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Existing Conditions
Report

Existing Conditions Report

Regional BRT Feasibility Study

Prepared for:

Regional Transportation District
1560 Broadway, Suite 700, FAS-71
Denver, CO 80202

Prepared By:

Felsburg Holt and Ullevig
6300 Syracuse Way, Suite 600
Centennial, CO 80111
(303) 721-1440

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1. Transit Service

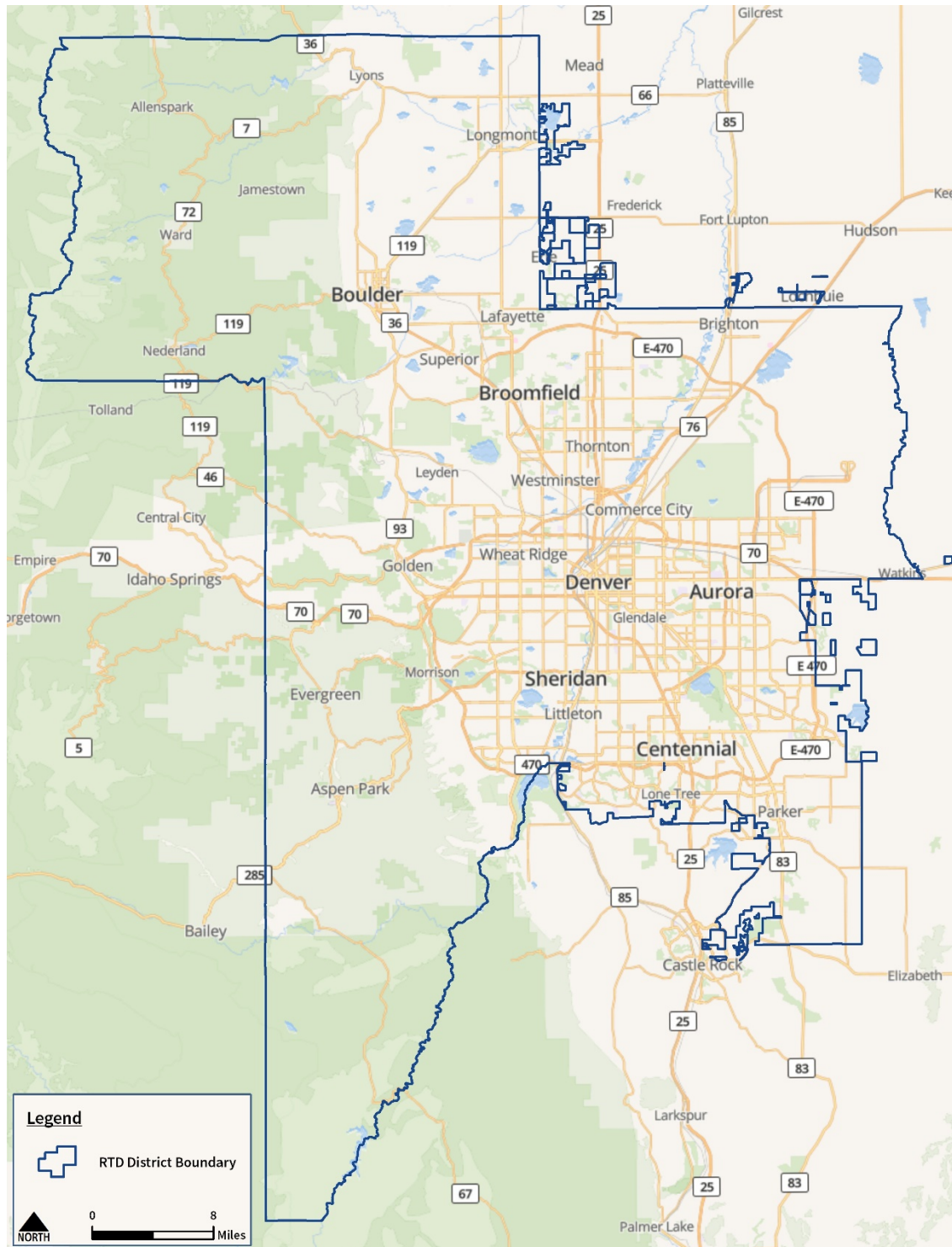
1.1 Network Characteristics

The Regional Transportation District (RTD) operates transit in the Denver metro area, a region spanning 8 counties and 40 municipalities, as shown on **Figure 1**. RTD services include 8 light rail lines, 2 commuter rail lines, and more than 100 local and regional bus routes. RTD also operates Call-n-Ride, Access-a-Ride, SportsRides, and SeniorRide services. Annual boardings across all RTD services were more than 100 million in 2017, with approximately 335,000 boardings on an average weekday.

RTD's network operates as a hub-and-spoke system, with downtown Denver acting as a central hub to which surrounding communities are linked via bus and rail lines. The existing light rail lines primarily run parallel to interstates and other major highways, and bus routes are provided on arterials, collectors, and local streets. Outside downtown, the bus routes are typically spaced every one-half to one mile. **Figure 2** presents the 2017 network map, and **Figure 3** shows average daily boardings by stop.

RTD's bus routes generally run at least every 30 minutes throughout the day, with several routes along major arterials running every 10 or 15 minutes. Most all-day service begins between 4:00 AM and 6:00 AM and operates between 10:00 PM and 12:00 AM. A few routes, including the 0 on South Broadway and the 15 on East Colfax Avenue, operate 24 hours a day. The light rail lines operate on 15- to 30-minute frequencies from approximately 5:00 AM until 12:00 AM. Sections of the light rail system shared by multiple lines are serviced by a train every 5 to 7 minutes during peak operating hours. The Flatiron Flyer regional BRT routes primarily operate every 15 to 30 minutes, with increased frequencies of 10 minutes or less during peak commute hours.

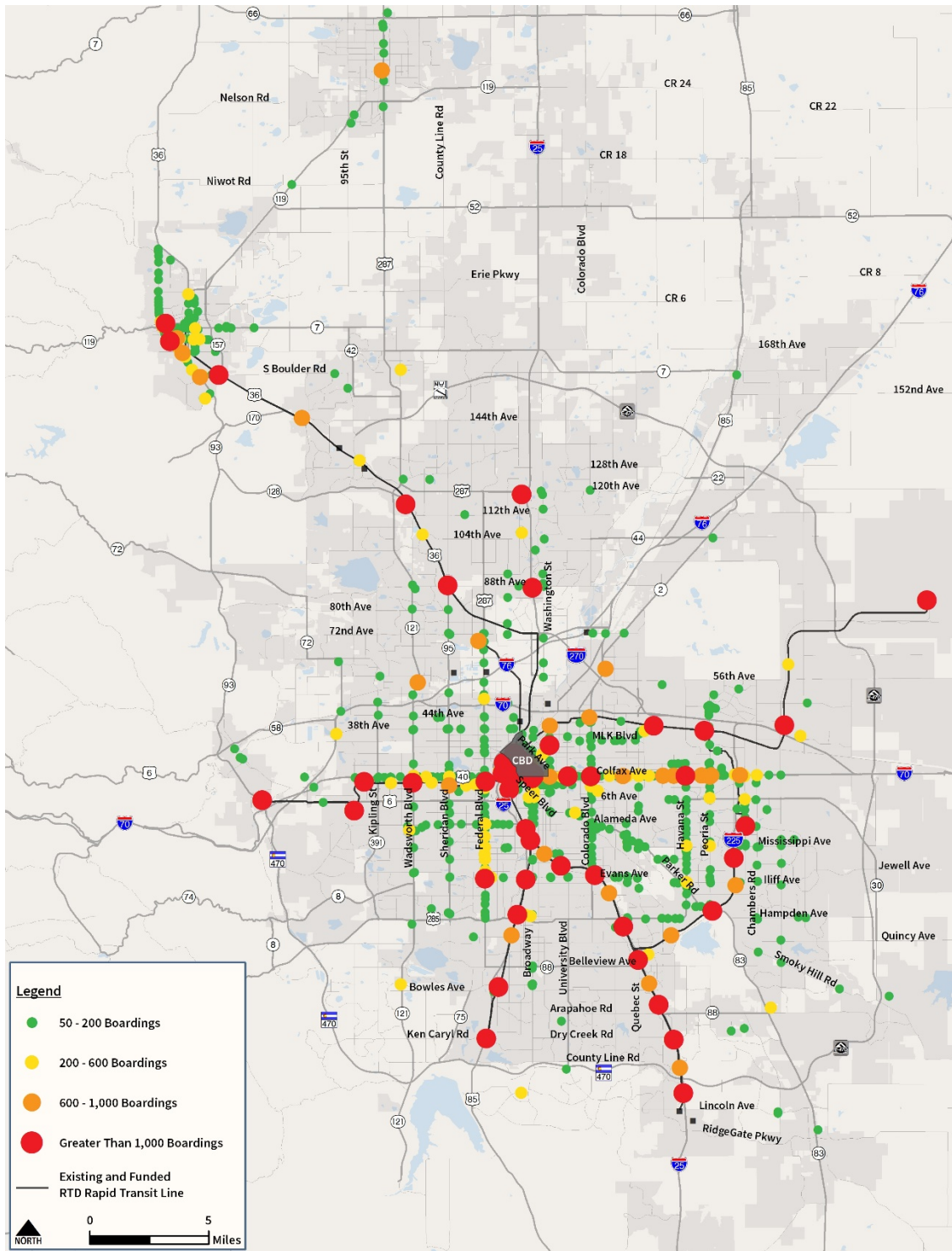
Figure 1 2017 RTD Service Area Map



Source: RTD, 2017



Figure 3 2017 RTD Transit Boardings by Stop



Source: RTD, 2017

1.2 System Performance

Bus travel speed is an important measure of transit performance; studying it helps identify routes and route segments where buses experience congestion and thus where transit priority treatments may be most beneficial. Moonshadow's Route Analyst tool provides a way to visually assess travel speed systemwide.

This section presents analysis results of RTD's latest run board for the period of January 2018 through March 2018. Additionally, a series of maps depicting transit speed for all RTD bus routes are included. Peak hour (7:30 AM to 8:30 AM and 4:30 PM to 5:30 PM) bus data from Tuesdays, Wednesdays, and Thursdays in March 2018 was used to develop these maps.

Table 1 below shows the existing RTD routes which had the lowest average morning peak (7 AM to 9 AM) speed in the first quarter of 2018, as well as the average midday (10:30 AM to 2:30 PM) speed for those routes as a comparison. Several east-west routes connecting to downtown Denver, such as 9, 10, 15, and 43, traveled at speeds below 16 mph during the morning peak and were several miles per hour slower than during the midday period. Route 209 serving the University of Colorado was also relatively slow in both directions during the morning peak.

Table 1 Routes with Lowest Average Speed, Morning Peak

Route (Direction)	Average Speed, Morning Peak	Average Speed, Midday
62: Commerce City/Dicks SG Park (Northbound)	9.4 mph	16.6 mph
10: East 12 th Avenue (Westbound)	13.6 mph	15.1 mph
9: West 10 th Avenue (Eastbound)	13.8 mph	15.1 mph
209: CU/Thunderbird (Eastbound)	14.4 mph	14.9 mph
15: East Colfax Avenue (Westbound)	15.1 mph	16.9 mph
9: West 10 th Avenue (Westbound)	15.7 mph	15.9 mph
30: South Federal Boulevard (Northbound)	15.9 mph	18.1 mph
43: MLK Boulevard/Gateway (Westbound)	16.0 mph	17.8 mph
209: CU/Thunderbird (Westbound)	16.1 mph	18.1 mph
44: 44 th Avenue (Eastbound)	16.3 mph	18.3 mph

Source: RTD Run Board, January to March 2018

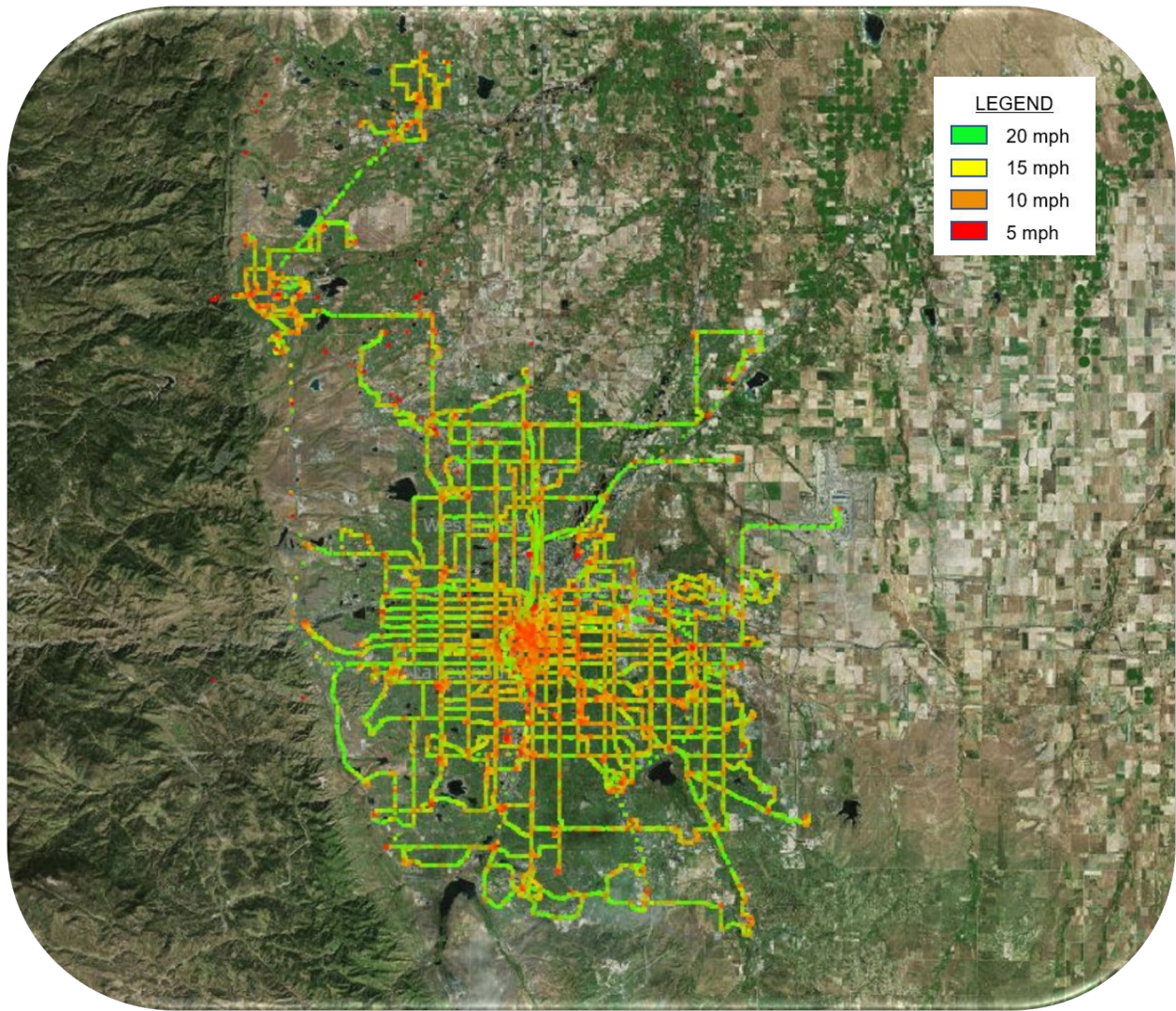
Table 2 below shows the existing RTD routes which had the lowest average evening peak (4:30 PM to 6 PM) speed in the first quarter of 2018, as well as the average midday speed for those routes as a comparison. Similar to the morning peak results in **Table 1**, east-west routes such as 9, 10, 15, and 38 connecting to downtown were among the slowest and generally several miles per hour slower during the evening peak than during midday.

Table 2 Routes with Lowest Average Speed, Evening Peak

Route (Direction)	Average Speed, Evening Peak	Average Speed, Midday
139: Quincy Avenue (Eastbound)	14.1 mph	23.9 mph
80: 80 th Avenue (Westbound)	14.6 mph	19.6 mph
15: East Colfax Avenue (Eastbound)	15.1 mph	19.1 mph
209: CU/Thunderbird (Eastbound)	15.1 mph	14.9 mph
10: East 12 th Avenue (Eastbound)	15.3 mph	16.6 mph
10: East 12 th Avenue (Westbound)	15.3 mph	15.1 mph
15: East Colfax Avenue (Westbound)	15.5 mph	16.9 mph
9: West 10 th Avenue (Westbound)	15.6 mph	15.9 mph
38: 38 th Avenue (Westbound)	15.7 mph	20.0 mph
48: East 48 th Avenue (Westbound)	15.7 mph	18.4 mph

Source: RTD Run Board, January to March 2018

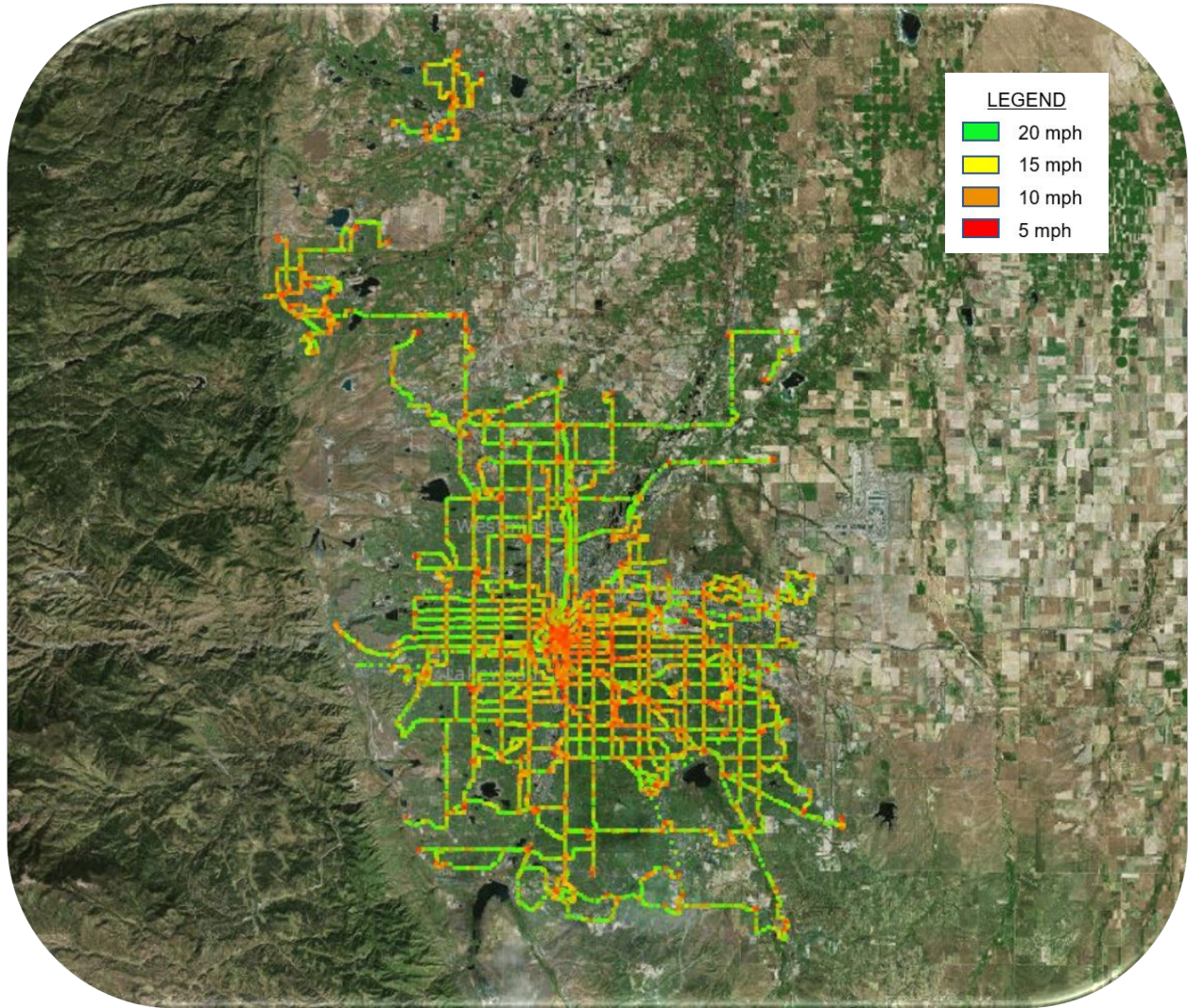
Figure 4 AM Peak Transit Speeds, Northbound and Eastbound



Source: Moonshadow Mobile, March 2018

As identified in **Figure 4**, northbound and eastbound bus routes serving downtown Denver and Boulder, as well as Federal Boulevard and Colorado Boulevard, have segments with average speeds below 10 miles per hour during the AM peak hour.

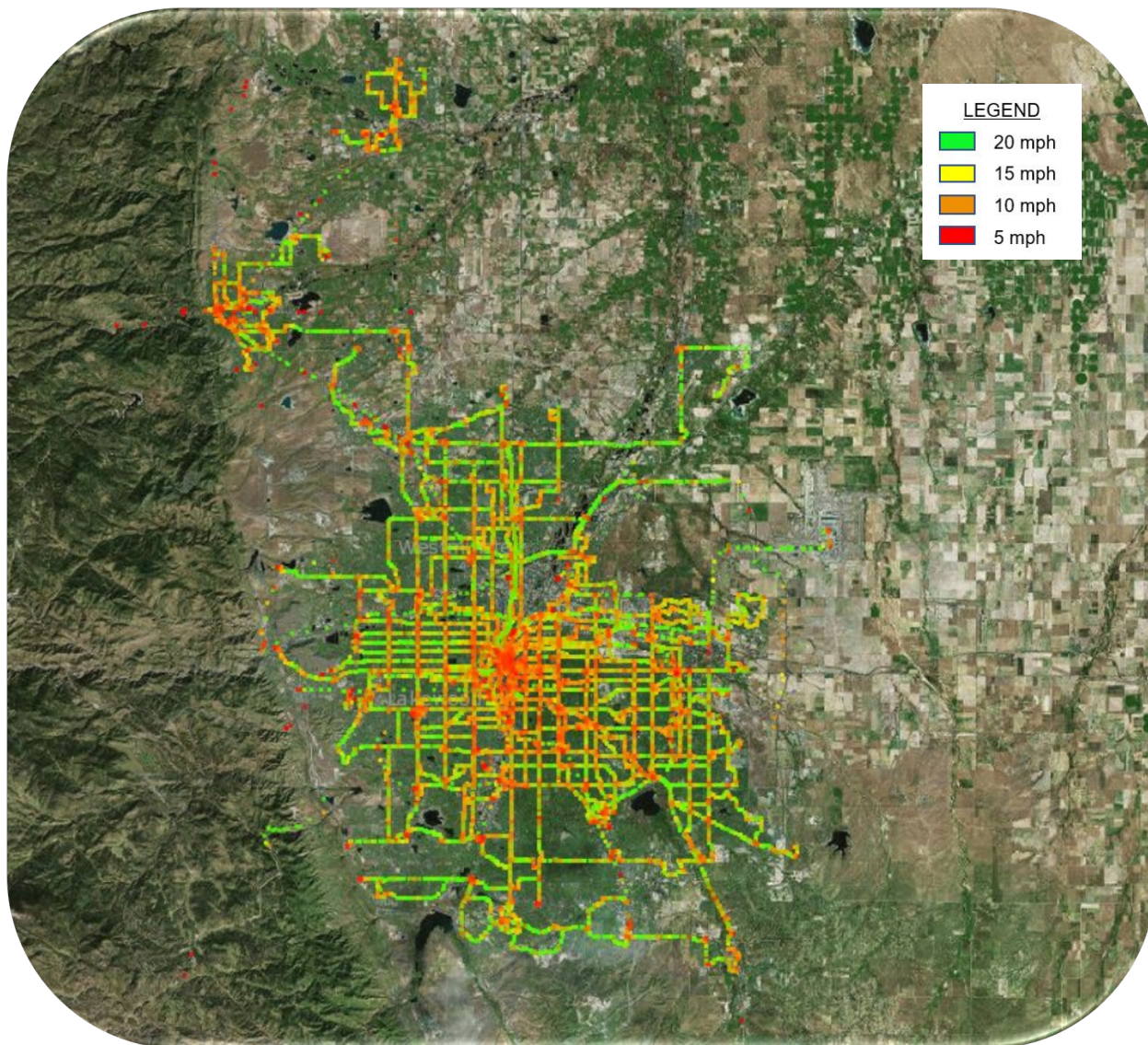
Figure 5 AM Peak Transit Speeds, Southbound and Westbound



Source: Moonshadow Mobile, March 2018

Figure 5 shows that southbound and westbound bus routes serving downtown Denver and Boulder, as well as Martin Luther King Boulevard and Broadway, have segments with average speeds below 10 miles per hour during the AM peak hour.

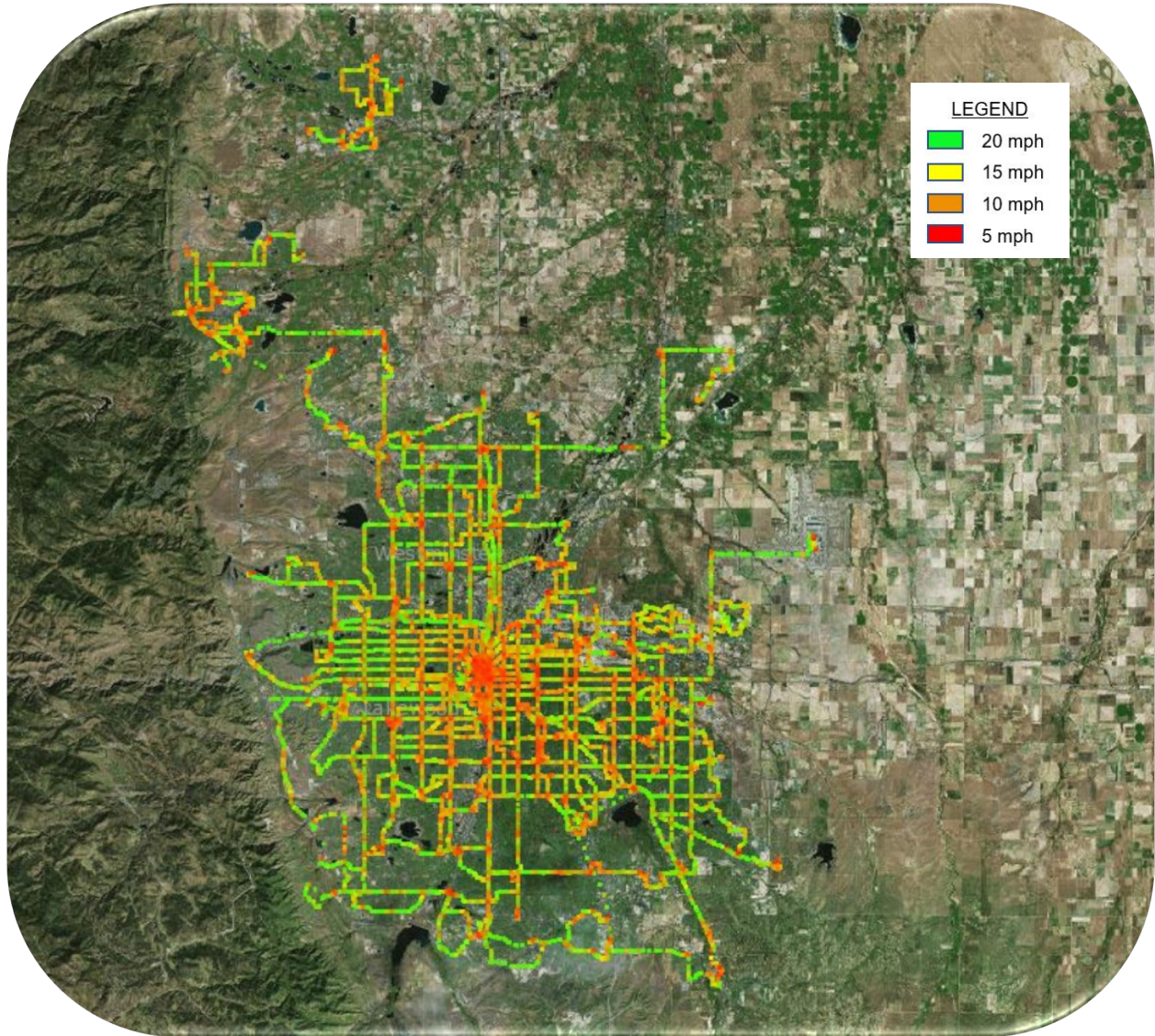
Figure 6 PM Peak Transit Speeds, Northbound and Eastbound



Source: Moonshadow Mobile, March 2018

As shown on **Figure 6**, northbound and eastbound bus routes serving downtown Denver and Boulder, as well as Wadsworth Boulevard and Peoria Street, have segments with average speeds below 10 miles per hour during the PM peak hour.

Figure 7 PM Peak Transit Speeds, Southbound and Westbound



Source: Moonshadow Mobile, March 2018

Figure 7 shows that southbound and westbound bus routes serving downtown Denver and Boulder, as well as University Boulevard and Sable Boulevard, have segments with average speeds below 10 miles per hour during the PM peak hour.

1.3 RTD Network Analysis and Transit Priority Analysis

RTD conducted the *Network Analysis of Potential Improvements to Bus Speed, Delay, and Access* in 2016 to identify a network of recommended priority corridors for near-term transit investments that will enhance the overall transit experience through:

- Faster travel times
- Reduced delay
- Better access to service
- Increased reliability
- An improved wait environment for patrons

RTD's 2015 system performance data was compiled and analyzed for the study. A prioritization and screening process, split into two primary stages, was developed and followed to winnow the entire RTD route network down to the high-priority corridors most in need of enhanced investment. Downtown Denver was excluded from the analysis because the regional corridors were the study's focus. New services added since RTD's *Network Analysis* include the Flatiron Flyer regional bus, A Line (commuter rail), and the R Line (light rail). Some corridors, such as Speer/Leetsdale and East Colfax, were not included in this study because they were already part of separate analysis efforts.

The first screening phase evaluated passenger loads and transit operating speeds for every RTD route. Routes were broken into block segments, and blocks in the top 15 percent were passed through the initial screening and joined to create complete corridors with connections to key transit hubs. Thirty corridors progressed to the second screening phase.

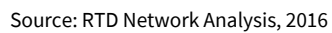
The second screening phase focused on system performance, network connectivity, impact on regional coordination, and feasibility. Specifically, this phase included an assessment of:

- Boardings per corridor mile
- Peak passenger time savings per corridor mile
- Passengers per in-service hour
- Number of connections to regional infrastructure (e.g., rail, BRT)
- Identification of priority corridors in other plans and studies

Corridors received scores for each measure. Cumulative scores were calculated for each remaining corridor. The following corridors received the highest scores and were recommended for near term priority investment (as shown on **Figure 12**):

- | | |
|-----------------------------|--------------------------------|
| ▪ Broadway/Lincoln | ▪ Evans Avenue/Iliff Avenue |
| ▪ Peoria Street | ▪ Havana Street/Hampden Avenue |
| ▪ West Colfax Avenue | ▪ Federal Boulevard |
| ▪ Broadway Street (Boulder) | ▪ Martin Luther King Boulevard |

Figure 8 High Priority Corridors and Bottleneck Intersections



Following the second phase analysis, a bottleneck analysis was conducted to identify particularly problematic corridor segments and intersections that would most benefit from capital improvements. The selected thresholds for defining a segment or an intersection as a bottleneck were passenger loads greater than 1,500 per day and operating speeds less than 10.5 miles per hour.

Using these criteria identified the following 10 bottleneck areas:

- 12th Avenue, Lincoln to York
- Alameda Avenue, Federal to Platte River
- Intersection of Allison Parkway and Virginia Avenue
- Broadway (Denver), Alameda to Mississippi
- Broadway (Denver), Colfax to Larimer
- Colfax Avenue, Broadway to York
- Downing Street, Bruce Randolph to 22nd
- Floyd Avenue, Englewood Station to Broadway
- Evans Avenue, Colorado to Dahlia
- Broadway Street (Boulder), Alpine to 16th

The high-priority corridors identified in the *Network Analysis* are included as Candidate Corridors for the *RTD Regional BRT Feasibility Study* and will be evaluated with all other corridors.

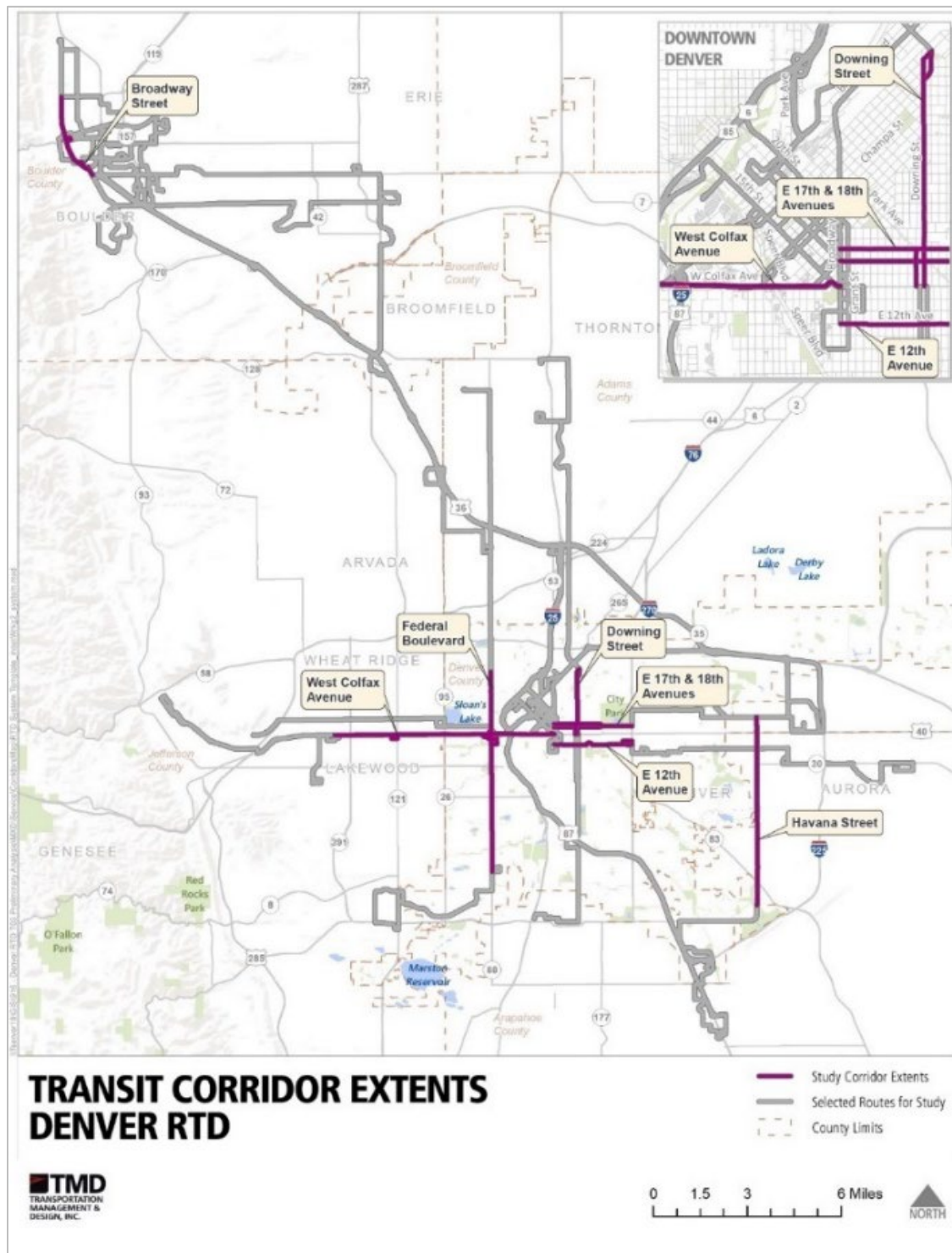
In 2018, RTD completed a *Transit Priority Analysis* study to identify specific improvement recommendations for seven of the high priority corridors identified in the *Network Analysis* study. The goal of the project was to develop recommendations for each of the corridors that will:

- Reduce transit passenger travel time
- Reduce transit travel time variability
- Improve bus stop siting, security, and amenities
- Integrate transit stops into the adjacent urban form

The following seven corridors were analyzed and are shown on **Figure 13**:

- Havana Street, Dartmouth Avenue to Montview Boulevard (Aurora)
- Broadway Street, Baseline Road to Iris Avenue (Boulder)
- Federal Boulevard, W Evans Avenue to W 38th Avenue (Denver)
- W Colfax Avenue, Oak Street to N Broadway (Denver/Lakewood)
- Downing Street, E Colfax Avenue to E 38th Avenue (Denver)
- E 17th and 18th Avenues, N Broadway to Colorado Boulevard (Denver)
- E 12th Avenue, N Broadway to Colorado Boulevard (Denver)

Figure 9 Transit Priority Analysis Study Corridors



Source: RTD Transit Priority Analysis, 2018

Through a multi-tiered screening process and extensive analysis of existing conditions metrics, including ridership, travel time, right-of-way allocation, and signal timing, RTD established these as having the greatest potential to benefit from transit priority treatments.

Recommended improvements from the study include bus stop consolidations and relocations, transit signal priority, bus bypass lanes and queue jumps, and stop improvements such as bus bulb-outs and added amenities. Specific quantities and locations of these treatments for each corridor were proposed; travel time saving benefits associated with each improvement were estimated using guidance from Transit Cooperative Research Program (TCRP) *Report 118: Bus Rapid Transit Practitioners Guide* and previous fieldwork. Conceptual-level cost estimates for the recommendations were also calculated.

1.4 RTD Service Standards

RTD maintains a set of standards to ensure consistency in the evaluation of services; these standards are intended to optimize use of RTD's resources. The standards and criteria are reviewed biannually and revised as needed in response to changes in resources or goals, and specific productivity standard values are updated every year with the latest available data. Separate standards are defined for each class of service and they are applied to both existing and proposed new services. RTD uses the following service classes:

- CBD Local – Local routes serving downtown Denver
- Urban Local – Local routes with 35 percent or more of length within a ¼ mile buffer of areas with population + employment density of 12 or more per acre
- Suburban Local – All other local routes
- Regional – High-speed routes on limited access highways with distances of 6 or more miles
- Call-n-Ride – Demand-responsive service at a specific place and time arranged in advance by passengers
- Rail – High-capacity light rail service typically operating within exclusive right-of-way parallel to freeway and highway corridors
- Mall – Free, high-frequency route through the 16th Street Mall between Union Station and Civic Center Station
- Access-a-Ride – Americans with Disabilities Act (ADA) complementary paratransit service for disabled passengers
- Vanpool – Contracted service allowing geographically clustered commuters to ride together to and from work in a van driven by one of the commuters

For existing services, the purpose of the standards is to identify those most in need of service changes, frequency changes, and/or additional marketing. Route elimination is a last resort if other cost-effective solutions for improvement are not available. Additionally, they are not meant to prevent the implementation of improvements to routes that do not meet the specified minimums. Proposed new services are evaluated with the same criteria but are not expected to meet productivity standards for at least six months after operation commences.

Service standards include ridership and economic measures. The primary values used to assess effectiveness and productivity are passenger per hour or trip and subsidy per passenger. Each year, those routes that fall in the bottom 10 percent of one of these measures for their respective service class or the bottom 25 percent of both are evaluated for change. Routes also must meet the minimum frequency standards as defined in **Table 3**. Additional standards are provided for demand-responsive service, reliability, geometric design, shelter placement, accessibility, shuttles, and service of transit-dependent populations. For this study, 2040 ridership projections will be based on a standard level of BRT service on all corridors, as described in **Table 3**.

Table 3 RTD Minimum Service Frequency

Service Type	Span of Service	Minimum Frequency
Local – Peak period	Mon – Fri 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM	30 minutes
Local – Off peak below 25% boardings per hour	Weekday midday (9:00 AM to 3:00 PM)	60 minutes
Local – Off peak above 25% boardings per hour	Weekday midday	30 minutes
Local	Evenings and weekends	60 minutes
Regional to CBD	3 peak trips, Mon – Fri. Trips should target 7:00, 7:30, 8:00 AM shift work start times and 4:00, 4:30, 5:00 PM shift end times.	
Rail & Enhanced Bus (BRT)	Weekday 6:00 AM to 6:00 PM	15 minutes
Rail & Enhanced Bus (BRT)	Weekday evenings 6:00 PM to 11:00 PM and Saturday	30 minutes
Rail & Enhanced Bus (BRT)	Night after 11:00 PM	60 minutes
Rail & Enhanced Bus (BRT)	Sunday and holidays	60 minutes
SkyRide	3:00 AM to 1:00 AM daily	60 minutes

Source: RTD Transit Service Policies and Standards, 2016

1.5 Future System Ridership

Average weekday transit boardings demonstrate the existing ridership and forecasted 2040 ridership on the RTD system. **Table 2** summarizes the boardings by mode, with an expected growth in bus boardings of 45 percent and rail boardings of 144 percent between 2015 and 2040. The 2040 ridership forecasts are based on travel demand modeling completed by using RTD’s Compass travel demand model.

Table 4 RTD System Ridership

	Average Weekday Bus Boardings	Average Weekday Rail Boardings	Average Weekday Total Boardings
2015 Counts	249,000	82,000	331,000
2040 Forecasts	360,000	200,000	560,000

Source: RTD Count Data and 2040 Travel Demand Model Ridership Forecast

1.6 Park-n-Ride Activity

RTD maintains a database of the geographic distribution of vehicles utilizing each of its Park-n-Ride facilities. This point-of-origin information is useful for identifying the typical catchment area for each Park-n-Ride, an indication of how far people are willing to drive to reach them. Figures 10 through 26 present the household origins of the vehicles recorded at RTD's most heavily used Park-n-Ride facilities. The concentric blue rings represent buffers of ½ mile to 5 miles from each Park-n-Ride. The tables below each map show the total number of households per buffer and a grand total of households. As these table show, most vehicles travel less than five miles to access one; only the I-25 & Broadway Park-n-Ride has greater than 50% of its users coming from over five miles away. Data from a license plate survey conducted at RTD's Park-n-Rides, aggregated into census block groups, was used to develop these maps.

Figure 10 40th & Airport PnR Household Origins

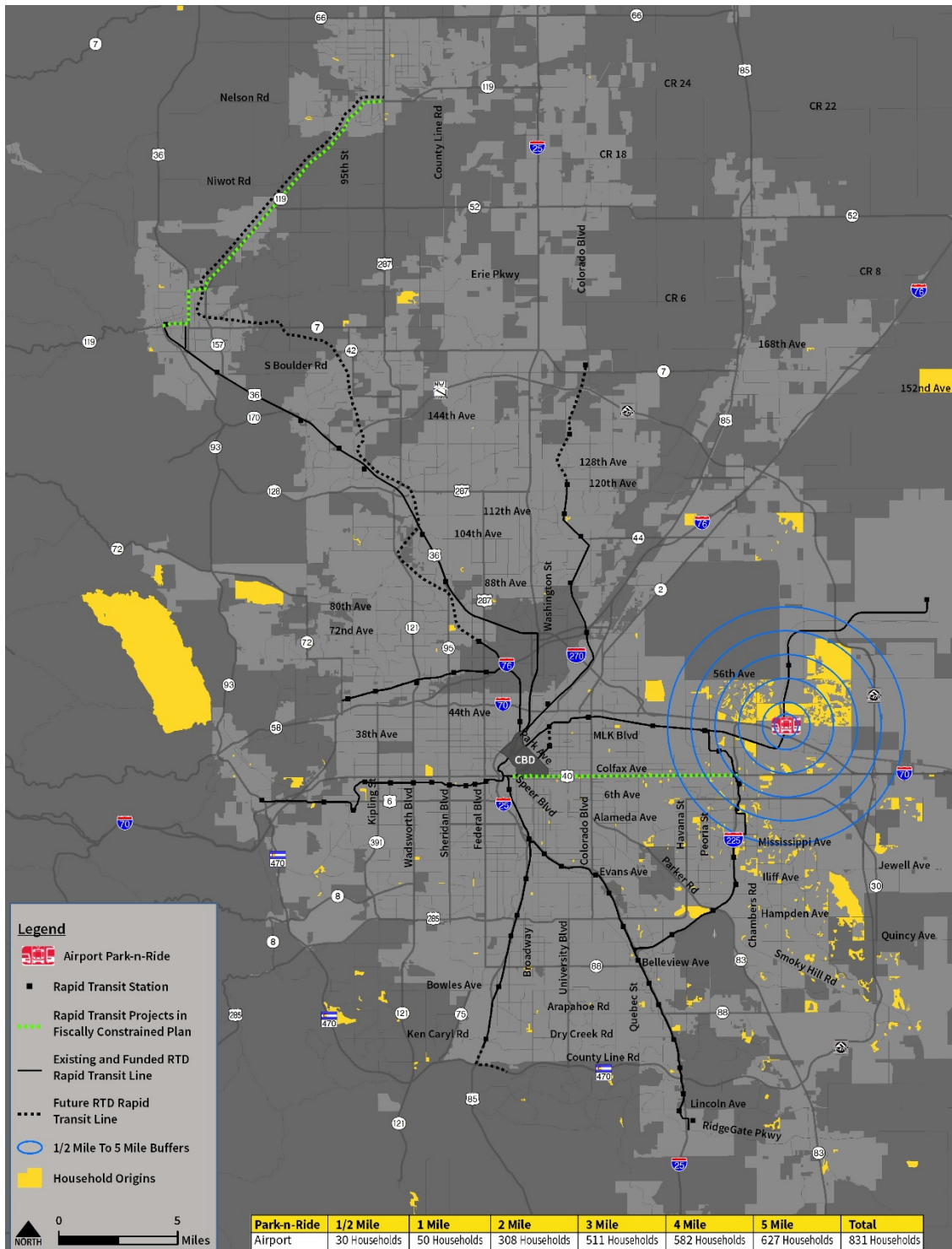


Figure 11 Arapahoe PnR Household Origins

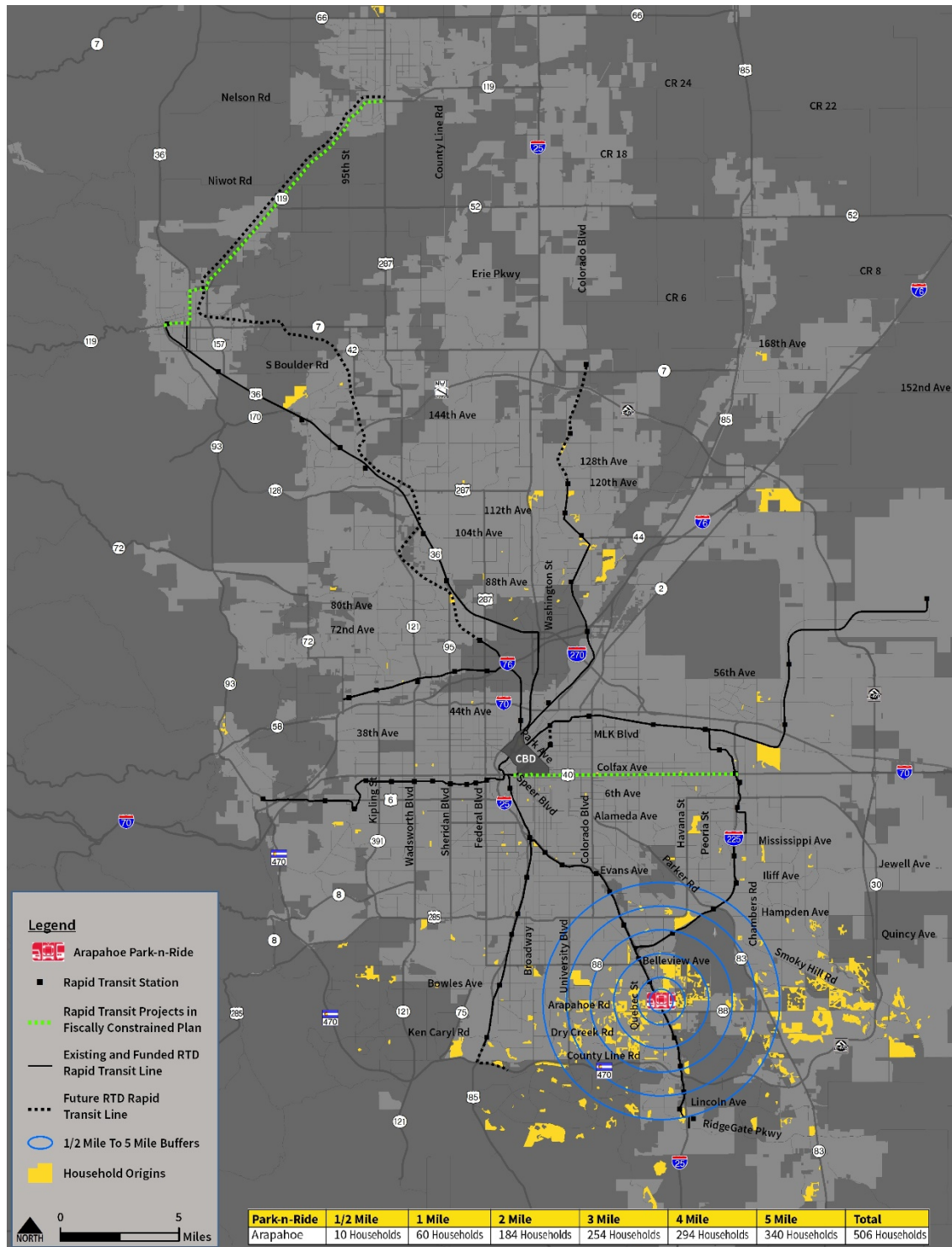


Figure 12 Central Park PnR Household Origins

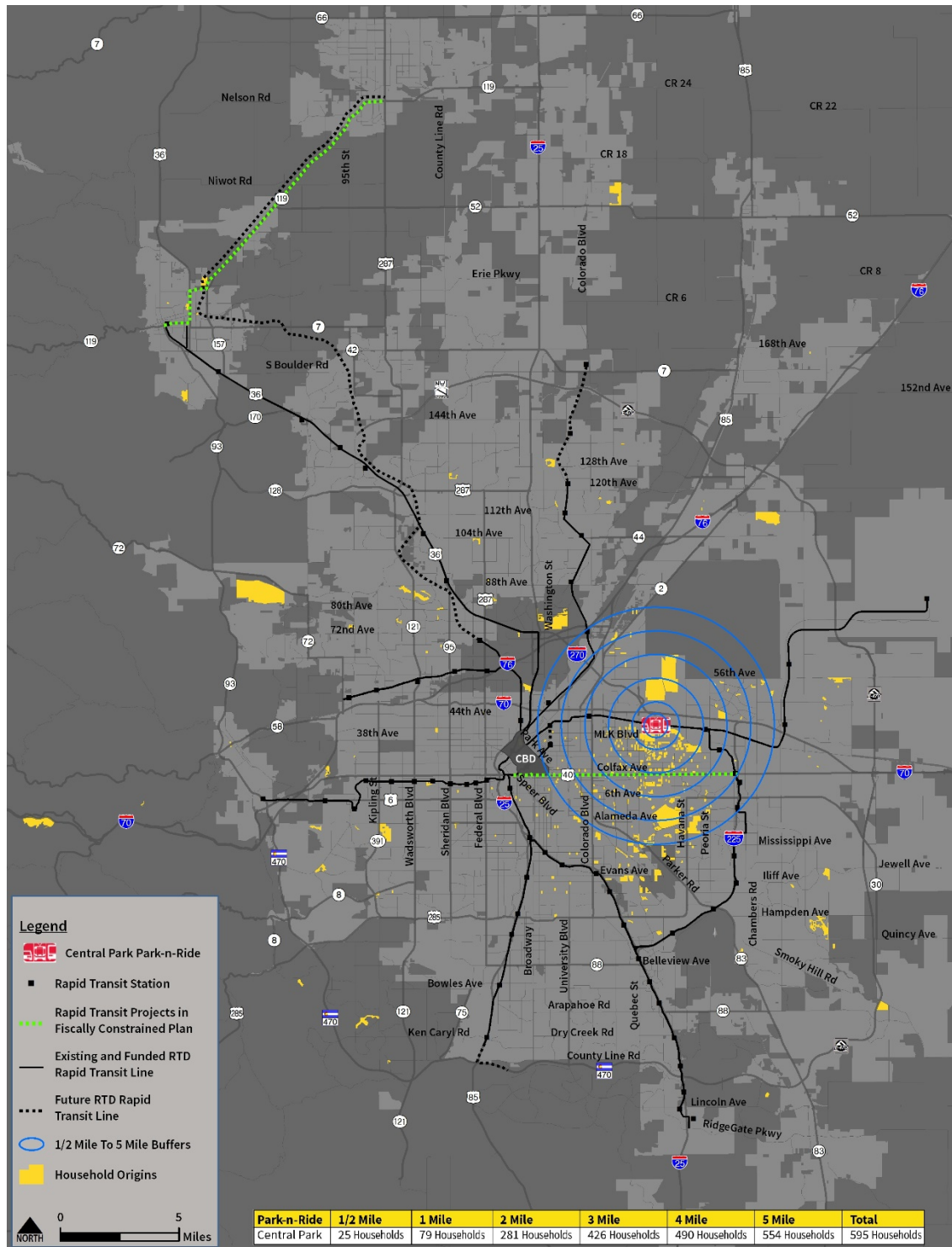


Figure 13 Englewood PnR Household Origins

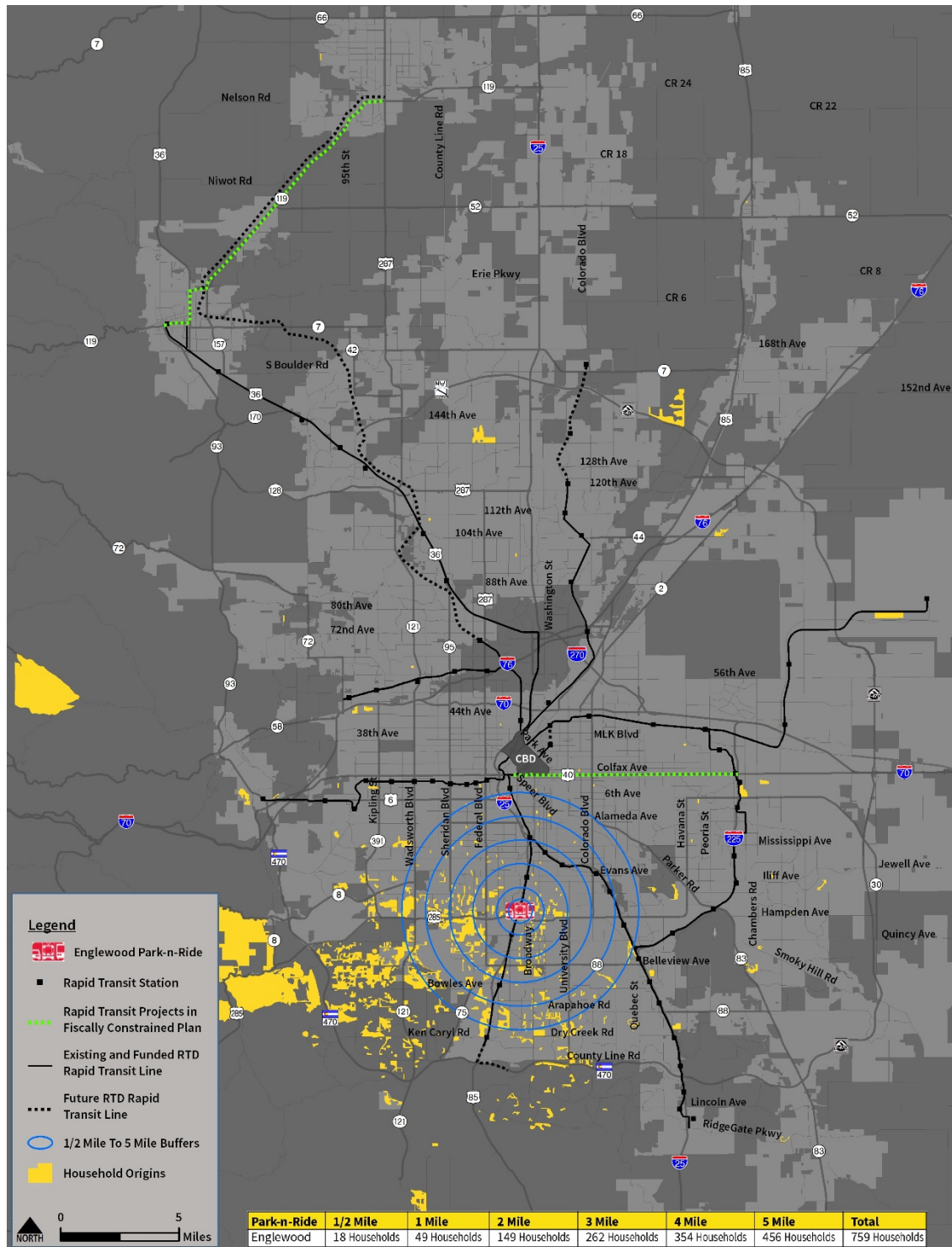


Figure 14 Federal Center PnR Household Origins

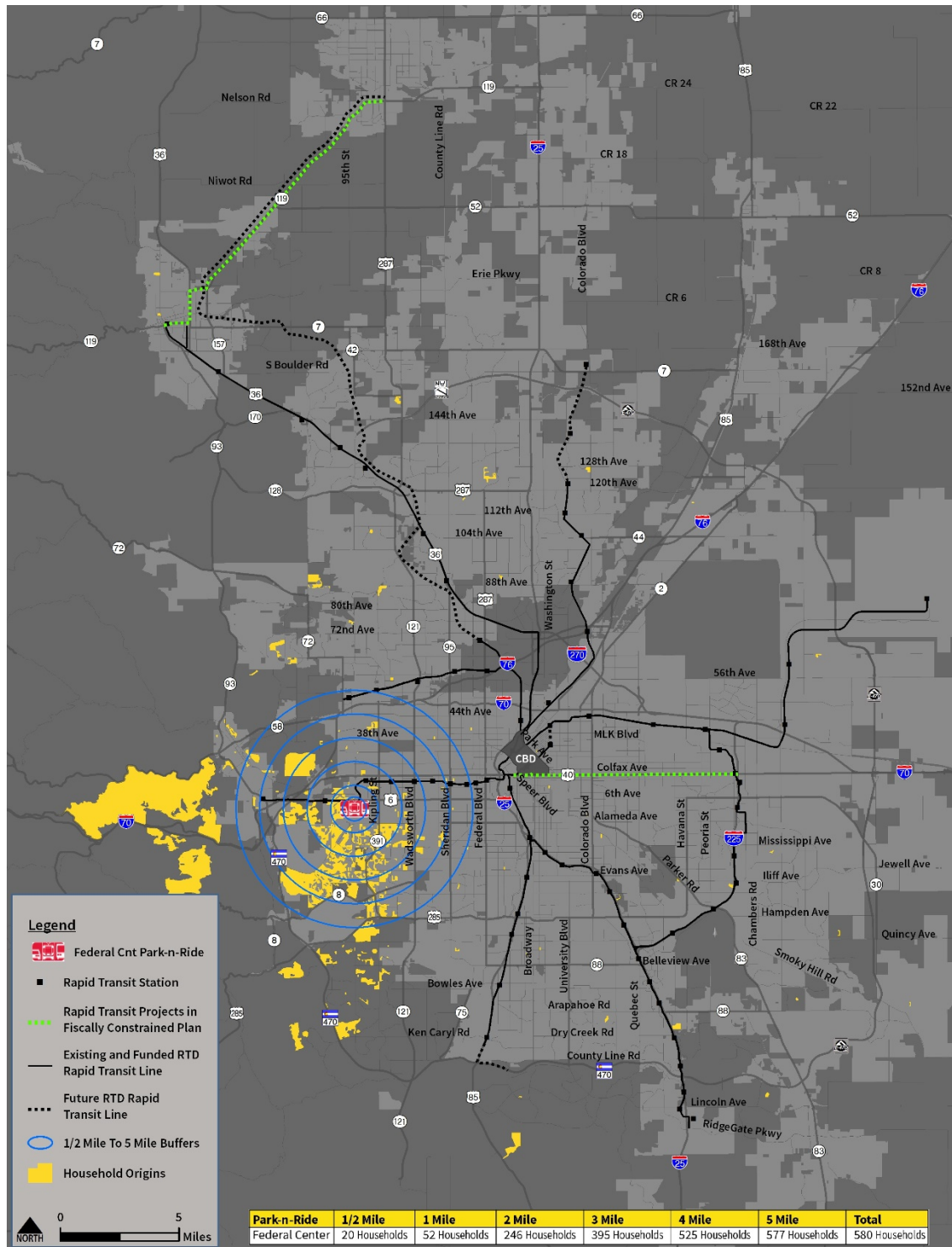


Figure 15 I-25 & Broadway PnR Household Origins

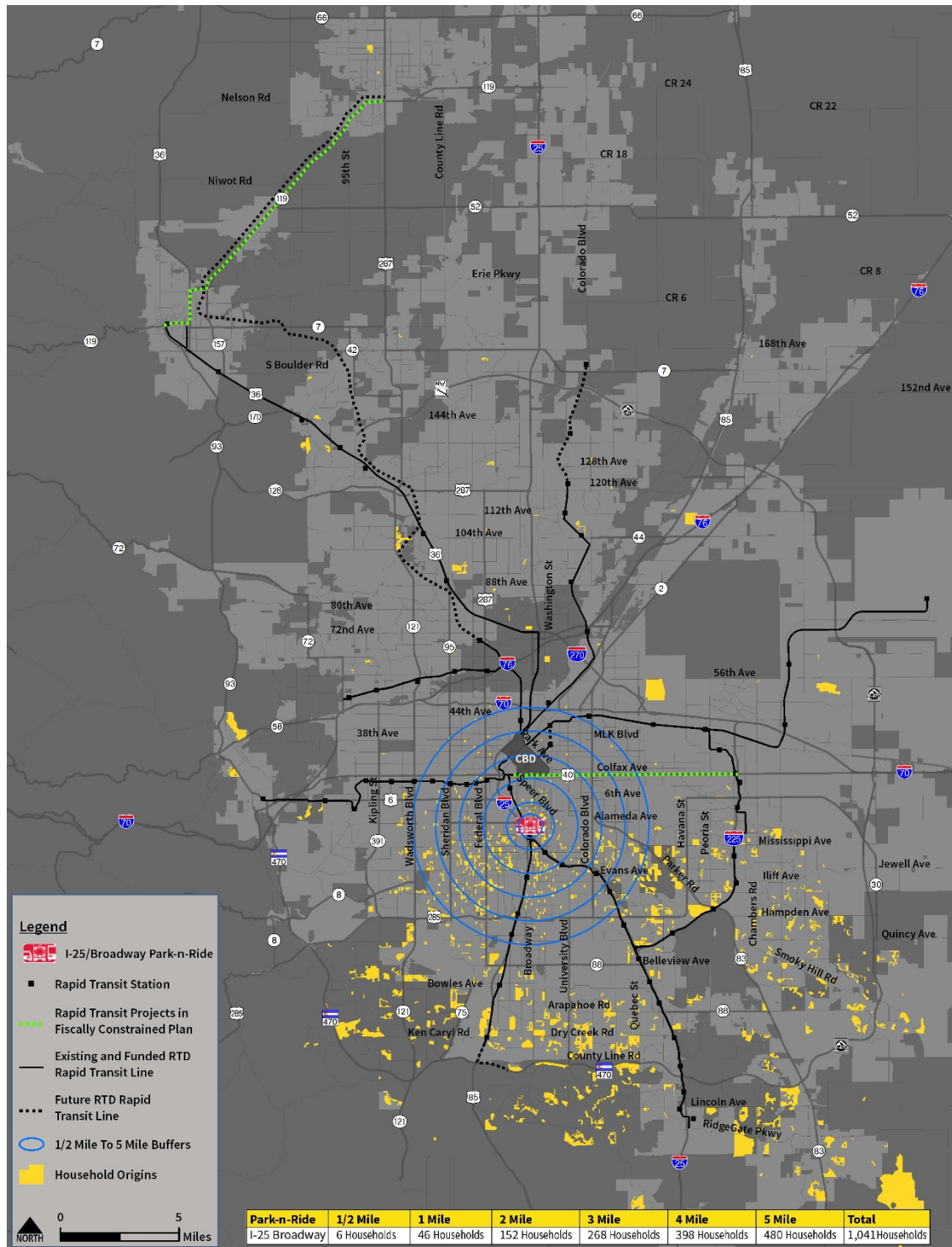


Figure 16 Lincoln PnR Household Origins

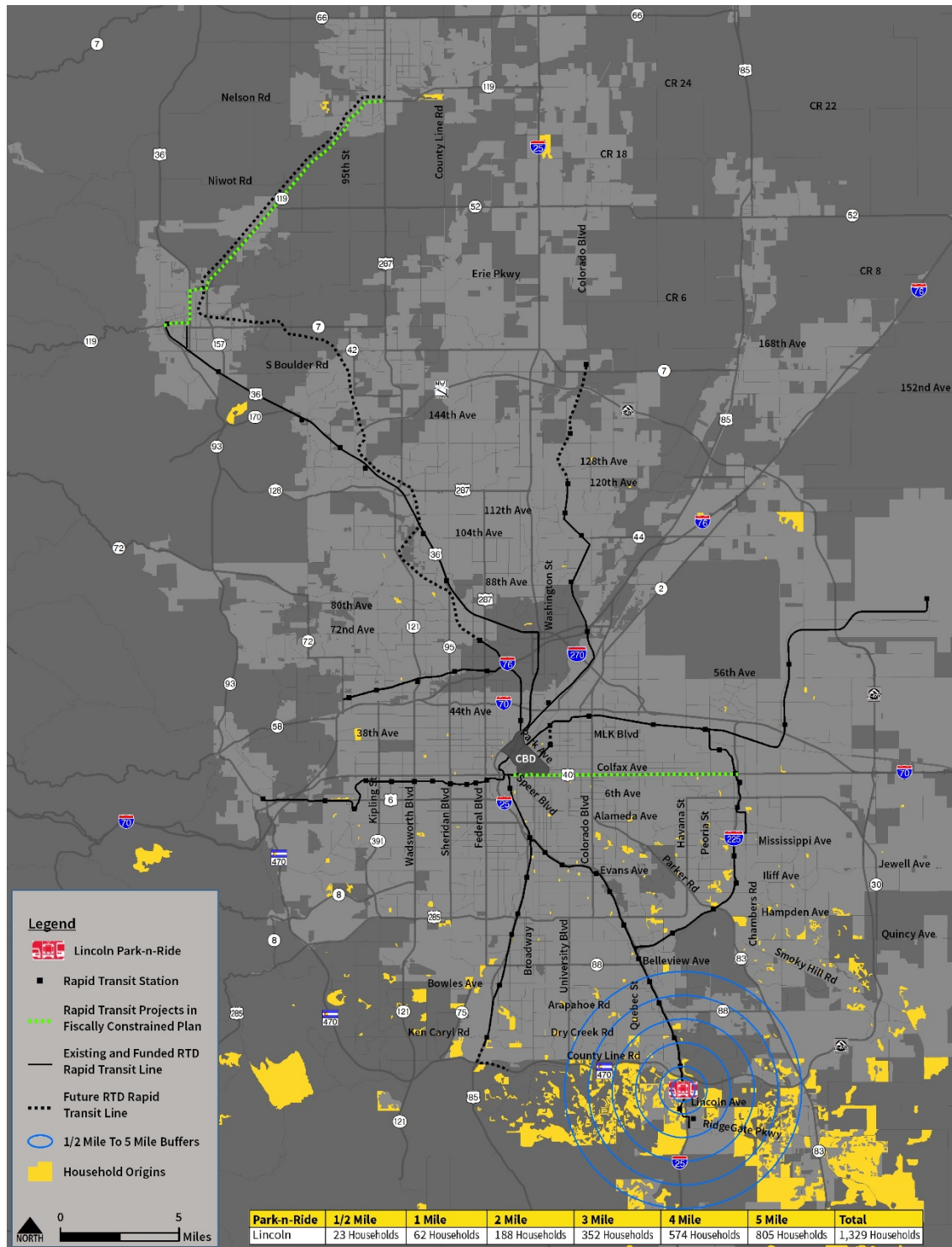


Figure 17 Littleton - Mineral PnR Household Origins

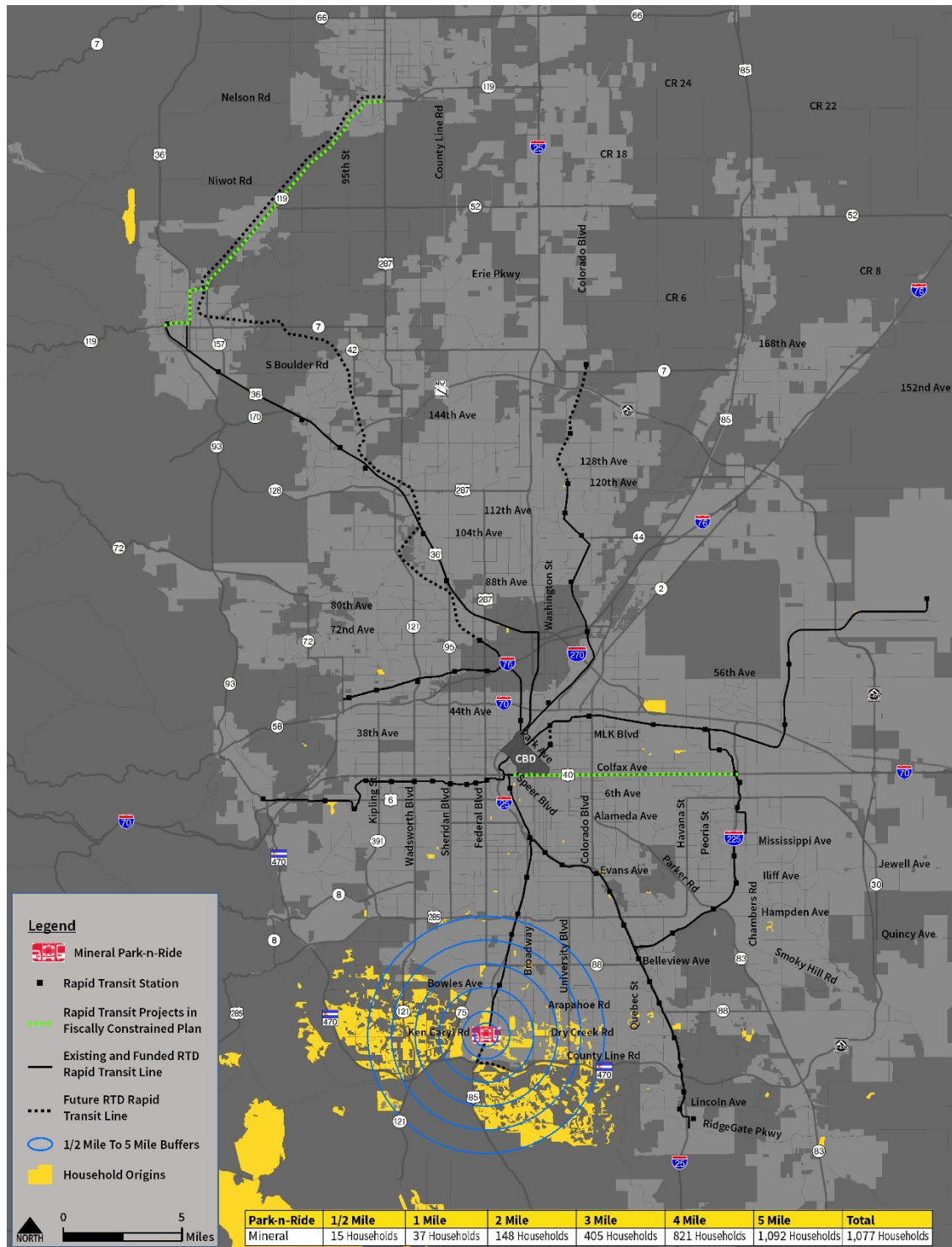


Figure 18 Nine Mile PnR Household Origins

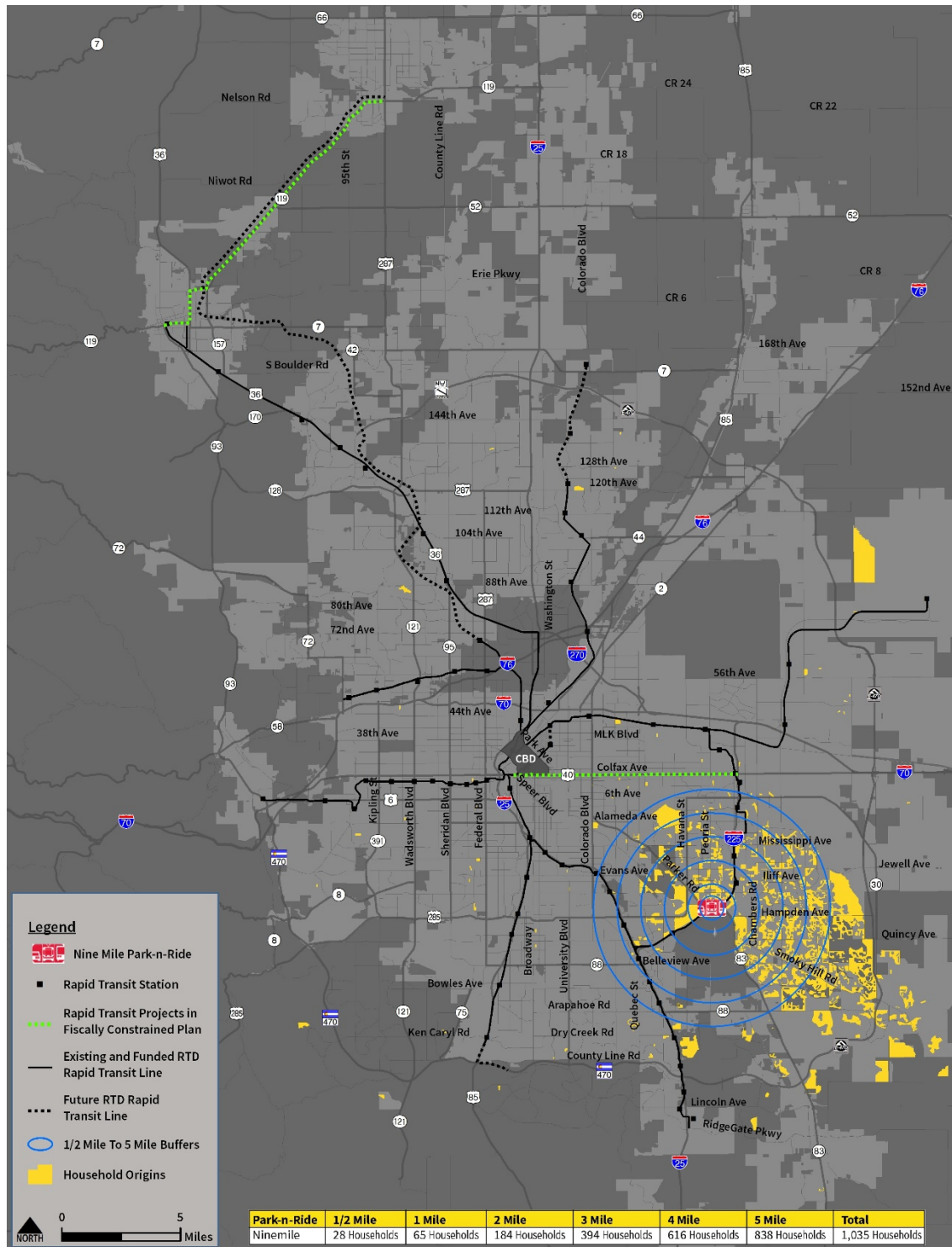


Figure 19 Southmoor PnR Household Origins

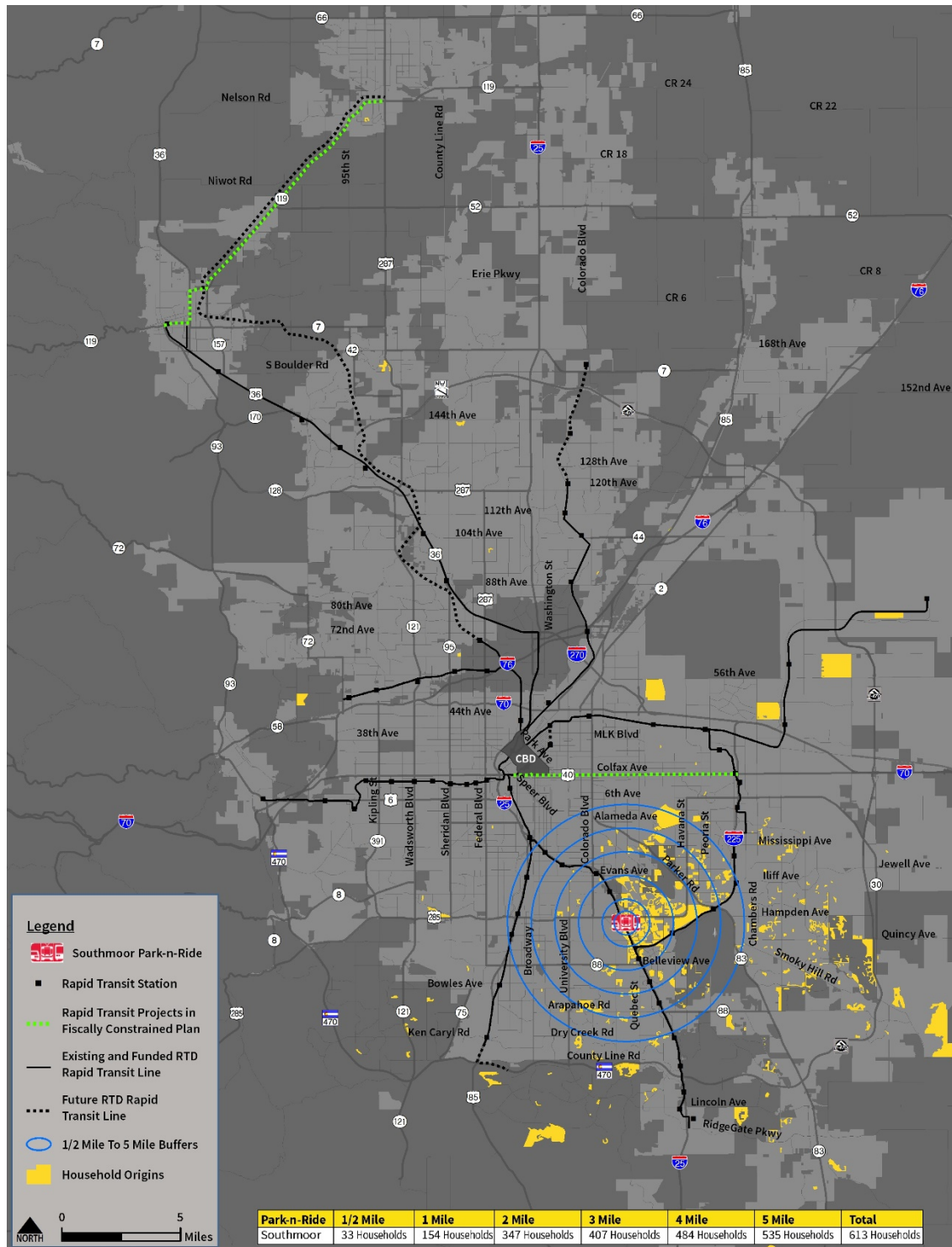


Figure 20 Thornton PnR Household Origins

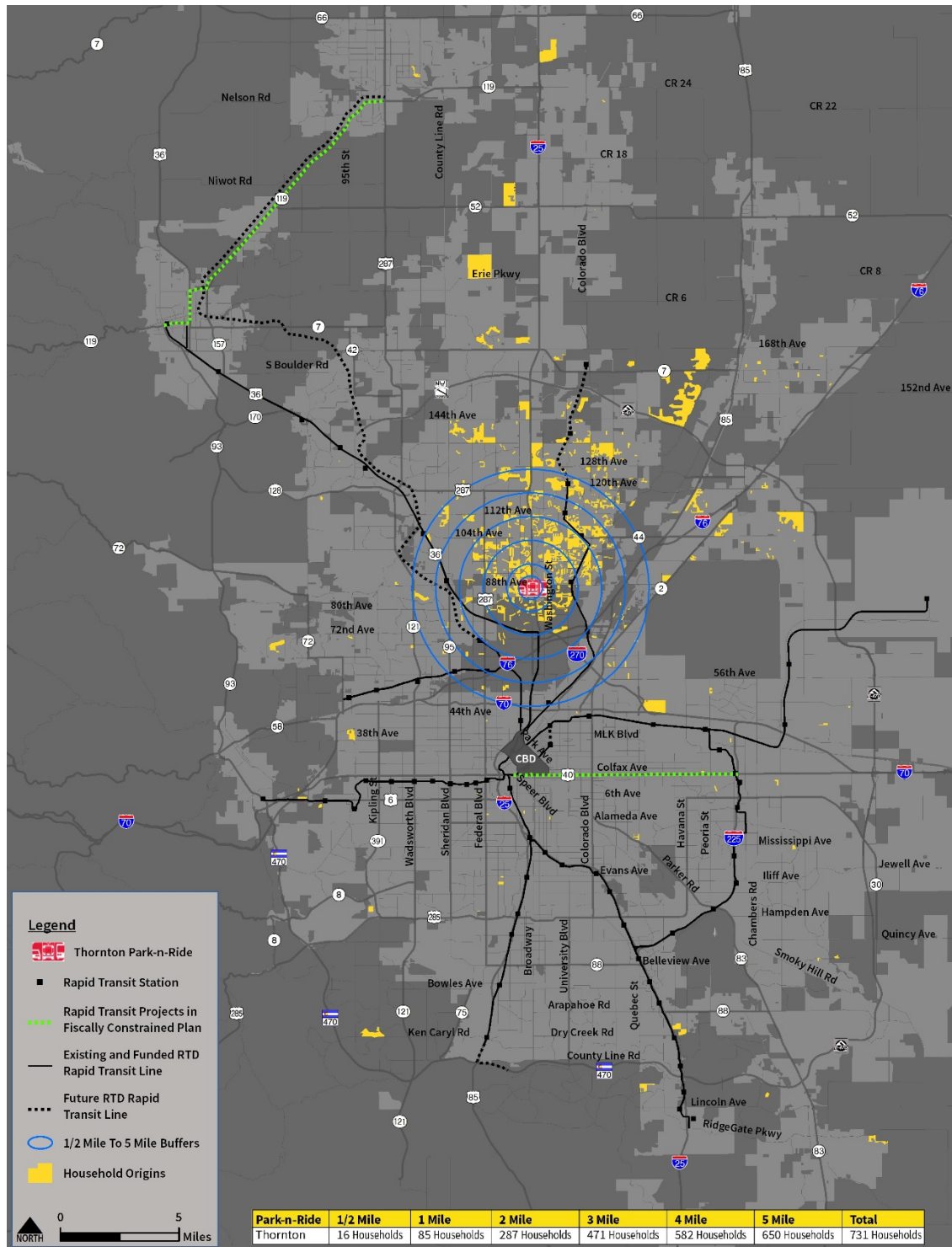


Figure 21 University of Denver PnR Household Origins

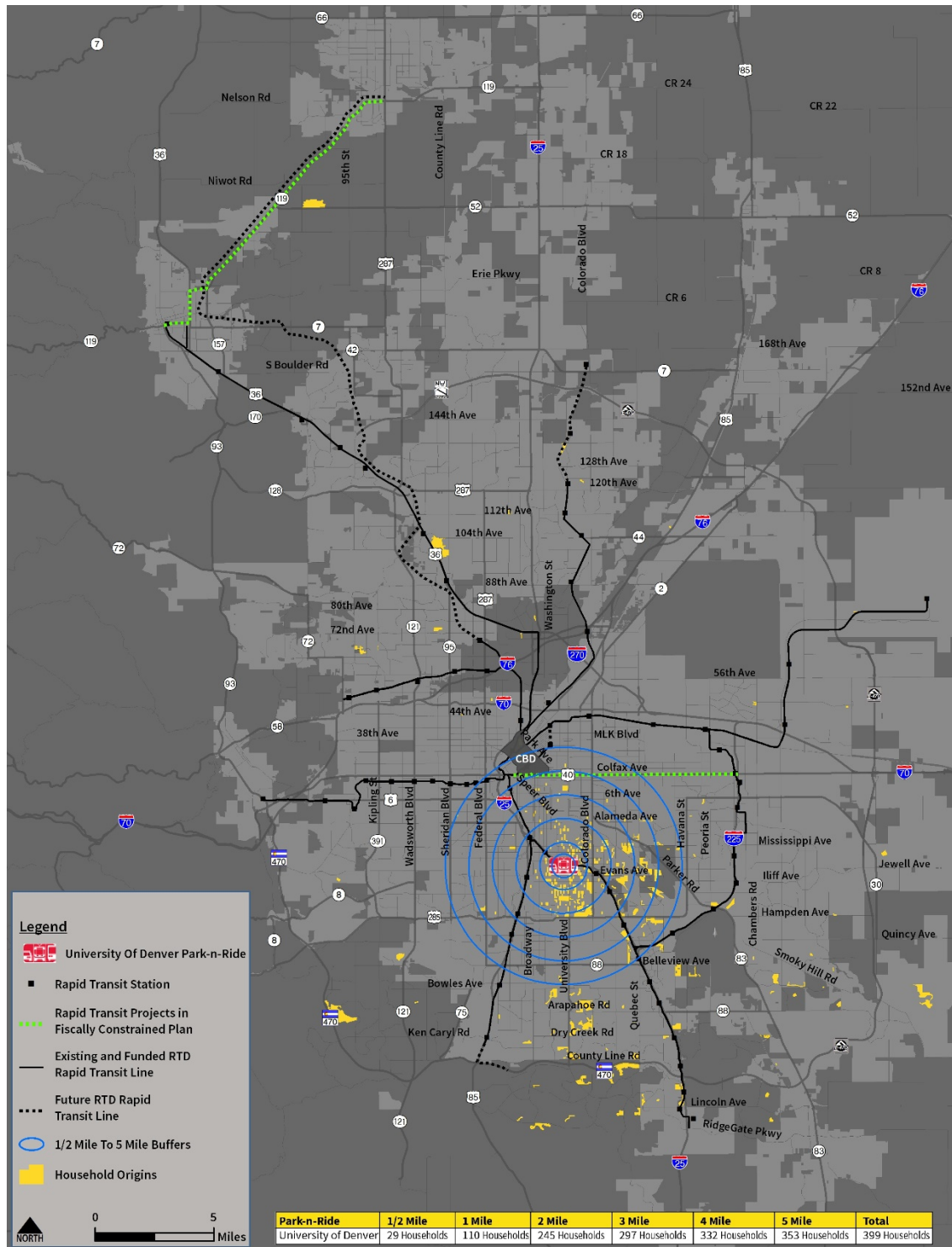


Figure 22 US 36 & Broomfield PnR Household Origins

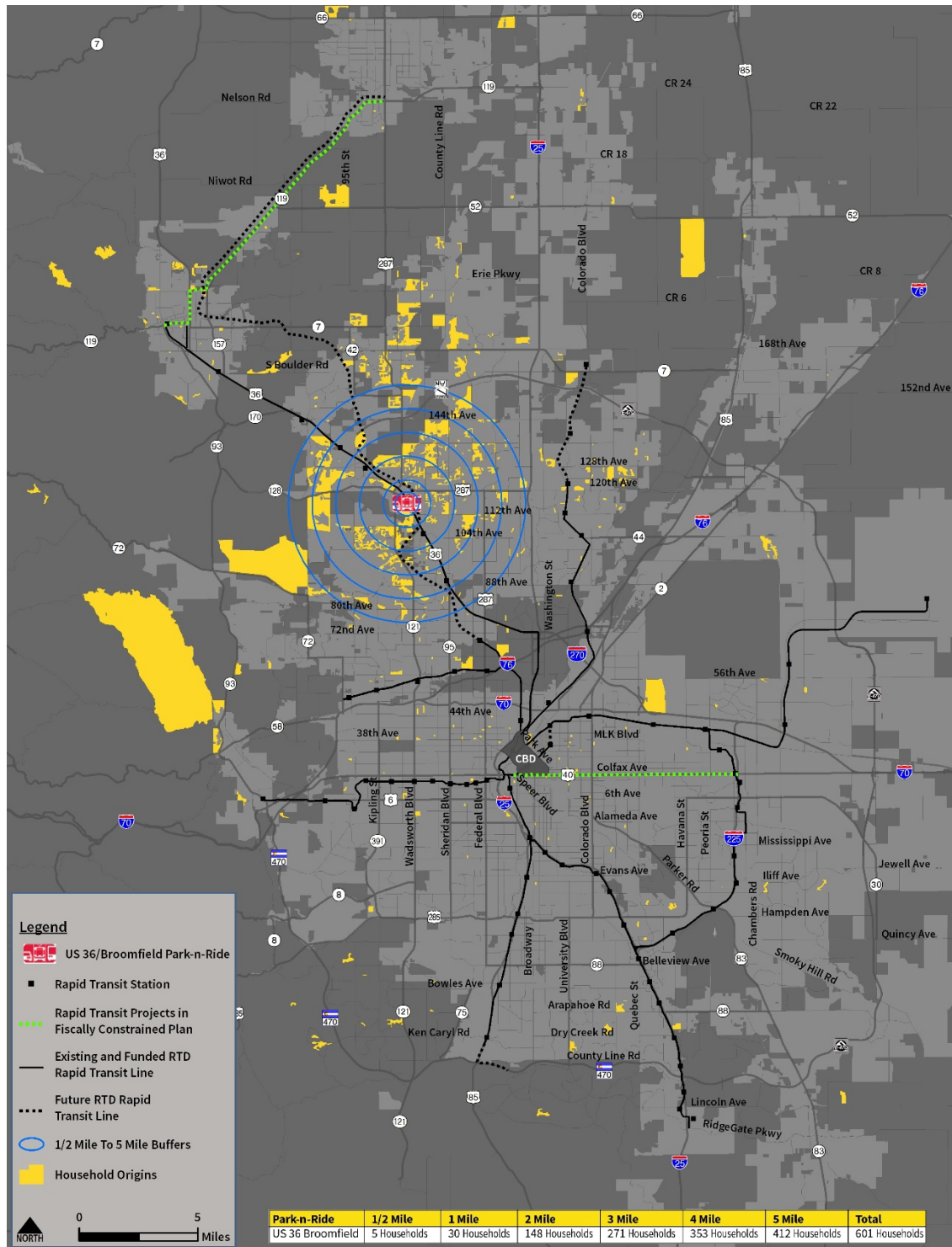


Figure 23 US 36 & McCaslin PnR Household Origins

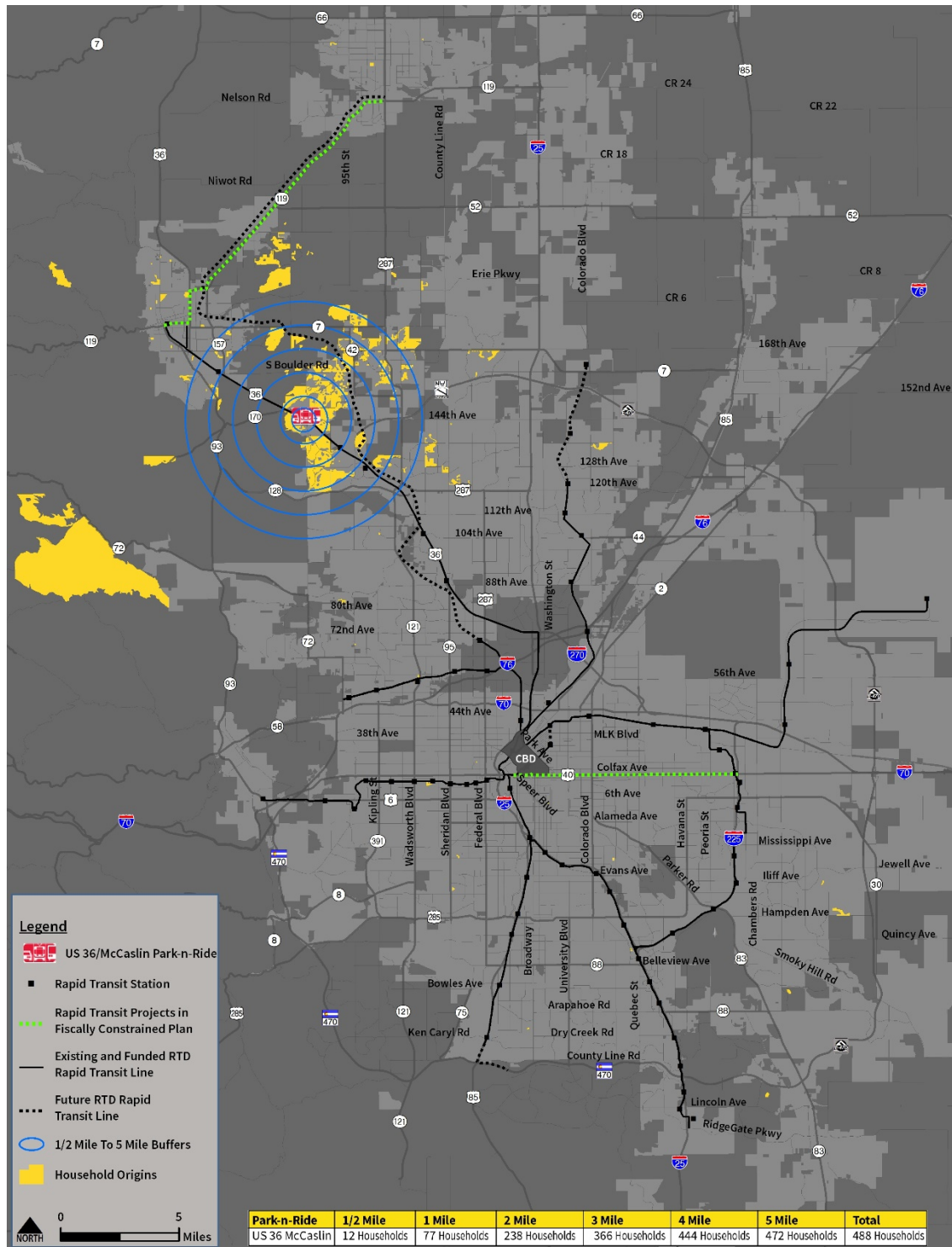


Figure 24 US 36 & Table Mesa PnR Household Origins

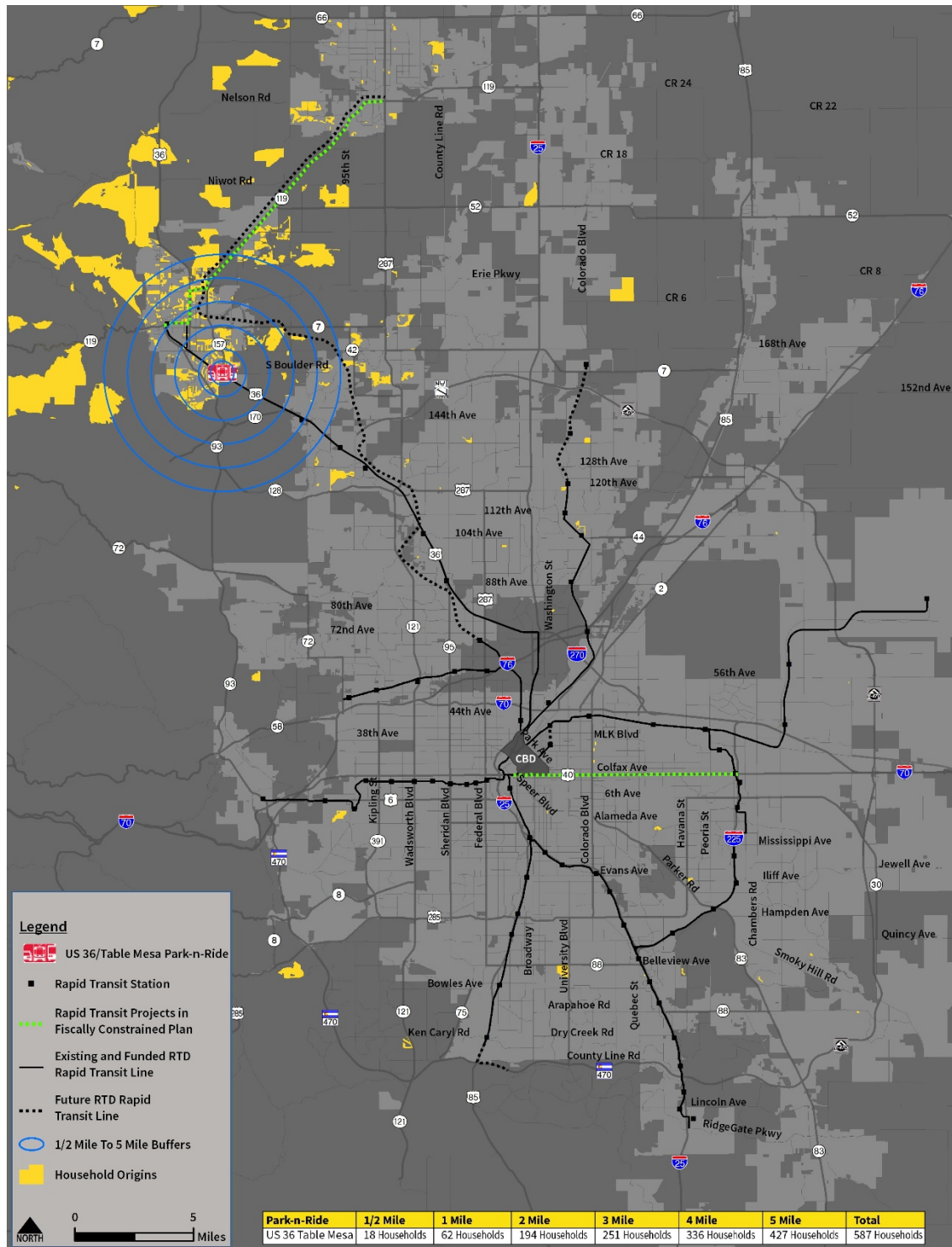


Figure 25 US 36 & Westminster PnR Household Origins

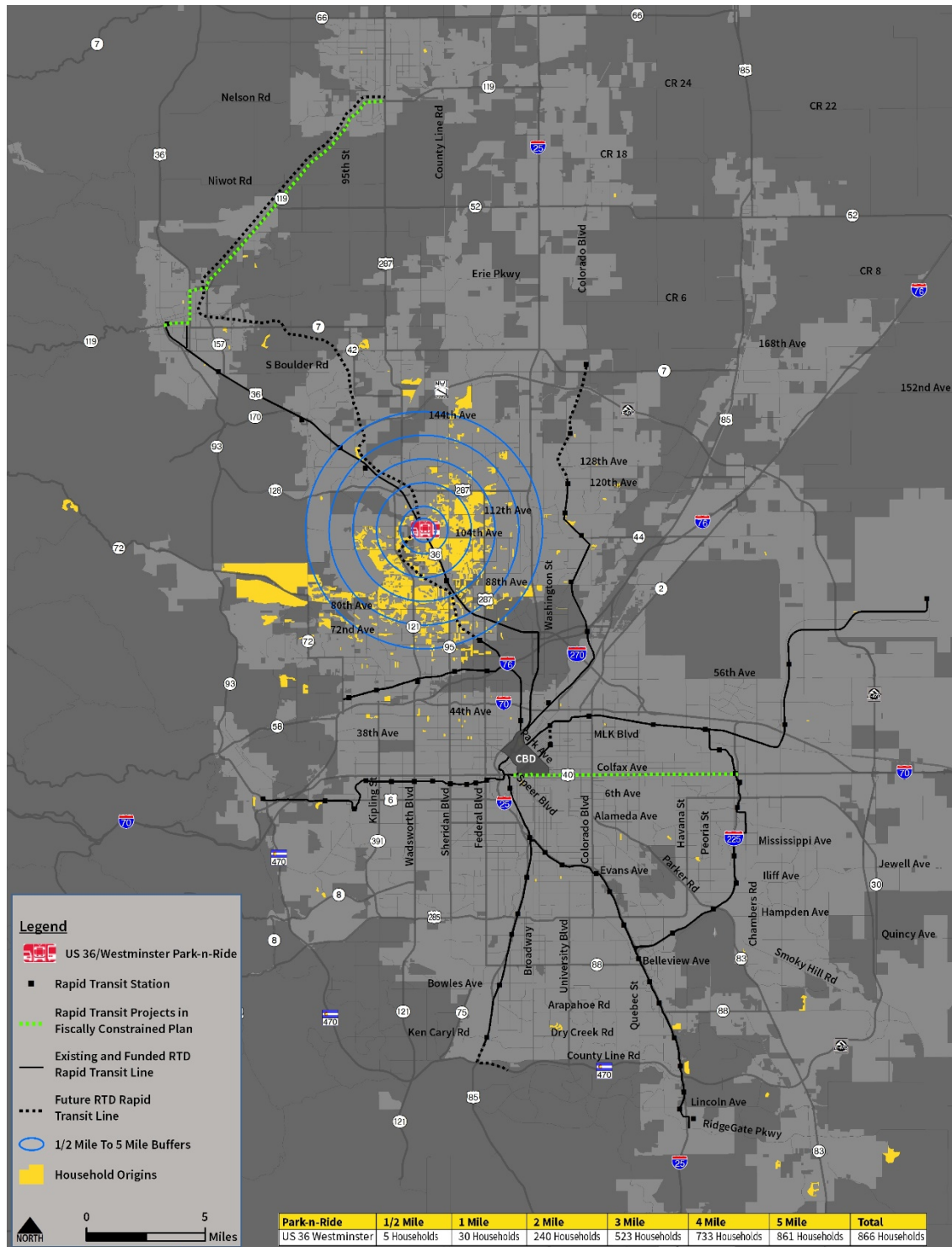
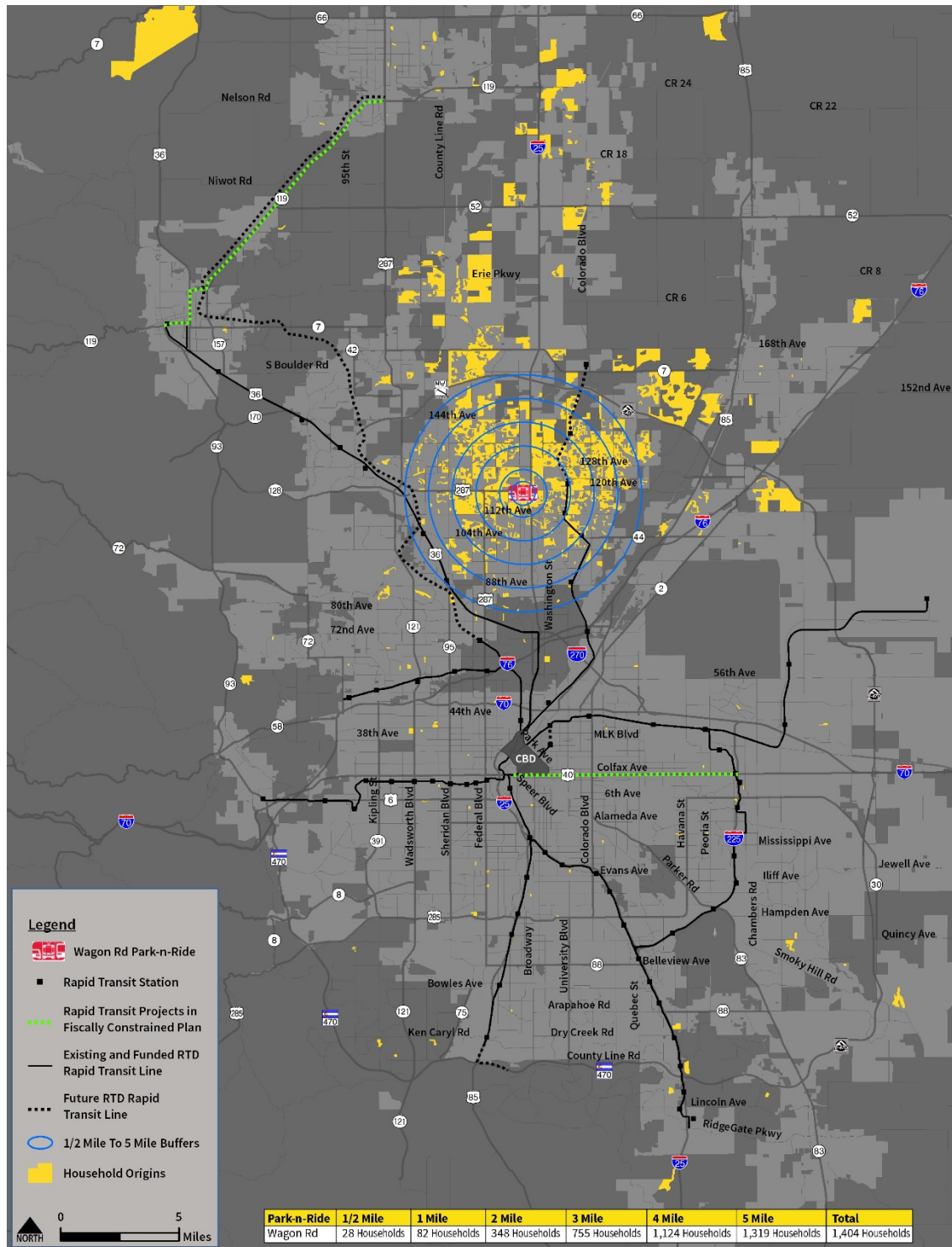


Figure 26 Wagon Road PnR Household Origins



1.7 Bustang

In 2015, the Colorado Department of Transportation began operating Bustang, an interregional bus system primarily serving the I-25 and I-70 corridors. Seven roundtrips connecting Colorado Springs and Fort Collins to Denver are provided each weekday; these are primarily aimed at long-distance commuters. An additional route along I-70 between Grand Junction and Denver operates three times every day of the week. CDOT also partners with several local transit agencies to provide Bustang Outrider routes serving Lamar, Pueblo, Alamosa, Gunnison, and Durango. Bustang stops at several RTD Park-n-Ride facilities in the Denver area, allowing for transfers between the two transit services.

2. Land Use

2.1 Demographics

The demographic makeup of an area provides valuable insight into its transportation needs. Certain segments of the general population, including older adults (over 65), low income families, minorities, and zero-vehicle households, tend to be more reliant on public transportation. Thus, access to high-quality transit for these population segments is critical. **Figure 27** through **Figure 30** identify the locations in the RTD service area and surrounding communities with high numbers of these typically transit-dependent populations. Notable takeaways from these demographics maps include:

- Significant elderly populations in the south and west suburbs of Denver
- Significant concentrations of impoverished households in west Denver and north Aurora
- Significant minority populations in southwest and northeast Denver
- Significant concentrations of zero vehicle households surrounding the Denver CBD

2.2 Existing and Future Land Use

Socioeconomic data contained within the DRCOG travel demand model has been summarized to provide a view of household and employment patterns and growth. This point-based information has been extracted from the UrbanSim regional socioeconomic model (that serves as a data input into the DRCOG travel demand model) and aggregated to represent persons per acre. This data will be used to identify corridors where future growth may be supportive of BRT services. In order to identify transit supportive areas, the persons per acre has been broken into two categories:

- 3-17 persons per acre – where 3 persons per acre is the minimum level RTD *Transit Service Policies and Standards* density that is potentially supportive of transit services

- Greater than 17 persons per acre¹ – where 17 persons per acre represents the level density to support BRT service (*Cost of a Ride: The Effects of Densities on Fixed-Guideway Transit Ridership and Capital Costs*, Guerra and Cervero, 2010)

Figure 32 and **Figure 33** show the 2015 and 2040 population densities per acre, respectively. Areas in red represent population density that is most likely to support BRT investment. By comparing the 2015 and 2040 maps, the location of future population growth can be discerned. Areas where significant increases to BRT supportive density is expected to occur include:

- Central Denver
- Santa Fe Drive south of Hampden Avenue
- Lincoln Avenue between I-25 and Parker Road
- West Colfax Avenue
- I-225 between I-70 and Colfax Avenue

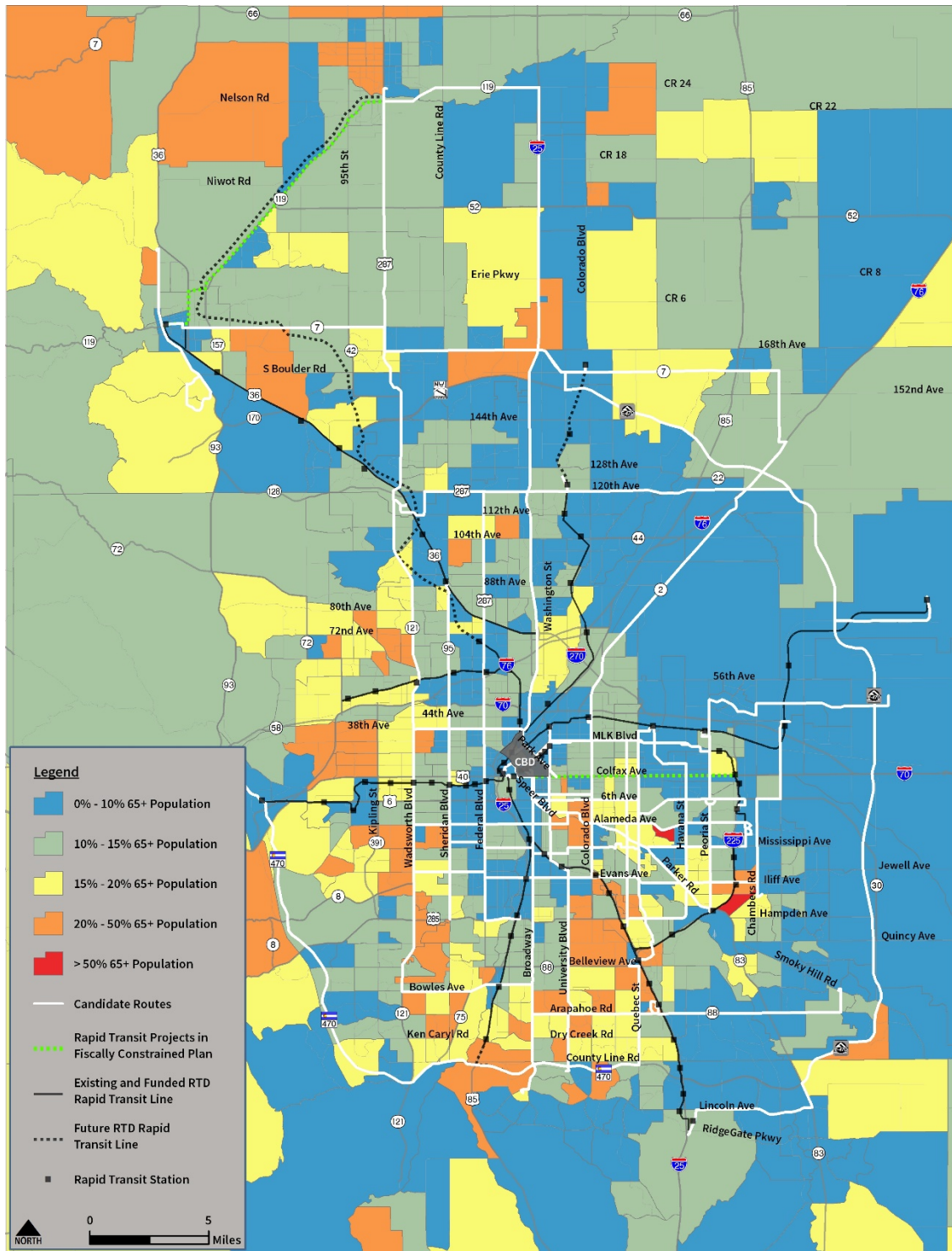
Figure 34 and **Figure 35** show the 2020 and 2040 employment densities per acre, respectively. Areas in blue represent employment density that is most likely to support BRT investment. By comparing the 2020 and 2040 maps, the location of future employment growth can be discerned. Areas where significant increases to BRT supportive density is expected to occur include:

- Central Denver
- Boulder
- Interlocken
- Golden
- Denver Tech Center
- Centennial Airport/RidgeGate
- Denver International Airport

2.3 Origin-Destination Patterns

¹ Table 8 refers to jobs plus population per acre

Figure 27 65+ Population Concentrations



Source: U.S. Census Bureau ACS 5-year Estimates (2012-2016)



Figure 31 O-D Patterns

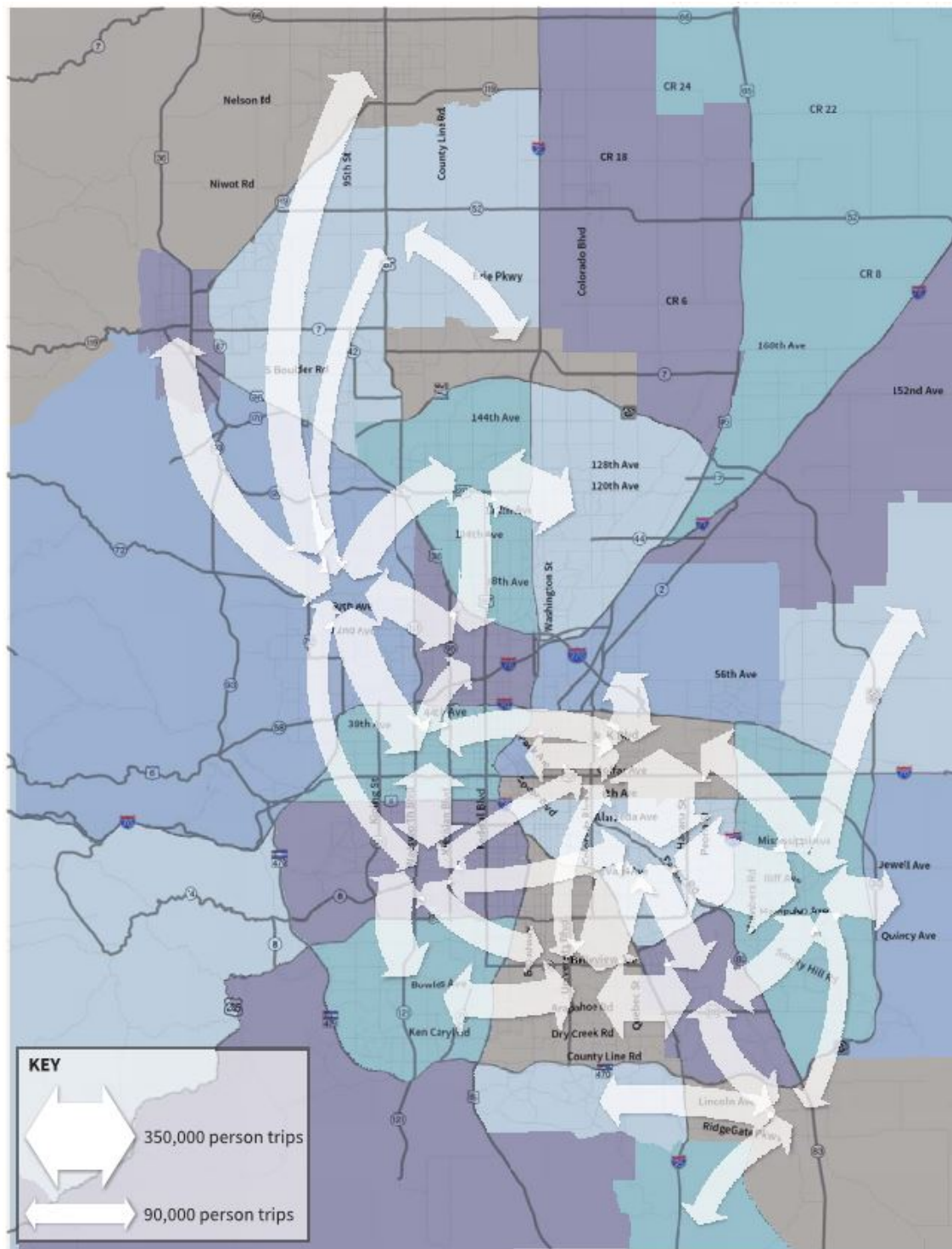
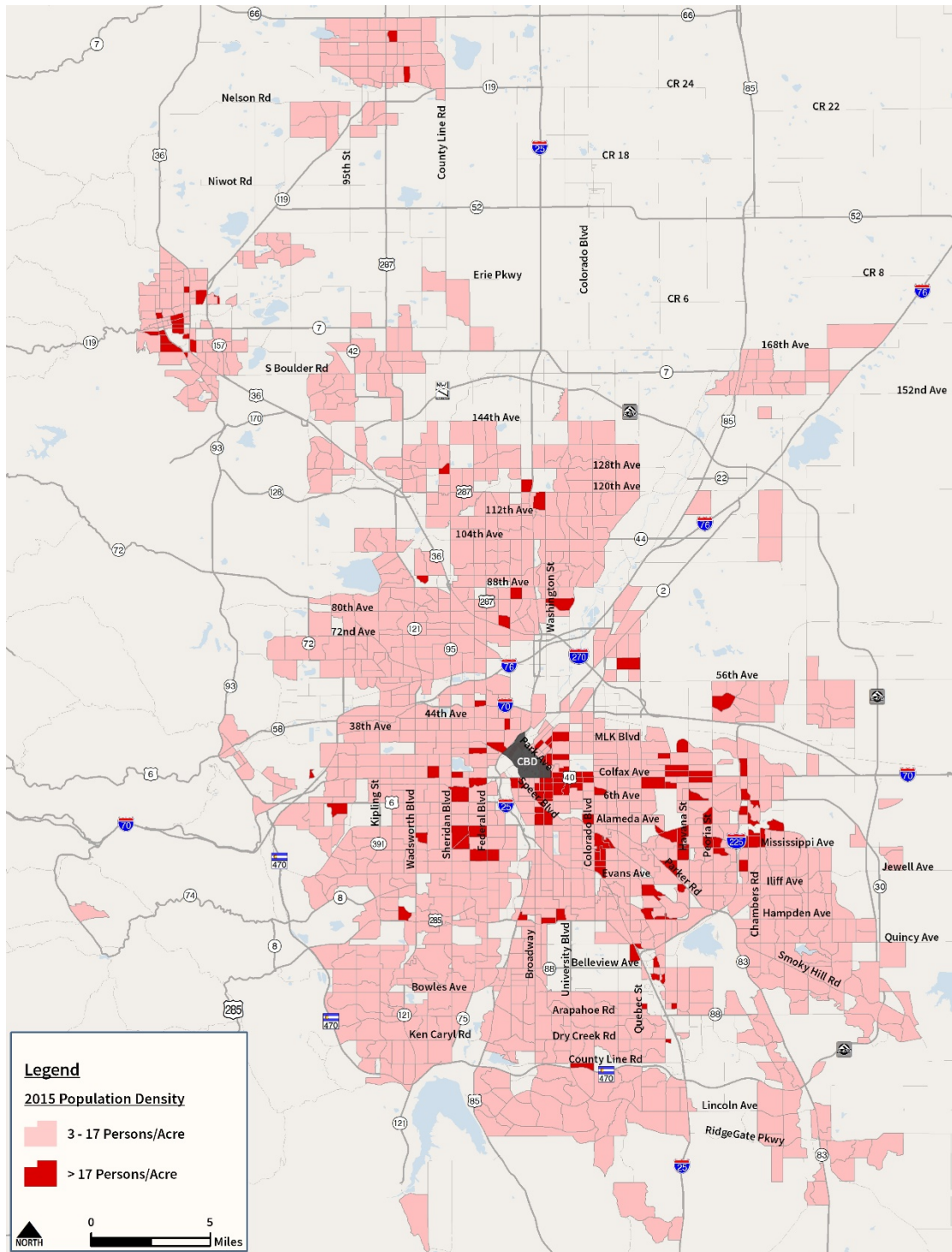
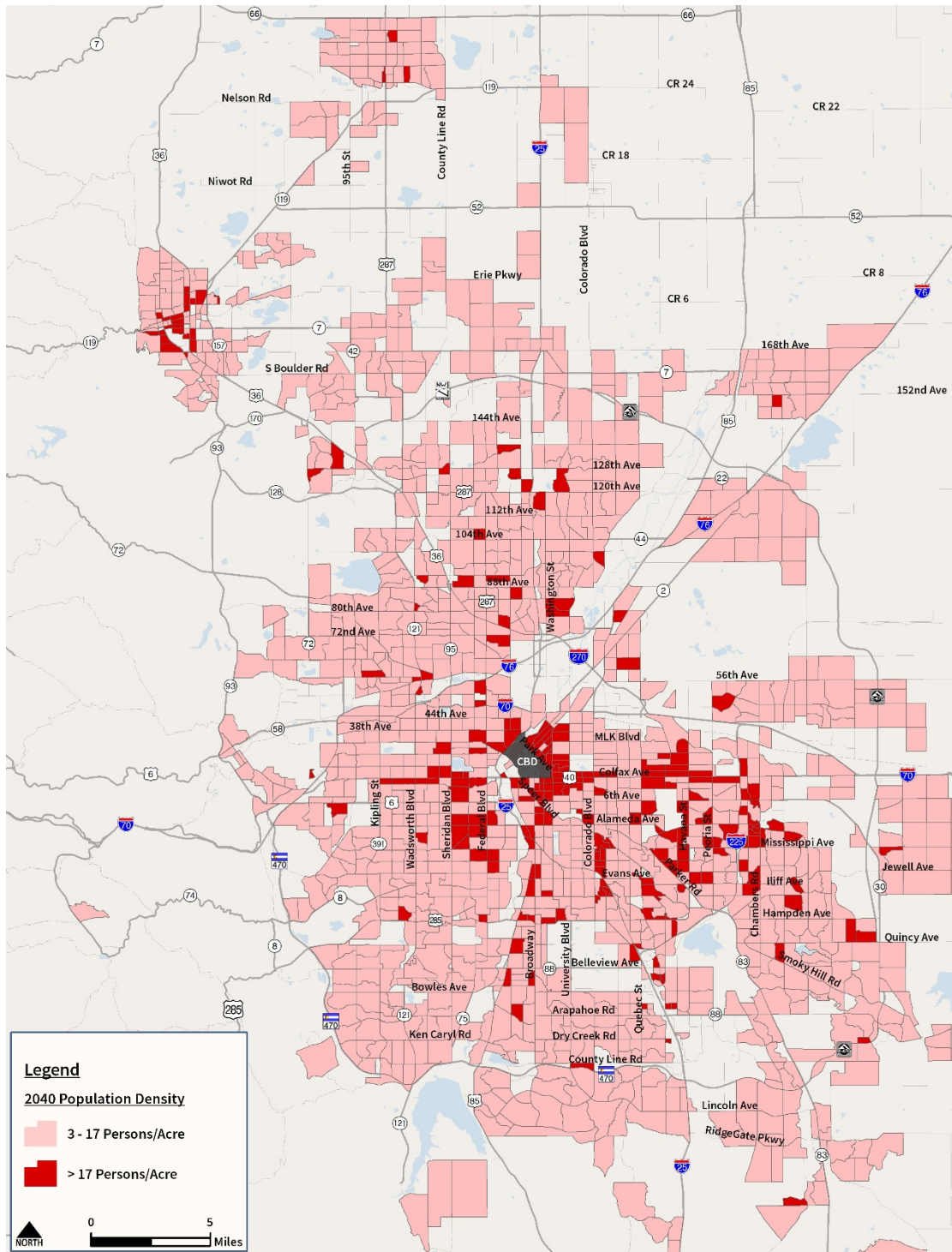


Figure 32 2015 Population Density



Source: DRCOG Regional Travel Demand Model (Focus 2.1)

Figure 33 2040 Population Density



Source: DRCOG Regional Travel Demand Model (Focus 2.1)

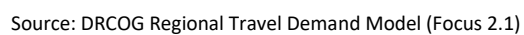
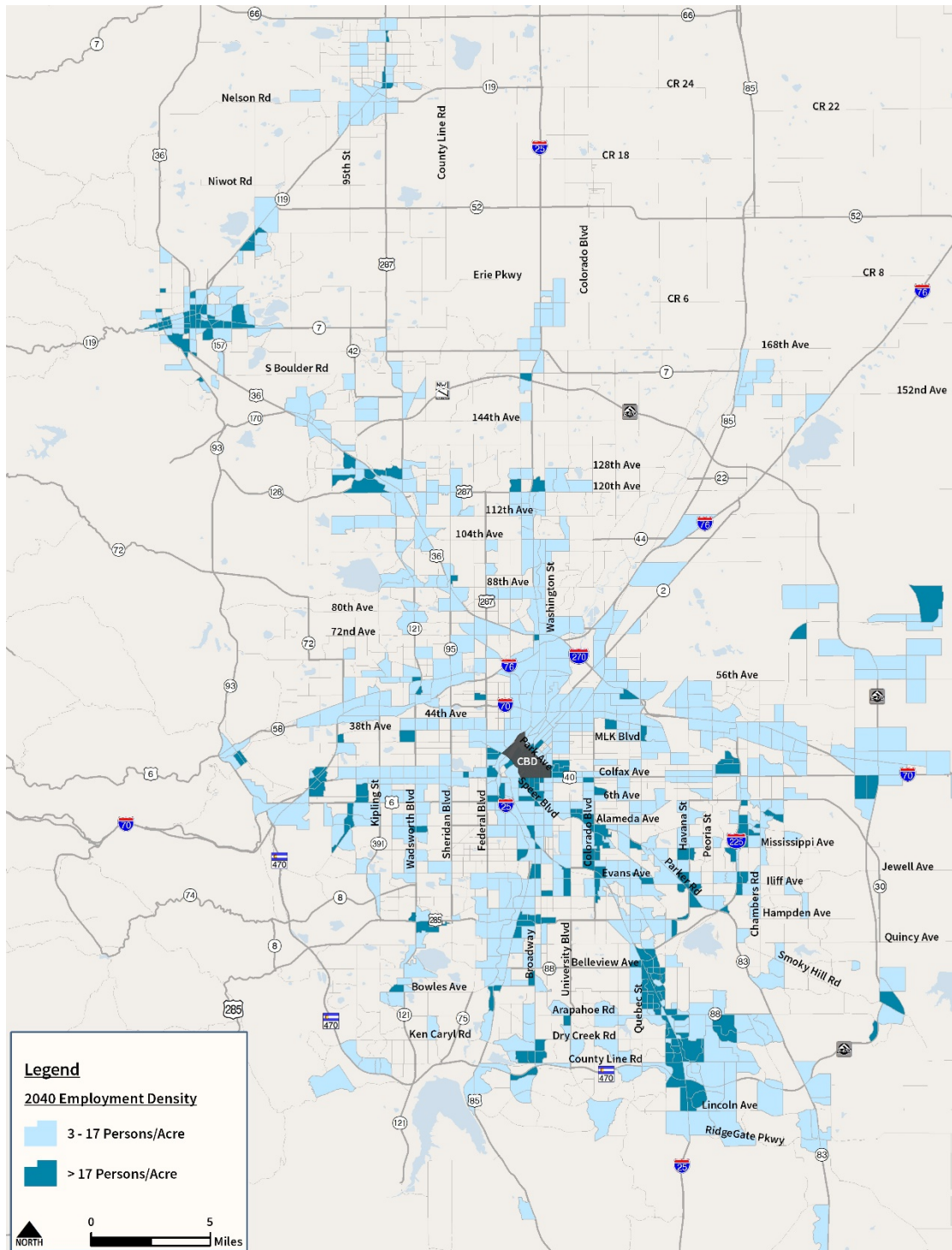


Figure 35 2040 Employment Density



Source: DRCOG Regional Travel Demand Model (Focus 2.1)

3. Concurrent Plans

Several planning efforts are occurring within the RTD service area, some led by RTD and some by other agencies within the study area. This section summarizes the various efforts and discusses their relevance to the *RTD Regional BRT Feasibility Study*.

3.1 State Highway 119 Bus Rapid Transit Study (Ongoing)

RTD is currently working with agencies and other stakeholders in the northwest portion of their service area to assess the viability of implementing BRT service along State Highway 119 (SH 119) between Boulder and Longmont. The *State Highway 119 BRT Study* kicked off in 2017 and is expected to conclude in December 2018. It will advance the high-level recommendation for BRT along the corridor from the *Northwest Area Mobility Study* (2014) into environmental analysis and preliminary design. A range of alternatives for the BRT alignment and operating characteristics will be evaluated. Because funding for this corridor is already included in DRCOG's fiscally constrained plan, SH 119 has been excluded from the corridors that will be assessed through the *RTD Regional BRT Feasibility Study*.

3.2 First and Last Mile Strategic Plan (Ongoing)

RTD is currently developing a *First and Last Mile Strategic Plan* to identify opportunities for enhancing multimodal connections to and from RTD services and facilities. A review of existing conditions and best practices from across the country will inform the creation of a series of station typologies and appropriate first/last mile accommodations for each. Potential recommendations include dockless bike sharing, local shuttles, grade-separated bike/ped crossings, and wayfinding programs. This effort may inform cost estimates that are prepared in the *RTD Regional BRT Feasibility Study*.

3.3 Mobility on Demand, Transportation as a Service, and Technology Providers Study (Ongoing)

RTD issued a Request for Information in November 2017 for the *Mobility on Demand, Transportation as a Service, and Technology Providers Study*. Work is expected to begin in early 2018; applicability to the *RTD Regional BRT Feasibility Study* is yet to be determined.

3.4 Denver Union Station Bus Facility Shared Use Study (Ongoing)

RTD issued a Request for Expressions of Interest in November 2017 for the *Denver Union Station Bus Facility Shared Use Study*. Work is expected to begin in early 2018; applicability to the *RTD Regional BRT Feasibility Study* is yet to be determined.

3.5 RTD Quality of Life Study (2017)

RTD's latest *Quality of Life Study*, released in 2017, details the progress made toward completing FasTracks projects between 2010 and 2015 and the impact of those projects on achieving the established FasTracks Program goals to:

- Balance transit needs with regional growth
- Increase transit mode share
- Improve transportation choices and options

RTD defined 61 indicators and quantifiable measures for tracking these three goals, and the *Quality of Life Study* provides data and analysis for each. The data is collected and reported at one of three scales: Region, Corridor, or Station. For this study, RTD defines a corridor as the area within 1 mile of a FasTracks line. The study includes both existing and planned FasTracks facilities (e.g., Northwest Rail Line).

The *RTD Regional BRT Feasibility Study* may use data from the *Quality of Life Study* as applicable in the study's evaluation of corridors.

3.6 The Mall Experience: Alternatives Analysis and Environmental Clearance (Ongoing)

In 2017, the City and County of Denver and RTD initiated *The Mall Experience* study, a planning and design effort to identify transportation improvements along the 16th Street Mall. The study is one component of a required National Environmental Policy Act (NEPA) review before changes to the Mall can be pursued. Current issues with the corridor that this study aims to correct include aging infrastructure, rising maintenance costs, and pedestrian safety concerns. A preferred alternative with center-running buses and an at-grade busway (no curb and gutter) was recommended for further development and refinement in early 2018. Applicability to the *RTD Regional BRT Feasibility Study* is yet to be determined.

3.7 Colfax Corridor Connections (Ongoing)

Colfax Corridor Connections is an ongoing effort by the City and County of Denver to plan and design a BRT system along East Colfax Avenue roughly from I-25 to I-225. Planning and analysis was initiated in 2012, and the project has progressed to a preliminary design stage anticipated to begin fall 2018.

Alternative screening and stakeholder engagement led to the selection of center-running exclusive BRT lanes as the preferred option for furthering into conceptual and final design. Twenty-one intersections (13 in Denver and 8 in Aurora) were identified as potential locations for median stations, which would incorporate features such as:

- High quality shelters
- Off-board fare payment
- Branding
- Lighting and security
- Public art
- Real-time transit information
- Protection from traffic

Because funding for this corridor is already included in DRCOG's fiscally constrained plan, this segment of East Colfax has been excluded from the corridors that will be assessed through the *RTD Regional BRT Study*.

3.8 Denver Moves: Transit (Ongoing)

The City and County of Denver began developing its first transit plan, *Denver Moves: Transit*, in 2016 as part of the four-pronged Denveright planning effort. The overarching focus of this plan, expected to be finalized in 2018, is to develop a 20-year vision for enhancing transit service within the City and County of Denver and to provide specific policy and infrastructure recommendations and implementation strategies for achieving that vision.

One plan component is to identify corridors within the City deserving of major transit capital investments based on analysis and stakeholder input. The 19 selected corridors were split into 3 proposed levels of investment: High Capacity Transit, Medium Capacity Transit, and Speed and Reliability. Both the High Capacity and Medium Capacity investment levels could become BRT-type service. The following specific corridors were assigned these levels of investment:

- Park Avenue
- Colfax Avenue
- Speer/Leetsdale
- Federal Boulevard
- Broadway/Lincoln
- Colorado Boulevard
- 38th Avenue
- Brighton/48th/Green Valley Ranch
- MLK Boulevard
- University Boulevard
- Alameda Avenue
- Mississippi Avenue
- Jewell/Evans/Illiff

3.9 Mobility Choice Blueprint (Ongoing)

An ongoing collaborative effort, *Mobility Choice Blueprint* began in 2017 among RTD, DRCOG, Colorado Department of Transportation (CDOT), and the Mobility Choice Initiative (a group of local leaders in the technology, transportation, economic, and government sectors). The goal was to develop a 15-year vision for enhancing the accessibility, connectivity, and reliability of metro Denver's

multimodal transportation network by leveraging emerging technologies. The final document will recommend implementation strategies for technology that promote mobility and livability, as well as policy and program changes. Applicability to the *RTD Regional BRT Feasibility Study* is yet to be determined.

3.10 Boulder County SH 7 Bus Rapid Transit Study (Ongoing)

In 2017, Boulder County, in coordination with CDOT and RTD, began work on the *State Highway 7 Bus Rapid Transit Study*, building from previous studies to assess the feasibility of implementing BRT between Boulder and Brighton. Analysis of projected growth in both density and travel demand along the corridor indicated a need for transit service. Modeling for the study found projected ridership in 2040 would be 30 to 40 percent higher if buses had an exclusive lane. The study recommends an exclusive or semi-exclusive bus travel way and 10 to 15 stations along the corridor. The SH 7 corridor has been identified as a Candidate Corridor for the *RTD Regional BRT Feasibility Study* and will be evaluated with all other corridors.

3.11 Downtown Boulder Station Feasibility Study (Ongoing)

The City of Boulder is currently conducting the *Downtown Boulder Station Feasibility Study* to assess how anticipated increases in transit service to downtown Boulder will impact the station and what improvements are needed to ensure that it has the capacity to accommodate future demand. Proposed BRT services on SH 119, SH 7, and South Boulder Road, all identified in RTD's *Northwest Area Mobility Study*, would connect to this station with 15-minute frequencies during peak hours. These new BRT services, along with projected increases in Flatiron Flyer service, would bring about a substantial increase in the daily bus trips in and out of Downtown Boulder Station. To adequately accommodate the additional bus trips, it is anticipated that the total number of gates at the station would need to grow from 14 to 22.

3.12 Aurora Northeast Area Transportation Study (Ongoing)

In 2017, the City of Aurora began updating the *Northeast Area Transportation Study* (the last update was completed in 2007). This update will include refinement of corridor recommendations from the 2009 *Aurora Comprehensive Plan*, accounting for changes in development plans and transportation needs since the 2007 update, and recommendations for additional transportation facilities and programs. Transit-specific recommendations from this latest update have not yet been developed, but the 2007 update showed future rapid transit along Jewell Avenue (E-470 to Monaghan Road), Smith Road (I-70 to E-470), and to Denver International Airport.

4. Local BRT Plans

This section of the report documents local BRT plans within the RTD service area. All corridors identified through these local plans have been included in the Candidate Corridors that will be evaluated in the *RTD Regional BRT Feasibility Study*.

4.1 Go Speer Leetsdale (2017)

In 2017, the City and County of Denver conducted a mobility study for the Speer/Leetsdale corridor entitled *Go Speer Leetsdale*. The study's intent was to determine "how to improve the way this corridor moves people between Broadway and East Mississippi Avenue through a variety of different transportation modes – including walking, biking, public transit, and driving." An analysis of existing and future conditions along the corridor found significant congestion and safety issues that will likely worsen without major transportation improvements.

The recommended alternative for transforming Speer/Leetsdale into a multimodal corridor includes managed transit lanes throughout the study's extents. Between Broadway and Bayaud Avenue, the outside lanes in each direction would be converted to "Buses and Right Turn Only" lanes. Transit signal enhancements would accompany these managed lanes to boost operational efficiency. From Bayaud Avenue to Mississippi Avenue, the study calls for a center-running reversible bus lane, in place of the existing medians and two-way left turn lanes, which private vehicles would be prohibited from entering. Bus stops along the reversible bus lane would be in the median and include:

- Real-time bus information
- Shelters
- Benches
- Lighting
- Bike racks

4.2 2040 Metro Vision Regional Transportation Plan (2017)

DRCOG *2040 Metro Vision Regional Transportation Plan*, adopted in 2018, expands on the transportation elements of *Metro Vision* with strategy and project recommendations for establishing a multimodal transportation system capable of handling projected future growth trends. Included within the *Metro Vision Regional Transportation Plan* is a fiscally-constrained version that "defines transportation elements and services to be provided over the next 25 years based on reasonably expected revenues."

The fiscally-constrained rapid transit projects in the 2040 MVRTP includes BRT guideways, facilities, and service on Colfax Avenue between Downtown Denver and Anschutz and along SH 119 between Downtown Boulder and the SH 66/US 287 interchange in Longmont.

The unconstrained (unfunded) 2040 vision also identifies potential BRT facilities and service on:

- SH 2 (I-70 to SH 7)
- 120th Avenue/US 287 (I-76 to SH 66)
- Arapahoe Avenue (SH 93 to I-76)
- Broadway/South Boulder Road (SH 119 to US 287)
- 95th Street/96th Street/Interlocken Boulevard (SH 7 to US 287)

The plan includes a series of “foundational measures” to show where the region stands currently with respect to an array of transportation-related performance measures and where it should be by 2040. One such measure is the share of regional housing and employment near high-frequency transit. The 2040 targets are to boost the housing share from 30 percent to 35 percent and the employment share from 48 percent to 60 percent.

4.3 Federal Boulevard Corridor Plan (2017)

In 2017, the City and County of Denver prepared the *Federal Boulevard Corridor Plan*, a long-term visioning document to guide the transformation of Federal Boulevard into a multimodal, community-oriented corridor. A previous *Existing Conditions Report* highlighted several safety, aesthetic, and economic-related issues, and this plan provides both “quick win” and long-term project recommendations to address them.

Results of a public survey for the plan found “Enhanced Transit Waiting Environment” and “Improved Transit Service” to be two of the three corridor improvements desired by the community, indicating a need for transit enhancements. The plan does not specifically call for BRT on Federal Boulevard but includes several recommendations for boosting transit efficiency. Working with RTD to identify opportunities for stop consolidation throughout the entire corridor is mentioned as a “quick win” project, and planning for high capacity transit is a long-term project. More specifically, the plan recommends converting the outside southbound lane of Federal between Dakota Avenue and Jewell Avenue and the outside northbound lane between 14th Avenue and 19th Avenue to transit-only lanes during peak hours. Though upgraded transit station locations are not designated, the plan does indicate that stations should include:

- | | |
|---------------------------------|---------------------------------|
| ▪ Signage and sidewalk platform | ▪ Off-board fare payment |
| ▪ Seating | ▪ Real-time bus arrival display |
| ▪ Shelter | ▪ Branding |
| ▪ Lighting | ▪ Waste receptacle |
| ▪ Bike parking | ▪ Green elements |
| ▪ All-door boarding | ▪ Near-level boarding |

4.4 Colorado Aerotropolis Visioning Study (2016)

CDOT administered the *Colorado Aerotropolis Visioning Study* in 2016 to assess the infrastructure requirements associated with the planned development of the Colorado Aerotropolis around Denver

International Airport. Model projections from the study showed the potential for a five-fold increase in employment and over 20,000,000 square feet of new commercial space in the study area with aerotropolis development, indicating a need for significant infrastructure improvement including to the transportation system. Consideration of BRT service in the area was recommended.

4.5 Northeast Area Transit Evaluation (2015)

The *Northeast Area Transit Evaluation* (NATE II) was conducted in 2015 by RTD, in coordination with CDOT, Adams County, City of Brighton, Commerce City, and City and County of Denver, to analyze opportunities and develop recommendations for commuter rail transit, light rail transit, and BRT in the area generally between US 85 and I-76, north and east of Commerce City to Weld County. NATE II served as update and expansion of the 2007 NATE study.

RTD conducted the *Denver Union Station-Cherry Creek-Glendale Corridor Feasibility Study* to identify opportunities for transit enhancements within the area bounded by Denver Union Station and Glendale; findings and recommendations from the study were released in 2014. The study area is one of metro Denver's key entertainment and employment corridors. The study projected that development would result in 4 million square feet of additional commercial, retail, and residential space by 2014. However, there is currently no single route between Union Station and Glendale and existing service is infrequent and inconsistent.

A two-level screening process identified BRT as the transit mode most in line with the objectives of NATE; four BRT alternatives for connecting the future Northeast rail line to DIA were developed and analyzed. The preferred alternative to come out of the study is a BRT route running from the Bridge Street/US 85 Park-and-Ride facility in Brighton to either the 40th & Colorado Station or Central Park Station. The recommended configuration of this BRT line consists of:

4.6 Denver Union Station-Cherry Creek-Glendale Corridor Feasibility Study (2014)

RTD conducted the *Denver Union Station-Cherry Creek-Glendale Corridor Feasibility Study* to identify opportunities for transit enhancements within the area bounded by Denver Union Station and Glendale; findings and recommendations from the study were released in 2014. The study area is one of metro Denver's key entertainment and employment corridors. The study projected that development would result in 4 million square feet of additional commercial, retail, and residential space by 2014. However, there is currently no single route between Union Station and Glendale and existing service is infrequent and inconsistent.

The study identified an Enhanced Transit Corridor as the preferred transit alternative. The proposed enhanced route would run between Civic Center Station and the intersection of Leetsdale and Alameda along the current 83L route. Headways of 7.5 minutes and 15 minutes would be maintained during peak and off-peak periods, respectively. The study did not include specific proposed infrastructure and operation characteristics, though it did recommend consideration of corridor branding, enhanced shelters, bike storage, transit-only lanes, and transit signal priority.

4.7 Northwest Area Mobility Study (2014)

RTD's *Northwest Area Mobility Study* (NAMS), completed in 2014, was carried out with the intent of developing a list of priority transit system enhancements in the northwest portion of RTD's service area. Five key areas were identified for evaluation, one of which was the feasibility of new arterial BRT service. A high-level screening process informed by metrics including ridership, environmental impacts, and capital costs reduced an initial list of more than 20 corridors to 6 potentially viable BRT candidates: SH 119, US 287, 120th Avenue, South Boulder Road, Arapahoe Avenue/SH 7, and SH 42. Key characteristics of each proposed BRT service were identified as follows:

- SH 119
 - **Termini:** Main Street/SH 66 Park-n-Ride and Boulder Transit Center
 - **Stations:** 30 major and 27 minor
 - **Operation:** Shoulder-running
- US 287
 - **Termini:** Main Street/SH 66 Park-n-Ride and Arista Civic Center Park-n-Ride
 - **Stations:** 22 major and 16 minor
 - **Operation:** Shoulder-running
- 120th Avenue
 - **Termini:** Arista Civic Center Park-n-Ride and Adams County Government Center
 - **Stations:** 18 major stations
 - **Operation:** Mixed traffic
- South Boulder Road
 - **Termini:** Boulder Transit Center and South Boulder Road/South Public Road Park-n-Ride
 - **Stations:** 33 major and 32 minor
 - **Operation:** Shoulder-running/exclusive lane (mixed traffic from Louisville to US 287)
- Arapahoe Avenue/SH 7
 - **Termini:** Boulder Transit Center and New SH 7/I-25 Park-n-Ride
 - **Stations:** 24 major and 22 minor
 - **Operation:** Mixed traffic (exclusive lanes from 28th St to US 287)
- SH 42
 - **Termini:** New Arapahoe Avenue/US 287 Park-n-Ride and Arista Civic Center Park-n-Ride
 - **Stations:** 15 major and 12 minor
 - **Operation:** Mixed traffic

The study proposed 15-minute headways during peak periods and 30-minute headways during off-peak periods for all six corridors. A prioritization process was performed to identify the appropriate

order of implementation. SH 119 and US 287 were designated short-term priorities, Arapahoe Avenue/SH 7 a medium priority, and the other three long-term priorities.

4.8 City of Boulder Transportation Master Plan (2014)

An update to the City of Boulder's *Transportation Master Plan* was developed in 2014 to serve as a "blueprint for an accessible and connected community through 2035." A significant purpose of the plan is to assist with the City's goal of reducing greenhouse gas emissions 80 percent by 2050. Accelerating the rate of mode shift away from single occupant vehicles is also a primary objective; all plan recommendations were developed with these in mind.

The plan includes "A Renewed Vision for Transit," which outlines service and capital improvement priorities specific to transit within Boulder. For additional BRT service within the city, the plan incorporated the proposed SH 119 and SH 7 routes from NAMS and recommended that local segments for them use Broadway Street, Canyon Boulevard, and 28th Street. Proposed BRT service along South Boulder Road to Louisville is also shown on the "Renewed Transit Vision" map. Recommended capital investments along BRT corridors include exclusive lanes, queue jumps, and/or transit signal priority, and highly-stylized, articulated buses. Though specific stop locations are not identified, the plan does indicate that BRT stops should have:

- High capacity shelters and seating
- Level boarding
- Real-time transit information
- Off-board fare payment
- Lighting
- Passenger/disabled waiting beacon
- Bicycle parking
- Pedestrian improvements within ½ mile radius

4.9 Centennial Transportation Master Plan (2013)

The City of Centennial developed their first *Transportation Master Plan* in 2013 as a means for prioritizing transportation investments within the City. The plan was set up to expand on the transportation elements of the *Centennial Comprehensive Plan* with more specific goals and objectives. The plan contains both project and policy-based recommendations.

One of the nine goals included in the plan was "Improve and Expand Public Transit Access and Service." One of the recommendations to achieve this goal is to implement BRT service along Arapahoe Road. The proposed BRT line would run between Arapahoe Road and Liverpool Street and Arapahoe Road and Broadway with 10-minute headways during peak periods and 20-minute headways during off-peak periods, with stops approximately every ½ mile. Buses would operate in general purpose lanes, but consideration of transit signal priority and queue jumps was recommended. Recommendations also included two new Park-n-Ride facilities, at Arapahoe Road and University Boulevard and at Arapahoe Road and Parker Road, and improved stop amenities such as shelters, trash cans, and lighting.

4.10 Boulder County Transportation Master Plan (2012)

Boulder County last updated its *Transportation Master Plan* in 2012. The overarching intent of the plan is to identify strategies for accomplishing the transportation-related goals from the *Comprehensive Plan* and achieving the transportation vision to “provide high quality, safe, sustainable, and environmentally responsible transportation infrastructure and services across all modes, to meet the mobility and access needs of all users.”

This latest plan placed a strong emphasis on multimodality and included several transit-related recommendations. On a map highlighting the County’s transit vision, conceptual BRT service is shown on South Boulder Road, SH 7/Arapahoe Avenue, SH 119, 28th Street/US 36, Broadway Street/SH 7, SH 287, SH 42, and SH 7/Baseline Road. The plan did not make specific operation or station recommendations but did mention a need to consider queue jumps, bus stop enhancements, and Park-n-Ride capacity improvements.

4.11 North I-25 Environmental Impact Statement (2011)

In 2011, the Federal Highway Administration (FHWA) and CDOT prepared an Environmental Impact Statement (EIS) to develop and assess a series of transportation improvement alternatives along the I-25 corridor between Fort Collins and Denver; primary foci of the effort were addressing accessibility, safety, aging infrastructure, and greater modal choice. Three reasonable alternatives, each with a high-capacity transit component, were considered: Package A, Package B, and the preferred alternative.

Most of the recommendations apply to portions of I-25 and US 85 outside the RTD boundary, but several new transit stations were proposed within. The Preferred Alternative option connects several communities in northern Colorado with downtown Denver via a US 85 commuter bus, tolled I-25 express lanes, and commuter rail parallel to US 287.

4.12 Town of Parker Fixed Guideway Transit Study (2005)

In 2005, the Town of Parker initiated the *Fixed Guideway Transit Study* to examine the feasibility of establishing a high-capacity transit connection between downtown Parker and the planned Southeast Corridor light rail station at RidgeGate. A series of alternatives that included both light rail and BRT was developed and evaluated based on criterion such as cost, potential ridership, and fit with the Town of Parker vision.

Ultimately, BRT service from RidgeGate to a new Park-n-Ride near Parker Town Center with a spur connection to Franktown was identified as the preferred alternative. Operating characteristics of the proposed BRT service include:

- 15-minute headways between Parker Town Center and RidgeGate all day
- 7.5-minute headways between Parker Transit Hub (Mainstreet and Parker Road) and Franktown during peak hours, and 30-minute headways during off-peak hours
- Exclusive curbside lanes on Mainstreet, RidgeGate to Chambers Road
- Exclusive curbside or median lanes on Mainstreet, Chambers Road to Parker Road
- Non-exclusive general purpose lanes on Mainstreet, Parker Road to Parker Town Center
- Non-exclusive general purpose lanes on Parker Rd, Mainstreet to Franktown

Eight station locations were identified for the proposed BRT:

- Franktown
- Pinery
- Parker Town Center
- Parker Transit Hub (Mainstreet and Dransfeldt)
- Mainstreet and Jordan Road
- Mainstreet and Chambers Road
- RidgeGate (2 stations)