FUTURE 64

COMMUNITY TRANSPORTATION TOGETHER

KINGSHIGHWAY TO JEFFERSON

EXISTING TRAFFIC, SAFETY & MULTIMODAL CONDITIONS

TECHNICAL REPORT

Prepared for:

MoDOT

Prepared by:

LOCHMUELLER GROUP

On behalf of:

HDR

June 29, 2022

CONTENTS

1. INTRODUCTION 1
1.1. Study Area 1
1.2. Roadway Network 3
1.2.1. Interchange Spacing 10

2. EXISTING TRAFFIC OPERATIONS 12
2.1. Road Network 12
2.2. Base Traffic Volumes 17
2.3. Methodology 27
2.3.1. Analysis Parameters 28
2.4. Tier 1 Limits: I-64 29
2.4.1. Access to I-64 29
2.4.2. Calibration & Validation of Traffic Models 30
2.4.3. VISSIM Results 34
2.4.4. Synchro Results 40
2.4.5. Correlation of VISSIM and Synchro Results 41
2.5. Tier 2 Limits: Arterials and Major Collectors 41
2.5.1. Synchro Results 41
2.6. Traffic Conclusions 47

3. SAFETY 48
3.1. Overview 48
3.1.1. High Crash Locations 58
3.1.2. Severe Clusters 62
3.1.3. Crashes Involving Bicyclists and Pedestrians 65
3.2. Tier 1 Limits: Crashes 67
3.3. Tier 2 Limits: Crashes 68
3.4. Crash Rate Analysis 70
3.5. Safety Concerns Relating to Interchange Spacing 77
3.6. Safety Conclusions 78

4. EXISTING MULTIMODAL MOBILITY 80
4.1. Bicycle and Pedestrian Activity 80
4.1.1. Trip Distance and Duration 80
4.1.2. Trip Purpose 82
4.2. Relevant Bicycle/Pedestian Plans and Studies 84
4.2.1. Gateway Bike Plan 84
4.2.2. Brickline Greenway 88
4.2.3. ULI Grand MetroLink Station Technical Assistance Report 89
4.2.4. Downtown St. Louis Transportation Study 89
4.2.5. City of St. Louis Americans with Disabilities Act (ADA) Transition Plan (2020 DRAFT) 91
4.2.6. Trailnet 2021 Crash Report 93
4.3. Pedestrian Facilities 93
4.3.1. Pedestrian Facility Inventory 93
4.3.2. Pedestrian Level of Service (PLOS) 95

4.3.3. Pedestrian Network Connectivity ... 99
4.4. Bicycle Facilities ... 102
4.4.1. Bicycle Facility Inventory ... 102
4.4.2. Bicycle Level of Traffic Stress ... 103
4.4.3. Bicycle Network Connectivity ... 107
4.5. Transit ... 110
4.5.1. Transit-Related Planning ... 110
4.5.2. Existing Transit Service ... 112
4.5.3. Transit Ridership Systemwide ... 118
4.5.4. Transit Ridership in the Study Area ... 120
4.5.5. Transit Trip Characteristics ... 123
4.5.6. Transit Needs ... 126
4.5.7. Transit On-Time Performance ... 130
4.5.8. Transit Crashes ... 131
4.5.9. Transit Stop Amenities ... 132
4.6. Multimodal Conclusions ... 135

APPENDICES

Appendix A RITIS I-64 Corridor Speed Data
Appendix B Tier 1 Year 2022 Baseline Traffic Operating Conditions – VISSIM
Appendix C Tier 1 Year 2022 Baseline Traffic Operating Conditions – Synchro
Appendix D Tier 2 Year 2022 Baseline Traffic Operating Conditions – Synchro
Appendix E Existing Crash Rates

FIGURES

Figure 1. Future64 PEL Study Area ... 2
Figure 2. I-64 at Kingshighway Blvd. ... 3
Figure 3. I-64 at Tower Grove Ave./Boyle Ave./Papin St. ... 4
Figure 4. I-64 at Vandeventer Ave. ... 5
Figure 5. I-64 at Market St./Bernard St. ... 6
Figure 6. I-64 at Grand Blvd./Forest Park Ave. ... 7
Figure 7. I-64 at Jefferson Ave. / 22nd St. ... 7
Figure 8. Intersections in the Study Area ... 9
Figure 9. I-64 Corridor Gore-to-Gore Measurements ... 11
Figure 10. Road Classification and the Relationship between Mobility and Land Access ... 14
Figure 11. I-64 PEL Roadway Functional Classification ... 15
Figure 12. Illustration of Access-Mobility Dynamic ... 17
Figure 13. I-64 Corridor Existing Peak Hour Traffic - Sheet 1 ... 19
Figure 14. I-64 Corridor Existing Peak Hour Traffic - Sheet 2 ... 20
Figure 15. Existing Peak Hour Traffic Sheet Layout ... 21
Figure 16. Existing Peak Hour Traffic - Sheet 1A ... 22
Figure 17. Existing Peak Hour Traffic - Sheet 1B ... 23
Figure 18. Existing Peak Hour Traffic - Sheet 1C ... 24

Figure 19. Existing Peak Hour Traffic - Sheet 1D 25
Figure 20. Existing Peak Hour Traffic - Sheet 1E 26
Figure 21. Base VISSIM Model Extents 31
Figure 22. Existing Conditions - AM Tier 1 VISSIM Analysis 36
Figure 23. Existing Conditions - PM Tier 1 VISSIM Analysis 37
Figure 24. VISSIM Simulation of PM Peak Hour Congestion Along I-64 Near Kingshighway Blvd. 38
Figure 25. RITIS Provided Speeds Along I-64: Kingshighway Blvd. to Jefferson Ave. 39
Figure 26. Existing Conditions - AM Tier 2 Synchro Analysis 45
Figure 27. Existing Conditions - PM Tier 2 Synchro Analysis 46
Figure 28. Crashes per Year – 2016 to 2020 (Tier 1 & Tier 2 Combined) 48
Figure 29. Crashes Per Month – 2016 to 2020 49
Figure 30. Crashes By Severity – 2016 to 2020 (Tier 1 & Tier 2 Combined) 51
Figure 31. Crash Dashboard – Tier 1 52
Figure 32A: Tier 1 Crashes by Type – Disabling, Fatal, and Suspected Serious Injury 53
Figure 32B: Tier 1 Crashes by Type – Minor Injury 54
Figure 33. Crash Dashboard – Tier 2 (Excludes all Tier 1 Crash Data) 55
Figure 34A. Tier 2 Crashes by Type (Excludes all Tier 1 Crash Data) – Disabling, Fatal, and Suspected Serios Injury 56
Figure 34B: Tier 2 Crashes by Type (Excludes all Tier 1 Crash Data) – Minor Injury 57
Figure 35. Total Crash Frequency Heat Map – 2016 to 2020 (Tier 1) 60
Figure 36. Total Crash Frequency Heat Map – 2016 to 2020 (Tier 2) 61
Figure 37. Total Crash Severity Hot/Cold Spot – 2016 to 2020 (Tier 1 & Tier 2 Combined) 64
Figure 38. Crashes Involving Bicyclists and Pedestrians by Severity – 2016 to 2020 66
Figure 39. Tier 1 Limits: Crashes per Year – 2016 to 2020 67
Figure 40. Tier 1 Limits: Crashes by Type – 2016 to 2020 68
Figure 41. Tier 2 Limits: Crashes by Year– 2016 to 2020 68
Figure 42. Tier 2 Limits: Crashes by Type – 2016 to 2020 69
Figure 43. Critical Crash Rates Compared to Statewide Average Critical Crash Rate 72
Figure 44. Critical Crash Rates Compared to Statewide Urbanized Area Crash Rate Averages 74
Figure 45. Critical Crash Rates Compared to City of St. Louis Crash Rate Averages 76
Figure 46. Average Trip Distance by Mode of Transportation 81
Figure 47. Average Trip Duration by Mode of Transportation 81
Figure 48. Passenger Motor Vehicle and Commercial Trips by Distance 82
Figure 49. Percentage of Trips by Travel Purpose 83
Figure 50. Percentage of Walk Trips by Travel Purpose 83
Figure 51. Percentage of Bicycle Trips by Travel Purpose 84
Figure 52. 2011 Gateway Bike Plan Network Recommendations (in the Study Area) 86
Figure 53. 2021 Gateway Bike Plan Update Recommended Facility Types 87
Figure 54. Brickline Greenway Routes Map 88
Figure 55. Downtown St. Louis Transportation Study Pedestrian Priority Routes Map 90
Figure 56. Downtown St. Louis Transportation Study Bicycle Network Map 91
Figure 57. City of St. Louis ADA Transition Plan Prioritization Map 92
Figure 58: I-64 Bicycle and Pedestrian Crossings 94
Figure 59. PLOS Scores as Percent of Study Area Roadway Network 96
Figure 60. PLOS Scores in the Study Area 98

Figure 61. Pedestrian Connectivity Analysis Results ... 101
Figure 62. Bicycle Level of Traffic Stress Scores as a Percentage of the Street Network ... 105
Figure 63. BLTS Scores for the Study Area ... 106
Figure 64. Bicycle Connectivity Analysis Results ... 109
Figure 65. MetroLink Stops and Routes in the Study Area ... 113
Figure 66. MetroBus Stops and Routes in the Study Area ... 114
Figure 67. Metro Ridership (2000-2020) ... 119
Figure 68. Ridership by MetroBus Stops ... 122
Figure 69. Estimated Mode Share for All Trips in the Study Area ... 123
Figure 70. Transit Trips by Origin and Destination ... 124
Figure 71. Trip Purpose for Transit Trips Ending in the Study Area ... 124
Figure 72. Trip Purpose for Transit Trips Originating in the Study Area ... 125
Figure 73. Average Trip Duration by Travel Mode and Origin/Destination ... 126
Figure 74. 10-Minute Bikeshed as Related to Transit Routes ... 127
Figure 75. 5- and 10-Minute Walksheds as Related to Transit Routes ... 128
Figure 76. Transit-Dependent Population in the Study Area ... 129
Figure 77. Primary Mode of Travel for Trips Made by Study Area Residents ... 130
Figure 78. On Time Performance – Southbound 70-Grand at Grand MetroLink Station ... 131
Figure 79. Study Area Transit Crashes By Year ... 132
Figure 80. Transit Crash Density as Compared to Pedestrian and Bicycle Crashes ... 133
Figure 81. MetroBus Stop Amenities ... 134

TABLES

Table 1. I-64 PEL Road Classification ... 16
Table 2. I-64 Truck Percentages ... 18
Table 3. Freeway Level of Service Thresholds ... 27
Table 4. Intersection Level of Service Thresholds ... 28
Table 5. Analysis Parameters ... 28
Table 6. Access Points to I-64 ... 29
Table 7. VISSIM Travel Time Comparison ... 33
Table 8. VISSIM Throughput Comparison ... 33
Table 9. Crashes by Severity – 2016 to 2020 (Tier 1) ... 49
Table 10. Crashes by Severity – 2016 to 2020 (Tier 2) ... 50
Table 11. MSHP Call Report Logs – Wrong-Way Drivers ... 58
Table 12. Bicycle and Pedestrian Crashes by Severity (Tier 1 & Tier 2 Combined) ... 65
Table 13. Tier 1 Limits: Crashes by Severity – 2016 to 2020 ... 67
Table 14. Tier 2 Limits: Crashes by Severity – 2016 to 2020 ... 69
Table 15. Statewide Average Crash Rates by Functional Class ... 70
Table 16. Statewide Urbanized Crash Rates by Functional Class ... 73
Table 17. St. Louis City Urbanized Crash Rates by Functional Class ... 75
Table 18. Roadway Segment Pedestrian Level of Service Scoring: Roadway Segments ... 95
Table 19. Existing Bicycle Facilities by Facility Type ... 102
Table 20. BLTS Categories ... 103
Table 21. Level of Traffic Stress Criteria ... 104

Table 22. BLTS Scores by Functional Classification 107
Table 23. Relevant Transit Planning Documents 110
Table 24. MetroLink Routes in the Study Area 112
Table 25. MetroBus Routes in the Study Area 115
Table 26. MetroBus Stops and Corresponding Route Numbers in the Study Area 115
Table 27. Ridership by MetroBus Stops 121
Table 28. Boardings by MetroLink Station 121

ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway Officials
ADA	Americans with Disabilities Act
ADT	Average daily traffic
AJR	Access Justification Report
AM	Ante meridiem
BLTS	Bicycle Level of Traffic Stress
BRT	Bus rapid transit
EPG	Engineering Policy Guide
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FY	Fiscal year
HCM	Highway Capacity Manual
I-64	Interstate 64
LOS	Level of Service
MoDOT	Missouri Department of Transportation
MOE	Measure of Effectiveness
mph	Miles per hour
MSHP	Missouri State Highway Patrol
MTI	Mineta Transportation Institute
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
OTP	On-time performance
pc/mi/ln	Passenger car per mile per lane
PEL	Planning and Environmental Linkages
PLOS	Pedestrian Level of Service
PM	Post meridiem
PMI	Potential Mobility Index
RITIS	Regional Integrated Transportation Information System
SAR	Statewide average crash rate
sec/veh	Seconds per vehicle
SPUI	Single-Point Urban Interchange
TAP	Technical Assistance Panel
ULI	Urban Land Institute
US 40	United States Highway 40
v/c	Volume to capacity
veh/ml/ln	Vehicle per mile per lane
VISSIM	Verkehr In Städten - SIMulationsmodell
vpd	Vehicles per day
vph	Vehicles per hour

1. INTRODUCTION

The purpose of the Future64 Kingshighway to Jefferson Planning and Environmental Linkages (PEL) Study for Interstate 64 (I-64) between Jefferson Ave. and Kingshighway Blvd. is to examine the existing conditions, issues, and needs of the corridor in the urban context. This type of study is generally conducted before any project construction phasing is identified, and before specific problems and solutions are known.

A key focus of the PEL is to address immediate asset management needs in the corridor while capitalizing on the opportunity to examine the corridor holistically. The intended outcome is to develop an actionable plan for near-term and long-term improvements to address transportation issues in a corridor or a specific location.

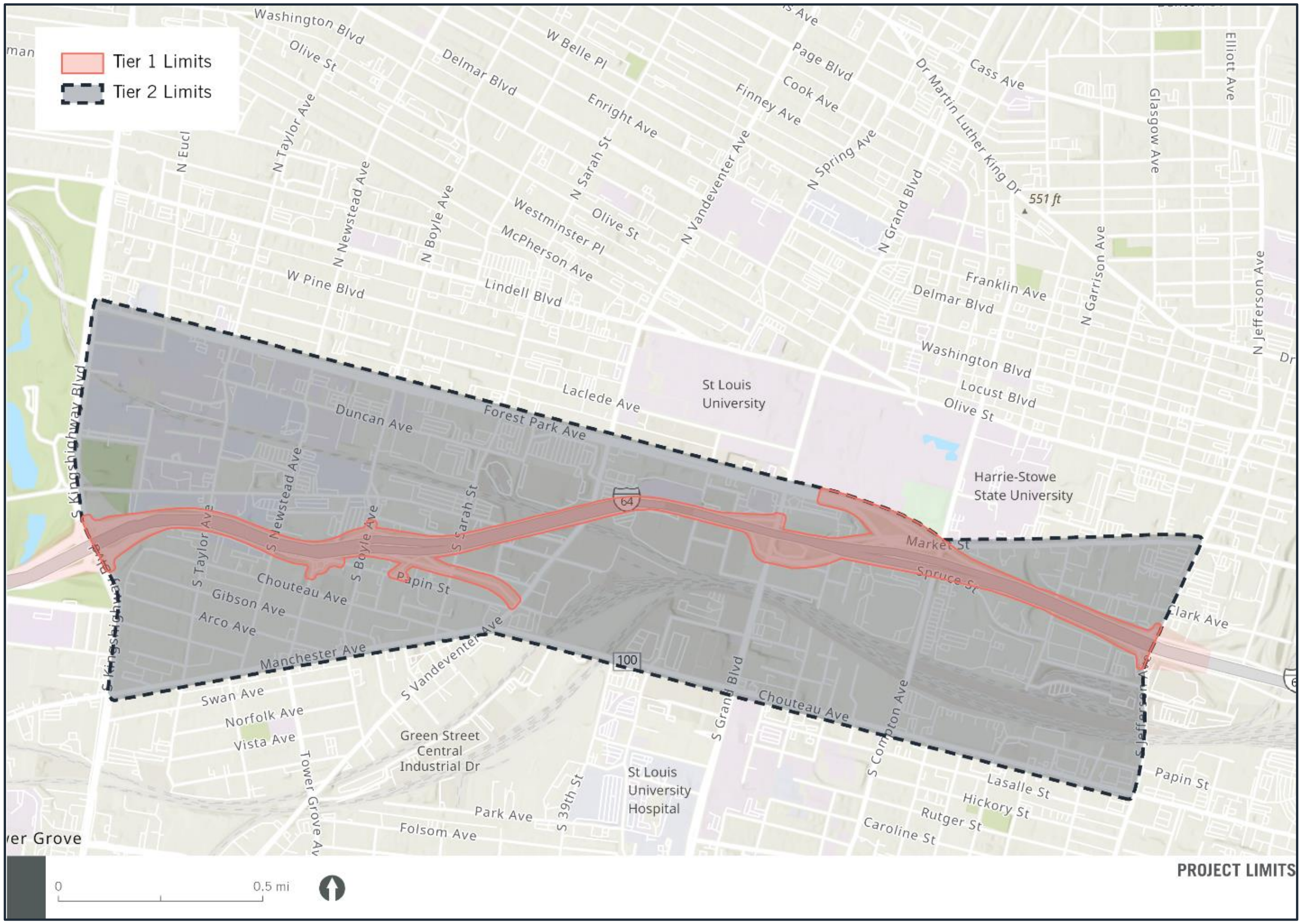
A critical first step in identifying potential transportation improvements along any corridor is to evaluate traffic, safety, and multimodal conditions as they currently exist. Gaining insight into the existing constraints can help guide the development of infrastructure improvements that address the needs and wants of all users along and adjacent to the corridor. Therefore, this technical report details the existing traffic, safety, and multimodal conditions within the Future64 PEL study area, in that order.

1.1. STUDY AREA

The Future64 PEL study area (study area) generally extends from Kingshighway Blvd. to the west to Jefferson Ave. to the east, and Forest Park Ave. to the north and Route 100 (Chouteau Ave./Manchester Ave.) to the south. The study area is broken into two tiers. The Tier 1 limits are defined as the area between Kingshighway Blvd. and Jefferson Ave. specific to the interstate system and contained within MoDOT right-of-way, inclusive of all merge, diverge, and weave sections, as well as the ramp terminals at each of the interchanges. Tier 2 limits encompass I-64 and the local transportation network that interfaces with I-64, including multimodal facilities, between Forest Park Ave./Market St. and Route 100 (Manchester Ave./Chouteau Ave.). The overall study area and Tier 1 and Tier 2 limits are shown in **Figure 1.**

The I-64 corridor between Jefferson Ave. and Kingshighway Blvd. is located in a redeveloping, dense, urban environment where major stakeholders are actively planning for new employment centers, housing units, retail, and entertainment. Additionally, the corridor features significant existing and planned multimodal investments, and thus this study evaluates transportation use by all modes. I-64 is directly tied to the local City of St. Louis street grid via several interchanges. Therefore, the study area includes portions of the local transportation network, which necessitates an urban corridor-based approach to consider investment needs for not only MoDOT but other local agencies and partners as well.

Figure 1. Future64 PEL Study Area

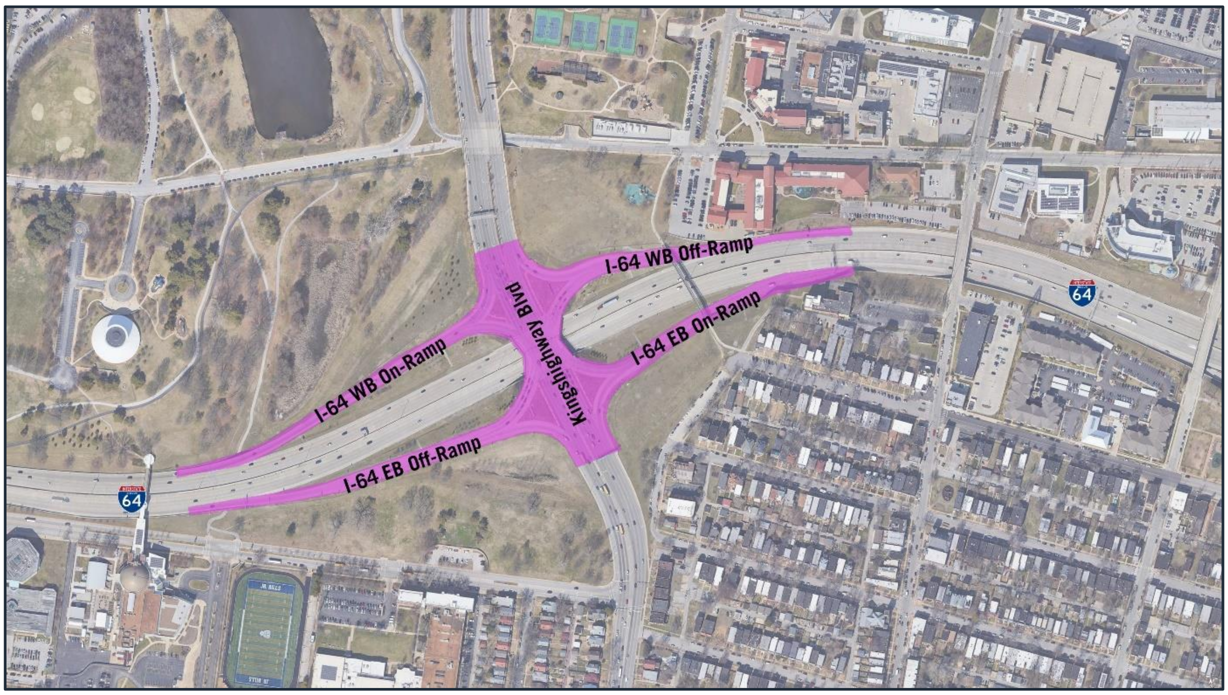


1.2. ROADWAY NETWORK

Within the Tier 1 limits, the I-64 mainline segments inclusive of merge, diverge, and weaving segments, and its interchanges were evaluated. The existing configuration of each interchange is described below and depicted in the accompanying figures.

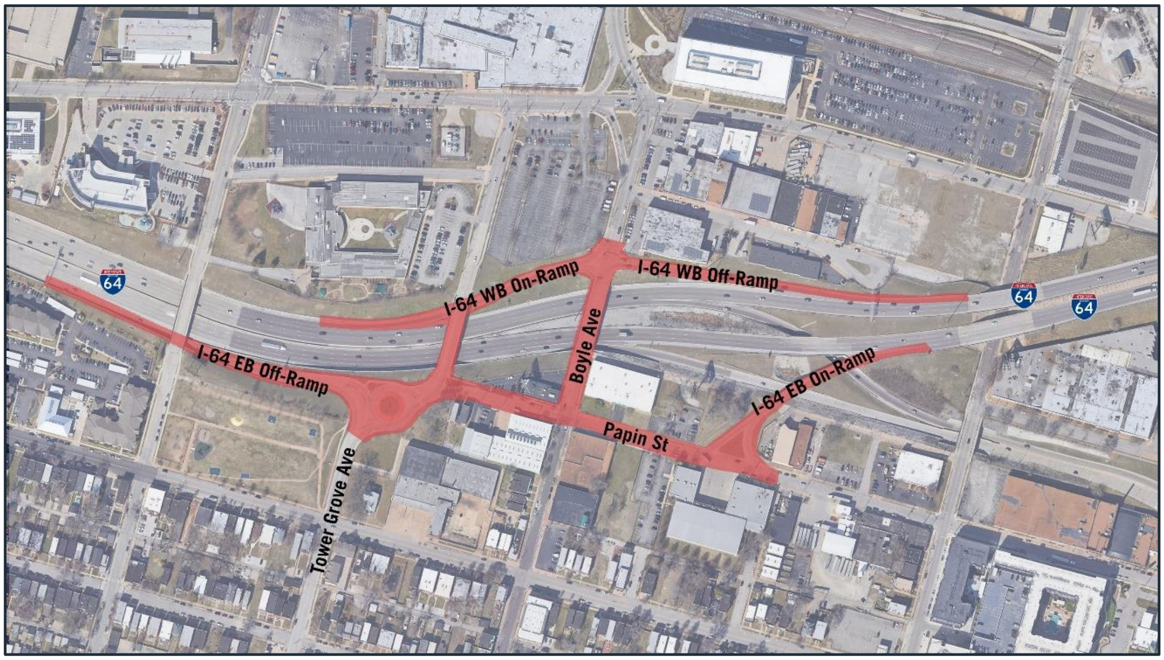
I-64 at Kingshighway Blvd. (Figure 2). A Single Point Urban Interchange (SPUI) providing full access to I-64 via four ramps accessed via a single signalized ramp terminal.

Figure 2. I-64 at Kingshighway Blvd.



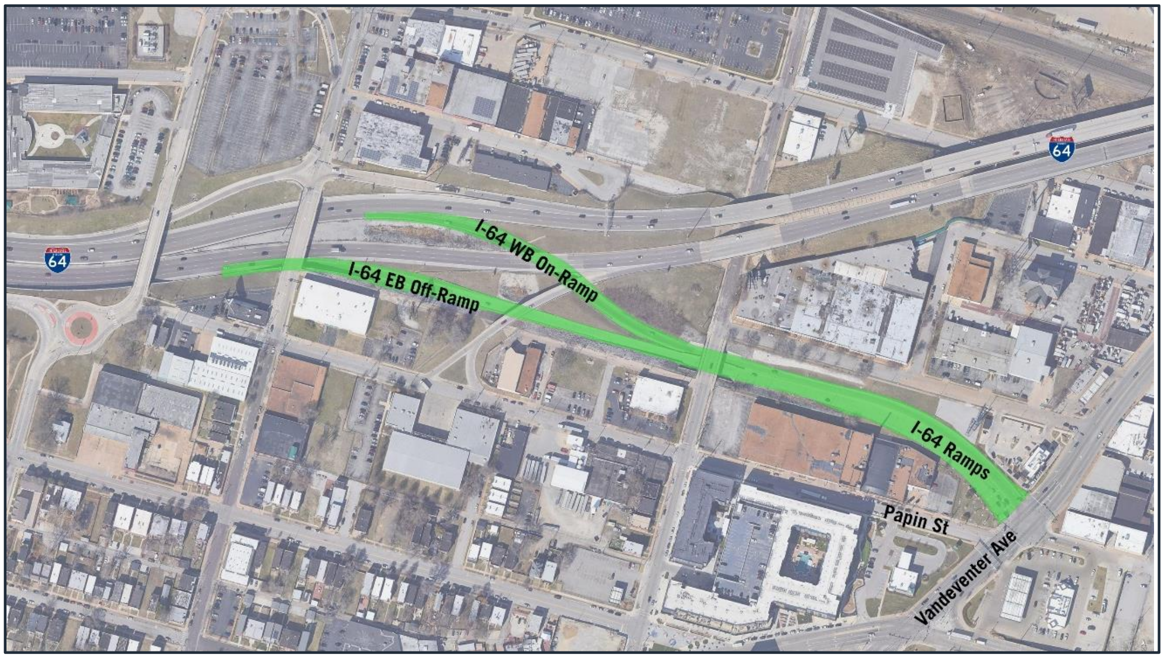
I-64 at Tower Grove Ave./Boyle Ave./Papin St. (Figure 3). Full access to I-64 via four ramps accessed by three local roadways: Tower Grove Ave., Boyle Ave., and Papin St. The eastbound off-ramp accesses the local network via the roundabout ramp terminal with Tower Grove Ave./Papin St; the westbound on- and off-ramps are accessed via the signalized ramp terminal with Boyle Ave; and the eastbound on-ramp to I-64 is accessed via Papin St. east of Boyle Ave.

Figure 3. I-64 at Tower Grove Ave./Boyle Ave./Papin St.



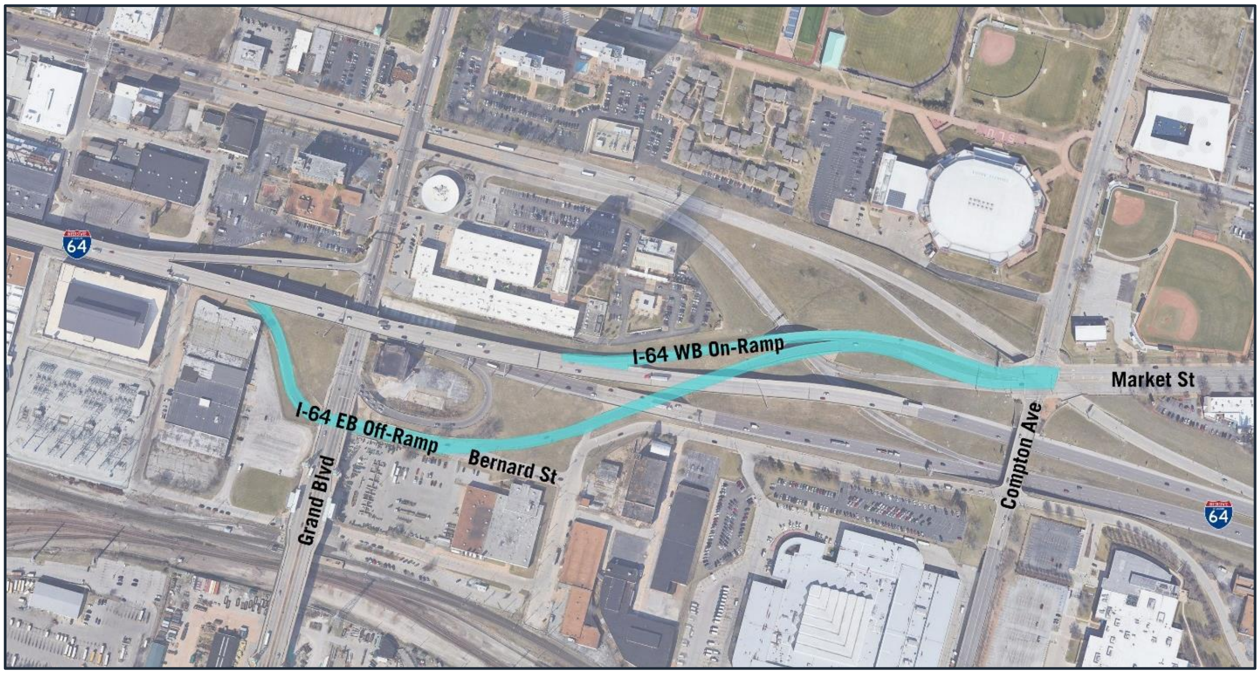
I-64 at Vandeventer Ave. (Figure 4). A partial interchange serving I-64 to and from the west via two ramps, one of which is a left-side entrance ramp accessed via a four-leg, signalized ramp terminal that also serves the east leg of Papin St. The west leg of Papin is located immediately south of the signalized intersection, is limited to right tuns only and is not under signal control.

Figure 4. I-64 at Vandeventer Ave.



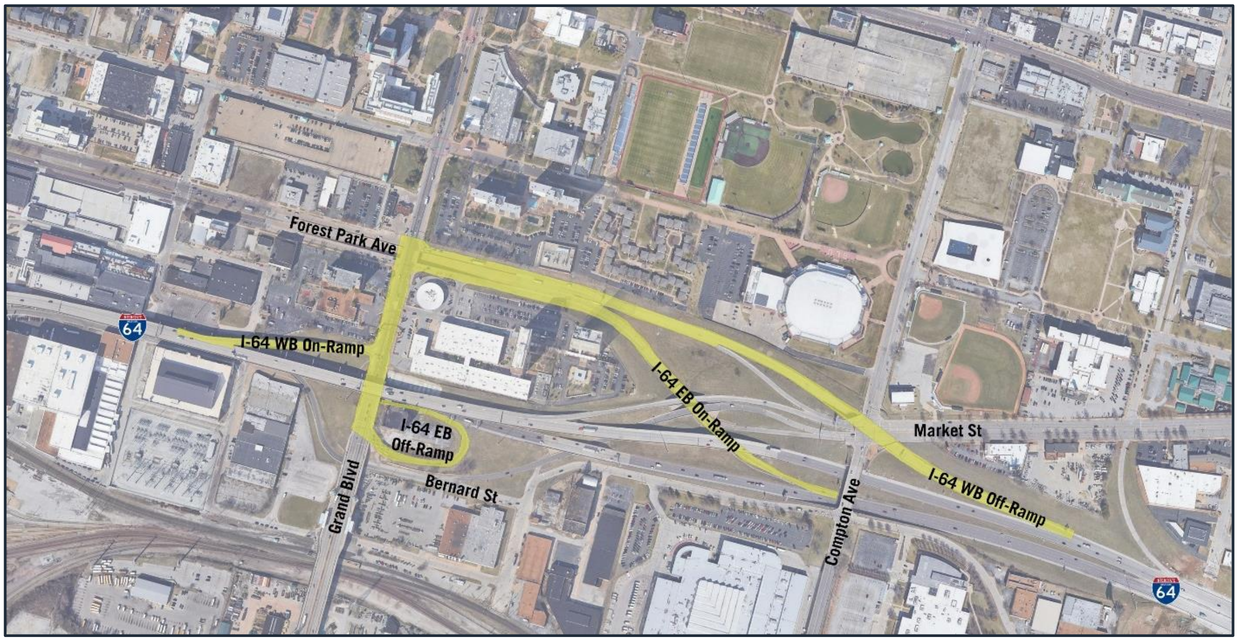
I-64 at Market St./Bernard St. (Figure 6). A partial interchange serving I-64 to and from the west with an exit ramp from eastbound I-64 located west of Grand Blvd. that terminates onto Bernard St. underneath Grand Blvd. Access to Market St. is then provided via a ramp that traverses northeasterly underneath I-64 before terminating at the elevated signalized ramp terminal with Compton Ave. and Market St., located east of Grand Blvd. Access to westbound I-64 is provided via an on-ramp accessed via the signalized ramp terminal with Compton Ave. and Market St. It should be noted that the signalized ramp terminal with Compton Ave. and Market St. also provides access to and from Forest Park Ave. to the west.

Figure 5. I-64 at Market St./Bernard St.



I-64 at Grand Blvd./Forest Park Ave. (Figure 6**)**. A full interchange between the ramps at Grand Blvd. and at Forest Park Ave. Access to and from the west on I-64 is accomplished via two ramps, one of which is a tight loop ramp with a radius of approximately 165 feet at a 3% superelevation compounded to a radius of 90 feet at 8% superelevation exiting the interstate. The ramp has a posted advisory speed limit of 20 mph although current configuration indicates an advisory speed of 15 mph. A signalized ramp terminal is provided for the eastbound off-ramp only. Access to and from the east is accomplished via ramps to and from Forest Park Ave., of which the on-ramp to I-64 is a left-side entrance ramp.

Figure 6. I-64 at Grand Blvd./Forest Park Ave.



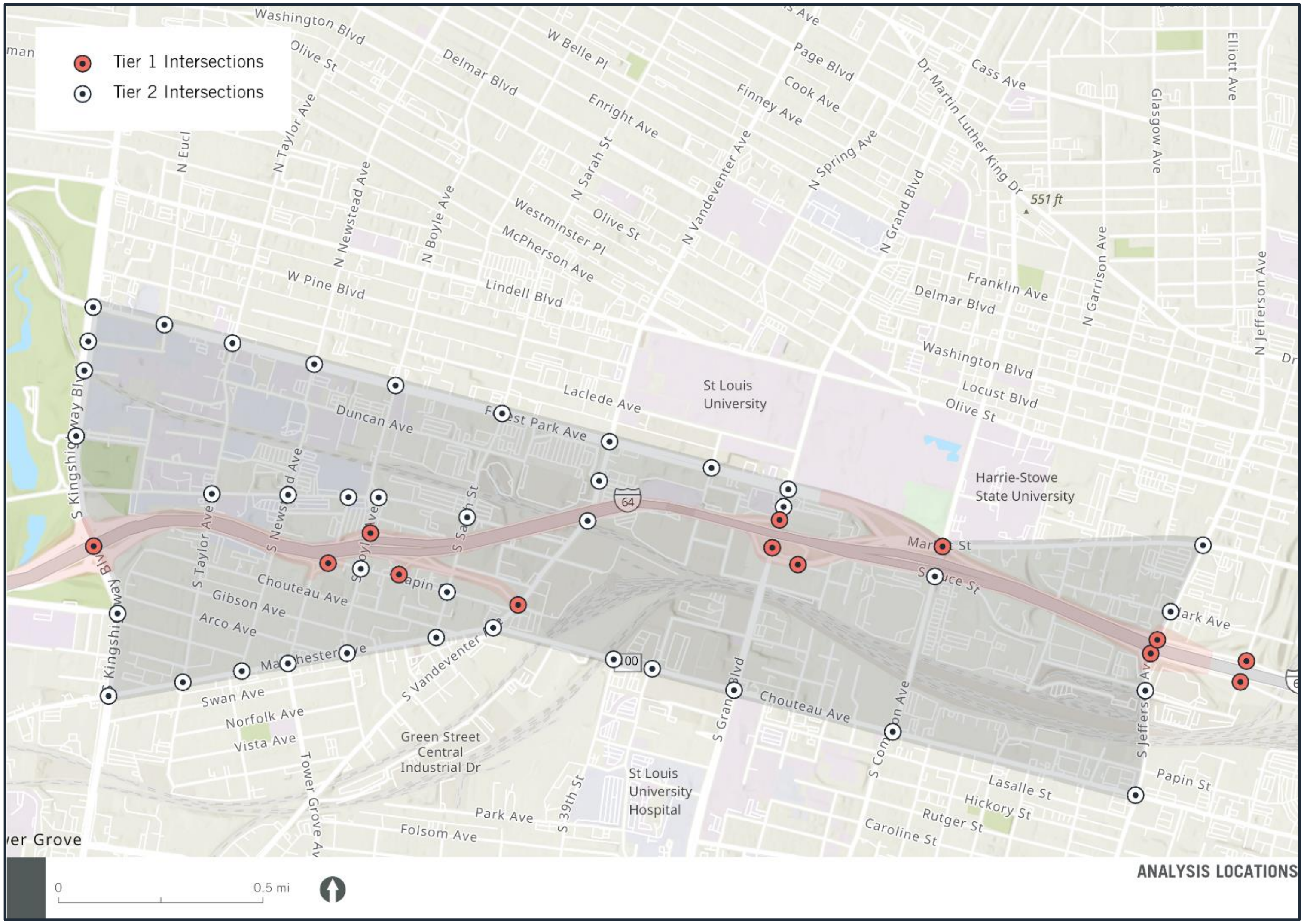
I-64 at Jefferson Ave. / 22nd St. (Figure 7). A modified split diamond configuration providing full access to I-64 via six ramps. Construction of this interchange is anticipated to be completed in 2022 and will include one-way outer roads between the Jefferson Ave. and 22nd St. ramp terminals, as well as two slip ramps to and from the west on I-64.

Figure 7. I-64 at Jefferson Ave. / 22nd St.

Within the study area, 52 intersections were included for analysis. 13 are ramp terminals with I-64 (Tier 1 limits) and the remaining intersections (Tier 2 limits) are critical with regards to operations along the City of St. Louis street grid system, as shown in **Figure 8** and listed below.

- Tier 1:
  - I-64 & Kingshighway Blvd. (ramp terminals)
  - I-64 & Boyle Ave. (ramp terminal)
  - I-64 & Tower Grove Ave./Papin St. (roundabout ramp terminal)
  - Papin St. & I-64 Onramps (ramp terminal)
  - I-64 Ramps/Papin St. & Vandeventer Ave. (ramp terminal)
  - WB I-64 On-ramp & Grand Blvd. (ramp terminal)
  - EB I-64 Off-ramp & Grand Blvd. (ramp terminal)
  - EB I-64 Off-ramp/Market St. & Compton Ave. (ramp terminal)
  - WB I-64 Off-ramp & Forest Park Ave. (ramp terminal)
  - I-64 Ramps & Jefferson Ave. (ramp terminals)
  - I-64 Ramps & 22nd St. (ramp terminals)
- Tier 2:
  - Kingshighway Blvd. & Forest Park Ave.
  - Kingshighway Blvd. & Parkview Pl.
  - Kingshighway Blvd. & Children's Pl.
  - Kingshighway Blvd. & Barnes Jewish Hospital Plz.
  - Kingshighway Blvd. & Oakland Ave.
  - Kingshighway Blvd. & Rte. 100 (Chouteau Ave./Manchester Ave.)
  - Forest Park Ave. & Euclid Ave.
  - Forest Park Ave. & Taylor Ave.
  - Forest Park Ave. & Newstead Ave.
  - Forest Park Ave. & Boyle Ave.
  - Forest Park Ave. & Sarah St.
  - Forest Park Ave. & Vandeventer Ave.
  - Forest Park Ave. & Spring Ave.
  - Forest Park Ave. & Grand Blvd
  - Clayton Ave. & Taylor Ave.
  - Clayton Ave. & Newstead Ave.
  - Clayton Ave. & Tower Grove Ave.
  - Clayton Ave. & Boyle Ave.
  - Clayton Ave. & Sarah St.
  - Papin St. & Boyle Ave.
  - Papin St. & Sarah St.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Taylor Ave.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Newstead Ave.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Tower Grove Ave.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Boyle Ave.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Sarah St.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Vandeventer Ave.
  - Vandeventer Ave. & Market St.
  - Vandeventer Ave. & Ikea Way/Foundry Way
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & S 39th St.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Spring Ave.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Grand Blvd.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Compton Ave.
  - Rte. 100 (Chouteau Ave./Manchester Ave.) & Jefferson Ave.
  - Grand Blvd. & Council Plz.
  - Market St. & Bernard St.
  - Compton Ave. & Spruce St.
  - Jefferson Ave. & Scott Ave.
  - Jefferson Ave. & Clark Ave.
  - Jefferson Ave. & Market St.

Figure 8. Intersections in the Study Area



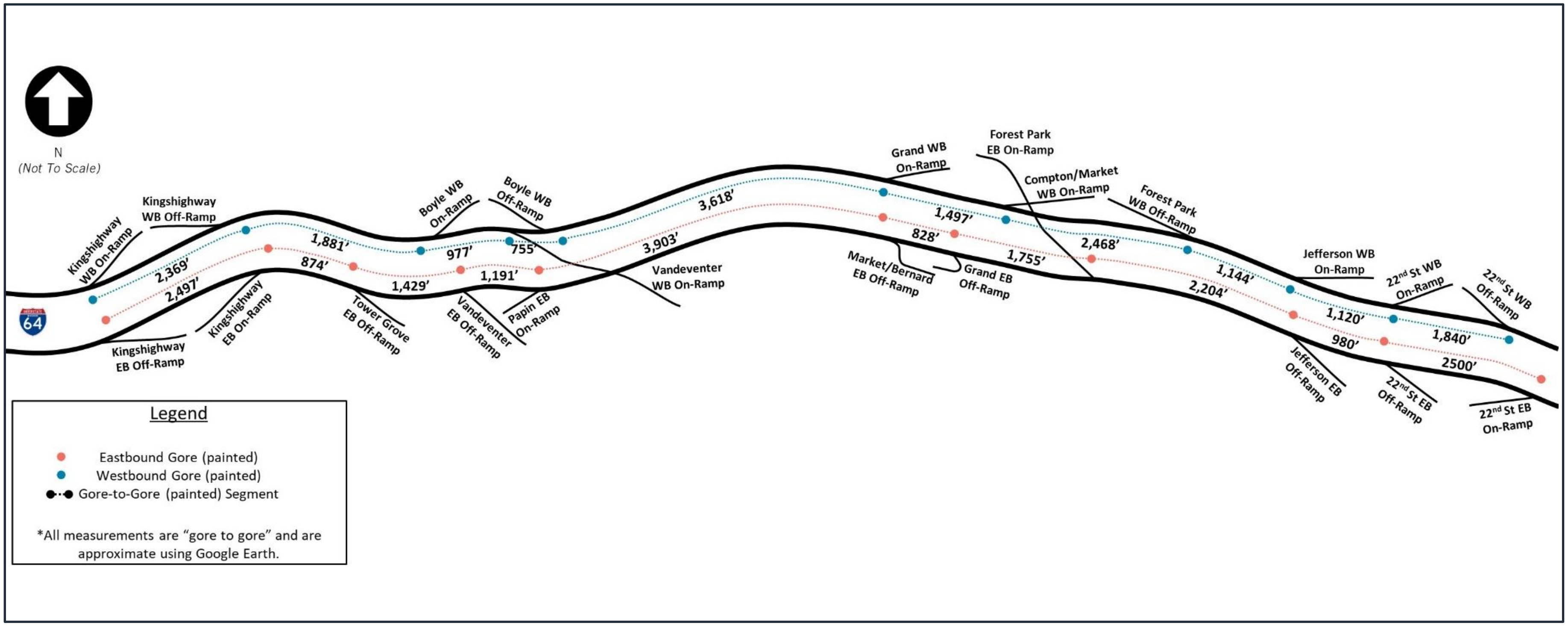
1.2.1. Interchange Spacing

The minimum spacing for urban interchanges specified in the American Association of State Highway Officials (AASHTO) Interstate Access Guide is one mile for service interchanges, which aligns with FHWA guidance. MoDOT's access management guidelines and EPG section 940.2 recommend interchange spacing that ranges between two to three miles. Interchange spacing decisions are to be supported by an operational and level of traffic service analysis. Connectivity, speed and safety are also to be considered.

However, it is likely that the above spacing standards are biased toward non urbanized areas where arterial spacing is tighter and land use is denser and often predates the construction of the highway itself. Therefore, in highly dense urban central city areas, the configuration of the local street system may require a closer interchange spacing to maintain vital connections and mobility. Within the study area, the existing spacing between the six interchanges is at or below the one-mile threshold, with spacing as low as 0.4 mile between the Grand Blvd. and Market St./Compton Ave. interchanges. The spacing between each painted gore along the I-64 corridor is shown in **Figure 9.**

It is worth noting there are two left-entry on-ramps within the study area—one eastbound from Forest Park Ave. and one westbound from Vandeventer Ave. In general, left-side on- and off-ramps are discouraged in practice because they do not meet the standards for driver expectancy and lead to safety issues.

Figure 9. I-64 Corridor Gore-to-Gore Measurements



2. EXISTING TRAFFIC OPERATIONS

This section details the existing vehicular traffic operating conditions on I-64, as well as the ramp terminals and other critical intersections, within the study area.

2.1. ROAD NETWORK

To analyze traffic conditions, roadway geometry, speed limits, traffic signal timings, functional classification, and more were obtained for the roadways within the study area. The parameters described in this section pertain to the sections of the roadways within the study area unless otherwise noted.

I-64, also known as US 40, runs east-west, is within MoDOT right-of-way, and is functionally classified as an interstate. Generally, I-64 consists of three lanes in each direction throughout the eastern portion of the study area. I-64 expands to four lanes in each direction generally in the vicinity of Boyle Ave. continuing west beyond the study area (the additional lanes are attributable to the on- and off-ramps associated with Vandeventer Ave.).

The typical section of I-64 has 12-foot lanes. Generally, there are continuous inside and outside shoulders. The inside shoulder varies in width from 4 to 12 feet, but generally is 6 to 8 feet wide in most locations. The outside shoulders are consistently 10 feet wide. In general, the ramps to and from I-64 vary in width from 12 to 20 feet.

I-64 has a posted maximum speed limit of 55 miles per hour (mph) and minimum speed limit of 40 mph. Ramp speeds range from the 55 mph, to match the mainline, to the lowest posted speed located at the loop ramp exit for Grand Blvd., which has an advisory speed of 20 mph.

Kingshighway Blvd. has a posted speed limit of 35 mph. The signals along Kingshighway Blvd. operate as part of a coordinated system. This arterial extends approximately 9 miles north-south through the City of St. Louis between Florissant Ave. and Gravois Ave. and varies in width and the number of lanes. In general, the roadway has three lanes in each direction. South of its interchange with I-64, Kingshighway Blvd. has three through lanes and a dedicated left-turn lane along its northbound approach and a dedicated right-turn lane along its southbound approach at Oakland Ave. Three through lanes and dedicated left-turn lanes are located along the northbound and southbound approaches of Kingshighway Blvd. at Manchester Ave. At its interchange with I-64, Kingshighway Blvd. has three through lanes and two dedicated left-turn lanes along the northbound and southbound approaches. The northbound approach at the interchange has one channelized right-turn lane and the southbound approach has two channelized right-turn lanes. North of its interchange with I-64, Kingshighway Blvd. has three through lanes. Dedicated left-turn and right-turn lanes are provided at each of the signalized intersections along Kingshighway Blvd. There is a parking lane with metered spaces along the southbound approach.

Forest Park Ave. runs east-west and has a posted speed limit of 30 mph. It serves as a vital northern access point to the Washington University Medical Campus, BJC Medical Group, University of Health

Sciences and Pharmacy in St. Louis, and Cortex. The signals along Forest Park Ave. operate as part of a coordinated system intended to progress through traffic. Forest Park Ave. generally has three through lanes in each direction. It transitions to two lanes in each direction as it progresses east. The section of roadway that goes under Grand Blvd. (intersection is grade separated) has two through lanes in each direction. Metered parking is provided along both sides of Forest Park Ave. To the east, Forest Park Ave. terminates at Market St. and I-64. West of Kingshighway Blvd., Forest Park Ave. becomes Forest Park Parkway.

Manchester Ave./Chouteau Ave., also known as Missouri Route 100, has a posted speed limit of 35 mph to the east of Vandeventer Ave. and 30 mph to the west of Vandeventer Ave. East of Vandeventer Ave., this roadway is referred to as Chouteau Ave; west of Vandeventer Ave. it is referred to as Manchester Ave. Manchester Ave. has one through lane in each direction. Dedicated left-turn lanes are provided at each study intersection along Manchester Ave. Metered parking is provided along both sides of Manchester Ave. Chouteau Ave. has two through lanes in each direction between Vandeventer Ave. and Spring Ave. East of Spring Ave., the eastbound approach has one through lane, the westbound approach has two through lanes, and there is one two-way left-turn lane. East of Grand Blvd., Chouteau Ave. narrows to one through lane in each direction and one two-way left-turn lane. Buffered bike lanes as well as parking lanes are provided along both sides of Chouteau Ave. east of Grand Blvd.

Clayton Ave. has a posted speed limit of 30 mph. Clayton Ave. runs east-west and serves as a vital southern access point to the Washington University Medical Campus, BJC Medical Group, University of Health Sciences and Pharmacy in St. Louis, and Cortex. Clayton Ave. has one through lane in each direction with separate turn lanes at the intersections.

Grand Blvd. has a posted speed limit of 35 mph. Grand Blvd. has two through lanes in each direction and the intersection of Grand Blvd. and Forest Park Ave. is grade separated. A viaduct from I-64 and Compton Ave. runs along Forest Park Ave. underneath Grand Blvd., bypassing the signal. Given that Grand Blvd. extends north-south for approximately nine miles, this roadway serves as a vital multimodal connector through the city as many bus and transit stops are along Grand Blvd. The Grand MetroLink Station is grade separated from Grand Blvd., which causes connectivity issues along the corridor.

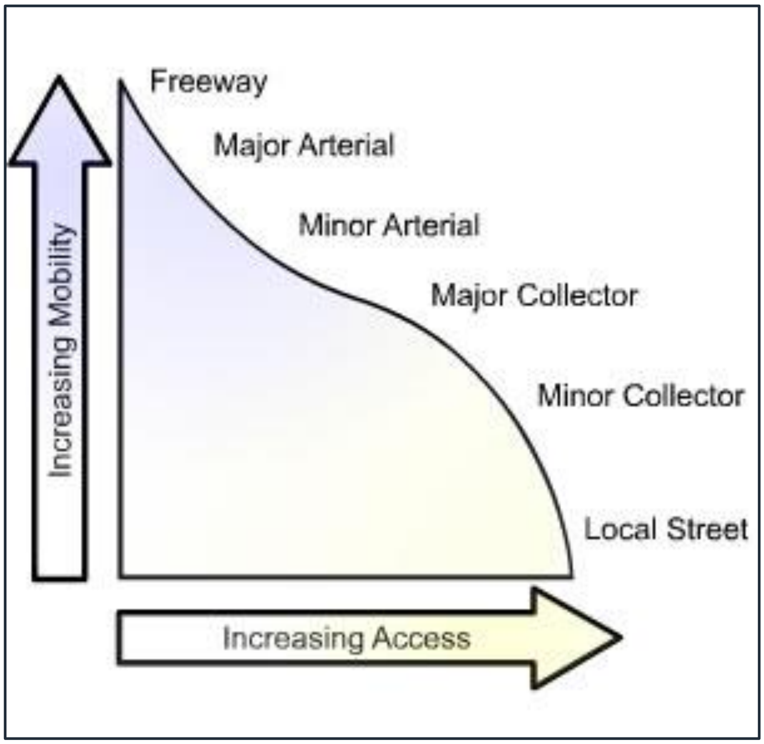
Compton Ave. has a posted speed limit of 30 mph. Compton Ave. has two through lanes in each direction. Compton Ave. travels north-south.

Jefferson Ave. has a posted speed limit of 35 mph. The length of Jefferson Ave. is approximately five miles and travels north-south. Jefferson Ave. generally has two through lanes in each direction. With the construction of the new interchange of I-64 with Jefferson Ave./22nd St., the existing access will be expanded to include a full interchange, with additional slip ramps to I-64.

Market St. has a posted speed limit of 35 mph. Market St. generally has two through lanes in each direction with a two-way left-turn lane. This east-west roadway begins at Memorial Drive by the Gateway Arch and terminates at Compton Ave. (although there is a remnant that runs along the south side of I-64 between Prospect Ave. and Vandeventer).

In order to better understand the road network within the study area, the functional classification of the roadways was reviewed. The functional classification of roadways defines the nature of the movement of vehicles through a network of roads. The hierarchy of roadways ranges from interstate highways, which are limited access roadways that have high speeds and can accommodate a high volume of vehicles, to local neighborhood roads that allow for the level of access but can only accommodate low speeds and low traffic volumes. As shown in **Figure 10**, freeways and arterials offer more higher mobility with less land access, whereas local streets offer less mobility with more land access.

Figure 10. Road Classification and the Relationship between Mobility and Land Access



Source: Federal Highway Administration.

The functional classifications for the roadways within the study area are shown in **Figure 11** and listed in **Table 1.**

Figure 11. I-64 PEL Roadway Functional Classification

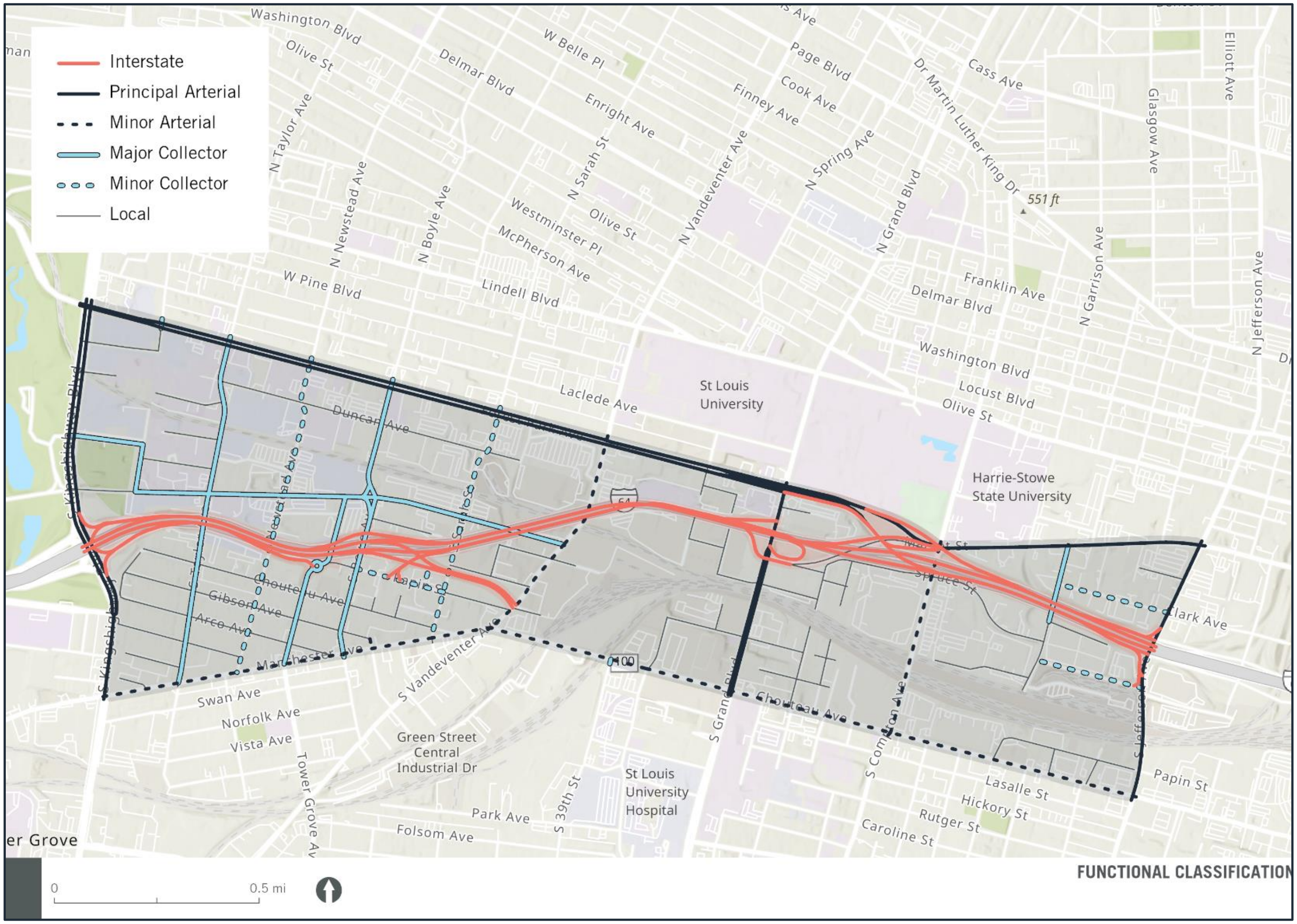


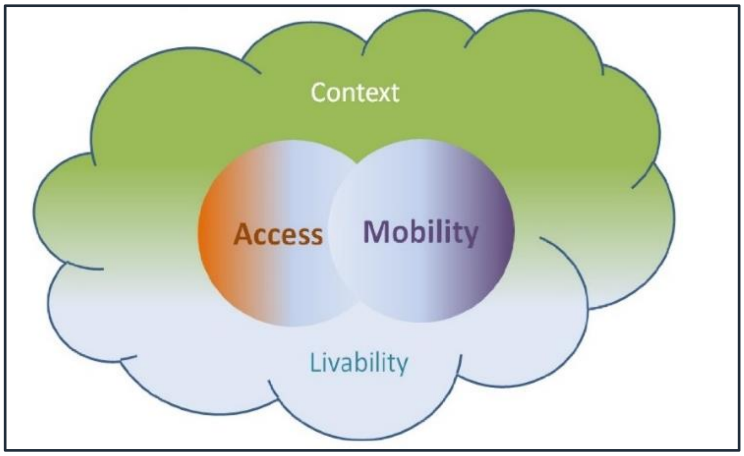
Table 1. I-64 PEL Road Classification

Roadway	Classification
I-64	Interstate
Kingshighway Blvd.	Principal Arterial
Forest Park Ave.	Principal Arterial
Grand Blvd.	Principal Arterial
Jefferson Ave.	Principal Arterial
Market St.	Principal Arterial (east of where is breaks off of Forest Park Ave. /Grand Blvd. Ramp) Local Road (west of the above-described area)
Manchester Ave./Chouteau Ave.	Minor Arterial
Vandeventer Ave.	Minor Arterial
Compton Ave.	Minor Arterial
Clayton Ave.	Major Collector
Oakland Ave.	Major Collector
Taylor Ave.	Major Collector
Newstead Ave.	Minor Collector
Tower Grove Ave.	Major Collector
39th St.	Major Collector
Boyle Ave.	Major Collector (north of Manchester Ave.) Minor Collector (south of Manchester Ave.)
Sarah St.	Minor Collector
Clark Ave.	Minor Collector
Scott Ave.	Minor Collector
Papin St.	Minor Collector (between Boyle and Sarah St.) Local Road (between Tower Grove Ave. and Boyle Ave. and between Sarah St. and Vandeventer Ave.)
All other roadways not listed	Local Roads

Source: MoDOT Functional Classification Maps.

However, functional classification-based designs may not always be responsive to context. Per the FHWA's *Livability in Transportation Guidebook*, a roadway, when considered solely based upon its functional classification may result in a *"lack of recognition regarding the influence of land use density and mix on the feasibility and desirability of walking, as well as the influence of land use density and mix on setting operating speeds that are appropriate for the level of pedestrian activity present."* Context classification of a roadway fosters the blending of the general characteristics of the roadway with its connections and adjacent land use to help the roadway function for all users who would be attracted to it—vehicles, pedestrians, cyclists, and transit-dependent users. As shown in **Figure 12**, the land access and mobility of a roadway help to blend the context of a roadway with its livability.

Figure 12. Illustration of Access-Mobility Dynamic



Source: Federal Highway Administration.

Therefore, it is imperative to keep in mind that discussions of traffic, safety, and multimodal within the study area is a balancing act between traditional traffic operations measures like level of service and volume to capacity ratios with community health, safety, and well-being issues that contribute to livability. The PEL process is designed to do just that; strike a balance between access, mobility, and the surrounding community's needs.

2.2. BASE TRAFFIC VOLUMES

Traffic volumes for roadways within the study area were obtained from MoDOT, the City of St. Louis, and previous traffic studies. Weekday AM and PM peak hour mainline, ramp, and intersection traffic data were consolidated for the years 2016 through 2022, including recent count data collected by MoDOT or the consulting team. Generally, 2020 data was not used because it was considered not representative of typical traffic volume trends that were lower during the COVID-19 pandemic.

The interchange of I-64 with Jefferson Ave./22nd St. is currently under construction and is expected to be completed by the end of 2022. It was determined that the existing conditions analysis for the PEL study should assume that the reconstructed interchange is in place. Due to ongoing construction, data representative of the split diamond configuration with additional slip ramps could not be collected. Therefore, traffic data presented in the approved 2018 *Jefferson/22nd Street Access Justification Report* (AJR) was referenced to determine 2022 volumes representative of the interchange being fully operational.

To balance the historical data and offset the unusually depressed 2020/early 2021 COVID-19 pandemic traffic volumes, additional traffic counts at critical intersections were collected in 2022. The 2022 data indicated that traffic as a whole has rebounded from the pandemic volumes, and, in general, current peak hour traffic volumes are comparable to, if not lower than, pre-pandemic levels. It was reasoned that the impact of hybrid/remote work schedules coupled with a slight decrease in population within the city supported the 2022 traffic volume data. Therefore, it was concluded that the 2022 traffic volumes were representative of current traffic trends within the study area and were appropriate for calibrating the historical data for the PEL study traffic operational analysis.

The traffic volumes were further refined to represent a balanced and cohesive network. The balancing was completed according to MoDOT's Engineering Policy Guide (EPG) Section 905.3.4.5 using the "Higher Volume Distributed" method. This was completed in order to provide realistic results for the model. There were cases where traffic volumes varied significantly between two intersections and the "Split the Difference" method was implemented so as to not overcompensate for any one specific location. Both of these traffic balancing methods provided realistic results for the model based on the available traffic volume data.

It was determined that the weekday peak hours within the study area occurred from 7:30 to 8:30 AM during the morning peak period and from 4:30 to 5:30 PM for the evening peak period. The existing traffic volumes along the I-64 corridor are shown in **Figure 13** and **Figure 14**. The peak hour traffic volumes at the study intersections are shown in **Figure 15** through **Figure 20.**

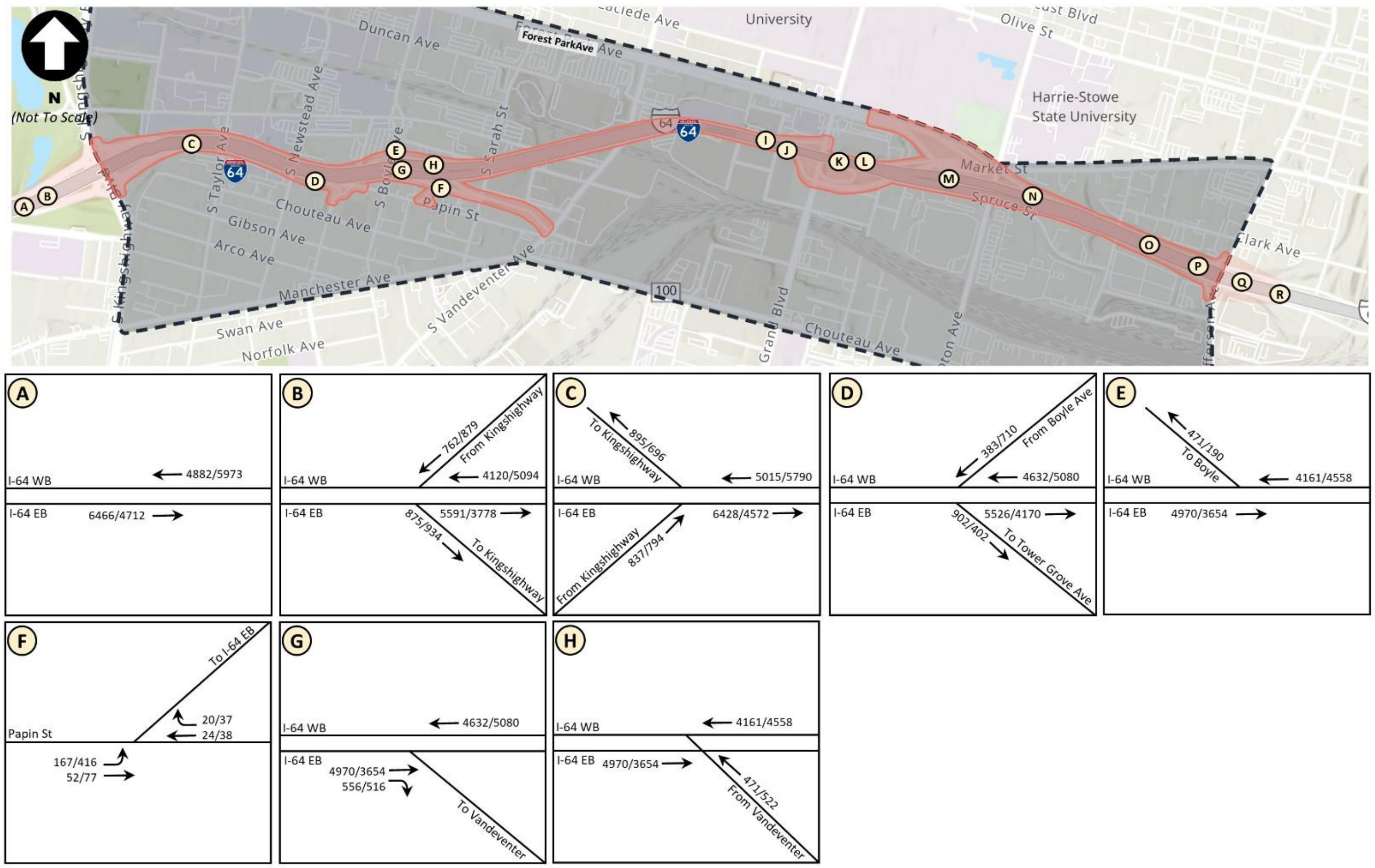
Table 2 shows the truck percentages based upon data obtained from MoDOT's detectors and Traffic Volume Maps. As shown, the truck percentages along I-64 vary based on location. The VISSIM model used a truck percentage of 2.5% for both peak periods in both directions to be conservative. The intersection truck percentages were based on the breakdown between passenger and heavy vehicles provided in the turning movement counts and varied by location.

Table 2. I-64 Truck Percentages

	I-64 WB @ West of Kingshighway Blvd.	I-64 EB @ West of Kingshighway Blvd.	I-64 WB @ Grand Blvd.	I-64 EB @ Grand Blvd.
AM Peak Hour	2.7%	1.4%	2.2%	1.5%
PM Peak Hour	6.5%	1.3%	1.2%	1.3%
AADT	18.4%	11.7%	18.4%	11.7%

While special event traffic was not evaluated as part of the PEL study, it is acknowledged that when events adjacent to the I-64 corridor occur (i.e., Grand Center, Chaifetz Arena, MLS, etc.), there is an impact upon traffic operations along the critical roadways and the interstate itself. In particular, the interchange at Grand Blvd./Forest Park Ave. and Market St./Bernard St. experience congestion, lengthy queueing, and delays.

Figure 13. I-64 Corridor Existing Peak Hour Traffic - Sheet 1



Legend

X/Y – Weekday AM/Weekday PM Peak Hour Traffic Volumes (vph)

Weekday AM Peak Hour: 7:30 AM – 8:30 AM
Weekday PM Peak Hour: 4:30 PM – 5:30 PM

Figure 14. I-64 Corridor Existing Peak Hour Traffic - Sheet 2

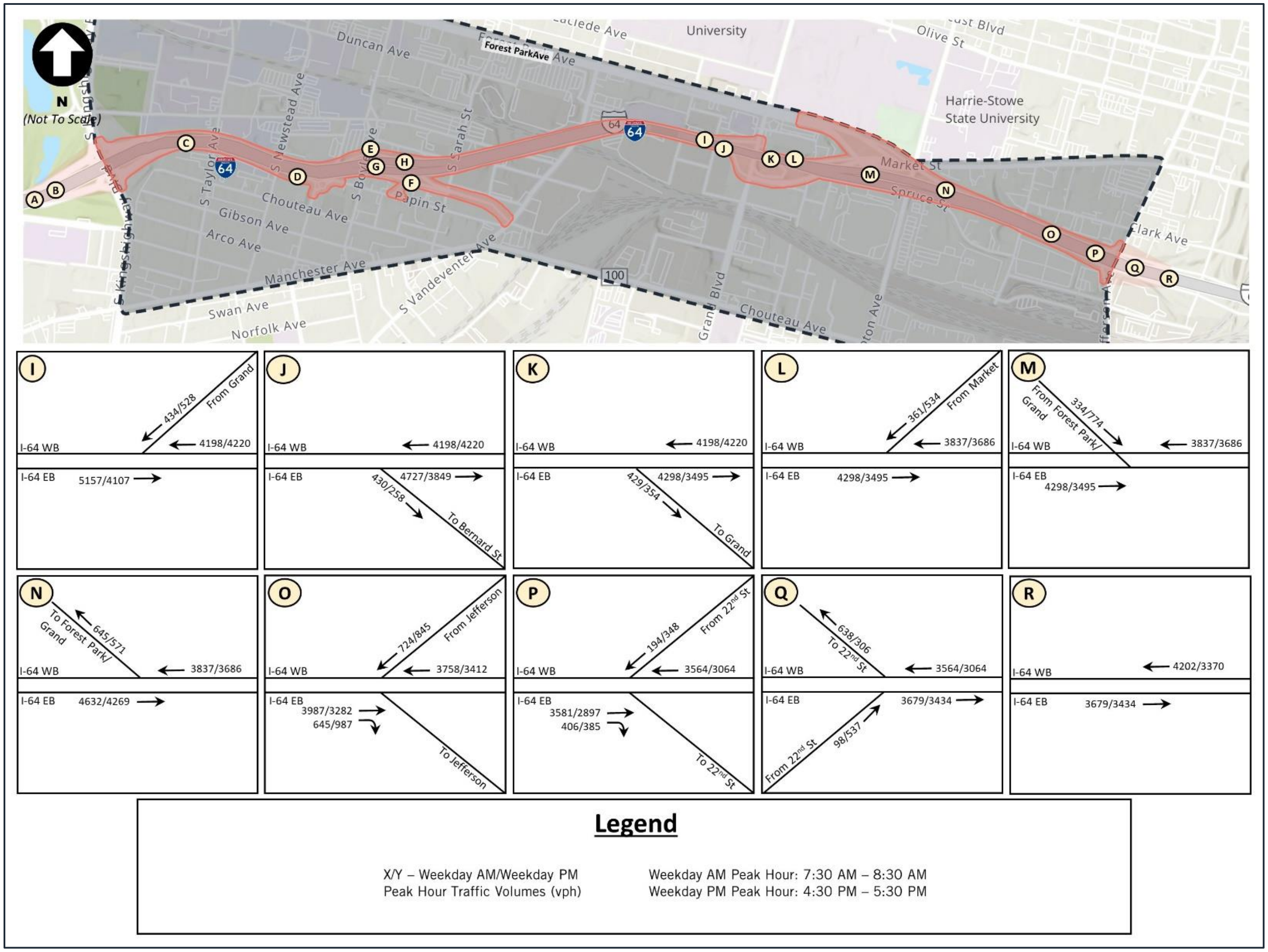


Figure 15. Existing Peak Hour Traffic Sheet Layout

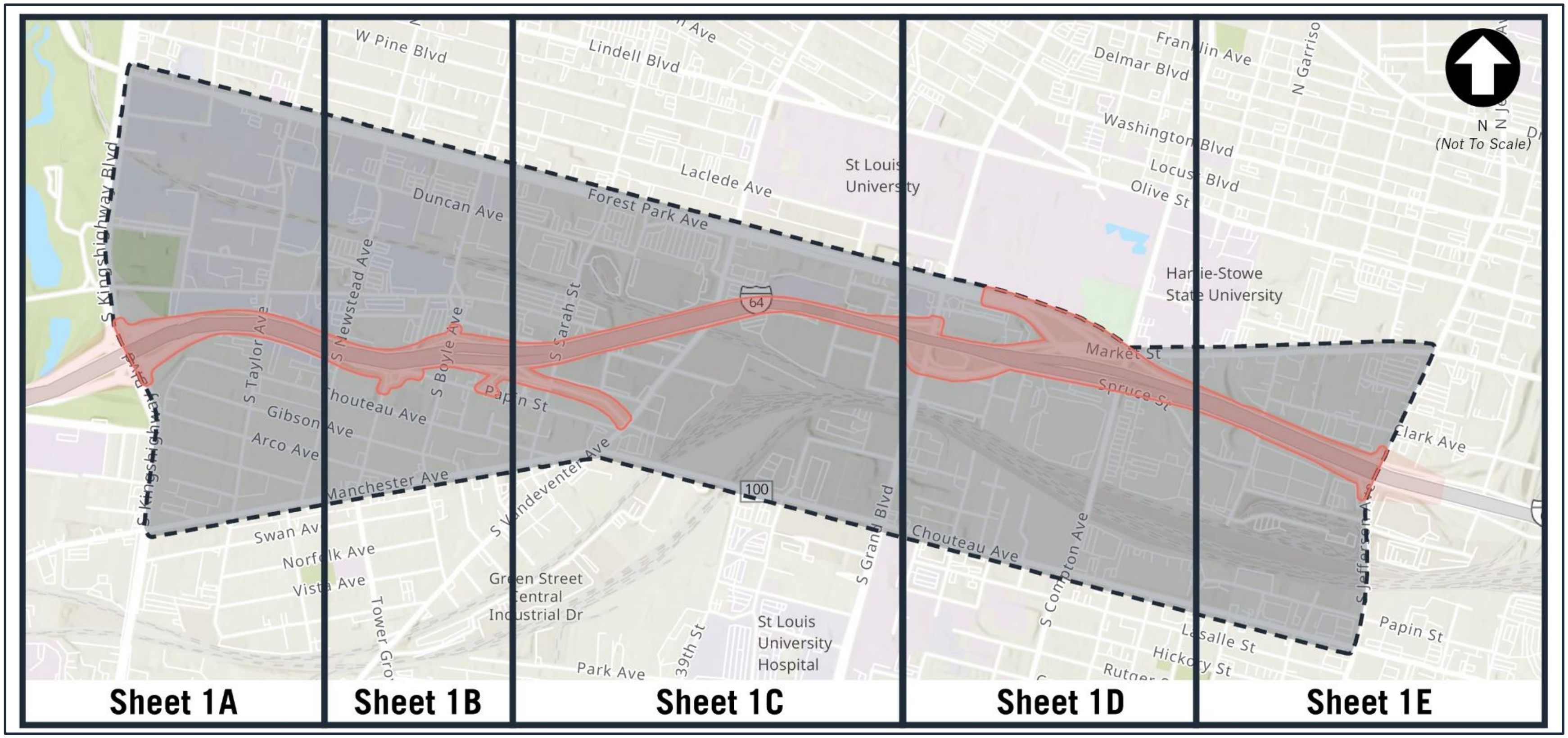


Figure 16. Existing Peak Hour Traffic - Sheet 1A

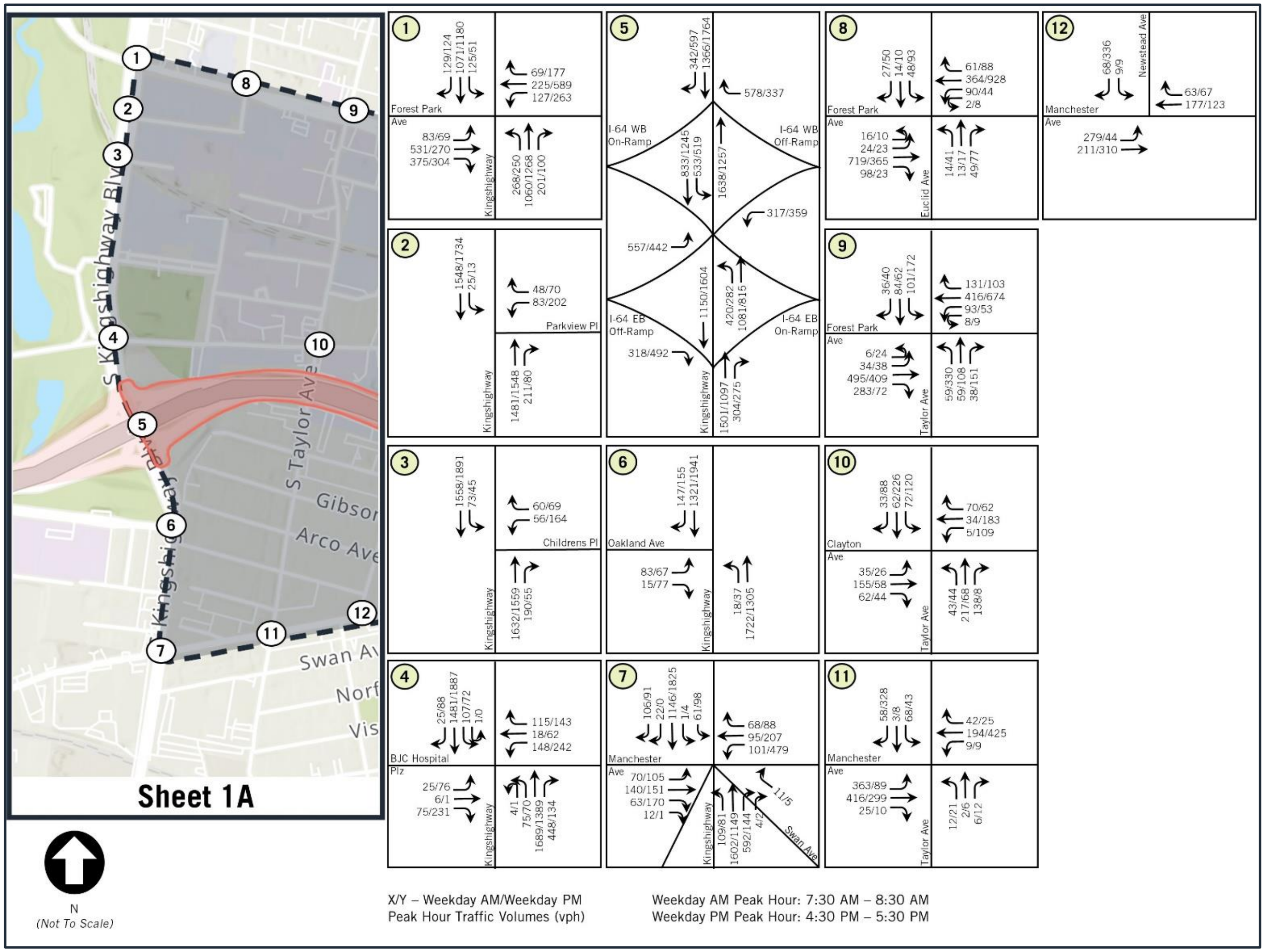


Figure 17. Existing Peak Hour Traffic - Sheet 1B

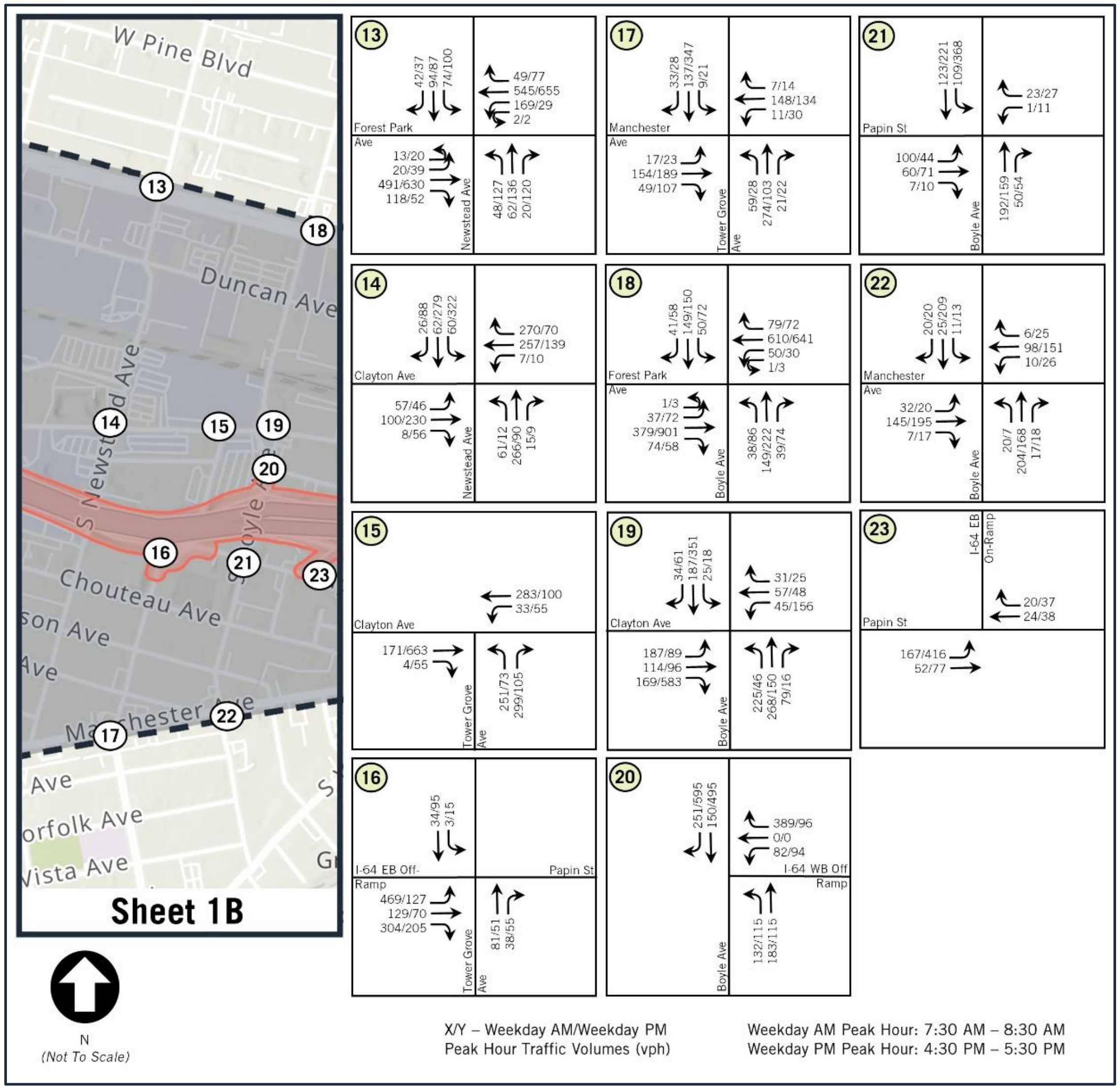


Figure 18. Existing Peak Hour Traffic - Sheet 1C

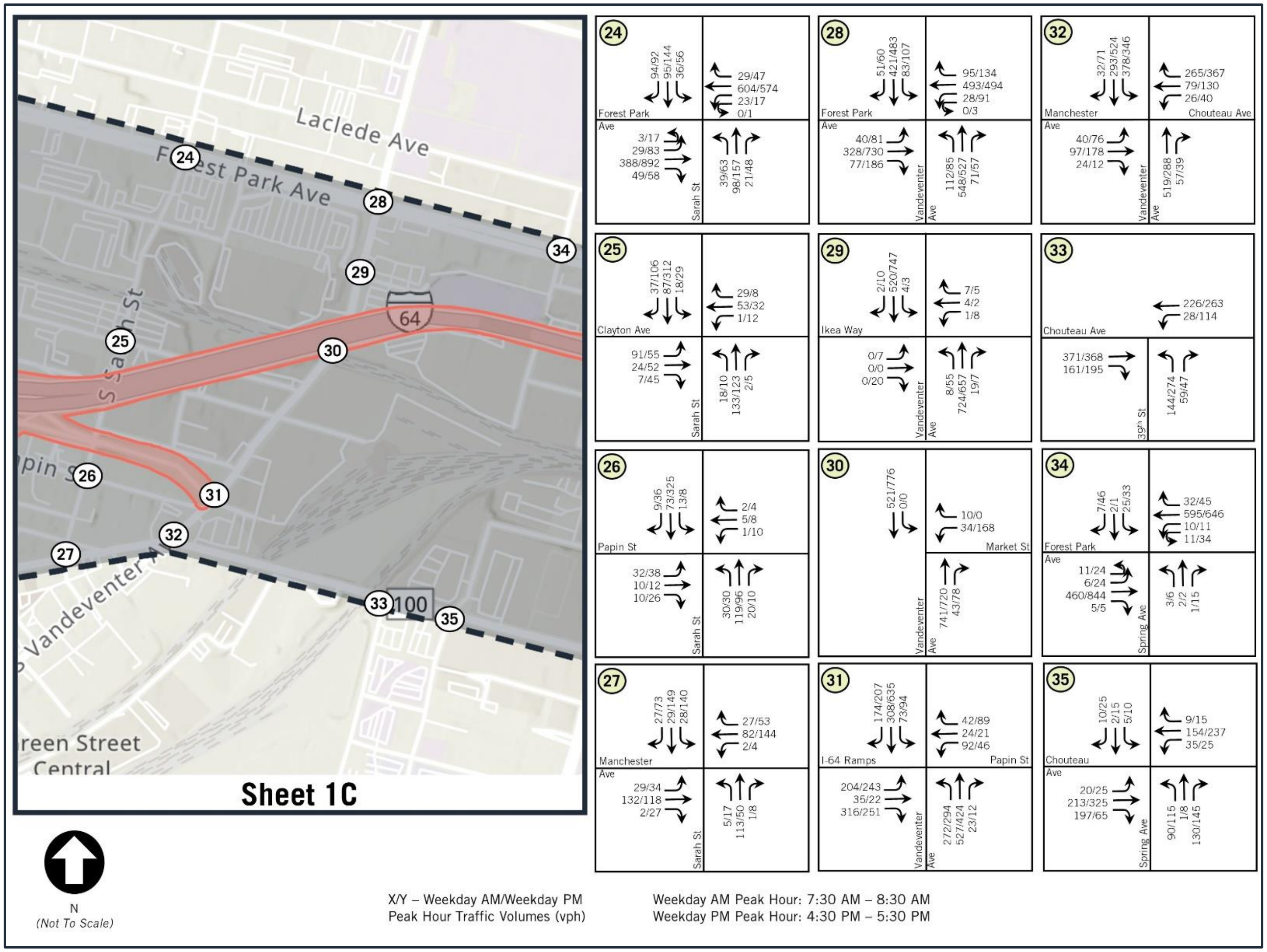


Figure 19. Existing Peak Hour Traffic - Sheet 1D

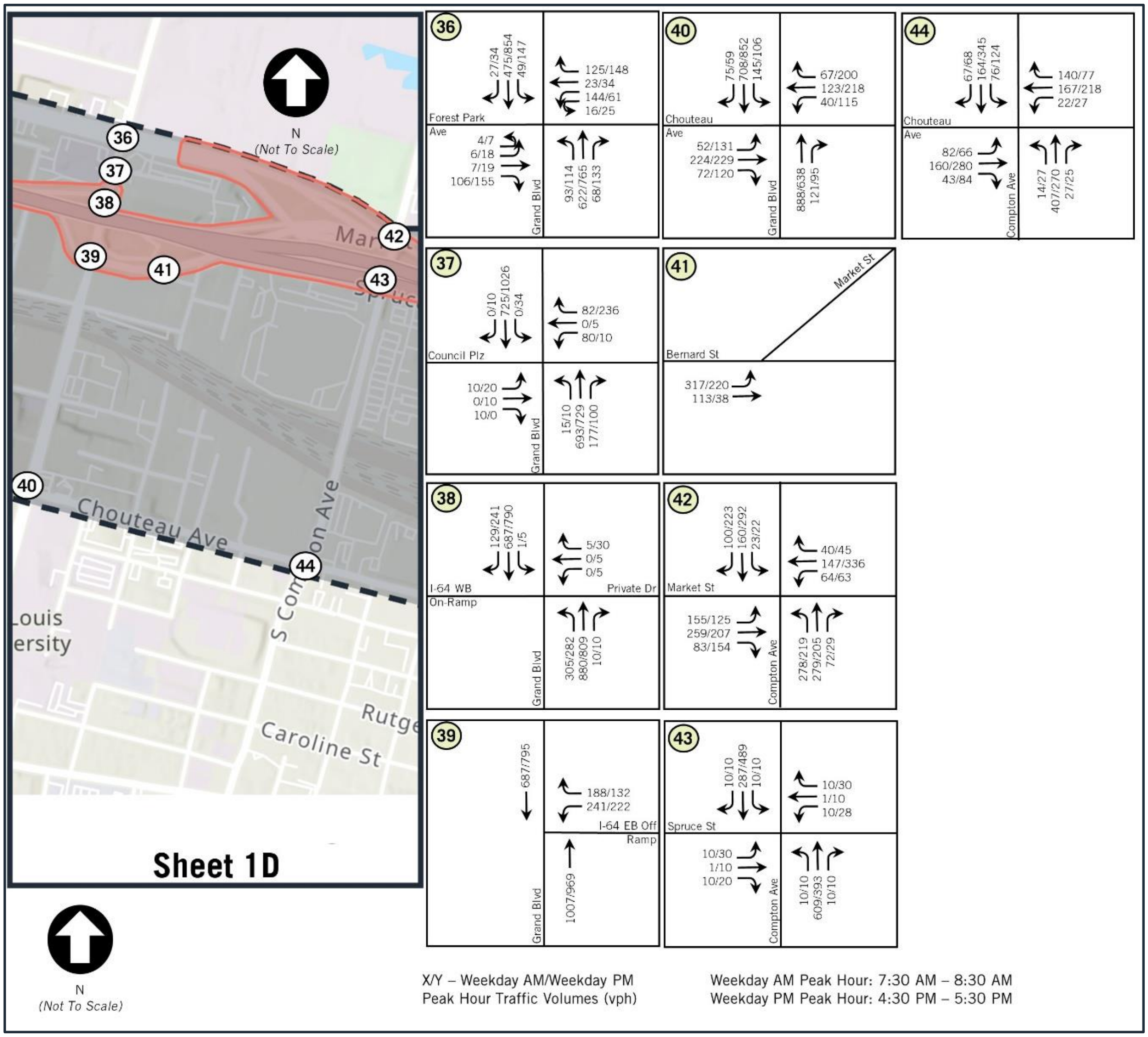
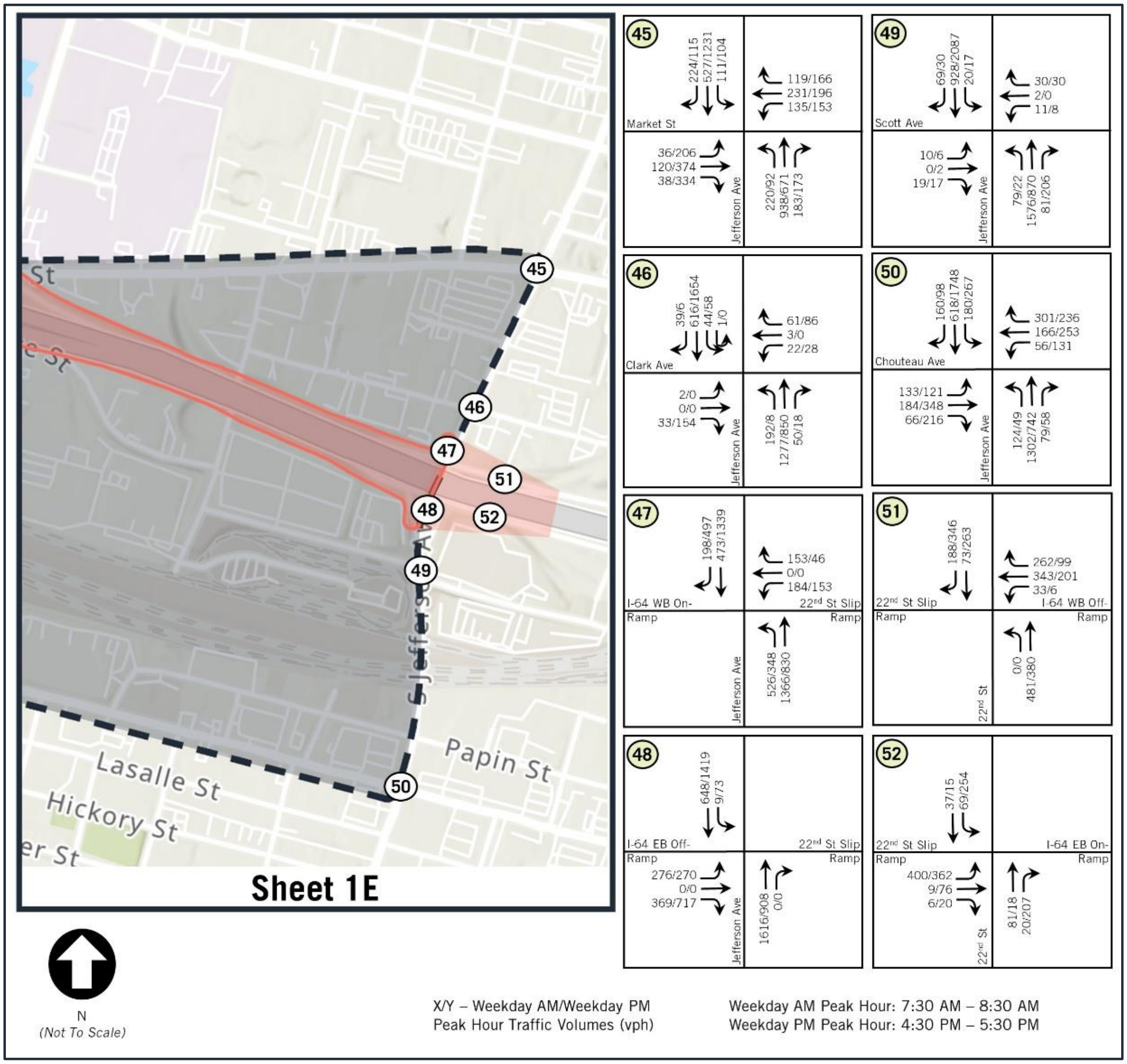


Figure 20. Existing Peak Hour Traffic - Sheet 1E



2.3. METHODOLOGY

The methodology, and associated assumptions, for the PEL were summarized in the Methods and Assumptions Report, as required by Section 905.3.7.1 of MoDOT's EPG which provides guidance for MoDOT reviewed Transportation Impact Analysis. The Methods and Assumptions Report was reviewed and approved by MoDOT before commencing with the analysis. The following represents the agreed upon methodology.

Capacity is generally quantified by Levels of Service (LOS), which are measures that reflect motorists' delay, density, speed, and maneuverability. The *Highway Capacity Manual, Sixth Edition* (HCM), published in 2016 by the Transportation Research Board, establishes six levels of service, ranging from LOS A ("free flow" conditions) to LOS F ("oversaturated" conditions). LOS C, which is commonly used for design purposes, represents a roadway with volumes utilizing approximately 70 to 80 percent of its capacity, whereas LOS E is widely considered an acceptable standard for peak period conditions in urban and suburban areas by MoDOT.

Analyses of freeway operations are quantified by LOS based on density. Although speed is a major indicator of service quality, freedom to maneuver within the traffic stream and proximity to other vehicles, as measured by the density of the traffic stream, are equally noticeable concerns. Density increases as flow increases, resulting in a measure of effectiveness that is sensitive to a broad range of flows. For these reasons, density is the parameter used to define LOS for freeway and ramp sections, as described in **Table 3**.

Table 3. Freeway Level of Service Thresholds

Level of Service	Merging / Diverging Segments (pc/mi/ln)*	Freeway Weaving Segment (pc/mi/ln)	Collector-Distributor Weaving Segments (pc/mi/ln)	Basic Freeway Segment (pc/mi/ln)
A	0-10	0-10	0-12	0-11
B	> 10-20	> 10-20	> 12-24	> 11-18
C	> 20-28	> 20-28	> 24-32	> 18-26
D	> 28-35	> 28-35	> 32-36	> 26-35
E	> 35	> 35	> 36	> 35 -45
F	Demand Exceeds Capacity	Demand Exceeds Capacity	Demand Exceeds Capacity	> 45

* pc/mi/ln = passenger car per mile per lane.

Likewise, the LOS criteria for intersections, such as ramp terminals, varies depending upon the type of control. Signalized intersections have higher delay tolerances than unsignalized locations because motorists are accustomed to and accept longer delays at signals. The corresponding thresholds for signalized and unsignalized intersections are summarized in **Table 4.**

Table 4. Intersection Level of Service Thresholds

Level of Service	Control Delay per Vehicle (sec/veh) Signalized	Control Delay per Vehicle (sec/veh) Unsignalized
A	< 10	0-10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

* sec/veh = seconds per vehicle.

LOS, delay, maximum (95th%) queue length, and volume-to-capacity ratio (v/c) were reported as measures of effectiveness to gauge existing intersection operations. The volume-to-capacity ratio compares vehicle demand to the capacity of an associated lane group and is generally used as an indicator for overall capacity of roadway approaches or movements. A volume to capacity ratio of 1.0 indicates that an approach or movement is at its functional capacity. A volume to capacity ratio of 0.85 or lower generally indicates surplus capacity is available at an approach or movement.

2.3.1. Analysis Parameters

To calibrate the existing conditions models, several site-specific inputs and parameters were collected through field observations, as-builts, aerial images, and available data sources. **Table 5** shows each of the analysis parameters used in the analysis.

Table 5. Analysis Parameters

Parameter	Description	Source
Interstate Geometry	Number of lanes, length of merge, diverge, weave sections, ramp lengths, gore locations	Field observations, as-builts, aerial photo, field photo/video
Intersection/ Roadway Geometry	Number of lanes, lane configuration, cross-sectional information	Field observations, field photo/video
Operational Data	Posted and travel speeds, travel times, intersection control, queues	Field work/measurements, field photo/video, MoDOT TMS probe data
Peak Hour Factor	Peak hour factor	Calculated from traffic data
Vehicle Classification	Vehicle Classification	Calculated from traffic data

In accordance with Sections 905.3.2 and 905.3.5 in MoDOT's EPG, VISSIM (Verkehr In Städten – SIMulationsmodell) and Synchro were the primary and predominant tools used for the traffic operations analysis. Using a calibrated VISSIM model, the Baseline (2022) traffic conditions along I-64 within Tier 1 limits were evaluated, including its ramp terminals. Synchro and Sidra were used to evaluate the surrounding road network within the Tier 2 limits (signalized/unsignalized intersections and roundabouts) for the baseline AM and PM peak hours.

2.4. TIER 1 LIMITS: I-64

The primary focus of the PEL study is on the I-64 infrastructure within MoDOT's right-of-way and how it can be improved to meet the goals of the study. The Tier 1 limits include the I-64 mainline and MoDOT right-of-way, from the western gore points of the ramps to and from Kingshighway Blvd. to the eastern gore points of the ramps at 22nd St. (which operates as a split diamond interchange with Jefferson Ave.). The limits include I-64, inclusive of all merge, diverge, and weave sections, as well as the ramp terminals at each of the interchanges.

2.4.1. Access to I-64

Tier 1 limits include 6 interchanges with I-64 and access points that connect I-64 to 12 local and regional roadways. **Table 6** provides a breakdown of the interchanges and access points within the study area.

Table 6. Access Points to I-64

Route	Mile Marker	Type	Access
I-64 at Kingshighway Blvd.	36A	Single-Point Urban Interchange (SPUI)	Full – Access to and from both directions of I-64
I-64 at Tower Grove/Boyle/Papin St.	36B	Non-traditional	Full – Access to and from both directions of I-64: • From I-64 EB to Tower Grove Ave. • Access to and from I-64 WB via Boyle Ave. • Access from Papin St. to I-64 EB
I-64 Ramps at Vandeventer Ave.	36C	Off-Ramp & On-Ramp	Partial – Access to and from the west on I-64 only (left side on-ramp)
I-64 at Market St./Bernard St.	37A	Off-Ramp & On-Ramp	Partial – Access to and from the west on I-64 via Market St./Bernard St. (off ramp Market/Compton (on ramp)
I-64 at Grand Blvd./Forest Park Ave.	37B/38A	Non-traditional	Full – Access to and from both directions of I-64: • To and from the west on I-64 via Grand Ave. • To and from the east on I-64 via Forest Park Ave.

Route	Mile Marker	Type	Access
I-64 at Jefferson Ave./22nd St.	38A/38B	Modified Split Diamond	Full - Access to and from both directions of I-64 with slip ramps midway between Jefferson and 22nd St. providing additional access to and from the west on I-64

2.4.2. Calibration & Validation of Traffic Models

The traffic analysis was based primarily upon a traffic simulation model developed using VISSIM 2021. VISSIM is a microsimulation tool that accurately replicates individual vehicles and their interactions within complex traffic streams, such as interchanges and freeways. A robust amount of data and field observations were necessary to calibrate VISSIM to reproduce field conditions.

In addition to VISSIM, a Synchro (Version 10) model of the study area was constructed for signal timing development and to aid in volume balancing. The HCM guidelines were used to evaluate merge, diverge, and weaving operations as a supplement to the VISSIM model.

The traffic simulation model calibration process began with the development of a base model, which aimed to replicate existing conditions. As previously noted, a vigorous data collection effort was required to support this effort, including roadway geometry, turning speeds, traffic signal timings, etc. Additionally, as recommended in Section 905.3.5.3.2.2.2 of MoDOT's EPG, the VISSIM network was based upon MoDOT's customized base model so that proper default initial parameters appropriate to Missouri were used. MoDOT provided the necessary files in February 2022.

The first step in base model development involved coding the roadway geometry (number of lanes and link lengths) with links and connectors using a recent aerial as a template. The base VISSIM model extents are shown in **Figure 21.**

Once the network backbone was established, free-flow speed distributions were created to guide traffic flow. In addition to free-flow speeds, reduced speed zones were established for turning movements and locations in the network where the roadway geometry physically limits speeds below the free-flow speed or posted speed limits.

Figure 21. Base VISSIM Model Extents

The next step addressed traffic control. Traffic signal timings obtained from MoDOT and the City of St. Louis were initially inputted into Synchro 10 and then converted to VISSIM's RBC controllers for input into the simulation. Detectors at signals were also coded where applicable. Stop-controlled movements received stop signs coded into the network. Locations where yielding or traffic control priority needed to be established (such as a right-turning movement on red) were coded with conflict areas or priority rules. Conflict areas were typically used unless further refinement of the gap times or yielding characteristics was necessary, in which case priority rules were deployed. Roundabouts were coded using conflict areas.

Traffic volumes are represented in VISSIM as an origin-destination matrix estimated from turning movement counts. The matrix specifies the model's traffic patterns and the routes vehicles take to traverse the model network. Traffic entering the model network was coded using vehicle inputs. Vehicle inputs specify volumes and vehicle type compositions, which were grouped into passenger vehicles and trucks. The origin-destination matrix was routed statically with routes traversing the entire network for optimum accuracy, rather than simply interchange by interchange.

Since VISSIM starts running with no vehicles in the network, a warm-up period is needed to initialize the model with traffic prior to capturing data. The warm-up period is known as the seeding period, and its length and volume characteristics were adjusted as part of the model calibration process. Given the scale of this network, a 30-minute seeding period was used to fully establish background traffic before recording results.

Due to the inherent stochastic nature of simulation (imposed by random seeds), multiple simulation runs using different seed numbers were required for each time period, and the reported model results were averaged across runs. Based on the characteristics of this model network, the planning-level effort associated with the PEL study and the agreed-upon level of effort during scoping, it was determined that 10 simulation runs were sufficient to obtain an appropriate level of confidence in the results.

The model calibration process involved a detailed review of model parameters and thorough consideration of adjustments to improve the model's ability to replicate field conditions. The calibration process compared data output from the model, such as travel times and flow rates, to field measurements of the same attributes. Example calibration measures undertaken as part of developing this model were as follows:

- A modified version of VISSIM's default "urban" link driver behavior type was employed to reflect arterial driving behavior in the St. Louis region. This adjustment lowered arterial capacity to reflect less aggressive driving and increased vehicle headways, as compared to larger metropolitan areas from which the default VISSIM driver behavior models are derived.
- Emphasis was placed on replicating traffic flows and travel times on westbound I-64 during the afternoon peak hour when congestion is amplified. Precise calibration of the congestion on I-64 west of Kingshighway Blvd. was critical to accurately replicate travel times for westbound traffic. Reduced speed areas were employed to replicate the field observed queuing.
- Based on field observations for all other merge points within the study area, the safety distance reduction factor and maximum deceleration for cooperative braking were modified to make merging vehicles more aggressive. Similarly, when applicable based on field observations, advanced merging was also selected as an option to further replicate the observed capacity at certain merge points.
- Lane change distances, which specify the position where vehicles begin to consider making a lane change, were adjusted to reflect observed traffic flows on links.

The model validation process confirms that the simulation depicts real world observations. Travel times are a common metric for model validation. The extent of congestion and traffic operations on I-64 was validated using the Regional Integrated Transportation Information System (RITIS) travel time data.

Table 7. VISSIM Travel Time Comparison

Direction	AM PEAK HOUR			PM PEAK HOUR		
	RITIS (sec)*	VISSIM (sec)	Deviation	RITIS (sec)	VISSIM (sec)	Deviation
I-64 Westbound	175	184	5%	226	228	1%
I-64 Eastbound	218	231	6%	220	229	4%

* sec = seconds.

As seen in **Table 7**, the VISSIM travel times during both the AM and PM peak hours correlate with RITIS travel time data for both directions on I-64. Special emphasis was given to calibrate the travel time for the I-64 westbound direction to replicate the observed congestion originating west of Kingshighway Blvd. during the afternoon peak. As a result, the travel time calculated by VISSIM on I-64 westbound during the afternoon peak hour is conservatively only 1% higher than the observed RITIS data, thereby confirming the model validity.

Throughput is another measure that was used to validate the model. Four locations were identified where the throughput was measured in the VISSIM model. These locations were positioned between the interchanges.

The throughput from the simulation model was compared to the volume from the MoDOT's traffic volume maps, as summarized in **Table 8.** The simulation model throughput is 0 to 1% different than the volumes provided by MoDOT, which further validates the VISSIM model.

Table 8. VISSIM Throughput Comparison

Location	AM PEAK HOUR			PM PEAK HOUR		
	Field (vph)	VISSIM (vph)	Deviation	Field (vph)	VISSIM (vph)	Deviation
Between Boyle Ave. & Kingshighway Blvd.						
I-64 Westbound	5015	5026	0%	5790	5803	0%
I-64 Eastbound	6428	6453	0%	4572	4586	0%
Between Grand Ave. & Boyle Ave.						
I-64 Westbound	4632	4657	1%	4748	4760	0%
I-64 Eastbound	5157	5172	0%	4107	4124	0%
Between Compton Ave. & Grand Ave.						
I-64 Westbound	3837	3856	0%	3686	3700	0%
I-64 Eastbound	4298	4302	0%	3495	3499	0%
Between Jefferson Ave. & Compton Ave.						
I-64 Westbound	4482	4493	0%	4257	4263	0%
I-64 Eastbound	4632	4617	0%	4269	4258	0%

2.4.3. VISSIM Results

A summary of the following Measures of Effectiveness (MOE) along the I-64 corridor and at its ramp terminals (by approach) are provided for the existing conditions analysis:

- Speed (I-64)
- Density (I-64)
- Throughput (I-64)
- Vehicular delay (ramp terminals)
- Vehicular queue lengths (ramp terminals)
- Volume/capacity ratio (ramp terminals)
- LOS (I-64 and ramp terminals)

This report presents, graphically, the overall conditions. Detailed operating results from the VISSIM and Synchro models are provided in the Appendices.

The existing operating conditions for Tier 1 limits were evaluated using VISSIM based upon the methodology and calibration previously described. **Figure 22** and **Figure 23** illustrate the existing operating conditions as modeled. As shown, the Tier 1 limits experience reasonable operating conditions along I-64, and most ramp terminals operate at LOS D or better.

However, the VISSIM model does indicate congestion at the following locations:

AM PEAK HOUR

- I-64 and Kingshighway Blvd.
  - ♦ The I-64 eastbound off-ramp at Kingshighway Blvd. experiences lengthy queues, with the maximum queue extending 600 feet back from the signal. The queue is contained on the ramp and does not spill back onto I-64. However, as the queue extends down the off-ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting I-64.
- I-64 and Boyle Ave.
  - ♦ The I-64 westbound off-ramp at Boyle Ave. handles significant traffic in the morning peak hours due to the heavy influx of traffic to the medical campus. Queuing extends south on Boyle Ave. from the signalized intersection of Clayton Ave. and Boyle Ave. and does, on occasion, impact queuing on the westbound off-ramp. However, the majority of this queuing occurs immediately prior to the network AM peak hour (6:45 AM) and often diminishes shortly past 7:00 AM.

    The queue on the ramp extends to a maximum length of about 400 feet back from the signal but does not typically spill back onto the interstate mainline. However, as the queue extends down the ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting I-64.

- I-64 and Grand Blvd.
    - The traffic on I-64 eastbound off-ramp at Grand Blvd. experiences queues up to 600 feet during the morning peak hour. The queue is restricted to the loop ramp and does not impede the through movement on I-64. However, as the queue extends down the ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting I-64.

PM PEAK HOUR

- I-64 westbound between the Kingshighway Blvd. off- and on-ramps
- Kingshighway Blvd. westbound on-ramp acceleration lane is limited by the congestion on the I-64 westbound mainline
- Along I-64 westbound west of Kingshighway Blvd.
    - The VISSIM results for the weekday PM peak period indicate congestion along westbound I-64 near Kingshighway Blvd., consistent with the field observations. This is a result of congestion originating west of the study area, closer to Hampton Ave., rather than within the Tier 1 limits. Nevertheless, this congestion does still impact traffic through the study area with rolling queues extending back toward westbound Kingshighway Blvd. **Figure 24** from the VISSIM model visually shows the congestion along I-64 westbound near Kingshighway Blvd. during the PM peak period.
    - **Figure 25** shows the average speeds along I-64 within the study area for both the AM and PM peak hours. As can be seen, the speeds along I-64 by Kingshighway Blvd. decrease between 3:30 and 6:00 PM, thereby indicating the duration of the congestion in this area. These speeds are consistent with the congestion observed in the VISSIM model. Detailed speed results from RITIS are provided in Appendix A. Detailed operating results from the VISSIM simulation model are provided in Appendix B.

Figure 22. Existing Conditions - AM Tier 1 VISSIM Analysis

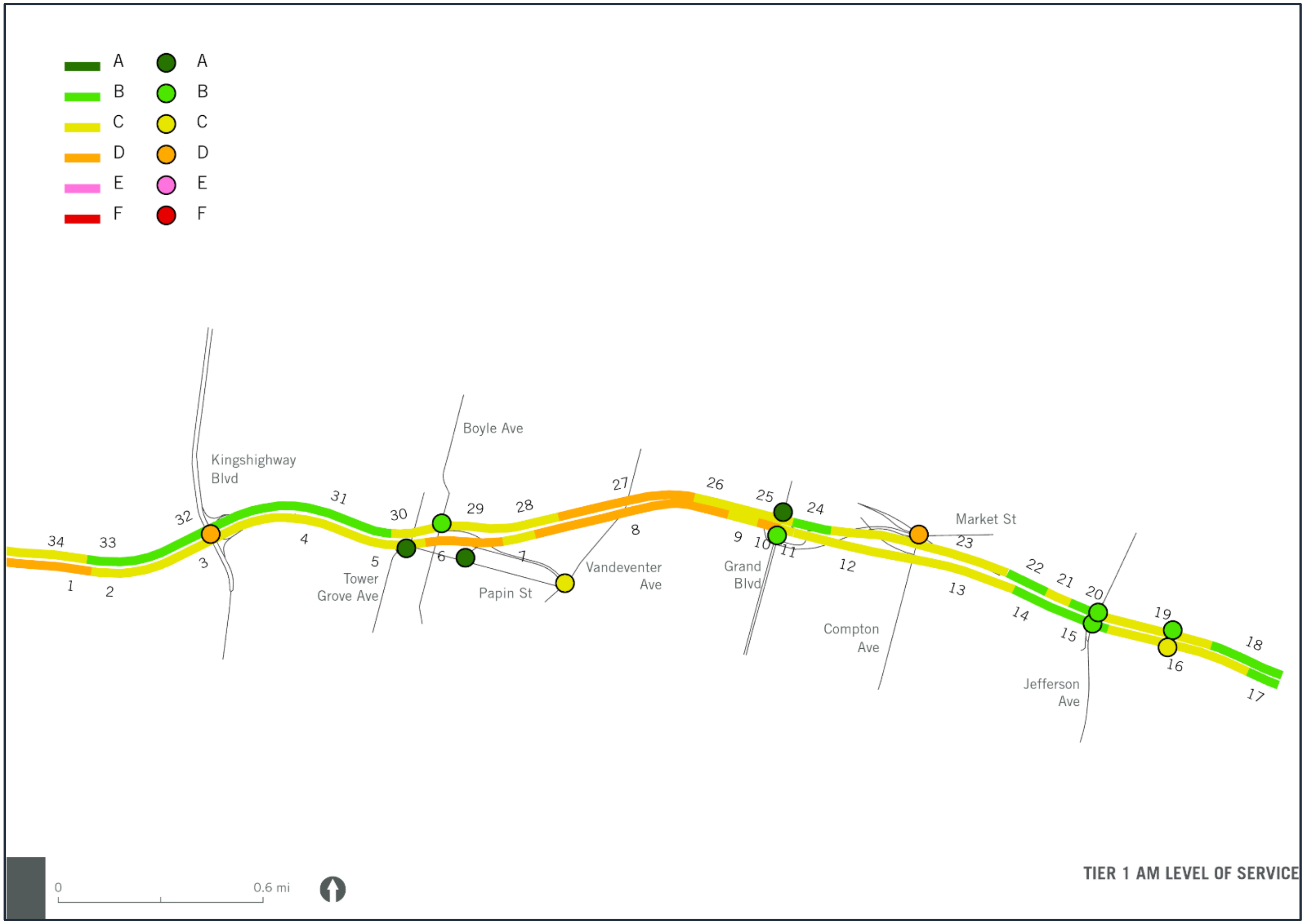


Figure 23. Existing Conditions - PM Tier 1 VISSIM Analysis

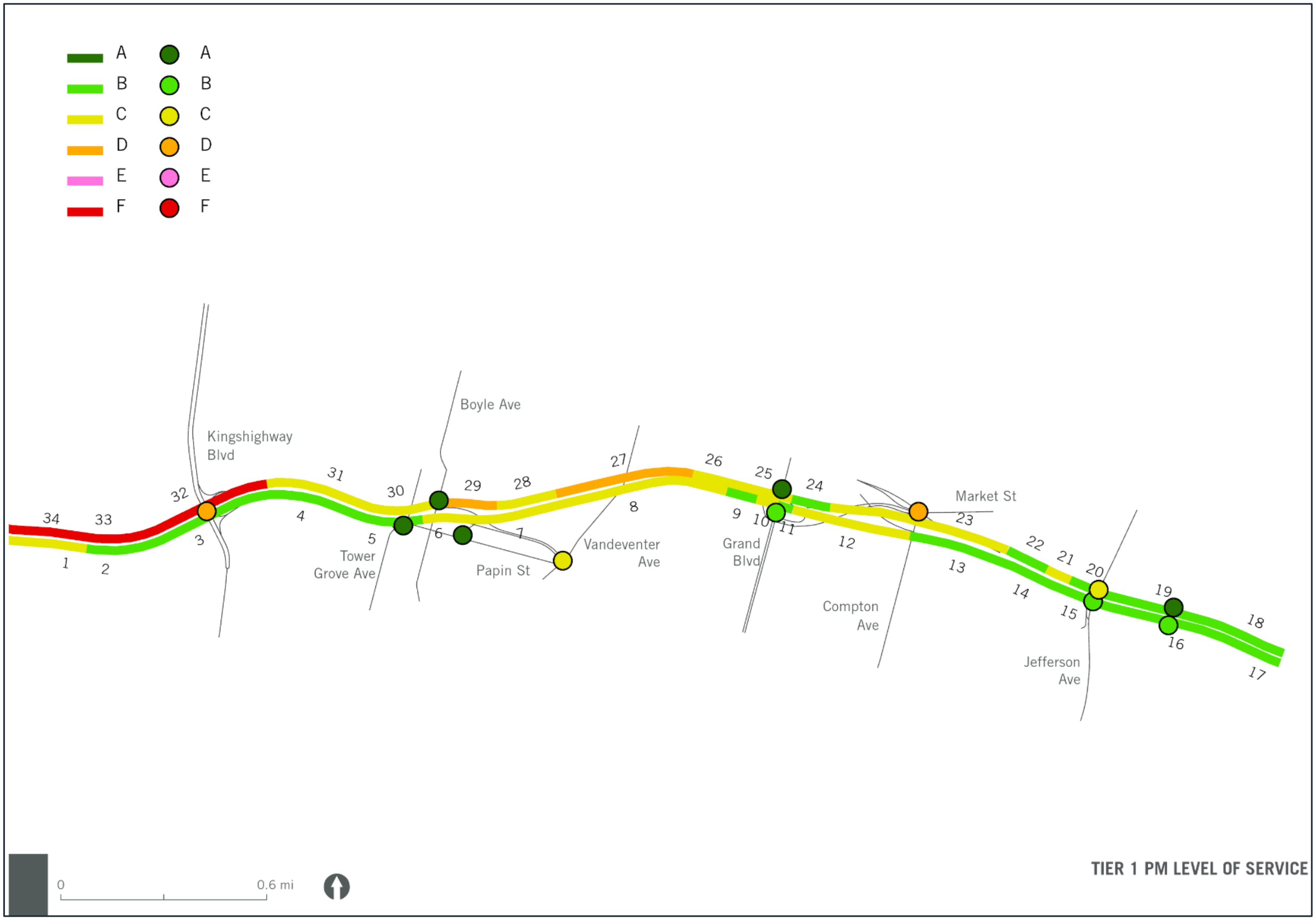
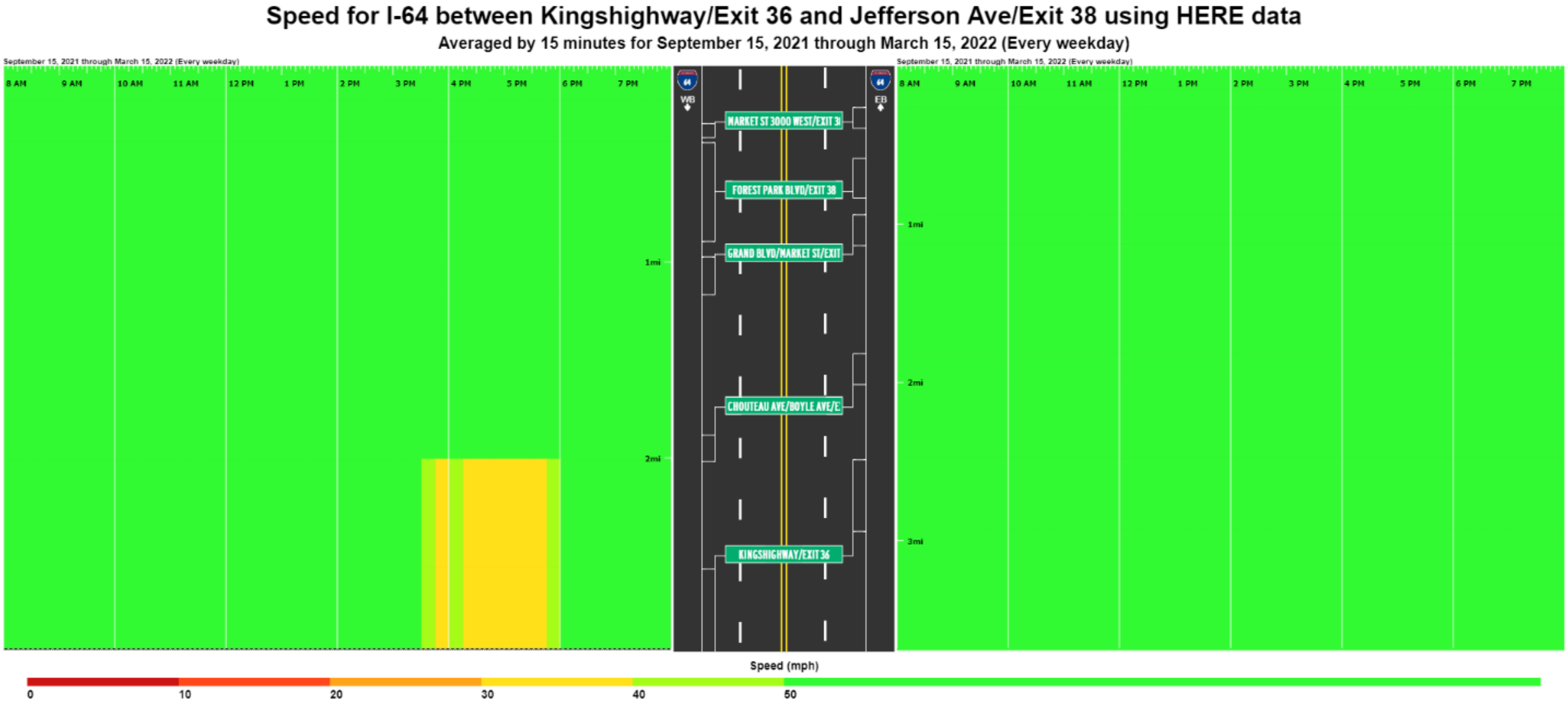


Figure 24. VISSIM Simulation of PM Peak Hour Congestion Along I-64 Near Kingshighway Blvd.

Figure 25. RITIS Provided Speeds Along I-64: Kingshighway Blvd. to Jefferson Ave.



2.4.4. Synchro Results

The existing operating conditions at the intersections within Tier 1 and Tier 2 limits were evaluated using Synchro 10, which is a traffic flow model based on the HCM. The Synchro analysis was completed in accordance with Section 905.3.5.2.3 of MoDOT's EPG. The roundabout at the intersection of the I-64 eastbound off-ramp at Tower Grove Ave. was analyzed using Sidra 8, which is based upon methodologies used by the HCM. The Sidra analysis was completed in accordance with Section 905.3.5.2.2 of MoDOT's EPG.

Detailed operating conditions for Tier 1 limits are provided in Appendix C as modeled by Synchro and Sidra. The intersections within the Tier 1 limits operate well overall. Each intersection has an overall LOS D or better.

In addition to LOS, the volume to capacity (v/c) ratios must be analyzed. Several ramp terminals experience high v/c ratios with particular movements. While the intersections overall appear to currently operate well, some individual movements experience borderline operating conditions. The following intersections have individual movements that operate at a LOS E or worse or have a v/c ratio above 0.90 for an off-ramp from I-64 or 0.95 for all other movements:

AM PEAK HOUR

- I-64 and Kingshighway Blvd.
    - The eastbound approach has a LOS E, and the southbound left-turn has a failing LOS. The southbound left-turn also has a v/c ratio of 1.14. As the eastbound queue extends down the ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting I-64.
- I-64 Eastbound Off-Ramp and Grand Blvd.
    - The westbound approach of the loop ramp's intersection with Grand Blvd. operates at a LOS E. As the queue extends around the ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting eastbound I-64.
- I-64 Westbound On Ramp/Outer Road and Jefferson Ave.
    - The westbound approach of the outer road has a LOS E.

PM PEAK HOUR

- I-64 and Kingshighway Blvd.
    - The eastbound and westbound approaches have a LOS E. As the queues extends down the ramps, the available deceleration length is diminished, posing a potential safety concern for motorists exiting I-64.
- I-64 Westbound On-Ramp and Grand Blvd.

- The stop-controlled westbound approach has a LOS E. However, the queue length is only about one vehicle.

- I-64 Eastbound Off-Ramp and Grand Blvd.
  - The westbound approach of the loop ramp's intersection with Grand Blvd. operates at a LOS E. As the queue extends around the ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting eastbound I-64.

- I-64 Eastbound Off Ramp/Outer Road and Jefferson Ave.
  - The eastbound approach of the off ramp from I-64 has a failing LOS. This approach also has a v/c ratio of 1.24 and a queue length of approximately 600 ft. While the queue length is long and nearly reaches I-64, it does not spill back onto I-64. However, as the eastbound queue extends down the ramp, the available deceleration length is diminished, posing a potential safety concern for motorists exiting I-64.

- I-64 Westbound On Ramp/Outer Road and Jefferson Ave.
  - The westbound approach of the outer road has a LOS E.

2.4.5. Correlation of VISSIM and Synchro Results

It is not uncommon for the VISSIM results (previously presented and summarized in Appendix B to deviate slightly from the Synchro and Sidra results (previously presented and summarized in Appendix C because of the difference in programs and the level of detail included in the inputs and parameters. However, it is still expected that the results should be comparable regardless of the program utilized.

When the results from the various analytical tools used for the traffic analysis are compared, the existing traffic operations for the overall intersection MOEs as well as the individual approaches are generally comparable to one another. The only differences observed between the various outputs were due to the manner in which a particular program handled the right-turn movement at intersections (VISSIM provides a more detailed analysis of the right-turn movement than Synchro).

2.5. TIER 2 LIMITS: ARTERIALS AND MAJOR COLLECTORS

Tier 2 includes the areas outside of Tier 1, but within the study area as defined by Forest Park Ave. and Market St. to the north and Route 100 to the south. Tier 2 encompasses several arterials and major collectors that cross or run parallel to I-64, described in Section 2.1.

2.5.1. Synchro Results

The traffic operations conditions within the Tier 2 limits were completed using the same methodology used for the Tier 1 traffic operations but were analyzed using only Synchro. **Figure 26** and **Figure 27** show the operating conditions as modeled by Synchro for the Tier 2 limits. Detailed operating conditions are provided in Appendix D per the approved scope, only overall intersection LOS is provided for intersections within the Tier 2 limits).

As shown, each of the intersections has an overall LOS of D or better, with the exception of two intersections (Kingshighway Blvd. at Route 100 and Jefferson Ave. at Clark Ave.), which operate at LOS E during the PM peak hour only. While LOS E is a reasonable service level given the urban context, some individual movements do experience worse service levels. The following intersections have at least one approach with a LOS E or worse during either the AM or PM peak period:

AM PEAK HOUR

- Kingshighway Blvd. and Forest Park Ave.
  - The westbound approach has an LOS E.
- Kingshighway Blvd. and Manchester Ave.
  - The eastbound approach has a failing LOS and the westbound approach has a LOS E during the AM peak period. The northbound approach has a v/c ratio of 0.93.
- Forest Park Ave. and Euclid Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Newstead Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Boyle Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Sarah St.
  - The northbound and southbound approaches have a LOS E.
- Forest Park Ave. and Vandeventer Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Grand Blvd.
  - It should be noted that Synchro is unable to model this intersection as it truly functions. Field observations revealed that due to the geometry of this intersection, many cars stop in the middle. This degrades the operating conditions as vehicles must maneuver around each other, decreasing the amount of usable green time. However, Synchro is unable to accurately replicate this. Therefore, the operating conditions at this intersection are likely understated.
- Manchester Ave./Chouteau Ave. and Vandeventer Ave.
  - The eastbound approach has a LOS E.
- Chouteau Ave. and Grand Blvd.
  - The eastbound and westbound approaches have a LOS E.
- Chouteau Ave. and Compton Ave.
  - The northbound and southbound approaches have a LOS E.
- Compton Ave. and Spruce St.
  - The eastbound approach has a LOS E.

- Chouteau Ave. and Jefferson Ave.
  - The eastbound and westbound approaches have a LOS E.
- Jefferson Ave. and Clark Ave.
  - The westbound approach has a failing LOS. This approach is unsignalized and must wait for the heavy through traffic along Jefferson Ave. to clear before completing their movement.

PM PEAK HOUR

- Kingshighway Blvd. and Forest Park Ave.
  - The eastbound approach has an LOS E and a v/c ratio of 0.93 during the PM peak period.
  - The northbound left-turn has a v/c ratio of 1.12 during the PM peak period.
- Kingshighway Blvd. and Manchester Ave.
  - The eastbound and westbound approaches of Manchester Road fail and both approaches have a v/c ratio of 1.06. Additionally, the southbound approach of Kingshighway has a v/c ratio of 0.97, indicating it is approaching capacity.
- Forest Park Ave. and Euclid Ave.
  - The southbound approach has a LOS F.
- Forest Park Ave. and Taylor Ave.
  - The northbound and southbound approaches have a LOS E. The northbound approach also has a v/c ratio of 0.93.
- Forest Park Ave. and Newstead Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Boyle Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Sarah St.
  - The northbound and southbound approaches have a LOS E.
- Forest Park Ave. and Vandeventer Ave.
  - The southbound approach has a LOS E.
- Forest Park Ave. and Grand Blvd.
  - It should be noted that Synchro is unable to model this intersection as it truly functions. Field observations revealed that due to the geometry of this intersection, many cars stop in the middle. This degrades the operating conditions as vehicles must maneuver around each other, decreasing the amount of usable green time. However, Synchro is unable to accurately replicate this. Therefore, the operating conditions at this intersection are likely understated.
- Clayton Ave. and Boyle Ave.
  - The eastbound approach has a LOS E, a v/c ratio of 1.06, and a 95th percentile queue length of approximately 630 ft.

- Vandeventer Ave. and Ikea Way
  - The westbound approach has a LOS E.
- Manchester Ave./Chouteau Ave. and Vandeventer Ave.
  - The eastbound approach has a LOS E.
- Chouteau Ave. and Grand Blvd.
  - The westbound approach has a LOS E during the PM peak period.
- Chouteau Ave. and Compton Ave.
  - The northbound approach has a LOS E.
- Compton Ave. and Spruce St.
  - The eastbound approach has a failing LOS and the westbound approach has a LOS E.
- Chouteau Ave. and Jefferson Ave.
  - The eastbound approach has a failing LOS and the westbound approach has a LOS E. In addition, the eastbound approach has a v/c ratio of 1.01, the westbound approach has a v/c ratio of 0.91, and the southbound approach has a v/c ratio of 0.93.
- Jefferson Ave. and Clark Ave.
  - The eastbound approach has a LOS E and the westbound approach has a failing LOS. Both of these approaches are unsignalized and must wait for the heavy through traffic along Jefferson Ave. to clear before completing their movement.

As stated above, many of the movements that experience LOS E are either side-street movements at unsignalized intersections where the traffic is unable to find a gap in the free-flowing traffic or where the traffic must wait through a long signal length, causing delays. In addition, there are lane changes which impact traffic operations such as Chouteau Ave., east of Grand Blvd., where it decreases from two through lanes to one through lane in each direction thereby diminishing the available capacity. More importantly, there are critical movements, most notably at Kingshighway Blvd. and Forest Park Ave., and Kingshighway Blvd. and Manchester Ave., that are over capacity.

Figure 26. Existing Conditions - AM Tier 2 Synchro Analysis

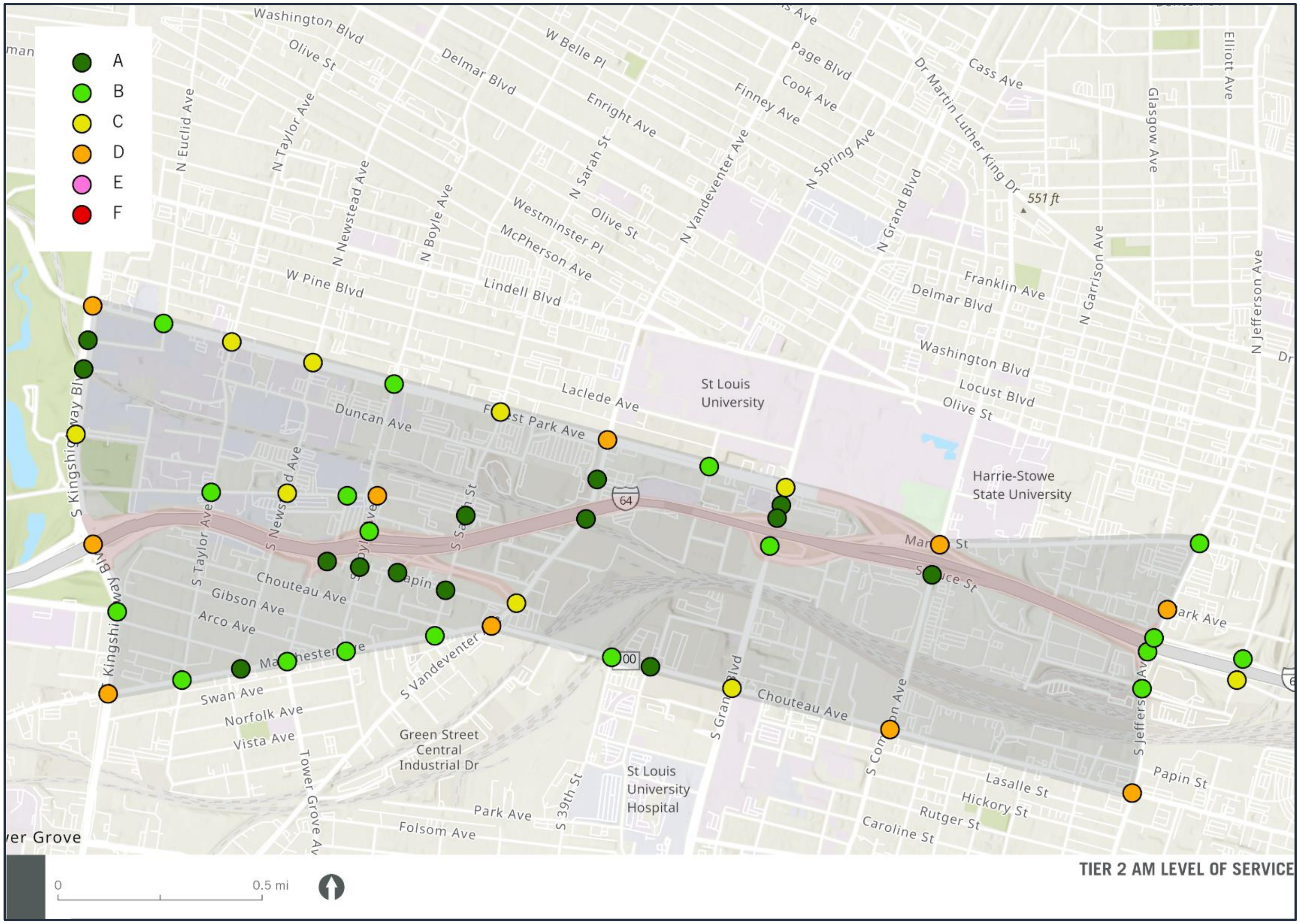
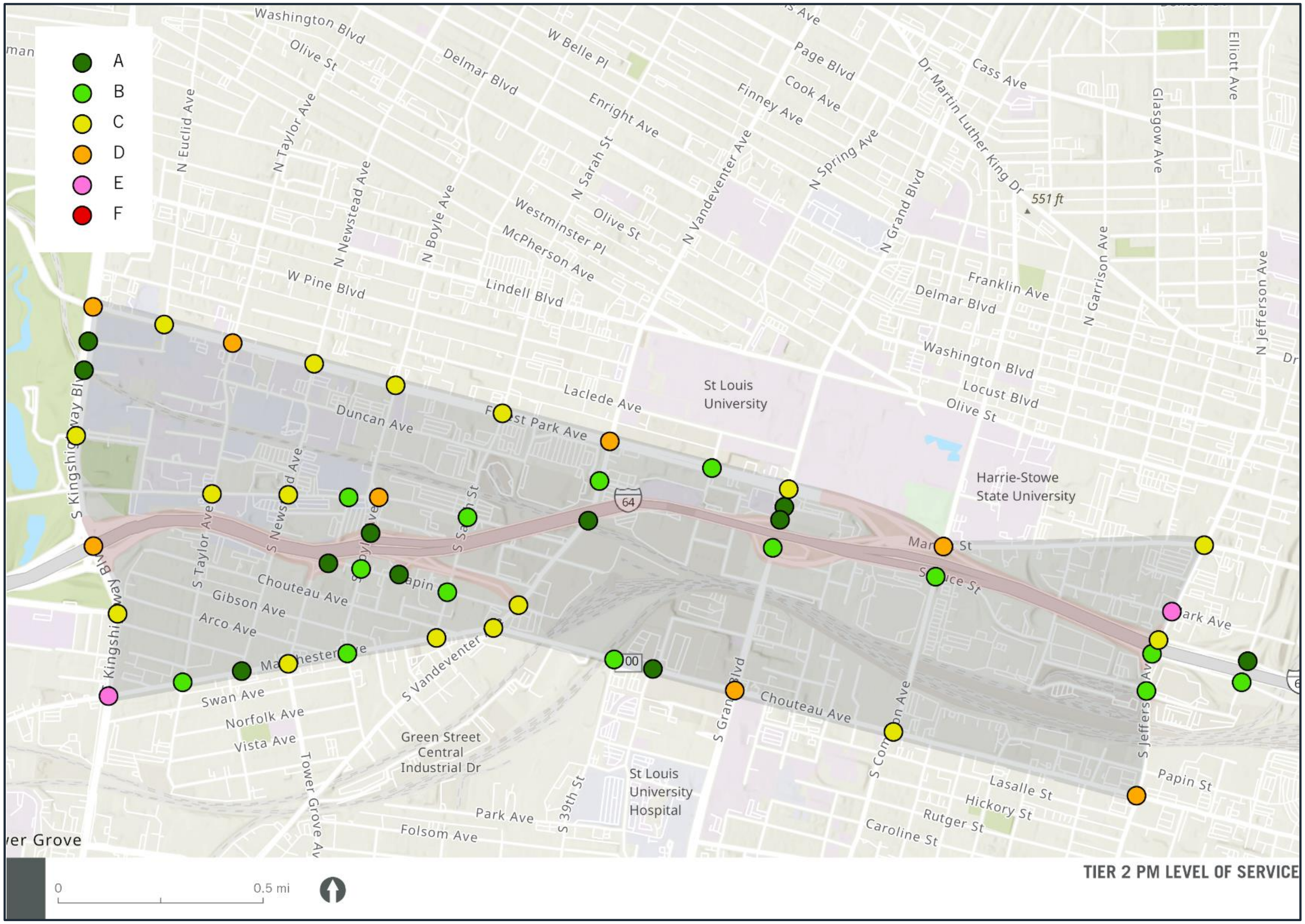


Figure 27. Existing Conditions - PM Tier 2 Synchro Analysis



2.6. TRAFFIC CONCLUSIONS

The following summarizes the overall conclusions relative to the existing traffic operations in the study area:

1. The study area is broken into two tiers. The Tier 1 limits are defined as the area between Kingshighway Blvd. and Jefferson Ave. specific to the interstate system and contained within MoDOT right-of-way, inclusive of all merge, diverge, and weave sections, as well as the ramp terminals at each of the interchanges. Tier 2 limits encompass I-64 and the local transportation network that interfaces with I-64 between Forest Park Ave./Market St. and Route 100 (Manchester Ave./Chouteau Ave.).
2. The study area is served by 52 intersections, including 6 interchanges, 4 of which provide full access and 2 that provide partial access serving to and from the west on I-64. Given that volumes accessing I-64 to and from the west within the study area typically represent 2/3 of the total traffic accessing I-64, the partial interchanges, including the additional slip ramps at the newly reconstructed interchange of Jefferson Ave./22nd St., serve this increased demand.
3. Interchange spacing along I-64 between Kingshighway Blvd., and Jefferson Ave. generally does not meet national or state standard guidelines. However, given the urban context of the study area and the dense surrounding land use, the spacing of interstate access to the road network attempts to balance access needs within the area.
4. VISSIM and Synchro were the primary and predominant tools used for the traffic operations analysis. The Baseline (2022) traffic conditions along I-64 within Tier 1 limits were evaluated using VISSIM and Synchro, including its ramp terminals. Synchro and Sidra were used to evaluate the surrounding road network within the Tier 2 limits.
5. The weekday peak hours within the study area occurred from 7:30 to 8:30 AM during the morning peak period and from 4:30 to 5:30 PM for the evening peak period.
6. The Tier 1 limits experience reasonable operating conditions along I-64, and most ramp terminals operate at LOS D or better. However, the following locations experience congestion or borderline operating conditions:
   - I-64 and Kingshighway Blvd.
   - I-64 and Boyle Ave.
   - I-64 and Grand Blvd.
   - I-64 westbound between the Kingshighway Blvd. off- and on-ramps
   - Kingshighway Blvd. westbound on-ramp acceleration lane
   - Along I-64 westbound west of Kingshighway
7. The intersections in the Tier 2 limits have an overall LOS of D or better, with the exception of two intersections (Kingshighway Blvd. at Route 100 and Jefferson Ave. at Clark Ave.), which operate at LOS E during the PM peak hour only.
8. Overall, the study area interchanges and intersections operate favorably. However, several interchanges and intersections experience borderline operating conditions where one or more approaches have either a LOS E or F in addition to long queue lengths and high v/c ratios.

3. SAFETY

To determine existing conditions for safety, five years of crash data (contributing factors and severity) were summarized to identify hot spots locations of high crash frequency and severity on I-64 (Tier 1 limits) and the surrounding road network (Tier 2 limits). This section summarizes the safety analysis using crash dashboards, heat maps, ranked lists, and crash maps filtered by type and severity for the Tier 1 and 2 limits.

3.1. OVERVIEW

A safety analysis was performed using MoDOT provided crash data within the study area (Tier 1 and Tier 2 limits) from 2016 through 2020 (last available year with 12 months of official data). It was revealed that a total of 4,259 crashes occurred within the study area during the five-year period. It should be noted that in 2020, there was a significant reduction in the number of crashes to a total of 689, likely due to the COVID-19 pandemic's impact upon vehicle miles traveled in 2020. For comparison, between 2016 and 2019, the average number of total crashes per year was 894. **Figure 28** shows crashes per year within the study area. For comparison, at a national level, total crashes in 2020 were 21.5% lower than the average from 2016-2019. However, the number of fatal crashes at the national level increased 4.5% in 2020 compared to 2016-2019, according to NHTSA's FARS database. Per Missouri's STARS database, total crashes decreased statewide by 15.8%, while fatal crashes increased by 7.7% in 2020.

Figure 28. Crashes per Year – 2016 to 2020 (Tier 1 & Tier 2 Combined)

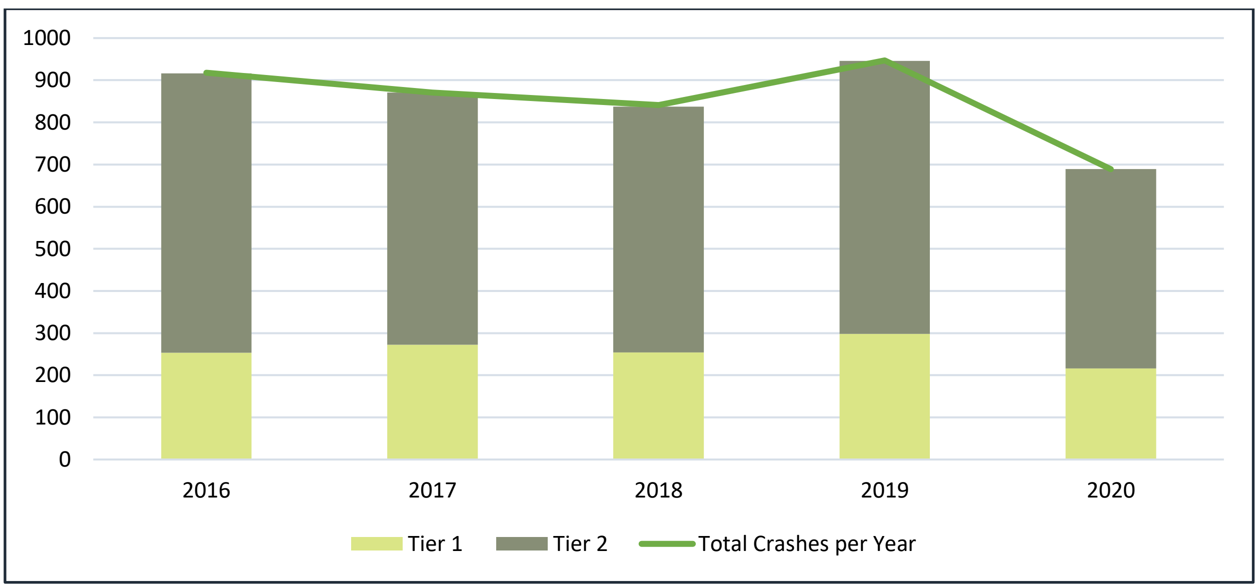
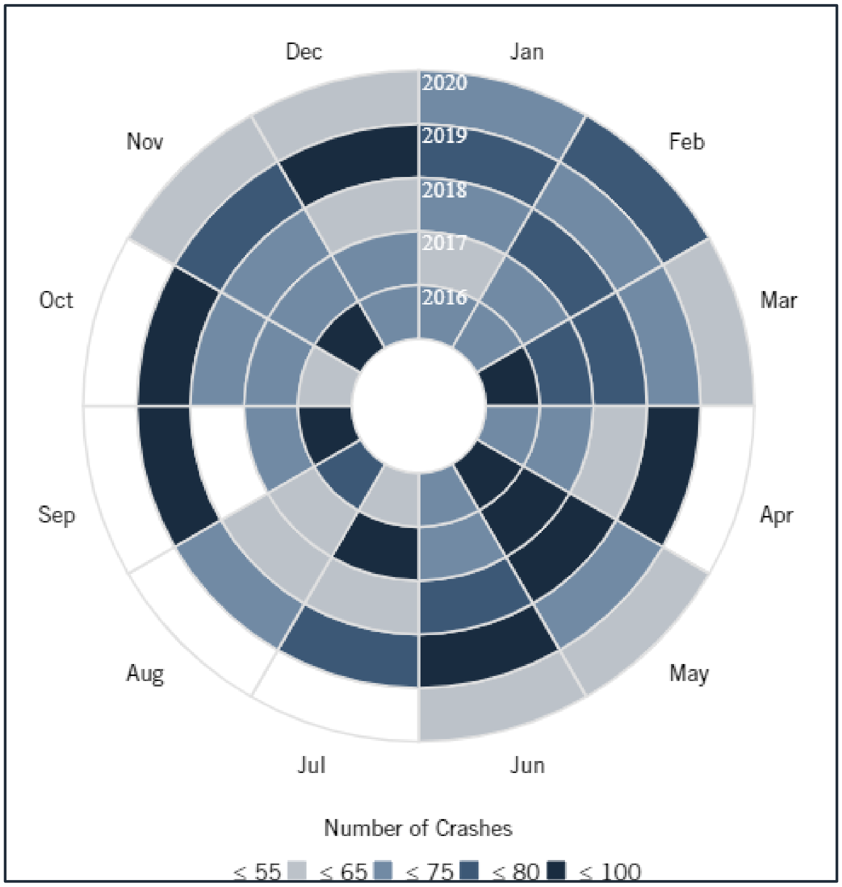


Figure 29 is a data clock representing total crashes per month for years 2016 to 2020. Generally, the number of crashes were spread evenly across all months of the year, without a specific seasonal aspect. However, the onset of COVID-19 is readily apparent in the outer ring of the data clock, where total crash frequency fell for several months starting in March/April 2020 and remained comparatively low through the remainder of 2020.

Figure 29. Crashes Per Month – 2016 to 2020



Within the study area between 2016 and 2020, there were six crashes that resulted in at least one fatality, and 1,084 crashes (approximately 25%) that resulted in an injury and/or fatality. **Table 9** and **Table 10** summarize the crash breakdown by severity for the five-year period within both Tier 1 and Tier 2 limits, respectively. **Figure 30** presents the crash severity by location within the study area.

Table 9. Crashes by Severity – 2016 to 2020 (Tier 1)

Crash Severity	Number of Crashes	Percent of Total
Fatal	3	0.2%
Suspected Serious/ Disabling Injury	22	1.7%
Minor Injury	294	22.7%
Property Damage Only	974	75.3%
Total	1,293	100.0%

Table 10. Crashes by Severity – 2016 to 2020 (Tier 2)

Crash Severity	Number of Crashes	Percent of Total
Fatal	3	0.10%
Suspected Serious/ Disabling Injury	43	1.45%
Minor Injury	719	24.2%
Property Damage Only	2,201	74.2%
Total	2,966	100.0%

Other crash characteristics examined include lighting conditions, weather conditions, surface conditions, and temporal differences in crash occurrences. **Figure 31, Figure 32A** and **Figure 32B** summarize these characteristics for Tier 1 limits. **Figure 33**, **Figure 34A** and **Figure 34B** summarize these characteristics for Tier 2 limits.

With regards to lighting conditions, a higher percentage of total crashes occurred during low light or overnight timeframes within the Tier 1 (32% of all crashes) limits versus the Tier 2 limits (29% of all crashes). Of note, albeit at a low overall percentage, the share of crashes noted as "Dark w. Street Lights Off" was higher along the I-64 (Tier 1 limits). This could be due to maintenance issues with existing lighting on I-64, or lack of continuous lighting on I-64 and associated ramps.

Weather conditions and surface conditions have an effect on the number of crashes. Within the Tier 1 limits, the relative difference of the number of crashes occurring under wet or dry conditions was more pronounced. Higher speeds along I-64, mixed with greater stopping distance needs, mainline curvature, and ramps with unique geometry and/or limited acceleration or deceleration distance contribute to a higher prevalence of crashes during wet or icy conditions.

When summarizing crashes by day of week, Friday stands out as having the greatest number of total crashes within both Tier 1 and Tier 2 limits, while Sundays experience noticeably fewer crashes. Total crashes for other weekdays were relatively similar, with the number of crashes on Monday being lower within both Tier 1 and Tier limits on typical commuter workdays. Within the Tier 2 limits, monthly total crashes were very consistent, averaging 49 crashes per month, and not varying by more than approximately 7% in any given month of the year. Monthly crash totals within Tier 1 limits varied much more significantly, from a high average number of crashes of 28 in November to a low average number of crashes of 17 in July.

Figure 30. Crashes By Severity – 2016 to 2020 (Tier 1 & Tier 2 Combined)

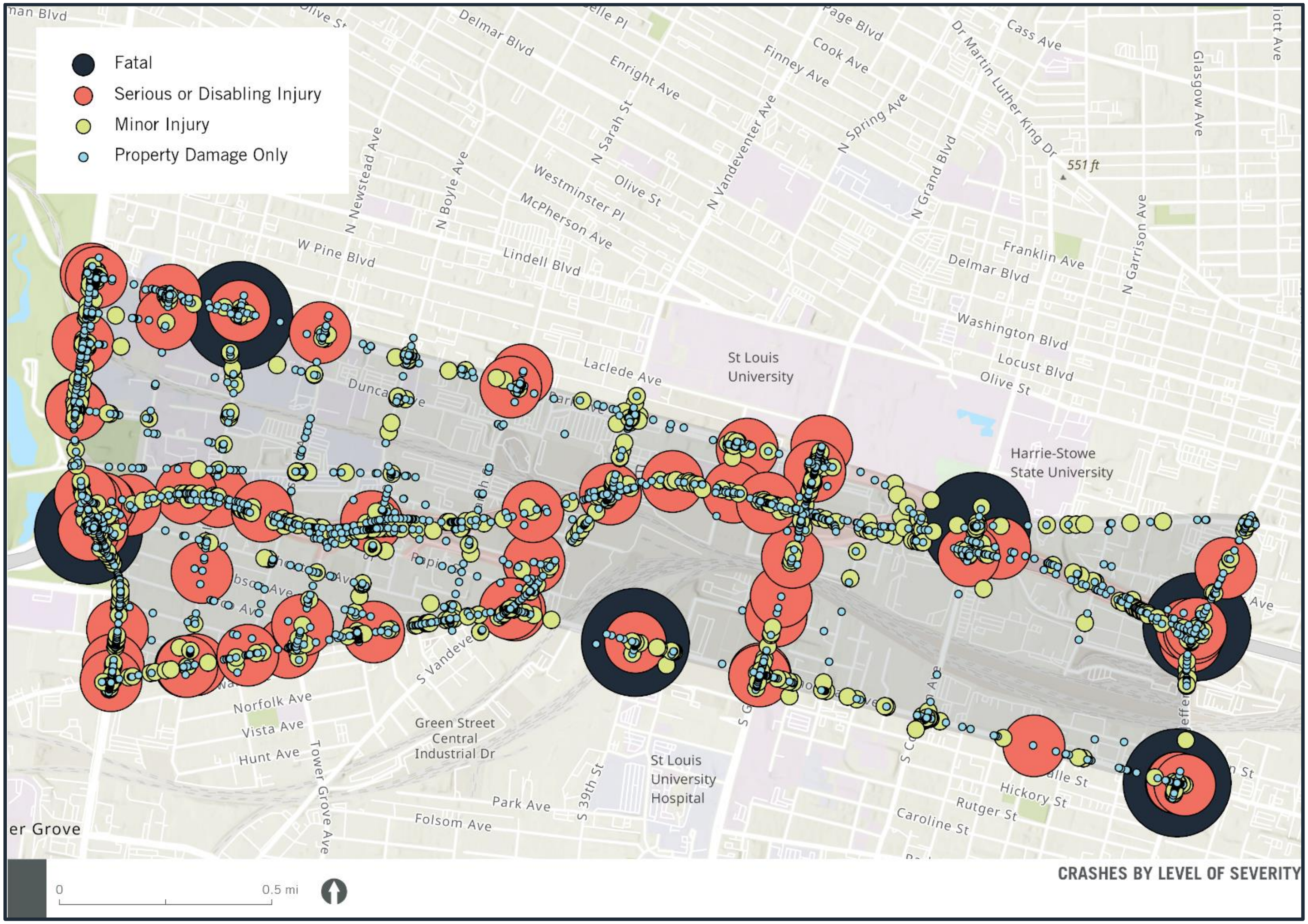


Figure 31. Crash Dashboard – Tier 1

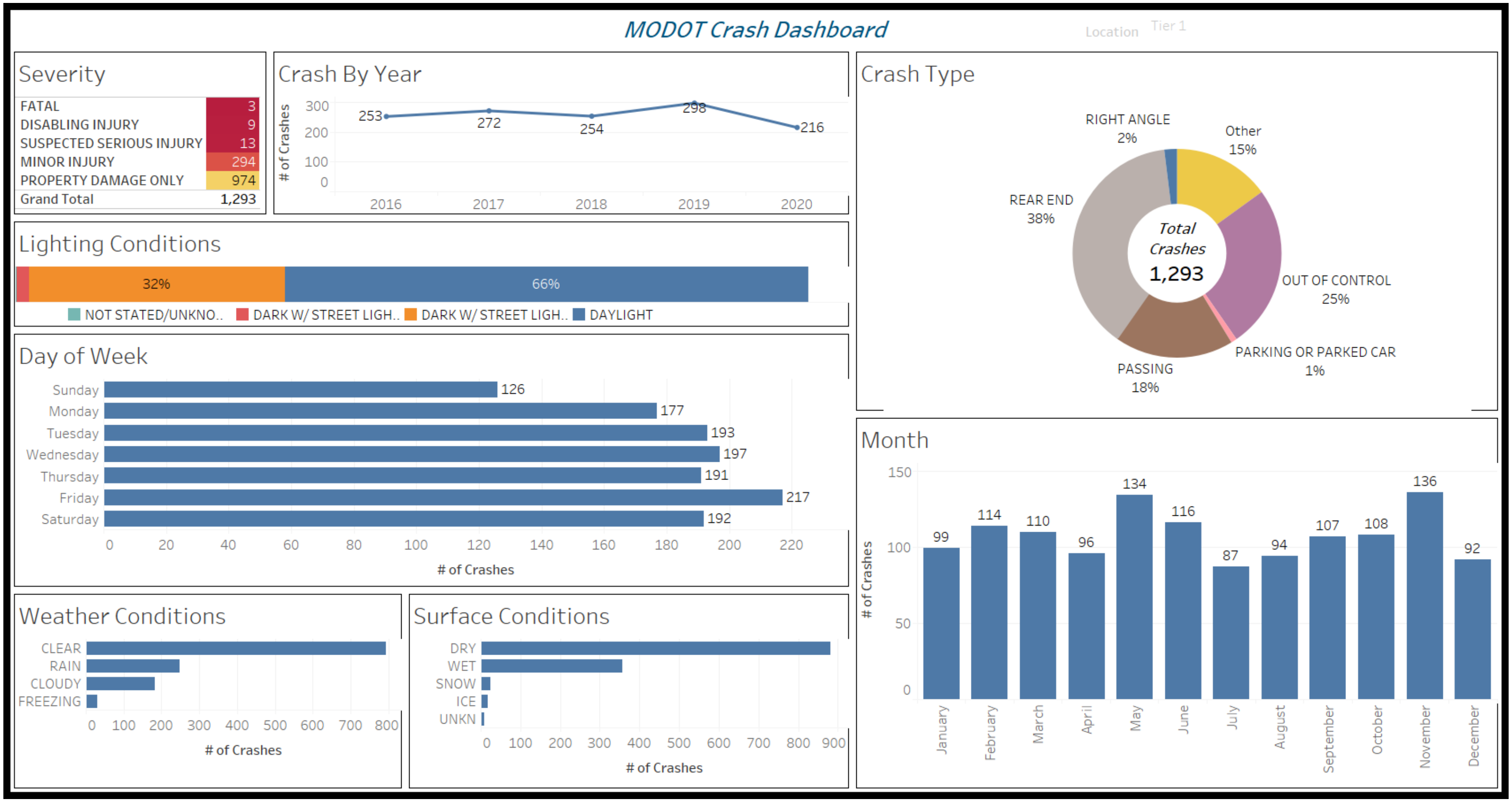


Figure 32A. Tier 1 Crashes by Type – Disabling, Fatal, and Suspected Serious Injury

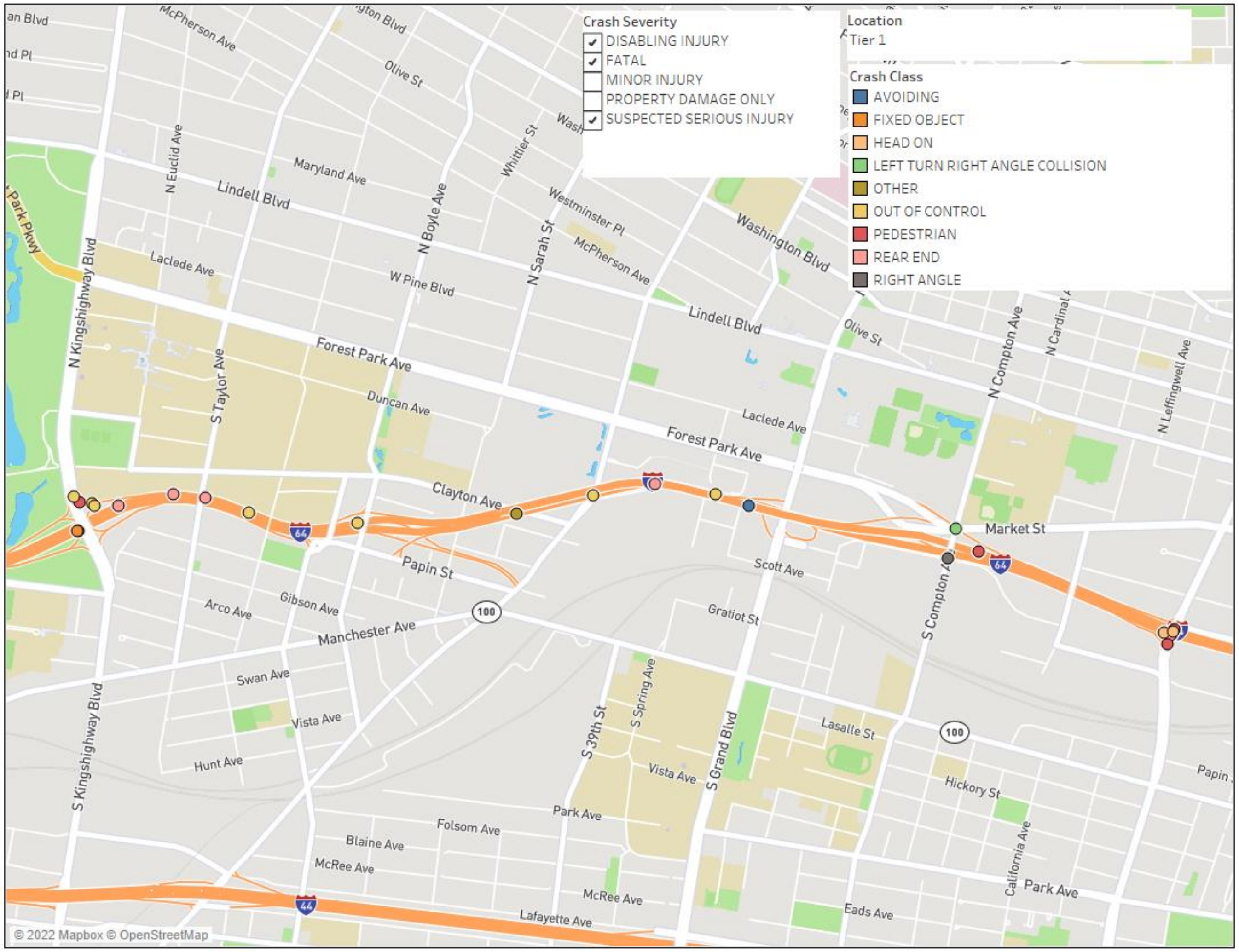


Figure 32B. Tier 1 Crashes by Type – Minor Injury

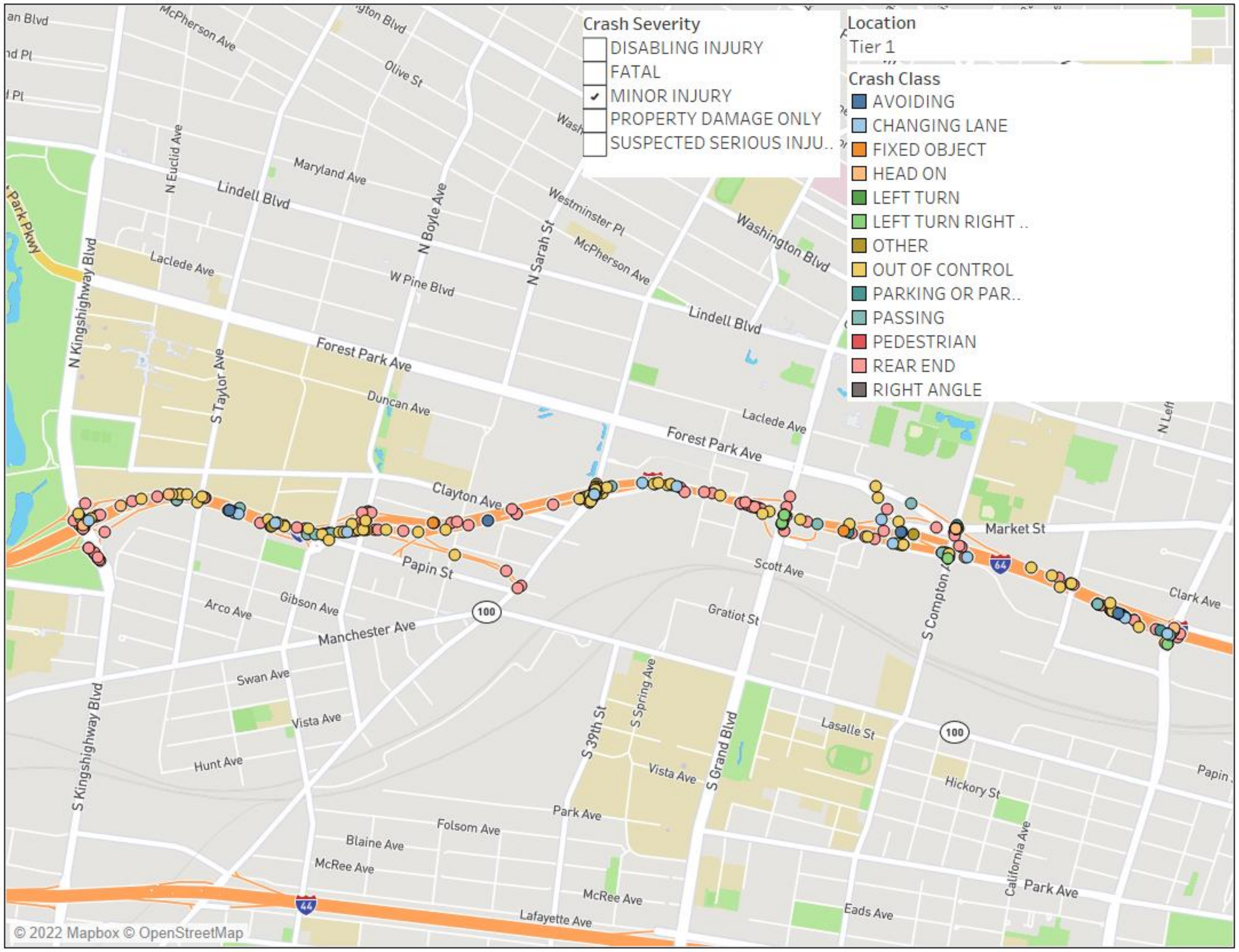


Figure 33. Crash Dashboard – Tier 2 (Excludes all Tier 1 Crash Data)

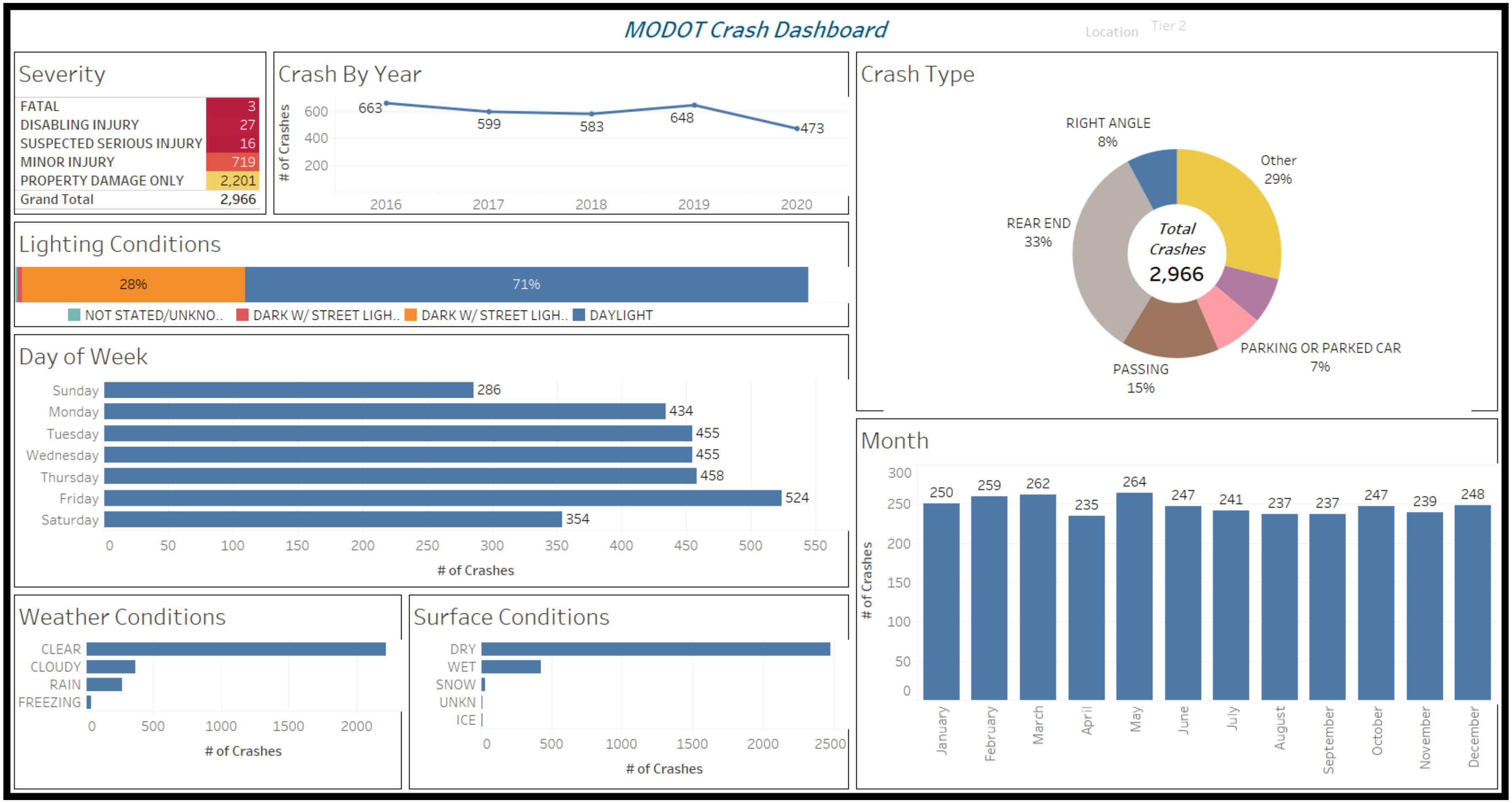


Figure 34A. Tier 2 Crashes by Type (Excludes all Tier 1 Crash Data) – Disabling, Fatal, and Suspected Serious Injury

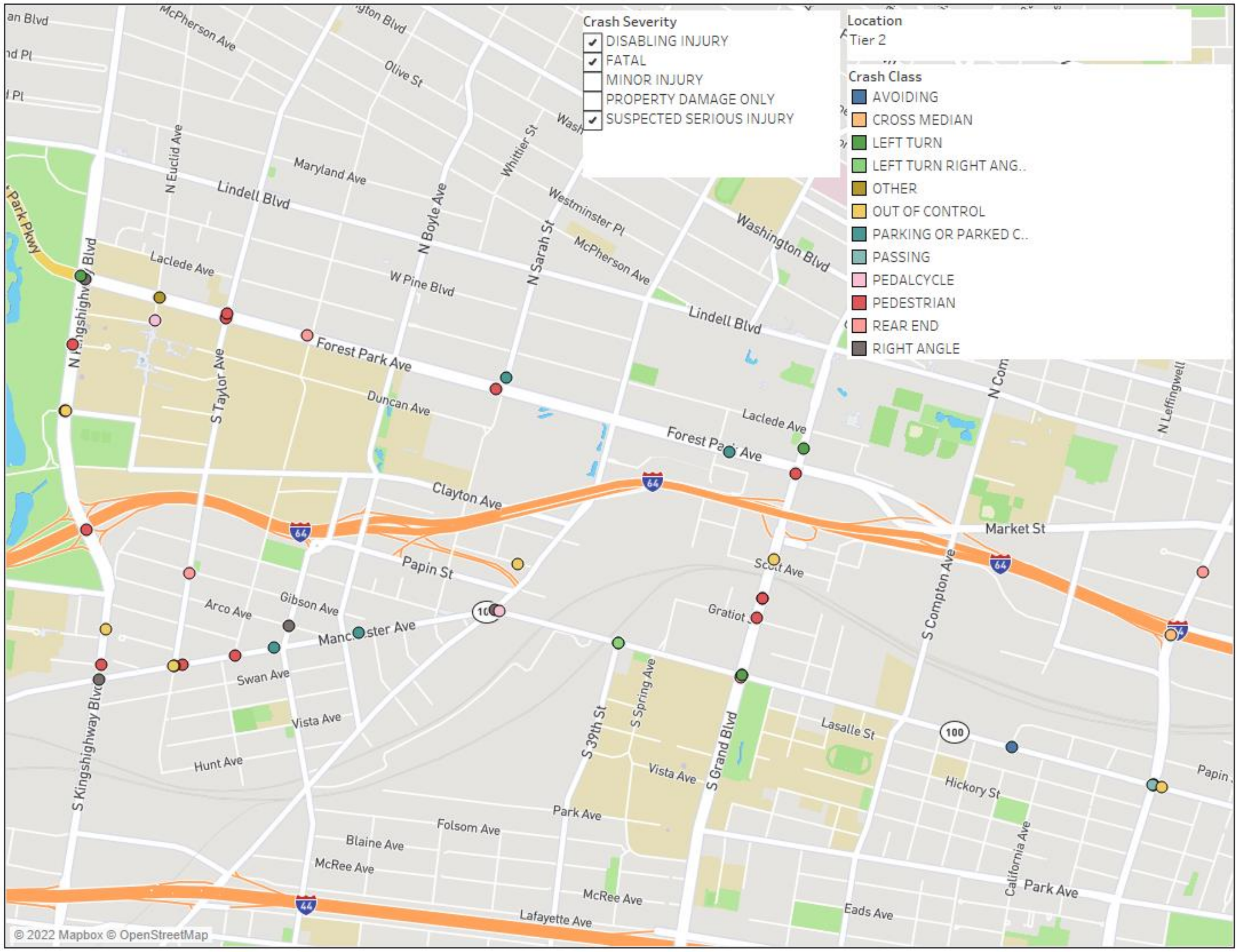
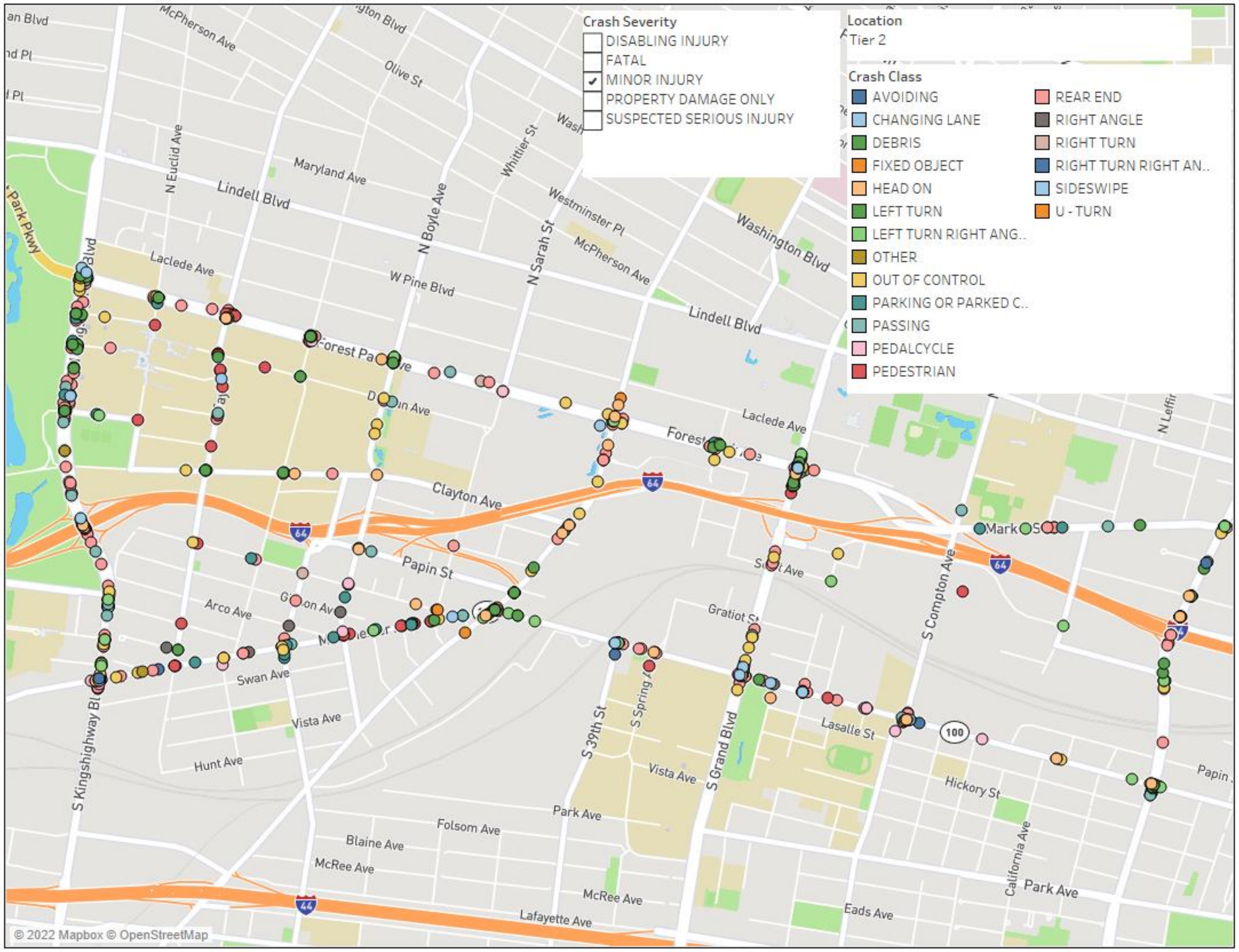


Figure 34B. Tier 2 Crashes by Type (Excludes all Tier 1 Crash Data) – Minor Injury



While crash reports themselves were not reviewed as part of the PEL study process, Missouri State Highway Patrol (MSHP) call reports were reviewed for wrong way codes within the study area given MoDOT's emphasis on wrong-way crash mitigation. **Table 11** summarizes the calls recorded where wrong-way drivers were encountered. Note that the MSHP call report log is limited to actual calls received by enforcement dispatch, and descriptions of locations are inconsistent due to a lack of standard form. Consequently, any logged instance that may be tied to the study area is listed for consideration. For example, the wrong-way call noting I-64 WB & S 14^{th} may refer to a vehicle traveling eastbound from the study area in the I-64 westbound lanes. Of note, seven of the nine recorded calls occurred during late evening or overnight hours, indicating potential confusion with wayfinding during low-light conditions, impaired drivers, or unfamiliar drivers originating from nearby entertainment land use.

Table 11. MSHP Call Report Logs – Wrong-Way Drivers

Date	Time	Recorded Location*
10/7/17	9:09 PM	I-64 & Jefferson Ave.
5/17/18	10:58 PM	I-64 WB & S 14th St.
10/29/18	1:13 AM	I-64 EB & Hampton Ave.
4/22/19	3:22 AM	I-64 EB & Kingshighway
10/27/19	12:43 AM	I-64 EB & S Vandeventer Ave.
11/26/19	6:45 PM	I-64 WB & Hampton Ave.
8/4/20	10:20 PM	WB in EB lanes I-64 from Jefferson Ave.
7/31/20	12:37 PM	I-64 WB & Hampton Ave.
11/9/20	12:02 AM	I-64 EB & S Kingshighway Blvd.

* Note: Recorded Location is verbatim from the call report log. Additional data regarding direction, point of entry, and other details are not readily available.

3.1.1. High Crash Locations

Locations that experience high numbers of crashes often have a mixture of high levels of economic activity, higher traffic volumes, and a substantial number of conflict points along a corridor or at specific intersections, at times involving varying modes of transportation (vehicle, transit, bike, pedestrian, etc.). High crash locations were determined using ESRI GIS statistical models incorporating kernel density geoprocessing methodology to find relative density of crashes along various corridors within the study area. As conveyed graphically in **Figure 35 and Figure 36**, higher crash frequency is experienced along corridors with those features, including Jefferson Ave., Grand Blvd., Vandeventer Ave., Kingshighway Blvd., and I-64 ramp intersections. Along the section of I-64 between Vandeventer Ave. and Grand Blvd., where the westbound direction is on structure above eastbound traffic, crash frequency skewed more heavily toward the eastbound direction, with approximately 67% of all crashes on I-64 in the Grand Blvd.

interchange area. Near the Vandeventer Ave. interchange, the share of crashes is more evenly split by direction. Within both tiers, comparatively high crash frequency locations include:

- Tier 1 Limits
  - I-64 & Jefferson Ave.
  - I-64 & Grand Blvd. (2/3 EB)
  - I-64 over Vandeventer Ave. (~50/50, slightly higher EB)
  - I-64 & Kingshighway Blvd.
- Tier 2 Limits
  - Chouteau Ave. & Jefferson Ave.
  - Forest Park Ave. & Grand Blvd.
  - Grand Blvd. & Chouteau Ave.
  - Chouteau Ave. & Vandeventer Ave.
  - Kingshighway Blvd. & Forest Park Ave.
  - Kingshighway Blvd. & Hospital Dr.
  - Chouteau Ave. & Kingshighway Blvd.

Figure 35. Total Crash Frequency Heat Map – 2016 to 2020 (Tier 1)

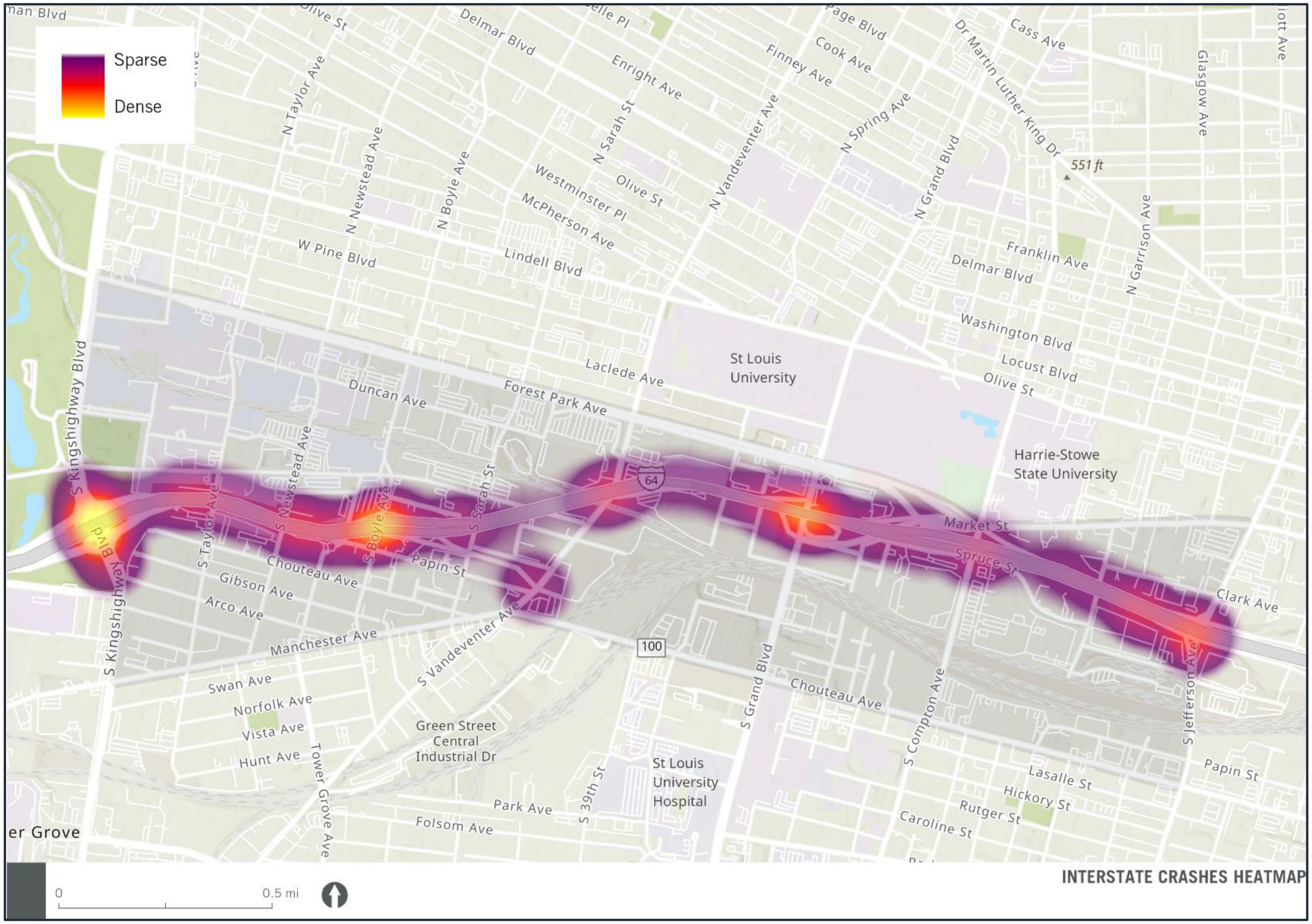
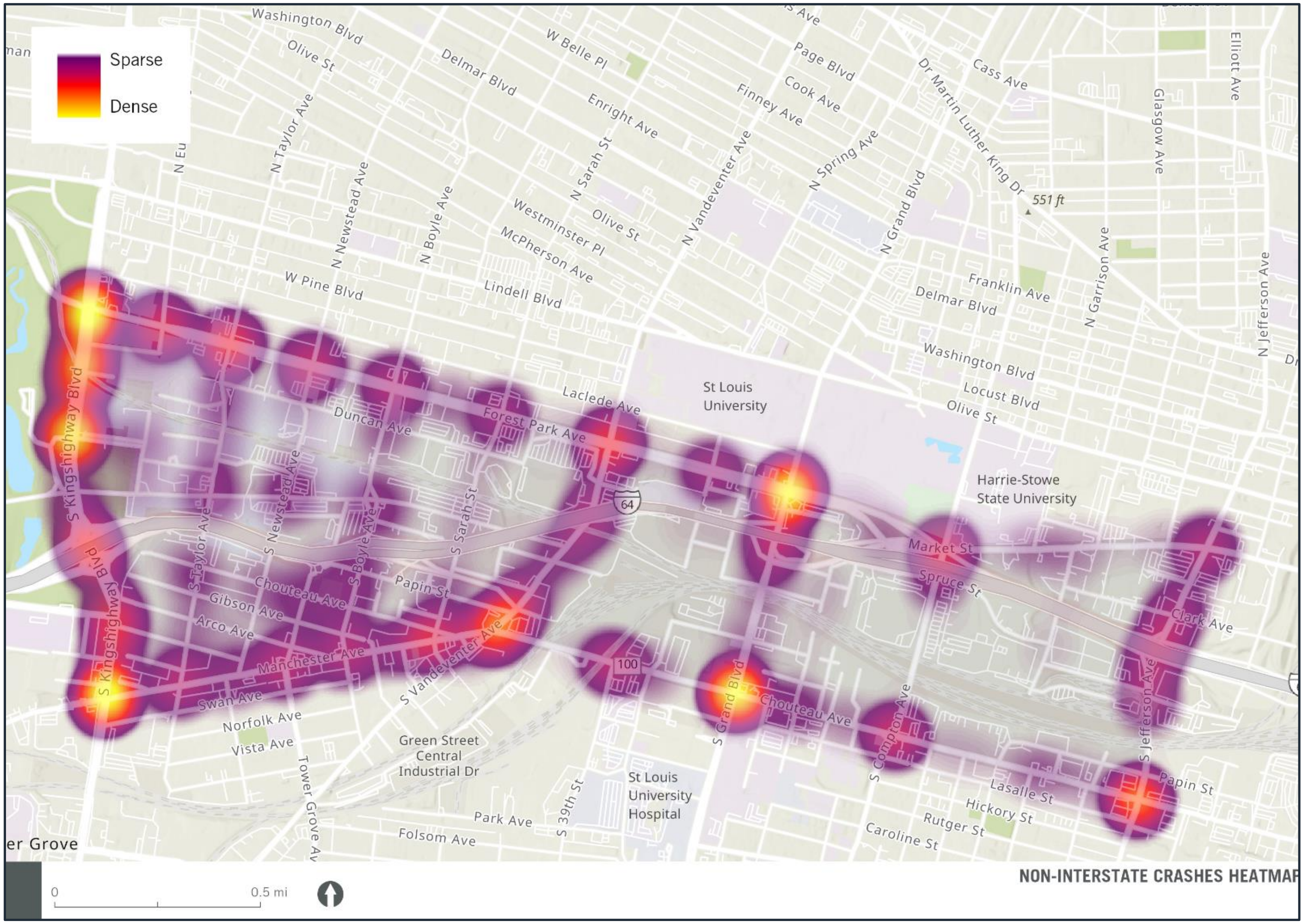


Figure 36. Total Crash Frequency Heat Map – 2016 to 2020 (Tier 2)



MoDOT annually generates traffic safety lists on a statewide and district level that include segments and intersections with high severity ratings. Of note, the segments included in the lists tend to be relatively long in nature, where a single segment is on the order of several miles in length. Review of the lists for the St. Louis district, based on crash data between 2018 and 2020, reveal the following segments and intersections for the various categories that fall within the study area limits:

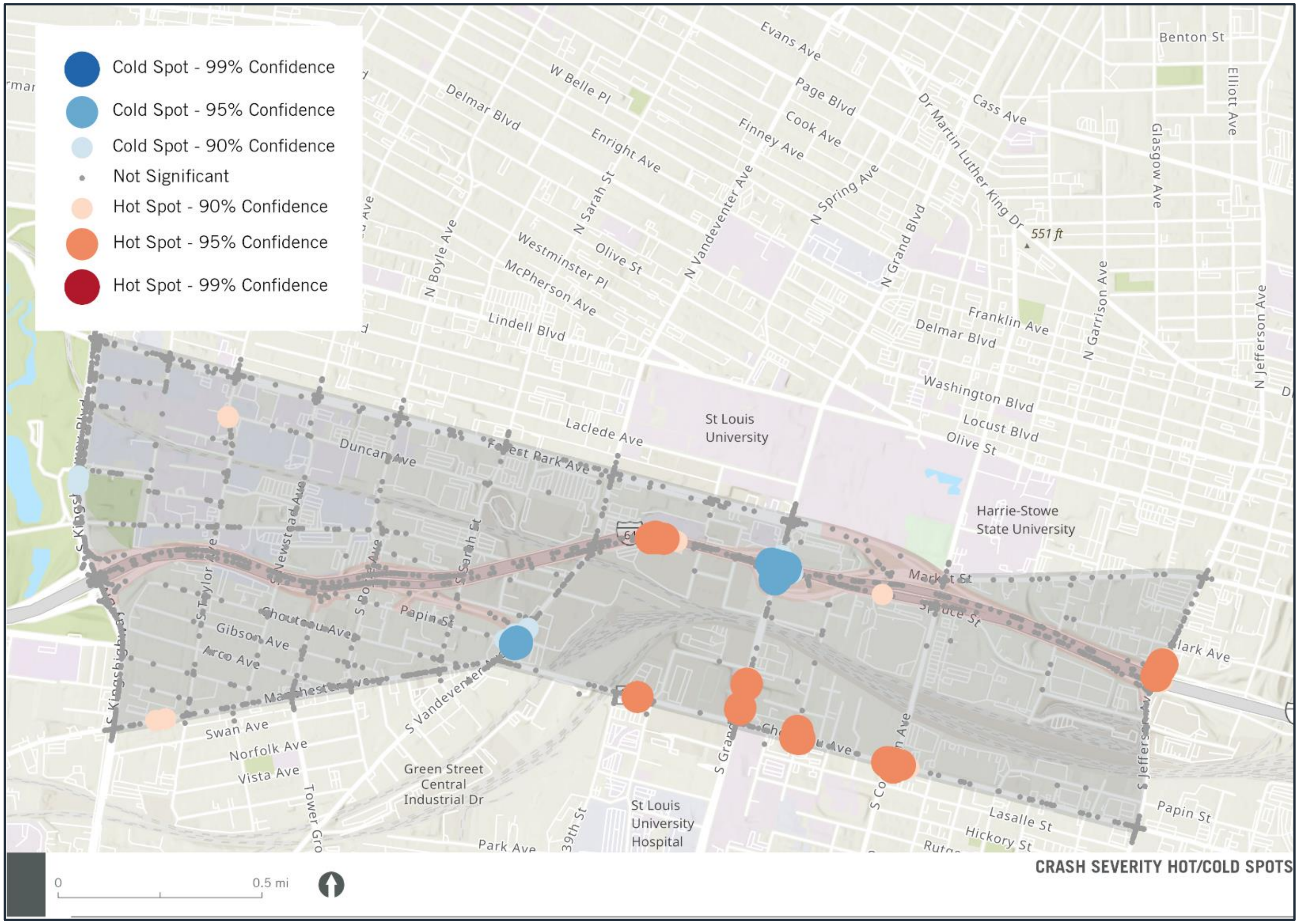
- Top Curve Locations
  - SB Kingshighway Blvd. between I-64 and Oakland Ave.
  - EB I-64 between Boyle Ave. and Vandeventer Ave.
  - Ramp from WB I-64 to Kingshighway Blvd.
  - Ramp from EB I-64 to Kingshighway Blvd.
  - WB I-64 between Tower Grove Ave. and Newstead Ave.
  - EB I-64 between Vandeventer Ave. and the ramp to Market St./Bernard St.
- Top Wet Pavement Locations
  - WB I-64 between Boyle Ave. and the ramp to Kingshighway Blvd.
  - EB I-64 between Tower Grove Ave. and the bridge over Metrolink tracks
  - EB I-64 between the pedestrian overpass just east of Kingshighway Blvd. and Tower Grove Ave.
  - WB I-64 between Sarah St. and Newstead Ave.
  - EB I-64 between the bridge over Metrolink tracks and the ramp to Market St./Bernard St.
  - EB I-64 between Papin St. on-ramp and the bridge over Vandeventer Ave.
  - WB I-64 between Newstead Ave. and Kingshighway Blvd.
  - WB I-64 between Kingshighway Blvd. and the Science Center pedestrian overpass
- Top Unrestrained Locations (full length of each corridor within project limits)
  - WB I-64
  - Kingshighway Blvd.
  - Jefferson Ave.
  - Manchester Ave./Chouteau Ave.
- Top High Severity Segments
  - EB I-64 (entire study limits, with higher emphasis on segment between Kingshighway Blvd. and the Market St. underpass bridge)
  - WB I-64 (entire study limits)
- Top High Severity Intersections
  - Chouteau Ave. at Jefferson Ave.
  - Chouteau Ave. at South 39th St.

3.1.2. Severe Clusters

Clusters of severe crashes illustrate nuances regarding the types of crashes and where they occur. Crash "hotspots" are locations where severe crashes are happening with more frequency and/or severity and may suggest issues related to speed, stopping sight distance, and severe conflict points. Conversely, crash “cold spots” indicate locations where a high number of crashes are occurring that are not severe (property damage only) and may suggest operational issues causing congestion, leading to a higher occurrence of crashes at slower speeds.

Figure 37 illustrates the hot spots and cold spots relative to crash severity within the study area (Tier 1 and Tier 2 limits). Severe crash hot spots include I-64 between Grand Blvd. and Vandeventer Ave., Grand Blvd. near Chouteau Ave., Chouteau Ave. at Theresa Ave. (an offset intersection where the mainline cross section changes), Chouteau Ave. at Compton Ave., and Jefferson Ave. near I-64. Severe crash cold spots include Grand Blvd. near I-64 and Vandeventer Ave. near Papin St. and the I-64 ramps.

Figure 37. Total Crash Severity Hot/Cold Spot – 2016 to 2020 (Tier 1 & Tier 2 Combined)



3.1.3. Crashes Involving Bicyclists and Pedestrians

Within the study area, there were 123 crashes between 2016 and 2020 involving a pedestrian or bicyclist, resulting in an average of more than 24 bicycle/pedestrian crashes per year. Of the 123 crashes, 89 involved pedestrians and 34 involved bicyclists. Crashes involving bicyclists and pedestrians are much more likely to result in an injury or fatality because the relationship between vehicle speed at impact and the severity of the crash is non-linear as speeds increase.

Of the 123 bicycle/pedestrian crashes, there were 2 fatalities (a subset of the 6 fatalities in the study area) and 108 injury crashes, indicating that approximately 90% of all bicycle/pedestrian crashes resulted in an injury or fatality. The injury/fatality rate for bicycle or pedestrian crashes (89%) is significantly higher than the overall injury/fatality rate of 25% (presented in Section 3.1). The combined rate of suspected serious/disabling injury and fatal crashes involving bicycles or pedestrians (14.6%) is higher than the overall fatality rate of 1.6%. Of note, non-injury bicycle/pedestrian crashes are frequently unreported, thereby causing the above injury/fatality rates to potentially be an overrepresentation of actual rates associated with bicycle/pedestrian crashes. **Table 12** shows the breakdown of bicycle and pedestrian crashes by severity.

Table 12. Bicycle and Pedestrian Crashes by Severity (Tier 1 & Tier 2 Combined)

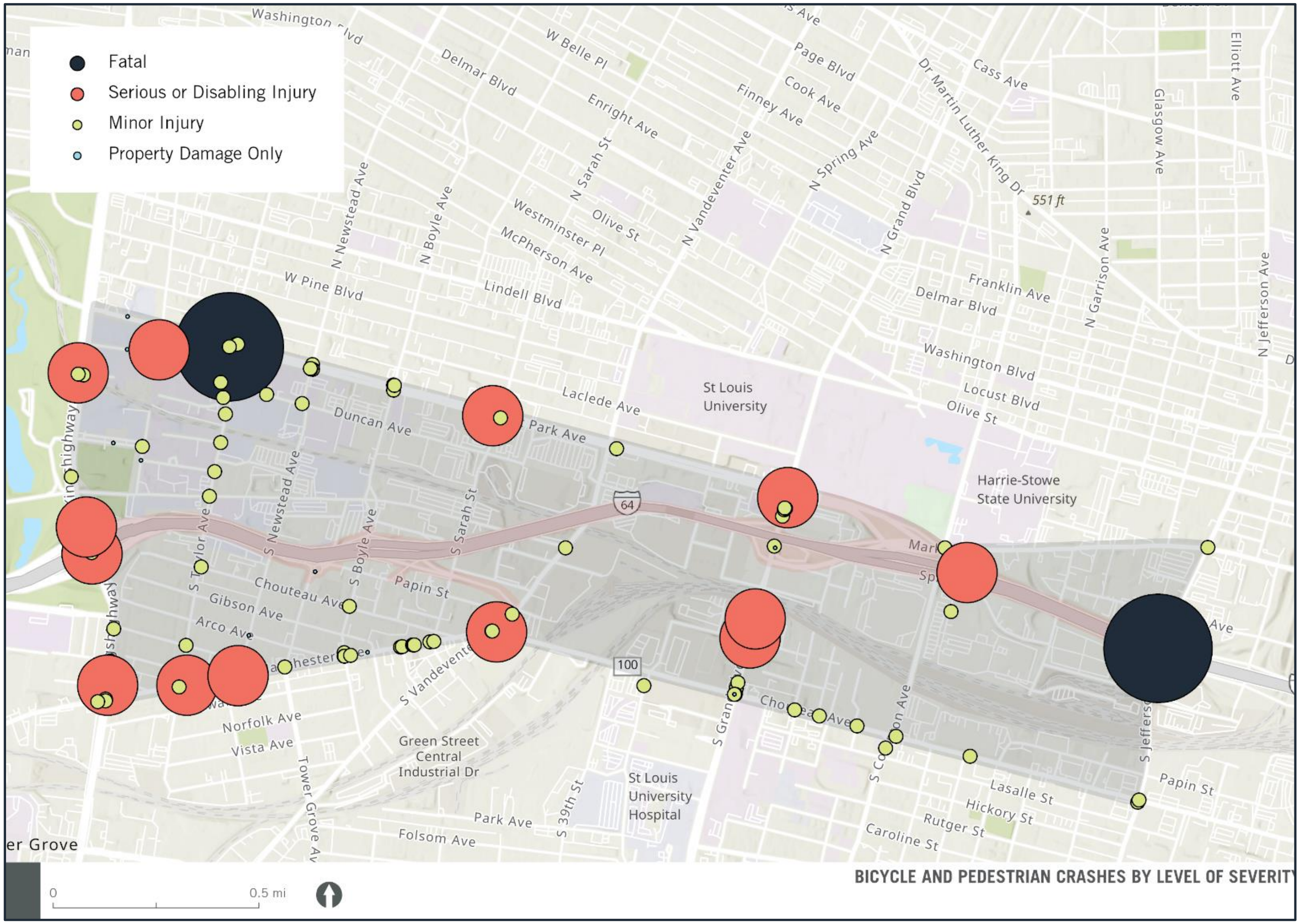
Crash Severity	Number of Crashes	Percent of Total
Fatal	2	1.6%
Suspected Serious/ Disabling Injury	16	13.0%
Minor Injury	92	74.8%
Property Damage Only	13	10.6%
Total	123	100.0%

As shown in **Figure 38**, crashes involving bicyclists and pedestrians are observed at high frequencies at these intersections throughout the study area:

- Along Kingshighway Blvd. adjacent to the BJC campus/Forest Park.
- Kingshighway Blvd. at the interchange with I-64.
- Along Forest Park Ave. at critical intersections with Grand Blvd., Sarah St. and Taylor Ave.
- Along Grand Blvd. between I-64 and Chouteau Ave., in the vicinity of the Metro transit station.

One fatal crash occurred at Forest Park Ave. and Taylor Ave., and the other occurred along Jefferson Ave. at the I-64 ramp terminals. There were 92 minor injury crashes involving bicyclists and pedestrians within the study area over the five-year period. In particular, both Chouteau Ave. and Taylor Ave. experienced minor injury crashes along nearly their entire length within the study area.

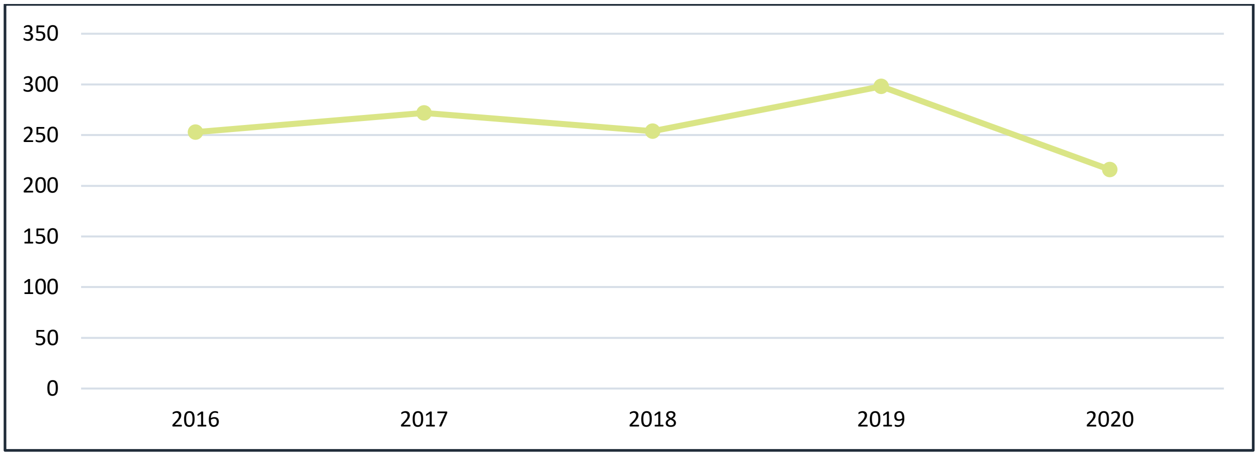
Figure 38. Crashes Involving Bicyclists and Pedestrians by Severity – 2016 to 2020



3.2. TIER 1 LIMITS: CRASHES

Within Tier 1 limits, there were 1,293 total crashes between 2016 and 2020. With the exception of 2020, where there was a noticeable drop in crashes (216), the crash totals within Tier 1 limits ranged from approximately 250 to 300 total crashes per year. Crashes within Tier 1 limits by year are shown in **Figure 39.**

Figure 39. Tier 1 Limits: Crashes per Year – 2016 to 2020

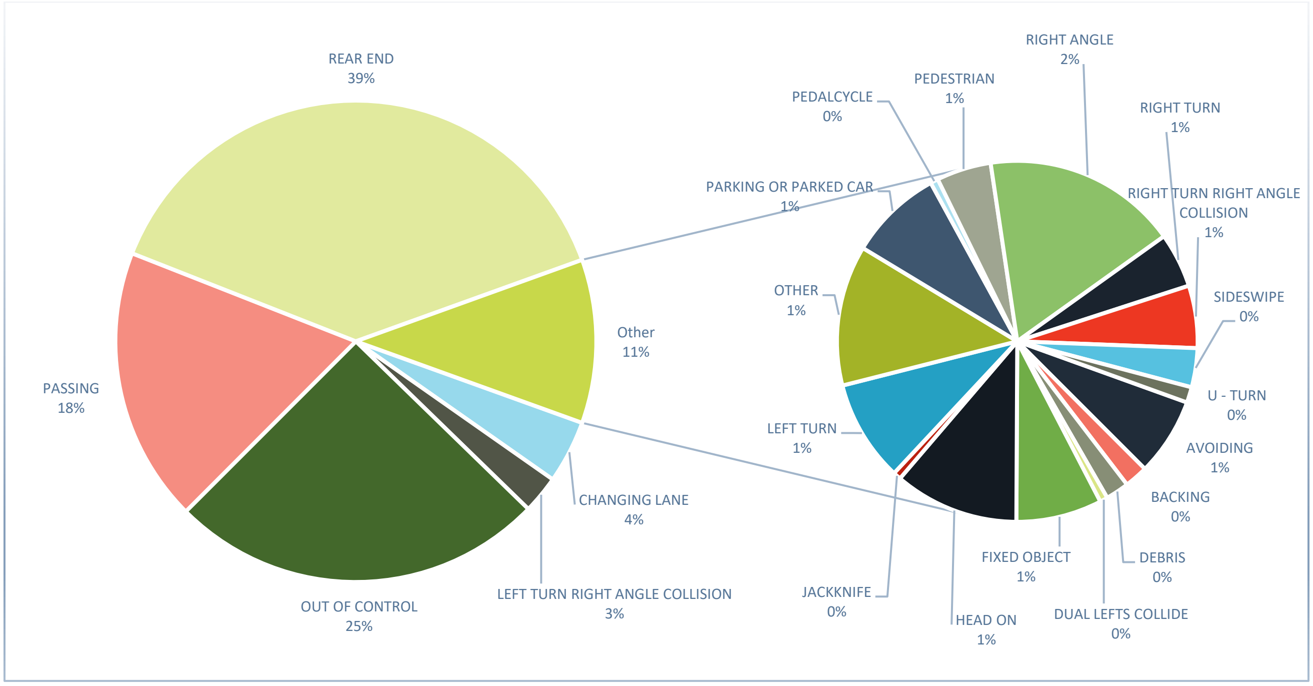


Within Tier 1 limits, there were 3 fatal crashes and 316 crashes that resulted in an injury, representing nearly 25% of the reported crashes. Of note, most crashes along I-64 are classified as either rear end (39%) or out of control (25%), which is likely a result of high speeds along I-64, unexpected congestion at various mainline and ramp locations throughout the corridor, existing geometric deficiencies, or confusing wayfinding signage. Crashes within Tier 1 limits by severity and type are shown in **Table 13** and **Figure 40.** The percentage breakdowns of crashes by severity within the Tier 1 limits and the study area are similar, as shown by comparing Table 9 and Table 13.

Table 13. Tier 1 Limits: Crashes by Severity – 2016 to 2020

Crash Severity	Number of Crashes	Percent of Total
Fatal	3	0.2%
Suspected Serious/ Disabling Injury	22	1.7%
Minor Injury	294	22.7%
Property Damage Only	974	75.3%
Total	1293	100.0%

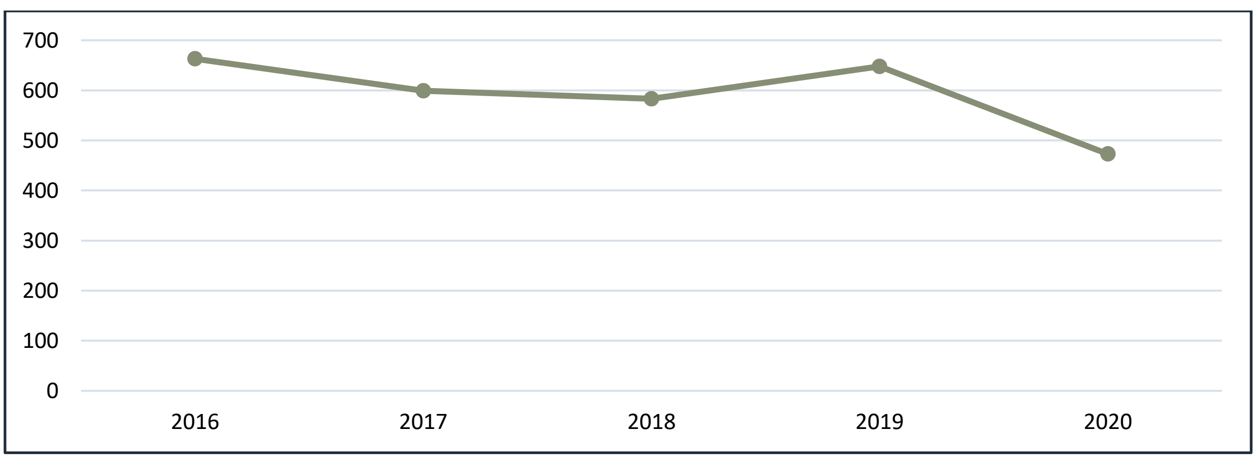
Figure 40. Tier 1 Limits: Crashes by Type – 2016 to 2020



3.3. TIER 2 LIMITS: CRASHES

Crashes within Tier 2 limits include crashes on the local roadway network and intersections with I-64. Within Tier 2 limits, there were 2,966 crashes during the five-year period from 2016 to 2020. From 2016 to 2019 (pre COVID-19 pandemic), the average total number of crashes was approximately 620 per year; whereas in 2020, there were 473 total crashes (likely due to the reduced vehicle miles traveled during the pandemic). Crashes within Tier 2 limits by year are shown in **Figure 41.**

Figure 41. Tier 2 Limits: Crashes by Year– 2016 to 2020

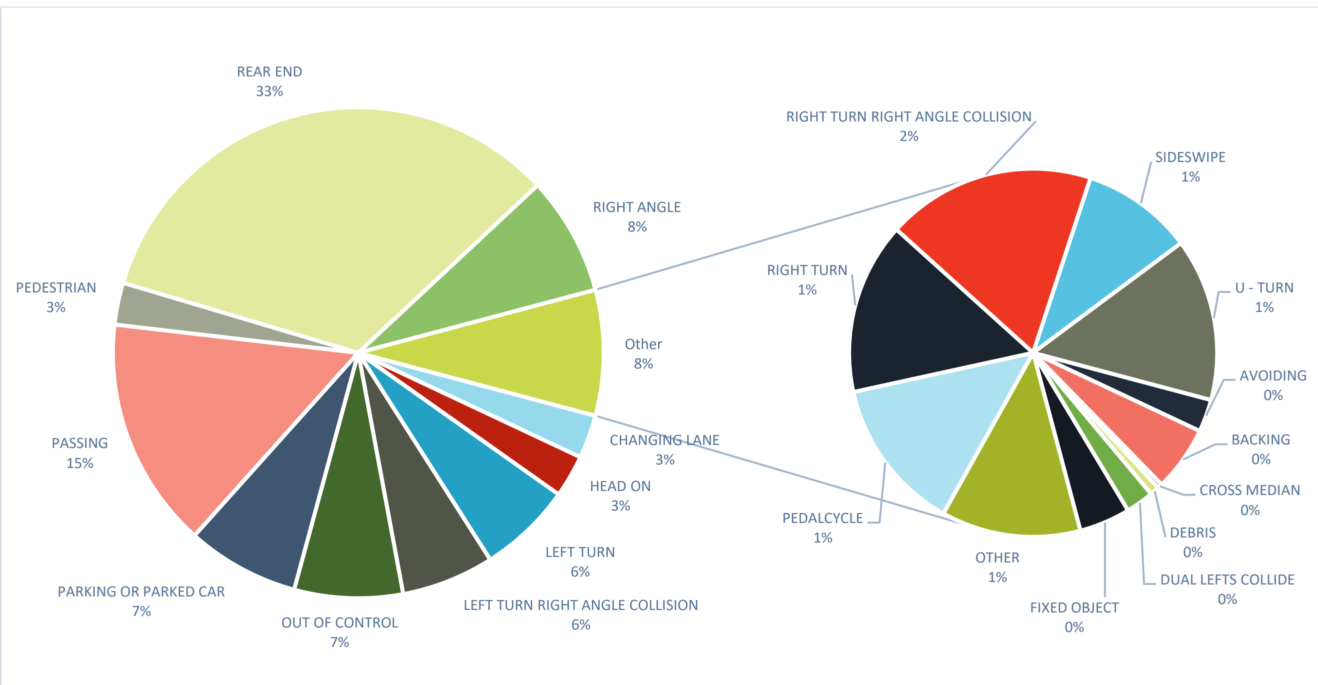


There were 3 fatal crashes and 762 crashes that resulted in an injury, representing approximately 25% of the total crashes within the Tier 2 limits. Rear-end crashes are the most prevalent crash type followed by a combination of other, less prevalent types. Passing type crashes were generally located on the wide arterial cross-sections along Kingshighway Blvd. Since Tier 2 limits encompass arterials and collectors with at-grade intersections, crash types vary from those within Tier 1 limits, for example angle and parked vehicle crashes. Crashes within Tier 2 limits by severity and type are shown in **Table 14** and **Figure 42.**

Table 14. Tier 2 Limits: Crashes by Severity – 2016 to 2020

Crash Severity	Number of Crashes	Percent of Total
Fatal	3	0.1%
Suspected Serious/ Disabling Injury	43	1.4%
Minor Injury	719	24.2%
Property Damage Only	2,201	74.2%
Total	2,966	100.0%

Figure 42. Tier 2 Limits: Crashes by Type – 2016 to 2020



3.4. CRASH RATE ANALYSIS

A crash rate analysis was performed for the study area to identify roadways experiencing safety-related challenges, which required a consolidation and aggregation of crashes to roadway segments. Segment length and volume were used to quantify exposure and then normalize raw crash numbers as a function of exposure. The formulas for crash rate and exposure are:

$$Crash\ Rate = \frac{Number\ of\ Crash}{Exposure}$$

$$Exposure = AADT \times Number\ of\ Years \times 365 \times Segment\ Length\ (miles)$$

A segment crash rate by itself does not lead to many conclusions. However, statewide average crash rates can be used to calculate a statistically significant critical crash rate within specific study areas. Per MoDOT guidance in EPG Section 905.3.6.1.4, the critical crash rate is used to compare directly to observed crash rates and offers the ability to *identify portions of the study area that are statistically out of the norm* as compared to other similar facilities throughout Missouri. The formula for critical crash rates is:

$$Critical\ Crash\ Rate = SAR + K \times \sqrt{\frac{SAR}{Exposure}} + \frac{1}{2 \times Exposure}$$

$$\text{Where: SAR} = \text{Statewide Average Crash Rate}$$

$$\text{K} = 1.645\text{; Probability factor for 95\% confidence interval}$$

Three separate crash rate analyses were performed. The first relied on statewide average rates by functional class. **Table 15** summarizes the statewide average crash rate used in the first analysis.

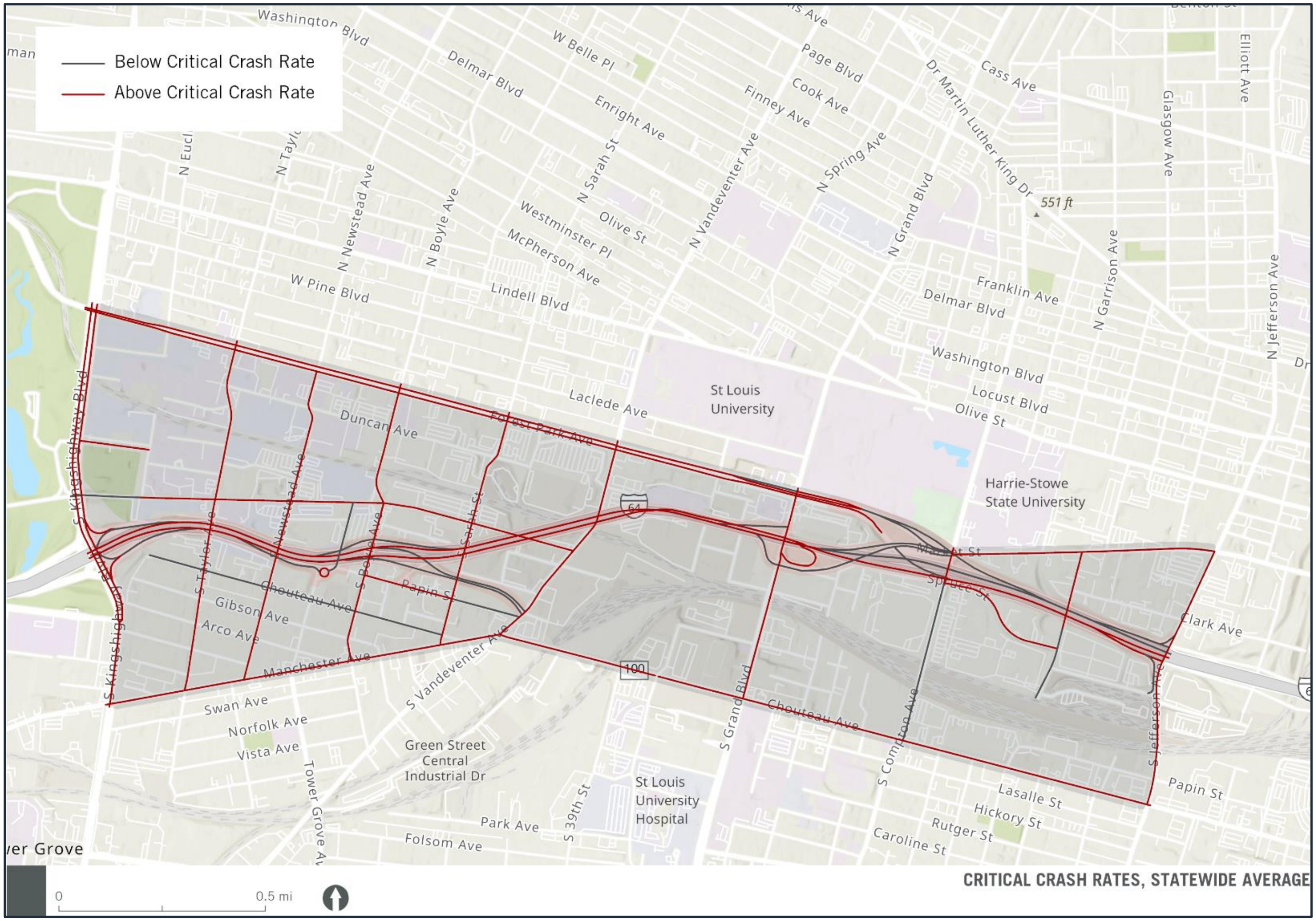
Table 15. Statewide Average Crash Rates by Functional Class

Functional Class	End Year	5-Year Rate	Area Designation
Freeway	2020	93.55	Statewide
Interstate	2020	80.07	Statewide
Local	2020	637.05	Statewide
Major Collector	2020	245.37	Statewide
Minor Arterial	2020	255.31	Statewide
Minor Collector	2020	282.82	Statewide
Principal Arterial	2020	228.46	Statewide

Source: Missouri Department of Transportation (MoDOT).

When comparing observed crash rates in the study area to the critical crash rates using statewide average rates, *nearly all corridors demonstrate crash rates above the critical crash rate*. As can be seen in **Figure 43**, nearly the entirety of I-64, as well as the primary north-south and east-west arterials, exhibit crash rates that are *above* the statewide average rates. Notable exceptions are Compton Ave. south of I-64 and westbound I-64 between Jefferson Ave. and Compton Ave., where the calculated crash rate was below the statewide average.

Figure 43. Critical Crash Rates Compared to Statewide Average Critical Crash Rate



The second analysis relied on statewide *urbanized* average crash rates. Urbanized areas are defined as communities with populations greater than 50,000. **Table 16** shows the statewide urbanized rates used in the second analysis.

Table 16. Statewide Urbanized Crash Rates by Functional Class

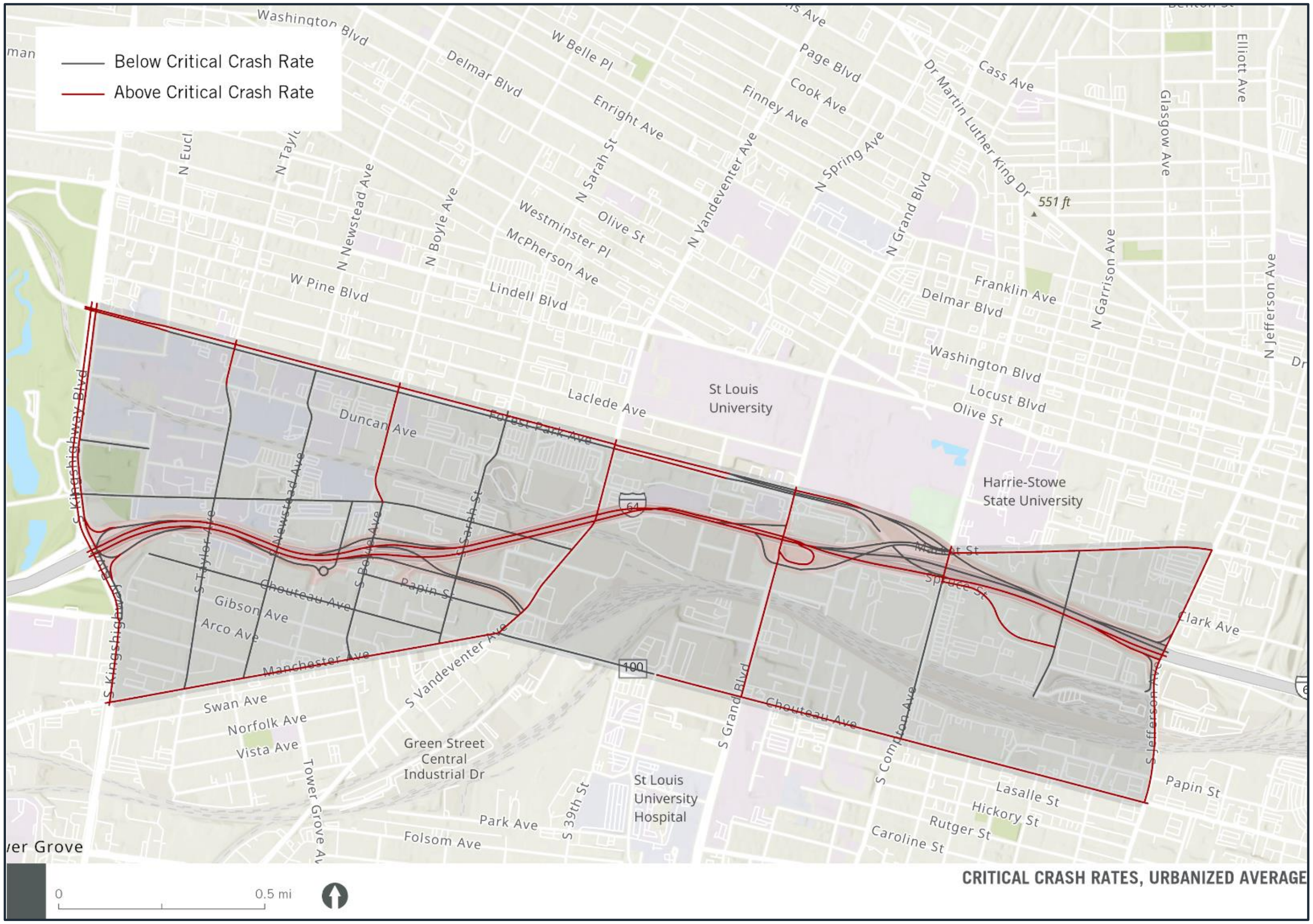
Functional Class	End Year	5-Year Rate	Area Designation
Freeway	2020	122.10	Urbanized
Interstate	2020	99.86	Urbanized
Local	2020	1067.66	Urbanized
Major Collector	2020	632.30	Urbanized
Minor Arterial	2020	545.71	Urbanized
Minor Collector	2020	1913.76	Urbanized
Principal Arterial	2020	292.50	Urbanized

Source: Missouri Department of Transportation (MoDOT).

When comparing the observed crash rates to the critical crash rates using the statewide urbanized rates, certain corridors stand out having higher than critical crash rates. The results of the urbanized crash rate analysis are shown in **Figure 44**. As can be seen, the majority of the I-64 segments remain *above* the statewide average when normalized to urban facilities. However, several local roadways west of Vandeventer Ave. drop below the statewide urbanized average, including Taylor Ave., Newstead Ave., Boyle Ave., Sarah St., and Clayton Ave. Additionally, a section of Chouteau Ave. east of Vandeventer Ave. to Spring Ave. was also found to be below urbanized statewide average for similar facility types.

A full list of segments with corresponding observed crash rates, statewide averages, and critical crash rates is included in Appendix E.

Figure 44. Critical Crash Rates Compared to Statewide Urbanized Area Crash Rate Averages



The third analysis relied on urbanized average crash rates specifically within the City of St. Louis given the population for the city is nearing 300,000. **Table 17** shows the St. Louis City rates as provided by MoDOT.

Table 17. St. Louis City Urbanized Crash Rates by Functional Class

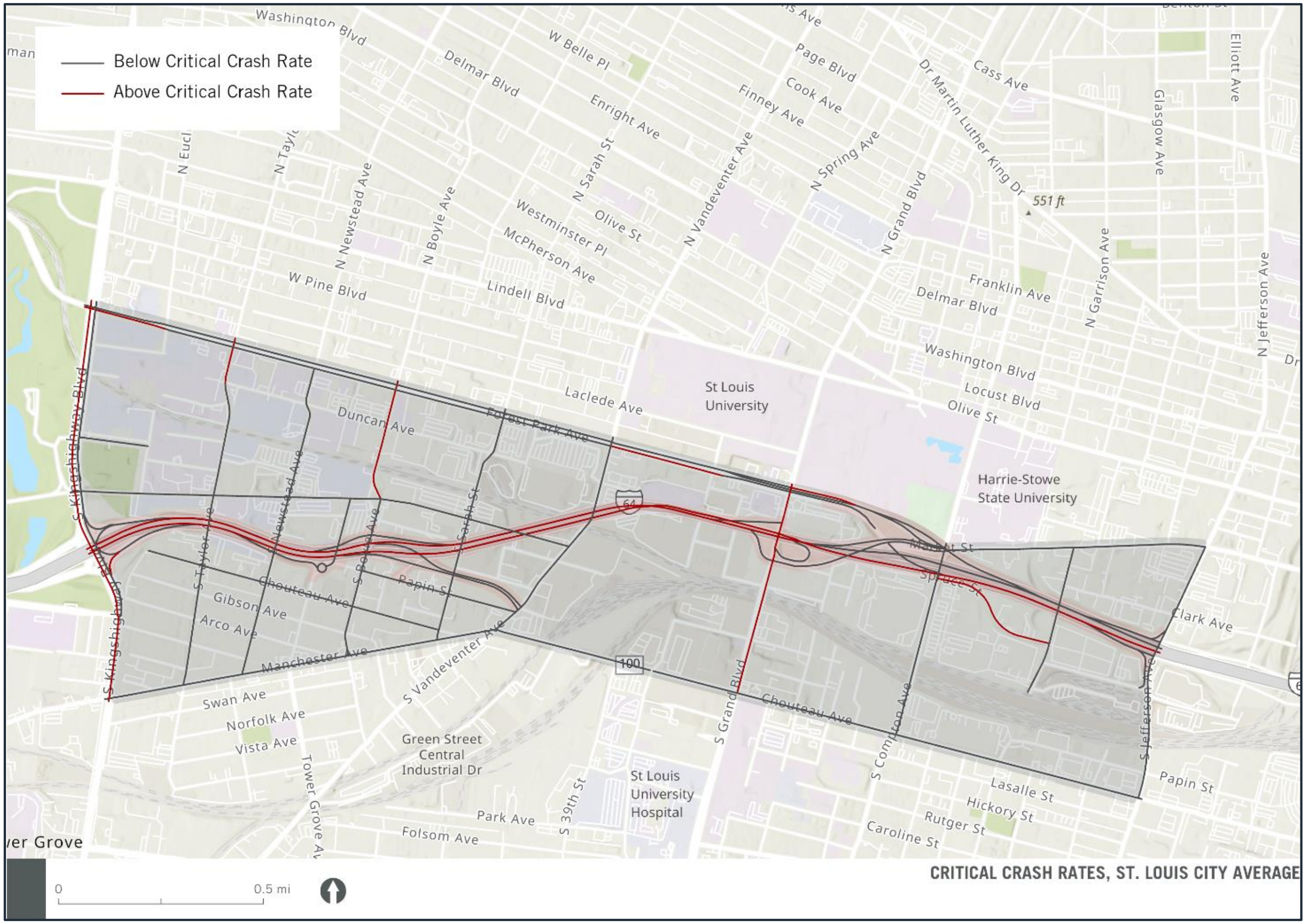
Functional Class	End Year	5-Year Rate	Area Designation
Freeway	2020	N/A	Urbanized (STL)
Interstate	2020	90.69	Urbanized (STL)
Local	2020	1112.25	Urbanized (STL)
Major Collector	2020	1367.43	Urbanized (STL)
Minor Arterial	2020	6114.85	Urbanized (STL)
Minor Collector	2020	10448.52	Urbanized (STL)
Principal Arterial	2020	619.64	Urbanized (STL)

Source: Missouri Department of Transportation (MoDOT).

When comparing the observed crash rates to the critical crash rates using the rates specific to the City of St. Louis, several of the collector and arterial segments fall below the critical crash rate, most notably along Manchester Ave./Chouteau Ave. and Forest Park Ave. The results of the urbanized crash rate analysis are shown in **Figure 45**. As can be seen, the majority of the I-64 segments remain *above* the statewide average when normalized to facilities located within the City of St. Louis.

A full list of segments with corresponding observed crash rates, statewide averages, and critical crash rates is included in Appendix E.

Figure 45. Critical Crash Rates Compared to City of St. Louis Crash Rate Averages



3.5. SAFETY CONCERNS RELATING TO INTERCHANGE SPACING

The minimum spacing for urban interchanges specified in the American Association of State Highway Officials (AASHTO) Interstate Access Guide is one mile for service interchanges, which aligns with FHWA guidance. MoDOT's access management guidelines and EPG Section 940.2 recommend interchange spacing that ranges between two to three miles. However, as previously mentioned, interchange spacing decisions are to be supported by an operational and level of traffic service analysis. Spacing less than two miles in urban areas may be considered when analysis indicates the lesser spacing is acceptable. However, all other options should be considered before spacing is reduced.

Research included in National Cooperative Highway Research Program (NCHRP) 687 notes a direct correlation between safety and ramp access points, presence of auxiliary lanes, entering and exiting volumes, and average daily volumes on the interstate. These planning-level tools approximately quantify percentage increases and decreases of total crashes, injury/fatal crashes, and single/multiple vehicle crash distributions as compared to a baseline configuration.

For a segment including an entrance ramp followed by an exit ramp, the baseline distance between painted gore points is 1,600 feet according to NCHRP 687. Sections within the I-64 corridor that are less than this baseline include eastbound I-64 between the entrance-ramp from Kingshighway Blvd. and the exit ramp to Tower Grove Ave./Boyle Ave., and westbound I-64 between the entrance-ramp from Jefferson Ave. and the exit ramp to Forest Park Ave.

For a segment including an entrance ramp followed by an entrance ramp, the baseline distance between painted gore points is 1,400 feet according to NCHRP 687. Two sections within the I-64 corridor that are near or below the 1,400-foot threshold include westbound I-64 between the 22nd St. entrance ramp and the Jefferson Ave. entrance ramp, as well as between the Vandeventer Ave. entrance ramp and the Boyle Ave. entrance ramp.

It is important to note the sample corridors used in the NCHRP 687 report were comprised of typical diamond interchanges, with limitations on specific ramp geometrics as well, meaning the dense urban interchange configurations within the I-64 corridor may not be directly applicable to the findings of NCHRP 687 and any inferences should be considered as guidance rather than unequivocable conclusions. Furthermore, in comparison to AASHTO and MoDOT EPG guidelines, the NCHRP 687 baseline distances fall well short of applicable federal and state standards.

Interchange spacing has recently been affected within the study area with the removal of the Ewing Ave. on-ramp to eastbound I-64 in 2020, and the westbound I-64 off-ramp to 3000 Market St. in 2021. Crashes through 2020 were reviewed specific to these locations, with no crashes found on the ramps themselves. Given the relatively low volume of traffic previously using these minor ramps, it is expected their impact is insignificant in the existing conditions analysis.

Lastly, guide and wayfinding signage is critical to convey direction to a motorist traveling along I-64. Without it, a motorist can become confused, thereby leading to safety concerns. Per the FHWA's Manual on Uniform Traffic Devices (MUTCD), the preference is to have standard advance signing at 2-

mile, 1-mile, ½-mile, then at the exit itself. However, the MUTCD recognizes that these standard spacing may not be achievable in urban areas and an interchange sequence sign and the exit sign may be all that is feasible. While guidance and wayfinding signage evaluations were not specifically included at the PEL study level of analysis, a preliminary review of the signage within the I-64 corridor indicates that the current signing meets the minimum requirements but would benefit from some clarification and consistency.

3.6. SAFETY CONCLUSIONS

The following summarizes the overall conclusions relative to safety of the existing transportation network in the study area:

1. Following national trends, the study area experienced a significant decrease in overall crashes in 2020 as compared to 2016-2019, but concurrently saw an increase in severe injury and fatal crashes, as noted below:
    - 2016 – 13 serious injury and fatal crashes.
    - 2017 – 10 serious injury and fatal crashes.
    - 2018 – 17 serious injury and fatal crashes.
    - 2019 – 11 serious injury and fatal crashes.
    - 2020 – 20 serious injury and fatal crashes.
2. A wide variety of crash types were noted within both tiers of the study area, with Rear End, Passing, and Out of Control being the predominant types throughout the study limits.
3. Clusters of severe crashes were located on I-64 between the Vandeventer Ave. and Grand Blvd., with the majority of those crashes occurring in the eastbound direction. On the collector/arterial roadway network, high severity clusters were noted along Grand Blvd. near Chouteau Ave., and on Chouteau Ave. between South 39th St. and Compton Ave.
4. An average of 24 bicycle or pedestrian crashes per year were reported within the analyzed timeframe, with nearly 90% of those crashes resulting in at least a minor injury. It is noted many non-injury bicycle/pedestrian crashes are not reported and are therefore not incorporated in the considered data.
5. When comparing crash rates along all segments in the study area to statewide averages for matching facility types, the majority of the roadway network (both Tiers 1 and 2) was found to be above the statewide threshold. Critical crash rates for urbanized areas and St. Louis City were also compared separately to observed rates, resulting in much of the collector/arterial part of the network falling below the more localized thresholds. Of note, most of the I-64 segments remain above the critical crash rates, even when compared to St. Louis City specific facilities.
6. Interchange spacing along I-64 between Kingshighway Blvd., and Jefferson Ave. generally does not meet national or state standard guidelines, posing challenges in terms of traffic operations and signage. Unique ramp configurations, substandard stopping sight distance, and other

substandard roadway geometries also contribute to frequent crash locations found within the study area.

4. EXISTING MULTIMODAL MOBILITY

This section presents a snapshot of the active transportation modes within the study area. It includes an overview of bicycle, pedestrian, and transit activity in the study area; an overview of relevant plans, studies, and proposed improvements that support active transportation; an analysis of the quality of existing pedestrian and bicycle facilities; and an analysis of existing network connectivity for active transportation modes. The findings included in this section of the report will be used to guide the development of conceptual alternatives and recommendations for enhancing walking, bicycling and transit ridership within the study area, while providing the baseline of current facility and network conditions against which to measure alternative scenarios.

4.1. BICYCLE AND PEDESTRIAN ACTIVITY

Bicycling and walking are important modes of transportation for many people that live, work, learn, and play within the study area. Characteristics of active travel trips for mode share, trip distance, trip duration, and trip purpose were calculated using travel data from ReplicaHQ's Places dataset, a high-fidelity activity-based travel model that simulates the movements of residents, visitors, and commercial vehicles in a given area. The Places Fall 2019 data was selected for the examination of trips within the study area for two reasons. First, it was the most recent dataset available. Second, it represented pre-COVID-19 pandemic conditions, and while the pandemic likely altered travel patterns (fewer overall trips, more people working from home, an increase in active mode trips, etc.), it is expected that these trends will continue to return closer to pre-pandemic conditions in the coming years.

Approximately 16,546 mid-week daily walking and bicycling trips occurred in the study area. These active travel trips constitute 3.73% of the 443,904 total trips that originate in, end in, or pass through the study area.

However, walking trips made up 53% of all trips that begin and end in the study area, while private auto trips made up just 32% of all trips. Bicycle trips represent less than 0.5% of all trips originating and ending in the study area. Despite the relatively short distances between destinations with the study area, the lack of supporting infrastructure for bicycle travel, such as a low-stress bicycle facility network and a public bikeshare system, appear to limit bicycling as a viable mode for short trips.

4.1.1. Trip Distance and Duration

Walking and bicycling trips originating and/or ending in the study area are shorter in distance and duration than nearly all other modes of transportation. Average trip duration and trip distance by mode are shown in **Figure 46** and **Figure 47,** respectively. The average trip distance and duration for trips of *all modes* is approximately 22 miles and 30 minutes. Walking and bicycling trips, in comparison, are shorter by both measures, with the average walking trip less than 0.5 mile in length and just over 7 minutes in duration, and the average bicycling trip roughly 4 miles in length and 22 minutes in duration.

Figure 46. Average Trip Distance by Mode of Transportation

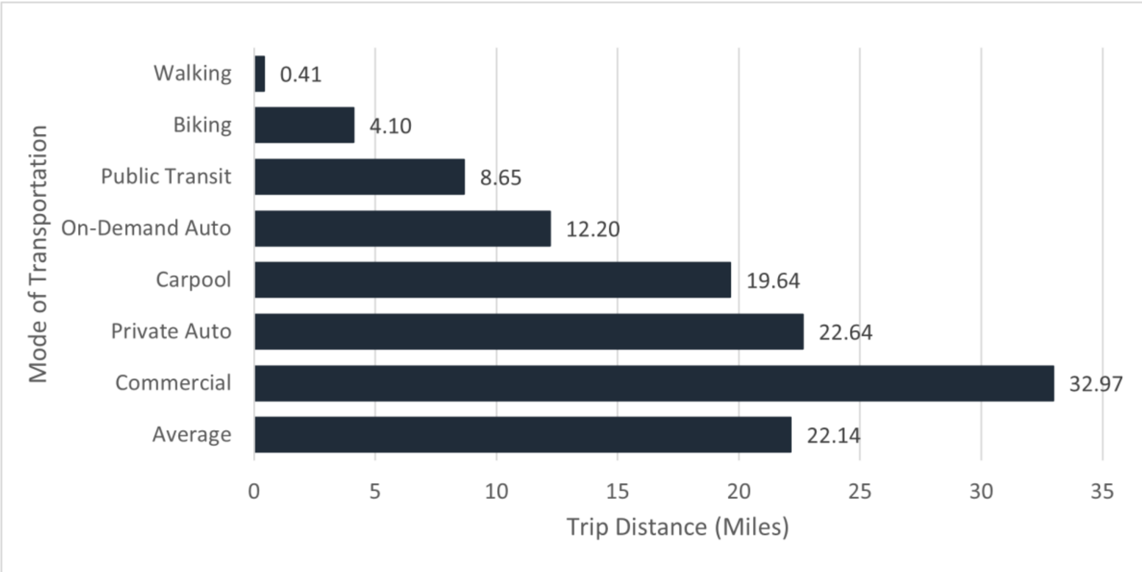
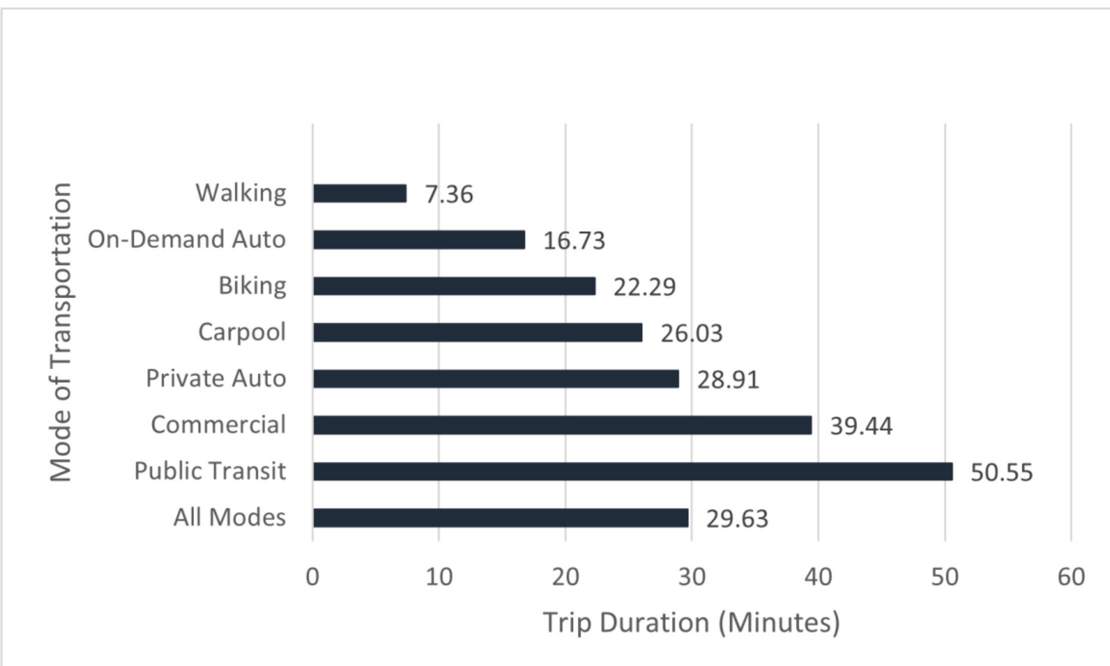


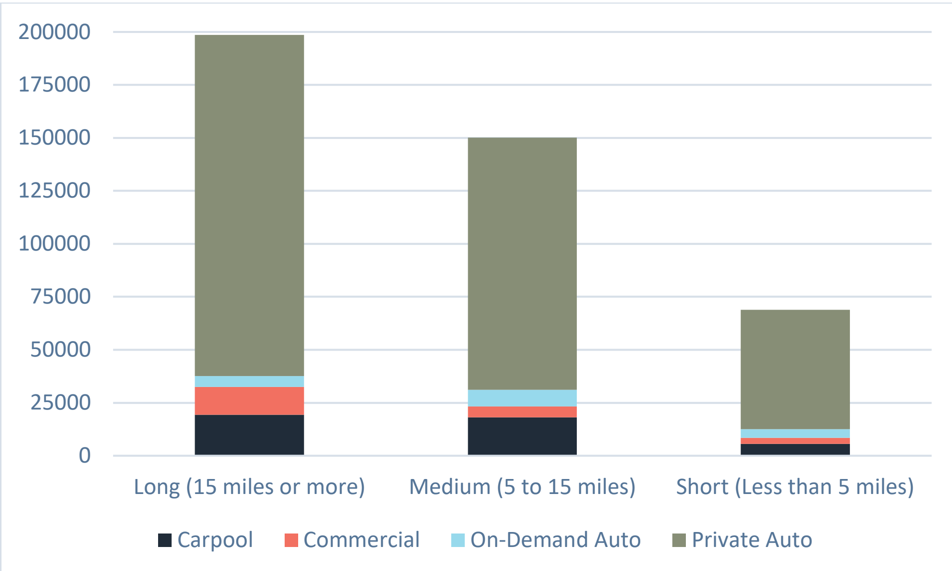
Figure 47. Average Trip Duration by Mode of Transportation



While the combined average trip distance for passenger (private auto, on-demand auto, and carpool) and commercial trips is 22.43 miles, there are thousands of short-distance trips (less than five miles) that convey the potential for modal shift to active travel modes like walking and bicycling. As shown in

Figure 48, nearly 69,000 passenger vehicle and commercial trips are less than five miles, representing 17% of trips by these modes.

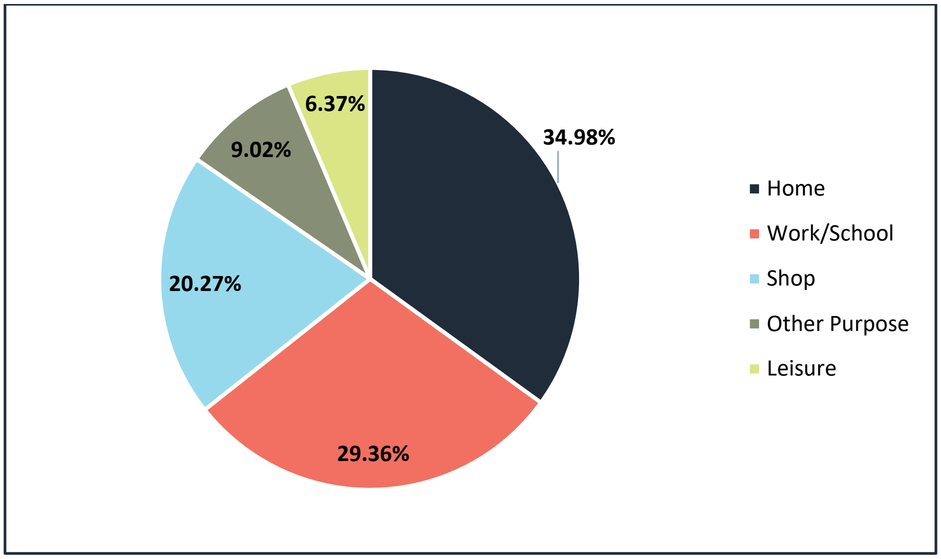
Figure 48. Passenger Motor Vehicle and Commercial Trips by Distance



4.1.2. Trip Purpose

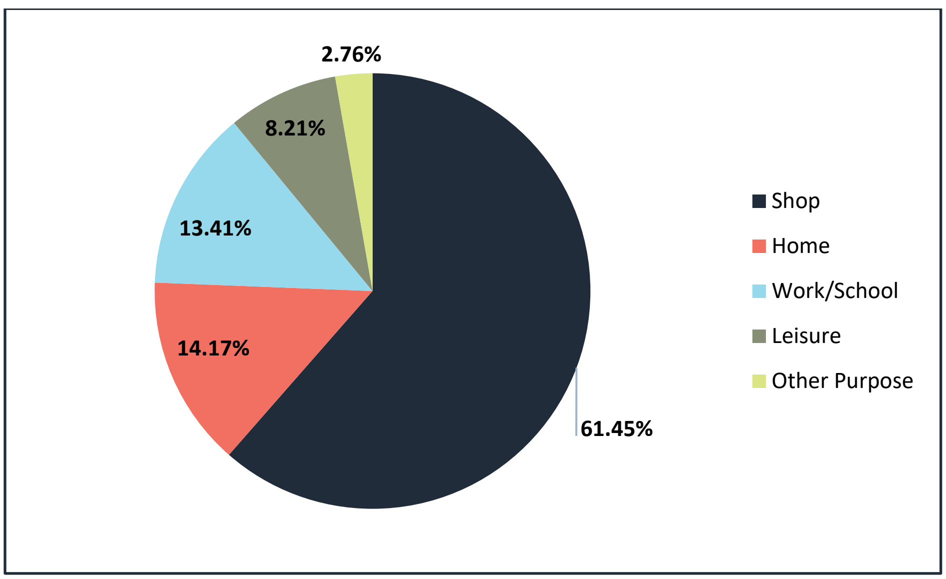
People travel to, from, and through the study area for a variety of purposes and destinations—commuter trips to and from work or school, daily errands, and shopping, eating out at local restaurants, or leisure trips to Forest Park or other recreational destinations in and around the study area. As shown in **Figure 49**, one in every three trips in the study area represents people traveling home. 29% of trips are to work or school; 20% are shopping trips (errands, eating out, and retail shopping).

Figure 49. Percentage of Trips by Travel Purpose



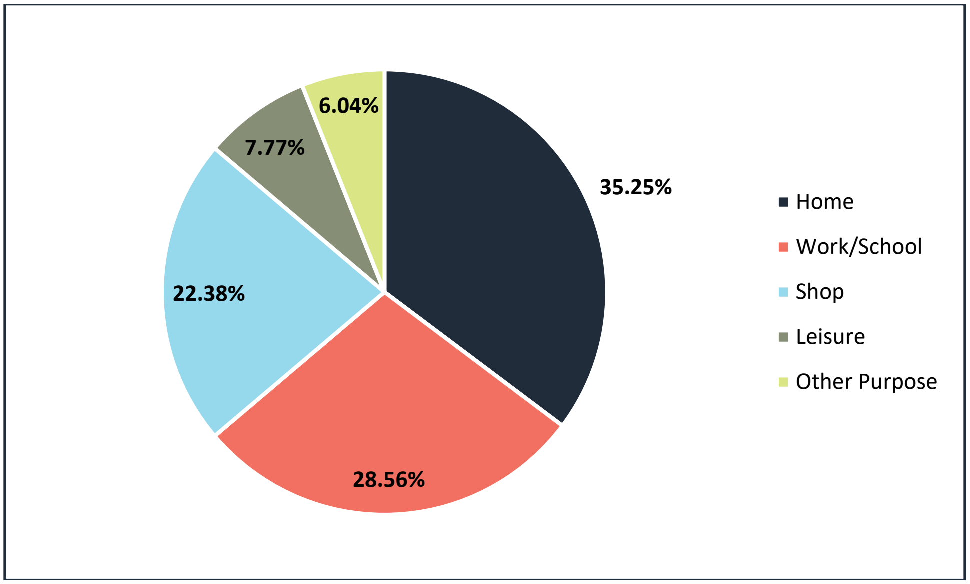
There are noticeable differences for walk and bicycle trips compared to trips by all modes and when compared to one another. **Figure 50** displays the travel purpose as a percentage of all walk trips. In this scenario, trips to work and school account for just 13% of all walk trips while over 60% of walk trips are to retail, restaurants, and other shopping destinations. For many people that work or live in the study area, walking presents the most efficient travel option for short trips to nearby retail and restaurants.

Figure 50. Percentage of Walk Trips by Travel Purpose



Travel purpose for bicycle trips (displayed in **Figure 51**) more closely mirrors travel purpose for all trips. At 35%, home trips comprise the largest share of bicycle trips, followed by work/school trips (29%) and shopping trips (22%).

Figure 51. Percentage of Bicycle Trips by Travel Purpose



4.2. RELEVANT BICYCLE/PEDESTIAN PLANS AND STUDIES

4.2.1. Gateway Bike Plan

Completed in 2011, the City of St. Louis Gateway Bike Plan is the first regional on-street bicycle facility plan for the City of St. Louis, St. Louis County, and St. Charles County. The planning process was led by Great Rivers Greenway with support from state, county, and local agencies. The Gateway Bike Plan envisions a network of over 1,000 miles of bikeways throughout the region, with supporting programs, policies, and events to achieve its mission of increasing bicycle activity and decreasing bicycle-related crashes. Great Rivers Greenway, in coordination with East West Gateway's Bicycle and Pedestrian Advisory Committee and Gateway Bike Plan Working Group, supported and monitored the plan's implementation for nearly ten years, developing an annual report card to track key metrics like miles of facilities constructed each year. In the ten years since the plan's adoption by the Great Rivers Greenway Board of Directors and by multiple county and local agencies, the on-street bicycle network has more than doubled, and at last count in mid-2019 stood at 280 miles of on-street bikeways, more than a quarter of the recommended Gateway Bike Plan Network. **Figure 52** illustrates existing bikeways and Gateway Bike Plan network recommendations within the study area.

In 2021, Great Rivers Greenway and its community partners updated the 2011 Gateway Bike Plan network for the City of St. Louis. This update focused on reevaluating the existing and recommended network and updating recommendations for the type of facility, to achieve a low-stress network supporting people of all ages and abilities. Using contextual guidance from the FHWA's *Bikeway*

Selection Guide (2019) and the North American City Transportation Official's *Urban Bikeway Design Guide, 2nd Edition* (2014), the Gateway Bike Plan Update's facility recommendations take into account both traffic and geometric conditions of the transportation system, including average daily traffic, number of travel lanes, posted speed limit, presence of parking, and other relevant roadway characteristics. The facility types proposed for the future network are shown in **Figure 53.**

The Gateway Bike Plan Update was completed in August 2021 and submitted to the City of St. Louis. While the City of St. Louis has not formally adopted the plan, City of St. Louis staff use the document for facility design guidance.

Figure 52. 2011 Gateway Bike Plan Network Recommendations (in the Study Area)

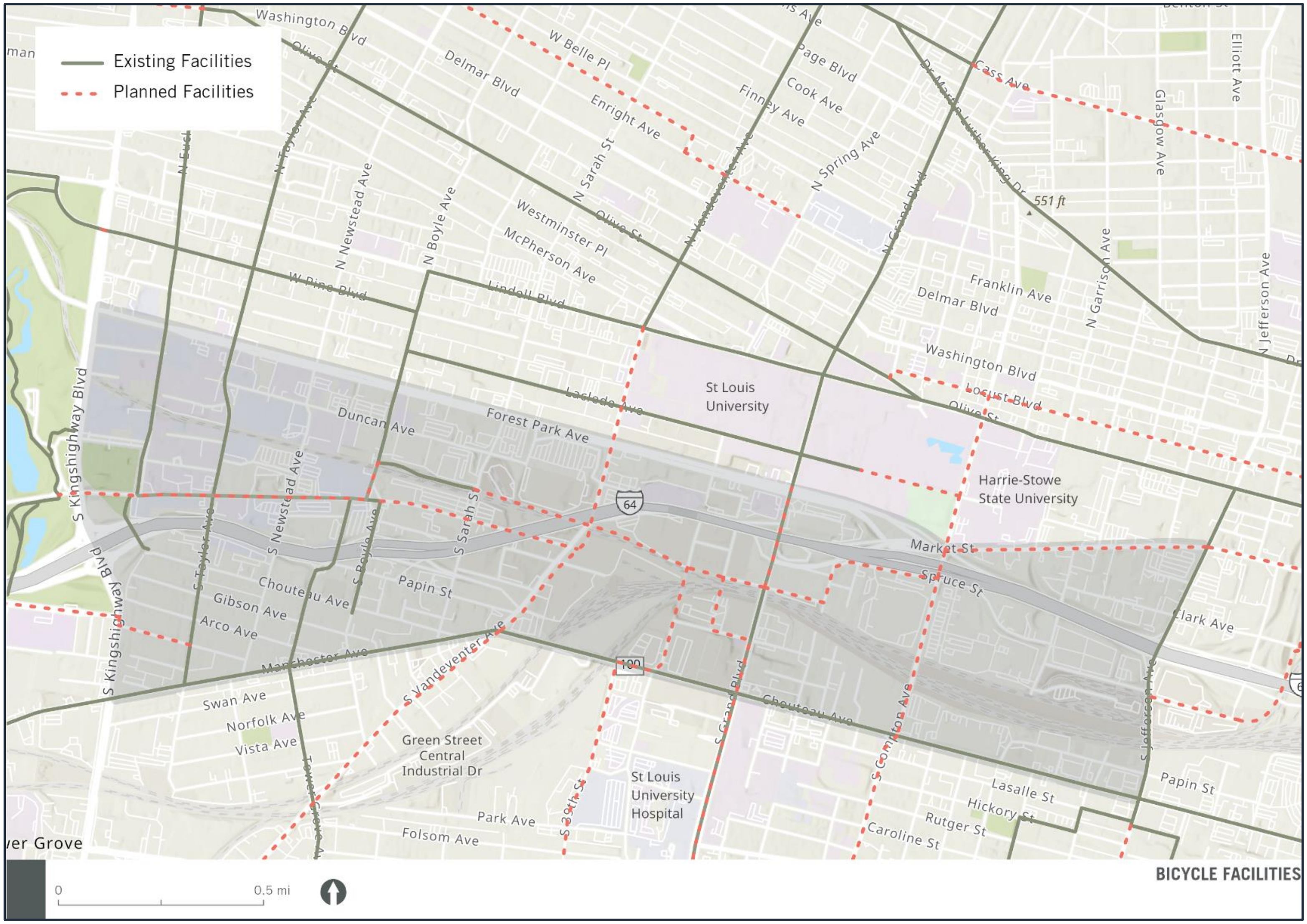
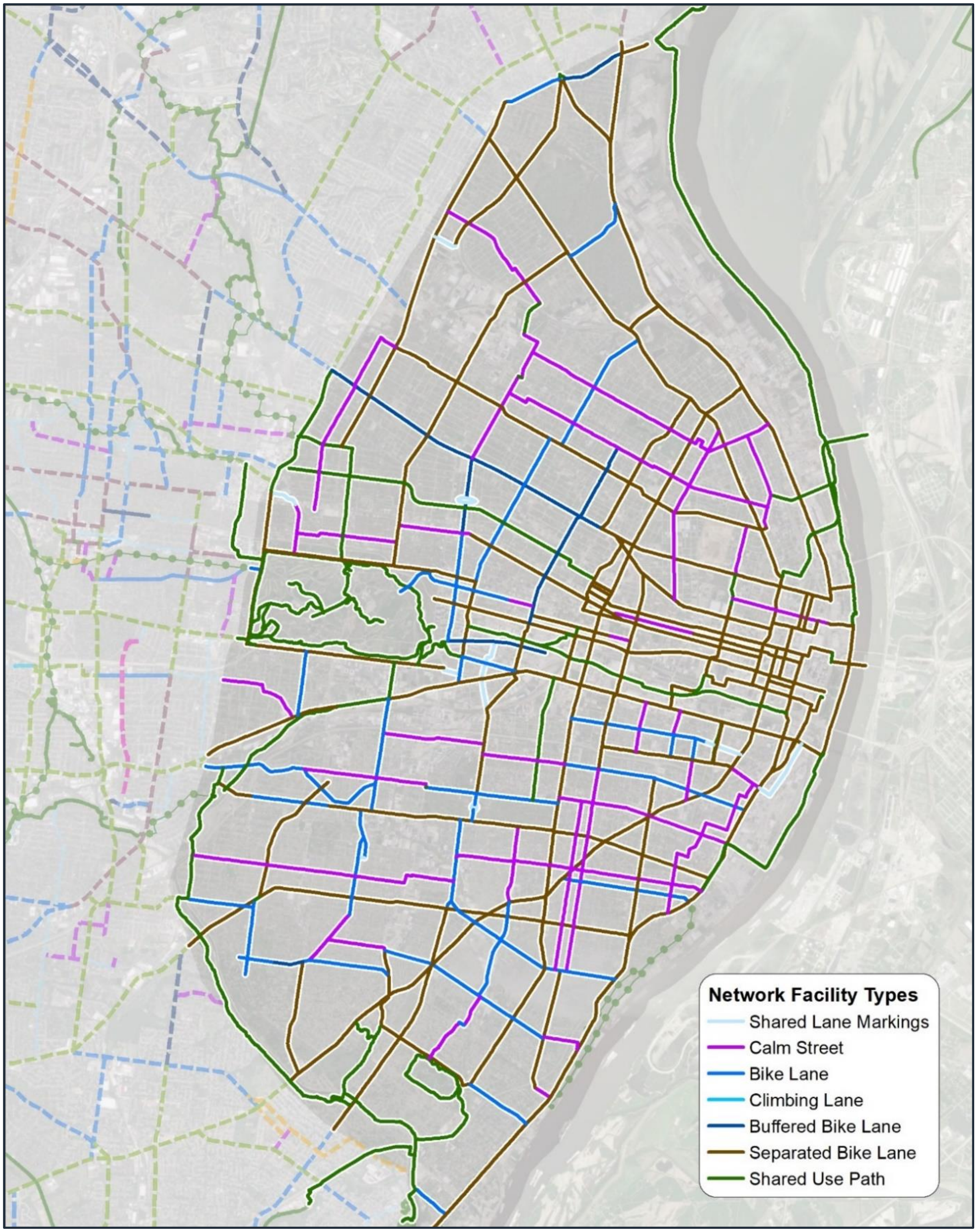


Figure 53. 2021 Gateway Bike Plan Update Recommended Facility Types



Source: City of St. Louis 2021 Gateway Bike Plan Update.

4.2.2. Brickline Greenway

The Brickline Greenway (shown in **Figure 54)** has evolved significantly from a conceptual linear greenway, once called the Chouteau Greenway, linking Forest Park to Downtown St. Louis and the riverfront, to a more expansive system of greenways and separated bikeways in the Central Corridor of St. Louis City and neighborhoods to the north and south. Following an international design competition, Great Rivers Greenway developed a framework plan identifying 20 miles of greenway corridors connecting Forest Park, Fairground Park, Tower Grove Park, Gateway Arch National Park, and hundreds of destinations in between.

Three segments of the Brickline Greenway are currently active and in various stages of development. These include the Mill Creek Valley segment along Market St. from 20th St. to Compton Ave., the Fairground Park to Grand Metro segment along Grand Blvd. and Spring Ave., and the Central West End to Grand Metro segment that will parallel the MetroLink light rail line. All three of these active project segments are at least partially located within the study area and, when complete, would serve as significant low-stress corridors for active transportation.

Figure 54. Brickline Greenway Routes Map

Source: Great Rivers Greenway (https://greatriversgreenway.org/brickline/project-process/).

4.2.3. ULI Grand MetroLink Station Technical Assistance Report

In 2012, the Urban Land Institute St. Louis (ULI of St. Louis) published a report detailing potential opportunities for development around the Grand MetroLink light rail station that capitalize on unique site advantages and acknowledge the unique physical constraints of the site, including grade-separation from Grand Blvd. and physical barriers like the railroad to the south and I-64 to the north. Through field reconnaissance and interviews with the City of St. Louis, Citizens for Modern Transit, Metro St. Louis, Saint Louis University, and other key stakeholders in the area, ULI of St. Louis's Technical Assistance Panel (TAP) developed a series of short-term and long-term improvements to guide capital and private investment around the light rail station.

Short-term recommendations included pedestrian crossing enhancements, increased pedestrian access to adjacent businesses and land uses, and the development of dedicated bike lanes on Grand Blvd. to facilitate north-south bicycle travel and increase access to Saint Louis University's north and south campuses, Grand Center, Tower Grove Park, South Grand Business District, and other destinations along the corridor. The long-term, game-changing vision includes the realization of the Chouteau Greenway (now Brickline Greenway), the incorporation of high-speed rail, and innovative platform development that add street-level retail, hotels, and other businesses along the Grand Ave. Bridge.

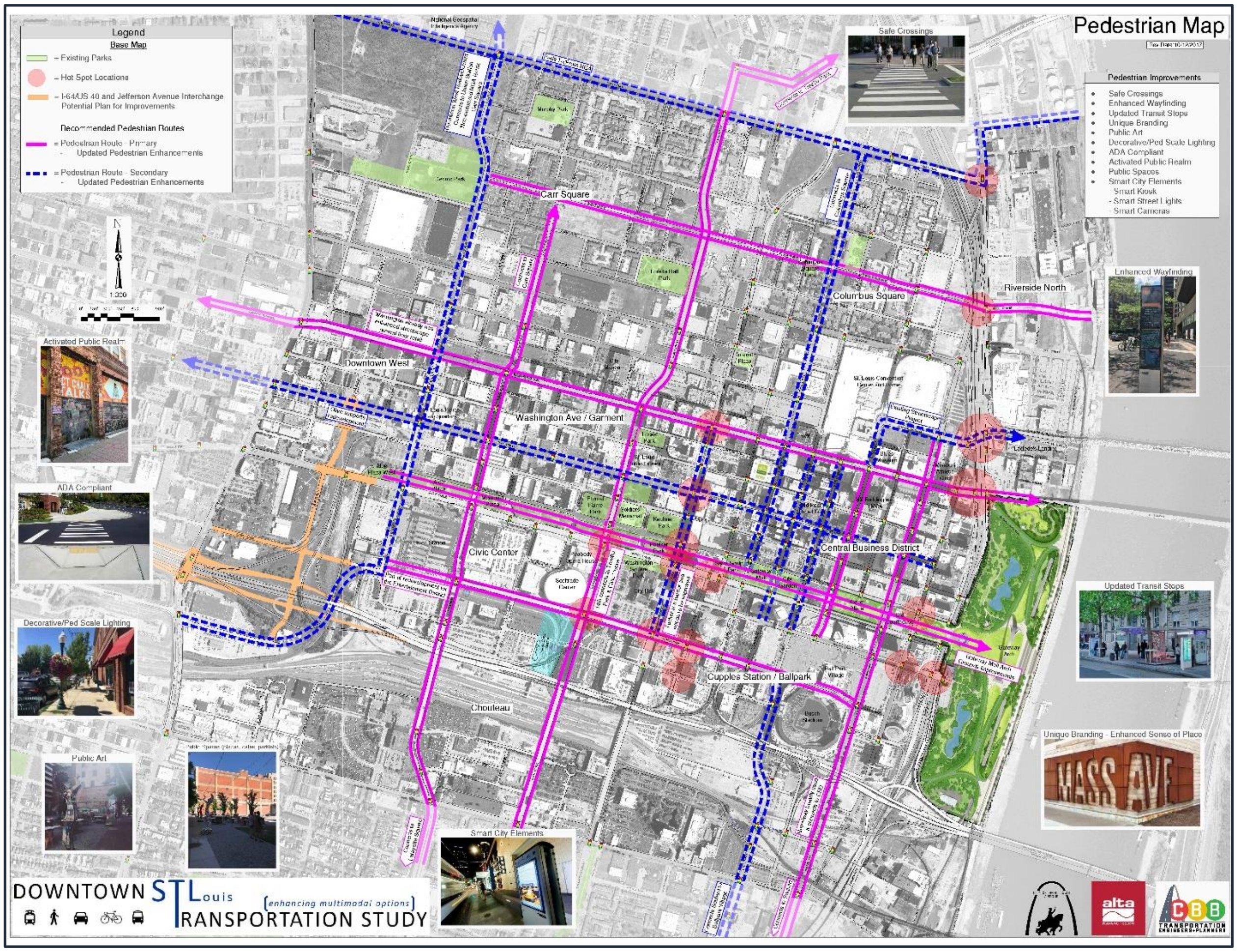
4.2.4. Downtown St. Louis Transportation Study

The Downtown St. Louis Transportation Study adopted by the City of St. Louis in 2018 envisions a future St. Louis that is well connected and provides reliable transportation options for all residents and visitors. The vision for this plan is to develop a robust multimodal system that enhances connections for pedestrians, bicyclists, transit users and motorists of all ages and abilities, while improving quality of life, supporting economic growth and community development, easing congestion, and bettering air quality and improving public health. The plan includes goals, objectives, strategies, and elements as actionable strategies to making this vision a reality.

Bicycle and pedestrian transportation are critical elements of downtown's envisioned multimodal system as outlined in this study. For pedestrian travel, the study identifies a grid of Primary and Secondary Pedestrian Routes to function much in the same way that arterial and collector roads do for motor vehicle traffic. These routes are shown in **Figure 55.** Future investments in these pedestrian routes (as defined by the Downtown St. Louis Transportation Study) include pedestrian-scale lighting, street furniture, wayfinding, and other elements that create comfortable and inviting public realm to support pedestrian activity.

There is only one recommended pedestrian route in this study that intersects the study area. This Secondary Pedestrian Route is located along Scott Ave. from Jefferson Ave. east past 22nd St., where it then continues to the north parallel to the MetroLink and connects to 20th St. at Clark Ave.

Figure 55. Downtown St. Louis Transportation Study Pedestrian Priority Routes Map

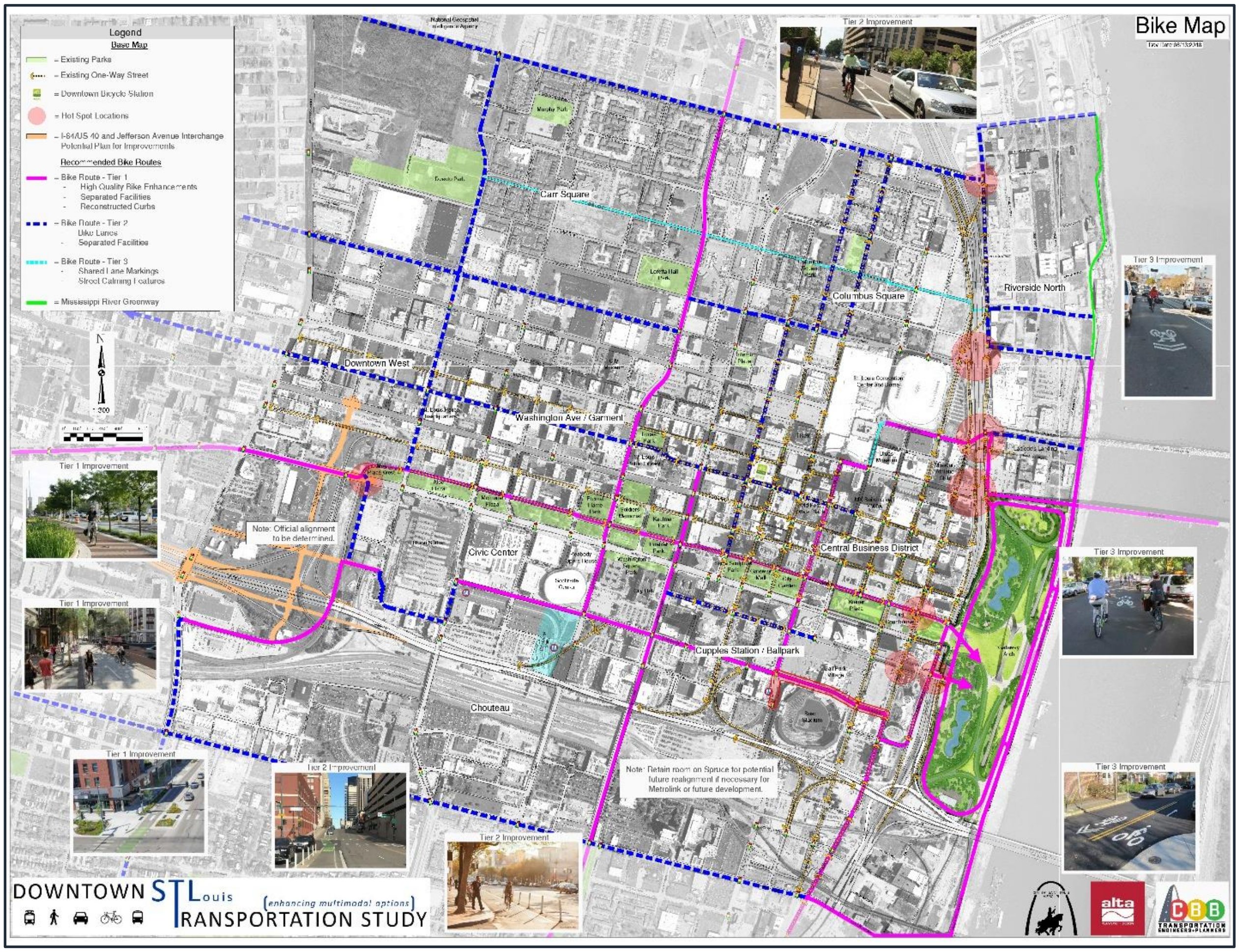


Source: Downtown St. Louis Transportation Study.

For bicycle travel, the study uses a three-tiered system of bicycle facility recommendations to create a low-stress bicycle network linking together destinations in downtown while also increasing access to and from adjacent neighborhoods. The proposed bicycle network is displayed in **Figure 56**.

Notable recommendations include separated bicycle lanes on Chouteau Ave., separated bike lanes on Jefferson Ave. from Chouteau Ave. north to Scott Ave., and a separated facility along Scott Ave. and north to 20th St. These improvements reflect the desire to shift bicycle traffic from Jefferson Ave. eastward to a future connection across I-64 as part of the Jefferson Ave./22nd St. interchange improvements, which was under design at the time the Downtown St. Louis Transportation Study was in progress and is currently under construction with an expected completion in 2022.

Figure 56. Downtown St. Louis Transportation Study Bicycle Network Map

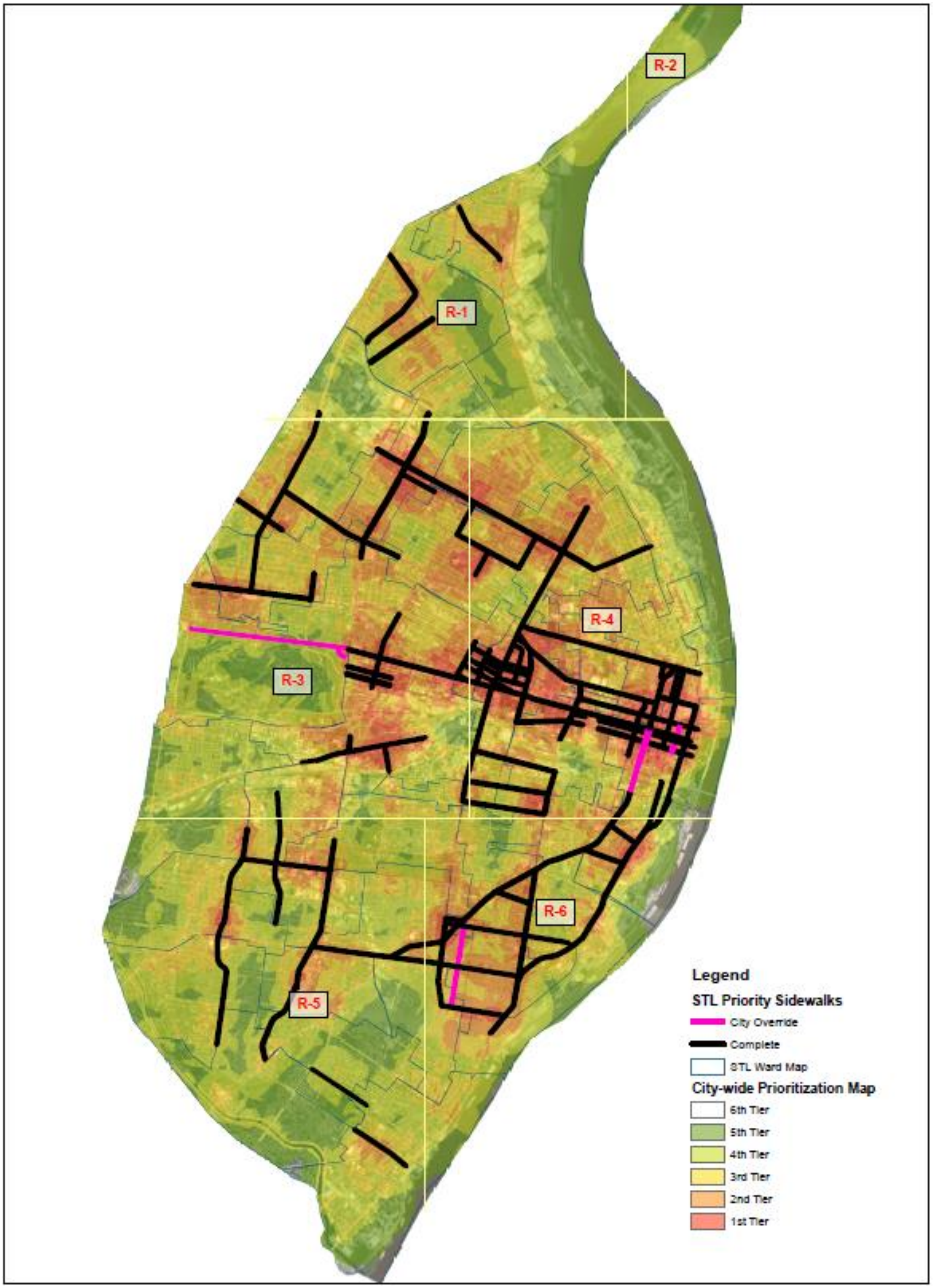


Source: Downtown St. Louis Transportation Study.

4.2.5. City of St. Louis Americans with Disabilities Act (ADA) Transition Plan (2020 DRAFT)

The City of St. Louis is in the process of finalizing its Americans with Disabilities Act (ADA) Transition Plan. The ADA Transition Plan identifies policies, procedures, conditions, and circumstances that present barriers to access the City's programs and facilities for people with disabilities and provides objectives and strategies to eliminate these barriers. As part of the self-evaluation component of the plan, the City evaluated conditions of City-maintained pedestrian facilities (sidewalk segments, curb ramps, and pedestrian traffic signals) to identify non-ADA-compliant facilities. All facilities not meeting applicable ADA standards were prioritized on physical condition and proximity to pedestrian traffic generators, then grouped into six tiers to help phase improvements over time. The results of the prioritization process and tiered grouping are shown in **Figure 57**. The Sidewalk Transition Plan (Chapter 7) details the methodology, data collection process, prioritization process, programming and funding considerations, and implementation monitoring recommendations.

Figure 57. City of St. Louis ADA Transition Plan Prioritization Map



4.2.6. Trailnet 2021 Crash Report

Trailnet, a regional non-profit whose mission is to lead in fostering healthy, active, and vibrant communities where walking, bicycling, and the use of public transit are a way of life, prepares an annual crash report that documents crash trends and increase community awareness of the impacts of traffic violence on people who live, work, and play in the St. Louis region. In early 2022, Trailnet released its 2021 crash report examining crashes during the 2021 calendar year (it is important to note that this crash data was not included in the crash reports provided by MoDOT for the years 2016 through 2020).

The corridor of Grand Blvd./Grand Ave. was, for the second year in a row, identified as the most dangerous road in the City of St. Louis for people walking and bicycling. Of all the bicycle crashes in the City of St. Louis, 5% occurred on Grand Blvd. between Forest Park Ave. and Lafayette Ave. just north of I-44. It should be noted that dedicated bicycle lanes are present for the entire length of this segment. Conversely, no bicycle crashes occurred on Grand Blvd. to the north or south of this segment. The report recommends several solutions to increase safety for road users, especially vulnerable road users like people walking and bicycling, including:

- Addressing pedestrian high-crash corridors.
- Reducing speed through traffic-calming street design and lower speed limits.
- Improving safety near bus stops.
- Adopting a comprehensive, needs-based approach to stop crashes.

4.3. PEDESTRIAN FACILITIES

While the pedestrian environment and travel experience is shaped to some degree by factors like adjacent land uses and proximity to destinations, as previously described, the presence, character, and quality of the pedestrian facilities like sidewalks, crosswalks, and shared-use paths (trails) significantly impact pedestrian travel. These facilities are the building blocks of the pedestrian network. This section of the report describes the existing pedestrian network, the existing Pedestrian Level of Service (PLOS) on streets within the study area, and the existing pedestrian network connectivity.

4.3.1. Pedestrian Facility Inventory

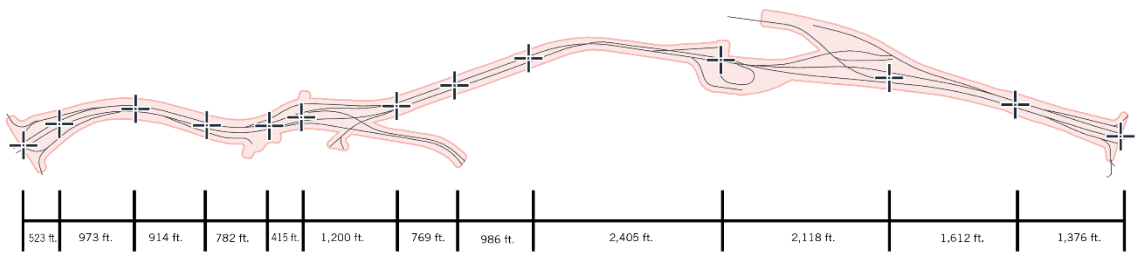
The pedestrian network in the study area is comprised of interconnected sidewalks, crosswalks, and shared-use paths. Sidewalks are the most prevalent pedestrian facility in the study area, with sidewalks present on at least one side, if not both, of most streets within the study area.

Data sources for the pedestrian facilities inventory vary significantly in terms of accuracy and completeness. The most notable gap in the sidewalk system is the section of Forest Park Ave. from Grand Blvd. to Compton Ave., which creates significant routing challenges given the limited connectivity in the surrounding area and the lack of access on private walkways through the Saint Louis University campus.

The impact of I-64 as a linear barrier to pedestrian (and bicycle) travel is evident in the presence and spacing of interstate crossings that support non-motorized transportation, as depicted in **Figure 58**.

There are 13 crossings that support pedestrian and bicycle activity, only one of which is a pedestrian- and bicycle-only bridge. The spacing of these crossings is denser west of Vandeventer Ave., where the street grid remains largely intact. The average spacing between crossings from Kingshighway Blvd. to Vandeventer Ave. is 820 feet. East of Vandeventer Ave. to Jefferson Ave., the average spacing between crossings is nearly 1,880 feet (0.36 mile). The longest distance between pedestrian and bicycle crossings is the 2,405-foot segment between Vandeventer Ave. and Grand Blvd. Additional crossing locations in the eastern half of the corridor can reduce circuitous pedestrian routing and increase the potential for active transportation trips to current destinations and future developments along the corridor.

Figure 58: I-64 Bicycle and Pedestrian Crossings



The presence of curb ramps and marked crosswalks varies widely throughout the study area. Curb ramps and crosswalks are present at all signalized and roundabout ramp terminals with I-64 interchanges, but their condition varies considerably. At some locations, such as the intersection of I-64 eastbound ramps and Vandeventer Ave., crosswalk markings have faded significantly. Data for the presence and quality of curb ramps and marked crosswalks was not available for this study, and the scope of work did not include a field inventory of these pedestrian elements. The City of St. Louis is in the process of developing an ADA Transition Plan to identify and address deficiencies in the pedestrian system, as well as other capital improvements to address mobility for people with disabilities.

There are two short segments of shared-use paths in the study area—the one-block segment of the Brickline Greenway parallel to the MetroLink between Boyle Ave. and Sarah St., and the bicycle/pedestrian bridge over I-64 between Kingshighway Blvd. and Euclid Ave.

Future redevelopment in the study area will likely have a positive impact on pedestrian facility quality and connectivity because as new sidewalks are installed, poor-quality sidewalks will be replaced, ADA facilities enhanced or added, and crosswalks enhanced. The Brickline Greenway improvements will also contribute to the pedestrian network, increasing connectivity and providing a low-stress east-west pathway through the heart of the study area.

4.3.2. Pedestrian Level of Service (PLOS)

4.3.2.1. Methodology

PLOS provides an objective measure of the perceived pedestrian experience based on sidewalk and roadway geometry and motor vehicle travel speeds. The methodology used for this PEL study is based on the PLOS methodology documented in the HCM and simplified to acknowledge certain limitations to the data available within the study area and the planning nature of the study. It is consistent with the methodology for PLOS used by St. Louis County in its 2021 *St. Louis County Action Plan for Walking and Biking*.

The underlying premise of the HCM's PLOS still drives the scoring in the simplified methodology: pedestrian comfort increases with fewer travel lanes, lower vehicle speeds, and greater separation from motor vehicle traffic. PLOS scoring for roadway segments ranges from PLOS 1 (most comfortable) to PLOS 5 (least comfortable), as shown in **Table 18.** These scores were assigned to each block/street segment within the study area, excluding interstate highways and ramps. PLOS scores were not calculated for intersections due to the lack of necessary data inputs.

Table 18. Roadway Segment Pedestrian Level of Service Scoring: Roadway Segments

Pedestrian Space Along Roadway	Speed Limit <= 25 mph		Speed Limit 30 - 35 mph		Speed Limit >= 40 mph	
	2 Lanes	> 2 Lanes	2 Lanes	> 2 Lanes	2 Lanes	> 2 Lanes
Complete sidewalk on both sides next to a buffer*	LOS 1	LOS 1	LOS 1	LOS 1	LOS 2	LOS 3
Complete sidewalk on both sides	LOS 1	LOS 1	LOS 2	LOS 3	LOS 3	LOS 4
Complete sidewalk on one side next to a buffer*	LOS 2	LOS 2	LOS 2	LOS 3	LOS 3	LOS 4
Complete sidewalk on one side	LOS 2	LOS 3	LOS 3	LOS 4	LOS 4	LOS 5
No sidewalk next to a buffer*	LOS 2	LOS 3	LOS 3	LOS 4	LOS 5	LOS 5
No dedicated space for walking	LOS 2	LOS 3	LOS 4	LOS 5	LOS 5	LOS 5

*A buffer typically consists of on-street parking, tree lawns, or bicycle lanes.

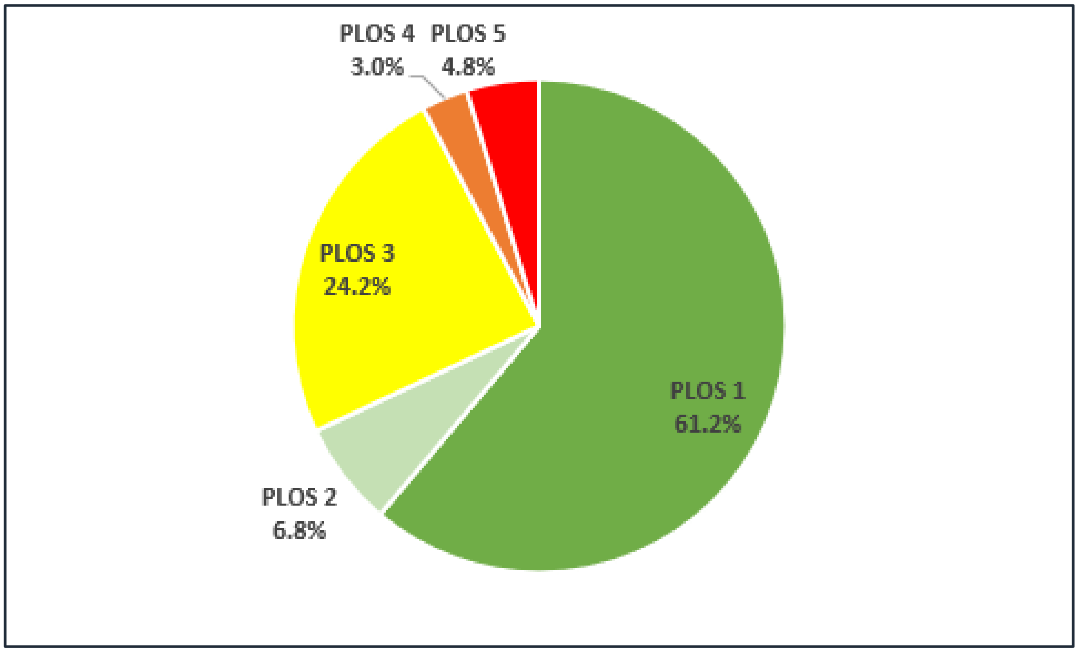
Source: St. Louis County Action Plan for Walking and Biking, Appendix 1: Technical Memoranda.

4.3.2.2. Findings

The results of the PLOS analysis indicate generally favorable conditions for people walking, primarily due to the widespread presence of sidewalks on roadways within the study area. **Figure 59** displays PLOS scores as a percentage of the roadway network. **Figure 60** depicts the PLOS scores for each roadway segment in the study area. Over two-thirds of all roads in the study area have a comfortable score of

PLOS 1 or 2. Most local and collector roads received a score of PLOS 1, as did some arterials, including Grand Blvd., Jefferson Ave., and sections of Forest Park Ave., Chouteau Ave., and Manchester Ave. PLOS scores on these arterials benefit from design characteristics that increase separation between motor vehicles and pedestrians, including tree lawns, on-street parking, dedicated bike lanes, and even vertical barriers. These scoring benefits, combined with data limitations, may overinflate PLOS scores on these arterial roads.

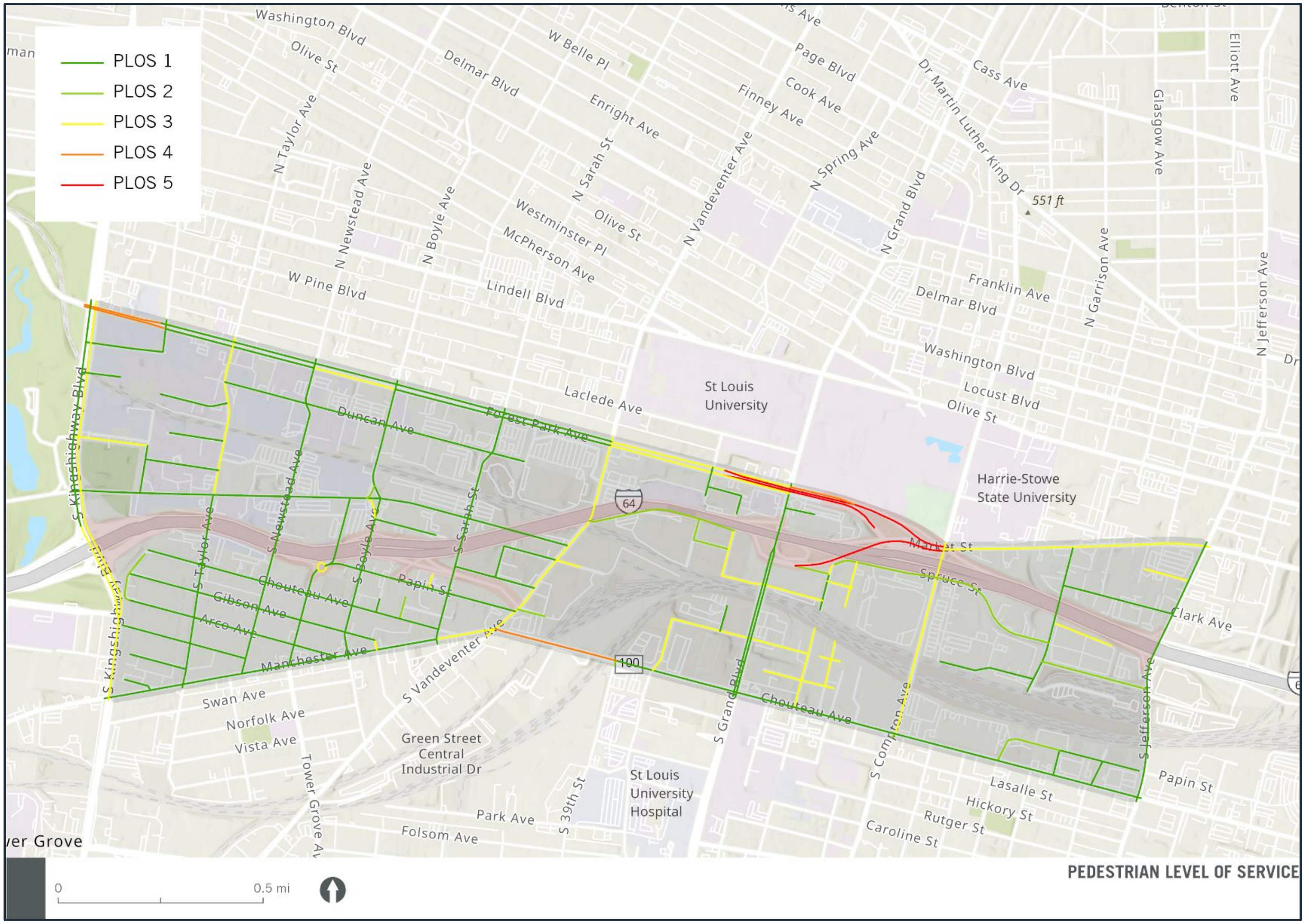
Figure 59. PLOS Scores as Percent of Study Area Roadway Network



Moderate PLOS scores of 3 are located on a number of arterial roadways, including Vandeventer Ave., Compton Ave., Market St., and Kingshighway Blvd. Higher stress conditions of PLOS scores of 4 and 5 represent less than 8% of the total roadway mileage in the study area and can be found on Forest Park Ave. between Spring and Compton Ave. and between Kingshighway and Euclid Ave., as well as Chouteau Ave. from Vandeventer Ave. to 39^{th} St.

It should be noted that the generally favorable pedestrian conditions described above do not align with the pedestrian experience on many roadways within the study area. This can be attributed to multiple factors, including the lack of readily available data necessary to assess intersections, crossing distances, sidewalk widths, buffer widths, and other geometric characteristics; the difference between posted speed limits and actual travel speeds on many arterial and collector roadways; and the model's omission of average daily traffic volumes as a criterion for scoring. Nonetheless, the results of the analysis provide a qualitative scale against which to measure the relative difference in pedestrian experience based on roadway type. As MoDOT and the City of St. Louis continue to invest in pedestrian improvements in the study area and elsewhere in St. Louis, the development of a more robust PLOS analysis methodology (and supporting data collection) to identify system gaps and deficiencies should be considered.

Figure 60. PLOS Scores in the Study Area



4.3.3. Pedestrian Network Connectivity

4.3.3.1. Background

Pedestrian connectivity is a measure of route directness and the ability of a person to walk to a destination with minimal out-of-direction travel. Certain characteristics of the transportation system, like block length and intersection density, are significant determinants of pedestrian connectivity. With shorter block lengths and more intersections, pedestrians have greater, more direct route choices and can travel greater distances within a five-minute trip duration.

4.3.3.2. Methodology

Utilizing the concept of Potential Mobility Index (PMI) as outlined in the established Karel Martens' *Accessibility and Potential Mobility as a Guide for Policy Action*[1], actual walking distances (walksheds) people are able to travel in a ten-minute walking trip are measured as a ratio of the as-the-crow-flies (by air) distance equivalent to a ten-minute walking trip (2,640 feet, or a half mile).[2] Connectivity ratios were calculated for points on a 500-foot grid overlaid upon the study area and displayed as a percent of land area that can be reached in a ten-minute walking trip from each point compared to the total land area within a quarter-mile of each point. The resulting ratios reflect the extent to which limited street connectivity and major barriers impact a person's ability to access nearby destinations within the study area. The connectivity ratios establish baseline conditions for pedestrian connectivity and can be used to identify opportunities for connectivity improvements and evaluate alternative scenarios.

4.3.3.3. Findings

The results of the pedestrian connectivity analysis are displayed in **Figure 61.** Connectivity scores vary widely throughout the study area, from a low of 0.06 to a high of 0.63, with lower scores indicating poor connectivity and higher scores indicating greater connectivity. The average (mean) pedestrian connectivity score is 0.41, which indicates that roughly 41% of the land area within walking distance can reached based on the characteristics of the pedestrian network. The most prominent cluster of high connectivity is in the Forest Park Southeast Neighborhood, where short block lengths and high intersection density increase pedestrians' ability to travel greater distances within a ten-minute trip duration. Other notable areas of high pedestrian connectivity are located along Clayton Ave. and Forest Park Ave. from Kingshighway Blvd. to Vandeventer Ave., and at major intersections including Grand Blvd. and Forest Park Ave., Compton Ave.. and Chouteau Ave., and Vandeventer Ave. and Manchester Ave. Low pedestrian connectivity areas are generally confined to the eastern portion of the study area bound by Vandeventer Ave., Chouteau Ave., Jefferson Ave., and I-64. Poor street connectivity, limited pedestrian accessways, and linear barriers like the railroad tracks restrict pedestrian movement and

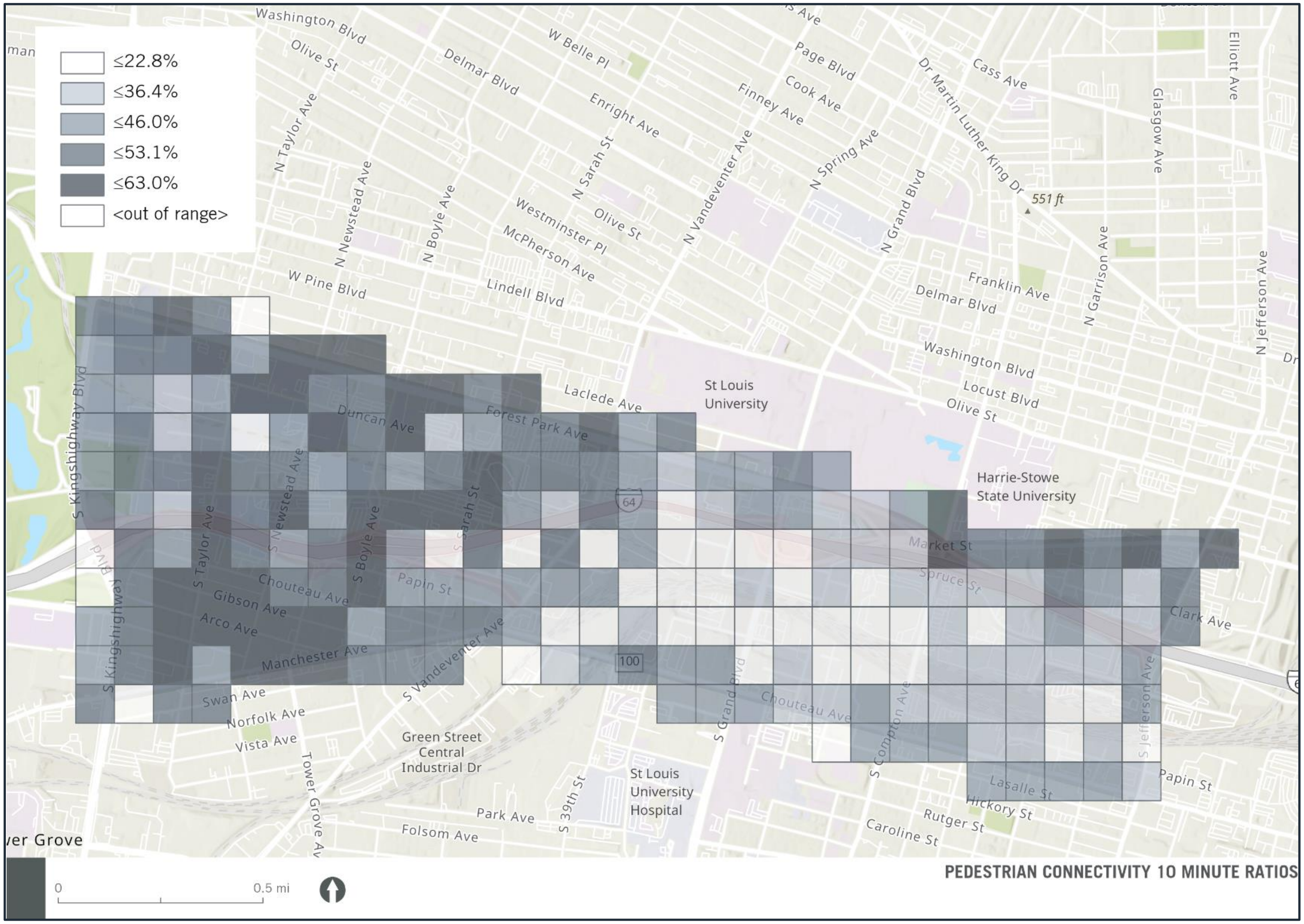
[1] Martens, K. (2015). Accessibility and potential mobility as a guide for policy action. Transportation research record, 2499(1), 18-24.

[2] Walking trip time based on findings in the *Transit Capacity and Quality of Service Manual, 3rd Edition* (2013) that between 50% and 95% of transit passengers walk no farther than 0.25 miles at an average of 3 miles per hour.

routing choices. Pedestrian traffic is generally channeled onto arterial roadways, increasing pedestrian trip distances, and decreasing pedestrian comfort.

As new private development and capital improvements reshape the study area, there is great potential to increase pedestrian connectivity. New projects like the Brickline Greenway will add new connections for pedestrians and bicyclists through low-connectivity areas and potentially add a new interstate crossing at Spring Ave. by the Foundry and the Armory. As the form and function of land uses in the study area transform over time, the transportation system must also adapt to better serve a variety of users and create a safer, more comfortable, and more connected environment for people of all ages and abilities.

Figure 61. Pedestrian Connectivity Analysis Results



4.4. BICYCLE FACILITIES

The bicycle network in the City of St. Louis has evolved significantly in the last two decades. The City's original Bike St. Louis Network has expanded from a short loop of signed routes emanating from downtown St. Louis to a handful of neighborhoods to the west and south, to a citywide system of signed and marked routes, bicycle Lanes, separated bike Lanes, and shared-use paths. This section of the report includes an inventory of existing bikeways within the study area, an analysis of level of traffic stress for people traveling by bicycle, and an examination of network connectivity in the bicycle system.

4.4.1. Bicycle Facility Inventory

There are approximately seven miles of existing on-street bikeways and shared-use paths in the study area, as shown in **Table 19**. The majority of these facilities (3.8 miles, 54%) have shared lane markings and directional wayfinding signs. These bikeways are typically located on local and collector streets, such as Taylor Ave., Clayton Ave., and Tower Grove Ave., but can also be found on Manchester Ave., a minor arterial. There are nearly three miles of standard and buffered bike Lanes in the study area, located on Manchester Ave., Chouteau Ave., Grand Blvd., and Jefferson Ave. The 0.4 mile of shared-use paths consist of two individual path—the short section of the Brickline Greenway between Boyle Ave. and Sarah St., and the bicycle and pedestrian bridge over I-64 connecting Chouteau Ave. to the intersection of Clayton Ave. and Euclid Ave.

Table 19. Existing Bicycle Facilities by Facility Type

Facility Type	Existing Miles	Percent of All Existing Facilities
Signed and Marked Shared Roadway	3.82	54%
Standard Bike Lane	1.19	17%
Buffered Bike Lane	1.69	24%
Shared-Use Path	0.40	5%
Total	7.10	100%

The existing network of bicycle facilities in the study area reflects the iterative process of facility and network development in the City of St. Louis. Early Bike St. Louis networks focused primarily on signed shared routes and were developed prior to the advancement of separated bikeway design. As opportunities arose through subsequent phases of Bike St. Louis expansion and improvements, as well as individual projects like the Chouteau Ave. resurfacing, facilities that provide a greater degree of separation from motor vehicle traffic and a higher level of bicyclist comfort have been installed. It should be noted that some construction associated with I-64 interchange improvements have impacted existing facilities. The Jefferson Ave. bike lanes, for example, have been removed as part of the Jefferson/22nd St. interchange project and will be replaced by a low-stress facility along Scott Ave. and 20th St., and shared lane markings on Boyle Ave. between Clayton Ave. and Papin St. have been removed as well.

4.4.2. Bicycle Level of Traffic Stress

4.4.2.1. Background

Bicycle Level of Traffic Stress (BLTS) provides an intuitive framework to categorize roadways based on the level of stress, or conversely level of comfort, for people bicycling. The analysis provides decision-makers, stakeholders, and the general public with a tool for understanding the suitability of individual street segments and paths for accommodating different types of people traveling by bicycle—from children and casual adult riders to daily commuters and experienced recreational cyclists. It can also be used to explore low-stress network connectivity, identify gaps in the low-stress network, and examine how changes to the system can provide low-stress connectivity and increase access to important community destinations.

4.4.2.2. Methodology

The BLTS methodology was adapted from the 2012 Mineta Transportation Institute (MTI) *Report 11-19: Low-Stress Bicycling and Network Connectivity* and the City of Boston's 2020 Level of Traffic Stress methodology, taking into account the limits and reliability of available data. The methodology uses geometric and traffic characteristics of a given roadway to assign a level of traffic stress ranging from 1 to 4, where 1 represents the lowest stress, and 4 represents the highest stress. These categories are described in **Table 20.**

Table 20. BLTS Categories

LTS	Target Bicycle User Type	Description
1	All Ages and Abilities	Presenting little traffic stress and demanding little attention from cyclists, and attractive enough for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a slow traffic stream with no more than one lane per direction or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where cyclists ride alongside a parking lane, they have ample operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross.
2	Interested but Concerned (Mainstream Adults)	Presenting little traffic stress and therefore suitable to most adult cyclists but demanding more attention than might be expected from children. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where a bike lane lies between a through lane and a right turn lane, it is configured to give cyclists unambiguous priority where cars cross the bike lane and to keep car speed in the right-turn lane comparable to bicycling speeds. Crossings are not difficult for most adults.

LTS	Target Bicycle User Type	Description
3	Enthused and Confident (Adult Commuters)	More traffic stress than LTS 2, yet markedly less than the stress of integrating with multilane traffic, and therefore welcome to many people currently riding bikes in American cities. Offering cyclists either an exclusive riding zone (lane) next to moderate-speed traffic or shared lane son streets that are not multilane and have moderately low speed. Crossings may be longer or across higher-speed roads than allowed by LTS 2 but are still considered acceptably safe to most adult pedestrians.
4	Strong and Fearless (Long-Distance Recreational Bicyclists)	A level of stress beyond LTS3, featuring streets and facilities on which few adults would feel is acceptable to bicycle.

Source: Mineta Transportation Institute (MTI) Report 11-19: Low-Stress Bicycling and Network Connectivity

Table 21 displays the scoring criteria applied to each street segment in the study area, not including I-64 and interstate ramps. The analysis incorporates motor vehicle volumes, posted speed limits, the presence of parking, and the presence of bike lanes as key determinants of level of traffic stress.

Table 21. Level of Traffic Stress Criteria

Vehicle Volumes[1]		Posted Speed 20	Posted Speed 25	Posted Speed 30+	All Ages & Abilities Treatments Separated Bike Lanes
<1,500	Bike Lane No Parking	LTS 1	LTS 1	LTS 2	LTS 1
	Bike Lane Parking	LTS 1	LTS 1	LTS 3	
	No Bike Lane	LTS 1	LTS 2	LTS 3	
1,500 – 3,000	Bike Lane No Parking	LTS 2	LTS 2	LTS 2	LTS 1
	Bike Lane Parking	LTS 2	LTS 2	LTS 3	
	No Bike Lane	LTS 2	LTS 2	LTS 3	
3,000 – 6,000	Bike Lane No Parking	LTS 2	LTS 2	LTS 2	LTS 1
	Bike Lane Parking	LTS 2	LTS 2	LTS 3	
	No Bike Lane	LTS 3	LTS 3	LTS 4	
> 6,000	Bike Lane No Parking	LTS 3	LTS 3	LTS 4	LTS 1
	Bike Lane Parking	LTS 3	LTS 3	LTS 4	
	No Bike Lane	LTS 3	LTS 4	LTS 4	

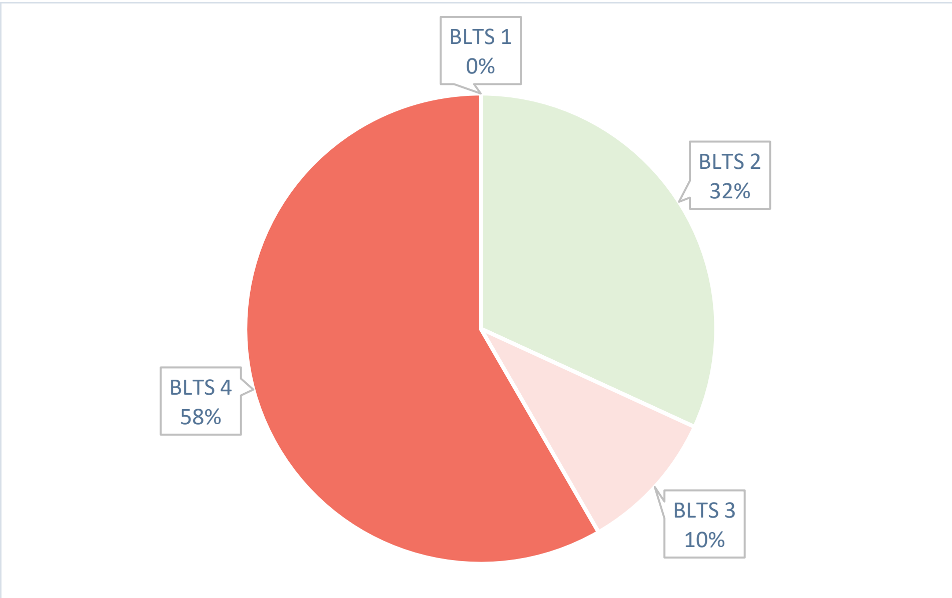
Notes:

1. Traffic volume data were only available on a limited set of the local roads in the overall network. Counts were available on major arterials and some collectors, and lower-volume local streets were unlikely to have recent count data. The analysis assumed that any roads classified as local roads carry 1,000 vehicles per day (vpd). This is sufficiently low to ensure BLTS scoring was not negatively impacted by traffic volumes on these roads.

4.4.2.3. Findings

The results of the BLTS analysis show the extent to which high-stress arterials and the lack of dedicated facilities at interstate crossings impact bicycle travel in the study area. **Figure 62** displays BLTS scores as a percentage of total street network mileage in the study area. BLTS scores for each segment of the roadway network are shown in **Figure 63.**

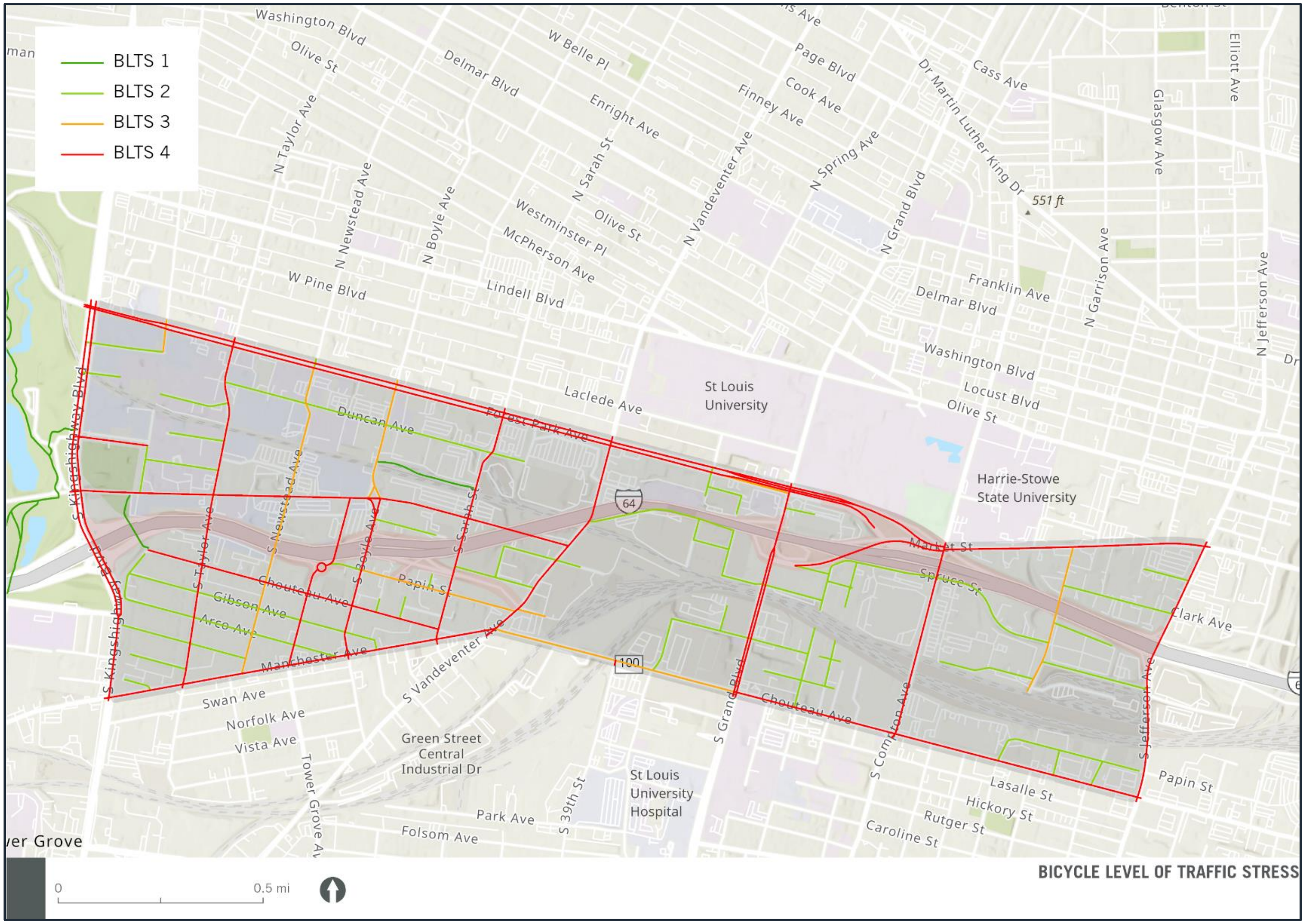
Figure 62. Bicycle Level of Traffic Stress Scores as a Percentage of the Street Network



The results of the bicycle level of traffic stress analysis highlight the poor conditions for bicycling within the study area. Even with the investments in wayfinding, dedicated bike lanes, and buffered bike lanes, there are no BLTS 1 on-street bikeways scores in the study area. In fact, none of the dedicated bikeways in the study area received a low-stress score of BLTS 1 or BLTS 2.

The 32% of streets in the study area that received a score of BLTS 2 consist primarily of low-speed, low-volume local streets. The lack of connectivity between BLTS 2 streets limits the potential for casual adult cyclists, children, seniors, and other people less comfortable bicycling with traffic to travel to destinations within the study area.

Figure 63. BLTS Scores for the Study Area



Sixty-eight percent of all streets in the study area are classified as high-stress and received a score of BLTS 3 (10%) or BLTS 4 (58%). As evident in Figure 63, most of the arterial and collector roads in the study area are designated as high-stress roads (13% BLTS 3, 83% BLTS 4). Not only do these arterials and collectors present challenges for people bicycling on these roadways, but they also create difficulties for people trying to cross these roadways, particularly at unsignalized crossings. In many cases, these high-stress arterials and collectors offer the only path of travel across major barriers like I-64 or the railroads to the south.

Table 22 displays centerline miles of roadways in the study area by BLTS score and functional classification. BLTS scores generally increase with functional classification, particularly in the absence of dedicated bicycle facilities.

Table 22. BLTS Scores by Functional Classification

Functional Classification (FC)	BLTS Score 1		BLTS Score 2		BLTS Score 3		BLTS Score 4		Total
	Miles	% of FC	Miles	% of FC	Miles	% of FC	Miles	% of FC	Miles
Local Road	0.00	0.0%	8.33	82.4%	0.48	4.7%	1.30	12.9%	10.10
Minor Collector	0.00	0.0%	0.60	27.3%	0.99	45.2%	0.60	27.4%	2.19
Major Collector	0.00	0.0%	0.12	3.2%	0.55	14.7%	3.06	82.1%	3.73
Minor Arterial	0.00	0.0%	0.02	0.7%	0.60	16.2%	3.08	83.1%	3.71
Principal Arterial	0.00	0.0%	0.00	0.0%	0.17	2.0%	8.56	98.0%	8.74
Totals	**0.00**	**0.0%**	**9.07**	**31.9%**	**2.79**	**9.8%**	**7.52**	**58.3%**	**28.46**

The build-out of the Gateway Bike Plan network can be expected to have a significant impact on BLTS scores in the study area, as many of the facility recommendations in the plan target arterial and collector roadways like Vandeventer Ave., Compton Ave., and Clayton Ave., and Sarah St.

4.4.3. Bicycle Network Connectivity

4.4.3.1. Background

Bicycle connectivity is a measure of route directness and the ability of a person bicycling to travel a destination with minimal out-of-direction travel. Certain characteristics of the transportation system, like block length and intersection density, are significant determinants of bicycle connectivity. With shorter block lengths and more intersections, people bicycling have multiple, more direct route choices and can travel greater distances within a ten-minute trip duration.

4.4.3.2. Methodology

Utilizing the concept of Potential Mobility Index (PMI) as outlined in the established Karel Martens' *Accessibility and Potential Mobility as a Guide for Policy Action*[3], the actual bicycling distances (bikesheds) that people are able to travel in a ten-minute bicycling trip are measured as a ratio of the Euclidean, as-the-crow-flies (by air) distance equivalent to a ten-minute bicycling trip (1.67 miles, assuming an average speed of 10 miles per hour). Connectivity ratios are calculated for points on a 500-foot grid overlaid upon the study area and displayed as a percent of land area that can be reached in a ten-minute bicycling trip from each point compared to the total land area within a 1.67-mile radius of each point. The resulting ratios reflect the extent to which limited street connectivity and major barriers impact a person's ability to access nearby destinations within the study area. The connectivity ratios establish baseline conditions for bicycle connectivity and can be used to identify opportunities for connectivity improvements and evaluate alternative scenarios.

4.4.3.3. Findings

The results of the bicycle connectivity analysis are displayed in **Figure 64**. Connectivity ratios vary widely across the study area, ranging from a low of just 0.30 to a high of 0.68, with lower scores representing poorer connectivity and higher scores representing greater connectivity. The average (mean) connectivity ratio for all cells within the study area is 0.59, which indicates that roughly 59% of the land area within biking distance can reached based on the characteristics of the bicycle network.

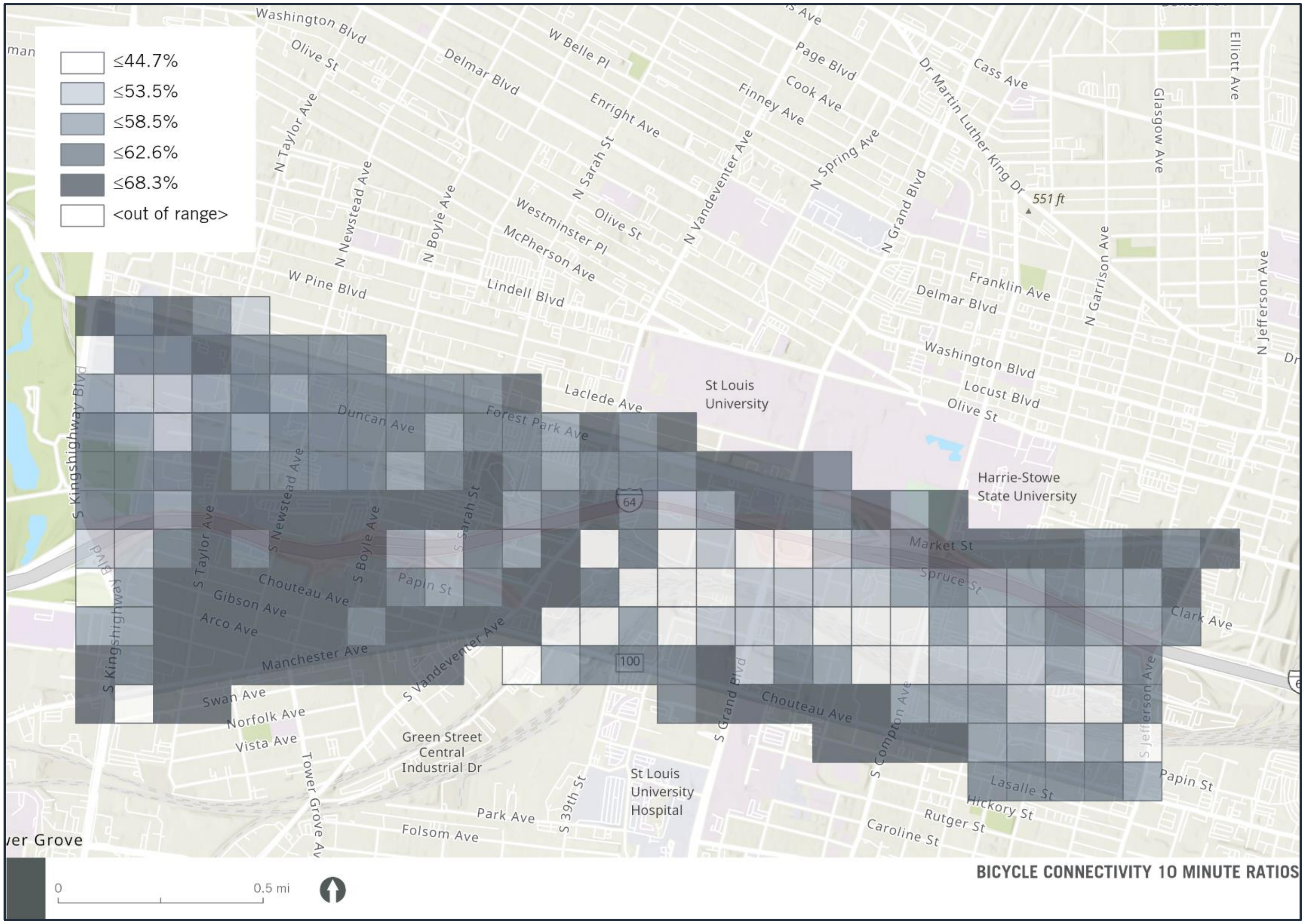
The largest cluster of higher connectivity ratios is located in the Forest Park Southeast Neighborhood, and additional higher connectivity scores can be found along Clayton Ave. and near major intersections like Vandeventer Ave. and Manchester Ave., Grand Blvd. and Chouteau Ave., and Market St. and Compton Ave. The largest cluster of low connectivity scores is located in the industrial area between I-64 and Chouteau Ave. from Vandeventer Ave. east to Compton Ave. Bicycle connectivity is severely limited in this area by large industrial parcels, a fractured street grid, and linear barriers like I-64 and the rail yard.

As new private development and capital improvements reshape the study area, there is great potential to increase bicycle connectivity. New projects like the Brickline Greenway will add new connections for bicyclists and pedestrians through low-connectivity areas and potentially add a new interstate crossing at Spring Ave. by the Foundry and the Armory. As the form and function of land uses in the study area transform over time, the transportation system must also adapt to better serve a variety of users and create a safer, more comfortable, and more inclusive environment for people of all ages and abilities.

---

[3] Martens, K. (2015). Accessibility and potential mobility as a guide for policy action. Transportation research record, 2499(1), 18-24.

Figure 64. Bicycle Connectivity Analysis Results



4.5. TRANSIT

Transit services are a vital component of the transportation system in the City of St. Louis and the study area. This section of the report examines current transit services and conditions, related plans and studies, bus and light rail ridership, and other transit characteristics in order to identify needs, issues, and opportunities related to transit accessibility and mobility.

4.5.1. Transit-Related Planning

Past and current planning efforts related to transit within the study area were reviewed. Several regional/citywide and local past and ongoing planning efforts impact the study area. **Table 23** contains a summary of the relevant plans, the agency who authorized the plan, and the date of completion.

Table 23. Relevant Transit Planning Documents

Document Title	Agency	Completion Date
Grand MetroLink Station, Connecting People to Transit and Development Opportunities*	Urban Land Institute, St. Louis	September 2021
Metro Reimagined	Bi-State Development Agency	May 2018
St. Louis Rapid Connector Transit Study*	Bi-State Development Agency	2014
Central Corridor Transit Access Study	Bi-State Development Agency with Citizens for Modern Transit	June 2014
Grand Metrolink Station, Technical Assistance Panel*	ULI of St. Louis	November 2012
Moving Transit Forward: St. Louis' Long Range Transit Plan	Bi-State Development Agency	February 2008

Plans that are noted in Table 23 with an asterisk have not been formally adopted by a governing agency, such as the City of St. Louis or Bi-State Development. A summary of the relevant findings of these documents is listed below.

- **Grand MetroLink Station, Connecting People to Transit and Development Opportunities** (2021) provided an update to the 2012 Technical Assistance Panel conducted by the ULI of St. Louis. The document was intended to advise Citizens for Modern Transit and the St. Louis Midtown Redevelopment Corporation on future actions that could improve connectivity in and around Grand MetroLink Station. The report recommended improved connections for non-motorized users between buildings and destinations, reconnecting the street grid for vehicular access, and implementing form-based codes and development guidelines to ensure future development supports mobility goals.

- **Metro Reimagined** (2018) was a comprehensive operational analysis of the services offered by the Bi-State Development Agency. The document identified three primary goals. The first goal was to ensure the design of effective, efficient, and equitable transit service. The second goal was to plan, design, and evaluate transit services and proposals fairly and consistently within applicable laws and regulations. The final goal was to respond to changing travel patterns and markets to continually improve customer mobility throughout the service area. The study and its recommendations were intended to ensure that Metro service is provided in a cost-effective and equitable manner, striking an appropriate balance between these priorities. The #70 Grand and the #95 Kingshighway were identified as routes providing frequent service at 15-minute headways or less. Service performance, transit operations, and network design changes identified in the plan were implemented the following year (2019).
- **St. Louis Rapid Transit Connector Study** (2014) proposed and recommended a 23-mile I-64 BRT corridor that would operate between the Chesterfield and downtown St. Louis. As proposed, the I-64 BRT would provide the region’s first single-seat transit ride between West County and Downtown and was projected to improve transit travel time by 30%, reducing transit travel times from 76 minutes to 53 minutes.
- **Central Corridor Transit Access Study** (2014) evaluated locations for a new MetroLink station in Cortex, developed conceptual designs and cost estimates for the new station, and forecasted ridership to inform development of a financial model of incremental operating and maintenance costs and anticipated farebox and tax revenues from new developments in the area. The study recommended a station location adjacent to Boyle Ave. The study also evaluated the Central West End Transit Center to determine if the existing location is optimal for facilitating transfers between MetroBus and MetroLink. The study confirmed the existing transit center location to be optimal.
- **Grand MetroLink Station Technical Assistance Panel** (2012) was conducted by the ULI of St. Louis to advise Bi-State Development and Citizens for Modern Transit on short- and long-term methods to improve development and connectivity around the Grand MetroLink Station. Recommendations included the creation of a Chapter 353 Re-development Corporation, the implementation of Chouteau’s Greenway, the addition of a station serving high-speed rail, and mixed-use development at the transit platform.
- **Moving Transit Forward** (2008) established a long-range vision for transit in the St. Louis region that moves tens of thousands of people to work every day, stimulates job growth and economic development, reduces pollution and traffic congestion, and improves the quality of life for all citizens, whether they use the system or not. Recommendations from the plan relevant to the study area include bus rapid transit (BRT) on I-64 between downtown St. Louis and Chesterfield and improvements to passenger amenities throughout the network. It also recommended BRT for Grand Blvd, though that recommendation was later removed during the St. Louis Rapid Transit Connector Study in 2014.

4.5.2. Existing Transit Service

The study area has traditionally been served by one transit district, the Metropolitan Transit District of St. Louis (Metro). Metro, an enterprise of the Bi-State Development Agency, was created through a compact between the States of Missouri and Illinois, ratified by the United States Congress in 1949. Metro operations are supported by passenger fares, sales taxes from St. Louis City and County, funding from the St. Clair County Transit District, and federal and state grants. Metro owns and operates the St. Louis Metropolitan region's public transportation system, which includes MetroLink, the region's light rail system; MetroBus, the region's bus system; and Metro Call-A-Ride, the region's paratransit system. All three services—MetroLink, MetroBus, and Metro Call-A-Ride—operate in the study area.

4.5.2.1. MetroLink

MetroLink currently operates two light rail lines (Red Line and Blue Line) with 38 stations (27 in Missouri and 11 in Illinois), as summarized in **Table 24.** Its routes connect Lambert-St. Louis International Airport to Scott Air Force Base and Shrewsbury, Missouri, to Fairview Heights, Illinois. MetroLink, which operates along 46 miles of light rail tracks, reported nearly 5.5 million annual boardings in fiscal year (FY) 2021. Two light rail lines and three light rail stations are located within the study area (**Figure 65**). The Red Line and Blue line service all three MetroLink stations located within the study area—Grand, Cortex, and Central West End.

Table 24. MetroLink Routes in the Study Area

Route Name	Start Point	End Point	Headway (minutes)
Red Line	Lambert Airport	Shiloh-Scott	15-20
Blue Line	Shrewsbury	Fairview Heights	15-20

4.5.2.2. MetroBus

MetroBus currently operates 59 routes, 47 of which serve Missouri and 12 Illinois. The system boasts 93% on-time performance and nearly 11.5 million annual boardings in FY 2021. There are 11 MetroBus routes with 64 stops within the study area (**Figure 66**). Route details are provided in **Table 25.** It should be acknowledged that the headways reported in **Table 25** are influenced by the ongoing driver shortage and changes in ridership due to the global pandemic. They do not reflect the redesigned service plan identified in Metro ReImagined. These headways may be considered temporary in that additional drivers may enable more frequent service. Major transfer centers between MetroLink and MetroBus lines are located at the Central West End Transit Center and the Grand Transit Center. A matrix of MetroBus stops and corresponding routes in the study area is shown in **Table 26.**

Figure 65. MetroLink Stops and Routes in the Study Area

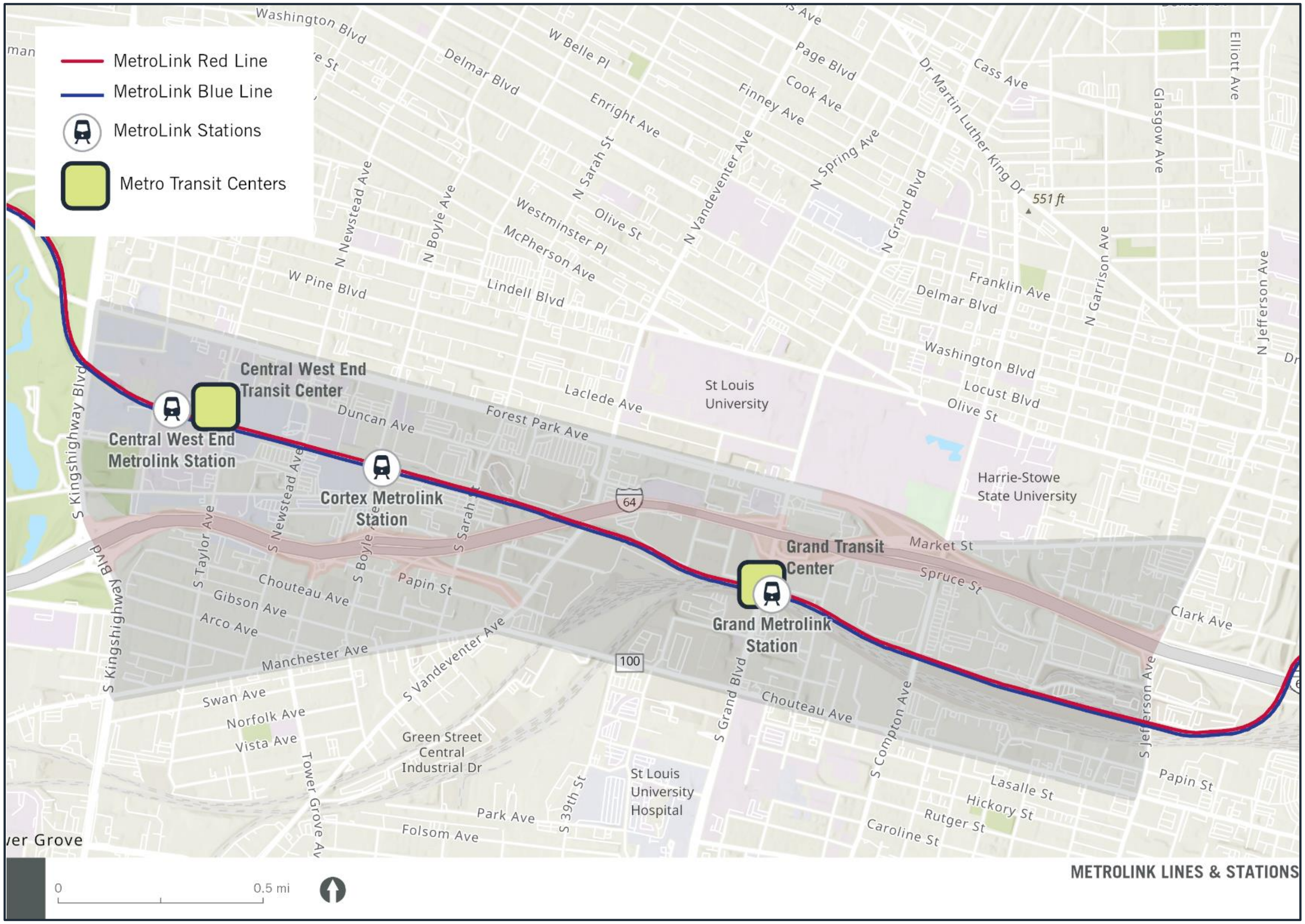


Figure 66. MetroBus Stops and Routes in the Study Area

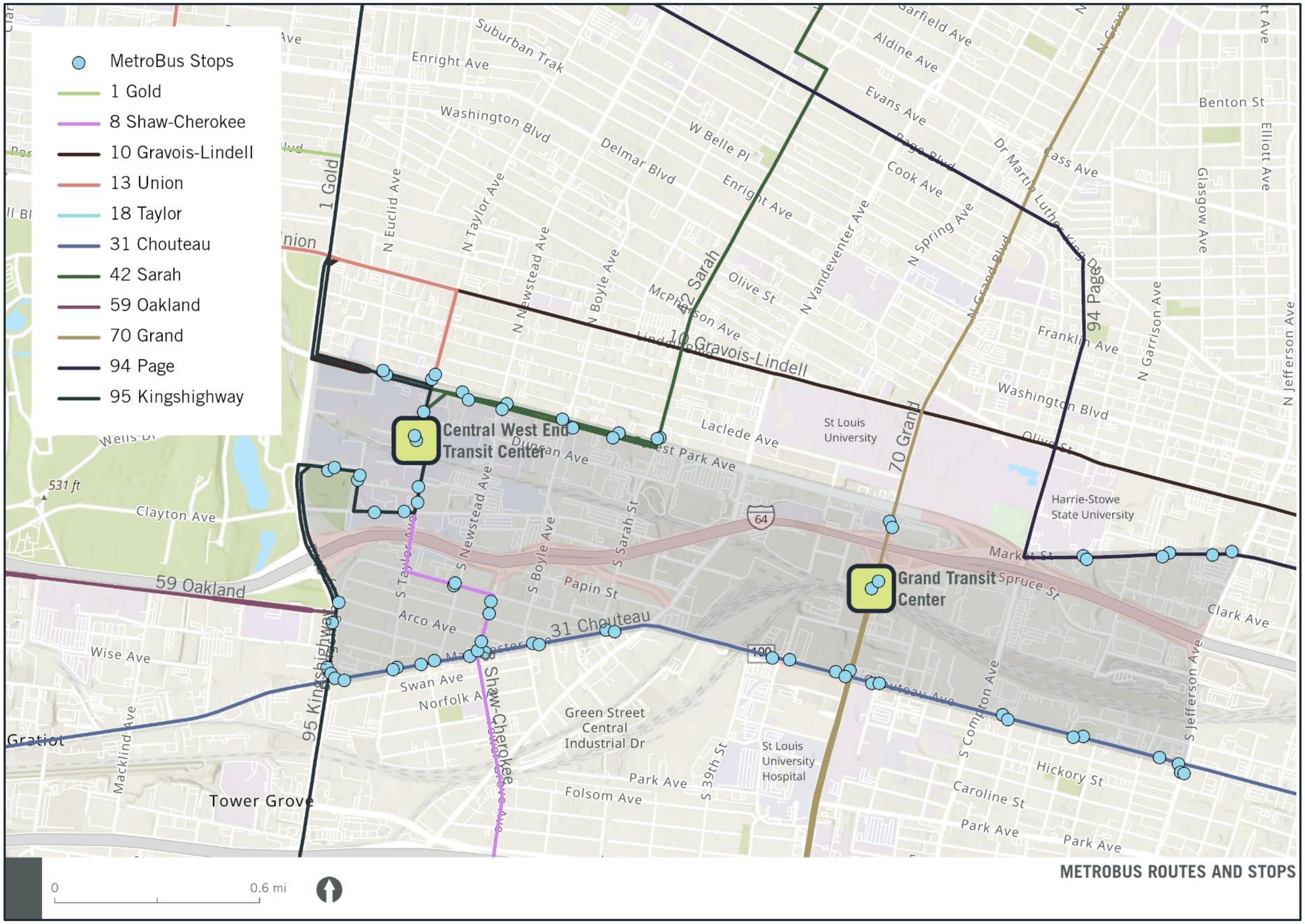


Table 25. MetroBus Routes in the Study Area

Route No.	Route Name	Start Point	End Point	Headway (minutes)*	Metro Reimagined Recommended Headway
1	Gold	Mallinckrodt Center	Central West End Transit Center	60	30
8	Shaw-Cherokee	Catalan Transit Center	Central West End Transit Center	60	30
10	Gravois- Lindell	Hampton-Gravois Transit Center	Lindell & Grand	30	30
13	Union	Central West End Transit Center	Union and West Florissant	60	30
18	Taylor	Central West End Transit Center	O'Fallon Park Rec Center	60	30
31	Chouteau	Maplewood Transit Center	Civic Center Transit Center	60	30
42	Sarah	Central West End Transit Center	West Florissant & Fair	60	30
59	Oakland	Highland Terrace & Richmond Center	Central West End Transit Center	60	30
70	Grand	Loughborough Commons	Broadway-Taylor Transit Center	20	15
94	Page	Lackland & Altom Center	Civic Center Transit Center	30	30
95	Kingshighway	Hampton-Gravois Transit Center	Broadway-Taylor Transit Center	20	15

Note that the current headways may be temporary due to lingering issues with COVID-19 affecting ridership as well as a current operator shortage.

Table 26. MetroBus Stops and Corresponding Route Numbers in the Study Area

Stop Location	Route Number										
	1	8	10	13	18	31	42	59	70	94	95
2820 MARKET EB										■	
4199 FOREST PARK WB							■				
4200 FOREST PARK EB							■				
4450 FOREST PARK EB							■				

Stop Location	Route Number										
	1	8	10	13	18	31	42	59	70	94	95
4451 FOREST PARK WB							■				
BARNES JEWISH HOSPITAL PLAZA EB								■			■
BARNES JEWISH HOSPITAL PLAZA WB								■			■
CENTRAL WEST END TRANSIT CENTER	■	■	■	■	■		■	■			■
CHOUTEAU @ CALIFORNIA WB						■					
CHOUTEAU @ CARDINAL EB						■					
CHOUTEAU @ CARDINAL WB						■					
CHOUTEAU @ CARR LN EB						■					
CHOUTEAU @ CARR LN WB						■					
CHOUTEAU @ EWING EB						■					
CHOUTEAU @ GRAND EB						■					
CHOUTEAU @ GRAND WB						■					
CHOUTEAU @ JEFFERSON EB						■					
CHOUTEAU @ JEFFERSON WB						■					
CHOUTEAU @ NEWSTEAD EB		■									
CHOUTEAU @ NEWSTEAD WB		■									
CHOUTEAU @ SPRING EB						■					
CHOUTEAU @ SPRING WB						■					
CLAYTON @ EUCLID EB								■			■
CLAYTON @ TAYLOR WB								■			■
EUCLID @ BARNES JEWISH HOSPITAL PLAZA NB								■			■
EUCLID @ MCKINLEY SB								■			■
FOREST PARK @ BOYLE EB							■				
FOREST PARK @ BOYLE WB							■				
FOREST PARK @ EUCLID EB	■		■								■
FOREST PARK @ EUCLID WB	■		■								■

Stop Location	Route Number										
	1	8	10	13	18	31	42	59	70	94	95
FOREST PARK @ NEWSTEAD EB							■				
FOREST PARK @ NEWSTEAD WB							■				
GRAND @ CHOUTEAU SB									■		
GRAND @ COUNCIL PLAZA NB									■		
GRAND @ COUNCIL PLAZA SB									■		
GRAND TRANSIT CENTER NB									■		
GRAND TRANSIT CENTER SB									■		
KINGSHIGHWAY @ MANCHESTER NB											■
KINGSHIGHWAY @ OAKLAND NB								■			■
MANCHESTER @ BOYLE EB						■					
MANCHESTER @ BOYLE WB						■					
MANCHESTER @ KINGSHIGHWAY EB						■					
MANCHESTER @ KINGSHIGHWAY WB						■					
MANCHESTER @ NEWSTEAD EB						■					
MANCHESTER @ NEWSTEAD WB						■					
MANCHESTER @ SARAH EB						■					
MANCHESTER @ SARAH WB						■					
MANCHESTER @ TAYLOR EB						■					
MANCHESTER @ TAYLOR WB						■					
MANCHESTER @ TOWER GROVE EB						■					
MANCHESTER @ TOWER GROVE WB						■					
MARKET @ BEAUMONT EB										■	
MARKET @ EWING WB										■	
MARKET @ GARRISON EB										■	
MARKET @ JEFFERSON WB										■	
MARKET St. @ GARRISON AVE.										■	

Stop Location	Route Number										
	1	8	10	13	18	31	42	59	70	94	95
TAYLOR @ CLAYTON NB		■						■			■
TAYLOR @ MCKINLEY SB		■						■			■
TAYLOR @ PARKVIEW PLACE SB	■		■	■	■		■				■
TOWER GROVE @ CHOUTEAU SB		■									
TOWER GROVE @ GIBSON NB		■									
TOWER GROVE @ MANCHESTER NB		■									
TOWER GROVE @ MANCHESTER SB		■									

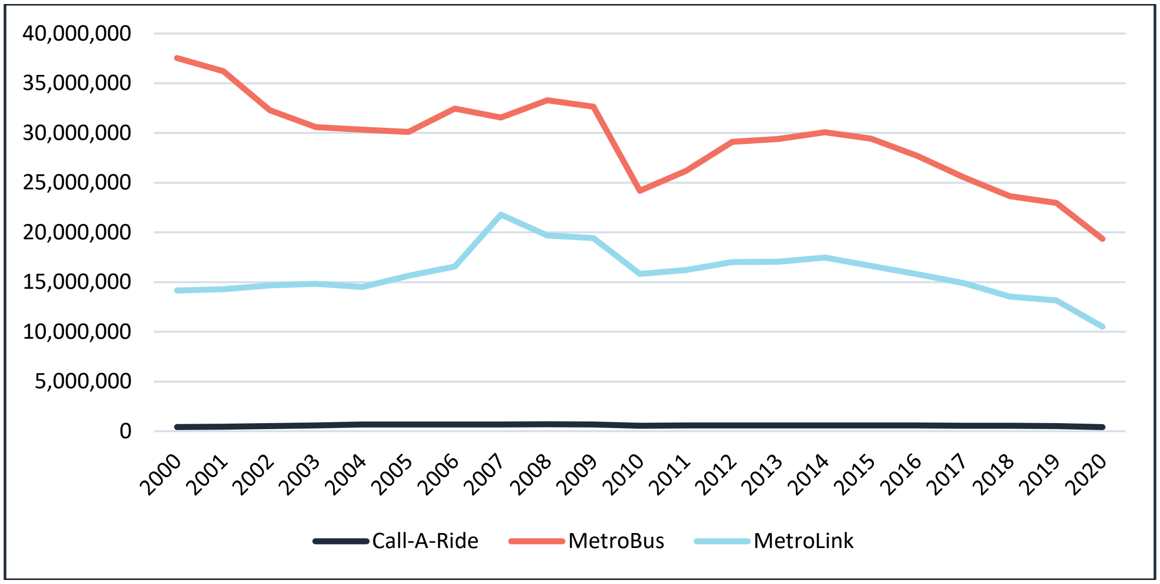
4.5.2.3. Metro Call-A-Ride

Metro Call-A-Ride provides paratransit service for qualified transit riders in the Metro service area. In FY2021, Call-A-Ride reported approximately 411,000 riders.

4.5.3. Transit Ridership Systemwide

As of 2020, Metro provided over 30 million passenger trips annually. Transit ridership across the St. Louis region peaked in 2007 with nearly 54 million annual passenger trips. Consistent with national trends, ridership has declined steadily since that time. Factors that affected this decline included a reduction in fuel costs in recent years (prior to 2022), increased auto ownership, job growth and wage increases, population loss in the City of St. Louis and population gains in suburban fringe areas, as well as security concerns with transit among others. **Figure 67** shows Metro ridership trends since 2000 for Metro Call-A-Ride, MetroBus, and MetroLink.

Figure 67. Metro Ridership (2000-2020)



Source: FTA National Transit Database.

In an effort to attract new riders and better serve existing riders, Metro implemented Metro-Reimagined during the third quarter of 2019. Metro-Reimagined introduced systemwide design and route frequency changes across the transit network. Unfortunately, only months later, the COVID-19 pandemic struck and significantly disrupted transit service. Consequently, it is unclear if the network redesign achieved its intended outcomes.

Adding to the ridership decline, restrictions related to COVID-19 led to major reductions in the demand for transit. In 2020, Metro ridership dropped dramatically to nearly half of 2019 levels. According to data from the Federal Transit Administration (FTA), Metro reported about 36 million annual boardings in 2019, with about 13.1 million of those on MetroLink. In 2020, it reported about 21 million annual boardings, with about 6.75 million of those on MetroLink.

In 2021, the nationwide labor shortage further compounded the challenges of 2020. Metro experienced an acute shortage of drivers and mechanics. In response, Metro was forced to implement frequency and service reductions starting in November 2021. Headways were decreased, and some routes and stops were eliminated entirely. These reductions were expanded in March 2022. The service Metro is able to deploy remains very fluid in the face of the ongoing driver shortage.

As a result of these influencing factors, ridership trends and stop-level ridership data taken at the time of this study are unstable and potentially unsuitable for long-range planning. The transit stop-level ridership analysis provides a relative snapshot of point-in-time conditions and should not be extrapolated for conclusions regarding long-term ridership trends or rider behavior.

4.5.4. Transit Ridership in the Study Area

The study area currently boasts average weekday transit boardings of approximately 5,032 riders on MetroBus and MetroLink. The three MetroLink stations in the study area have combined daily boardings of approximately 3,000 riders; MetroBus in the study area has daily boardings of 2,032 riders.

The most popular MetroBus stop is the Central West End Transit Center, attracting over 1,900 daily users (boardings + alightings). The least popular stops are Manchester at Newstead (eastbound), Clayton at Euclid (eastbound) and Tower Grove at Chouteau (southbound), which each had one rider per day. The average MetroBus stop in the study area has daily boardings and alightings of approximately 65 riders. The ten most frequently used stops in the study area are listed in **Table 27**, and a map of stops by ridership activity is shown in **Figure 68**. Note that a significant portion of the MetroBus ridership at the Central West End and Grand Stations represents transfers to and from MetroLink.

Table 27. Ridership by MetroBus Stops

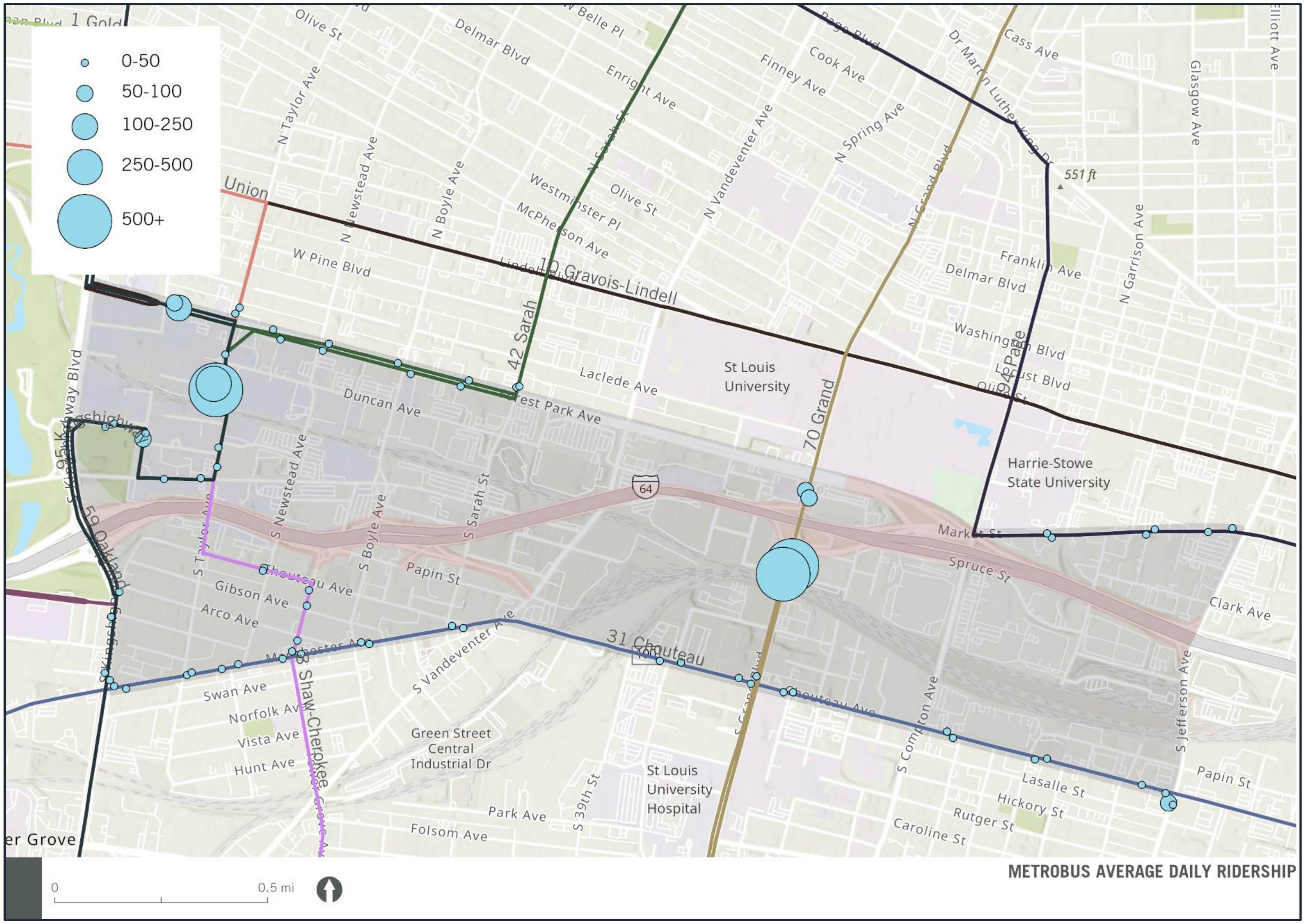
Rank	Stop Name	Daily Boardings & Alightings
1	Central West End Transit Center	1916
2	Grand Transit Center NB	619
3	Grand Transit Center SB	575
4	Forest Park @ Euclid EB	105
5	Euclid @ McKinley SB	92
6	Forest Park @ Euclid WB	84
7	Grand @ Council Plaza SB	78
8	Grand @ Council Plaza NB	70
9	Kingshighway @ Manchester NB	48
10	Euclid @ Barnes Jewish Hospital Plaza NB	46

The average monthly and daily boardings from October 2019 to December 2021 for MetroLink stations in the study area are shown in **Table 28**. This time period was chosen since Metro-Reimagined was implemented in the Fall 2019. The Central West End MetroLink Station has the highest number of boardings, followed by the Grand MetroLink Station and finally the Cortex MetroLink Station.

Table 28. Boardings by MetroLink Station

Rank	Stop Name	Average Boardings
1	Central West End Metrolink Station	Calculated Monthly: 52,084 Estimated Daily: 1,709
2	Grand MetroLink Station	Calculated Monthly: 31,448 Estimated Daily: 1,032
3	Cortex MetroLink Station	Calculated Monthly: 9,805 Estimated Daily: 322

Figure 68. Ridership by MetroBus Stops



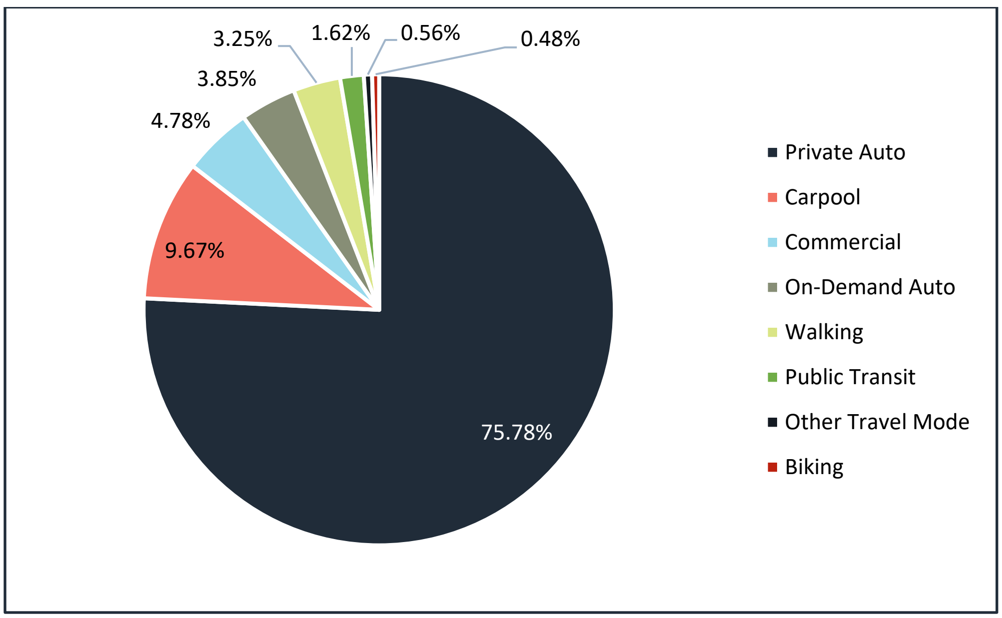
4.5.5. Transit Trip Characteristics

Transit ridership data from alternative sources for trip distances, trip durations, and trip purposes can also provide valuable insight into transit rider characteristics. The information gleaned from these sources contributes to a more robust understanding of travel patterns within the study area beyond just the number of trips or passengers, and can be used to determine transit mode share, develop a transit commuter travelshed, and calculate potential transit trip demand.

ReplicaHQ's Places dataset is a high-fidelity activity-based travel model that simulates the movements of residents, visitors, and commercial vehicles in a given area. The most current iteration of the dataset utilizes data gathered on a Thursday in mid-October of 2019 to simulate trips of an average weekday.

According to ReplicaHQ, an estimated 7,183 transit trips begin, end, or pass through the entire study area on an average weekday. Transit trips comprise 1.6% of all trips within the study area limits, as shown in **Figure 69**. Only bicycling and "other travel mode" have lower mode shares than transit.

Figure 69. Estimated Mode Share for All Trips in the Study Area



Examining transit trip origins and destinations relative to the study area**,** more than two thirds of all transit trips pass through and do not originate or end within the study area, as shown in **Figure 70**. These pass-through transit trips also have the longest average trip duration, which is not surprising given the transit service in the study area serves the bi-state region on MetroLink and large portions of the City of St. Louis on MetroBus. A roughly equal percent of trips either begin in or end in the study area (15.7% and 15.6%, respectively). A mere 0.2% of all transit trips begin *and* end in the study area. This confirms that transit is not a major mode of choice for short-distance local trips.

Figure 70. Transit Trips by Origin and Destination

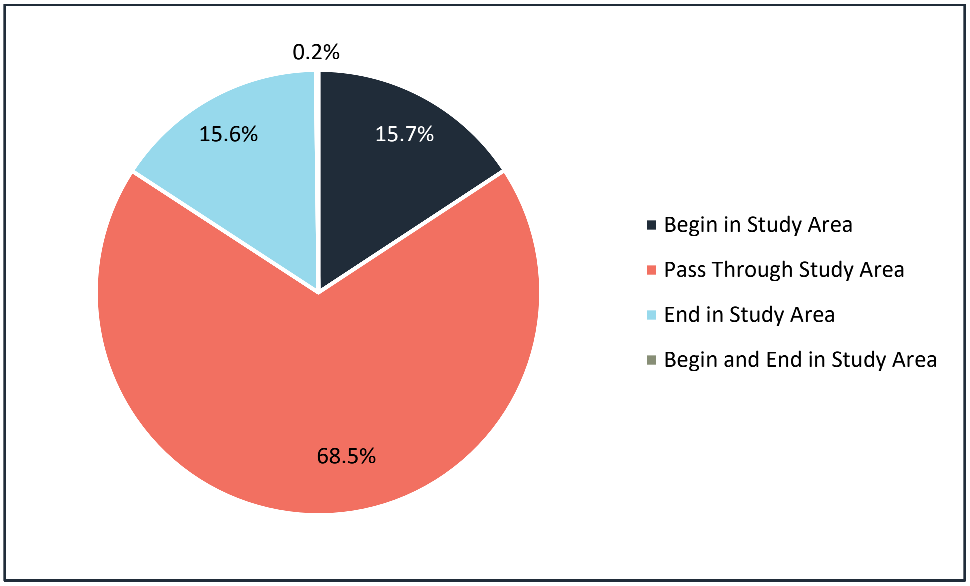
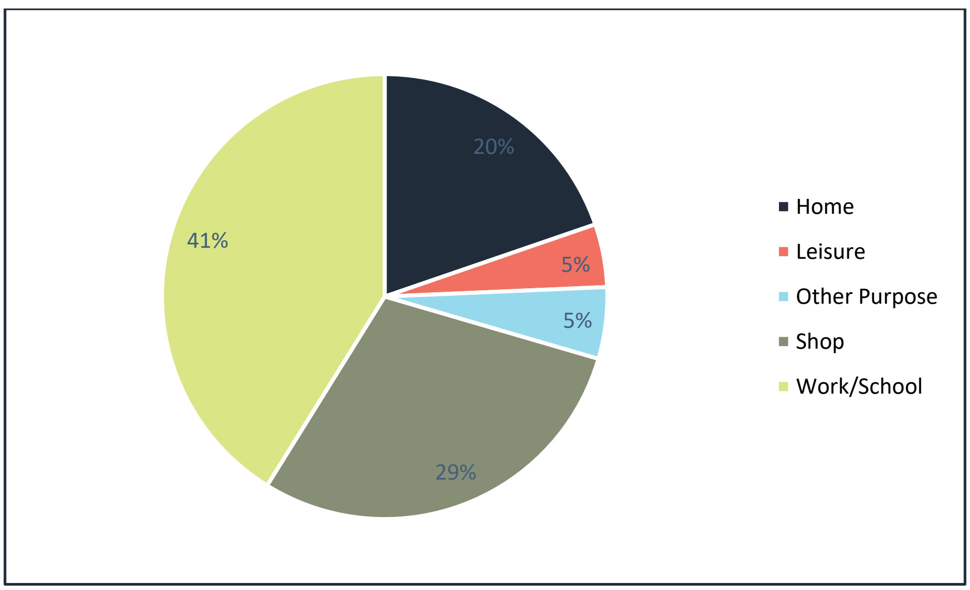


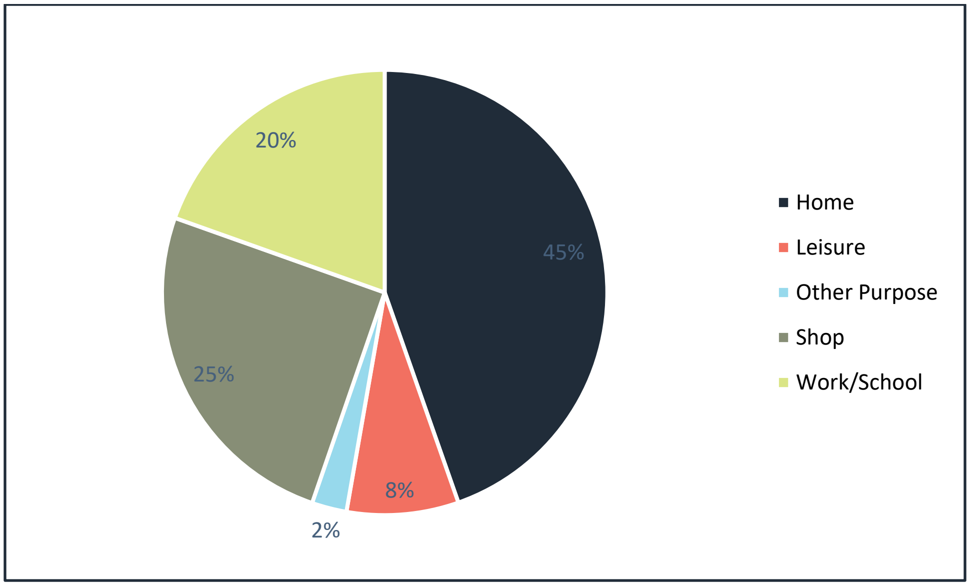
Figure 71 displays trip purpose as a percent of all transit trips ending in the study area, providing insight into the types of destinations people are accessing along the I-64 corridor. Work and school trips comprise the largest share of transit trips to the study area at 41%, followed by shopping trips at 29%, which includes retail, restaurants, and services, and trips to home at 20%.

Figure 71. Trip Purpose for Transit Trips Ending in the Study Area



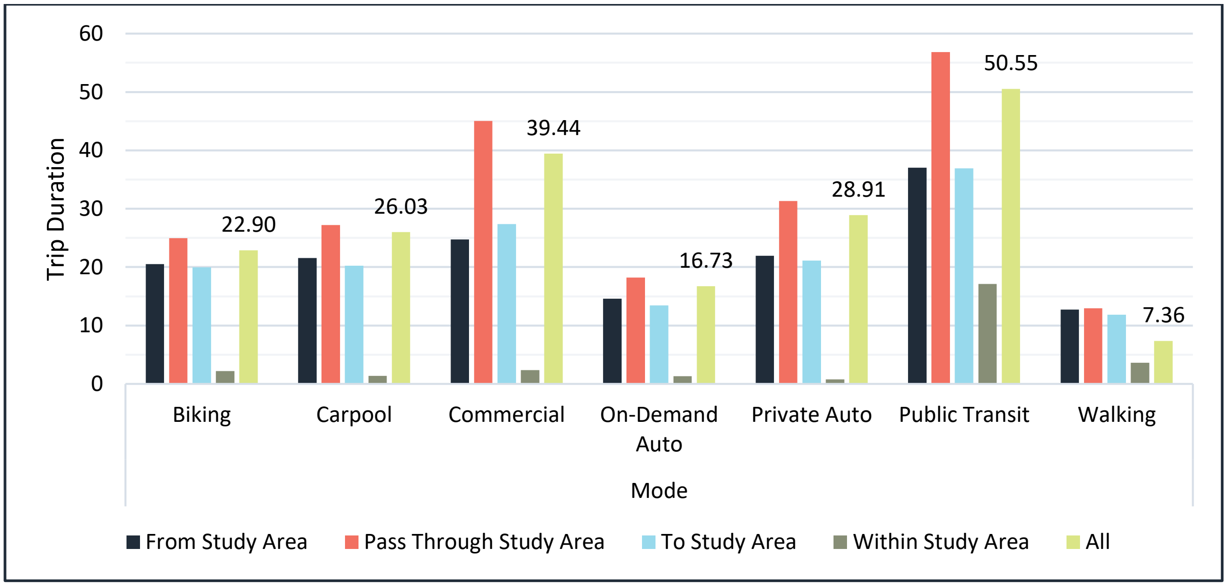
Trip purpose for transit trips originating in the study area are displayed in **Figure 72**. Trips to home destinations constitute the largest portion of all trips originating in the study area at 45%, a reflection of the density of employment, institutions, retail, and restaurant destinations within the study area. Planned Transit Oriented Developments in the study area have the potential to better accommodate transit embracing and transit-dependent populations, which could provide opportunities to expand study area transit ridership. Shopping trips comprise the second largest portion of trips originating in the study area at 25%, followed by work and school trips at 20%.

Figure 72. Trip Purpose for Transit Trips Originating in the Study Area



Trip duration is a function of both trip distance and travel speed. As shown in **Figure 73**, public transit trips have the highest average trip duration of all travel modes (50.6 minutes), exceeding even private auto trip duration by more than 21 minutes.

Figure 73. Average Trip Duration by Travel Mode and Origin/Destination



Since many, if not all transit trips begin and/or end with a non-motorized trip (bike or walk), it is also important to examine those walksheds as they relate to the transit lines in the study area. **Figure 74** and **Figure 75** depict the 10-minute bike shed and the 5- and 10-minute walksheds respectively. As shown, the ability of cyclists and pedestrians to access transit in the study area is evident, especially throughout the study area for bicycles and along major roadways for pedestrians. The access for these modes though is not equal or uniform and reveals that for pedestrian access (walk), there are gaps in the system, particularly south of I-64, and room for improvement through enhanced accommodations and accessibility.

4.5.6. Transit Needs

The need for transit service in the study area was estimated based on the number of transit-dependent residents. This was calculated from a formula developed by the US Department of Transportation[4] that, while imperfect, considers vehicle availability as the primary driver of whether a household has transit-dependent individuals. The formula estimates the transit-dependent population based on the total number of vehicles available subtracted from the total number of drivers. The estimates are based on Census data, so to the extent that college students are counted in the study area, they are included in this analysis. Based on the study area population, a total of 3,647 residents were estimated to be transit-dependent. This represents approximately half of the total residential population within the study area. **Figure 76** depicts where in the study area these individuals reside.

[4] Steiss, T.A. 2006. Calculating/analyzing transit dependent populations using 2000 census data and GIS. Census Transportation Planning Package 2000 Status Report. U.S. Department of Transportation. Washington, DC.

Figure 74. 10-Minute Bikeshed as Related to Transit Routes

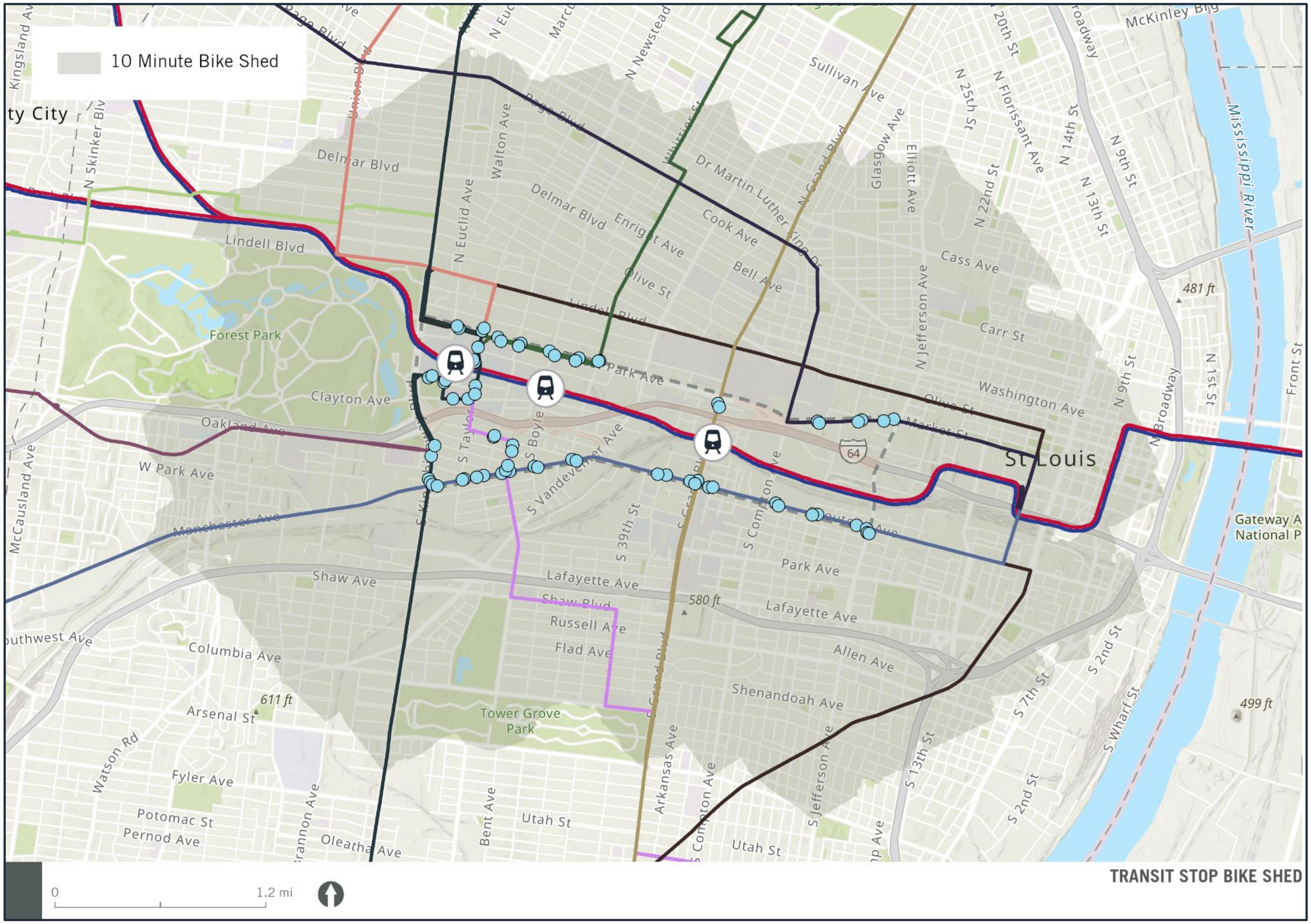


Figure 75. 5- and 10-Minute Walksheds as Related to Transit Routes

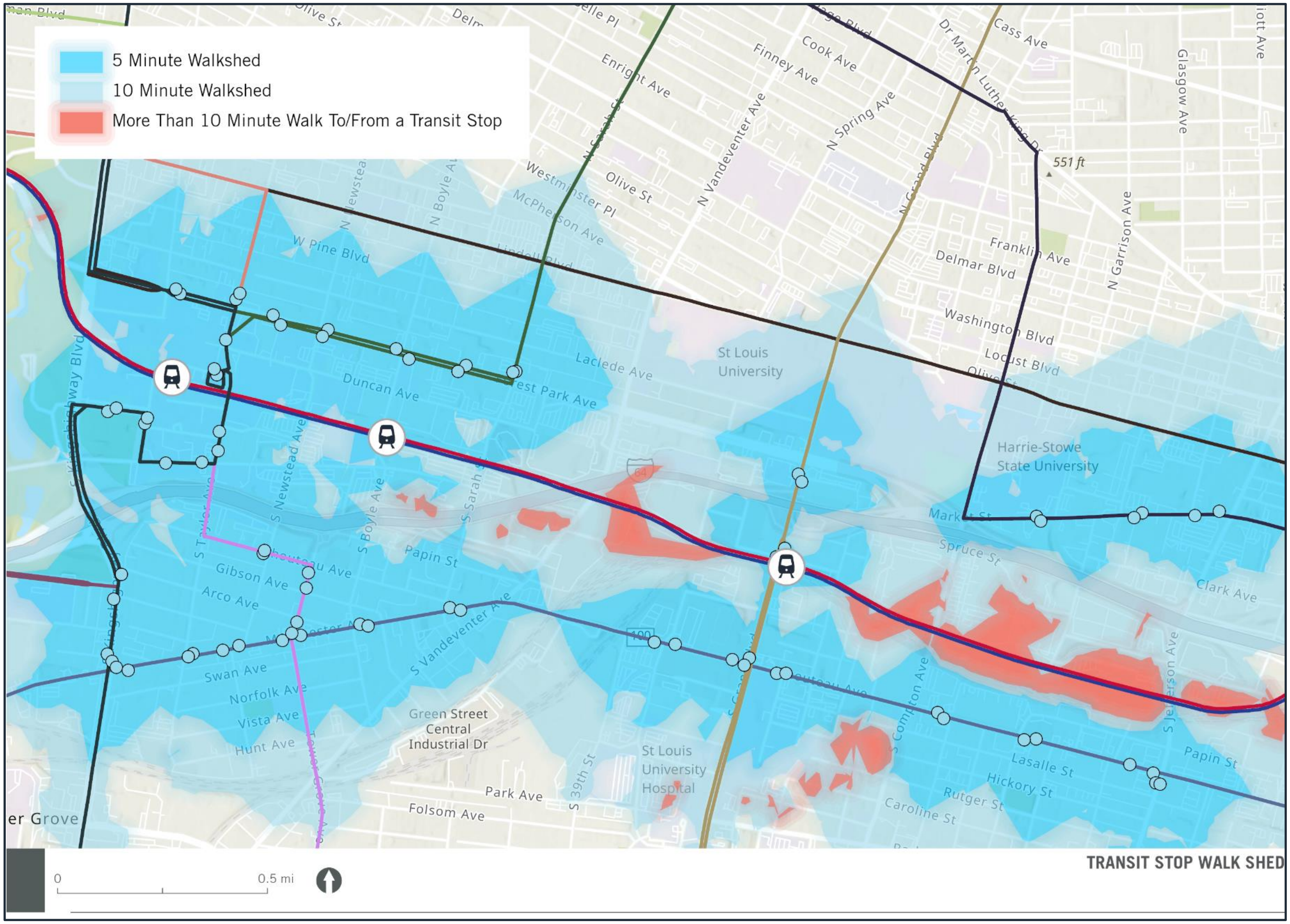
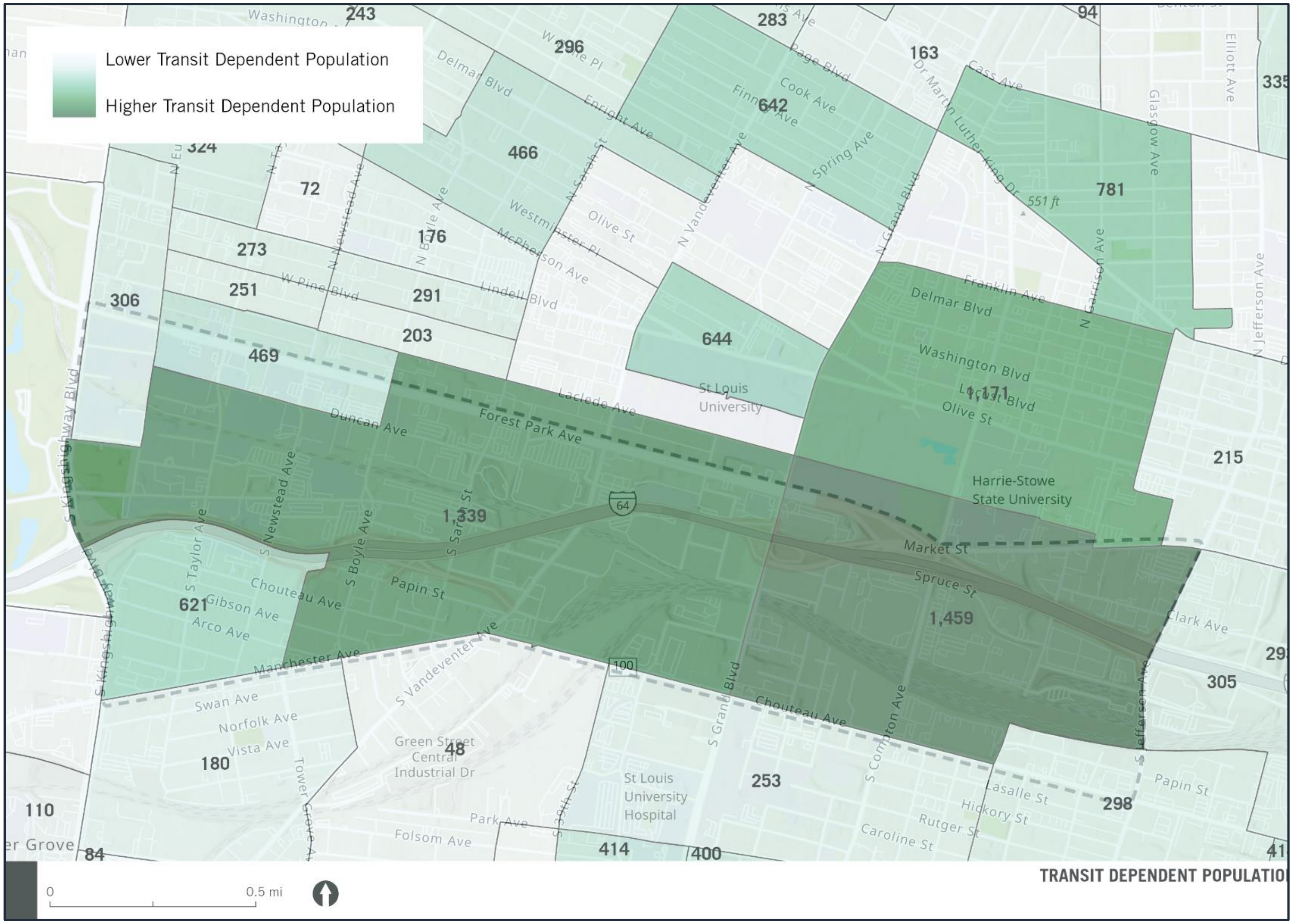


Figure 76. Transit-Dependent Population in the Study Area

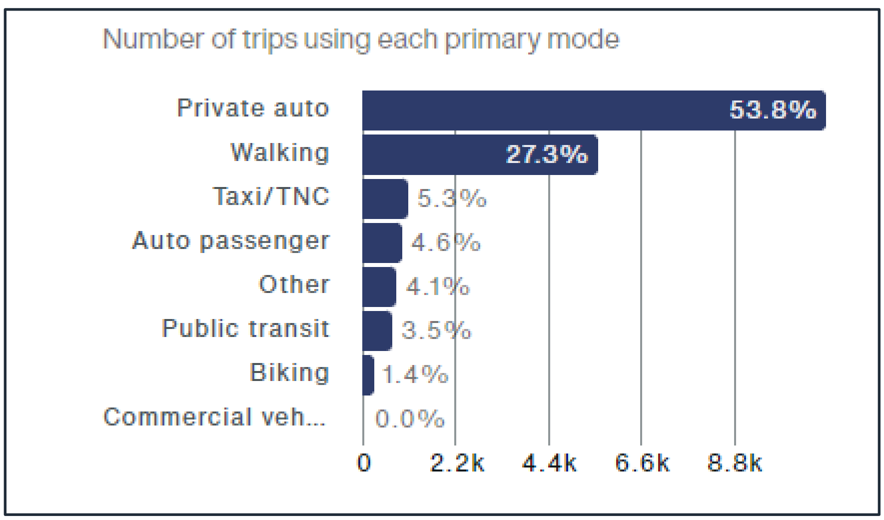


Based on Figure 74 and Figure 75, it could be interpreted that I-64 itself is acting as a physical and psychological barrier, to some degree, preventing some residents from fully accessing and utilizing transit. This is due to a lack of north-south pedestrian and bicycle connections across or under the interstate. Where crossings exist, they frequently occur alongside a major arterial roadway where traffic volumes and vehicle speeds foster an unwelcoming environment for pedestrians and bicyclists. For example, from Compton Ave. to Vandeventer Ave. (a distance of approximately one mile), Grand Blvd. represents the only crossing of I-64 for vehicles, pedestrians, or bicycles.

Utilizing ReplicaHQ, the transit mode share of residents in the study area was estimated to be 3.5%, as illustrated in **Figure 77**. This is equivalent to approximately 700 daily trips and compares to 3,647 transit-dependent residents in the study area. It is evident that there is a gap between the need for transit and the amount of transit service being utilized by residents.

That said, it is also clear from Figure 77, that almost half of the study area population is using modes other than private single-occupant vehicles for their transportation needs. A significant portion are walking, carpooling, or using ride share services. It would appear that there is an opportunity for transit to capture a larger portion of the mode share for and within the study area by enabling transit-dependent populations to reach destinations outside a typical walkshed or to lessen their reliance on rideshare services, which can be costly.

Figure 77. Primary Mode of Travel for Trips Made by Study Area Residents

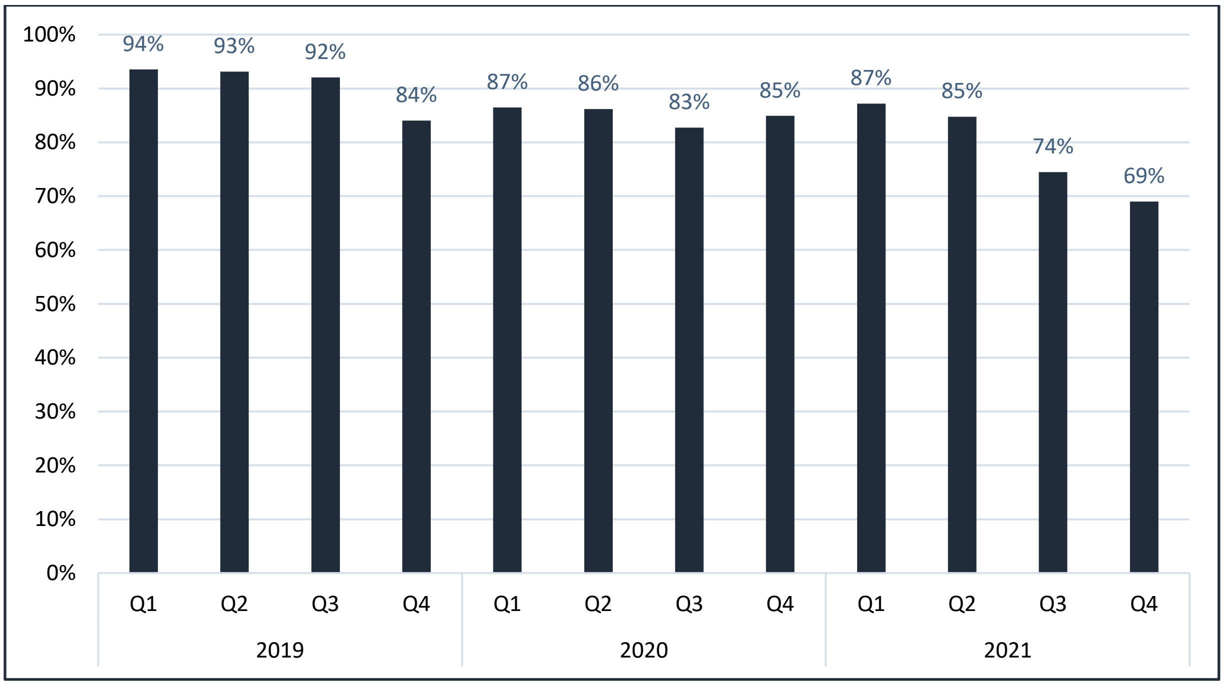


4.5.7. Transit On-Time Performance

Prior to the COVID-19 pandemic and labor shortages, MetroLink boasted a 98% on-time-performance (OTP) and MetroBus 93%. Within the study area, the 31-Chouteau, the 70-Grand, and the 95-Kingshighway have the poorest schedule adherence. However, these routes maintain an average OTP around 84%, which still exceeds the systemwide OTP for many large urban transit agencies across the nation.

Over the most recent year of data available (2021), one stop location worth noting is the Southbound 70-Grand at the Grand MetroLink station. This stop has seen the sharpest decline in performance (18% reduction) from 87% OTP to 69% OTP as shown in **Figure 78**. It is unclear if this decline can be attributed to traffic conditions, staffing issues, or other factors. In recent years, Metro has deployed articulated buses and fully electric buses along the 70-Grand. The impact of recharging electric vehicles on OTP is unknown.

Figure 78. On Time Performance – Southbound 70-Grand at Grand MetroLink Station



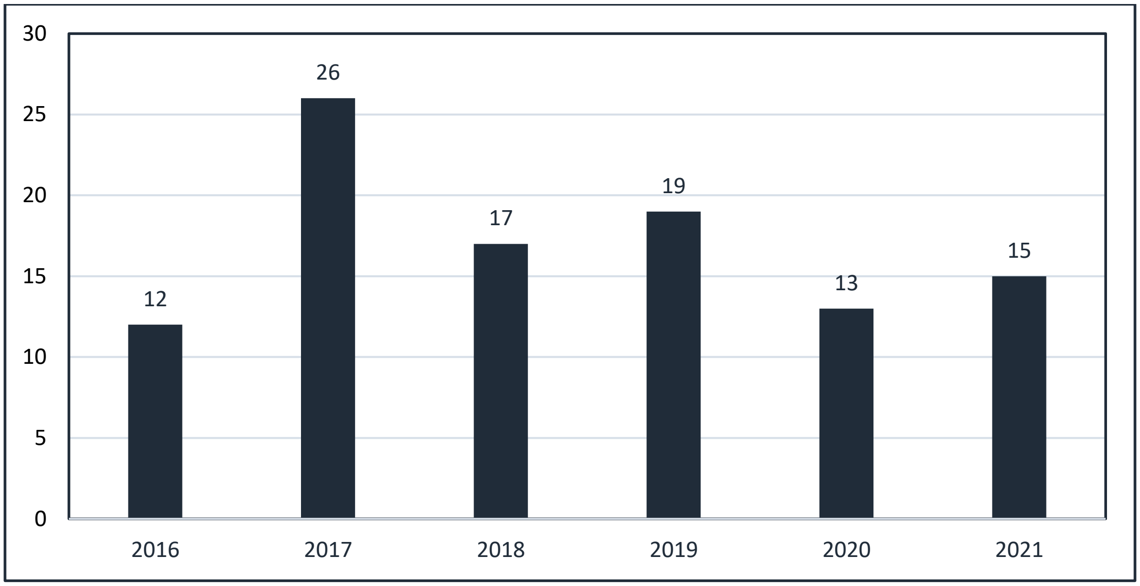
Source: Metro.

As noted in the Section 4.5.3, a number of factors including labor shortage and ridership declines have resulted in lower operational revenue and reduced service capabilities. Service reductions were implemented in November of 2021 and again in March of 2022 in response to changing ridership characteristics resulting from the COVID-19 pandemic. These service reductions impacted the 31-Choteau, 70-Grand, 94-Page, and 95-Kingshighway, which operate in the study area. Express routes were temporarily suspended at that time as well.

4.5.8. Transit Crashes

Crashes by year are summarized in **Figure 79**. A total of 105 transit crashes involving Metro transit vehicles occurred within the study area between July 2016 and December 2021. Of those, the majority (96%) were categorized as minor in that all vehicles were drivable, and injuries did not require medical attention. As shown, the number of crashes annually has been relatively steady from 2016 to 2021.

Figure 79. Study Area Transit Crashes By Year



As shown in **Figure 80,** the most common locations within the study area for crashes to occur are at the Central West End Transit Center (33%), followed by the Grand Transit Center (13%). These locations correlate with the highest MetroBus ridership in the study area, as well as a higher frequency of bus volumes. The most common routes to experience safety issues are 70-Grand (23%), 95-Kingshighway (22%) and 10-Gravois-Lindell (10%). Given the heavy traffic volumes along Grand Blvd. and Kingshighway Blvd., the opportunity for conflict between buses and regular traffic is high along these corridors.

Since transit is also usually accessed via non-motorized modes, it is also important to examine where transit vehicle crashes may overlap with pedestrian and bike crashes. As seen in Figure 80, there is some correlation with the location of transit vehicle crashes and bike and pedestrian crashes, especially in the western part of the study area along Taylor Ave., West Park Ave., but also along Grand Blvd.

4.5.9. Transit Stop Amenities

Transit station amenities, including ADA-accessible stops, bus shelters, and benches, contribute to a safe and comfortable environment for riders to wait for transit vehicles to arrive. Of the 64 stops located within the study area, 53 are ADA accessible, 10 have shelters, and 19 have benches. **Figure 81** shows the locations of various MetroBus station amenities throughout the study area.

Figure 80. Transit Crash Density as Compared to Pedestrian and Bicycle Crashes

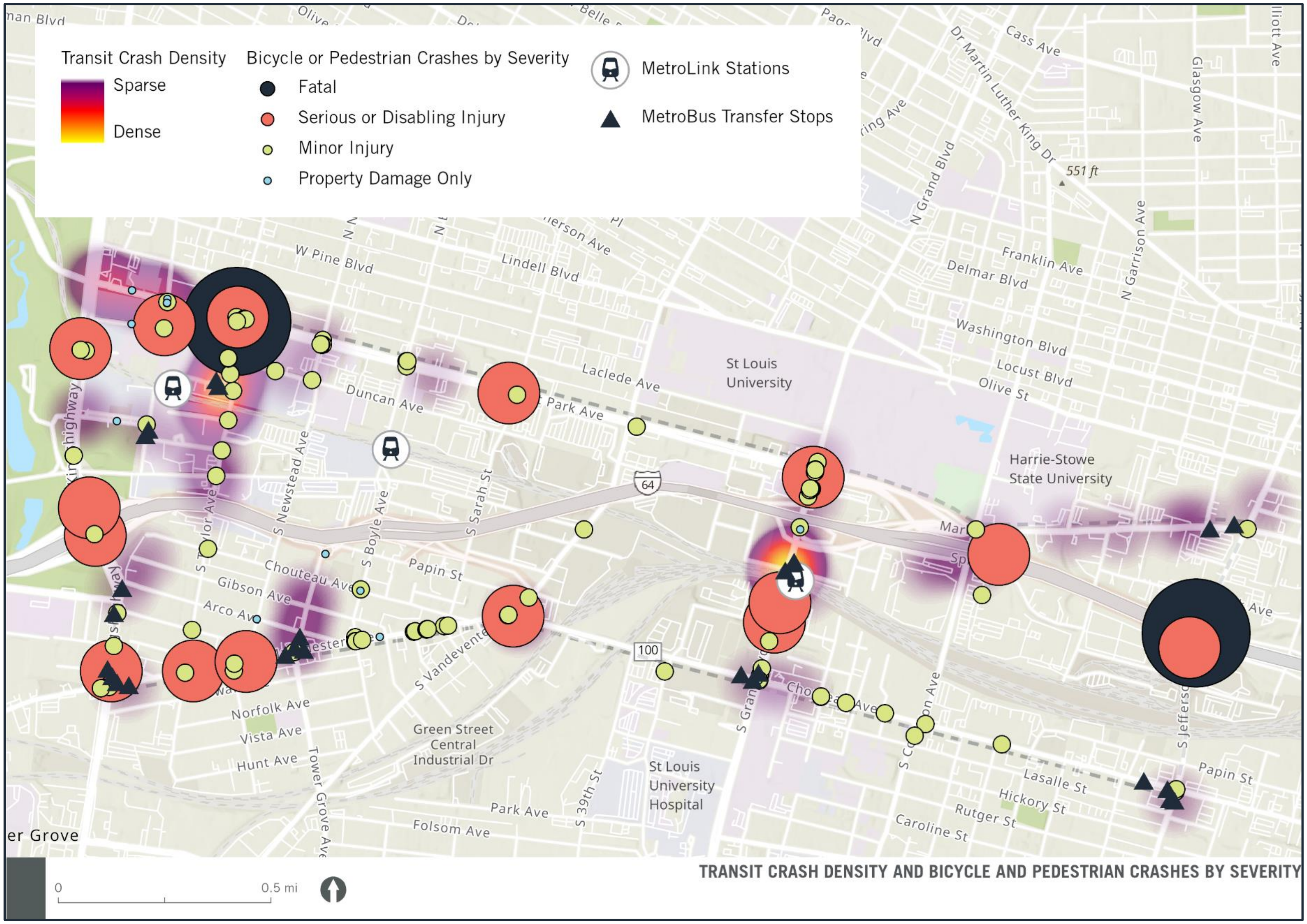


Figure 81. MetroBus Stop Amenities

4.6. MULTIMODAL CONCLUSIONS

The following summarizes overall conclusions relative to pedestrian and bicycle transportation in the study area:

7. The 16,546 mid-week daily walking and bicycling trips that occurred in the study area constitute just 3.73% of the 443,904 total trips that originate in, end in, or pass through the study area.
8. Approximately 69,000 automobile trips in the study area (17% of total automobile trips) are less than five miles, highlighting the potential for modal shift to active transportation modes like walking and bicycling.
9. Multiple plans and studies have been published in recent years recommending strategies and infrastructure to support active transportation within the study area, including greenways, on-street bikeways, pedestrian facilities, and enhanced connections to transit. When implemented, these plans will have a significant impact on pedestrian and bicycle safety, connectivity, and comfort.
10. The spacing between the 13 bicycle and pedestrian crossings of I-64 varies from a minimum of 415 feet to a maximum of 2,405 feet. These longer distances between crossings create challenges for pedestrian connectivity and limit routing options to reach destinations on the opposite side of the interstate.
11. Pedestrian facilities are present throughout the study area, and most streets include sidewalks on both sides of the street.
12. The quality of pedestrian experience afforded by these sidewalks (and adjacent streets) as measured by pedestrian level of service varies considerably and is generally presented as better than observed conditions. The lack of data and the limitations of the PLOS methodology limit the model’s utility without additional modifications and data collection.
13. Pedestrian connectivity ranges widely, with limited connectivity most prevalent in the eastern portion of the study area where the disconnected street grid and linear barriers like Interstate 64 and the railroad increase reliance on arterial roadways and limit comfortable and direct routing options.
14. There are more than seven miles of on-street bikeways and shared use paths in the study. These facilities consist primarily of signed and marked shared roadways (3.82 miles) and dedicated bike lanes (2.88 miles).
15. Despite the buildout of the bicycle network, there are no low-stress on-street bikeways in the study area. The majority of streets in the study area (68%) are categorized high-stress (even where dedicated bike lanes are present) and are not suitable for people of all ages and abilities.
16. Like pedestrian connectivity, bicycle connectivity is equally constrained by linear barriers, a disconnected street grid, and higher-stress conditions along arterials and collectors.

The following summarizes the overall conclusions relative to transit in the study area:

1. The study area is served by significant transit service, including 3 MetroLink stations, 11 MetroBus routes, and 64 MetroBus stops.
2. Transit in the study area has been the subject of several studies over the previous ten years. Several identified new high-capacity transit services that could bisect the study area both east-west and north-south. However, none of these services is actively in planning at this time and none have been incorporated into the region's Long-Range Transportation Plan.
3. Systemwide transit ridership has been on the decline since the early 2000s. This decline has been exacerbated by the COVID-19 pandemic and currently by a major shortage of transit operators.
4. The study area currently boasts average weekday transit boardings of approximately 5,032. This represents a combination of MetroBus and MetroLink. The three MetroLink stations combined have daily boardings of approximately 3,000 riders, whereas MetroBus throughout the study area has daily boardings of 2,032 riders, representing approximately 1.6% of all trips in the study area.
5. A total of 3,647 study area residents within the study area were estimated to be transit-dependent. This represents approximately half of the study area population. Utilizing ReplicaHQ, the transit mode share of residents in the study area was estimated to be 3.5%, equivalent to approximately 700 daily trips. Therefore, there is a gap between the need for transit and the actual amount of transit service being consumed by residents.
6. When examining where transit-dependent populations live, it appears that I-64 acts as a physical and psychological barrier preventing residents in the study area from fully accessing and using transit services that are present. However, given the data provided for the PEL study, it is not possible to definitively quantify the extent by which I-64 affects transit ridership.
7. Metro OTP exceeds 84% in the study area, which should be deemed acceptable as it exceeds the systemwide performance of many large urban transit agencies across the nation.
8. Transit vehicle crashes are heavily concentrated near major stop locations, particularly the Central West End Transit Center and the Grand MetroLink Station. Almost all incidents were very minor in nature. That said, opportunities exist to improve station locations, signage and pavement markings at stations, and their adjacent streets to allow transit vehicles and riders safer passage in station areas.

Appendix A

RITIS I-64 CORRIDOR SPEED DATA

Table A.1. I-64 Speed Data Between Kingshighway Blvd./Exit 36 and Jefferson Ave./Exit 38 using HERE data - Left graph September 15, 2021, through March 15, 2022 (Every Weekday

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119+04325	119P04325	119+04326	119P04326	119+04327	119P04327	119+04328	119P04328	119+04329	119P04329	119+04330	119P04330
MILES	0.029472	0.144632	0.116189	0.066308	0.031233	0.495771	0.082907	0.187632	0.716904	0.129747	0.54927	0.421106
12:00 AM	60	60	60	60	61	61	61	61	61	61	61	61
12:15 AM	60	60	60	60	61	61	62	62	61	61	60	60
12:30 AM	59	59	59	59	60	60	61	61	61	61	60	60
12:45 AM	60	60	59	59	61	61	61	61	61	61	60	60
1:00 AM	59	59	59	59	60	60	61	61	61	61	60	60
1:15 AM	59	59	58	58	59	59	60	60	60	60	60	60
1:30 AM	59	59	59	59	60	60	61	61	61	61	60	60
1:45 AM	59	59	59	59	60	60	60	60	61	61	60	60
2:00 AM	59	59	59	59	60	60	61	61	60	60	60	60
2:15 AM	61	61	61	61	61	61	62	62	61	61	61	61
2:30 AM	60	60	61	61	62	62	62	62	62	62	61	61
2:45 AM	60	60	59	59	60	60	60	60	60	60	58	58
3:00 AM	60	60	60	60	60	60	60	60	58	58	59	59
3:15 AM	58	58	59	59	61	61	61	61	60	60	60	60
3:30 AM	60	60	60	60	61	61	62	62	61	61	60	60

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119+04325	119P04325	119+04326	119P04326	119+04327	119P04327	119+04328	119P04328	119+04329	119P04329	119+04330	119P04330
MILES	0.029472	0.144632	0.116189	0.066308	0.031233	0.495771	0.082907	0.187632	0.716904	0.129747	0.54927	0.421106
3:45 AM	61	61	61	61	62	62	63	63	62	62	61	61
4:00 AM	63	63	62	62	63	63	64	64	63	63	62	62
4:15 AM	60	60	61	61	61	61	62	62	61	61	60	60
4:30 AM	62	62	63	63	63	63	63	63	62	62	62	62
4:45 AM	63	63	63	63	64	64	64	64	63	63	63	63
5:00 AM	62	62	62	62	63	63	63	63	63	63	63	63
5:15 AM	64	64	64	64	65	65	65	65	63	63	62	62
5:30 AM	64	64	64	64	66	66	65	65	64	64	64	64
5:45 AM	64	64	64	64	66	66	66	66	65	65	65	65
6:00 AM	64	64	64	64	65	65	65	65	64	64	64	64
6:15 AM	62	62	63	63	65	65	64	64	63	63	63	63
6:30 AM	60	60	61	61	63	63	63	63	61	61	63	63
6:45 AM	61	61	61	61	64	64	64	64	61	61	63	63
7:00 AM	61	61	62	62	64	64	64	64	62	62	64	64
7:15 AM	59	59	61	61	63	63	63	63	62	62	63	63
7:30 AM	56	56	59	59	63	63	63	63	61	61	62	62
7:45 AM	55	55	59	59	64	64	63	63	61	61	60	60

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119+04325	119P04325	119+04326	119P04326	119+04327	119P04327	119+04328	119P04328	119+04329	119P04329	119+04330	119P04330
MILES	0.029472	0.144632	0.116189	0.066308	0.031233	0.495771	0.082907	0.187632	0.716904	0.129747	0.54927	0.421106
8:00 AM	56	56	60	60	60	60	60	60	61	61	61	61
8:15 AM	56	56	58	58	58	58	58	58	60	60	61	61
8:30 AM	57	57	58	58	59	59	60	60	60	60	60	60
8:45 AM	60	60	61	61	63	63	61	61	60	60	55	55
9:00 AM	61	61	62	62	63	63	62	62	61	61	56	56
9:15 AM	61	61	61	61	63	63	62	62	61	61	61	61
9:30 AM	60	60	61	61	62	62	62	62	61	61	61	61
9:45 AM	60	60	60	60	62	62	62	62	60	60	61	61
10:00 AM	61	61	61	61	62	62	62	62	61	61	61	61
10:15 AM	61	61	61	61	62	62	62	62	60	60	57	57
10:30 AM	61	61	61	61	62	62	61	61	58	58	56	56
10:45 AM	61	61	61	61	62	62	58	58	57	57	51	51
11:00 AM	61	61	61	61	61	61	57	57	56	56	56	56
11:15 AM	61	61	61	61	63	63	62	62	60	60	61	61
11:30 AM	61	61	61	61	63	63	62	62	60	60	61	61
11:45 AM	61	61	61	61	63	63	62	62	61	61	61	61
12:00 PM	61	61	61	61	62	62	62	62	61	61	61	61

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119+04325	119P04325	119+04326	119P04326	119+04327	119P04327	119+04328	119P04328	119+04329	119P04329	119+04330	119P04330
MILES	0.029472	0.144632	0.116189	0.066308	0.031233	0.495771	0.082907	0.187632	0.716904	0.129747	0.54927	0.421106
12:15 PM	60	60	60	60	62	62	61	61	60	60	61	61
12:30 PM	60	60	60	60	62	62	61	61	60	60	61	61
12:45 PM	60	60	61	61	62	62	61	61	60	60	61	61
1:00 PM	61	61	61	61	62	62	61	61	60	60	61	61
1:15 PM	61	61	61	61	62	62	62	62	61	61	61	61
1:30 PM	61	61	61	61	62	62	62	62	61	61	61	61
1:45 PM	61	61	61	61	62	62	62	62	61	61	61	61
2:00 PM	61	61	61	61	62	62	62	62	61	61	62	62
2:15 PM	61	61	61	61	63	63	62	62	61	61	62	62
2:30 PM	61	61	62	62	63	63	62	62	61	61	62	62
2:45 PM	62	62	62	62	63	63	62	62	62	62	60	60
3:00 PM	62	62	62	62	64	64	63	63	62	62	60	60
3:15 PM	62	62	62	62	64	64	63	63	61	61	57	57
3:30 PM	62	62	62	62	64	64	62	62	61	61	49	49
3:45 PM	62	62	63	63	64	64	63	63	60	60	39	39
4:00 PM	63	63	63	63	64	64	63	63	60	60	42	42
4:15 PM	59	59	62	62	64	64	62	62	58	58	38	38

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119+04325	119P04325	119+04326	119P04326	119+04327	119P04327	119+04328	119P04328	119+04329	119P04329	119+04330	119P04330
MILES	0.029472	0.144632	0.116189	0.066308	0.031233	0.495771	0.082907	0.187632	0.716904	0.129747	0.54927	0.421106
4:30 PM	60	60	62	62	64	64	62	62	59	59	36	36
4:45 PM	62	62	62	62	63	63	60	60	57	57	31	31
5:00 PM	61	61	61	61	62	62	60	60	56	56	34	34
5:15 PM	60	60	60	60	61	61	60	60	55	55	30	30
5:30 PM	60	60	60	60	61	61	61	61	58	58	33	33
5:45 PM	61	61	61	61	62	62	59	59	59	59	44	44
6:00 PM	61	61	61	61	61	61	60	60	60	60	57	57
6:15 PM	60	60	60	60	62	62	62	62	60	60	60	60
6:30 PM	61	61	60	60	62	62	62	62	60	60	61	61
6:45 PM	61	61	61	61	62	62	63	63	61	61	61	61
7:00 PM	60	60	56	56	61	61	62	62	61	61	59	59
7:15 PM	59	59	54	54	61	61	62	62	61	61	61	61
7:30 PM	60	60	58	58	61	61	60	60	58	58	61	61
7:45 PM	61	61	60	60	61	61	59	59	57	57	61	61
8:00 PM	61	61	61	61	62	62	59	59	58	58	61	61
8:15 PM	60	60	60	60	61	61	62	62	61	61	59	59
8:30 PM	61	61	60	60	61	61	62	62	62	62	57	57

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119+04325	119P04325	119+04326	119P04326	119+04327	119P04327	119+04328	119P04328	119+04329	119P04329	119+04330	119P04330
MILES	0.029472	0.144632	0.116189	0.066308	0.031233	0.495771	0.082907	0.187632	0.716904	0.129747	0.54927	0.421106
8:45 PM	60	60	60	60	61	61	62	62	62	62	59	59
9:00 PM	60	60	60	60	61	61	61	61	61	61	61	61
9:15 PM	59	59	59	59	61	61	62	62	61	61	61	61
9:30 PM	60	60	60	60	61	61	62	62	62	62	61	61
9:45 PM	60	60	60	60	61	61	62	62	62	62	62	62
10:00 PM	60	60	60	60	61	61	62	62	61	61	62	62
10:15 PM	60	60	60	60	62	62	62	62	61	61	61	61
10:30 PM	61	61	61	61	62	62	62	62	62	62	61	61
10:45 PM	61	61	61	61	62	62	63	63	63	63	62	62
11:00 PM	60	60	61	61	62	62	63	63	62	62	62	62
11:15 PM	60	60	61	61	62	62	62	62	62	62	61	61
11:30 PM	61	61	61	61	63	63	63	63	63	63	62	62
11:45 PM	61	61	61	61	62	62	63	63	63	63	62	62

Table A.2. I-64 Speed Data Between Kingshighway Blvd./Exit 36 and Jefferson Ave./Exit 38 using HERE data - Right graph September 15, 2021, through March 15, 2022 (Every Weekday)

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119N04325	119-04325	119N04326	119-04326	119N04327	119-04327	119N04328	119-04328	119N04329	119-04329	119N04330	119-04330
MILES	0.144143	0.114763	0.124937	0.195177	0.244066	0.1101	0.187632	0.684453	0.188663	0.477476	0.444584	0.764113
12:00 AM	62	62	61	61	60	60	61	61	62	62	64	64
12:15 AM	62	62	61	61	60	60	61	61	62	62	64	64
12:30 AM	61	61	61	61	60	60	60	60	61	61	64	64
12:45 AM	61	61	61	61	59	59	60	60	61	61	64	64
1:00 AM	60	60	60	60	60	60	60	60	61	61	63	63
1:15 AM	60	60	61	61	60	60	60	60	61	61	63	63
1:30 AM	59	59	60	60	59	59	59	59	60	60	64	64
1:45 AM	60	60	61	61	60	60	60	60	61	61	63	63
2:00 AM	60	60	60	60	59	59	60	60	60	60	64	64
2:15 AM	60	60	59	59	59	59	59	59	60	60	63	63
2:30 AM	59	59	59	59	58	58	58	58	60	60	62	62
2:45 AM	58	58	59	59	58	58	59	59	60	60	63	63
3:00 AM	58	58	58	58	58	58	59	59	60	60	62	62
3:15 AM	60	60	59	59	58	58	59	59	60	60	63	63
3:30 AM	60	60	60	60	60	60	60	60	61	61	63	63

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119N04325	119-04325	119N04326	119-04326	119N04327	119-04327	119N04328	119-04328	119N04329	119-04329	119N04330	119-04330
MILES	0.144143	0.114763	0.124937	0.195177	0.244066	0.1101	0.187632	0.684453	0.188663	0.477476	0.444584	0.764113
3:45 AM	61	61	61	61	61	61	61	61	61	61	64	64
4:00 AM	59	59	61	61	61	61	61	61	61	61	63	63
4:15 AM	58	58	60	60	60	60	60	60	61	61	63	63
4:30 AM	59	59	60	60	59	59	60	60	60	60	63	63
4:45 AM	63	63	63	63	62	62	62	62	63	63	66	66
5:00 AM	62	62	63	63	62	62	63	63	63	63	66	66
5:15 AM	63	63	64	64	64	64	63	63	64	64	67	67
5:30 AM	65	65	65	65	65	65	64	64	65	65	68	68
5:45 AM	65	65	65	65	64	64	64	64	65	65	67	67
6:00 AM	64	64	63	63	63	63	63	63	64	64	66	66
6:15 AM	62	62	61	61	62	62	62	62	63	63	66	66
6:30 AM	63	63	57	57	57	57	62	62	64	64	65	65
6:45 AM	65	65	59	59	56	56	62	62	64	64	65	65
7:00 AM	65	65	59	59	54	54	62	62	64	64	65	65
7:15 AM	66	66	60	60	57	57	62	62	64	64	66	66
7:30 AM	64	64	59	59	50	50	61	61	62	62	64	64
7:45 AM	64	64	59	59	51	51	58	58	61	61	63	63

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119N04325	119-04325	119N04326	119-04326	119N04327	119-04327	119N04328	119-04328	119N04329	119-04329	119N04330	119-04330
MILES	0.144143	0.114763	0.124937	0.195177	0.244066	0.1101	0.187632	0.684453	0.188663	0.477476	0.444584	0.764113
8:00 AM	64	64	58	58	52	52	59	59	60	60	63	63
8:15 AM	64	64	58	58	51	51	58	58	59	59	63	63
8:30 AM	63	63	56	56	54	54	58	58	62	62	64	64
8:45 AM	63	63	56	56	51	51	59	59	62	62	64	64
9:00 AM	63	63	63	63	61	61	60	60	63	63	65	65
9:15 AM	63	63	63	63	61	61	60	60	62	62	64	64
9:30 AM	63	63	63	63	61	61	60	60	62	62	64	64
9:45 AM	63	63	63	63	61	61	60	60	62	62	65	65
10:00 AM	63	63	63	63	61	61	60	60	62	62	65	65
10:15 AM	62	62	62	62	61	61	60	60	62	62	65	65
10:30 AM	58	58	58	58	61	61	60	60	62	62	65	65
10:45 AM	60	60	54	54	56	56	60	60	60	60	64	64
11:00 AM	62	62	61	61	60	60	60	60	63	63	65	65
11:15 AM	62	62	61	61	59	59	60	60	62	62	65	65
11:30 AM	62	62	61	61	59	59	59	59	62	62	65	65
11:45 AM	62	62	61	61	59	59	60	60	62	62	65	65
12:00 PM	62	62	61	61	60	60	60	60	62	62	65	65

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119N04325	119-04325	119N04326	119-04326	119N04327	119-04327	119N04328	119-04328	119N04329	119-04329	119N04330	119-04330
MILES	0.144143	0.114763	0.124937	0.195177	0.244066	0.1101	0.187632	0.684453	0.188663	0.477476	0.444584	0.764113
12:15 PM	63	63	62	62	60	60	59	59	62	62	64	64
12:30 PM	62	62	62	62	60	60	59	59	62	62	64	64
12:45 PM	62	62	62	62	60	60	59	59	62	62	64	64
1:00 PM	62	62	62	62	60	60	59	59	62	62	64	64
1:15 PM	63	63	62	62	60	60	60	60	62	62	64	64
1:30 PM	62	62	62	62	60	60	60	60	62	62	64	64
1:45 PM	63	63	62	62	61	61	60	60	62	62	65	65
2:00 PM	63	63	62	62	60	60	60	60	62	62	65	65
2:15 PM	62	62	62	62	60	60	60	60	62	62	65	65
2:30 PM	61	61	61	61	60	60	60	60	62	62	65	65
2:45 PM	60	60	60	60	60	60	60	60	62	62	65	65
3:00 PM	59	59	60	60	60	60	60	60	63	63	65	65
3:15 PM	60	60	59	59	58	58	60	60	63	63	65	65
3:30 PM	59	59	58	58	58	58	60	60	63	63	65	65
3:45 PM	58	58	58	58	56	56	60	60	63	63	65	65
4:00 PM	55	55	56	56	56	56	59	59	62	62	65	65
4:15 PM	54	54	56	56	56	56	59	59	62	62	65	65

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119N04325	119-04325	119N04326	119-04326	119N04327	119-04327	119N04328	119-04328	119N04329	119-04329	119N04330	119-04330
MILES	0.144143	0.114763	0.124937	0.195177	0.244066	0.1101	0.187632	0.684453	0.188663	0.477476	0.444584	0.764113
4:30 PM	52	52	54	54	57	57	59	59	62	62	65	65
4:45 PM	52	52	53	53	57	57	58	58	61	61	65	65
5:00 PM	52	52	53	53	57	57	58	58	61	61	64	64
5:15 PM	53	53	57	57	58	58	58	58	61	61	63	63
5:30 PM	58	58	59	59	58	58	58	58	61	61	63	63
5:45 PM	60	60	60	60	58	58	58	58	60	60	63	63
6:00 PM	60	60	59	59	57	57	58	58	61	61	63	63
6:15 PM	59	59	58	58	56	56	56	56	60	60	62	62
6:30 PM	57	57	57	57	56	56	56	56	60	60	61	61
6:45 PM	52	52	56	56	57	57	55	55	58	58	62	62
7:00 PM	51	51	51	51	55	55	55	55	55	55	62	62
7:15 PM	52	52	52	52	57	57	57	57	57	57	57	57
7:30 PM	54	54	51	51	57	57	59	59	61	61	54	54
7:45 PM	58	58	58	58	59	59	60	60	61	61	57	57
8:00 PM	60	60	61	61	60	60	60	60	61	61	58	58
8:15 PM	58	58	61	61	60	60	60	60	61	61	57	57
8:30 PM	60	60	61	61	60	60	60	60	61	61	59	59

NAME	JEFFERSON AVE/EXIT 38	JEFFERSON AVE/EXIT 38	MARKET ST 3000 WEST/EXIT 38	MARKET ST 3000 WEST/EXIT 38	FOREST PARK BLVD/EXIT 38	FOREST PARK BLVD/EXIT 38	GRAND BLVD/MARKET ST/EXIT 37	GRAND BLVD/MARKET ST/EXIT 37	CHOUTEAU AVE/BOYLE AVE/EXIT 36	CHOUTEAU AVE/BOYLE AVE/EXIT 36	KINGSHIGHWAY/EXIT 36	KINGSHIGHWAY/EXIT 36
TMC CODE	119N04325	119-04325	119N04326	119-04326	119N04327	119-04327	119N04328	119-04328	119N04329	119-04329	119N04330	119-04330
MILES	0.144143	0.114763	0.124937	0.195177	0.244066	0.1101	0.187632	0.684453	0.188663	0.477476	0.444584	0.764113
8:45 PM	62	62	61	61	60	60	61	61	62	62	58	58
9:00 PM	62	62	61	61	60	60	61	61	62	62	61	61
9:15 PM	62	62	61	61	60	60	61	61	62	62	62	62
9:30 PM	61	61	61	61	60	60	60	60	62	62	62	62
9:45 PM	61	61	62	62	61	61	61	61	62	62	65	65
10:00 PM	62	62	61	61	61	61	61	61	62	62	65	65
10:15 PM	62	62	59	59	60	60	61	61	62	62	65	65
10:30 PM	61	61	59	59	59	59	61	61	62	62	65	65
10:45 PM	62	62	62	62	61	61	61	61	62	62	65	65
11:00 PM	61	61	61	61	61	61	61	61	62	62	65	65
11:15 PM	62	62	62	62	61	61	61	61	62	62	65	65
11:30 PM	62	62	61	61	61	61	61	61	62	62	65	65
11:45 PM	61	61	61	61	60	60	60	60	62	62	65	65

Appendix B

TIER 1 YEAR 2022 BASELINE TRAFFIC OPERATING CONDITIONS – VISSIM

Table B.1. Year 2022 VISSIM Link Segment Results – Tier 1

Link Number	Direction	Name	Type	AM PEAK HOUR			PM PEAK HOUR		
				LOS	Density (veh/mi/ln)	Speed (mph)	LOS	Density (veh/mi/ln)	Speed (mph)
1	EB	I-64 EB west of Kingshighway Blvd.	Basic	D	28.0	58	C	20.1	59
2	EB	Kingshighway Blvd. EB Off-Ramp Decel Lane	Diverge	C	26.3	50	B	16.6	57
3	EB	Btwn Kingshighway Blvd. EB Off-Ramp & EB On-Ramp	Basic	C	24.2	58	B	16.1	59
4	EB	Btwn Kingshighway Blvd. EB On-Ramp & Tower Grove EB Off-Ramp	Weave	C	23.6	55	B	15.7	58
5	EB	Btwn Tower Grove EB Off-Ramp & Vandeventer Ave./Papin St. EB Off-Ramp	Diverge	C	24.6	56	B	18.0	58
6	EB	Btwn Vandeventer Ave./Papin St. EB Off-Ramp & Papin St. EB On-Ramp	Basic	D	28.5	58	C	20.8	59
7	EB	Papin St. EB On-Ramp Accel Lane	Merge	C	24.6	52	C	21.0	49
8	EB	Btwn Papin St. EB On-Ramp & Market St. EB Off-Ramp	Basic	D	29.9	58	C	23.6	58
9	EB	Market St. EB Off-Ramp Decel Lane	Diverge	C	22.4	58	B	17.6	59
10	EB	Btwn Market St. EB Off-Ramp & Grand Blvd. EB Off-Ramp	Basic	D	27.4	58	C	22.1	58
11	EB	Grand Blvd. EB Off-Ramp Decel Lane	Diverge	C	22.1	54	B	17.7	54

Link Number	Direction	Name	Type	AM PEAK HOUR			PM PEAK HOUR		
				LOS	Density (veh/mi/ln)	Speed (mph)	LOS	Density (veh/mi/ln)	Speed (mph)
12	EB	Btwn Grand Blvd. EB Off-Ramp & Forest Park Ave. EB On-Ramp	Basic	C	24.5	58	C	19.8	59
13	EB	Btwn Forest Park Ave. EB On-Ramp & Jefferson Ave. EB Off-Ramp	Weave	C	20.1	58	B	18.6	57
14	EB	Jefferson Ave. Off-Ramp Decel Lane	Diverge	B	15.9	58	B	14.6	58
15	EB	Btwn Jefferson Ave. EB Off-Ramp & 22nd St. EB Off-Ramp	Diverge	B	16.9	59	B	13.9	59
16	EB	Btwn 22nd St. EB Off-Ramp & EB On-Ramp	Basic	C	20.2	59	B	16.3	59
17	EB	I-64 EB east of 22nd St	Merge	B	15.7	59	B	14.6	59
18	WB	I-64 WB east of 22nd St	Diverge	B	17.8	59	B	14.2	59
19	WB	Btwn 22nd St. WB Off-Ramp & WB On-Ramp	Basic	C	20.3	59	B	17.3	59
20	WB	22nd St. WB On-Ramp Accel Lane	Merge	B	16.0	58	B	14.5	58
21	WB	Btwn 22nd St. WB On-Ramp & Jefferson Ave. WB On-Ramp	Basic	C	21.4	59	C	19.4	59
22	WB	Btwn Jefferson Ave. WB On-Ramp & Forest Park Ave. WB Off-Ramp	Weave	B	19.7	57	B	18.6	57
23	WB	Btwn Forest Park Ave. WB Off-Ramp & Market St. WB On-Ramp	Basic	C	21.8	59	C	20.9	59
24	WB	Market St. WB On-Ramp Accel Lane	Merge	B	18.2	58	B	18.4	58
25	WB	Btwn Market St. WB On-Ramp & Grand Blvd. WB On-Ramp	Basic	C	24.2	58	C	24.2	58

Link Number	Direction	Name	Type	AM PEAK HOUR			PM PEAK HOUR		
				LOS	Density (veh/mi/ln)	Speed (mph)	LOS	Density (veh/mi/ln)	Speed (mph)
26	WB	Grand Blvd. WB On-Ramp Accel Lane	Merge	C	21.2	55	C	21.7	55
27	WB	Btwn Grand Blvd. WB On-Ramp & Boyle Ave. WB Off-Ramp	Basic	D	27.0	57	D	27.4	58
28	WB	Boyle Ave. WB Off-Ramp Decel Lane	Diverge	C	22.1	53	C	21.0	57
29	WB	Btwn Boyle Ave. WB Off-Ramp & Vandeventer Ave./Papin St. On-Ramp	Basic	C	24.0	58	D	26.1	58
30	WB	Btwn Vandeventer Ave./Papin St. On-Ramp & Boyle Ave. WB On-Ramp	Basic	C	19.8	59	C	21.7	59
31	WB	Btwn Boyle Ave. WB On-Ramp & Kingshighway WB Off-Ramp	Weave	B	17.8	56	C	21.4	54
32	WB	Btwn Kingshighway Blvd. WB Off-Ramp & WB On-Ramp	Basic	B	17.7	58	F	59.9	21
33	WB	Kingshighway Blvd. WB On-Ramp Accel Lane	Merge	B	17.1	57	F	90.8	13
34	WB	I-64 WB west of Kingshighway Blvd.	Basic	C	21.0	59	F	106.8	14

Table B.2. Year 2022 VISSIM Baseline Traffic Operating Conditions – Tier 1

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	**PM Peak Hour**
I-64 and Kingshighway Blvd. (signalized)		
Overall Intersection	**D (46.2)**	**D (36.3)**
Eastbound Approach	F (96.0) [226] <588>	E (57.7) [108] <362>
Westbound Approach	E (56.1) [77] <293>	E (59.2) [87] <296>
Northbound Approach	D (49.8) [241] <522>	D (35.6) [156] <395>
Southbound Approach	D (44.5) [209] <511>	D (43.5) [265] <551>
I-64 EB Off-Ramp and Tower Grove Ave. (roundabout)		
Overall Intersection	**A (6.7)**	**A (1.9)**
Eastbound Approach	A (5.4) [<25] <486>	A (2.1) [<25] <118>
Northbound Approach	B (17.8) [<25] <167>	A (2.4) [<25] <73>
Southbound Approach	A (1.4) [<25] <22>	A (1) [<25] <45>
I-64 WB Off-Ramp and Boyle Ave. (signalized)		
Overall Intersection	**B (18.4)**	**A (8.8)**
Westbound Approach	D (39) [167] <629>	C (22.8) [38] <155>
Northbound Approach	A (7) [<25] <131>	A (4.8) [<25] <89>
Southbound Approach	A (3.9) [<25] <121>	A (7.3) [36] <453>
I-64 EB On-Ramp and Papin St. (unsignalized)		
Overall Intersection	**A (0.8)**	**A (1.8)**
Eastbound Approach	A (0.8) [<25] <49>	A (1.7) [<25] <127>
Westbound Approach	A (0.5) [<25] <21>	A (2) [<25] <37>
I-64 EB Off-Ramp and Papin St./Vandeventer Ave. (signalized)		
Overall Intersection	**C (30.8)**	**C (32.7)**
Eastbound Approach	D (54.7) [95] <325>	E (59.1) [88] <260>
Westbound Approach	C (34.1) [59] <238>	C (33.8) [53] <187>
Northbound Approach	B (19.5) [93] <515>	C (21.9) [80] <437>
Southbound Approach	B (19.9) [43] <282>	C (24.3) [95] <542>
I-64 WB On-Ramp and Grand Blvd. (unsignalized)		
Overall Intersection	**A (1.2)**	**A (1.6)**
Westbound Approach	B (11.2) [0] <43>	B (13.2) [2] <77>
Northbound Approach	A (0.8) [0] <72>	A (1.4) [1] <85>
Southbound Approach	A (0.9) [1] <91>	A (1.4) [6] <195>
I-64 EB Off-Ramp and Grand Blvd. (signalized)		
Overall Intersection	**B (16.4)**	**B (12.0)**
Westbound Approach	D (45.1) [144] <595>	D (41.1) [110] <447>
Northbound Approach	B (12.1) [<25] <306>	B (11.1) [<25] <276>
Southbound Approach	A (6.2) [<25] <294>	A (2.2) [<25] <219>

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
I-64 EB Off-Ramp at Market St. and Compton Ave. (signalized)		
Overall Intersection	**D (43.9)**	**D (39.7)**
Eastbound Approach	C (29.4) [55] <319>	C (27.4) [55] <339>
Westbound Approach	D (38.3) [44] <265>	D (40.8) [108] <448>
Northbound Approach	E (63.1) [220] <636>	D (53.6) [137] <449>
Southbound Approach	C (32) [61] <212>	C (29.3) [88] <302>
I-64 EB Off-Ramps and Jefferson Ave. (signalized)		
Overall Intersection	**B (18.3)**	**B (13.3)**
Eastbound Approach	C (27.3) [65] <248>	C (22.6) [69] <418>
Northbound Approach	C (20.8) [59] <490>	B (15.6) [<25] <217>
Southbound Approach	A (3.7) [<25] <211>	A (5.8) [<25] <223>
I-64 WB On-Ramps and Jefferson Ave. (signalized)		
Overall Intersection	**B (16.8)**	**C (26.9)**
Westbound Approach	E (68.2) [88] <283>	E (67.4) [52] <211>
Northbound Approach	B (13.5) [75] <220>	A (7.0) [56] <207>
Southbound Approach	C (24.2) [53] <215>	D (35.4) [215] <838>
22nd St. and WB Outer Road (signalized)		
Overall Intersection	**B (13.0)**	**A (8.9)**
Westbound Approach	C (22.3) [49] <212>	C (23.1) [26] <133>
Northbound Approach	A (5.4) [22] <270>	A (4.3) [<25] <253>
Southbound Approach	A (4.4) [<25] <116>	A (4.7) [<25] <222>
Scott Ave. and Eastbound Outer Road (signalized)		
Overall Intersection	**C (22.7)**	**B (16.5)**
Eastbound Approach	C (28.8) [92] <454>	C (25.2) [83] <404>
Northbound Approach	A (9.3) [<25] <115>	A (4.3) [<25] <99>
Southbound Approach	B (11) [<25] <90>	B (11.6) [<25] <217>
I-64 EB Slip Ramp Off (unsignalized)		
Overall Intersection	**A (0.9)**	**A (1.3)**
Eastbound Approach	A (0.2) [<25] <0>	A (0.5) [<25] <0>
Southbound Approach	A (1) [<25] <30>	A (1.5) [<25] <82>
I-64 WB Slip Ramp On (unsignalized)		
Overall Intersection	**A (0.3)**	**A (0.2)**
Westbound Approach	A (0.3) [<25] <2>	A (0.2) [<25] <2>

Appendix C

TIER 1 YEAR 2022 BASELINE TRAFFIC OPERATING CONDITIONS – SYNCHRO

Table C.1. Year 2022 Synchro Baseline Traffic Operating Conditions – Tier 1

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
I-64 and Kingshighway Blvd. (signalized)		
Overall Intersection	**D (53.2)**	**D (49.4)**
Eastbound Approach	D (56.7) [306] <0.75>	E (62.8) [280] <0.77>
Westbound Approach	D (47.7) [176] <0.47>	E (55.1) [218] <0.58>
Northbound Approach	D (36.9) [252] <0.73>	D (42.1) [336] <0.77>
Southbound Approach	E (69.1) [#434] <1.14>	D (49.7) [521] <0.86>
I-64 EB Off-Ramp and Tower Grove Ave. (roundabout, Sidra Results)		
Overall Intersection	**A (6.7)**	**A (5.4)**
Eastbound Approach	A (6.5) [77] <0.43>	A (5.6) [<25] <0.17>
Northbound Approach	A (9.0) [<25] <0.18>	A (5.4) [<25] <0.11>
Southbound Approach	A (4.5) [<25] <0.03>	A (4.7) [<25] <0.08>
I-64 WB Off-Ramp and Boyle Ave. (signalized)		
Overall Intersection	**A (8.7)**	**B (10.0)**
Westbound Approach	A (4.7) [34] <0.51>	C (23.3) [100] <0.56>
Northbound Approach	B (15.2) [73] <0.45>	A (2.8) [<25] <0.24>
Southbound Approach	A (8.3) [68] <0.45>	A (9.0) [272] <0.54>
I-64 EB On-Ramp and Papin St. (unsignalized, Sim Traffic Results)		
Eastbound Left-Turn	A (2.5) [<25]	A (2.9) [62]
I-64 EB Off-Ramp and Papin St./Vandeventer Ave. (signalized)		
Overall Intersection	**C (32.7)**	**C (28.1)**
Eastbound Approach	D (34.2) [194] <0.66>	D (44.4) [#220] <0.77>
Westbound Approach	D (40.2) [116] <0.56>	D (41.1) [118] <0.57>
Northbound Approach	C (30.1) [170] <0.71>	C (27.6) [140] <0.71>
Southbound Approach	C (33.0) [180] <0.26>	B (17.5) [213] <0.46>
I-64 WB On-Ramp and Grand Blvd. (unsignalized)		
Westbound Approach	B (11.9) [<25] <0.01>	E (37.0) [28] <0.28>
Northbound Left-Turn	B (13.4) [55] <0.44>	C (16.4) [68] <0.50>
Southbound Left-Turn	B (10.1) [<25] <0.00>	A (9.8) [<25] <0.01>
I-64 EB Off-Ramp and Grand Blvd. (signalized)		
Overall Intersection	**B (19.6)**	**B (14.3)**
Westbound Approach	E (60.4) [270] <0.79>	E (66.2) [295] <0.78>
Northbound Approach	A (7.3) [112] <0.32>	A (4.7) [54] <0.27>
Southbound Approach	A (5.5) [92] <0.33>	A (1.6) [<25] <0.32>
I-64 EB Off-Ramp at Market St. and Compton Ave. (signalized)		
Overall Intersection	**C (32.8)**	**C (27.9)**
Eastbound Approach	C (27.4) [172] <0.28>	C (21.9) [141] <0.29>

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Westbound Approach	C (23.4) [71] <0.24>	C (29.8) [207] <0.57>
Northbound Approach	D (35.4) [172] <0.81>	C (27.8) [87] <0.78>
Southbound Approach	D (40.7) [125] <0.46>	C (31.5) [192] <0.45>
Market St. and Bernard St. (unsignalized, Sim Traffic Results)		
Eastbound Left-Turn	A (0.4) [<25]	A (0.0) [<25] <0.00>
I-64 WB Off-Ramp and Grand Blvd./Forest Park Ave. (unsignalized, Sim Traffic Results)		
Westbound Approach	A (9.2) [106]	A (9.5) [134]
I-64 EB Off-Ramps and Jefferson Ave. (signalized)		
Overall Intersection	**B (11.6)**	**D (48.5)**
Eastbound Approach	C (33.2) [202] <0.64>	F (132.1) [#593] <1.24>
Northbound Approach	A (4.2) [148] <0.33>	A (9.6) [98] <0.21>
Southbound Approach	A (9.7) [79] <0.21>	B (12.8) [507] <0.88>
I-64 WB On-Ramps and Jefferson Ave. (signalized)		
Overall Intersection	**B (16.9)**	**C (24.7)**
Westbound Approach	E (72.3) [#168] <0.85>	E (62.6) [#126] <0.71>
Northbound Approach	A (3.1) [67] <0.34>	B (11.5) [222] <0.27>
Southbound Approach	C (27.6) [101] <0.45>	C (29.0) [m362] <0.68>
22nd St. and WB Outer Road (signalized)		
Overall Intersection	**B (18.3)**	**B (17.3)**
Westbound Approach	B (18.0) [110] <0.54>	C (23.1) [74] <0.45>
Northbound Approach	C (26.7) [304] <0.46>	D (36.1) [288] <0.32>
Southbound Approach	A (3.2) [27] <0.19>	A (2.6) [35] <0.31>
Scott Ave. and Eastbound Outer Road (signalized)		
Overall Intersection	**C (20.5)**	**B (16.6)**
Eastbound Approach	C (28.1) [104] <0.75>	C (30.0) [m151] <0.72>
Northbound Approach	A (5.8) [36] <0.08>	A (2.3) [28] <0.22>
Southbound Approach	A (5.0) [24] <0.09>	A (5.9) [118] <0.33>

Delay presented in vehicles per second

Appendix D

TIER 2 YEAR 2022 BASELINE TRAFFIC OPERATING CONDITIONS – SYNCHRO

Table D.1. Year 2022 Synchro Baseline Traffic Operating Conditions – Tier 2

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Kingshighway & Forest Park Ave. (signalized)		
Overall Intersection	D	D
Kingshighway & Parkview Pl. (signalized)		
Overall Intersection	A	A
Kingshighway & Children's Pl. (signalized)		
Overall Intersection	A	A
Kingshighway & Barnes Jewish Hospital Plz. (signalized)		
Overall Intersection	C	C
Kingshighway & Oakland Ave. (signalized)		
Overall Intersection	B	C
Kingshighway & Rte. 100 (Choteau Ave./Manchester Ave.) (signalized)		
Overall Intersection	D	E
Forest Park Ave. & Euclid Ave. (signalized)		
Overall Intersection	B	C
Forest Park Ave. & Taylor Ave. (signalized)		
Overall Intersection	C	D
Forest Park Ave. & Newstead Ave. (signalized)		
Overall Intersection	C	C
Forest Park Ave. & Boyle Ave. (signalized)		
Overall Intersection	B	C
Forest Park Ave. & Sarah St. (signalized)		
Overall Intersection	C	C
Forest Park Ave. & Vandeventer Ave. (signalized)		
Overall Intersection	D	D
Forest Park Ave. & Spring Ave. (signalized)		
Overall Intersection	B	C
Forest Park Ave. & Grand Blvd. (signalized)		
Overall Intersection	C	C
Clayton Ave. & Taylor Ave. (signalized)		
Overall Intersection	B	C
Clayton Ave. & Newstead Ave. (signalized)		
Overall Intersection	C	C
Clayton Ave. & Tower Grove Ave. (signalized)		
Overall Intersection	B	B
Clayton Ave. & Boyle Ave. (signalized)		
Overall Intersection	D	E

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Clayton Ave. & Sarah St. (unsignalized, all-way STOP)		
Overall Intersection	A	B
Papin St. & Boyle Ave. (signalized)		
Overall Intersection	A	B
Papin St. & Sarah St. (unsignalized, all-way STOP)		
Overall Intersection	A	B
Rte. 100 (Chouteau Ave./Manchester Ave.) & Taylor Ave. (signalized)		
Overall Intersection	B	B
Rte. 100 (Chouteau Ave./Manchester Ave.) & Newstead Ave. (signalized)		
Overall Intersection	A	A
Rte. 100 (Chouteau Ave./Manchester Ave.) & Tower Grove Ave. (signalized)		
Overall Intersection	B	C
Rte. 100 (Chouteau Ave./Manchester Ave.) & Boyle Ave. (signalized)		
Overall Intersection	B	B
Rte. 100 (Chouteau Ave./Manchester Ave.) & Sarah St. (signalized)		
Overall Intersection	B	C
Rte. 100 (Chouteau Ave./Manchester Ave.) & Vandeventer Ave. (signalized)		
Overall Intersection	D	C
Vandeventer Ave. & Market St. (unsignalized, Sim Traffic Result)		
Overall Intersection	A	A
Vandeventer Ave. & Ikea Way/Foundry Way (signalized)		
Overall Intersection	A	A
Rte. 100 (Chouteau Ave./Manchester Ave.) & S 39th St. (signalized)		
Overall Intersection	B	B
Rte. 100 (Chouteau Ave./Manchester Ave.) & Spring Ave. (signalized)		
Overall Intersection	A	A
Rte. 100 (Chouteau Ave./Manchester Ave.) & Grand Blvd. (signalized)		
Overall Intersection	C	C
Rte. 100 (Chouteau Ave./Manchester Ave.) & Compton Ave. (signalized)		
Overall Intersection	D	C
Rte. 100 (Chouteau Ave./Manchester Ave.) & Jefferson Ave. (signalized)		
Overall Intersection	D	D
Grand Blvd. & Council Plz. (signalized)		
Overall Intersection	A	A
Compton Ave. & Spruce St. (signalized)		
Overall Intersection	A	B
Jefferson Ave. & Scott Ave. (signalized)		

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Overall Intersection	B	B
Jefferson Ave. & Clark Ave. (unsignalized, side-St STOP)		
Overall Intersection	D	E
Jefferson Ave. & Market St. (signalized)		
Overall Intersection	B	C

Appendix E

EXISTING CRASH RATES

Table E.1. Existing Crash Rate Calculations

ID	Name	AADT (2019)	Functional Classification	Miles	Crashes per Mile	Observed Crash Rate	Exposure	Statewide Critical Crash Rate	Urbanized Critical Crash Rate	Stl Critical Crash Rate	Statewide CCR Difference	Urbanized CCR Difference	Stl CCR Difference
1	Interstate 64 On-Ramp	3,111	Ramp	0.20	1.98	174.52	229,192.34	708.43	699.26	5,808.29	-533.92	-524.75	-5,633.78
2	BERNARD ST	4,184	Ramp	0.16	5.09	333.33	239,988.45	708.43	699.26	5,808.29	-375.10	-365.93	-5,474.96
3	Interstate 64 On-Ramp	7,078	Ramp	0.17	3.49	135.24	443,642.50	708.41	699.24	5,808.22	-573.17	-564.00	-5,672.98
4	Interstate 64 On-Ramp	4,681	Ramp	0.33	2.42	141.82	564,068.19	708.40	699.23	5,808.20	-566.58	-557.41	-5,666.38
5	Interstate 64 On-Ramp	5,905	Ramp	0.40	3.46	160.67	871,321.81	708.39	699.22	5,808.16	-547.72	-538.55	-5,647.50
6	Interstate 64 Off-Ramp	9,020	Ramp	0.23	7.11	215.92	740,956.50	708.39	699.22	5,808.18	-492.47	-483.30	-5,592.25
7	Interstate 64 Off-Ramp	5,363	Ramp	0.09	52.90	2,702.23	185,021.03	708.44	699.27	5,808.32	1,993.79	2,002.96	-3,106.09
8	Interstate 64 On-Ramp	3,233	Ramp	0.15	3.98	337.51	177,762.69	708.44	699.27	5,808.33	-370.94	-361.77	-5,470.82
9	Interstate 64 On-Ramp	4,810	Ramp	0.06	10.63	605.34	99,111.77	708.48	699.31	5,808.43	-103.14	-93.97	-5,203.09
10	Interstate 64 On-Ramp	9,611	Ramp	0.20	2.04	58.09	688,604.75	708.39	699.22	5,808.18	-650.31	-641.14	-5,750.10
11	Interstate 64 Off-Ramp	12,877	Ramp	0.47	5.12	109.03	2,201,052.00	708.37	699.20	5,808.11	-599.34	-590.17	-5,699.08
12	Interstate 64 On-Ramp	7,824	Ramp	0.16	2.54	88.80	450,414.19	708.41	699.23	5,808.22	-619.60	-610.43	-5,719.41

13	Interstate 64 On-Ramp	2,689	Ramp	0.07	91.86	9,359.09	70,515.35	708.50	699.33	5,808.50	8,650.58	8,659.75	3,550.59
14	Interstate 64 Off-Ramp	9,416	Ramp	0.47	10.24	297.92	1,611,068.25	708.37	699.20	5,808.13	-410.45	-401.28	-5,510.21
15	Interstate 64 Off-Ramp	9,312	Ramp	0.19	24.70	726.74	632,926.19	708.40	699.22	5,808.19	18.34	27.52	-5,081.45
16	Interstate 64 On-Ramp	9,611	Ramp	0.04	4.52	128.88	155,168.00	708.45	699.28	5,808.35	-579.57	-570.40	-5,679.46
17	Interstate 64 Off-Ramp	2,913	Ramp	0.19	7.24	681.36	205,458.28	708.44	699.27	5,808.31	-27.07	-17.90	-5,126.94
18	Interstate 64 Off-Ramp	5,875	Ramp	0.17	32.63	1,521.78	367,968.31	708.41	699.24	5,808.24	813.37	822.54	-4,286.46
19	Interstate 64 Off-Ramp	5,573	Ramp	0.23	4.40	216.36	462,171.56	708.40	699.23	5,808.21	-492.05	-482.88	-5,591.86
20		9,312	Ramp	0.11	16.53	486.35	370,078.91	708.41	699.24	5,808.24	-222.06	-212.89	-5,321.88
21	Interstate 64	46,149	Interstate	0.90	12.69	75.34	15,129,778.00	80.07	99.86	90.69	-4.73	-24.52	-15.35
22	Interstate 64	54,365	Interstate	0.97	32.27	162.65	19,304,502.00	80.07	99.86	90.69	82.57	62.78	71.95
23	Interstate 64	58,179	Interstate	1.10	27.87	131.26	23,310,366.00	80.07	99.86	90.69	51.19	31.40	40.57
24	Interstate 64	59,555	Interstate	1.09	29.67	136.48	23,738,106.00	80.07	99.86	90.69	56.41	36.62	45.79
25	Interstate 64	63,946	Interstate	0.64	28.74	123.15	14,940,570.00	80.07	99.86	90.69	43.07	23.28	32.45
26	Interstate 64	66,007	Interstate	0.73	57.96	240.59	17,538,978.00	80.07	99.86	90.69	160.52	140.73	149.90
28	Forest Park Avenue	2,629	Principal Arterial	0.20	1.96	204.70	195,396.08	228.52	292.56	619.73	-23.82	-87.86	-415.03
29	S COMPTON AVE	10,467	Minor Arterial	0.39	5.07	132.80	1,505,968.75	255.33	545.74	6,114.95	-122.53	-412.94	-5,982.16
33	FOREST PARK AVE	8,541	Principal Arterial	0.40	7.90	253.53	1,262,093.50	228.48	292.53	619.68	25.05	-38.99	-366.14

37	FOREST PARK AVE	3,171	Principal Arterial	0.17	1.21	104.68	191,048.83	228.52	292.56	619.73	-123.84	-187.89	-515.05
39	FOREST PARK PKY	9,619	Principal Arterial	0.21	62.15	1,770.08	723,085.50	228.49	292.53	619.69	1,541.59	1,477.55	1,150.40
40	S GRAND BLVD	14,027	Principal Arterial	0.37	42.59	831.79	1,875,357.88	228.48	292.52	619.67	603.31	539.27	212.12
41	FOREST PARK AVE	11,417	Principal Arterial	0.33	11.56	277.41	1,369,732.38	228.48	292.52	619.67	48.93	-15.11	-342.27
44	FOREST PARK AVE	2,813	Principal Arterial	0.16	24.43	2,379.84	168,068.20	228.52	292.57	619.74	2,151.32	2,087.28	1,760.10
48	MARKET ST	8,193	Local	0.37	5.34	178.51	1,120,321.75	637.09	1,067.71	1,112.30	-458.58	-889.20	-933.79
49	BARNES JEWISH HOSPITAL PLAZA	6,540	Major Collector	0.17	9.45	396.06	403,954.38	245.41	632.37	1,367.53	150.65	-236.31	-971.47
50	FOREST PARK AVE	14,230	Principal Arterial	0.04	4.95	95.30	209,845.70	228.51	292.56	619.73	-133.21	-197.26	-524.43
52	SPRUCE ST	1,260	Local	0.34	5.96	1,295.86	154,328.69	637.16	1,067.80	1,112.39	658.70	228.06	183.47
53	PAPIN ST	4,406	Local	0.17	5.88	365.62	273,488.31	637.13	1,067.76	1,112.35	-271.51	-702.14	-746.73
55	S EWING AVE	3,410	Local	0.18	3.33	267.27	224,474.88	637.14	1,067.77	1,112.37	-369.86	-800.50	-845.09
56	S EWING AVE	3,410	Major Collector	0.19	3.14	252.43	237,679.73	245.42	632.38	1,367.55	7.00	-379.96	-1,115.13
57	S BOYLE AVE	3,771	Major Collector	0.30	24.73	1,796.93	411,788.81	245.41	632.36	1,367.52	1,551.52	1,164.56	429.40
58	S NEWSTEAD AVE	4,312	Minor Collector	0.77	6.74	427.98	1,214,947.88	282.85	1,913.83	10,448.67	145.13	-1,485.85	-10,020.70
59	PAPIN ST	4,406	Minor Collector	0.22	13.71	852.23	351,996.13	282.87	1,913.88	10,448.80	569.36	-1,061.65	-9,596.57

61	CLAYTON AVE	5,700	Local	0.17	12.89	619.34	355,193.78	637.12	1,067.75	1,112.34	-17.78	-448.41	-493.00
62	CHOUTEAU AVE	6,236	Local	0.73	8.45	371.08	1,670,704.25	637.08	1,067.70	1,112.29	-266.00	-696.62	-741.21
63	S TAYLOR AVE	6,282	Major Collector	0.75	13.63	594.39	1,715,953.88	245.39	632.33	1,367.48	349.00	-37.95	-773.09
64	CLAYTON AVE	6,808	Major Collector	1.06	9.80	394.44	2,636,497.75	245.39	632.33	1,367.47	149.05	-237.89	-973.03
65	S TAYLOR AVE	7,197	Major Collector	0.11	73.92	2,813.83	291,399.94	245.42	632.38	1,367.54	2,568.41	2,181.45	1,446.29
66	S SARAH ST	7,358	Minor Collector	0.59	20.31	756.29	1,586,603.88	282.84	1,913.82	10,448.65	473.44	-1,157.53	-9,692.37
67	FOREST PARK AVE	7,477	Principal Arterial	0.28	22.19	813.05	762,512.50	228.49	292.53	619.69	584.56	520.52	193.37
68	TOWER GROVE AVE	8,120	Major Collector	0.07	15.33	517.24	193,320.20	245.43	632.39	1,367.57	271.82	-115.15	-850.32
69	TOWER GROVE AVE	8,120	Major Collector	0.18	3.30	111.25	539,280.63	245.41	632.36	1,367.51	-134.15	-521.10	-1,256.26
70	FOREST PARK AVE	8,173	Principal Arterial	0.29	15.36	514.80	854,644.81	228.49	292.53	619.68	286.32	222.27	-104.88
71	FOREST PARK AVE	9,619	Principal Arterial	1.12	8.73	248.71	3,940,171.50	228.47	292.51	619.66	20.23	-43.81	-370.96
72	FOREST PARK AVE	9,858	Principal Arterial	1.33	19.41	539.52	4,781,773.50	228.47	292.51	619.66	311.04	247.00	-80.14
73	MARKET ST	10,264	Principal Arterial	0.64	20.72	552.95	2,387,055.00	228.48	292.52	619.67	324.47	260.43	-66.72
74	S COMPTON AVE	10,785	Minor Arterial	0.07	36.49	926.92	280,481.47	255.36	545.78	6,115.09	671.56	381.14	-5,188.17
75	S BOYLE AVE	11,028	Major Collector	0.39	23.88	593.34	1,584,168.00	245.39	632.33	1,367.48	347.94	-39.00	-774.14

76	CHOUTEAU AVE	12,141	Minor Arterial	0.15	73.93	1,668.38	647,294.81	255.34	545.76	6,115.01	1,413.04	1,122.62	-4,446.63
77	MANCHESTER AVE	12,141	Minor Arterial	0.82	59.04	1,332.31	3,647,575.50	255.32	545.73	6,114.92	1,076.99	786.58	-4,782.61
78	S COMPTON AVE	12,461	Minor Arterial	0.02	48.43	1,064.74	75,130.88	255.41	545.85	6,115.32	809.34	518.89	-5,050.57
79	CHOUTEAU AVE	14,251	Minor Arterial	1.23	46.60	895.79	6,407,391.00	255.32	545.73	6,114.90	640.47	350.06	-5,219.11
80	CHOUTEAU AVE	14,251	Minor Arterial	0.39	20.53	394.76	2,026,428.00	255.33	545.74	6,114.94	139.43	-150.98	-5,720.18
81	S VANDEVENTER AVE	20,276	Minor Arterial	0.27	70.12	947.52	2,005,102.50	255.33	545.74	6,114.94	692.20	401.79	-5,167.42
82	S VANDEVENTER AVE	20,819	Minor Arterial	0.29	64.99	855.29	2,221,343.50	255.33	545.74	6,114.94	599.96	309.55	-5,259.65
83	S KINGSHIGHWAY BLVD	23,310	Principal Arterial	0.19	82.35	967.90	1,611,632.50	228.48	292.52	619.67	739.42	675.38	348.23
84	S GRAND BLVD	23,602	Principal Arterial	0.16	217.69	2,527.00	1,377,046.50	228.48	292.52	619.67	2,298.52	2,234.47	1,907.32
85	S JEFFERSON AVE	25,562	Principal Arterial	0.26	49.72	532.85	2,402,043.00	228.48	292.52	619.67	304.37	240.33	-86.82
86	S KINGSHIGHWAY BLVD	29,423	Principal Arterial	0.60	50.45	469.75	6,471,136.50	228.47	292.51	619.66	241.28	177.24	-149.91
87	S KINGSHIGHWAY BLVD	31,591	Principal Arterial	0.61	74.23	643.79	7,020,441.00	228.47	292.51	619.66	415.33	351.28	24.14

88	S KINGSHIGHWAY BLVD	33,499	Principal Arterial	0.19	29.94	244.83	2,368,886.25	228.48	292.52	619.67	16.35	-47.69	-374.84
89	S JEFFERSON AVE	33,978	Principal Arterial	0.39	43.79	353.06	4,814,766.00	228.47	292.51	619.66	124.59	60.55	-266.60
90	S KINGSHIGHWAY BLVD	41,965	Principal Arterial	0.21	184.45	1,204.23	3,155,362.25	228.47	292.52	619.66	975.75	911.71	584.56