plan options. This service complements MTS service by offering a way to live in San Diego without a car through short-term car rentals. Individuals are able to use MTS for the majority of trips, but have the option to use ZipCar when a car is needed. Another car sharing service, Car2Go, operated in San Diego for several years before leaving the region in December 2016.

Taxis, Jitneys, and Transportation Network Companies (TNCs)

For-hire vehicles are another part of the mobility solution in the MTS service area. Taxicabs, jitneys, and TNCs all complement public transit solutions by providing access for unique trip patterns that may be unserved by public transit. Below is a summary of the different for-hire options within San Diego County.

Multiple taxi services operate throughout San Diego and provide quick and convenient first and last mile service to a number of destinations. San Diego taxi companies include American Cab, Orange Cab, Silver Cab, and Yellow Cab, which each charge a starting rate of $2.80 and an additional $3.00 for each mile. Taxi services offer convenient service for many tourists traveling from the airport and to various points of interest throughout the city. Taking a taxi is an attractive option for those wishing to travel short distances with limited wait time.

Jitneys operate in select areas of San Diego, such as San Ysidro, where they offer minibus services along local routes connecting the border to nearby residential and commercial centers. These services operate on a fixed route with specific boarding and alighting locations. The MTS Taxicab division licenses and regulates jitneys to ensure that their operation supports rather than competes with MTS services. Currently eight jitney services are operated within the MTS service area with passenger fares ranging between $1.00 and $2.25.

Transportation Network Companies have gained popularity in recent years. Uber and Lyft are the most prominent TNCs which connect riders with drivers via iPhone or Android smart phone apps. Uber launched in San Diego in the summer of 2012, while Lyft began operations in the city about a year later. The most common Uber trips offered by uberX cost $0.15 per minute and $1.10 per mile with a minimum fare of $5.75. Likewise, Lyft rides have a base rate of $0.15 per minute and $1.12 per mile with a minimum fare of $4.00. Both services use dynamic, rather than fixed, pricing to adjust fares up during periods of high demand. Uber and Lyft services can be used for first and last mile trips connecting riders to work, school, home, and between transit stations.

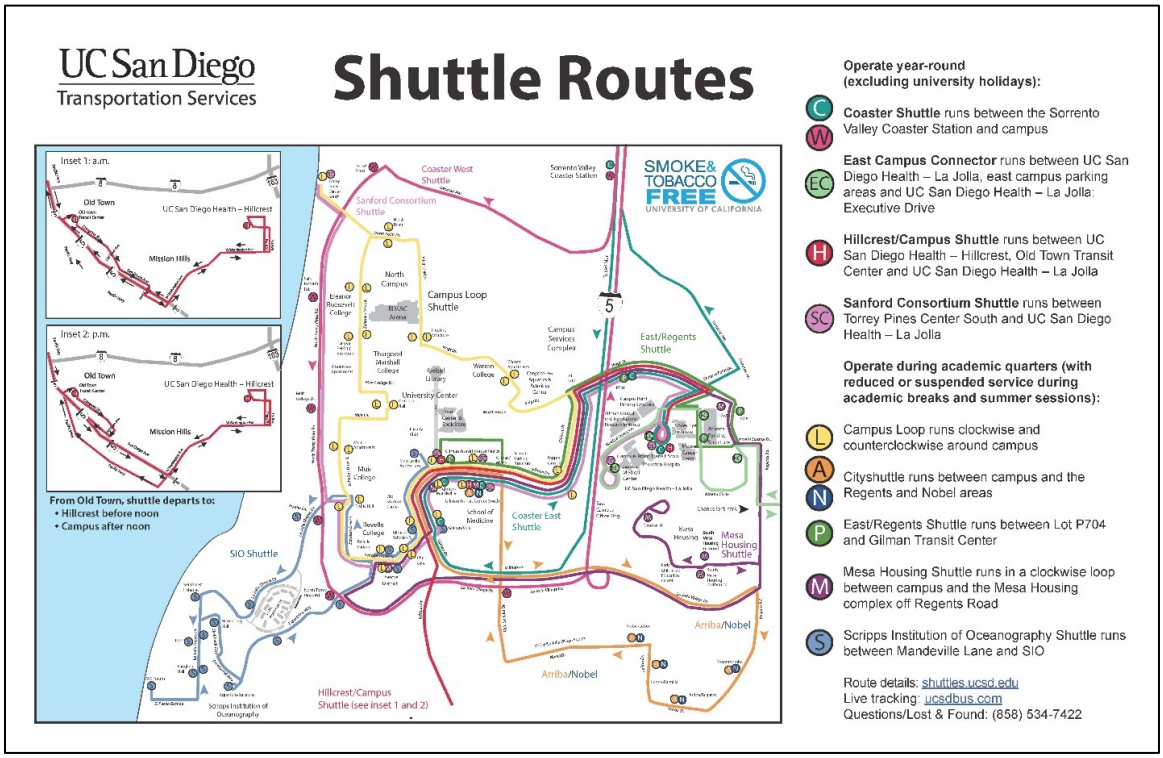
Both TNCs also offer Microtransit ride-sharing services, uberPOOL and Lyft Line, that pairs riders who are traveling along similar routes. MTS has partnered with Uber in the past during special events such as Comic-Con and the MLB All-Star Game to offer $5 discounts for riders using uberPOOL between the event and certain MTS transit centers. These TNCs can complement MTS services by allowing travelers a wider range of mobility choices during off-peak late night hours when transit service hours are reduced.

UC San Diego Campus Shuttles

The University of California, San Diego (UCSD) operates a separate system of shuttles that are designed to transport students and faculty around campus and to nearby residential areas. There are three shuttles that operate on weekdays year-round and five that operate regularly during academic quarters with reduced or suspended service during academic breaks and summer sessions. Shuttles are available and free only for students, faculty, and staff with verified UCSD campus ID. UCSD campus shuttle operating costs are primarily funded through parking fees and citation revenues with additional funding from Student Affairs and UCSD Housing and Dining Services[2]. The UCSD campus shuttles provide complementary service to students, faculty, and staff who require additional transportation around the UCSD campus outside of the services MTS provides. The campus shuttles also help alleviate passenger loads from the MTS Rapid routes that operate on campus. UCSD shuttles also serve the Old Town Transit Center and the UCSD Medical Center in Hillcrest.

[2] "UC San Diego Transportation Services Transit and Shuttle Funding Project: Summary of Project Findings." *Sandstrom and Associates.* UC San Diego Transportation Services, 2009.

Figure 6: UCSD Shuttle System



Source: UC San Diego Transportation Services

Free Ride Everywhere Downtown (FRED)

Free Ride Everywhere Downtown (FRED) is a free ride-hailing service that operates in downtown San Diego. FRED rides can be requested on smartphones via "The Free Ride" app. FRED launched its electric vehicle fleet in San Diego on August 9, 2016, with plans to grow over the next five years. The service and vehicles are self-funded by ads sold on the inside and outside of vehicles. FRED operates between 7 AM and 9 PM on weekdays with extended late night service on the weekends. FRED complements MTS services by supplying the need for short trips and alleviating traffic and parking congestion in downtown.

Existing Fixed-Route Conditions

The condition of the existing MTS fixed route system was assessed using key metrics to measure system, service tier, and route performance.

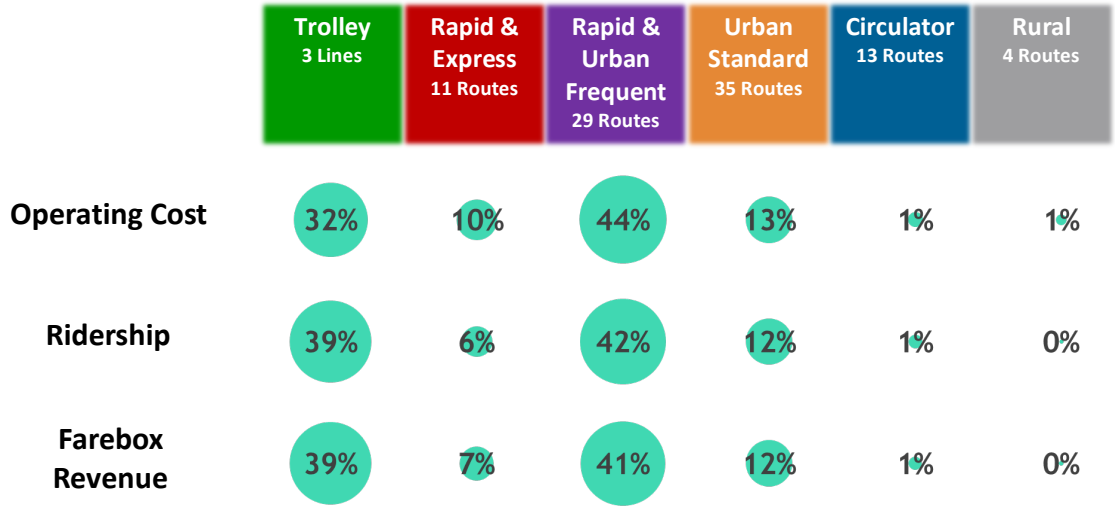
- Ridership
- Productivity

- Farebox recovery
- Subsidy per passenger boarding
- On-time performance
- Layover percentage (schedule efficiency)

Data is collected from a variety of sources. The primary source of ridership was automatic passenger counter (APC) system which tracks how many passengers get on and off the bus at each stop for each trip. Service operating data for most of the MTS buses came from the automated vehicle location (AVL) system which uses GPS to track vehicle movement. Additionally, manual ridecheck data was provided for the same time period for routes operated by minibuses which do not have APC or AVL equipment.

Figure 6 summarizes of the relative contribution of each MTS service tier to overall system performance, proportionally assessing ridership, revenue, and operating cost. Frequent services including the Trolley, Urban Frequent and Rapid routes are responsible for over three-quarters of the ridership (81%), revenue (80%), and cost (76%) in the MTS system. Trolley lines carry proportionally more people with both ridership and farebox revenue averaging above the percent required to operate the services. Express and Rapid Express routes account for approximately 10 percent of the system costs, but carry proportionally fewer people and therefore generate a lesser proportion of farebox revenue. Urban Standard, Circulator, and Rural routes generate a proportional number of riders and revenue relative to operating costs. Rural routes essentially generate zero farebox revenue, but are largely subsidized by federal grants, so their impact on MTS operating costs is low. Overall, this graphic illustrates that the expenditure and consumption of resources are fairly well balanced.

Figure 7: System Overview – Service Share



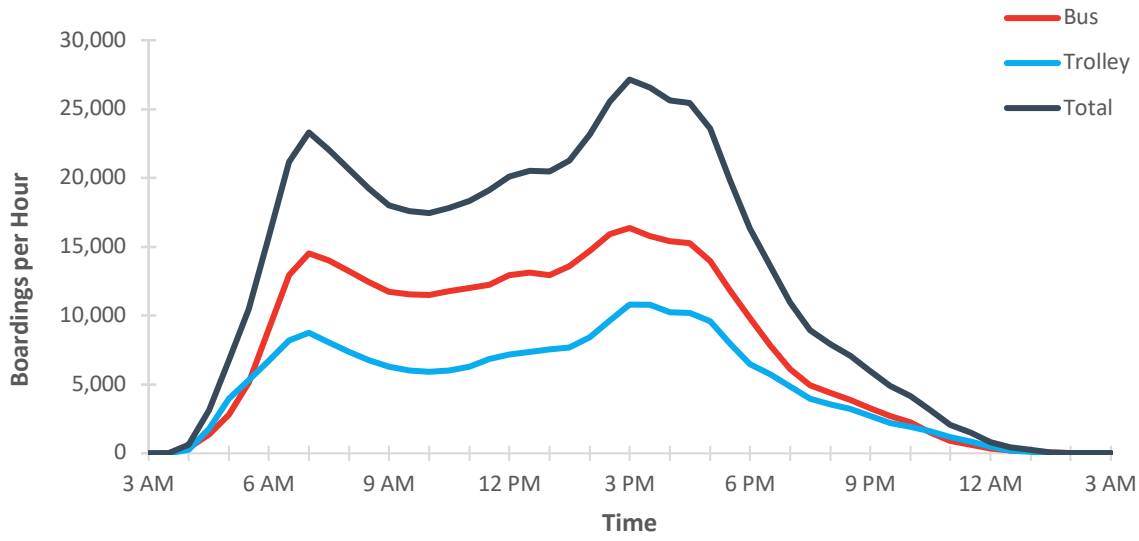
System Ridership

Understanding current ridership activity relative to the amount of service provided is an important indicator of service effectiveness (productivity). To fully understand the ridership and service relationship, both geographic and time-of-day patterns were analyzed.

Ridership by Time of Day

Boardings were analyzed by time period to identify how service is used by time of day and day of week. Weekday ridership exhibits the relatively flat demand pattern typical of a service area dominated by a transit lifestyle urban core. Ridership peaks during the morning between 6 AM and 7 AM with 23,200 boardings, while the afternoon rush hour has its highest ridership of 27,100 boardings between 3 PM and 4 PM. Midday ridership is robust, averaging between 17,000 and 21,000 boardings per hour. The strong midday ridership is the result of the frequent all-day all-week network that allows for a live-work-play lifestyle. Early morning and evening service had significantly lower ridership, which corresponds to reduced overall public travel during these periods.

Figure 8: Weekday Boardings by Time of Day



Ridership by Geography

Corridors with frequent service should have higher ridership and MTS is no exception with the Trolley and major bus routes demonstrating this trend. However, frequency itself does not generate ridership. Routes need to have frequency combined with both transit-supportive densities and land uses that offer access to a variety of trip generators and attractors and a key network mobility role to leverage both network and corridor ridership.

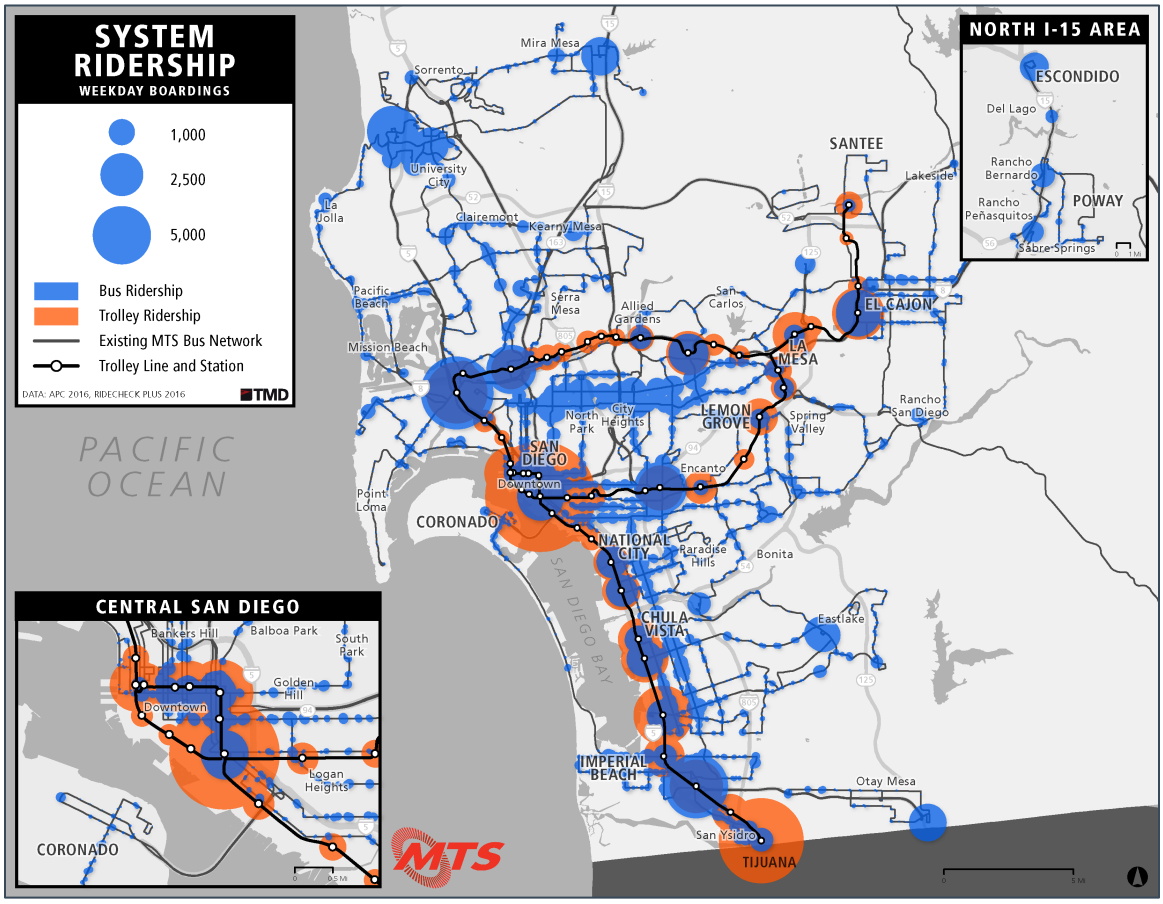
Ridership throughout the MTS service area is highest along Trolley lines, with heavy south to north movement in the South County along the Blue Line and significant east to west movement between downtown and El Cajon along the Orange and Green Lines. Bus ridership is also notably high in North Park, Mid-City, South Bay urban west, and El Cajon; and around UC San Diego and the U.S./Mexico Border Ports of Entry[3]. Areas such as the U.S. Border, downtown, and UC San Diego have high ridership because they are key destination points which generate demand, parking is expensive and/or scarce, and trip lengths, origins, and destinations are conducive to transit. Other locations at major transit centers or at key intersections have high ridership due to a large number of passengers transferring between routes. Many major network stops in North Park, Mid-City, Chula Vista, and El Cajon have high network-based ridership.

[3] Ports of Entry within the MTS service area: PedWest (Virginia Ave Transit Center), San Ysidro, Otay Mesa, Tecate

- **South Bay (Orange Line South to the Border):** There are 26 routes that operate south of the Orange Line Trolley. Strong ridership is found at Blue Line stations, which is due to the strong network travel between downtown San Diego (and points north and east) and National City, Chula Vista, Palm City, Imperial Beach, Otay Mesa, and San Ysidro. Because the Blue Line serves not just point-to-point, but is the spine of the South Bay transit network (to be augmented by South Bay Rapid in the future) nearly all routes in this sub-region connect to Trolley stations. Outside Blue Line stations, the large concentrations of passenger activity were found at the Otay Mesa Border Crossing and Southwestern College. With the introduction of the South Bay Rapid, north-south ridership will both increase and disperse, more so than the current concentration along the Blue Line. The South County sub-region is a key area of study considering the large-scale influx of daily travelers at both U.S./Mexico border crossings.
- **East County (East of Route 235 to El Cajon):** East County is connected to the rest of the MTS network primarily through the Green and Orange Lines. The five Urban Frequent routes, 14 Standard routes, two Express routes, and three Circulator routes all connect to the Trolley, resulting in the majority of passenger boardings in this region occurring at the Trolley stations. The El Cajon Transit Center has nearly an equal share of bus and Trolley boardings, while the Grossmont Transit Center has a significantly larger share of Trolley boardings compared to bus boardings. The majority of bus transfers here are to Grossmont College, several miles north of the station. Much of the east to west movement from El Cajon to downtown San Diego is facilitated by the Green and Orange Line Trolleys. Within El Cajon, ridership is evenly distributed along the corridors served outside of major destinations such as Parkway Plaza Mall.
- **I-15/163 Corridor (Downtown to Kearny Mesa & Mira Mesa):** There are 17 routes along the SR-163 Corridor from downtown San Diego and Fashion Valley to Mira Mesa. Travel along this corridor is utilized primarily by commuters travelling to jobs and activity centers in Mira Mesa, Kearny Mesa, and downtown. High employment density in Kearny Mesa and Mira Mesa creates demand for *Rapid* Express routes along SR-163, I-15, and I-805. Express Routes 20 and 110 serve 28 and 31 passengers per trip, respectively. *Rapid* Express Routes 280 and 290, which provide faster travel times and a higher quality product, serve 26 and 28 passengers per trip, respectively.
- **Downtown to UC San Diego (West of Route 235 North to UC San Diego):** Downtown San Diego is a regional destination with high concentrations of population, employment, government, tourist attractions, and entertainment centers, which emphasizes the need for a high frequency transit network. Downtown is a major destination for tourists and commuters who work in the business district. All three trolley lines and 21 MTS routes run through or originate in downtown. Average weekday productivity of all downtown MTS bus routes is 31 boardings per revenue hour with an average total of 3,420 weekday riders. At the other end of this sub-area, there are 15 routes that provide

service to and from UC San Diego and University City, an area with major travel origins and destinations for university, employment, and retail travel. The variety of travel modes (Urban Frequent service, Urban Standard service, Express and Rapid service, and Circulator routes) provides a range of mobility choice to a range of diverse travel population.

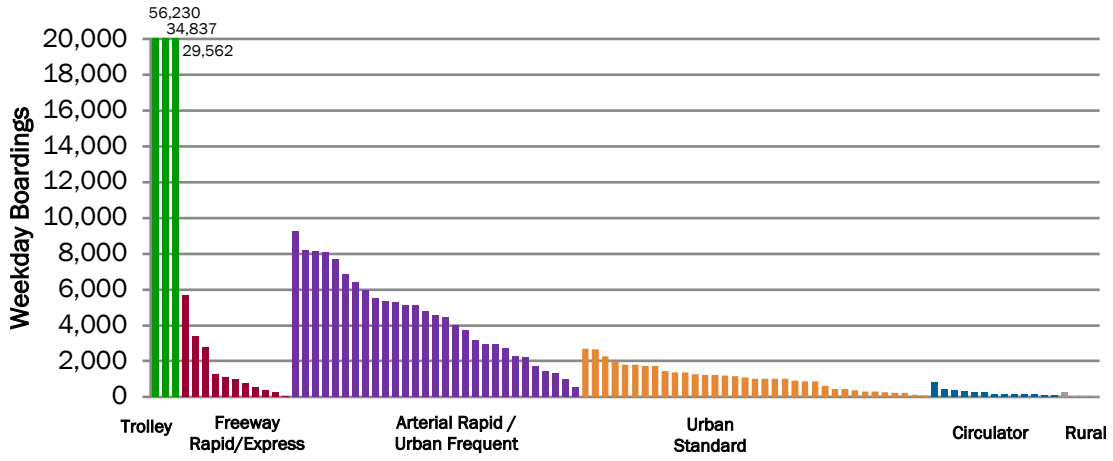
Figure 9: Weekday System Ridership (Boardings by Stop)



Ridership by Service Tier

Understanding how consumers use a transit network helps determine which service types are successful and which services need to be adjusted to match customer demand and expectations. In this analysis, individual routes in various service types were compared to each other to better reflect how routes performed relative to comparable services. A more detailed version of the weekday ridership by route chart (Figure 10) can be found in the Appendix.

Figure 10: Average Weekday Ridership Summary by Route and Service Tier



TROLLEY

Daily ridership on the Blue, Orange, and Green trolley lines accounts for 39 percent of total MTS weekday ridership with around 121,000 riders. The regional connectivity these services provide coupled with higher operating speeds result in higher ridership. Of these three routes, The UC San Diego Blue Line Trolley has the highest ridership with 56,000 riders each weekday, connecting the key market between the US/Mexico border and downtown San Diego. The Green and Orange Line Trolleys facilitate key east-west movements between downtown San Diego and Mission Valley, Southeast San Diego, Lemon Grove, SDSU, La Mesa, El Cajon, and Santee, carrying 35,000 and 30,000 riders daily, respectively.

Saturday Trolley ridership is almost 70 percent of weekday ridership with 82,500 boardings; it accounts for almost half of the total system Saturday ridership. Similarly, Trolley ridership drops to 58,700 boardings on Sundays, but serves over half of the total system Sunday riders. The proportional increase in Trolley versus bus ridership on weekends is due to the all-day, all-week nature of these services which cater to multiple market groups.

FREEWAY RAPID/EXPRESS

Ridership on freeway-oriented Express, *Rapid*, and *Rapid Express* routes accounts for 5.5 percent of total weekday ridership. *Rapid* Route 235 has the highest weekday ridership among routes in this service tier with an average of 5,673 weekday riders. Routes 20, 150, and 237, which all provide service along the I-5 or I-15/SR-163 corridors, each serve more than 1,000 weekday riders. Additionally, with high pedestrian traffic through the Otay Mesa Port of Entry, ridership on Route 950 serves almost 1,300 weekday riders. With direct service to the Blue Line Trolley, Route 950 offers a key connection from the Otay Mesa border crossing to Chula Vista and San Diego, via a Trolley transfer at Iris Avenue Transit Center. Express Route 870 is the least

used Express route with only 56 weekday riders. This route offers a faster connection between El Cajon and Kearny Mesa, but with only two round trips per day. Three of the four Express routes with the highest weekday ridership (Routes 20, *Rapid* 235, and 950) also operate on Saturdays and Sundays.

ARTERIAL RAPID/URBAN FREQUENT

Urban Frequent routes account for 42 percent of total weekday ridership with 130,594 riders, nearly 8 percent more than carried by the Trolley. Ridership on the top four Urban Frequent routes, Routes 7, 11, SuperLoop *Rapid* 201/202, and 929 make up 26 percent of the total weekday ridership within the service tier. These four routes each have over 8,000 weekday boardings, largely by providing very frequent service through high density corridors. Route 7 is the most frequent route in the system, operating every 6 minutes during peak periods (directionally), followed closely by the SuperLoop *Rapid* (weekday peak directional service every 5-10 minutes), Route 929 (weekday service every 12-15 minutes) and Route 11 (weekday service every 15 minutes). Weekend ridership on Urban Frequent routes remains healthy at 37 percent of the total system Saturday ridership and 38 percent of the total system Sunday ridership. The heavy concentration of ridership on the top four Urban Frequent routes illustrates the importance of a small number of routes to the service tier and the system.

All but two Urban Frequent routes carry more than 1,000 riders each weekday. Routes 992 and SuperLoop *Rapid* 204 have fewer than 1,000 weekday riders, which is due to the limited market potential and short route length. Route 992 performs better on weekends, which is likely due to an increase in weekend travelers to and from the airport. Despite its proximity and shared design features to SuperLoop *Rapid* 201/202, one of the highest ridership routes in the system, Route 204 underperforms because it doesn't provide service to UC San Diego.

URBAN STANDARD

Ridership on Urban Standard routes accounts for 12 percent of weekday ridership. Routes in the East and South regions of the MTS service area serve more riders than other Urban Standard routes within the system. In El Cajon, local market conditions and overlapping Urban Standard routes create frequent corridors which contribute to better performance. In South County, Route 905 connects Otay Mesa to the Blue Line Trolley at Iris Avenue and serves 2,251 riders each weekday, many of them among the large number of pedestrians crossing the border at Otay Mesa. However, ridership on Route 905 has more recently declined due to of the expansion of Express Route 950, which offers a faster connection to the Blue Line Trolley. Additionally, both routes will likely be affected by the South Bay Rapid upon its completion in 2018.

Urban Standard weekend ridership drops to just 10 percent of system ridership on Saturdays and 8 percent of system ridership on Sundays. There is a significant drop in ridership from the

weekdays to the weekends, which is attributable to the level of service provided. The number of Urban Standard revenue hours drops from 1,450 hours on weekdays to 730 hours on Saturdays and 410 hours on Sundays. Additionally, the 35 weekday routes under this category are reduced to 30 on Saturdays and 21 on Sundays, which operate at a reduced frequency of every 60 minutes from every 30 minutes.

CIRCULATOR

Primary purposes of Circulator routes are to provide key first and last mile connections, and to provide coverage in areas that don't have the propensity to support a more robust level of service. These short trips in low density areas result in Circulator routes accounting for just one percent of total weekday ridership. None of the 13 Circulator routes have more than 1,000 weekday riders and over half of them serve fewer than 200 riders per day. Low ridership on Circulator routes is likely due to limited weekday frequency and low density service areas. Only four Circulator routes operate at peak frequencies of 30 minutes with the majority of routes operating at frequencies of 60 minutes or less. Routes 88 and 965 are the only two Circulator routes that operate on Saturdays, when they serve a combined average of 356 riders. None of these routes operate on Sundays.

Circulator routes require a limited amount of resources due to their lower operating costs, but there could still be opportunities to improve or replace these underperforming routes.

RURAL

Ridership on Rural routes makes up less than one percent of all weekday ridership. The four rural routes receive 338 total weekday riders, with ridership on Route 894 accounting for 80 percent of all rural riders. The primary driver of Route 894 ridership is the connection between the urban MTS service area and the Tecate Port of Entry, with other rural routes connecting low density communities to El Cajon 1-2 days a week[4].

System Efficiency and Effectiveness

Productivity is the measurement of service effectiveness, calculated by dividing the total passenger boardings by the total revenue hours for each route. It measures ridership generated per unit of service, making it possible to compare the performance of routes with greatly differing ridership and service levels. Productivity is influenced by both market and service

[4] Route 888 (Jacumba Hot Springs – El Cajon) only operates one round trip Mondays and Fridays; Routes 891 (Borrego Springs – El Cajon via Shelter Valley / Ramona) operates one round trip on Fridays and 892 (Borrego Springs – El Cajon via Ranchita / Ramona) operates one round trip on Thursdays.

design choices. Agencies do not directly control the market for transit, but they can mitigate poor market conditions through more efficient and effective service and network design. Matching service levels to market opportunities together with designing services that use resources efficiently within an integrated network are the keys to improving service productivity. Routes with high seat turnover and short average passenger trip lengths will have higher productivity than routes with little seat turnover and longer passenger trips (e.g., Express, Rapid Express).

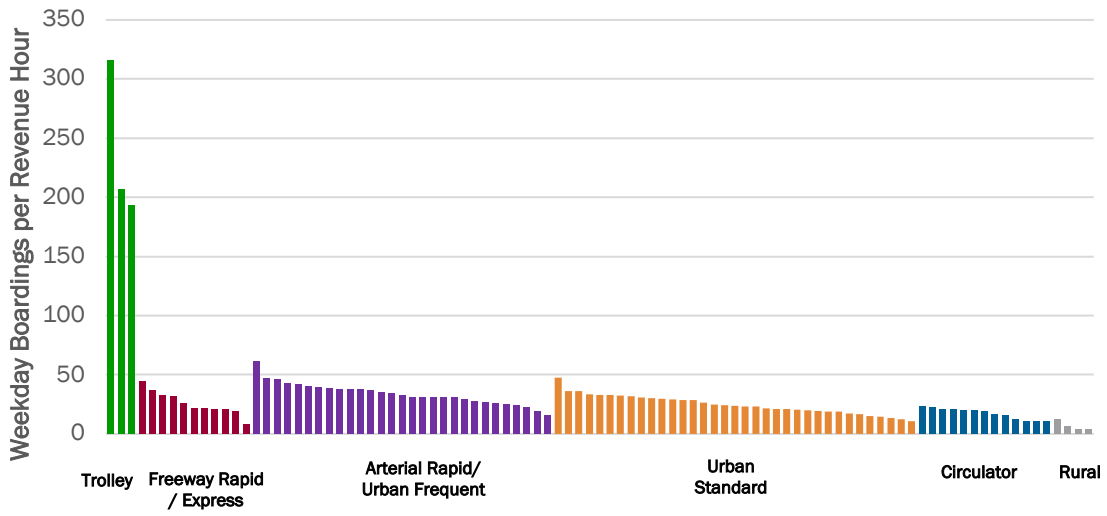
Financial stability, also crucial to the success of any transit network, is developed by efficiently managing resources and route investment. Routes with strong financial effectiveness are candidates for additional investment while routes with weak financial effectiveness should be analyzed for more efficient services. Two measures taken into consideration for measuring financial effectiveness are farebox recovery ratio and subsidy per passenger boarding. The California Transportation Development Act (TDA) mandates that for urban transit systems to receive state funding, they must have a farebox recovery of at least 20 percent. Most MTS peer agencies struggle to achieve this minimum standard while MTS has historically achieved a farebox recovery of twice the TDA minimum.

Most MTS peer agencies struggle to achieve this minimum standard while MTS has historically achieved a farebox recovery of twice the TDA minimum.

Service Productivity

Currently, MTS bus services average 31 passenger boardings per revenue hour, an excellent system average. Factoring in Trolley services, productivity jumps to 47 boardings per revenue hour. There are only four routes in the entire system that average above 50 boardings per revenue hour, including the three Trolley lines. As a system, MTS performs well, but there is still room for improvement and opportunities to alter and reallocate services to improve efficiency.

Figure 11: Weekday Productivity Summary by Route and Service Tier



TROLLEY

During weekdays, each of the Trolley lines operates with three cars per train. The Blue, Green, and Orange Lines average 241 passenger boardings per revenue train hour on weekdays[5]. The Blue Line Trolley averages 316 boardings per revenue train hour with the highest number of boardings at the San Ysidro Port of Entry and in downtown. The Blue Line serves 18 percent of all MTS weekday riders and has the highest productivity of any line or route in the system, numbers that will likely increase once it is extended north to UC San Diego.

On weekends, the Blue Line operates with three cars per train, while the Orange and Green Lines operate with either two or three cars per train, depending on demand. Productivity on the Blue Line "dips" to 206 boardings per revenue train hour on Saturdays and 167 boardings per revenue train hour on Sundays; these are still healthy numbers and well above every other route in the system. Productivity on Trolley lines reveals just how attractive high frequency and fast service is to MTS customers. With future construction and improvements underway, efficiency on Trolley lines will likely increase in the next few years.

FREEWAY RAPID/EXPRESS

Express routes average 28 passenger boardings per revenue hour on weekdays. Average productivity is slightly lower than some of the local routes due to the long distance they travel without seat turnover, making consideration of boardings per one-way trip also useful. On a per trip basis, *Rapid* Express routes average 27 passengers per trip, *Rapid* Routes 235 and 237

[5] Data is based on train consist rather than train car. Historical data is based on train cars.

average 40 passengers per trip, and Express routes average 30 passengers per trip. The most productive Express route, Route 950, averages 45 boardings per revenue hour with service between Otay Mesa and Iris Avenue. This route will be impacted by the South Bay Rapid (service begins in 2018), but with an increase in pedestrian traffic through Otay Mesa, it will remain an essential connection between Otay Mesa and the Blue Line Trolley.

Between the four Express routes that operate on Saturdays, productivity averages 22 boardings per revenue hour. Of the three that operate on Sundays, productivity averages 17 boardings per revenue hour. Each of the four weekend Express routes serve markets where there are very few local route options along the I-163 and I-5 corridors. Weekend productivity along these routes falls below Trolley, Urban Frequent, and Urban Standard services, and are likely worth reevaluating.

ARTERIAL RAPID/URBAN FREQUENT

The Urban Frequent service tier is the second most productive service type, averaging 35 weekday passenger boardings per revenue hour. Urban Frequent routes provide service to a large portion of MTS riders and the majority of routes average above 30 boardings per revenue hour.

The most productive Urban Frequent weekday route is the SuperLoop *Rapid* Route 201/202, averaging 62 boardings per revenue hour. The efficiency of this route demonstrates the demand for high-quality frequent service through the UCSD campus. The SuperLoop *Rapid* 201/202 provides frequent service in a high-density area, connecting college residences to the UC San Diego campus. Route 201 (Counterclockwise) is much more productive in the afternoons and evenings, whereas Route 202 (Clockwise) is much more productive during the AM Peak to midday - making a frequency offset worth considering. Route 204, the East loop, does not perform nearly as well as Route 201/202, averaging just 19 boardings per revenue hour. Route 204 performs just ahead of Route 992, which averages only 16 boardings per revenue hour. Route 992 is much more productive on weekends when it runs every 30 minutes instead of every 15 minutes. Low weekday productivity on Route 992 could also likely be a result of long dwell times related to tourists dealing in cash fares, heavy traffic through the airport terminals, poor traffic signal optimization, and stop locations on Broadway and Harbor Drive.

Urban Frequent Saturday and Sunday productivity remains relatively high at 31 and 30 boardings per revenue hour, respectively. Weekend productivity is comparable to weekday productivity, showing that the existing service frequencies meet current ridership demand. Route 703 currently operates Sunday-only service in Chula Vista, taking the place of segments of Routes 701, 704, 707, and 709. These routes (with the exception of route 707, which only operates weekdays) average 20.5 boardings per revenue hour on Saturdays. Route 703 averages 27 boardings per revenue hour on Sundays, with the highest concentrations of ridership at the Otay Ranch Town Center, Hilltop Drive, H Street, and the Sharp Chula Vista Medical Center off

East Palomar Street. Weekend productivity also improves along several other Urban Frequent routes, particularly routes that serve coastal areas like La Jolla, Pacific Beach, Point Loma, and Imperial Beach, and on routes that provide service in corridors where weekend service is dramatically reduced from weekday service, such as the I-15/SR-163 corridor. Urban Frequent routes that perform well on Saturdays are positive indicators for restoring lost Sunday services.

URBAN STANDARD

Urban Standard routes average 26 passenger boardings per revenue hour on weekdays. Low frequency service and short stop-spacing likely factor into lower productivity among the service tier. Despite a lower average among Urban Standard routes, there are several routes that average above 30 boardings per revenue hour. Similar to Express Route 950, which has the highest productivity among Express routes, productivity on Route 905 in the same corridor is the highest among Urban Standard routes. High productivity on these two routes is unsurprising considering high demand from pedestrians crossing the border at Otay Mesa. Additionally, several routes in East County (815, 855, 854, and 856) also are strong performers with 30-minute service. Several of these routes dove-tail with other routes to provide effective improved trunk frequencies. Identifying which segments of these routes which may warrant consistent improved frequencies will be a key goal of the Transit Optimization Plan.

Low performing routes in this service tier tend to be circuitous and serve lower density residential neighborhoods. For example, Routes 967 and 968 both have low productivity, averaging just 14 boardings per revenue hour. These routes serve 24th Street Transit Center, D Avenue, and adjacent, parallel corridors in National City before terminating in low density residential areas in Alta Vista and Paradise Hills on the east end.

Urban Standard routes average 23 boardings per revenue hour on both Saturday and Sunday, which is comparable to weekday productivity and illustrates that existing services meet current ridership demands.

CIRCULATOR

Aside from rural routes, Circulator productivity is the lowest in the system averaging 16 passenger boardings per revenue hour. Routes 14, 18, 83, 84, and 965 are below the tier average. These routes deviate through low density neighborhood streets or compete with routes that have higher frequencies and greater ridership. Circulator Routes 88 and 965 also operate on Saturdays, averaging just 13 boardings per revenue hour. Consistently low productivity on Circulator routes highlights a low level of demand for low frequency neighborhood feeder services like these. Typically, shorter distance travel is more sensitive to frequency (i.e. wait versus travel times), making infrequent circulator service in low density markets a major productivity challenge.

RURAL

The four rural routes serve a total of 338 riders each weekday, averaging just nine passenger boardings per revenue hour. Route 894, with service from the Tecate Port of Entry, accounts for 80 percent of weekday ridership and averages 12 boardings per revenue hour, while the other three routes average fewer than six boardings per revenue hour of service. Rural routes are lifeline services, which typically have long trips with low turnover resulting in minimal productivity.

Financial Effectiveness

A farebox recovery ratio is the percent of the public transit service operating cost that is recovered through fares.[6] The higher the farebox recovery ratio, the lower the subsidy needed to operate, leaving more funding available to operate more service. The current system-wide weekday farebox recovery is approximately 41 percent, which is excellent for a system like MTS and well ahead of its peers. However, farebox revenue has been declining in the past two fiscal years. The *System and Service Evaluation* aims to identify areas within the system where efficiency and financial effectiveness are particularly low, and develop a plan to optimize resources that will eventually help recover revenue.

Fare Structure

San Diego MTS provides a number of different services throughout its service area. Fares vary depending on the service, with the potential for discounts when purchasing passes or participating in special programs. The one-way adult cash fare on MTS regular service (all routes except Routes 20, 50, 60, 110, 280, 290, 870, 950, Rural buses, and the Trolley) and Rapid Route 215 is $2.25. Express routes (Routes 20, 50, 60, 110, 870, 950), Trolley lines, and Rapid Routes 235 and 237 have a cash fare of $2.50 for a one-way trip. Rapid Express (Routes 280, 290) and 1-zone Rural routes have an adult cash fare of $5 for one-way trips (two Rural zones is $10 for a one-way trip). The Sorrento Valley COASTER Connection (SVCC) bus is free (virtually all SVCC riders are transfers to/from the NCTD COASTER, so NCTD subsidizes the fare).

MTS also offers day passes, multi-day passes, and monthly passes for frequent users and travelers who are making multiple transfers in a single day. Transfers are not available for one-way fares. In addition to MTS routes, the passes are also accepted on North County Transit District (NCTD) BREEZE bus routes and the NCTD SPRINTER rail line. Riders have the option to choose from three different passes: a Regional Pass (valid on MTS Trolley, MTS Bus/Express, MTS *Rapid*, NCTD BREEZE, and NCTD SPRINTER), a *Rapid* Express/Premium Pass (also valid on MTS *Rapid* Express and NCTD FLEX), and a COASTER Pass (also valid on MTS *Rapid* Express, NCTD

[6] Sometimes an "operating ratio" is reported that includes other operating revenue like advertising and other special subsidies.

FLEX, and NCTD COASTER). Riders can purchase a 1-day Regional Pass for $5, or a 1-day RegionPlus Pass for $12 (includes access to *Rapid* Express bus service and the NCTD COASTER). Riders also have the option to buy a 2-day, 3-day, 4-day, or 14-day Regional Pass, which range in price from $9 to $43. Monthly passes are available for all three pass types, and range in price from $72 for a Regional Pass to $165 for a 3-zone COASTER Pass. Discounted fares and passes are offered for seniors, disabled persons, and Medicare recipients.

Passes are also available at discounted prices for youth (18 and under), college students, and employers who qualify for the ECO Pass Program. Employers who participate in the ECO Pass Program are also eligible for discounts of up to 25 percent each month when they buy a minimum number of passes for their employees annually. Students from select colleges can purchase monthly passes for $57.60 and semester passes for up to $178. UC San Diego students passed a referendum to add a regional transit "U-Pass" to their student fees. The U-Pass is valid on all regular bus services, Trolley and SPRINTER routes spanning both MTS and NCTD service areas.

Figure 11 represents the annual historic changes in fare revenue for the entire MTS system. During the Great Recession, MTS eliminated free transfers in 2008 and increased monthly pass prices in 2009. The hike in fare revenues seen in 2009 is a direct result of the new pass prices and revised transfer policy. MTS has not implemented any significant changes in fares since 2009, but has experienced a steady increase in fare revenue until recently. In the past year, system ridership and fare revenues have declined despite an increase in system revenue hours.

Figure 12: Annual Historic Fare Revenue

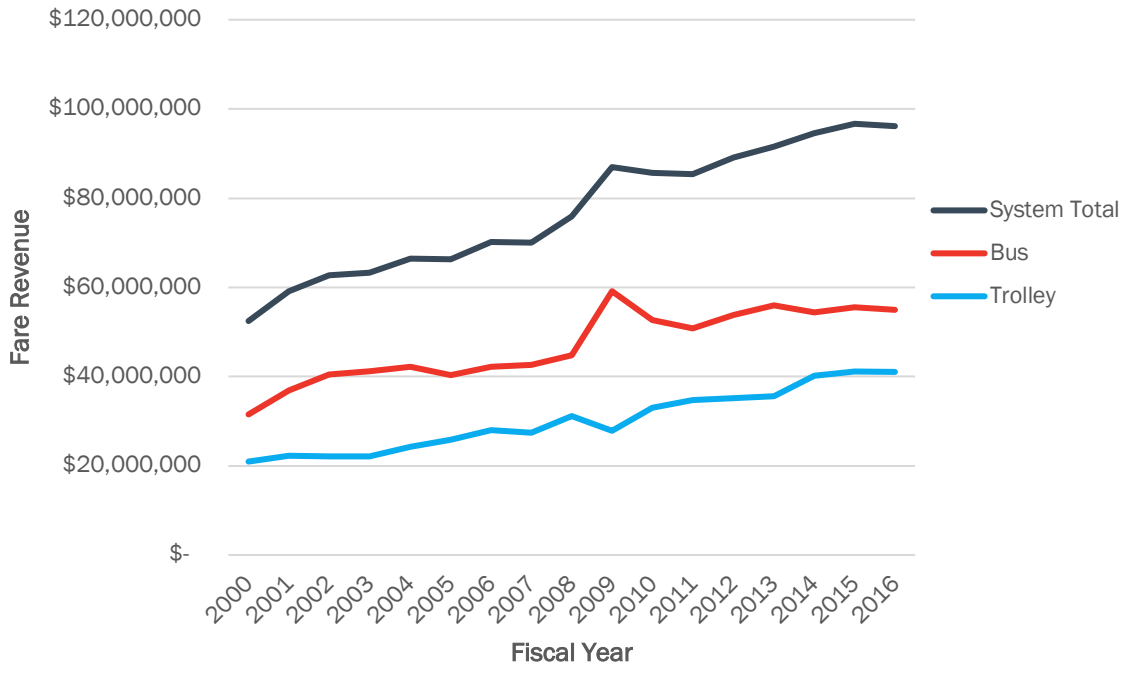
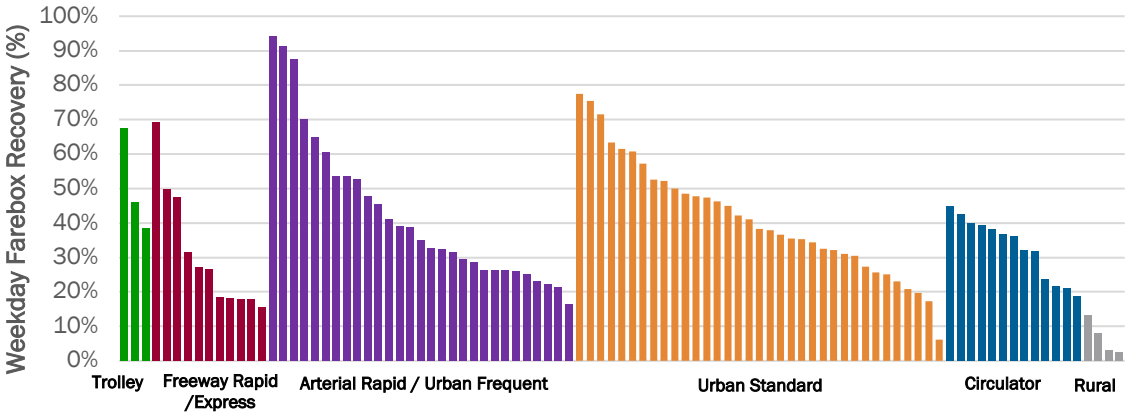
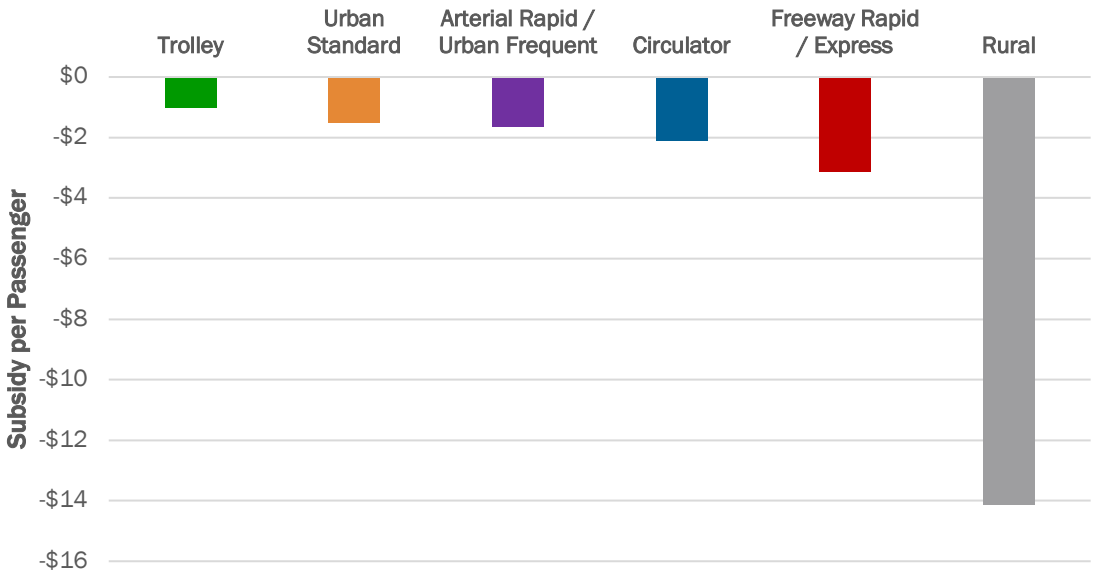


Figure 13: Weekday Farebox Recovery Summary by Route and Service Tier



Subsidy per passenger boarding measures the net cost to operate a route on a "per boarding" basis. It is calculated using passenger revenue minus operating cost divided by the total number of passenger boardings. Financial performance is not always proportional to the service productivity. A route could have a few boardings, but also a low subsidy per boarding, if the route has low operating costs that could result from the efficient use of few vehicles or a higher average passenger fare.

Figure 14: Average Weekday Subsidy per Passenger by Service Tier



TROLLEY

MTS subsidizes an average of $1.01 for each Trolley passenger, which is also the lowest subsidy in the system. Additionally, average weekday farebox recovery ratio on Trolley lines is 51 percent, the highest in the system. With the highest ridership, productivity, farebox recovery, and the lowest subsidies, Trolley lines are the most effective and efficient routes in the MTS system.

FREEWAY RAPID/EXPRESS

On weekdays, fares from Express services cover about 28 percent of the operating costs. Higher *Rapid* Express fares on Routes 280 and 290 result in a higher farebox recovery of 47 percent and 69 percent, respectively. The other Express Routes should generate a similar revenue based on higher fares, however because the day pass is accepted on these routes, five of the eleven weekday Express services generate less than 20 percent farebox recovery. Some of these routes have long travel distances with low seat turnover, which also likely corresponds to low fare revenue generation.

Express routes draw a relatively high subsidy per passenger, second only to Rural routes. MTS subsidizes an average of $3.13 per passenger trip, high by MTS standards but low compared with industry peers. Like farebox recovery, the Express routes with the highest subsidies are routes that traverse long distances with low seat turnover like Routes 237, 280, and 870.

ARTERIAL RAPID/URBAN FREQUENT

Weekday fares from Urban Frequent routes cover an average of 38 percent of the operating costs, which is the third highest in the system. MTS subsidizes only $1.64 per passenger on average for the Urban Frequent routes. Average weekend farebox recovery declines to 32 percent, with a $2.12 subsidy per passenger on Saturdays, and 31 percent farebox recovery and $2.31 subsidy per passenger on Sundays.

Routes with the highest weekday farebox recovery and the lowest subsidy per passenger are Routes 3, 5, and 906/907, which all recover over 87 percent of their weekday operating costs from fare revenue. Additionally, per passenger subsidies on these three routes are below $0.15. A primary reason for high farebox recovery and low subsidy per passenger on Routes 3 and 5 is the existing contract structure by which contractors are paid to provide service[7]. Route 5 is the second most productive Urban Frequent route with a path from downtown to Euclid Avenue Transit Center along Market Street, a high-density population and employment corridor. Route 3 also serves the same two destinations, but travels along Ocean View Blvd. south of the Orange Line Trolley. Route 906/907 is a neighborhood feeder bus service in San Ysidro. High volumes of pedestrians who cross the border at San Ysidro primarily utilize this service for transportation within the local community. More recently, increased volumes on Routes 906/907 are attributable to people connecting between the San Ysidro Blue Line station and the new Ped West crossing at the Virginia Avenue Transit Center[8]. Frequency on Routes 3 and 5 is reduced from 15 minutes on weekdays to 30 (Route 5) and 60 (Route 3) minutes on weekends, and frequency on Route 906/907 is reduced from 15 minutes on weekdays to 20 minutes on Saturdays and 30 minutes on Sundays. Weekend productivity remains strong on all three routes.

The eastern loop of the SuperLoop Rapid, Route 204, once again performs at the bottom of the service tier for both farebox recovery and subsidy per passenger. Route 204 recovers only 16 percent of its weekday operating costs. It is subsidized at $5.19 per passenger on weekdays, nearly $13 on Saturdays, and $15.80 on Sundays. Route 204 maintains high frequency on weekends, which doesn't match the reduced ridership of the service and warrants review. Note that SuperLoop Rapid services are funded and subsidized specifically by TransNet through SANDAG.

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[7] Transdev, which operates many MTS routes including Routes 3 and 5 described here, are paid on a per revenue mile basis. The cost estimation for routes directly operated by MTS (San Diego Transit Corporation) uses revenue hours as the basis of cost (with the hourly expense of the operator being a primary cost driver), resulting in a higher cost per seat mile compared to Transdev.

[8] Passengers using Route 907 to travel from the Virginia Avenue Transit Center to the San Ysidro Transit Center may purchase a one-way trolley ticket and board the bus without requiring separate fare.

URBAN STANDARD

On weekdays, fares from Urban Standard routes cover 41 percent of the operating costs, second only to Trolley services. MTS subsidizes $1.52 per passenger on Urban Standard routes during the weekdays. Farebox recovery drops just barely to 38 percent on Saturdays and 37 percent on Sundays. Additionally, per passenger subsidies remain below $2.00 per passenger at $1.69 per passenger on Saturdays and $1.77 per passenger on Sundays. High financial effectiveness throughout the week indicates adequate service supply among Urban Standard routes, and is also a positive indication of recovering weekend services in some high-demand corridors.

Routes 28, 35, and 815 all recover over 70 percent of their operating costs from fares and require subsidies lower than $0.50 per passenger. Fares on Routes 31 and 904 both recover less than 20 percent of their operating costs. Route 31 has not been significantly impacted by the introduction of Route 237 and has generated a consistent number of boardings over the past few years. Route 904 performs poorly during the winter months due to the tourist-oriented nature of this route; this is reflected in this analysis because of the the dataset used, but performance improves greatly during the summer months (June – September)[9].

CIRCULATOR

Fares on Circulator routes recover 32 percent of their weekday operating costs and 25 percent of their Saturday operating costs. MTS subsidizes $2.10 per passenger on weekdays and $2.97 per passenger on Saturdays.

Four of the Circulator routes are shuttles that provide connections between Sorrento Valley and the COASTER and are free to the public. NCTD pays MTS $1.00 for each boarding to subsidize the shuttles. The free shuttles likely contribute to higher subsidies and lower farebox revenue among the service tier. Routes 14, 18, 83, and 84 have the lowest productivity among Circulator routes. These four routes also have the lowest farebox recovery of all system Circulators, each below 24 percent. Consequently, MTS is paying between $3.00 and $4.00 subsidies per passenger on each of these routes.

RURAL

Fares from Rural routes generate the lowest farebox revenue in the system at just eight percent of weekday operating costs. MTS subsidizes an average of $14.14 per passenger. The subsidy for Route 891, with service from Borrego Springs to El Cajon, is $51.11 per passenger, which is the

[9] Route 904 operates with a standard fare every 60 minutes during the off-season (September – June), but during the summer months (June – September), the City of Coronado subsidizes passenger fares and additional service to respond to increased tourist demand. In previous years, service operated every 20 minutes during the summer season, but has more recently been improved to bus service every 15 minutes.

highest subsidy in the system. Route 892, with service from Lake Henshaw to El Cajon has similarly high subsidies at $44.45 subsidy per passenger. These Rural routes are lifeline services that are largely subsidized by specific Section 5311(f) federal funds. Thus, high subsidies on only four Rural routes do not significantly impact the MTS budget.

Service Quality

Operating speeds and travel time are key determinants to both MTS operators and individuals using the transit system. While frequency is the most important consumer attraction attribute, speed is the next highest attribute that encourages new riders to use transit services or encourages current riders to use transit for additional trips. Routes with higher speeds and lower travel times are a "win-win" for MTS making service more attractive for customers and reducing the resources needed to operate service.

Service reliability affects a passenger's ability to predict travel in a timely and consistent manner and is the number one factor in retaining transit customers, who expect the promised service delivered every day, every trip. Two primary components comprise service reliability: service availability and schedule delivery. Service availability metrics include percent service completed (actual v. scheduled) and miles between road calls or service interruptions. Scheduled delivery metrics are comprised of on-time performance or frequency delivery.

On-Time Performance and Service Speed

On-time performance helps retain ridership and improve passenger experience. Early or late service and unpredictable arrivals negatively affect perception of service quality and reduce the competitiveness of transit with other modes of transportation[10]. Based on existing MTS standards, 90 percent[11] of trips on Trolley, Express, Rapid Express, Urban Standard, and Circulator routes should be on-time and 85 percent of Urban Frequent and *Rapid* routes should be on-time. Currently, only 13 MTS bus and Trolley routes have above 90 percent on-time performance and 19 MTS routes are on-time less than 80 percent of the time[12]. As a system, 83 percent of MTS trips arrive on-time, 14 percent arrive late, and 2 percent arrive early, which is

[10] Non-riders in San Diego claimed that the number one reason they don't use MTS services is because the trip takes too long or has too many transfers. Riders cited this same factor as the second reason they don't ride more often, the first being that transit services are not frequent enough.

[11] Typical industry best practice calls for 85% on-time for arterial operation (best balance of operating cost versus customer experience) with higher standards (90% and up) reserved for services in exclusive running ways (Trolley and some of the Express tier have partial exclusive right-of-way).

[12] This data is based on routes that are equipped with AVL; 23 MTS routes are not equipped.

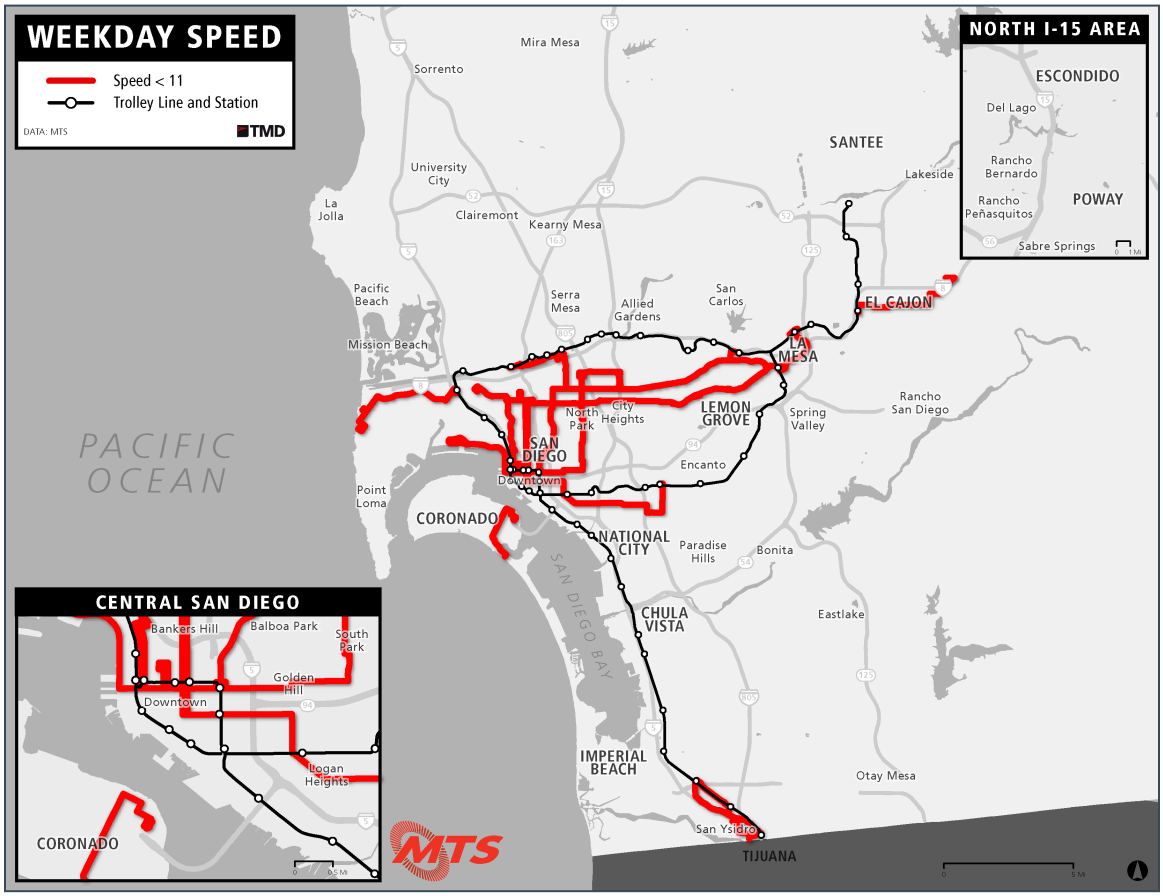
very good compared with MTS peers. The two SuperLoop *Rapid* routes have the highest on-time performance, both above 95 percent. A large majority of MTS routes do not meet on-time performance thresholds because rush hour services are run in local corridors with highly variable conditions. MTS Policy 42 currently holds a 90.0% standard for Urban Standard and Circulator routes, even though these operate in mixed-flow traffic in urban and suburban environments.

The high on-time performance standard may be one reason for the decline in transit service speeds. Setting the percentage too high results in additional time built into the schedule and results in vehicles waiting at timepoints to ensure that the bus is not early. Decreasing service speeds ultimately lead to forced additional operating resources to meet existing schedules. Eleven routes currently average speeds below 11 miles per hour. The majority of these routes are concentrated in the dense urban core of San Diego between the Orange and Green Trolley Lines where traffic is congested and there is heavy turnover at transfer stops. The *Transit Optimization Plan* will consider updated design and operating strategies. These strategies will include improved stop spacing and transit priority. Improved stop spacing is especially critical for high frequency, high investment services. Passengers are willing to walk further for frequent service and the recommendations should optimize around this fact.

Two changes may improve (both perceived and realized) transit reliability:

- Routes which run every 10 minutes or better should be measured on a headway-based approach to match customer expectations. A customer waiting for a frequent service should not wait more than 150 percent of the scheduled headway (e.g. more than 15 minutes for a 10-minute headway).
- Routes which run less than every 10 minutes should be measured based on the existing timepoint-based standard (0 minutes early to 5 minutes late). All routes should be set to an 85 percent on-time standard rather than the existing 90 percent standard.

Figure 15: MTS Routes with Service Speeds below 11 mph



Route Spacing

Effective route spacing is crucial to maximize network access. Placing services too close together or too far apart can negatively impact cost effectiveness for the entire network (unproductive competition). In most urban contexts, route spacing should be no closer than ½ a mile and no farther apart than 1 mile. Route spacing is strongly influenced by existing street networks, the mode and service level.[13]

Within the MTS service area, route spacing varies widely. If spaced too closely, ridership can be cannibalized resulting in less efficient allocation of resources. An example of this can be found in

[13] Industry best practice design recognizes that customers walk further for better transit with basic local bus service drawing 80% of its riders within ¼ mile while rail and better bus (Rapid/BRT) have larger customer walksheds with 80% coming from within ½ mile.

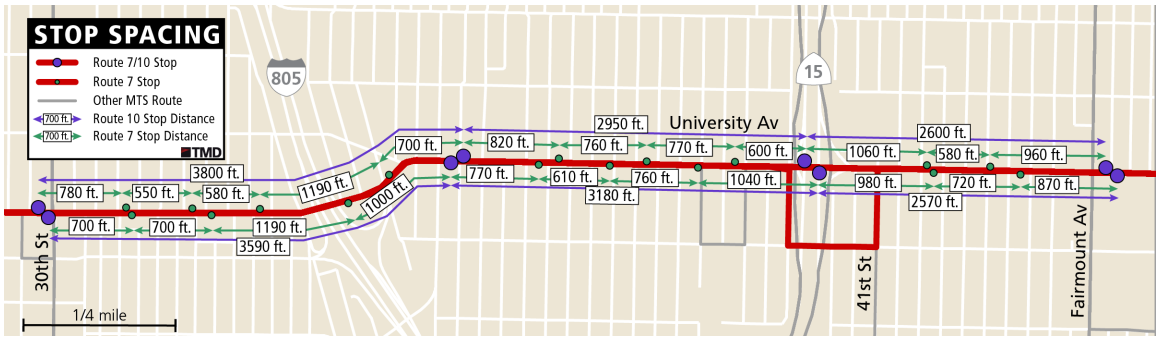
National City where Routes 967 and 968 largely serve the same neighborhoods no further than ¼ mile apart. A consolidated service in this area could continue to serve the community while preserving limited operating dollars for other uses. Not all closely spaced routes are without merit. In some cases, two routes will serve the same corridor but perform different functions in a complementary manner. One example can be found in Mid-City where Route 1 and Route 215 both serve El Cajon Boulevard, with Route 1 operating local service and Route 215 serving longer distance trips with more limited stops.

Stop Spacing

Stop spacing impacts the effectiveness of transit service and has a large effect on ridership attraction. Although closely spaced stops may appear to enhance service accessibility for riders, tight stop spacing makes the service less attractive to people using the bus and may increase operating costs by slowing service speed. Dwell time at bus stops is one of the major contributors to operating delays and the resulting on-time performance issues. Excessive dwell time significantly impacts service reliability and slows down operating speed. A balance between efficient stop spacing to maintain convenient access to transit and reducing unnecessary delay leads to improvements in transit service effectiveness. This service design tool will be an important component of achieving cost savings and delivering efficient transit service.

The effects of stop spacing can be seen along the University Avenue corridor in Mid-City. Both Route 7 and Route 10 operate on this corridor with varying stop spacing. Between Texas Street and 52nd Street Route 7 stops an average of every 0.15 miles or about 1/6 of a mile while Route 10 stops every 0.48 miles or about every 1/2 of a mile. As a result, Route 10 travel time in this segment of University Avenue is 6 minutes compared to a travel time of 10 minutes for Route 7. That represents a speed that is 40% faster. Even a slight increase in the distance between Route 7 stops would save significant resources by improving speeds on the high frequency, high volume urban corridor.

Figure 16: Existing Route 7 / 10 Stop Spacing along University Avenue



Fleet and Infrastructure

MTS contracts many of its services out to several different transit providers throughout the week. With a total fleet size of 797 fixed-route and paratransit buses, MTS directly operates 25 routes while the other 68 routes are operated by contract service providers. The busiest time for MTS operations is during the PM Peak period (3pm-6pm) on weekdays where as many as 454 fixed-route vehicles in service at one time. Articulated buses are used primarily for Rapid and Urban Frequent route operations, 40-foot buses serve some Urban Frequent and most Urban Standard routes, and minibuses primarily serve slower and less frequent routes such as Circulator services.

MTS owns five bus operating divisions throughout the region. Two are directly operated and three are operated by contractors. Four divisions operate full size standard buses while a fifth operates light- and medium duty minibuses in fixed-route and ADA complementary paratransit service. Current *Rapid* service is all directly operated, but the South Bay Rapid opening in 2018 will be operated from the South Bay Maintenance Facility. The two *Rapid* Express routes are operated using a fleet of 24 over-the-road coaches operated from the East County Bus Maintenance Facility (ECBMF). Rural service is also operated from ECBMF, using 40' standard coaches on Route 894 and minibuses on the other three routes. All other minibuses are operated from the Copley Park Maintenance Facility, where the fleet is being converted from gasoline power to propane. Non-*Rapid* articulated buses are currently only operated from Imperial Avenue and Kearny Mesa divisions, but MTS expects to order up to ten for the South Bay Maintenance Facility in 2017-2018 to be used on heavy ridership routes in the South Bay.

Four of the five bus operating divisions are largely at capacity. The ECBMF was expanded in 2016 and has space to absorb some additional buses, but the remaining four divisions have very little room to accommodate growth. The 2016 ballot Measure A that would have funded additional transit services included funding for a sixth bus operating division. The measure did not meet the two-thirds approval required for passage. Any major future growth in bus counts is assumed to require a new expansion bus facility.

Figure 17: MTS Bus Operating Divisions

Division	Location	Operator	Buses	Current Fuel Types
Imperial Avenue (IAD)	Downtown SD	MTS	98 Standard 40' 26 Artic 18 *Rapid* Artic 12 *Rapid* 35' Hybrid **154 TOTAL**	CNG, Gasoline

Kearny Mesa (KMD)	Kearny Mesa	MTS	77 Standard 40' 13 Artic 29 *Rapid* Artic **119 TOTAL**	CNG
South Bay (SBMF)	Chula Vista	Transdev	218 Standard 40' 13 Mid-Size 30'-32' **231 TOTAL**	CNG
East County (ECBMF)	El Cajon	Transdev	53 Standard 40' 24 OTR 45' Coach 3 Type VII Minibus **90 TOTAL**	CNG, Diesel, Gasoline
Copley Park (CPMF)	Kearny Mesa	First Transit	39 Type VII Minibus 172 Type II ADA Minibus **211 TOTAL**	Propane, Gasoline

Key Findings

The service evaluation identified several key findings for MTS to consider in the Transit Optimization Plan recommendations.

- MTS has taken steps to maintain and build ridership since the implementation of the COA service changes in 2006-2007. Ridership grew significantly beginning in 2006 on both bus and Trolley services, and several additional services have been implemented since then. However, despite the many successes, there have been declines in ridership, productivity, and fare revenue in the past two years, likely caused by low gas prices, increasing employment rates, an improved economy which encourages more people to drive, and possibly new competition from TNCs. The TOP should consider specific service options for optimizing resource allocation and meeting mobility needs.
- Weekday boardings peak during morning (6:00am – 8:00am) and afternoon (3:00pm – 6:00pm) commute hours. Midday ridership remains high with around 20,000 system boardings each hour. Trolley ridership is slightly higher during the peak periods, but is sustained between 6,000 and 11,000 passenger boardings each hour from 6:00am to 6:00pm.

- Ridership within the MTS service area is heavily concentrated at Trolley stations and transit centers and in San Diego Mid-City and the western urban core in South County. Trolley lines facilitate north to south movement from the border to downtown and east to west movement between downtown and El Cajon.
- Each of the MTS service tiers plays a distinct role in serving various demographic groups. Generally, resources are currently allocated proportionally to ridership and farebox revenue for each service tier. Trolley services, which outperform all bus services nearly ten to one in train versus bus productivity, have the lowest cost to ridership and cost to revenue ratio. Thus, MTS spends less on Trolley services for higher ridership and farebox revenue returns justifying the infrastructure costs. MTS currently invests proportionally more resources into bus services than they receive in ridership and fare revenue. The TOP will consider where future investments will most benefit ridership and revenue returns throughout the MTS service area while serving community mobility needs.
- MTS as a system recovers 41 percent of its operating costs from farebox revenue and subsidizes an average of $1.48 per passenger trip. Longer trips and low seat turnover mean that Express routes recover a lower percent of their operating costs with higher subsidies. Urban Standard routes maintain high farebox recovery and low subsidies throughout the week. The TOP will identify where investments can be reallocated to optimize ridership and reduce costs and subsidies.
- Currently, the majority of bus routes do not meet on-time performance standards set forth in Policy 42. As well, a number of major bus lines have operating speeds that are below 11 MPH, making critical corridor service less attractive to customers and adding operating cost. The TOP will analyze operating speeds, layover percentage, and on-time performance to establish revised service standards and pinpoint services where speeds and performance can be improved.

Figure 18: Weekday Ridership