1 EXECUTIVE SUMMARY

The Research Park Strategic Vision Plan is a transformative program of investment and development that re-imagines the Research Park campus as a regional destination and town center that can support a robust mix of employment, residential, cultural, and entertainment uses. The increased density and use of available space proposed by the Vision Plan would attract a variety of daily and special event trips to an already mobility constrained Research Park site. As part of the Strategic Vision, however, the university is considering significant investment in the multimodal infrastructure needed to support a paradigm shift in single occupancy vehicle (SOV) production to the site which would enable a sustainable program of growth and land use redevelopment.

This document summarizes the high capacity transit (HCT) elements of the Research Park Strategic Vision Plan. It documents the **existing conditions**, highlighting the objectives and proposed investments (capital and operational changes). It summarizes the **transit mode share and vehicle trip reduction analysis as a result of the implementation of the HCT network**, reviewing the methods, inputs, and estimated future HCT demand. Finally, it proposes a **package of recommendations** for the Research Park, translating the district vision and project work into specific and tangible actions.

The assessment of potential HCT connectivity and integration opportunities for the Strategic Vision Plan consider existing and projected conditions prior to the first positive case of COVID 19 and "stay safe, stay home" orders for the state of Utah. Additional multimodal elements of the Strategic Plan, including parking, transportation demand management (TDM), and analysis of overall traffic and travel patterns are discussed under separate cover for this Strategic Vision effort.

Existing Conditions

- Tucked in the in the foothills of the Wasatch Front, and the natural topography the Research Park campus has led to a disconnected roadway network with limited auto, transit, and active transportation infrastructure to support multimodal arrival or circulation to neighboring land uses.
- Current HCT connections for trips Research Park are available through the TRAX light rail transit (LRT) Red Line, with service to the University of Utah Rice-Eccles Stadium, main campus via South Campus and Fort Douglas stations, and University of Utah Medical Center.
- Separated from the University main and medical campuses by Red Butte Creek and a disconnected sidewalk network, neither TRAX station is within a 1-mile walkshed of Research Park destinations.

- Approximately 65% of existing Research Park commuter travel flows come from southeastern Salt Lake City, making Foothill Drive a primary access roadway and potential mobility impacts related to increases in traffic congestion significant community concerns.
- Many regional trips from areas in the upper and lower valley which are channeled along major east-west arterials such as 2nd Avenue, S Temple, 500 S / University Drive, and 800 S / 900 S / Sunnyside Drive.
- People making trips to Research Park have a significantly lower propensity for transit use (mode-share) when compared with University main campus and medical center.

Results of a transportation behavior survey of Research Park employees identified the following results:

- 18% of Research Park employees get to the study area via public transit.
- Among Research Park employees, light rail was the highest ranked transportation choice (followed by bus and parking access) to have located near a destination.
- 80% of Research Park employees drive alone for their commute.
- 80% of Research Park employees commute to work between 7 and 9 AM and from work between 4 and 6 PM.
- Amongst University affiliates, people whose primary destination was Research Park had a higher drive-alone rate than any of the other sections of the University campus.
- 7% of non-University Research Park employees who live in Salt Lake City ride a bicycle to work.

Analysis Approach

This High Capacity Transit technical memo documents the analysis approach for identification of the potential impacts to transit mode-choice trends for all trips to Research Park throughout the region for the following milestones:

- ***Existing Conditions (2020)*** – This scenario represents current traffic conditions and the existing transit and roadway networks. Transit mode share is based on existing origin-destination (O-D) patterns adopted within the Wasatch Front Regional Council (WFRC) regional travel demand model.
- ***Phase 2 (10-Year) Conditions (2030)*** – Future traffic conditions based on the Wasatch Front Regional Council (WFRC) regional travel demand model projected growth for 2030 and Research Park transit mode share associated with the Phase 2 HCT network vision.
- ***Phase 3 (20-Year) Conditions (2040)*** – Future traffic conditions based on the Wasatch Front Regional Council (WFRC) regional travel demand model projected growth for 2040 and Research Park transit mode share associated with the Phase 3 HCT network vision.

A pivot-point analysis of the existing and adopted regional travel demand (origin-destination) patterns was used to project the potential change in utilization of HCT bus and rail services for all trips in the Wasatch region to research park with the additional HCT infrastructure and service scenarios proposed by the Strategic Vision Plan. This is a supply-based approach, where travel behavior is responsive to the quality of transit service that is being offered and did not consider the additional land uses and development density proposed by the Phase 2 and 3 buildouts of the Vision Plan, respectively.

In addition to the transit mode share pivot-point analysis, the Vision Plan also conducted an overall travel demand analysis to estimate single occupancy vehicle (SOV) trips generated by the phased land development component of the Vision Plan, as well as the potential of HCT and multimodal scenarios promoting increased modal connectivity to reduce SOV dependency. The California Air Pollution Control Officers Association (CAPCOA) reduction model was used to estimate vehicle miles travelled (VMT) reductions from six primary categories of transportation improvements. HCT inputs to the CAPCOA model considered SOV trip reduction factors based on implementation and expansion of the HCT network, as well as relative increases in service frequency and travel speeds.

Refer to the *Travel Demand Technical Memorandum (03Sept2020)* of the Vision Plan for further details of the travel demand methodology and analysis.

HCT Assumptions

The most significant HCT recommendations of the Strategic Vision Plan are shown below and include:

Phase 2 (Figure 1)

- Construction of the **Arapeen Connector -** a transit, bicycle, and pedestrian only roadway linking South Campus Drive to Arapeen Drive for expedited HCT vehicle circulation, access and egress to Research Park
- Implementing the **Campus Circuit -** a program of transit priority treatments connecting to the Arapeen Connector (along Arapeen Dr, Chipeta Way, Connor Rd, Ft. Douglass Rd) to create a series of curb side transit bus and right turn only business access lanes for expedited **University, employee and community shuttle service** between Research Park and surrounding land uses
- Realigning proposed **future HCT bus lines** to provide direct access and service to Research Park core tenants and facilities.
- Implementation of **Mobility Hubs** at strategic locations around the University and Research Park campuses to facilitate connection to first and last mile pedestrian, bicycle, and emerging mobility opportunities

Phase 3 (Figure 2)

- Realigning proposed **future TRAX rail lines** to provide direct access and service to Research Park core tenants and facilities.
- Phased addition of new **employee and community shuttle** routes connecting Research Park with surrounding land uses
- Expansion of **Mobility Hubs** at strategic locations around the University and Research Park campuses to facilitate connection to first and last mile pedestrian, bicycle, and emerging mobility opportunities

Figure 1 Proposed Phase 2 (2030) Transit Network Improvements

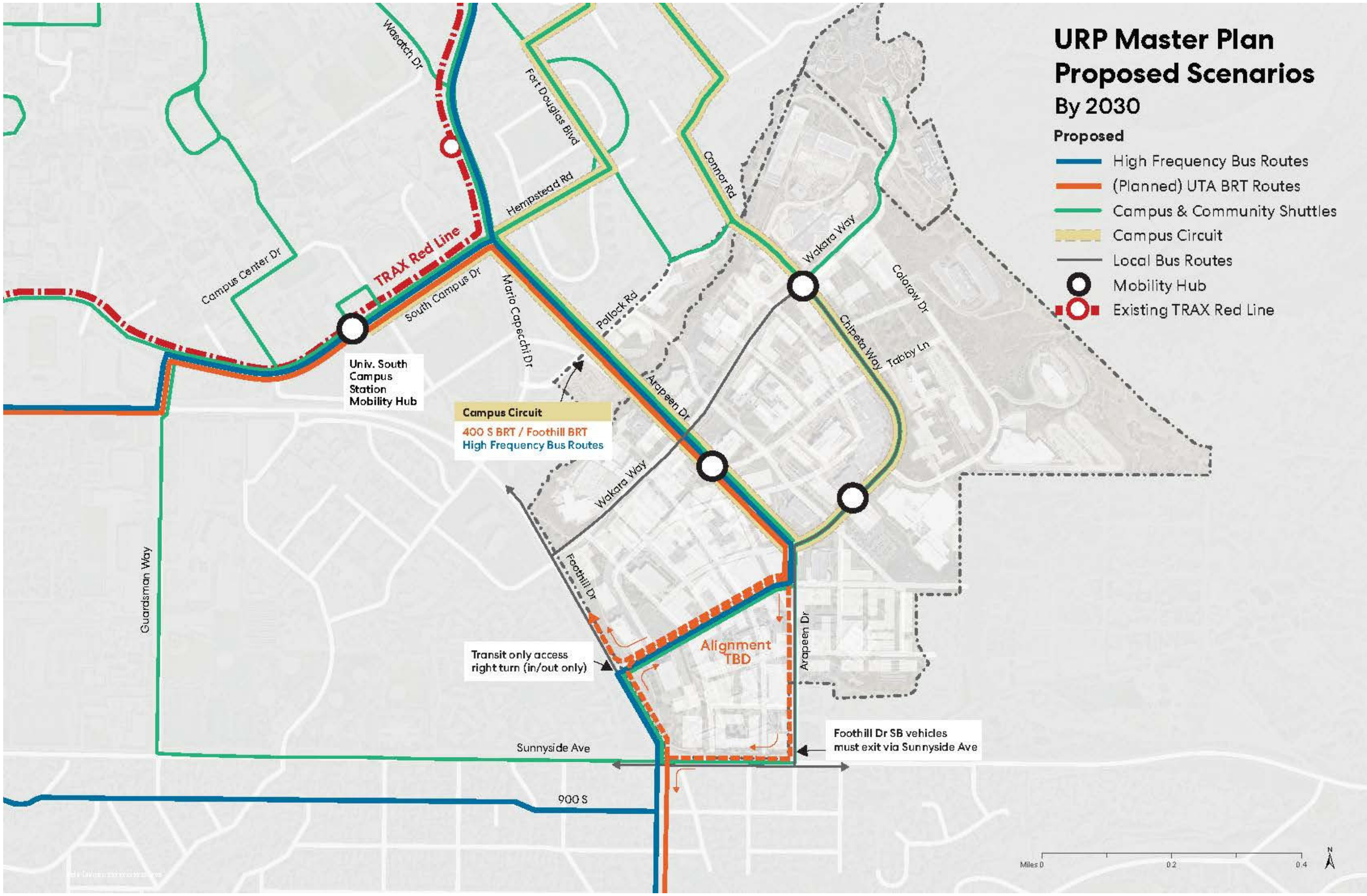
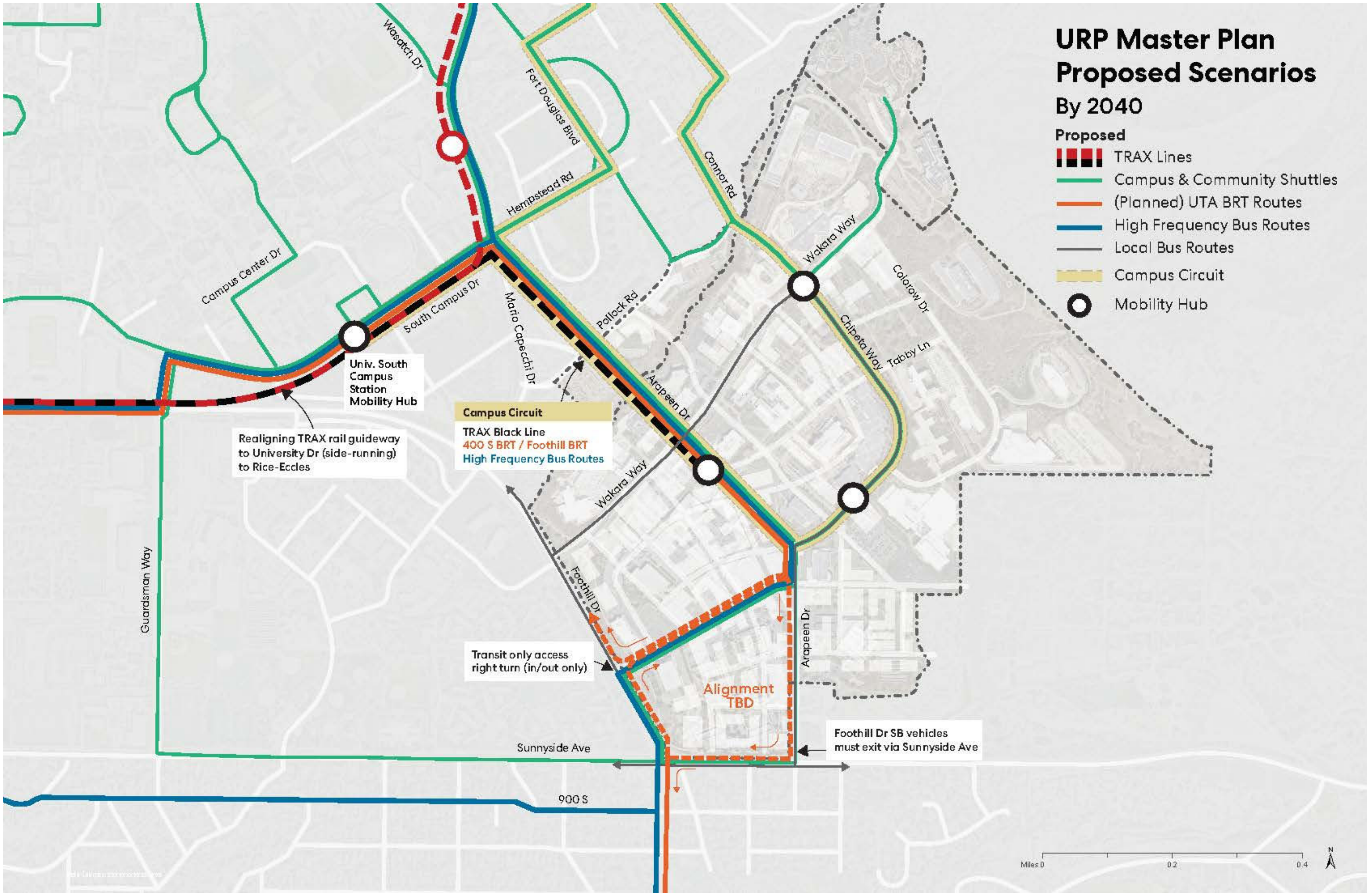


Figure 2 Proposed Phase 3 (2040) Transit Network Improvements

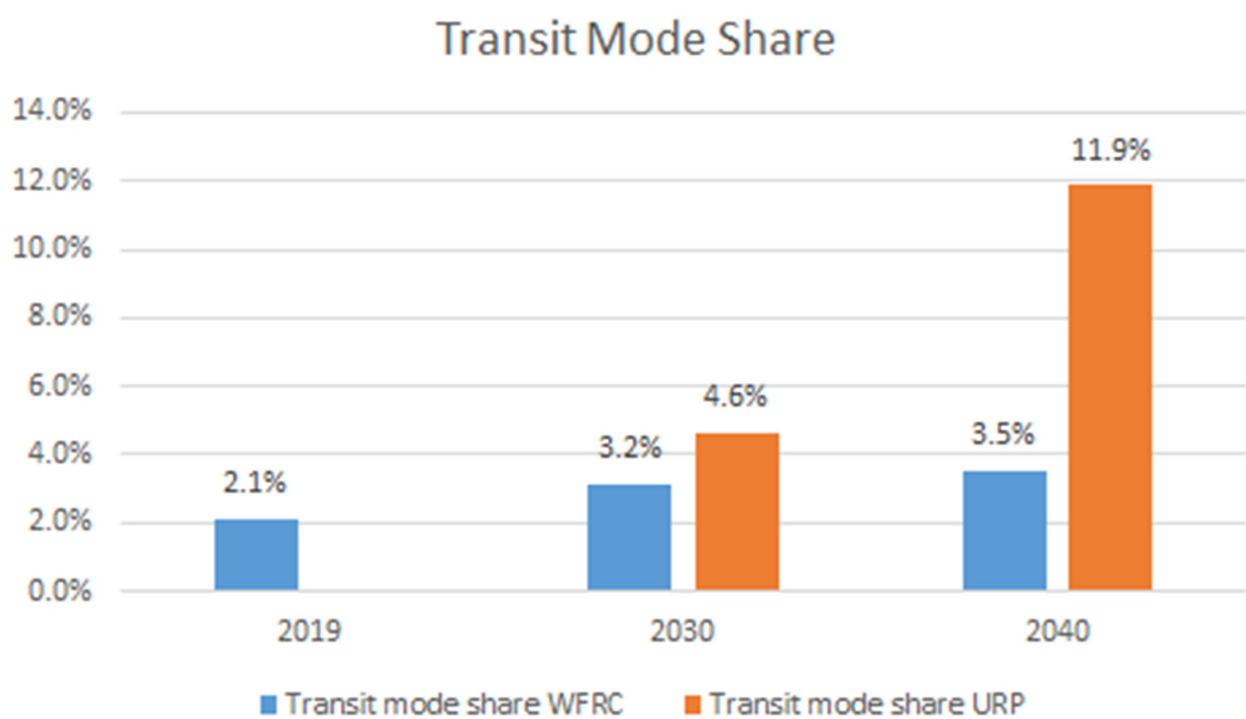


Findings and Next Steps

The results of pivot-point analysis identified the proposed HCT investments and service modifications may increase the transit mode share for trip arrival to Research park to up to 4.6% in 2030 and 11.9% in 2040. As shown in Figure 3, the implementation of direct BRT service to Research Park in Phase 2, increases the transit mode share of all trips to the area by approximately 1.5% (an increase of 50%). The extension of the new TRAX LRT line from the airport into the new terminus at Arapeen Dr and Wakara Way provides a significant increase in the appeal of HCT for trips to the campus, as reflected by the over eight percentage-point rise in mode share over the WFRC projected rate (240% increase).

It should be noted that adjustments to the future 2030 and 2040 HCT network assumptions made within the URP scenarios are not reflected in the WFRC baseline transit mode share rates shown. Projected changes in mode share are also irrespective of proposed transit-supportive land use changes at Research Park.

Figure 3 Projected transit mode share to/from Research Park



The HCT recommendations of the Vision Plan will require continued coordination with regional transportation stakeholder agencies and operators with jurisdictional control over infrastructure, facilities, and service operations to realize the integrated mobility opportunities at Research Park. This study recommends development of specific projects for further development, detailed design, and implementation as part of a phased capital improvement plan for transportation recommendations. The phasing plan should include flexibility for incremental (near-, midrange-, and long-term) investments in transit supportive infrastructure such that service deployment aligns with the redeveloped land uses and roadway network.

Figure 4 Proposed Research Park HCT Connectivity

Several examples of recommended next steps to develop transportation improvement program that includes the infrastructure, service, and technology components necessary to support the HCT, parking, and TDM solutions identified in Figure 5.

Figure 5 Recommended HCT Strategic Vision Implementation Strategy

HCT Improvement	Phase 1 (2025)	Phase 2 (2030)	Phase 3 (2040+)
Arapeen Connector	▪ Design multimodal bridge (including LRT component) and connecting transit priority guideway	▪ Construction and operation of Arapeen Connector ▪ Space activation - LRT ROW preservation	▪ Remove and/or relocate space activation
Campus Circuit and Transit Priority	▪ Circuit transit priority lane, traffic calming, wayfinding pilots and design ▪ E Village transit priority access/egress design and UDOT coordination	▪ Implement Campus Circuit transit treatments on E Campus and Research Park ▪ and E Village transit priority access/egress	▪ Vacate auto traffic along Arapeen Dr (from Wakara Way to Tabby Lane)
Campus Shuttle Network	▪ Plan and implement Research Park to MedX/Medical Center shuttle improvements. ▪ Community and business shuttle funding coordination	▪ Continue developing funding partnerships and refine existing shuttles as redevelopment occurs ▪ Pilot community and business shuttle opportunities	▪ Expansion of shuttle network, as needed
BRT, Fixed Route Service	▪ Coordinate with UTA for consideration of BRT realignment alignment from Foothill Dr to Arapeen Dr and circulation of fixed routes to Research Park	▪ Implement Foothill BRT and high frequency bus service with direct access to Research Park	▪ Continued operations
LRT Service	▪ Coordinate with ongoing plans and studies (ex - Future of Light Rail Study and downtown redevelopment plans) ▪ Coordinate with regional transportation stakeholders (UTA, WFRC) to study proposed extension to Research Park	▪ Preliminary engineering and environmental clearance ▪ Final Design ▪ Capital and operating funding plan	▪ Implementation of TRAX LRT service from SLC airport to University Research Park terminus at Convergence Hall (between Wakara Way & Tabby Lane)

2 EXISTING CONDITIONS

Research Park is located in the southeast corner of the University of Utah campus. It is bounded on the north by Red Butte Creek, on the east by the Wasatch Mountain Range foothills, on the west by Foothill Drive, and on the south by East Sunnyside Avenue as shown in Figure 7. Most roads in the campus lead to either Wakara Way or Foothill Dr, which then creates a major congestion bottleneck during peak travel periods. Current traffic congestion observed along Foothill Drive and the intersection of Wakara and Chipeta during rush hours have also been identified as a potential detractor towards further development of Research Park.

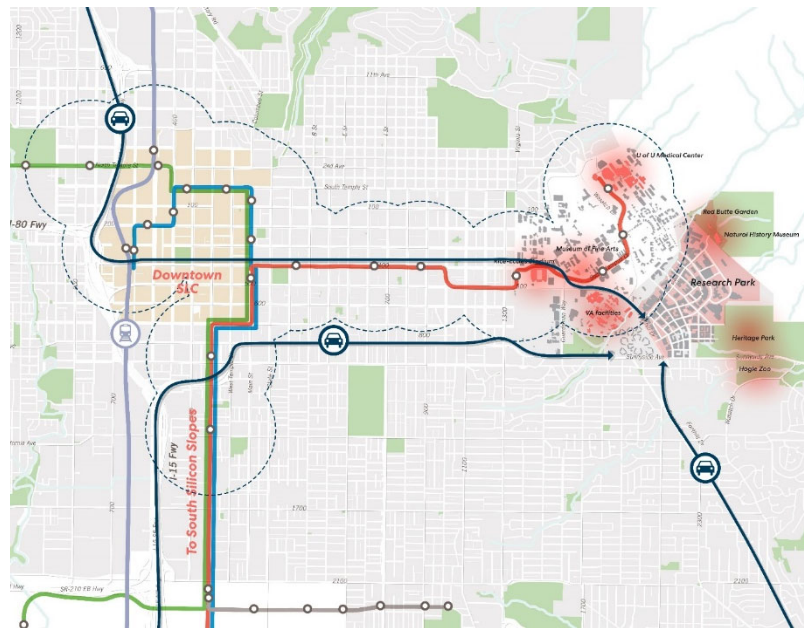
The natural features of the area, as well as its proximity to downtown Salt Lake City, make Research Park and the surrounding area a regional destination for nature and recreational activities as well as cultural facilities. The Strategic Vision will emphasize these trip generators by evolving the Research Park area into a regional town center and anchor of first-class development and transportation in Utah. These aspirations make the development of balanced and sustainable mixture of alternative modes of transportation even more critical for maintaining mobility into-, out of-, and within Research Park.

RESEARCH PARK ACCESS AND CIRCLATION

As part of the initial assessment of existing conditions for the Strategic Vision Plan, the study identified the travel patterns of current Research Park commuters. Existing and future travel flows projected within the Wasatch Choice regional travel demand model, shown in Figure 6, demonstrate strong trip generation to the study area and University campuses through the 2040 analysis horizon.

The 2016 analysis of the Research Park's TDM program noted several findings regarding the arrival and mobility trends of existing employee and student commercial tenants:

Figure 6 Research Park Regional Destinations, Rail Service, and Travel Flows

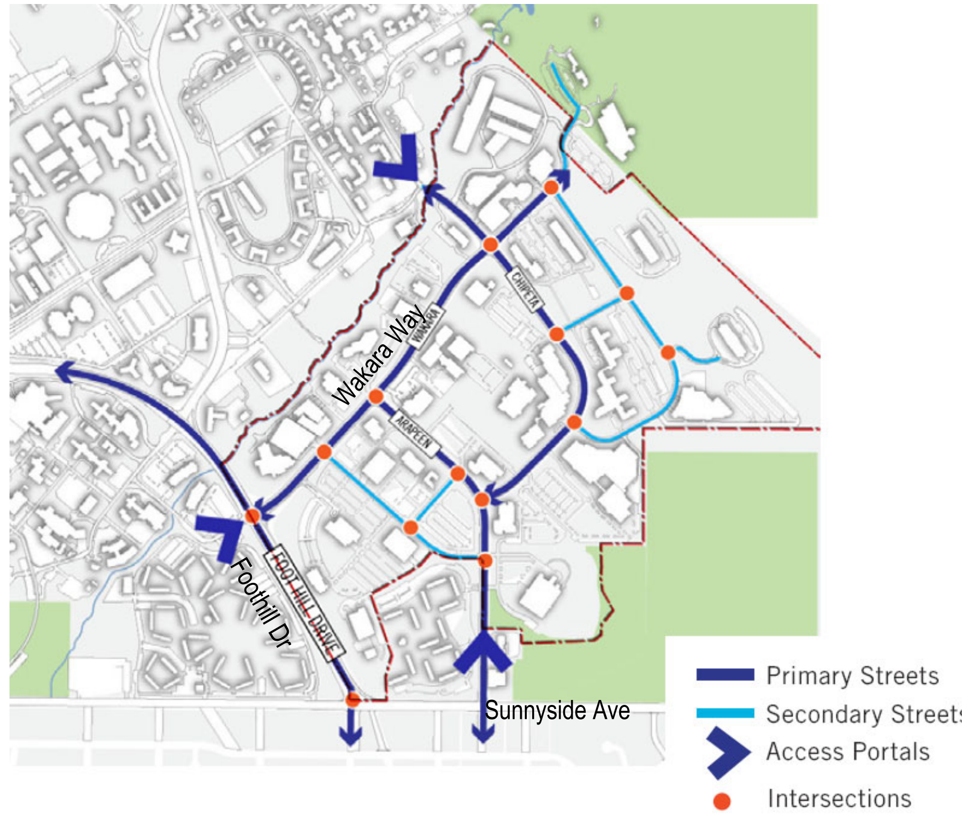


– Research Park has a drive-alone commute share of over 80%
– Most daytime trip destinations outside Research Park are to the main University campus, the Medical Center, or downtown Salt Lake City

- Many employees are estimated to lack access to bike facilities, transit passes, carpool spots, or a company car; while employees with access are more likely to be aware of such amenities if they are affiliated with the University
- A vast majority of lunch trips occur outside of the office parks, creating additional auto trips

Figure 7 University Research Park Project Area

Figure 8 University Research Park Site Access



TRANSIT SERVICE AND CONNECTIVITY

The Utah Transit Authority (UTA) operates fixed route bus and TRAX light rail transit (LRT) service to the University of Utah Campus. However, routes offers limited connectivity between Research Park and major University and Medical Center destinations north of Red Butte Creek. Service is currently limited by the constrained singular crossing of Red Butte Creek at Chipeta Way and the traffic circulation challenges of using Foothill Drive as the only other connecting roadway between campuses (see Figure 8). UTA Fixed routes generally serve either Main Campus or Research Park, but not both. This is evidenced in see Table 1 by the roughly one-third of UTA fixed routes serving the University Main Campus, TRAX, and or Medical Science area (14), of which only five also connect to the Research Park campus. Three frequent routes (having 15 minute service or better) serve the main campus and avoid the circuitous routing to access Research Park. Fixed routes serving Research Park are primarily oriented towards regional commuters in the North and South Valleys and only operated at 30 to 40-minute frequency during peak hours. Route 3 offers consistent, all day service between Research Park and the CBD, including FrontRunner regional rail transfer opportunities.

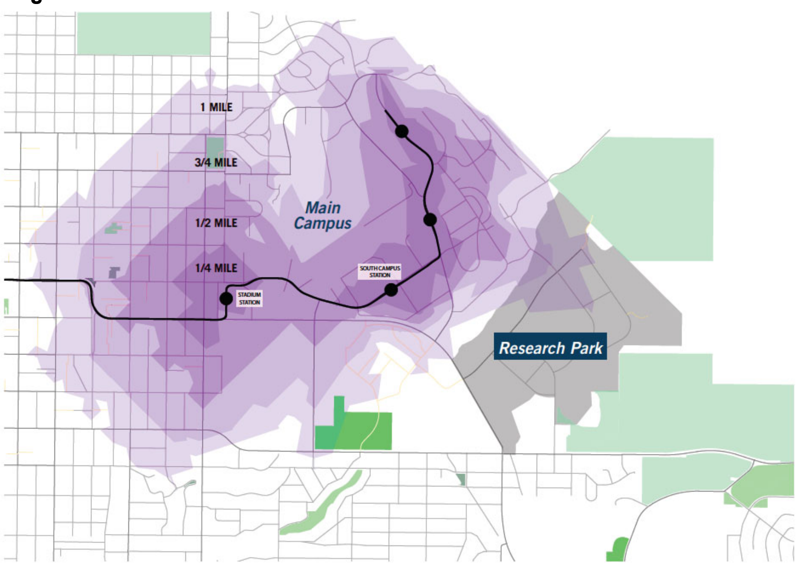
Table 1 UTA Fixed Route Bus Service to Research Park

Route	Service Frequency	Campus Destinations	Primary Roadway(s)
2	15+	N Campus Dr, University Hospital	200 S to SL Central Station
3	30+	Research Park, TRAX Stadium	3rd Ave to N Temple Station (Green Line, FrontRunner)
2X	Limited Stop	TRAX - Stadium, S Campus, Med Center	200 S to SL Central Station (Blue Line, FrontRunner)
6	30+	N Campus Dr, University Hospital	6th Ave to So SL Central Station (Blue Line, FrontRunner)
9	15+	Union Bldg., TRAX - S Campus, Med Center	900 S to Redwood
11	30+	N Campus Dr, University Hospital	11th Ave to LDS Hospital, SL Central Station
17	30+	Union Bldg., TRAX - S Campus, Med Center	1700 S to Central Pointe
21	15+	Union Bldg., TRAX Med Center	2100 S to Central Pointe
213	30+	Union Bldg., TRAX - S Campus, Med Center	1300 E to Midvale Center
223	30+	Research Park, TRAX Med Center	2300 E to Cottonwood
313	Express	Research Park, TRAX - Stadium, Med Center	I-215, 1300 E to South Town

Route	Service Frequency	Campus Destinations	Primary Roadway(s)
354	Express	TRAX - Stadium, Med Center	I-215 to Sandy
455	30+	Research Park, TRAX S Campus	SH-89 to Ogden, Davis City (Weber State)
473	Express	Research Park, TRAX - S Campus, Med Center	SH-89 to Ogden, Davis City (Weber State)

TRAX LRT Red line connects South SLC (along the I-15 corridor) to the downtown CBD and the University Main Campus, operating at 15 min frequency from 5:30 am to 7:30 pm and every 30 minutes thereafter on weekdays. Weekend service operates at 30-minute frequency from approximately 6:30 am to 1130 pm weekends. It has stations located at the Rice-Eccles Stadium (S Campus Dr @ 1300 E), South Campus (near the Jon M. Huntsman Center on S Campus Dr), Fort Douglas (Mario Capecchi @ S Wasatch Dr) and terminates at the University Medical Center (Mario Capecchi, South of N Campus Dr).

Figure 9 TRAX Station Walkshed

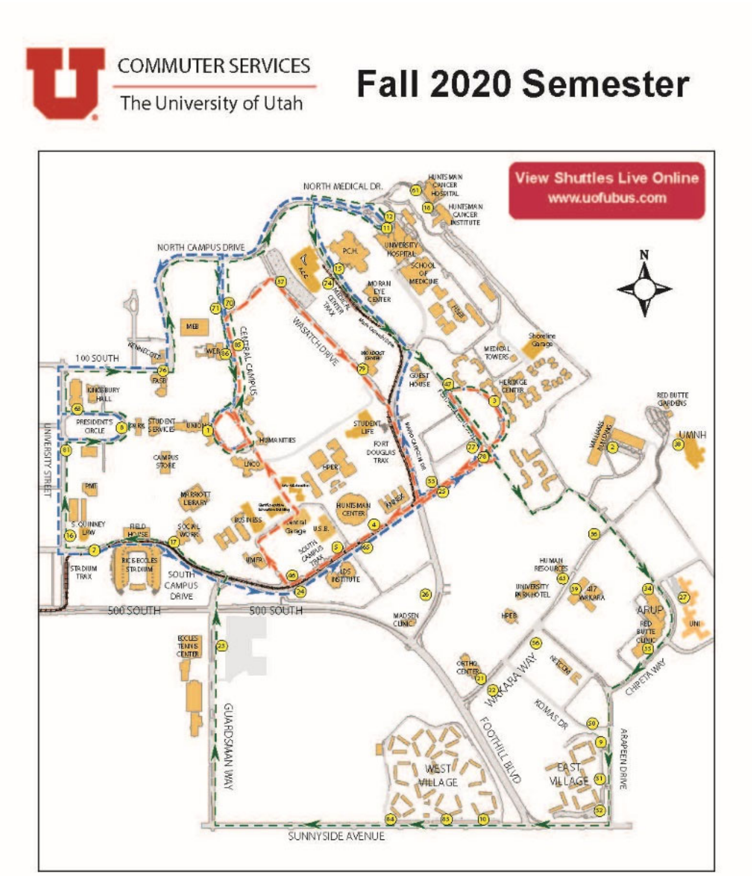


The TRAX Green Line does not offer direct service to the University and Research Park for Airport visitors, instead requiring transfer to Red Line at the Downtown Courthouse station. Students and employees commuting to the project area from the upper and lower valley areas such as Ogden or Sandy, and using alternative transportation methods have options of UTA regional express buses (313, 455, and 473) or Front Runner commuter rail, which requires two transfers. The first transfer may be to either the TRAX Green Line at North Temple Bridge station, or the Blue Line at the Salt Lake Central station. A second transfer is required to reach the University area via the Red Line at the Downtown Courthouse station.

The topography of the study area also plays a significant role in the connectivity and circulatory options for transit service that may desire to link with destinations in the Research Park study area.

The nearest TRAX station access to Research Park (see Figure 9) is located at the South Campus station near the Jon M. Huntsman Center. Although this is less than one mile away from the heart of the corporate office park, limited options for pedestrians and vehicles to cross Red Butte

Creek make the actual walking distance well over a mile. These connectivity and walkability challenges are large contributor to the disparity in transit mode of arrival to Research Park versus that of the Main Campus and Health Science areas.



The University of Utah operates three shuttle routes available to students on weekdays from 6 am to 8:30 pm, as well as on demand for pickup and drop-off at existing stop locations. Shuttles operate as 1-way circulators at between 15 and 30-minute frequency depending on demand. Only one of three (Green) routes serves the Research Park Campus, before it continues west of Foothill Drive to connect with the West Village hosing area, Rice-Eccles Stadium and West Campus before serving the Medical Science uses. Those wishing to travel from Research Park to destinations within the University main campus or Medical Center are discouraged due to the out of direction travel and extended trip time required. Typical shuttle boardings (Jan - June 2019) reflect strong on-campus student resident ridership on the Green route (14,000+), and the Orang route carried approximately 70 passengers per hour.

Due to the various barriers to alternative transportation and mobility network use within Research Park, the transit utilization (mode share) to the area is far lower than that of adjacent land uses within the University main campus and Medical Center/East Campus, as shown in Table 2.

Table 2 University of Utah and Research Park Base Transit Mode Share (WFRC)

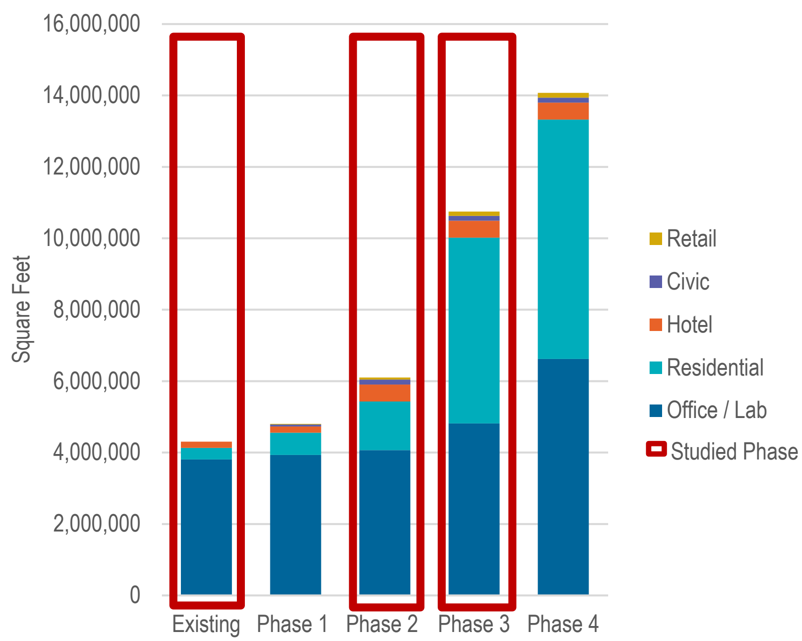
Traffic Analysis Zone (TAZ)	2019	2030	2040
University Main Campus (1075)	12%	14%	16%
University Health Sciences and East Campus (1076)	9%	11%	13%
University Research Park (1077)	2%	3%	3.5%

Source: Wasatch Choice 2040 regional travel demand model

3 HCT SCENARIO DEVELOPMENT

The University of Utah has developed four phases for the land use buildout of the Strategic Vision Plan as shown in Figure 10.

Figure 10 Land Use Program, by Phase



Phase	Projected Timeline	Year of Completion
Phase 1	5 Years	2025
Phase 2	10 Years	2030
Phase 3	20 Years	2040
Phase 4	30 Years	2050

Three analysis scenarios, highlighted as "Studied Phase" in Figure 10, were chosen for the transit mode share modeling element of the project to determine the extent to which the proposed HCT service and supporting transit infrastructure may affect the transportation arrival trends to Research Park.

The Existing conditions assessed the 2020 transit mode share for all trips to the University Research Park traffic analysis zone defined by the Wasatch Front Regional Council (WFRC) Wasatch Choice regional transit plan.

Phase 2 (2030)

Adopted Network

As shown in Figure 11, the planned transportation and mobility improvements adopted by the Wasatch Front Regional Council (WFRC) and Utah Transit Authority (UTA) include future Frequent Transit Network (FTN) routes as well as high capacity transit (HCT) bus and rail service near the Research Park planning area. UTA proposed implementation of BRT service along Foothill Drive as well as University Dr/400 S, providing rapid HCT connections between Research Park trip origins in Southeast SLC as well as existing activity centers in the CBD. Connectivity to the University and Research Park is provided via stations at the South Campus TRAX station and Foothill Dr @ Wakara Way. A one-seat ride on TRAX LRT service operating from the SLC airport to the University, terminating at the existing South Campus station, is also planned this horizon period.

While significantly improving the frequency and quality of HCT service to the University of Utah academic and medical campuses, the lack of a connected street network in the future conditions continues to prevent the penetration of these services into the office park area needed to support redevelopment and transportation mode choice goals.

No significant transit or transportation investments are planned from 2030 to the 2040 WFRC planning horizon.

HCT Vision

The Strategic Vision Plan is based on the adopted future HCT network, and identifies a series of transit supportive infrastructure and operational improvements to facilitate the direct, seamless HCT connections absent in the adopted regional plan, as shown in Figure 12.

Figure 11 WFRC Adopted (2030/2040) HCT Network

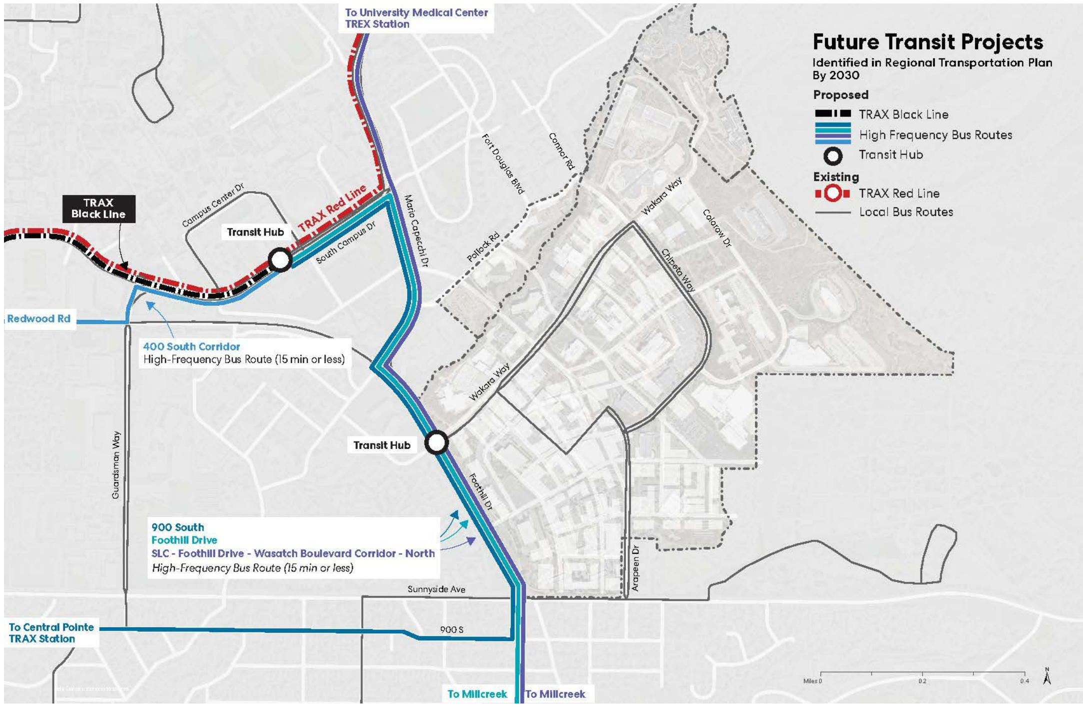
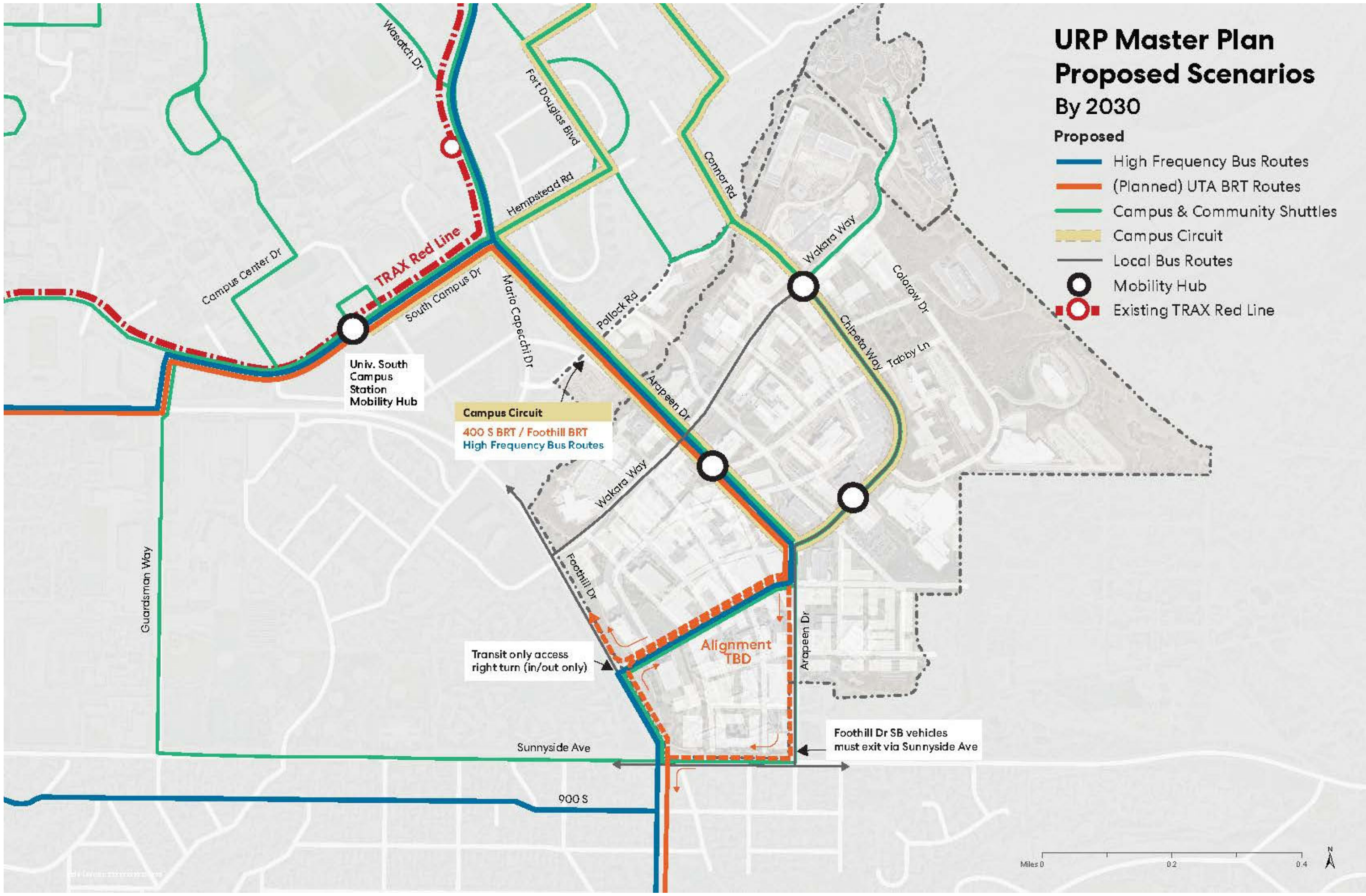


Figure 12 Proposed (Phase 2) HCT Network



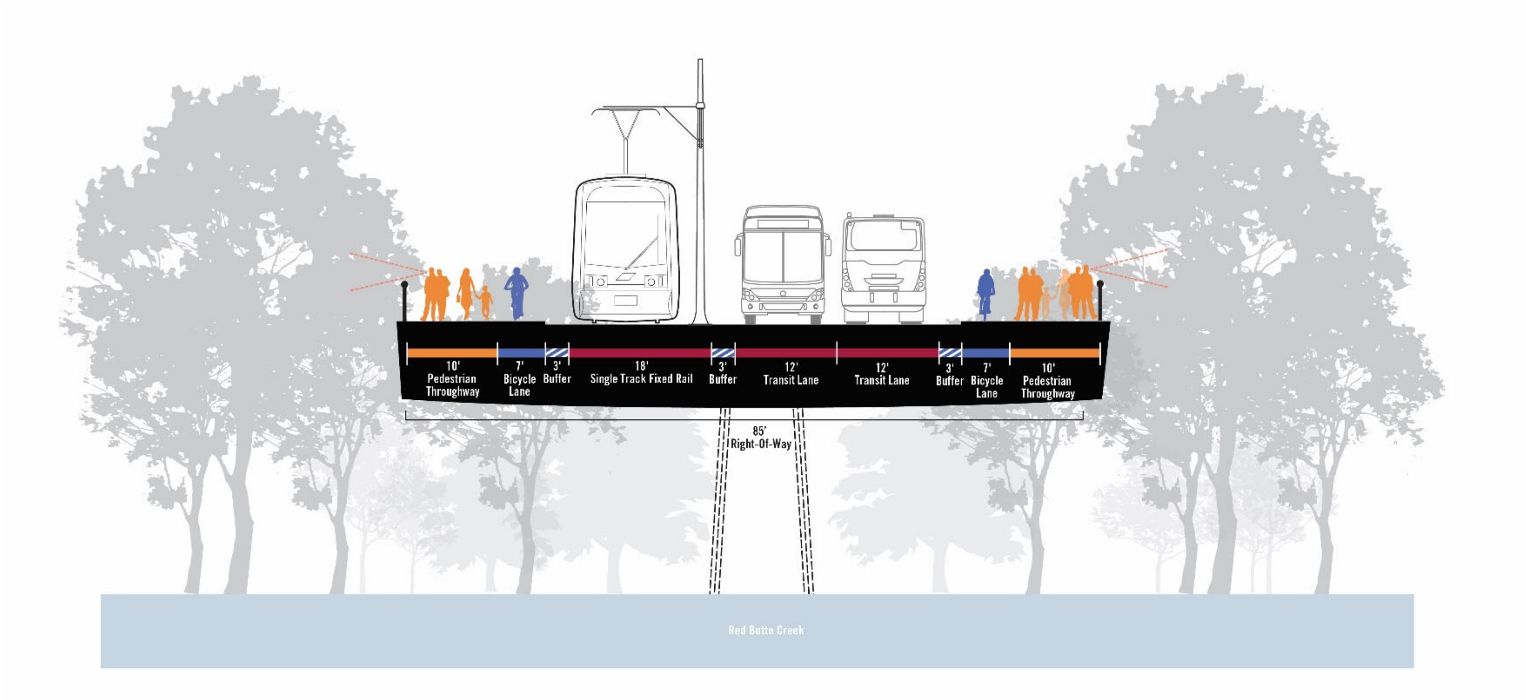
Priority transit supportive investments and services proposed for deployment by the Phase 2 (2030) planning horizon are described below. The Vision Plan also recommends postponement of the proposed TRAX 1-seat ride LRT service from the SLC airport to the existing South Campus TRAX station until the Phase 3 implementation period.

Arapeen Connector

The single most significant component of transit supportive infrastructure in the Vision Plan is the Arapeen Connector. This new (transit, bicycle, and pedestrian only) facility will be constructed from the existing intersection of South Campus Drive and Mario Capecchi Drive to the southern bank of Red Butte Creek, where a new multimodal bridge crossing will be constructed. The proposed cross section of the Arapeen connector will accommodate bi-directional bus, BRT, and University shuttle transit service between Research Park and the South Campus TRAX station. Although TRAX LRT extension to Research Park is not proposed until the Phase 3 horizon, the Arapeen Connector would preserve right of way for a continuous single track of rail guideway between South Campus Drive and the new proposed terminal station at Wakara Way and Arapeen Drive.

A special, transit-only signal phase would be required at the intersection of Mario Capecchi Drive, South Campus Drive, and the Arapeen Connector to facilitate the transit vehicle access/egress of the facility's northern end. Transit only access would be controlled with signage and pavement markings at the southern bank of the Red Butte Creek bridge and the Connector merges with the existing Arapeen Drive.

Figure 13 Arapeen Connector – Ultimate (2040) Proposed Cross Section



Bus Rapid Transit (BRT)

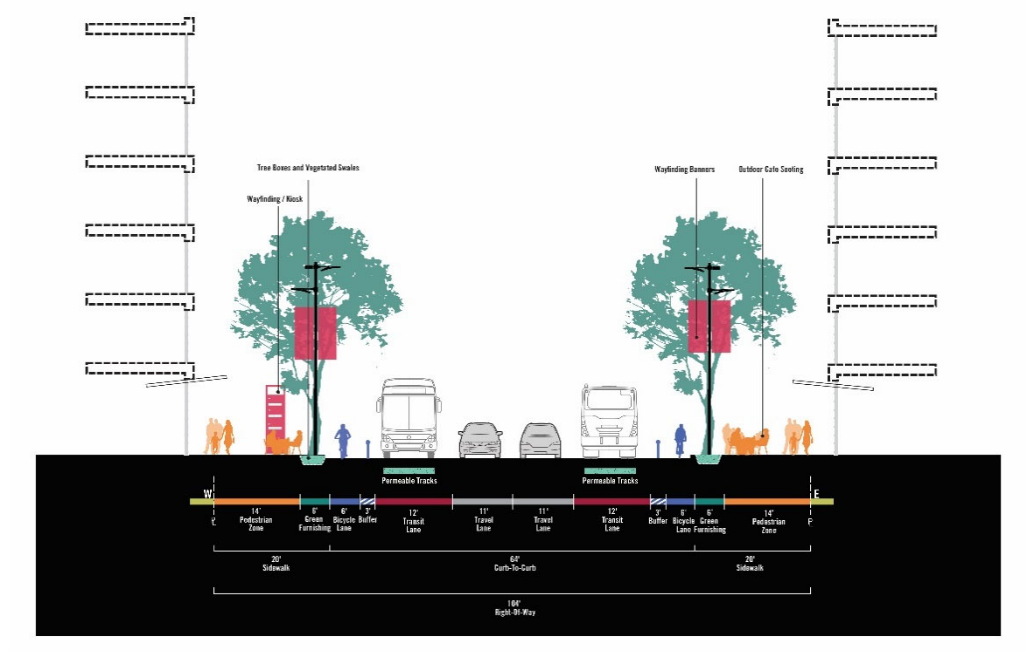
As shown in Figure 12, the Vision Plan proposes realignment of the proposed UTA BRT lines and high frequency routes operating on Foothill Drive and University Drive/400 S to serve Research Park campus directly via the Arapeen Connector and Arapeen Drive. Northbound routes along Foothill Drive will access Research Park via a new, transit only access/egress point near the location of the existing East Village housing complex which is also scheduled for redevelopment within 7 yrs. Buses will then turn North along Arapeen Drive at the intersection with Chipeta Way to serving a new mobility hub in front of the planned Convergence Hall and Social Spine (south of the intersection of Arapeen Drive and Wakara Way), before continuing to the South Campus TRAX station and destinations further west.
For BRT and rapid bus service planning connections to the University from origins to the North and/or West, via 400 S or Mario Capecchi, the Arapeen connector may be also utilized to provide direct access to Research Park at the new Convergence Hall mobility hub. Vehicles will continue south along Arapeen to make their northbound egress to Foothill drive through the new East Village transit only gateway.
Left turns will not be allowed out of the transit-only access/egress point at the East Village, requiring southbound vehicles to circulate to Sunnyside Drive in order to turn south along Foothill Drive.

Campus Circuit

The Campus Circuit is a series of transit priority, access management, and preservation of ROW improvements to facilitate the rapid movement of people around the University and Research Park campuses without the need for short SOV trips. Fixed route transit buses as well as University, community and employee shuttles will have a dedicated operating space via the installation of business access and transit (BAT) lanes along the outer, curbside lanes of the roadways shown in Figure 14.

Beginning with the Arapeen Connector and proceeding counter-clockwise, BAT lane painting, restriping, and/or signage may be placed along sections of Arapeen Dr, Chipeta Way, Connor Rd, Red Butte Creek Road, through the Heritage Plaza, along Medical Tower Way, South Medical, Vollum Way, Ft. Douglass Boulevard, and Hempstead Road to illustrate the location of the Campus Circuit designated operating space to transit operators, other motorists, potential passengers and multimodal users.

Figure 14 Cross Section of Proposed Campus Circuit



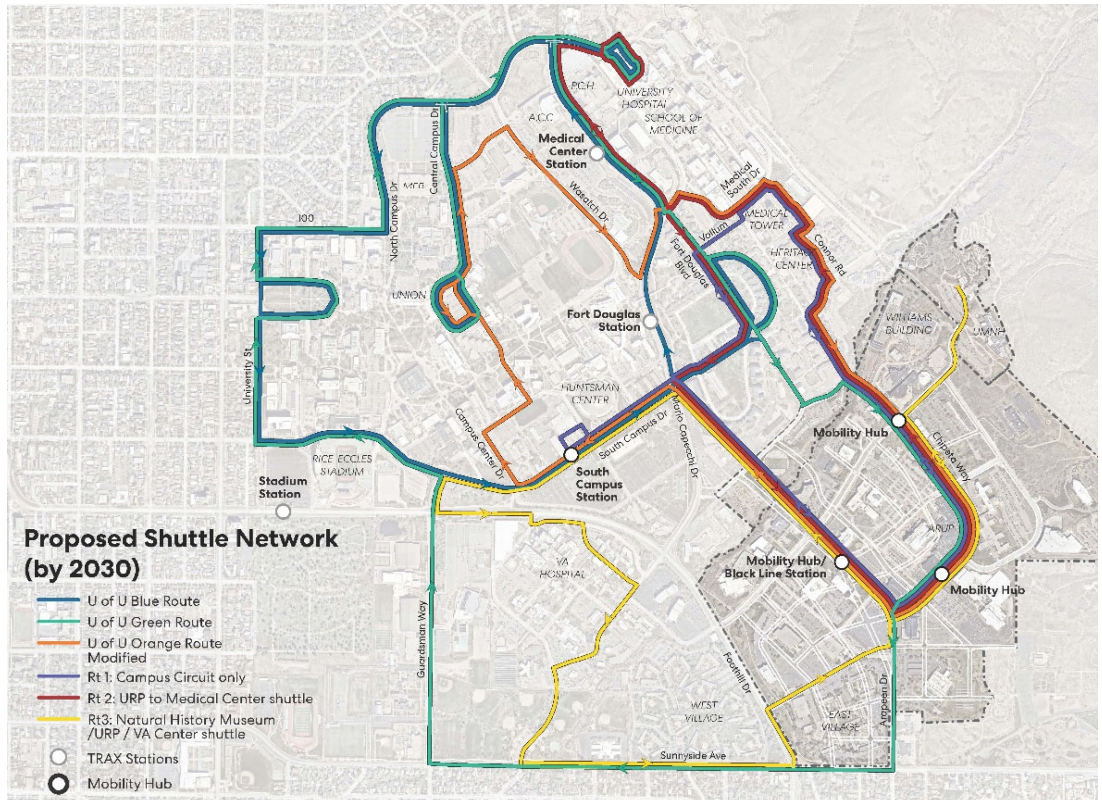
Vehicles utilizing the Campus Circuit are anticipated to serve the TRAX South Campus station and mobility hub. However, there will not be transit priority treatments along the segment of South Campus Drive, between the Arapeen Connector and turnaround at the South Campus mobility hub.

Shuttle Network

The three routes of the University of Utah student shuttle network may be modified or expanded in various ways to improve circulation between the University main campus, Medical Science Center, Research Park, as well as east and west student villages. As part of the overall TDM strategic vision, the proposed scenario also assumes implementation of three (3) employee and community shuttles to connect the University and Research Park destinations with adjacent land uses such as the Medical Center, West Village, Veterans facilities, as well as residential neighborhoods, civic and nature activities opportunities in the mountain foothills.

The three additional employee and community shuttles, shown in Figure 15, are described as follows:

Figure 15 Proposed University and Research Park Shuttle Network



- Route 1 provides rapid connectivity between the core of the University and Research Park with frequent 10-minute and 20-minute peak/off-peak, bi-directional service only within the described Campus Circuit.
- Route 2 is proposed to operate in 1-way (counterclockwise) loop that prioritizes connectivity between Research Park and the hospitals in the Medical Center. Shuttles would run every 20 and 40 minutes during peak and off-peak times.

- Route 3 connects Research Park with natural and cultural destinations at the Natural History Museum, as well as West Village, Veteran's and social services west of Foothill Drive. This shuttle would operate as a 1-way (counterclockwise) loop at 20 and 40-minute frequencies during peak and off-peak periods.

For the purposes of the Pivot-Point modeling analysis, all three employee and community shuttle routes were assumed to be in service at the 2030 scenario horizon. Proposed implementation of shuttle services (as well as mobility hub and shuttle stop locations) may be modified, added, or removed as needed to meet the mobility and development needs of the University of Utah and Research Park Strategic Vision.

Phase 3 (2040)

Adopted Network

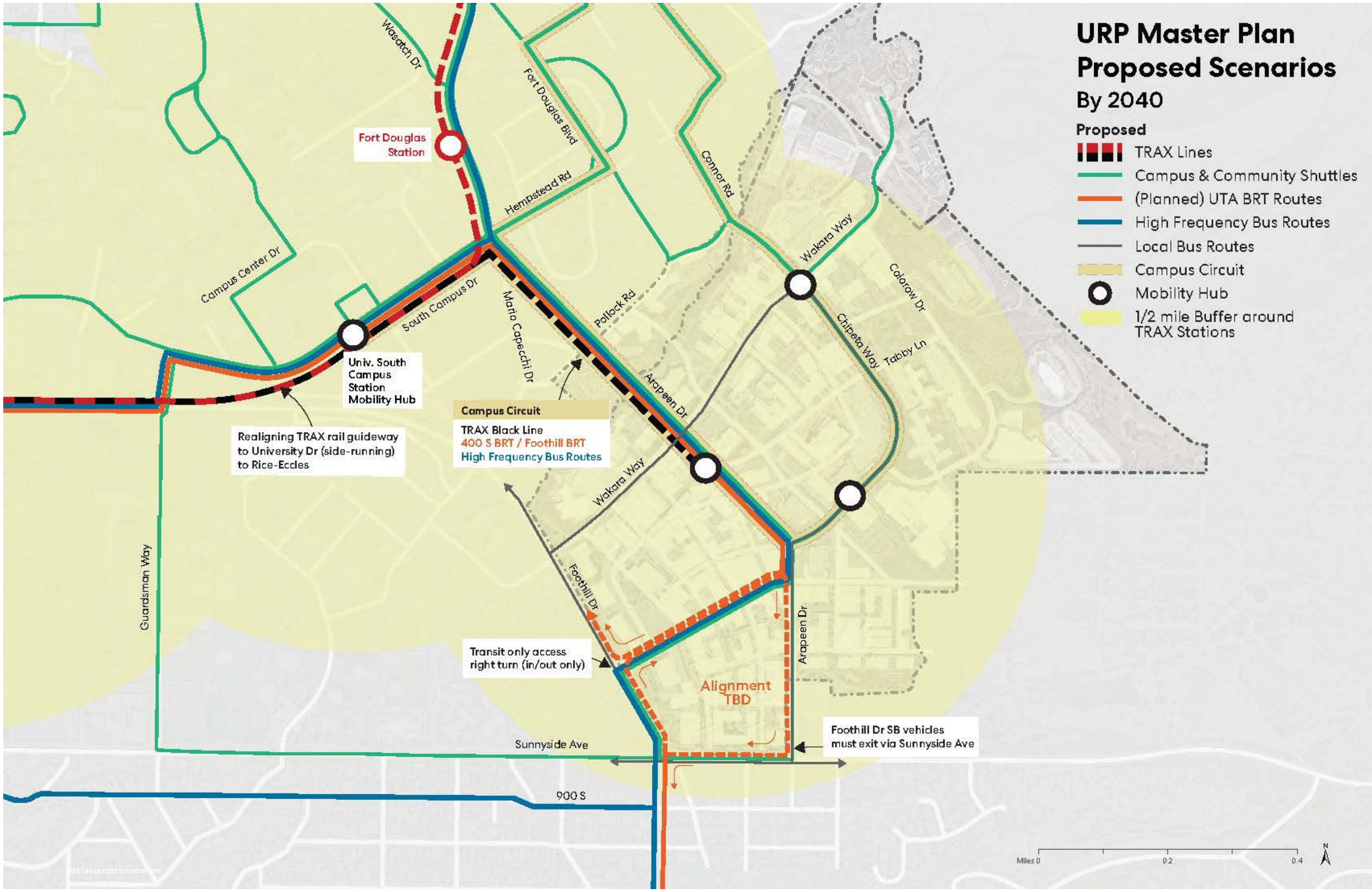
The HCT network adopted in the WFRC 2040 horizon period does not include any significant improvements to service to the University Research Park study beyond the 2030 network (Figure 11).

HCT Vision

Instead of implementing new TRAX LRT service in the 2030 milestone scenario, the Strategic Vision proposes adding new 1-seat ride rail service during the Phase 3 buildout to serve the Research Park directly via the Arapeen Connector. The new guideway extension will terminate at the proposed multimodal hub in front of the new Convergence Hall and Social Spine (along Arapeen Drive, south of Wakara Way). The LRT would operate as a dual-track alignment through the South Campus Station area, but converge into a single-track guideway configuration for the (approximately) half-mile extension due to right of way constraints and the preservation of bi-direction bus operations within the Arapeen Connector as it crosses Red Butte Creek. Rail service would operate from approximately 5 am to 12 am, at 15-minute peak and 30-minute off peak frequencies on weekdays and 30-minute all day frequency on weekends.

In addition to, and in support of, the extension of LRT service into Research Park via the Arapeen Connector, the Vision Plan proposes realignment of the UTA TRAX Red Line to stay along 500 S between 1300 E and Guardsman Way in support of a future Black/Orange Line LRT direct connection into Research Park, via the proposed Arapeen Connector as shown in Figure 16.

Figure 16 Proposed (Phase 3) HCT Network



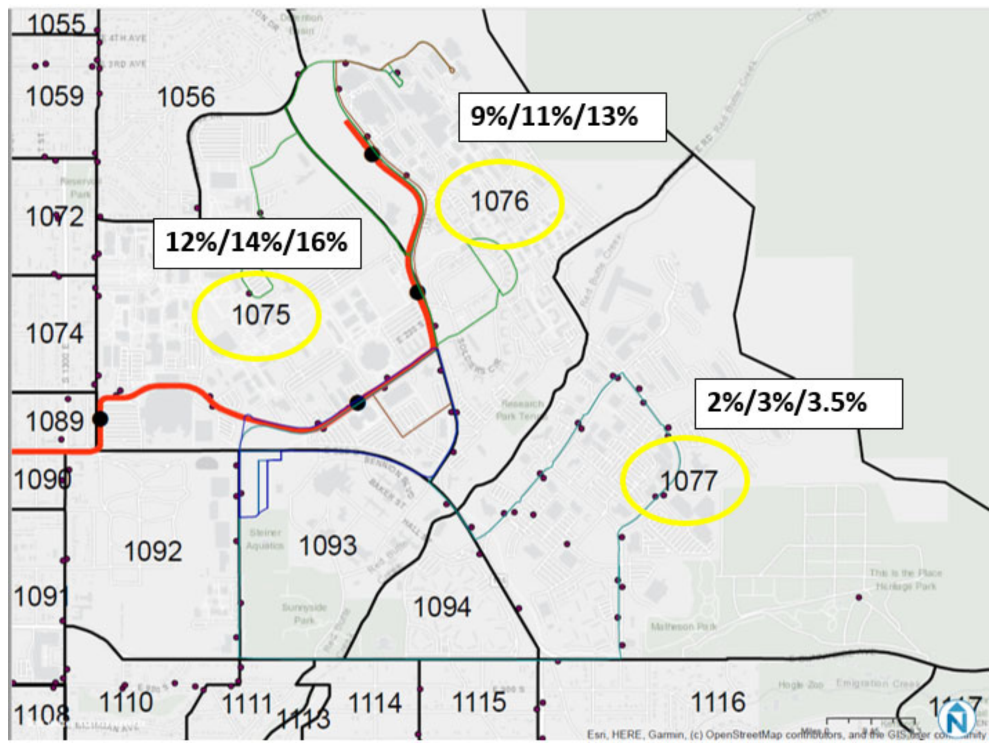
4 TRANSIT MODE SHARE ANALYSIS

WHY PERFORM A MODE SHARE ANALYSIS?

The Vision Plan defines a growing and evolving Research Park in the coming decades. To understand the potential impacts of additional HCT service connectivity to travel patterns to Research Park, this study assesses the planned WFRC future transit network and assumed HCT infrastructure and service investments to project changes to the forecast mode share trends. This analysis provides the Vision Plan with the role that high capacity transit could play within the Research Park, and how it could capture trips from other modes, providing alternative options to all users and alleviating pressure on the road network.

As a reference, the existing transit mode share for the area where Research Park is located is 2%, according to the WFRC Regional Model, which also estimates an increase to 3% and 3.5% for 2030 and 2040 with the transit improvements shown in Figure 17. The same model, though, shows a higher mode shares in areas near University South Campus station, with a current mode share of 12% and a projection of 14% and 16% in 2030 and 2040, respectively. This model accounts for several growth in the region, but only estimates an increment of 2000 trips to/from Research Park in 2040 in relation to 2019.

Figure 17 University & Research Park Transit Mode Share (WFRC 2019/2030/2040 Scenarios)



METHODOLOGY

To account for the differences between the WFRC Regional Model 2030 and 2040 transit scenarios and the ones proposed by the Strategic Vision, we have applied a Pivot-Point model (or Incremental models), which is a frequent approach to estimate transit ridership or mode share based on changes relative to a base-year situation.

This methodology estimates ridership that could be captured by transit from private automobiles by normalizing and comparing all generalized costs of each mode into a single utility function. The generalized cost of travelling is the sum of monetary and non-monetary costs of a journey. Monetary or “out-of-pocket” costs might include the transit fare versus the costs of fuel, parking, and tolls. Conversely, non-monetary costs refer to the time spent in travel, including in-vehicle time, wait time, access time, and transfer time. Time is monetized using a valuation of time, which usually varies according to the traveler's income and the purpose of the trip. See Appendix A for more details on the methodology.

We have compared the transit generalized cost of all trips with origin or destination in the study area between the 2030 transit network in the WFRC *Wasatch Choice* Regional Transportation Plan (RTP) with the proposed 2030 transit network in this plan (Analysis 1), and similarly, the 2040 transit network in the WFRC RTP with the proposed 2040 transit network in this plan (Analysis 2), assuming that the generalized cost of driving won’t change. The analysis was also considerate of the additional cost of the new TRAX into the generalized cost per rider variance between Base and Future scenarios.

SCENARIOS

Phase 2 Analysis

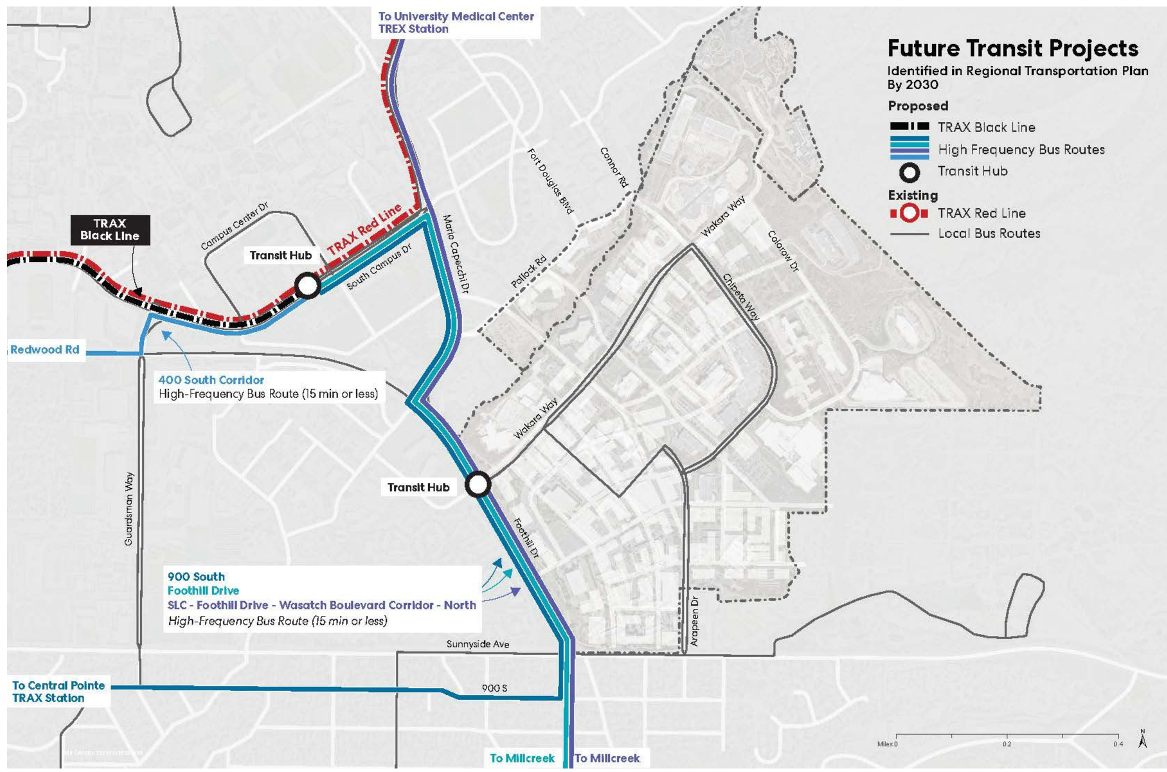
Compares the transit proportion of all trips occurring to Research Park (given the HCT network in the RTP Model Base 2030 horizon year), with the same network plus the Strategic Vision Plan adjustments of direct BRT service integration to Research Park via the Arapeen Connector.

Phase 3 Analysis

Compares transit proportion of all trips occurring to Research Park (given the HCT network in the RTP Model Base 2040 horizon year), with the same network plus the direct BRT service and extension of the new proposed TRAX LRT service to the new Convergence Hall terminus within Research Park.

Transit Generalized cost vary between Base and Future scenarios as a result of the

Figure 18 WFRC Adopted (2030/2040) HCT Network

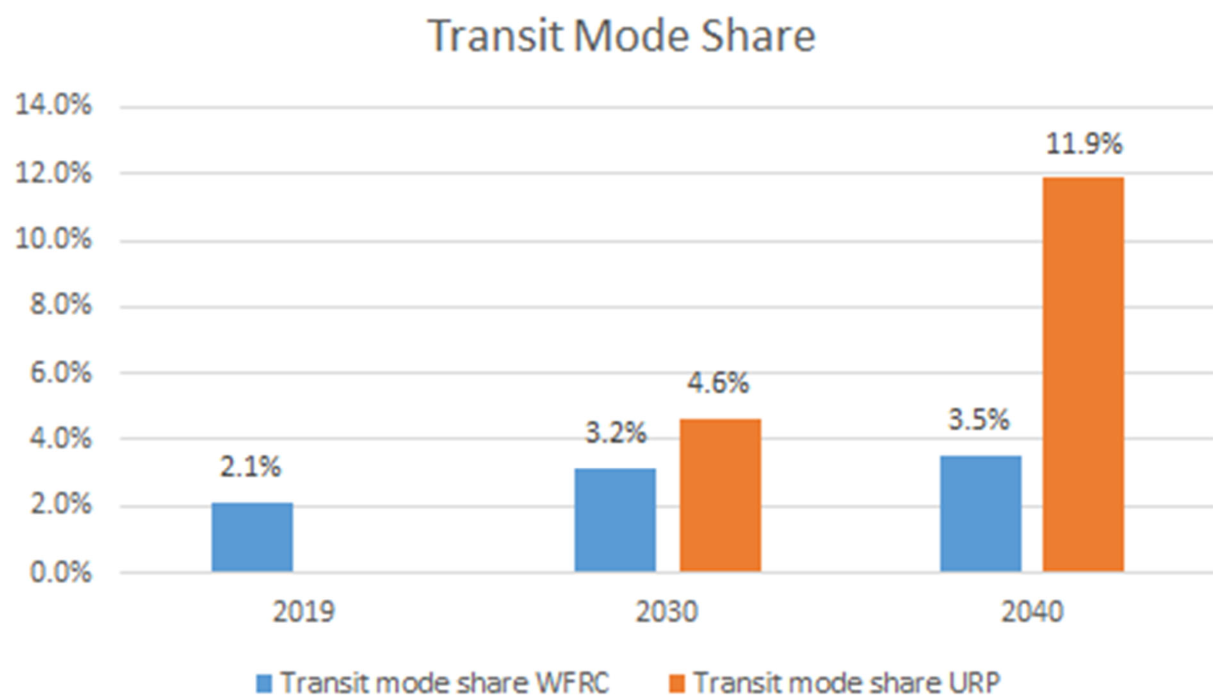


extension of the Black Line. The extension of the black line allows to some travelers to reduce transit travel times between some origin-destinations and this results in the reduction of generalized costs.

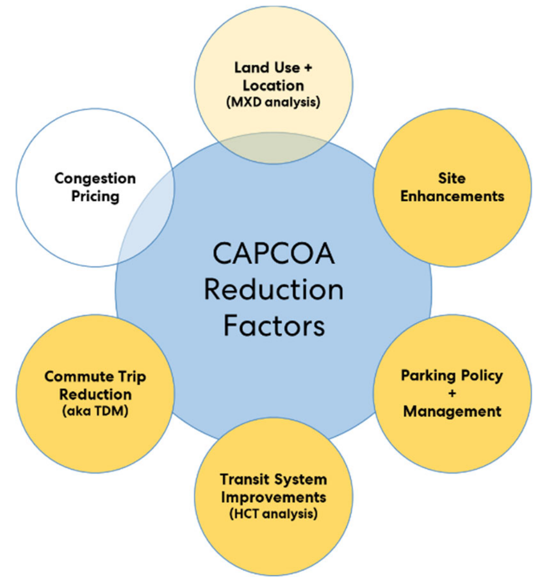
RESULTS

As shown in the Figure 19 below, BRT routes on Arapeen Dr could increase transit mode share to 4.6% in 2030, in relation to the 3.2% estimated in the WFRC Regional Model, where BRT routes were on Foothill Dr, and extending the Black Line to the core of Research Park would increase transit mode share to almost 12%, in relation to the 3.5% estimated on the same model, where the Black Line ended in the proposed Transit Hub.

Figure 19 Projected transit mode share to/from Research Park



5 CAPCOA REDUCTION FACTORS



Traditional traffic and parking models do not always capture the impacts of mixed-used development, multimodal investments, and TDM programs. *Quantifying Greenhouse Gas Mitigation Measures* prepared by the California Air Pollution Control Officers Association (CAPCOA) provides additional guidance to estimate vehicle miles travelled (VMT) reductions from six primary categories of transportation improvements. This Strategic Vision effort also conducted a travel demand analysis (modified-TIA) as a tool **to estimate the potential vehicle trip reduction impacts** at Research Park.

Within its six general categories, CAPCOA also provides a range of impacts for a more specific subset of projects, policies, or program elements/strategies. The expected range of impact is primarily dependent on level of investment/implementation (e.g. amount of transit service expansion or increase in employee parking price) and overall land use context for the project site – "urban, compact infill, suburban center, and suburban." In short, the higher the level of implementation and the more "urban" the land use context, the higher potential impact. Other methodological notes include:

- **Impact estimation:** CAPCOA provides a *range of quantitative methods and factors*. It is important to note that application of CAPCOA, especially with a district master plan, is based on a mix of its quantitative methods and qualitative assumptions. For example, predicting trip and/or parking reduction impacts 20 years from now from a TDM program that is currently in development is ultimately an exercise in best available judgement and reasonable assumptions. CAPCOA is best utilized to provide *an approximate range of impact*.
- **Combining elements or strategies:** Transportation strategies are often implemented together, not in isolation, which complicates measurement of cumulative impact. Strategies are not additive, as "each successive measure is slightly less effective than predicted when implemented on its own." CAPCOA provides guidance on how to combine strategies to avoid "double counting" reduction impacts.
- **Global maximum**: CAPCOA also caps reduction impacts, recognizing that the location of a project site is crucial. For example, even the most robust TDM program in a "suburban" setting will be limited in its ability to reduce vehicle trips simply due to its suburban location.

Finally, it is important to note that while the modified-TIA and the HCT Scenario Analysis are related efforts, they are ultimately distinct analyses. For the TIA, CAPCOA provides a cumulative vehicle trip reduction factor for transit, parking, and TDM improvements in the 10-year and 20-year model scenarios, supplementing the MXD model's ability to estimate reduced vehicle trips due to internal capture. For the HCT Pivot-Point model, additional development and land uses beyond those planned in the WFRC RTP model were not utilized. Nor was CAPCOA utilized as a *direct* input for HCT mode share analysis, but rather to ensure that the SOV trip reductions achieved in the Pivot-Point model due to increased transit utilization are equivalent in scale to what was assumed in the modified-TIA.

The redevelopment of Research Park will result of an increase of trips to/from campus. The Strategic Vision Plan *Travel Demand Analysis Memorandum (03Sept202)* estimates the number of vehicle trips that would be generated as a result of this new redevelopment, which could be reduced by mixing the uses, designing the streets for all modes and users, offering transportation programs, as well as improving transit access to/from the study area.

TRANSIT TRIP REDUCTION FACTORS

The potential of vehicle trip reduction has been estimated in the RTP 2030 and 2040 scenarios, comparing 2019 scenario with the proposed Phase 2 and Phase 3 Research Park transportation and TDM improvements in these future scenarios. This section identifies the CAPCOA factors utilized by the Strategic Vision Plan to estimate the transit portion of the initially estimated vehicle trips that could be reduced by improving transit.

Due to the various potential SOV reduction factors available within the model, the CAPCOA global maximum reduction for a suburban center (the land use context most appropriate for this analysis) is 35% overall. CAPCOA includes six (TST-1 through TST-6) possible reduction factors that consider various transit-based investments, but the Travel Demand Analysis focused on the TST-3 and TST-4 measures, which estimate the vehicle trip reduction as a result of expanding the transit network and increasing transit service frequency/speed, respectively. Descriptions of these measures and the justification by which the reduction factors are applied are as follows and shown in Table 3:

TST-3 Expand Transit Network

This measure assumes SOV trip reduction benefits if a project will expand the local transit network by adding or modifying existing transit service to enhance the service near the project site. This will encourage the use of transit and therefore reduce VMT.

Assumptions of the HCT Vision include:

- No additional transit capture was assumed in Phase 2. BRT lines are not operating on a dedicated fixed-guideway, with the exception of the Arapeen Connector.
- Additional transit capture in Phase 3 as a result of extending LRT Black Line to the core of Research Park

TST-4 Increase Transit Service Frequency/Speed

This measure assumes SOV trip reduction benefits if a project will reduce transit-passenger travel time through more reduced headways and increased speed and reliability. This makes transit service more attractive and may result in a mode shift from auto to transit which reduces VMT.

Assumptions of the HCT Vision include:

- Additional transit capture in Phase 2 as a result of new 10/15-minute frequency BRT service frequency within the proposed Research Park transit network

- Additional transit capture in Phase 3 as a result of 15/30-minute frequency TRAX LRT service directly connecting with Research Park

Refer to CAPCOA guidance found in *Quantifying Greenhouse Gas Mitigation Measures (Aug2010)* for further information.

Table 3 CAPCOA Potential SOV Trip Reductions

Scenario	Additional Transit capture – Network expansion TST-3	Additional Transit capture – Frequency increase TST-4
10y Phase (2030)	N/A	0.3%
20y Phase (2040)	8.2%	0.4%

Refer to the Strategic Vision Plan *Travel Demand Analysis Memorandum (03Sept2020)* for additional information on the results of CAPCOA single-occupancy vehicle trip reduction analyses.

APPENDIX A. PIVOT-POINT MODEL METHODOLOGY

The percentage (or share) of trips choosing a given mode “a” from a choice of “m” modes is equal to the exponentiated utility associated with mode “a” divided by the sum of the exponentiated utility for all “m” modes. The equation is:

$$P_a = \frac{e^{U_a}}{\sum_{i=1}^{m} e^{U_i}}$$

where,

P_a is the probability of a traveler choosing mode a;
U_a is the utility (or attractiveness) of mode a; and
ΣU_i is the sum of the utilities for all m modes.

The utility equation, Ua, is mode-specific and can be represented in the following general form:

$$U_a = c_1 \times Distance_a + c_2 \times Fare_a + c_3 \times InVehicleTime_a + \ldots + C_a$$

where,

U_a is the utility (or attractiveness) of mode a;

$Distance_a$
$Fare_a$
In-Vehicle Time_a
$\ldots_a$ are level of service variables of mode a for this trip

c1,c2,.. are coefficients estimated for each of the terms based on survey results

c_a is the constant for mode a – obtained through calibration

The expression can also be expressed as follows, and Ci would be the generalized costs per mode (or utilities):

$$P_1 = \frac{EXP(-\lambda \cdot (C_1 + \delta))}{EXP(-\lambda \cdot (C_1 + \delta)) + EXP(-\lambda \cdot C_2)}$$

$$P_2 = \frac{EXP(-\lambda \cdot C_2)}{EXP(-\lambda \cdot (C_1 + \delta)) + EXP(-\lambda \cdot C_2)}$$

This would be equivalent to the following expression, which allows to calibrate both lambda and delta by a lineal regression:

$$LN\left(\frac{P_1}{1-P_1}\right) = \lambda \cdot (C_2 - C_1) + \lambda \cdot \delta$$

The model can also be applied to increments with the following expression, which allows to instead of calibrating the model, do a strategic analysis by testing different logic lambda values (elasticity between the cost variation and the variation of the model split between an O pair). That way, the model will only be applied to the cost variations, which will affect incrementally the mode split of the current scenario.

$$LN\left(\frac{P_1}{1-P_1}\right)_{futur} = LN\left(\frac{P_1}{1-P_1}\right)_{actual} + \lambda \cdot (\Delta C_2 - \Delta C_1)$$

Generalized Cost Private vehicle:

GCPV = AM Travel time * VT + Parking fare + Toll + Walking Time to final destination

Generalized Cost Transit:

GCT = (Access Time + Waiting time M1 + In-Vehicle Time M1 + Transfer time M12 + Waiting time M2 + In-Vehicle Time M2 + Transfer time M23 + Waiting time M3 + In-Vehicle Time M3 + Walking Time to final destination) *VT + Parking Fee + Fare M1 + Fare M2 + Fare M3

VT is $15/hr.