MADERA METRO

SERVICE DESIGN GUIDELINES

Approved by City Council
September 2022

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1 INTRODUCTION

WHAT ARE THE SERVICE DESIGN GUIDELINES?

The Madera Metro Service Design Guidelines establish criteria and standards to ensure the Madera Metro fixed-route network can grow and improve following standard guidelines that delivers consistent service to its customers and supports the mission of the department as shown in Figure 1. Specifically, these guidelines aim to bring clarity and consistency to the decision-making process when Madera Metro staff consider changes and/or additions to the network. Establishing these guidelines ensures the network continues to evolve to respond to customer needs while confirming Madera Metro resources are used in an efficient manner. The guidelines apply to the following topics:

- **Bus Route and Stop Design**
- **Bus Stop Development and Changes**
- **Fixed-Route Scheduling**
- **Performance Measurements**

Figure 1 Madera Metro Mission

The City of Madera Transit Division seeks to provide transit customers in the City's transit service area with public transportation to specified destinations in a professional, courteous, and timely manner with equipment that is accessible, affordable, and comfortable.

HOW WERE THE SERVICE DESIGN GUIDELINES DEVELOPED?

The Service Design Guidelines were developed utilizing common transit planning concepts and a robust review of relevant industry white papers and peer case studies. These high-level concepts and strategies were then tailored to account for available Madera Metro resources along with the city's land use, street network including the pedestrian environment, customers' travel patterns, and key trip generators in the city. Table 1 provides a summary of the documents reviewed and how they were incorporated into the Service Design Guidelines.

Table 1 Peer Case Studies and Industry Best Practices Summary

Document	Date Published	Description	Document Reference
TCRP Synthesis 139: Transit Service Evaluation Standards	2019	Provides an overview of the purpose, use, and application of performance measures, service evaluation standards, and data collection methods at North American transit agencies.	Section 5 – Performance Measures: Provided list of possible measurements/metrics to use and definitions of various transit planning concepts.
TransLink Transit Service Guidelines	June 2018	Provides a framework for TransLink to meet its objectives of planning, managing, and delivering an integrated transit network and provide access and mobility for people across the Vancouver, B.C. region.	Section 2 – Bus Route and Stop Design: Provided route design standards and definitions of various transit planning concepts.
Santa Clara Valley Transportation Authority Transit (VTA) Service Guidelines	April 2018	Guides VTA's service planning efforts by establishing a framework to monitor and evaluate VTA's transit services, process to develop service design recommendations for the VTA Board of Directors to consider, and measures to guide service planning decisions that are equitable, systematic, timely, and move VTA toward achieving the goal of providing Faster Frequent Reliable Transit from the VTA Strategic Plan.	Section 2 – Bus Route and Stop Design: Provided route design standards.
Regional Transportation District (RTD) Transit Service Policies & Standards	July 2016	Establishes a set of service standards maintained by RTD to ensure consistent evaluation of service proposals and that service being provided represents the most cost-effective use of the District's resources.	Section 2 – Bus Route and Stop Design: Provided stop spacing standards.
National Association of City Transportation Officials (NACTO) Transit Street Design Guide	April 2016	Provides design guidance for the development of transit facilities on city streets, and for the design and engineering of city streets to prioritize transit, improve transit service quality, and support other goals related to transit.	Section 2 – Bus Route and Stop Design: Provided various route and bus stop design standards, graphics, and definitions of various transit planning concepts.
OmniTrans Transit Design Guidelines	March 2013	Provides design criteria guidelines that should be considered when designing and placing safe and secure transit facilities.	Section 2 – Bus Route and Stop Design:

Document	Date Published	Description	Document Reference
			Provided graphics and concepts for bus stop placement. Section 3 – Bus Stop Change and Development Policy: Provided potential steps to include in the bus stop change process.
TCRP Report 165: Transit Capacity and Quality of Service Manual	2013	Provides current research-based guidance on evaluating quality of transit service, measuring transit capacity, speed, and reliability, sizing elements of transit stops and stations, and guidance on ways to positively influence all the above.	Section 2 – Bus Route and Stop Design: Provided stop spacing standards.
USF Best Practices in Transit Service Planning	March 2009	Defines operating standards and philosophies, provides a framework for transit service planning, and formulizes a decision process to make transit service changes.	Section 4 – Fixed Route Scheduling: Provided metrics and standards to use when deciding on potential headways.

USING THE SERVICE DESIGN GUIDELINES

The Service Design Guidelines should be used by Madera Metro staff to support and guide decision making related to adding, adjusting, or eliminating various elements of transit service. These guidelines should be consulted whenever Madera Metro staff receive a request from the public either as a standalone comment or through the Madera County Transportation Commission's (MCTC) Unmet Transit Needs process. Typical applications for each section of the Service Design Guidelines can be found below:

- **Bus Route and Stop Design:** This section should be consulted when Madera Metro staff are choosing to amend or add a new route or bus stop.
- **Bus Stop Development and Change Policy:** This section includes a process Madera Metro staff should follow whenever they receive a request to add, remove, or change a bus stop's location.
- **Fixed-Route Scheduling:** This section should be consulted when Madera Metro staff are determining schedules and headways for new or amended routes.
- **Performance Measures:** This section should be used to establish a performance measurement process to determine the performance of the network and develop potential necessary changes for improvement.

2 BUS ROUTE AND STOP DESIGN

2.1 OVERVIEW

The following section outlines recommended standards for the design of Madera Metro's routes and bus stop elements. This section was developed utilizing common transit planning concepts along with findings from the relevant industry white papers and peer case studies listed in Section 1. These high-level concepts and strategies were then tailored to account for available Madera Metro resources along with the city's land use, population and demographics, street network including the pedestrian environment, and key trip generators in the city.

Route design refers to the length and directness of a route. Section 2.2 establishes standards for how routes should be designed to optimize travel times, reliability, and ease of use for the customer. At a minimum, routes should be designed to be as direct (limited number of turns) and short as possible while still serving key trip generators. Bus stop design, addressed in Section 2.3, refers to where a stop should be located in relation to an intersection, how far apart stops should be spaced, and possible amenities to be provided at each stop.

2.2 ROUTE DESIGN

Madera Metro's routes should have a simple and consistent design and alignment that is easy for customers to use and understand. This will assist with easing a customer's understanding of how to complete a trip using Madera Metro. Ensuring that routes operate on the same street in each direction where possible can assist with this. However, in cases where this design is not possible due to one-way streets, the alignment of the route in the opposite direction should be as close as possible.[1]

To prevent duplicative service, routes should be spaced approximately ½ mile from each other where the street network and land use allows. This will ensure access to the network is provided without overserving areas. Routes should also be located on streets that are conducive to high-quality transit service including those that serve key destinations and areas with more intense/mixed-use development, and provide safe pedestrian environments (sidewalks, marked crosswalks, etc.). Establishing "anchors" (key trip generators) at each end of the route also provides an opportunity to serve a potential high ridership area and provide them access to destinations throughout the route path.

As stated in Section 2.1. routes should have a minimal number of turns (specifically left-turns) and short travel paths to improve travel times and ensure reliability. Short and direct travel paths ensure that resources spent serving low transit-demand areas can be redistributed to providing high-frequency service to potential high ridership areas. Although a large amount of turns for a route typically causes an increase in travel time, there are some cases where a more circuitous route alignment can be considered. Specifically, adding turns to a route should be considered if it will increase the route's overall productivity, serve a greater number of customers, and will not interfere with its own service frequencies.

Typical key route design concepts are shown in Figure 2.[2]

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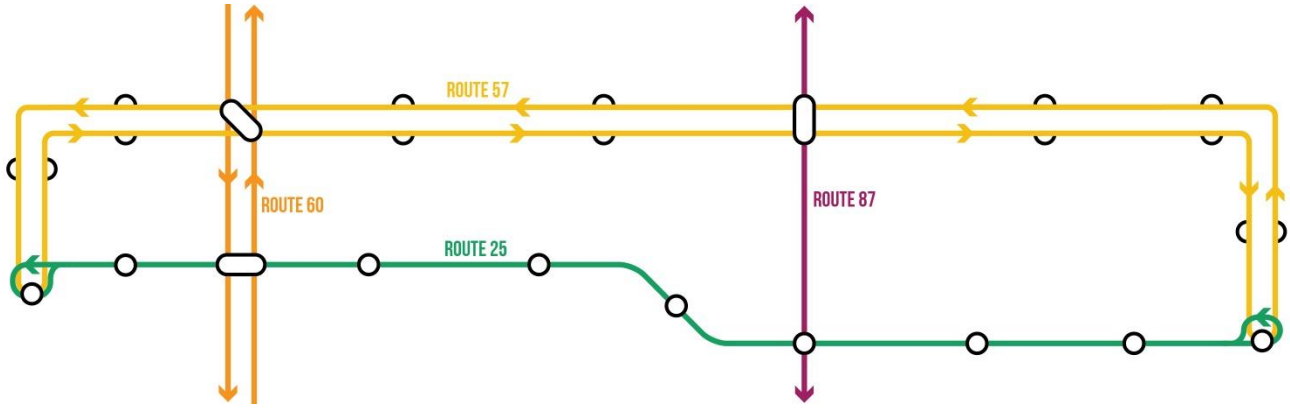
[1] Santa Clara VTA Transit Service Guidelines

[2] NACTO Transit Street Design Guide

Figure 2 Route Design Concepts



1 Routes are as straight as possible while ensuring key destinations are served.

2 Routes are aligned to facilitate transfers between various lines.

3 Where possible, routes operate on the same street in each direction. For one-way streets, routes are aligned as closely as possible in each direction.

4 Where possible, routes are spaced approximately ½ mile from each other to ensure network accessibility without overserving an area.

2.3 BUS STOP DESIGN

SPACING

The distance between stops should be carefully considered when implementing a new bus stop or removing/adjusting an existing bus stop. Establishing stop spacing standards is critical as greater distances between stops will cause longer walking distances for customers but allow for faster travel times. Conversely, stops spaced closer together will reduce customer walking distances but lead to slower and more unreliable travel times.

It can be expected that customers will typically walk up to 5 minutes, or ¼ mile (1,320 feet), to access a stop.[3] Therefore, it is recommended that bus stops be spaced no further than ¼ mile from each other. However, the placement of each bus stop should be considered on a case-by-case basis and the ¼ mile-standard can be amended as necessary based on a wide variety of factors, including, but not limited to, the following:

- **Bus schedule adherence:** Stops spaced too closely together can cause delays and bus bunching for the next trip(s).
- **Pedestrian environment:** The desired average stop distance can be adjusted to ensure stops are located near crosswalks.
- **Key trip generators:** The desired average stop distance can be adjusted based on the presence of key trip generators.

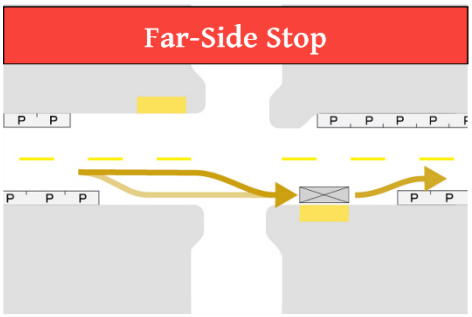
[3] TCRP Report 165: Transit Capacity and Quality of Service Manual

- **Surrounding land use:** Stops can be located further apart than ¼ mile if the route travels through areas with sparse development.

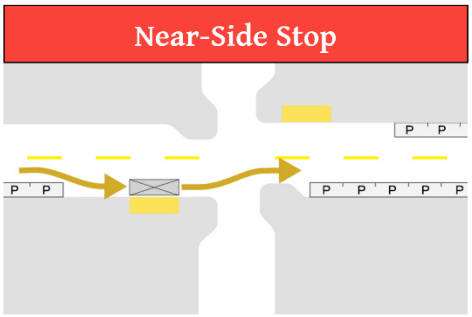
PLACEMENT

Whether it be along the far-side of the intersection, near-side of the intersection, or mid-block, stop placements should be carefully considered as it can affect traffic and pedestrian safety. A far-side stop is a stop that is located immediately after an intersection. A near-side stop is a stop that is located immediately before an intersection. Lastly, a mid-block stop is a stop located 200 feet or more beyond or before an intersection. Additionally, if a stop exists in one direction, a stop in the opposite direction should be provided as well (creating a "bus stop pair") to allow the customer to easily return to their original location. Figure 3 provides examples of the three types of stops[4] and when to implement them.[5]

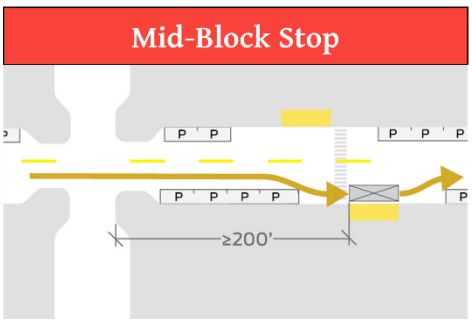
Figure 3 Bus Stop Examples



When to Implement:
- Traffic volumes are higher at near-side of intersection
- Route requires a left or right turn (near-side stops increase difficulty of accessing left-turn lanes especially)
- Intersection has heavy turn volumes
- Far-side of intersection has safer pedestrian environment (including signalized street crossing) and dedicated area for customers getting on and off the bus



When to Implement:
- Traffic volumes are higher at far-side of intersection
- Near-side of intersection has safer pedestrian environment (including signalized street crossing) and dedicated area for customers getting on and off the bus
- Bus route continues straight through intersection



When to Implement:
- Safe, well-marked crossing or signalized crossing is located adjacent to the stop
- Block is long (>300 feet) and locating the stop close to the intersection is not feasible

[4] NACTO Transit Street Design Guide

[5] OmniTrans Transit Design Guidelines

AMERICANS WITH DISABILITIES ACT (ADA) CONSIDERATIONS

Bus stop locations should meet ADA requirements.[6] This includes providing an accessible boarding area at least 96 inches long and 60 inches wide and connected to streets, sidewalks, or pedestrian paths by an accessible route. The boarding area should be at least five feet wide for a wheelchair waiting area, plus additional width to deploy a wheelchair ramp to serve the waiting area (typically three feet).[7] Regardless of location in relation to the intersection, bus stops should be placed in areas where wheelchair lifts or ramps can be deployed on a firm, stable surface. Where possible, stops should also be located near crosswalks for added pedestrian safety.

AMENITIES

Bus stop amenities can improve the customer experience and promote increased ridership. To help customers use the network, all stops should have signs that identify the bus stop's location, route information (route name, headways, spans, etc.), and display Madera Metro's telephone number and website. If possible, adding real-time arrival information at bus stops will greatly improve the customer experience. The following amenities should also be implemented at bus stop locations where possible:

- **Benches:** Benches provide a comfortable option for customers to use while waiting for their bus to arrive. Comfortable seating at bus stops dramatically improves the customer experience. Providing seating options at bus stops is also a way to foster a sense of place by incorporating an attractive and recognizable design. Benches should be prioritized at frequently used stops (ex: stops that serve 10 or more customers per day) or when the route has a long headway (ex: routes that provide service every 60 minutes or worse).
- **Shelters:** Locating shelters at bus stops can also add to the customer experience. Shelters can provide refuge from inclement weather as well as seating options and information on available transit services at the stop. This can significantly improve the perception of wait time and customer satisfaction. Shelters should be prioritized at transfer points, frequently used stops, and in areas that serve higher senior populations and residents with disabilities. Shelters should not be placed directly on the wheelchair landing area, sidewalk, or in front of store windows. The shelter should also be designed in a way that provides wheelchair accessibility and seating for at least four people.
- **Lighting:** When feasible, a bus stop should be placed where there is already an existing streetlight. However, when this is not feasible, ornamental streetlights should be used at the bus stop. Adequate lighting at bus stops increases safety for customers and promotes use of the network at different times of the day and night.
- **Trash receptacles:** Bus stops should also be equipped with trash receptacles. This will ensure cleanliness of the stop itself and the surrounding area. Customers will feel more comfortable using the stop and the overall customer experience will be improved as a result. Location of trash receptacles should also prevent any conflicts with wheelchair accessibility and be placed outside the curb clear zone or landing area.

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[6] Americans with Disabilities Act

[7] NACTO Transit Street Design Guide

The photo on the left in Figure 4 shows an example of the elements listed above that should be located at a minimum at each stop. The photo on the right shows a typical shelter that should be implemented where possible based on available resources and level of ridership at a particular stop.

Figure 4 Madera Metro Bus Stop Sign and Shelter

2.4 TRANSIT PRIORITY TREATMENTS

Figure 5 shows potential transit priority treatments that can be implemented in the future as Madera Metro ridership increases and more funding becomes available.[8] These treatments are not intended to be prescriptive, but rather provide examples of infrastructure investments that can improve Madera Metro service and increase ridership as a result. These treatments can help alleviate reliability issues transit services may experience on surface streets and are context-sensitive to unique street conditions. Deploying these strategies should be considered on a case-by-case basis.

Figure 5 Transit Priority Treatments

Transit Signal Priority

Modifies traffic signal timing or phasing to prioritize movement of transit vehicles through an intersection.

Bus Bulbs

Curb extensions that align the bus stop with the parking lane to allow buses to stop and board customers without leaving the travel lane.

Queue Jump Lanes

Utilize either a leading bus interval or active signal priority to allow buses to easily enter traffic flow in a priority position.

[8] NACTO Transit Street Design Guide

3 BUS STOP DEVELOPMENT AND CHANGE POLICY

A policy should be developed and implemented to evaluate requests for adding, removing, or making changes to any bus stop. These requests can be received through passenger demand, calls to Madera Metro, and the annual Unmet Transit Needs process.

The proposed process below ensures any request to change bus stop locations do not adversely affect existing routes and are placed in areas that are safe for customers to access and serve key destinations. The standards described in Section 2.2 should be used as the basis for approving or denying bus stop requests during reviews. Once a request is received, the proposed process shown in Figure 6 should be followed.

Figure 6 Proposed Bus Stop Change Policy

4 FIXED-ROUTE SCHEDULING

4.1 OVERVIEW

Bus route scheduling determines when a bus will arrive at a given stop. The time intervals between the arrival times of buses at a bus stop is called a headway. Headways are often set at 15-minute intervals and can be set based on the clock face or schedule. Determining headways are based on several factors, such as ridership demand, resource availability (operating budget), operator availability, route length (time to complete round trip) and vehicle availability. 15, 30, and 60-minute windows are common headways that reflect the operator's ability to deliver the service based on the above factors. Establishing consistent headways ensures buses show up on time consistently.

Frequency of service is the number of vehicles that arrive at the bus stop in one hour. Headway based schedules are typically easier for the public to understand compared to frequency of service, which may not have even intervals for buses arriving at the bus stop.

Span of service is the timeframe in which transit service is provided (ex: 6:00 AM to 8:00 PM). Madera Metro route spans should be developed in a way that works for the city. Shorter spans require fewer resources; however, longer spans can provide more access to services for a larger portion of the population. Spans and frequencies should balance meeting ridership demand and available financial resources.

In addition to regular fixed route trips that have the same origin and destination for each trip, Madera Metro should consider offering trips during typical school arrival and departure time periods that specifically serve school locations in the city. These trips would deviate from their typical travel path during these specific time periods to provide direct service for school students.

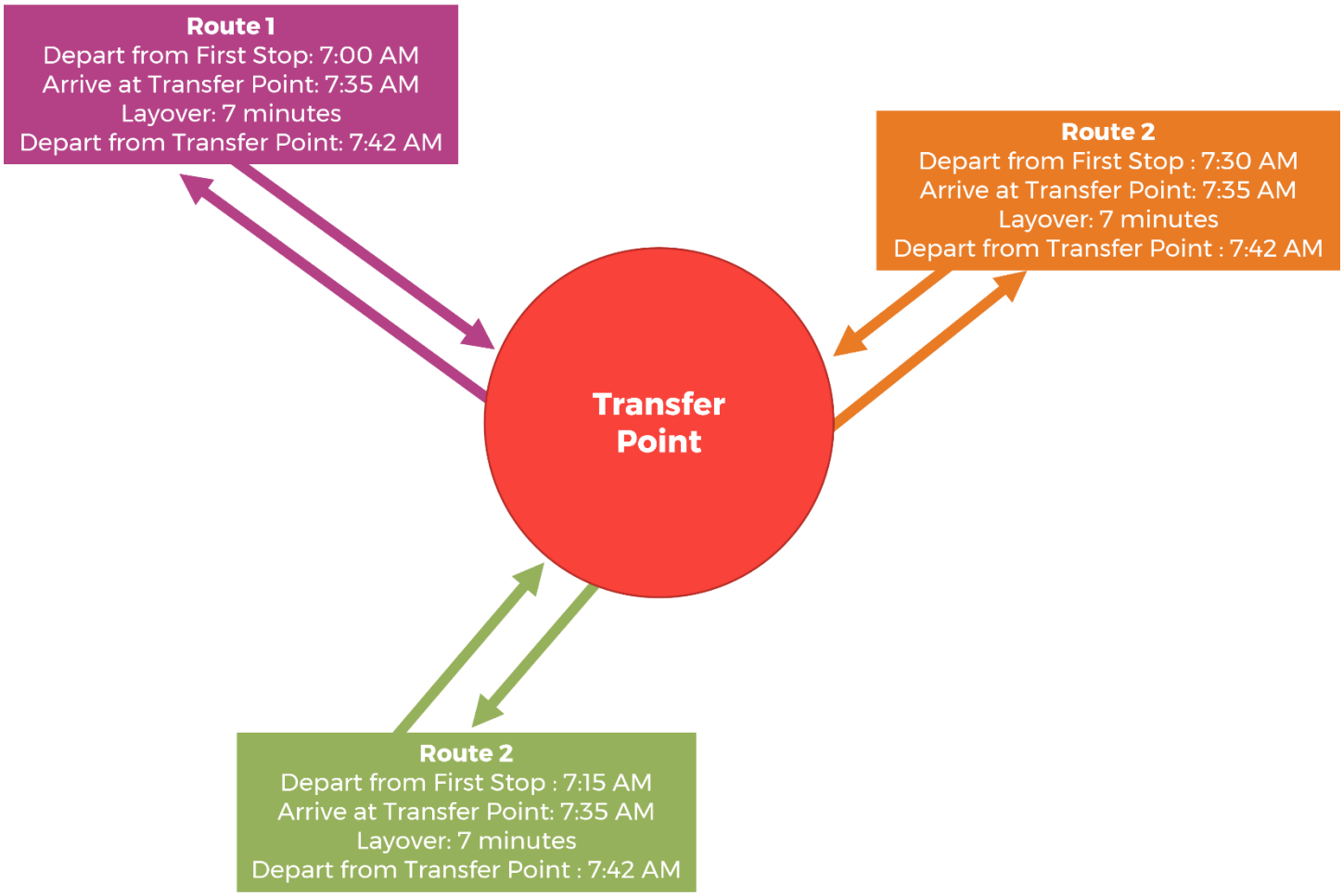
4.2 SCHEDULING CONSIDERATIONS

TIMED TRANSFERS

Timed transfers are a scheduling strategy where vehicles from different routes are routed and scheduled to meet simultaneously at common stops to reduce the time needed to transfer to different routes. Timed transfers are typically deployed for routes with longer headways where transit demand may be lower. Two potential locations to implement timed transfers include the existing Walmart stop on Cleveland Avenue and the Madera Intermodal Station on North E Street. Madera Metro staff should examine the feasibility of timed transfers to improve connectivity of the network and ease the process of transferring to another route.

An example of a timed transfer scenario can be found in Figure 7. Note that the routes are scheduled to arrive at the transfer point at 7:35 AM and each route is also scheduled to have a seven-minute layover before departing to give customers sufficient time to make their connection.

Figure 7 Timed Transfer Scenario



SERVICE LEVEL ALLOCATION

Working within a constrained budget requires making tough decisions in terms of providing transit service. It's important for Madera Metro to establish their priorities and realize span of service and headways may be in competition with each other for scarce resources.

To help match service levels with ridership demand, transit systems typically provide different levels of service for different periods of the day (peak vs. off-peak) and days of the week (weekdays vs. weekends). Peak periods are times in the day (typically in the morning and late afternoon) where ridership demand is highest.

Table 2 shows an example of three routes with different spans and levels of service. While the Purple Line has the highest level of service and longest span, there is a trade-off between the Orange Line and Green Line where one has a shorter span but shorter headways in the peaks, while the other offers longer headways but also a longer span. These time windows and headways can be adjusted as necessary based on factors including, but not limited to, ridership demand, available resources, and areas that are being served.

Table 2 Potential Service Levels Allocation

Route	Span	Headways					
		Overnight **12:00 AM – 6:00 AM**	**AM Peak** **6:00 AM – 9:00 AM**	**Midday** **9:00 AM – 4:00 PM**	**PM Peak** **4:00 PM – 7:00 PM**	**Early Evening** **7:00 PM – 9:00 PM**	**Late Evening** **9:00 PM – 12:00 AM**
Purple	24 hours	60 min	15 min	30 min	15 min	30 min	60 min
Orange	4:00 AM – 10:00 PM	60 min	30 min	60 min	30 min	60 min	60 min
Green	6:00 AM – 8:00 PM	N/A	15 min	30 min	15 min	30 min	N/A

5 PERFORMANCE MEASURES

5.1 MONITORING AND REPORTING PROCESS

Performance measurements provide a set of standards and strategies to measure the effectiveness of a transit network in many different areas. These measurements can be either quantitative based on available data from the operator, or qualitative based on surveying customers' travel behavior and feelings towards the services provided. These measurements should be reported on a regular basis (monthly, quarterly, or annually depending on staff resources) to both internal stakeholders and the public. Analyzing the results of these measurements can guide future decision making on changes to the network to improve any low-performing routes.

5.2 METRICS

The metrics shown in Table 3 provide both qualitative and quantitative measures to analyze the Madera Metro network and propose changes to meet customers' needs and improve route performance and productivity.

Table 3 Performance Measures

Category	Performance Measure	Description	Target Standard
Ridership 	Annual Average Ridership	Total number of unlinked one-way trips	**> 100,000**
	Customers Per Revenue Hour	Number of customers that board the system divided by the amount of revenue hours over the same period	**> 8**
	Customers Per Revenue Mile	Number of customers that board the system divided by the amount of revenue miles over the same period	**> 1**
Performance 	On-Time Performance	The percentage of trips that are picked up on-time (within an established time period)	**> 80%**
Productivity 	Operating Cost Per Revenue Hour	Cost to operate service divided by revenue hours	**< $82.00**
	Operating Cost Per Revenue Mile	Cost to operate service divided by amount of revenue miles	**< $6.00**
	Farebox Recovery	Amount of fare received per the cost to operate service	**> 15%**
	Cost Per Passenger	Total operating expenses required to deliver service divided by total number of boardings	**< $23.00**

Category	Performance Measure	Description	Target Standard
	Subsidy Per Passenger	Total operating cost of providing service minus any fare (and other revenue) per the number of customers	**< $23.00**
	Average Fare Per Passenger	Total fare received divided by number of customers that board the system	**TBD**
Customer Satisfaction 	On-Board Ridership Survey	Survey should be conducted regularly to gauge customer satisfaction with the network	**Complete twice per year**
Access 	Population Within ¼ Mile of a Bus Stop	Measure of percentage of residents within walking distance (¼ mile) of a bus stop	**> 85%**
Safety 	Accidents Per 100,000 Vehicle Miles Traveled	Identifies how often preventable accidents occur over time	**<2 accidents**

5.3 EQUITY

In addition to the performance measures listed above, Madera Metro should make consistent efforts to ensure their services are adequately serving areas of the city with higher percentages of households with low income, people of color, seniors, people with disabilities, and other traditionally underserved populations. This includes identifying populations that rely on transit service the most and developing strategies to improve transit service in those areas. As updates are made to the network and services are expanded and/or adjusted, it is imperative that these changes are not made at the expense of those that use the network the most.

Future changes to the network should be made in consultation with the findings of the equity analysis conducted as part of the MCTC's 2022 Regional Transportation Plan & Sustainable Communities Strategy.[9] Specifically, the plan states, "Residents who rely on public transit most, should subsequently receive the largest share of transit investment."

The plan also defines five Target Areas in the Madera Region listed below. It should be noted that Target Area III, which includes the City of Madera, has the largest proportion of minority and low-income residents.

- **Target Area I:** Town of La Vina, located in the southwest corner of Madera County
- **Target Area II:** City of Chowchilla and surrounding block groups.
- **Target Area III:** City of Madera and surrounding block groups.

[9] MCTC 2022 Regional Transportation Plan & Sustainable Communities Strategy

- **Target Area IV:** Madera Ranchos area near Avenue 12 between Highway 41 and Road 34.
- **Target Area V:** Mountain communities within Madera County, north of the Madera Canal.

6 GLOSSARY

Americans with Disabilities Act (ADA): Civil rights law passed by Congress in 1990 which makes it illegal to discriminate against people with disabilities in employment, services provided by state and local governments, public and private transportation, public accommodations, and telecommunications.

Fixed Route: Service provided on a repetitive, fixed-schedule basis along a specific route with vehicles stopping to pick up and deliver passengers to specific locations.

Frequency: The number of vehicles that arrive at the bus stop in one hour.

Headway: Time interval between vehicles moving in the same direction on a particular route.

Layover: Time built into a schedule between arrival at the end of a route and the departure for the return trip.

MCTC: Madera County Transit Commission

Peak Period: Time periods when transit ridership is highest.

Span of Service: The time that service starts and ends.

Transfer: When passengers interchange from one route or vehicle to another.