WEST DAVIS
CORRIDOR


Technical Memorandum 26:

# West Davis Corridor Transit Study

**March 2012**

WEST DAVIS CORRIDOR

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# EXECUTIVE SUMMARY

The Utah Department of Transportation (UDOT) is preparing an Environmental Impact Statement (EIS) for a transportation solution to projected 2040 transportation needs in west Davis County and southwest Weber County. This study effort is known as the West Davis Corridor (WDC) EIS. During the Alternatives Development process, UDOT and FHWA considered a transit-only scenario as well as various alternatives combining transit and roadway. The results of that analysis are included in the Alternatives Screening Report. In summary, though the transit-only alternative proposed was very extensive and did increase ridership, it did not, by itself, provide enough regional mobility benefits to meet the purpose and need. In addition, combining these transit improvements with roadway alternatives did not have an effect on which alternatives met the purpose and need. Nevertheless, one of the objectives of the EIS is to improve the relationships between various modes of transportation. Thus as part of the EIS process, UDOT is considering transit alternatives as part of a multiple travel mode evaluation. This document describes the transit study performed by the WDC Team in an effort to identify and refine a transit scenario that could be included in the EIS.

The scope of this transit study was developed in coordination with several non-governmental organizations (NGO) that are advocates for transit to be included as part of the WDC project. As a group, UDOT and the NGOs agreed that for any transit alternative to be advanced for further consideration in the EIS that it must:

1. Meet UTA criteria for a capital cost effectiveness and operational cost and be fully supported by UTA,
2. Provide benefits that offset any negative impacts to the community or environment caused by the transit investment, and
3. Increase transit ridership and mode share in the WDC EIS study area in 2040, which should result in a reduction in peak period vehicle miles of travel (VMT) in 2040 in the WDC study area.

To begin the process of developing a preferred transit scenario that could be carried forward in the EIS, the Initial Transit Scenario was developed and analyzed to test the relative competitiveness of Bus Rapid Transit (BRT) routes on the primary east-west streets in the WDC study area. The analysis was performed for estimated 2040 conditions using version 6.1 of the Wasatch Front Regional Council (WFRC) travel demand model.

The concept behind the Initial Transit Scenario was to evaluate transit on each of the primary east-west streets in the WDC study area to determine which corridors would generate the highest transit ridership. Six BRT lines were coded into the model, each with assumed headways of 15 minutes in the peak and off-peak periods. Each line connected to a commuter rail station. The six corridors chosen for analysis were:

- 2550 South (Ogden)
- 4000 South (Roy)
- 5550 South (Roy)
- 1800 North (Clinton)
- 700 South (Clearfield)
- Gentile Street (Layton)

The underlying Regional Transportation Plan (RTP) transit network was generally left in place for the Initial Transit Scenario. Local bus routes were removed from roads that also had the study BRT routes. In the 2040 RTP, there is a BRT line on Antelope Drive from 2000 West to Main Street, therefore a stand-alone BRT line on Antelope Drive was not considered.

In order to satisfy the first study goal, that the transit alternative be fully supported by UTA, a general ridership guideline for BRT service was obtained from UTA that recommended at least 250 future daily boardings per mile.

The best performing route was the one on 2550 South with approximately 240 boardings per mile, which provided service to the Ogden Intermodal Center and downtown Ogden. This connection to downtown is the main reason why this route performed so well. The second tier of routes contained 4000 South, 5550 South,

and 1800 North with boardings per mile ranging from about 110 to 120. The final tier of routes consisted of 700 South and Gentile Street, which had 50 and 75 boardings per mile, respectively.

The second tier of routes was selected for further analysis in the refinement portion of the WDC Transit Study. The 2550 South route was not selected for further analysis because it was primarily serving downtown Ogden and not the core study area.

The three second tier BRT routes (4000 South, 5550 South, & 1800 North) were each modeled separately as stand-alone projects. Of these routes, the 1800 North route had the highest boardings per mile at approximately 120. This value is about half of the UTA recommended minimum threshold of 250 boardings per mile to justify a BRT investment. The routes on 4000 South and 1800 North had 103 and 93 boardings per mile, respectively. These relatively poor results led the study to consider other transit projects that would generate more ridership or would require a smaller investment by UTA.

The North-South Scenario was developed wherein the portion in the WDC study area of the Ogden-Layton BRT line included in the RTP would be advanced so that it would be built earlier than currently planned. This route would provide BRT service from the Roy CRT station to the Clearfield CRT station via Midland Drive, 2000 West, and Antelope Drive. A scenario was envisioned where upon initial construction the route would operate on 30-minute peak headways and 60-minute off-peak headways to match commuter rail service. Station amenities would be provided including shelters and ticket vending machines. Queue jumper lanes would be provided at signalized intersection, which would likely be coupled with signal priority given to transit vehicles.

This scenario was analyzed for 2009 and 2040 conditions. The 2040 analysis consisted of extracting ridership data from the portion of the Ogden-Layton BRT route that would comprise the initial build segment. The 2009 analysis was to determine the near term ridership that could be expected from the service. The analysis resulted in an estimated 41 boardings per mile in 2009, which is expected to increase to 176 in 2040. While the results were better than the east-west routes, it was still less than the desired 250.

Another scenario was developed that would provide transit service nearer to the WDC roadway, which could compete for the same user market as the roadway. This scenario consisted of an express bus route that would run along the WDC roadway and provide service to downtown Salt Lake City. As modeled, the route would begin in Roy near I-15 and travel west on 5550 South to the WDC roadway. The route would then travel along the WDC roadway and exit at each interchange to service a stop at an assumed park-and-ride lot before getting back on the WDC roadway. The route would then merge onto I-15 and continue without stop to downtown Salt Lake City where it would make a small loop of downtown and terminate at the Salt Lake Intermodal Center. It was assumed that the route would operate with 30-minute headways only in the peak hours and only in the peak direction (i.e. it would provide one-way service into downtown in the morning and out of downtown in the evening).

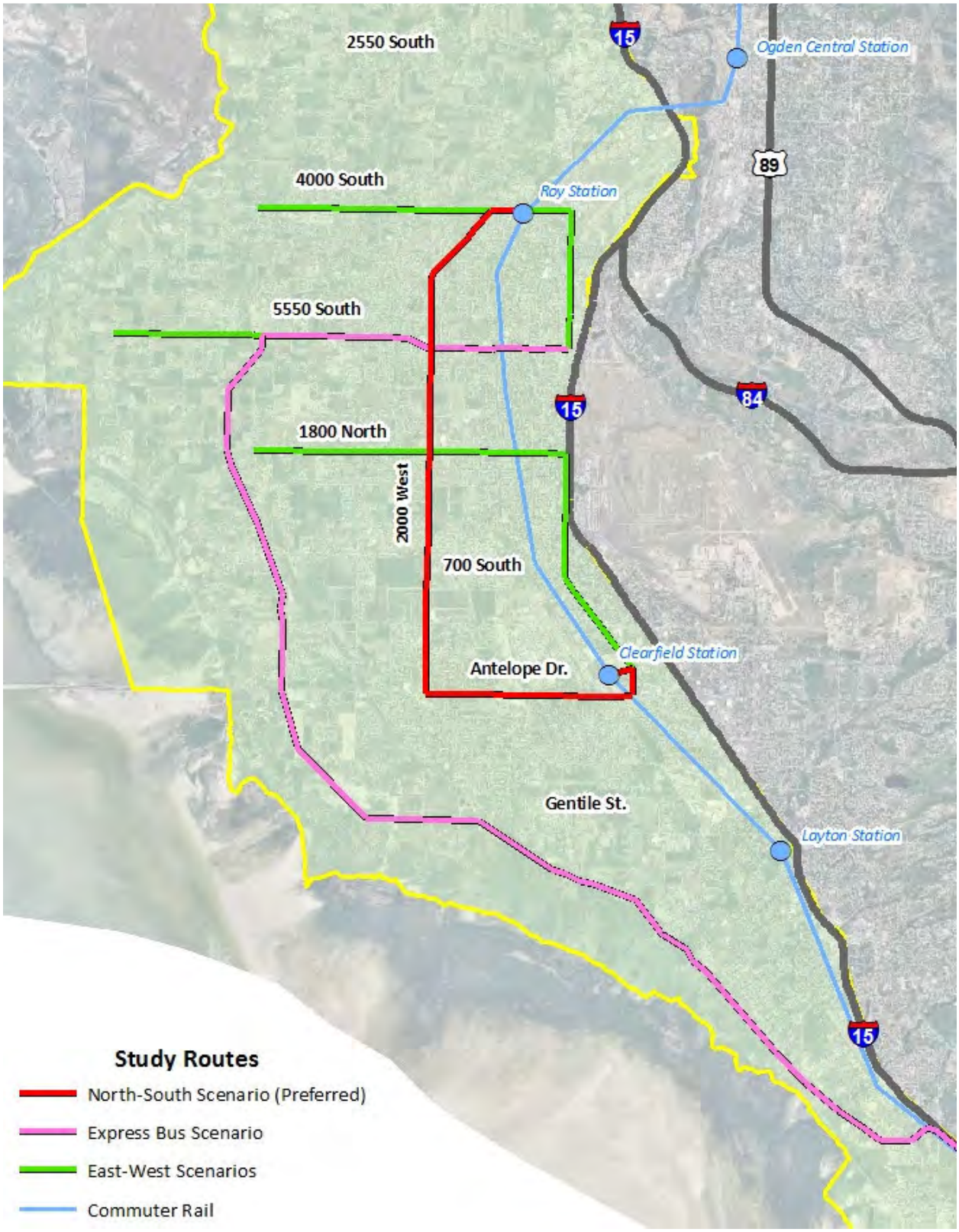
This scenario was also analyzed for 2009 and 2040 conditions. In 2009, the estimated total daily boardings were 500, which was comparable to the 2009 daily ridership of the North-South Scenario, although because the route is so much longer there were only 12 boardings per mile. In 2040 the projected daily ridership is 1,070 boardings, or 25 boardings per mile. However, the express bus also steals 40% of its 2040 riders from commuter rail, for which reason it was not advanced for further consideration.

Exhibit ES-1 illustrates the 2009 (where applicable) and 2040 daily boarding information for the five routes that were studied. In summary, the North-South Scenario had the best overall performance, but was still below UTA's criteria of 250 boardings per mile to justify a BRT investment. Exhibit ES-2 shows the key study routes

*Exhibit ES-1 – Daily Boarding Summary*

| Scenario | Headway (Pk/Ok) | Round Trip Length (mi.) | 2009 Daily Boardings | 2009 Boardings / Mile | 2040 Daily Boardings | 2040 Boardings / Mile |
|---|---|---|---|---|---|---|
| East-West | | | | | | |
| 4000 South | 15/15 | 7.7 | n/a | n/a | 400 | 103 |
| 5550 South | 15/15 | 19.1 | n/a | n/a | 890 | 93 |
| 1800 North | 15/15 | 16.7 | n/a | n/a | 1,000 | 120 |
| North-South | 15/15 | 24.6 | 510 | 41 | 2,160 | 176 |
| Express Bus | 30/-- | 42.4 | 550 | 12 | 1,070 | 51 |

*Exhibit ES-2 – Key Study Routes*



# 1.0 INTRODUCTION

The Utah Department of Transportation (UDOT) is preparing an Environmental Impact Statement (EIS) for a transportation solution to projected 2040 transportation needs in west Davis County and southwest Weber County. This study effort is known as the West Davis Corridor (WDC) EIS. During the Alternatives Development process, UDOT and FHWA considered a transit-only scenario as well as various alternatives combining transit and roadway. The results of that analysis are included in the Alternatives Screening Report. In summary, though the transit-only alternative proposed was very extensive, it did not, by itself, provide enough regional mobility benefits to meet the purpose and need. In addition, combining these transit improvements with roadway alternatives did not have an effect on which alternatives met the purpose and need. Nevertheless, one of the objectives of the EIS is to improve the relationships between various modes of transportation. Thus as part of the EIS process, UDOT is considering transit alternatives as part of a multiple travel mode evaluation. This document describes the transit study performed by the WDC Team in an effort to identify and refine a transit scenario that could be included in the EIS.

The scope of this transit study was developed in coordination with several non-governmental organizations (NGO) that are advocates for transit to be included as part of the WDC project. It was agreed that for any transit alternative to be advanced for further consideration in the EIS that it must:

1. Meet UTA criteria for a capital cost effectiveness and operational cost and be fully supported by UTA,
2. Provide benefits that offset any negative impacts to the community or environment caused by the transit investment, and
3. Increase transit ridership and mode share in the WDC EIS study area in 2040, which should result in a reduction in peak period vehicle miles of travel (VMT) in 2040 in the WDC study area.

A scope of work for the transit analysis was developed that comprised the following tasks:

1. Review Existing Modeling – Examine modeling already performed by the WDC EIS Team and evaluate the transit performance
2. Evaluate Transit Market – Examine socioeconomic data and resulting trip generation in the travel model to find concentrated areas of high activity
3. Develop Initial Transit Scenario – Compare transit line performance in a scenario with multiple high capacity/high-frequency lines
4. Refine Transit Scenario – Evaluate and refine top performing line from the previous task and develop a final, recommended scenario

Explanations of the analysis performed for each of these tasks, along with a description of the current transit service in the study area, are the bulk of this report.

The group generally agreed that the WDC study area is not now, nor is it expected to become, an area with a great degree of high density development. As such, it was also agreed that a higher class of transit service (i.e. rail) would not be considered as part of the study. Instead, the study focused on Bus Rapid Transit (BRT) and express bus services. With this same sentiment, it was also generally agreed that the transit scenario should focus on bringing people to the existing commuter rail service (FrontRunner), by which they could reach more employment destinations.

BRT represents a higher class of transit service than typical local bus service. There are three types of possible BRT services depending on the associated amenities, which are simply referred to as BRT Types I, II, and III, with Type III representing the highest class of service. on the following page describes the characteristics of enhanced bus and the three different types of BRT. UTA currently has one BRT line, which operates on 3500 South in Salt Lake County. The Regional Transportation Plan (RTP) includes hundreds of miles of additional BRT lines over the next 30 years.

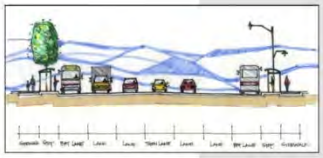
*Exhibit 1 – UTA Bus Rapid Transit Types*

## ENHANCED BUS SERVICE

**Improvements to Existing Bus Service**

. Increased Frequency
. Shuttles and/or special trips for targeted areas
. Improved location of stops
. Park and ride lots
. Peak hour express services
. Improved passenger stops

## TYPE I BRT



**Additions to Existing Bus Service**

Enhanced Bus Service features, plus:

. Signal priority and coordination
. Strategic spacing of stops
. Improved Safety
. Reduced wait time
. Off board fare collection
. Improved passenger stations
Passenger information displays

## TYPE II BRT

**Queue-Jump Lanes for Busses**

Type I BRT features, plus:

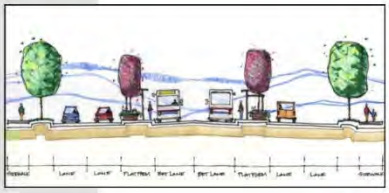
. Queue-jump lanes for busses at intersections
. Lanes can be used as HOV lanes for automobiles
. Longer distances between stops
. Some roadway improvements
. Improved Safety
. Faster Speed
. Pre-pay or partial pre-pay systems at stops

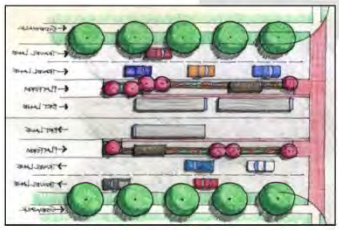
## TYPE III BRT

**Dedicated Lane for Busses**

Type II BRT features, plus:

. Exclusive bus lanes
. Signal priority and coordination
. 1/2 mile to 1 mile distance between stops
. Improved Safety
. Future ROW for light rail possible






*Source: Utah Transit Authority*

In order to satisfy the first study goal, that the transit alternative be fully supported by UTA, general ridership and construction cost information was obtained from UTA via a memo that can be found in the appendix. These guidelines provide desired ridership per mile values for various levels of transit investment. Exhibit 2 shows this data. The key value in this table is 250 future boardings per mile, which is the minimum desired threshold for a BRT I investment. The memo also mentions that the only currently operating BRT route in the UTA system (on 3500 South) currently has about 230 daily boardings per mile. Based on this figure it is reasonable to assume that the future boardings will exceed the 250 boardings per mile threshold.

*Exhibit 2 – UTA Ridership and Capital Cost Guidelines*

| Mode | Capital Cost per Mile | Future Daily Boardings per Mile |
|---|---|---|
| BRT I | $0.5M - $1.2M | 250 - 500 |
| BRT II | $8M - $25M | 250 - 500 |
| BRT III | $8M - $25M | 500 - 700 |
| LRT | $35M - $75M | > 1,000 |

In evaluating the third goal of increasing transit ridership, general ridership and mode share data were extracted from the WFRC travel model for 2009 base year and 2040 RTP conditions for both the WDC study area and the entire model region. The data are presented for work trips, which typically have higher transit usage than most of other types of trips, and for all trips. The ridership values are the number transit riders entering or exiting either the study or the region. The mode share information is the percentage of transit trips compared to the total number of trips. Exhibit 3 shows this data, which is utilized for comparison purposes in several sections of the report.

*Exhibit 3 – 2009 Base Year & 2040 RTP Transit Ridership Data*

| | Daily Ridership | | | | Transit Mode Share (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Work Trips | | All Trips | | Work Trips | | All Trips | |
| | WDC | Region | WDC | Region | WDC | Region | WDC | Region |
| 2009 Base | 3,360 | 50,660 | 5,050 | 99,620 | 2.59 | 4.19 | 0.60 | 1.14 |
| 2040 RTP | 7,160 | 109,050 | 12,370 | 229,310 | 3.09 | 5.19 | 0.84 | 1.54 |

As a test of the model's accuracy in predicting transit ridership, a comparison was made between the 2009 model results and 2009 American Community Survey (ACS) data. The ACS is administered by the U.S. Census Bureau and is an ongoing survey that provides interim year data regarding a number of socio-economic factors, including where people work and how they get there. The ACS data is available at the county level. A comparison between the travel model and the ACS data was made for work trips for people living in Davis County and for people working in Davis County. **Error! Reference source not found.** below compares the transit mode share between the two data sources and shows that the model does a good job of estimating the mode share, varying by no more than 0.2% for each type of work trip.

*Exhibit 4 – 2009 Model vs. ACS Comparison*

| Data Source | From Davis County | To Davis County |
|---|---|---|
| ACS | 3.6% | 1.7% |
| Model | 3.4% | 1.8% |

# 2.0 EXISTING TRANSIT SYSTEM

Information was obtained from UTA regarding existing transit routes providing service to the WDC study area and the ridership on each of those routes. There are currently four main routes that serve the study area, each of which is briefly described below.

- **470 – Ogden - Salt Lake Intercity** – Local service between the Salt Lake and Ogden Intermodal Centers
- **604 – West Ogden / Roy** – Local service between Roy and the Ogden Intermodal Center with service to the Roy commuter rail transit (CRT) station
- **626 – West Roy / WSU Davis** – Local service between west Roy and the Davis campus of Weber State University
- **F628 – Syracuse / Hooper** – Flex-route service between Roy and Clearfield FrontRunner CRT stations (flex routes may deviate up to ¾ mile from the set route upon request to pick-up or drop-off passengers)
- **640 – Layton Hills Mall / Weber State University** – Local service between the Layton Hills Mall and Weber State University in Ogden with service to the WSU Davis campus and the Clearfield CRT station

The exhibits on the following two pages are excerpts of UTA route maps. Exhibit 6 shows the transit system map for the general WDC study area. However, that map does not include the F628 line, so Exhibit 7 shows the individual route map for that line, which includes a ¾ mile buffer around the route illustrating where route deviations may take place.

Various route-level operational and weekday ridership data for 2010 were obtained from UTA and are summarized in Exhibit 5. It shows that on a boardings per mile basis that Route 470 – Ogden - Salt Lake Intercity has the highest ridership, while Route F628 – Syracuse / Hooper has the lowest ridership.

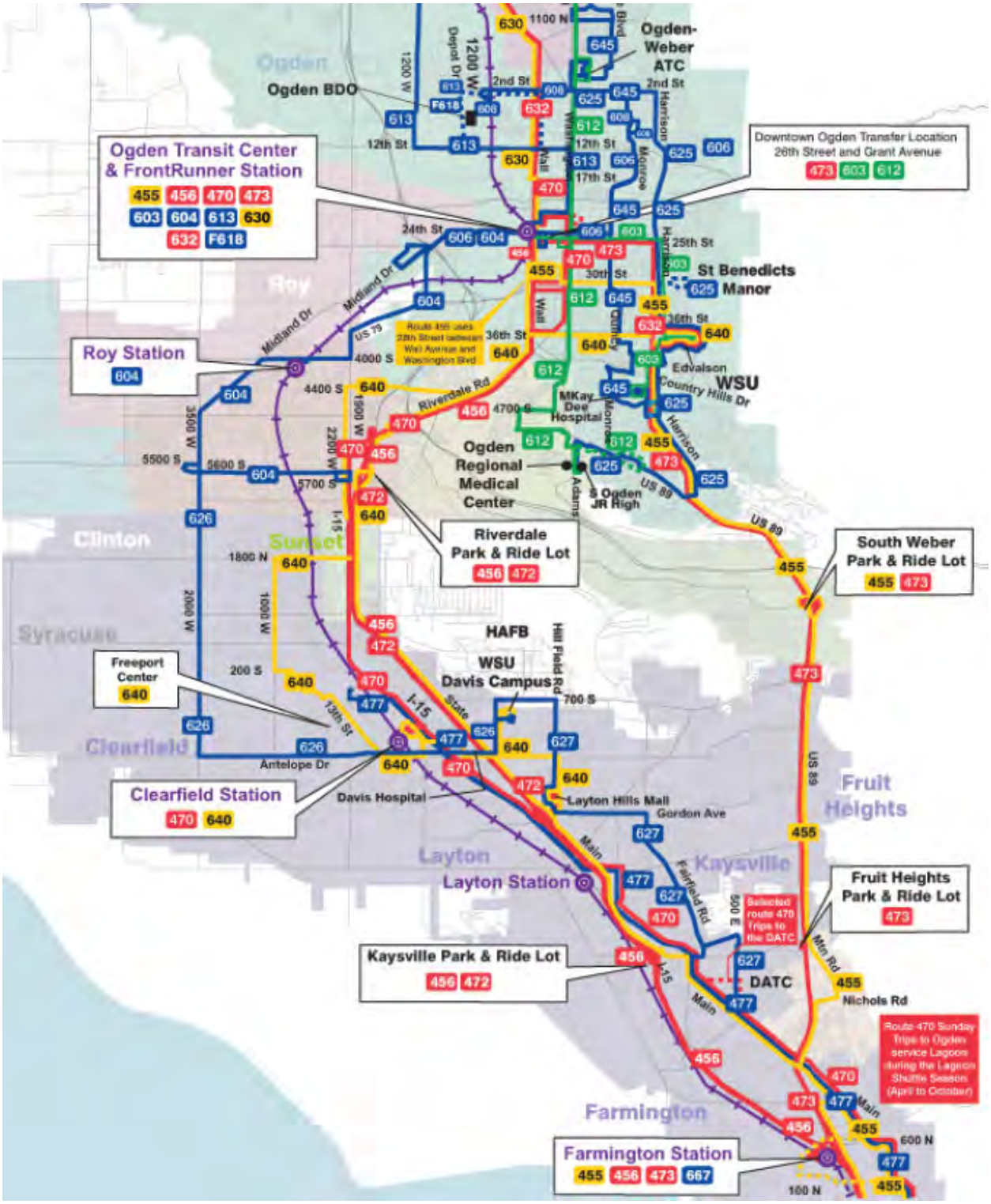
*Exhibit 5 – Existing Study Area Transit Routes & Ridership*

| Route Number | Route Name | Route Length | Headway (Pk/Ok)[1] | Trips / Day | Daily Board. | Board. / Mile | Board. / Trip |
|---|---|---|---|---|---|---|---|
| 470 | Ogden - Salt Lake Intercity | 43.6 | 20/30 | 85 | 3,831 | 88 | 45 |
| 604 | West Ogden / Roy | 12.0 | 30/30 | 53 | 453 | 38 | 9 |
| 626 | West Roy / WSU Davis | 10.4 | 60/75 | 25 | 209 | 20 | 8 |
| F628 | Syracuse / Hooper | 19.1 | 90/-- | 10 | 10 | 1 | 1 |
| 640 | Layton Hills Mall / Weber State University | 21.8 | 30/30 | 54 | 780 | 36 | 14 |

[1] *Pk/Ok = Peak / Off Peak*

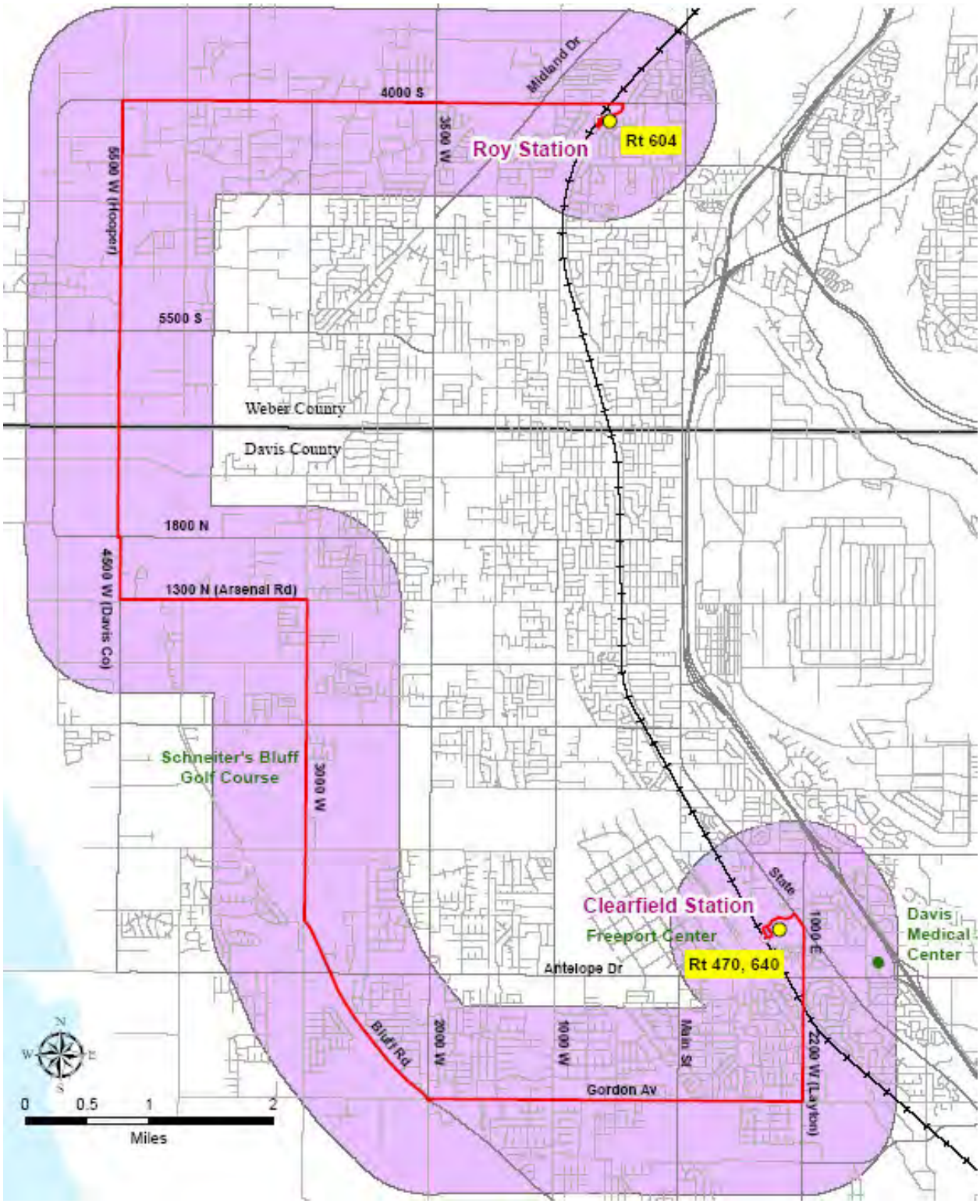
Based on travel model output, it is estimated that there are currently approximately 5,000 weekday transit trips to or from the WDC study area. These are trips that use any transit route or mode (e.g. commuter rail), not just the bus routes described above. Existing transit use accounts for about 2.6% of all work trips to/from the study area and 0.6% of all trips. Overall these ridership results are fairly modest, reflecting the suburban nature of the study area with few major employment centers.

*Exhibit 6 – General WDC Study Area Transit System Map*




*Source: Excerpt of UTA Weber County System Map*

*Exhibit 7 – F628 Route Map*




*Source: Excerpt of UTA Route Map*

# 3.0 REVIEW PREVIOUS TRANSIT MODELING

During the Alternatives Screening phase of the WDC EIS a robust 2040 transit-only alternative was considered and modeled using version 6.0 of the Wasatch Front Regional Council's (WFRC) regional travel demand forecasting model. This alternative was initially evaluated prior to this transit study and was reviewed in greater detail at the outset of the WDC Transit Study.

The transit-only alternative was very robust in its assumptions and included two light rail transit (LRT) lines, two BRT lines, and several local bus routes, along with the existing commuter rail line. The LRT lines were primarily east-west lines connecting to CRT stations. One line was on 4000 South (SR-37) in Roy and the other was on Antelope Drive (SR-108) in Clearfield. One of the BRT lines ran north-south on 2000 West (SR-108) from the Ogden Intermodal Center to the Layton CRT station. The other BRT line ran east-west on 1800 North (SR-37) in Clinton with access to Hill Air Force Base. The local bus service was scattered throughout the study area with most routes providing access to a CRT station. Boarding results for the LRT and BRT routes in 2040 were:

- **4000 South LRT** – 410 boardings/mile
- **Antelope Drive LRT** – 470 boardings/mile
- **1800 North BRT** – 170 boardings/mile
- **2000 West BRT** – 270 boardings/mile

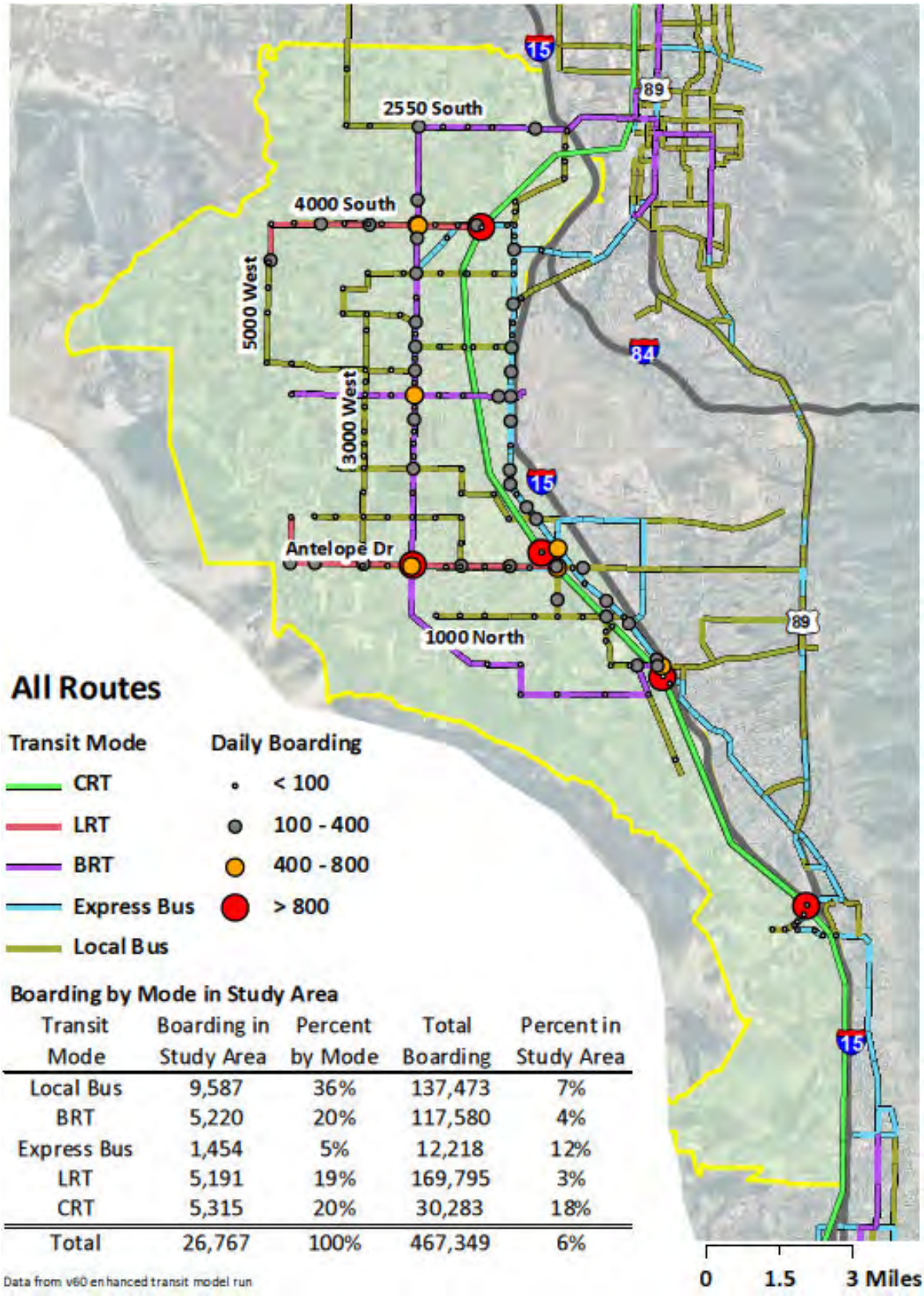
Boardings on the two LRT lines were below the desired 1,000 boardings per mile for an LRT investment. This supports the assumption made while developing the scope of the transit study that an LRT project would probably not be justified in the WDC study area. The 1800 North BRT ridership was a little below the desired 250 boardings per mile threshold for BRT I service, while the 2000 West line was a little over the threshold, indicating that BRT service may be justified. Exhibit 9 on the following page shows all of the transit routes in the WDC study area that comprised the transit-only alternative and the station-level boardings associated with those routes.

To more clearly understand the ridership in the corridor, boardings on key east-west roads were aggregated from the various routes traversing each road. Some roads were served by multiple routes (and multiple transit modes), while others were served by a single route. Exhibit 8 shows the roads for which boardings were aggregated, the modes of the routes serving the corridors, and the resulting ridership. This inconsistency of routes made it difficult to draw any firm conclusions from the analysis, so the analysis was not as useful as anticipated. The most interesting result is probably how high the demand on 2550 South was for only having local bus and BRT service.

*Exhibit 8 – 2040 Transit-Only Ridership by Corridor*

| Corridor | Modes | Daily Boardings | Boardings per Mile |
|---|---|---|---|
| 2550 South | Local Bus, BRT | 3,570 | 290 |
| 4000 South | Local Bus, LRT | 2,520 | 300 |
| 1800 North | BRT | 840 | 170 |
| Antelope Drive | Local Bus, LRT | 3,780 | 220 |
| 700 South | Local Bus | 160 | 40 |
| 1000 North | Local Bus | 490 | 70 |
| Gentile Street | BRT | 1,090 | 210 |

*Exhibit 9 – 2040 Transit-Only Alternative Boardings*




**Boarding by Mode in Study Area**

| Transit Mode | Boarding in Study Area | Percent by Mode | Total Boarding | Percent in Study Area |
|---|---|---|---|---|
| Local Bus | 9,587 | 36% | 137,473 | 7% |
| BRT | 5,220 | 20% | 117,580 | 4% |
| Express Bus | 1,454 | 5% | 12,218 | 12% |
| LRT | 5,191 | 19% | 169,795 | 3% |
| CRT | 5,315 | 20% | 30,283 | 18% |
| Total | 26,767 | 100% | 467,349 | 6% |

Data from v60 enhanced transit model run

# 4.0 TRANSIT MARKET EVALUATION

In order to better understand the potential for transit trips in the WDC study area, an analysis was performed of the study area travel market. The study area is characterized by low-density suburban development with few nodes of concentrated development. City general land use plans indicate that the development pattern is not likely to substantially change in the near future. There are only a few notable employment destinations in the area, none of which are actually in the WDC study area. These include downtown Ogden and Hill Air Force Base.

Using the travel model, a comparison was made between 2040 home-based work trip productions and attractions in the WDC study area. Home-based work trips are those associated with traveling to and from work and represent the primary source of transit riders. Trip productions are associated with the houses, while trip attractions are associated with jobs. The analysis compared the number of trip productions and attractions in the study area for work trips and all trips. Exhibit 10 shows the 2040 study area total for each category. Exhibit 11 on the following page graphically illustrates the location of 2040 work trip productions and attractions by model zone (the location of the dots on the graphic are meant merely to illustrate the quantity and not necessarily the exact location of households or jobs).

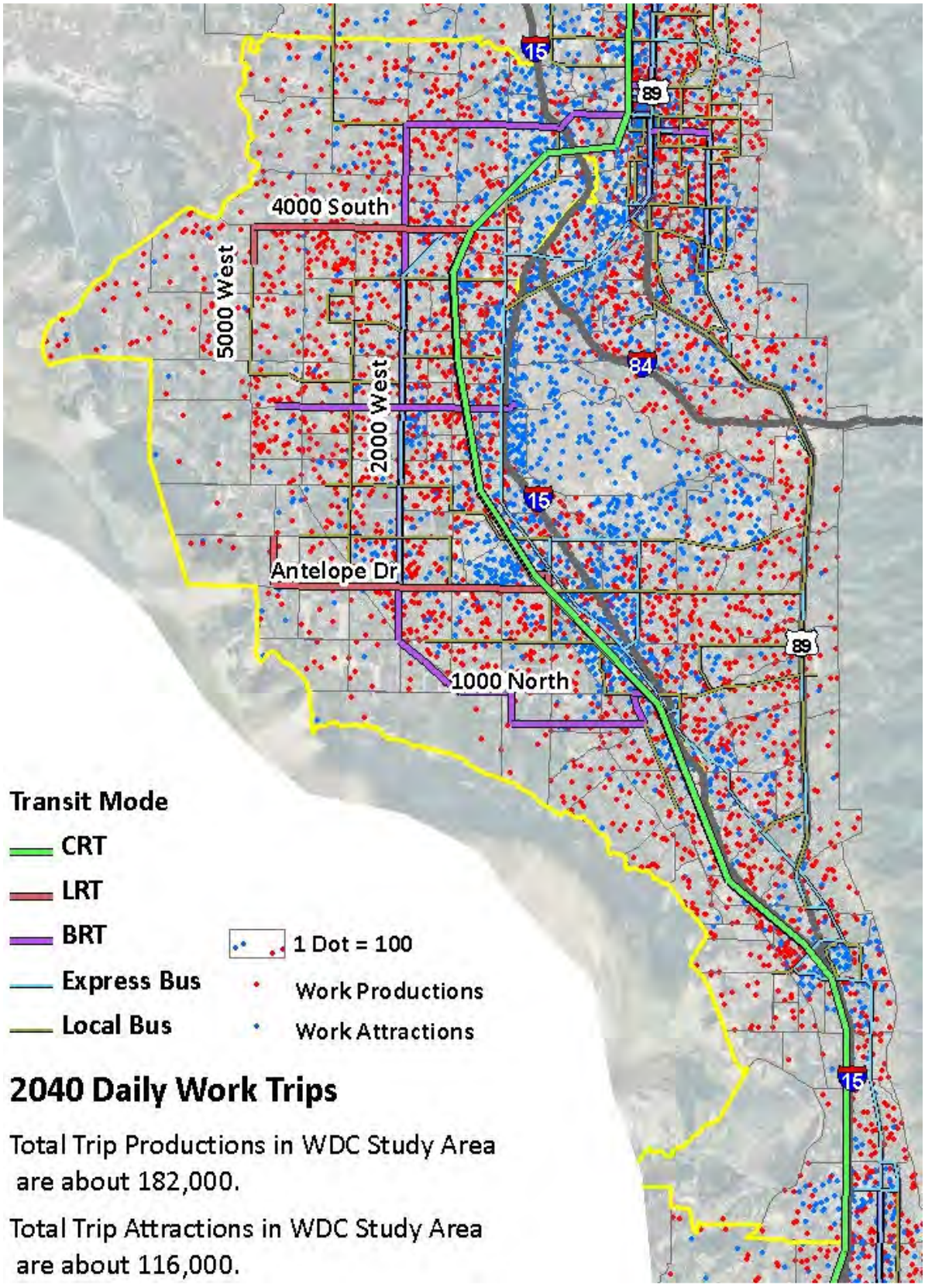
*Exhibit 10 – 2040 Study Area Productions & Attractions*

| Trip Purpose | Daily Productions | Daily Attractions |
|---|---|---|
| Home Based Work | 182,000 | 116,000 |
| All Trips | 1,321,000 | 1,155,000 |

Not surprisingly, the exhibits show for work trips that the study area is a net exporter of work trips. When all trips are considered the productions and attractions are more equal since most of the non-work trips are shorter local trips. The graphic shows that nearly all of the work trip attractions are located along the I-15 corridor, while most of the productions are located farther to the west. Looking at the graphic it is also apparent that there are few concentrations of development in the WDC study area.

These results initially suggest that it will be difficult to serve the corridor with high capacity transit service efficiently. Since work trip productions (i.e. households) are dispersed, it will be difficult to bring the transit service proximate to a sufficient density of travelers.

*Exhibit 11 – 2040 Work Productions & Attractions by Model Zone*



# 5.0 INITIAL TRANSIT SCENARIO

To begin the process of developing a preferred transit scenario that could be carried forward in the EIS, the Initial Transit Scenario was developed and analyzed to test the relative competitiveness of BRT routes on the primary east-west streets in the WDC study area (in support of the general agreement that the transit scenario should feed CRT). The analysis was performed for estimated 2040 conditions using version 6.1 of the WFRC travel demand model. In addition to the Initial Transit Scenario, an RTP Only scenario was analyzed to provide a basis of comparison with the Initial Transit Scenario. Additionally, sensitivity tests were performed to evaluate the effects of some changes and different assumptions regarding the transit system in the study area.

## 5.1 WFRC Travel Model

At the beginning of the WDC Transit Study process, the EIS was using version 6.0 of the WFRC travel model for its transportation forecasting, because version 7.0 had not yet been released. It was decided that the transit study would be prepared using version 6.1, since it was the version that UTA used for preparing the New Starts federal funding submittal to the Federal Transit Administration (FTA) for the Draper LRT Extension. In going through that rigorous process the transit component of the version 6.0 model was modified and subsequently approved by FTA.

Using version 6.1 also allowed for the WDC Transit Study to utilize the same inputs as the EIS while providing forecasts with an FTA-approved model. By the time the study was completed in the fall of 2011, version 7.0 of the travel model had been officially released. A sensitivity test was performed comparing the model results between versions 6.1 and 7.0. The results of this test are described in section 7.0.

## 5.2 RTP Only Scenario

The RTP Only Scenario is based on the WFRC 2040 RTP. It includes two north-south BRT lines in the study area and four east-west local bus lines. One BRT line is generally on 2000 West and is part of a longer line that runs from North Ogden to Layton. The second BRT line is generally on SR-126 (often called Main Street in the study area); however, through the Clearfield and Clinton area the line crosses to east side of I-15 to provide access to Hill Air Force Base. This line is part of a longer line that runs from Ogden to Salt Lake City.

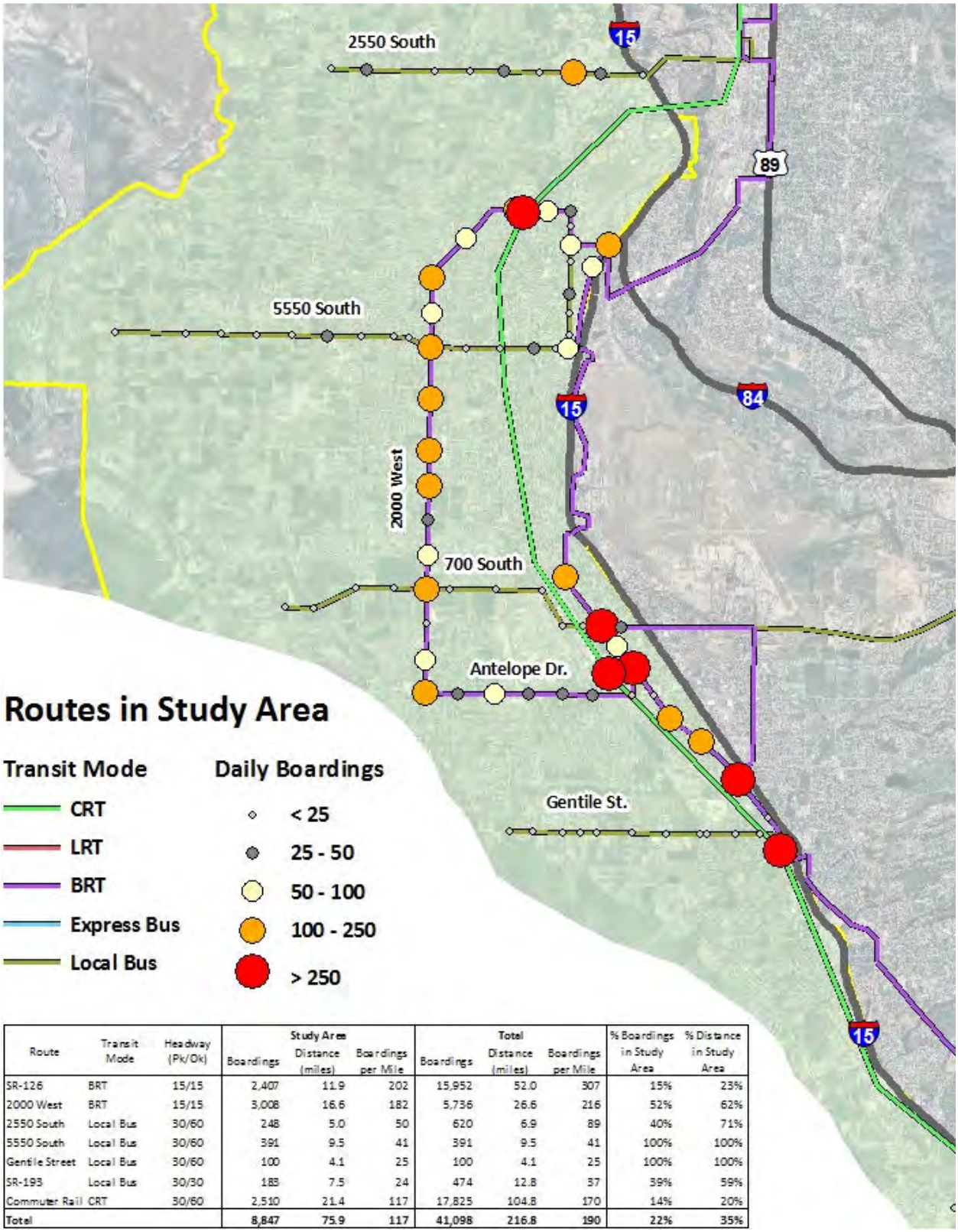
This scenario was analyzed for 2040 conditions using the travel model. Exhibit 12 below compares the total transit ridership and mode share for the study area and the entire four county model region. It shows that transit use in the study area is expected to be less than that of the region, which is largely due to the anticipated lack of development density.

*Exhibit 12 – 2040 RTP Only Scenario Transit Ridership & Mode Share*

| | Daily Ridership | | Transit Mode Share (%) | |
|---|---|---|---|---|
| | HBW | All | HBW | All |
| Study Area | 7,200 | 12,400 | 3.1 | 0.8 |
| Region | 109,000 | 229,300 | 5.2 | 1.5 |

Exhibit 13 on the following page shows the 2040 study area transit routes included in the RTP along with an indication of the number of boardings associated with each stop. At the bottom of the figure there is a table that gives the ridership for the routes that traverse the study area. The Salt Lake-North Ogden BRT line is expected to have over 300 boardings per mile, although only about 200 per mile in the WDC study area. The Layton-Ogden (via SR-108) BRT line is expected to have nearly 220 boardings per mile with about 180 per mile in the WDC study area. Commuter rail is expected to have approximately 2,500 riders from the study area.

*Exhibit 13 – 2040 RTP Only Scenario Transit Routes & Boardings*




| Route | Transit Mode | Headway (Pk/Ok) | Study Area Boardings | Study Area Distance (miles) | Study Area Boardings per Mile | Total Boardings | Total Distance (miles) | Total Boardings per Mile | % Boardings in Study Area | % Distance in Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| SR-126 | BRT | 15/15 | 2,407 | 11.9 | 202 | 15,952 | 52.0 | 307 | 15% | 23% |
| 2000 West | BRT | 15/15 | 3,008 | 16.6 | 182 | 5,736 | 26.6 | 216 | 52% | 62% |
| 2550 South | Local Bus | 30/60 | 248 | 5.0 | 50 | 620 | 6.9 | 89 | 40% | 71% |
| 5550 South | Local Bus | 30/60 | 391 | 9.5 | 41 | 391 | 9.5 | 41 | 100% | 100% |
| Gentile Street | Local Bus | 30/60 | 100 | 4.1 | 25 | 100 | 4.1 | 25 | 100% | 100% |
| SR-193 | Local Bus | 30/30 | 183 | 7.5 | 24 | 474 | 12.8 | 37 | 39% | 59% |
| Commuter Rail | CRT | 30/60 | 2,510 | 21.4 | 117 | 17,825 | 104.8 | 170 | 14% | 20% |
| **Total** | | | **8,847** | **75.9** | **117** | **41,098** | **216.8** | **190** | **22%** | **35%** |

## 5.3 Initial Transit Scenario Analysis

The concept behind the Initial Transit Scenario was to evaluate transit on each of the primary east-west streets in the WDC study area to determine which corridors would generate the highest transit ridership. Six BRT lines were coded into the model, each with assumed headways of 15 minutes in the peak and off-peak periods. Each line connected to a CRT station. The six corridors chosen for analysis were:

- 2550 South (Ogden)
- 4000 South (Roy)
- 5550 South (Roy)
- 1800 North (Clinton)
- 700 South (Clearfield)
- Gentile Street (Layton)

The underlying RTP transit network was left in place, except for those local bus routes that were on the same roads as the study BRT routes, which were removed. A new BRT line on Antelope Drive was not considered because the Ogden-Layton BRT route that runs on 2000 West travels on Antelope Drive from 2000 West to Main Street. Exhibit 14 compares the transit ridership and mode share percentage between the RTP Only and the Initial Transit Scenarios. The Initial Transit Scenario increases total estimated 2040 daily transit ridership by approximately 2,200, resulting in a mode share increase of approximately 0.5%.

*Exhibit 14 – 2040 Initial Scenario Ridership & Mode Share Comparison*

| | Daily Ridership | | | | Transit Mode Share (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Work Trips | | All Trips | | Work Trips | | All Trips | |
| | RTP Only | Initial | RTP Only | Initial | RTP Only | Initial | RTP Only | Initial |
| Study Area | 7,200 | 8,400 | 12,400 | 14,600 | 3.1 | 3.6 | 0.8 | 1.0 |
| Region | 109,000 | 110,400 | 229,300 | 231,600 | 5.2 | 5.3 | 1.5 | 1.6 |

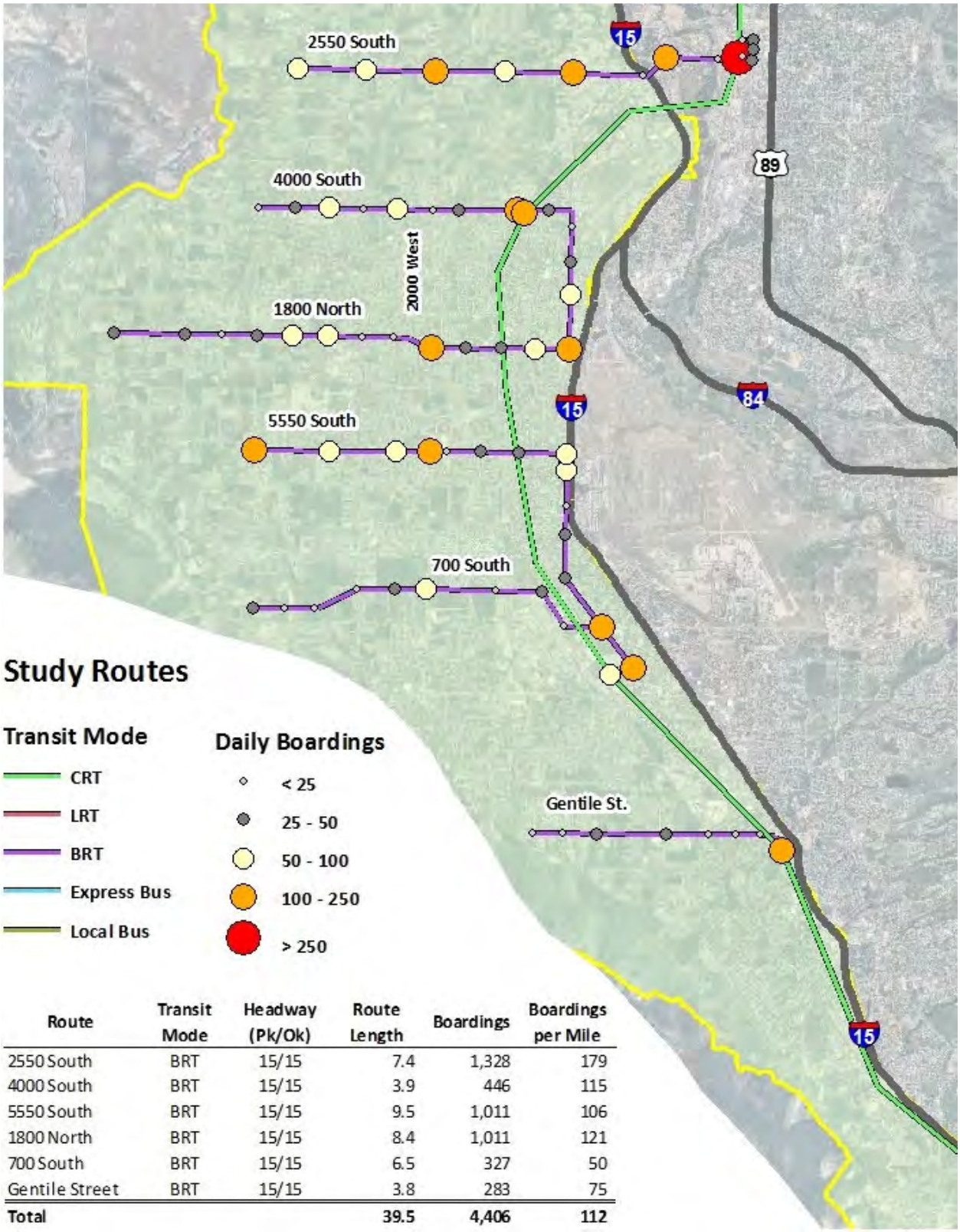
Exhibit 15 on the following page graphically shows the six study routes and the boardings on each of those routes. The figure does not show the underlying BRT and local bus service described in the RTP Only Scenario, but those lines were included in the analysis as part of the background transit network. The table at the bottom of the figure shows the boardings per mile for each study route. The best performing route was the one on 2550 South with approximately 180 boardings per mile, which provided service to the Ogden Intermodal Center and downtown Ogden. This connection to downtown is the main reason why this route performed so well. The second tier of routes contained 4000 South, 5550 South, and 1800 North with boardings per mile ranging from about 110 to 120. The final tier of routes consisted of 700 South and Gentile Street, which had 50 and 75 boardings per mile, respectively.

The second tier of routes was selected for further analysis in the refinement portion of the WDC Transit Study. The 2550 South route was not selected for further analysis because it was primarily serving downtown Ogden and not the core study area. While BRT on 2550 South was not selected for further analysis in this study, the route remains competitive and may merit further consideration by UTA in the future.

## 5.4 Park-and-Ride Lots

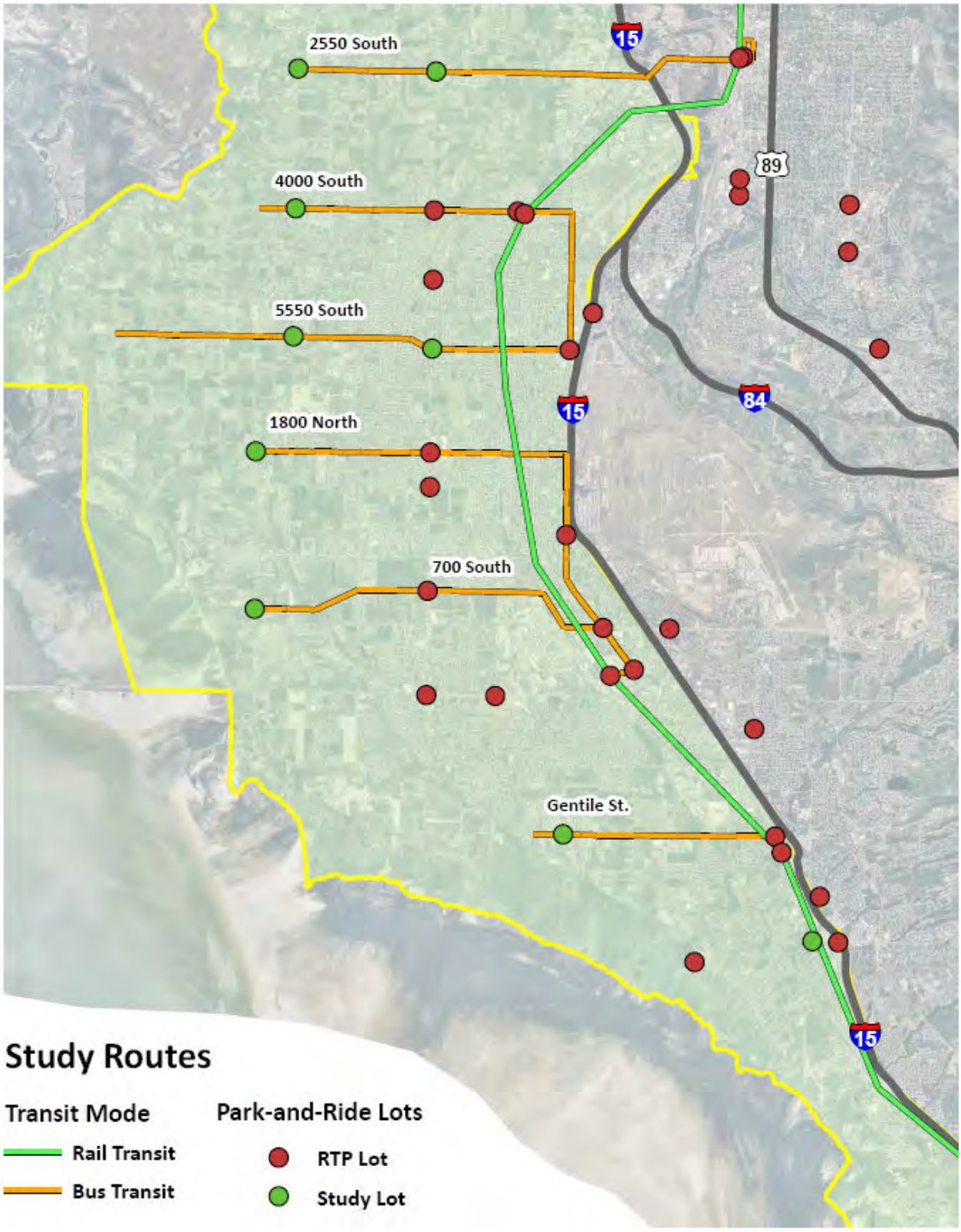
A component of the travel modeling associated with the WDC Transit Study was the assumptions made regarding park-and-ride (PNR) lots. Generally speaking, the RTP assumes PNR lots at several locations along 2000 West (SR-108), which served both the Ogden-Layton BRT line and most of the study routes associated with the Initial Transit Scenario. Additional PNR lots, not included in the RTP, were generally assumed farther west along the study routes, resulting in two PNR lots for most of the six study routes. Exhibit 16 shows the location of the PNR lots and identifies which lots were included in the RTP and which were assumed for the study. These PNR assumptions were used throughout the study.

*Exhibit 15 – 2040 Initial Scenario Transit Routes & Boardings*




| Route | Transit Mode | Headway (Pk/Ok) | Route Length | Boardings | Boardings per Mile |
|---|---|---|---|---|---|
| 2550 South | BRT | 15/15 | 7.4 | 1,328 | 179 |
| 4000 South | BRT | 15/15 | 3.9 | 446 | 115 |
| 5550 South | BRT | 15/15 | 9.5 | 1,011 | 106 |
| 1800 North | BRT | 15/15 | 8.4 | 1,011 | 121 |
| 700 South | BRT | 15/15 | 6.5 | 327 | 50 |
| Gentile Street | BRT | 15/15 | 3.8 | 283 | 75 |
| **Total** | | | **39.5** | **4,406** | **112** |

*Exhibit 16 – 2040 Park-and-Ride Lot Locations*



## 5.5 Sensitivity Tests

Three sensitivity tests were performed on the Initial Transit Scenario to examine a few different options associated with the scenario. The first test considered the effects if the transit system in the WDC study area were more accessible and reliable. This was done by reducing the walk-to-transit distance and reducing the transfer wait time at the CRT stations. This type of a scenario would be characterized by higher density around transit stops with good pedestrian access. This scenario was essentially a "best case" scenario.

The second test considered a BRT route on Antelope Drive that would be directly comparable to the six study routes. This BRT line extended farther to the west beyond 2000 West. To avoid having two BRT lines running on Antelope Drive from 2000 West to Main Street, the Ogden-Layton BRT line was eliminated in this sensitivity test.

The third test considered, where possible, extending the study routes of the Initial Transit Scenario to the east to provide access to Hill Air Force Base. Exhibit 17 shows the change in the transit system ridership based on each sensitivity test and relative to the Initial Transit Scenario.

*Exhibit 17 – Initial Transit Scenario Sensitivity Test Results*

| Sensitivity Test | Change in System Ridership |
|---|---|
| Reduced walk access distance and transfer wait times at CRT stations | + 1,000 |
| Eliminated 2000 West BRT line and added Antelope Drive BRT line | - 2,000* |
| Extend 5550 South, 1800 North, and 700 South lines to serve HAFB/Falcon Hill | + 400 |

**Antelope BRT line performance is comparable to the second tier lines*

The table shows that the "best case" scenario increases total 2040 system ridership by about 1,000 riders per day. This means that the total increase in system ridership compared to the RTP Only Scenario would be approximately 3,200 riders.

The net decrease in riders associated with the second test come from the elimination of the Ogden-Layton BRT route. The loss of ridership associated with this route was not fully made up by the new Antelope Drive BRT route. As mentioned in the note on the table, ridership on the Antelope Drive route would place it in the second tier of routes. Overall, it seems to confirm that connecting the 2000 West BRT line back to the east (e.g. to I-15, FrontRunner, etc.) on Antelope was a good decision by WFRC.

The third test showed that there would be some benefit from extending any east-west service to Hill Air Force Base/Falcon Hill. This type of alignment was not included in any other scenarios, but it remains an option for the future.

The sensitivity tests show that it is possible to nominally increase transit ridership through either increased accessibility or better service to the HAFB area, but neither option is likely to increase ridership to the point that it would change the overall competitiveness of any route.

# 6.0 REFINE TRANSIT SCENARIO

After evaluating the six study routes in the Initial Transit Scenario, the three routes that comprised the second tier were evaluated individually. Additional routes were analyzed that were not part of the Initial Transit Scenario, but include the north-south BRT route on 2000 West and express bus routes that would run on the West Davis Corridor roadway to downtown Salt Lake City.

## 6.1 East-West Routes

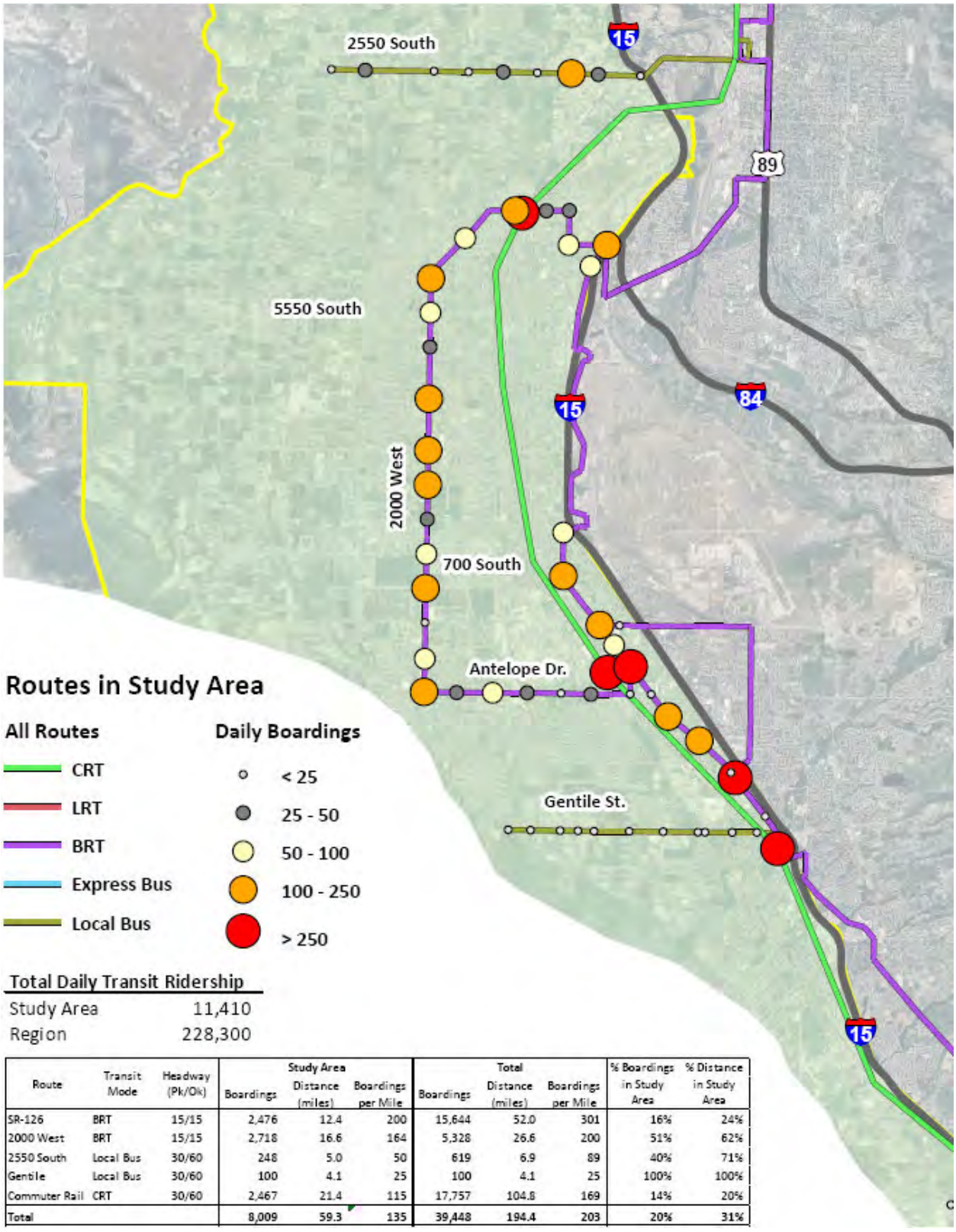
The three second tier BRT routes from the Initial Transit Scenario (4000 South, 5550 South, & 1800 North) were each modeled separately as stand-alone projects. These projects were compared to a Baseline Scenario that was a modified 2040 RTP Only Scenario without local bus service on any of the study routes. As such, the only local bus service in the WDC study area were routes on 2550 South and Gentile Street. The background BRT routes on 2000 West and Main Street were unchanged from the RTP Only Scenario. Exhibit 18 compares the estimated 2040 daily transit system ridership and mode share for work and all trips. The 4000 South Scenario increased total daily ridership by 220 passengers, while the 5550 South and 1800 North Scenarios each increased ridership by about 700 passengers per day.

*Exhibit 18 – 2040 Transit Ridership and Mode Share for East-West Routes*

| | Daily Ridership | | | | Transit Mode Share (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Work Trips | | All Trips | | Work Trips | | All Trips | |
| | WDC | Region | WDC | Region | WDC | Region | WDC | Region |
| Baseline | 6,590 | 108,480 | 11,410 | 228,340 | 2.84 | 5.17 | 0.75 | 1.53 |
| 4000 South | 6,810 | 108,700 | 11,790 | 228,720 | 2.93 | 5.18 | 0.77 | 1.54 |
| 5550 South | 7,260 | 109,140 | 12,560 | 229,480 | 3.13 | 5.20 | 0.82 | 1.54 |
| 1800 North | 7,320 | 109,280 | 12,590 | 229,600 | 3.16 | 5.21 | 0.82 | 1.54 |

Exhibit 19 on the following page shows the study area routes and associated 2040 daily boardings for the Baseline Scenario. Exhibit 20 to Exhibit 22 on subsequent pages show the study route and boardings for the 4000 South, 5550 South, and 1800 North Scenarios, respectively. Tables at the bottom of each figure show boarding information for each study route, including boardings per mile. These tables show that the 1800 North route has the highest boardings per mile at approximately 120. This value is about half of the UTA recommended minimum threshold of 250 boardings per mile to justify a BRT investment. This relatively poor result led the study to consider other transit projects that would generate more ridership or would require a smaller investment by UTA.

*Exhibit 19 – 2040 Baseline Scenario Transit Routes & Boardings*

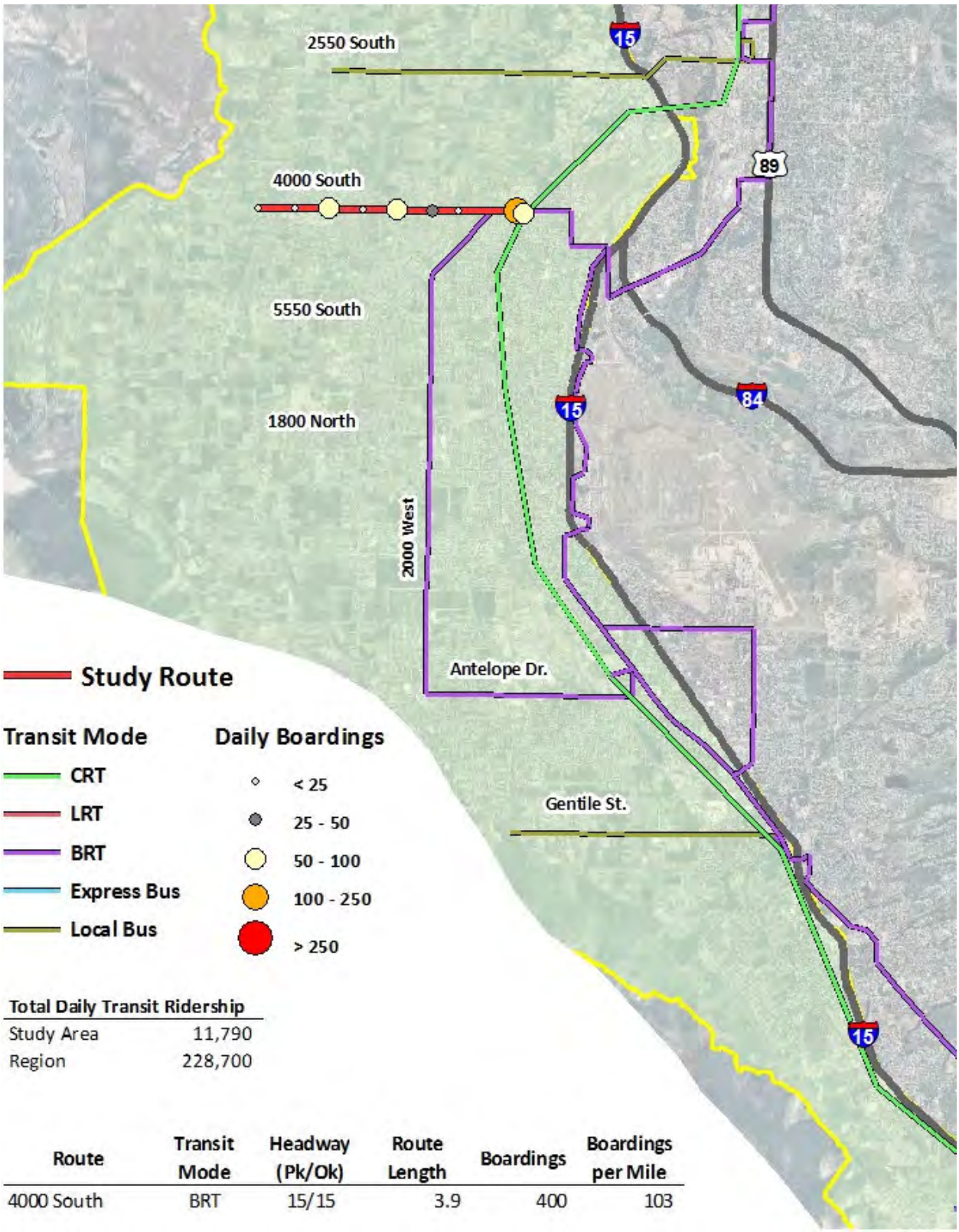



**Total Daily Transit Ridership**

| | |
|---|---|
| Study Area | 11,410 |
| Region | 228,300 |

| Route | Transit Mode | Headway (Pk/Ok) | Study Area Boardings | Study Area Distance (miles) | Study Area Boardings per Mile | Total Boardings | Total Distance (miles) | Total Boardings per Mile | % Boardings in Study Area | % Distance in Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| SR-126 | BRT | 15/15 | 2,476 | 12.4 | 200 | 15,644 | 52.0 | 301 | 16% | 24% |
| 2000 West | BRT | 15/15 | 2,718 | 16.6 | 164 | 5,328 | 26.6 | 200 | 51% | 62% |
| 2550 South | Local Bus | 30/60 | 248 | 5.0 | 50 | 619 | 6.9 | 89 | 40% | 71% |
| Gentile | Local Bus | 30/60 | 100 | 4.1 | 25 | 100 | 4.1 | 25 | 100% | 100% |
| Commuter Rail | CRT | 30/60 | 2,467 | 21.4 | 115 | 17,757 | 104.8 | 169 | 14% | 20% |
| Total | | | 8,009 | 59.3 | 135 | 39,448 | 194.4 | 203 | 20% | 31% |

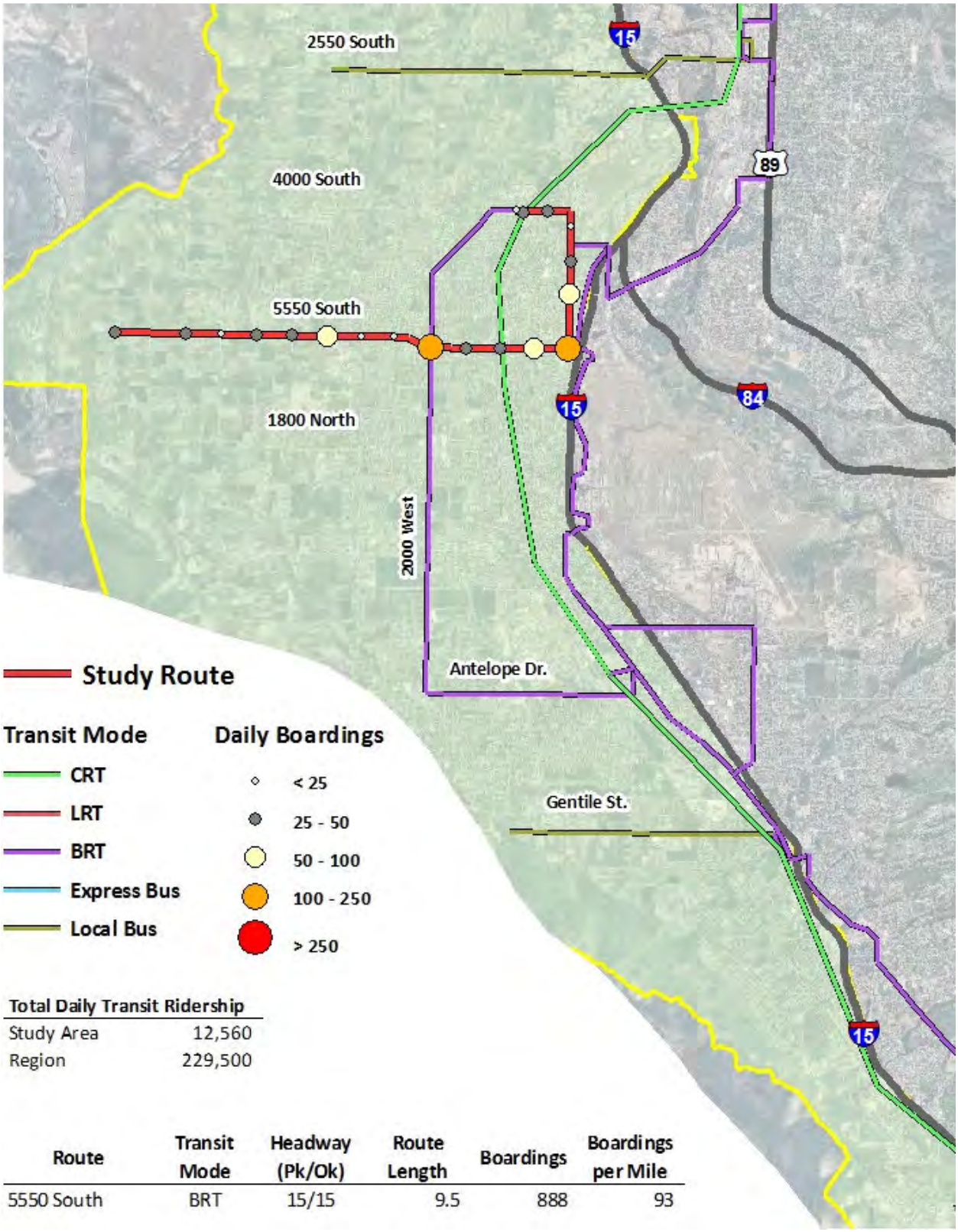
*Exhibit 20 – 2040 Route & Boardings for 4000 South BRT Scenario*




| Total Daily Transit Ridership | |
|---|---|
| Study Area | 11,790 |
| Region | 228,700 |

| Route | Transit Mode | Headway (Pk/Ok) | Route Length | Boardings | Boardings per Mile |
|---|---|---|---|---|---|
| 4000 South | BRT | 15/15 | 3.9 | 400 | 103 |

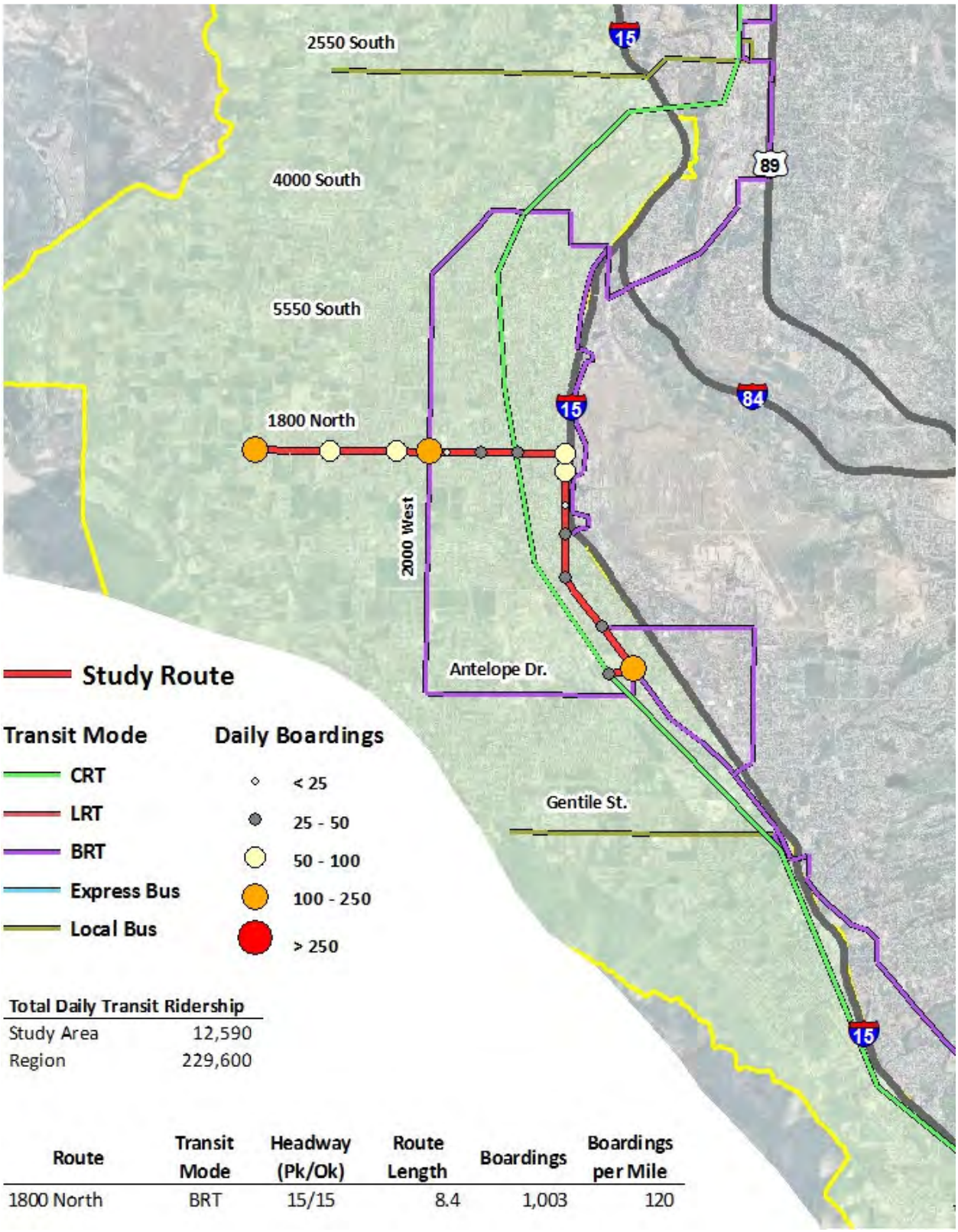
*Exhibit 21 – 2040 Route & Boardings for 5550 South BRT Scenario*




| Total Daily Transit Ridership | |
|---|---|
| Study Area | 12,560 |
| Region | 229,500 |

| Route | Transit Mode | Headway (Pk/Ok) | Route Length | Boardings | Boardings per Mile |
|---|---|---|---|---|---|
| 5550 South | BRT | 15/15 | 9.5 | 888 | 93 |

*Exhibit 22 – 2040 Route & Boardings for 1800 North BRT Scenario*




| Total Daily Transit Ridership | |
|---|---|
| Study Area | 12,590 |
| Region | 229,600 |

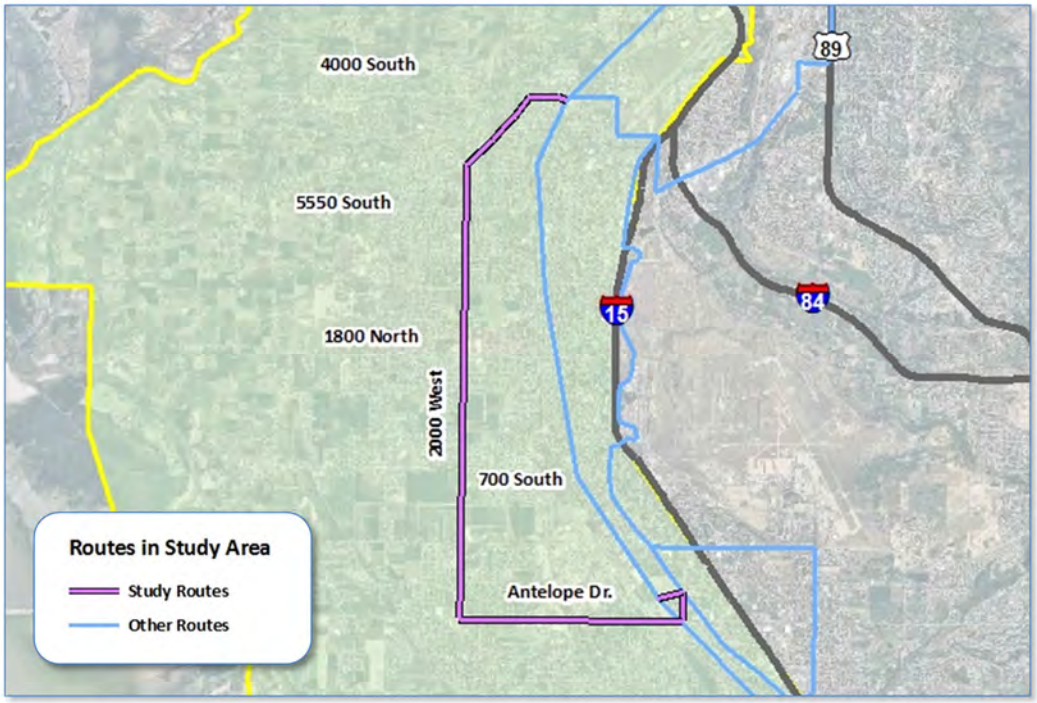
| Route | Transit Mode | Headway (Pk/Ok) | Route Length | Boardings | Boardings per Mile |
|---|---|---|---|---|---|
| 1800 North | BRT | 15/15 | 8.4 | 1,003 | 120 |

## 6.2 North-South Routes

When the analysis of the east-west routes showed that none of the routes would approach the UTA desired minimum ridership threshold, the study team decided to look a little more closely at north-south transit routes. Specifically, consideration was given to advancing the portion of the Ogden-Layton BRT line in the WDC study area so that it would be built earlier than currently envisioned by UTA.

A north-south scenario was developed that would provide BRT service from the Roy CRT station to the Clearfield CRT station. As shown in Exhibit 23, the route would be: Roy CRT station to 4000 South to Midland Drive to 2000 West to Antelope Drive to the Clearfield CRT station. A scenario was envisioned where upon initial construction the route would operate on 30-minute peak headways and 60-minute off-peak headways to match commuter rail service. Station amenities would be provided including shelters and ticket vending machines. Queue jumper lanes would be provided at signalized intersection, which would likely be coupled with signal priority given to transit vehicles.

*Exhibit 23 – North-South Scenario BRT Alignment*




This scenario was analyzed for 2009 and 2040 conditions. The 2040 analysis consisted of extracting ridership data from the portion of the Ogden-Layton BRT route that would comprise the initial build segment. The 2009 analysis was to determine the near term ridership that could be expected from the service. Exhibit 24 shows the 2009 and 2040 boarding results for the north-south transit scenario. Boardings per mile would be expected to increase dramatically from a hypothetical 41 in 2009 to 176 in 2040, which are less than the desired 250. This increase would be due to land use growth in the area and an increase in service frequency. In 2009, the north-south BRT is only expected to increase commuter rail ridership by less than 20 riders per day. This is primarily because the majority of commuter rail riders drive to a station rather than to walk to a bus and then transfer to commuter rail.

*Exhibit 24 – North-South Transit Scenario Boardings*

| Analysis Year | Headway (Pk/Ok) | Length (mi.) | Boardings | Boardings / Mile |
|---|---|---|---|---|
| 2009 | 30/60 | 12.3 | 510 | 41 |
| 2040 | 15/15 | 12.3 | 2,160 | 176 |

Exhibit 25 shows the total transit ridership and mode share information for the study area and the region. The 2040 results for the RTP and the North-South Scenario are the same because the BRT line that comprises the North-South Scenario is included as part of the RTP. The benefit of this scenario is in the early years with the line being built earlier than assumed in the RTP.

*Exhibit 25 – North-South Transit Scenario Total Ridership & Mode Share*

| | Daily Ridership | | | | Transit Mode Share (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Work Trips | | All Trips | | Work Trips | | All Trips | |
| | WDC | Region | WDC | Region | WDC | Region | WDC | Region |
| 2009 Base | 3,360 | 50,660 | 5,050 | 99,620 | 2.59 | 4.19 | 0.60 | 1.14 |
| 2009 North-South | 3,500 | 50,810 | 5,300 | 99,890 | 2.70 | 4.20 | 0.63 | 1.14 |
| 2040 RTP | 7,160 | 109,050 | 12,370 | 229,310 | 3.09 | 5.19 | 0.84 | 1.54 |
| 2040 North-South | 7,160 | 109,050 | 12,370 | 229,310 | 3.09 | 5.19 | 0.84 | 1.54 |

## 6.3 Express Bus Routes

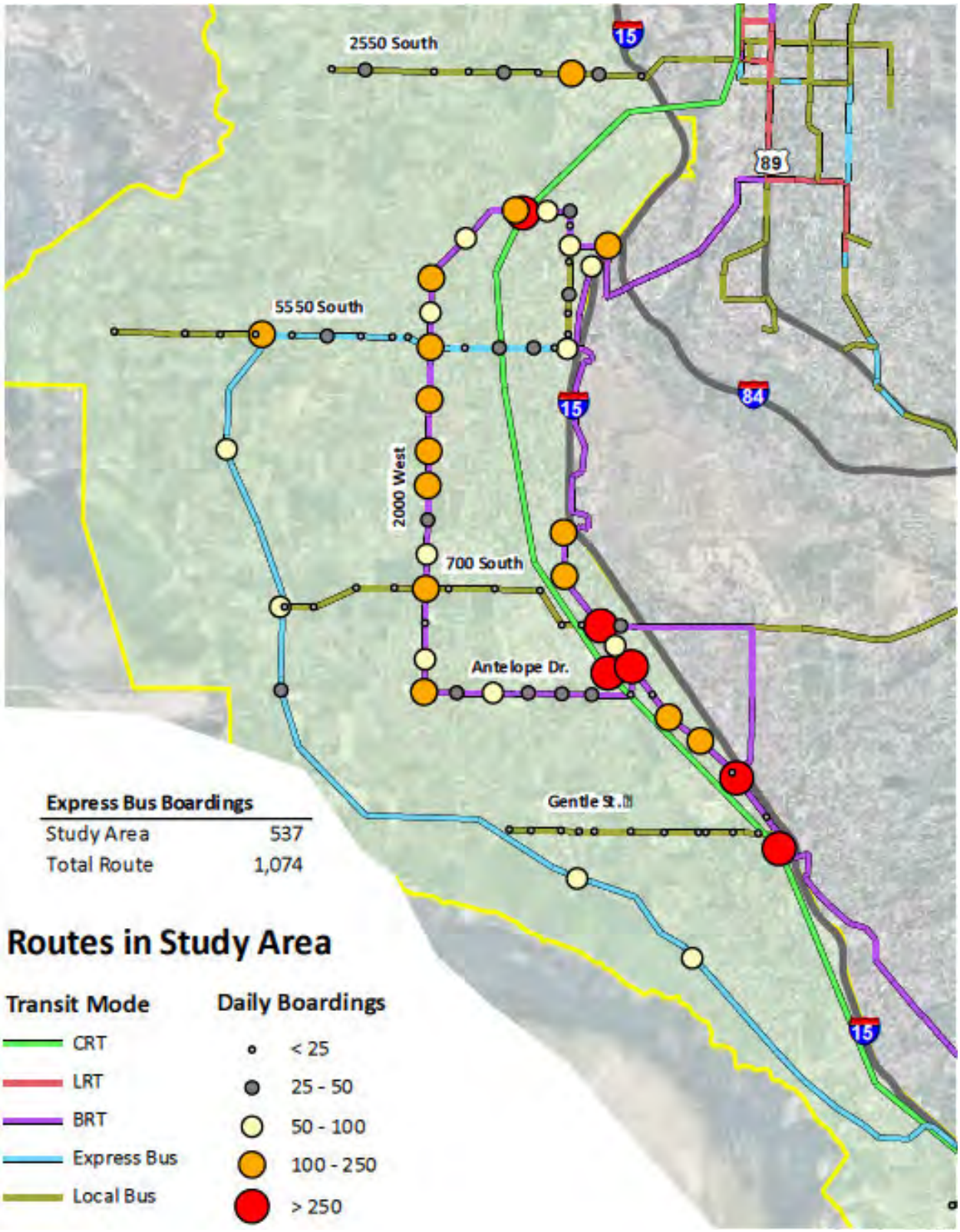
In meeting with the NGOs a question was raised about providing transit service nearer to the WDC roadway, which could compete for the same user market. Based on that feedback an express bus scenario was developed that would run along the WDC roadway and provide service to downtown Salt Lake City. As modeled, the route would begin in Roy near I-15 and travel west on 5550 South to the WDC roadway. The route would then travel along the WDC roadway and exit at each interchange to service a stop at an assumed park-and-ride lot before getting back on the WDC roadway. The route would then merge onto I-15 and continue without stop to downtown Salt Lake City where it would make a small loop of downtown and terminate at the Salt Lake Intermodal Center. It was assumed that the route would operate with 30-minute headways only in the peak hours and only in the peak direction (i.e. it would provide one-way service into downtown in the morning and out of downtown in the evening).

This scenario was modeled for 2009 and 2040 conditions. In each case it represents a completely new transit service to the study area. Exhibit 26 shows the estimated 2009 and 2040 daily ridership for the Express Bus Scenario. Exhibit 27 on the following page shows the assumed route through the study area and 2040 boardings.

*Exhibit 26 – Express Bus Transit Scenario Boardings*

| Analysis Year | Headway (Pk/Ok) | Length (mi.) | Boardings | Boardings / Mile |
|---|---|---|---|---|
| 2009 | 30/-- | 44.3 | 550 | 12 |
| 2040 | 30/-- | 42.4 | 1,070 | 25 |

*Exhibit 27 – 2040 Route & Boardings for Express Bus Scenario*



In 2009 the ridership is very comparable to the 2009 ridership of the North-South Scenario, although because the route is so much longer the boardings per mile are quite poor. However, as an express bus service, the 250 boardings per mile threshold is not applicable.

Exhibit 28 shows the 2009 and 2040 total system ridership and transit mode share for the WDC study area and the region. A concern with future express bus service in the UTA service area is that it would steal riders from commuter rail. In 2040, the Express Bus Scenario adds about 470 new riders to the transit system. It also moves about 470 riders from other modes. One hundred of the moving riders are coming from BRT and the other 370 are coming from commuter rail. Those 370 riders coming off of CRT represent about 10% of the total WDC study area CRT passengers. So in 2040, about 50% of the express bus passengers are new to transit, about 10% are coming from BRT, and the remaining 40% are coming from CRT. This result is in conflict with the goal of increase commuter rail ridership, and as such was eliminated from further consideration.

*Exhibit 28 – Express Bus Transit Scenario Boardings*

| | Daily Ridership | | | | Transit Mode Share (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Work Trips | | All Trips | | Work Trips | | All Trips | |
| | WDC | Region | WDC | Region | WDC | Region | WDC | Region |
| 2009 Base | 3,360 | 50,660 | 5,050 | 99,620 | 2.59 | 4.19 | 0.60 | 1.14 |
| 2009 Build | 3,500 | 50,800 | 5,210 | 99,800 | 2.69 | 4.20 | 0.62 | 1.14 |
| 2040 RTP | 7,160 | 109,050 | 12,370 | 229,310 | 3.09 | 5.19 | 0.84 | 1.54 |
| 2040 Build | 7,520 | 109,410 | 12,840 | 229,780 | 3.24 | 5.21 | 0.84 | 1.54 |

## 6.4 Operating Costs

To meet the stated goal of being fully supported by UTA, an analysis of the cost-effectiveness of the various transit scenarios was prepared. Revenue miles of service is one of the measures that was used in performing this analysis. This is simply a measure of how many miles a day is the transit vehicle being driven while in service. For this analysis it was assumed that the peak periods comprise six hours of the day and that off-peak periods comprise ten hours of the day. The number of daily boardings was divided by the revenue miles to obtain boardings per revenue mile. This value is an indicator of the cost-effectiveness of each route. Exhibit 29 shows the results of this analysis.

*Exhibit 29 – 2040 Cost Effectiveness Comparison*

| Scenario | Headway (Pk/Ok) | Round Trip Length (mi.) | Daily Boardings | Boardings / Mile | Revenue Miles | Boardings / Rev. Mile |
|---|---|---|---|---|---|---|
| East-West | | | | | | |
| 4000 South | 15/15 | 7.7 | 400 | 103 | 495 | 0.8 |
| 5550 South | 15/15 | 19.1 | 890 | 93 | 1,221 | 0.7 |
| 1800 North | 15/15 | 16.7 | 1,000 | 120 | 1,069 | 0.9 |
| North-South | 15/15 | 24.6 | 2,160 | 176 | 1,573 | 1.4 |
| Express Bus | 30/-- | 42.4 | 1,070 | 51 | 508 | 2.1 |

Per the table, the Express Bus Scenario appears to be the most cost-effective of the various scenarios. It is possible that the cost effectiveness of this scenario is a little overstated for a couple of reasons: (1) as a peak-only route there may be more non-revenue miles traveled as buses may make more than one trip in the peak period and (2) additional buses may be needed to meet the projected demand. Nevertheless, the Express Bus Scenario seems to be very competitive with the other scenarios.

# 7.0 MODEL VERSION 7.0 SENSITIVITY TESTS

WFRC officially released version 7.0 of their travel demand model towards the end of the transit study process. Rather than redo the analyses, the study team decided to do a few sensitivity tests comparing results between model versions 6.1 and 7.0. The tests were a comparison of how the analysis results might change with version 7.0 rather than an analysis of the differences between model versions. All of the travel model inputs changed between model versions: TAZ structure, land use data, transportation networks (roadway and transit), etc. The transit networks in the study area and the general Weber / Davis County area were very similar between model versions. Most of the differences in transit networks were in the rest of the region.

Comparisons were made between the 2009 base year and the 2040 RTP Only Scenario. Exhibit 30 and Exhibit 31 compare the mode share estimates in the WDC study area for several different travel modes for work trips and all trips for 2009 base year and 2040 RTP Only Scenario model runs, respectively. The gray shaded rows represent the different transit services that add up to the transit numbers in the unshaded rows.

*Exhibit 30 – 2009 Base Year Mode Share Comparison*

| Mode | Work Trips | | | | All Trips | | | |
|---|---|---|---|---|---|---|---|---|
| | v6.1 Trips | v7.0 Trips | v6.1 Share | v7.0 Share | v6.1 Trips | v7.0 Trips | v6.1 Share | v7.0 Share |
| Auto | 123,800 | 119,200 | 97.4% | 97.7% | 778,000 | 769,000 | 99.4% | 99.4% |
| Transit | 3,360 | 2,800 | 2.6% | 2.3% | 5,050 | 4,450 | 0.6% | 0.6% |
| Local | 1,650 | 1,400 | 49.0% | 50.0% | 2,970 | 2,470 | 58.9% | 55.4% |
| BRT | 0 | 0 | 0.0% | 0.0% | 0 | 0 | 0.0% | 0.0% |
| Express | 730 | 180 | 21.8% | 6.3% | 870 | 200 | 17.2% | 4.4% |
| LRT | 0 | 0 | 0.1% | 0.1% | 10 | 10 | 0.1% | 0.1% |
| CRT | 980 | 1,220 | 29.0% | 43.6% | 1,200 | 1,780 | 23.8% | 39.9% |

The 2009 exhibit shows that model version 7.0 produces fewer auto and transit trips in the study area than version 6.1. However, the percentage of total transit trips is very close between the two models. The version 7.0 model has more commuter rail trips than 6.1, which is generally offset by a decrease in express bus trips.

*Exhibit 31 – 2040 RTP Only Scenario Mode Share Comparison*

| Mode | Work Trips | | | | All Trips | | | |
|---|---|---|---|---|---|---|---|---|
| | v6.1 Trips | v7.0 Trips | v6.1 Share | v7.0 Share | v6.1 Trips | v7.0 Trips | v6.1 Share | v7.0 Share |
| Auto | 219,900 | 189,800 | 96.8% | 96.8% | 1,411,000 | 1,207,000 | 99.1% | 99.1% |
| Transit | 7,160 | 6,210 | 3.2% | 3.2% | 12,370 | 10,430 | 0.9% | 0.9% |
| Local | 310 | 140 | 4.4% | 2.2% | 700 | 350 | 5.7% | 3.4% |
| BRT | 4,260 | 3,320 | 59.5% | 53.4% | 6,760 | 5,150 | 54.6% | 49.3% |
| Express | 220 | 0 | 3.0% | 0.0% | 260 | 0 | 2.1% | 0.0% |
| LRT | 500 | 210 | 7.0% | 3.4% | 1,390 | 860 | 11.3% | 8.2% |
| CRT | 1,870 | 2,540 | 26.1% | 41.0% | 3,260 | 4,070 | 26.3% | 39.0% |

As with the 2009 exhibit, the 2040 data shows that model version 7.0 produces fewer auto and transit trips. However, the transit share is unchanged for 2040 between the two models. Again, version 7.0 has more commuter rail trips than 6.1, which in this case is partially offset by a decrease in BRT trips. As an aside, it is interesting to observe how big a part of the transit system BRT is projected to become by 2040.

To understand changes to 2040 boardings on individual routes a comparison was made for transit boardings in the WDC study area on key routes. Exhibit 32 shows the resulting comparison, which was done for the 2040 RTP Only Scenario. It shows that study area boardings for the SR-126 BRT route are virtually identical, while those for the 2000 West route are about 10% lower with version 7.0. The local bus routes are generally pretty similar with the exception of the 5550 South route, which loses about 40% of its boardings. As seen in the shares data, commuter rail boardings are quite a bit higher in version 7.0. It is important to remember that these are the total number of boardings at the four CRT stations in the study area (Farmington, Layton, Clearfield, and Roy) and not just those from trips to or from the study area.

*Exhibit 32 – 2040 RTP Only Scenario Study Area Boardings Comparison*

| Route | Transit Mode | Version 6.1 | | | Version 7.0 | | |
|---|---|---|---|---|---|---|---|
| | | Boardings | Distance (miles) | Boardings per Mile | Boardings | Distance (miles) | Boardings per Mile |
| SR-126 | BRT | 2,410 | 11.9 | 202 | 2,390 | 10.9 | 220 |
| 2000 West | BRT | 3,010 | 16.6 | 182 | 2,700 | 16.7 | 161 |
| 2550 South | Local Bus | 250 | 5.0 | 50 | 260 | 4.9 | 52 |
| 5550 South | Local Bus | 390 | 9.5 | 41 | 230 | 8.1 | 28 |
| Gentile Street | Local Bus | 100 | 4.1 | 25 | 90 | 3.9 | 24 |
| SR-193 | Local Bus | 180 | 7.5 | 24 | 150 | 5.5 | 27 |
| Commuter Rail | CRT | 2,510 | 21.4 | 117 | 4,140 | 21.4 | 194 |

Based on the above sensitivity tests, it is apparent that the versions 6.1 and 7.0 of the WFRC travel demand model perform very similarly at an aggregate transit mode share basis. However, when examined at the individual mode level, there is a clear increase in commuter rail trips in version 7.0, which is partially offset by a decrease in BRT ridership. In particular, boardings for the segment of the 2000 West BRT route that comprises the North-South Scenario are down by about 10% in version 7.0. It is reasonable to look at these two values for the same route as forming a range of expected boardings for the North-South Scenario, so that the anticipated boardings per mile are from 160 to 180. The results of the sensitivity tests indicate that the results of the study do not change with version 7.0, although the expected BRT boardings in the study area are lower than with version 6.1.

# 8.0 CONCLUSION

In considering a possible transit scenario to be include as part of a build alternative in the West Davis Corridor EIS, five separate transit routes were considered, including three east-west BRT routes, one north-south BRT route in the study area, and one express bus route with service to Salt Lake City. Each of these routes was analyzed with 2040 daily ridership projected for each. Exhibit 33 shows the boarding information for each route along with the mode share information for the WDC study area for work trips. Exhibit 34 on the following page shows the location of the key study routes.

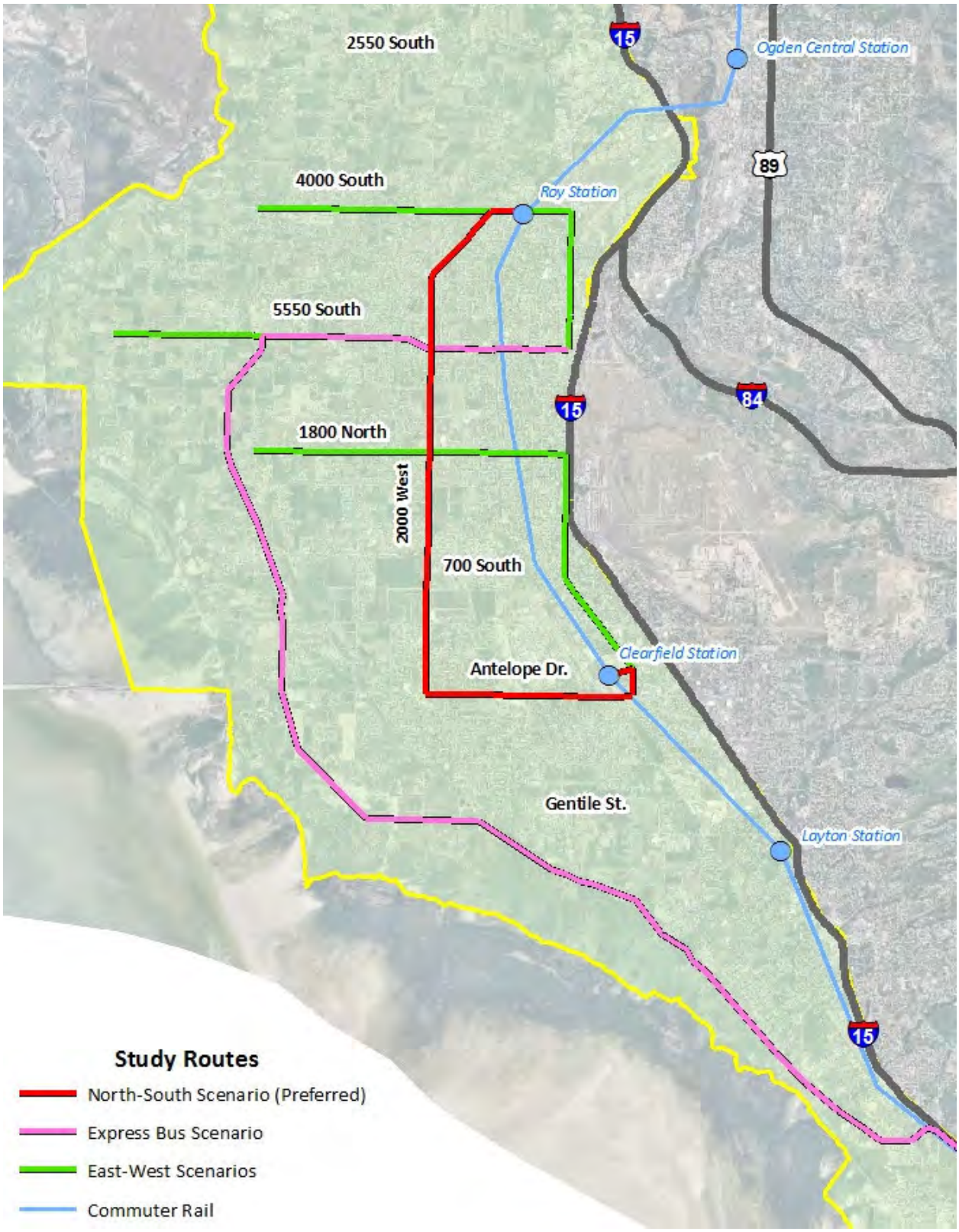
*Exhibit 33 – 2040 Transit Route Comparison Summary*

| Scenario | Headway (Pk/Ok) | Round Trip Length (mi.) | Daily Boardings | Boardings / Mile | Total Study Area Ridership[1] | Study Area Mode Share[1] |
|---|---|---|---|---|---|---|
| East-West BRT | | | | | | |
| 4000 South | 15/15 | 7.7 | 400 | 103 | 6,810 | 2.9 |
| 5550 South | 15/15 | 19.1 | 890 | 93 | 7,260 | 3.1 |
| 1800 North | 15/15 | 16.7 | 1,000 | 120 | 7,320 | 3.2 |
| North-South BRT | 15/15 | 24.6 | 2,160 | 176 | 7,160 | 3.1 |
| Express Bus | 30/-- | 42.4 | 1,070 | 51 | 7,520 | 3.2 |

[1]*Home Based Work Trips*

None of the BRT routes generates the UTA desired 250 boardings per mile and the express bus route was eliminated because it steals riders from commuter rail. Of the four BRT routes considered, the north-south route attracted the most total daily riders and the most boardings per mile, but even in 2040 would not meet UTA's criteria of 250 boardings per mile for a BRT investment.

*Exhibit 34 – Key Study Routes*



WEST DAVIS
CORRIDOR

# APPENDIX

UTA

## MEMORANDUM

**To:** Randy Jefferies, Vince Izzo, Ivan Hooper, Jayson Cluff
**From:** G.J. LaBonty, UTA
**Cc:**

**Date:** Monday 10 March, 2011

## RE: BRT Assumptions

Randy,

Regarding the current evaluation of transit alternatives in the West Davis Corridor, I am submitting this memo to you describing some of the general assumptions that UTA includes in evaluating Bus Rapid Transit (BRT) as a feasible mode for studies that are conducted along the Wasatch Front.

**Capital Costs**

Currently UTA uses ranges for preliminary estimations of capital costs associated with BRT construction. For BRT I (or Enhanced Bus), UTA uses a range estimate between $500,000 and $1.2 million/mile. For BRT II and BRT III UTA uses a range of $8 - $25 million/mile. These ranges are then used recognizing that there are significant differences between the application of BRT technology in different geographic corridors.

**Cost Effectiveness**

While UTA does not have any published standards with regard to cost effectiveness, we do use a general range when evaluating the performance of a potential new capital investment. A range of 500-700 riders per mile per day represents a reasonable threshold for a capital investment of a BRT III. A range of 250-500 riders per mile per day represents a reasonable threshold for a capital investment of a BRT I or II. Below is a table with a few of the recommended BRT lines from the current RTP.

| Route | Miles | Boardings (2040) | Boardings per Mile |
|---|---|---|---|
| Provo-Orem (Utah County) | 8.67 | 12,653 | 1,459 |
| 1300 East (Salt Lake County) | 15.26 | 9,841 | 645 |
| State Street (Salt Lake County) | 24.44 | 14,568 | 596 |
| Foothill to Wasatch Blvd (Salt Lake County) | 19.96 | 9,828 | 492 |
| Redwood Rd (Salt Lake County) | 26.57 | 11,418 | 430 |

The Federal Transit Administration applies the term “user benefits” when evaluating major capital investments for cost effectiveness. In its simplest form, user benefits can be represented as simple a ratio of annualized costs to annualized new riders. The cost effectiveness threshold per new rider to reach a “Medium” rating would be less than $25. Using the projects above, the following table represents a rough calculation (assuming a uniform capital cost of $15,000,000/mile) of the cost effectiveness for each project.

| Route | Miles | Unit Cost/Mile | Capital Cost | Amortized Annual Cost | Annualized New Riders | Cost Effectiveness Index |
|---|---|---|---|---|---|---|
| Provo-Orem (Utah County) | 8.67 | $15,000,000 | $130,050,000 | $10,404,000.00 | 1,859,991 | $5.59 |
| 1300 East (Salt Lake County) | 15.26 | $15,000,000 | $228,900,000 | $18,312,000.00 | 1,446,627 | $12.66 |
| State Street (Salt Lake County) | 24.44 | $15,000,000 | $366,600,000 | $29,328,000.00 | 2,141,496 | $13.70 |
| Foothill to Wasatch Blvd (Salt Lake County) | 19.96 | $15,000,000 | $299,400,000 | $23,952,000.00 | 1,444,716 | $16.58 |
| Redwood Rd (Salt Lake County) | 26.57 | $15,000,000 | $398,550,000 | $31,884,000.00 | 1,678,446 | $19.00 |

**Current BRT Systems in UTA**

UTA currently has one BRT route, the 35 MAX. This route includes a fully dedicated right-of-way portion (1 mile) of the 13 mile alignment. This line currently carries approximately 3,000 riders/day (230 riders/mile). For the 1 mile section of dedicated right-of-way that is currently operational the capital costs were approximately $10 million. This cost falls in the lower end of the range of capital costs cited above due to some cost sharing that was agreed to by UDOT. Scheduled roadway improvements by UDOT were leveraged in order to reduce UTA’s overall construction costs for the dedicated right-of-way for this particular BRT system.