



MEMORANDUM

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Subject: MARC Bikeway Data Summary Memo

1 Introduction

As part of the Mid-America Regional Council (MARC) Greater Kansas City Regional Bikeways Plan Update, this memo summarizes (1) existing regional bike activity and (2) short- and medium-length vehicle trips that could potentially shift to biking. This analysis leverages big data sources (Replica and Strava) to estimate trips across the entire nine-county MARC region.

2 Data Sources

Physically collecting bike data across a nine-county region is challenging, time consuming, and expensive. Instead, Replica and Strava were utilized to provide estimates for travel patterns. Replica and Strava are both “big data” sources and can provide insights into trip purposes, user characteristics, and other information not available from traditional count data. The primary challenge with big data sources is understanding and accounting for their underlying assumptions and limitations within analysis.

Replica

Replica is a mobility data platform that models travel behavior using sampled mobile devices and connected vehicle data. This data is combined with other sources such as commercial transactions and real estate records to generate a representation of travel patterns on a typical day.

Replica’s “Places” module offers a detailed, granular depiction of a synthetic population across the United States. Although the platform does not support analysis for specific dates or days of the week, it provides detailed trip tables for user-defined geographies, reflecting modeled typical travel behavior and patterns. These tables are available for an average weekday (Thursday) and an average weekend day (Saturday) on a seasonal basis. This analysis of trip profiles draws on multiple data tables representing travel behavior on an average Thursday during Fall 2024, the latest available data at the time of this memo.

Considering Replica extrapolates traffic trends from a variety of data sources, the primary factor determining accurate and actionable data is sample size. Replica data loses accuracy as the study/sample becomes increasingly granular. Therefore, this study aggregates replica data to the Census block group level rather than at the block or individual Open Street Map (OSM) link (i.e., facility) level.

Strava

Strava is an activity tracker and social media platform that is primarily utilized by cyclists and runners to monitor their workouts. Strava aggregates user data and provides heat maps showing where activities are most commonly recorded on their free online platform¹. These maps can be filtered to display only specific activity types. The use of these maps is limited, however, since the data on the free platform does not provide quantifiable metrics and the terms of use of the heat maps limit their use for third parties.

Strava's Metro platform offers more detailed analysis by quantifying activities along specific roadway or trail segments and providing insights into time of day, day of the week, and average speed trends. Strava Metro, which is offered to public organizations, is geared for those organizations to understand how people are getting around, improve safety, and support infrastructure investment decisions. In the future, MARC may wish to explore the platform with the understanding that Strava Metro has known limitations and is geared towards understanding existing bike activity.

While Strava and Strava Metro are both powerful tools for evaluating bike trips, there are a few limitations to consider:

- The platforms are based on existing trips and heavily influenced by existing facilities. Strava Metro is not the best tool for accessing new facility locations or latent demand.
- As a fitness-focused social app, Strava may skew trip data towards recreational purposes.
- Demographic challenges – Strava may be used by certain population groups based on age or income and could therefore skew results towards specific communities.

3 Methodology

Two separate exports were filtered in Replica: one capturing bike trip origins and the other capturing vehicle trip origins. The primary unit of spatial analysis was the Census block group, which enabled the aggregation of individual trip origins across the nine-county metropolitan area. Each trip record includes extensive information about the trip, trip purpose, and trip taker. For this analysis, the primary focus was on trip mode, trip distance, and trip purpose.

The raw trip-level data was first inspected to establish preliminary statistics for individual trips. Then, those records were aggregated so that the metrics of counts by mode, distance, and purpose were assigned to block groups rather than retained at the trip level. The resulting summary tables from

¹ <https://www.strava.com/maps/global-heatmap?sport=Ride>

Replica were joined to a U.S. Census block group spatial layer in GIS to map and explore those aggregated metrics, revealing spatial patterns in both bike and vehicle trips that form the basis of this analysis.

The geospatial analysis examined three distinct trip types:

- Bike trips
- Short length vehicle trips (up to three miles)
- Medium length vehicle trips (three to ten miles)

Short and medium-length vehicle trips were specifically identified, as these trips could feasibly be taken via bike given there are available facilities. The thresholds for short and medium trips were assigned based on an academic study called [Understanding and Measuring Bicycling Behavior: a Focus on Travel Time and Route Choice](#) from ORTEC. The study recorded bicyclist trips for an eight-month period in Portland and found that 53% of bike trips were less than three miles, while 39% of bike trips were between three and ten miles.

Trip origins were aggregated at the block group level. Trip Density was the primary metric that was evaluated; calculated as trip origins per square mile. This metric adjusts for differences in block group size, which vary across urban and rural block groups in the region.

For each of the three trip types, the ten block groups with the highest trip density values were identified to serve as supplemental trend markers. These block groups help distinguish differences between trip type patterns, especially where regional trends may appear similar at the block group level. These block groups could represent targeted opportunities for bike-focused interventions and investments.

4 Findings

This section summarizes bike trips, short vehicle trips, medium vehicle trips, and overall trip purposes for the MARC region. For bike trips, Strava and Replica datasets are compared to better understand how different data sources vary. This data should be used for the purpose of general observations and to indicate regional patterns. If any specific infrastructure recommendations are to be made based on this data, the data should be vetted using engineering judgement and/or supplemental bike counts.

BIKE TRIPS

Strava Trip Patterns

Strava, while not providing raw data, offers a publicly available trip density map based on user GPS activity aggregated at the link level. **Figure 1** displays a screen capture of these patterns. Overall trends broadly align with Replica, showing the densest bike activity in the metropolitan core, reduced activity in suburban and exurban areas, and an east-west isolation of the downtown Kansas City Area.

However, there are several key differences observed between the datasets:

- Trips skewed towards Johnson County – visually, Strava shows elevated bike activity in Johnson County, KS, a contrast to Replica's more even spatial distribution.
 - This may be a result of socio-economic demographics and dedicated trail facilities leading to more recreational Strava activities being logged in the County.
- Local Discrepancies - certain areas exhibit divergent patterns. For example:
 - Eastern Kansas City, KS, appears dense in Replica but is minimally represented in Strava.
 - Exurban towns such as Lawson, MO, and Harrisonville, MO, contain a dense block group in Replica but show negligible activity in Strava.

Replica Trip Patterns

According to Replica, approximately 31,000 bike trips occur daily in the Kansas City metropolitan area. This accounts for 0.6% of all trips when compared to vehicle travel. **Figure 2** displays the spatial distribution of these trips.

The highest bike trip densities are located within or immediately adjacent to the region's urban core. Block groups with the highest density of bike trips are in Kansas City, MO, downtown Kansas City, KS and Gladstone, MO.

Beyond the urban core, bike trip clusters are scattered across suburban areas. In exurban areas, a few isolated hotspots emerge, most notably in Leavenworth, KS; Harrisonville, MO; Excelsior Springs, MO; and Lawson, MO.

Both Replica and Strava consistently highlight the Kansas City urban core as the region's dominant center for bike activity. However, notable differences emerge in the representation of suburban and exurban trip densities, particularly in east-west spatial distribution and specific municipal areas. These differences may reflect disparities in data collection methods and user base representation. Replica's model includes all trip types, while Strava reflects only its user-generated activity, skewed toward recreational cyclists.

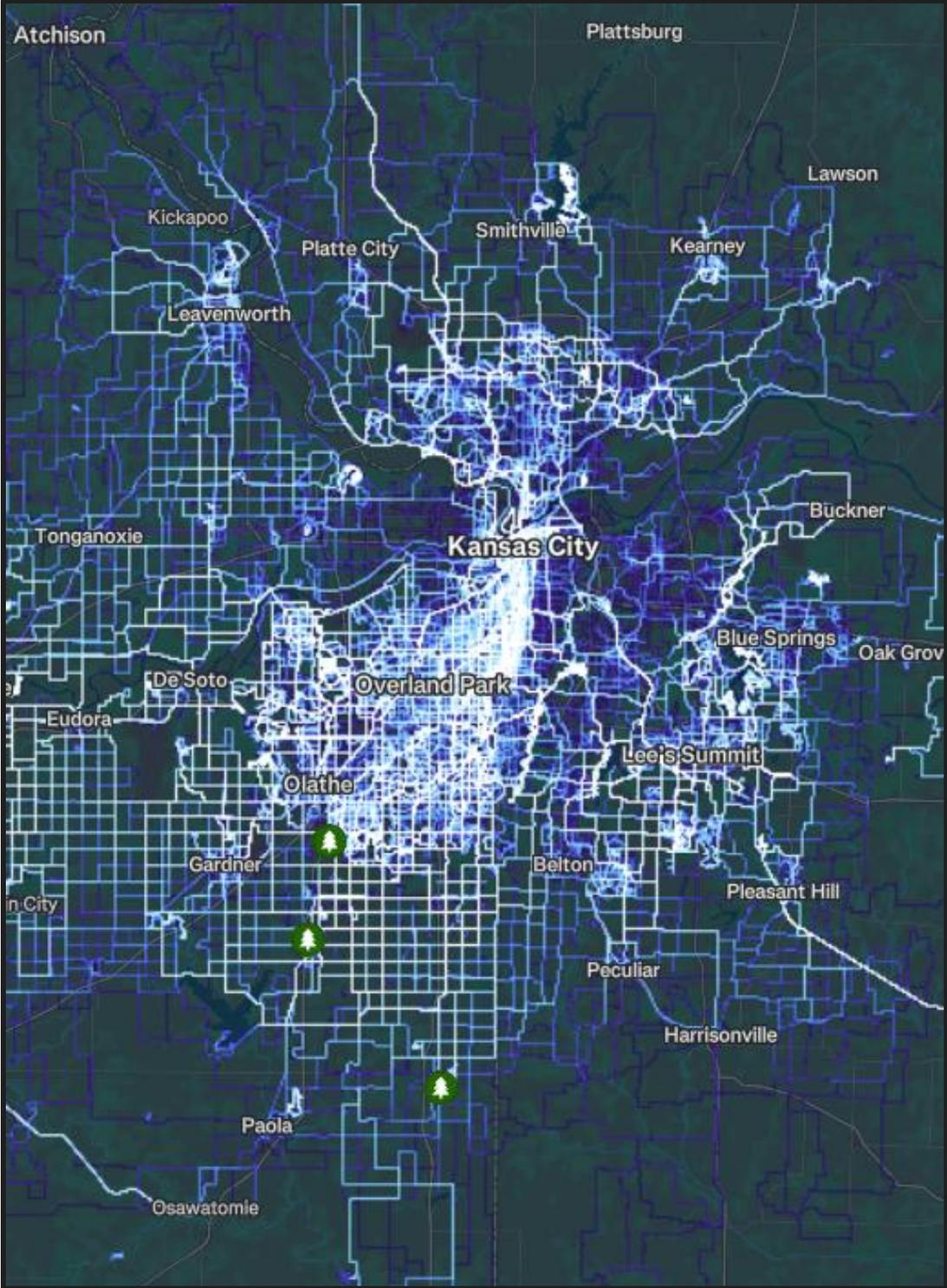


Figure 1. Regional Bike Trips by Facility (Source: Strava)

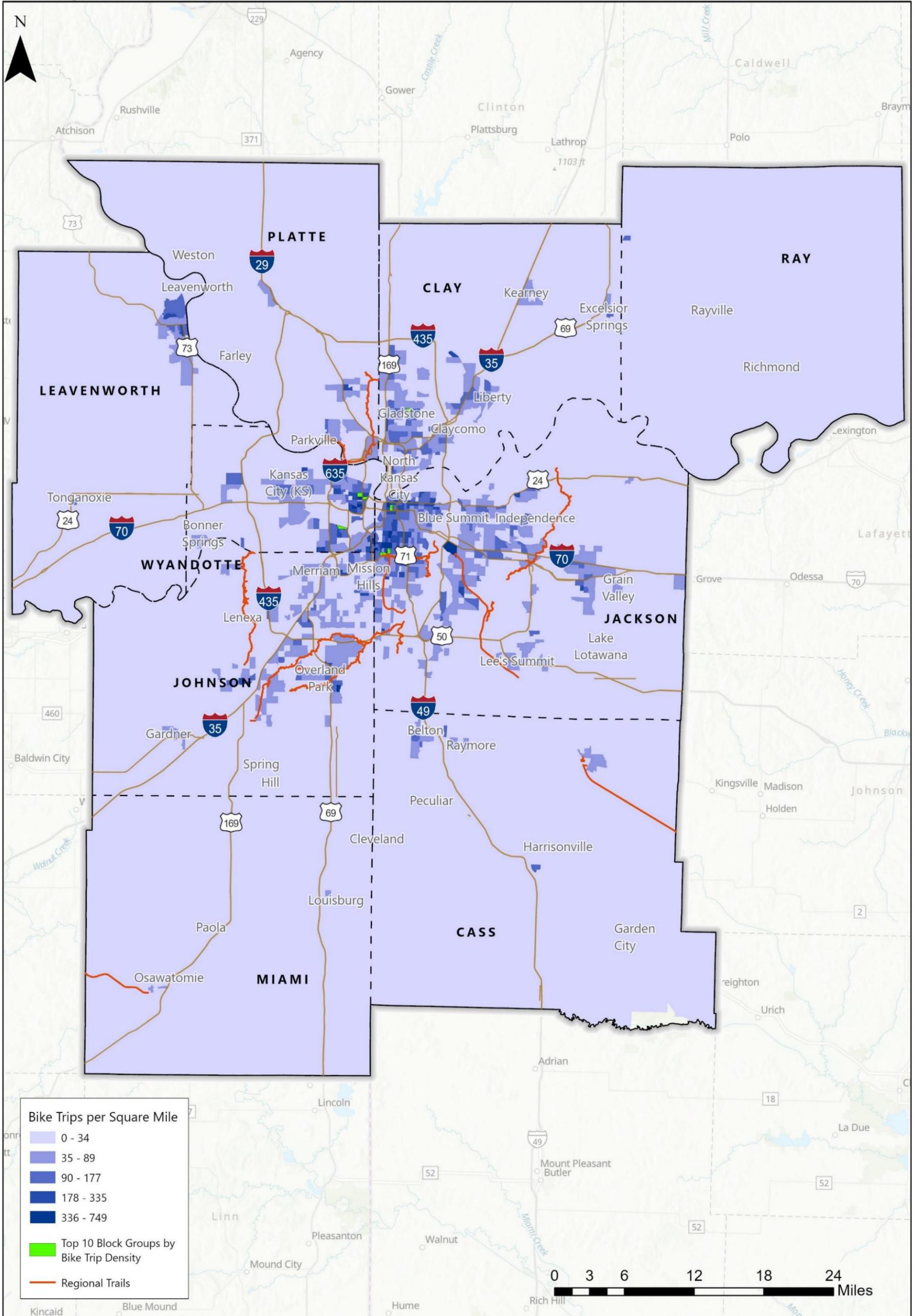


Figure 2: Regional Bike Trip Density by Census Block Group (Source: Replica)

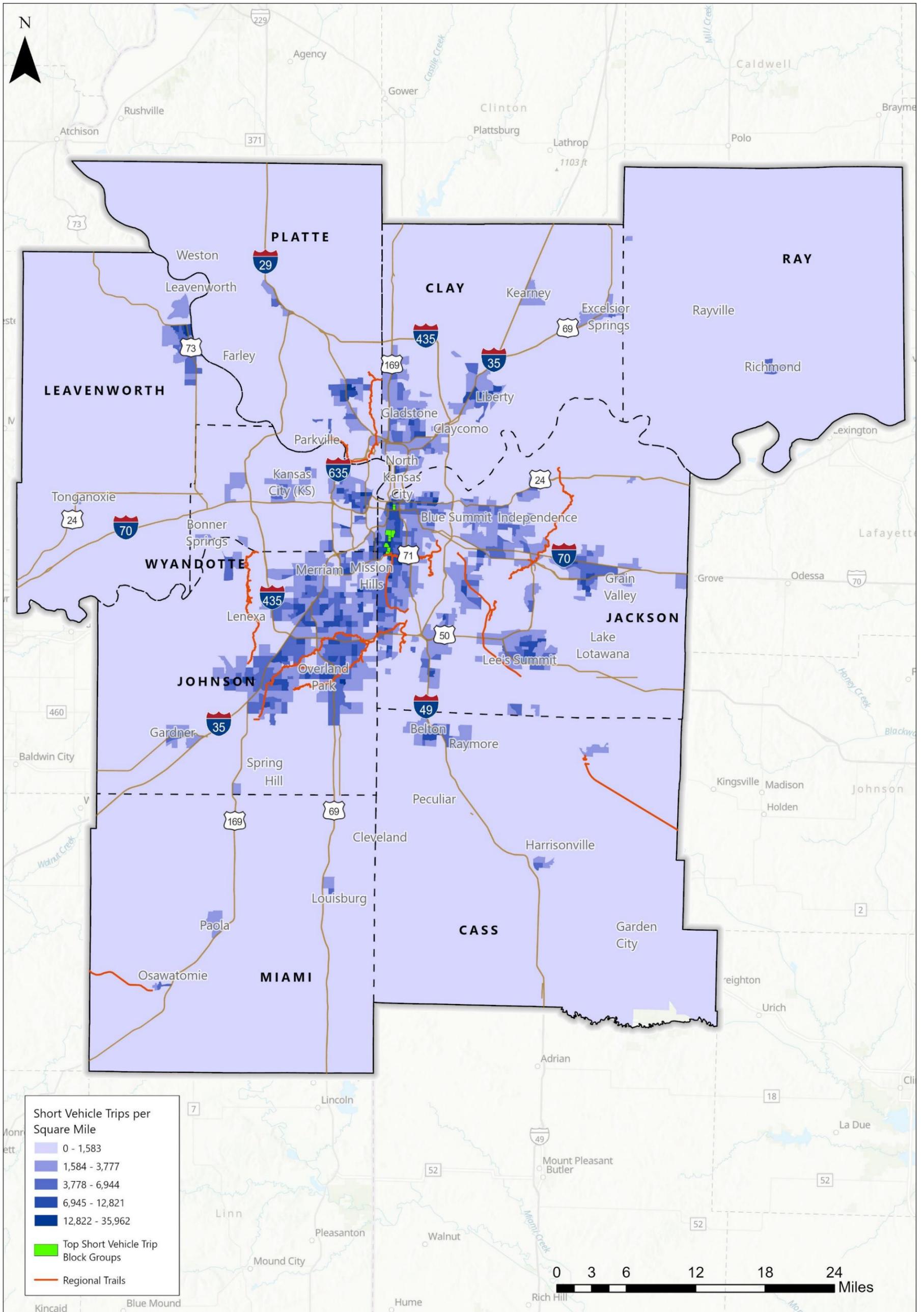


Figure 3. Short Vehicle Trip Density (Source: Replica)

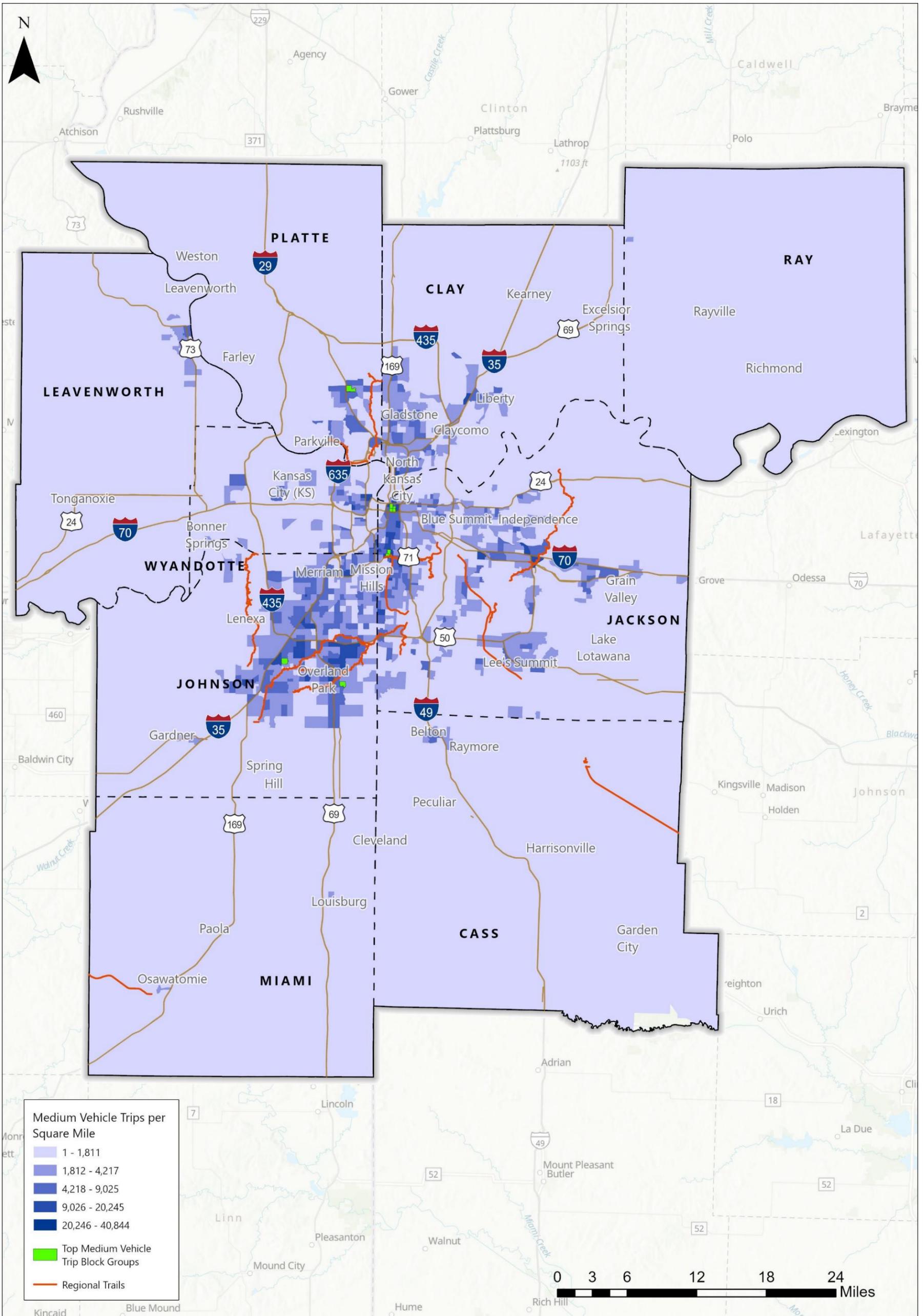


Figure 4. Medium Vehicle Trip Density (Source: Replica)

VEHICLE TRIPS

Vehicle trips were sourced from Replica. These trips were filtered to “private auto” trips to exclude auto passenger, commercial vehicle, and taxi/TNC trips in order to highlight the type of auto trips for which mode shift is more likely.

Short-Length (0-3 Miles) Vehicle Trip Density

According to Replica’s dataset, short, private auto trips (less than three miles) total approximately 1,866,000 vehicle trips in the metro region, reflecting 34% of all regional automobile travel.

The highest densities of short trips are concentrated along a generally continuous regional corridor extending from Gladstone, MO to the north, through downtown Kansas City MO, and southwest into the Johnson County suburbs, terminating near Olathe, KS, see **Figure 3**. Notably, this trend aligns closely with the regional bike trip densities as visualized by the free Strava platform. All ten of the highest density block groups are located within a narrow hotspot between downtown Kansas City, MO, and the Country Club Plaza area, suggesting a strong prevalence of short-length vehicle trips in the urban core.

Medium Length (3-10 Miles) Vehicle Trip Density

Medium-length private auto trips (three to ten miles) constitute approximately 1,885,000 daily trips, according to Replica. This figure is also approximately 34% of all trips, although slightly exceeding the short-trip category in absolute numbers.

Trip densities for 3-10 mile trips reveal a regional spatial pattern similar to short trips (0-3 miles), concentrated along the same north-to-southwest regional corridor. However, the highest density block groups are more spatially dispersed:

- Johnson County includes two of the ten highest-density block groups, located in Overland Park, KS, and Olathe, KS.
- Platte County contains one high-density block group near Weatherby Lake.
- The remaining top block groups are in Kansas City, MO, but cover a broader area than the top short-trip cluster.

This distinction suggests that although both trip types are shaped by the same overarching regional geography, the intensity of trip-making within the corridor is more decentralized for medium-length trips, indicating that people in these areas are more likely to drive longer distances to get to destinations.

TRIP PURPOSES

Figure 5 illustrates the Replica distribution of daily trip counts by purpose across bike trips, short-length vehicle trips, and medium-length vehicle trips for the entire MARC region. This figure excludes home trips.

Trips to and from home are the most common purpose for all three trip types, with home trips making up approximately 40% of trips. Beyond home-based trip purposes, bike, short-length vehicle, and medium-length vehicle trips display a very similar hierarchical breakdown of purposes.

While bike trips follow a similar trip purpose profile to vehicle trips, a notable exception is school travel. For bike trips, school ranks as the third most common purpose, a sharp contrast to vehicle modes where it ranks last (excluding lodging). This suggests a distinctive role for biking in serving school-related travel, potentially reflecting proximity-based biking by students or supportive infrastructure near educational institutions.

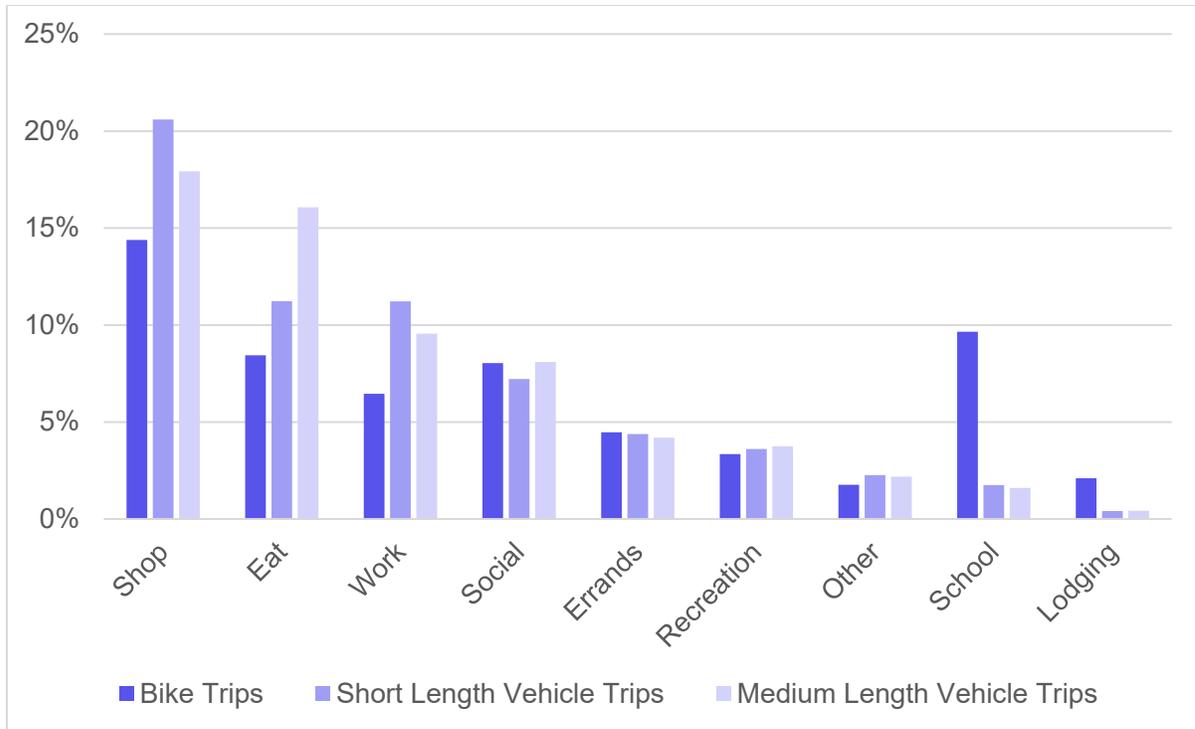


Figure 5. Trip Purposes by Trip Type (Excluding Home Trips)

Bike trips are generally underrepresented for shopping, eating, or working-related trips. Mode choice is a complex decision made at the trip level with a variety of factors; however, this may be indicative that these land uses may not be adequately connected to bike infrastructure.

Another interesting trend that can be evaluated using Replica as a next step is trip linking. Particularly within the suburbs and exurbs, anecdotally, it is known that many bike trips start with a vehicle trip (e.g., a person driving to the trail head to then go on a bike trip). Replica provides trip taker IDs for each trip throughout the typical day. These trip taker IDs can be linked to evaluate where people are taking a vehicle trip to then take a bike trip and ultimately evaluate where connections to existing bike infrastructure should be targeted. This investigation could be a potential future analysis with Replica data but was not completed for the purposes of this memo.

5 Conclusions

According to multiple big data sources, bike trips in the Kansas City region are generally concentrated in the region's core. Replica data implies that the densest bike activity occurs in downtown Kansas City, MO, and KS. Strava data affirms this core pattern but provides a greater emphasis on bike trips in Johnson County, likely due to differences in user base and data methodology.

By comparison, short and medium-length vehicle trips follow a shared north-south regional corridor cluster from Gladstone to Olathe, centered around downtown Kansas City, MO. The highest densities of short trips are tightly clustered in the urban core, while those of medium-length trips are slightly more spatially dispersed, reaching into suburban areas like Johnson and Platte Counties. This information should be considered when planning and prioritizing investments in bicycle infrastructure.

Replica estimates that bike trips account for 0.6% of trips in the MARC region, whereas short and medium length vehicular trips account for 68% of trips. This indicates an opportunity for a mode shift if even a small portion of these trips were converted.