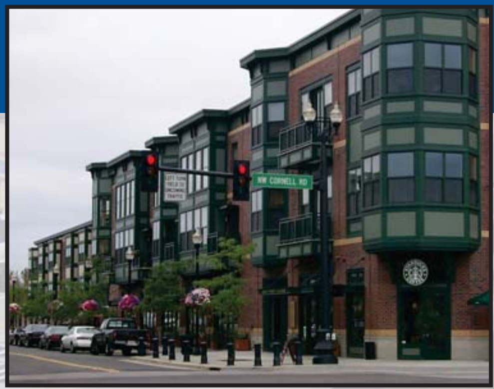
STATE STREET TRANSIT AND TRAFFIC OPERATIONS PLAN



TRANSIT OPERATIONS PLAN

January 2011

VRT
VALLEY REGIONAL TRANSIT

STATE STREET TRANSIT AND TRAFFIC OPERATIONS PLAN

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January 2011

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Valley Regional Transit

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Table of Contents

List of Figures

List of Tables

List of Acronyms

ACHD: Ada County Highway District
BRT: Bus Rapid Transit
CIM: Communities in Motion
CMAQ: Congestion Mitigation and Air Quality
COMPASS: Community Planning Association of Southwest Idaho
HOV: High-occupancy vehicle
ITD: Idaho Transportation Department
SAFETEA-LU: Safe Accountable Flexible Efficient Transportation Equity Act, a Legacy for Users
STP: Surface Transportation Program
TOD: Transit-oriented development
TTOP: Transit and traffic operations plan
VRT: Valley Regional Transit

1. Introduction

The State Street Transit and Traffic Operations Plan (TTOP) builds on previous plans and policy decisions that envision improvements that would create a transit supportive streetscape with good pedestrian and bicycle access and transit-oriented development (TOD). This Transit Operations Plan describes transit routing and operating concepts and how they were defined and evaluated as an integral part of the TTOP. This Plan also provides recommendations and an implementation strategy for transit service improvements in the corridor.

Background

Transit improvements in the State Street corridor have been included in planning and policy documents for the past several years. The TTOP study represents a major follow-on effort of the State Street Corridor Strategic Plan Study (February, 2004). The Strategic Plan considered a range of possible streetscape and operational scenarios for State Street. The study team and the community selected the transit scenario as their preferred vision for a multi-modal State Street. The transit scenario included Bus Rapid Transit (BRT)-style transit service in a shared high-occupancy vehicle (HOV) lane or an exclusive transit lane that had the following characteristics:

- Traffic signal priority
- Park-and-ride lots at nodes
- Enhanced pedestrian and bicycle facilities
- Transit supportive redevelopment at TOD nodes

Other plans and policies in the region also support the vision of improved transit operations on State Street. Some of these plans and policies are highlighted below:

Communities in Motion

Communities in Motion (CIM) was adopted by the Community Planning Association of Southwest Idaho (COMPASS) Board in 2006 as the Regional Transportation Plan for the Treasure Valley. Both the adopted plan and the CIM update that is currently underway, identify BRT on State Street between Eagle and downtown Boise as an unfunded element of the long-range plan.

30th Street Area Master Plan

A draft plan was completed in June 2009 and related policy changes were included in the Blueprint Boise in March 2010. The plan describes State Street as a possible BRT alignment.

State Street Corridor Transit Oriented Development Policy Guidelines

These guidelines were developed in April 2008 to provide guidelines or policies to guide transit-oriented development in the corridor.

Treasure Valley in Transit

This is a comprehensive plan adopted by the Valley Regional Transit (VRT) Board in 2006 for transit service in the Treasure Valley. Treasure Valley in Transit describes seven transit service typologies including Premium Service, Express Service, Primary Service and Secondary Service. Treasure Valley in Transit includes Premium Service on State Street between Eagle and downtown Boise, Express Service via SH 44/State Street from Caldwell to downtown Boise and Primary Service via SH 44/State Street from Middleton to downtown Boise.

Garden City Comprehensive Plan (2006)

This plan supports significant improvement to transit service on State Street and includes policies that encourage transit-oriented development at appropriate locations.

Blueprint Boise (Draft May 2010)

This is a draft of a new comprehensive plan for Boise. The plan supports development of bus rapid transit on State Street and calls for transit-oriented developments at key nodes, pedestrian-oriented development patterns and rehabilitation of strip centers through façade and landscape improvements.

Eagle Comprehensive Plan (August 2009) and Downtown Plan (Draft June 2010)

The Comprehensive Plan includes policies that encourage local and regional transit, park-and-ride lots and transit amenities. The Downtown Plan encourages planning for transit improvements and improved pedestrian facilities.

This transit operations plan builds upon these previous plans and adopted policies to describe transit service in the State Street corridor that would support and be compatible with BRT capital improvements. This service plan is designed to provide a level of transit accessibility and improved transit travel times that could support TOD nodes along the corridor.

The Transit Operations Plan includes several elements:

- Description of Existing Transit Service
- Transit Service in 2035
- State Street BRT Scenario Analysis
- Bus Rapid Transit Concepts
- Implementation Strategy

The purpose of the plan is to evaluate and recommend transit service improvements that support the vision of State Street as a multi-modal street serving relatively dense, transit-oriented development at major nodes. This report describes the analysis methods and approach. This plan has been developed to build upon the adopted plans and policies with input from VRT, ACHD, the City of Boise, Garden City, City of Eagle, ITD and COMPASS.

2. Description of Existing Transit Service

Transit service in the Treasure Valley is provided by Valley Regional Transit. VRT operates 15 local routes in Boise, four routes serving Nampa and Caldwell, and five inter-county routes with express and limited-stop service between Boise and the Nampa/Caldwell area. The following describes the existing transit routes serving the region. These are shown in Figure 1 and described in Table 1.

Figure 1. Existing VRT Transit Routes

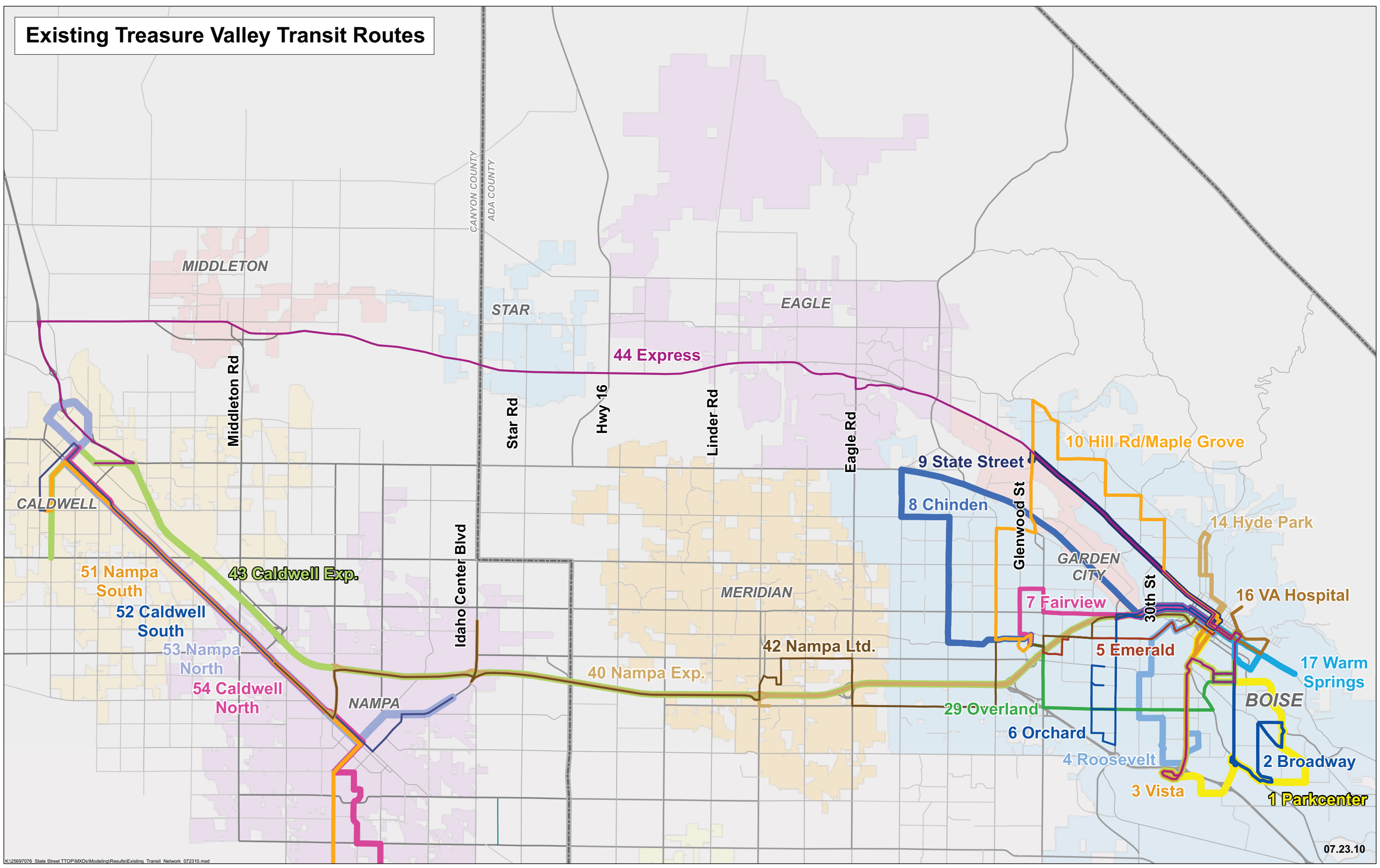


Table 1. Description of Existing VRT Transit Routes

Route	Destinations	Span of Service	Frequency of Service
Boise Area Routes			
Route 1 - Parkcenter	Downtown Boise to southeast Boise.	5:40 AM to 6:40 PM Monday through Friday.	Every 30 minutes during peak. Every 60 minutes during midday.
Route 2 - Broadway	Downtown Boise, Broadway Avenue, and southeast Boise.	6:45 AM to 7:15 PM Monday through Friday. 7:45 AM to 5:55 PM on Saturday.	Every 60 minutes.
Route 3 - Vista	Downtown Boise to Boise Airport via Vista Ave.	5:55 AM to 6:35 PM Monday through Friday. 7:45 AM to 6:00 PM on Saturday.	Every 20 minutes during peak weekdays. Every 40 minutes during the midday weekdays. Every 60 minutes on Saturday.
Route 4 - Roosevelt	Downtown Boise to south Boise near Boise Airport via Roosevelt, Latah, and Owyhee.	6:10 AM to 7:10 PM Monday through Friday.	Every 30 minutes during peak. Every 60 minutes during midday.
Route 5 - Emerald	Downtown Boise to Boise Towne Square Mall.	6:10 AM to 7:05 PM Monday through Friday. 7:45 AM to 6:05 PM on Saturday.	Every 30 minutes during peak. Every 60 minutes during midday. Every 60 minutes on Saturday.
Route 6 - Orchard	Downtown Boise to southwest Boise via Orchard.	6:15 AM to 7:09 PM Monday through Friday. 7:45 AM to 6:09 PM on Saturday.	Every 30 minutes during peak. Every 60 minutes during midday. Every 60 minutes on Saturday.
Route 7 - Fairview	Downtown Boise to Boise Towne Square Mall via Fairview.	5:40 AM to 6:55 PM Monday through Friday. 7:45 AM to 6:10 PM on Saturday.	Every 40 minutes on weekdays. Every 60 minutes on Saturday.
Route 8 - Chinden/Five Mile	Downtown Boise to Hewlett Packard via Boise Towne Square Mall and Five Mile.	7:20 AM to 5:54 PM Monday through Friday plus 2 morning and 2 evening express runs (Route 8X).	Every 40 to 60 minutes all day.
Route 9 - State Street	Downtown Boise to State Street/ Gary Lane shopping area via State Street.	5:15 AM to 7:05 PM Monday through Friday plus 2 morning and 2 evening express runs (Route 9X). 7:45 AM to 6:35 PM on Saturday.	Every 30 minutes on weekdays. Every 60 minutes on Saturday.
Route 10 - Hill Road/Maple Grove	Downtown Boise to State Street/ Gary Lane shopping area via Hill Road and to Boise Towne Square Mall via Glenwood and Maple Grove.	5:45 AM to 7:40 PM Monday through Friday.	Every 60 minutes all day.
Route 11 - Garden City	Downtown Boise to Garden City via Fairview, Chinden, and Adams.	Midday only, 9:45 AM to 3:14 PM Monday through Friday.	Every 60 minutes.
Route 14 - Hyde Park	Downtown Boise to Parkhill and Bogus Basin via 15th and Harrison.	5:45 AM to 6:35 PM Monday through Friday. 8:15 AM to 5:35 PM on Saturday.	Every 30 minutes during peak. Every 60 minutes during midday. Every 60 minutes on Saturday.

Route	Destinations	Span of Service	Frequency of Service
Route 16 - VA Shuttle	Downtown Boise to VA Medical Center and then Coston via Washington and Warm Springs.	6:15 AM to 6:40 PM Monday through Friday.	Every 60 minutes all day.
Route 17 - Warm Springs	Downtown Boise to Old Penitentiary Road via Warm Springs.	6:45 AM to 6:10 PM Monday through Friday.	Every 60 minutes all day.
Route 29 - Overland	Boise State University (BSU) to Boise Towne Square Mall via Overland and Cole.	6:45 AM to 7:05 PM Monday through Friday. 7:45 AM to 6:05 PM on Saturday.	Every 30 minutes during peak. Every 60 minutes during midday. Every 60 minutes on Saturday.
Nampa/Caldwell Routes			
Route 51 - Nampa South	Travels southeast on Nampa-Caldwell Blvd. and serves the southern portion of Nampa.	7:34 AM to 7:10 PM Monday through Friday.	Every 60 minutes all day.
Route 52 - Caldwell South	Travels northwest on Nampa-Caldwell Blvd. and serves the southern portion of Caldwell.	6:48 AM to 7:29 PM Monday through Friday.	Every 60 minutes all day.
Route 53 - Nampa North	Travels southeast on Nampa-Caldwell Blvd. and serves the northern portion of Nampa, including the Idaho Center and the College of Western Idaho.	6:59 AM and 7:44 PM Monday through Friday.	Every 60 minutes all day.
Route 54 - Caldwell North	Travels northwest on Nampa-Caldwell Blvd. and serves the northern portion of Caldwell.	6:20 AM to 7:56 PM Monday through Friday.	Every 60 minutes all day.
Note: These four routes together form a single trunk route along Nampa-Caldwell Blvd. with 30 minute all-day frequencies.			
Inter-County Routes			
Route 40 - Nampa/Meridian Express	BSU to Karcher Mall via downtown Boise and I-84 express.	Peak hours only Monday through Friday.	Every 30 minutes during peak.
Route 42 - Nampa/Meridian Limited Stop	BSU to Karcher Mall via downtown Boise and I-84 with limited stops.	Primarily peak hour service Monday through Friday with limited midday service.	Every 60 minutes during peak. Every 3 hours during midday (2 round trips).
Route 43 -Caldwell Express	Boise Airport to downtown Caldwell via BSU, downtown Boise, and I-84.	Monday through Friday.	1 trip per day each way during peak.
Route 44 - Express	Boise Airport to downtown Caldwell via BSU, downtown Boise, and SH 44.	Monday through Friday.	1 trip per day each way during peak.
Route 45 - Express	BSU to College of Western Idaho.	Midday and late evening service only Monday through Friday.	2 Mid morning runs and service every 60 minutes in the evenings.

State Street Corridor Transit

The State Street corridor is currently served by three bus routes: Route 9 State Street, Route 44 Express, and Route 10 Hill Road/Maple Grove. Routes 9 and 10 provide regularly scheduled service as far west as Glenwood Street/Gary Lane. West of Glenwood Street/Gary Lane, service is limited to one morning and one evening trip provided by Route 44 Express.

Route 9 State Street provides daily, local service on State Street between downtown Boise and Glenwood Street/Gary Lane. Route 9 has the highest ridership in the VRT system with an average of 690 riders per day between October 2008 and September 2009 for an average annual ridership of over 200,000[1]. This route accounts for approximately 14 percent of the average annual ridership on the entire VRT system (1.4 million riders in 2009).

Route 44 Express provides one morning peak period run from Caldwell to downtown Boise, BSU, and the Boise Airport and one evening peak period run from the Boise Airport, BSU, and downtown Boise to Caldwell each weekday. Route 44 carried an average of 30 riders per day and 6,600 per year between October 2008 and September 2009.

Route 10 Hill Road/Maple Grove serves neighborhoods north of State Street and it carries approximately 355 riders per day for an average annual ridership of 91,000.

1 Valley Regional Transit data

3. Transit Service in 2035

Elected officials and other policy makers in the valley recognize that significant improvement in transit service frequency and coverage is needed in order to support policy objectives adopted through the Communities in Motion regional plan, local comprehensive plans and the State Street Corridor Strategic Plan.

In preparing the Communities in Motion plan update for year 2035, COMPASS and VRT jointly developed concepts for future transit service in the Treasure Valley. One concept relied on existing revenue sources and as such assumed no new transit service over and above what is provided today. This future year transit concept was analyzed for the State Street TTOP and referred to as the Low Transit Network. A second future transit concept, called the High Transit Network assumed the ability to generate additional revenue to support a significant growth in transit service in the valley. This High Transit Network provided the basis for most of the scenarios analyzed for the State Street TTOP project.

The 2035 High Transit Network includes many new bus routes serving the valley as well as light rail operating between Caldwell and downtown Boise along the Boise Cutoff railroad corridor. For the State Street TTOP, the analysis scenarios included the overall system improvements in the High Transit Network as well as different strategies for transit service improvements on the State Street corridor.

2035 Low Transit

The 2035 Low Transit Network was analyzed as the baseline, funded network for 2035. This network is included as the Financially Constrained (i.e. funded) transit network included in the 2035 Communities in Motion update model. The Low Transit Network provides a point of comparison with the High Transit Network and the various State Street transit analysis scenarios.

With the Low Transit Network, the three routes that would operate in the State Street corridor are the same as the three existing bus routes: Route 9 State Street, Route 10 Hill Road/ Maple Grove, and Route 44 Express. These are summarized in Section 2 and described in further detail below. Figure 2 shows the State Street corridor routes included in the 2035 Low Transit network.

Route 9 State Street

Route 9 State Street is a local route serving a heavily traveled commercial corridor. It is the highest ridership route in the current VRT system. It serves downtown Boise, Boise High School, the Downtown YMCA, North Junior High, and the State Street/Gary lane shopping area.

Route 9 serves the downtown Boise transit mall on Main Street between 9th Street and Capitol Boulevard. It connects to State Street via Capitol Boulevard and 8th Street (northbound) and 9th Street (southbound). It travels northwest on State Street, making stops every few blocks. The route terminates at Glenwood Street, serving the State Street/ Gary Lane shopping area.

In the 2035 Low Transit Network, Route 9 would operate at 30-minute headways all day with a daily span of service of 14 hours.

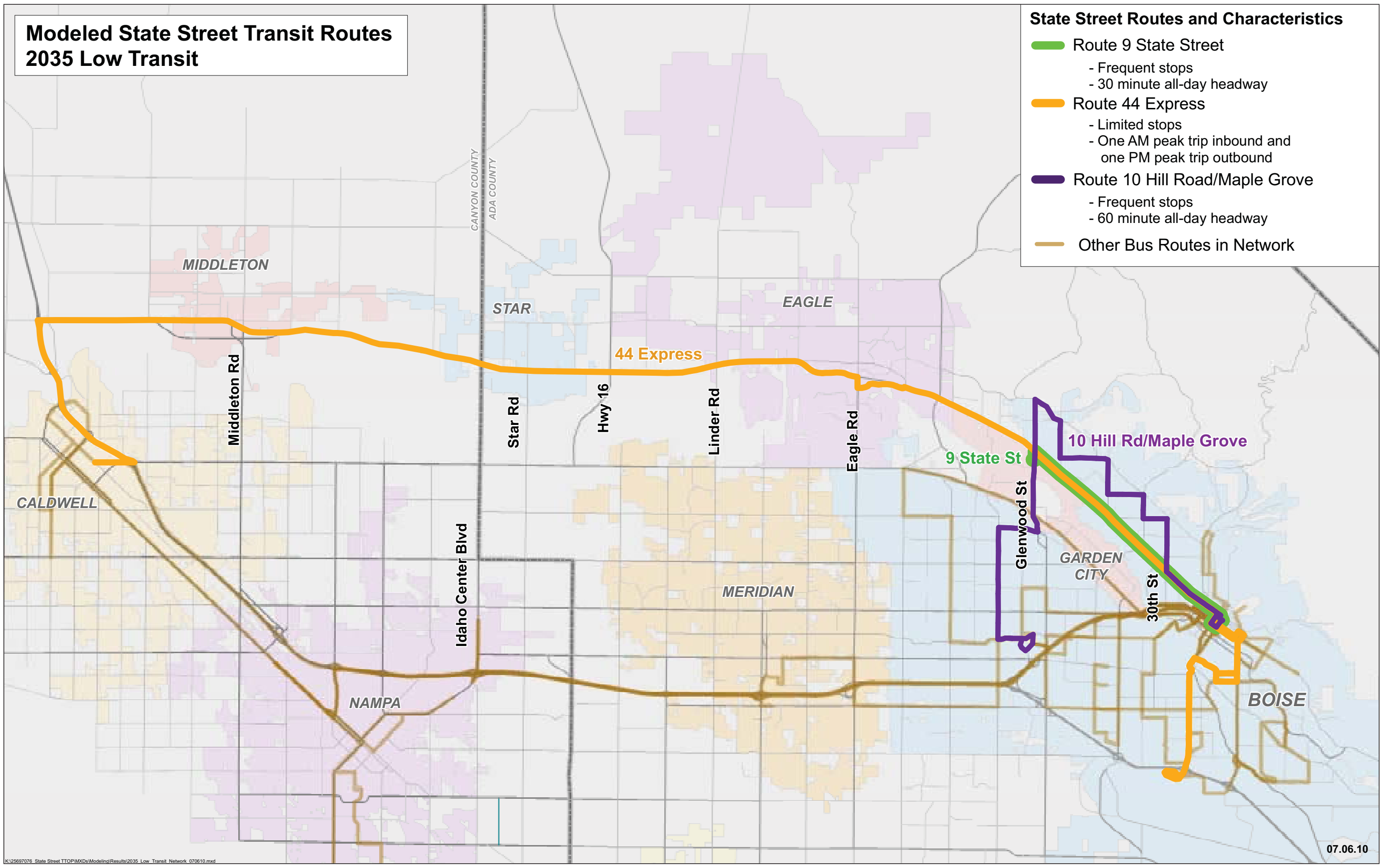
Route 10 Hill Road/Maple Grove

Route 10 serves the residential areas north of State Street between downtown Boise and Glenwood Street and continues south on Glenwood and Maple Grove Streets to the Boise Towne Square Mall. Route 10 connects downtown Boise, Boise High School, the Downtown YMCA, Northgate Mall, Hawks Stadium, Expo Idaho, Capital High School, and Boise Towne Square Mall.

Similar to Route 9, Route 10 Hill Road/Maple Grove would serve the downtown Boise transit mall on Main Street between 9th Street and Capitol Boulevard, and connect to State Street via Capitol Boulevard and 8th Street (northbound) and 9th Street (southbound). Route 10 then runs northwest on State Street as far as 28th Street, where it turns north to Hill Road. At Gary Lane, Route 10 turns south, crosses State Street, and follows Glenwood Street and then Maple Grove Street. At Emerald Street, the route turns east and terminates at the Boise Towne Square Mall Park-and-Ride.

Route 10 was included in the 2035 Low Transit Network with a 60-minute headway and a span of service of 14 hours.

Figure 2. 2035 Low Transit Network Routes



Route 44 Express

In the Low Transit Network, Route 44 Express is a peak-hour express route serving commute trips along the State Street/ SH 44 corridor connecting Caldwell, Middleton, Star, Eagle, downtown Boise, BSU and the Boise Airport.

Route 44 Express runs north from the Boise Airport to BSU via Vista Avenue, then east through the campus to Broadway Avenue, where it turns north and heads into downtown Boise. It runs along Idaho and Main Streets serving the downtown transit mall, and then north on 9th Street to State Street. Route 44 follows State Street/SH 44 west to I-84, where it turns south and terminates in downtown Caldwell. The route provides limited-stop service, with stops at 32nd Street, Horseshoe Bend Road, Eagle Riverside Park-and-Ride, Star, Middleton, and downtown Caldwell.

2035 High Transit

The 2035 High Transit Network would significantly increase transit service throughout the Treasure Valley. This network represents a vision of transit playing an important role in the growth of the Treasure Valley over the next twenty years. Plans and policies envision improved transit service, pedestrian and bicycle environment, and transit-oriented development on State Street.

The 2035 High Transit Network would establish a relatively dense network of bus routes, including increased service to downtown Boise and the other regional downtowns and several new cross-town routes. Light rail was assumed to operate on the Boise Cutoff Railroad connecting downtown Boise to Meridian, Nampa, and Caldwell.

Treasure Valley in Transit

The vision of significantly improved transit service in the State Street corridor and in the region overall, has been described in a number of documents. Treasure Valley in Transit is VRT's comprehensive plan to expand transit service in the Treasure Valley. The High Transit Network was developed to be consistent with Treasure Valley in Transit, which calls for:

- More routes and more frequent service within cities.
- More express bus service between cities.
- The initiation of rapid transit service.
- New transit centers and stops. [2]

2 Treasure Valley in Transit: http:/www.valleyregionaltransit.org/Portals/0/TreasureValleyInTransit/TVITPlan.pdf

Treasure Valley in Transit defines categories of transit service types. The plan calls for three types of service in the State Street corridor.

- Primary Service
- Express Service
- Premium Service

These service types define route frequencies, types of connections, and frequency of stops. Treasure Valley in Transit defines them as follows.

Primary Service

Primary Service would provide a direct link between major activity centers. Transit frequency would be every 15 to 30 minutes during peak hours and every 30 to 60 minutes during off-peak, including early morning and late evening. Primary service would have frequent stop spacing to provide for local trips. On State Street, Primary Service would operate from downtown Boise to Middleton.

Express Service

Express Service would connect park-and-ride lots with major employment centers. The service would run frequently during commute hours. On State Street, Express Service would be provided from downtown Boise to I-84 and connecting to downtown Caldwell.

Premium Service

Premium Service would run on major corridors, connecting park-and-ride lots with city centers. Frequent service would be provided with 15 to 30 minute frequencies all day, including early morning, late evening, and weekends. Routes would have limited stops to provide rapid regional travel and could utilize HOV or exclusive transit lanes. On State Street, Premium Service would be provided between downtown Boise and downtown Eagle.

2035 High Transit Route Definitions

The 2035 High Transit Network was designed to be consistent with the vision laid out in Treasure Valley in Transit. The High Transit Network would include the following routes on State Street. These are illustrated in Figure 3.

State Street Primary

This route would be the main trunk line on State Street, running from downtown Boise to Middleton with stop spacing every one-half to one mile. Buses would run every 15 minutes during peak hours and every 30 minutes during off-peak hours. Buses would also run during the early morning, late evening, and weekends. This route would be similar to the existing Route 9 State Street, but with higher frequency and service extended west from Glenwood Street to Middleton.

State Street Express

This route would provide peak-only service on State Street between downtown Boise and I-84 at the western end of the corridor. The State Street Express would run every 30 minutes during peak hours. There would be no off-peak service. The State Street Express would operate with limited stops to provide rapid service through the corridor, with stops every two to three miles. This route would be similar to the existing Route 44 State Street Express, but with higher frequency and a few additional stops.

Additional State Street Routes

In addition to the two routes that specifically serve State Street, the following three routes would add additional layers of service to State Street between downtown Boise and downtown Eagle. Each route would function partly as a feeder route and upon accessing State Street, would operate with the limited stops served by the State Street Express. These routes would run every 15 minutes during peak hours and every 30 minutes during off-peak hours, including early morning, late evening, and weekends.

- **State Eagle Direct:** This route would branch off from State Street and head north on Eagle Road to serve anticipated new growth in the foothills.
- **Eagle Foothills West Direct:** This route would branch off from State Street at Linder Road and continue north to serve the Northwest Foothills area.
- **Idaho Center/Star/Boise:** This route would run on State Street between downtown Boise and Eagle, and then follow Floating Feather Road to downtown Star. From Star, the route would head south on Star Road and Idaho Center Boulevard to connect with the Boise Cutoff light rail line at the Idaho Center.

These five routes together would provide a very high level of transit service on State Street between downtown Boise and Eagle (some stops would have service every three to four minutes in this segment). This is consistent with Treasure Valley in Transit's classification of State Street as a Premium Service corridor. All five routes would serve the proposed downtown Boise multimodal center, accessing State Street via 11th and 12th Streets.

The route structure is a fundamental consideration in designing a BRT system. One advantage of a BRT system is its ability to provide multiple bus routes on a single trunk line that serve different end points. This branching route structure (shown in Figure 3) is particularly advantageous in a dispersed metropolitan area, such as the Treasure Valley. This structure is able to provide a "one-seat" ride from multiple outlying areas to a central downtown. With multiple routes converging on the trunk line, this enables the trunk portion of the system to have very high-frequency service. This branching route structure was selected for the High Transit Network analysis in order to maximize the number of "one-seat" rides that would be possible with the system.

A different route structure concept that was considered and operates similar to a light rail system is shown in Figure 4. This route structure, known as "light rail lite," would have a single trunk route providing very frequent service to all stations on State Street (similar to the State Street Primary route described above). With this concept, all off-line service would be provided by feeder bus routes which provide the ability to extend the reach of the system. This concept would require more passengers to transfer between the trunk route and the feeder bus routes. This type of route structure works best where there is sufficient density to enable both the feeder routes and the trunk route to operate at high frequencies and keep transfer times short. However, in a region with less density, a branching route structure tends to provide the more attractive option and would likely attract higher ridership.

For analysis purposes, the project team chose a branching route structure as the primary 2035 High Transit Network configuration (shown in Figure 3). The team also decided to use the model to test the difference between the branching route structure and the "light rail lite" structure with separate feeder routes and a trunk line. This strategy is discussed further in Section 4.

2035 Ridership in the State Street Corridor

The 2035 High Transit Network would include more robust transit service than the 2035 Low Transit Network, which would result in much higher transit ridership system wide and within the State Street corridor. In 2010, fewer than one percent of all trips within the State Street corridor were on transit. The proportion of trips on transit is forecast to increase to approximately 1.4 percent in 2035 with the Low Transit Network. With the 2035 High Transit Network, the share of trips on transit in the State Street corridor would nearly double to 2.6 percent of all trips.

Figure 3. 2035 High Transit Network State Street Routes

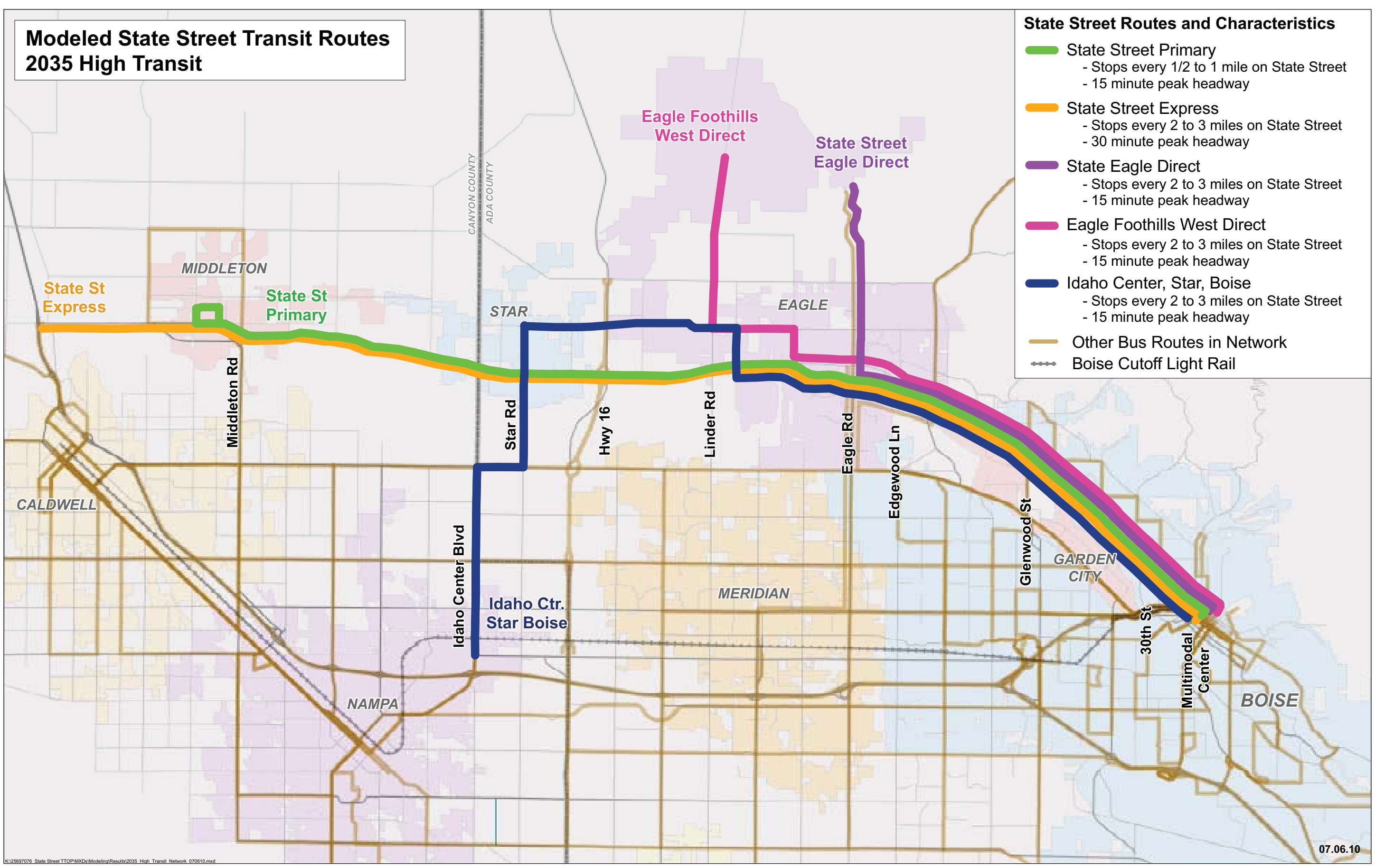
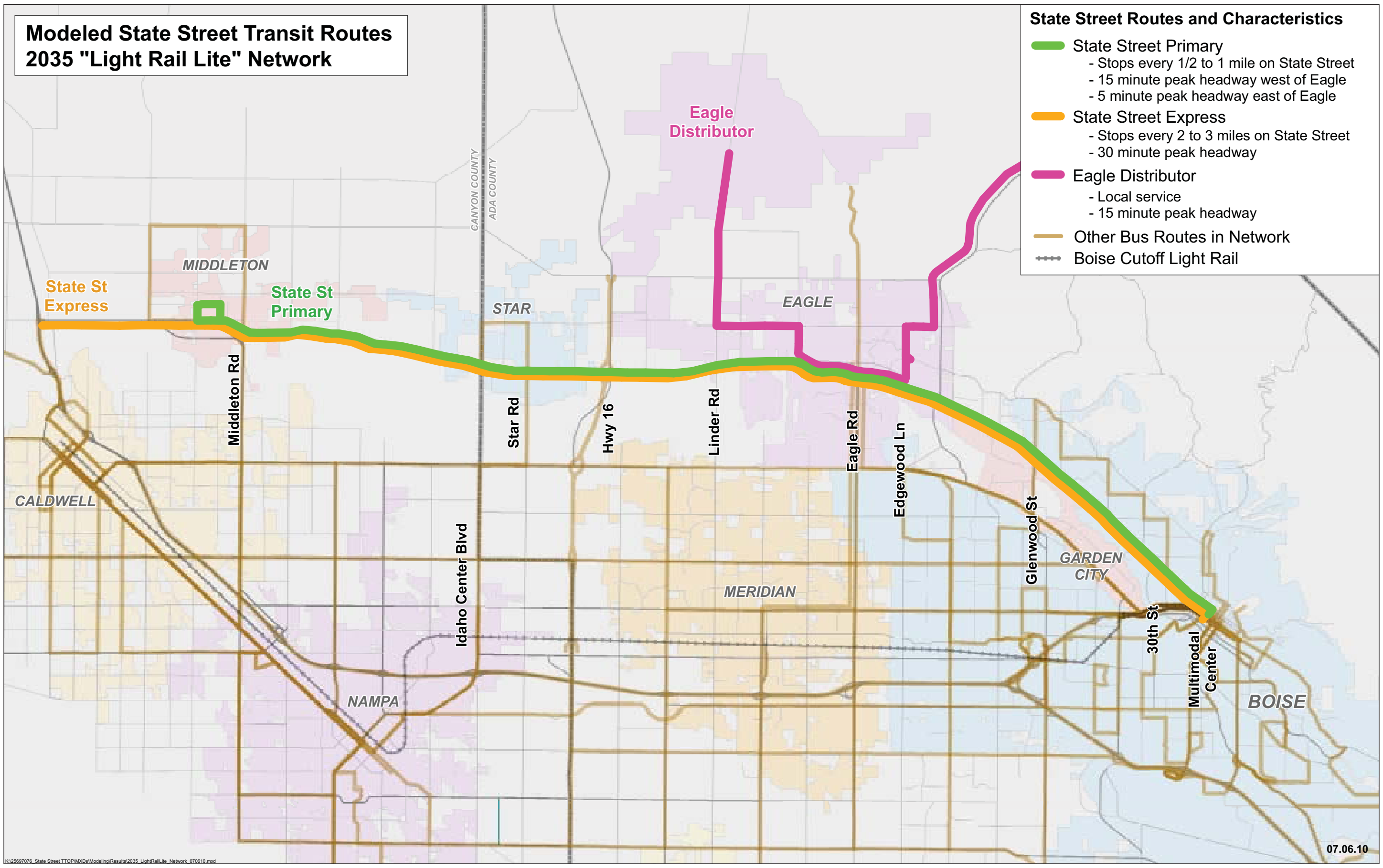


Figure 4. "Light Rail Lite" Route Structure



This mode share for transit trips in the corridor is similar to transit shares found in similar corridors being considered for bus rapid transit improvements. For example, Utah Transit Authority (UTA), the transit operator in the Salt Lake City region, reports a transit mode share of 0.9 percent for trips within the 5400 South study corridor and 2.2 percent for trips within the 1300 East and 400 South corridor (for year 2015) from recent BRT corridor modeling work[3]. The recently completed Environmental Assessment for the Pioneer Parkway BRT line in Eugene-Springfield, Oregon, reports a transit mode share for trips within the study corridor destined for downtown Springfield of 2.2 to 2.4 percent (in year 2025).[4]

3 Gregory Macfarlane, UTA, e-mail communications on May 6, 2010

4 Lane Transit District, Bus Rapid Transit System Improvements for the Pioneer Parkway Corridor, Springfield Oregon, September 2006, page 4-30. http://www.ltd.org/search/showresult.html?versionthread=589610273b7846b109cbc028f2a61e0b

4. State Street BRT Scenario Analysis

In order to evaluate how effective various BRT-style treatments could be on State Street, several transit scenarios were developed to model in the COMPASS travel demand model and analyze transit travel times and ridership. The 2035 High Transit Network was used as the base transit network to test the BRT-style capital improvements in the State Street corridor. The study team developed a set of 2035 modeling scenarios that were structured to answer key transit performance and traffic operations questions. These scenarios were developed to test the following BRT improvements and roadway configurations:

Queue-bypass lane with separate signal phase giving priority to the bus Portland, OR

Queue-bypass lanes and transit signal priority

A queue-bypass lane at the approach to a signalized intersection allows a bus to bypass other traffic waiting at a red light. To be effective, a queue-bypass lane must be long enough to reach the typical back of queue. Often existing right-turn lanes are used as queue-bypass lanes. Signal priority treatments include communication equipment that enables a signal to stay green longer or turn green sooner if a bus is behind schedule. They can also include a separate signal for a queue-bypass lane that turns green prior to the adjacent signals, allowing a bus to merge ahead of adjacent traffic.

Widening to five lanes between Ballantyne Lane and SH 16

One scenario tests the effects of widening State Street from two lanes to five lanes between Ballantyne Lane and SH 16 in conjunction with queue-bypass lanes and transit signal priority.

Exclusive transit lanes with signal preemption

A BRT operating in exclusive lanes can operate like a light rail line, being granted a green light when it approaches the intersection. Scenarios with exclusive transit lanes were analyzed with five general-purpose lanes between 23rd Street and SH 16.

Increased transit-oriented developments (TOD)

The potential impact of increased residential and employment density and pedestrian improvements near transit stations was analyzed in conjunction with exclusive transit lanes.

Accessing downtown via 23rd Street and Main Street/Fairview Avenue

Access to downtown Boise via 23rd Street and Main Street/Fairview Avenue instead of 11th and 12th Streets was analyzed in conjunction with exclusive transit lanes.

Light Rail Lite

A "light rail lite" route structure rather than a branching route structure was analyzed in conjunction with exclusive transit lanes.

Widening to seven lanes between 23rd Street and SH 16

Widening State Street to seven general-purpose lanes between 23rd Street and SH 16 was modeled with BRT operating in mixed traffic with queue-bypass lanes and transit signal priority.

The scenarios are described in detail in Table 2 and organized by the following categories.

2035 Funded Roadway Projects

This group of scenarios was based on State Street including the roadway elements included in the 2035 funded network, adopted by the COMPASS Board. On State Street, the funded network includes widening from five to seven lanes between 23rd Street and Glenwood Street.

SH 44 Corridor Study Network

In addition to the funded network, this group includes widening State Street from two lanes to five lanes between Ballantyne Lane and SH 16. This configuration is consistent with the number of travel lanes included in the SH 44 Corridor Study.

Widened State Street, BRT in Exclusive Lanes

This group includes widening State Street to accommodate an exclusive transit lane in each direction from 23rd Street to SH 16. This group also includes the following additional sensitivity tests:

- Increased TOD at selected locations along State Street.
- Connection from State Street to downtown Boise via 23rd Street and Main Street/Fairview Avenue.
- A "light rail lite" transit route structure.

Widened State Street, BRT in Mixed Traffic

This group includes widening State Street from five to seven lanes between SH 16 and 23rd Street. However, with this group the added lanes would operate as general purpose travel lanes with transit operating as BRT service in mixed traffic.

2035 Funded Roadway Network

Scenarios 1A through 1D are based on the 2035 Funded Roadway Network. This includes the roadway projects included in the 2035 Funded Project roadway network that was adopted by the COMPASS Board on January 25, 2010. Under this network, State Street would be widened to seven lanes between 23rd Street and Glenwood Street. The following provides details on each of these scenarios.

Scenario 1A. 2035 Low Transit

This is the 2035 Low Transit Network described in Section 3. It is the same transit network as exists today with 2035 projected demand.

Scenario 1B. 2035 Low Transit with Three Cities River Crossing

This scenario was developed to test the effect on traffic volumes and transit ridership of adding the Three Cities River Crossing, a new roadway connection that would cross the Boise River in the vicinity of SH 55 and Five Mile Road. It is otherwise the same as Scenario 1A.

Scenario 1C. 2035 High Transit

This is the 2035 High Transit Network described in Section 3. This scenario provides increased transit routes and frequencies throughout the Treasure Valley and increases transit service in the State Street corridor that are consistent with Treasure Valley in Transit. All subsequent scenarios (1D through 4A) are based on this transit network.

Scenario 1D. 2035 High Transit with BRT in Mixed Traffic

This is the first BRT capital improvement scenario. It is the same as Scenario 1C, but adds signal priority and queue-bypass lanes at signalized intersections between 23rd Street and SH 16.

SH 44 Corridor Study Network

The second State Street roadway configuration that was analyzed was the SH 44 Corridor Study Network. This is similar to the 2035 Funded Roadway Network, however this scenario includes widening State Street from two lanes to five lanes between Ballantyne Lane and SH 16. One scenario was modeled using this roadway configuration.

Scenario 2A. 2035 High Transit with BRT in Mixed Traffic (5 Lanes to SH 16)

Other than the widening of State Street from Ballantyne Lane to SH 16, this scenario is the same as Scenario 1D, with BRT operating in mixed traffic with signal priority and queue-bypass lanes at signalized intersections between 23rd Street and SH 16.

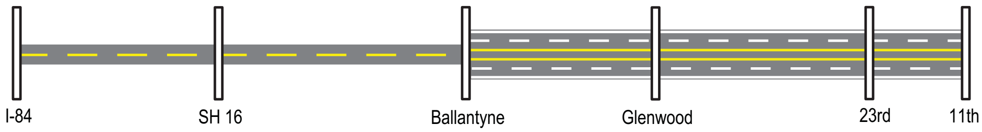
Widened State Street, BRT in Exclusive Lanes

Four BRT scenarios were developed that would utilize an exclusive transit lane on State Street. Under this group of scenarios, State Street would be widened to seven lanes between 23rd Street and SH 16. One lane in each direction would be an exclusive transit lane, leaving five general-purpose lanes for the entire length between 23rd Street and SH 16. Note that under this scenario, the number of general-purpose lanes would actually be reduced between 23rd Street and Glenwood Street from the seven lanes included in the 2035 Funded Roadway Network to five lanes. The following

Table 2. State Street TTOP Travel Demand Modeling Scenarios

2008 Base Year

Existing Roadway Network
Existing roadway and transit network. Transit operates in mixed traffic.



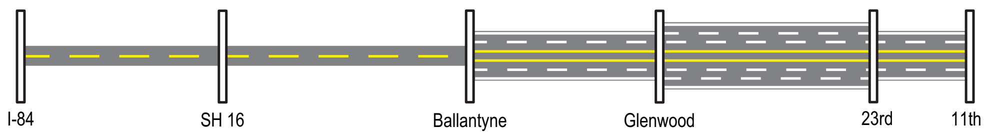
1. 2035 Funded Roadway Network

1A. 2035 Low Transit
Base 2035 funded roadway network with existing transit network.

1B. 2035 Low Transit with Three Cities River Crossing
Adds Three Cities River Crossing.

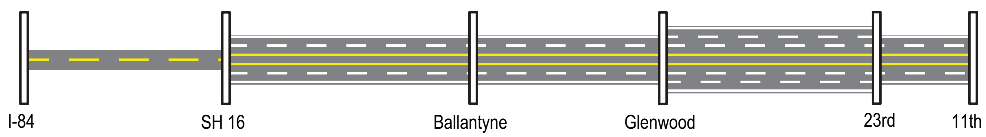
1C. 2035 High Transit
Base 2035 funded roadway network with high level of transit service throughout Treasure Valley with focus on State Street.

1D. 2035 High Transit with BRT in Mixed Traffic
Adds BRT in mixed traffic with signal priority and queue-bypass lanes on State Street.



2. SH 44 Corridor Study Network

2A. 2035 High Transit with BRT in Mixed Traffic (5 Lanes to SH 16)
Widens SH 44 to five lanes from Ballantyne Lane to SH 16. BRT in mixed traffic with signal priority and queue-bypass lanes.



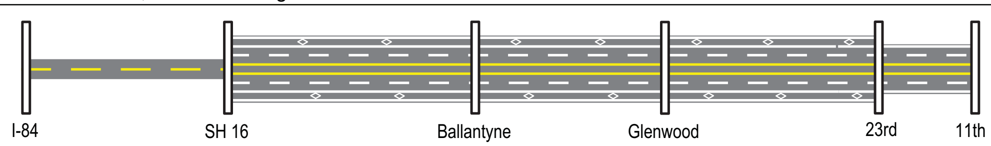
3. Widened State Street, BRT in Exclusive Lanes

3A. 2035 High Transit BRT in Exclusive Lanes
Adds exclusive transit lane to State Street from 23rd Street to SH 16. Reduces State Street from 7 general purpose lanes to 5 between 23rd Street and Glenwood Street.

3B. 2035 High Transit BRT in Exclusive Lanes with Increased TOD
Same as above but with maximized TOD growth in TAZs close to State Street transit routes. Reduces population allocations elsewhere in the corridor.

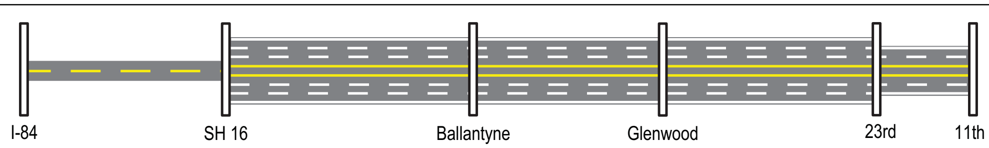
3C. 2035 High Transit BRT in Exclusive Lanes to Downtown Boise via 23rd
Exclusive lane on State Street from 23rd Street to SH 16. Utilizes 23rd Street and Main Street/Fairview Avenue to access downtown. Includes exclusive lanes on 23rd Street and Main Street/Fairview Avenue.

3D. 2035 High Transit BRT in Exclusive Lanes with "Light Rail Lite" Operating Plan
Exclusive lane on State Street, but utilizes "Light Rail Lite" transit route structure.



4. Widened State Street, BRT in Mixed Traffic

4A. 2035 High Transit with BRT in Mixed Traffic (7 Lanes to SH 16)
Widens State Street to seven general purpose lanes from 23rd Street to SH 16. BRT operates in mixed traffic with signal priority and queue-bypass lanes on State Street.



describes the four BRT scenarios modeled with exclusive transit lanes.

Scenario 3A. 2035 High Transit BRT in Exclusive Lanes

This scenario included BRT operating in exclusive lanes between 23rd Street and SH 16 with signal preemption. This is different from the signal priority included with the mixed-traffic BRT. Signal priority simply lengthens a green light when a bus is approaching, but does not automatically give a green light to an approaching bus. A BRT operating in exclusive lanes would operate like a light rail line, being granted a green light when it approaches the intersection.

Scenario 3B. 2035 High Transit BRT in Exclusive Lanes with Increased TOD

Like Scenario 3A, this scenario would include BRT operating in exclusive lanes between 23rd Street and SH 16 with signal preemption. Under Scenario 3B, new growth in 2035 would be focused on the State Street corridor with residential and employment development focused at transit-oriented development sites at selected locations along the corridor.

Scenario 3C. 2035 High Transit BRT in Exclusive Lanes to Downtown Boise Via 23rd

This scenario would be the same as Scenario 3A except for its routing to downtown Boise. Scenario 3A, as with all of the other High Transit scenarios, includes the State Street bus routes using State Street until 11th and 12th Streets and then connecting to the downtown multimodal center. Scenario 3C would instead route the State Street bus routes down 23rd Street and the Main Street/Fairview Avenue couplet to connect to the downtown multimodal center. This scenario tests whether this alternative connection would improve ridership or travel time.

Scenario 3D. 2035 High Transit BRT in Exclusive Lanes with "Light Rail Lite" Operating Plan

This scenario would utilize a slightly different transit route structure in order to test how ridership would respond. All of the other High Transit scenarios utilize the branching route structure, as shown in Figure 3. Scenario 3D tests the "light rail lite" route structure that maintains a high-frequency BRT branded trunk service on State Street, but distribution to destinations off of State Street would be provided by feeder routes (shown in Figure 4). This structure would operate more like a light rail line, requiring passengers to transfer from the trunk line to feeder routes to access destinations off of the main line. Other than the route structure, Scenario 3D would be the same as Scenario 3A.

Widened State Street, BRT in Mixed Traffic

The final BRT scenario tests the effects of widening State Street to seven general-purpose lanes from 23rd Street to SH 16 and operating BRT in mixed traffic.

Scenario 4A. 2035 High Transit with BRT in Mixed Traffic (7 Lanes to SH 16)

This scenario would operate the same way as Scenarios 1D and 2A, with BRT operating in mixed traffic with queue-bypass lanes and signal priority at signalized intersections between 23rd Street and SH 16, but there would be seven general-purpose lanes for the entire length between 23rd Street and SH 16.

State Street BRT Scenario Analysis Findings

The scenarios described above were modeled using COMPASS' travel demand model. This section summarizes the analysis methods and the travel time and ridership data derived from the model for each of the modeling scenarios.

Methodology

Transit and auto travel times are reported along State Street from 23rd Street to SH 16.

- Transit travel times for transit operating in mixed traffic were based on congested auto travel times. Transit travel time savings were applied at locations that would include queue-bypass lanes and/or signal priority.
- Transit travel times for transit operating in exclusive lanes were based on uncongested auto travel times with time added to account for acceleration, deceleration, and dwell time at stations.

Transit travel times are reported as in-vehicle travel times. In-vehicle transit travel times include only the time that a traveler would spend in a transit vehicle and does not include time to access the bus stop or time waiting for the bus. The time to access the bus stop via walking, biking, driving, or feeder bus and wait time at the stop would add time to the transit trip. While a few transit trips that originate adjacent to a bus stop could see a faster travel time than via auto (with BRT in exclusive lane), most transit trips in the corridor would still take more total travel time than the same trip via auto.

Transit ridership is reported as daily transit boardings along State Street. This is a total of all of the boardings on each of the routes on State Street. In addition, screenline locations were defined and the number of passengers on-board the

State Street routes (passenger loads) at each of the screenlines is reported. This shows the highest ridership locations along State Street and how they differ among the scenarios.

Summary of Analysis Findings

The following summarizes the key findings from each scenario. The subsequent sections describe the analysis results in more detail.

Scenario 1A. 2035 Low Transit

- Auto travel times are forecast to nearly double in the segment of State Street from 23rd Street to SH 16 between the 2008 Base Year and 2035.
- Daily transit boardings are projected to triple along State Street between the 2008 Base Year and Scenario 1A. The increase in boardings is simply a result of projected population growth between 2008 and 2035.
- Total passengers on-board State Street routes are projected to double at the peak load point (the point where the most passengers are on-board) between the 2008 Base Year and Scenario 1A

Scenario 1B. 2035 Low Transit with Three Cities River Crossing

- Traffic volumes would decrease slightly on portions of State Street, resulting in a slight improvement in auto travel time under Scenario 1B compared to Scenario 1A.
- Transit boardings and passenger loads on State Street would be similar to Scenario 1A.

Scenario 1C. 2035 High Transit

- Auto travel times would be similar to Scenario 1A.
- With no exclusive lanes or signal priority, transit travel time between 23rd Street and SH 16 would be approximately 20 to 30 percent longer than auto travel time.
- The improvements in transit coverage and frequency included in Scenario 1C would result in a more than 200 percent increase in daily boardings along State Street compared to Scenario 1A.
- Peak passenger loads on State Street would increase by over 140 percent under Scenario 1C compared to Scenario 1A.

Scenario 1D. 2035 High Transit with BRT in Mixed Traffic

- The addition of signal priority and queue-bypass lanes between 23rd Street and SH 16 would reduce in-vehicle transit travel time to a level that is comparable with auto travel time.
- This improvement in transit travel time and competitiveness would result in a 19 percent increase in daily boardings along State Street compared with Scenario 1C.

Scenario 2A. 2035 High Transit with BRT in Mixed Traffic (5 Lanes to SH 16)

- Auto and transit travel time would improve with widening SH 44 to five lanes between Ballantyne Lane and SH 16.
- Daily boardings would increase slightly along State Street compared to Scenario 1D.
- Passenger loads are similar to passenger loads under Scenario 1D, except in the widened segment between Ballantyne Lane and SH 16. Passenger loads would double in this segment under Scenario 2A.

Scenario 3A. 2035 High Transit BRT in Exclusive Lanes

- A dedicated transit lane between 23rd Street and SH 16 would improve transit travel time significantly, making in-vehicle transit travel time faster than auto travel time between 23rd Street and SH 16.
- This travel time improvement would result in a nearly 50 percent increase in daily boardings along State Street under Scenario 3A compared to Scenario 1C.
- Peak passenger loads under Scenario 3A are also significantly higher than under Scenario 1C.

Scenario 3B. 2035 High Transit BRT in Exclusive Lanes with Increased TOD

- Operationally, this scenario is identical to Scenario 3A. The only difference is in population and employment densities adjacent to stations. As a result, transit travel times are identical to Scenario 3A. Auto travel times, however, are slightly higher under Scenario 3B than under Scenario 3A.
- Siting TODs adjacent to BRT stations would result in a moderate increase in daily boardings and passenger loads compared with Scenario 3A.

Scenario 3C. 2035 High Transit BRT in Exclusive Lanes to Downtown Boise Via 23rd

- Routing BRT along 23rd Street and the Main Street/Fairview Avenue couplet to access downtown Boise would result in a slight increase in travel time compared to Scenario 3A.
- This increase in travel time would result in a decrease in daily boardings and passenger loads under this scenario compared to Scenario 3A.

Scenario 3D. 2035 High Transit BRT in Exclusive Lanes with "Light Rail Lite" Operating Plan

- In-vehicle transit travel times with a "light rail lite" route structure would be the same as under the other exclusive lane options. However, a higher level of transfers would increase the total transit travel time for many trips.
- The increased total travel time and reduced convenience due to the higher level of transfers would reduce the daily boardings and passenger loads compared to Scenario 3A.

Scenario 4A. 2035 High Transit with BRT in Mixed Traffic (7 Lanes to SH 16)

- Auto and transit travel time would improve with widening State Street to seven general-purpose lanes for the entire length of the corridor, compared to Scenario 2A.
- Transit travel times would be slightly longer under this scenario than with exclusive transit lanes. Auto travel times would be moderately shorter under this scenario than with exclusive transit lanes.
- Daily boardings and passenger loads would be somewhat higher under this scenario than under Scenario 2A, but would not be as high as with exclusive transit lanes.

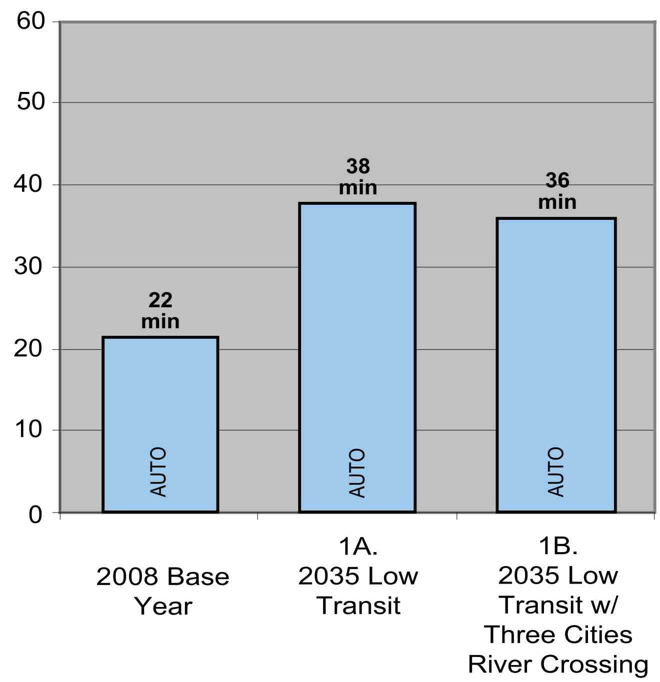
In summary, the 2035 High Transit Network would result in significant improvements in transit ridership in the State Street corridor over the 2035 Low Transit Network due to a significant expansion of transit service. Beyond these improvements, the BRT capital improvements offer shorter transit travel times and further increase ridership. Exclusive lanes would maximize the transit travel time benefits and yield the highest ridership, in conjunction with increased TODs on State Street.

The following sections illustrate the travel time and ridership differences among the scenarios in more detail.

Transit Travel Times

Auto travel times are forecast to nearly double in the segment of State Street from 23rd Street to SH 16 between the 2008 Base Year and 2035. Figure 5 shows the auto travel time increase from the 2008 Base Year to Scenario 1A - 2035 Low Transit.

Figure 5. 2008 and 2035 Average Congested Auto Travel Time SH 16 to 23rd Street (minutes)



The modeled 2008 auto travel time between 23rd Street and SH 16 is approximately 22 minutes. In 2035, the auto travel time is forecast to be approximately 38 minutes due to the following characteristics:

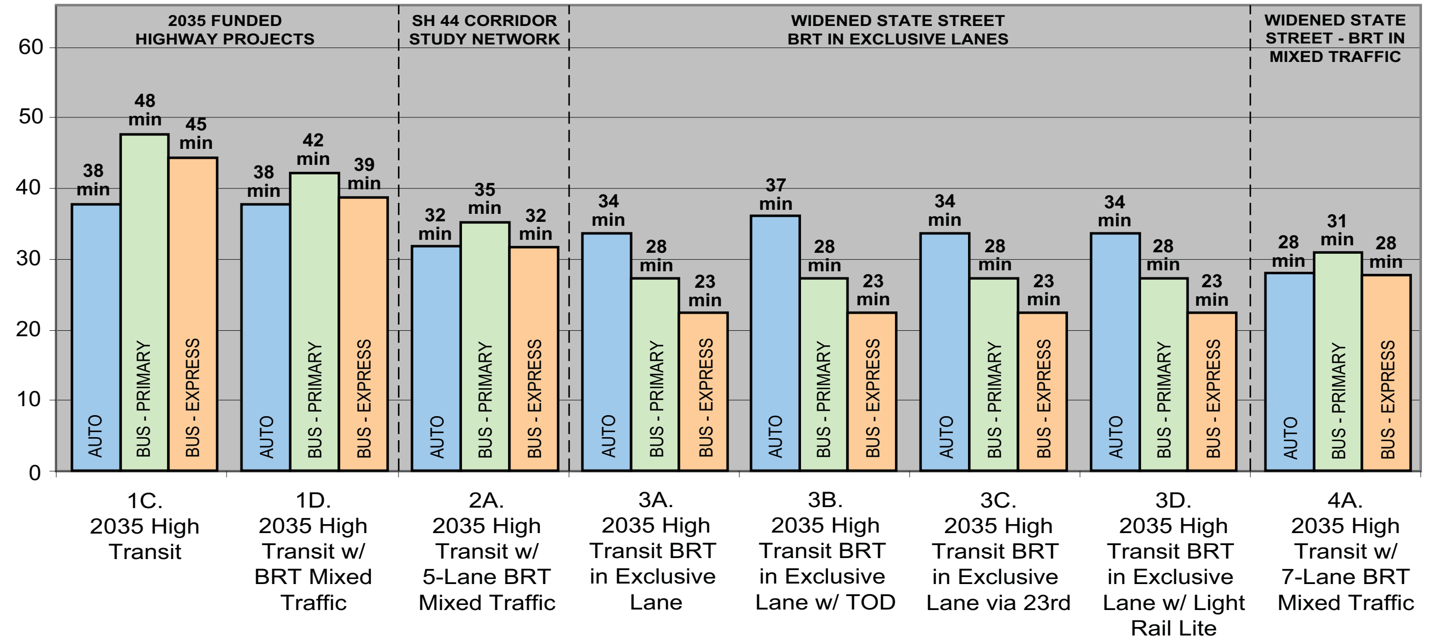
- Rapid population and employment growth adjacent to the corridor especially at the western edge of the study area.
- With the funded network the segment between Ballantyne Lane and SH 16 would remain as a two-lane section. Traffic increases resulting from the forecast population and employment growth result in long delays at the signalized intersections and slower speeds on the roadway.

The Three Cities River Crossing (modeled in Scenario 1B) would reduce 2035 auto travel time minimally, due to a slight decrease in traffic volumes on portions of State Street with trips diverting to utilize the new river crossing.

This study did not include any roadway or transit capital improvements west of SH 16. However, the 2035 models indicate significant auto travel time degradation in that area. Due to population growth west of SH 16 and no added roadway capacity, travel times between Middleton and SH 16 are forecast to triple, from 13 minutes in 2008 to over 39 minutes in 2035. All transit scenarios include routes extending west on State Street to Caldwell. The portions of these routes west of SH 16 would all be affected in a similar manner by these longer travel times. This report focuses on travel times east of SH 16 due to the similar transit and auto travel time for all scenarios west of SH 16.

Figure 6 details the auto and in-vehicle transit travel time results for the State Street Primary and State Street Express routes under Scenarios 1C through 4A. Scenario 1C is the base High Transit scenario with no BRT capital improvements (queue-bypass lanes, signal priority, or exclusive transit lanes). Scenarios 1D through 4A are the BRT capital improvement scenarios. The other State Street routes do not extend west to SH 16, but were designed with operations and stop locations similar to the State Street Express route. These other routes would have similar travel time characteristics to the express route between Eagle and downtown Boise.

Figure 6. 2035 Average Congested Auto and In-Vehicle Transit Travel Time on State Street SH 16 to 23rd Street (minutes)



As shown in Figure 6, transit capital improvements between 23rd Street and SH 16 would result in the potential for significant transit travel time savings. The following summarizes the key travel time findings.

- The addition of signal priority and queue bypass lanes between 23rd Street and SH 16 (Scenario 1D) would reduce transit travel time by approximately six minutes for both the State Street Primary (48 minutes to 42 minutes) and the State Street Express (45 minutes to 39 minutes). These treatments would allow transit to provide a more competitive choice to auto travel time (38 minutes) in this segment of the corridor.
- Both auto and transit travel time would be reduced by six to seven minutes with the widening of SH 44 to five lanes.
- An exclusive transit lane would improve transit travel time by 40 to 50 percent compared with Scenario 1C, making in-vehicle transit travel time faster than auto travel time between 23rd Street and SH 16.
- Widening State Street to seven general-purpose lanes for the entire segment between 23rd Street and SH 16 would result in a four minute travel time improvement for both auto and transit time in comparison to the five general-purpose lane scenario.
- Transit travel time would be three to five minutes faster with exclusive transit lanes than with seven general-purpose lanes. However, auto travel time would be six minutes faster with seven general-purpose lanes than with exclusive transit lanes.

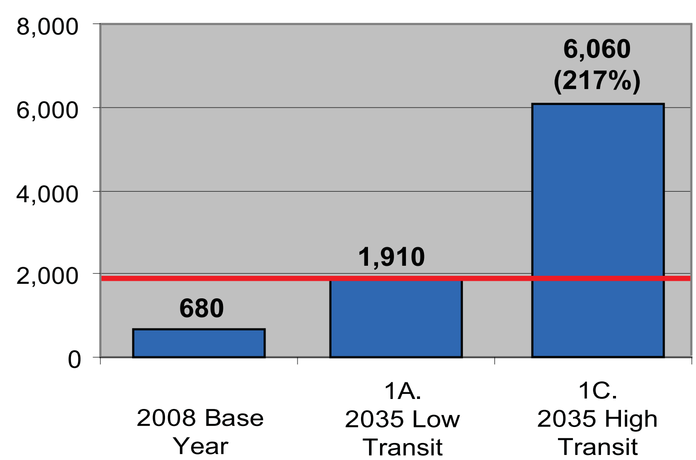
Route Level Boardings

Higher transit boardings would result from improvements to transit coverage and frequency as well as the improved transit travel times that would result from the transit capital improvements in the State Street corridor. Scenario 1C – 2035 High Transit includes boardings on the following five State Street routes:

- State Street Primary: Replaces Route 9 State Street, increases frequency, lengthens stop spacing, and extends to Middleton.
- State Street Express: Replaces Route 44 Express, adds some stops, and increases frequency.
- State Eagle Direct: New route that connects to the foothills area north of Eagle and runs with limited stops on State Street to downtown Boise.
- Eagle Foothills West Direct: New route that connects to the Northwest Foothills area and runs with limited stops on State Street to downtown Boise.
- Idaho Center/Star/Boise: New route that runs between the Idaho Center and Star and then runs with limited stops on State Street to downtown Boise.

Figure 7 shows the average daily boardings from the model for the 2008 Base Year, Scenario 1A, and Scenario 1C.

Figure 7. 2008 and 2035 Total Daily Boardings Along State Street (2008 Base Year, 1A, and 1C) and Percent Increase from Low Transit to High Transit



As shown in Figure 7, a substantial increase in transit boardings can be achieved with an increase to transit frequency and coverage in the corridor. Scenario 1C – 2035 High Transit includes the following key transit enhancements on the corridor:

- Major increase in service coverage and frequency regionwide,
- Addition of several new east-west routes serving the State Street corridor, and
- Increase in frequencies for most routes to 15 minutes during the peak hour and 30 minutes during the off-peak.

Figure 8 shows the increases in transit boardings along State Street that are forecast with each of the capital improvement scenarios (Scenarios 1C through 4A).

As Figure 8 shows, capital improvements on State Street can result in significant increases in transit boardings along State Street. The key findings are summarized below.

- The addition of signal priority and queue-bypass lanes could save a substantial amount of travel time over the length of the State Street corridor. These improvements result in a 19 percent increase in boardings over Scenario 1C.
- Widening SH 44 to five lanes between SH 16 and Ballantyne Lane with signal priority and queue-bypass lanes would improve travel time for both transit and auto. Since there would be no change in the relative travel times between transit and auto, this scenario would result in a modest increase in boardings over Scenario 1D (approximately 250).
- An exclusive transit lane between 23rd Street and SH 16 would maximize transit boardings along State Street. The exclusive lane scenarios would result in an increase in boardings between 41 and 54 percent compared to Scenario 1C. An exclusive transit lane in conjunction with TODs at stations would result in the highest increase in boardings.
- Utilizing 23rd Street to access downtown rather than 11th and 12th Streets or utilizing a "light rail lite" route structure would slightly reduce the number of boardings.
- Widening to seven general-purpose lanes with signal priority and queue-bypass lanes would result in a 33 percent increase in transit boardings over Scenario 1C. The improved auto travel time from widening to seven general-purpose lanes would tend to dampen the attractiveness of the transit choice with this scenario.

In summary, the highest increases in transit boardings along State Street come from providing an exclusive transit lane and land use changes that would increase densities near transit stations along State Street. Signal priority treatments would improve transit travel time, but buses operating in mixed traffic would still be subject to congestion and would be less reliable. Minimal benefit to the number of boarding rides is observed with an exclusive lane via 23rd Street and Main Street/Fairview Avenue or with a "light rail lite" route structure.

Transit Screenline Analysis

The previous section summarized route-level boardings for the State Street portions of each of the modeled routes. This section describes what the passenger loads would be on the State Street routes at various points along the route under the various scenarios.

Figure 8. 2035 Total Daily Boardings Along State Street and Percentage Increase over Scenario 1C

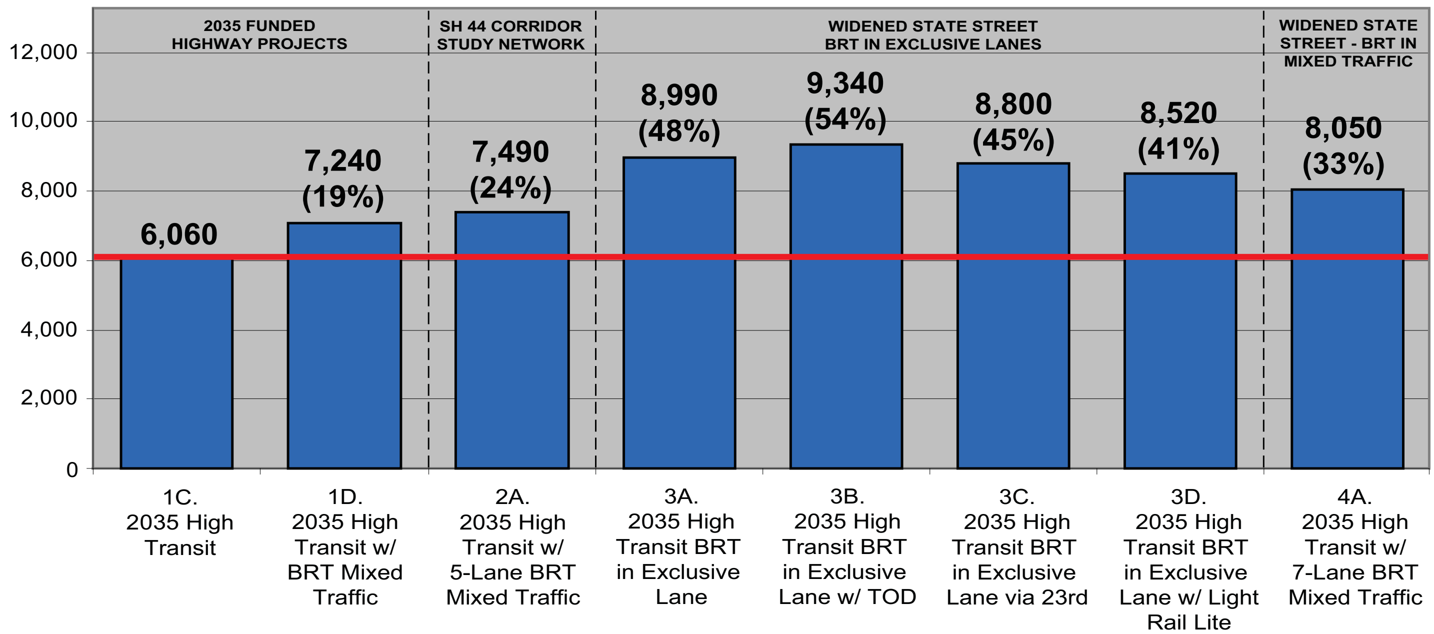
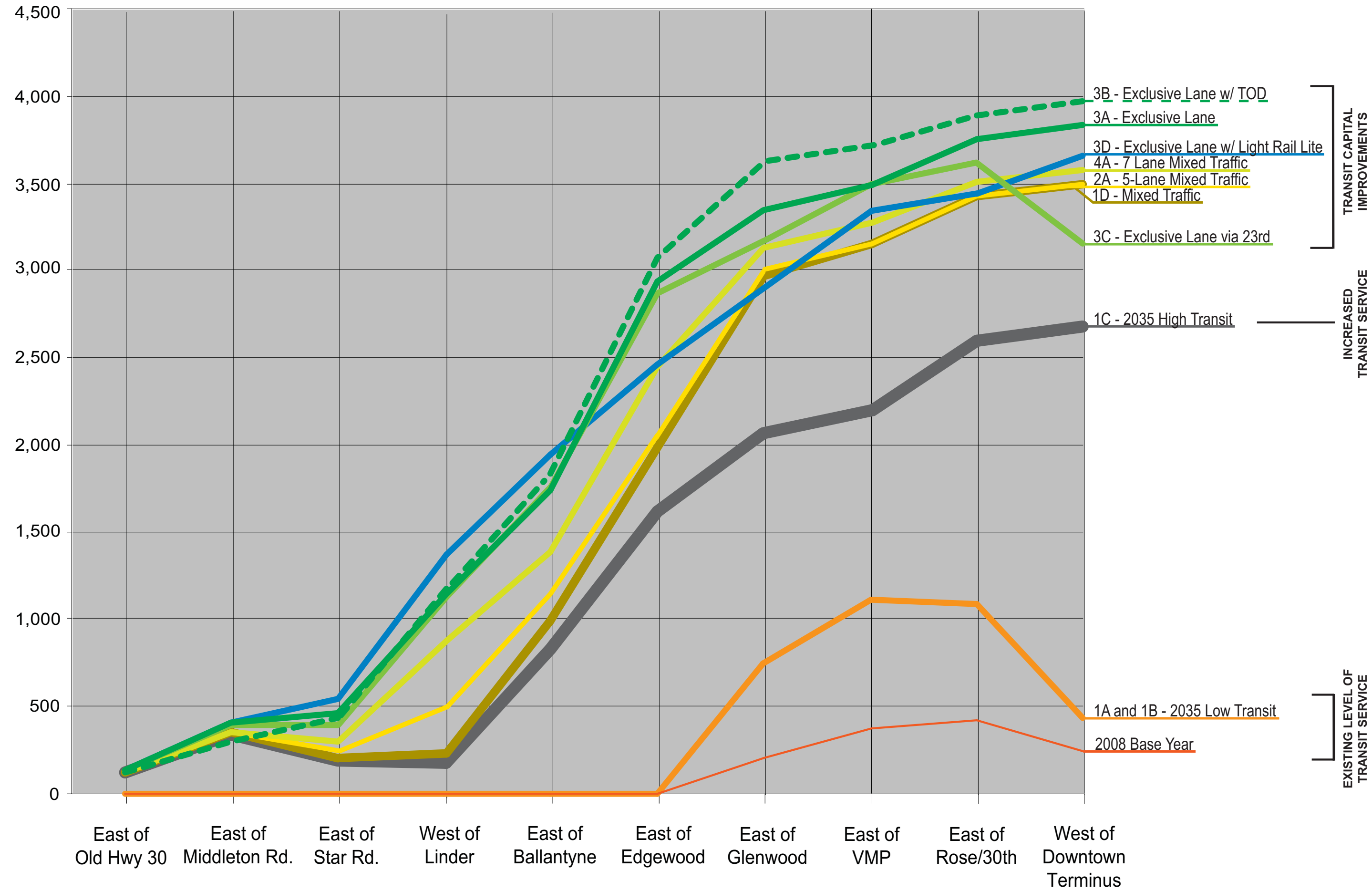


Figure 9. 2035 Total Daily Passengers On-Board State Street Routes at Screenline Locations by Scenario



The number of passengers on-board all State Street routes were totaled at the following screenline locations along State Street. This is shown in Figure 9.

- East of Old Highway 30
- East of Middleton Road
- East of Star Road
- West of Linder Road
- East of Ballantyne Lane
- East of Edgewood Lane
- East of Glenwood Street
- East of Veterans Memorial Parkway (VMP)
- East of Rose Street/30th Street
- West of Downtown Terminus

Figure 9 shows the forecast transit ridership with each of the scenarios and helps to illustrate the higher ridership locations along State Street. Additionally, this figure illustrates the differences in transit ridership when comparing the low transit with the high transit scenarios.

The gap between the 2035 Low Transit Network (Scenarios 1A/1B) and the 2035 High Transit Network (Scenario 1C) indicates an increase in transit ridership of over 140% at the highest ridership points in the corridor. This gap between the Low Transit and the High Transit scenarios reflects what is achievable through significant improvements in transit frequency and coverage.

The ridership increase from Scenario 1C High Transit with no capital improvements compared with the capital improvement scenarios ranges from 25 percent to 45 percent. The exclusive transit lane scenarios (3A, 3B, 3C and 3D) have the largest increases due to providing the fastest transit travel times. The mixed traffic scenarios with less transit travel time improvement still provide over 25 percent increase in transit ridership.

The following describes the key findings.

- Transit loads on State Street are projected to grow to approximately 1,000 passengers per day on the east end of the corridor under the 2035 Low Transit scenarios.
- The 2035 High Transit scenario would add significant service along the entire length of State Street. Peak passenger loads would occur west of the downtown Boise multimodal center with nearly 2,700 passengers (140 percent higher than with the Low Transit scenarios).
- Travel time improvements with signal priority treatments on State Street would result in an additional 800 passengers compared with Scenario 1C at the peak load point west of the downtown Boise multimodal center.

- Exclusive lane operation would increase passenger loads to over 3,800 at the peak load point west of the downtown Boise multimodal center. This is an increase of 1,100 compared with Scenario 1C (40 percent growth) and 300 more than with five general-purpose lanes in mixed traffic.

State Street BRT Scenario Analysis Conclusions

The COMPASS regional travel demand model provides important insights into the ability of various measures to improve transit ridership in the State Street corridor. The following are some key findings from the ridership analysis:

- Significant increases in transit service coverage and frequency (the difference between the 2035 Low Transit and 2035 High Transit scenarios) can triple the amount of transit ridership in the corridor.
- Transit capital improvements could significantly reduce transit travel times on State Street.
- An exclusive transit lane between 23rd Street and SH 16 can maximize transit ridership with approximately 20 percent more boardings than with queue-bypass lanes and signal priority. It may be cost-effective to identify key locations on the corridor where providing an exclusive transit lane for a limited section would be beneficial to the transit travel times and ridership.
- The TOD scenario maximizes transit ridership by locating more jobs and housing immediately adjacent to transit stations.
- The added travel time associated with the 23rd Street alignment makes it somewhat less attractive for trips traveling through to downtown Boise.
- The "light rail lite" concept, which would require more transfers, would attract fewer transit trips than the branching route structure.

State Street Scenario Operating Costs

Operating costs are largely driven by the amount of service provided. The amount of service has two components; the headway (or frequency) of the service and the span of service (the number of hours per day service is provided). Headways can be determined based on a local policy that directs a certain level of service be provided, or based on the number of runs per hour that are required to provide adequate capacity (with service being more frequent during the peak hours). The span of service is also a policy-based decision, where the transit provider determines when service will start and end, usually balancing community needs and desires and funding availability.

Order-of-magnitude operating costs were prepared in order to compare among the ten State Street transit scenarios. These operating cost estimates used information from the model on the round trip runtime for each route and used the headways and span of service assumed as each network was developed for modeling and analysis. The purpose of these estimates is to provide a general sense of the operating costs associated with different styles of transit service.

Table 3 summarizes the operating costs for each scenario. The costs for the State Street corridor include the State Street Primary and Express bus routes and all supporting routes serving the corridor. The table also reports the order-of-magnitude cost for the remainder of transit services in the region. Reporting the data in this manner provides context for the State Street services relative to the remainder of the region and provides a sense of where the differences among scenarios occur.

Table 3. Annual Operating Cost Summary for State Street 2035 Modeling Scenarios (2009$)

	2008 VRT System	Scenarios 1A and 1B 2035 Low Transit	Scenario 1C 2035 High Transit	1D and 2A 5-Lane Mixed Traffic BRT 2035 High Transit	3A & 3B Exclusive BRT 2035 High Transit	3C Exclusive BRT - 23rd 2035 High Transit	3D Light Rail Lite BRT 2035 High Transit	4A 7-Lane Mixed Traffic BRT 2035 High Transit
State Street Corridor	$569,000	$1,610,000	$10,100,000	$10,410,000	$10,170,000	$10,260,000	$9,220,000	$9,980,000
Remainder of Region	$8,677,000	$10,300,000	$57,380,000	$57,380,000	$57,380,000	$57,380,000	$57,380,000	$57,380,000
TOTAL	$9,246,000	$11,910,000	$67,480,000	$67,790,000	$67,550,000	$67,640,000	$66,600,000	$67,360,000
Change from 2035 Low Transit	-$2,664,000		$55,570,000	$55,880,000	$55,640,000	$55,730,000	$54,690,000	$55,450,000

The following lists the key findings from the operating cost analysis of the State Street transit scenarios.

- The future year (2035) scenarios that are based on the Low Transit network (Scenarios 1A and 1B) would cost about $11.9 million, approximately $2.7 million more than the existing with a similar level of transit service. This $2.7 million of additional cost is primarily due to the longer travel times in the forecast year due to additional roadway congestion.
- Scenario 1C High Transit, which would increase transit service throughout the Treasure Valley from approximately 550 hours of daily service under the Low Transit scenarios to 2,500 hours of daily service, would cost approximately $55.6 million more than the 2035 Low Transit scenarios.
- The operating cost for each of the High Transit scenarios are similar, ranging from $66.6 million to $67.8 million. The largest change in operating cost is the $55.6 million difference between the 2035 Low Transit scenario and the High Transit scenario.
- Scenario 1C High Transit, which does not include any BRT treatment, has a slightly lower operating cost than most of the High Transit scenarios with BRT treatment due to using the standard bus cost per hour rather than the 10% higher BRT cost.
- Scenario 2A with BRT operating in mixed traffic with 5 lanes would have slower run times than the other BRT scenarios which results in this scenario having the highest total operating cost.
- The exclusive lane BRT with the "light rail lite" operating plan would have the lowest operating cost of the BRT scenarios due to only the State Street Primary and Express routes traveling all of the way into downtown Boise.

Table 3 shows an increased cost of approximately $55 million per year to achieve the High Transit level of service. This is a system wide cost that would buy significantly improved service throughout the region and it would not vary substantially among the State Street transit capital improvement scenarios. However, there are small differences between the State Street scenarios that reflect nuances in how service in the State Street corridor would be structured. Additional information on the operating cost analysis and comparison with other cities is included as part of the general discussion of Bus Rapid Transit concepts in Chapter 5.

Summary of State Street BRT Analysis

Table 4 summarizes the analysis results for each scenario. The table shows the relative differences among the scenarios in number of routes, headways, travel times, ridership, and operating costs. These are useful for making comparisons among scenarios and give a general sense of the magnitude of improvements that could be expected from various BRT treatments.

Table 4. Summary of State Street BRT Analysis Results

Scenario	Number of Routes on State Street	Composite Headways on State Street[1]	Auto Travel Time 23rd Street to SH 16	Transit In-Vehicle Travel Time 23rd Street to SH 16[2]	Transit Boardings on State Street	Peak Transit Loads[3]	Annual Operating Cost
2008 Base Year	2	30 min. all day	22 min.	NA	680	400	$9.2 million
1A – 2035 Low Transit	2	30 min. all day	38 min.	NA	1,910	1,100	$11.9 million
1B – 2035 Low Transit w/ Three Cities River Crossing	2	30 min. all day	36 min.	NA	1,910	1,100	$11.9 million
1C – 2035 High Transit	5	3 min. peak	38 min.	45 to 49 min.	6,060	2,700	$67.5 million
1D – 2035 High Transit w/ BRT in Mixed Traffic	5	3 min. peak	38 min.	39 to 43 min.	7,240	3,500	$67.8 million
2A – 2035 High Transit w/ BRT in Mixed Traffic (5 Lanes to SH 16)	5	3 min. peak	32 min.	30 to 34 min.	7,490	3,500	$67.8 million
3A – 2035 High Transit BRT in Exclusive Lanes	5	3 min. peak	34 min.	23 to 28 min.	8,990	3,800	$67.6 million
3B – 2035 High Transit BRT in Exclusive Lanes w/ Increased TOD	5	3 min. peak	37 min.	23 to 28 min.	9,340	4,000	$67.6 million
3C – 2035 High Transit BRT in Exclusive Lanes to Downtown Via 23rd	5	3 min. peak	34 min.	23 to 28 min.	8,800	3,600	$67.6 million
3D – 2035 High Transit BRT in Exclusive Lanes w/ "Light Rail Light"	5	4 min. peak	34 min.	23 to 28 min.	8,520	3,700	$66.6 million
4A – 2035 High Transit w/ BRT in Mixed Traffic (7 Lanes to SH 16)	5	3 min. peak	28 min.	27 to 30 min.	8,050	3,700	$67.4 million

[1] Composite headway means the combined headway for all routes stopping at a given stop. Uses Glenwood stop as an example. Low Transit Scenarios only include Route 9. High Transit Scenarios include all five State Street routes stopping at this station.

[2] Transit travel time from 23rd Street to SH 16 was not analyzed for the existing or the Low Transit scenarios because the Route 9 does not extend west of Glenwood. As a point of comparison, the current schedule for the Route 44 Express lists a scheduled travel time between 32nd Street and Star of 37 to 42 minutes.

[3] Peak transit load refers to the highest number of passengers on-board at one point along the route.

5. Bus Rapid Transit Concepts for State Street

This section describes various transit elements to be considered for inclusion in the package of transit improvements on State Street. This includes information on current BRT applications in North America and how they treat elements such as BRT stations and amenities, operating concepts, transit vehicles, fare collection and park-and-ride lots. There are advantages and disadvantages related to various strategies and elements and those trade-offs for each are discussed in this section.

BRT Route Structures

There are many ways to structure a BRT transit network. A branching route structure and a "light rail lite" route structure represent two ends of a continuum of options. For modeling purposes, the project team chose a branching route structure as the primary network type to test the different scenarios. This structure can more effectively serve a lower density region, such as the Treasure Valley, because it serves multiple end points with a single BRT service and reduces the need to transfer, essentially extending the reach of the core BRT trunk line (along State Street) to multiple end points with a one-seat ride.

While the modeling results suggest that the branching route structure would more effectively serve the State Street corridor, this does not necessarily mean that final implementation of a BRT strategy would adhere precisely to this concept.

One consideration in making route structure decisions is whether or not vehicles would need to pass each other on the system. An advantage of a branching route structure is that multiple bus routes can utilize the same BRT running way on the core portion of the system. However, if some of those routes would run as express or limited-stop routes, they would need to be able to pass local buses stopped at stations that the express routes would bypass. This would require additional right-of-way and is one of the reasons why several recently implemented BRT systems have opted for a "light rail lite" style of operation.

There are several BRT systems in place in North America and there are examples of both types of routes structures.

Eugene, Oregon EmX

The EmX Green Line in Eugene, Oregon, was originally conceived as a branching route structure with branded buses that served multiple points off of the main trunk line. As planning and implementation evolved, the ultimate system that was built is more like a "light rail lite" structure. It includes a single branded bus route that remains on a single trunk line and serves two major regional destinations at each terminus (downtown Eugene and downtown Springfield).

The primary advantage of a "light rail lite" operating style is that it reinforces the identity of the line as a premium service. The EmX has rail-like station platforms. On the central transitway portion of the route along Franklin Boulevard, the stations are located in the median, such that passengers board the vehicle through doors on the left side. The transitway itself reinforces the identity of the system through its track-like design as two parallel paved strips separated by a grassy strip and separated from the roadway by curbs. This system requires buses with passenger doors on both sides and all buses on the EmX line to serve all stops.

Grassy "track-like" running way on EmX Line
Eugene, OR

Salt Lake City MAX 3500 South Line

In July 2008, the Utah Transit Authority (UTA) opened its first BRT line along 3500 South, connecting the western suburbs of Magna and West Valley City to the TRAX light rail system in South Salt Lake. The route is approximately 15 miles long, including approximately one mile of exclusive median transit lanes. This line also represents a "light rail lite" style of operation because it is a single branded line. However, because it is only separated from other travel lanes by striping and the stations are all on the right side of the bus, there is greater flexibility for running other routes on the same running way than with the Eugene system.

Median running way on MAX 3500 South Line
Salt Lake City, UT

Los Angeles Orange Line

The Los Angeles Orange Line, which opened in 2005, is a 14-mile long dedicated busway that extends from the Metro Red Line subway in North Hollywood though the San Fernando Valley. Built on a former railroad right-of-way, it operates much like a light rail line with ticket vending machines and real time bus arrival displays at the stations. While this system is a "light rail lite" style of operation, it does feature bus pullouts at several of the stations offering the potential to operate a mix of express and local services on the same running way.

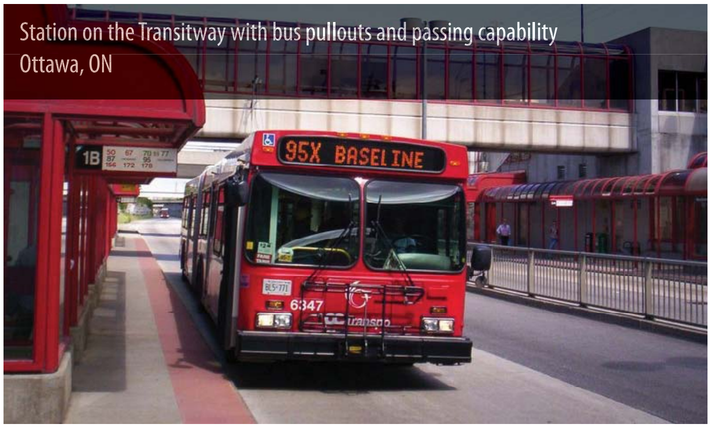
One of the primary reasons for choosing a "light rail lite" style of operation for the Orange Line was to keep the line simple and easy for customers to understand. Every bus that arrives at a given station would be going to the same destination. While the Orange Line was originally built on this route structure, it can easily be scaled up in the future, with additional routes serving different destinations added to the core running way.

Exclusive busway on Orange Line
Los Angeles, CA

Ottawa, Ontario

One of the most often cited examples of a branching route structure BRT system in North America is Ottawa, Ontario. The Transitway BRT system, operated by OC Transpo, opened in 1983. It consists of an extensive network of mostly grade-separated busways, high-speed service, and a mix of several local, express, and limited-stop routes. The stations feature room for buses to pass as well as room for multiple buses to board at the same time. This system is effective in connecting passengers to multiple destinations with minimal transfers and short wait times.

The Ottawa example represents the branching route structure end of the continuum of route structure styles, while the Eugene example represents the "light rail lite" end. Most systems fall somewhere in between. BRT improvements on State Street can be implemented as a "light rail lite" operation style initially and can later be scaled up to a branching operation style by adding routes to it. The key considerations are whether the initial running way will have the flexibility to operate multiple routes in the future, especially if these multiple routes will include a mixture of local and express routes. Implementing a running way similar to the Salt Lake City MAX would allow for some flexibility in buses being able to leave the running way and use the general-purpose lanes to pass stopped buses. Also, siting station platforms so that they are on the right side of the bus would allow for flexibility in adding routes to the system because the running way would not require the use of specialized buses with doors on both sides.



Station on the Transitway with bus pullouts and passing capability
Ottawa, ON

BRT Running Ways

An advantage of BRT is its ability to reduce travel time and increase schedule reliability through dedicated or shared running way. This can take a wide range of forms from targeted improvements like queue-bypass lanes and signal priority that can reduce delay at specific congested intersections to fully separated running ways that enable operations similar to a light rail line. This section discusses the advantages and trade-offs of various running way types.

Mixed Traffic

The most basic form of BRT operates in mixed traffic. Several recently implemented systems operate entirely or partially in mixed traffic. The Metro Rapid system in Los Angeles began primarily as a mixed traffic system, though it is gradually installing sections of dedicated running way and queue-bypass lanes.

Mixed Traffic with Queue-Bypass Lanes and Signal Priority

As a lower-cost alternative to fully dedicated running ways or a first step in a phased implementation strategy, queue-bypass lanes and signal priority measures can be installed at the most heavily congested intersections, enabling buses to avoid delays. This targeted investment can result in significant improvements to travel time and reliability because it focuses improvements on the intersections where there would be the most benefit. The VIVA BRT system in the York Region outside of Toronto, Ontario, is a good example of this type of running way treatment.

York Regional Transit (YRT) operates VIVA on several corridors region-wide and operates almost entirely in mixed traffic. VIVA utilizes signal priority and queue-bypass lanes to enable buses to avoid congested intersections.

VIVA has implemented intersection priority treatments as a first phase in an overall plan to ultimately construct a dedicated running way system. These treatments were included as part of the first phase due to their ability to reduce transit travel time and increase reliability and the fact that they can be implemented much more quickly than dedicated running ways. According to the Bus Rapid Transit Practitioner's Guide (Transit Cooperative Research Program [TCRP] Report 118), typical transit travel time improvements can be in the range of 8 to 12 percent for signal priority treatments and 5 to 15 percent for queue-bypass lanes. [6]

Dedicated Running Ways

Dedicated running ways represent the highest level of investment in BRT infrastructure. A dedicated running way can improve transit travel time by 0.5 to 1 minutes per mile in developed corridors and helps ensure reliable transit travel time by helping buses avoid congestion. [7] The level of reliability varies depending on the level of separation from general-purpose traffic. There are three general types of dedicated running ways for BRT. The following discusses the advantages and trade-offs:

Curb-side, on-street, dedicated bus lane

A curb-side dedicated bus lane enables buses to bypass congestion in the adjacent lanes. However, driveways to adjacent businesses and residences generally need to be maintained. In practice, curb-side transit lanes are typically shared with right-turning traffic accessing driveways. This is known as a BAT (Business Access and Transit) lane. This can result in slower, less reliable transit service, though it is generally only a marginal impact. Other potential impedances to transit with a curb-side lane can include delivery vehicles parked illegally in the transit lane or congestion due to vehicles parking where curb-side parallel parking exists adjacent to a transit lane.

Median, on-street, dedicated bus lane

A median dedicated bus lane avoids many of the issues associated with curb-side bus lanes. Median bus lanes allow buses to maintain a higher speed without delays due to turning vehicles. Traffic signal treatments and a widened cross-section are usually required at intersections where general traffic would be turning left across the median bus lanes. Median bus lanes are generally implemented with a separate signal phase at intersections, often with a "light rail like" signal preemption. The Eugene EmX and the Cleveland HealthLine are both examples of this type of running way. This type of running way can be separated from other traffic by several different types of delineation, including striping, rumble strips, or curbing.

Off-street, dedicated busway

A dedicated busway on its own roadway, completely separate from other traffic, represents the ultimate application of BRT separation. This type of application is similar to a rail line in that general-purpose traffic can only impede bus service at intersections. This type of running way is often operated with signal preemption at intersections. Several systems are largely grade-separated, eliminating most intersections. This enables buses to travel at very high speeds and provide a very rapid and reliable service. The Ottawa, Ontario, Transitway is a good example of this type of system. Other examples include the busways in Pittsburgh and the Orange Line in Los Angeles.

Two key issues to consider with dedicated running ways are whether stations would be located in the center, requiring boarding on the left side of the vehicle, and whether there is a desire to run overlapping transit routes on the same running way, with a combination of express and local services.

Creating passing capacity at stations to enable express buses to pass local buses usually requires additional right-of-way. The busway in Ottawa includes passing lanes at stations where multiple express and local buses operate, while the Los Angeles Orange Line uses bus pullouts at stations. Where right-of-way is constrained, passing capabilities can be created using the adjacent general-purpose lanes if the running way is not curb or barrier separated. This, however, can reduce the efficiency of the BRT line and subject it to congestion in adjacent lanes.

Bus Stops/BRT Stations

The term "bus stop" can cover a range of styles and amenities where passengers wait for and access bus service. At a minimum, a bus stop includes a sign and a place for passengers to stand while waiting for a bus to arrive. More expansive bus stops include additional amenities such as shelters, benches, waste receptacles, and schedule

6 Transit Cooperative Research Program Report 118, Bus Rapid Transit Practitioner's Guide, pp. 4-32 to 4-39. Transportation Research Board, 2007. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf

7 Transit Cooperative Research Program Report 118, Bus Rapid Transit Practitioner's Guide, p. 4-23, Transportation Research Board, 2007. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf

Typical curb side station on MAX 3500 Line, Salt Lake City, UT

"Rail like" median station on EmX System, Eugene, OR, source: Lane Transit District)

information. Additional amenities such as real-time bus location information and sidewalk extensions further enhance the bus patron experience and begin to move in the direction of amenities typically found at BRT or rail stations.

As with BRT operations, there is a wide range of improvements and amenities that can be found at BRT stations. BRT systems range from conventional buses and basic stops to more rail-like vehicles with rail-like stations. A rail-like station can have pre-boarding fare payment, real-time bus arrival information, and level boarding. One of the advantages of BRT is that a single BRT line does not have to have the same station type at every station. Investments in rail-like stations with a full range of passenger amenities could be focused on a few stations that would be projected to have the highest passenger boarding and alighting levels, while less heavily patronized stations could have a more modest complement of amenities.

The recently developed BRT systems in Salt Lake City, Utah and Eugene, Oregon represent the range of station treatments and amenities that are typically found in BRT systems. Both include off-board fare payment machines, lighted shelters, and a design that is unique to the BRT brand, setting them apart from other bus stops. The Salt Lake City MAX 3500 South line has primarily curb side stations with a simple sign and shelter that feature the MAX logo. The Eugene EmX Green Line represents a higher end of station amenities with median stations that look more like a light rail station, with raised platforms for faster boarding and architectural shelters and railings.

Focusing Station Investments on State Street

The transit modeling conducted for State Street provides an indication of which stations would be most heavily used and, therefore, would benefit most from focused investment in station amenities. Figure 10 shows the relative levels of

Figure 10. Total Daily Passenger Boardings and Alightings on State Street Routes. Scenario 3A – 2035 High Transit BRT in Exclusive Lanes

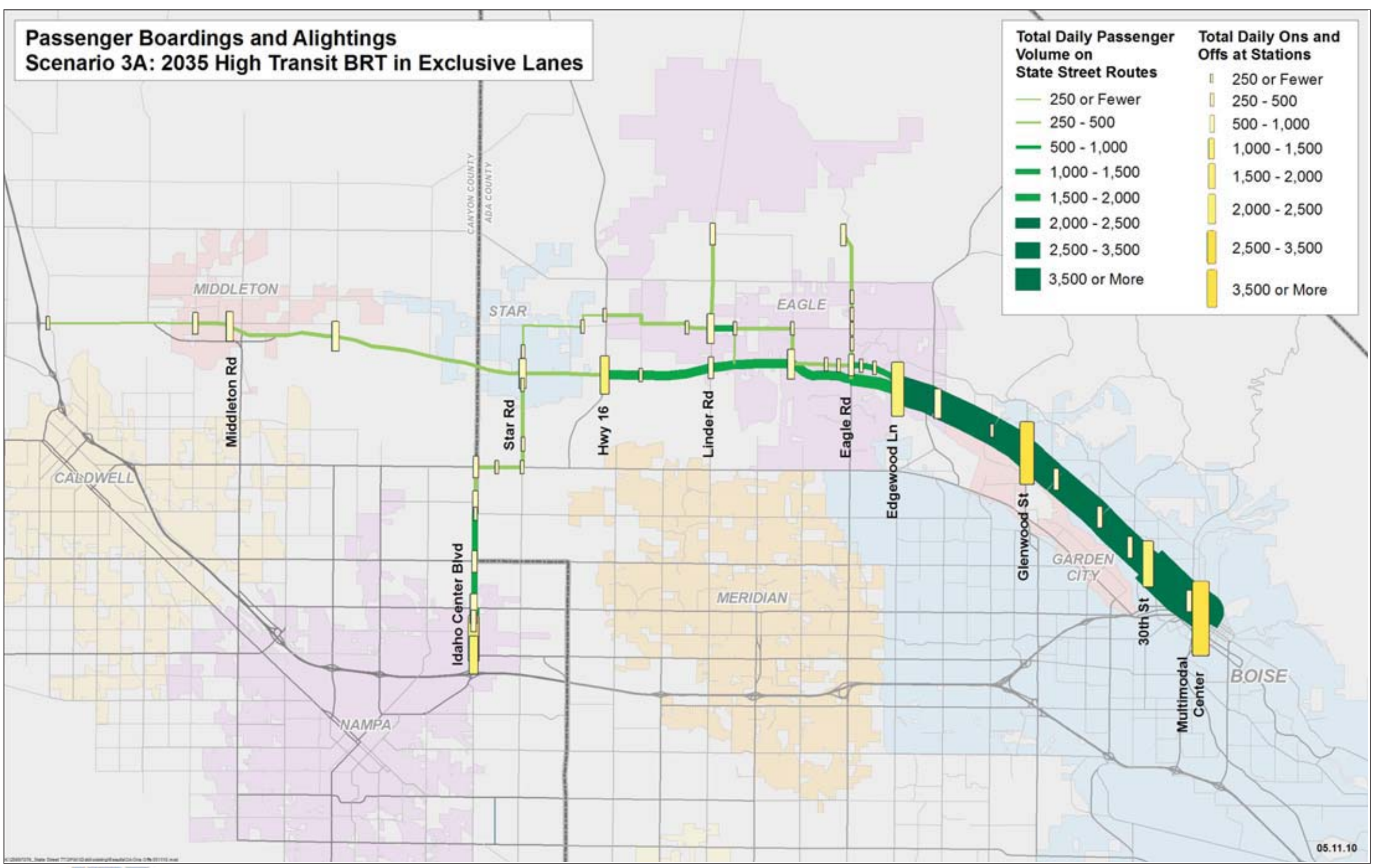


Table 5. Total 2035 Daily Passenger Boardings and Alightings on State Street Routes. From Downtown Boise Multimodal Center to SH 16. Scenario 3A – 2035 High Transit BRT in Exclusive Lanes

Station	Total Boardings and Alightings	Proportion of Total (Multimodal Center to SH 16)
Downtown Multimodal Center	3,840	26%
16th Street	310	2%
30th Street	1,650	11%
Veterans Memorial Parkway	310	2%
Collister Drive	280	2%
Pierce Park Lane	280	2%
Glenwood Street	2,990	20%
Bogart Lane	170	1%
SH 55	620	4%
Edgewood Lane	2,370	16%
Ballantyne Lane	680	5%
Linder Road	380	3%
Palmer Lane	20	< 1%
SH 16	1,010	7%

boardings and alightings projected for each station under Scenario 3A - 2035 High Transit BRT in Exclusive Lanes. This scenario was chosen as representative of the capital improvement BRT scenarios, all of which would have similar relative levels of station activity. The boardings and alightings at each station between the downtown Boise multimodal center and SH 16 are shown in Table 5.

As shown in Figure 10 and Table 5, the highest levels of station activity with BRT on State Street are forecast to occur at the downtown Boise multimodal center, 30th Street, Glenwood Street, Edgewood Lane, and SH 16. While the actual implementation of transit improvements in the corridor may look different than what was modeled, the modeling results do indicate that these five stations would be most likely to have high levels of station activity.

Transit stations at Glenwood Street and Edgewood Lane are forecast to have daily boardings and alightings between 2,000 and 3,000. These stations are also identified as high priority TOD sites. With relatively high boardings and potential TOD development in the area, these sites would be the most likely locations to be considered for a high level of station amenities. As potential TOD locations, these sites would benefit from design treatments that could integrate the station with nearby development sites to create a pedestrian friendly streetscape.

The station at 30th Street, with a forecast of 1,650 daily boardings and alightings, has also been identified as a high priority TOD site and should be considered for higher-end station investments. This station is located adjacent to the northern boundary of the 30th Street Area Master Plan area. This plan envisions a high-density, mixed use, pedestrian and transit-oriented community along the 30th Street extension between State Street and Main Street. [8] A high-end BRT station with a full range of amenities at this location could complement and act as a gateway for the 30th Street area.

The station at SH 16 is forecast to serve over 1,000 daily boardings and alightings under Scenario 3A. The SH 16 station has been identified as a potential TOD site, but not one that is likely to develop within the next 10 years. This station may be a good candidate for a moderate level of station investment and possibly with a park-and-ride lot that could later be incorporated into a TOD. This station location would be the western terminus of the BRT capital improvements and an appropriate level of station amenities should be provided to mark the beginning of the line. Since the intersection of SH 16 and SH 44 is planned for a future interchange, the siting of this station would need to be coordinated with Idaho Transportation Department.

Station Configuration

A key consideration in designing a BRT system is whether the stations will be curb side or in the median, and if in the median, whether vehicles would board on the left side, right side, or both. Issues to consider in configuring a station in the roadway cross-section include, but are not limited to the following:

- Pedestrian access and safety
- Waiting environment of the station
- Width of available right-of-way
- Cost of vehicles with doors on the left side or both sides
- Ability of express buses to pass stopped buses at the station as needed
- Traffic operations (i.e., traffic demand, right-turn traffic, and vehicle queue lengths) at the intersection
- Left-turn lanes, vehicle paths, and signal phasing

BRT Vehicle Types

Bus rapid transit encompasses a wide range of vehicle types. BRT vehicles are designed to provide a high-quality transit service by increasing the speed, reliability, capacity, and attractiveness of bus service. In addition to running-way improvements such as exclusive lanes, signal priority, and greater spacing between stops, the vehicles themselves can improve the quality and attractiveness of the service by providing high-capacity (larger, articulated vehicles), low-floor configurations, wider and more numerous doors, doors located on either or both sides to increase flexibility in running way/station layouts, and even guided docking systems at stations.

8 City of Boise website: http://www.cityofboise.org/Departments/PDS/Transportation/30thStreet/page14010.aspx

There are several vehicles on the market today that meet the various needs of BRT systems. Vehicles range from conventional buses to modern looking vehicles with amenities designed to provide a “light rail like” riding experience. There are standard length 40-foot buses and extended length (60-foot) articulated buses available from multiple manufacturers. Many available vehicles have low floor configurations that can help speed boarding and alighting, especially for wheelchair access. Many different power plants are also available, including diesel-electric hybrids and compressed natural gas (CNG) engines.

In order to implement BRT along State Street, decisions need to be made regarding whether buses would operate in the median or in the curb lane, whether stations would be located on the right side of the vehicle or the left side, whether off-board fare collection would be utilized, and what passenger capacity would be required.

The following discusses some examples of recently implemented BRT systems and how the vehicles are configured.

ABQ Rapid Ride hybrid articulated vehicle, Albuquerque, NM

Albuquerque, New Mexico

Albuquerque opened its first BRT line in December 2004. Called the Rapid Ride, it uses a conventional fleet of 60-foot New Flyer articulated low-floor vehicles with hybrid diesel/electric engines that operate in mixed traffic on three routes. This model, which typically has a capacity of approximately 100 to 110 passengers (seated and standing), is in wide use in cities across North America.

MAX BRT vehicle with three boarding doors, Salt Lake City, UT

Salt Lake City, Utah

The 3500 South MAX line, which opened in July 2008 connecting the western suburbs of Magna and West Valley City to the TRAX light rail system in South Salt Lake, utilizes 10 new branded BRT vehicles. The vehicles are modern 40-foot buses that feature low floors for the entire length of the vehicle and three doors to allow rapid passenger loading and unloading and reduce dwell times at stations. The advantage of having three doors is maximized by pre-boarding fare payment at ticket vending machines located at the stations. This allows passengers to purchase their tickets prior to the bus’s arrival and then board at any of the three doors.

The vehicles, produced by Van Hool, have a capacity of approximately 60 passengers (seated and standing) and were purchased for $403,000 each. [9] Sixty-foot articulated vehicles are also available from Van Hool, which have a passenger capacity of approximately 100 and feature four doors with low floors throughout.

EmX BRT vehicle with doors on both sides Eugene, OR

Eugene, Oregon

The first EmX BRT route opened in 2007, running approximately 4 miles between downtown Springfield and downtown Eugene. EmX is a distinctive BRT branding that is exclusive to the BRT service. The route operates with a mix of exclusive median operation and mixed traffic operation. The service uses modern stylized 60-foot articulated hybrid electric vehicles produced by New Flyer with doors on both sides to facilitate both curb side stations and center platform stations in the exclusive median guideway sections.

The New Flyer vehicles have a capacity of approximately 100 (seated and standing) and were purchased for $960,000 each. [10]

9 Deseret News, May 25th, 2008: http://www.deseretnews.com/article/700228958/Bus-Rapid-Transit-coming-soon-to-3500-South.html

10 Lane Transit District (LTD) website: http://www.ltd.org/search/showresult.html?versionthread=45a4b83927fba5cb751c741bf4ac81e3

Making BRT Vehicle Choices

The Federal Transit Administration has published a guide for BRT implementation. The *Characteristics of Bus Rapid Transit for Decision-Making* [11] report offers guidance on running ways, stations, vehicle types, fare collection, intelligent transportation systems (ITS), and service and operating plans. The FTA guide describes the following four primary attributes used to define BRT vehicles:

Attribute #1 - Vehicle Configuration

This includes considerations such as vehicle length, passenger capacity, and floor height. There are five basic types of vehicle configurations.

Conventional Standard

This is the traditional bus vehicle and is typical of most U.S. transit systems. Typically 40 to 45 feet long, a conventional standard bus typically has a seated and standing capacity of 50 to 60 passengers and costs between $375,000 and $400,000.

Stylized Standard

This is generally the same as a conventional standard vehicle in terms of length and capacity, but incorporates more modern, aerodynamic, and attractive vehicle design. Stylized standard vehicles typically cost between $425,000 and $450,000. The MAX BRT vehicles used in Salt Lake City would be an example of this type of configuration.

Conventional Articulated

Articulated vehicles add approximately 50 percent more passenger capacity over standard length vehicles. Typically 60 feet long, passenger capacity generally ranges between 80 and 90 (seated and standing) passengers. Typical cost for a conventional articulated vehicle is between $700,000 and $750,000. The Albuquerque Rapid Ride BRT vehicles would be an example of this configuration.

Stylized Articulated

This vehicle configuration would be similar to a conventional articulated vehicle, but adds streamlined styling for a more modern, attractive, "light rail like" appearance. Capacity is similar to a conventional articulated vehicle. Typical cost would be between $800,000 and $950,000. This type of configuration is used in the EmX BRT system in Eugene.

Specialized BRT Vehicles

Specialized vehicles use a more modern and aerodynamic body style than a stylized articulated vehicle. These vehicles are more of a hybrid between a bus and a light rail vehicle. Special drivetrain and axle configurations are often employed to create a full low floor. Advanced propulsion systems, ITS, and guidance systems for precision docking at stations are also used with this vehicle type. This type of BRT vehicle is currently in use in Las Vegas, Nevada.

Civis specialized BRT vehicle on MAX line
Las Vegas, NV

Attribute #2 - Aesthetic Enhancement

Image and branding is important for BRT to attract transit riders who would otherwise not choose transit. In addition to the basic vehicle configurations, aesthetic elements such as paint schemes unique to the BRT line, larger windows, and enhanced interior amenities (i.e., WiFi internet service, rear windows, interior bike racks) are important to providing an easily recognizable and high-quality transit service.

Attribute #3 -Passenger Circulation Enhancement

Alternative seat and door layouts can be key considerations in designing a BRT system. These features can have large impacts on dwell time, capacity, and passenger comfort. As the Salt Lake City MAX system demonstrates, increased curb side doors used in conjunction with pre-boarding fare payment enables rapid passenger boarding and alighting. As demonstrated by the Eugene EmX, doors on both sides enables median platform stations as well as curb side stations. Increased doors reduce the number of seats available, but can significantly reduce travel time by reducing dwell time and provide a more "light rail like" passenger experience.

Attribute #4 -Propulsion Systems

Many alternative fuel and hybrid propulsion systems are available. Besides reducing emissions and using less fossil fuel, some types of propulsion systems can enhance the quality of the passenger experience by reducing noise and creating a smoother ride. Many systems are adding hybrid electric vehicles to their fleets. Seattle has over 200 diesel-electric hybrids in operation. The Albuquerque and Eugene BRT systems utilize diesel-electric hybrids. Electric power creates smoother, quieter, and more rapid acceleration from stops than conventional diesel engines.

11 Federal Transit Administration, February 2009: http://www.nbrti.org/docs/pdf/High%20Res%20CBRT%202009%20Update.pdf

A number of manufacturers offer buses with CNG and diesel-electric hybrid power plants. Basic internal combustion engines powered by either diesel or CNG are the most commonly used and readily available propulsion systems today. CNG adds approximately $60,000 per vehicle in purchase price plus $700,000 to $1,000,000 in fueling infrastructure. [12]

Diesel-electric hybrids are growing in popularity and are offered by several manufacturers, including New Flyer, Orion, and North American Bus Industries (NABI). Hybrids offer improved fuel efficiency, reduced emissions, smoother and quicker acceleration, and more efficient braking.

These vehicles cost between $150,000 and $250,000 more than conventional buses with internal combustion engines and have some additional maintenance infrastructure costs.

Application to State Street

In choosing the most appropriate BRT vehicle for the State Street corridor, the following key questions will need to be answered:

- How many vehicles will be required and what are the passenger capacity requirements?
- How will the system be branded? Will a unique vehicle design play a key role in the identification of the BRT line as a unique transit service?
- Will the State Street BRT route run in the curb lane or in dedicated median lanes, or a combination of both?
- Will there be pre-boarding fare payment or will fares be paid on-board?
- How will bikes be accommodated on the vehicle?

BRT Marketing and Branding

The introduction of a new type or level of transit service provides transit districts with a significant opportunity to both market the new service and to rationalize or develop further the marketing of the full range of transit services offered. As seen in multiple examples in North America and abroad, the creation of a brand or identity for bus rapid transit service, separate from that of the local bus service, is a key element in attracting choice riders to BRT. [13]

BRT and rapid bus operations in the U.S. generally employ the following three strategies when it comes to marketing and branding for specialized services.

- BRT marketed with minimal differentiation from other service/routes
- BRT marketed as a separate level of service (e.g., "premium")
- BRT marketed as element of a larger rapid transit system (including other rapid transit modes)

BRT marketing may be accomplished in a phased approach timed to coincide with major upgrades in service levels and amenities (e.g., corresponding to readily identifiable features like new buses, stations, etc.). Table 6 highlights the marketing opportunities and decision points associated with transit service improvements.

Branding of fixed-route transit service may also occur prior to full deployment of BRT service/features if there are distinguishable features to market. The lower portion of Table 6 shows two examples, in Eugene and Portland, Oregon, where transit operators branded non-BRT service separately from other fixed-route transit service. In Eugene, a new, frequent service, fixed-route line connecting the highest ridership destinations in the system (downtown Eugene, a university and a regional shopping center) was branded as "The Breeze" instead of designated with a standard route number. The "Breeze" branding was added to buses dedicated to the route, bus stop signs, shelters and schedules. This route, which was a very popular service from 2001 to 2010 (but was recently cut due to sizable budget cuts), used standard stop spacing and no priority measures; its most marketable features were its frequency and its one-seat ride service between popular destinations (rather than requiring a transfer downtown).

In Portland, TriMet branded its highest frequency (15-minute or better frequencies all day, every day) bus routes with the "Frequent Service" moniker. A majority of these routes had been improved with reduced numbers of stops, transit signal priority and additional amenities (including new bus stop signs and new/additional shelters).

VRT may choose to market or brand new or improved transit service in the State Street corridor prior to full deployment of BRT service/features. A key determining factor is whether there are enough distinguishing features/improvements to warrant a separate brand prior to the full deployment of BRT service. In the State Street corridor, marketing of improved service would likely be useful whereas a separate, new identity or brand would likely prove more cost-effective in conjunction with deployment of full BRT service/features.

12 Federal Transit Administration, February 2009: http://www.nbrti.org/docs/pdf/High%20Res%20CBRT%202009%20Update.pdf

13 Ibid

Table 6. Marketing Opportunities and Decision Points for Improvements in Transit Service

Decision Points	Potential Improved Service Elements	Integrate/Rationalize with System Marketing	Examples
Introduction of Improved Service In Corridor	• Longer span of service • Additional frequency • Additional amenities • Priority treatments • Travel time reductions • Improved reliability • One-seat ride between popular destinations (without transfers)	• Opportunity but not required	LTD's Breeze Breeze TriMet's "Frequent Service" Frequent Service
Introduction of BRT Service In Corridor	Above items, plus: • New vehicles • New stations • New amenities (e.g. next arrival displays) • Additional priority treatments • Corridor service brand	• Opportunity and desirable	LTD's EmX BRT EmX UTA's MAX BRT MAX YRT's VIVA BRT VIVA

Transit District Location	Transit District Brand/Logo	BRT Brand Separate from Other Fixed Route Service	Non-BRT Brand Separate from Other Fixed-Route Service
Eugene, OR Lane Transit District (LTD)	LTD	EmX	Breeze
Portland, OR Tri-County Metropolitan Transit District of Oregon (TriMet)	TRI MET	NA	Frequent Service
Salt Lake City/ Salt Lake County, UT Utah Transit Authority (UTA)	UTA	MAX	NA
York, ON (Toronto, ON suburb)	YORK REGION TRANSIT	VIVA	NA

The "Breeze" Non-BRT Transit Service Branded Separately from Other Fixed-Route Service, Eugene, OR (source: Lane Transit District)

"MAX" BRT Transit Service Branded Separately from Fixed-Route Service, Salt Lake City, UT (source: Utah Transit Authority)

Several BRT elements affect brand identity. They include:

- Exclusive rights-of-way and right-of-way markings
- Station types and amenities
- Vehicle configuration, amenities and propulsion systems
- Fare collection process and payment options
- Intelligent transportation systems (ITS)

Each of these elements not only can improve the transit service, but also serve to differentiate the premium service from typical or standard/local bus service.

Several challenges exist relative to marketing BRT service. First, maintaining the brand/identity of a BRT service and its perception as a premium service requires continued investment and attention. Second, marketing BRT as a separate level of service, but still a service product of the larger transit provider, does not always translate back to the service provider. Sometimes the positive attributes of a premium service may only be associated with the premium product itself.

Park and Ride Lots

There are currently fifteen park-and-ride lots in the region operated by ACHD Commuteride. All of the park-and-ride lots have been designed to serve as meeting points for vanpools and carpools and seven of the fifteen park-and-ride lots also serve Valleyride bus routes.

A regional park-and-ride plan or adopted regional park-and-ride policy is currently not in place. However, several jurisdictions in the area have adopted policies supportive of transit-oriented developments. The potential development of TODs along State Street is recognized in policy documents such as Blueprint Boise Draft Plan, Garden City 2006 Comprehensive Plan, and Draft Eagle Downtown Plan. These and other policy documents reflect the desire to have State Street evolve into a corridor that includes a significant role for transit. In addition to being a fundamental element necessary to support BRT development in the corridor, park-and-ride lots could also be an interim use at certain potential TOD sites that could provide support for transit investments in the short term while providing transit-supportive densities in the long term.

Two of the three transit service types identified for State Street in Treasure Valley in-Transit specifically mention connections with park-and-ride lots as a key component. Park-and-ride lots will be an important piece of the overall transit strategy to serve the State Street corridor, in part due to the low-density and dispersed nature of existing residential areas in the corridor.

The transit ridership modeling and analysis assumed that park-and-ride access was available throughout the State Street corridor. This study identified the general locations which could merit consideration for a park-and-ride lot. The criteria used to identify these general vicinities included roadway connections, access considerations, market potential and feeder bus availability. Particular consideration was given to locations adjacent to major north-south roadways such as SH 16 and SH 55 that could provide access from a range of neighborhoods. This assessment did not evaluate specific sites within these general areas.

The modeled network included park-and-ride lots on the corridor in the vicinity of the following locations:

- SH 16
- Near Eagle Road and Edgewood Lane
- Near Horseshoe Bend Road and SH 55

In addition, two park-and-ride lots were included in the modeled network near Middleton Road and near I-84.

Discussions of a park-and-ride strategy for the State Street corridor have identified two styles of park-and-ride lots for consideration:

- Long-term lots designed to provide capacity needed to meet the long-term demand in the corridor. These lots would typically include 100 to 500 spaces and would be designed to provide one of the backbones necessary to support an investment in a BRT system in the State Street corridor. These locations would be primarily west of Glenwood.
- Short-term lots at locations that have been identified as potential TOD sites. These are locations where land could be acquired initially as park-and-ride lots and then could transition to a transit-oriented development, while retaining some level of park-and-ride capacity. These locations would be primarily east of the city of Eagle.

In addition to the park-and-ride concepts that have been developed for the State Street corridor, the region should develop park-and-ride plans and policies that describe roles and responsibilities for planning, siting, and developing these facilities.

Summary of BRT Concepts for State Street

Route structure, running ways, stations, vehicles, branding, and park-and-rides are all elements that make up a BRT system. The FTA's Characteristics of Bus Rapid Transit for Decision-Making describes in detail the reasons to implement each element and the important considerations and trade-offs with each. The implementation guidelines offer cost estimates for various elements, such as vehicles and power plants, in order to assist in making decisions among different options. Table 7 summarizes these elements and includes the most important considerations for the State Street corridor. This summary table offers guidance on the trade-offs between different route structures, different running way types, different levels of station investment, different vehicle and power plant types, vehicle enhancements, branding, and park-and-rides.

Table 7. Summary of BRT Elements and Implementation Considerations for State Street

	Reasons to Implement	Considerations for State Street	Examples
Route Structure			
Single BRT route ("light rail lite")	• Easy for customers to understand. • Emphasizes the branded BRT route.	• Requires riders to transfer to reach destinations off the main route.	• Eugene EmX Green Line.
Branching route structure with mix of local and express routes	• Provides more "one-seat rides" in a dispersed region. • Provides shorter overall trip times for more riders.	• Increases complexity of the system for new or infrequent riders. • Requires infrastructure with passing capabilities at stations.	• Ottawa, Ontario, Transitway.
Hybrid route structure with branching routes, but no skip-stop service.	• Provides more "one-seat rides" in a dispersed region. • Simplifies the system for new or infrequent riders. • Can be implemented without passing capabilities at stations.	• Limits ability to add express service at a later date.	
Running Ways			
Curb side in mixed traffic	• Low cost.	• Buses would be subject to delays due to congestion. • Can be implemented as an interim step while priority treatments or running ways are developed.	• Los Angeles Metro Rapid. • Salt Lake City MAX 3500 S. Line. • Albuquerque Rapid Ride.
Queue-bypass lanes and signal priority	• Can significantly reduce delay at the most congested intersections. • Lower cost than full length exclusive lanes.	• Requires signal and communication equipment. • Requires additional right-of-way or use of existing right turn lanes. • Can be used as an interim step toward a fully exclusive lane.	• Eugene EmX Green Line. • Los Angeles Metro Rapid.
Exclusive transit lane	• Reduces transit travel time and increases schedule reliability. • Can significantly increase the visual presence of transit in the corridor.	• May require additional right-of-way. • May require reducing the number of general-purpose lanes. • Requires consideration of whether lanes would be exclusively for transit at all times or only during peak hours. • Requires analysis of whether HOVs could also use the lanes. • Requires enforcement.	• Eugene EmX Green Line. • Cleveland Healthline. • Salt Lake City MAX 3500 S. Line. • Boston Silver Line.
Curb side exclusive lanes.	• Used with curb side stations. • Curb side stations likely to cost slightly less than median stations. • Can be shared lane with right turning vehicles, requiring less signal modification than median running ways.	• The need to maintain access to driveways generally means allowing right turning vehicles to use the lane, potentially reducing the travel time benefits to transit. • More readily allows express buses to utilize general-purpose lanes to pass stopped buses. • Can be an interim step toward development of a median running way.	• Boston Silver Line.
Median exclusive lanes	• Used with median stations. • Increases schedule reliability over a curb side lane because other traffic would be completely excluded from the transit lane. • Increases the visual presence of transit in the corridor over a curb side lane.	• Generally requires additional right-of-way for stations than curb side transit lanes. • Requires additional phase at signalized intersections to allow left turning vehicles to cross the bus lanes safely. • Without pullouts at stations, express buses would not be able to pass local buses.	• Eugene EmX Green Line. • Cleveland Healthline. • Salt Lake City MAX 3500 S. Line.

Stripe-separated running ways	• Lower cost than curb or barrier separated running ways. • Enables greater flexibility for express buses to pass local buses.	• Requires enforcement to keep the running way clear for transit vehicles. • Can be an interim step toward a fully separated transit running way.	• Salt Lake City MAX 3500 S. Line. • Albuquerque Rapid Ride. • Boston Silver Line. • Cleveland Healthline (also has rumble strips).
Curb- or barrier-separated running ways	• Ensures that other vehicles do not use the lanes and maintains schedule reliability. • Increases the visual presence of transit in the corridor over striped separation.	• Can require slightly more right-of way than striped separation. • Without pullouts at stations, express buses would not be able to pass local buses.	• Eugene EmX Green Line.
BRT Stations			
Station Location			
Curb side station	• Used with curb side transit lane or mixed traffic operation. • Allows skip-stop buses to pass stopped buses via adjacent general-purpose lane, if a bus bay is not provided at the station. • Provides a more pleasant waiting area than median stations.	• Less distinct from conventional bus stops than a median station. • Space in the sidewalk may be limited.	• Boston Silver Line. • Salt Lake City MAX 3500 S. Line.
Median station with boarding on both sides of the bus	• Used with median running way. • Can help make the stations stand out as more distinct than conventional bus stops.	• Depending on running way layout, may not allow for skip-stop buses to pass stopped buses. • Less pleasant waiting area for passengers • Requires consideration of pedestrian safety to access the stations. • Requires specialized vehicles with doors on the left side.	• Eugene EmX Green Line. • Cleveland Healthline.
Median station with boarding on right side of the bus	• Used with median running way. • Specialized vehicles with doors on the left side are not required.	• Requires additional right-of-way.	• Salt Lake City MAX 3500 S. Line.
Median station with boarding on the left side of the bus	• Used with median running way. • Fits more easily into the roadway cross-section where right-of-way is limited.	• Requires specialized vehicles with doors on the left side.	
Station Types			
Simple bus shelter	• Low cost: Average $15,000 to $20,000 per shelter (not including platform costs).	• Is not distinct from a basic bus shelter.	• Sacramento EBus, Stockton Line • San Jose Rapid 522.
Enhanced shelter	• Differentiates a BRT stop from a conventional bus stop, reinforcing the BRT branding. • Provides a higher-quality waiting environment, with improved weather protection and lighting. • Can be used on the curb side and integrated with sidewalk infrastructure.	• Costs $25,000 to $35,000 per shelter (not including platform costs).	• Albuquerque Rapid Ride. • Boston Silver Line. • Cleveland Healthline. • Eugene EmX Green Line. • Los Angeles Metro Rapid. • Phoenix Rapid.
Station enclosure	• Further reinforces BRT branding. • May include level passenger boarding and a full array of passenger amenities.	• Costs $150,000 to $300,000 per station (includes platform, enclosure, and pedestrian access costs).	• Curitiba, Brazil, RIT. • Bogota, Columbia, TransMillenio. • Ottawa, Ontario, Transitway.

Station Amenities			
Passenger information	• Accurate information about transit routes, schedules, and real-time bus arrival (where available) helps customers make travel decisions and helps make transit a more attractive option.	• Requires maintenance to ensure it is up-to-date. • Real-time bus arrival information requires automatic vehicle locator (AVL) and communication equipment.	• Typical for most BRT systems. • Real-time arrival information is still relatively new, but is becoming a common element in many BRT systems.
Off-board fare payment	• Reduces dwell times by allowing passengers to board at multiple doors.	• Requires ticket vending machines at stations. • Requires random fare inspections.	• Eugene EmX Green Line. • Salt Lake City MAX 3500 S. Line. • Cleveland Healthline. • York Region, Ontario VIVA. • Los Angeles Orange Line.
Passenger comfort and convenience (including seating, weather protection, vending machines, newspaper boxes, trash cans, heating and cooling, and high-quality materials and finishes)	• Improves the quality of the passenger experience while waiting. • High-quality amenities can attract customers and improve the image of transit.	• Amenities add both capital and maintenance costs.	• Typical for most BRT systems.
Passenger security (lighting, video cameras, emergency telephones)	• Improves both actual and perceived passenger safety. • Improving safety improves the image of transit.	• Requires ongoing maintenance and supporting infrastructure.	• Typical for most BRT systems.
BRT Vehicles			
Vehicle Configuration			
Conventional standard vehicle	• Most affordable vehicle option.	• Does not differentiate BRT service from other transit services (though vehicle can be painted differently). • Typical capacity (seated and standing): 50 to 60 passengers. • Typical cost: $375,000 to $400,000.	• Ottawa, Ontario Transitway. • Sacramento EBus Stockton Line.
Stylized standard vehicle	• More modern, aerodynamic, and attractive vehicles help distinguish BRT as a higher-quality service, separate from standard bus service.	• Typical capacity (seated and standing): 50 to 60 passengers. • Typical cost: $425,000 to $450,000. • May require alternative procurement methods.	• Salt Lake City MAX 3500 S. Line. • Los Angeles Metro Rapid. • Phoenix Rapid. • Kansas City MAX.
Conventional articulated vehicle	• Adds 50% more passenger capacity.	• Typical capacity (seated and standing): 80 to 90 passengers. • Typical cost: $700,000 to $750,000. • Some limitation on routing due to length and turning radius.	• Albuquerque Rapid Ride. • Boston Silver Line.
Stylized articulated vehicle	• More modern, aerodynamic, and attractive vehicles help distinguish BRT as a higher-quality service, separate from standard bus service.	• Typical capacity (seated and standing): 80 to 90 passengers. • Typical cost: $800,000 to $950,000. • Some limitation on routing due to length and turning radius. • May require alternative procurement methods.	• Eugene EmX Green Line. • Cleveland Healthline. • Los Angeles Orange Line.

Aesthetic and Passenger Circulation Enhancement			
Specialized logos and paint schemes	• Supports BRT branding to distinguish the BRT service from standard bus service.	• Part of a broader branding scheme. • Requires a dedicated fleet. Operating unbranded branching routes on the same running way may detract from the identification of the BRT route as a unique service. • Specialized BRT logos and branding should be applied to vehicles that are of higher quality than the standard bus fleet. Applying BRT branding to the standard bus fleet that already exists could detract from the reputation of the BRT brand.	• Typical for most BRT systems.
Larger windows and enhanced lighting	• Increased sense of passenger comfort and security.	• Slight increase in maintenance costs.	• Salt Lake City MAX 3500 S. Line. • Eugene EmX Green Line.
Enhanced interior amenities (higher-quality seating surfaces, materials, finishes, and climate control)	• Increased passenger comfort and higher-quality passenger experience can attract riders and improve the perception of BRT as a high-quality service.	• Potentially more subject to wear and vandalism, increasing maintenance costs.	• Salt Lake City MAX 3500 S. Line. • Eugene EmX Green Line.
Alternative seat layouts	• Reducing the number of seats can increase total passenger capacity and ease circulation, reducing dwell times	• The trade-off between number of seated passengers and number of standing passengers becomes more critical as systems mature and passenger volumes approach vehicle capacity. Reducing the number of seats allows room for more standing passengers and eases circulation when the vehicle is at or near capacity.	• Eugene EmX Green Line (wide aisles and doors). • Cleveland Healthline (wide aisles and doors). • Kansas City MAX.
Additional door channels	• Additional doors and wider doors can significantly ease passenger circulation and speed boarding and alighting, resulting in reduced dwell times. • Adding doors to the left side of the vehicle can enable center median stations.	• The benefit of additional doors is maximized by off-board fare payment, which allows passengers to board at multiple doors at the same time. • Left side doors may require structural modifications, potentially increasing procurement costs.	• Salt Lake City MAX 3500 S. Line (additional door on right side). • Eugene EmX Green Line (doors on both sides). • Cleveland Healthline (doors on both sides).
Exterior mounted bicycle racks	• Increases options for passengers to access transit.	• Can increase dwell time. • Capacity for bicycles is limited.	• Becoming a common element for standard bus service, with many systems equipping the entire fleet with bike racks.
Interior bicycle securement	• Can speed boarding of passengers with bicycles and reduce dwell time compared to exterior mounted bicycle racks. • Can increase capacity for bicycles compared to exterior mounted bicycle racks.	• Can reduce overall passenger capacity.	• Eugene EmX Green Line. • Cleveland Healthline.
Enhanced wheelchair securement	• Can speed boarding of disabled passengers and reduce dwell time.	• Prices and seating capacity can vary considerably.	• Typical for most BRT systems.

Propulsion Systems			
Compressed Natural Gas (CNG)	• In relatively wide use. • Improved fuel economy and reduced emissions. • Requires minimal adjustment to existing maintenance infrastructure.	• Increases cost over a standard diesel engine by $60,000 per vehicle. • Requires approximately $700,000 to $1,000,000 in fueling and maintenance infrastructure.	• Los Angeles Metro Rapid and Orange Line. • Orlando LYMMO. • Sacramento EBUS Stockton Line.
Hybrid-electric	• Improved fuel economy and reduced emissions (potential gains in fuel efficiency of up to 60%). • Smoother, quicker, and quieter acceleration than a conventional diesel bus. • More efficient braking than a conventional diesel bus.	• Some added maintenance infrastructure may be required. • Proper maintenance of batteries is essential. • Increases cost over a conventional diesel bus by $150,000 to $250,000.	• Albuquerque Rapid Ride. • Eugene EmX Green Line. • Cleveland Healthline.
BRT Branding			
Brand name	• Packages all of the elements of the BRT system (routes, stations, vehicles) into an easily identifiable name.	• Must be distinct from, but relate to other services within the broader system.	• Typical for most BRT systems.
Logo and color schemes	• Visually distinguishes the BRT system from other transit services.	• Must be distinct from, but relate to other services within the broader system.	• Typical for most BRT systems.
Park-and-Rides			
Surface park-and-ride lots	• Most affordable type available.	• Typically would be designed with a capacity of 100 to 500 spaces.	
Parking structures	• Can provide much greater capacity than a surface parking lot.	• Much more expensive to construct than a surface lot. However, some locations may start out with surface lots initially and transition into structured parking in conjunction with development at TOD sites when they develop.	

6. TRANSIT FINANCE AND IMPLEMENTATION STRATEGY

Implementation Strategy/Funding

BRT-style improvements in the State Street corridor include both substantial service and capital improvements. This section describes funding opportunities and a recommended phased implementation strategy for transit operational improvements on State Street. As demonstrated by the transit analysis described in Chapter 4, significant ridership increases could be achieved by improving the frequency and coverage of transit service in the corridor and region. BRT capital improvements should be considered after ridership has grown significantly in response to service improvements.

Current Transit Funding

Valley Regional Transit is currently funded using an array of local and federal funding sources. As with most transit agencies in the United States, transit operations is funded from different sources than transit-related capital projects. VRT budgets separately for bus service in Boise and Garden City and for buses serving Nampa and Caldwell.

Capital Costs

Federal funds typically cover approximately 80 percent of the capital expenditures for VRT. Current capital projects include bus and equipment purchases, right-of-way, ADA bus stop improvements, and the design and construction of a new downtown Boise multimodal center.

Operating Costs

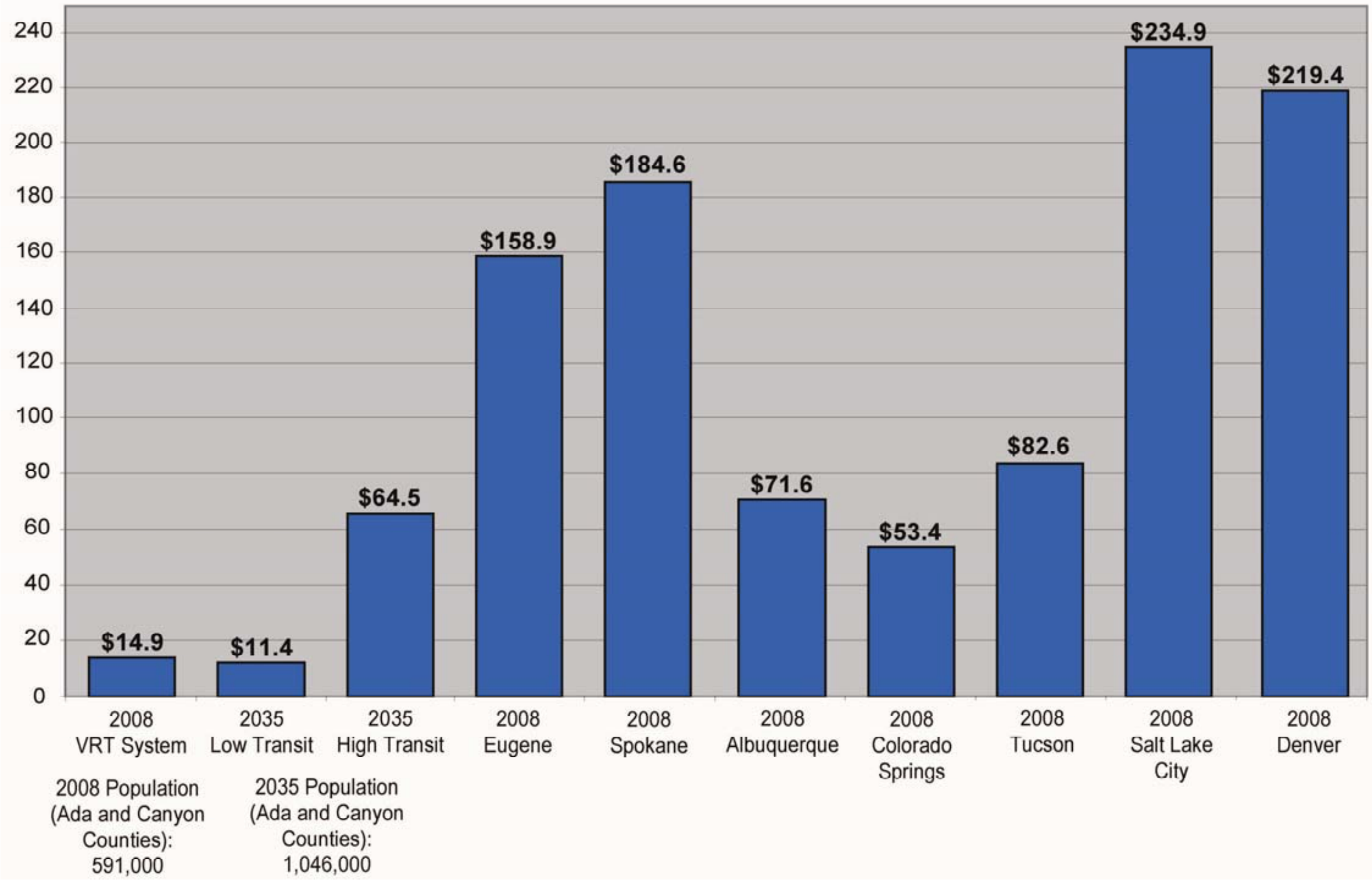
The majority of local funding for operations comes from voluntary contributions from Ada and Canyon counties and the cities of Boise, Garden City, Meridian, Nampa, and Caldwell. Smaller amounts of funding are contributed from other cities in the region. In addition, these same regional partners contribute a smaller amount of dues based on population.

Federal operating funds are used to augment local funding. VRT receives direct federal operating support for the Nampa/Caldwell services and has historically received a waiver that allows them to use federal capital funds to support operations in the Boise/Garden City service area. The total operating revenues for the full agency in FY 2010 were approximately $10 million, with about 30 percent provided by federal funds.

Data on the amount of service provided by VRT and the associated operating costs were compared with other systems in the Northwest, Mountain States, and in similar-sized peer cities in the west. The data for other systems was derived from the Federal Transit Administration's National Transit Database (2008). Figure 11 illustrates where the Treasure Valley stands in comparison to these other systems.

The Treasure Valley spends the lowest amount per capita compared to other transit systems in the west, including peer cities of similar size. Even after making the increased investment in a future High Transit Network (see Chapter 3), the region would still be within the lower end of transit investment per capita compared with other western cities.

Figure 11. Operating Cost per Capita in the Treasure Valley and Western and Mountain State Cities



Future Funding Opportunities

Operating Costs

In order to seriously consider implementing BRT-style improvements on State Street, VRT would need to increase their operating budget significantly, bringing it more in line with Albuquerque, Colorado Springs, and Tucson. This level of investment in transit operations would be consistent with Treasure Valley in Transit and could provide an adequate foundation for considering implementing BRT capital improvements.

Public transportation funding is currently being discussed as part of the Governor's Task Force on Modernizing Transportation Funding. The task force has established a Public Transportation Subcommittee that has identified and ranked potential funding sources that could be used for transit operations. User fees and fares was the highest ranked option, followed by a local option sales tax, a local option resort tax and a local option real property tax.

In recent legislative sessions, a proposal has been developed to provide local areas with the authority to ask voters to consider a local option sales tax with the ability to fund transit, but has not had success. If a local option sales tax for transit is included as part of the overall package of funding modernization that comes out of the Governor's Task Force, it may significantly improve chances of passing the legislature. Past efforts to provide local jurisdictions with this local option have had strong support within the Treasure Valley region but have failed to garner enough support from other parts of the state. If the legislature were to provide the authority to ask local voters to assess additional sales tax, the region would need to develop a package of transportation improvements (either transit-only or transit plus roadway) and ask the voters for their support to impose a tax in order to fund the improvements.

Other options to fund additional transit operations (such as real property tax, local option registration fee, payroll tax and vehicle tax) are potentially available, but these options do not have the level of support necessary to be considered viable options at this time.

Capital Costs

The capital elements for a State Street BRT would likely include some of the following elements:

- Stations with shelters
- Exclusive or semi-exclusive travel lanes (including HOV lanes)

- Special branded vehicles
- Advanced signaling systems (i.e., transit signal priority)
- Real-time traveler information
- Off-board payment machines
- Signage and striping
- Limited amounts of additional right-of-way
- Bus pull-outs

Local capital funding could be available through ACHD if the specific improvement could demonstrate benefit to general purpose traffic. Capital elements that could potentially be funded through ACHD include shared traffic lanes (including HOV lanes), traffic signals, right-of-way, and pedestrian and bicycle improvements.

The current federal transportation authorization, Safe Accountable Flexible Efficient Transportation Equity Act, a Legacy for Users (SAFETEA-LU) passed congress in 2005 and has been extended through 2010. A new transportation authorization bill is anticipated to come out of congress in 2011. The following discussion of potential federal capital funding sources is based on sources available through SAFETEA-LU.

Federal funding for BRT improvements can come from a variety of sources including 5307 formula funds, 5340 formula funds, Congestion Mitigation and Air Quality (CMAQ) funds, Surface Transportation Program (i.e. "Flexible") funds and Section 5309 grant programs (including the New Starts and Small Starts programs). The following describes these funding sources and issues related to their potential use for transit capital improvements on State Street.

5307 and 5340 Formula Funds

These funds are available on a population-based formula and can be used for planning, construction and in some cases, operations. BRT capital elements that could be covered with 5307 funding include bus purchase, passenger facilities and traffic signals.

CMAQ Funds

ITD oversees the distribution of CMAQ funds in Idaho. Grants are provided for projects to demonstrate air quality benefit in air pollution problem areas. Northern Ada County is currently classified as a Maintenance Area for carbon monoxide (CO) and particulates. A case could be made that BRT capital improvements on State Street would have an air quality benefit for Ada County by improving the transit mode share and reducing the number of motor vehicles in the corridor.

Surface Transportation Program (STP) Funds

These are federal flexible funds that are distributed through the COMPASS Transportation Improvement Program. STP funds have been used in many regions as a substantial funding source for major transit improvements. Determining the priority for use of STP funds for a major transit investment on State Street could require modification of COMPASS's project ranking methods.

New Starts/Small Starts Grants

The largest potential source for transit capital improvements on State Street would be through FTA's New Starts Program, also known as the Section 5309 Capital Investment Grant Program. The New Starts Program is a discretionary and competitive grant program that typically provides 50 to 60 percent of capital funding for high-capacity transit capital improvements. There are currently three categories of projects that are considered:

- **Very Small Starts** – These projects include a total capital costs of less than $50 million and less than $3 million per mile (excluding vehicles). A corridor must have existing transit ridership of 3,000 per day in order to qualify for Very Small Starts funding.
- **Small Starts** – These are projects with a total capital cost of less than $250 million with no greater than $75 million requested in federal 5309 funding. Small Starts must have at least 50 percent of the project length in a fixed guideway or be a corridor BRT project with substantial stations, signal priority, low-floor vehicles, 10-minute peak frequency, and at least 14 hours of service per day.
- **New Starts** – These projects include a total capital cost of more than $250 million. (Note: the term "New Starts" refers to this specific funding category but it is also used to refer to the overall Section 5309 Capital Investment Grant Program).

A successful application for New Starts/Small Starts funding requires a corridor with a strong base of existing transit ridership and forecast growth and a project that can provide significant improvement in transit travel time and attract new riders. In order to prepare a successful New Starts/Small Starts project for the State Street corridor, it will be necessary to build up the level of transit service, maintain that built-up level of service, and then allow the increased service to operate for several years in order to attract additional riders. It will also require developing a project that can achieve significant travel time savings for transit and potentially compete with other projects nationally.

The federal New Starts Program has authority to provide up to 80 percent of the project cost, however in actual practice, most projects receive between 50 and 60 percent depending on a range of factors. Local match funding typically needs to provide 40 to 50 percent of the project capital cost. Sources that could be considered as potential sources for local match for a BRT project on State Street include:

- Revenue bonds (backed by property taxes)
- Local improvement district (LID) funds
- Impact fees

Initial Phases to Build Ridership on the State Street Corridor

In order to consider significant BRT-style improvements and to potentially compete for New Starts/Small Starts funding, it is critical to start with a strong base of existing ridership. The first phase for any BRT improvement strategy would need to focus on increasing ridership in the corridor prior to any major capital investment. The following discussion presents the recommended steps for phased service improvements and an estimate of the associated additional annual operating costs for each improvement on State Street.

Annual operating costs are expressed as a range in order to account for increased congestion over time. Increasing congestion slows buses along with the general purpose traffic and results in higher operating costs. Actual operating cost increases would be closer to the low end of the range if implemented immediately, but would increase toward the higher end of the range by 2035 due to slower transit operating speeds resulting from traffic congestion increasing over time.

All costs are expressed in 2009 dollars. Each incremental cost increase is additive and is based on an assumption that the previous steps will have been implemented. These service improvements are presented in one potential sequence, however, based on specific needs or policy priorities the sequence could be altered while still maintaining a logical progression of improvements.

1. Increase peak-period frequency on Route 9 State Street to 15 minutes.

Route 9 currently operates at 30-minute headways all day (currently from 5:30 a.m. to 7 p.m.). The frequency of Route 9 would be increased to 15 minutes during the morning and evening peak periods.

Additional annual operating cost: $100, 000 to $150,000.

2. Increase frequency on Route 9 State Street to 15 minutes all day.

The frequency of Route 9 would be increased to 15 minutes throughout the entire day (for VRT's current extent of service for Route 9 from 5:30 a.m. to 7 p.m.). This improvement would provide a frequent and consistent level of service on the corridor, between Saxton Drive and downtown Boise.

Additional annual operating cost: $200, 000 to $350,000.

3. Expand service on Route 9 State Street to late evenings and weekends.

The span of service on Route 9 would be expanded to late evenings and weekends with 15 minute frequencies most parts of the day, with frequencies tapering off in the late evening. This expansion would provide a dependable service that could significantly increase ridership. One key result of increasing service frequency and span of service is that this increases reliability to the rider, who can depend on the transit service being there and being consistent.

Additional annual operating cost: $250,000 to $400,000.

4. Extend Route 9 State Street east to St. Luke's Hospital and BSU

Extending Route 9 State Street east to the hospital and the eastern portions of the BSU campus would increase the attractiveness of this service with a relatively moderate cost by providing a one-seat ride to these significant trip generators. This capability would match this similar feature currently available to riders in the I-84 corridor which is served by routes 40, 42, 43 and 45 that extend to the hospital and BSU. VRT could explore potential cost sharing arrangements with with St Luke's and BSU.

Additional annual operating cost: $400,000 to $600,000.

5. Increase frequency on Route 44 Express to 30 minutes during peak hours.

The Route 44 Express currently makes only one inbound run during the morning peak and one outbound run during the evening peak time periods. The frequency of service would be increased to every 30 minutes, resulting in a much wider span of service and a more attractive option for peak period commuters. This improvement could be made in conjunction with development of a park-and-ride lot in the vicinity of SH 16.

Additional annual operating cost: $200,000 to $400,000 (does not include operating costs for the park-and-ride lot).

6. Extend Route 9 State Street west to Eagle; extend Route 9x Express west to Eagle.

Extending Route 9 with 15-minute all-day service west to Eagle would nearly double the route length, increasing it from six miles to ten miles. This would be a significant increment and could be considered in conjunction with development of park-and-ride lots in the vicinity of Horseshoe Bend Road/SH 55 and Eagle Road/Edgewood Lane.

Additional annual operating cost: $300,000 to $600,000 (does not include operating costs for the park-and-ride lots) for extension of Route 9 State Street west to Eagle; additional $100,000 to $150,000 for extension of Route 9x Express west to Eagle.

7. Extend Route 9 State Street west to SH 16.

As growth occurs and ridership builds in the corridor west of Eagle, Route 9 would be extended further west to SH 16. This expansion would increase the route length by 50 percent, from ten miles to fifteen miles. This route could serve a park-and-ride lot near SH 16. This is a relatively expensive step, because this would be extending the route with frequent all-day service. A lower cost option would be to extend service from Eagle to SH 16 at 30-minute headways.

Additional annual operating cost: $350,000 to $800,000.

8. Add connecting services.

Once a Primary Service Route (Route 9) with frequent, all-day service (extended to late evenings and weekends as noted above) and park-and-ride lots are established, the next step would be to add appropriate feeder routes. Three State Street feeder routes (Eagle Foothills, Eagle Direct and Idaho Center/Star) were included in the 2035 transit networks developed for modeling and analysis (see Chapter 3). In the 2035 networks these routes were through-routed on State Street into downtown Boise.

Initial feeder routes could be developed that are not through-routed into downtown Boise, in order to provide an appropriate level of service and keep costs down. Feeder routes could connect to the State Street routes at key stations and/or park-and-ride lots, which could evolve into transfer centers. The feeder routes could be extended into downtown Boise as ridership increases enough along the State Street Primary Service Route.

New feeder routes would not necessarily need to conform to those routes that were developed for modeling. Actual routing should be based on an assessment of travel markets once a high level of trunk service along State Street has been established.

To provide a sense of what it would cost to operate feeder routes, operating costs were estimated for a generic route that would match the span of service and frequency of the expanded Route 9 State Street. Operating costs are for one five-mile length of a generic feeder route.

Additional annual operating cost: $1,200,000 to $1,500,000 (per one five-mile length of feeder route).

These steps would create a strong frequent-service trunk line for the entire length of the State Street corridor from downtown Boise to SH 16, supported by park-and-rides and feeder routes. These service improvements would move the corridor toward the level of investment and service construct that was identified for State Street in the Treasure Valley in Transit Plan.

Table 8 summarizes the estimated operating costs that would be required to implement this system. Some of these service improvement elements could be implemented as part of an overall strategy or as stand-alone elements in order to meet strategic or policy goals. If the total package of service improvements were implemented the the total estimated operating costs would range from $3 million to $4.8 million per year.

In conjunction with these phased implementation steps, additional low-cost measures could be applied to reinforce rider perception of the improved service. Once a frequent, all-day, everyday service is established, branding could be applied to reinforce the consistency and reliability of the new service. For example, in Portland, TriMet's Frequent Service is applied to any route in the network that runs at 15-minute frequencies or better all day, every day. This enables a rider to recognize that this is a service that will be consistently available and can be relied upon. It is identified by a Frequent Service logo on schedules and bus stop signs.

Table 8. Phased State Street Transit Service Improvements and Operating Cost Estimate

	Estimated Annual Operating Cost Range	Total Additional Annual System Operating Cost	Service Improvement Benefit
1. 15 Minute Peak Service on Route 9	$100,000 - $150,000	+ $100,000 - $150,000	Establish high quality peak service
2. All Day15 Minute Service on Route 9	$200,000 - $350,000	+$300,000 - $500,000	Establish frequent service and reinforce corridor as premier transit corridor
3. Add Late Evening and Weekend Service on Route 9	$250,000 - $400,000	+$550,000 - $900,000	Reliably available service in the corridor
4. Extend Route 9 to St Luke's and BSU	$400,000 - $600,000	+$950,000 - $1,500,000	Extend reach of corridor service to important markets
5. Increase Route 44 Express to 30 Minute Peak Service	$200,000 - $400,000	+$1,150,000 - $1,900,000	Serve longer distance commute trips and provide for rider flexibility
6. Extend Route 9 & 9X to Eagle	$300,000 - $600,000	+$1,450,000 - $2,500,000	Establish Eagle as a key transit market
7. Extend Route 9 to SH 16	$350,000 - $800,000	+$1,800,000 - $3,300,000	Provide good access to park-and-ride lot
8. Add Feeder Service (one 5-mile route)	$1,200,000 - $1,500,000	+$3,000,000 - $4,800,000	Expand the reach of transit service in the corridor

Development of BRT Capital Improvements on the State Street Corridor

Once an appropriate level of service has been established and ridership has begun to approach 3,000 riders per day for a few years, the State Street corridor could be in good standing to compete for New Starts/Small Starts funding for BRT capital improvements. These could include exclusive lanes, signal priority treatments, queue-bypass lanes, special vehicles, or improved stations.

The key to this phased approach is that the early phases would build a solid base of ridership prior to applying for capital funding via the New Starts or Small Starts programs. The initial phases could be accomplished in a relatively short time span (assuming funding availability), as they are primarily increases in service, and not major capital projects. This would likely require procurement of additional vehicles, hiring additional drivers, and changes to signage and schedules. These initial phases could be achieved by focusing available funding on the corridor which could be considered as a "Transit Demonstration Project." Treating the State Street corridor as a demonstration project would require a strong policy commitment from the regional decision-makers.

Since the New Starts/Small Starts programs are competitive grant programs and applicants need to demonstrate that there is a need for a project and that the project would significantly improve service, this phased implementation strategy would enable VRT to demonstrate that large improvements in travel time that could result from the capital improvement projects (exclusive lanes, signal priority, queue-bypass lanes, off board fare payment, etc.) would benefit the most people, because ridership will have already been increased as much as possible without capital improvements.

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