South Virginia Street

TOD Study

RTC Washoe

DRAFT Transit Technical Memorandum

June 2024

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1 INTRODUCTION & BACKGROUND

MEMO PURPOSE

The South Virginia Street Transit Oriented Development (TOD) Study's purpose is to analyze the need for future transit service in the South Virginia Street corridor from Meadowood Mall to Mt. Rose Highway based on regional demand, and current and future growth. The TOD Study will also analyze the land use planning tools that will encourage a walkable, transit-supportive development pattern that meets the growth and development needs of the region.

The purpose of this Transit Technical Memorandum is to provide an overview of transit alternatives that could be considered to support that visioning for an expansion of RTC's Virginia Line Bus Rapid Transit (BRT) service along the South Virginia Street corridor. The following sections of the memo present existing conditions influencing current transit service and potential future BRT service, existing Virginia Line BRT ridership trends north of the study area, and transit service phasing recommendations that would support the future vision to implement BRT within the study area.

STUDY AREA & PROJECT GOALS

Study Area

The study area for the South Virginia TOD Study extends along South Virginia Street within Reno and portions of unincorporated Washoe County between Meadowood Mall in the north and Summit Mall in the south, including a small portion of Mt Rose Highway at the far southern end. The study area expands to the east on the southern end of the corridor to include the Downtown Damonte area encompassing higher density housing and retail destinations. The full study area is shown in **Figure 1**.

As shown in **Figure 2**, land adjacent to the South Virginia Street corridor is zoned for a mix of uses throughout, with a primarily mixed-use urban designation north of Neil Road and a primarily mixed-use suburban designation to the south. The Damonte Ranch area is zoned as planned unit development and residential uses of varying intensity with the highest densities being in the Downtown Damonte area.

Project Goals

The goals of the South Virginia TOD Study are to:

- Promote multimodal transportation within the corridor
- Create continuity throughout the corridor
- Allow for the safe movement of all forms of transportation
- Improve transit service
- Encourage mixed-use development

This memo focuses on the analysis and recommendations that would support the goals related to improving transit service and multimodal transportation options.

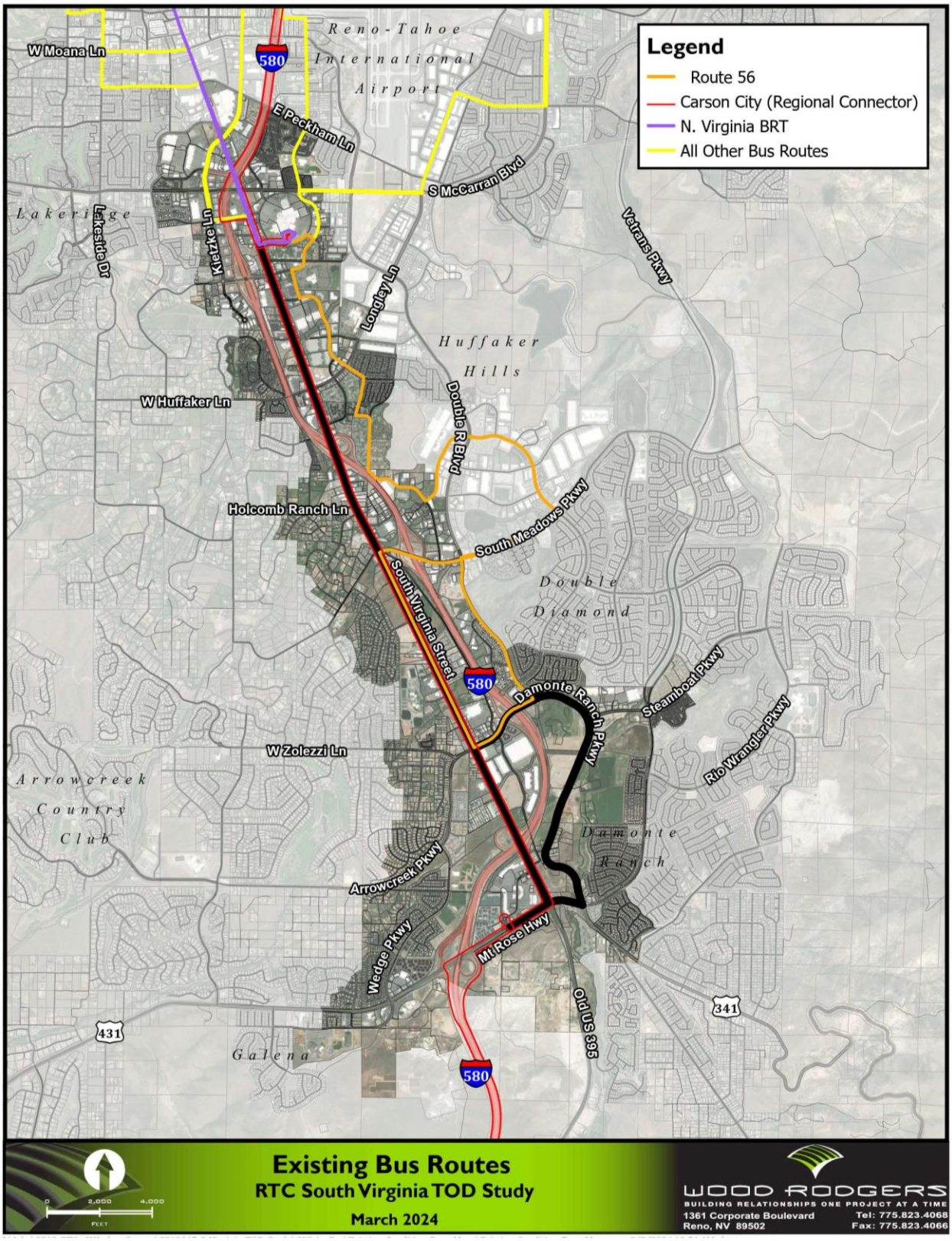

Figure 1 – Existing Transit Service in relation to the Study Area

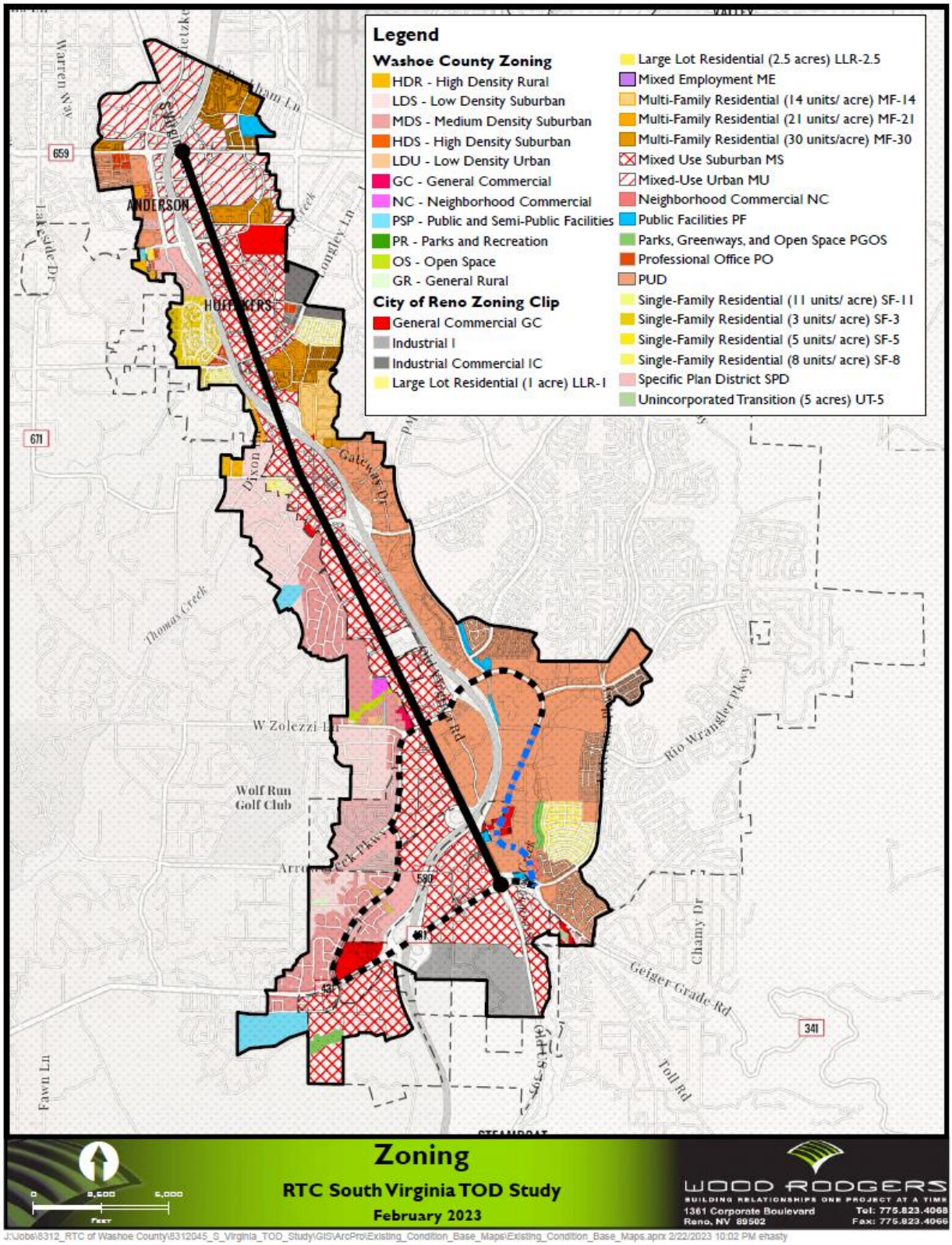

Figure 2 - Zoning in the Study Area

2 TRANSIT SUPPORTIVE LAND USES

TRANSIT RIDERSHIP FACTORS

Transit exists to get people where they want to go, such as home, work, school, a friend's house, or an appointment. In other words, there must be a market for transit to serve.

Transit demand is strongly related to six factors:

- **Population and Population Density:** Transit relies on having more people in close proximity to service. Higher population density makes it possible to provide higher levels of transit service.
- **Socioeconomic Characteristics:** People may be more or less likely to use transit based on socioeconomic characteristics. For example, households with one or no cars are much more likely to use transit than households with several cars.
- **Jobs and Job Density:** Traveling to and from work often accounts for the most frequent type of transit trip. As a result, the location and density of jobs is a strong indicator of transit demand and the level of transit service that is possible.
- **Land Use Patterns:** In all cities, there is a strong correlation between land use patterns and transit ridership. In areas with denser development, mixed-use development, and a good pedestrian environment, transit can be very convenient for more people.
- **Major Activity Centers:** Large employers, universities, tourism destinations, and other high-activity areas attract large volumes of people and can generate a large number of transit trips.
- **Travel Flows:** People use transit to get from one place to another. Major transit lines such as rapid transit services or high frequency bus routes are designed to serve trips or corridors with high volumes of travel.

Of these six factors, **population and job density are the most important when it comes to demand for transit and how much service is feasible to provide.**

This is because:

- The reach of bus transit is generally limited to one-quarter mile of a bus stop.
- As a result, the size of the transit market depends on how many people or jobs are within that area. Higher densities near a transit stop mean that there are more people or jobs within that area, which means that there is a larger market for transit service.
- Larger markets support more frequent service, while smaller markets with fewer people or jobs can support only less frequent service.

Based on research conducted by Nelson\Nygaard, **Figure 3** shows the correlation and accompanying thresholds between corridor land use characteristics (e.g., population and job densities) and transit service types and treatments. The main takeaway from this research is that denser corridors are more supportive of high capacity and more frequent transit service.

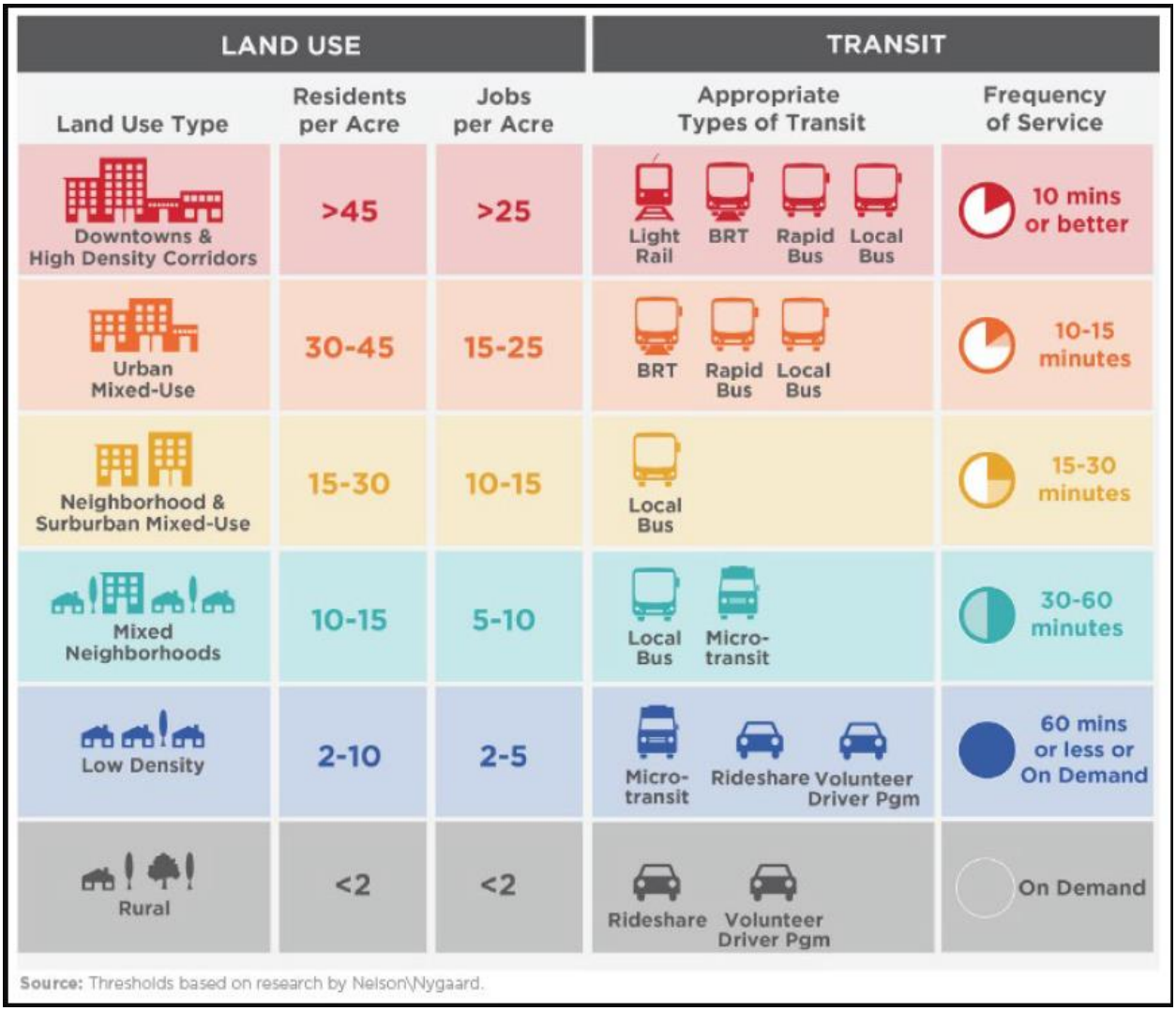

Figure 3 – Land Use Characteristics vs Transit Service Typology

SOUTH VIRIGINIA CORRIDOR POPULATION

The South Virginia Street corridor is targeted in the City of Reno Master Plan for future growth, which has held true with an increase in population and employment over the past decade. However, growth in transit service has not matched the recent growth in population and employment in the corridor.

To better understand future ridership potential in the corridor current population and future growth scenarios (further described in the South Virgina TOD Land Use Tools Memorandum) were developed based on current land use and the land available for infill and redevelopment opportunities. To calculate the potential ridership for the South Virginia Street corridor, population were analyzed for the existing BRT routes. **Figure 4** provides a comparison of the existing BRT Line populations along with the existing and projected populations for the South Virginia Street corridor growth scenarios. Based on the average daily ridership observed for the two existing BRT lines, daily ridership is 4.5% - 6.5% of the corridor population. It is reasonable to assume that the proposed Virginia Line extension would serve a slightly lower percentage of the corridor population when compared to the existing Virginia Line based on its lower overall density.

RTC Route	Corridor Population[1]	Average Daily Riders[2]	% of Riders Per Pop.
Lincoln Line	50,700	2,280	4.5%
Virginia Line	67,300	4,250	6.5%
Study Area	**Corridor Population**	**Ridership Potential[3]**	**% of Riders Per Pop.**
Existing South Virginia Street Corridor	43,000[1]	1,290 – 2,150	3-5%
Future Growth Scenario 1[4]	58,000	1,740 – 2,900	3-5%
Future Growth Scenario 2[4]	64,000	1,920 – 3,200	3-5%
Future Growth Scenario 3[4]	80,000	2,400 – 4,000	3-5%

Notes:

1. 2020 population of census tracts adjacent to each corridor
2. 2019 average daily ridership
3. Forecast potential South Virginia Street ridership based on corridor population
4. Forecasted 2050+ population based on land use scenarios and level of future infill/redevelopment

Figure 4 – Corridor Population Compared to Existing BRT Lines

3 EXISTING CONDITIONS

CHARACTERISTICS OF REGIONAL TRANSIT RIDERS

Replica[1] data for Washoe County from Spring 2023 was analyzed to better understand the trip-making and demographic characteristics of the transit market. The Replica dataset includes detailed attributes for all trips by primary mode.

This data is meant to augment the ridership modeling and forecasting results and to help inform any future service planning and phasing recommendations.

Figure 5 provides a summary of high-level findings from the regional Replica data and additional detail is provided below.

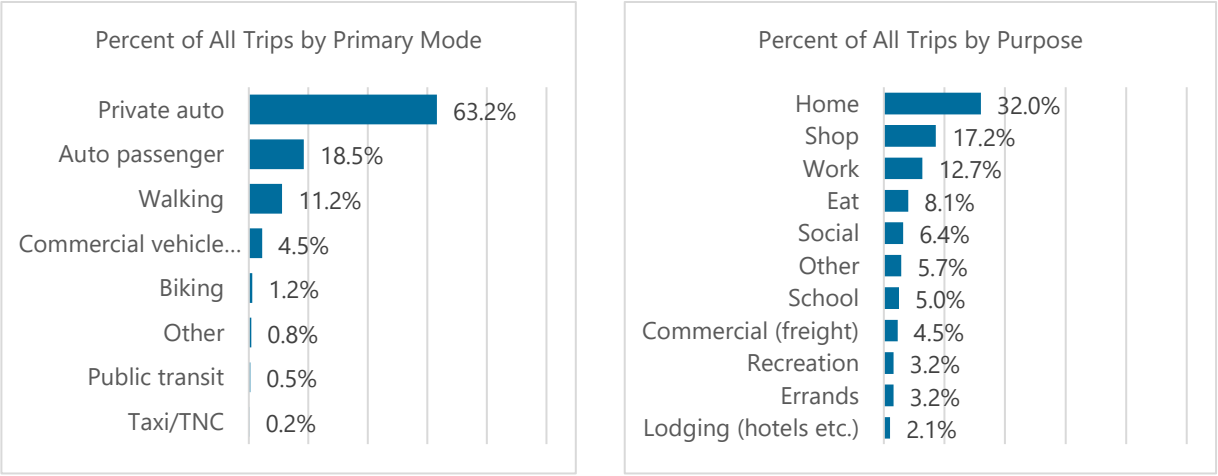

Figure 5 – Existing Trip Characteristics in Reno

[1] Replica is a data platform that provides simulations of the complete activities and movements of residents, visitors, and commercial vehicle fleets in a region and season on a typical day. The output of each simulation is a complete, disaggregate trip and population table for an average weekday and average weekend day in the subject season (e.g., Fall 2021). The model represents a 24-hour period with second-by-second temporal resolution, and point-of-interest-level spatial resolution. This data is used in planning work to understand the mobility trends and specific demographic characteristics of the population in a given study area.

- **Trip Purpose.** 42% of transit trips are made for the purpose of going to work, which is significantly higher than the 12% for all modes.
    - There are employment centers along the South Viriginia corridor that are not currently served by frequent transit suggesting that there may be an opportunity to maximize ridership along South Virginia by ensuring that service is provided to employment centers.
- **Trip Duration.** The average duration of a transit trip is 39.9 minutes, 16.6 minutes for auto-based trips, and 13.5 minutes for active trips. [2]
- **Trip Distance.** The average distance of a transit trip is 5.1 miles, an auto-based trip is 6.2 miles and an active trip is 1 mile.
- **Vehicle Availability.** 76% of transit trip takers did not have a vehicle available for the trip, meanwhile less than 3% of the remaining trip takers did not have a vehicle available.
- **Household Income.** The median household income of transit trip takers is $54,800, an auto-based trip taker is $91,600, and an active trip taker is $75,200.
- **Household Size.** 34% of transit trip takers are from single-person households, whereas auto-based trip takers are from a single-person household only 11% of the time.
- **Age.** The average age of a transit trip taker is 46; meanwhile, the average age of an auto-based trip taker is 41 and 37 for an active trip taker.
- **Sex.** 58% of transit trip takers are male and 42% are female. This proportion is more balanced for auto-based and active trips with male trip takers accounting for 51% of the trips and female for 49%.
- **Tenure.** 71% of transit trip takers are renters whereas only 38% of non-transit trip takers are renters.
- **Commute Mode.** 53% of transit trip takers already commute via public transit versus less than 1% of auto-based trips commuting by public transit.
- **Employment Status.** 90% of transit trip takers are employed. This is higher than the 70% of auto-based trip takers and 61% of active trip takers.
- **Time of Day.** Almost half of all transit trips occur during the typical peak travel periods. 22% occur between 6:00 am and 9:00 am and 25% occur between 4:00 pm and 7:00 pm. 36% of trips occur during the middle of the day, from 9:00 am to 4:00 pm.
- **Land Use.** 65% of transit trips originate from these top three land uses: retail (27%), multi-family (25%), and mixed use (14%). Single-family residential land uses account for 11% of transit trips. A deeper dive into the destination land use of work trips revealed that 33% went to retail land uses, suggesting that retail workers represent a significant transit market.

[2] Auto-based trips include trips taken by auto, taxi or TNC. Active trips include biking and walking trips.

EXISTING TRANSIT SERVICE IN THE STUDY AREA

RTC provides public transit services to the greater Reno-Sparks area. RTC has a fleet of 65 buses for fixed-routes services and provides approximately five million transit rides per year on 20 routes. Most of the Local routes in the RTC system operate 30-minute or hourly service seven days per week, with the operating hours varying based on the corridor.

RTC currently operates BRT service on Virginia Street (Virginia Line) and 4th Street/Prater Way (Lincoln Line). These corridors have proven to be successful with the Viriginia Line (along with the Route 1 Local underlay service) providing over one million rides per year on the five-and-a-half-mile route between the University of Nevada, Reno and Meadowood Mall. The Lincoln Line is a shorter route at approximately three-and-a-half-miles between the 4th Street Station in Downtown Reno and Centennial Plaza in Downtown Sparks. The Lincoln Line (along with the Route 11 Local underlay service) provides over 700,000 annual rides. The BRT Lines provide frequent service with headways of 10 minutes throughout the day on weekdays and 12 minutes on weekends. The span of service for the two BRT Lines varies with the Viriginia Line providing service into the late evening hours past midnight. The Lincoln Line service operates from approximately 6 am to 8:30 pm. Along with a premium level of service, the BRT Lines include enhanced stations with larger shelters and real-time passenger information, among other amenities consistent with BRT service.

RTC also operates FlexRIDE microtransit, vanpool, Access ADA paratransit service, and partners with taxis and transportation network companies (TNCs), such as Uber and Lyft to provide service that can provide more flexibility for ADA passengers.

The South Virginia Street Study Area is currently served by Route 56, a standard fixed route, and the Regional Connector, which is a commuter route that operates between Reno and Carson City. Paratransit service is also available in the area, as well as RTC's vanpool and taxi/TNC programs. RTC plans to add FlexRIDE to the Damonte Ranch area in May 2024, but does not have any other immediate plans for expansion in the area. These services are described below as it will be critical to integrate them with the potential future extension of the Virginia Line.

Route 56

Local bus service within the South Meadows and Damonte Ranch areas is currently provided by Route 56, operating between Meadowood Mall in the north and Damonte Ranch in the south (see **Figure**). Route 56 operates at the following frequencies:

- Monday – Friday
  - 5:30am – 5pm: 30 minutes
  - 5pm – 10pm: 60 minutes
- Saturday
  - 6am – 8pm: 60 minutes
- Sunday
  - 7am – 6pm: 60 minutes

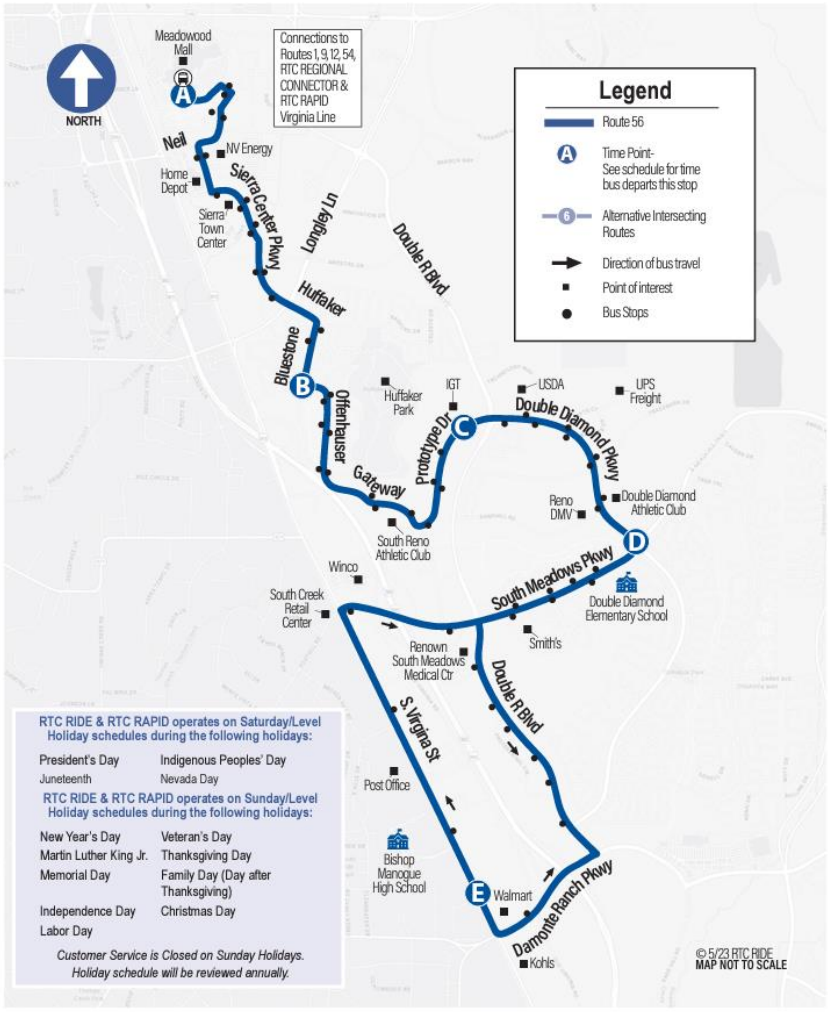

Figure 6 - RTC Route 56 Map

Route 56's alignment largely parallels the S. Virginia Street corridor to the east, including a clockwise loop along Double R Boulevard, Damonte Ranch Parkway, S. Virginia Street, and South Meadows Parkway in the southern portion of the route. As of October 2019, Route 56 was observed to have an average weekday ridership of approximately 750 boardings. This places Route 56 on the lower range of average ridership for an RTC route. There are eight routes in the post-2020 network that average fewer daily riders than Route 56.

RTC Regional Connector

Regional, commuter-focused bus service along the S Virginia Street corridor is currently provided by the RTC Regional Connector, operating between Downtown Reno in the north and Carson City in the south (see **Figure 7**). The Regional Connector operates at the following frequencies:

- Monday – Friday
  - Southbound
    - 5:45am – 6:45am: 30 minutes
    - 3pm – 5:30pm: 60 – 90 minutes
  - Northbound
    - 6:50am – 7:50am: 30 minutes
    - 4:15pm – 6:45pm: 60 – 90 minutes

Primarily traveling on Interstate 580 between Reno and Carson City, the Regional Connector has several stops along S Virginia Street, including at Meadowood Mall and Summit Mall.

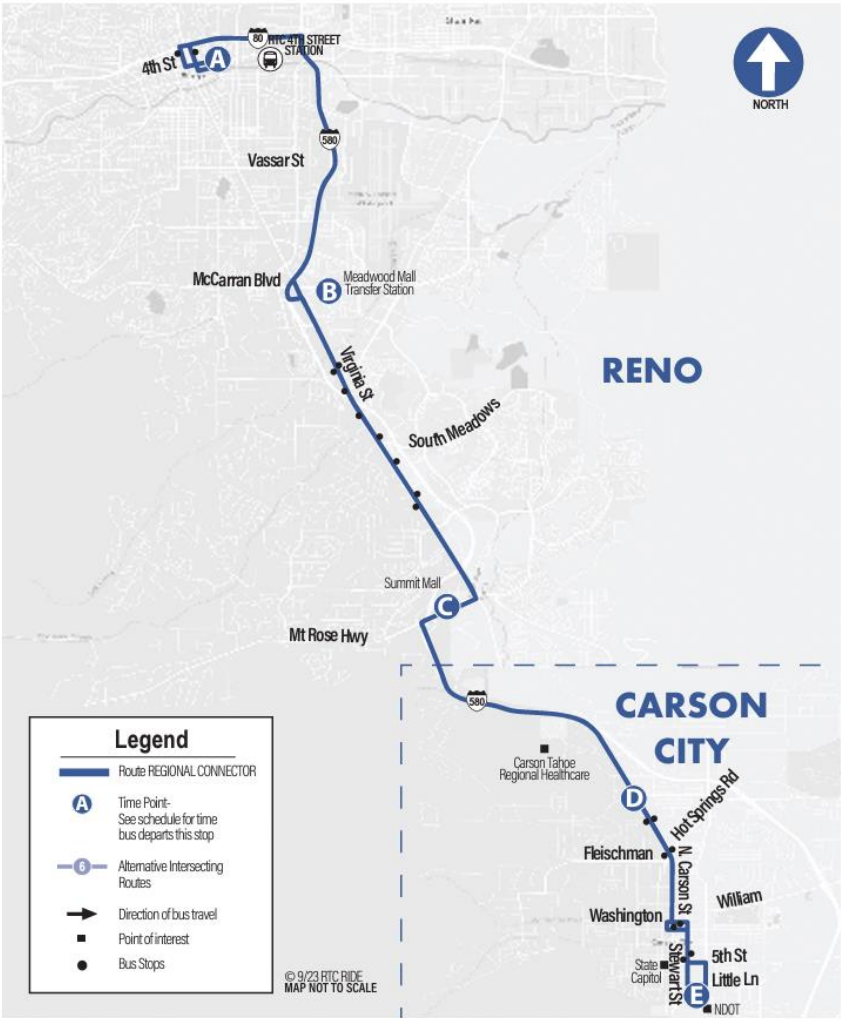

Figure 7 - RTC Regional Connector Route Map

RTC FlexRIDE

FlexRIDE is RTC's curbside-to-curbside on-demand transit service, operating seven days a week in select areas of Sparks/Spanish Springs, Somersett/Verdi, and North Valleys. This type of on-demand service can function both as first- and last-mile travel to and from fixed-route transit hubs, and as a means of providing transit in areas that cannot support fixed-route service, such as those with low population densities, irregular street networks, or unique and challenging geographies. Connections to fixed-route service are provided at transit hubs, transfer points, and other key bus stops.

While no FlexRIDE service is currently provided in the South Meadows and Damonte Ranch areas, RTC is planning to implement FlexRIDE service in these areas in May 2024(see **Figure 8**)[3] In addition to the service area itself, FlexRIDE is anticipated to provide service to the following destinations outside of the service area:

- Raley's at Galena Junction
- UNR Redfield Campus
- South Valleys Library/Sports Complex
- Reno Ice
- South Meadows Walmart
- IGT
- DMV
- WinCo
- Smith's
- United States Post Office

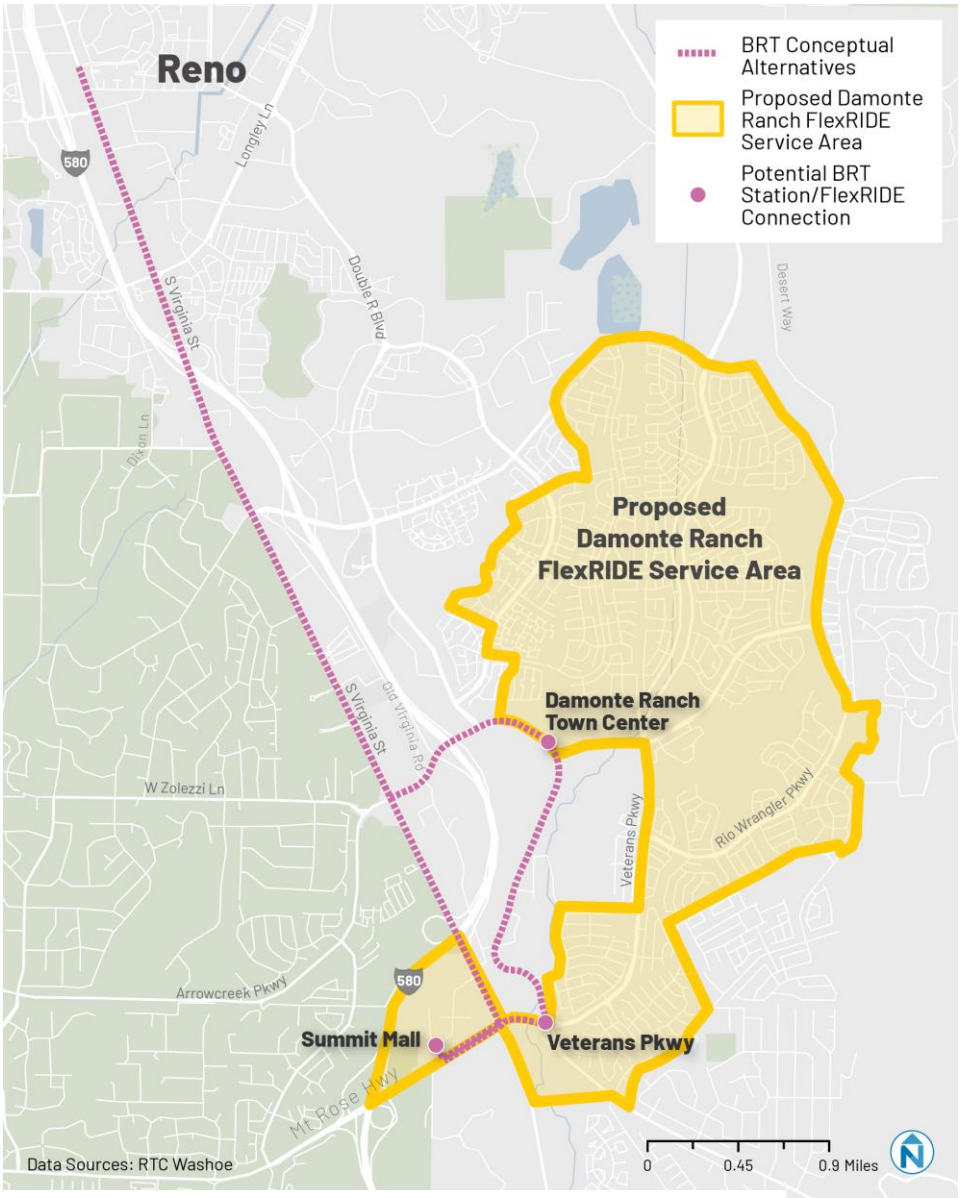

Figure 8 - Proposed Damonte Ranch RTC FlexRIDE Service Area

Meadowood Mall Transfer Center

The Meadowood Mall Transfer Center is located between the south end of the mall and Meadowood Mall Circle. The transfer center is comprised of seven bays, serving RTC Routes 1, 9, 12, 54, and 56, as well as the Virginia Line and the Regional Connector. Amenities at the transfer center include three shelters, benches, and trashcans. RTC is currently in the process of designing a new transfer center at Meadowood Mall to the east of the existing location (see **Figure 9**).

[3] The Damonte Ranch FlexRIDE service area is preliminary and will be undergoing a formal RTC Washoe public participation and review process.

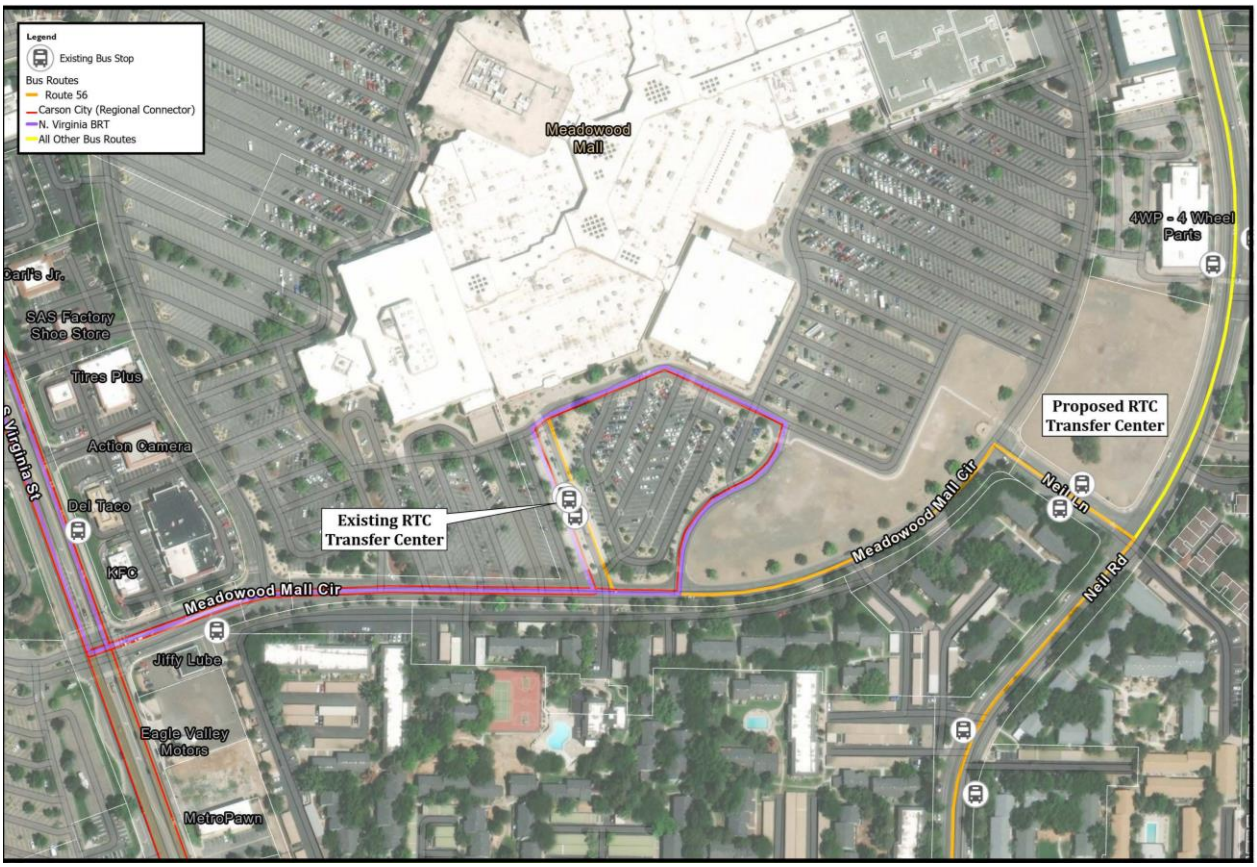

Figure 9 - Proposed Meadowood Mall Transfer Center Relocation

Bus Stops

Outside of the Meadowood Mall Transfer Center, existing bus stops within the study area are currently served by RTC Route 56 and the Regional Connector. Stops are primarily comprised of a bus stop flag on the sidewalk, with roughly half of the stops including a bench and two with a shelter. **Figure 10** displays the current level of amenities for existing bus stops on S Virginia Street, and **Figure 11** lists the details of all existing stops within the study area. Only two stops along the corridor currently have shelters.

Figure10 - Existing Bus Stops on S Virigina Street for Route 56 & the Regional Connector

Stop Name	Direction	Routes	Amenities
Meadowood Mall Cir and S Virginia St	EB	1, 9	Flag, sidewalk
S Virginia St and Longley Ln	NB	Regional Connector	Flag, sidewalk
S Virginia St and Longley Ln	SB	Regional Connector	Flag, sidewalk
S Virginia St and E Patriot Blvd	SB	Regional Connector	Flag, sidewalk
S Virginia St and Holcomb Ranch Ln	SB	Regional Connector	Flag, sidewalk
S Virginia St and South Meadows Pkwy (Winco Entrance)	NB	Regional Connector	Flag, sidewalk, shelter, bench
S Virginia St and Artisan Means Way	NB	56	Flag, sidewalk
S Virginia St and McCabe Dr (Auto Center Dr)	NB	56, Regional Connector	Flag, sidewalk
S Virginia St and McCabe Dr	SB	Regional Connector	Flag, sidewalk, bench
S Virginia St and Trinity Ln	NB	56, Regional Connector	Flag, sidewalk, shelter, bench, trashcan
S Virginia St and Trinity Ln	SB	Regional Connector	Flag, sidewalk, bench
S Virginia St and Damonte Ranch Pkwy	NB	Regional Connector	Flag, sidewalk, bench
S Virginia St and Damonte Ranch Pkwy (Arrowcreek Pkwy)	SB	Regional Connector	Flag, sidewalk, bench

Figure 11 - Existing Bus Stops and Amenities on S Virginia Street

4 BRT CONCEPTUAL ALTERNATIVES

OPERATIONS PLANNING CONCEPTS

Four conceptual BRT service alternatives were developed for this study to illustrate the level of operations investment that would be needed by RTC to support a new BRT line serving the South Virginia Street and Damonte Ranch destinations. The operational investment is one of the key pieces of information that is necessary when determining whether to move forward with a transit capital project. These concepts are intended to be a starting point that could be used for future corridor planning including a formal Alternatives Analysis that would be required to seek federal funding to support a BRT transit capital investment for the South Viriginia Street corridor.

Remix transit planning software was used to calculate the operating statistics and estimated operations costs for all service alternatives in this study. The annual operations costs from Remix were evaluated for accuracy compared to actual RTC operations cost and were deemed to be within reason and valid for planning purposes to evaluate service options as part of this analysis.

EXISTING VIRGINIA LINE BRT

The existing Virginia Line BRT service operates within the City of Reno between the University of Nevada, Reno (UNR) in the north and Meadowood Mall in the south. Primarily traveling on Virginia Street, the Virginia Line BRT connects UNR, RTC's 4th Street Station, Downtown Reno, the Riverwalk District, Midtown Reno, and Meadowood Mall as it travels north to south. Operational statistics for the existing Virginia Line BRT are shown in Figure 10.

Existing Virginia Line BRT	
Peak Operational Vehicles	7
Roundtrip Length (mi)	12.34
Stations (total)	26
Average Station Spacing (mi)	0.51
Weekday Frequency (min)	10.6 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Saturday Frequency (min)	12.3 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Sunday Frequency (min)	12.3 min (6:30am – 7pm) / 30 min (7 – 9pm) / 60 min (9 – 11pm)
Annual Operating Cost Estimate	$3.10 million (Remix estimate) | $3.43 million (RTC 2019-2020 estimate)

Annual Operating Hours Estimate	30,966

Figure 12 - Existing Virginia Line BRT Operations Summary

PROPOSED STOP LOCATIONS

The proposed stop locations for each alternative are based on a combination of regional growth plans, best practices including the current spacing found with the Virginia Line, and an analysis of current and future land uses. Based on the City of Reno ReImagine Reno Master Plan, which was updated in 2021, the South Virginia Street corridor is mostly identified as Suburban Mixed Use (SMU) which encourages "concentrated nodes of higher-intensity development…at major intersections." Furthermore, the plan identifies four multi-modal hubs which shall, "incorporate transit stops and other multi-modal facilities." The four areas are located at the Meadowood Mall, South Meadows Parkway, Damonte Ranch Parkway, and the Summit Mall as shown in **Figure 13**.

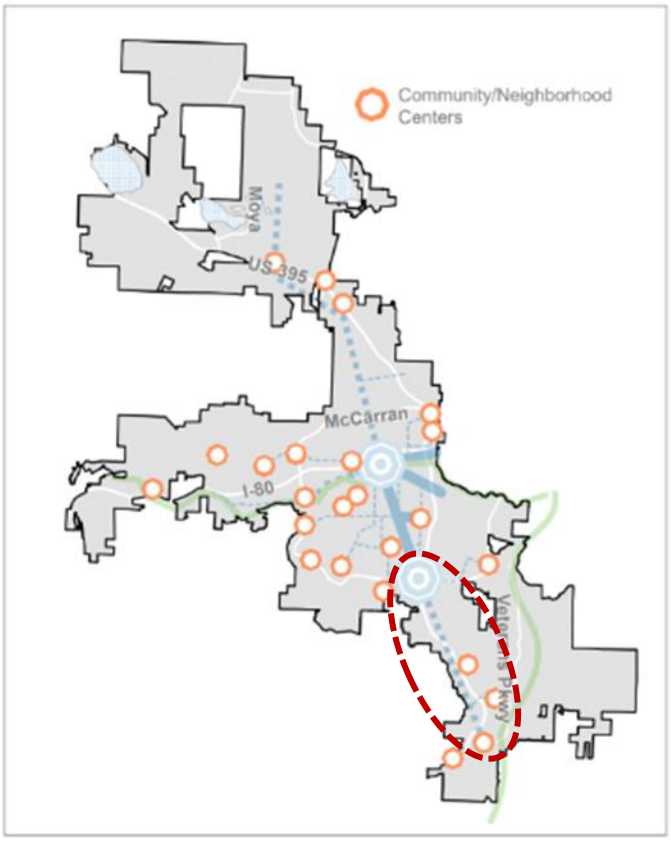

Figure 13: Multi-Modal Hubs identified in the ReImagine Reno Master Plan

In addition to the multimodal hubs identified in the ReImagine Reno Master Plan, many of the major intersections including Longley Lane, South Meadows Parkway, and Damonte Ranch Parkway were prioritized because of connectivity to the surrounding neighborhoods. Further, best practices indicate stops should be placed approximately one-half mile apart to decrease travel times and increase ridership. This approach is consistent with RTC's existing BRT stop spacing. Finally, existing and future conditions were considered including the potential for development of higher densities, employment nodes, and areas of future growth potential.

Figure 14 shows the composite of the current and future conditions and the relationship with the proposed stop locations. As the figure shows, the highest growth opportunity within the study corridor shows a deviation from South Virginia Street along Damonte Ranch Parkway. The proposed stop locations align with the locations with the highest density or planned growth along the corridor including the stop along Damonte Ranch Parkway. A few of the stops are in less dense segments of the corridor to maintain consistent stop spacing and should be considered for targeted growth locations in the future.

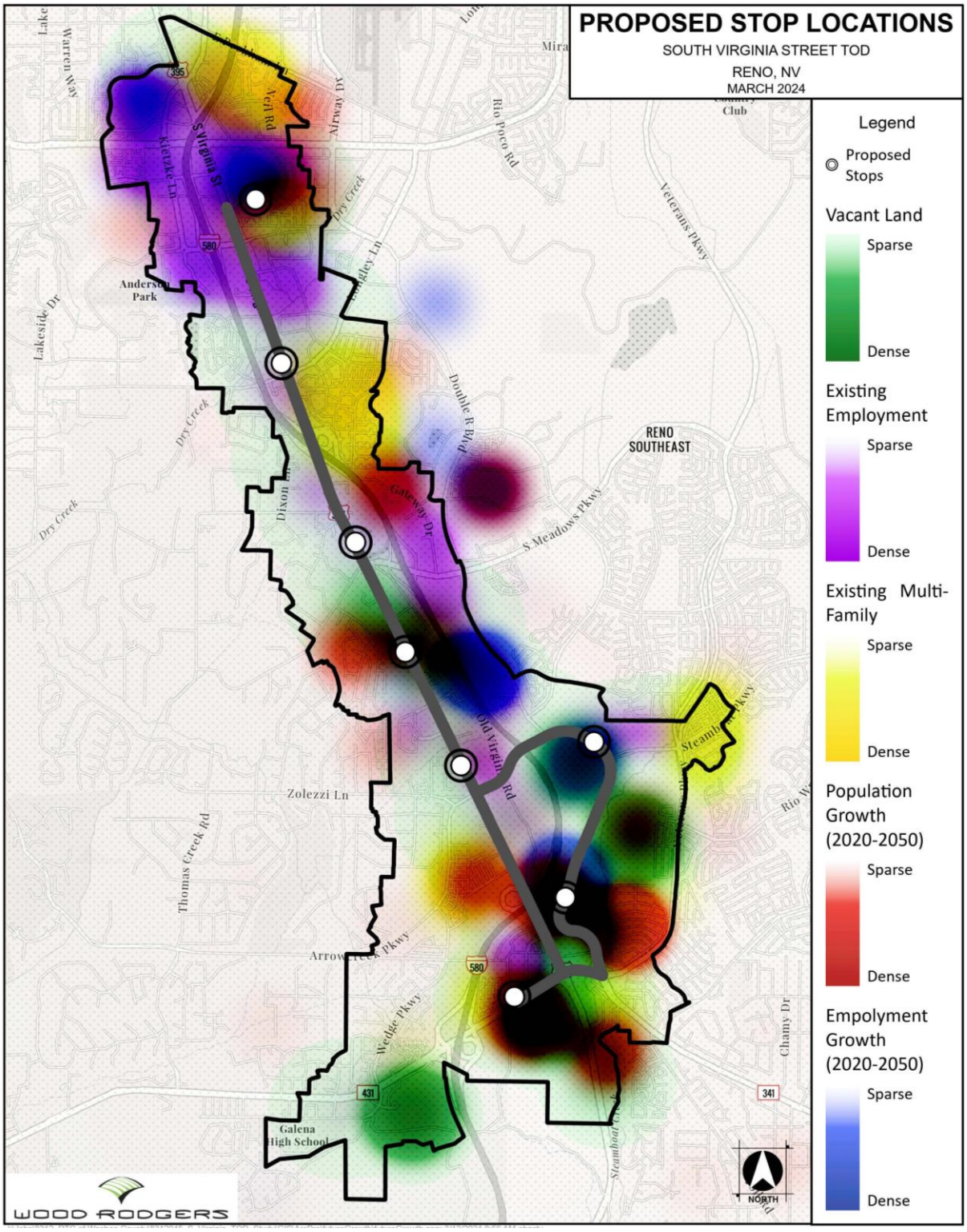

Figure 14: Land use analysis composite relative to proposed stop locations

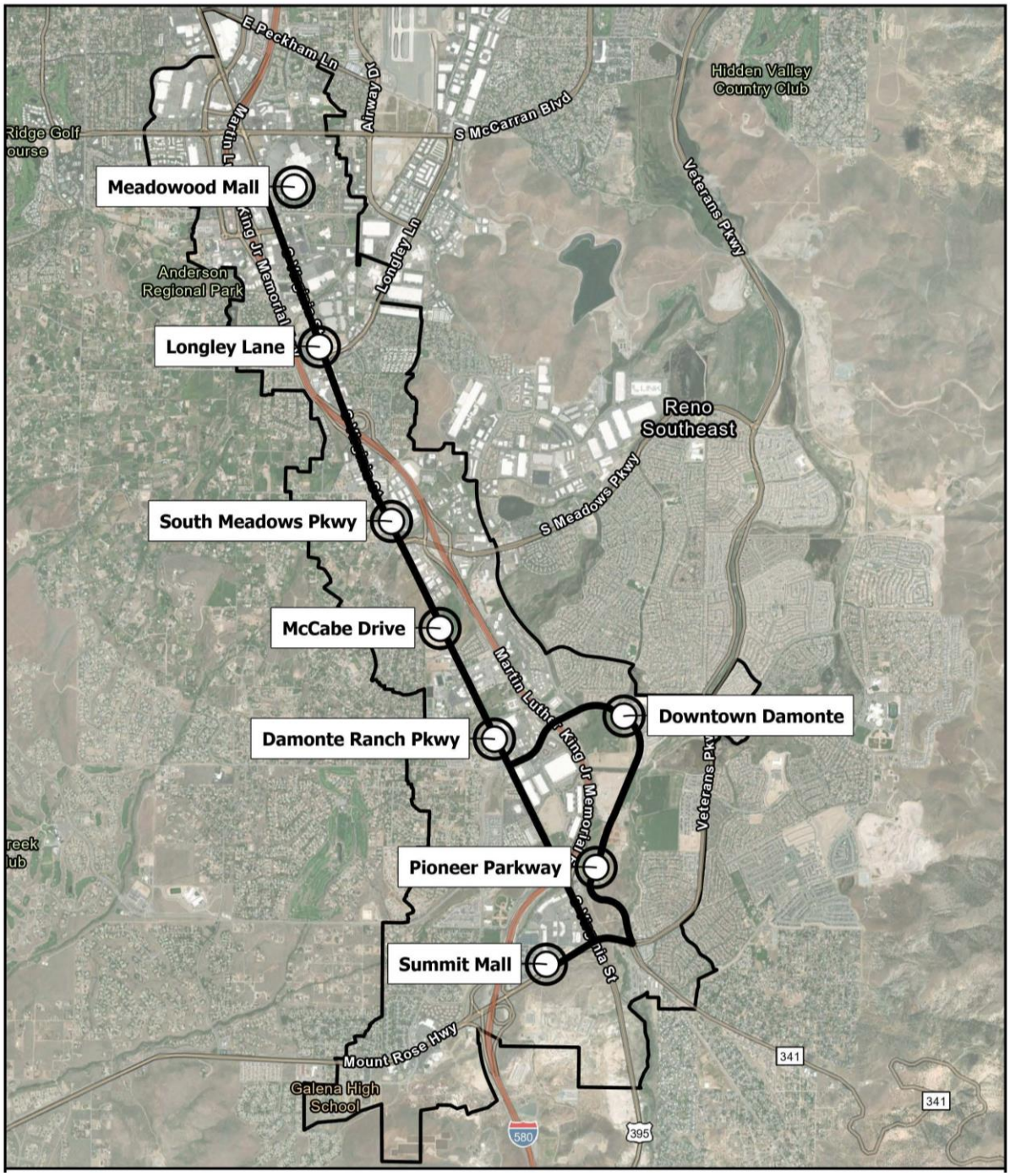

Figure 15: Stop Locations and Names

Considering all of the above criteria a total of eight stop locations were identified, six stop locations along South Virginia Street and two which deviate from South Virginia Street at Damonte Ranch Parkway and follow the planned connection between Damonte Ranch Parkway and Veterans Parkway. These eight stop locations and the opportunities that surround them are shown in **Figure 16**.

Proposed Stop Location	Major Intersection	ReImagine Reno Multi-Modal Hub	Existing Employment Node	Existing Multifamily	Vacant Land or Redevelopment Opportunities	Future Population Growth	Future Employment Growth
Meadowood Mall	X	X	X	X	X	X	X
Longley Lane	X		X	X			X
South Meadows Parkway	X	X	X		X	X	X
McCabe Drive			X	X	X	X	X
Damonte Ranch Parkway	X		X		X		X
Downtown Damonte	X	X	X	X	X	X	X
Pioneer Parkway					X	X	X
Summit Mall	X	X	X	X	X	X	X

Figure 16: Factors influencing recommended stop locations.

The table identifies three major stop locations that include all criteria of an ideal stop location. The two north and south anchor points, Meadowood Mall in the north and the Summit Mall in the south justify the beginning and end of the proposed route. The third, in the area identified as Downtown Damonte, currently has the highest potential for concentration of riders and the greatest opportunity to include future development that will serve riders for transit along the corridor. Therefore, as part of this effort, alternatives explore the possibility of a transit route deviating from South Virginia Street to capture and serve the current and future population near Downtown Damonte.

ALTERNATIVE 1 – SUMMIT MALL

Route Description

Alternative 1 would provide service along S Virginia Street between Meadowood Mall in the north and Summit Mall in the south, as shown in **Figure 17**.

Stations would be at Longley Lane, South Meadows Parkway, McCabe Drive, Trinity Lane, and Damonte Ranch Parkway, and would connect riders to Bishop Manogue High School, Tamarack Casino, and various residential, retail and employment destinations along S Virginia Street.

To estimate the operational statistics shown in **Figure 8**, daily service frequency was assumed to be 15 minutes between 6am and 7pm and 30 minutes between 7pm and 10pm. 15-minute headways is the minimum level of service that would be considered BRT.

Operational statistics were also estimated for a "Robust Service Level Option" where service levels and spans match those of existing Virginia Line BRT. In this scenario, buses would operate at the frequencies and spans indicated in **Figure 9**.

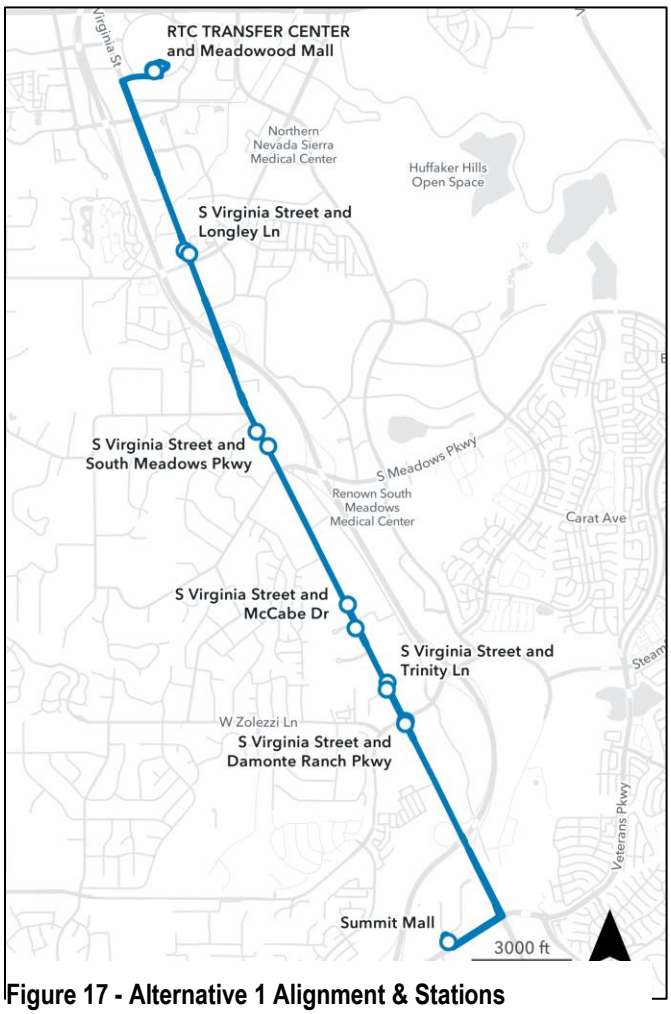

Figure 17 - Alternative 1 Alignment & Stations

Alternative 1 – Summit Mall	
Peak Operational Vehicles	4
Roundtrip Length (mi)	11.92
Stations (total)	12
Average Station Spacing (mi)	0.98
Frequency (min)	15 min (6am – 7pm) / 30 min (7 – 10pm)
Annual Operating Cost Estimate	$2.05 million
Annual Operating Hours Estimate	20,500

Figure 18 - Alternative 1 Operations Summary

Alternative 1 – Summit Mall – Robust Service Level Option	
Peak Operational Vehicles	6
Roundtrip Length (mi)	11.92
Stations (total)	12
Average Station Spacing (mi)	0.98
Weekday Frequency (min)	10.6 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Saturday Frequency (min)	12.3 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Sunday Frequency (min)	12.3 min (6:30am – 7pm) / 30 min (7 – 9pm) / 60 min (9 – 11pm)
Annual Operating Cost Estimate	$2.79 million
Annual Operating Hours Estimate	27,851

Figure 19 - Alternative 1 Robust Service Levels Operations Summary

ALTERNATIVE 2 – DAMONTE RANCH

Route Description

Alternative 2 would provide service along South Virginia Street and Damonte Ranch Parkway between Meadowood Mall in the north and Damonte Ranch Town Center in the south, as shown in **Figure 20**.

Stations would be at Longley Lane, South Meadows Parkway, McCabe Drive, and Trinity Lane, and would connect riders to Bishop Manogue High School, and various residential, retail and employment destinations along S Virginia Street, mixed use retail and employment at the Damonte Ranch Town Center, and residences along Damonte Ranch Parkway.

To estimate the operational statistics shown in **21**, daily service frequency was assumed to be 15 minutes between 6am and 7pm and 30 minutes between 7pm and 10pm.

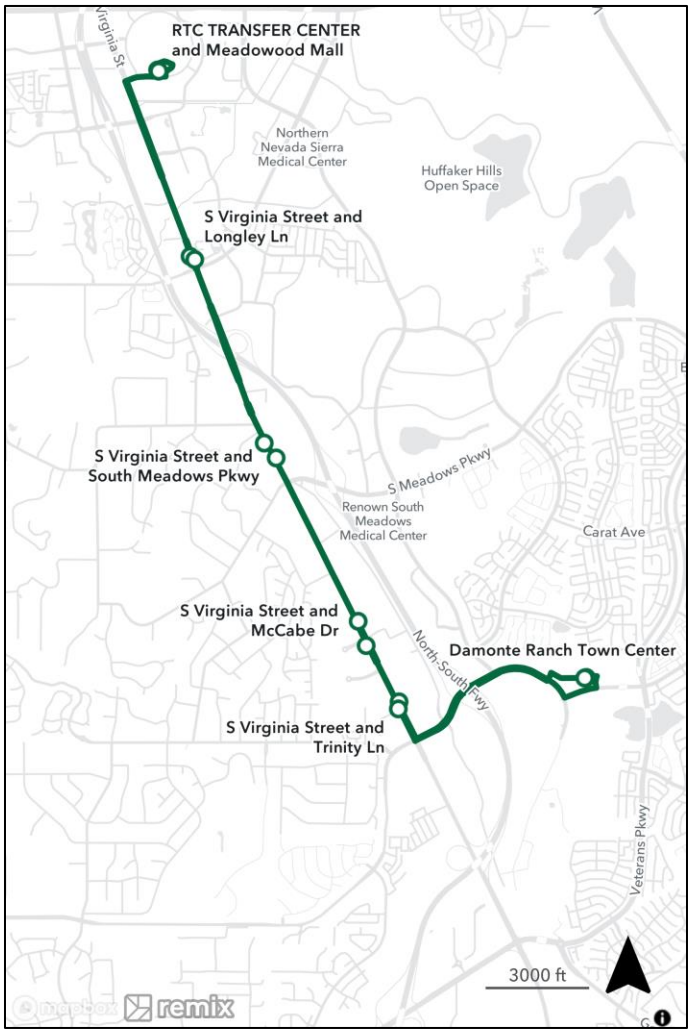

Figure 20 - Alternative 2 Alignment & Stations

Operational statistics were also estimated for a "Robust Service Level Option" where service levels and spans match those of existing Virginia Line BRT. In this scenario, buses would operate at the frequencies and spans indicated in **Figure 22**. The proposed stop and route within Damonte Ranch is preliminary and would need to be finalized as the project moves forward.

Alternative 2 – Damonte Ranch Town Center	
Peak Operational Vehicles	4
Roundtrip Length (mi)	11.07
Stations (total)	10
Average Station Spacing (mi)	1.11
Frequency (min)	15 min (6am – 7pm) / 30 min (7 – 10pm)
Annual Operating Cost Estimate	$1.95 million
Annual Operating Hours Estimate	19,400

Figure 21 - Alternative 2 Operations Summary

Alternative 2 – Damonte Ranch Town Center – Robust Service Level Option	
Peak Operational Vehicles	6
Roundtrip Length (mi)	11.07
Stations (total)	10
Average Station Spacing (mi)	1.11
Weekday Frequency (min)	10.6 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Saturday Frequency (min)	12.3 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Sunday Frequency (min)	12.3 min (6:30am – 7pm) / 30 min (7 – 9pm) / 60 min (9 – 11pm)
Annual Operating Cost Estimate	$2.64 million
Annual Operating Hours Estimate	26,378

Figure 22 - Alternative 2 Robust Service Levels Operations Summary

ALTERNATIVE 3 – SUMMIT MALL / DAMONTE RANCH LOOP

Route Description

Alternative 3 would operate as two independent loop routes, differentiated by a clockwise or counterclockwise direction of travel around the loop created by S Virginia Street, Damonte Ranch Parkway, Sage Hill Road, and Veterans Parkway. Each trip for both routes would begin and terminate at Meadowood Mall, extending to Summit Mall in the south, as shown in **Figure** .

Stations would be at Longley Lane, South Meadows Parkway, McCabe Drive, Trinity Lane, Damonte Ranch Parkway, Damonte Ranch Town Center, and Veterans Drive, and would connect riders to Bishop Manogue High School, Tamarack Casino, and mixed-use retail and residential destinations along S Virginia Street, Damonte Ranch Parkway, and Veterans Parkway.

To estimate the operational statistics shown in **Figure 24**, daily service frequency was assumed to be 15 minutes between 6am and 7pm and 30 minutes between 7pm and 10pm.[4]

Operational statistics were also estimated for a "Robust Service Level Option" where service levels and spans match those of existing Virginia Line BRT. In this scenario, buses would operate at the frequencies and spans indicated in the table below.

[4] Each loop route would operate independently at a 30-minute frequency from 6am – 7pm and a 60-minute frequency from 7 – 10pm. Service for both loop routes would overlap along S Virginia Street between Meadowood Mall and Damonte Ranch Parkway, creating 15-minute frequency from 6am – 7pm and 30-minute frequency from 7 – 10pm along that portion of the route. Bi-directional service along the loop portion of the route would operate at a 30-minute frequency from 6am – 7pm and a 60-minute frequency from 7 – 10pm.

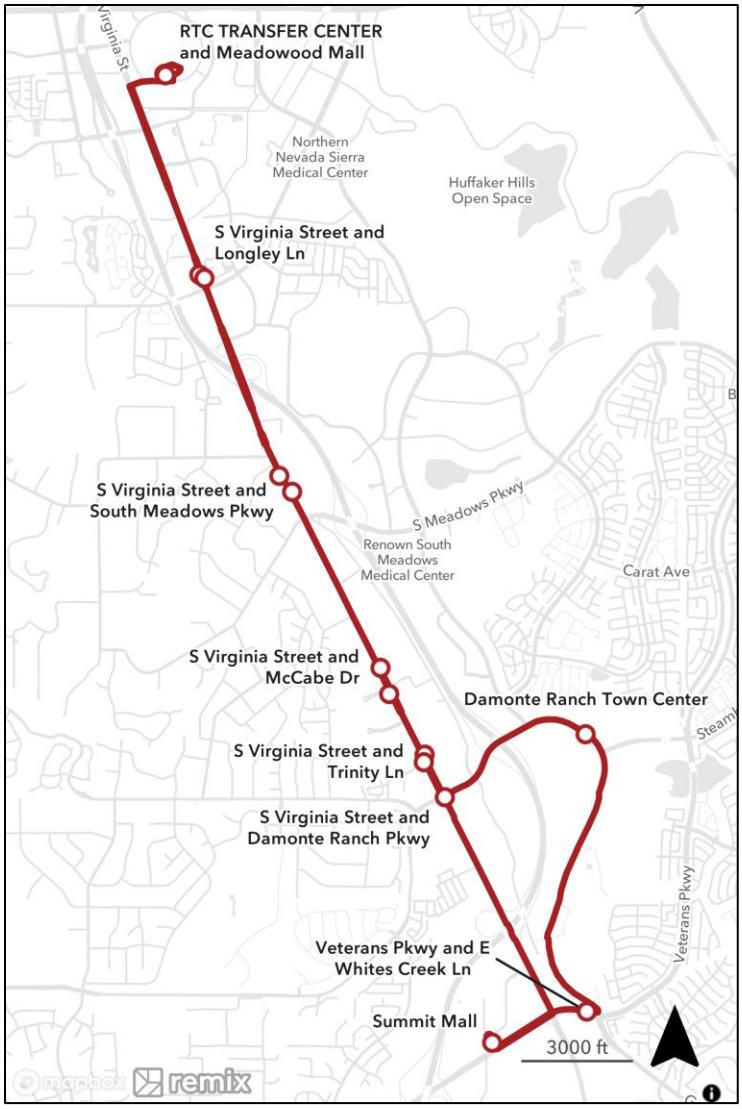

Figure 23 - Alternative 3 Alignment & Stations

Alternative 3 – Summit Mall / Damonte Ranch Loop	
Peak Operational Vehicles	4
Roundtrip Length (mi)	13.5
Stations (total)	15
Average Station Spacing (mi)	1.04
Frequency (min)	15 min (6am – 7pm) / 30 min (7 – 10pm)
Annual Operating Cost Estimate	$2.16 million
Annual Operating Hours Estimate	21,700

Figure 24 - Alternative 3 Operations Summary

Alternative 3 – Summit Mall / Damonte Ranch Loop – Robust Service Level Option	
Peak Operational Vehicles	6
Roundtrip Length (mi)	13.5
Stations (total)	15
Average Station Spacing (mi)	1.04
Weekday Frequency (min)[5]	10.6 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Saturday Frequency (min)[6]	12.3 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Sunday Frequency (min)[7]	12.3 min (6:30am – 7pm) / 30 min (7 – 9pm) / 60 min (9 – 11pm)
Annual Operating Cost Estimate	$2.90 million
Annual Operating Hours Estimate	29,046

Figure 25 - Alternative 3 Robust Service Levels Operations Summary

[5] On weekdays, each loop route would operate independently at a 21.2-minute frequency from 6am – 7pm, a 60-minute frequency from 7 – 10pm, and a 120-minute frequency from 10 – 11:59pm. Service for both loop routes would overlap along S Virginia Street between Meadowood Mall and Damonte Ranch Parkway, creating a 10.6-minute frequency from 6am – 7pm, a 30-minute frequency from 7 – 10pm, and a 60-minute frequency from 10 – 11:59pm along that portion of the route. Bi-directional service along the loop portion of the route would operate at a 21.2-minute frequency from 6am – 7pm, a 60-minute frequency from 7 – 10pm, and a 120-minute frequency from 10 – 11:59pm.

[6] On Saturdays, each loop route would operate independently at a 24.6-minute frequency from 6am – 7pm, a 60-minute frequency from 7 – 10pm, and a 120-minute frequency from 10 – 11:59pm. Service for both loop routes would overlap along S Virginia Street between Meadowood Mall and Damonte Ranch Parkway, creating a 12.3-minute frequency from 6am – 7pm, a 30-minute frequency from 7 – 10pm, and a 60-minute frequency from 10 – 11:59pm along that portion of the route. Bi-directional service along the loop portion of the route would operate at a 24.6-minute frequency from 6am – 7pm, a 60-minute frequency from 7 – 10pm, and a 120-minute frequency from 10 – 11:59pm.

[7] On Sundays, each loop route would operate independently at a 24.6-minute frequency from 6:30am – 7pm, a 60-minute frequency from 7 – 9pm, and a 120-minute frequency from 9 – 11pm. Service for both loop routes would overlap along S Virginia Street between Meadowood Mall and Damonte Ranch Parkway, creating a 12.3-minute frequency from 6:30am – 7pm, a 30-minute frequency from 7 – 9pm, and a 60-minute frequency from 9 – 11pm along that portion of the route. Bi-directional service along the loop portion of the route would operate at a 24.6-minute frequency from 6:30am – 7pm, a 60-minute frequency from 7 – 9pm, and a 120-minute frequency from 9 – 11pm.

ALTERNATIVE 4 – EXTENSION OF EXISTING VIRGINIA LINE BRT TO DAMONTE RANCH

Alternative 4 would extend the existing Virginia Line BRT south of Meadowood Mall, creating a continuous route between the University of Nevada, Reno in the north and Damonte Ranch in the south, as shown in **Figure 7.**

Between Meadowood Mall and Damonte Ranch, Alternative 4 would provide service along S Virginia Street and Damonte Ranch Parkway, with stations located at Longley Lane, South Meadows Parkway, McCabe Drive, and Trinity Lane. These stations would connect riders to Bishop Manogue High School, various residential, retail and employment destinations along S Virginia Street, mixed use retail and employment at the Damonte Ranch Town Center, and residences along Damonte Ranch Parkway.

Alternative 4 operational statistics were estimated through assuming service levels and spans that match those of existing Virginia Line BRT as shown in Figure . Buses would operate at the frequencies and spans indicated in the table below.

Alternative 4 – Damonte Ranch	
Peak Operational Vehicles	10
Roundtrip Length (mi)	23.43 (12.36 miles of the existing Viriginia Line with 11.07 being new service)
Stations (total)	36
Average Station Spacing (mi)	0.69
Weekday Frequency (min)	10.6 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Saturday Frequency (min)	12.3 min (6am – 7pm) / 30 min (7 – 10pm) / 60 min (10 – 11:59pm)
Sunday Frequency (min)	12.3 min (6:30am – 7pm) / 30 min (7 – 9pm) / 60 min (9 – 11pm)
Annual Operating Cost Estimate	$4.81 million
Annual Operating Hours Estimate	48,085

Figure 26 - Alternative 4 Operations Summary

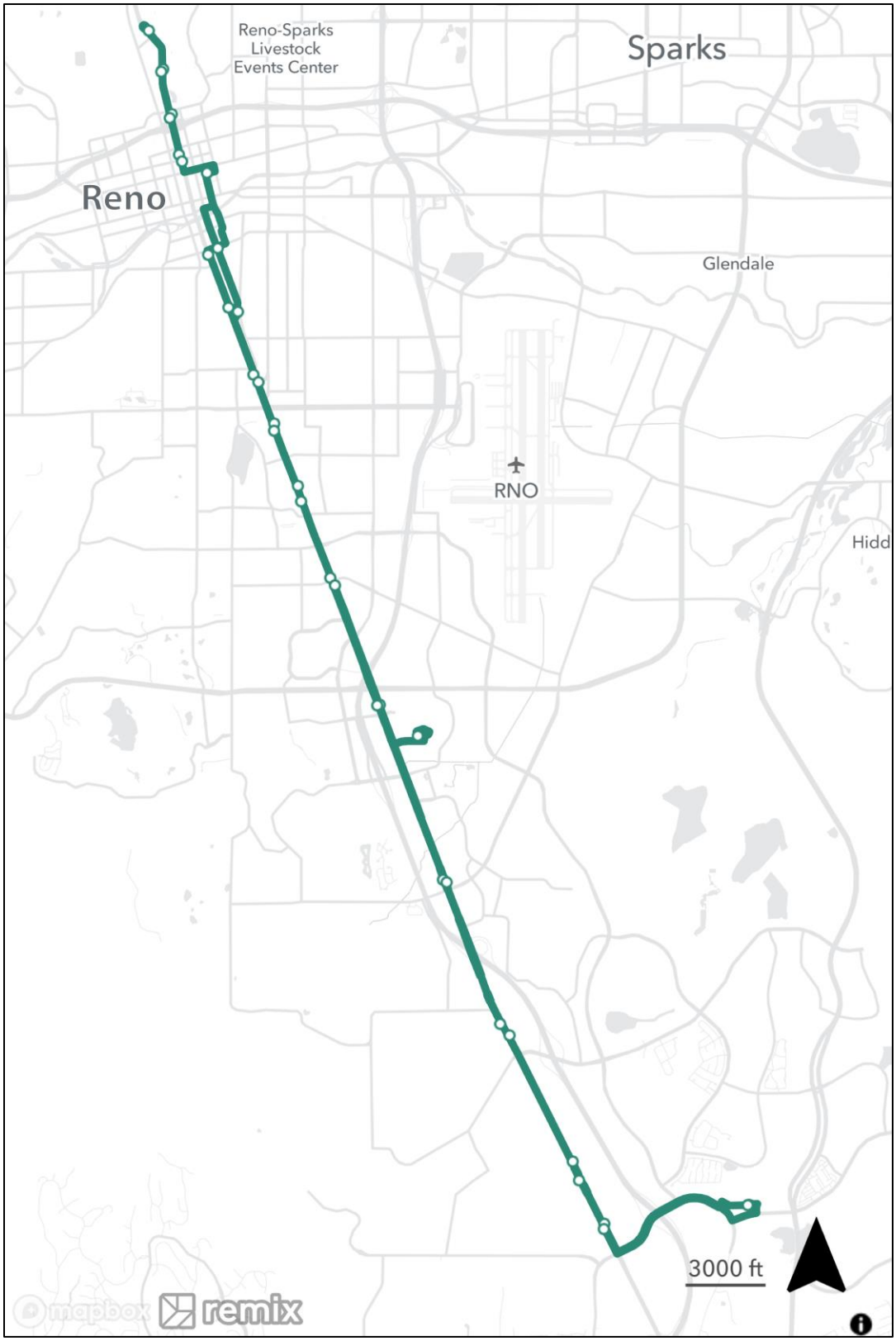

Figure 37 - Alternative 4 Alignment & Stations

ALTERNATIVES COMPARISON

A snapshot of the service and passenger experience pros and cons related to the four BRT service alternatives is provided below in **Figure 8**. As this corridor continues to develop, the potential service options could be updated to align station locations with new developments or pedestrian and bicycle facilities. These will be important factors in developing a final BRT service recommendation. Opportunities to connect with the planned FlexRIDE or Route 56 should be considered when comparing the benefits of potential service plans.

Alternative	Pros	Cons
Alternative 1 – Summit Mall	▪ Shorter roundtrip length resulting in lower estimated annual operating costs ▪ Most direct BRT route staying on the South Viriginia corridor ▪ ▪	▪ Fewest destinations served, does not directly serve Downtown Damonte missing a large ridership opportunity (lowest ridership potential of the alternatives) ▪ Would require connecting transit service or FlexRIDE to reach the Damonte Ranch destinations. ▪ Would require passengers traveling from the North Viriginia corridor to transfer to a new route.
Alternative 2 – Damonte Ranch	▪ Shortest roundtrip length ▪ Lowest estimated annual operating cost ▪ Serves one of the highest ridership nodes	▪ Fewer destinations served including existing density near Summit Mall (lower ridership potential) ▪ Would require connecting transit service or FlexRIDE to reach the Summit Mall destinations. ▪ Would require passengers traveling from the North Viriginia corridor to transfer to a new route.
Alternative 3 – Summit Mall/Damonte Ranch Loop	▪ Greatest number of destinations served (highest ridership potential)	▪ Longest roundtrip length ▪ Highest estimated annual operating cost

Alternative	Pros	Cons
	▪ Largest geographic coverage that would likely be more productive for generating ridership than connecting service that would require a transfer.	▪ Lower level of service in loop portion of route ▪ Would require passengers traveling from the North Viriginia corridor to transfer to a new route.
Alternative 4 – Extension of Current Virginia Line BRT to Damonte Ranch[8]	▪ Fewest number of peak operational vehicles required compared to scenarios where Alternatives 1, 2, or 3 and existing Virginia Line BRT service would be operated as separate routes ▪ Shortest roundtrip travel time compared to scenarios where Alternatives 1, 2, or 3 and existing Virginia Line BRT service would be operated as separate routes ▪ Lowest estimated annual operating cost compared to scenarios where Alternatives 1, 2, or 3 and existing Virginia Line BRT service would be operated as separate routes ▪ Passengers would not need to transfer for trips to the north Viriginia corridor	▪ Fewer destinations served including existing density near Summit Mall (lower ridership potential) ▪ Would require connecting transit service or FlexRIDE to reach the Summit Mall destinations.

[8] Alternatives 1, 2, and 3 above assume that BRT service south of Meadowood Mall would be provided through a separate bus route than that of the existing Virginia Line BRT north of Meadowood Mall. In contrast, Alternative 4 is an extension of the existing Virginia Line BRT, combining service north and south of Meadowood Mall into one bus route. Because of this, the "Pros" and "Cons" listed for Alternative 4 compare against scenarios where existing Viriginia Line service would be maintained and a new, separate BRT line south of Meadowood Mall, either Alternative 1, 2, or 3, would operate concurrently (i.e., for comparison with Alternative 4, operational statistics for Alternatives 1, 2, or 3 assume that two separate routes are operated and are combined with the statistics of the existing Virginia Line BRT). Assumed service levels and spans for Alternative 4 match those of the existing Virginia Line BRT.

Figure 48 - Pros and Cons of BRT Service Alternatives

Figure 9 displays a comparison of estimated operational statistics for the four BRT service alternatives, assuming service levels and spans that match those of the existing Virginia Line BRT. To provide an accurate comparison between Alternative 4, which includes the full Virginia corridor between the University of Nevada, Reno and Damonte Ranch, and the other three alternatives, operational statistics for Alternatives 1, 2, and 3 were combined with those of the existing Virginia Line BRT. This ensures that, for comparison purposes, each alternative considers the full Virginia corridor from the University of Nevada, Reno in the north to either Summit Mall or Damonte Ranch in the south.

As shown in **Figure 9**, there would be cost efficiencies associated with operating BRT service in the Virginia Street corridor south of Meadowood Mall as an extension of the existing Virginia Line BRT (Alternative 4) compared to operating service north and south of Meadowood Mall as two independent routes (Alternatives 1, 2, and 3). When determining whether to operate service south of Meadowood Mall as an extension of existing service, the ability to maintain on-time performance along the full route between the University of Nevada, Reno and Summit Mall or Damonte Ranch would need to be considered.

Alternative	Annual Operating Cost Estimate	Peak Operational Vehicles	Roundtrip Length	Stations	Annual Operating Hours Estimate
Existing Virginia Line + Alt 1 – Summit Mall	$5.89 million	13	24.26 mi	38	58,817
Existing Virginia Line + Alt 2 – Damonte Ranch	$5.74 million	13	23.41 mi	38	57,344
Existing Virginia Line + Alt 3 – Summit Mall/ Damonte Ranch Loop	$6.00 million	13	25.84 mi	41	60,012
Alt 4 – Existing Virginia Line Extension to Damonte Ranch	$4.81 million	10	23.43 mi	36	48,085

Figure 59 – Operations Comparison of BRT Service Alternatives

5 CORRIDOR RIDERSHIP FORECASTS

STOPS Ridership Modeling Forecasts

The Federal Transit Administration (FTA) has developed the Simplified Trips-on-Project Software (STOPS) that can be used to develop ridership forecasts for transit corridor projects. As part of this study, multiple STOPS model approaches were developed for the South Virigina Street corridor to evaluate ridership potential of the conceptual BRT service alternatives. The STOPS-based approaches relied on underlying Census data and a transit rider origin-destination survey conducted in 2017. Given the limited existing transit service/historical ridership and existing development in the project study area, using STOPS to forecast ridership for the South Viriginia corridor, especially the southern end of the corridor, proved challenging. The results were nonetheless useful in providing high-level verification of four conceptual BRT alignments and potential ridership scenarios identified in the population analysis shown in Figure 9. However, the STOPS model would need to be refined for a more formal FTA Alternatives Analysis, which is necessary if the RTC were to apply to the FTA for discretionary grants to fund a future extension of the Virginia Line.

Four conceptual alignment/service alternatives were evaluated with the STOPS model. The conceptual alternatives are described in greater detail in the next section (Section 3) of the report. In addition to the four conceptual BRT alternatives, two land use alternatives were developed, tested, and analyzed to determine the impact that transit-supportive land use outcomes might have on ridership forecasts. And finally, STOPS includes a setting that represents the "visibility" of various levels of partial-fixed guideway transit services, such as BRT. Higher visibility settings are intended to represent features that improve the reliability and attractiveness of BRT, such as exclusive lane and/or signal priority treatment. Multiple variations of the visibility setting were tested to determine the potential impact that BRT service enhancements might have on ridership forecasts.

Initial forecasts based off the STOPS model indicate that the BRT service alternatives could generate between 1,000 and 2,000 additional daily riders in the South Virginia Street corridor by 2050. The lower end of the range would represent basic BRT service without a transit-supportive land use future, while the higher end of the range includes enhanced BRT service along with the realization of transit-supportive land uses.

While the overall magnitude of the STOPS-based forecasts is lower than the population-based ridership projections discussed in Figure 9, it is perhaps more useful to focus on the significant percentage changes in ridership that emerged from the STOPS modeling and testing. Those percentage changes in ridership outcomes are discussed in further detail below, but overall, initial STOPS modeling suggests that **ridership forecasts could increase by 46% to 53% over initial baseline forecasts**.

Several key findings that emerged from the STOPS modeling have broader implications for subsequent phases of this project, as noted below:

- By a large margin, the existing Virginia Line consistently shows up as the strongest performer in terms of ridership. This is not only the case for near-term ridership forecasts, but also for the long-term. This confirms the existing Virginia Line as a logical foundational choice to build off and extend future service.
- Transit-supportive land uses matter. Sensitivity testing conducted with additional land use alternatives indicated that ***complementary land uses could boost ridership 15%-22%***.
- Stop location/spacing positively influences ridership. Average stop spacing for the existing Virginia Line is every half-mile. Proposed average stop spacing for the four conceptual BRT alternatives under consideration in this study is one-mile. ***Sensitivity testing conducted with the STOPS model during the latter phases of this study indicated that stop spacing closer to the existing Virginia Rapid Line could yield ridership gains of 15%-20%.***
- BRT enhancement treatments mean additional ridership. A visibility factor of .15 was used to calibrate the current year STOPS model. This factor represents the current level of visibility for the existing Virginia and Lincoln Lines. Factors of .30 and .50 were tested to determine the potential impact that enhancements might have on ridership outcomes for the four conceptual BRT alternatives under consideration in this study. The results of the sensitivity testing indicated that **BRT treatment enhancements such as exclusive lanes and/or signal prioritization could mean a ridership bump of 10%-26%**.

Should this project advance for further study, additional model calibration and refinement will be required to utilize STOPS for this corridor and for any FTA discretionary grant processes. In particular, the model would greatly benefit from a post-pandemic rider survey to update current behavior and more refined assumptions around future station access. While the forecasts based off the STOPS model are lower than the population-based ridership potential discussed in the previous section, they provide useful data points and findings to consider for the evaluation of the corridor for future BRT service.

The table below represents projected ridership from the STOPs model of the overall Virginia Line assuming a full route was in place from the UNR campus to Damonte Ranch/Summit Mall.

	2020 Baseline			2050 (Low)			2050 (High)		
	Virginia Line	Project	Total	Virginia Line	Project	Total	Virginia Line	Project	Total
Alternative 1	6,900	1,000	7,900	8,450	1,250	9,700	8,800	1,900	10,700
Alternative 2	6,850	950	7,800	8,350	1,200	9,550	8,800	1,900	10,700
Alternative 3	6,850	950	7,800	8,350	1,200	9,550	8,800	1,850	10,650
Alternative 4	6,700	850	7,550	8,250	1,050	9,300	8,650	1,500	10,150

Figure 30 – STOPS Model Forecasts for Alternatives

6 RECOMMENDATIONS FOR NEXT STEPS

FTA ALTERNATIVES ANALYSIS

Based on the preliminary ridership forecasts completed as part of this effort along with the recommendations for TOD supportive land use improvements, the corridor could be a candidate for future BRT capital investment. A full Alternatives Analysis incorporating an updated STOPS ridership model should be completed as a first step in determining the feasibility for a full BRT investment. The service alternatives outlined in Section 3 should be used as a starting point for options to evaluate.

An important part of an Alternatives Analysis process is to determine capital and operating funding sources to support a new transit capital investment. This should include an evaluation of whether to pursue a Federal Transit Administration (FTA) Small Starts Capital Investment Grant (CIG). **Figure 31** shows a summary of the evaluation criteria that are used to evaluate projects for eligibility and award of federal CIG grants.

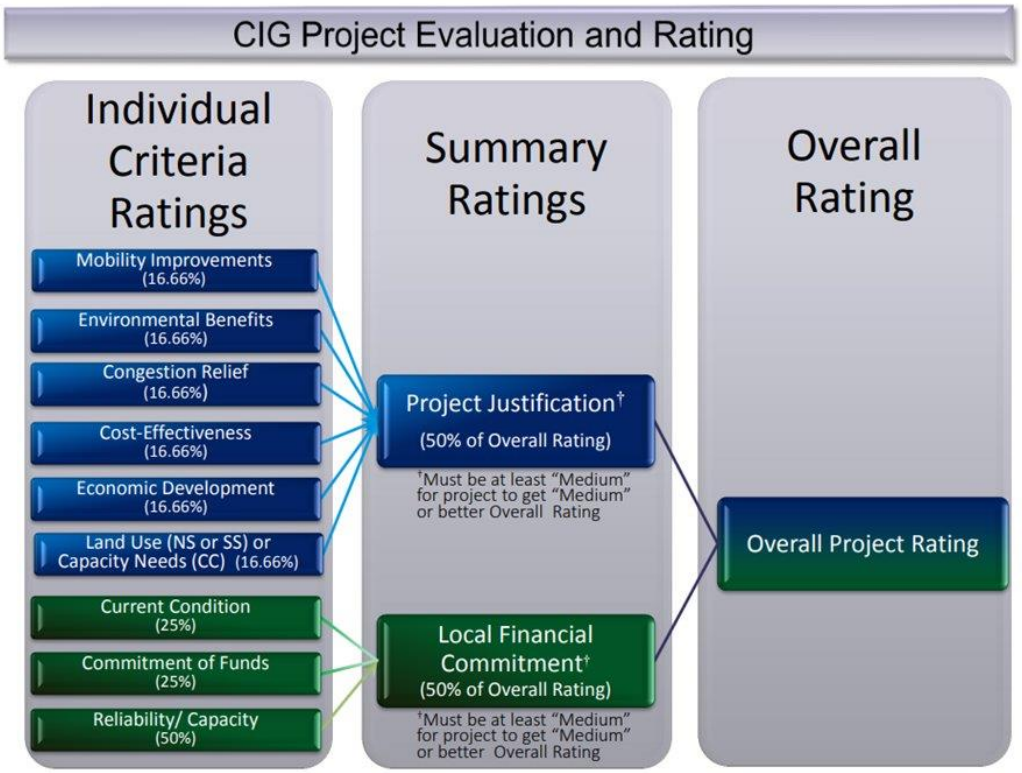

Figure 31- Capital Investment Grant Evaluation Criteria Summary

OPPORTUNITIES TO BUILD TRANSIT RIDERSHIP PRIOR TO BRT INVESTMENT

In addition to continuing with further study, there are opportunities to make incremental improvements to transit service along the South Virginia Street corridor that could build ridership to further support the future investment. These improvements could be made in coordination with new development along the corridor.

Phase 1 – Implement a Fixed Route Along on South Viriginia

Prior to the delivery of full BRT service along the South Virginia Street corridor south of Meadowood Mall, interim service at frequencies lower than that of full BRT but greater than service levels provided by the Regional Connector could be introduced between Meadowood Mall, Summit Mall, and Damonte Ranch.

This would be beneficial if funding for operating transit service along the corridor becomes available ahead of funding for capital expenditures associated with full BRT service and passenger amenities. Introducing a route along South Virginia Street could also assist RTC in starting to build a ridership base along the corridor south of Meadowood Mall that could help build community and funding support for full BRT service delivery. This interim service could supplement the existing, or work in conjunction with a modified Route 56 service. Introducing service as a local route prior to a full BRT investment is also an opportunity to evaluate which stops are the most productive and would be good candidates for capital investments or to help inform how many stations would be needed for a future BRT route.

Phase 2 – Bus Stop Improvements

An interim step for enhancing transit service within the study area could be the improvement of passenger amenities at existing bus stops along the portions of Route 56 and the RTC Regional Connector that overlap with any of the proposed alternatives described above. Within the quickly growing study area, RTC Washoe could coordinate with those responsible for the development of properties adjacent to existing or potential bus stops on the improvement of passenger facilities and safe access to them.

Phase 3 – BRT Service Implementation

After the implementation of interim transit service along the South Virginia Street corridor, ridership should be monitored to gauge the potential viability of BRT service within the study area. This interim service ridership, along with future ridership potential driven by planned changes in land use intensity and the enhanced service levels and passenger amenities associated with BRT, should be considered key factors in determining when BRT should be implemented.

In connecting the planned FlexRIDE on-demand service area to South Virginia Street BRT within the study area, considerations would need to be given to the provision of space within BRT station

footprints for on-demand transit use, the deployment of rides to align with fixed-route schedules, and the maintenance of sufficient vehicle capacity to handle peak-period demand connecting to fixed-route service. Potential connection points between FlexRIDE and South Virginia Street BRT are shown in **Figure 8**.

The analysis in this study suggests extending the existing Virginia Line route may be a good option to provide enhanced transit service to the South Viriginia study area. This could be done incrementally with an initial extension to Damonte Ranch. The service could be modified to serve additional stops or destinations in response to continued development along the corridor.