



# Regional Connectivity and Market Analysis Report

The Rapid Transit Master Plan

Interurban Transit Partnership (ITP)

July 24, 2023

## Quality information

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# Introduction

This Regional Connectivity and Market Analysis Report builds upon the assessment of regional demographics and the performance of The Rapid's transit services outlined in the *Existing and Future Conditions Report* to identify travel patterns and key travel markets as well as current gaps in The Rapid's transit network and areas for potential expansion of service. These results, along with the public involvement results, will inform the *Future Options and Scenarios Technical Report* which will identify opportunities and scenarios for improving transit service in the short-, medium- and long-term future.

## Study Area

To analyze both regional needs as well as existing gaps in service, three areas of analysis are used in this report as depicted in Figure 1.

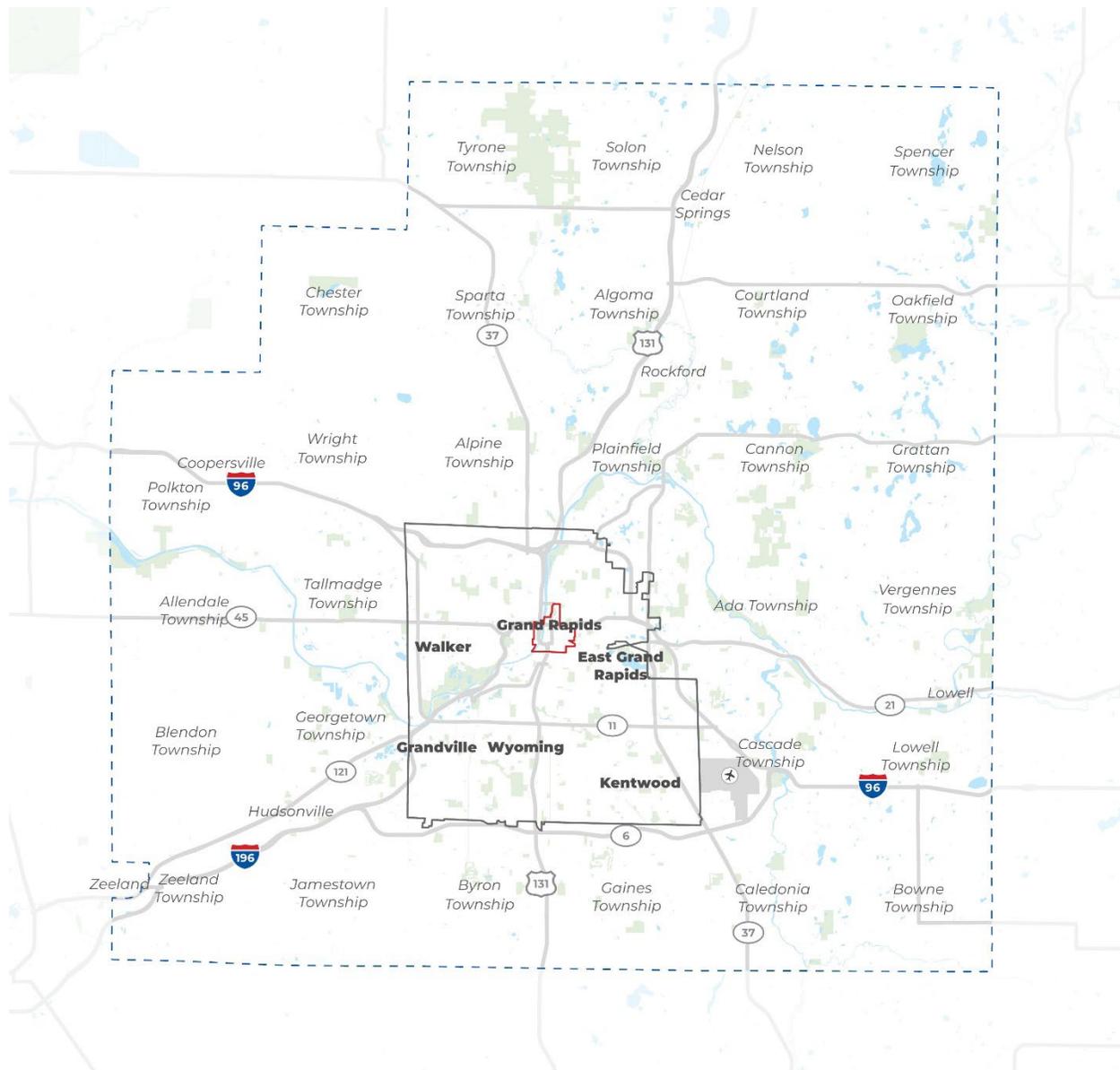
1. **Downtown Grand Rapids:** Defined as the Central Business District (CBD) Transportation Analysis Zones (TAZ) as identified by the Grand Valley Metro Council (GVMC)
2. **The Rapid's Existing Six-City Service Area (also referred to as the ITP-member communities):** Defined as Grand Rapids and the surrounding cities of Walker, East Grand Rapids, Kentwood, Wyoming, and Grandville
3. **Zone One:** Includes the ITP-member communities as well as the rest of Kent County and parts of Ottawa County that intersect the Grand Rapid's urbanized area

## Report Organization

The remainder of this report is divided into three sections: **Regional Connectivity Analysis**, **Market Analysis**, and **Emerging Mobility Options**.

- In the **Regional Connectivity Analysis** section of the report, trip characteristics and origin-destination desire lines are presented and analyzed to answer the questions: *How and why do people travel?* and *Where are people traveling to and from?*
- In the **Market Analysis** section of the report, key transit locations, connections, and mobility options are reviewed. Areas of elevated transit propensity and demand as well as trip generation potential are analyzed to identify *Where does transit need to go?* Then, origin-destination desire lines are overlaid on this base layer to answer the question: *What locations need to be connected to each other?* Based on these baseline conditions, opportunities for improved transit connectivity and mode shift from automobile travel to transit are identified.
- In the **Emerging Mobility Options** section of the report, several emerging mobility options are introduced and potential applications for The Rapid to leverage these technologies to complement and/or supplement traditional fixed route services are highlighted.

**Figure 1: Regional Connectivity and Market Analysis Study Area**



**Regional Connectivity and Market Analysis Study Area**

- Zone One Boundary
- ITP Member Communities
- Downtown Grand Rapids (CBD)



Source: The Rapid, GVMC

# Regional Connectivity Analysis

Regional connectivity analyses involve the examination of trip data to contextualize travel patterns, such as the volume of trips taken, the modes used to travel, the purpose behind a trip, the time it takes to travel, and the origins or destinations of each trip. Analysis of trip data can help answer where people travel, how they travel, and why they travel to destinations.

## Trip Characteristics

### *How and why do people travel in the Grand Rapids region?*

To understand how and why people travel in the Grand Rapids region, analyses for trips within The Rapid's existing Service Area (ITP-member communities) and from Zone One to the Service Area were conducted using Replica, an activity-based travel model generated using mobile location data, consumer marketing data, and census data and calibrated using observed transportation counts.<sup>1</sup> This analysis uses the Fall 2021 Replica model for a typical Thursday (weekday), as it is the most recent model available and represents typical trip patterns throughout the week. Replica trip summaries for trips within the Service Area and from Zone One to the Service Area are summarized in the sections below.

### **Key Findings**

#### **Trip Volume**

- The number of trips per person going to downtown Grand Rapids is the same for both Zone One and Service Area trips
- The Zone One area captures about 23,000 more trips and 138,000 more trip takers going downtown to Grand Rapids than those originating in the Service Area.

#### **Mode Split**

- Nearly two thirds (~65-67%) of all trips from both Zone One and The Rapid's Service Area are taken via private automobile (single-occupancy vehicles)
- Walking is the second most likely form of transportation for trips from The Rapid's Service Area to downtown (16%)
- Less than 2% of daily trips within the service area are taken by transit

#### **Trip Purpose**

- Trip generation is primarily associated with four trip purposes: home-related, shopping, working, or eating.
- Of the 350,000 additional trips to downtown originating in Zone One compared to the Service Area, over 9,000 are work-related trips

#### **Travel Time:**

- On average, transit travel times are 2-3 times longer than other modes
- Non-transit trips are typically less than 15-minutes long
- Transit trips to downtown Grand Rapids are 23-28% shorter than other transit trips

<sup>1</sup> Replica's activity model methodology is provided here: <https://documentation.replicahq.com/docs/seasonal-mobility-model-methodology-summary-places>

## Trip Volume

Trip volume metrics can be used to provide insight into travel patterns between different locations, such as how often an average person travels to a particular destination or area. Table 1 depicts the volume of typical weekday trips destined for The Rapid's Service Area and downtown Grand Rapids using three metrics: daily trip quantity, total trip takers, and the average number of daily trips per person. Four different trip patterns are analyzed based on their origin location:

- From The Rapid's Service Area
  - Within the Service Area
  - To Downtown Grand Rapids
- From Zone One
  - To The Rapid's Service Area
  - To Downtown Grand Rapids

Table 1 describes the distribution of trips for the four different trip patterns above, including the differences between trips originating in the Service Area and trips originating in Zone One. Zone One's geographic boundary includes all of the Service Area. As a result, any differences in trip volume are measures of the additional number of trips Zone One adds to the Service Area's number of trips.

**Table 1: Weekday Trip Volumes**

From	To The Rapid Service Area			To Downtown Grand Rapids		
	Daily Trips	Trip Takers	Average Trips per Person	Daily Trips	Trip Takers	Average Trips per Person
The Rapid Service Area	1,110,000	346,000	3.2	72,000	48,600	1.5
Zone One	1,460,000	484,000	3.0	95,700	64,800	1.5
<b>DIFFERENCE</b>	<b>350,000</b>	<b>138,000</b>	<b>-0.2</b>	<b>23,700</b>	<b>16,200</b>	<b>0.0</b>

Source: Fall 2021 Replica data for a typical weekday (Thursday)

### Trips from The Rapid's Service Area

Despite only encompassing 10% of the Zone One area (128 of 1,198 square miles), 76% of all Zone One trips to The Rapid's existing Service Area originate within the Service Area meaning that Zone One is not adding a significant number of trips despite the significant added geographic area. Zone One's larger trip capture area results in a thinner distribution of trips across the population compared to the average trips within The Rapid's service area (3.2 vs. 3.0 trips per day)

### Trips from Zone One

Three quarters of Zone One trips to downtown Grand Rapids also begin within the downtown area. The number of trips into downtown per person does not appear to increase or decrease by changing the origin zone from The Rapid's service area to Zone One as trip takers within both geographies take an average of about 1.5 trips per day to downtown.

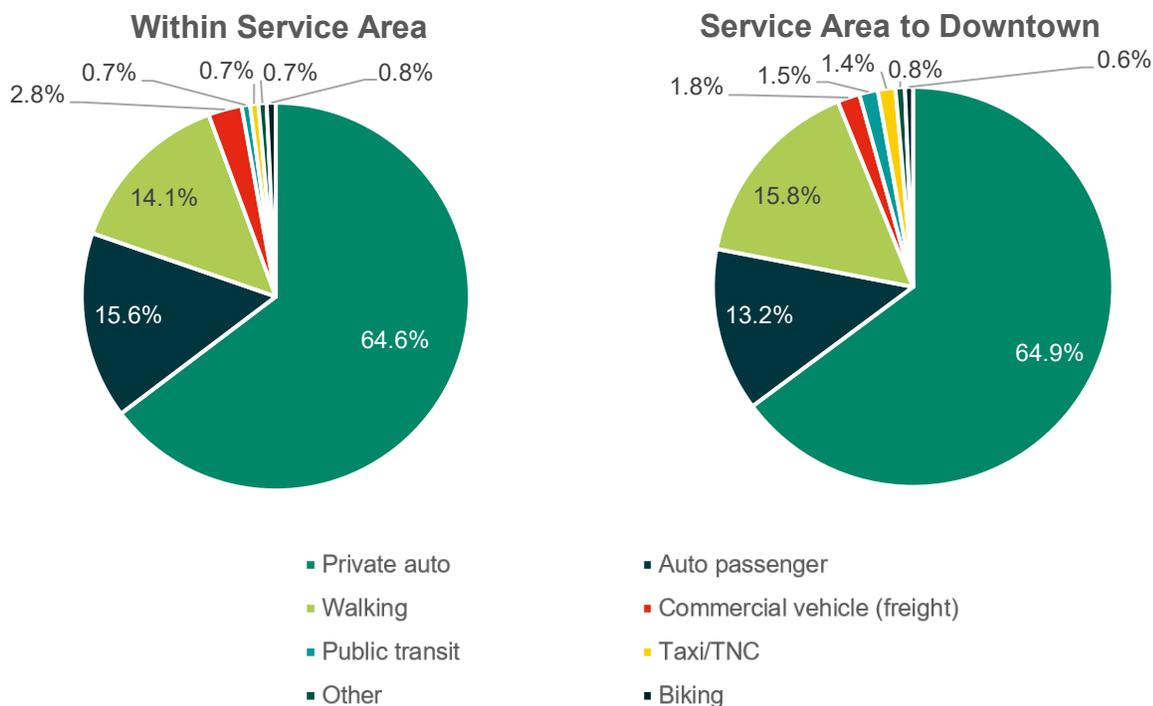
## Mode Split

The following section outlines the distribution of trips by transportation mode for trips beginning in The Rapid’s Service Area (Figure 2) as well as trips beginning in the greater Zone One area (Figure 3) to highlight the existing size of the transit market relative to other modes of transportation.

### Trips from The Rapid’s Service Area

The distribution of trips by transportation mode within The Rapid’s Service Area and to downtown Grand Rapids is shown in Figure 2. For both trip patterns, nearly two thirds of trips are taken by private automobiles (single-occupancy vehicles). Carpooling (auto passenger) and walking round out the top three modes, representing between 13 and 16 percent of trips. As people generally walk to destinations that are less than two miles from their origin, this suggests that a significant percentage of trips beginning within The Rapid’s Service Area are likely short in length. For both trip patterns, less than two percent of daily trips are taken by transit, closely comparable to the share of trips taken by freight vehicles, bike, taxis, or other modes. Compared to intra-Service Area trips, Service Area trips to downtown are twice as likely (1.5% vs 0.7%) to utilize public transit.

**Figure 2: Mode Split within the Service Area and from the Service Area to Downtown**



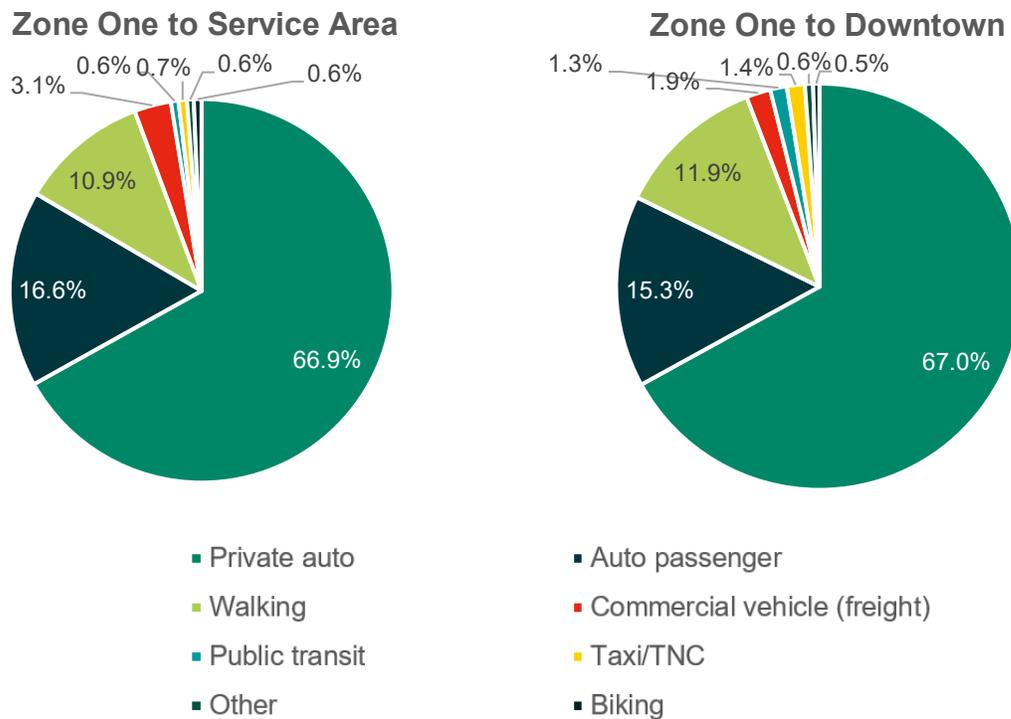
Source: Fall 2021 Replica data for a typical weekday (Thursday)

### Trips from Zone One

The distribution of trips by transportation mode from Zone One to the Service Area and downtown Grand Rapids is shown in Figure 3 and closely mimics the mode split of trips beginning within The Rapid’s Service Area. Like trips beginning within the Service Area, approximately two thirds of trips from Zone One are taken by private auto (single-occupancy vehicle). Unlike trips from the Service Area, however, walking represents a much smaller mode share (11-12%) of Zone One trips compared to trips from the Service Area (14-16%). For all trip patterns, less than two percent of daily trips are taken by transit, again closely comparable to the share of trips taken by freight vehicles, bike, taxis, or other modes. Trips from Zone One to downtown Grand Rapids are also twice as likely to utilize public transit than Zone One trips to

the broader service area (1.3% vs 0.6%). This may be due to the high volume of transit trips from GVSU to downtown Grand Rapids.

**Figure 3: Mode Split from Zone One to the Service Area and to Downtown**



Source: Fall 2021 Replica data for a typical weekday (Thursday)

**Zone One and Service Area Trip Comparison**

At a high-level, mode split for the Zone One study area is comparable to the mode split for Service Area trips as private auto trips represent about two-thirds of all trips while transit represents less than two percent. At a more granular level, trips with Zone One origins are slightly more likely to be traveled using a private automobile than within the Service Area (67% versus 65%) and less likely to be walked (11-12% verses 14-16%) reflecting a more auto-oriented trip nature of the greater Zone One area.

Despite encompassing a much larger area compared to The Rapid’s current Service Area, transit mode share similarities between Service Area and Zone One trips are likely primarily driven by the high volume of transit trips from the GVSU Allendale Campus and downtown Grand Rapids offsetting additional auto trips particularly as the strongest transit origin-destination desire lines for the entire region are along the Lake Michigan Drive corridor as described in the Origin-Destination Desire Lines section below. Furthermore, lower population density and limited access to transit in the geographic areas between the Service Area and Zone One boundaries suggests any difference in mode split may be due to either auto-oriented development patterns or limited access to transit. As such, there is potential for the 4.6 percentage points greater share of private automobile trips going downtown from Zone One to be replaced by transit trips if access to transit services were expanded to Zone One communities. However, further conclusions regarding transit propensity of Zone One compared to the existing Service Area are limited using mode split findings alone. Further insight into trip purposes and trip travel time by mode is needed to continue to discuss potential impact of trip characteristics on the transit propensity of Zone One.

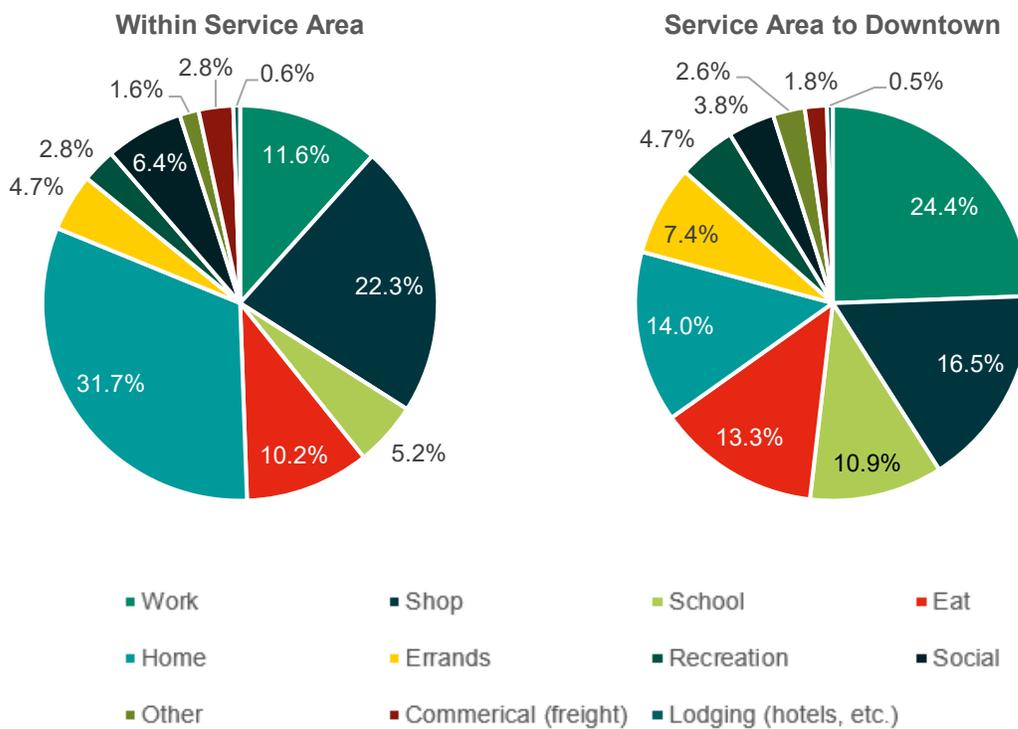
## Trip Purpose

Trip purpose can greatly influence travel behavior and mode choice. This section analyzes the distribution of trip purposes to understand why people travel within the Grand Rapids region.

### Trips from The Rapid’s Service Area

The distribution of trips by trip purpose within the Service Area and from the Service Area to downtown Grand Rapids is shown in Figure 4. Within the Service Area, trip generation is primarily associated with four trip purposes: home-related (31.7%), shopping (22.3%), working (11.6%), or eating (10.2%). These same categories also comprise the top four trip purposes for travel from the Service Area to downtown, although a greater percentage of downtown trips are for work (24.4%) and eating (13.3%) while school-trips represent a higher percentage (more than 10%) of trips.

**Figure 4: Trip purpose within the Service Area and from the Service Area to Downtown**

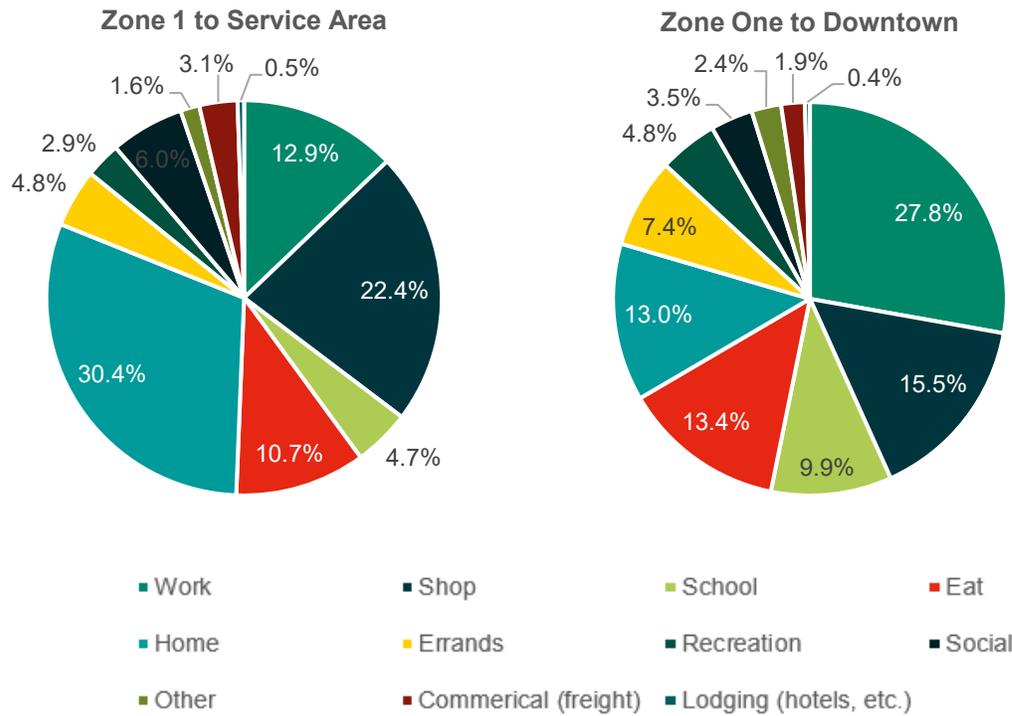


Source: Fall 2021 Replica data for a typical weekday (Thursday)

### Trips from Zone One

The distribution of trips by transportation mode from Zone One to the Service Area and to Downtown Grand Rapids is shown in Figure 5. From Zone One to the Service Area, the greatest share of trips are for home-related purposes (30.4%) followed by shopping (22.4%), working (12.9%), and eating (10.7%). These same categories also comprise the top four purposes for travel from Zone One to downtown although work-related trips (27.8%) and shopping-related trips (15.5%) are more prevalent.

**Figure 5: Distribution of Trips by Purpose from Zone One to the Service Area and Downtown**



Source: Fall 2021 Replica data for a typical weekday (Thursday)

**Zone One and Service Area Trip Comparison**

Trip purpose data from both origin zones indicates that the primary trip generators ending downtown are places of employment and retail shopping, followed by eating and returning home. The primary trip generators from both trip patterns that end in the Service Area are residential land uses, retail shopping, and places of employment, also followed by eating.

These larger trends and distributions of trip purposes are consistent whether trips originate in Zone One or the current Service Area. The largest difference is a greater prevalence for work-related trips between Zone One and downtown Grand Rapids than from the existing Service Area (+3.4 percentage points). This translates to about 9,000 more work-related trips traveling downtown from Zone One compared to the Service Area. Employment centers are typically concentrated in a limited number of areas downtown and generally tend to have consistent working hours. These 9,000 additional work-related trips represent an underserved market of trip takers who may benefit from services such as express commuter routes and is an area to potentially explore further.

## Travel Time Comparison

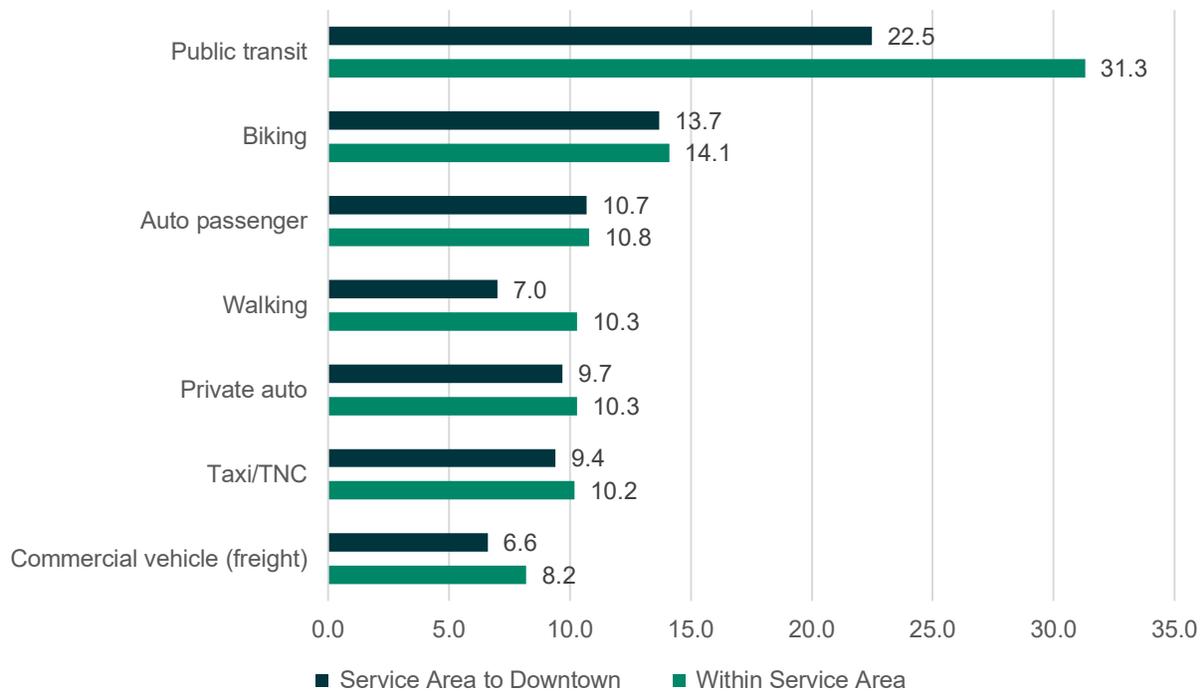
Travel time can be used as a reflection of how convenient it is to travel by different transportation modes. The shorter a trip’s travel time, the more efficient it is at moving people or goods to their destination. Travel time is a major decision factor in travel behavior as well as mode choice. This section analyzes the distribution of trip travel time across modes to understand how quickly people can travel to destinations within the Grand Rapids region.

### Trips from The Rapid’s Service Area

The average trip duration (in minutes) by transportation mode within the Service Area and to downtown Grand Rapids from the Service Area is shown in Figure 6. In general, trips beginning within The Rapid’s Service Area are fairly short in duration with walking trips and trips by private autos, auto passengers, and taxis all averaging trip durations of between 7 and 11 minutes. Comparatively, average transit travel times are two to three times longer than on other transportation modes. This time may be even longer when accounting for time traveling to and from transit stops, in addition to time waiting for transit services to arrive.<sup>2</sup>

Aside from transit, trip duration differs by about three minutes or less between the average trip within the Service Area and the average trip from the Service Area to downtown Grand Rapids. Comparatively, the average transit trip from the Service Area to downtown Grand Rapids is 28% shorter (9 minutes) than within the Service Area. This is likely influenced by The Rapid’s hub and spoke transit network model where routes are designed to connect areas in the periphery to the downtown but may require a transfer to travel between non-downtown communities.

**Figure 6: Average Trip Duration (in minutes) by Transportation Mode within the Service Area and to Downtown from the Service Area**



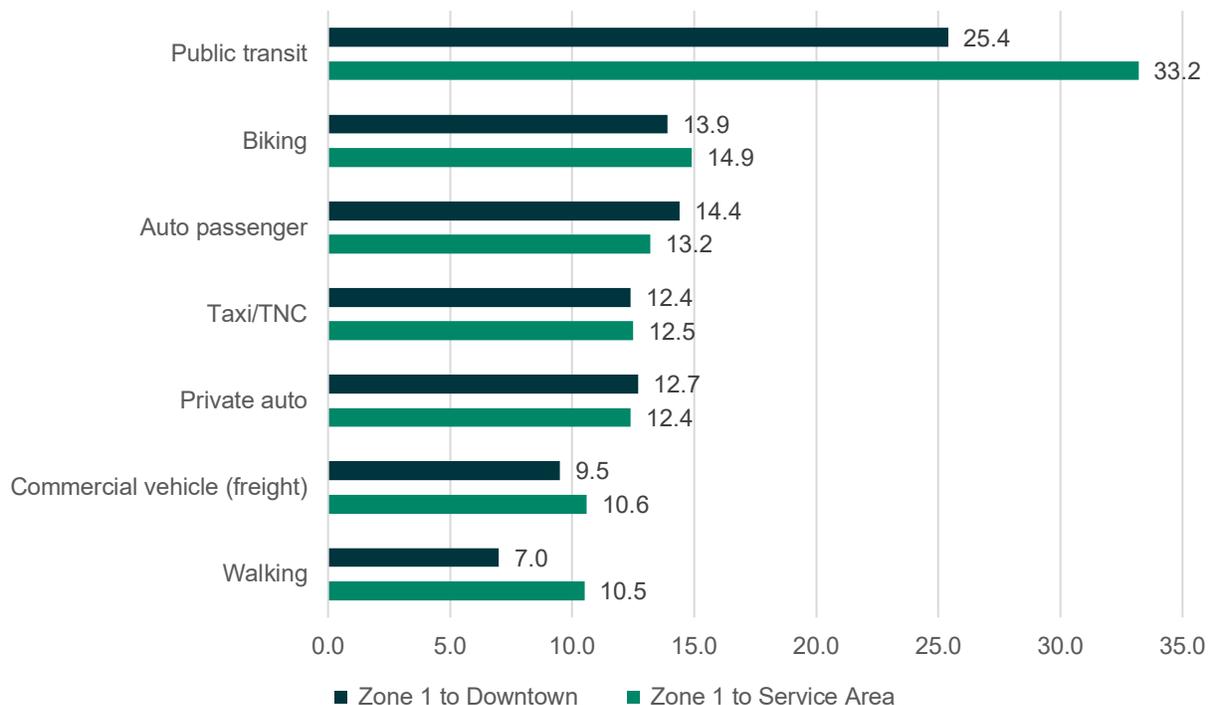
Source: Fall 2021 Replica data for a typical weekday (Thursday)

<sup>2</sup> A trip is often made up of multiple travel modes, such as a journey to work that includes a walk to a bus station followed by a bus ride. In this case if two modes were used by the traveler during their trip, such as walking and public transit, only the primary mode of travel across a set of trip segments is included. As such, trips using transit are likely even longer than indicated in the data. (Source: Replica Transit Trips Dataset Overview)

### Trips from Zone One

The average trip duration (in minutes) from Zone One to the Service Area and to downtown Grand Rapids is shown in Figure 7. On average, Zone One trips are typically between 7 and 15 minutes in length. Trips by private autos, auto passengers, and taxis average 12-14 minutes in duration for travel from Zone One to both the service area and downtown. However, transit trips are significantly longer, at about 33 minutes from Zone One to the service area and 25 minutes to downtown Grand Rapids. Similar to trips from the service area, walking trips are the shortest duration non-transit trips while biking trips are the longest.

**Figure 7: Average Trip Duration (in Minutes) from Zone One to the Service Area and to Downtown**



Source: Fall 2021 Replica data for a typical weekday (Thursday)

### Zone One and Service Area Trip Comparison

In general, travel time characteristics of trips for all modes beginning in Zone One are highly similar to trips beginning within The Rapid’s Service Area. Trips by all travel modes beginning in Zone One are typically only 1-2 minutes longer than those originating within The Rapid’s existing Service Area.

On average, transit travel times are **2-3 times longer** compared to other modes

However, the distance between origin and destination points for all trip modes originating in Zone 1 are also 1.5 to 2.5 miles farther than those originating in the service area. This suggests that Zone 1 trips have higher average travel speeds like due to highway usage compared to the traditional street grid in the Service Area.

Across both study areas, average transit trip durations are two to three times longer than other transportation modes. Transit trips are also 0.3 to 1.3 miles shorter than trips made by all other modes (except for transit trips within the service area, which are 0.2 miles farther than all other modes). This may be due to the way transit trips are categorized in the dataset separately from the first-last mile mode used to travel to and from the transit service (e.g., walking to a bus stop is registered as a separate trip).

## Origin-Destination Desire Lines

### *Where are people traveling to and from?*

The Fall 2021 Replica model for a typical Thursday (weekday) was also used to identify the most common origin-destination pairs within the Service Area and from Zone One to the Service Area. Replica generates a trip table based on filters that are applied to the model, such as Trip Origin and Trip Destination. Data from trip tables for trips within the Service Area and from Zone One to the Service Area are summarized in the sections below.

### **Key Findings**

#### **All Modes:**

- Nearly all of the strongest desire lines are already served by or in close proximity to The Rapid's fixed route network or Rapid Connect zones.
- Desire lines with opportunities for greater connectivity within the ITP-member communities include the Kalamazoo Avenue corridor between M-11 (28<sup>th</sup> Street) and M-6 and connections between key destinations such as RiverTown Crossings, Calvin University, Woodland Mall, and their surrounding areas.
- Desire lines with opportunities for greater connectivity outside the ITP-member communities include connections between the Alpine Meadows mobile home park and Route 33, the Plainfield Avenue (M-44) corridor between I-96 and East Beltline Avenue, and the East Beltline Avenue (M-44) corridor between I-96 and 3 Mile Road.
- Potential for new direct connections to Downtown Grand Rapids is strongest in Kentwood, the Calvin University and surrounding area, Woodland Mall area, Jenison, the Plainfield Avenue (M-44) corridor between I-96 and East Beltline Avenue, and the area around the lakes in Rockford/northwestern Cannon Township.

#### **Transit:**

- The strongest transit desire lines are served by The Rapid's existing BRT routes.
- Transit desire lines with opportunities for greater connectivity include connections between the Gaines Marketplace area and the UM Health – West Hospital area to the west, and between the Gaines Marketplace area and the Woodland Mall area to the north.

## All Modes

Origin-destination desire lines for all modes of transportation are mapped in Figure 8. Desire lines depict the number of daily trips between transportation analysis zone (TAZ) pairs with darker red lines indicating a greater number of daily trips. For visual simplicity, only the highest volume desire lines (200+ daily trips) are mapped. All of the strongest desire lines have at least one end that is served by or in close proximity to The Rapid's fixed route network. However, as these desire lines represent some of the strongest connections within the Zone 1 area, there are opportunities to streamline transit travel and provide more direct connections to make transit a more competitive alternative to auto trips. The following summary categorizes the strongest connections based on their proximity to The Rapid's fixed route network.

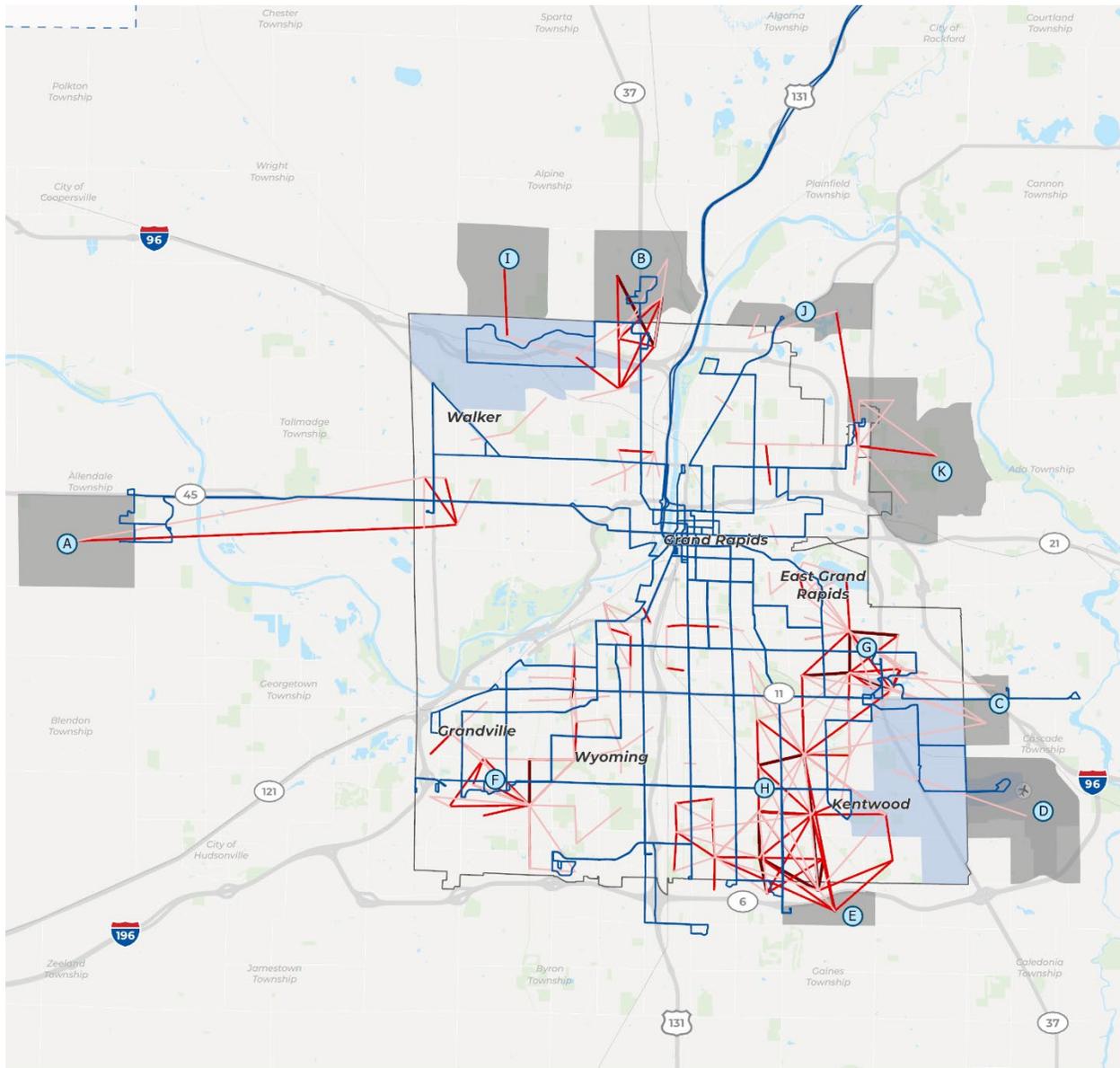
Strong connections where both ends of the desire line are served by The Rapid's fixed route network include:

- Between Grand Valley State University (GVSU)'s main campus in Allendale <sup>Ⓐ</sup> and the Standale area of the City of Walker, which is served by the Laker Line BRT route
- Between the Alpine Center neighborhood and the Walmart shopping center on Alpine Avenue (M-37) and the surrounding housing <sup>Ⓑ</sup>, which is served by Route 9
- The 28<sup>th</sup> Street (M-11) corridor out to Cascade Township <sup>Ⓒ</sup>, which is served by Route 29
- Between the airport <sup>Ⓓ</sup> and the Broadmoor Avenue (M-37) corridor, which is served by Route 27 and the Kentwood Rapid Connect zone
- Between Gaines Marketplace <sup>Ⓔ</sup> and other areas along the Kalamazoo Avenue corridor, which is served by Route 2
- Between RiverTown Crossings in Grandville and the surrounding area <sup>Ⓕ</sup>, which is served by Routes 8, 24, and 44
- Between Calvin University, Woodland Mall, and the surrounding area <sup>Ⓖ</sup>, which is served by Routes 5, 6, 24, 25, 28 and 29
- The Kalamazoo Avenue corridor between M-11 and M-6 <sup>Ⓗ</sup>, which is served by Routes 2 and 44

Strong desire lines that are in close proximity to The Rapid's fixed route network but present opportunities for greater connectivity include:

- Between the area encompassing the Alpine Meadows mobile home park <sup>Ⓘ</sup> and Route 33, which falls just outside of the Walker Rapid Connect zone
- The Plainfield Avenue (M-44) corridor between I-96 and East Beltline Avenue <sup>⓵</sup>, which is partially served by Route 11
- The East Beltline Avenue (M-44) corridor between I-96 and 3 Mile Road <sup>⓶</sup>, which is just beyond the terminus of Route 15

**Figure 8: Highest Volume Desire Lines for All Modes**



**Trips by All Modes Throughout Zone 1**

- 200 - 300 Daily Trips
- 301 - 500 Daily Trips
- 501 - 1,431 Daily Trips
- TAZs Outside ITP Member Communities with Strong Desire Lines
- Zone One Boundary
- ITP Member Communities
- Rapid Connect Service Areas
- The Rapid Routes (Winter 2023)



Source: Fall 2021 Replica Origin-Destination Details for trips with origins in any TAZ within Zone One and destinations in any TAZ within Zone One

Desire lines for all modes of transportation specifically to and from the downtown Grand Rapids CBD are mapped in Figure 9. Although there are a significant number of trips connecting to the downtown Grand Rapids CBD (see Table 1 on page 8), these desire lines are weaker and more disperse than many of the desire lines between Zone 1 TAZs. For example, whereas many desire lines between Zone 1 TAZs had more than 300 daily trips, all but one desire line connecting to the downtown Grand Rapids CBD had less than 100 daily trips. This difference in volume is highlighted to contextualize the desire lines shown in Figure 9.

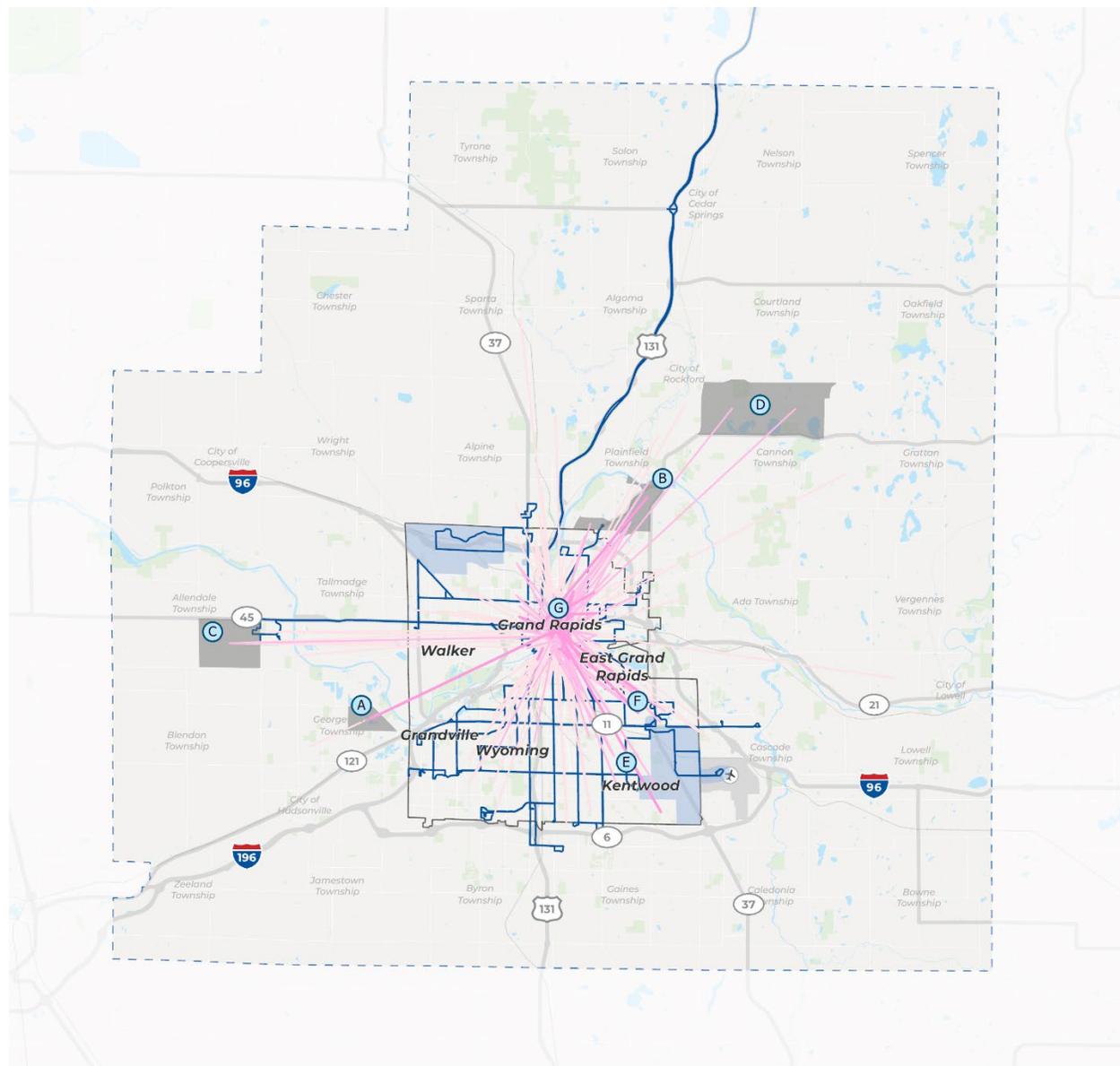
The strongest desire lines to the downtown Grand Rapids CBD from outside the ITP-member communities are listed below and include two potential service expansion opportunities:

- The Jenison area of Georgetown Township <sup>Ⓐ</sup> [Not currently served by The Rapid]
- The Plainfield Avenue (M-44) corridor between I-96 and East Beltline Avenue <sup>Ⓑ</sup>
- GVSU Allendale Campus <sup>Ⓒ</sup>
- The area around the lakes in Rockford/northwestern Cannon Township <sup>Ⓓ</sup> [Not currently served by The Rapid]

The strongest desire lines to the Downtown Grand Rapids CBD from within the ITP-member communities are currently served by existing fixed route services and include:

- Kentwood <sup>Ⓔ</sup>
- The Calvin University and Woodland Mall area <sup>Ⓕ</sup>
- The neighborhoods surrounding the CBD <sup>Ⓖ</sup>

**Figure 9: Downtown Desire Lines for All Modes**



**Trips by All Modes to Downtown Grand Rapids CBD**

- 20 - 30 Daily Trips
- 31 - 50 Daily Trips
- 51 - 119 Daily Trips
- TAZs Outside ITP Member Communities with Strong Desire Lines
- - - Zone One Boundary
- ITP Member Communities
- Rapid Connect Service Areas
- The Rapid Routes (Winter 2023)

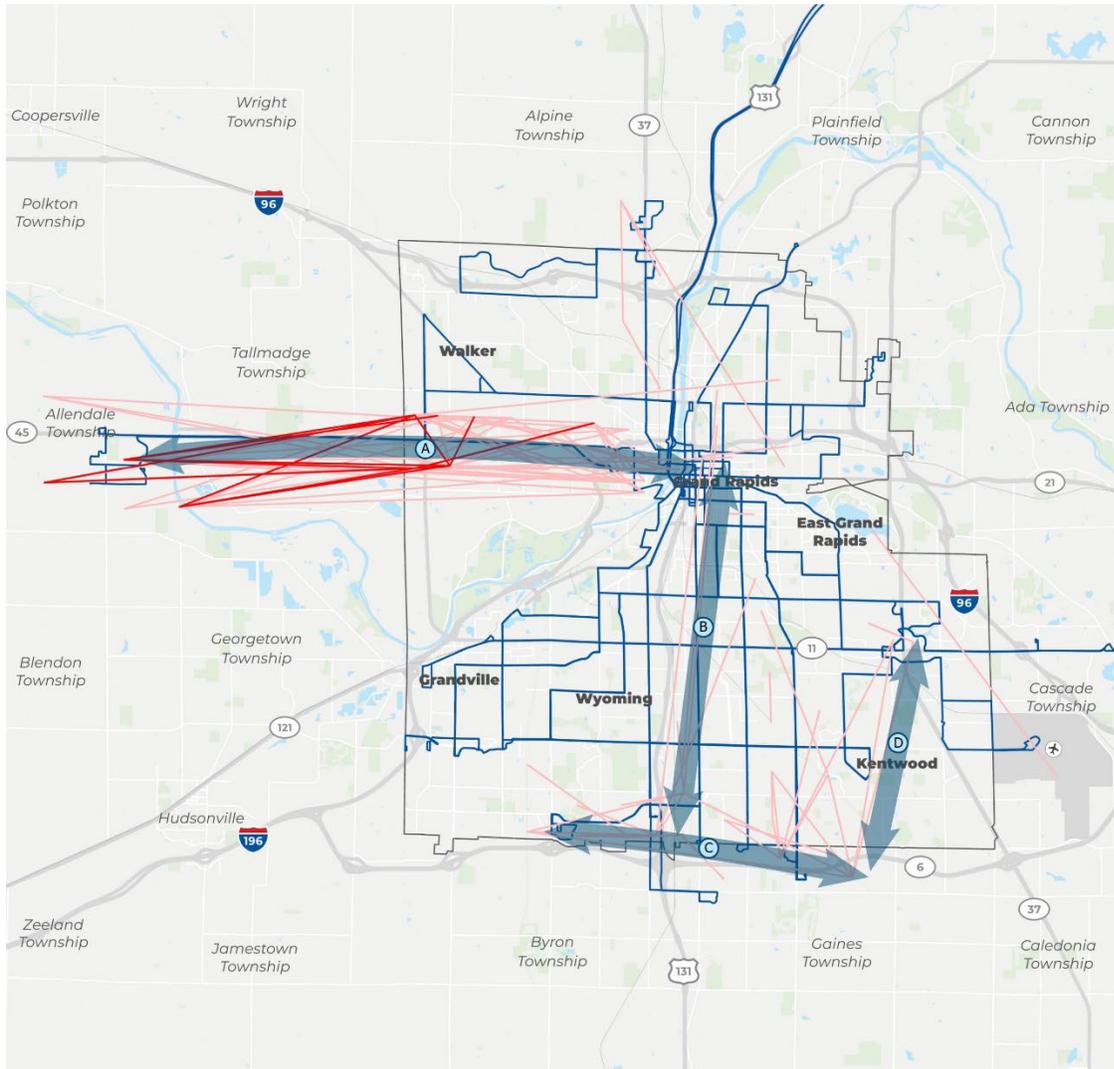


Source: Fall 2021 Replica Origin-Destination Details for trips with origins in any TAZ within Zone One and destinations in any TAZ within the Downtown Grand Rapids CBD

## Transit

Origin-destination desire lines for public transit only are mapped in Figure 10. The Lake Michigan Drive (M-45) corridor served by the Laker Line BRT route **A** is far and away the strongest desire line, followed by the Division Avenue corridor served by the Silver Line BRT route **B**, and lines connecting to the Gaines Marketplace area from the UM Health – West Hospital area to the west **C** and the Woodland Mall area to the north **D**.

**Figure 10: Highest Volume Public Transit Desire Lines**



### Trips by Public Transit Throughout Zone 1

- ITP Member Communities
- The Rapid Routes (Winter 2023)
- Public Transit Desire Lines Between TAZs
- 5 - 15 Daily Trips
- 16 - 43 Daily Trips



Source: Fall 2021 Replica Origin-Destination Details for trips with origins in any TAZ within Zone One, destinations in any TAZ within Zone One, and primary mode of public transit

# Market Analysis

This section describes the transit market analysis process and results. The transit market analysis establishes areas of The Rapid's existing service area and surrounding communities that have a stronger potential for transit and may be used to determine the type and level of investment for potential transit service as well as highlighting existing gaps in service. Two key questions guide this market analysis:

- Where should transit services go?
- Which locations should be connected to each other by transit?

## Key Findings

### Locations: Where should transit services go?

- As of Fall 2022, The Rapid's fixed route service was well aligned with key transit markets as a majority of the Zone 1 population (77%) and jobs (89%) in block groups with "Very High" or "High" transit market scores were within a quarter mile of a bus stop
- Areas with the strongest transit markets containing high transit demand propensity, and trip generation potential include:
  - Within and adjacent to downtown Grand Rapids
  - Northern Cutlerville east of US-131
  - The Alpine Avenue NW Corridor (Comstock Park, Alpine Center, and West Grand neighborhoods)
  - The Burton Street SW Corridor
  - Surrounding the intersection of 44th Street SE and Breton Road SE in Kentwood
  - Adjacent to colleges/universities including GVSU and Calvin University
- Areas with sufficient transit demand as well as transit propensity and trip generation potential to support potential service extensions outside the ITP-member communities include extending Route 11 further north along Plainfield Avenue NE to the North Kent Center and Five Mile Road as well as serving Jenison (Georgetown Township) potentially by extending Route 28.

### Connections: Which locations should be connected to each other by transit?

- Based on a synthesis of transit market locations and origin-destination desire lines, there are approximately a dozen key connections throughout Zone One that should be connected by transit services. The majority of these connections are served by or in close proximity to at least one fixed route or Rapid Connect service. Four connections, however, either lack existing service or require more than one transfer. Connections with opportunities for greater connectivity include:
  - East Beltline Avenue
  - Between Jenison and downtown Grand Rapids
  - Between Gaines Marketplace to Woodland Mall/Calvin University
  - Between UM Health – West Hospital and Gaines Marketplace

## Transit Market Locations

### Where should transit services go?

To identify where transit services should go, a transit market score was generated for all Zone One block groups based on three transit market components assessed in the *Existing and Future Conditions Report*: Transit Demand, Transit Propensity, and Trip Generation. The following subsections provide a brief overview of each component culminating in a composite transit market score that reveals the micro-markets within Zone One.

### Transit Demand

As introduced in the *Existing and Future Conditions Report*, the two primary factors indicating existing demand for transit services are population and employment density. Aggregating these two quantitative metrics<sup>3</sup> reveals that nearly all block groups (98%) within the ITP-member communities have sufficient demand to support some level of fixed route bus service while north-south corridors have stronger demand than east-west crosstown corridors (Figure 11). Downtown Grand Rapids, has the highest demand for transit with demand diminishing towards the periphery of the ITP-member communities. Areas with sufficient demand to support 60-minute fixed route service outside The Rapid's current service area include Jenison and further west along Baldwin Street (Georgetown Township) as well as further north along Plainfield Avenue NE to the Grand River.

Key corridors most supportive of fixed route bus services include:

- Burton Street SW (East-West) <sup>Ⓐ</sup>
- Alpine Avenue NW (North-South)
- Division Avenue (North-South)
- Eastern Avenue SE (North-South) <sup>Ⓑ</sup>
- Kalamazoo Avenue SE (North-South) <sup>Ⓒ</sup>
- Plainfield Avenue NE (North-South)
- 28th Street [M-11] (East West)
- 44<sup>th</sup> Street (East-West)

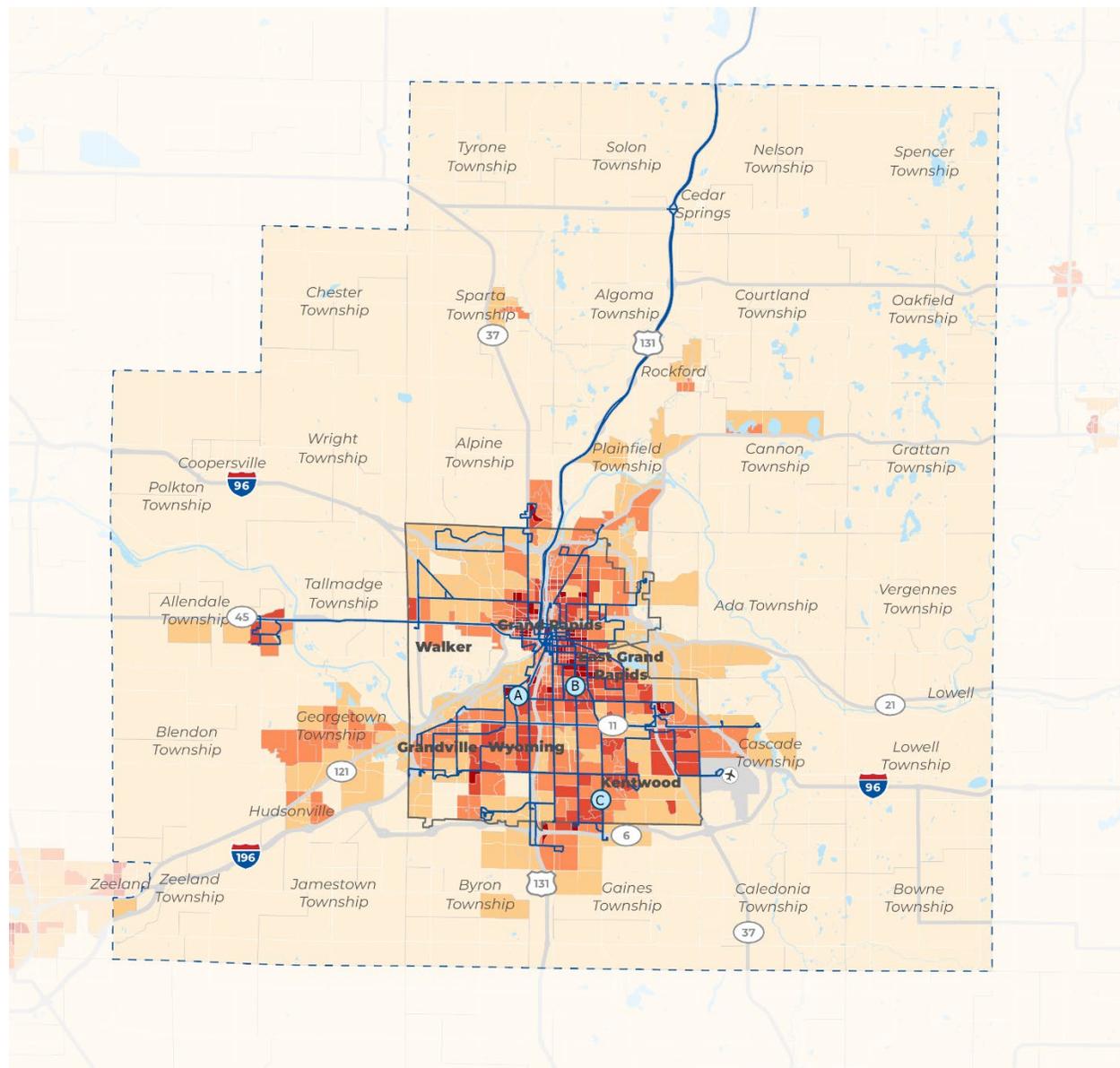
More than 95% of Zone One block groups supportive of 30-minute service are within 0.25 mi of a route with 30-minute or better service

To identify potential service gaps, the level of service supported by existing transit demand was compared to the level of midday service provided by The Rapid's fixed routes on weekdays in Fall 2022.

- More than two-thirds (23/30) of Zone One block groups supportive of 15-minute or better service are within a quarter mile of a bus stop served by a high frequency route. Five of the seven block groups greater than a quarter mile from high frequency routes are located within a quarter mile of either Route 10 or Route 24.
- More than 95% of Zone One block groups supportive of 30-minute service are within a quarter mile of a bus stop served by a route with 30-minute or better headways. Although portions of these block groups fall within a quarter mile of 30-minute or better bus service many of the industrial block groups along Broadmoor Ave SE (Route 27) exceed this distance. In these locations, however, customers can use Rapid Connect services to could connect to 30-minute or better service.

<sup>3</sup> Please see **Appendix A** of the *Existing and Future Conditions Report* for additional detail on the Transit Demand scoring methodology.

**Figure 11: Existing Transit Demand Index**



**Transit Demand Index**

Service Frequency Supported by Existing Population and Employment

- Insufficient Demand
- > 60 Minutes
- 60 Minutes
- 30 Minutes
- 15 Minutes or Better
- Zone One Boundary
- ITP-Member Communities
- The Rapid Routes (Winter 2023)



Source: 2019 US Census Bureau Longitudinal Employer-Household Dynamics (LEHD) dataset, 2021 American Community Survey (ACS) 5-Year Block Group Estimates, The Rapid

## Transit Propensity

As outlined in the *Existing and Future Conditions Report*, evaluating transit propensity is an essential component in understanding the transit market as a transit propensity analysis identifies areas where the population is more likely to need and utilize public transportation services compared to the general public.

To identify census block groups with higher rates of transit propensity, this analysis equally weighted the densities of eight population/household characteristics typically correlated with transit reliance and usage. These indicators were each scored from 1 (lowest propensity) to 5 (highest propensity) to produce a composite transit propensity index with a maximum possible value of 40. Please see **Appendix A** of the *Existing and Future Conditions Report* for additional detail on the Transit Propensity scoring methodology.

As illustrated in Figure 12, areas with particularly high transit propensity are clustered into four primary areas:

- **Downtown Grand Rapids:** Generally bounded by Michigan St NE, Eastern Avenue NE, Wealthy Street SE, and the Grand River this core area ranks highly in nearly all of the eight population characteristics
- **West Grand Rapids (West Grand, SWAN) <sup>Ⓐ</sup>:** Similar to downtown Grand Rapids, the West Grand and SWAN neighborhoods contain high concentrations of low income and zero vehicle households as well as rental units, persons with disabilities, and existing transit users.
- **Along Burton Street SE:** This crosstown street runs east-west through the southern portion of Grand Rapids connecting the cities of Wyoming and Kentwood. This area ranks highly across all eight population characteristics particularly along the northeast side of the street. Additionally, the block groups surrounding the intersection of Division Street and Burton Street SE <sup>Ⓑ</sup> as well as near Calvin University have some of the highest densities of existing transit users in the Zone One Study Area.
- **South East End <sup>Ⓒ</sup>:** Adjacent to the Burton Street SE Corridor, the South East End neighborhood contains a high density of low-income and minority populations as well as persons with disabilities.

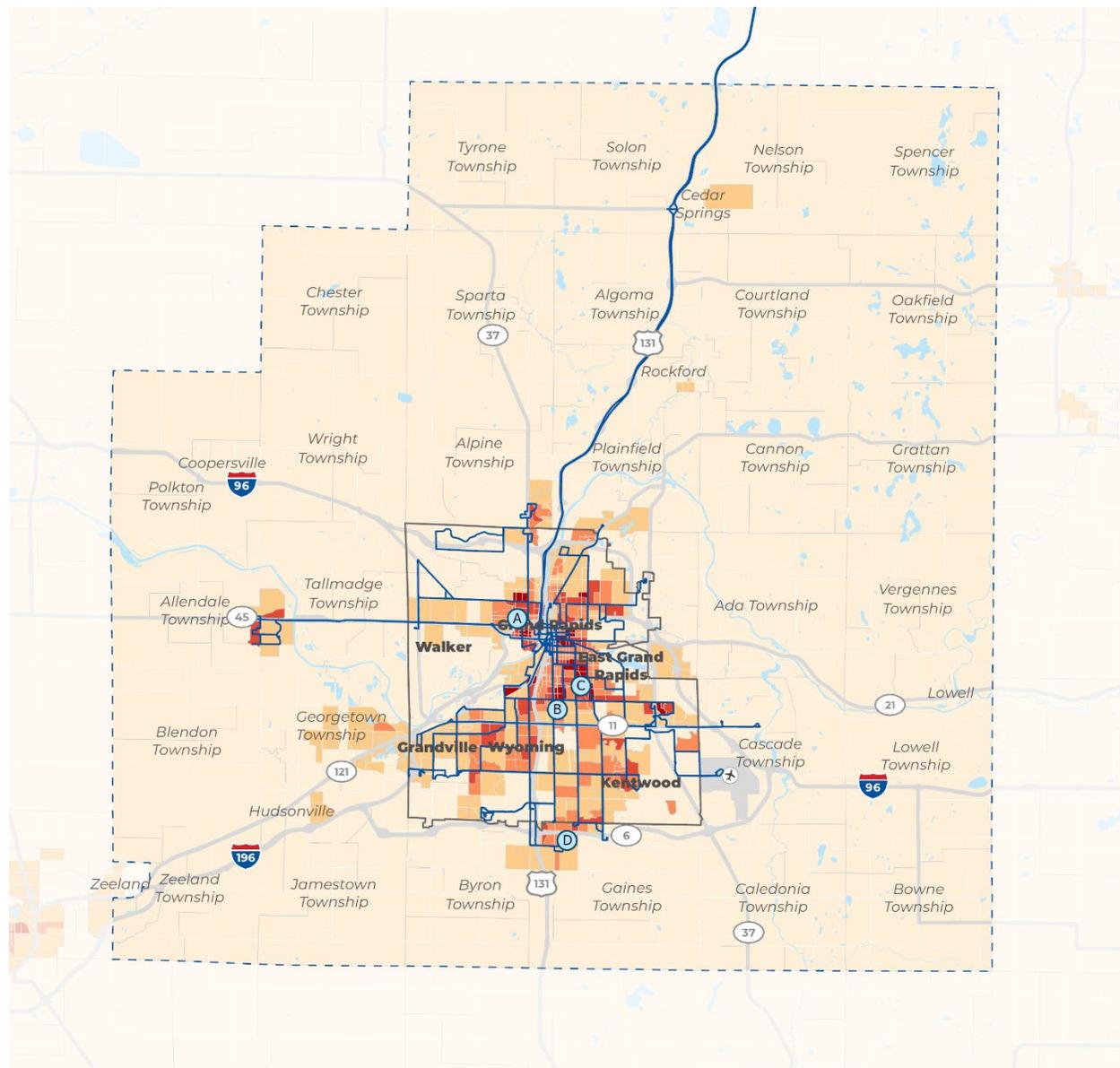
The Rapid's existing bus service serves nearly all block groups with a "Medium" or higher transit propensity both within and outside the ITP-member communities. Outside the ITP-member communities, only about a dozen of the more than 200 Zone One block groups have a "Medium" or higher transit propensity. These blocks are located near Cutlerville <sup>Ⓓ</sup>, GVSU and Route 9's northern terminus in Alpine Township (Comstock Park/Alpine Center neighborhoods between Lamoreaux Drive NW and I-96) as well as one block group in Georgetown Township. Out of these 12 block groups, all but one are located near an existing bus route.

### Transit Propensity Indicators

- Minority Populations
- Young adults ages 18-24
- Seniors ages 65+
- Persons with disabilities
- Individuals living below the poverty line
- Zero-vehicle households
- Rental units
- Existing transit users

Existing bus routes serve nearly all block groups with a "Medium" or higher transit propensity both within and outside the ITP-member Communities

**Figure 12: Composite Transit Propensity Index (2021)**



**Composite Transit Propensity Index**

- Very Low (8 - 11)
- Low (12 - 16)
- Medium (17 - 21)
- High (22 - 26)
- Very High (27 - 34)
- Zone One Boundary
- ITP Member Communities
- The Rapid Routes (Winter 2023)



Source: 2021 American Community Survey (ACS) 5-Year Block Group Estimates, The Rapid

## Trip Generation

In addition to transit demand and transit propensity, transit usage is also influenced by the built environment and trip purpose. To quantify and identify areas with high trip generation potential, equal weight was applied to each of three metrics at the census block group level: existing land use, future land use, activity center density.<sup>4</sup> These characteristics were each scored from 1 (lowest potential) to 5 (highest potential) and then summed together to produce a composite index with a maximum possible value of 15. Existing and master plan (future) land use characteristics were summarized as the percentage of a block group's area that had a high intensity transit supportive land use<sup>5</sup> while activity center data was summarized as the density of activity centers within a block group. Please see **Appendix A** of the *Existing and Future Conditions Report* for additional detail on the Transit Generation scoring methodology.

As highlighted in Figure 13, nearly all block groups with high trip generation potential are in close proximity to a bus route. Areas with particularly high trip generation potential are clustered into eight primary areas:

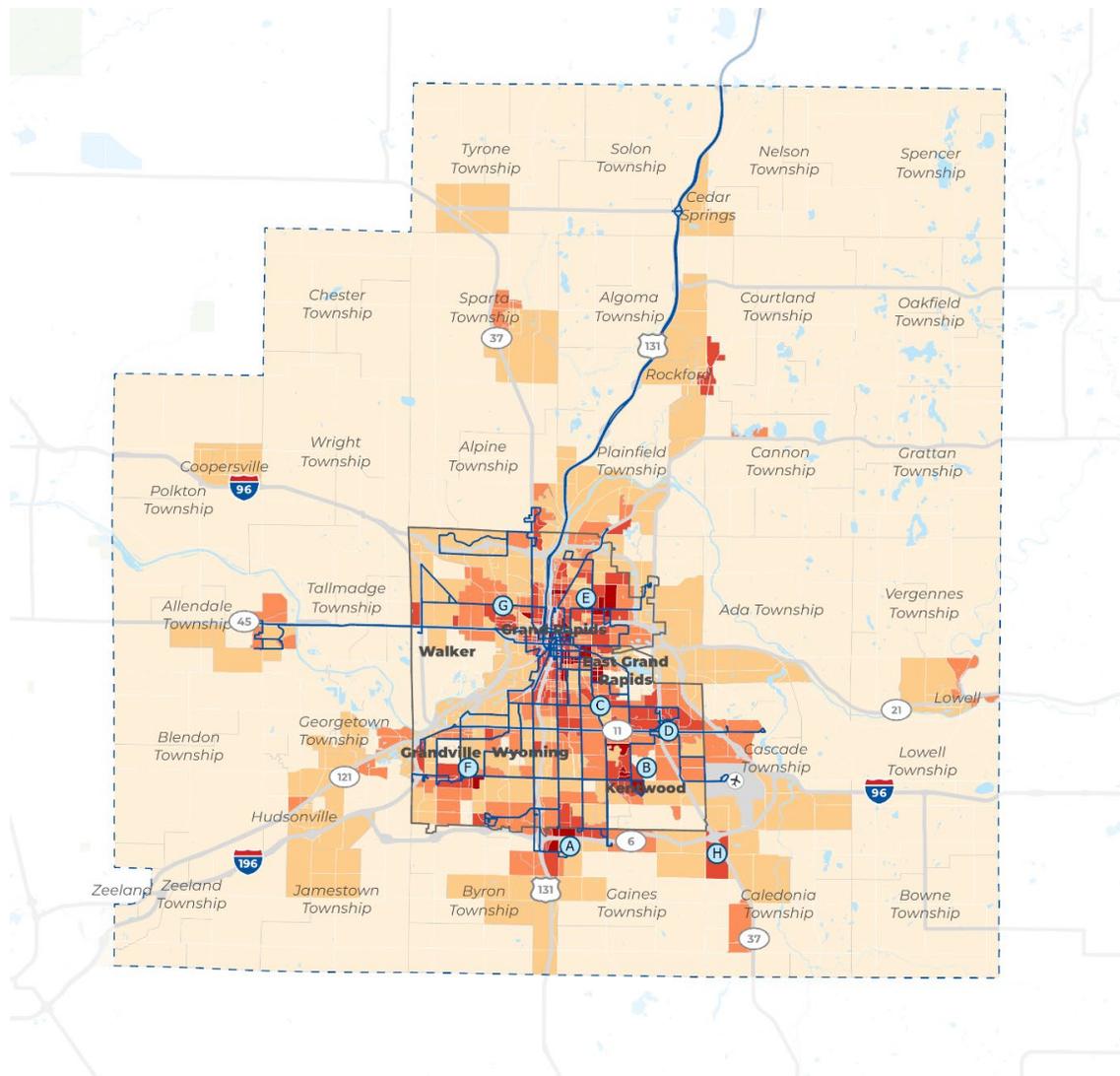
- **Downtown Grand Rapids:** Generally bounded by Michigan St NE, Eastern Avenue NE, Wealthy Street SE, and the Grand River this core area ranks highly in all three trip generation metrics
- **Cutlerville <sup>Ⓐ</sup>:** With 9 existing mobile home parks as well as planned multifamily and mixed-use land uses in the future, the portion of Cutlerville east of US-131 has very high trip generation potential
- **Central Kentwood <sup>Ⓑ</sup>:** The presence of the Ross Medical Education Center, several multifamily apartments, and a variety of groceries and other stores located near the intersection of 44<sup>th</sup> Street SE and Breton Road SE suggest very high trip generation potential in this area
- **Burton Street SE Corridor <sup>Ⓒ</sup>:** Much like for the transit propensity index and transit demand index, the east-west Burton Street SE Corridor ranks highly across all three trip generation metrics characteristics particularly along the north and eastern side of the corridor.
- **Surrounding Calvin University <sup>Ⓓ</sup>:** This area contains a high density of activity centers located in a mix of multifamily housing, and civic, medical, and commercial uses.
- **Northeast Grand Rapids between I-96 and I-196 <sup>Ⓔ</sup>:** Although currently comprised of primarily single-family residential uses, the area has a high concentration of activity centers, and the planned land uses for this area are primarily mixed use.
- **Bucktown Shopping Center and RiverTown Crossing Mall Area <sup>Ⓕ</sup>:** Located along Rivertown Parkway/44<sup>th</sup> Street SW from I-196 to Byron Center Ave SW, this area has a diverse amount and high density of activity centers including the Ferrand Estates mobile home park and the RiverTown Crossing mall.
- **West Grand Rapids (West Grand, SWAN) <sup>Ⓖ</sup>:** This area, particularly near the Grand River, has significant portions of existing civic/institutional uses and is planned to be primarily mixed use in the future

<sup>4</sup> Note: Activity centers include the following categories: College/University, Entertainment, Gerald R. Ford International Airport, Grocery Store/Supermarket, Healthcare Facilities, Child Care Center, K-12 Facilities, Mobile Home Parks

<sup>5</sup> Note: High intensity transit supportive land uses include the following categories: Airport, Civic/Institutional, Commercial/Office, Mixed Use, Multifamily Residential

Outside the ITP-member communities, areas with “Medium” or higher trip generation potential include portions of Sparta Township, Lowell, and Rockford, as well as south of M-6 near Davenport University and the Amazon Warehouse located off of 68<sup>th</sup> Street SE **H**.

**Figure 13: Composite Trip Generation Potential Index**



**Composite Trip Generation Potential Index**

- Very Low (1 - 4)
- Low (5 - 7)
- Medium (8 - 9)
- High (10 - 11)
- Very High (12 - 15)
- Zone One Boundary
- ITP-Member Communities
- The Rapid Routes (Winter 2023)



Source: GVMC Single Source Online Web Map, Homeland Infrastructure Foundation-Level Data (HIFLD), Urban Footprint, AECOM  
 Note: Compared to other block groups, the area encompassed by the Gerald R. Ford International Airport is unique in that it contains only one activity center rather than a high density of smaller activity centers. Recognizing that the airport is a significant trip generator that may not be otherwise captured by this methodology, the airport footprint has been shaded light gray but is treaded as a key trip generation location.

## Composite Transit Market Score

To calculate a composite transit market score for all Zone One block groups, each of the three transit market components were scored from 1 (lowest potential) to 5 (highest potential) based on the breakpoints shown in Figure 12 to Figure 14. These individual component scores were then summed together to produce a composite index with a maximum possible value of 15. For example, if a given block group had “Low” (2) transit demand, “High” (4) transit propensity, and “High” trip generation potential (4) the block group would receive a composite transit market score of 10. Block groups were then categorized based on naturally occurring breakpoints in the distribution of their composite transit market scores as depicted in Figure 14.

Figure 14 shows the transit market score for block groups throughout the Zone One analysis area. The lightest tan color represents areas with the lowest transit market scores (less than 5), and the darkest red represents areas with the highest transit market scores (12 and over). As of Fall 2022, The Rapid’s fixed route service is well aligned with key transit markets as more than three quarters of the Zone One population (77%) and nearly 89% of jobs in block groups with “Very High” or “High” transit market scores are within a quarter mile of a bus stop.

Existing fixed route services are well aligned with key transit markets as 77% of people and 89% of jobs in Zone One. **Very High or High** transit market block groups are within a quarter mile of a bus stop as of Fall 2022

Overall, the largest share of block groups with “Very High” and “High” transit market scores are located in and adjacent to downtown Grand Rapids <sup>Ⓐ</sup> bounded by the Grand River to the west, Leonard Street NE to the north, Plymouth Avenue NE to the east, and Burton Street SE to the south. This area both produces and attracts many transit trips and contains populations with high transit propensity. Other notable areas with “Very High” and “High” transit market scores include northern Cutlerville <sup>Ⓑ</sup>, the Comstock Park and Alpine Center neighborhoods <sup>Ⓒ</sup> between Alpine Ave NW, Lamoreaux Drive NW, US-131, and I-96, the West Grand neighborhood <sup>Ⓓ</sup>, surrounding the intersection of 44<sup>th</sup> Street SE and Breton Road SE in Kentwood <sup>Ⓔ</sup>, and adjacent to GVSU Allendale Campus <sup>Ⓕ</sup> and surrounding Calvin University <sup>Ⓖ</sup>.

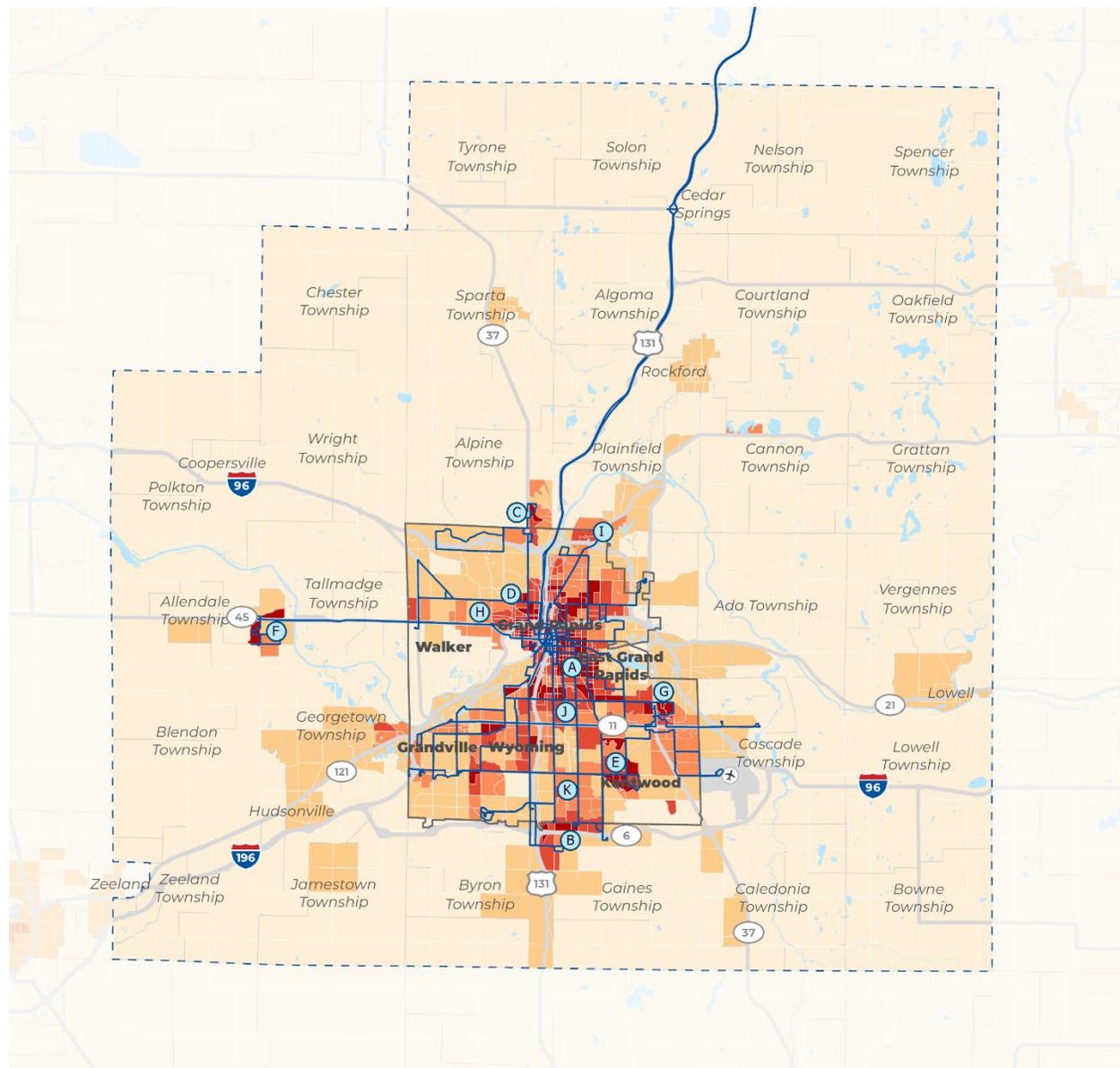
Mid-level transit markets with a “Medium” score are primarily concentrated in the Westside Connection neighborhood <sup>Ⓗ</sup>, northwest of the Gerald R. Ford International Airport, along Plainfield Ave NE <sup>Ⓘ</sup>, between Burton Street SE and 28<sup>th</sup> Street SE (M-11) <sup>Ⓝ</sup>, and between Division Avenue S and Kalamazoo Avenue SE <sup>Ⓚ</sup>. Within the ITP-member communities, only Southern Walker and Southeast Kentwood have significant uninterrupted areas that have a “Very Low” transit market.

### Potential Areas for New Fixed Route Service

Opportunities for future service expansion could include providing additional service to “Medium” transit markets where just 55% of the population and 60% of jobs in these Zone One block groups are currently within a quarter mile of a bus stop. Although nearly all “Medium” transit market block groups are contained within the ITP-member communities, more distant areas with elevated transit markets for potential fixed route transit service extension include Jennison (Georgetown Township) and further north along Alpine Avenue NW and Plainfield Avenue NE.

Opportunities for future fixed route service expansion into medium transit markets could include extending Route 28 to Jenison and Route 11 to 5 Mile Road and the North Kent Center

**Figure 14: Transit Market Score**



**Composite Transit Market Score**

- 3 - 4 (Very Low)
- 5 - 7 (Low)
- 8 - 9 (Medium)
- 10 - 11 (High)
- 12 - 15 (Very High)
- Zone One Boundary
- ITP Member Communities
- The Rapid Routes (Winter 2023)



Source: 2021 American Community Survey (ACS) 5-Year Block Group Estimates, GVMC Single Source Online Web Map, Homeland Infrastructure Foundation-Level Data (HIFLD), Urban Footprint, Fall 2021 Replica Data, AECOM

## Transit Market Connections

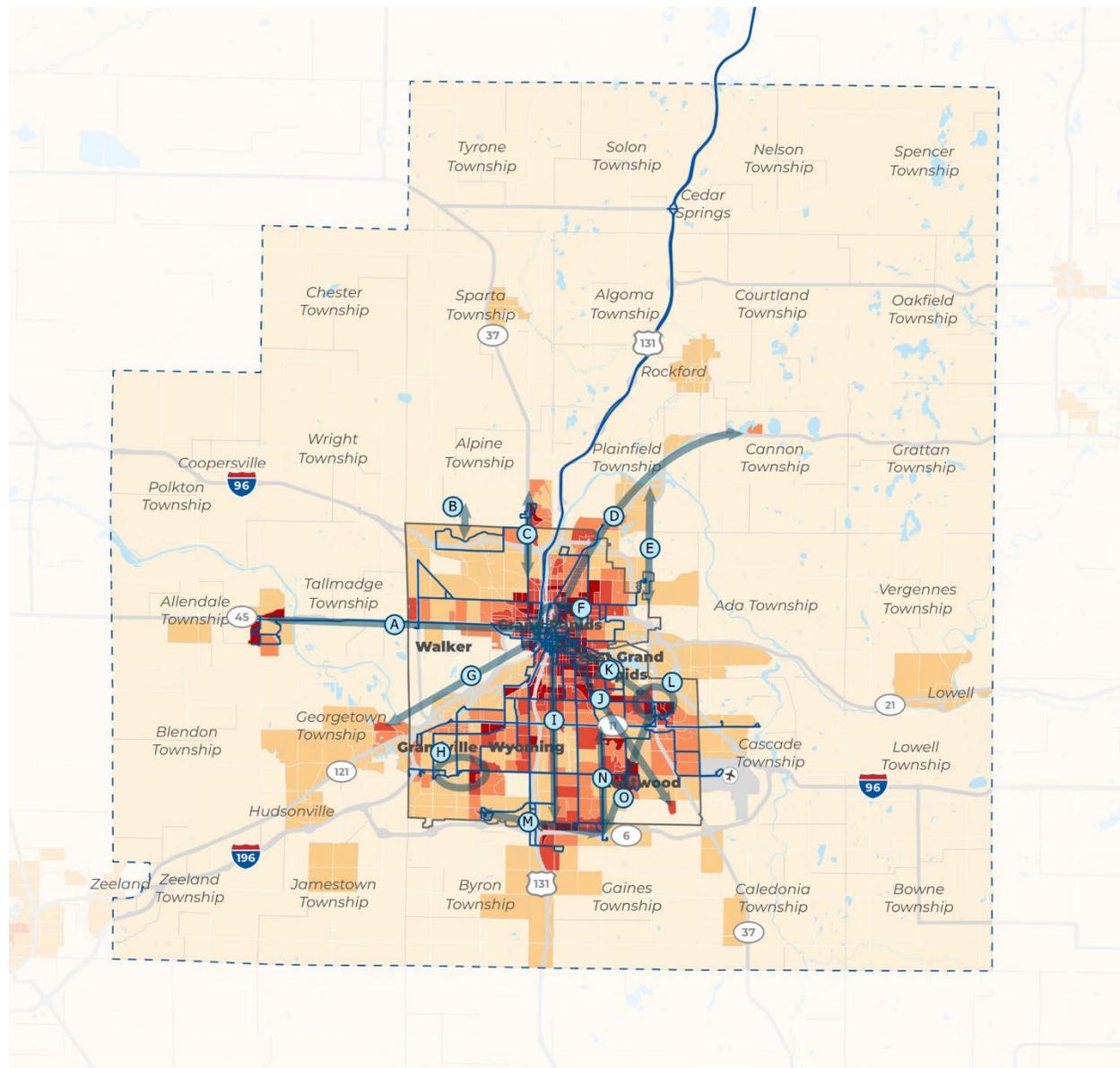
### *Which locations should be connected by transit?*

The strongest Zone One origin-destination desire lines, represented as generalized connections or areas, are overlaid on the transit market layer in Figure 15 and identified below. These desire lines represent opportunities for improved transit connectivity and mode shift from automobile travel to transit. The majority of these key connections are served by at least one fixed route service or Rapid Connect zone however four connections either have no existing fixed-route service or one or more transfers would be required using the fixed route network as of Fall 2022. Due to the prevalence of trips between these locations, these connections could be considered for future transit service provided either via traditional fixed route services or emerging mobility options such as on-demand Rapid Connect microtransit services.

**Table 2: Top Generalized Desire Lines**

Connection	Existing and Nearby Route(s)
Ⓐ Lake Michigan Drive Corridor	Laker Line BRT
Ⓑ Alpine Meadows Mobile Home Park – North Walker Industrial Area	Route 33 (Winter 2023) Walker Rapid Connect Zone
Ⓒ Alpine Avenue NW/M-37 Corridor	Route 9
ⒹⒺ The M-44 corridors (Plainfield Avenue / East Beltline Avenue)	Plainfield Avenue: Route 11 with <b>No Existing Fixed-Route Service north of the Plainfield Meijer</b> East Beltline Avenue: <b>No Existing Fixed-Route Service</b>
Ⓕ Between Downtown Grand Rapids and its surrounding neighborhoods	All routes except Routes 24, 27, 28, 29, 33, 37, 48, 85, and 100
Ⓖ Between Jenison and Downtown Grand Rapids	<b>No Existing Fixed-Route Service</b>
Ⓗ Between RiverTown Crossings and its surrounding area	Routes 3, 8, 24, and 44
Ⓘ Division Avenue Corridor	Silver Line BRT, Route 1
Ⓙ Between northern Kentwood and Downtown Grand Rapids	Routes 2, 5
Ⓚ Between the Calvin University and Woodland Mall area and Downtown Grand Rapids	Route 6
Ⓛ Between Calvin University, Woodland Mall, and their surrounding areas	Routes 5, 6, 24, 27, 28, 29, and 44 Kentwood Rapid Connect Zone
Ⓜ Between UM Health – West Hospital and Gaines Marketplace	<b>No Direct Fixed-Route Service</b>
Ⓝ Kalamazoo Avenue Corridor	Route 2
Ⓞ Between Gaines Marketplace and Woodland Mall/Calvin University and surrounding areas	<b>No Direct Fixed-Route Service</b>

**Figure 15: Top Desire Lines**



**Composite Transit Market Score and Top Origin-Destination Desire Lines**

- 3 - 4 (Very Low)
- 5 - 7 (Low)
- 8 - 9 (Medium)
- 10 - 11 (High)
- 12 - 15 (Very High)
- Zone One Boundary
- ITP Member Communities
- The Rapid Routes (Winter 2023)



Source: 2021 American Community Survey (ACS) 5-Year Block Group Estimates, GVMC Single Source Online Web Map, Homeland Infrastructure Foundation-Level Data (HIFLD), Urban Footprint, AECOM

# Emerging Mobility Options

The Rapid has a long history of implementing and leveraging emerging mobility technologies. Examples include the Passenger Adaptive Suburban Service (PASS) program (a demand response suburban feeder shuttle that transports passengers from their curb to the fixed-route system), the introduction of two Rapid Connect On-Demand service areas in job-growth zones at the outer edges of the service area, and supported the partnership of May Mobility with Mobile GR to pilot autonomous vehicles on the DASH West route<sup>6</sup> from 2019 to April 2022.

Building upon this history of innovation, this section introduces several emerging mobility options; highlights associated challenges and opportunities; and explores potential applications for The Rapid to leverage these technologies to enhance traditional fixed route services. The trends and technologies evaluated here include both **mobility services** (microtransit, Mobility as a Service (MaaS), and shared mobility solutions) as well as **emerging vehicle technologies** (Automated Vehicles, Connected Vehicles, and Electric Vehicles).

## Key Findings

Emerging mobility services and vehicle technologies are changing the transportation industry and transforming the traditional transit market. Generally, microtransit can provide on-demand, highly flexible routing and scheduling with a much smaller group of passengers and smaller vehicles compared to conventional transit options; MaaS integrates multiple types of transportation services and enables more dynamic and comprehensive trip-planning and payment for individual users; Automated and Connected Vehicle Technologies can be deployed into different modes and scenarios and potentially transport people in much cleaner, safer, and affordable ways; Shared Mobility Solutions complements conventional public transit and alleviates mobility equity issues; and Electric Vehicle Technologies reduces greenhouse gas (GHG) emissions and noise impacts, creating a more sustainable roadway environment.

Potential markets for further exploration and analysis of emerging mobility suitability include:

- **Microtransit:**
  - Areas of lower fixed route demand including Jenison (Georgetown Township), East Beltline Avenue Corridor, and Cutlerville/along US-131 south of M-6
  - Extension of the Kentwood Rapid Connect Zone to serve existing and growing employment centers near Davenport University and Amazon
  - Along or in place of portions of underperforming routes such as Routes 24 and 27
- **MaaS:**
  - Consideration of system-wide MaaS
  - Mobility hubs at high-capacity transit stations, transit centers and high-volume stops, and regional shopping centers including, but not limited to, Rapid Central Station, Woodland Mall/Kentwood Station, Rivertown Transit Center, Alpine Center, GVSU, Calvin University, and Standale and Jenison Meijer Stores
- **Shared Mobility:**
  - Areas with high in-zone trip demand or young adult population density including between Calvin University, Woodland Mall, and the Surrounding Area, as well as Alpine Center, the West Grand Neighborhood, and between RiverTown Crossings and its surrounding area

<sup>6</sup> Source: Mobility for All: Comprehensive Operational Analysis, The Rapid, March 2021

## Emerging Mobility Services

Emerging mobility services including Microtransit, Mobility as a Service (MaaS), and Shared Mobility Services are often software-centric, small-scaled mobility services. Some of these emerging mobility services may be able to meet The Rapid's needs for new or expanded transit services. The benefits and challenges of each emerging mobility service are detailed in Table 3.

### Microtransit

Microtransit is a small-scale, on-demand public transit service that can offer fixed routes and schedules, as well as flexible routes and on-demand scheduling.<sup>7</sup> Microtransit services typically offer more expansive service coverage than fixed-route transit systems, feature shorter travel times and more convenient booking and payment experiences, as well as affordable and comfortable trips. Across the industry, on-demand microtransit services have been increasingly embraced as a cost-effective solution to provide high-quality transit services in areas of low density and transit demand. However, depending on the purpose and scope of the program, the service is usually geographically restricted to certain zones/areas, and most booking systems require smartphones, which could also limit the potential user base for the new service.

In 2019, the Transit Cooperative Research Program (TCRP) conducted a survey of 22 transit agencies that had implemented demand response/microtransit service to summarize the current state of the practice. This survey identified that several of the primary reasons for providing microtransit service were to gain operational efficiency and reduce costs, provide jurisdictional equity, expand economic opportunity, and continue service for the elderly and those with disabilities.<sup>8</sup> When planning and designing microtransit services, agencies typically consider the existing transit demand and transit market as well as areas served by underperforming fixed routes. Although the definition of an underperforming route differed between agencies, routes that “carried less than half of the system average in terms of passengers per hour were often considered...potentially good candidates for microtransit service.”<sup>8</sup> Due in part to the recent rise of this mobility service and lack of industry service standards, survey respondents noted that identifying micromobility zones and designing service typically requires a high level of involvement with the communities to be served.

### Recent Local Examples

Following the recommendations outlined in The Rapid's most recent comprehensive operational analysis (COA), The Rapid recently implemented on-demand microtransit. Rapid Connect is an on-demand service that launched in January 2022, providing a flexible curb-to-curb mobility option for two service areas located in Kentwood and Walker. Each area was a job-growth zone at the edge of the fixed-route system that had not historically been adequately served by fixed-route transit. Rapid Connect trips connect riders to fixed route services and each trip must begin and end within each of the service areas (*i.e.*, customers cannot travel between Walker and Kentwood without transferring to the fixed route bus system). A study of 2022 Rapid Connect Pickups and Drop-Offs (see Existing Conditions report) identified a concentration of rides beginning and ending at major transit transfer centers.

Much like other ride hailing services such as Uber and Lyft, Rapid Connect customers book rides via a mobile app in real-time or up to up to 7-days in advance. All Rapid Connect service vehicles are ADA-accessible Ford Transit vans (See Figure 16) and operate Monday through Friday from 6:00 AM to 10:00 PM. A ride costs \$1.75 per adult passenger and can be paid by cash or transit payment “Wave” cards. Over 5,100 passengers used Rapid Connect in its first year (2022) and served an average of 1.8 passengers per hour and 0.3 passenger per mile. This is significantly lower than the average fixed route bus productivity of 16.2 passenger per

<sup>7</sup> Source: [Microtransit](#), APTA

<sup>8</sup> Source: [Microtransit or General Public Demand Response Transit Service: State of the Practice](#), TCRP, 2019

hour and 1.4 passengers per mile in October 2022. Although microtransit has many opportunities as an emerging mobility service (see Table 3) and may be compatible with several potential markets in the Grand Rapids region (see Table 5), further study of 2022 Rapid Connect performance (see Existing Conditions report) is needed prior to any expansion into additional potential markets.

**Figure 16: Rapid Connect Vehicle**



Source: <https://www.ridetherapid.org/rapidconnect>

## Mobility as a Service (MaaS)

Mobility as a Service (MaaS) is "a single platform [software] where travelers can source and pay for rides across multiple transportation modes."<sup>9</sup> MaaS may include but is not limited to peer-to-peer car sharing, rideshare and other private transportation modes, microtransit, e-scooter and bike sharing, as well as public transit services.

MaaS platforms often provide an integrated suite of mobility services and serve as the nucleus of the physical infrastructure in a MaaS system. MaaS systems are often supported by physical infrastructure such as mobility hubs—locations where a range of transportation options connect and interact with each other. Mobility hubs are essential for a safe and convenient transfer between transportation modes and can enhance the overall traveler experience by supplying dynamic, real-time travel and location-based information. Site selection for mobility hubs typically considers locations such as major high-capacity transit stations, transfer points, park and ride locations, areas of concentrated mobility demand such as employment centers, areas of investment opportunities, and existing transit centers.

## Recent Local Examples

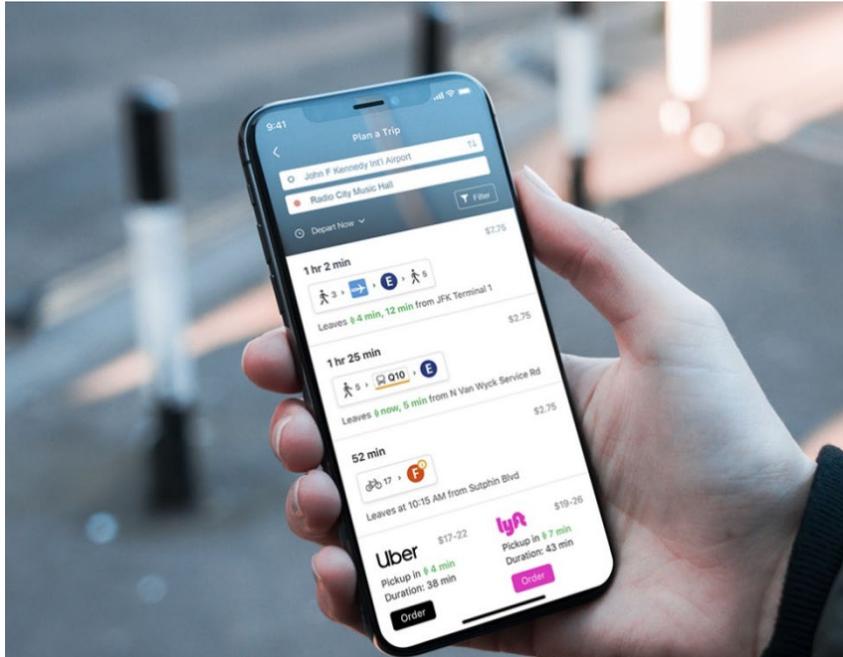
The State of Michigan launched a pilot in March 2023 to develop a state-wide mobility wallet program in support of the State's goal to eventually have a "one stop shop where residents can plan, book and pay for public and private transit, whether it be by bus, train, ride share, or bicycle/scooter rental, through one mobile phone app."<sup>10</sup> Three entities were awarded funds to develop mobility wallet pilots: Ecolane, Feonix – Mobility Rising, and Regional Transit Authority of Southeast Michigan (RTA). Ecolane is a transit technology company currently operating a mobile app that allows users to view a variety of transportation options at once, including price and wait times (similar to City of Tampa example in Figure 17). The RTA is working to develop a mobility wallet that allows for fare capping (a method of setting price caps to reduce the

<sup>9</sup> Source: [Uber Pivots to On-Demand Everything](#), CityLab Transportation, April 11 2018

<sup>10</sup> Source: [Michigan to test mobile apps that make it easier to book, pay for transit](#), MLive, April 21, 2023

difference in costs between short and long-term pay purchase options) and will be compatible with QLine, the Detroit People Mover, the Suburban Mobility Authority for Regional Transportation (SMART) and Detroit Department of Transportation (DDOT). Feonix – Mobility Rising is a non-profit that aims to develop a mobility wallet that meets the needs of veterans and individuals experiencing poverty in Detroit and Jackson as well as locally in Grand Rapids. The Feonix – Mobility Rising project is anticipated to kickoff in August 2023.

**Figure 17: City of Tampa Trials MaaS**



Source: <https://cities-today.com/florida-city-trials-mobility-as-a-service-app/>

## Flex Routes

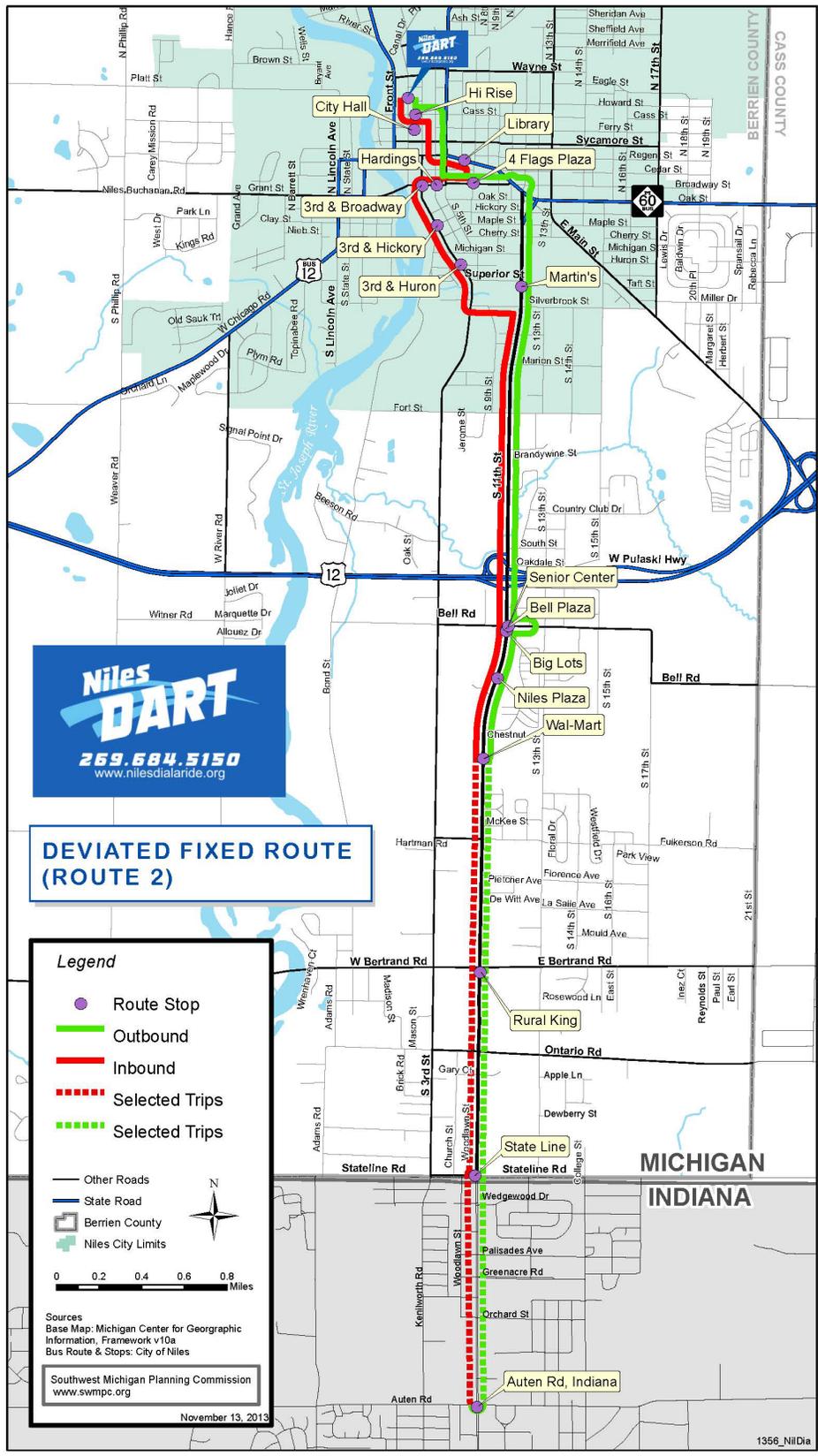
Flex routes (sometimes called deviated routes, deviated fixed routes, or flexible routes) are demand-response bus services that deviate from a fixed route to pick up and drop off passengers. Deviations are requested a minimum of a day in advance and are typically limited to a defined service area. This service helps to increase transit coverage without a significant increase in operations. Flex routes work best in areas of limited transit resources and low population density, most frequently rural areas. Flex routes services are also classified as demand-responsive, meaning they do not need to operate with complementary paratransit services in order to meet American Disability Act (ADA) requirements.

## Recent Local Examples

Niles, Michigan is a city of 11,800 people located on the northern border of Michigan and Indiana. Niles Dial-A-Ride Transportation (DART) services operate demand-response and flex route transit services for the greater Niles and Buchanan area. A division of the City of Niles, DART allows riders to request a pick-up or drop-off at locations up to ½ mile away from the Route 2 bus stops and within specific service areas (see dashed route in Figure 18).

Reservations can be made via phone up to one-hour before pick-up and are taken on a first-come, first-served basis. Drop-offs within the Route 2 bus stop area can also be requested upon boarding however, a limited number of off-route stops are allowed on any given trip. Niles' policy is to bring riders as close to the requested destination as possible, however passengers may be requested to board or exit as much as a block away from their destination if there are operational conflicts, such as narrow streets.

Figure 18: Niles Dial-A-Ride Deviated Fixed Route Service



Source: [www.nilesmi.org/departments\\_and\\_divisions/dial\\_a\\_ride\\_transportation/deviated\\_fixed\\_route\\_service.php](http://www.nilesmi.org/departments_and_divisions/dial_a_ride_transportation/deviated_fixed_route_service.php)

## Shared Mobility Solutions

Shared mobility refers to “transportation services and resources that are shared among users, either concurrently or one after another”<sup>11</sup> which enable users to have short-term access to transportation modes on an “as-needed” basis.”<sup>12</sup> Shared mobility can include auto-based modes such as carsharing, ridesharing (carpooling and vanpooling), ride-hailing and microtransit as well as micromobility (bikesharing and scooter sharing) and public transit. The benefit of shared mobility is access to a wide variety of transportation modes without the costs of individual ownership. Shared mobility services and resources are designed to be convenient and accessible.

### Recent Local Examples

In September 2020, the City of Grand Rapids launched a micromobility pilot to “provide solo, low-cost transportation options on-demand...intended to connect with other transportation services like transit, parking, park-and-ride, and ride sharing.”<sup>13</sup> Between June and September 2021, nearly 100,000 trips were taken using Lime’s e-scooters and e-bikes.<sup>14</sup> In Summer 2022, following the conclusion of the pilot program, the City of Grand Rapids approved the year-round operation of Lime’s dockless e-scooter and e-bike share programs within a select, 12-square mile area near the city’s downtown (see Figure 18). Users register and pay to ride the e-bikes and scooters through a mobile-phone based app. Several city-required safety regulations must be met for users to operate the shared mobility service. For instance, all bikes and scooters must be returned to one of the more than 175 designated virtual “parking areas” once a ride is complete in order to prevent scattering of the dockless mobility devices.

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<sup>11</sup> Source: [What is Shared Mobility?](#), Shared-Use Mobility Center, 2023

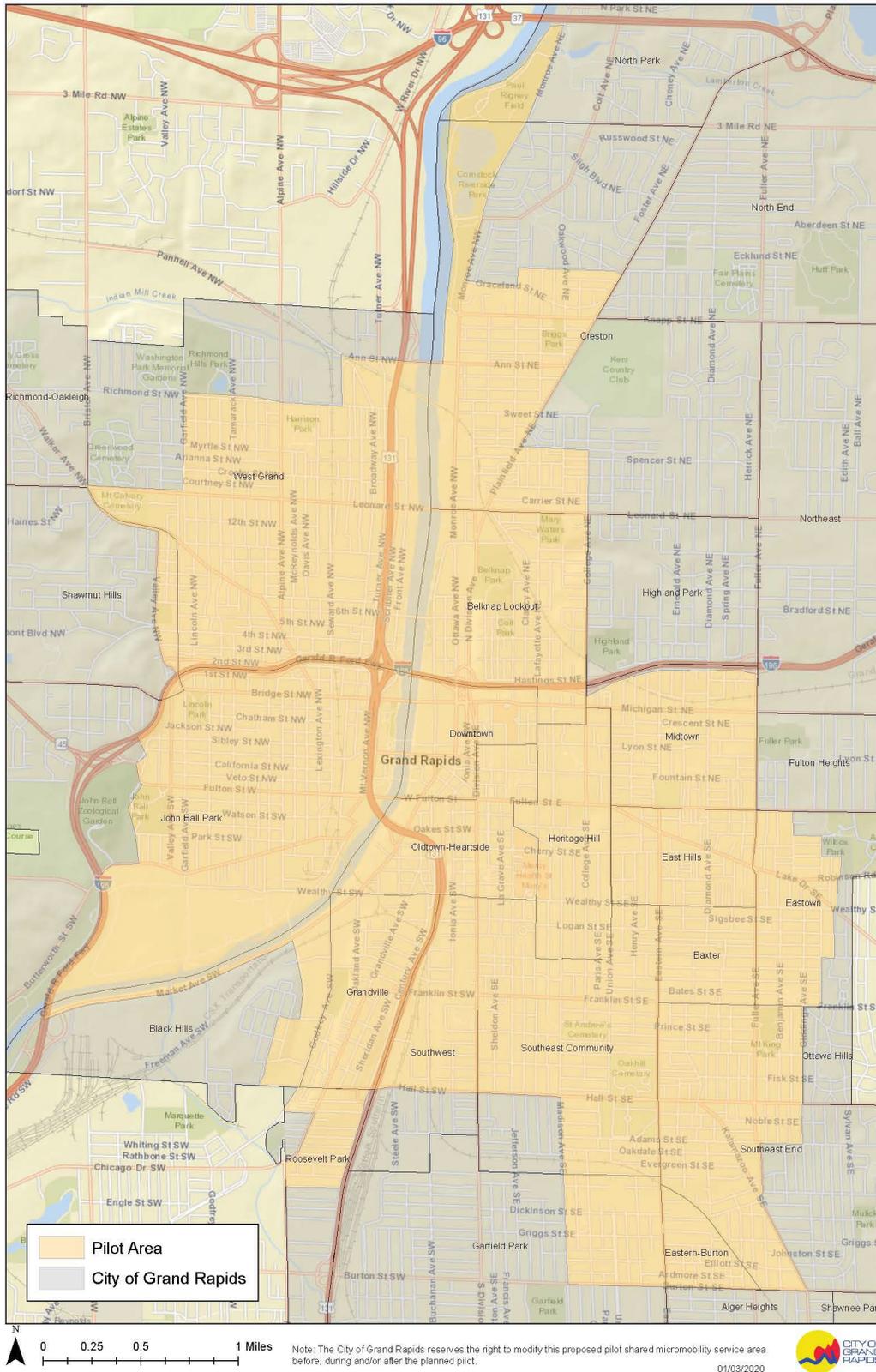
<sup>12</sup> Source: [Shared Mobility: A Sustainability and Technologies Workshop](#), Shaheen et. al., September 2015

<sup>13</sup> Source: [Bike and Scooter Share Program](#), City of Grand Rapids

<sup>14</sup> Source: [Grand Rapids grows micromobility pilot with more e-scooters, bikes](#), Crain’s Grand Rapids Business, June 11, 2021

Figure 19: City of Grand Rapids E-Scooter and E-Bike Share Program Pilot Area

Proposed Shared Micromobility Pilot Service Area



Source: <https://www.grandrapidsmi.gov/Government/Departments/Mobile-GR/Bike-and-Scooter-Share-Program>

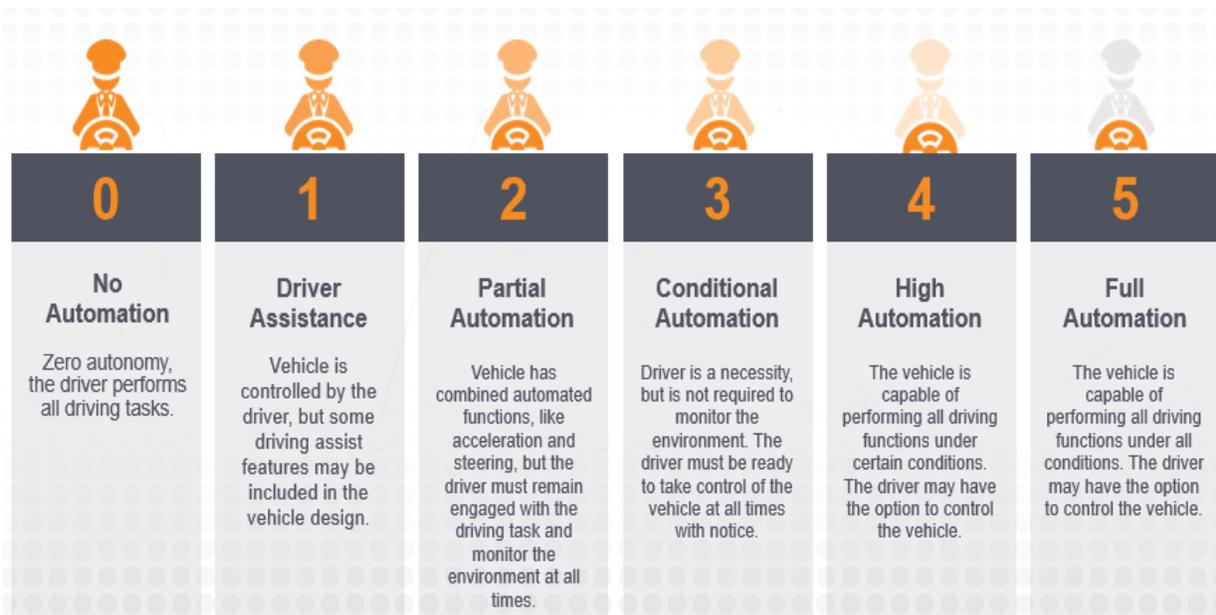
## Emerging Mobility Vehicle Technologies

Emerging mobility vehicle technologies including Autonomous Vehicle (AV) technologies, Connected Vehicle (CV) technologies, and Electric Vehicle (EV) technologies are vehicle-centric and can be applied to any type of vehicle utilized in the aforementioned emerging mobility services. Some of these emerging mobility vehicle technologies may be able to meet The Rapid’s needs for new or expanded transit services. The benefits and challenges of each emerging mobility vehicle technology are detailed in Table 3.

### Autonomous Vehicle Technologies

Autonomous Vehicle (AV) technologies enable cars to operate without direct control or constant monitoring from human drivers. As defined by the United States Department of Transportation (USDOT), automated vehicles are those in which at least some aspect of safety-critical control function (e.g., steering, throttle, or braking) occurs without direct driver input. Automated vehicles may be self-governing (i.e., use only vehicle sensors) or may be connected (i.e., use communications systems in which cars and roadside infrastructure communicate wirelessly). The National Highway Traffic Safety Administration (NHTSA) has adopted a six-level definition of autonomous vehicles based on the capability of the automated system as published by the Society of Automotive Engineers as outlined in Figure 19.<sup>15</sup>

**Figure 20: Automation Levels for Autonomous Vehicles**



Source: Society of Automotive Engineers, adapted by AECOM, 2020

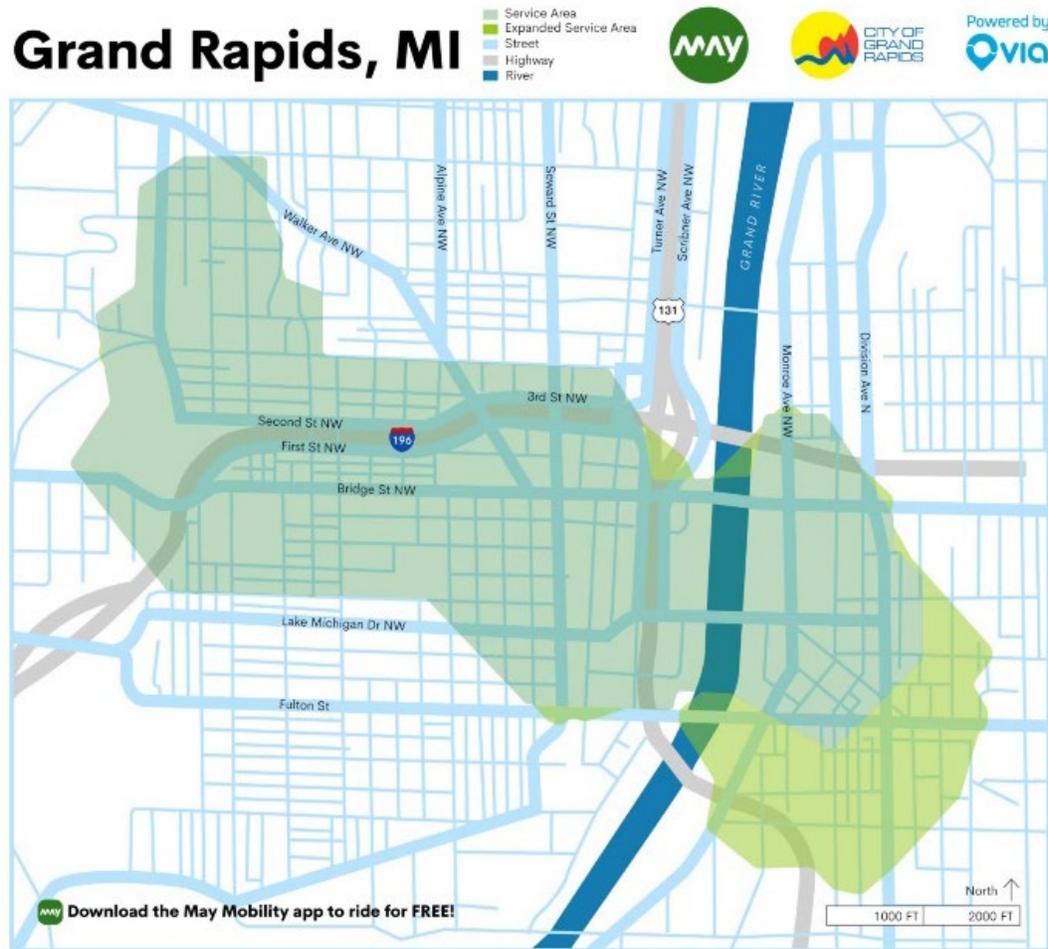
### Recent Local Examples

The City of Grand Rapids; the autonomous vehicle provider, May Mobility; and the on-demand rideshare company Via partnered to launch the Grand Rapids Autonomous Vehicle Initiative (AVGR) pilot, the first publicly available autonomous on-demand system in Michigan. AVGR started as a fixed-route autonomous shuttle in 2019 and later transitioned to a fully on-demand service complementing part of the existing DASH West fixed-route service in July 2021 (Figure 20) before the pilot concluded in April 2022. AVGR operated mostly the same as an on-demand ridesharing transit service however vehicles were not operated by a person, although an

<sup>15</sup> Source: [NHTSA Posts The Evolution of Automated Safety Technologies](#), Automotive Safety Council

attendant was always present in the vehicle. In-vehicle screens enabled riders to confirm boarding with a QR code and provide real-time trip information. Within the first 6 months of the pilot program, more than 2,000 rides were provided. Based on a rider survey conducted in December 2019 designed to capture initial public impressions of the fixed-route autonomous shuttle portion of the pilot, 90% of surveyed AVGR riders had previously used public transit while 24% said that AVGR caused them to try the DASH shuttle while 12% said that AVGR caused them to try The Rapid or transit in another city. Overall, nearly 90% of respondents believed that the AVGR pilot positively impacted Grand Rapids.

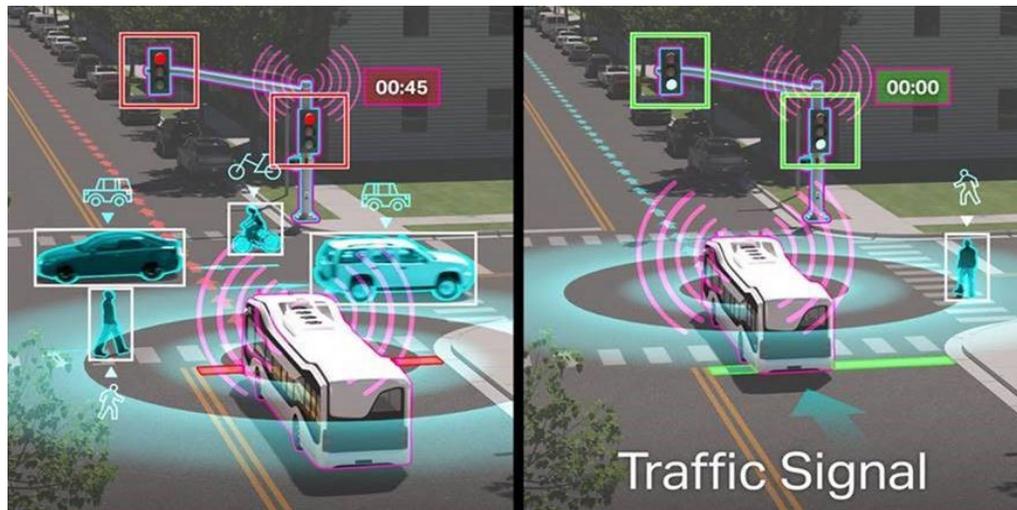
**Figure 21: AVGR Service Area Map**



## Connected Vehicles

Connected vehicles (CVs) communicate with each other through in-vehicle and wireless technology, similar to the frequencies of modern Wi-Fi. Utilizing this new technology, CVs can transfer data relating to position, direction, and speed to the driver, or AV, enabling them to react to information and resulting in lowering the probability of crashes and increasing traffic flow efficiency. CVs can also cooperate with infrastructure to communicate data like tolls, road closures, and traffic levels, and indicate nearby mobility hubs. Furthermore, CVs can be connected to pedestrians via smartphone devices to promote roadway safety, allowing vehicles to intelligently and promptly avoid pedestrians.

**Figure 22: Connected Vehicle Vehicle-to-Everything (V2X) Communications**



Source: AECOM

## Electric Vehicles

Electric vehicle (EV) technology innovations entail vehicle and infrastructure advancements. Specifically public transit related, Battery Electric Buses (BEBs) are completely powered by an on-board battery. Figure 22 shows three charging methods on the market for BEBs: plug-in, wireless conductive, and wireless inductive charging.

### Recent Local Examples

The Rapid developed a Zero Emission Bus (ZEB) transition plan in April 2023 to map out the best strategy and anticipated cost to convert the fleet to a ZEB operation. While The Rapid does not currently operate any ZEBs, the transition plan outlines an entire fleet conversion by 2048 and The Rapid has plans to conduct a pilot program of up to six battery electric buses (BEBs) at the Busch Drive Demand Response facility. Challenges associated with this transition primarily relate to the limited range of BEBs, the duty cycle requirement of the fleet, and limitations in current BEB technology.

**Figure 23: Plug-in Charging and Wireless Charging Technology**

		
PLUG-IN CHARGING	CONDUCTIVE CHARGING	INDUCTIVE CHARGING (Wireless)
<b>Charge Type:</b> AC or DC	<b>Charge Type:</b> DC	<b>Charge Type:</b> AC or DC
<b>Charge Power:</b> 40-120 kW	<b>Charge Power:</b> 175-500 kW	<b>Charge Power:</b> 5-300 kW
<b>Charge Time:</b> 1-8+ hours	<b>Charge Time:</b> 5-20+ minutes	<b>Charge Time:</b> 5 mins - 8 hours
<b>Pros:</b> lower infrastructure cost, lower peak demand electricity	<b>Pros:</b> potential in-route operations, smaller capacity batteries required	<b>Pros:</b> decreased infrastructure footprint, simpler charging mechanism, consistent power supply to lower range anxiety
<b>Cons:</b> buses must charge at depot, larger capacity battery required (especially for slow charging), larger batteries may reduce passenger capacity	<b>Cons:</b> higher charging infrastructure costs, potential peak demand utility costs, most visual impact	<b>Cons:</b> higher charging infrastructure costs, less efficient than conductive

Source: AECOM

## Applicability to The Rapid

The following section documents opportunities and challenges associated with each technology, typical characteristics that are most supportive of emerging mobility services, as well as potential markets for additional study and analysis.

### Opportunities and Challenges

Building upon the above introduction of each emerging mobility technology, Table 3 summarizes the opportunities and challenges associated with each emerging mobility technology.

**Table 3: Opportunities and Challenges by Mobility Technology**

Mobility Technology	Opportunities	Challenges
Microtransit	<ul style="list-style-type: none"> <li>– First/Last mile solution to feed fixed-route services</li> <li>– Provide affordable, local transit connections to activity centers, especially for groups who are mobility impaired and are less able to walk to a bus stop</li> <li>– Leverage technology to provide app-based on-demand services and enhance the competitiveness of public transit services over private services.</li> </ul>	<ul style="list-style-type: none"> <li>– Public outreach and acceptance of new service model</li> <li>– Integrating private companies into the service mix</li> <li>– Resisting the temptation to apply everywhere regardless of “fit”</li> <li>– Ensure optimum functionality of software/app/website user interface used for scheduling trips</li> </ul>
MaaS	<ul style="list-style-type: none"> <li>– First/last mile solution</li> <li>– Opportunity to implement a technology-driven platform to encourage multimodal trip planning and mobile payment</li> <li>– Reduce private vehicle ownership and promote sustainable transportation modes</li> </ul>	<ul style="list-style-type: none"> <li>– Implementation requires infrastructure investment to make mass transit services competitive and desirable</li> <li>– Mobile payment for disadvantaged populations such as unbanked/underbanked or people with no smartphones</li> <li>– Data sharing and user privacy concerns</li> </ul>
Flex Routes	<ul style="list-style-type: none"> <li>– First/last mile solution to a fixed-route bus service</li> <li>– Provides local transit connections, especially for groups who are mobility impaired</li> </ul>	<ul style="list-style-type: none"> <li>– Potential need to limit the number of deviations to maintain operational efficiency and service reliability</li> <li>– Public outreach and acceptance of new service model</li> <li>– Need for the bus operator to navigate new routes and potentially challenging curb conditions</li> </ul>
Shared Mobility	<ul style="list-style-type: none"> <li>– First/last mile solutions for bike share, e-scooters, and peer-to-peer carshare</li> </ul>	<ul style="list-style-type: none"> <li>– Curb space needs</li> <li>– Limited prior experience with the vendors, policies and regulations</li> </ul>
AV	<ul style="list-style-type: none"> <li>– First/last mile solution</li> <li>– Improve safety and operational efficiency</li> </ul>	<ul style="list-style-type: none"> <li>– Public acceptance</li> <li>– Significant costs</li> <li>– Safety</li> <li>– Policy and regulation</li> <li>– Extended timeframe until Level 4 and 5 automation is widely implemented</li> </ul>
CV	<ul style="list-style-type: none"> <li>– Improve safety and operational efficiency</li> </ul>	<ul style="list-style-type: none"> <li>– Infrastructure upgrades</li> <li>– Data sharing and user privacy protection</li> </ul>
EV	<ul style="list-style-type: none"> <li>– More sustainable and cleaner transportation system</li> </ul>	<ul style="list-style-type: none"> <li>– Infrastructure upgrades</li> <li>– High upfront cost of vehicle procurement</li> <li>– Service restructuring likely necessary to accommodate shorter vehicle range</li> </ul>

## Typologies and Potential Markets for Additional Analysis

This section outlines supporting characteristics and typologies of emerging mobility services and assesses the potential for emerging mobility services and vehicle technologies based on a review of local and regional plans and priorities as well as transit market and existing transit ridership and efficiency trends documented in the *Existing and Future Conditions Report*.

### Emerging Mobility Services

Emerging mobility services have the potential to be strategically leveraged to **complement** fixed route services by providing first/last mile connections and integrated trip planning services or **supplement** underperforming routes by replacing portions of these routes or providing additional first/last mile connections and integrated trip planning services to increase accessibility and efficiency.

To identify and highlight existing routes with lower service efficiency, and therefore greater opportunity to strategically leverage emerging mobility services, Table 4 ranks each fixed route's performance for five indicators discussed in the *Existing and Future Conditions Report*: ridership, passengers per revenue hour and per revenue mile, and cost per passenger and per revenue mile. Routes are ranked for each metric from 1 to 29 (total number of fixed routes as of Fall 2022) where a rank of one indicates the best performance while 29 indicates the worst performance. As high ridership and low costs are desirable, a ranking of one is associated with the largest ridership and passengers per hour and mile values and the lowest costs. These five metrics are synthesized into an overall rank that is calculated by ordering the routes' average ranking across the five metrics from best to worst where lower ranking again indicates better performing routes.

Based on the overall ranking contained in Table 4, existing directly operated routes with lower service efficiency, and therefore greater opportunity to strategically leverage emerging mobility services, include Routes 3, 14, 24, 27, 29, and 44. Building upon this information Table 5 outlines specific typologies and supporting characteristics as well as potential markets for additional exploration and analysis for each emerging mobility service.

### Emerging Mobility Vehicle Technologies

Emerging mobility vehicle technologies such as AV, CV, and EV technologies could be used to modernize existing or planned high-capacity services such as BRT or light/heavy rail which aligns with City's long-term multimodal development and sustainability goals. Table 6 assesses each emerging mobility vehicle technology based on the following:

- Alignment with The Rapid's Mission, Vision, and Transportation Master Plan goals and guiding principles
- Ease of implementation
- Cost of implementation

Based on this assessment, the most suitable vehicle technology for further exploration in the short-term are EVs, while AVs and CVs are more suitable for the mid- to long-term future after the technologies have further matured and supporting regulations have been established.

**Table 4: Fixed Route Ridership and Efficiency Summary (Fall 2022)**

Route Name	Fixed Route Rank From 1 (Best) to 29 (Worst)					
	Ridership	Passengers per Hour	Passengers Per Mile	Cost Per Passenger	Cost per Mile	Overall Rank
<i>Laker Line BRT</i>	1	1	4	2	15	1
<i>Route 37 – GVSU North Campus</i>	3	2	2	1	25	2
Route 12 – Westside	13	4	8	5	3	2
<i>Route 48 – GVSU South Campus</i>	5	3	3	3	24	4
Silver Line BRT	2	6	10	8	21	5
Route 2 – Kalamazoo	4	10	15	9	9	5
Route 15 – East Leonard	11	5	6	6	19	5
Route 9 – Alpine	6	8	7	7	23	8
Route 1 – Division / Madison	8	13	14	12	13	9
Route 10 – Clyde Park	15	12	12	11	12	10
<i>Route 51 – DASH West</i>	10	11	5	14	28	11
Route 7 – West Leonard	18	14	20	15	2	12
Route 11 – Plainfield	9	18	21	17	5	13
<i>Route 60 – GRCC Shuttle</i>	26	7	1	10	29	14
Route 4 – Eastern	7	20	19	18	11	15
<i>Route 85 – GVSU Apartment Connector (Combined 37/48)</i>	28	9	9	4	27	16
Route 6 – Eastown / Woodland	14	15	13	16	22	17
Route 13 – Michigan / Fuller	21	16	16	13	16	18
Route 5 – Wealthy / Woodland	20	17	17	19	18	19
Route 8 – Prairie / Rivertown	17	22	24	21	7	19
Route 28 – West 28th	12	25	25	25	10	21
Route 14 – East Fulton	24	21	18	20	17	22
Route 44 – 44th Street	16	26	26	26	6	22
<i>Route 52 – DASH North</i>	23	19	11	22	26	24
Route 3 – Wyoming / Rivertown	22	23	23	24	14	25
Route 24 – Burton	19	27	27	27	8	26
Route 29 – East 28th	25	24	22	23	20	27
Route 27 – Airport Industrial	27	28	28	28	4	28
<i>Route 100 – Ferris State University (FSU) Shuttle</i>	29	29	29	29	1	29

Source: The Rapid, Oct. 2022 Monthly Report and FY23 Summary. Contracted services italicized and table sorted by overall rank.

**Table 5: Emerging Mobility Service Supporting Characteristics and Potential Markets**

Emerging Mobility Service	Transit Supportive Applications	Typology / Supportive Characteristics	Potential Markets for Additional Analysis
<b>Microtransit (Rapid Connect)</b>	<ul style="list-style-type: none"> <li>• First/Last Mile Connections</li> <li>• Enhancement/replacement of underperforming fixed-route services</li> <li>• Options to augment paratransit service to address transportation equity</li> </ul>	<ul style="list-style-type: none"> <li>• Low fixed route transit demand</li> <li>• Employment clusters in close proximity but not directly served by fixed route transit</li> <li>• Areas with disconnected road network which impede efficient fixed route services</li> <li>• Along fixed route service with low ridership and productivity</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Expansion of the Kentwood Rapid Connect Zone</b> to serve 68th St and M-37 to provide first/last mile connections to this existing employment cluster which includes Davenport University, Amazon Fulfillment Center, Farmers &amp; Foremost Insurance, and Credit Unions and is projected to have significant future growth</li> <li>• <b>Expansion of the Walker Rapid Connect Zone</b> to serve the Alpine Meadows Mobile Home Park and Kenowa Hills High School.</li> <li>• <b>Jenison (Georgetown Township)</b> which contains pockets of medium-high transit market scores but is not currently served by the fixed route system</li> <li>• <b>East Beltline Avenue Corridor</b> which has a high volume of daily trips (all modes) but no existing transit service</li> <li>• <b>Cutlerville and along US-131 south of M-6</b> to serve a key desire line between UM Health – west Hospital and Gaines Marketplace and to provide first/last mile connections to Route 10 and the Silver Line for an area with several mobile home parks and large but dispersed employment locations</li> <li>• Potential to <b>enhance/replace portions of underperforming routes</b> such as Route 24 and 27, both of which are at or below half the weekday system average for passengers per hour and therefore have high costs per passenger as well as other routes with lower service efficiency including portions of Routes 3, 14, 29, and 44</li> </ul>
<b>MaaS (Mobility Hubs and/or Technology Platform)</b>	<ul style="list-style-type: none"> <li>• First/Last Mile Connections</li> <li>• Multimodal development</li> <li>• Engaging private service providers</li> <li>• Mobile application payment alternatives</li> </ul>	<ul style="list-style-type: none"> <li>• Developed urban areas</li> <li>• Existing multimodal demand</li> <li>• Familiarity of digital payment</li> <li>• Established transit market and infrastructure</li> <li>• Mobility hub placement at high-capacity transit stations, transit centers and high-volume stops, regional shopping centers</li> </ul>	<ul style="list-style-type: none"> <li>• Consideration of system-wide MaaS implementation</li> <li>• Example Mobility Hub Candidates:                         <ul style="list-style-type: none"> <li>– Rapid Central Station</li> <li>– Gaines Marketplace</li> <li>– Laker Line Lafayette Ave Station (Cook-DeVos Center for Health Sciences)</li> <li>– Grand Rapids Community College</li> <li>– Meijer in Standale</li> <li>– Woodland Mall/Kentwood Station</li> <li>– Rivertown Transit Center</li> <li>– Walmart Supercenter at 54<sup>th</sup> Street SW (Kelloggsville)</li> <li>– Meijer in Jenison</li> <li>– Alpine Center/Comstock Park</li> <li>– GVSU (Allendale and Pew Campuses)</li> <li>– Calvin University</li> </ul> </li> </ul>

Emerging Mobility Service	Transit Supportive Applications	Typology / Supportive Characteristics	Potential Markets for Additional Analysis
<b>Flex Routes</b>	<ul style="list-style-type: none"> <li>• First/Last Mile Connections</li> <li>• Enhancement of underperforming fixed-route services</li> </ul>	<ul style="list-style-type: none"> <li>• Low fixed route transit demand</li> <li>• Jurisdictions of low density or constrained transit resources</li> <li>• Along fixed route service corridors with low ridership and/or productivity</li> </ul>	<ul style="list-style-type: none"> <li>• Potential to <b>enhance portions of underperforming routes</b> such as Route 24 and 27, both of which are at or below half the weekday system average for passengers per hour and therefore have high costs per passenger as well as other routes with lower service efficiency, including portions of Routes 3, 14, 29, and 44</li> </ul>
<b>Shared Mobility (Micromobility and Carsharing)</b>	<ul style="list-style-type: none"> <li>• First/last mile connections to fixed-routes</li> <li>• Fostering a larger transit user base</li> </ul>	<ul style="list-style-type: none"> <li>• Residential areas or employment clusters removed from the fixed-route network</li> <li>• Areas with high in-zone trip demand</li> <li>• Areas with built infrastructure such as bike lanes and bike stations</li> <li>• Areas with greater densities of young adult populations</li> <li>• Often implemented at mobility hub locations</li> </ul>	<ul style="list-style-type: none"> <li>• High in-zone trip demand areas including:                             <ul style="list-style-type: none"> <li>– Between Calvin University, Woodland Mall, and the surrounding areas</li> <li>– Between RiverTown Crossings and its surrounding area</li> <li>– Alpine Center /Comstock Park between Lamoreaux Drive NW and I-96</li> </ul> </li> <li>• Areas with greater densities of young adult populations more likely to use shared technologies including car-sharing, e-scooters and e-bikes<sup>16,17</sup> including:                             <ul style="list-style-type: none"> <li>– Surrounding Route 7 in the West Grand Neighborhood which features a variety of existing bike infrastructure</li> <li>– Adjacent to colleges/universities: Aquinas College, Calvin University, and GVSU</li> <li>– Downtown Grand Rapids</li> <li>– Portions of Eastern Kentwood</li> </ul> </li> <li>• Partnerships with TNCs and car-sharing services to augment the existing Rapid Connect services particularly around employment clusters like Broadmoor Avenue SE and 44<sup>th</sup> Street SE</li> </ul>

<sup>16</sup> Source: [To scoot or not to scoot: Findings from a recent survey about the benefits and barriers of using E-scooters for riders and non-riders](#), Sanders et. al., September 2020

<sup>17</sup> Source: [A review of the socio-demographic characteristics affecting the demand for different car-sharing operational schemes](#), Amirnazmiafshar and Diana, June 2022

**Table 6: Emerging Mobility Vehicle Technology Assessment Summary**

Assessment Area	Autonomous Vehicle (AV)	Connected Vehicle (CV)	Electric Vehicle (EV)
<b>Alignment with Master Plan Goals and Guiding Principles</b>	<p style="text-align: center;">●</p> <p>In alignment with the Transit Master Plan’s guiding principle to develop plans for multiple possible futures – providing space for adaptation, innovation, and expansion but less in alignment with attaining long-term fiscal sustainability</p>	<p style="text-align: center;">●</p> <p>In alignment with the Transit Master Plan’s guiding principle to deliver convenient and dependable transportation modes to our community, through accountability and safety while also developing plans for multiple possible futures – providing space for adaptation, innovation, and expansion</p>	<p style="text-align: center;">●</p> <p>In alignment with The Rapid’s goal to convert to a 100% zero-emission fleet by 2048, in support of The Rapid’s vision that public transportation supports sustainability, and in alignment with the Transit Master Plan’s guiding principles of adaptability</p>
<b>Ease of Implementation</b>	<p style="text-align: center;">🕒</p> <p>Needs infrastructure, testing, and regulations in place before mass implementation. Compared to CVs and EVs existing examples on transit services are limited</p>	<p style="text-align: center;">🕒</p> <p>Needs infrastructure, policy/regulations on data sharing considering user privacy protection, and public outreach before mass implementation</p>	<p style="text-align: center;">🕒</p> <p>Significant service restructuring may be needed to accommodate the reduced range of an electric vehicle and additional infrastructure is required before mass implementation. However, national standards exist and industry experience is rapidly growing. Piloting electric vehicles on individual alignments should be explored before a full transition to electric vehicles.</p>
<b>Cost of Implementation</b>	<p style="text-align: center;">○</p> <p>Expensive to implement since technology is still in an early stage of development</p>	<p style="text-align: center;">🕒</p> <p>Relatively affordable to implement with mature technologies and predecessors. Medium to high upfront cost depending on the scope</p>	<p style="text-align: center;">🕒</p> <p>Relatively expensive to implement due to the high cost of ZEBs and charging stations and scope of the project. In 2021, however, the Bipartisan Infrastructure law increased the funding for low- and no-emission bus grants six-fold over a five-year period</p>
<b>Summary &amp; Potential Markets</b>	<p style="text-align: center;">🕒</p> <p>Relatively immature solution that needs further technology development and implementation examples on transit services.</p> <p>Building upon local experience with AVGR, if The Rapid is financially enabled with community support, AV shuttles or circulators could be considered for key regional destinations such as the airport or downtown Grand Rapids</p>	<p style="text-align: center;">🕒</p> <p>Satisfactory solution that could be beneficial for the mid- or long-term future with proper investment</p> <p>Implementation of CV technologies such as Vehicle-to-Everything (V2X) devices and roadside units, transit signal priority, and and/or speed control technologies to fixed route services with particular prioritization on routes with low performance and efficiency such as the Silver Line BRT which consistently has some of the lowest on-time performance</p>	<p style="text-align: center;">🕒</p> <p>Good and necessary solution that The Rapid should continue to explore and invest in in the short- to mid-term future as outlined by the ZEB Rollout Plan for Clean Transportation.</p> <p>Higher ridership routes such as the Laker Line and Silver Line as well as Routes 2, 9, 4, and 1 could be prioritized to maximize environmental benefits. As the fleet is being electrified, supporting infrastructure for EVs and vehicles equipped with connected vehicles should be planned and built throughout the network, especially at mobility hubs.</p>

**Legend:** ● **High-ranking**, recommended for implementation; ● **Medium-high-ranking**, recommended for further consideration; 🕒 **Medium-ranking**, recommended for exploration; 🕒 **Medium-low-ranking**, suggest further research; ○ **Low-ranking**, not currently recommended.

# Conclusion

This *Regional Connectivity and Market Analysis Report* builds upon the assessment of regional demographics and the performance of The Rapid's transit services outlined in the *Existing and Future Conditions Report* to identify travel patterns and key travel markets as well as current gaps in The Rapid's transit network, and areas for potential expansion of services.

Origin-Destination Desire Line analyses found nearly all the strongest desire lines across all transportation modes are already served by The Rapid's fixed route network or Rapid Connect zones, meaning transit geographic coverage may already be sufficient, although there are opportunities for further improvements to service frequency and span so that a greater percentage of the region is near high frequency service. A market analysis found that as of Fall 2022, The Rapid's fixed route service is well aligned with key transit markets as more than three quarters of the Zone One population (77%) and nearly 89% of jobs in block groups with "Very High" or "High" transit market scores are within a quarter mile of a bus stop. Areas with the greatest transit markets include downtown Grand Rapids, Northern Cutlerville, Alpine Center/Comstock Park between Lamoreaux Drive NW and I-96, West Grand, Central Kentwood, and adjacent to GVSU's Allendale and Pew Campuses, and Calvin University and surrounding area.

## Greatest Transit Markets:

- Downtown Grand Rapids
- Northern Cutlerville
- Alpine Center/Comstock Park
- West Grand
- Central Kentwood (44<sup>th</sup> Street SE & Benton Road SE)
- Adjacent to GVSU and Calvin University

Although transit coverage is strong in key transit markets, trip characteristics, market data, and origin-destination line analyses suggest there are still opportunities for service expansion and improvements to the quality and type of transit services. For example, the duration of transit trips downtown from points outside of the downtown area are 2-3 times longer than trips made by all other transportation modes, before considering the additional time spent walking to transit stops and waiting for transit to arrive.

Market data and origin-destination desire lines indicate there are a select number of areas of elevated transit propensity and demand that could support potential service extensions within and outside the ITP-member communities. Areas *within* the Service Area with the greatest opportunity for transit connection improvements include:

- Establishing connections between key destinations such as RiverTown Crossings, Calvin University, Woodland Mall, and their surrounding areas
- Establishing direct transit connections between UM Health – West Hospital and Gaines Marketplace and between Gaines Marketplace and Woodland Mall

Opportunities *outside* the service area include:

- Extending Route 11 further north along Plainfield Avenue NE to the North Kent Center and Five Mile Road as well as potential direct connections to downtown Grand Rapids from the area around the lakes in Rockford/northwestern Cannon Township
- Service to Jenison (Georgetown Township) potentially by extending Route 28

In addition to exploring expanding and establishing transit services in the above areas, it is important to identify areas of opportunity where emerging mobility options could be leveraged to complement and/or supplement traditional fixed route services. Providing transit to some of the lower density areas between the boundary of the Service Area and Zone One are particularly challenging due to generally low residential and employment density, as well as a predominantly auto-oriented travel and development patterns. Emerging mobility services and vehicle technologies are changing the transportation industry and transforming the traditional transit market. Some of these emerging mobility services may be able to meet the needs for new or expanded transit services.

### Areas of Opportunity for Emerging Mobility Options

- **Microtransit:**
  - Low density areas
  - Employment Clusters
  - Along fixed route service with low ridership and productivity
- **Mobility Hubs:**
  - High-capacity transit stations, transit centers and high-volume stops, regional shopping centers
- **Shared Mobility:**
  - Areas with high in-zone trip demand
  - Areas with greater densities of young adult populations
  - At or adjacent to mobility hubs

**Microtransit:** when operating most efficiently, microtransit can provide on-demand, highly flexible routing and scheduling with a much smaller group of passengers compared to conventional transit options. Potential areas for microtransit consideration include Jenison (Georgetown Township), East Beltline Avenue Corridor, and Cutlerville/along US-131 south of M-6 as well as an extension of the Kentwood Rapid Connect Zone to serve existing and growing employment centers near Davenport University and Amazon.

**MaaS:** integrates multiple types of transportation services and enables more dynamic and comprehensive trip-planning and payment for individual users. Mobility hubs should be considered at high-capacity transit stations, transit centers and high-volume stops, and regional shopping centers such as Rapid Central Station, Woodland Mall/Kentwood Station, and Gaines Marketplace.

**Shared Mobility Solutions:** complements conventional public transit and alleviates mobility equity issues.

**Automated and Connected Vehicle Technologies:** can be deployed into different modes and scenarios and potentially transport people in much cleaner, safer, and affordable ways.

**Electric Vehicle Technologies:** reduces greenhouse gas (GHG) emissions and noise impacts, creating a more sustainable roadway environment.

These recommended service area improvements and connection opportunities will be expanded upon in the *Future Options and Scenarios Technical Report*, which will identify opportunities for improving The Rapid's transit service in the short-, medium- and long-term future.