APPENDIX H

Onward Analysis

MetroPlan 2045 Regional Transportation Plan

Onward Analysis

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1.0   Introduction

MetroPlan (formerly Flagstaff Metropolitan Planning Organization) is updating its regional transportation plan (RTP) for a 25-year planning horizon. The 2017 Update to the RTP identified $250 Million in projects and resulted in 3 ballot initiatives being sent to voters: Proposition (Prop) 419 for general transportation, Prop 420 for a Lone Tree railroad overpass, and Prop 421 for transit service improvements. Two of those initiatives passed, but the transit funding was not approved by voters. As a result of these 2018 ballot box decisions that established transportations sales taxes for twenty years, the 2022 RTP update is more focused on "how" than "what." In other words, the region is clear on the projects that need to be completed and has a commitment to voters to deliver. However, the design, relative modal emphasis of the projects, and program schedule needs further exploration in light of recent policy developments.

In addition to the passage of funding propositions in 2018, the City of Flagstaff recently declared a climate emergency and seeks to achieve carbon neutrality by 2030. MetroPlan is positioned to support this effort through the RTP. One way MetroPlan can provide support is to clearly communicate to decision makers and the public the effectiveness of various transportation design strategies in meeting mobility, accessibility, and climate action goals.

Two scenarios were evaluated as part of *Stride Forward,* the MetroPlan 2045 Regional Transportation Plan (RTP): Onward and Upward. Both Onward and Upward were developed with the same future levels of population and employment. Onward examines the effects of existing growth plans and transportation investments in the MetroPlan area. Onward aligns with voter-approved initiatives, so maintains fiscal constraints. Upward, the second, illustrative scenario for consideration in the Stride Forward Plan, examines the strategies needed to achieve the transportation-related goals in the Carbon Neutrality Plan (CNP) and their effects on the Flagstaff region. The goals tested include:

- Hold vehicle miles traveled (VMT) in the community to 2019 levels
- 54% of all trips will be taken by biking, walking, or taking the bus by 2030
- 34% of all work commute trips will be taken by biking, walking, or taking the bus by 2030

These targets are specific to trips that start and end in the City of Flagstaff per the CNP. The CNP includes a goal for regional electric vehicle adoption; this was not examined within this analysis. Analysis of the Upward Concept may be found in **Appendix J.**

This document analyzes the performance of the Onward Scenario based on the existing network and planned investments. Onward is fiscally constrained and serves as the long-range plan for the region.

1.1.   Study Area

The study area includes the greater Flagstaff region, a 525 square-mile planning area including the City of Flagstaff, Bellemont, Fort Valley, Kachina Village, Mountainaire, Doney Park, and the surrounding area. *Figure 1* illustrates the MetroPlan planning boundary.

Figure 1 – Study Area
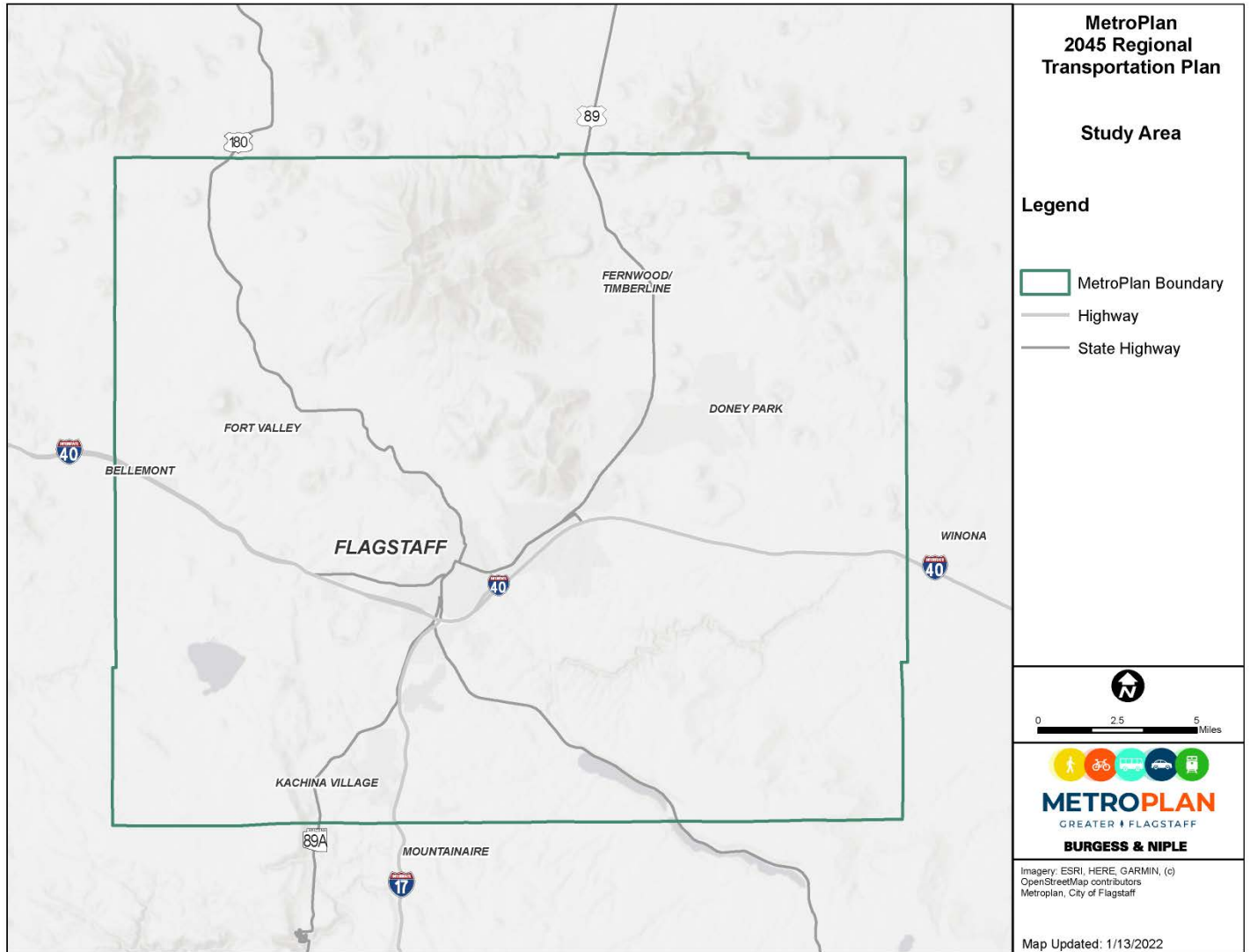
2.0   Existing Population and Employment

A separate socioeconomic profile technical memorandum was prepared as part of *Stride Forward* which reviews current population, employment, and socioeconomic attributes. According to 2019 5-year average ACS data, there were approximately 93,000 people living and 47,400 people working in the region. Summary maps are included herein for reference as *Figure 2* and *Figure 3*. Both population and employment are generally concentrated in the City of Flagstaff and along I-17.

Figure 2 – Current Population Density
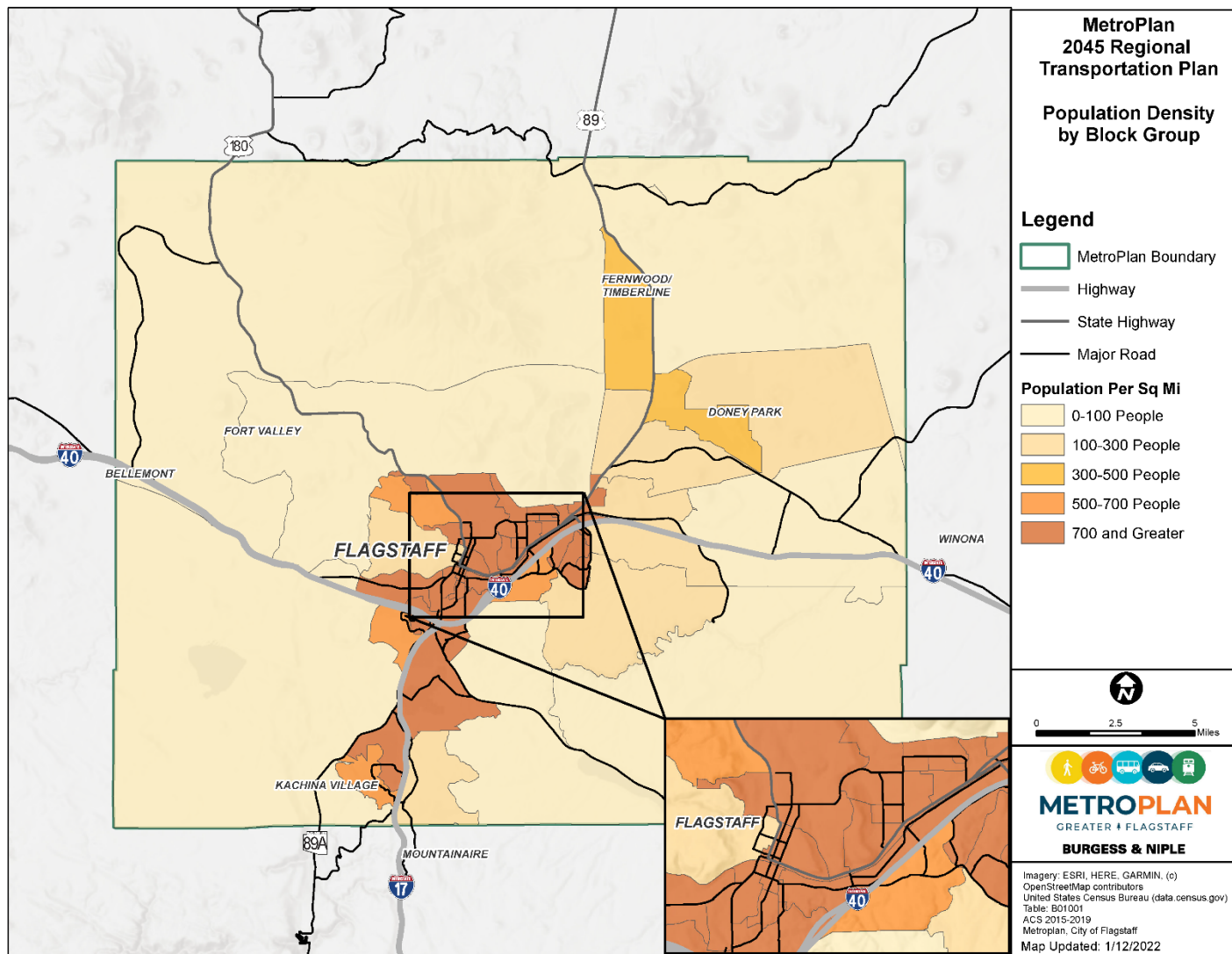
Figure 3 – Current Employment Density
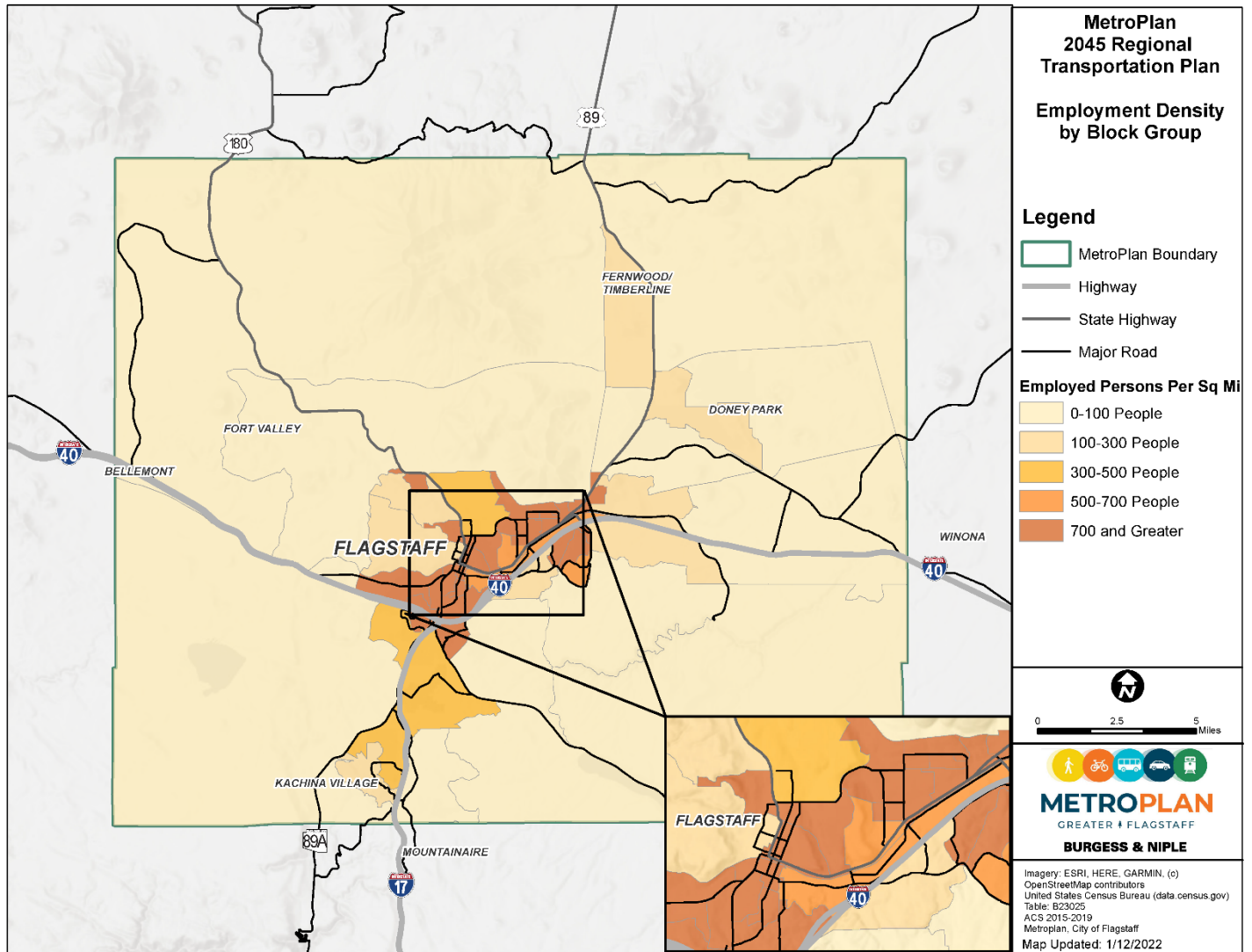
3.0   Existing Transportation System

3.1.   Roadway Network

The functional classification of the existing roadway network is shown in *Figure 4*. Major north-south and east-west thoroughfares are Interstate 17 and Interstate 40, respectively. Interstate 17 supported nearly 37,000 vehicles per day and Interstate 40 supported over 25,000 vehicles in 2021. *Table 1* provides a summary of the existing roadway functional classification miles in the region. Note, roadways indicated as major arterials function as principal arterials within the federal functional classification context.

Figure 4 – Existing Functional Classification
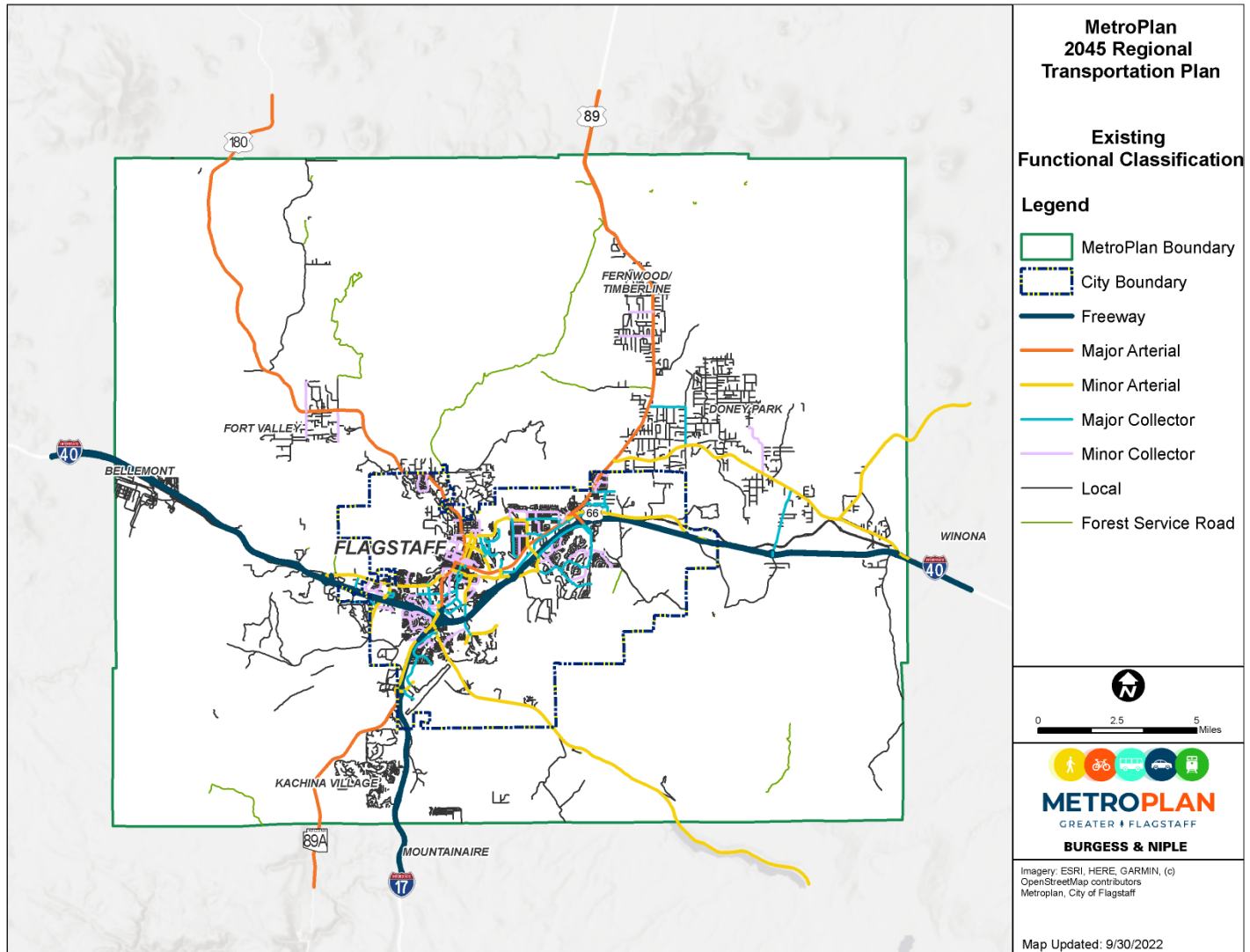
Table 1 – Existing Miles of Roadway by Functional Classification		
Functional Classification	Miles of Roadway	% of Roadway
Freeway	102.3	7.9%
Major Arterial	57.7	4.5%
Minor Arterial	42.8	3.3%
Major Collector	72.1	5.6%
Minor Collector	42.8	3.3%
Local	943.9	73.0%
Forest Service Road	31.6	2.4%
Total	1,293.2	100.0%

3.1.1. Vehicle Miles Traveled and Travel Demand

One of the CNP goals is to maintain 2019 internal Vehicle Mile Traveled (VMT) levels within the region. For context, internal VMT (trips starting and ending within MetroPlan) has generally increased since 2014, with a dip in 2019. *Table 2* provides a summary of the recent historical daily internal VMT for the region. The MetroPlan travel demand model (TDM) was used to assess roadway network performance; roadways that currently have a failing level of service (LOS) are shown in *Figure 5.*

Table 2 – 2014 – 2020 MetroPlan Internal Vehicle Miles Traveled		
Year	**Daily Internal VMT**	**% Change from previous year**
2014	1,474,767	-
2015	1,524,069	3.3%
2016	1,537,765	0.9%
2017	1,604,288	4.3%
2018	1,615,410	0.7%
2019	1,594,818	-1.3%
2020	1,740,832	9.2%
Source: *MetroPlan 2020 Emissions Report*		

Figure 5 – 2019 Roadways with Failing Level of Service
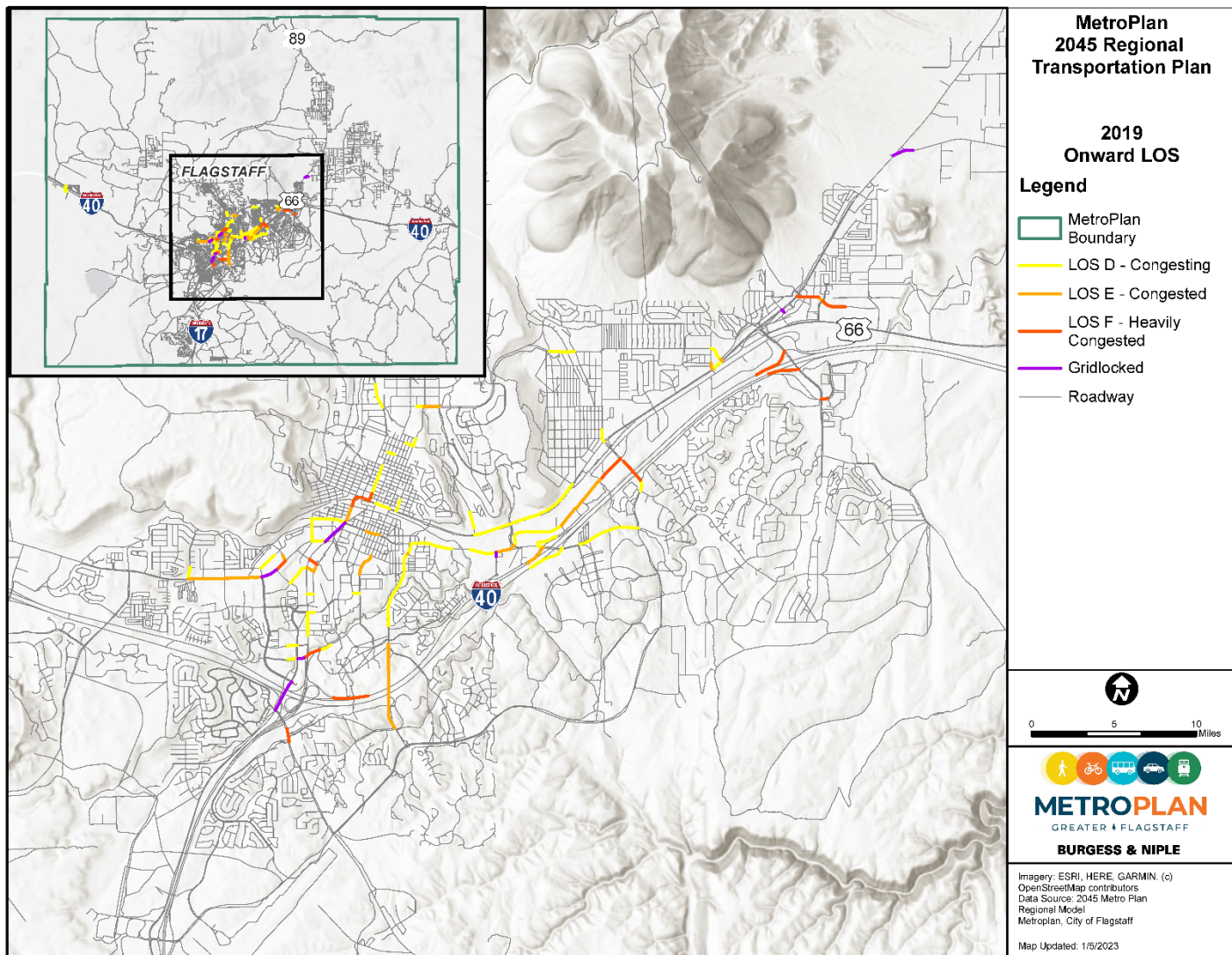
3.2.   Active Transportation Facilities

3.2.1.   Bicycle Network

The bicycle network is comprised of shared use paths (SUP), multi-use trails/paths (MUP), bike lanes, bike routes, shared roadways, and bicycle accessible trails within the Flagstaff Urban Trail System (FUTS). The bicycle network comprises over 130 miles of SUP, MUP, bike lanes, bike routes, shared roadways, and FUTS. The bicycle network by type of bikeway within the City of Flagstaff is shown in *Figure 6* and summarized in *Table 3*.

Table 3 – Existing Bicycle Network		
Bicycle Network	**Miles of Facility**	**% of Network**
Bicycle Lanes	29.7	22.3%
Shared Lane Bicycle Lanes	1.2	0.9%
Buffered Bicycle Lanes	0.7	0.5%
FUTS	96.6	72.7%
Shared Use Paths	10.8	3.4%
Route	0.2	0.2%
Total	132.9	100.0%

Figure 6 – Existing Bicycle Network
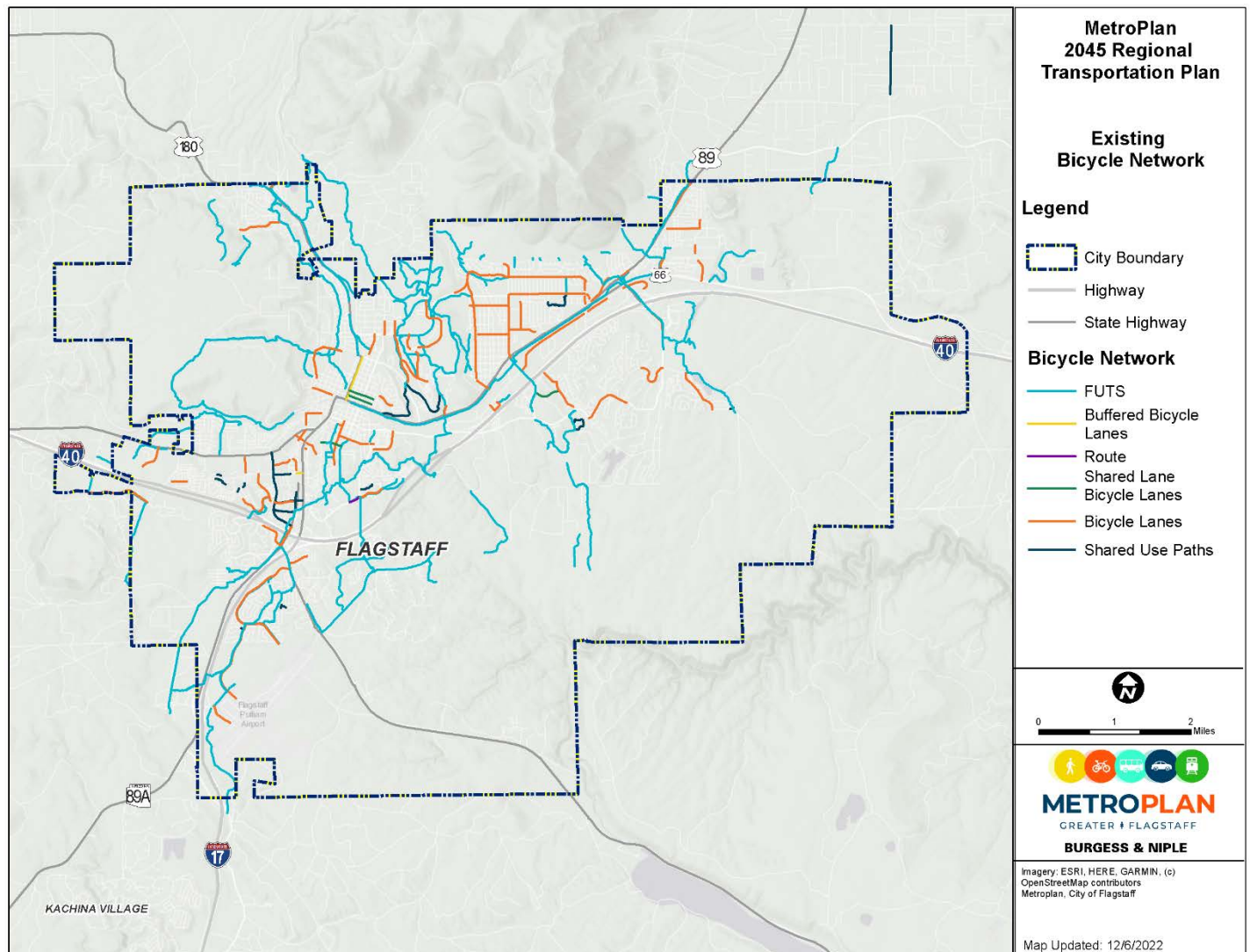
3.2.2. Pedestrian Network

Pedestrian facilities include sidewalks, trails, SUP, and FUTS; facilities are summarized in **Table 4**. Ancillary facilities such as pedestrian bridges and tunnels support the pedestrian network. The pedestrian network comprises over 500 miles of sidewalks, trails, SUP, and FUTS. Sidewalks, SUP, and FUTS are shown in **Figure 7**. **Figure 8** shows these facilities, as well as trails. Trails are typically not ADA compliant and so provide enhanced connectivity for some users; cyclists may also use trails.

Table 4 – Existing Pedestrian Network		
Pedestrian Network	**Miles of Facility**	**% of Network**
Sidewalk	264.6	52.3%
FUTS	60.0	11.9%
SUP	10.8	2.1%
Trail	170.9	33.8%
Total	506.4	100.0%

Figure 7 – Existing Pedestrian Facilities
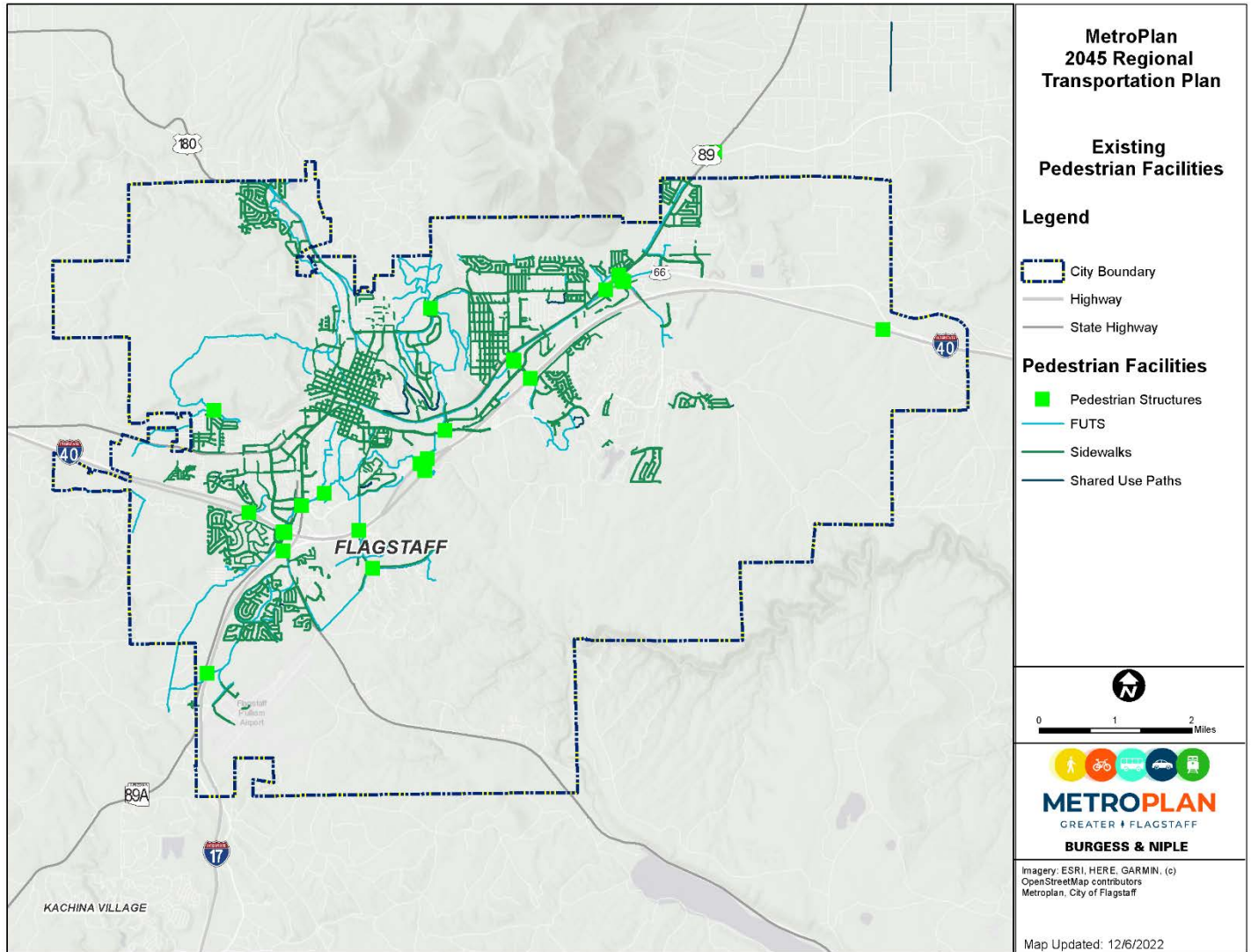
Figure 8 – Existing Pedestrian Facilities and Trails
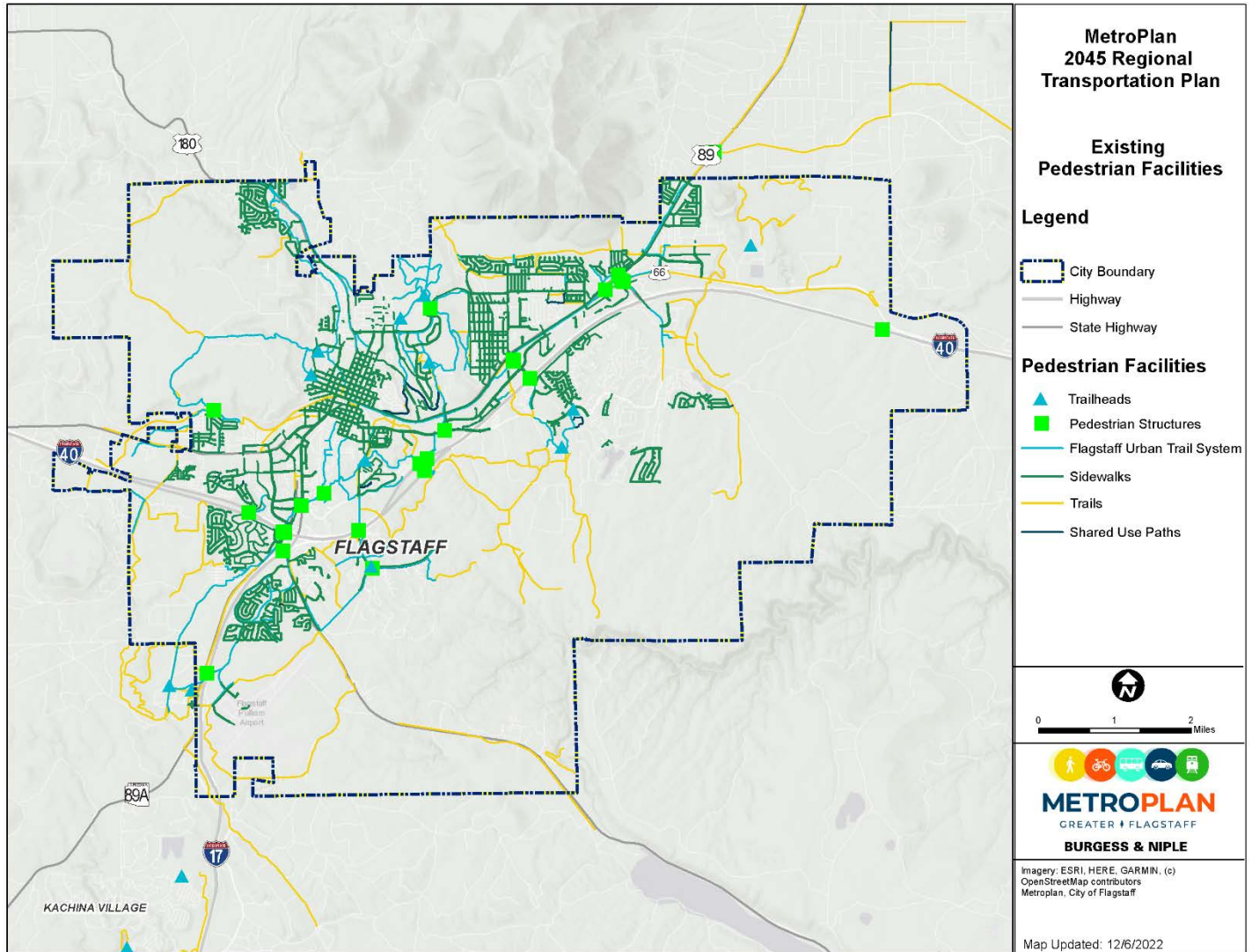
3.3.   Transit System

Mountain Line, also known as the Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA), is the transit agency in northern Arizona. It is responsible for operating the Mountain Line fixed route transit services and supporting paratransit service in the City of Flagstaff. In addition, Mountain Line provides demand-responsive service in the east part of the City, a taxi-voucher service within the County part of the MPO, and a van-pool service. The Mountain Line Bus System operates nine routes. The existing routes and stops within the City of Flagstaff are shown in *Figure 9*. Mountain Line is currently updating its short and long-range transit goals via the *Flagstaff in Motion* planning effort.

Figure 9 – Existing Transit Network
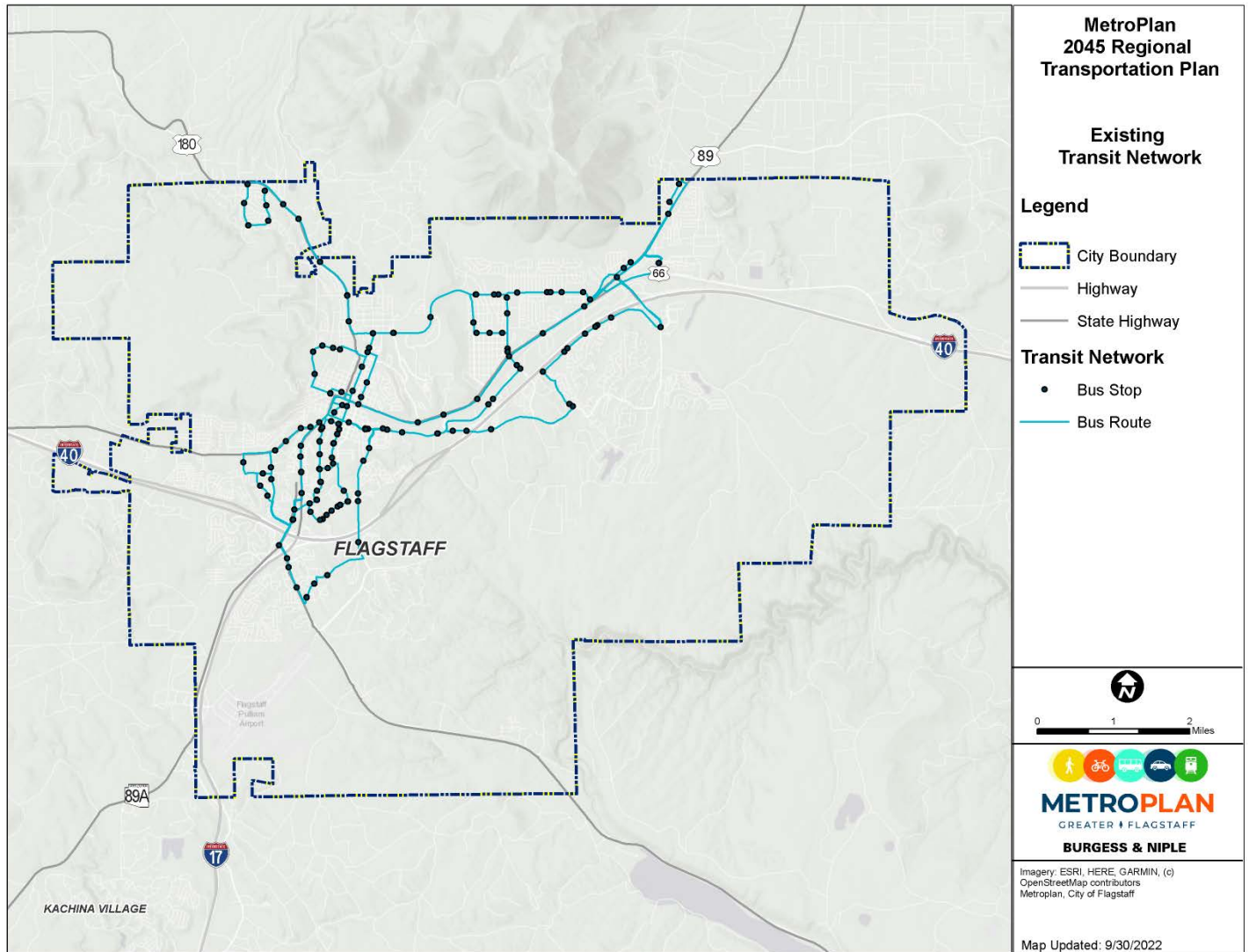
3.4.   Passenger Rail

Amtrak operates the Southwest Chief between Chicago and Los Angeles with stop in Flagstaff. The train carries approximately 50,000 passengers per year. Planning is underway to improve operations at the historic downtown train station.

3.5. Freight

The freight transportation system is crucial to the development and economic success of the region. The freight system includes truck routes, rail, and air cargo. Truck routes commonly consist of interstates, arterials, and major collectors in the region including I-17, I-40 and US 89. The BNSF transcontinental Class I railroad runs east-west through the region. Air cargo is either transported via Flagstaff Pulliam Airport or transported to Phoenix Sky Harbor Airport.

The Flagstaff Regional Freight Study conducted in 2014 describes policy objectives and strategies for freight in the region. The objectives outlined in the study are summarized below.

- Form Freight Advisory Board and Roundtable
- Form the Regional Truck Task Force
- Form the Shipper Association
- Work with the Team to Create a Project List
- Review Regional Freight Strategy with FMPO Executive Board

3.6. Passenger Air Travel

Air transportation in the region is accessible at the Flagstaff Pulliam Airport or through the Phoenix Sky Harbor Airport.

3.7. Pipeline

Several pipelines run throughout the region operated by El Paso Natural Gas Co, Transwestern Pipeline Company LLC, and Unisource Energy Services.

3.8. Crash Analysis

Crash data for the five-year period from January 1, 2016, to December 31, 2020 was obtained from the ADOT Accident Location Identification Surveillance System (ALISS) database. Within this period, 10,287 crashes occurred in the MetroPlan region. Crash distribution by year and severity is summarized in *Table 5.* A Strategic Transportation Safety Plan update is currently underway, the last plan was completed in 2018.

Table 5 – Crash Distribution by Year and Severity						
Year	Fatal	Incapacitating	Non-incapacitating Injury	Possible Injury	No Injury	Total
2016	12	40	189	241	1,846	2,328
2017	9	76	210	251	1,760	2,306
2018	6	38	201	254	1,691	2,190
2019	16	47	235	283	1,596	2,177
2020	10	31	156	102	987	1,286
Total	53	232	991	1131	7880	10,287

In the following crash analysis, crash information is compared to 2020 Arizona statewide averages. These averages are published in the *Arizona Motor Vehicle Crash Facts* (Crash Facts)*,* 2020 edition, produced by ADOT and released on July 27, 2021. *Table 6* provides a summary of the first harmful event, or in other words the crash type, for all crashes in the study area. Crash events that exceed the statewide average are shown in bold, red, italicized text.

Table 6 – First Harmful Event						
First Harmful	**Total Number**	**% Total**	**2020 Statewide Average %**	**Fatal**	**% Fatal**	**2020 Statewide Average %**
Multi-vehicle	7,070	68.7%	72.5%	15	28.3%	38.1%
Overturning	316	*3.1%*	1.9%	*9*	17.0%	10.2%
Collision with Pedestrian	137	1.3%	1.4%	*16*	30.2%	21.9%
Collision with Pedalcyclist	150	*1.5%*	0.8%	1	1.9%	3.4%
Collision with Animal	695	*6.8%*	1.8%	0	0.0%	0.2%
Collision with Fixed Object	1,105	10.7%	12.5%	*11*	20.8%	20.0%
Collision with Non-fixed Object*	731	*7.1%*	6.0%	0	0.0%	2.1%
Vehicle Fire or Explosion	25	0.2%	0.4%	0	0.0%	0.0%
Other Non-collision**	54	0.5%	0.6%	*1*	1.9%	0.5%
Unknown	4	<0.1%	2.2%	0	0.0%	3.6%
Total	10,287	100.0%	100.0%	53	100.0%	100.0%
* Includes Collision with parked Vehicles, Trains, Railway Vehicles, and Work Zone Equipment						
** Includes Vehicle Immersion, Jackknife, Fell or Jumped from Vehicle, Thrown or Falling Object, and Cargo Loss or Shift						

As shown, crashes with non-motorized users account for a higher proportion of crashes in the region for crashes of all severity and fatal crashes. This may be due to a higher number of cyclists and pedestrians (increased exposure) and/or indicative of a need to enhance safety of active transportation facilities. Crash heat maps depicting all crash types and pedestrian and bicycle crashes are included as *Figure 10* and *Figure 11*. Notably, the area around Milton Road near the Milton/Butler Avenue bend represents a hot spot for all crash types as well as bicycle and pedestrian crashes.

Overturning crashes are also overrepresented in the region. The majority of overturning crashes (all severity as well as fatal) occurred on ADOT routes, including I-17, I-40, and to a lesser extent US 89.

Figure 10 – All Crashes Heat Map
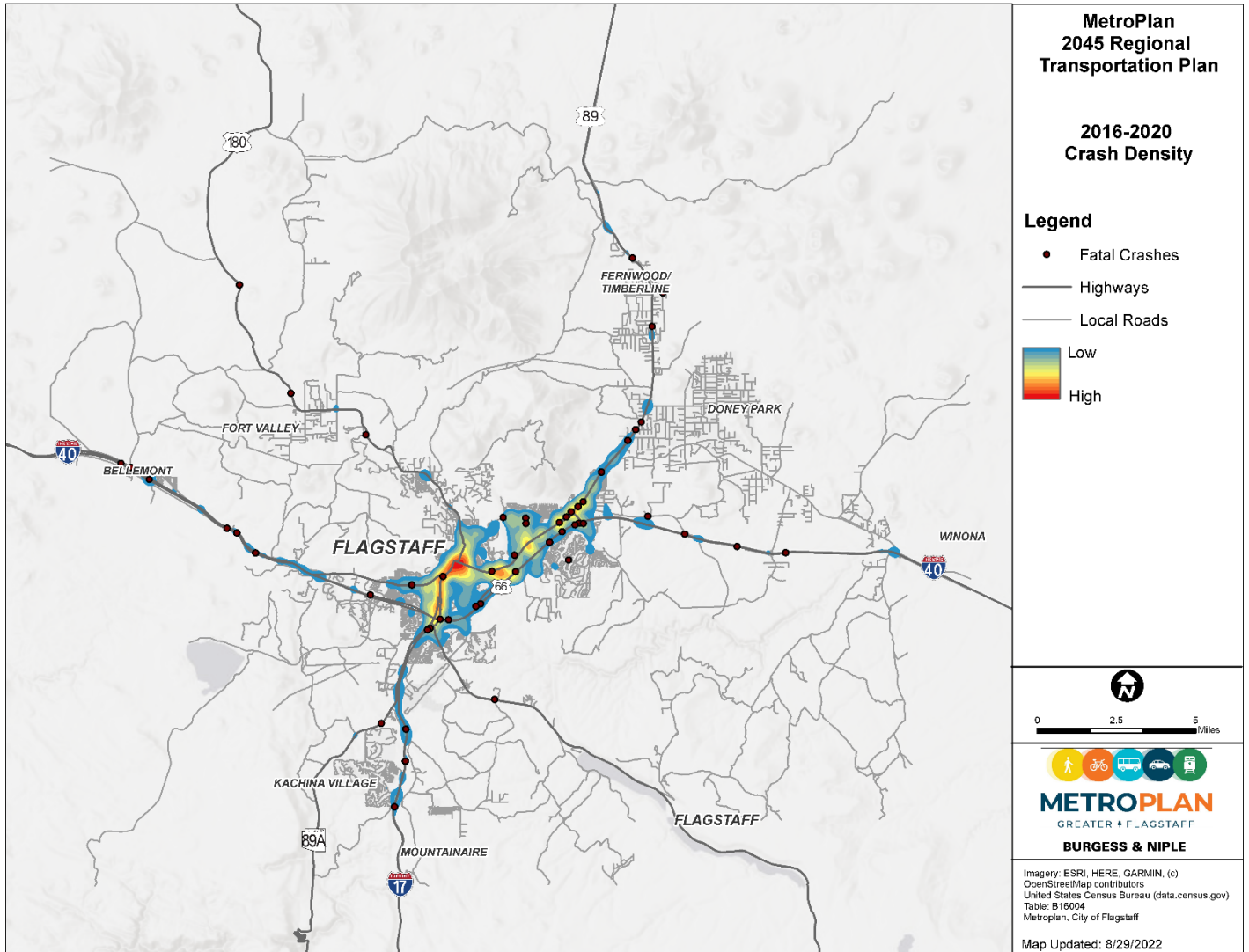
Figure 11 – Bicycle and Pedestrian Heat Map
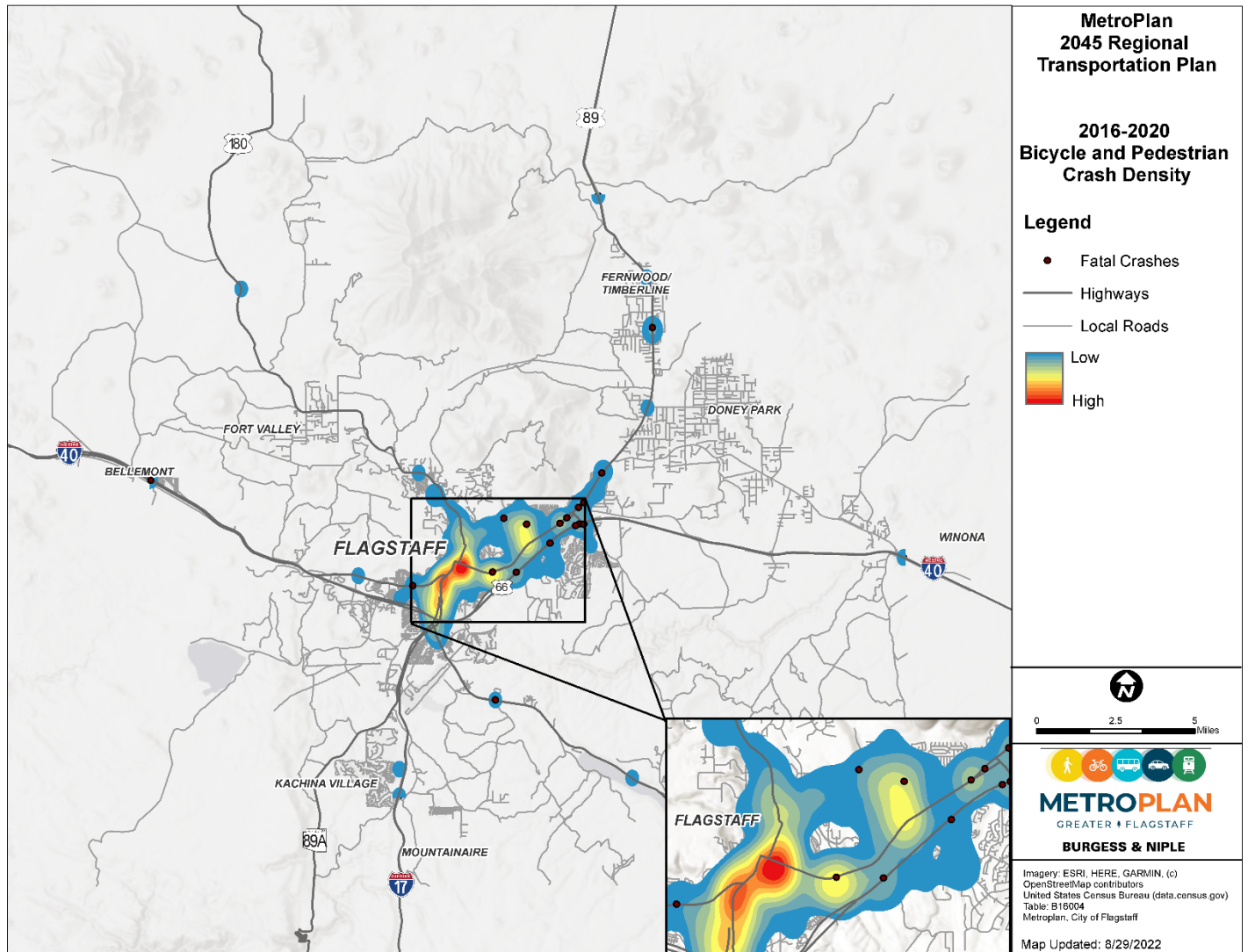
4.0 Future Population and Employment

Future population projections are informed by the state demographer and local future land use plans. Projected future population and employment data were adjusted to the existing TAZ structure; future densities are shown in *Figure 12* and *Figure 13*. For reference, the 2019 population and employment are 93,000 and 47,400, respectively; these numbers increase to approximately 120,000 and 61,000 by 2045, respectively. This yields about a 29% population increase and a 29% employment increase. Linear interpolation yields 2030 population and employment at approximately 104,500 and 53,200, increasing 12.4% and 12.2% from 2019, respectively. Notably, the Blueprint 2040 future year analysis was based on future population of 124,200, and Prop 419 and 420 were introduced and passed to accommodate infrastructure needs to support the growing population. As such, the capacity analysis associated with that effort is still valid. Additional roadway expansion projects are not introduced due to lack of need, feasibility, and/or public support for them. The majority of population growth is within Flagstaff, specifically downtown and along I-40.

Figure 12 – Future Population Distribution
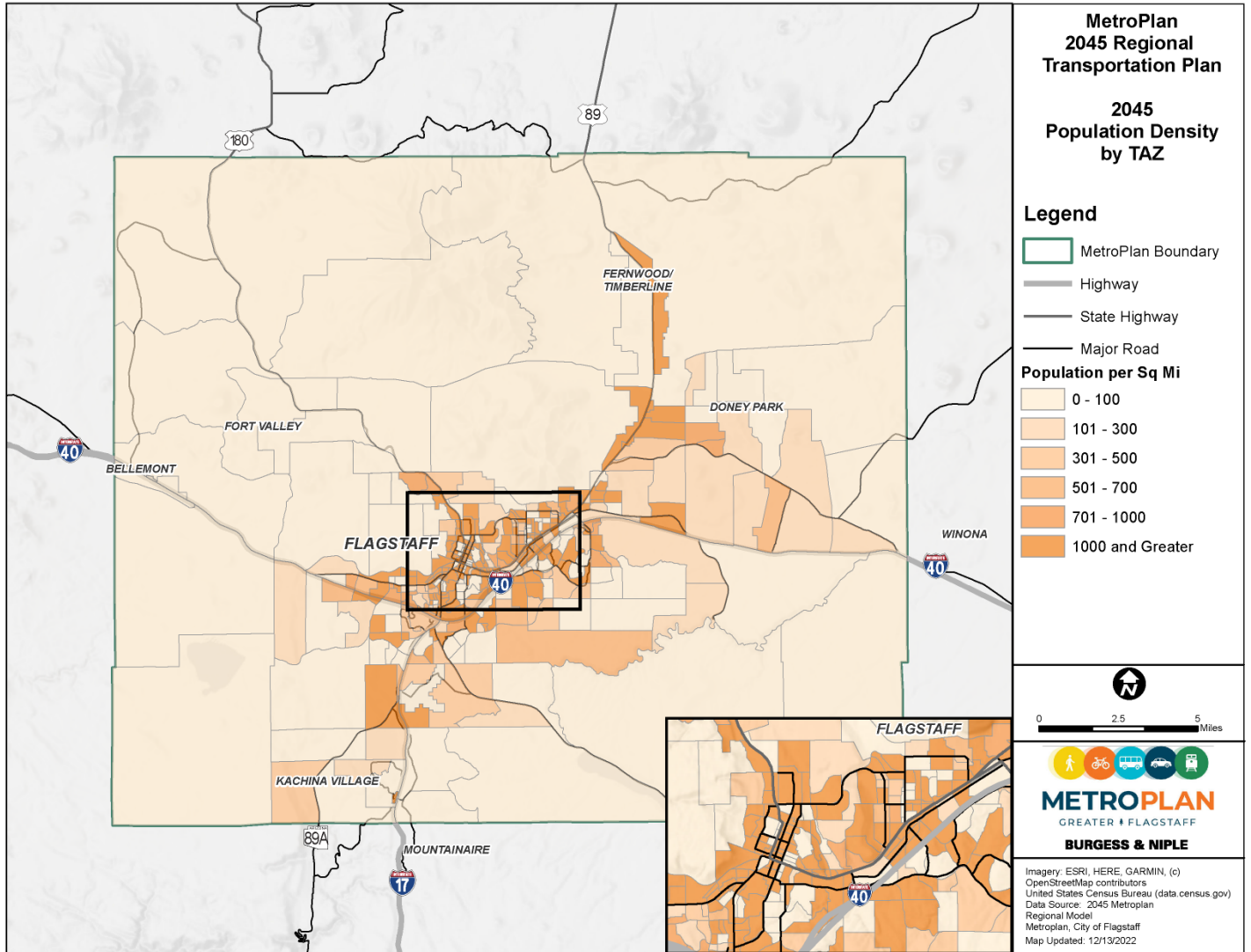
Figure 13 – Future Employment Distribution
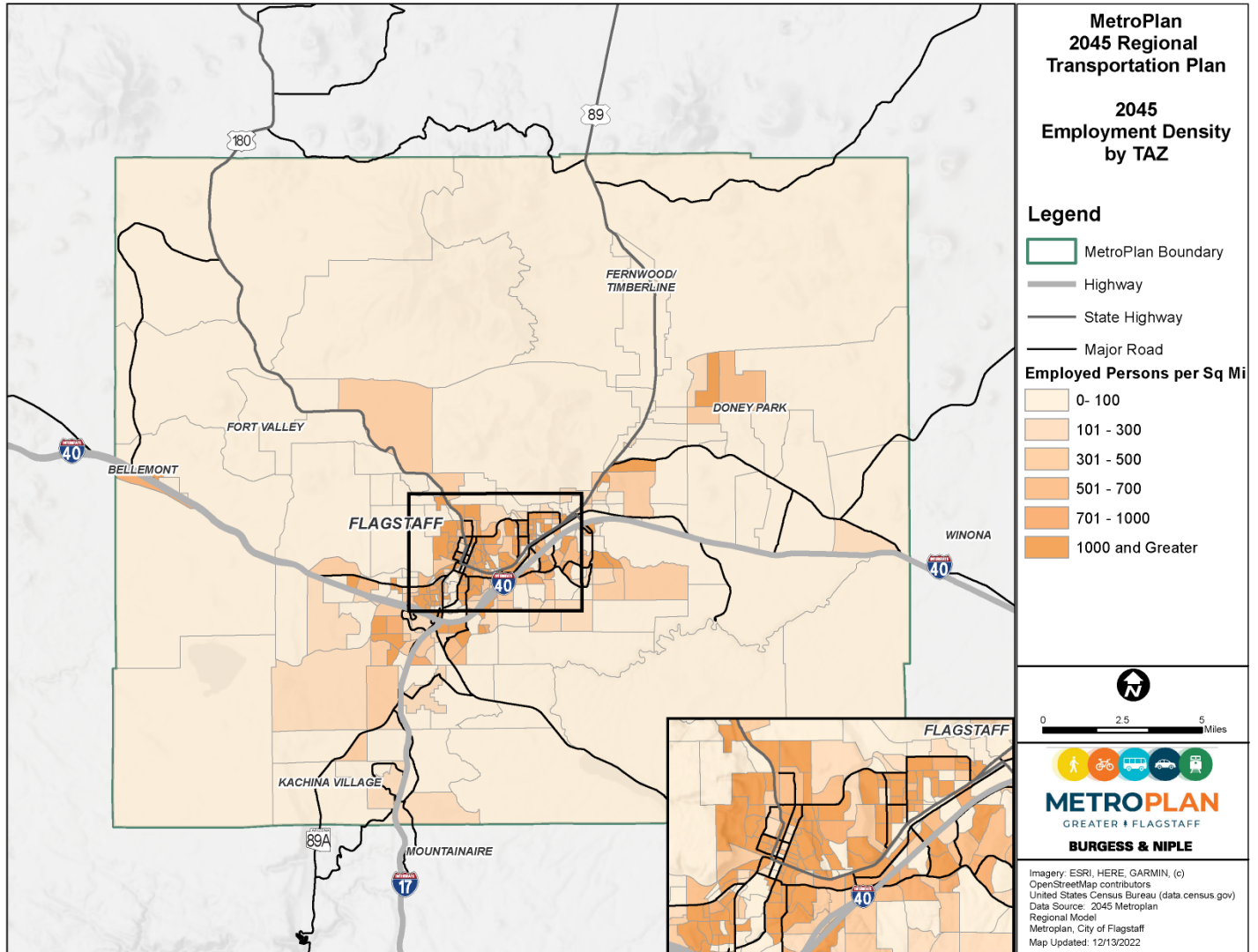
5.0   Future Transportation System

The future transportation network includes the existing system, as well as projects identified in Prop 419, 420, and other initiatives as identified herein. The regional financial plan describes funding for these network improvements and is included as ***Appendix I*** of the *Stride Forward* report.

5.1.   Roadway Network

Propositions 419 and 420 will expand the roadway network in City of Flagstaff approximately 13 miles; a list of these projects is provided in ***Table 7*** and shown in ***Figure 14***. New local roads are anticipated as development occurs. There are no additional new arterials anticipated beyond Prop 419 and 420. The City of Flagstaff was awarded a $34 million INFRA grant for construction of the Downtown Mile that includes replacement of the Milton Road Railroad Underpass, pedestrian improvements and upgrades to the railroad. Functional classification of the existing network is show in **Figure 15**. Coconino County voters approved Proposition 403, which focuses on existing roadways.

5.2.   Future Travel Demand

The MetroPlan travel demand model (TDM) was used to assess future roadway network performance; roadways that are projected to have a failing level of service (LOS) are shown in ***Figure 16***.

Table 7 – Proposition 419 and 420 Projects		
Project Name	**Project Limits**	**Functional Classification**
Lone Tree Road Railroad Overpass – Phase 1	Route 66 to Franklin Avenue	Minor Arterial
Fourth Street Extension - South Phase 1	Butler Avenue to Rio De Flag	Not Established
Fourth Street Extension – South Phase 2	Fourth Street: Rio de Flag to J.W. Powell Boulevard	Minor Arterial
Fourth/Butler Intersection & Butler Widening	Butler Avenue: I-40 to Sinagua Heights Drive	
W. Rte 66 Widening – Phase 1	Woody Mountain Road to Flag Ranch Road	Freeway
Lone Tree Widening – Phase 2	Lone Tree Road: Franklin Avenue to Pine Knoll Drive	Minor Arterial
Lone Tree Widening – Phase 3	Lone Tree Road: Pine Knoll Drive to J.W. Powell Boulevard	Major Collector
J.W. Powell Blvd Extension – Phase 1	J.W. Powell Boulevard: Lone Tree Road to Fourth Street	Not Established
J.W. Powell Blvd Extension – Phase 2	J.W. Powell Boulevard: End of J.W. Powell Boulevard to Fourth Street	
J.W. Powell Blvd Airport	J.W. Powell Boulevard: Pulliam Drive to Lake Mary Road	
Pedestrian and Bicycle Improvements	Various	Not Applicable
Neighborhood Plans	Various	Not Applicable
General Improvements & Partnering Opportunity	Various	Not Applicable
Traffic Signal and Advanced Traffic Management	Various	Not Applicable
Street Lighting (Dark Skies)	Various	Not Applicable

Figure 14 – Prop 419 and 420 Roadway Projects
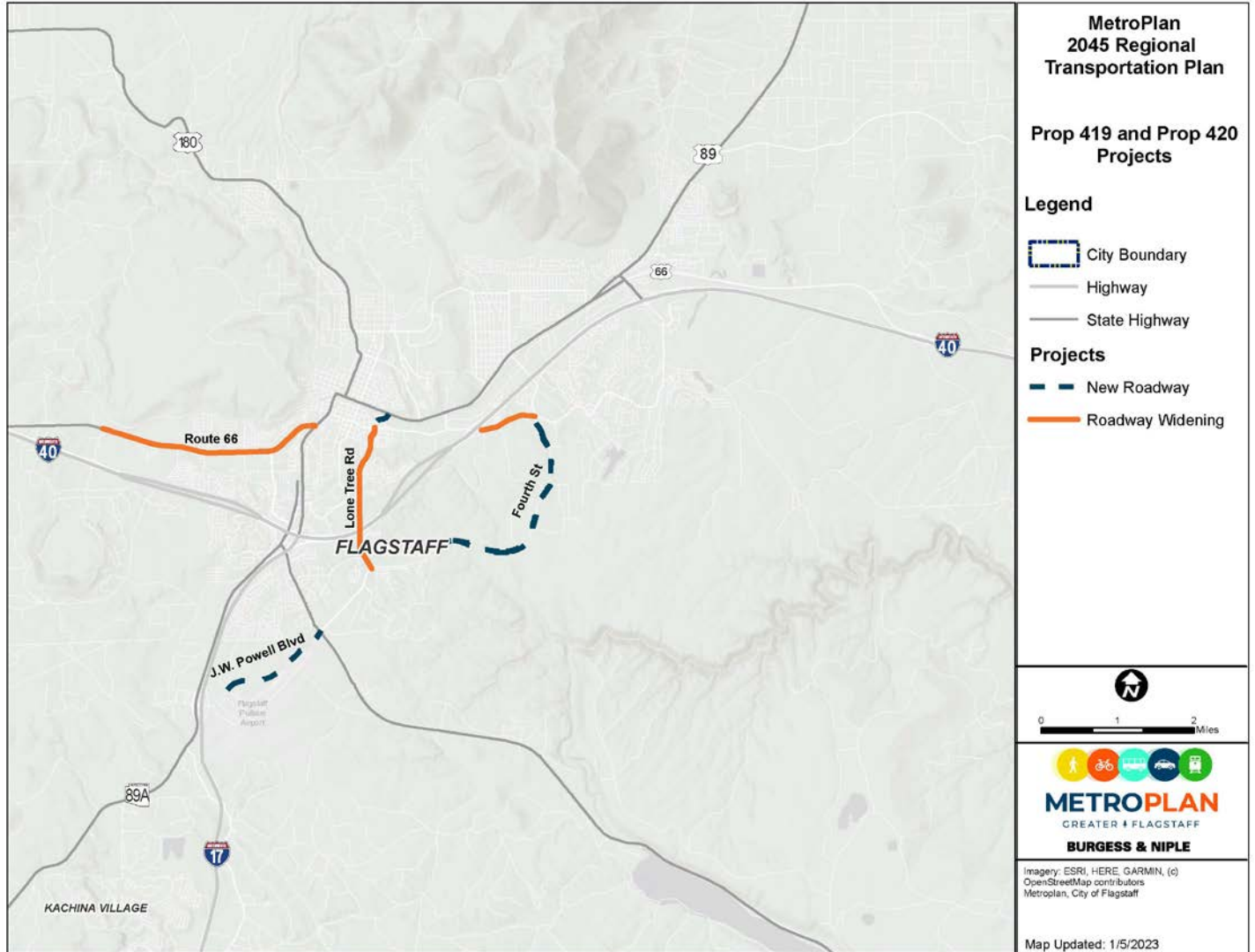
Figure 15 – Future Functional Classification
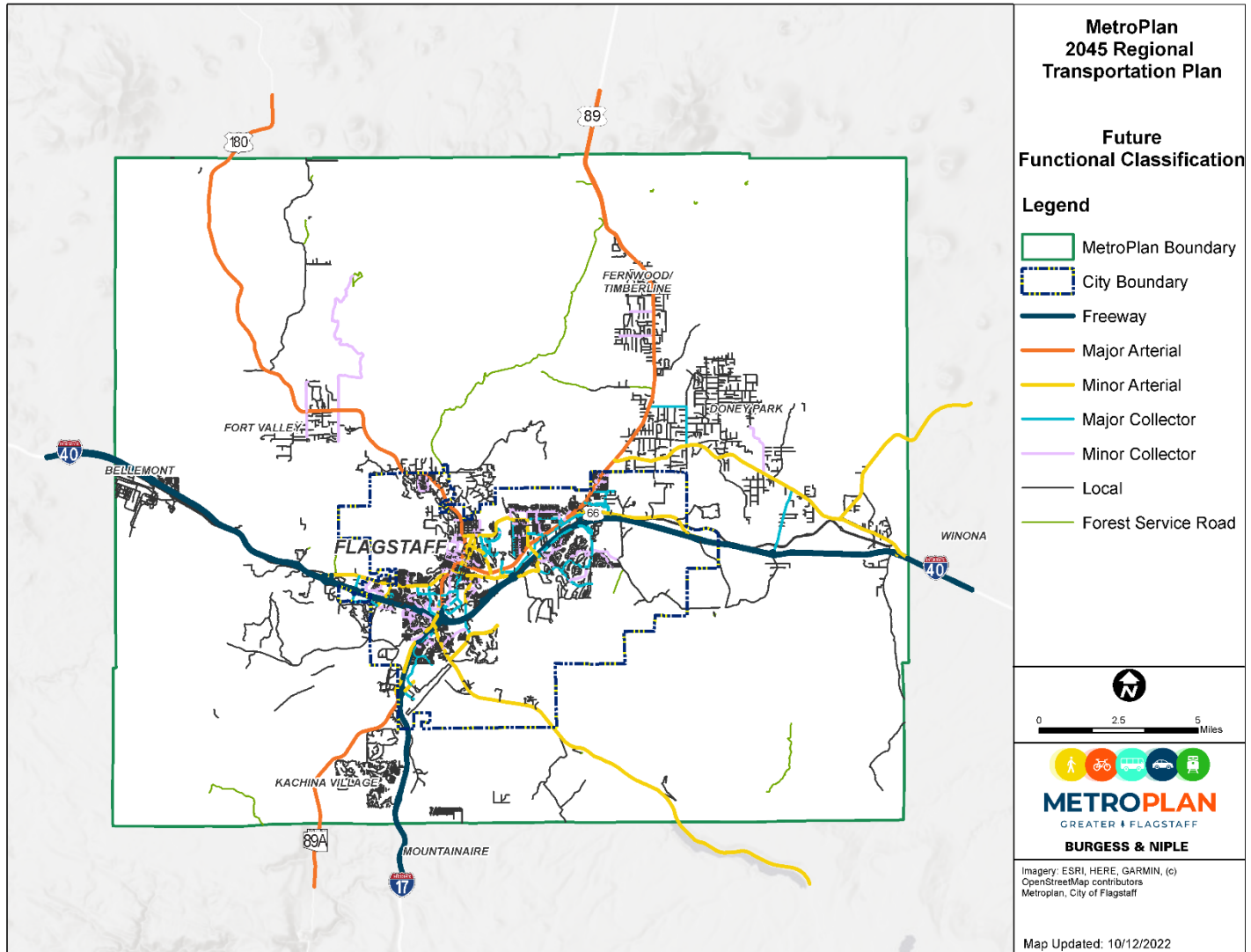
Figure 16 – Onward 2045 Roadways with Failing Level of Service
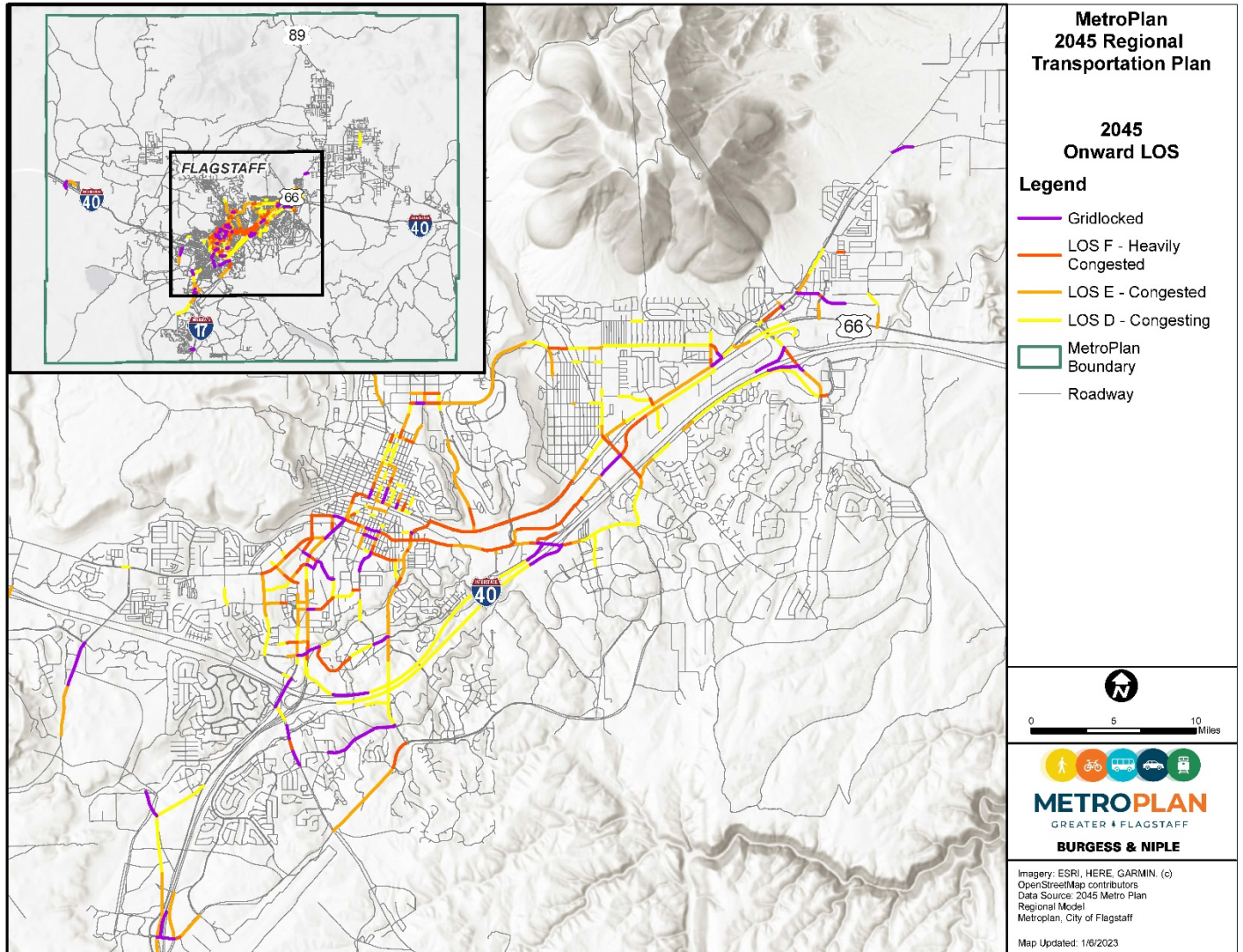
Programmed projects in Prop 419 and 420 mitigate some LOS challenges in the future and provides some system redundancy. However, the population increase exacerbates congestion throughout town. Jurisdictional control, existing development, and other constraints have limited improvement opportunities for those corridors. Relocating the hospital contributes to congestion along Beulah Boulevard and other facilities south of I-40; City of Flagstaff is currently pursuing a RAISE grant to improve this corridor.

5.3. Future Active Transportation Network

The City of Flagstaff recently completed its Active Transportation Master Plan (ATMP) (adopted October 2022) which identifies a wide range of active transportation focused infrastructure enhancements. The outreach, engagement, and analysis performed in conjunction with this effort suggests this is both the most likely and most effective path forward. The following is excerpted from the ATMP and summarizes planned facility types and costs.

- The cost to complete all missing sidewalks is estimated at $21.80 million; this includes $4.96 million for sidewalks that are considered first priority
- The total estimated cost for all planned enhanced crossings is $18.72 million. First priority crossings are estimated to cost $4.72 million

- The total cost for all planned grade-separated crossings is $65 million. First priority projects add up to $12 million
- The total estimated cost to complete the bikeways network is $62.93 million. First priority bikeways are estimated at $17.3 million.
- The total estimated cost to complete all planned FUTS is estimated at $28.74 million, while first priority FUTS will cost $4.29 million to construct

The total program from the ATMP is estimated to cost over $197 million, with first priority projects at $39 million. City of Flagstaff has dedicated bicycle and pedestrian funding through Proposition 419 and a first mile last mile grant (section 5307-5339 grant). These sources are anticipated to yield $29 million and $5.5 million, respectively, for a total of $34.5 million. This nearly addresses the first priority projects, but second, third, and fourth priority projects are unfunded. Bicycle and pedestrian projects included in Prop 419 are shown in *Figure 17* and *Figure 18;* unfunded future ATMP projects are shown but denoted as unfunded.

Figure 17 – Future Bicycle Network
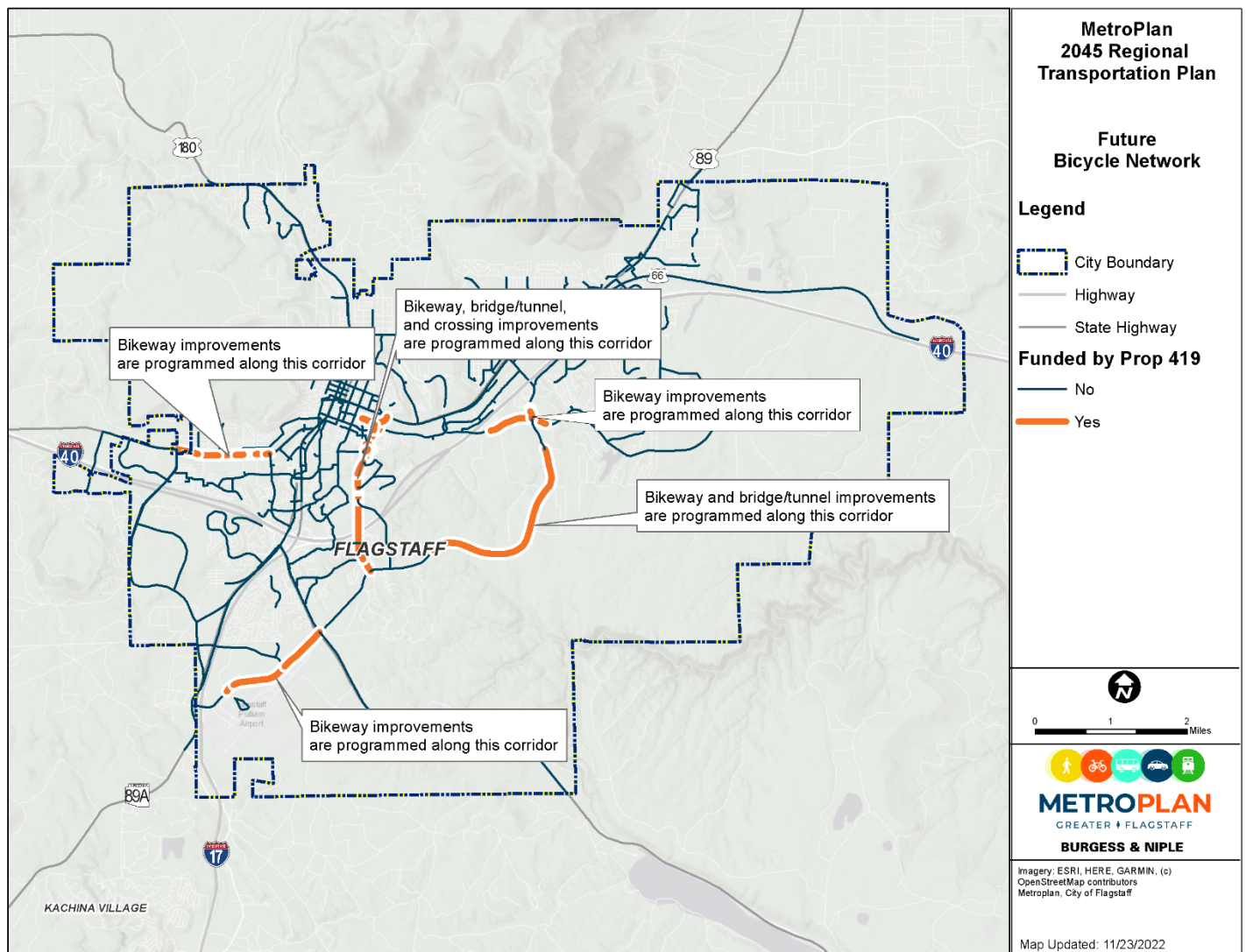
Figure 18 – Future Pedestrian Network
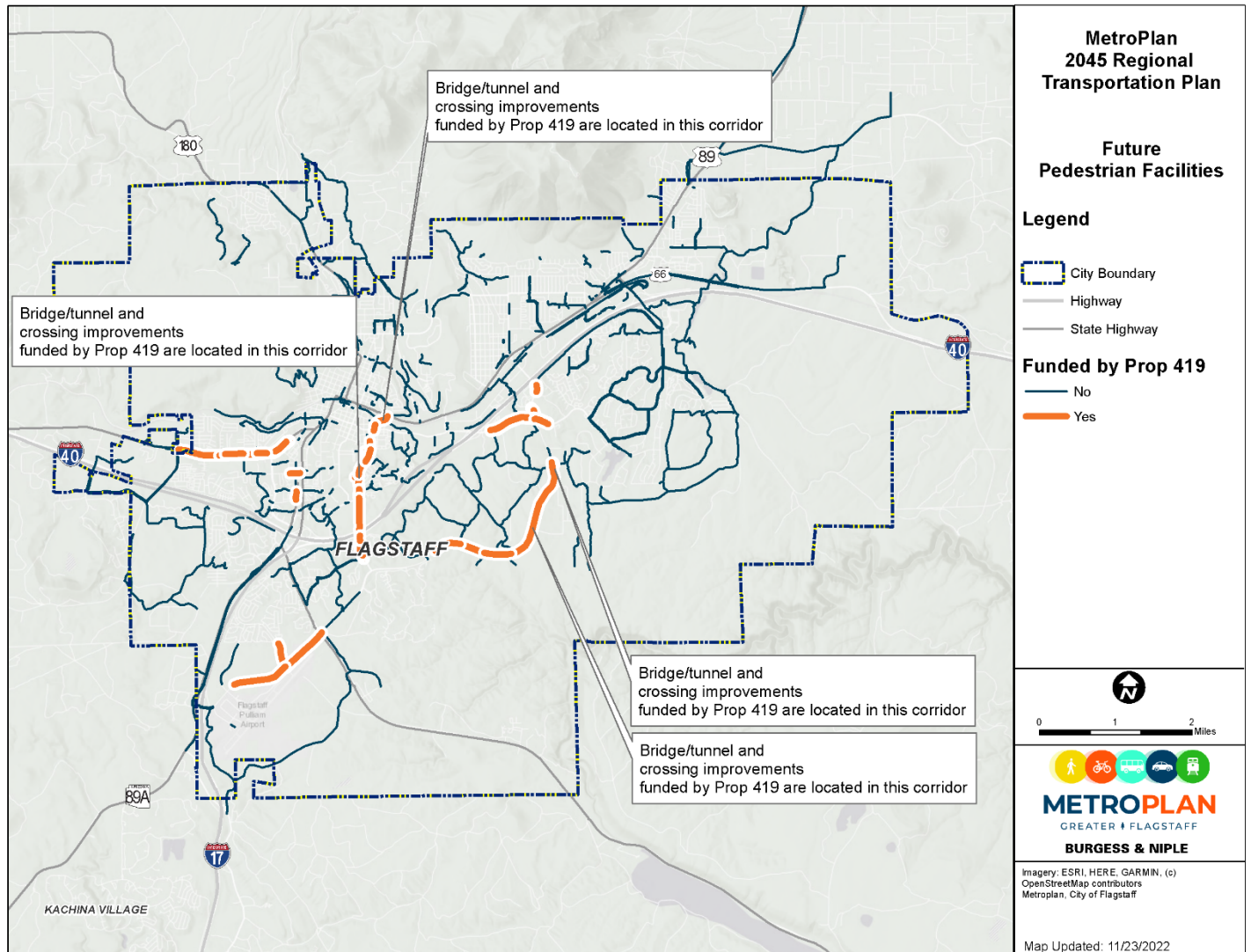
5.4.   Transit System

As previously noted, NAIPTA is completing *Flagstaff in Motion*, which may be used to inform a future funding proposition. Future transit was assumed to match existing service in this Onward analysis and includes federally-funded upgrades to the Downtown Connection Center.

6.0   Performance Measures

One of the federal requirements for regional transportation plans is performance-based planning and programming. This section provides details on how MetroPlan utilizes performance measures to meet these requirements and to further regional objectives. These measures are utilized for several different purposes including system evaluation and project selection at the MPO level. Additionally, they can be used to provide selection context for one transportation scenario over another. From these measures performance targets can be developed as part of a long-range vision to guide investment decisions specifically for resource allocation and further the values specific to the MPO. As a result of these steps the organization can measure and report on the efficacy of these decisions and provide detailed information back to residents as a larger part of informed decision-making for both the individual and the organization. *Figure 19* details the steps in performance-based planning and programming.

Figure 19 – Steps in a Performance-Based Planning Project

MetroPlan reports on federal performance measures and has developed Stride Forward performance measures in line with local priorities and 2021 Planning Emphasis Areas, including:

- Tackling the Climate Crisis – Transition to a Clean Energy, Resilient Future
- Complete Streets

Two other emphasis areas, Equity and Justice in Transportation Planning and Public Involvement, were integral in the planning process; associated efforts are documented in ***Appendix A, D, and E***.

6.1. Stride Forward Performance Measures

Performance measures provide a way to quantitatively measure progress towards a defined goal. A goal is a desired outcome, and best practice is to develop SMART goals: Specific, Measurable, Achievable, Relevant, and Time-bound. What makes a good performance measure is typically one that has data characteristics of being retrievable, reliable, and robust (or the three "R's"). Performance measures that support the CNP were vetted as part of *Stride Forward*; ***Table 8*** provides a summary of those used. Additional performance measures were considered, but not assessed at this time due to data availability or other limitations. These performance measures are also used with Upward; both Onward and Upward are reported for comparison. As illustrated, EVs make a significant contribution to achieving GHG emission goals. Preliminary findings were presented at public meetings in October 2022; these have been updated to reflect a more refined analysis.

Table 8 – Stride Forward Performance Measures			
Performance Measure	Target and Baseline	Target Reference	Onward Performance
Vehicle miles traveled (VMT)	Maintain internal VMT at 2019 levels - 2,160,000 VMT regionally 836,000 Flagstaff internal VMT	CNP	2,550,000 region-wide 18.0% over target 1,020,000 Flagstaff internal VMT 22.1% over target
Greenhouse Gases (GHGs) from Transportation in Metric tons of carbon dioxide equivalent (MTCO2e)	Reduce GHGs from transportation by 35% compared to 2030 business as usual - 147,900 MTCO2e	CNP	205,572 MTCO2e 39.0% over target

Table 8 – Stride Forward Performance Measures			
Performance Measure	**Target and Baseline**	**Target Reference**	**Onward Performance**
Total (%) mode share of walking/biking/ transit trips	54% mode share by 2030	CNP	13.0% 41% under target
Vehicle Hours Traveled (VHT)	No target established	Provides insight to congestion paired with VMT	96,000 hours

VHT is reported, though no target is set. The output from model runs for 2019 and Onward 2045 are included in the **Appendix On-1**. The Carbon Neutrality Plan identifies a goal to have 30% of internal VMT from electric vehicles; that metric was evaluated separately using the ClearPath Forecast Tool to examine its impact and summarized in **Table 9.** Both Onward and Upward are reported for comparison. As illustrated, EVs make a significant contribution to achieving GHG emission goals.

Table 9 – GHG Emissions with Varying EV Adoption Rates		
Scenario	**Emissions (MTCO2e)**	**% Relative to Target**
2019 Actual	252,654	170.8%
Onward 2030, default EVs	205,572	139.0%
Onward 2030, 30% EVs	172,902	116.9%
Onward 2030, 50% EVs	*136,025*	*92.0%*
Onward 2045, 30% EVs	211,525	143.0%
Onward 2045, 50% EVs	164,519	111.2%
Upward 2030, default EVs	167,700	113.4%
Upward 2030, 30% EVs	*141,041*	*95.4%*
Upward 2045, 30% EVs	154,298	104.3%
Note: Bold, green text is used to illustrate values that surpass the CNP goal		

Notably, Onward would need between 30 and 50% EV adoption to achieve the 2030 CNP goal. Upward with 30% EV adoption exceeds the goal, as does Onward with 50% EV adoption. This indicates the role broad EV adoption could have and the extent necessary to achieve CNP goals. Based on a preliminary literature review, EV adoption is anticipated to reach 7-10% of the vehicular fleet by 2030.

6.2. Federal Performance Measures

On July 6, 2012, the Federal Highway Administration signed into law the Moving Ahead for Progress in the 21st Century (MAP-21). This program promotes performance-based and multimodal transportation goals that work to address a host of challenges facing the U.S transportation system. Subsequent to this, on December 4, 2015, the Fixing America's Surface Transportation (FAST) Act was signed into law to maintain this performance-based approach to transportation planning. Both programs outline funding and requirements for multimodal transportation planning in metropolitan areas and their respective states. Through these programs both MPOs and states are required to develop transportation plans and transportation improvement programs that function through performance driven and outcome-based approaches to planning. **Table 10** lists the national performance goals for the federal-aid highway program.

Table 10 – National Performance Goals	
Goal Area	**National Goal**
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
Infrastructure condition	To maintain the highway infrastructure asset system in a state of good repair
Congestion reduction	To achieve a significant reduction in congestion on the National Highway System
System reliability	To improve the efficiency of the surface transportation system
Freight movement and economic vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
Environmental sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment
Reduced project delivery delays	To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices

States in coordination with MPOs were required to establish targets in support of the National Performance Goals for the safety performance measures by August 31, 2017 and for the remaining performance measures by May 20, 2018 in the areas listed below:

- Pavement condition on the Interstate System and on remainder of the National Highway System (NHS)
- Performance of the Interstate System and the remainder of the NHS
- Bridge condition on the NHS
- Fatalities and serious injuries—both number and rate per vehicle mile traveled--on all public roads
- Traffic congestion
- On-road mobile source emissions
- Freight movement on the Interstate System

MPOs either adopted the state targets or established their own within 6 months. Performance targets are established annually for safety measures and every 2 and/or 4 years for the remaining measures. The 4-year targets may be adjusted at the same time as the 2-year performance report is developed.

6.2.1. Arizona Targets
Based on the performance measures identified as part of MAP-21, ADOT established the targets in *Table 11.*

Table 11 – Federal Performance Measures	
Performance Measure	**Target**
Number of Fatalities	2% increase
Rate of Fatalities/100 Million Vehicle Miles Travelled	2% increase
Number of Serious Injuries	7% decrease
Rate of Serious Injuries/100 Million Vehicle Miles Travelled	8% decrease
Number of Non-motorized Fatalities and Serious Injuries	1% decrease
Percent of National Highway System (NHS) Bridges classified in good condition based on deck area	52%
Percent of NHS Bridges classified in poor condition based on deck area	4%
Percent of Interstate Pavements in good condition	44%
Percent of Interstate Pavements in poor condition	2%
Percent of Non-Interstate NHS Pavements in good condition	28%
Percent of Non-Interstate NHS Pavements in poor condition	6%
Freight Reliability on the Interstate (Truck Travel Time Reliability Index)	1.35
Percent of person-miles that have reliable travel times on the Interstate	85.8%
Percent of person-miles that have reliable travel times on the Non-Interstate NHS	74.9%

MetroPlan has adopted the ADOT performance targets.

Travel Time Reliability
Data for the MetroPlan region for Travel Time Reliability is not available from ADOT at this time.

CMAQ Emissions Reduction
MetroPlan is not within an air quality non-attainment area and therefore does not report data related to the CMAQ emissions reduction performance measure to ADOT.

6.2.2. Federal Performance Measures Assessment
Not all ADOT's performance targets are applicable to the MetroPlan region, this is noted in ***Table 12***. MetroPlan's status in reference to each of the performance targets is shown below in ***Table 12***. All datasets contain the latest available data as of December 2020. Safety statistics are based on five year rolling averages per the ADOT Statewide Traffic Safety Plan.

Table 12 – MetroPlan Performance Measure Target Status

Performance Measure	ADOT Performance Target	MetroPlan Performance Metric	Meeting Target
Pavement Condition	44% or more of interstate pavements in Good condition	38.76% of interstate pavements in Good condition	X
	2% or less of interstate pavements in Poor condition	1.5% of interstate pavements in Poor condition	✓
	28% or more of non-interstate NHS pavements in Good condition	13.8% of non-interstate pavements in Good condition	X
	6% or less of non-interstate NHS pavements in Poor condition	2.3% of non-interstate pavements in Poor condition	X
Bridge Condition	52% or more of NHS bridges in Good condition	15.9% of NHS bridges in Good condition	X
	4% or less of NHS bridges in Poor condition	0% of NHS bridges in Poor condition	✓
Safety	2% or less increase in fatalities	10.2% decrease in fatalities	✓
	2% or less increase in fatality rate	12.6% decrease in fatality rate	✓
	7% or more decrease in suspected serious injuries.	6.5% decrease in suspected serious injuries.	X
	8% or more decrease in suspected serious injury rate.	9.0% decrease in suspected serious injury rate.	✓
	1% or more decrease in non-motorized fatalities and serious injuries.	2.7% increase in non-motorized fatalities and serious injuries.	X
Travel Time Reliability	Interstate Truck Travel Time Reliability Index of 1.35	Data for these targets not currently available.	—
	85.8% of person-miles on interstate have reliable travel times.	Data for these targets not currently available.	—
	74.9% of person-miles on non-interstate NHS have reliable travel times.	Data for these targets not currently available.	—
CMAQ Emissions Reductions	Reduce Volatile Organic Compounds by 385 kg/day	Not applicable - MetroPlan within air quality standards.*	N/A
	Reduce Carbon Monoxide by 6,985 kg/day	Not applicable - MetroPlan within air quality standards.*	N/A
	Reduce Nitrogen Oxide by 761 kg/day	Not applicable - MetroPlan within air quality standards.*	N/A
	Reduce PM10 by 1,399 kg/day	Not applicable - MetroPlan within air quality standards.*	N/A
	Reduce PM2.5 by 112 kg/day	Not applicable - MetroPlan within air quality standards.*	N/A

* MetroPlan is not within an air quality non-attainment area

The MetroPlan region is meeting most of the federal performance measures. MetroPlan is in an area where freeze/thaw occurs on roadways more quickly degrading the pavement in comparison to more temperate areas which increases

maintenance needs to maintain comparable condition ratings. Operational and Management Strategies for System Preservation and Resiliency.

7.0   System Preservation

System preservation includes the operations and maintenance of the transportation system. Elements of the transportation system include pavement, signage, structures, and other assets. Agencies in the region document their system preservation plans in their respective transportation/capital improvement plans. The agencies included in this review are the Arizona Department of Transportation (ADOT), the City of Flagstaff, Coconino County, and Mountain Line.

7.1.   ADOT

MetroPlan is located within the ADOT North Central District. There are four pavement preservation or bridge rehabilitation projects in the ADOT 2023-2027 Five-Year Transportation Facilities Construction Program and MetroPlan Draft Transportation Improvement Program FY 2023-2027 located in the study area, those projects are listed below.

- ADOT ID 101004, SR 89A to I-40B, Pavement Rehabilitation, MP 402 to MP 403
- ADOT ID 100241, I-17, Pavement Preservation SB, County line to McConnell Drive Bridge
- ADOT ID 100199, Cosnino Road TI Underpass, Bridge Rehabilitation, I-40 at Cosnino Road
- ADOT ID 8808, Winona TI Underpass, Bridge Rehabilitation, I-40 at Townsend-Winona Road

7.2.   City of Flagstaff

The maintenance of city roads and streets is administered by the City of Flagstaff Public Works Division. The Street Section maintains 664 lane-miles of asphalt streets and 28 lane-miles of dirt roads. There are three pavement preservation or bridge rehabilitation projects in the MetroPlan Draft Transportation Improvement Program FY 2023-2027 located in the study area, those projects are listed below. Not listed below are two area wide improvements including chip seal and pavement overlay.

- Road Reconstruction and Utility Replacement, Pulliam Drive
- Pavement Preservation, West Flag Quadrant Repairs
- Coconino Estates, Streets Reconstruction, US 180: Meade Lane to Humphreys Street and Forest Avenue: Navajo Drive to Rim Drive

7.3.   Coconino County

The maintenance of county roads and streets is administered by the Coconino County Public Works Road Maintenance Division. There are two pavement preservation projects programmed in the MetroPlan Draft Transportation Improvement Program FY 2023-2027 and Roadway Capital Improvements Plan FY 2018-2028 located in the study area, those projects are listed below. Coconino County contracts with the US Forest Service and the Bureau of Indian Affairs; roadway preservation projects owned by those agencies are not included below.

- Kachina Trail Overlay, Mill and Overlay, Ancient Trail to Kona Trail
- Ancient Trail Overlay/Shoulders, Mill and Overlay; add Shoulders, Kachina Trail to Tonalea Trail

7.4.   Mountain Line

The maintenance and operation of transit systems in the study area is administered by Mountain Line. Mountain Line has identified several gaps in their transit system including unmet pedestrian and bicycle infrastructure, availability of accessible vehicles, and ITS communication systems and infrastructure (fiber optics). Mountain Line identified two action items to address these gaps including researching grant opportunities and leveraging local funds.

7.5.   Disaster Resiliency and Emergency Preparedness

In compliance with 23 U.S. Code § 134 (i) (2) (G), natural disasters common to the study area are discussed below. Natural disasters or emergencies may include wildfires, floods, severe weather, and others. Other types of disasters or emergencies may include release of hazardous materials, seismic activities, and terrorism. These other types of emergencies may naturally occur less often or from non-natural intervention. Both Coconino County and the City of Flagstaff have emergency preparedness/response plans. A brief summary of these plans is provided below.

Coconino County has several emergency preparedness/response resources including an Emergency Operation Plan (EOP), Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), and Emergency Preparedness Guide. The EOP is an all-hazard regional plan that describes how Coconino County will organize and respond to emergencies. The MJHMP identifies relevant strategies to address hazards and risks that threaten the county. These strategies aim to decrease vulnerability and increase resiliency and sustainability. The Emergency Preparedness Guide provides citizens with information and strategies to help them prepare for an emergency. Coconino County also has an emergency notification system that provides its users with relevant information for a variety of emergency situations.

The City of Flagstaff has emergency preparedness/response resources that focus on wildfires. These resources are the Personal Wildfire Action Plan known as "Ready, Set, GO!" and Fire Restriction Stages. Additionally, the City of Flagstaff adheres to the strategies listed in the Coconino EOP and MJHMP.

8.0   Conclusion

Onward advances the projects and operations and maintenance levels approved by voters via Propositions 403, 406, 419, and 420. It provides congestion relief in the region, enhances connectivity, reduces future VHT, and completes much of the highest priority bicycle and pedestrian projects in the ATMP. It falls short of the goals in the Carbon Neutrality Plan; this is to be expected, as the Carbon Neutrality Plan and its goals did not exist when the current propositions were advanced. Due to fiscal constraint, Onward is the long-range plan for the region. Future funding propositions could supplement the projects identified herein to better achieve regional climate goals.

Appendix On-1: 2019 Base Year and 2045 Onward Model Run

2019 Base Year

VMT Summaries (Count Links Only)

```
---------------------------------------------------------------------
| Facility Type      |   TOT VMT  |  Count VMT  | % Deviation  |
|-------------------------------------------------------------------|
|  Freeways          |   378591   |   358239    |        5     |
|  Major Arterials   |    80667   |   100791    |      -19     |
|  Minor Arterials   |    66618   |    92387    |      -27     |
|  Major Collectors  |    24556   |    36575    |      -32     |
|  Minor Collectors  |     6157   |     8836    |      -30     |
|  Ramps             |    19625   |    20743    |       -5     |
|  Local Roads       |     3441   |     5086    |      -32     |
|  Unpaved County Roads|      0   |        0    |       NA     |
|  System Ramps      |        0   |        0    |       NA     |
---------------------------------------------------------------------
```

Percent Root Mean Square Error by Facility Type

```
-------------------------------------------------------------------
| Facility Type      | Observations |   Model  |   Target   |
|-----------------------------------------------------------------|
|  Freeway           |      14      |     6    |     25     |
|  Major Arterials   |      27      |    12    |     40     |
|  Minor Arterials   |      49      |    21    |     50     |
|  Major Collectors  |      46      |    31    |     50     |
|  Minor Collectors  |      29      |    32    |     50     |
|  Ramps             |      11      |    14    |     50     |
|  Local Roads       |      11      |    57    |     50     |
|  Unpaved County Roads|     0      |    NA    |     65     |
|  Total             |     187      |    20    |  30 to 40  |
|-----------------------------------------------------------------|
```

Percent Root Mean Square Error by Volume Group

```
-------------------------------------------------------------------
| Facility Type      | Observations |   Model  |   Target   |
|-----------------------------------------------------------------|
|  0 to 4,999        |      62      |    33    |    120     |
|  5,000 to 9,999    |      68      |    26    |     45     |
|  10,000 to 19,999  |      34      |    15    |     40     |
|  20,000 to 39,999  |      21      |    11    |     35     |
|  40,000 to 59,999  |       2      |    11    |     30     |
|  60,000 and greater|       0      |    NA    |     20     |
|-----------------------------------------------------------------|
```

2019 mode share

Mode	Trips	
Auto_Vehicle	AM_AUTO	73668.03
Auto_Vehicle	OP_AUTO	128714
Auto_Vehicle	PM_AUTO	80768.29
Auto_Vehicle	NT_AUTO	55819.33
Auto_Vehicle	DLY_AUTO	386467.4
Bike_Person	Bike	19311.84
Transit_Person	Transit	19539.69
Walk_Person	Walk	62568.56

2045 Model Summary

```
//////////////////////////////////////////////////
Flagstaff MPO 3d Model Daily Summary Report
Roadway Link Performance (excludes connector)
//////////////////////////////////////////////////

Directory:                    C:\Flagstaff Model\Model
Runs\Stride22_On&Up\Onward2045\

3D Model VMT:                  3,450,770
Auto Model VMT:                3,155,690

3D Model VHT:                  115,822
Auto Model VHT:                93,284

3D Model Av Delay (Hr):        38,244
Auto Av Delay (Hr):            23,350

3D Model Av Speed:             29.8
Auto Model Av Speed:           33.8

3D Person Trips:               939,182
3D Walk Trips & Share:         108,549        11.6
3D Transit Trips & Share:      13,787         1.5
3D Auto Trips & Share:         816,846        87.0

3D Vehicle Trips:              639,419
Auto Vehicle Trips:            667,859

3D Av Veh Trip Length:         5.4
Auto Av Veh Trip Length:       4.7

3D Av Veh Trip Time:           10.9
Auto Av Veh Trip Time:         8.4

3D PM VMT:                     269,481
Auto PM VMT:                   226,334

3D PM VHT:                     7,625
Auto PM VHT:                   6,188

3D PM Av Speed:                35.3
Auto PM Av Speed:              36.6

3D PM Delay (Hours):           1,744.7
Auto PM Delay (Hours):         1,148.6
```

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Appendix On-2: Federal Performance Measure Calculations

1.1.1.   Federal Performance Assessment Methodology

The following provides an overview of the methodology utilized to evaluate the performance of the transportation system in MetroPlan based on the federal performance measures. The methodology follows documentation published by FHWA and data obtained from ADOT and MetroPlan.

Pavement Condition

Pavement condition rating is based on the FHWA Computation Procedure for the Pavement Condition Measures, May 2018. This document details the necessary data required and methodology to calculate pavement condition rating for both Interstate and Non-Interstate National Highway System (NHS) pavement. The pavement condition performance measure computation excludes lanes miles (LM) of bridges and unpaved roads and any mainline highway with missing data. The data used to calculate MetroPlan's pavement condition ratings was obtained from ADOT as well as computed for the roads within the MetroPlan region. Equations 1 through 4 display the computation methodology that was utilized to assess pavement condition.

(1)
$$\% \, Good \, Condition \, (Interstate) = \frac{LM \, of \, Pavement \, on \, Interstate \, System \, in \, Good \, Condition}{Total \, LM \, of \, Pavement \, on \, Interstate \, System} x100$$

(2)
$$\% \, Poor \, Condition \, (Interstate) = \frac{LM \, of \, Pavement \, on \, Interstate \, System \, in \, Poor \, Condition}{Total \, LM \, of \, Pavement \, on \, Interstate \, System} x100$$

(3)
$$\% \, Good \, Condition \, (Non-Interstate) = \frac{LM \, of \, Pavement \, on \, Non-Interstate \, System \, in \, Good \, Condition}{Total \, LM \, of \, Pavement \, on \, Non-Interstate \, System} x100$$

(4)
$$\% \, Poor \, Condition \, (Non-Interstate) = \frac{LM \, of \, Pavement \, on \, Non-Interstate \, System \, in \, Poor \, Condition}{Total \, LM \, of \, Pavement \, on \, Non-Interstate \, System} x100$$

Bridge Condition

Bridge condition rating is based on the FHWA Computation Procedure for Bridge Condition Measures, April 2018. This document details the necessary data required and methodology to calculate bridge condition rating for bridges on the NHS. The National Bridge Inventory (NBI) dataset, specific to the state of Arizona was utilized to calculate MetroPlan's bridge condition ratings. This dataset was requested from and furnished by ADOT. Equations 5 and 6 display the computation methodology that was utilized to assess bridge conditions.

(5)
$$\% \, Good \, Condition = \frac{Deck \, Area \, of \, NHS \, Bridges \, in \, Good \, Condition}{Total \, Deck \, Area \, of \, NHS \, Bridges} x100$$

(6)
$$\% \, Poor \, Condition = \frac{Deck \, Area \, of \, NHS \, Bridges \, in \, Poor \, Condition}{Total \, Deck \, Area \, of \, NHS \, Bridges} x100$$

Safety

Safety Performance Measures are based on the FHWA Procedure for Safety Performance Measure Computation and State Target Achievement Assessment, February 2019. This document details the necessary data required and methodology to calculate the five safety performance measures included in the federal Highway Safety Improvement

Program (HSIP) data submittal that each state is required to participate in annually. Incident data published by ADOT was used to calculate MetroPlan's Safety Performance. VMT information was not available from MetroPlan therefore Average Annual Daily Traffic (AADT) volumes were used. Equations 7 through 11 display the computation methodology that was utilized to assess safety in the region for the performance year, 2020. Five-year averages of 2015-2019 and 2016-2020 were compared to determine the regions progress towards safety goals.

(7)

$$\# \ of \ Fatalities \ Measure = \frac{Total \ Fatal \ Crashes \ (2016 - 2020)}{5}$$

(8)

$$Rate \ of \ Fatalities \ Measure = \frac{(Total \ Fatal \ Crashes \ (2016 - 2020)) x 100,000,000}{V x 365 x N}$$

Where V = AADT volumes
Where N = Number of years of data

(9)

$$\# \ of \ Non-Motorized \ Measure = \frac{Total \ Non-Motorized \ Crashes \ (2016 - 2020)}{5}$$

(10)

$$\# \ of \ Serious \ Injuries \ Measure = \frac{Total \ Serious \ Injury \ Crashes \ (2016 - 2020)}{5}$$

(11)

$$Rate \ of \ Serious \ Injuries \ Measure = \frac{(Total \ Serious \ Injury \ Crashes \ (2016 - 2020)) x 100,000,000}{V x 365 x N}$$

Where V = AADT volumes
Where N = Number of years of data