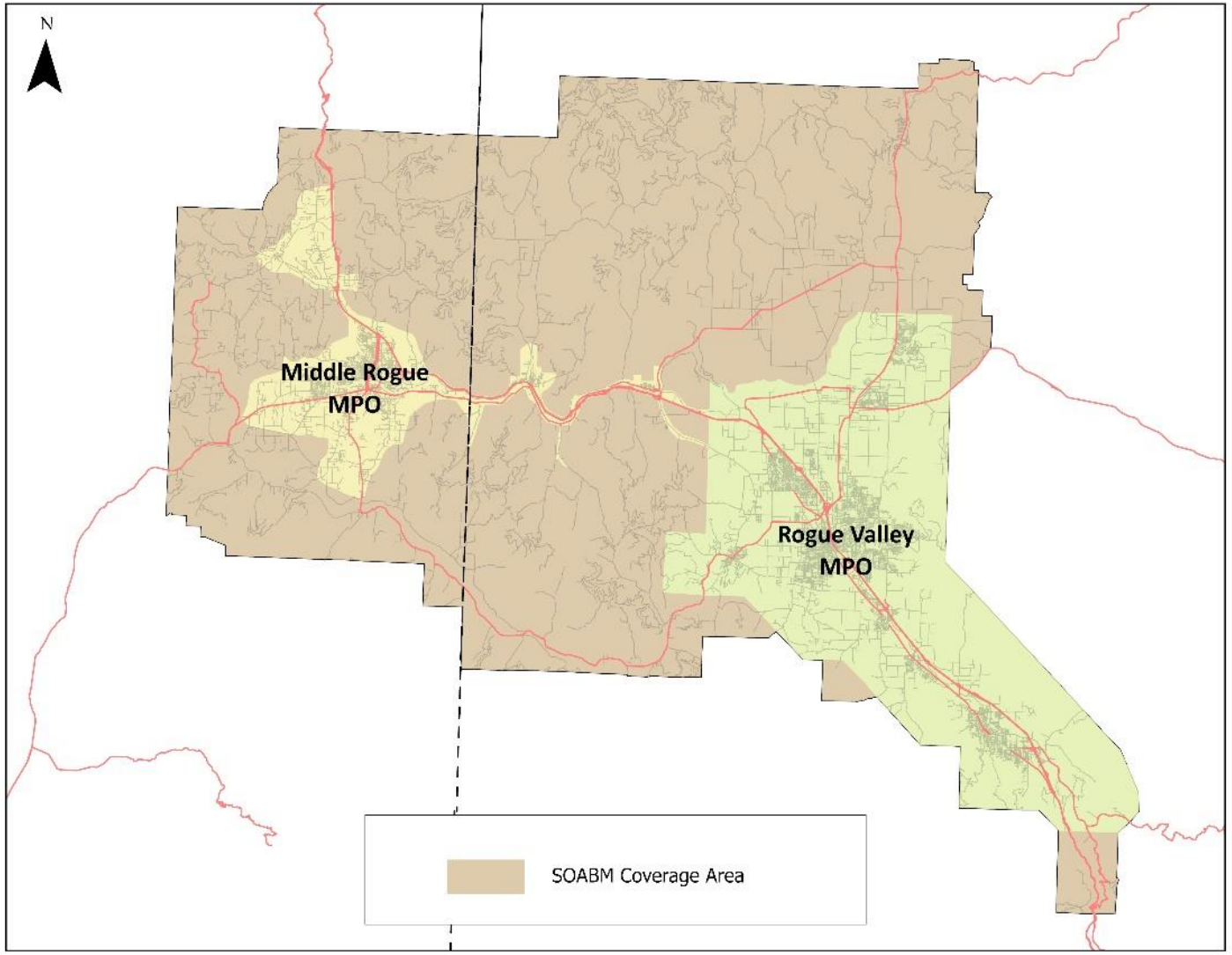
Chapter 11 – System Performance

System Performance in this chapter are forecasts of future travel conditions, for example, system performance, traffic congestion, Vehicle Mile Traveled (VMT), and Transit ridership. The forecasts are estimates produced by the Southern Oregon Activity-Based Travel Demand Model (SOABM). The model is maintained and updated by Oregan Department of Transportation Planning Analysis Unit (TPAU). The model, computer software that performs a series of calculations, is based on information about population, employment, and land use.

This is the first and only Activity-Based Travel Model in the State of Oregon. Activity-based models incorporate significantly more detailed input information and produce significantly more detailed outputs than trip-based models. By operating at the level of individual persons and households, activity-based models can use a wider range of important explanatory variables to predict travel patterns than trip-based models.

Southern Oregon Activity-Based Travel Demand Model (SOABM)

The Oregon Department of Transportation (ODOT) Southern Oregon Activity-Based Travel Demand Model (ABM) is a new travel demand model for the Middle Rogue and Rogue Valley MPOs. The process of developing the model started in 2016. And it was first used for MRMPO & RVMPO RTP updates in 2020 and 2021. The new modeling system includes 50,000+ people in Grants Pass and 175,000+ people in the Rogue Valley urban areas; see Map 11-1 for coverage area.



Map 11-1- SOABM Coverage Area

Activity-Based Travel Model Background

Activity-based models are based on the principle that travel demand is derived from people's daily activity patterns. Activity-based models predict which activities are conducted when, where, for how long, for and with whom, and the travel choices they will make to complete them. Having this type of detailed model at their disposal allows policy makers to evaluate the effect of alternative policies on individuals travel behavior at a high level of temporal and spatial resolution and select the best policy alternative considering a potential wide range of performance indicators. For a comprehensive introductory overview of this paradigm, consider reading the Activity Based Modeling Primer published under SHRP2 in 2014.

Compared to traditional trip-based models, the model system has more detailed and accurate representation of space, time, travel patterns, and significantly more person and context-based explanatory variables. The ABM better models non-motorized travel, time-of-day, ride sharing, non-home-based travel, accessibility effects, and provides a flexible household travel survey-like database for custom summaries. This modeling system was also developed as the eventual framework for exploring new policy issues: new vehicle types and emissions, parking and different pricing scenarios, connected and automated vehicles, vehicle ownership moving to service, light-weight vehicle infrastructure, telecommuting, and others.

How do we use Travel Models?

Travel models are used to provide objective assessments of the advantages and disadvantages of different alternatives within SOABM. These alternatives may include transportation projects, capital investments, policies, land use configurations, socioeconomic and demographic assumptions, and many other factors. By running the travel model with different sets of input assumptions representing these alternatives, analysts can evaluate differences between alternatives using a broad range of metrics and can help answer decision makers' key questions.

"Trip" vs "Tour" vs "Activity"

- **Trip** (aka four step model) — individual person trips, does not understand that trips are interrelated
- **Tour** — strings together trips that will be typically done in sequence, but does not account for vehicle capacities or total course of the day
- **Activity** — accounts for vehicle trips (accounts for vehicle capacity) and how trips would be strung together over the course of a day

In developing the 2024–2049 RTP, the SOABM was utilized to assess the performance of the transportation system in future years, given the plan's forecasts for growth. Results are described in the following sections.

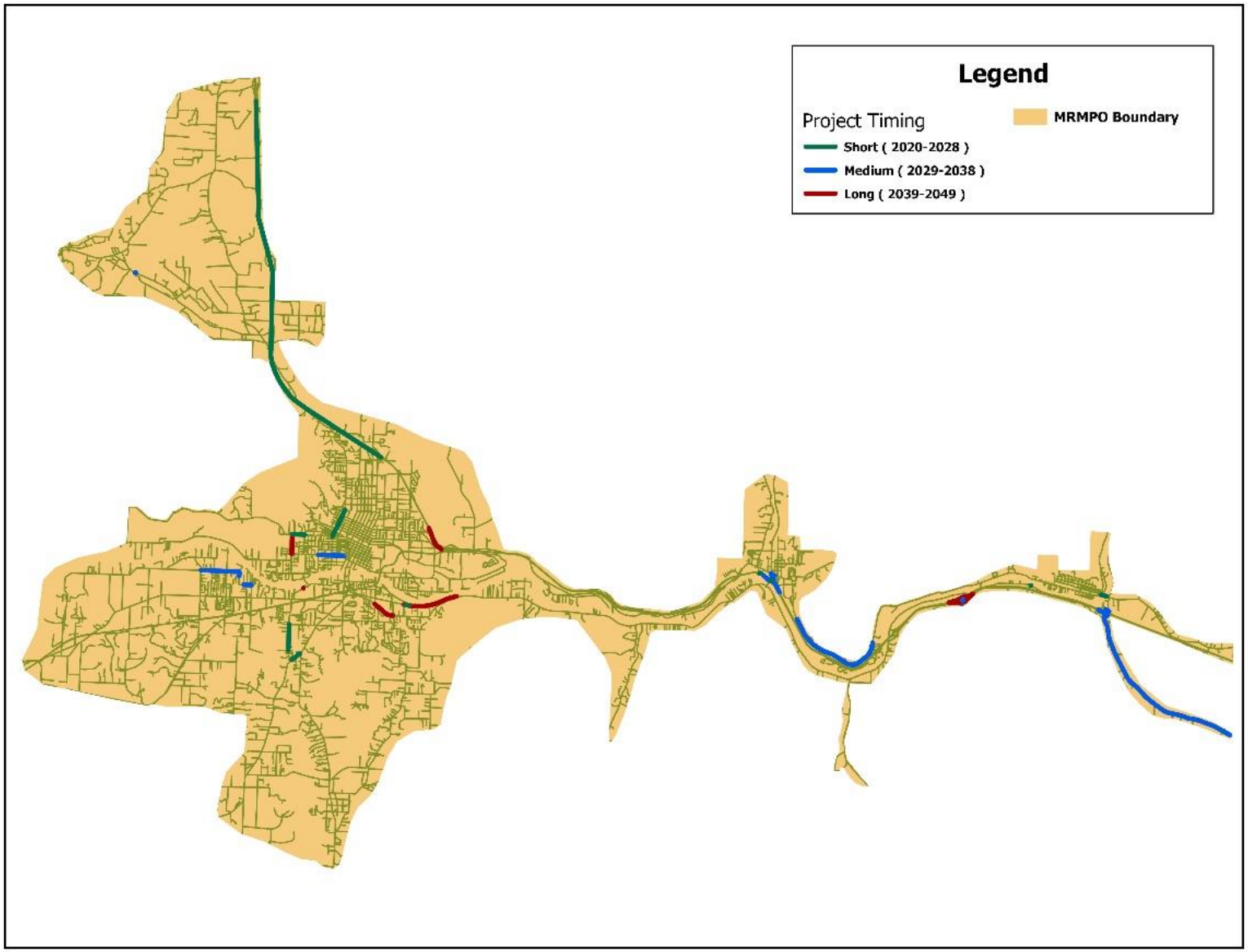
Model Output

Travel models are designed to provide travel forecasts that are based on generalized land use patterns and transportation networks. Since models do not represent individual land uses, driveways, or neighborhood-scale streets, the forecasts produced are not sensitive to these specific land use and transportation characteristics.

It is inappropriate to use raw model outputs for transportation and land use decisions. Post processing of the raw data is required to estimate the impacts these decisions have on the transportation system.

Because the current Oregon TPR (Transportation Planning Rule) requires having the daily VMT calculations by only the MPO internal zones to internal zones, which exclude the vehicle trips or VMTs from internal zones to external zones, from external zones to internal zones. As with the case of MRMPO, the internal zones are the zones within the MRMPO boundary and external zones are all other zones outside of the boundary.

Map 11-2 shows the MRMPO part of the SOABM with model network links with the RTP projects.



Map 11-2 - MRMPO Model Network links

The MRMPO 2020-2049 RTP projects were coded on the 2020 SOABM network to reflect the future year 2049 RTP network scenario; however, the future 2049 No Build SOABM scenario does not include the RTP projects but maintains the 2020 base year network conditions and utilizes the 2049 land use forecasts.

Vehicle Miles Traveled (VMT)

Table 11-1 shows the model output for the daily VMT per Capita for internal trips within the MRMPO planning area. In 2020, VMT was estimated at 8.7 miles per capita. The 2049 No-Build scenario estimates VMT per capita at 8.298 miles which is a 4.31% reduction in VMT per capita from 2020. The 2049 RTP Build scenario VMT per capita is estimated at 8.339 miles which is a 3.83% reduction from 2020 VMT per capita. The difference in VMT per capita between the two scenarios is that the MRMPO area will have several more lane miles (1,183 miles vs 1,175 miles) due to new transportation projects being built during the 25-year RTP planning period. Therefore, there will be more daily VMTs compared with No-Build scenario since the two scenarios share the same future land use data but different network.

Table 11-1: Daily Internal VMT/Capita

SOABM Scenario Forecasting	2020 Base Year	2049 No Build	2049 RTP Build
MRMPO Area Population	67,840	88,800	88,800
Total Lane Miles (within MRMPO)	1,175	1,175	1,183
Daily VMT (Internal-Internal)	588,266	736,822	740,524
Daily VMT/Capita	8.671	8.298	8.339
VMT Per Capita Change%	0%	-4.31%	-3.83%

Table 11-2

MRMPO RTP20-49 Percentage of VMT by Demand/Capacity Ratio Range* P.M. Peak Hour						
Demand/Capacity Ratio Range	Reference 2020		No-Build 2049		RTP-Build 2049	
	VMT	% VMT	VMT	% VMT	VMT	% VMT
0.0 - 0.59	135,124	80.7%	147,850	70.9%	139,348	67.1%
0.60 - 0.69	26,573	15.9%	30,485	14.6%	28,309	13.6%
0.70 - 0.79	3,284	2.0%	20,700	9.9%	30,747	14.8%
0.80 - 0.89	1,146	0.7%	4,574	2.2%	4,955	2.4%
0.90 - 0.99	216	0.1%	1,604	0.8%	1,511	0.7%
> 1.0	1,065	0.6%	3,198	1.5%	2,848	1.4%
Total	167,408	100%	208,411	100%	207,718	100%

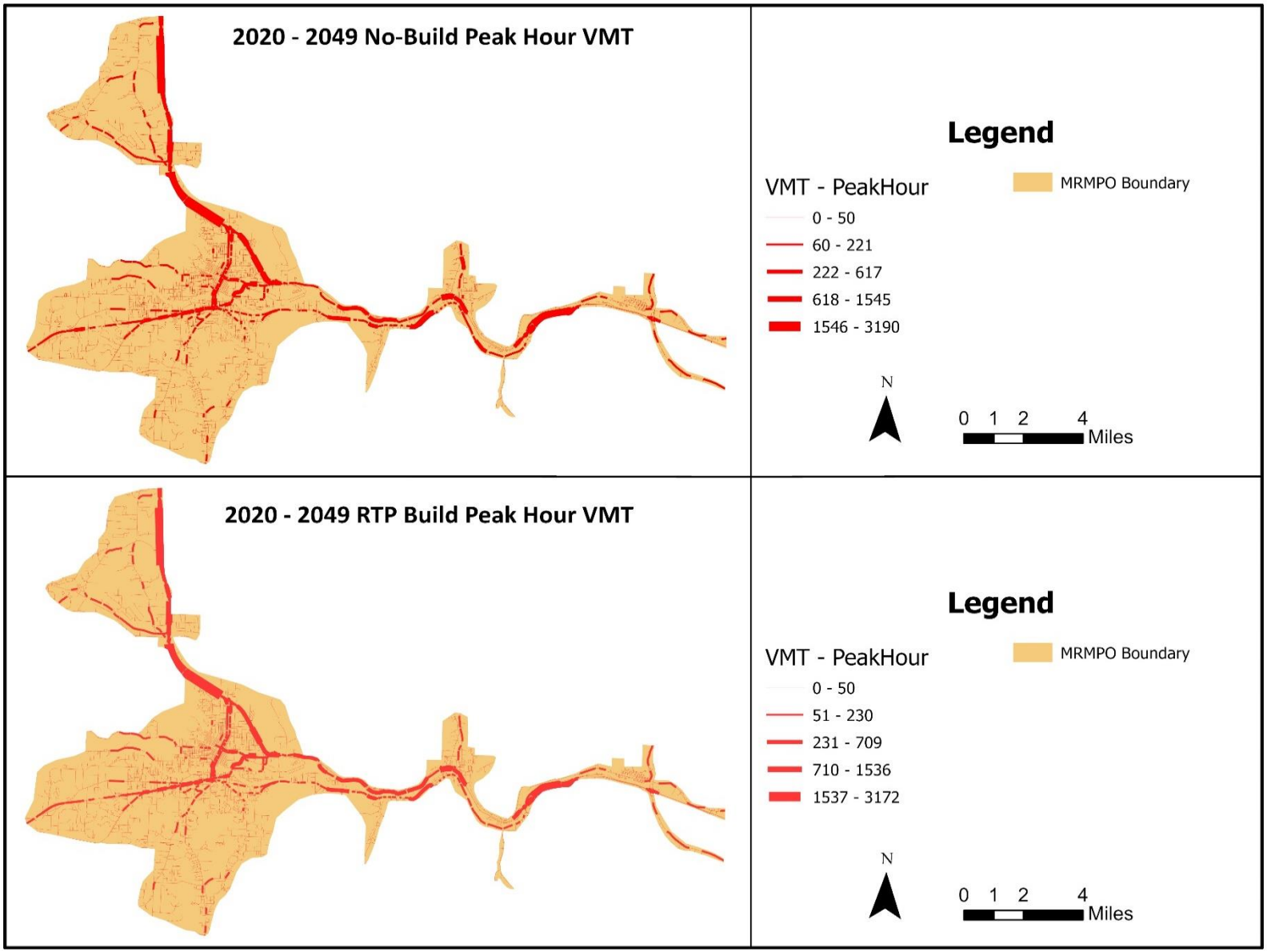
** Congestion defined as model links with demand/capacity ratio ≥ 0.90*

** High Congestion defined as model links with demand/capacity ratio > 1.0*

Table 11-2 shows VMT percentages in comparison to Demand to Capacity Ratio in Peak hours, PM peak hour (4:30-5:30 PM), of the MRMPO network. In the 2049 No-Build scenario, 97.6% of the network VMT falls between 0.0 to 0.89 which means no congestion. Moreover, 0.8% of the network VMT is shown to be considered congested and 1.5% of the network VMT is considered to be high congestion. However, in the 2049 RTP-Build scenario, 97.9% of the MRMPO VMT is going to come from not congested network. Also, 0.7% of the network VMT is shown to be congested and remaining 1.4% of the network VMT is classified as high congestion.

The main difference between the two scenarios is that what is classified as congestion and high congestion is actually going down in the scenario where the RTP Projects get built within the MRMPO network. Even though the numbers might not look that drastic, but the long-term effectiveness of the network is progressing positively.

Map 11-3 shows the comparison between the two scenarios on the MRMPO streets network. It illustrates the peak hours VMT and its clear that with the RTP build scenario the VMT is less than the No-build scenario within the MRMPO area.



Map 11-3 - VMT Peak Hours Comparison

Daily Modal Trips

One of the outcomes of the SOABM model is daily modal trips and their purpose. These modes include Biking, Walk-Transit, Park & Ride Transit, and other modes. Mode purposes also varies in what it includes, for example, discretionary which means not mandatory such as work commute, work-related, school, shopping basically trips that people make at their own judgement. Also, eating out, escorting, and other trips are calculated by the model as daily modal trips.

Table 11-3 shows percentages of the daily modal trips generated by the SOABM model. The trips are sorted by nine different trip types: Bike, Drive alone (DA), Kiss and Ride (KnR), Park and Ride (PnK), School bus, Shared – 2 general lanes (SR2GP), Shared – 3+ general lanes (SR3GP), Walk, Walk to Transit. In 2020 the drive alone trips are accounted for to be 52.37% of the total trips. Transit generated 0.2% trips in the same year with biking having 1.33% trips.

In 2049 Daily with No-Build scenario, the drive alone trips went up to 54.21% the same thing goes for transit, walking, and biking. Those trip categories slightly went up from the base year, 2020. On the other hand, the 2049 Daily with RTP Build scenario, the drive alone trips generate 54.03% with transit having 0.64% trips, higher than both the base year and No-Build scenario. The other mode of trips stays relatively the same throughout the two scenarios.

Table 11-3: Daily Modal Trips

	BIKE	DA	KnR	PnR	SCHOOL BUS	SR2GP	SR3GP	WALK	Walk to Transit
2020 Base Year	1.33 %	52.37 %	0.03 %	0.03 %	2.07%	24.84 %	12.57 %	6.57 %	0.21%
2049 DAILY (No-Build)	1.57 %	54.21 %	0.02 %	0.02 %	1.95%	23.89 %	10.26 %	7.61 %	0.46%
2049 DAILY (RTP Build)	1.54 %	54.03 %	0.03 %	0.04 %	1.95%	23.87 %	10.34 %	7.58 %	0.64%

Figure 11-1 showcase Table 11-3 numbers in a line chart to illustrate the changes overtime and the differences between trip types.

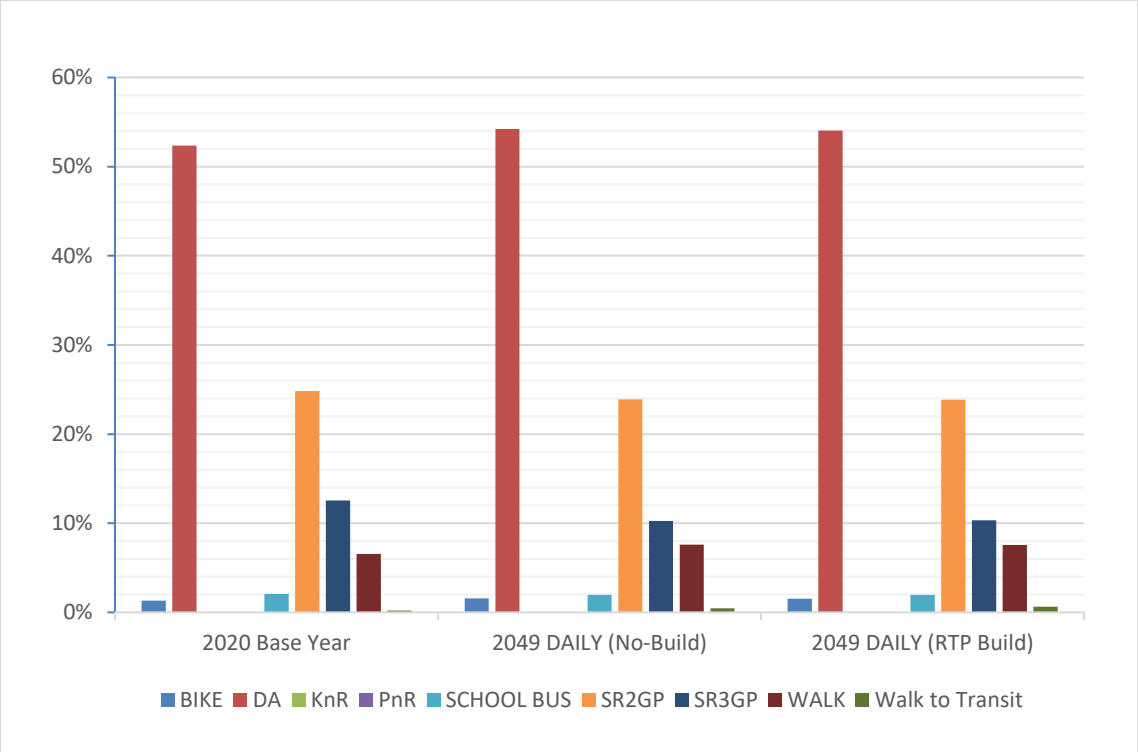


Figure 11-1 - Daily Modal Trips

Performance Comparison

System-wide performance measures were analyzed using aggregated PM peak hour congested vs. non-congested lane miles, VMT and VHT by the defined Demand to Capacity Ratio (DCR) ranges in the MRMPO area. As shown below, Table 11-4 displays the total lane miles, PM peak hour congested lane miles and congestion percentages, average speed, VMT and VHT.

Table 11-4 below shows percent of congested lane miles, travel speed and VMT for the roadway system in the MRMPO area. Roadway congestion is higher in the future years compared to the base year. It is interesting to note that the 2049 No-RTP (no build) scenario has 6.8 lane miles of congestion on 1,175 lane miles as compared to 6.4 congested lane miles on 1,183 lane miles in the 2049 RTP Build scenario.

Also, VMT and VHT numbers are increasing from the base year. But the 2049 No-RTP scenario is generating 208,411 in VMT and 5,673 VHT. On the other hand, 2049 RTP-Build scenario is generating 207,718 VMT and 5,668 VHT. This means less miles will be traveled and less hours will be spent in travel in the RTP Build scenario than the No-RTP scenario.

Table 11-4: System-wide Peak Hour Performance Comparison

Performance Measures by Scenario	2020 Ref Year	2049 No RTP	2049 RTP Build
Scenario Year (PM Peak Hour)	**2020**	**2049**	**2049**
Model-wide Lane Miles	1,175	1,175	1,183
Lane Miles Congested (V/C ≥ 0.90)	**1.45**	**6.8**	**6.4**
Percent Lane Miles Congested	0.1%	0.6%	0.5%
Mean Travel Speed (mph):	38	37	37
Vehicle Miles Traveled (VMT)	167,408	208,411	207,718
Vehicle Hours Traveled (VHT)	4,365	5,673	5,668

Demand-to-Capacity

For the 2024-49 RTP update, a demand-to-capacity analysis was performed to show congestion levels on specific roadways in the MRMPO area. Demand-to-Capacity Ratios (DCR) for the 2020-2049 model run are shown in Table 11-5 below for freeway, principal arterial, minor arterial, and collector lane miles within the MRMPO area. Congestion is defined as roadways (model links) with a DCR equal to or greater than (≥) 0.90.

Table 11-5 shows the reference year, 2020, and the level of congestion across the MRMPO network. The light orange color with a DCR ≥ 0.90 is considered congested. Table 11-5 shows there is less than 1 lane mile across the MRMPO network that is considered congested. The dark orange is considered a high congestion level where the DCR is greater than (>) 1. There is only 0.08 congested lane miles in the MRMPO network.

Table 11-5

2020 Reference Peak Lane Miles				
Demand/Capacity Ratio Range	**Freeway**	**Principal Arterial**	**Minor Arterial**	**Collector**
0.0 - 0.59	90.92	63.33	77.36	178.83
0.60 - 0.69	18.82	3.63	1.20	0.72
0.70 - 0.79	0.00	2.32	0.64	0.44
0.80 - 0.89	0.00	0.59	0.18	0.37
0.90 - 0.99	0.00	0.13	0.07	0.14
> 1.0	0.00	0.00	0.00	0.08
TOTAL	**109.74**	**70.00**	**79.45**	**180.58**

* Congestion defined as model links with demand/capacity ratio ≥ 0.90

* High Congestion defined as model links with demand/capacity ratio > 1.0

Table 11-6 shows the 2049 No-RTP scenario. In this scenario congestion levels are higher from what it was in the base year. There is 1.41 lane miles that are congested within functional class in the MRMPO area. Also, high congestion lanes have increased, total of 0.96 miles, within the network and this is without any additional lane miles added to the MRMPO network.

Table 11-6

2049 No RTP$_{20\text{-}49}$ Peak Lane Miles				
Demand/Capacity Ratio Range	**Freeway**	**Principal Arterial**	**Minor Arterial**	**Collector**
0.0 - 0.59	76.04	61.99	75.41	176.57
0.60 - 0.69	21.68	2.02	1.97	1.31
0.70 - 0.79	12.02	2.48	1.02	0.93
0.80 - 0.89	0.00	2.74	0.64	0.58
0.90 - 0.99	0.00	0.40	0.30	0.71
> 1.0	0.00	0.37	0.11	0.48
TOTAL	**109.74**	**70.00**	**79.45**	**180.58**

* Congestion defined as model links with demand/capacity ratio ≥ 0.90

* High Congestion defined as model links with demand/capacity ratio > 1.0

Table 11-7 showcase the model numbers for RTP Build scenario. In this scenario, the total lane miles have increased from the base year by 8 miles with a total of 1,183 lane miles across the MRMPO. The model output indicated that there is around 1.31 lane miles that is considered congested across the MRMPO. In addition, there is 0.69 lane miles that is considered a high congestion within the network.

Table 11-7

2049 RTP_{20-49} Peak Lane Miles				
Demand/Capacity Ratio Range	**Freeway**	**Principal Arterial**	**Minor Arterial**	**Collector**
0.0 - 0.59	75.14	59.81	83.55	169.57
0.60 - 0.69	16.40	2.83	2.00	8.07
0.70 - 0.79	18.20	2.32	1.20	3.12
0.80 - 0.89	0.00	2.73	0.42	2.05
0.90 - 0.99	0.00	0.66	0.13	0.52
> 1.0	0.00	0.14	0.15	0.40
TOTAL	**109.74**	**68.49**	**87.45**	**183.73**

* Congestion defined as model links with demand/capacity ratio ≥ 0.90

* High Congestion defined as model links with demand/capacity ratio > 1.0

Congested Roads

Travel conditions on several key roads were examined with the model. The analysis includes selected principal and minor arterial roadways identified by staff as key travel routes within the model area. Below Table 11-8, Table 11-9, and Table 11-10 show estimated outputs for base year 2020 and future conditions in 2049 with No-RTP build scenario and with RTP build scenario. Travel conditions expressed are peak hour conditions, which are calculated to be typical conditions a motorist is likely to encounter at the late afternoon–early evening hours–the time of the greatest amount of travel in the MRMPO region.

The numbers in the columns in these two tables are the percentages of lane miles on a particular road that are at the demand-to-capacity ratio ranges indicated in the first column. Congestion is expressed as a ratio of travel demand, or number of vehicle trips to roadway capacity for accommodating vehicles. High congestion indicates too many vehicles attempting to travel on the segment of road, causing delay. The estimates report peak hour travel - travel at certain hours in the day, generally mid-afternoon in the MRMPO area. (Peak hour varies from region to region, dependent on conditions such as shift changes and school hours.) Congestion on the roads shown on these tables can lead to delays on intersecting roads as well. The model data may be used to identify highly traveled and congested roadways, which can be prioritized for funding through the MRMPO Transportation Improvement Program (TIP) and Regional Transportation Plan (RTP) project selection processes

Table 11-8

2020 Reference Peak Lane Miles %													
Demand/Capacity Ratio Range	**Rogue River Hwy (OR99)**	**Redwood Hwy (OR199)**	**Jacksonville Hwy (OR238)**	**Highland Ave**	**Redwood Ave**	**G St**	**A St**	**Allen Creek Rd**	**Bridge St**	**E St**	**F St**	**M St**	**Parkdale Drive**
0 – 0.59	93%	87%	98%	100%	88%	91%	100%	99%	95%	99%	98%	92%	86%
0.59 – 0.69	3%	7%	1%	0%	7%	6%	0%	1%	0%	0%	0%	4%	14%
0.69 – 0.79	3%	4%	0%	0%	3%	3%	0%	0%	5%	0%	2%	3%	0%
0.79 – 0.89	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
0.89 – 0.99	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%
0.99 – 9.99	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No Congestion	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	100%
Congestion	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%
High Congestion	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Lane Miles	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 11-9

2049 No-RTP$_{20\text{-}49}$ Peak Lane Miles %													
Demand/Capacity Ratio Range	**Rogue River Hwy (OR99)**	**Redwood Hwy (OR199)**	**Jacksonville Hwy (OR238)**	**Highland Ave**	**Redwood Ave**	**G St**	**A St**	**Allen Creek Rd**	**Bridge St**	**E St**	**F St**	**M St**	**Parkdale Drive**
0 – 0.59	92%	84%	98%	94%	86%	91%	100%	95%	76%	94%	98%	90%	83%
0.59 – 0.69	0%	4%	1%	6%	7%	6%	0%	2%	15%	6%	0%	0%	3%
0.69 – 0.79	2%	7%	0%	0%	3%	0%	0%	2%	3%	0%	0%	3%	14%
0.79 – 0.89	6%	3%	0%	0%	3%	3%	0%	1%	0%	0%	0%	7%	0%
0.89 – 0.99	0%	1%	0%	0%	1%	0%	0%	0%	5%	0%	2%	0%	0%
0.99 – 9.99	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%
No Congestion	100%	98%	100%	100%	99%	100%	100%	100%	95%	99%	98%	99%	100%
Congestion	0%	1%	0%	0%	1%	0%	0%	0%	5%	0%	2%	0%	0%
High Congestion	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%
Total Lane Miles	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 11-10

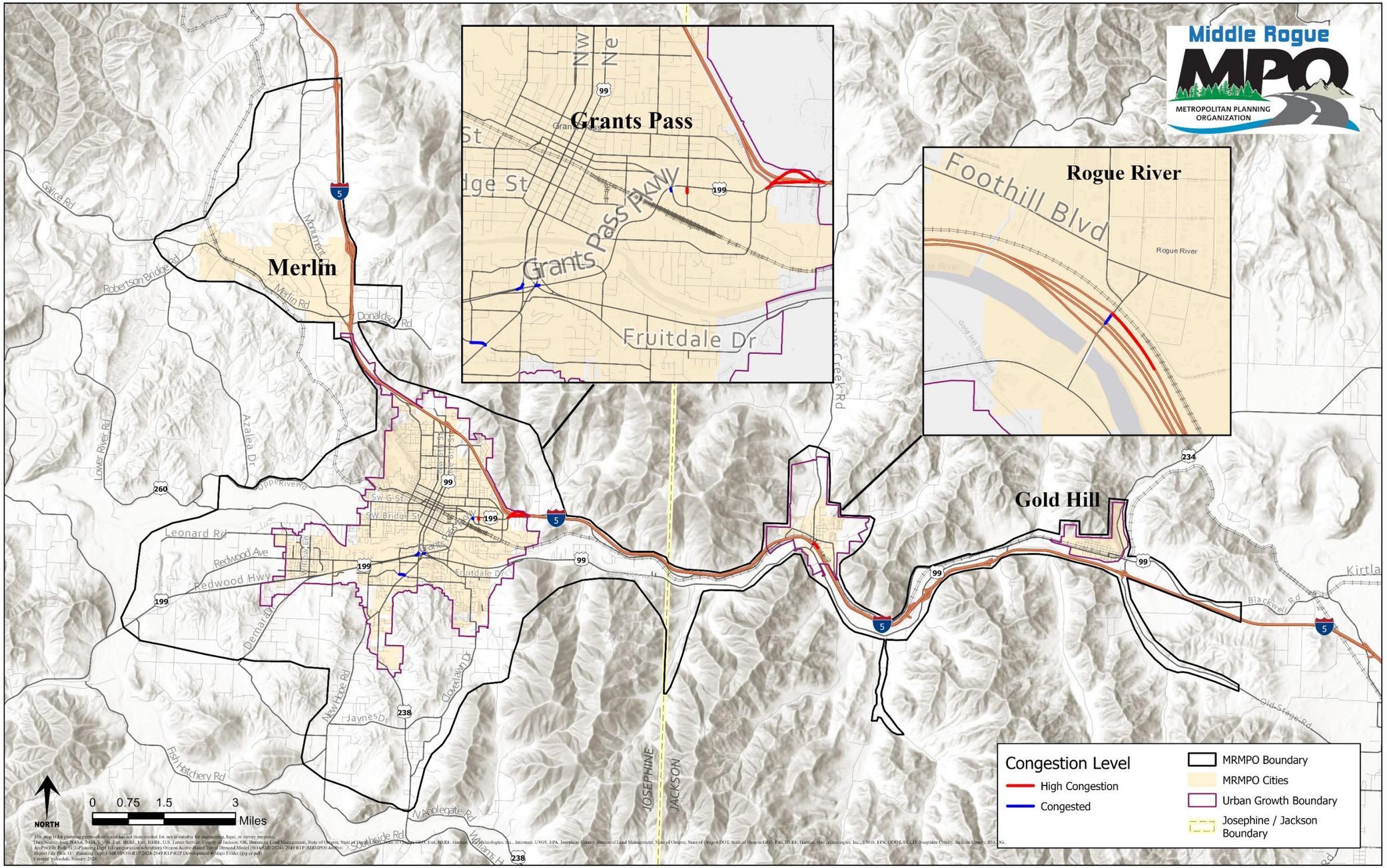
2049 RTP$_{20\text{-}49}$ Peak Lane Miles%													
Demand/Capacity Ratio Range	**Rogue River Hwy (OR99)**	**Redwood Hwy (OR199)**	**Jacksonville Hwy (OR238)**	**Highland Ave**	**Redwood Ave**	**G St**	**A St**	**Allen Creek Rd**	**Bridge St**	**E St**	**F St**	**M St**	**Parkdale Drive**
0 – 0.59	90%	83%	98%	99%	86%	83%	100%	95%	76%	91%	98%	89%	71%
0.59 – 0.69	1%	6%	1%	1%	7%	8%	0%	2%	24%	8%	0%	5%	12%
0.69 – 0.79	5%	4%	0%	0%	3%	6%	0%	2%	0%	0%	0%	3%	17%
0.79 – 0.89	3%	5%	0%	0%	3%	3%	0%	1%	0%	0%	0%	0%	0%
0.89 – 0.99	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	2%	0%	0%
0.99 – 9.99	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	3%	0%
No Congestion	100%	98%	100%	100%	99%	100%	100%	100%	100%	99%	98%	97%	100%
Congestion	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	2%	0%	0%
High Congestion	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	3%	0%
Total Lane Miles	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Congestion Maps

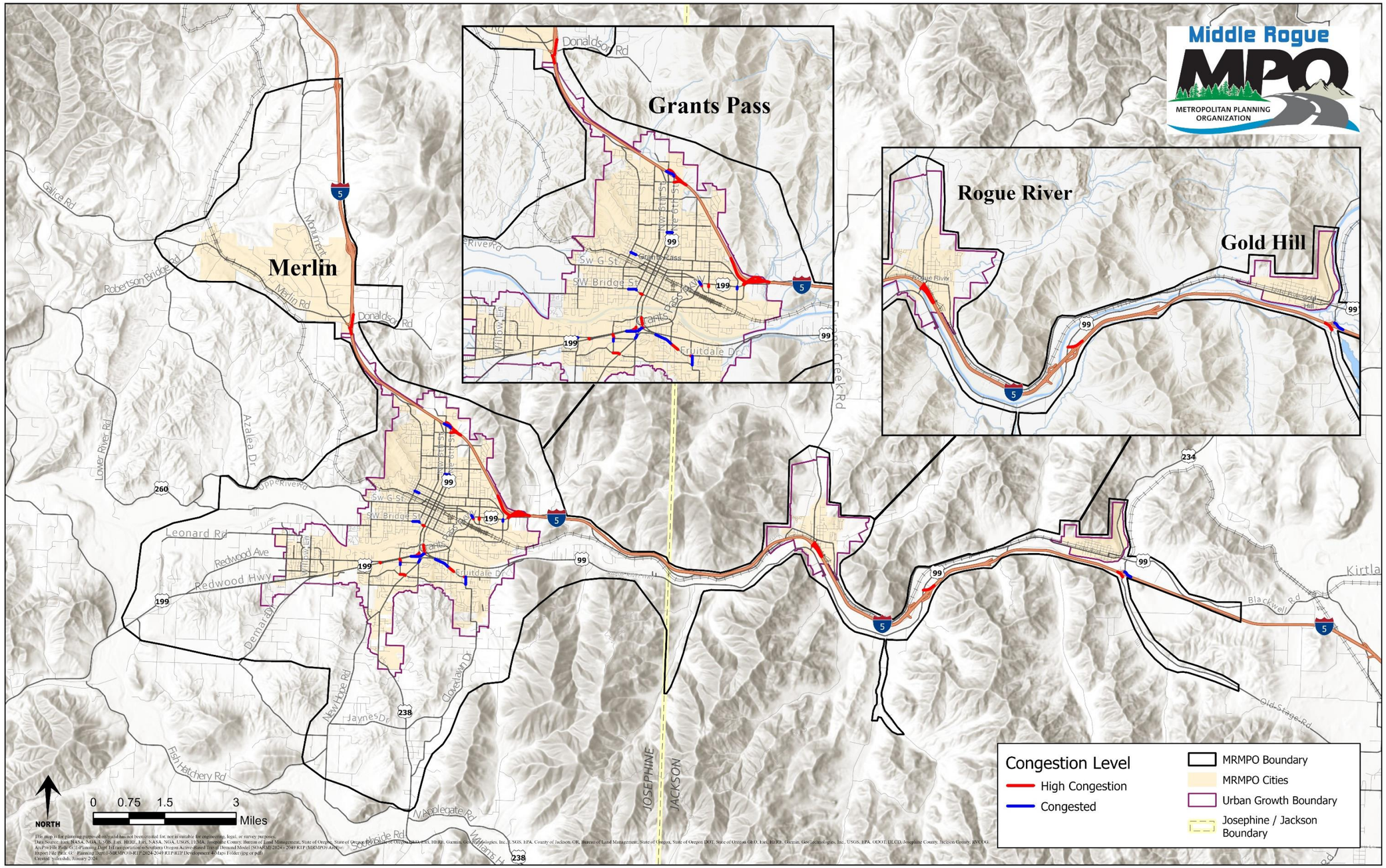
Maps on the following pages indicate locations where the MRMPO travel demand model estimates potential for peak hours congestion in future years. Please note that the maps showcase congestion across the MRMPO road network, except for local roads, and not limited to the roads mentioned in the previous tables.

Years shown are 2020 base year 2049 as the future year. Note that 2049 year do have two scenarios (1) No-RTP scenario and (2) 2049 RTP Build scenario. By viewing the maps in succession, it's possible to see how, where, and when congested conditions are likely to expand.

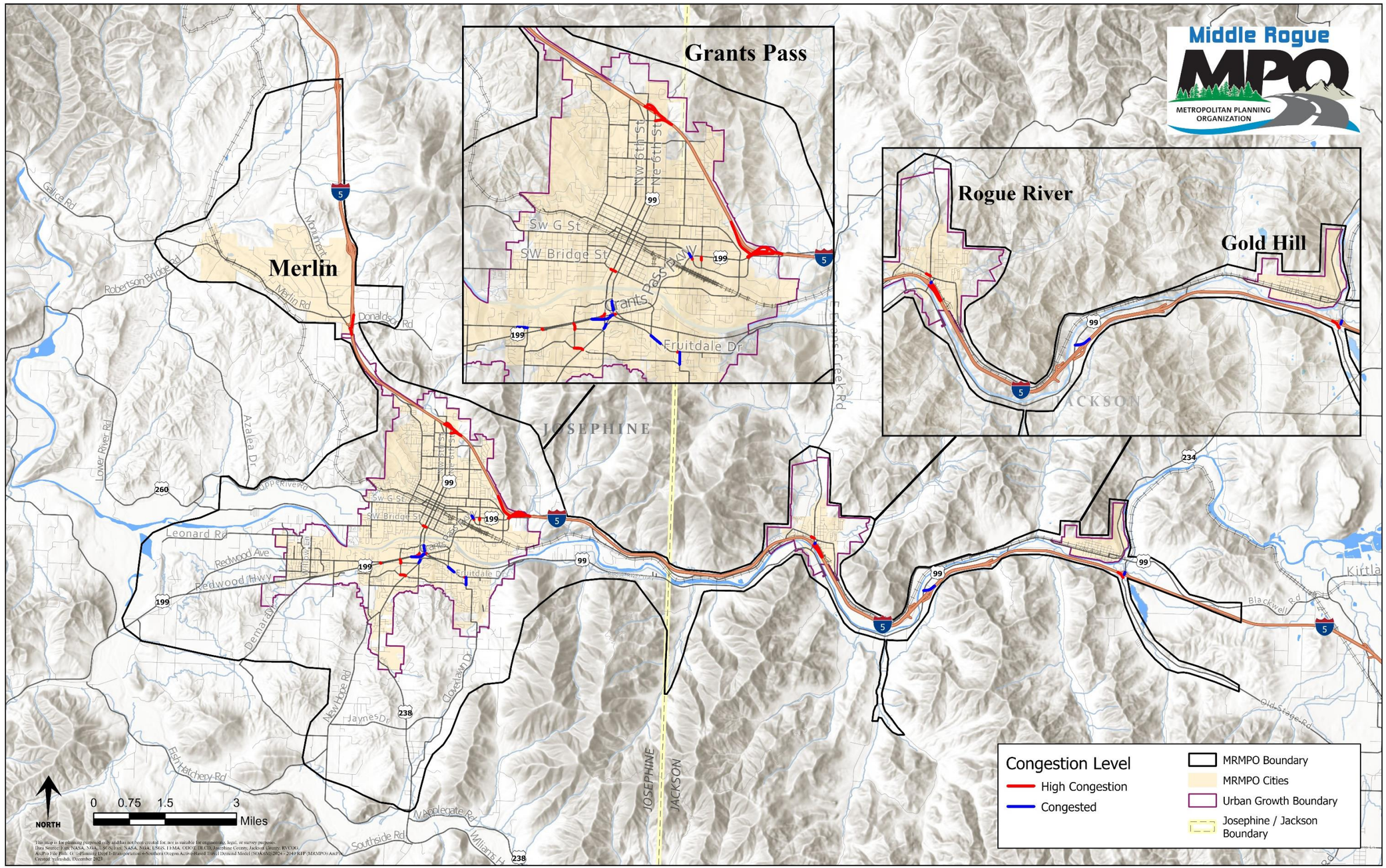
The futures shown here are far from certain because MRMPO jurisdictions are in agreement that additional funds will need to be identified for projects not yet in the plan. Beyond that, there are projects being planned, but are not included in this analysis because RTP projects must be financially constrained, as described in Chapter 8 Financial Plan.



Map 11-4 - 2020 Peak Hour Congestion



Map 11-5 - 2049 No-RTP Peak Hour Congestion



Map 11-6 - 2049 RTP-Build Peak Hour Congestion