APPENDIX L ///

OPERATIONS ANALYSIS

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TECHNICAL MEMORANDUM

Date: January 17, 2018

Project #: 21255

To: Karl MacNair, City of Medford

From: Susan Wright, P.E. and Sara Parks, Kittelson & Associates, Inc.

Project: City of Medford TSP Supplement

Subject: Operations Analysis Memorandum

This memorandum provides an overview of the study area selection, future transportation system operations and deficiencies, and the transportation system mitigations developed by the project team to address the deficiencies. This memorandum includes information regarding the selection of study intersections, the travel demand model and development of forecast traffic volumes, the operations methodology and resulting analysis, and the mitigations needed to equip the transportation system to meet standards in the 2038 planning horizon.

STUDY INTERSECTIONS

Study Area Selection Criteria

The TSP update includes an identification of facilities that are needed to provide an integrated, interconnected system that supports the land use vision, economic development goals and provides for all modes of travel for people and goods movement. The study area selection was based on traffic count data collected, regional significance, needs identified in the existing TSP, existing operational performance level, proximity to developable lands or UGB amendment areas, and agency comments. The study area selection and existing conditions analysis started as a part of prior planning efforts where the City and Kittelson & Associates, Inc. (KAI) evaluated different UGB expansion area alternatives.

Traffic Counts and Peak Hour Volume Development

The City of Medford collects intersection and roadway traffic volumes on an annual basis. These counts are typically conducted between 6:00 a.m. and 8:00 p.m. and include both vehicular and pedestrian volumes. As a part of prior planning efforts with the City, traffic counts were obtained in 2007, 2008, and 2009. As shown in Exhibit 1, the volumes generally increase steadily throughout the day with the highest volumes on the transportation system generally occurring during the evening peak period. Another important point to note is that midday traffic volumes are nearly 95 percent of those during the evening peak period.

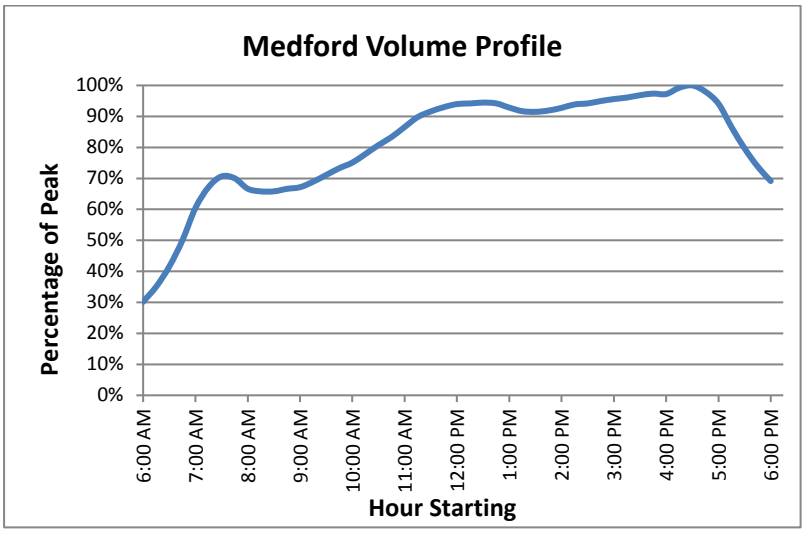


Exhibit 1. Illustration of daily volume profiles throughout the City of Medford.

At certain locations such as major shopping centers, schools, or other unique land uses, traffic volumes were higher than the evening peak period. However, the evening peak period generally represents the highest demand on the entire system. The TSP update focuses on the weekday evening peak period to ensure that facilities would be appropriately identified to meet the needs of the daily peak travel patterns.

Seasonal Factors

Design hour traffic volumes (seasonal adjustments) were provided based on Citywide adjustment factors. Review of the available Automatic Traffic Recorder (ATR) stations within the region show two ATRs within the study area. These include ATR 15-019 (0.33 miles south of the Medford interchange) along the I-5 corridor and 12-017 along OR 62 (milepost 1.11, 0.64 miles east of I-5). As discussed with the City staff, seasonal adjustments will be applied to ODOT facilities based on methodology included in the Analysis Procedures Manual (APM), however the City facilities were generally counted in the summer and seasonal adjustments were not necessary.

Historical Factors

We also reviewed those locations throughout the city where data was collected during multiple years to understand the historical fluctuations in traffic volumes.

As shown in Exhibit 2, between 2007 and 2009 traffic volumes in the City generally decreased by 10 percent. To ensure that the decrease in traffic volumes due to the economic recession did not result in an underestimation of long-term facility needs, the TSP update used 2007 traffic count data where possible to establish base conditions. In cases where major infrastructure changes have influenced travel behavior and route choice, the 2008 or 2009 data was used. Due to the significant changes in the South Medford Interchange (SMI) area, new counts were collected and different growth rates were assumed for intersections significantly impacted by this area.

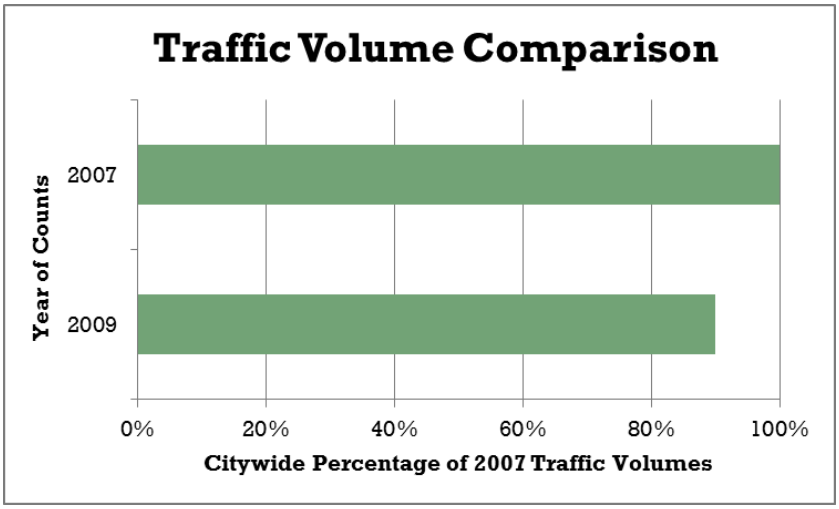


Exhibit 2. Comparison of 2007 and 2009 Peak Hour Traffic Volumes

Regional Significance

The Regional Transportation Plan (RTP) prepared by the Rogue Valley Metropolitan Planning Organization identifies facilities considered "regionally significant" according to federal and state guidance. The study area selection was focused on both regionally significant facilities identified by the RTP and the arterial and collector network within the City.

Previously Identified System Needs

Review of the City's 2003 TSP identified improvement needs on the transportation system to accommodate traffic in a 2023 planning horizon. Some of these improvements, such as the South Medford Interchange, have subsequently been constructed, but other improvement needs remain. Primary vehicular system needs identified in this plan are summarized within Figure 5-1 of the 2003 TSP and are summarized in Table 1.

Table 1: Previously Identified Intersection Needs

Intersection	Projected LOS in 2023
4th at Central	A[1]
4th at Riverside	F
Hwy 99 at South Stage Rd	E
Hwy 62 at Poplar/Bullock	F

Hwy 62 at Hwy 99/Hwy 238	E
Hwy 62 at Delta Waters	F
Hwy 62 at Vilas	E
Hwy 238 at Sage	F
Barnett at Black Oak	E
Barnett at N Phoenix	E
Jackson at Crater Lake	F
Main at Columbus	F
Main at Ross	F
Biddle at McAndrews	E
Crater Lake at Delta Waters	F

[1]4th at Central operates with an acceptable level of service but was noted to require a change from permissive to protected left turn signal phasing.

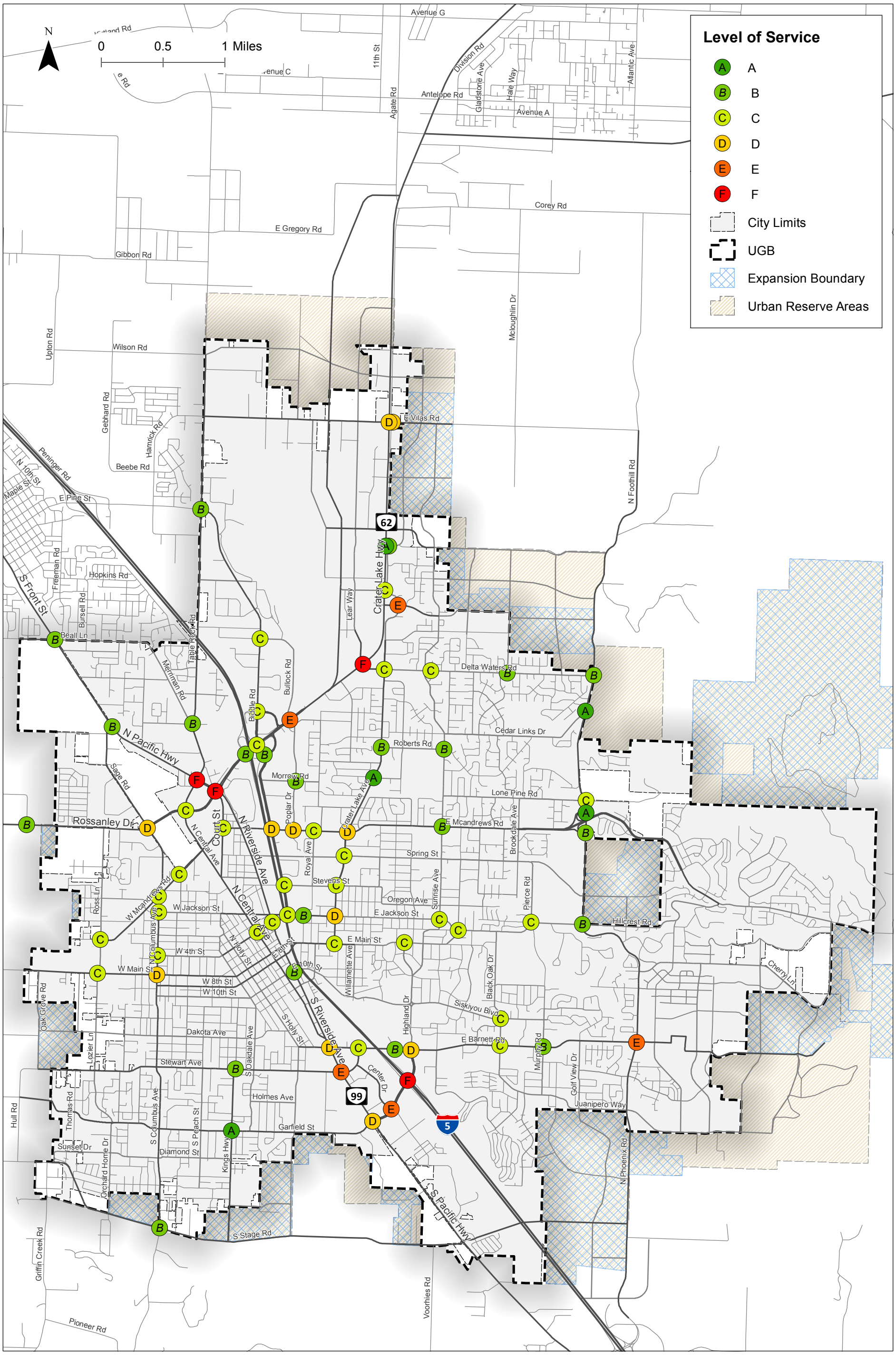
Source: City of Medford TSP Table 5-1.

Existing Operational Performance

In addition to traffic count data, the City maintains a Synchro model that includes the majority of the collector and arterial system. Separate models are available to assess the weekday a.m., midday, and p.m. peak hour performance throughout the system. The City uses the model to assist with signal timing plans, monitor development impacts as part of its concurrency process, and identify capital improvements. The information contained within the model enables a review of the citywide intersection operational performance, including level of service, volume to capacity ratios, and intersection delays.

Of the 167 intersections included within the Synchro model, 28 intersections operate at Level of Service “A” and 47 operate at Level of Service “B”. The highest density of intersections operating at LOS “A” or “B” occurs in the downtown City core within the one-way roadway network. Capacity-enhancing transportation improvements within this area are unlikely due to the higher emphasis on active travel modes and the efficient auto system provided with the one-way grid network. For these reasons, intersections within the downtown core were not considered representative study locations.

Figure 1 illustrates the location of the study intersections and their existing Level-of-Service. The City of Medford’s standard is for intersections to operate with a Level-of-Service “D” or better. As shown in Figure 1, there are several intersections that do not currently meet the City’s Level-of-Service standard. They are primarily located at the South Medford Interchange, along OR 62 and OR 99 (Pacific Highway).



Existing Intersection Level-of-Service
Medford, Oregon

Figure
1

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KITTELSON & ASSOCIATES

Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet

Forecast Traffic Volumes

Forecast traffic volumes for the City of Medford TSP update were developed for the study intersections based on the methodology identified in the National Cooperative Highway Research Program (NCHRP) Report 255 *Highway Traffic Data for Urbanized Area Project Planning and Design*. The methodology combines the 30th Hour Volumes (30 HV) traffic volumes developed based on 2007, 2008, and 2009 counts at the study intersections with base year 2006 and future year 2038 traffic volume forecasts from ODOT's travel demand model for the RVMPO area (version 4.2, scenario C). The general methodology to develop the volumes is outlined below.

- The year 2007, 2008, and 2009 design hour traffic volumes are used to represent the base year volumes. These volumes will directly correlate to base year model volumes.
- The percentage change in the model's base and horizon year traffic volume for each movement is calculated and applied to the base year 30 HV traffic volumes. Each table reports the existing and future model volumes, in addition to the percentage change as applied.
- The numerical change (delta) in the model's traffic volumes is also calculated and applied to the base year 30 HV traffic volumes.
- The results obtained from the percentage and numerical change calculations are averaged to obtain the year 2038 analysis traffic volumes.

Post processing of the traffic volumes occurred first on a link basis. Once the volumes are adjusted, the link volumes were converted into turn movements at the intersections. This process was applied to all of the study intersections that exist in the base year model. The reasonableness of the averaging method was reviewed at each location, especially in instances in which the numerical and percentage change yielded significantly different results (which can often occur on very low volume movements in the base model that increase significantly in 2038) or when the existing model differs significantly from the existing turning movement counts. On these occasions, the available data and travel forecasts were reviewed to determine the appropriate year 2038 analysis volumes. The resulting unbalanced year 2038 volumes were rounded and balanced, as appropriate, for use in the forecast conditions assessment.

South Medford Interchange

Due to the significant changes in the South Medford Interchange (SMI) area and absence of updated travel forecasting data, the NCHRP 255 methodology was not used and specific growth rates were assumed for intersections significantly impacted by this area. The development of the forecasts considered the four data sources outlined below.

Historical Traffic Counts Surrounding the SMI Area

The City provided traffic counts in the vicinity of the SMI recorded generally between 2005 and 2007 (prior to construction of the SMI) and these were compared to counts collected in 2015. This provided a historical annual growth rate of 1.01%.

Other Transportation Related Plans and Studies Prepared in the Vicinity of the SMI

The only study available was the October 11, 2015 *I-5 Rouge Valley Corridor Plan* prepared by David Evans & Associates focused on the mainline I-5 corridor, and provided volume forecasts that could reasonably reflect anticipated growth at interchanges. This study included 2007/2008 base volumes and projected 2034 volumes. This study reflects an overall annual growth rate along the I-5 mainline of 2%.

ODOT Automatic Traffic Recorder (ATR) data

The ODOT historical traffic counts were obtained at the permanent traffic recorder located north of the SMI on the I-5 Viaduct. The annual growth rates between 1995 and 2000 were much higher than those recorded in the years between 2000 and 2015. Over the 20 years between 1995 and 2015, the historical growth rate averages approximately 1.5%.

City of Medford and Jackson County Population Growth Rates

While population does not directly correlate with traffic volumes, changes in population were reviewed to assess reasonableness of growth rates. The population growth correlates with the highest recorded growth in traffic volumes along the I-5 corridor between 1995 and 2015. Based on this review of historical and forecasted changes in population and vehicles on the I-5 mainline and ramps, a 1.5% annual growth rate was applied for the SMI area. While most of the forecasts show rates closer to 1% per year, UGB expansion will increase development pressure on the Barnett corridor. Use of the higher rate of 1.5% provides a reasonably conservative estimate of growth.

Intersection Operational Standards

The City of Medford bases intersection operations on level-of-service (LOS), specifying a minimum performance of LOS “D” which is applicable to all intersection control types throughout the City. Jackson County requires intersection volume-to-capacity ratio to be less than 0.95 for County-maintained intersections within the MPO area.

The 1999 Oregon Highway Plan (OHP) outlines specific performance measures to be maintained along ODOT facilities as part of adopted Highway Mobility Standards. These standards are aimed at maintaining mobility along important roadway corridors and vary according to functional classification, location, travel speed, and role within the National Highway System (NHS). Per the OHP, the following intersection performance measures are applicable for facilities within Medford:

- Volume-to-capacity (v/c) ratio of 0.85 for Interstate 5 ramps given their designation as Interstate facilities within a Metropolitan Planning Organization (MPO).
- Volume-to-capacity (v/c) ratio of 0.85 for Crater Lake Highway (OR 62) given its classification as a Statewide Highway. OR 62 is classified as an expressway through the Delta Waters Road (milepost 1.59 to milepost 10.0) intersection providing a mobility standard of 0.85 inside the MPO boundary.
- Pacific Highway (OR 99) and Rossanley Drive (OR 238) allow a volume-to-capacity ratio of 0.90 within the MPO boundary given their classification as a District Highway.

The standards above reflect signalized performance standards. At stop-controlled intersections where through highway movements do not experience control delay the appropriate mobility standard is based on the classification of the intersecting roadway.

Analysis Model Parameters

The City of Medford created and maintains extensive Synchro analysis networks extending throughout the City limits. A separate network has been created for the weekday a.m., p.m., and midday peak hours and contains an extensive amount of data, including peak hour turning movement volumes, peak hour factors, heavy vehicle percentages, and signal timings, among others. These networks were used as a basis for the operational analysis conducted for this project.

Synchro network data was reviewed based on the raw traffic counts provided by the City, including turning movements, peak hour factors, pedestrians, bicycles, and heavy vehicle percentages, as available. The traffic counts were reviewed to identify the critical system analysis period, which occurs during the weekday evening peak period (4:00 to 6:00 p.m.).

The bullets below identify the specific sources of data and methodologies utilized.

Intersection/Roadway Geometry (lane numbers and arrangements, cross-section elements, signal phasing, etc.) was verified for consistency with previous work efforts and reviewed through aerial photography. The analysis model used was provided by the City as described above.

1. *Operational Data* (such as posted speeds, intersection control, parking, transit stops, rail crossings, right-turn on red, etc.) were verified, as necessary. Data was reviewed and supplemented by available GIS data and aerial photography.
2. *Peak Hour Factors* (PHF) were calculated for each intersection and applied to the existing conditions analyses. PHFs of 1.00 were used for the year 2038 analysis for high-order facilities.
3. *Traffic Volume* development is described above.
4. *Signal Timing Data* was provided in the City's Synchro analysis network as described above for use in the existing conditions analysis. Signal parameters such as Flash Don't Walk, Walk, and Minimum Times were retained in the forecast analysis with the signal splits optimized to better serve the future traffic volume patterns. Optimized signal cycle lengths may range between 60 and 120 seconds.

5. Traffic Operations

   a. The 2000 Highway Capacity Manual (HCM 2000) methodology was used to analyze traffic operations at the signalized intersections while the HCM 2010 methodology was used to analyze traffic operations at the unsignalized intersections.

   b. The existing and future no-build traffic operations analyses uses Synchro 9 software using HCM 2000 reports for signalized intersections and HCM 2010 reports for unsignalized intersections. Level-of-service, delay, and volume-to-capacity ratios were reported at each of the study intersections regardless of roadway jurisdiction.

Traffic Analysis Software and Input Assumptions

Synchro software, Version 9 was used for intersection analysis. The reported results included level of service, intersection delay, and v/c ratios generated by the HCM report. Analysis assumptions are listed in Table 2.

Table 2: Synchro Operations Parameters/Assumptions

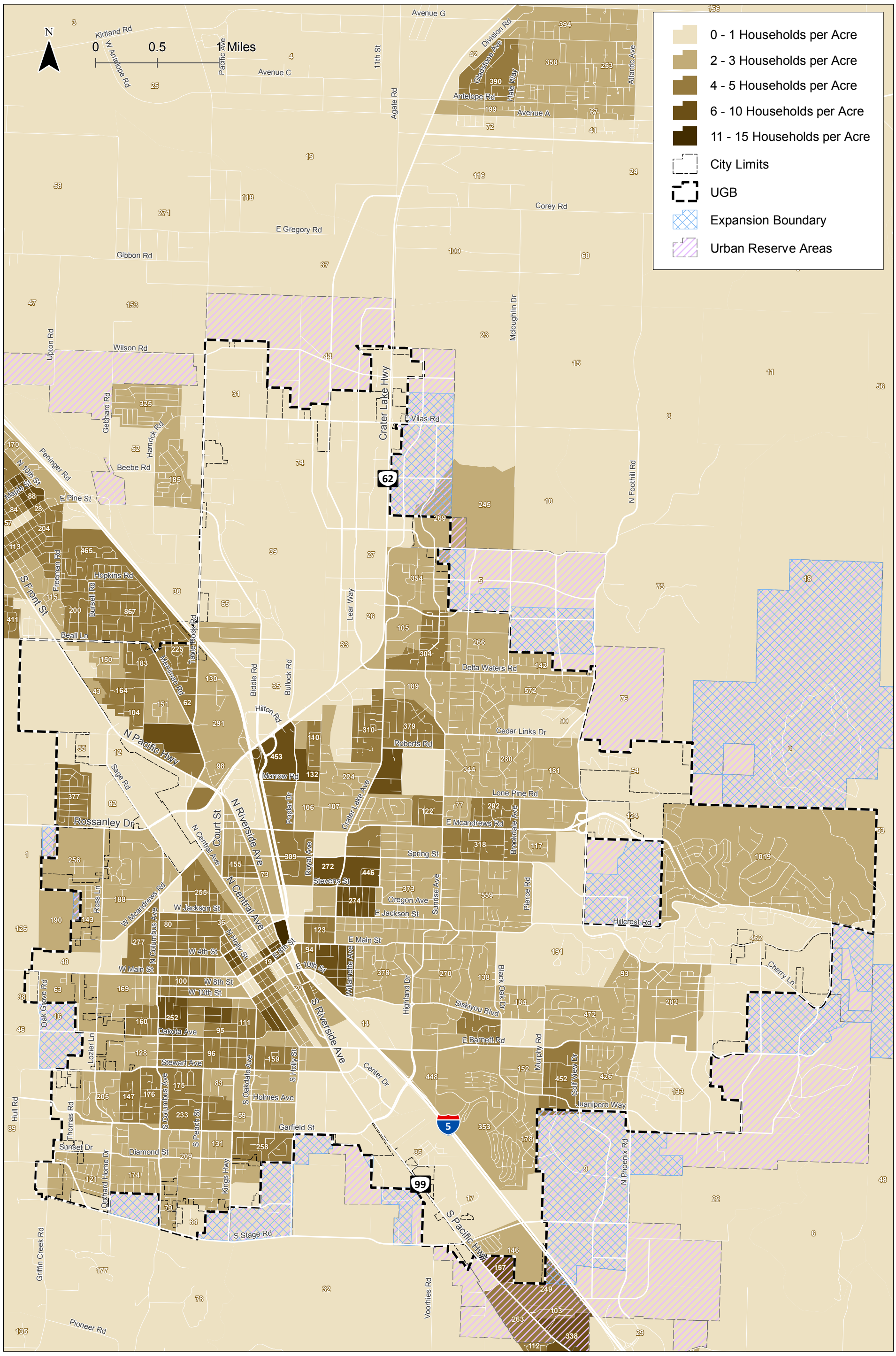
Arterial Intersection Parameters	Existing Conditions
Peak Hour Factor	From traffic counts
Conflicting Bikes and Pedestrian per Hour	From traffic counts, as available
Area Type	Other
Ideal Saturation Flow Rate (for all movements)	1,800 passenger cars per hour green per lane
Percent Heavy Vehicles	From traffic counts by movement, as available
Percent Grade	Estimated based on field observations
Intersection signal phasing and coordination	From ODOT/County/City
Intersection signal timing optimization limits	Maximum cycle length = 120 seconds
Minimum Green time	From timing plans
Yellow and all-red time	From timing plans

FUTURE TRANSPORTATION SYSTEM OPERATIONS ANALYSIS

Population and Employment Projections

Land use plays an important role in developing a comprehensive transportation system. The amount of land that is planned to be developed, the type of land uses, and how the land uses are mixed together will have a direct impact on how the transportation system will be used in the future. Understanding land use is critical to taking actions to maintain or enhance the transportation system.

The land use data within the travel demand model includes base year 2006 and forecast year 2038 household and employment (retail, service, and other) estimates by Transportation Analysis Zone (TAZ). Upon review of the data from RVMPO, City staff provided revised Medford data for all internal UGB areas and affected external TAZs. Figures 2 – 4 illustrate the TAZs and the household and



2006 Households by TAZ
Medford, Oregon

Figure
2

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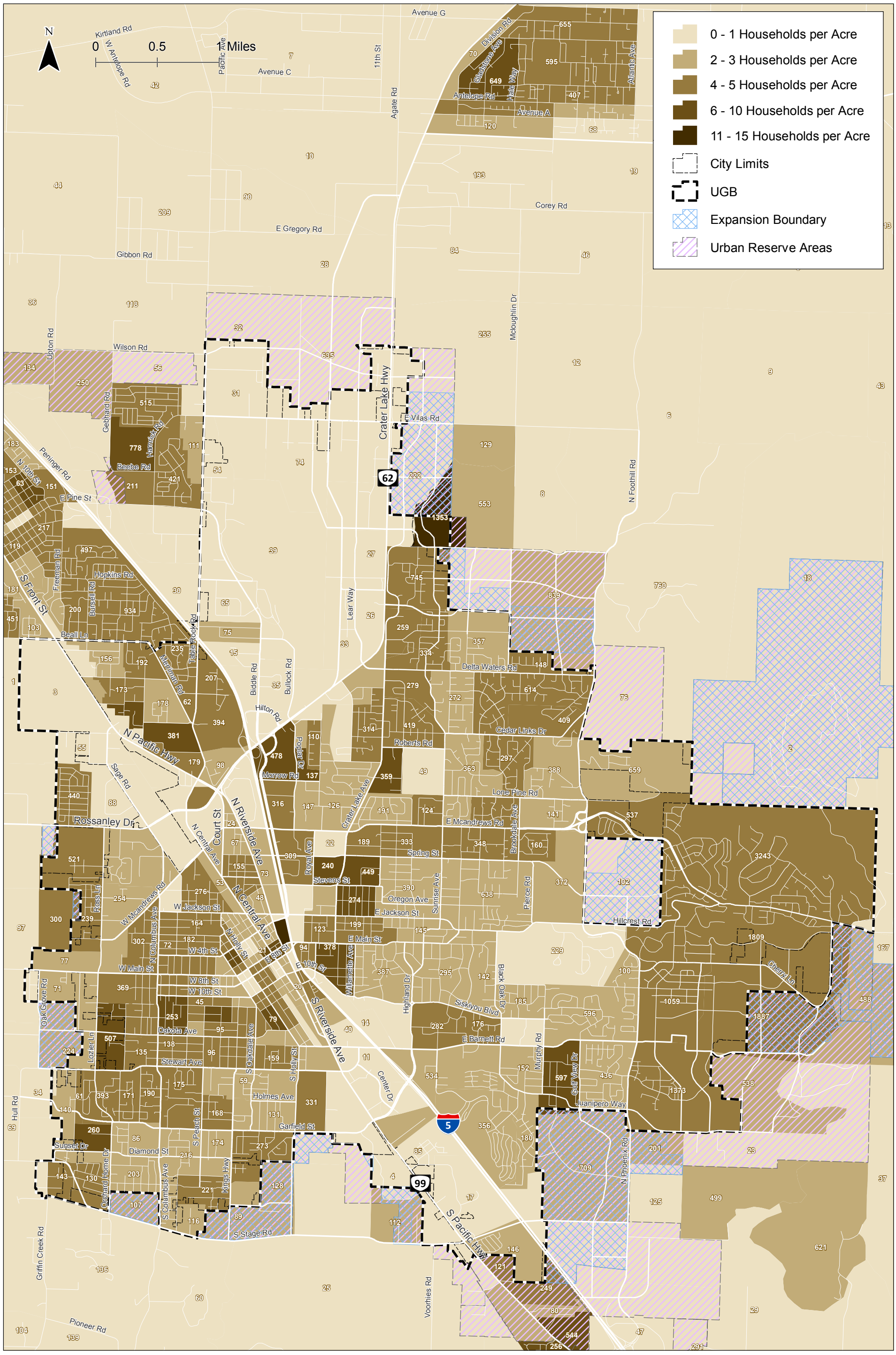
Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet



2038 Households by TAZ
Medford, Oregon

Figure 3

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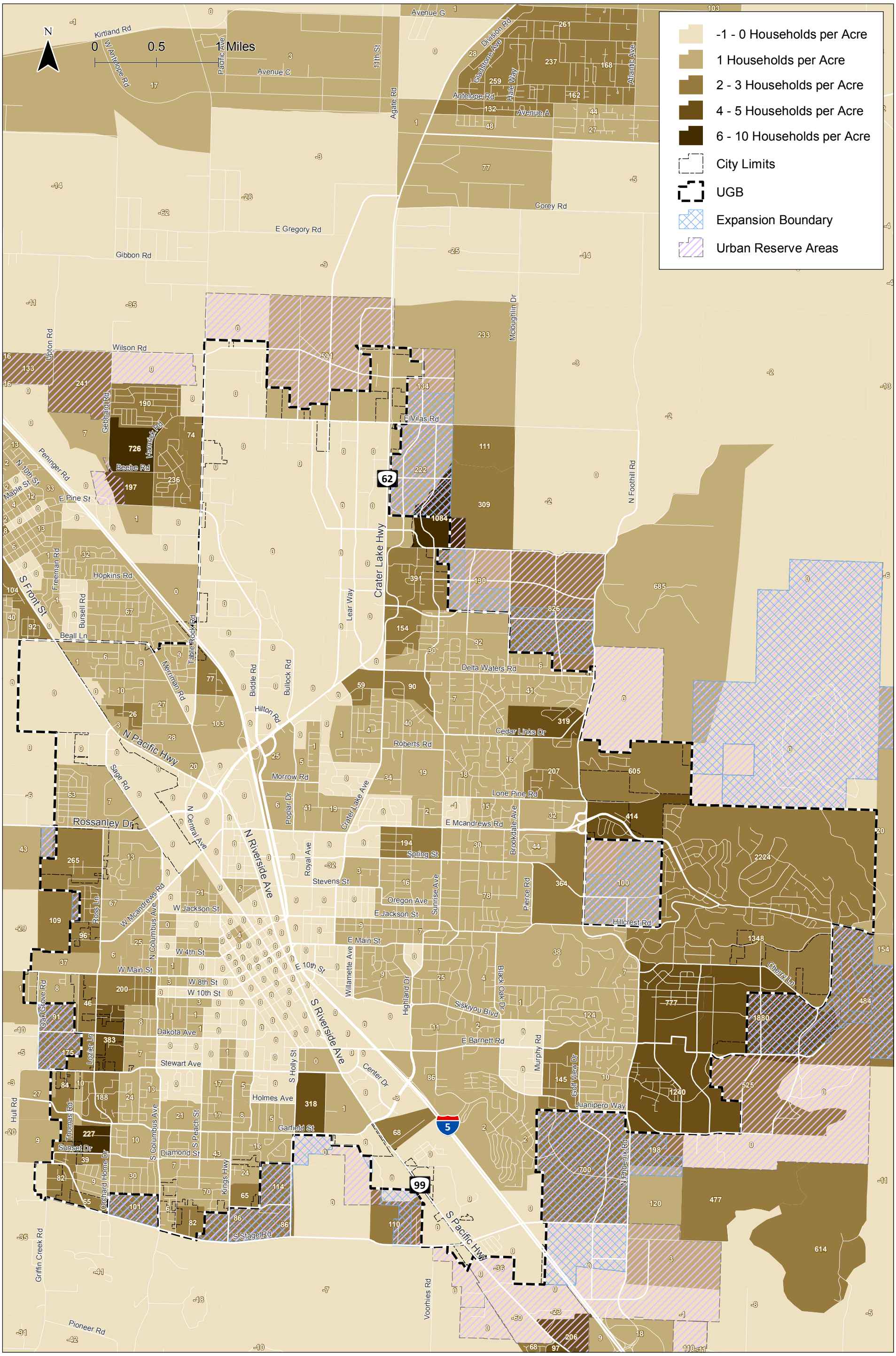
Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet



Change in Households by TAZ
Medford, Oregon

Figure
4

KITTELSON & ASSOCIATES

Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet

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employment changes expected between base year 2006 and forecast year 2038. Table 3 summarizes the TAZ data for base year 2006 and forecast year 2038 conditions.

Table 3: City of Medford Land Use Summary

Land Use	2006	2038	Change	Percent Change
Population	79,488	127,676	48,188	61%
Households	31,182	49,139	17,957	58%
Employment	45,250	81,227	35,977	80%

These numbers are based on the travel demand model and the TAZs within the model. Each TAZ has a different set of characteristics for land use, population, employment, households, etc. The model uses information to predict future conditions. The inputs into the model and TAZs try to represent as accurately as possible the existing transportation system and incorporate future changes. The TAZ boundaries and corresponding summaries may not match exactly to City limit and expansion area combined boundaries, however, they represent what is anticipated within the 20 year horizon. Increased numbers mean the model is expecting growth, business/job opportunities and households, in these areas. New businesses and developments are likely to be established in 30 years which is what the model and TAZs are showing.

Transportation System Improvements

The travel demand model uses the financially constrained transportation network as its base. The analysis accounts for construction of several significant roadway network changes including the OR 62 Bypass up to OR 62 south of White City near Corey Road (without an interchange at Vilas Road), the North Foothill Road Extension to OR 140, and the South Stage Road Extension over I-5. The Foothill Road Extension is outside of the City of Medford but impacts travel patterns within the City of Medford. Each of these connections will change existing travel patterns and better serve the multimodal needs of existing and future city residents. Other projects that were requested as part of the modeling to serve urbanizing lands are listed below.

- S Stage Road Extension across Hwy 99 and I-5 overcrossing east to Phoenix Road
- Hemlock Drive Extension west to Foothill Road
- Hemlock Drive Extension south to Hillcrest Road/Urano Lane intersection
- Owen Drive Extension east to Foothill Road
- Owen Drive Extension south along McLoughlin Road to Delta Waters Road
- Oak Grove/Madrona Lane Extension east to Lozier Lane
- Springbrook Boulevard Extension north to Vilas Road
- Barnett Road Extension to Cherry Lane
- S Holly Road Extension to S Stage Road
- Golf View Drive extension to S Stage Road

South Stage Road Extension

The S Stage Road Extension is the only project of those listed above included in the model, that is not in the Regional Transportation Plan financially constrained project list in the planning horizon; however, the City of Medford anticipates including a local match for this project in their financially constrained plan. The South Medford Interchange is one of the most congested areas of the City. Medford anticipates growth in both southwest and southeast Medford. Providing an east-west connection between these two areas will help reduce congestion at the South Medford Interchange, provide access to Major Arterials including North Phoenix Road, Riverside Avenue, and Columbus Avenue, allowing for travel around Medford without reliance on I-5 and the South Medford Interchange. This connection would also remove circuitous trips between areas of Medford and Phoenix. This new connection over I-5 is assumed in the transportation analysis of the 2038 forecast conditions.

As a part of prior planning efforts with the City, Kittelson & Associates, Inc. made model requests to compare two scenarios that would test the benefits of a new extension of S Stage Road across the I-5 corridor. Based on this review, the S Stage connection was found to significantly reduce demands on Barnett Road and provide minor reductions in traffic on east-west connections throughout the City. As shown in the Figure 5, not building the S Stage extension would cause higher volumes at interchanges and along Barnett Road.

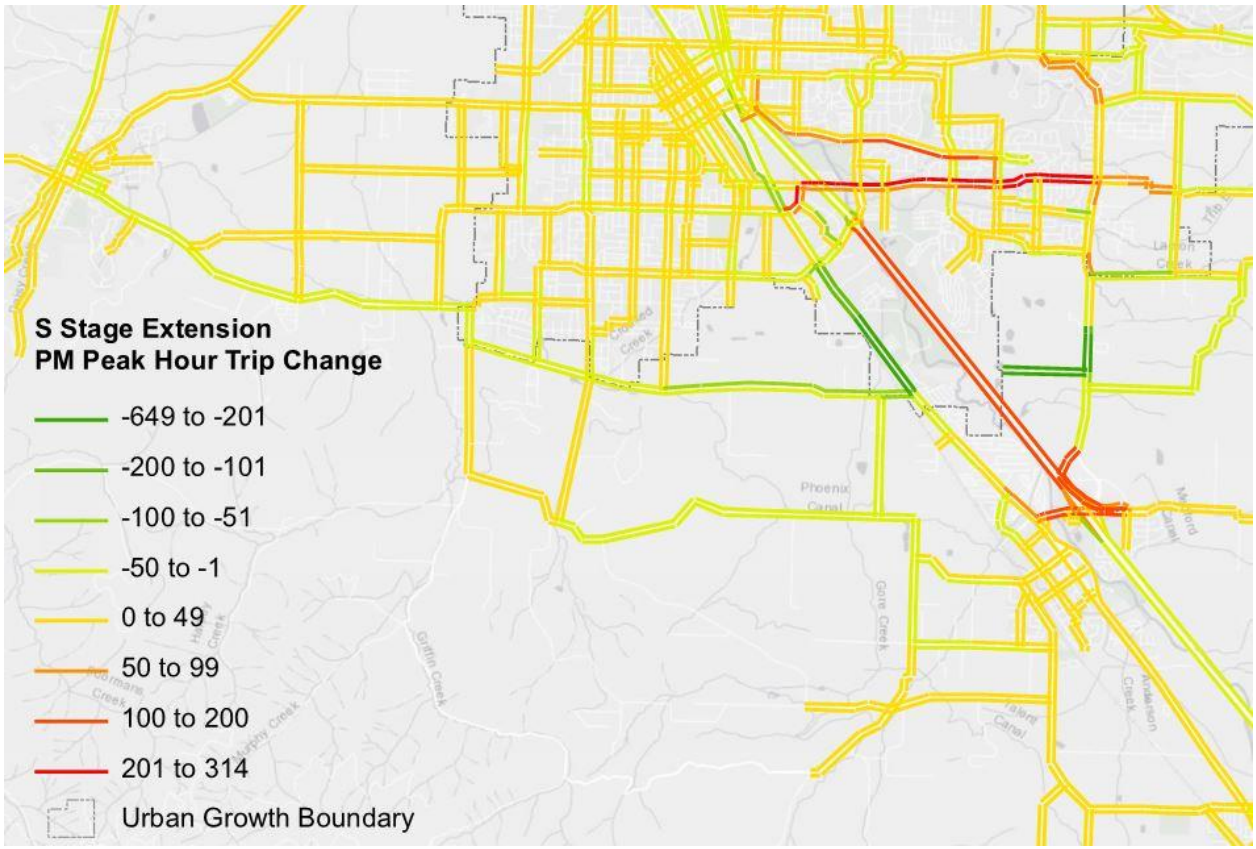


Figure 5. S Stage Extension trip difference.

If the extension of S Stage Road does not occur, the following intersections will have increased turning movement volumes:

- 83 – Stewart Avenue & Barnett Road
- **84 – Stewart Avenue & Riverside Road**
- 88 – Murphy Road & Barnett Road
- 89 – Black Oak Drive & Barnett Road
- **90 – South Medford I-5 Interchange/Highland Drive & Barnett Road**
- 91 – Alba Drive & Barnett Road
- 100 – N Phoenix Road & Barnett Road
- **826 – Garfield Street & South Medford I-5 Interchange**

It should be noted that three of the intersections (highlighted in bold) were identified to need further study for the potential of alternative mobility standards. These studies should be performed without the assumption of a new connection over I-5 extending S Stage Road.

Traffic Volume Projections

Forecast traffic volumes were developed based on existing traffic counts and ODOT's travel demand model for the RVMPO area (version 3.1, scenario C). The travel demand model provides base year 2006 and forecast year 2038 traffic volume projections that reflect anticipated land use changes and planned transportation improvements within the study area. This analysis assumes regional growth consistent with the current Rogue Valley Metropolitan Planning Organization (RVMPO) Regional Transportation Plan (RTP), including build-out of the City's expansion areas. The forecast traffic volumes were developed by applying the post-processing methodology presented in the National Cooperative Highway Research Program (NCHRP) Report 255 *Highway Traffic Data for Urbanized Area Project Planning and Design*, in conjunction with engineering judgment and knowledge of the study area.

Year 2038 Intersection Operations

The year 2038 projected traffic conditions analysis identifies how the study area's transportation system will operate in the TSP horizon year 2038. The traffic volumes were used to analyze traffic operations at the study intersections under year 2038 (no-build) traffic conditions. Figures 6A through 6J illustrate the year 2038 traffic volumes and summarize the results of the traffic operations analysis at the study intersections for the weekday p.m. peak hour. As shown in Figures 6A through 6J, in addition to those highlighted in the existing conditions analysis, several intersections are projected to exceed the Level-of-Service "D" standard including intersections along Crater Lake Avenue, East Main Street, Jackson Street, and Foothill Road.

2038 Mitigated Traffic Operations

Study intersections not projected to meet the City's Level-of-Service "D" standard or ODOT's mobility target for ODOT facilities under 2038 forecast conditions were evaluated to identify potential improvements. Potential solutions include updating signal timing or modifying signal phasing at existing signals, adding turn lanes or through lanes to an intersection, installing a signal or roundabout at unsignalized intersections, or other potential solutions. Solutions that were identified, associated lane configurations, and the resulting 2038 mitigated traffic operations are provided in Figures 7A through 7J. The solutions are included in the intersection project list in Section 5 of the TSP. Other types of solutions to reduce single-occupancy vehicle trips and maximize the efficiency of the system are also included in the TSP and described in the Transportation System Management and Operations (TSMO) Plan.

Table 4 provides a comparison between the 2038 No-Build traffic operations and the proposed 2038 mitigations. As shown in Table 4 and Figures 7A through 7J, most study intersections are projected to operate acceptably with the improvements identified in Section 5 with the exception of nine locations described below. One location shown to operate at a LOS "E" but not described below is the intersection of Jackson Street and Sunrise Avenue. This location will operate better than projected based on rerouting that will occur with the planned traffic signal at Valley View Drive and Hillcrest Road (Project I75).

Table 4. 2038 No-Build and 2038 Mitigated Traffic Operations

#	Intersection	Control	Standard	V/C	Delay	LOS	Mitigation	V/C	Delay	LOS
6	S Riverside Avenue & E 4th Street	Signalized	LOS D	0.93	38.9	D				
13	N Central Avenue & E 4th Street	Signalized	LOS D	0.81	31.6	C				
21	S Riverside Avenue & W 10th Street	Signalized	LOS D	0.7	19.4	B				
41	N Columbus Avenue & W Main Street	Signalized	LOS D	0.84	48.6	D				
43	Biddle Road & Jackson Street	Signalized	LOS D	0.62	29.2	C				
44	Hawthorne Street & Jackson Street	Signalized	LOS D	0.46	11.4	B				
45	Biddle Road & Stevens Street	Signalized	LOS D	0.67	20.3	C				
48	Biddle Road & Crater Lake Highway EB Ramps	Signalized	LOS D	0.67	17.1	B				
50	E Main Street & Crater Lake Avenue	Signalized	LOS D	0.92	57	E	Optimize splits	0.92	47.3	D
51	Crater Lake Avenue & Jackson Street	Signalized	LOS D	0.89	62	E	Remove split phasing and make all left's permitted	0.72	13.2	B
52	Crater Lake Avenue & Stevens Street	Signalized	LOS D	0.62	27.6	C				
54	Crater Lake Avenue & Spring Street	Signalized	LOS D	0.78	40.8	D				
55	Crater Lake Avenue & E McAndrews Road	Signalized	LOS D	0.98	82.6	F	Optimize splits	0.95	54.2	D
60	Court Street & E McAndrews Road	Signalized	LOS D	0.75	31.3	C				
61	Biddle Road & E McAndrews Road	Signalized	LOS D	0.79	41	D				
62	Royal Avenue & E McAndrews Road	Signalized	LOS D	0.95	35.9	D				
63	Poplar Drive & E McAndrews Road	Signalized	LOS D	0.94	61.3	E	Optimize splits	0.93	50.8	D
64	Columbus Avenue & E McAndrews Road	Signalized	LOS D	0.54	33.5	C				
65	Summit Avenue & E McAndrews Road	Signalized	LOS D	0.72	35.4	D				
66	N Pacific Highway & Crater Lake Highway	Signalized	v/c = 0.90	1.2	127.7	F	ODOT facility (optimize brings to E) (part of adaptive system)	1.05	67.9	E
69	N Pacific Highway & W Table Rock Road	Signalized	v/c = 0.90	1.05	63.2	E	ODOT facility - Convert second SBL to SB Thru Left (split phase) - improves LOS, not v/c, unlikely to be implemented by ODOT	1.05	63.2	D
70	Crater Lake Highway & Cardinal Avenue	TWSC	LOS D	0.27	14	B				
72	Crater Lake Avenue &	Signalized	LOS D	0.93	54.9	D				

	Delta Waters Road									
73	Crater Lake Highway & Delta Waters Road	Signalized	LOS D	0.74	43.4	D				
74	Crater Lake Avenue & Brookhurst Street	Signalized	LOS D	0.56	3.8	A				
75	I-5 SB Ramps & Crater Lake Highway	Signalized	v/c = 0.85	0.83	18.8	B				
77	Poplar Drive & Crater Lake Highway	Signalized	v/c = 0.85	1.26	113.8	F	ODOT facility - no minor improvement (4th EBTH and 2nd WBLT mitigates but not likely feasible/desirable)	1.26	113.8	F
80	King Street & Stewart Avenue	Signalized	LOS D	0.71	17.4	B				
83	Stewart Avenue & Barnett Road	Signalized	LOS D	0.69	36.6	D				
84	Stewart Avenue/Riverside Avenue	Signalized	LOS D	1.16	151.2	F	No minor improvement	1.16	151.2	F
85	Center Drive & Stewart Avenue	Signalized	LOS D	0.63	31.9	C				
87	Pacific Highway/Stewart Avenue & Garfield Street	Signalized	v/c = 0.90	0.83	75.8	E	Optimize splits	0.8	47.1	D
88	Murphy Road & E Barnett Road	Signalized	LOS D	0.9	31.1	C				
89	Black Oak Drive & E Barnett Road	Signalized	LOS D	0.7	23.2	C				
90	South Medford I-5 Interchange/Highland Drive & Barnett Road	Signalized	v/c = 0.85	1.18	98.7	F	ODOT facility - Add second NB right lane (prot.)	1.04	77	E
91	Alba Drive & Barnett Road	Signalized	LOS D	0.45	7.2	A				
92	Riverside Avenue & Barnett Road	Signalized	LOS D	0.83	51.5	D				
93	Black Oak Drive & Siskiyou Boulevard	Signalized	LOS D	0.63	24.5	C				
95	Springbrook Road & E McAndrews Road	Signalized	LOS D	0.71	29.4	C				
97	Crater Lake Avenue & Roberts Road	Signalized	LOS D	0.82	21.7	C				
99	Poplar Drive & Morrow Road	Signalized	LOS D	0.59	21.9	C				
100	N Phoenix Road & E Barnett Road	Signalized	LOS D	1.34	128.9	F	Second SBTH lane, SBL and NBL perm+prot	1.04	53.6	D
101	Biddle Road & Hilton Court	Signalized	v/c = 0.85	0.76	58.1	E	ODOT facility - meets ODOT standard			
103	Springbrook Road & Roberts Road	Signalized	LOS D	0.98	37.5	D				
108	Biddle Road & Lawnsdale Road	Signalized	LOS D	1.02	79.4	E	EBL and WBL to perm+prot with WBR overlap	0.82	27.1	C
109	N Central Avenue & Crater Lake Highway	Signalized	v/c = 0.85	0.88	48.4	D				
110	Sage Road & Rossanley Drive	Signalized	v/c = 0.90	0.89	49.1	D				

111	Foothill Road & Hillcrest Road	Signalized	LOS D	0.95	46.6	D				
119	Table Rock Road & Merriman Road	Signalized	LOS D	0.75	34.3	C				
120	I-5 NB Ramps & Crater Lake Highway	Signalized	v/c = 0.85	0.81	98	F	Optimize splits	0.81	23.7	C
306	Foothill Road & Cedar Links Drive	Signalized	LOS D	0.72	8.3	A				
310	Crater Lake Avenue & E Vilas Road	TWSC	LOS D	2.00	$529.8	F	City plans to re-align Crater Lake Ave to the east			
311	Crater Lake Avenue & Coker Butte Road	Signalized	LOS D	0.57	23.1	C				
313	Columbus Avenue & E 4th Street	TWSC	LOS D	0.44	30.4	D				
320	Foothill Road & Delta Waters Road	TWSC	LOS D	1	92.4	F	Dual NB/SB Thru - planned to be signalized (LOS A when signalized)	0.73	34.3	D
321	Springbrook Road & Delta Waters Road	Signalized	LOS D	0.89	43.4	D				
325	Foothill Road & Lone Pine Road	TWSC	LOS D	2.26	$662.6	F	Signal or roundabout	0.88	17.5	B
328	Highland Drive & E Main Street	TWSC	LOS D	0.79	51.1	F	Signal or roundabout	0.63	9	A
330	Hillcrest Road & Pierce Road	TWSC	LOS D	0.89	91.3	F	Signal or roundabout	0.58	13.5	B
331	Valley View Drive & Hillcrest Road	AWSC	LOS D	1.1	50.5	F	Signal or roundabout	0.63	9.5	A
341	N Ross Lane & W McAndrews Road	Signalized	LOS D	0.8	31.8	C				
343	Ross Lane & Rossanley Drive	Signalized	v/c = 0.90	0.82	21.8	C				
346	Kings Highway & Garfield Stret	AWSC	LOS D	0.39	11.4	B				
401	Lozier Lane & W Main Street	Signalized	LOS D	1.15	51	D				
403	Crater Lake Avenue & Owens Drive	TWSC	LOS D	1.76	$412.50	F	City is considering multilane roundabout			
405	N Pacific Highway & Sage Road	Signalized	v/c = 0.90	0.74	18.6	B				
407	Crater Lake Highway & Coker Butte Road	Signalized	LOS D	0.46	14.3	B				
408	Crater Lake Highway & E Vilas Road	Signalized	LOS D	1.22	150.6	F	Monitor after construction of Crater Lake Hwy Bypass			
409	Table Rock Road & Biddle Road	Signalized	LOS D	1.15	48.8	D	Optimize splits	0.98	42.8	D
412	Foothill Road & EB McAndrews Ramps	Signalized	LOS D	0.63	20.9	C				
413	Foothill Road & WB McAndrews Ramps	Signalized	LOS D	0.59	10	A				
430	Columbus Avenue & S Stage Road	AWSC	LOS D	0.92	28.8	D				

437	N Pacific Highway & Beall Lane	Signalized	0.90	0.79	31.1	C				
803	N Columbus Avenue & Jackson Street	AWSC	LOS D	0.58	18.5	C				
821	Delta Waters Road & McLoughlin Drive	TWSC	LOS D	0.02	11.1	B				
824	Sunrise Avenue & Jackson Street	Signalized	LOS D	1.32	69.2	E	No mitigation, other network improvements that will help distribute traffic	1.32	69.2	E
826	Garfield Street & South Medford I-5 Interchange	Signalized	0.85	1.88	232.5	F	ODOT facility - no minor improvement	1.88	232.5	F
827	Center Drive & Garfield Street	Signalized	0.85	2.12	153.8	F	ODOT facility - no minor improvement	2.12	153.8	F

Intersections Requiring Further Study or Alternative Standards

The following describes the intersections that are projected to exceed the City or ODOT's mobility standards and do not have an identified mitigation in the TSP. These locations require additional analysis as part of an Interchange Area Management Plan (IAMP) and/or will require an alternative standard to the City's existing LOS "D" standard or to ODOT's volume-to-capacity based mobility target.

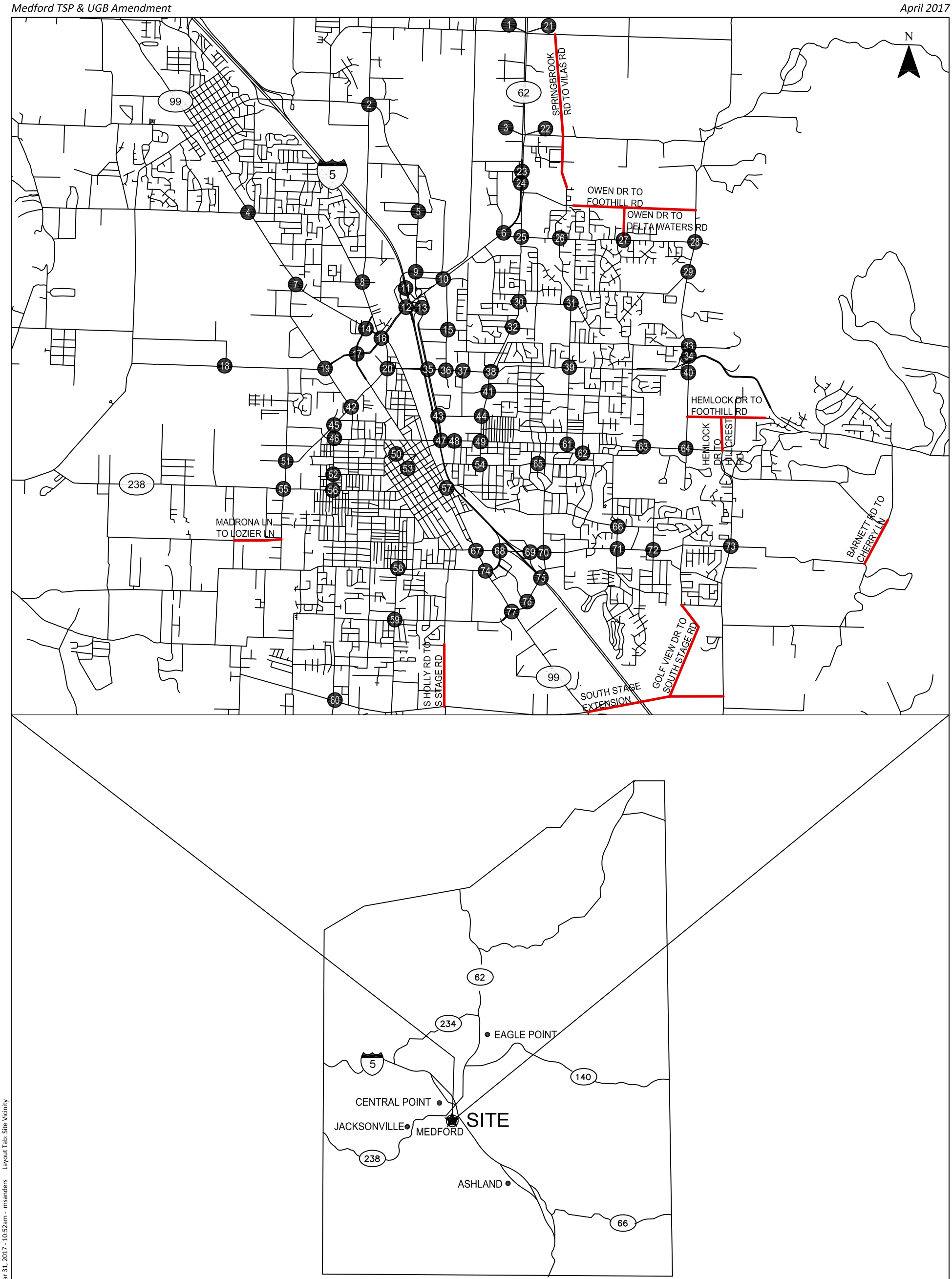
City Intersections

- **Crater Lake Highway/Vilas Road** – This intersection is projected to operate at a Level-of-Service "F" and over capacity. This intersection will be monitored after the opening of the OR62 Bypass to verify how travel patterns change and affect the operations of the system (Project I-40). This intersection will also be evaluated as part of a future Interchange Area Management Plan (IAMP) conducted by ODOT at the OR62 Bypass/Vilas Road interchange.
- **Highland Drive/Barnett Road** - This intersection needs a second northbound right-turn lane to meet the City's LOS "D" standard (Project I-78), although it would still operate over capacity. The city will need to adopt an alternative standard if this improvement is not feasible.
- **Riverside Avenue/Pacific Highway/Stewart Avenue** – This intersection needs second southbound and eastbound left-turn lanes or displaced northbound and southbound left-turn lanes (Project I-17). The city will need to adopt an alternative standard if these improvements are not feasible.

ODOT Intersections

- **South Medford Interchange (I-5/Garfield Street)** and **Garfield Street/Center Drive** – These intersections are projected to operate at a Level-of-Service "F" and over capacity even with the South Stage Road Extension. These intersections need alternative mobility targets (Project I-83 and I-84) or to be evaluated further as part of an update to the Exit 27 IAMP. This future IAMP should also incorporate analysis of affected the City intersections including Highland Drive/Barnett Road and Riverside Avenue/Pacific Highway/Stewart Avenue.
- **OR62 (Crater Lake Highway)/Bullock Road/Poplar Drive** - This intersection is projected to operate at a Level-of-Service "F" and over capacity with Phase 1 of the OR62 Bypass. ODOT has a split diamond interchange planned for the I-5/OR62/OR62 Bypass interchange as part of a future phase of the OR62 Bypass. This will significantly reduce the traffic volumes at this location and it is not included in the modeling for the TSP. ODOT will be conducting an IAMP at this location (Exit 30). This intersection may need an alternative mobility target unless a split diamond interchange is adopted within the financially constrained Regional Transportation Plan (Project I-81).
- **OR 99 (Pacific Highway)/Table Rock Road** – This intersection is projected to operate at a Level-of-Service "F" and over capacity. It would be improved but still not meet ODOT's mobility targets by converting the second southbound left-turn lane to a shared through-left with split phasing. This intersection needs to be studied as part of the Exit 30 IAMP and may need an alternative mobility target (Project I-79).

- **OR99/OR62/OR238** - This intersection is projected to operate at a Level-of-Service “E” but over capacity. This intersection needs to be studied as part of the Exit 30 IAMP and may need an alternative mobility target (Project I-80).



Sites & Vicinity Map
Medford, Oregon

Figure
6A

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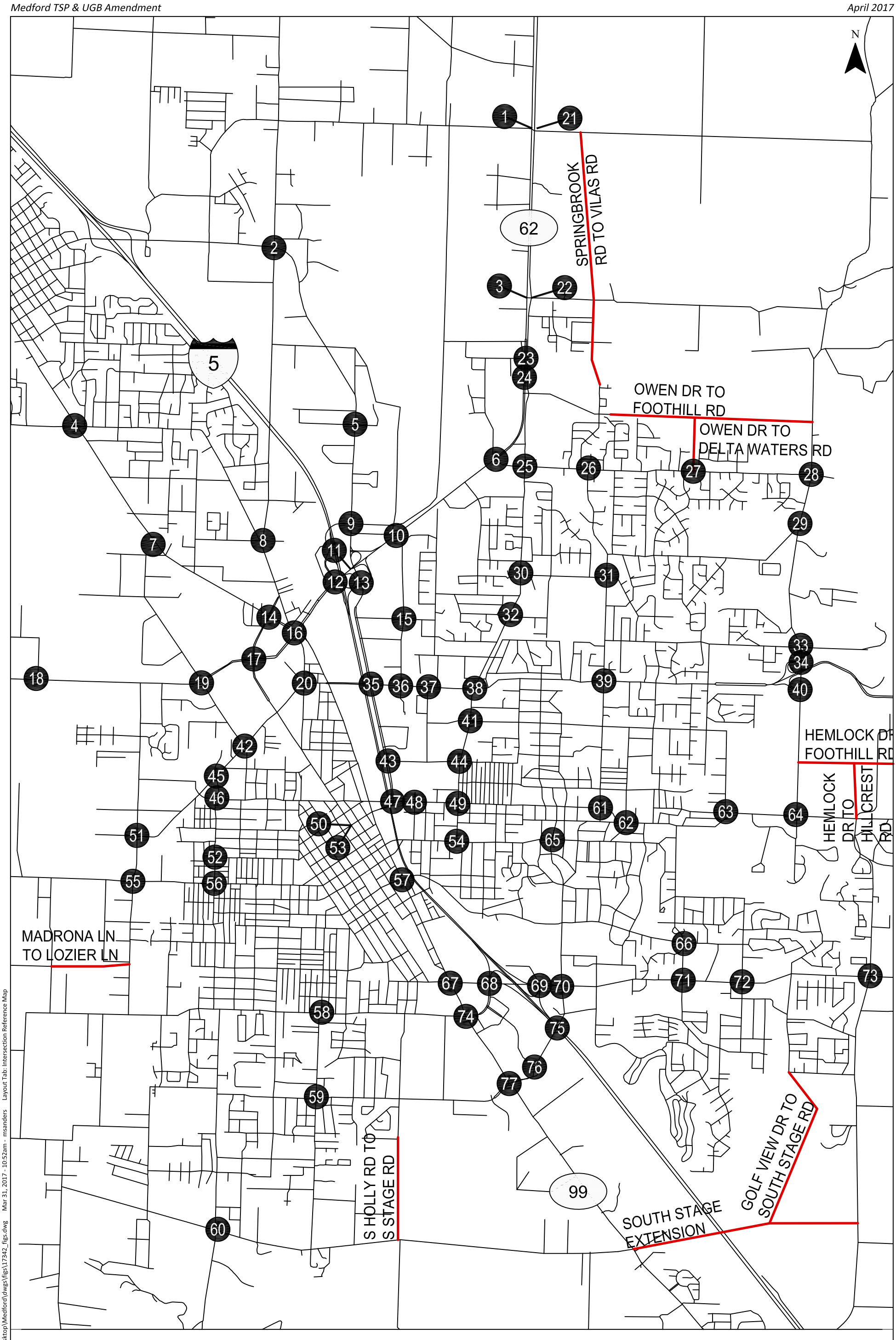
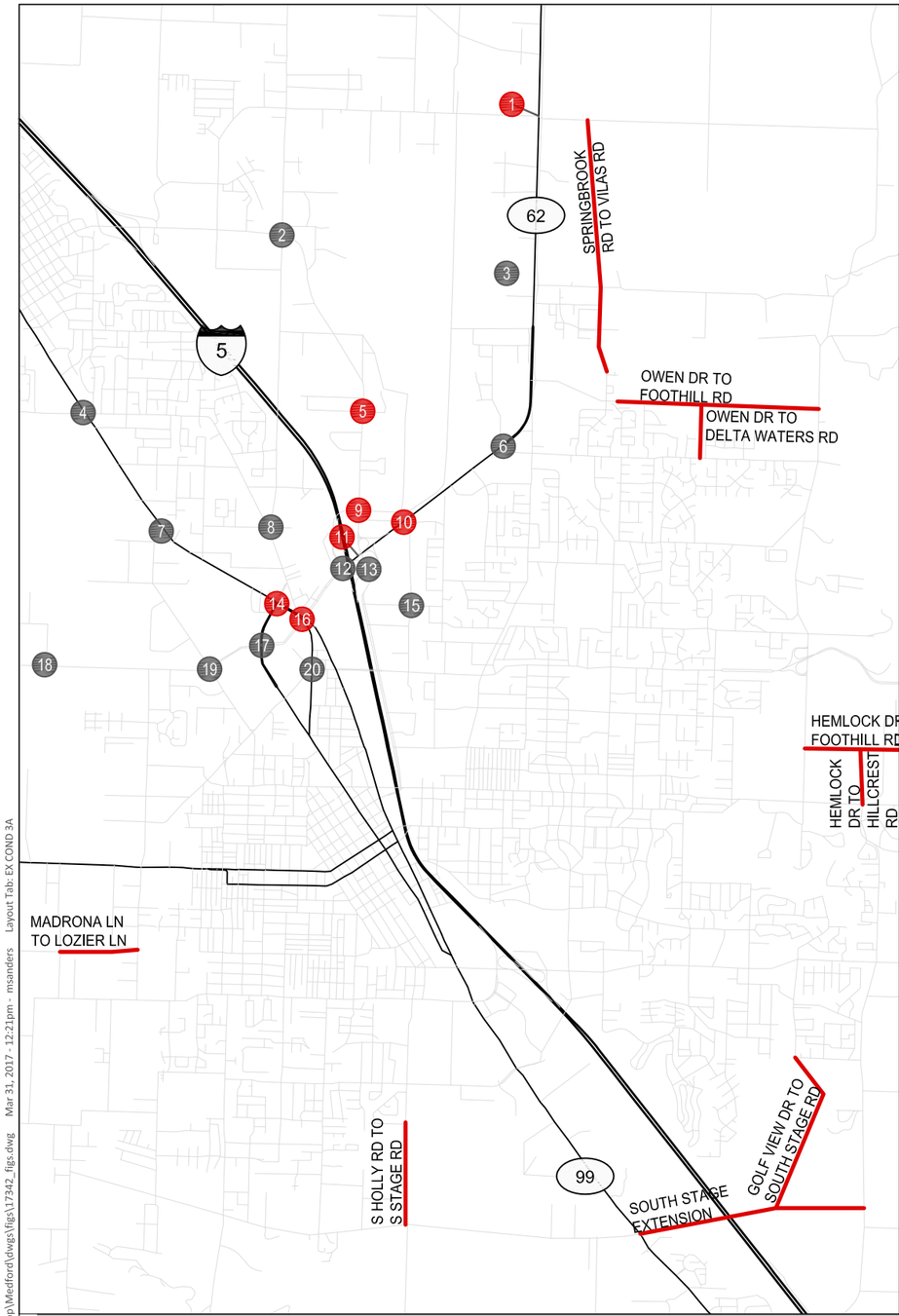
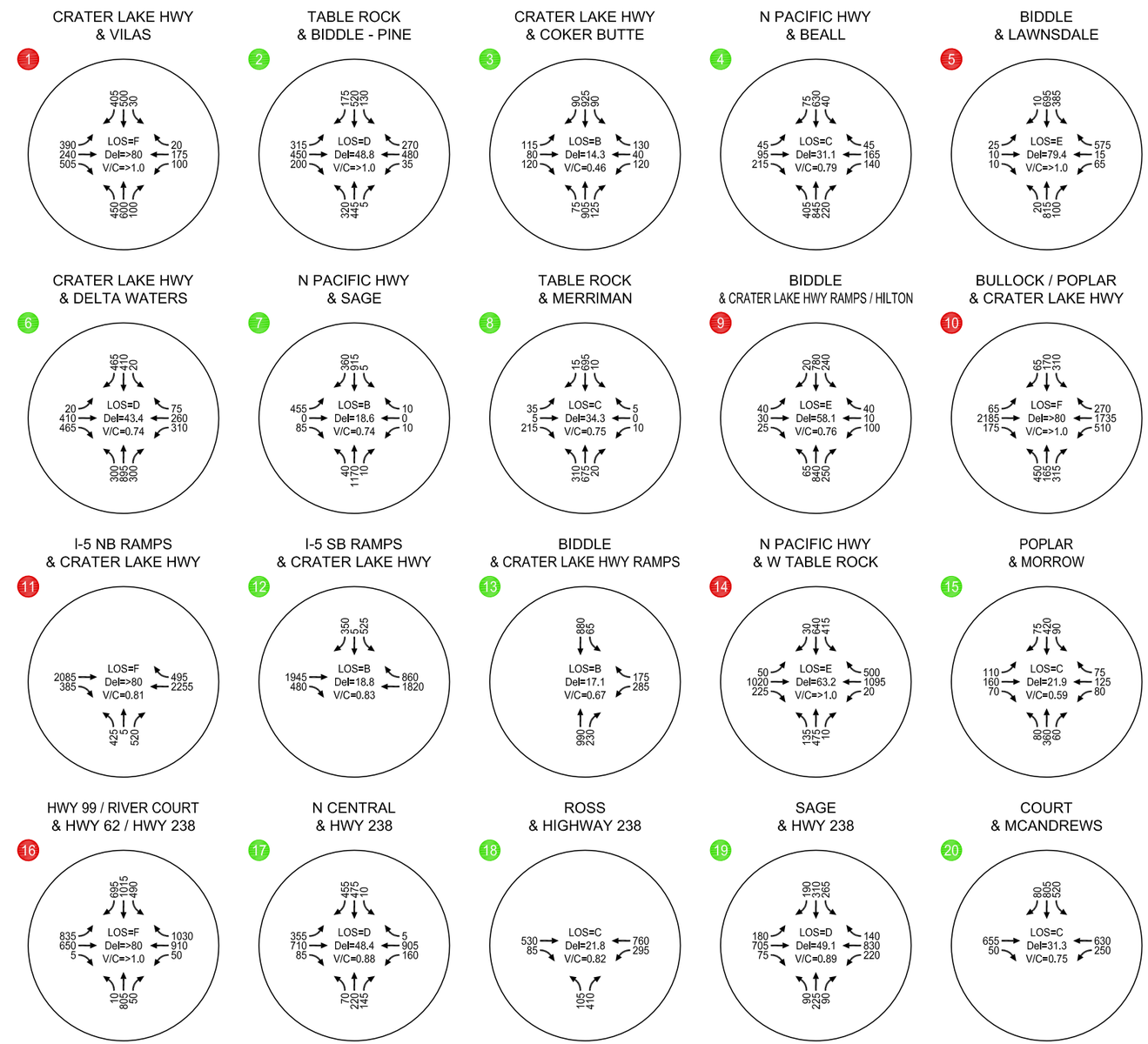


Study Intersection Reference Map
Medford, Oregon

Figure
6B





Year 2038 Traffic Volumes
Weekday PM Peak Hour
Medford, Oregon

Figure
6C

- Meets City of Medford Level of Service Requirements
- Does not Meet City of Medford Level of Service Requirements

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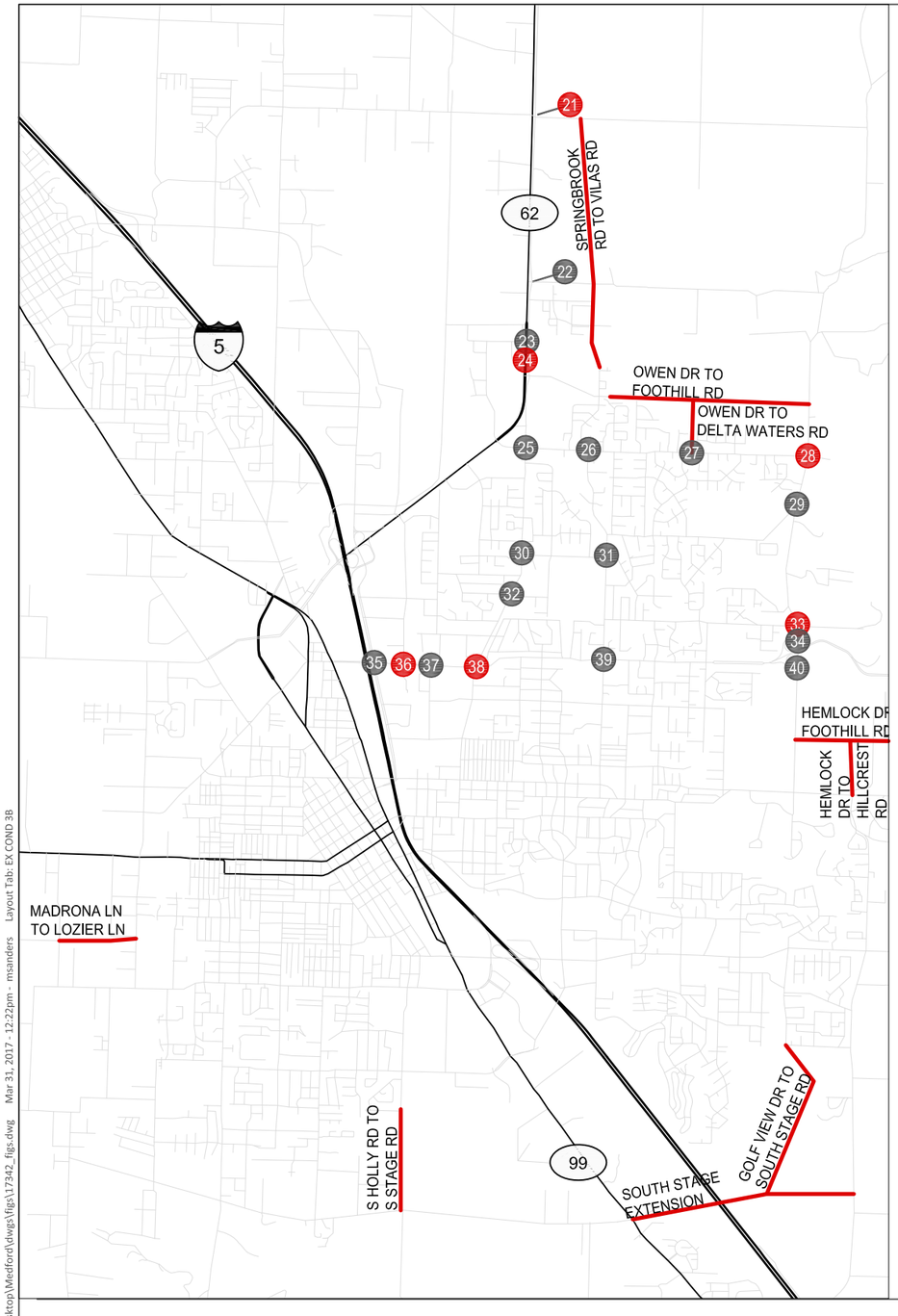

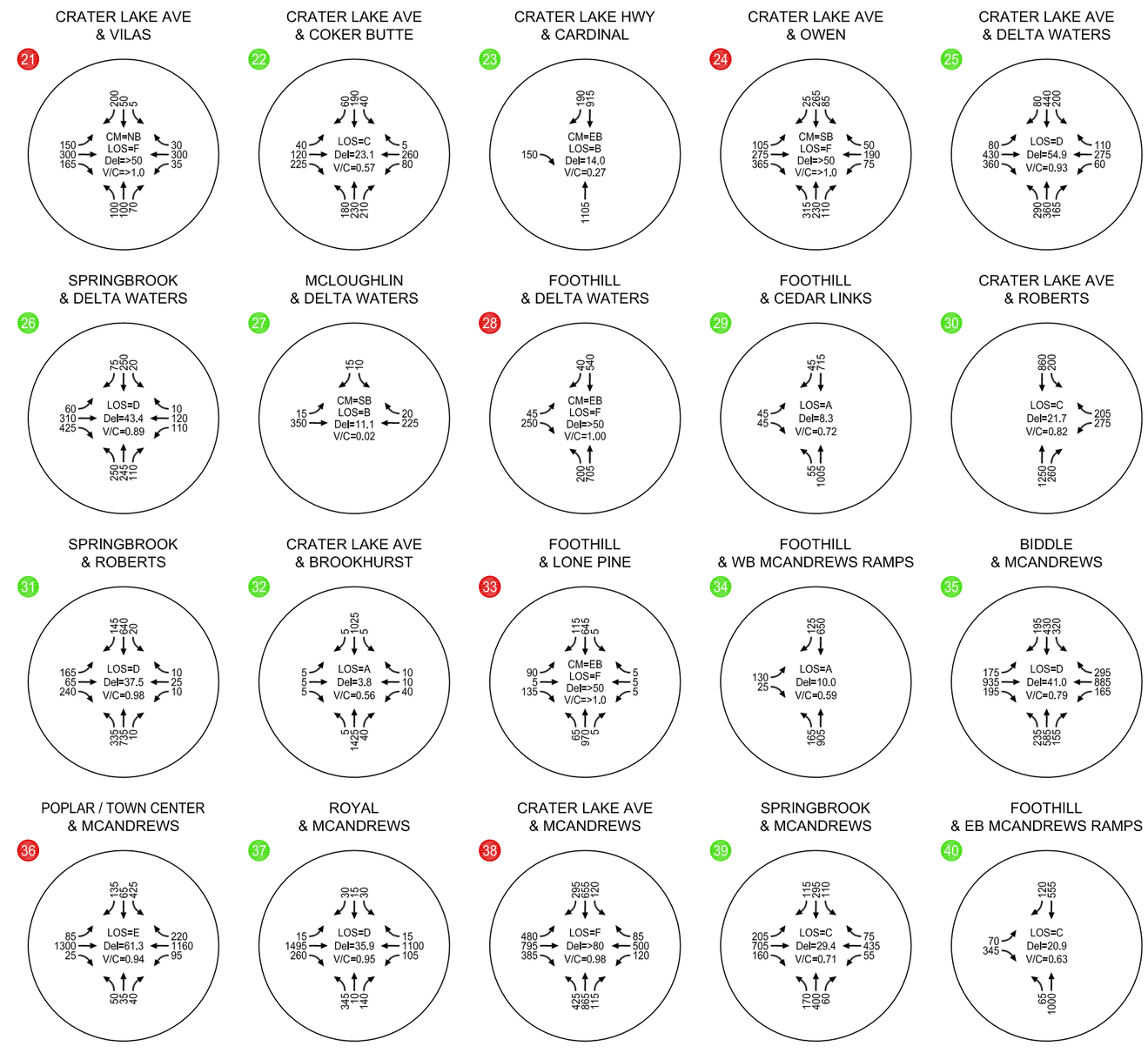

- Meets City of Medford Level of Service Requirements

- Does not Meet City of Medford Level of Service Requirements

Year 2038 Traffic Volumes
Weekday PM Peak Hour
Medford, Oregon

Figure
6D

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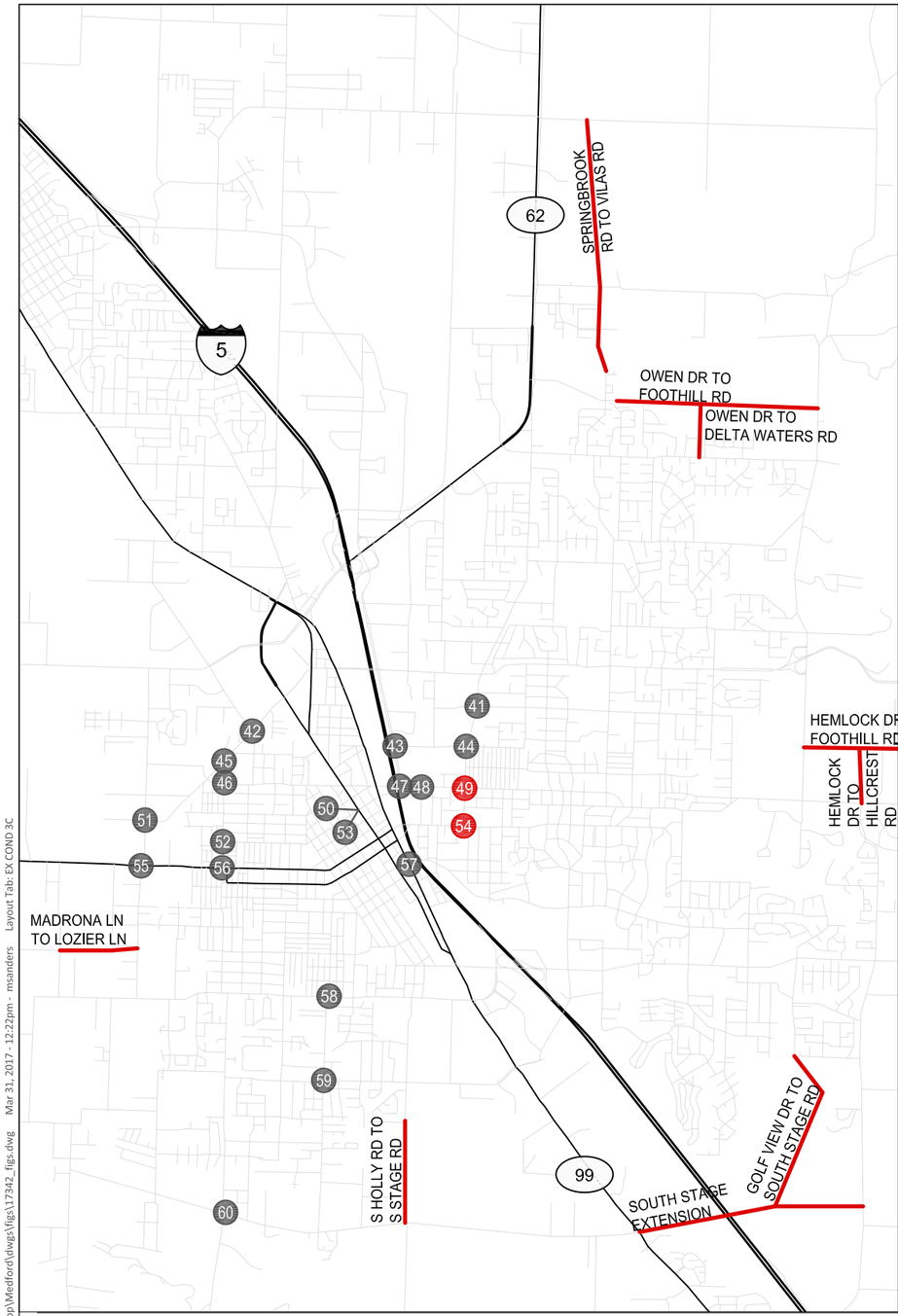

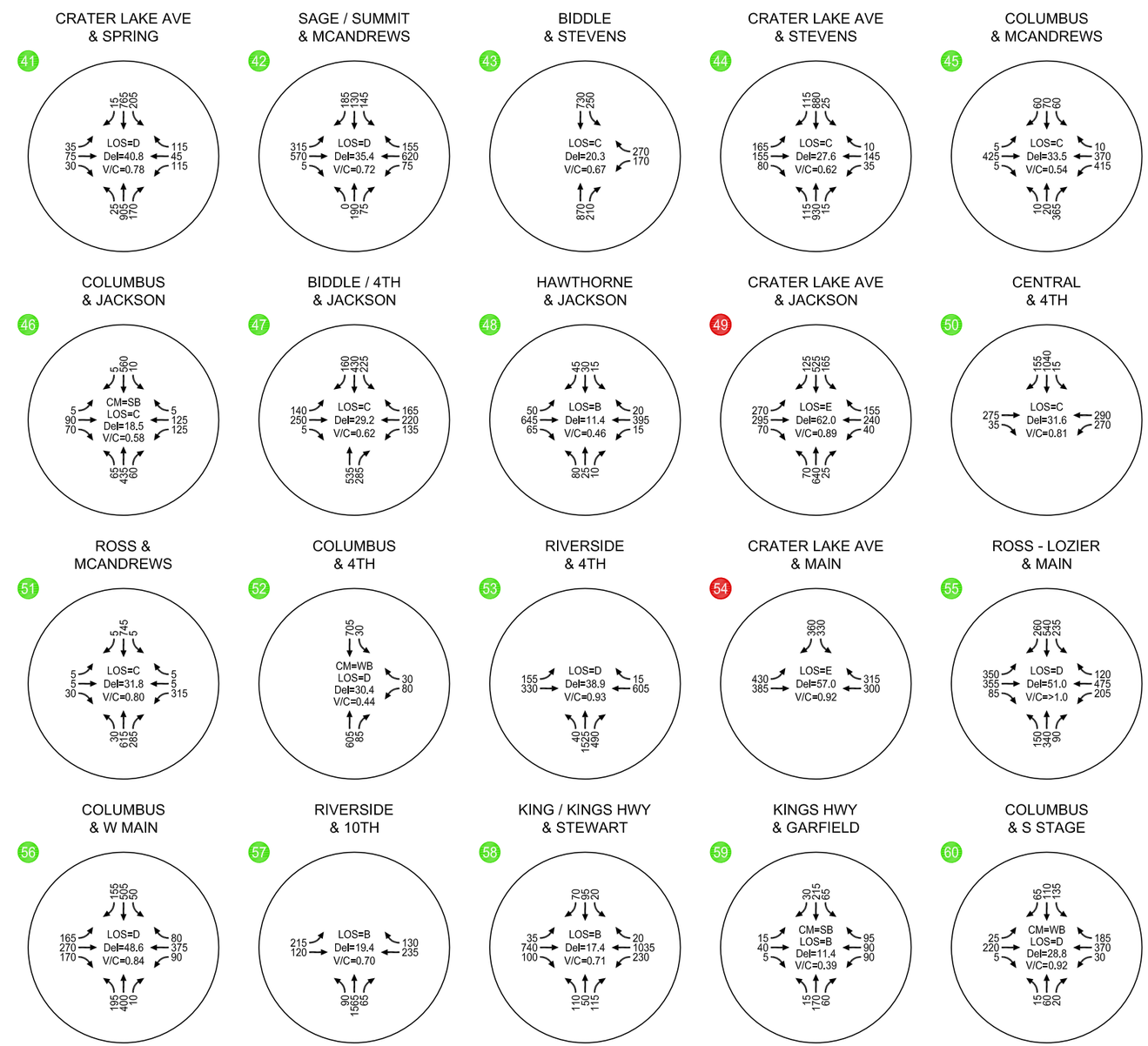

- Meets City of Medford Level of Service Requirements

- Does not Meet City of Medford Level of Service Requirements

Year 2038 Traffic Volumes
Weekday PM Peak Hour
Medford, Oregon

Figure
6E

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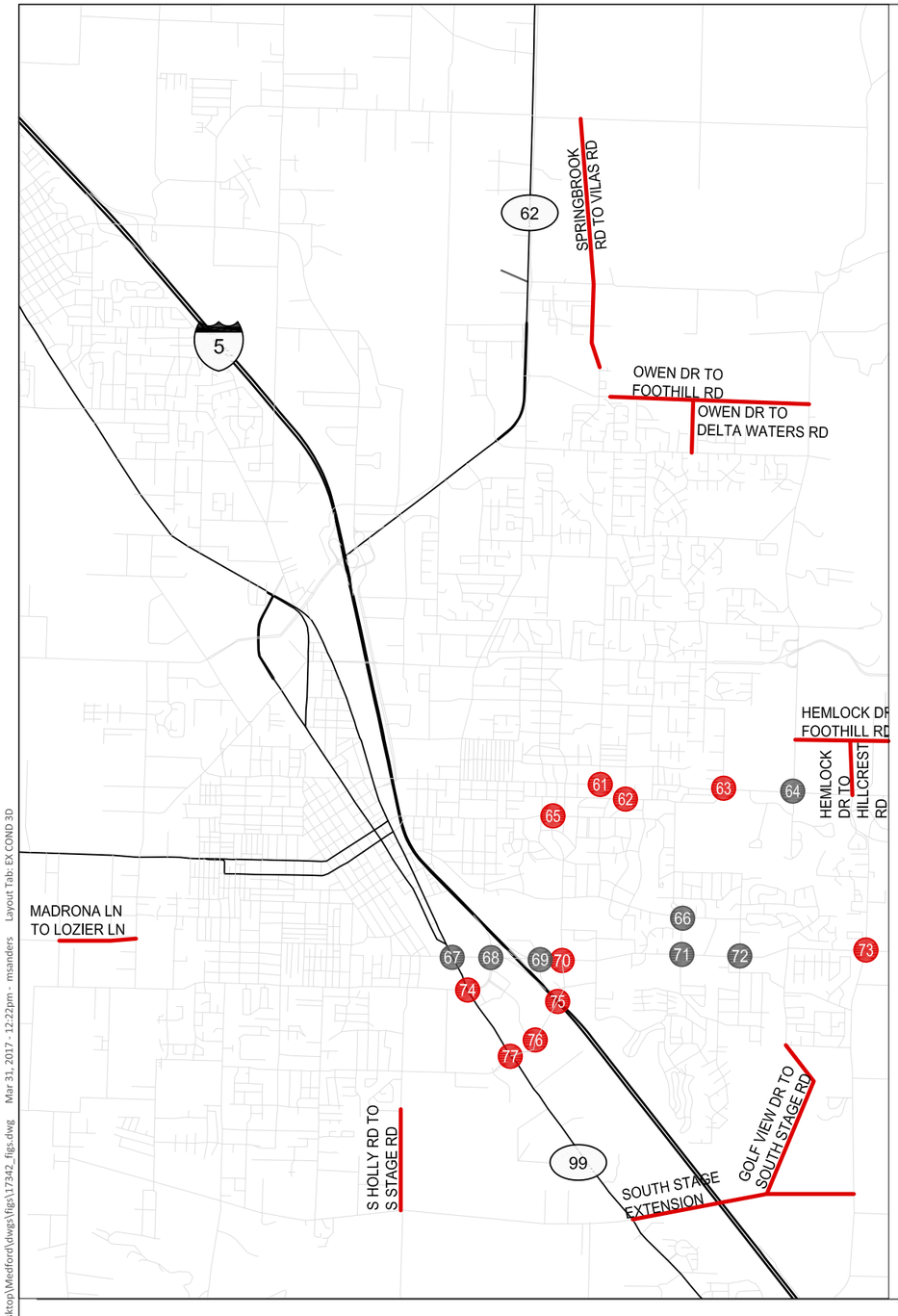

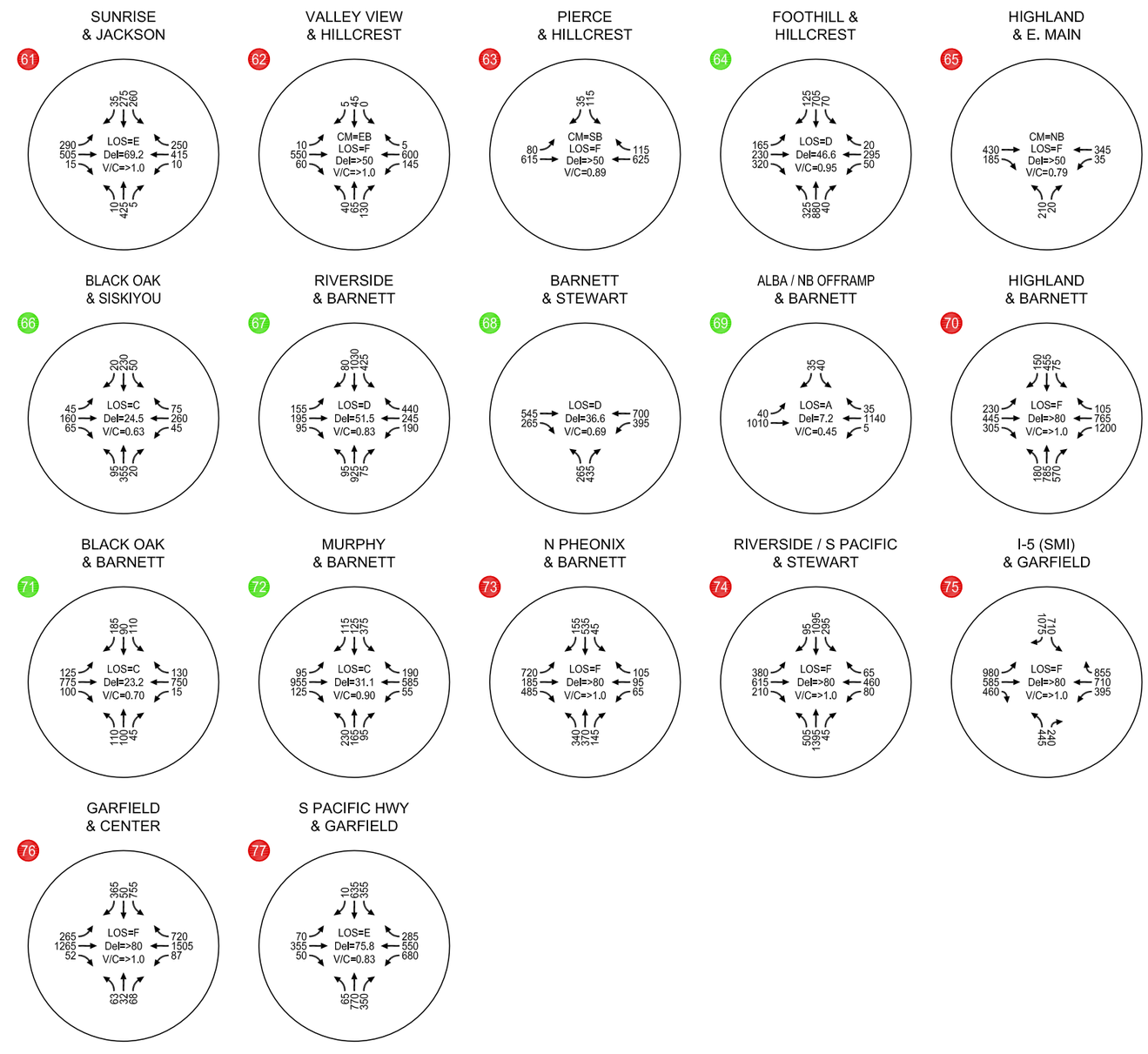

- Meets City of Medford Level of Service Requirements

- Does not Meet City of Medford Level of Service Requirements

Year 2038 Traffic Volumes
Weekday PM Peak Hour
Medford, Oregon

Figure
6F

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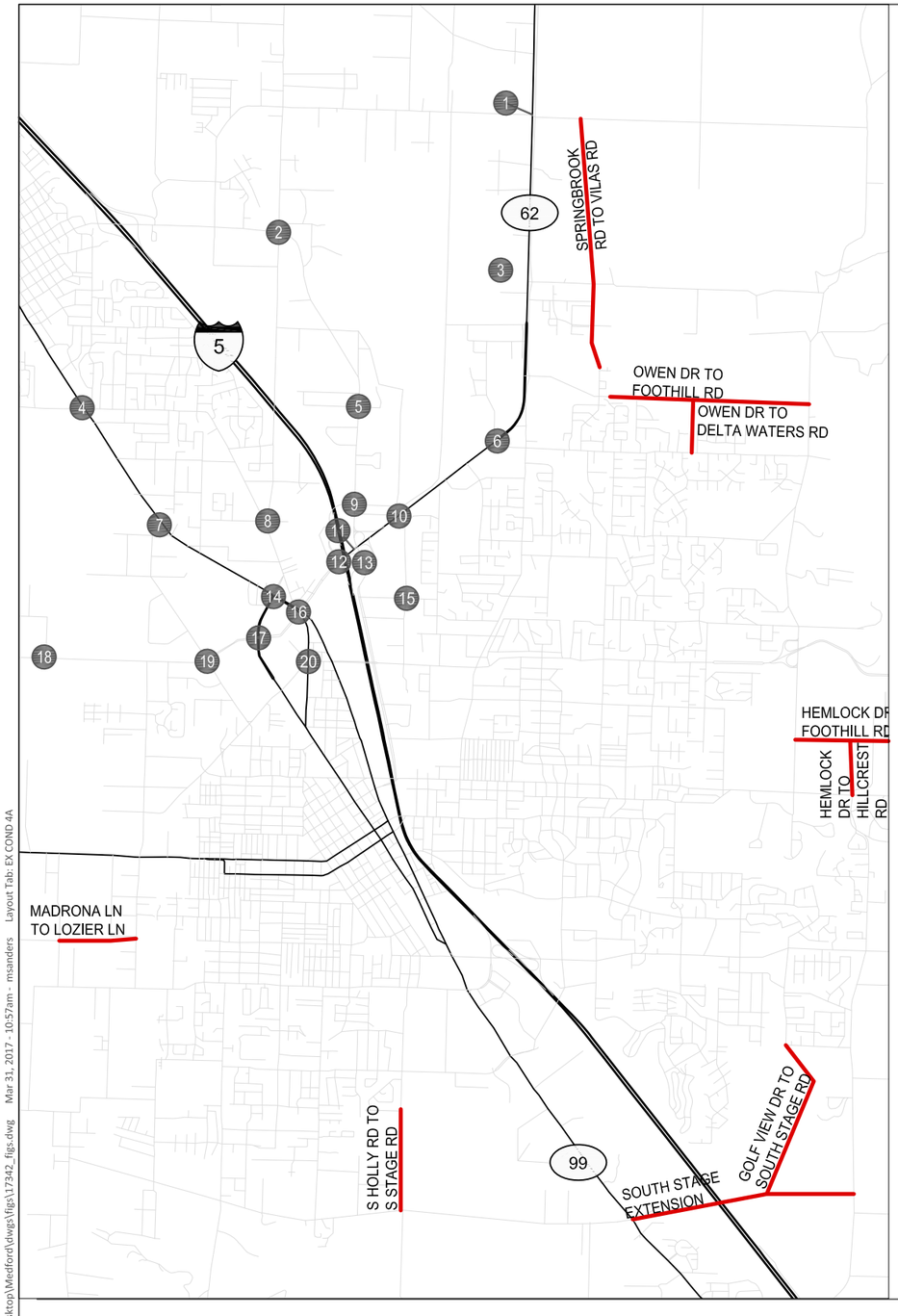

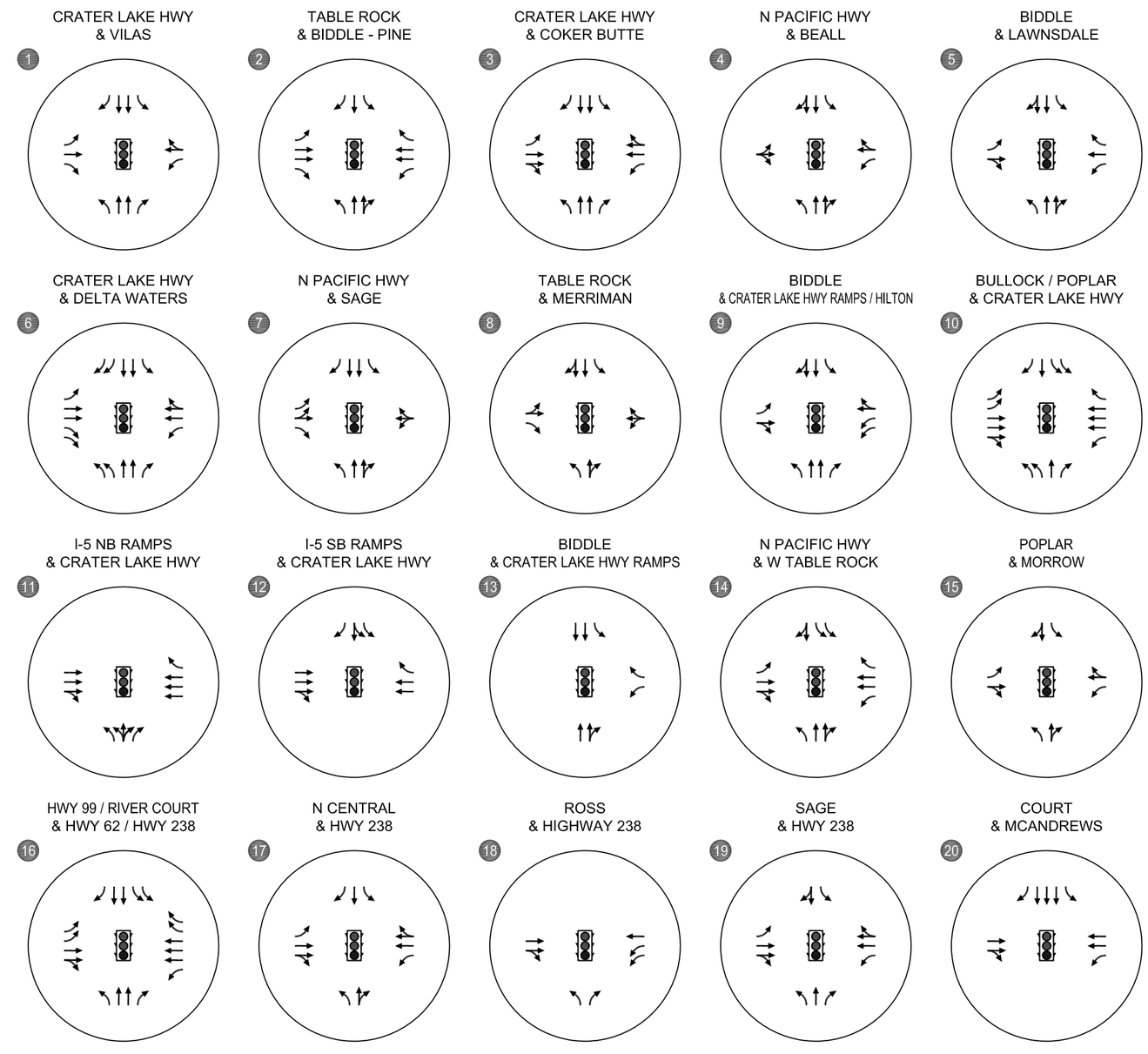

- STOP SIGN
- TRAFFIC SIGNAL

Year 2038 Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure 6G

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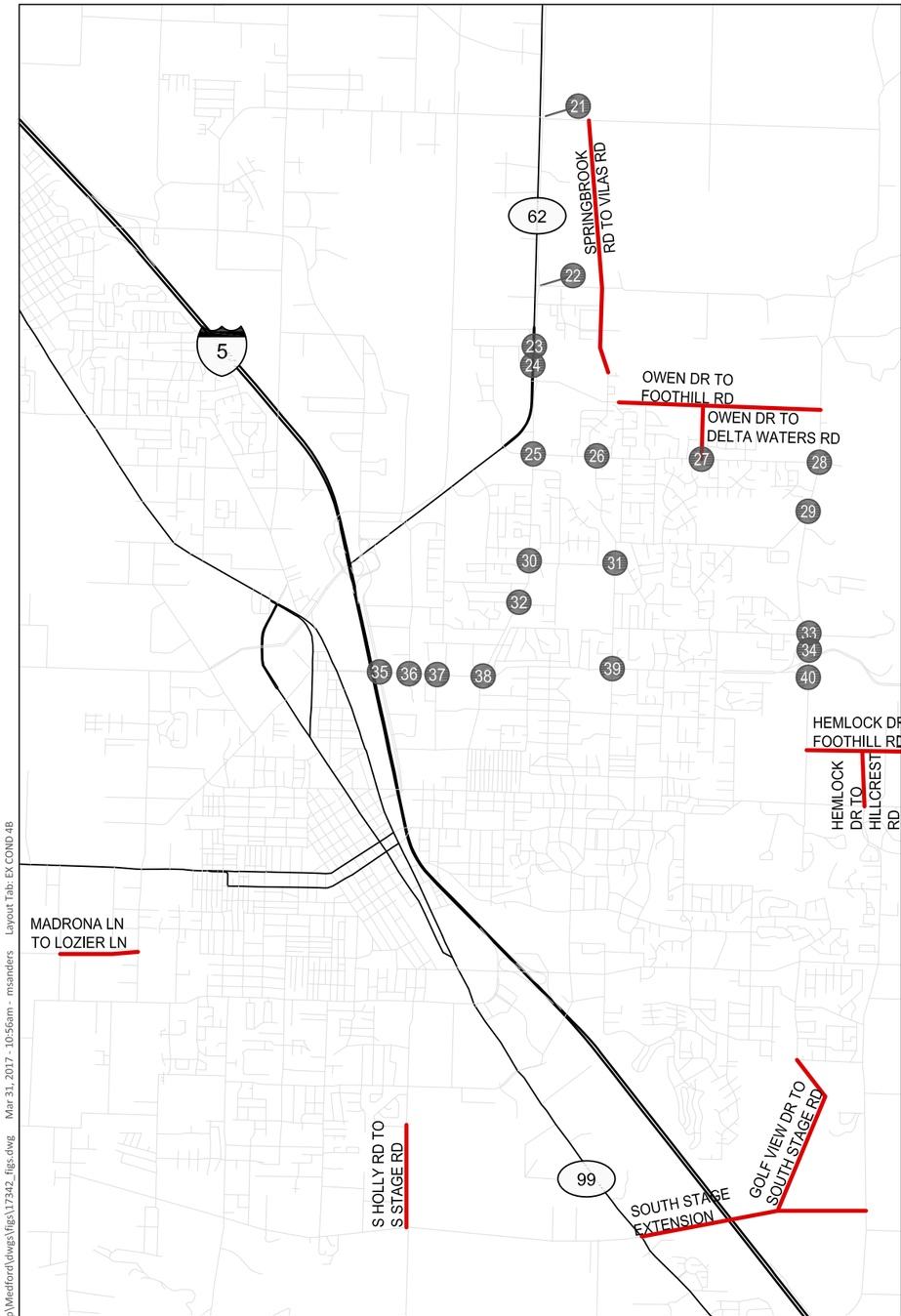

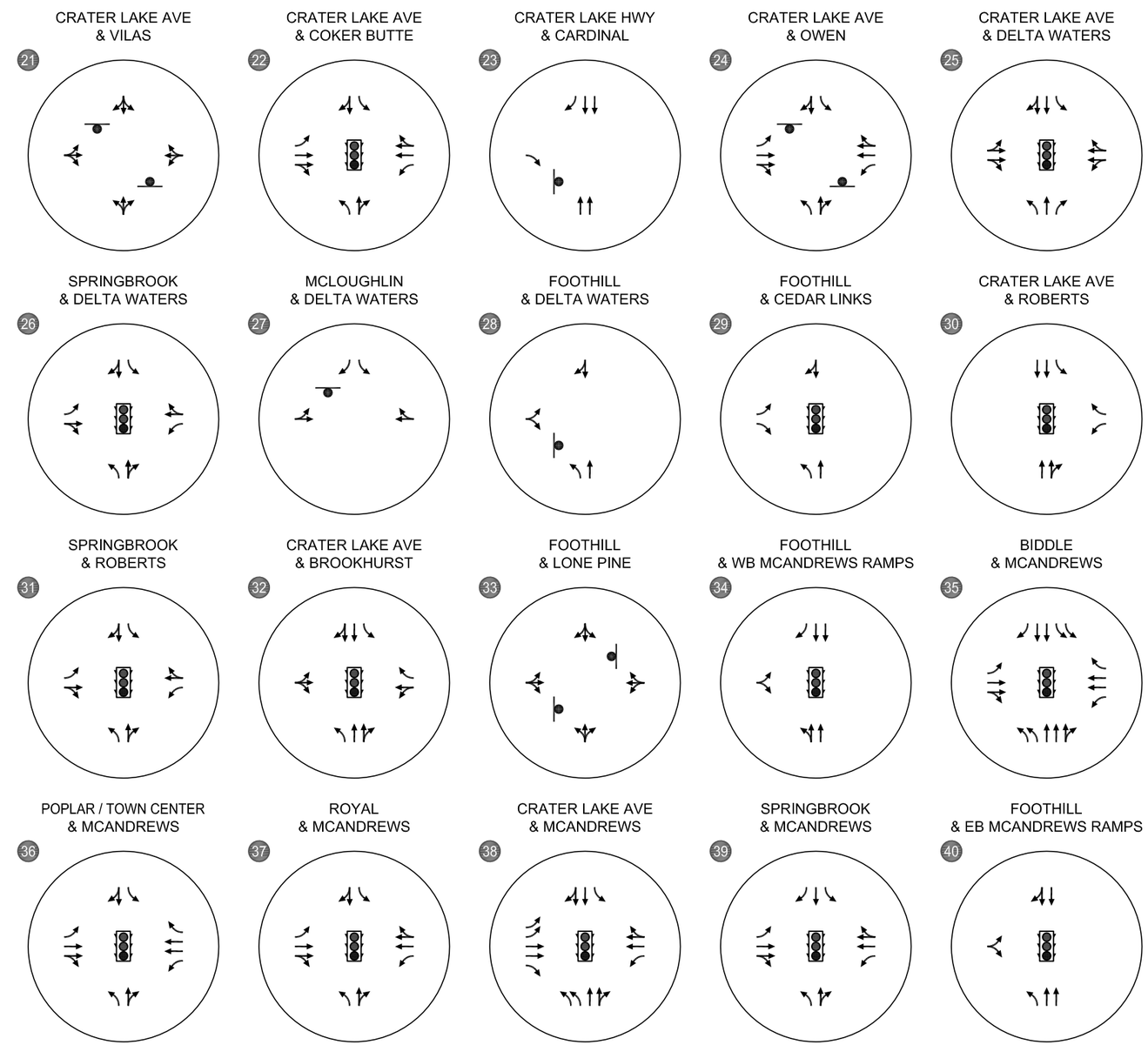

- STOP SIGN
- TRAFFIC SIGNAL

Year 2038 Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure 6H

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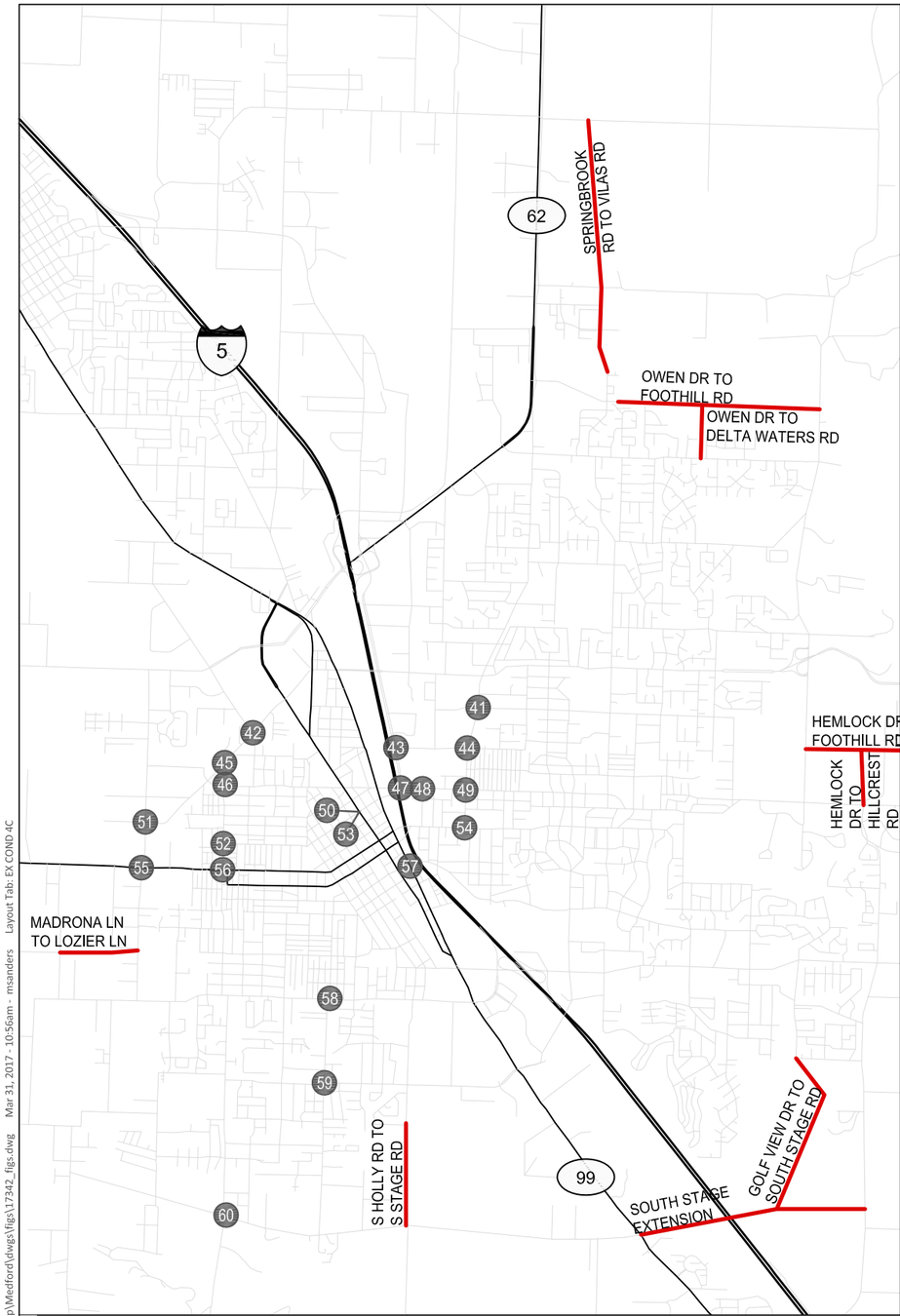

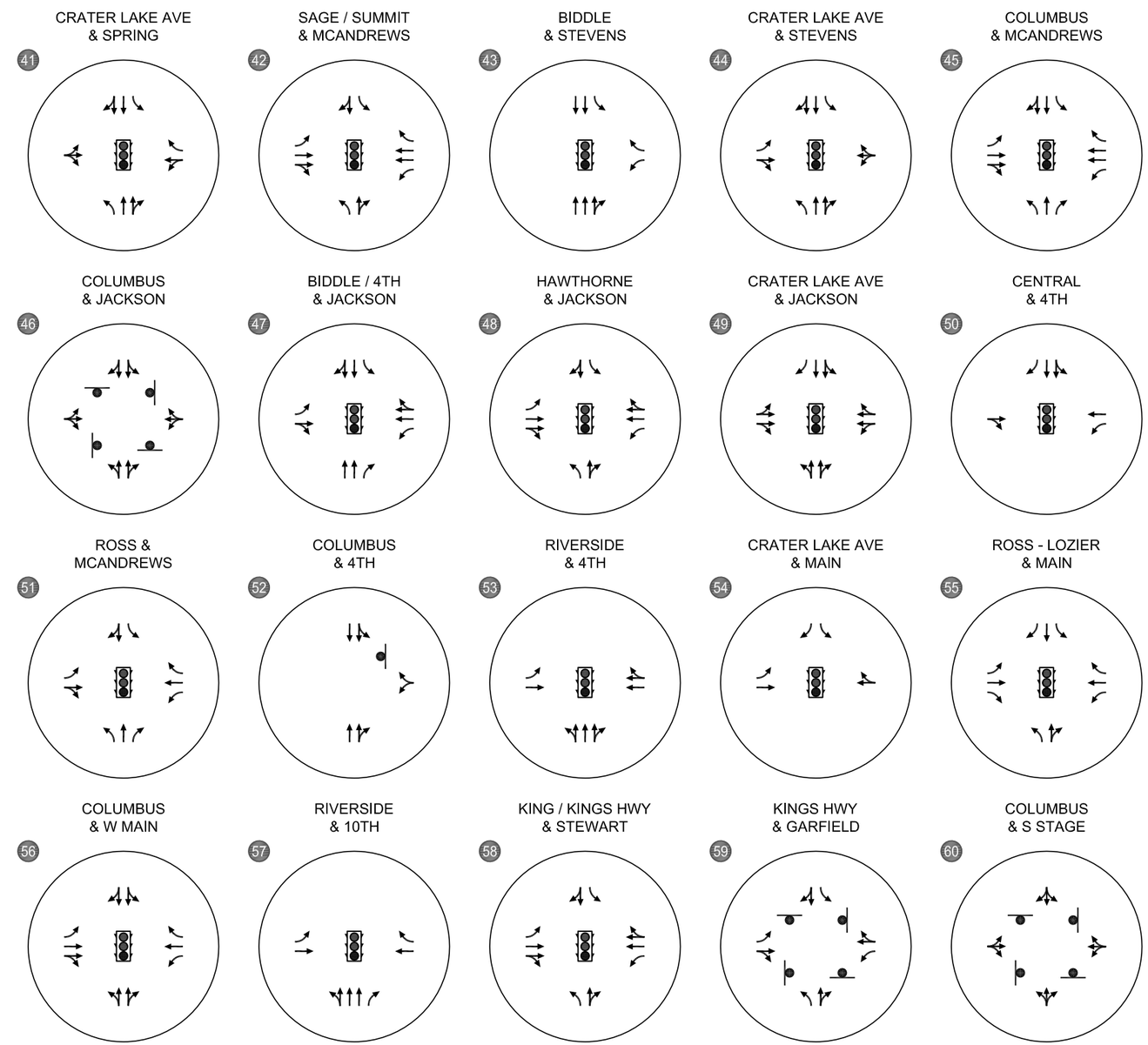

- STOP SIGN
- TRAFFIC SIGNAL

Year 2038 Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure
6I

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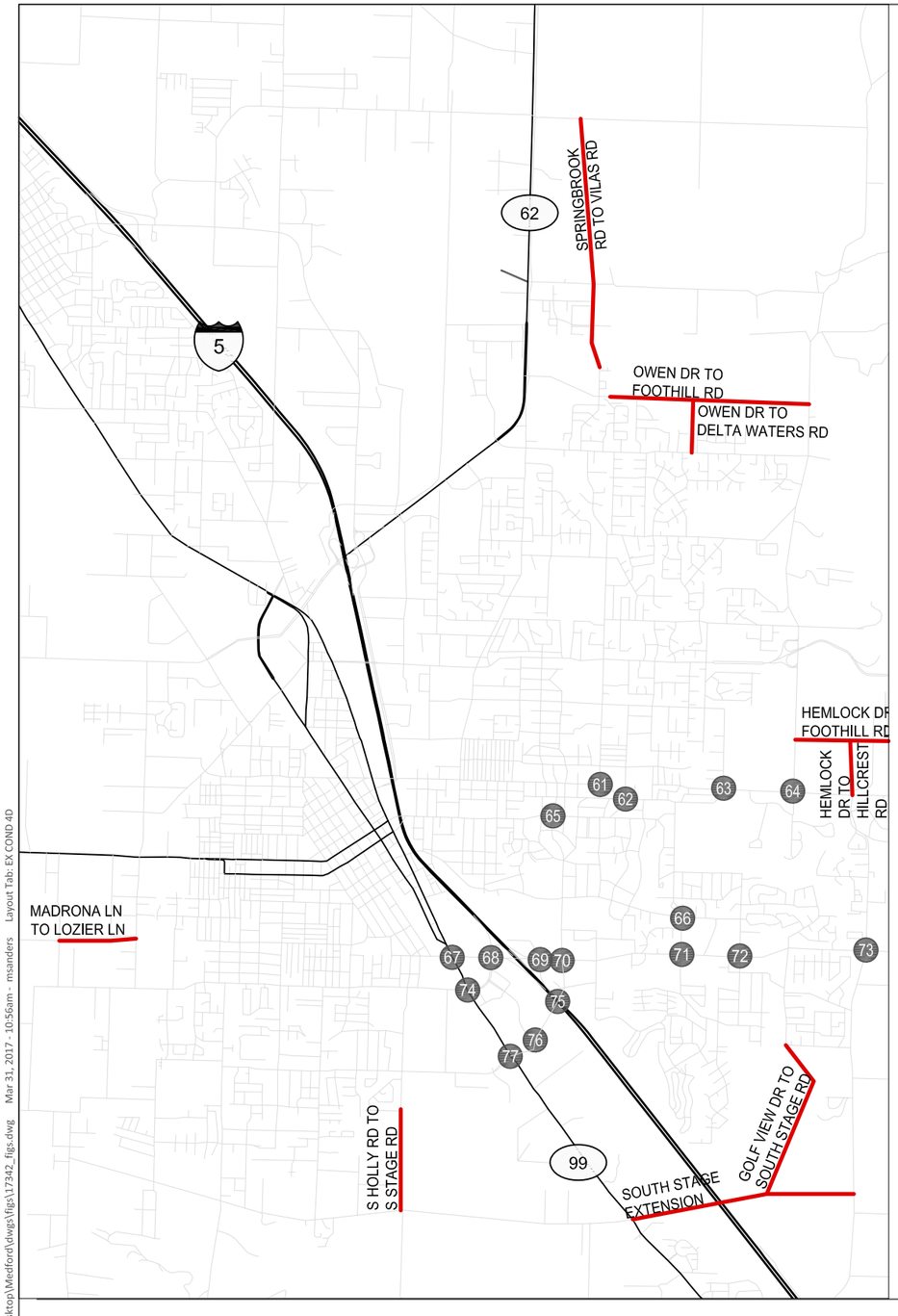

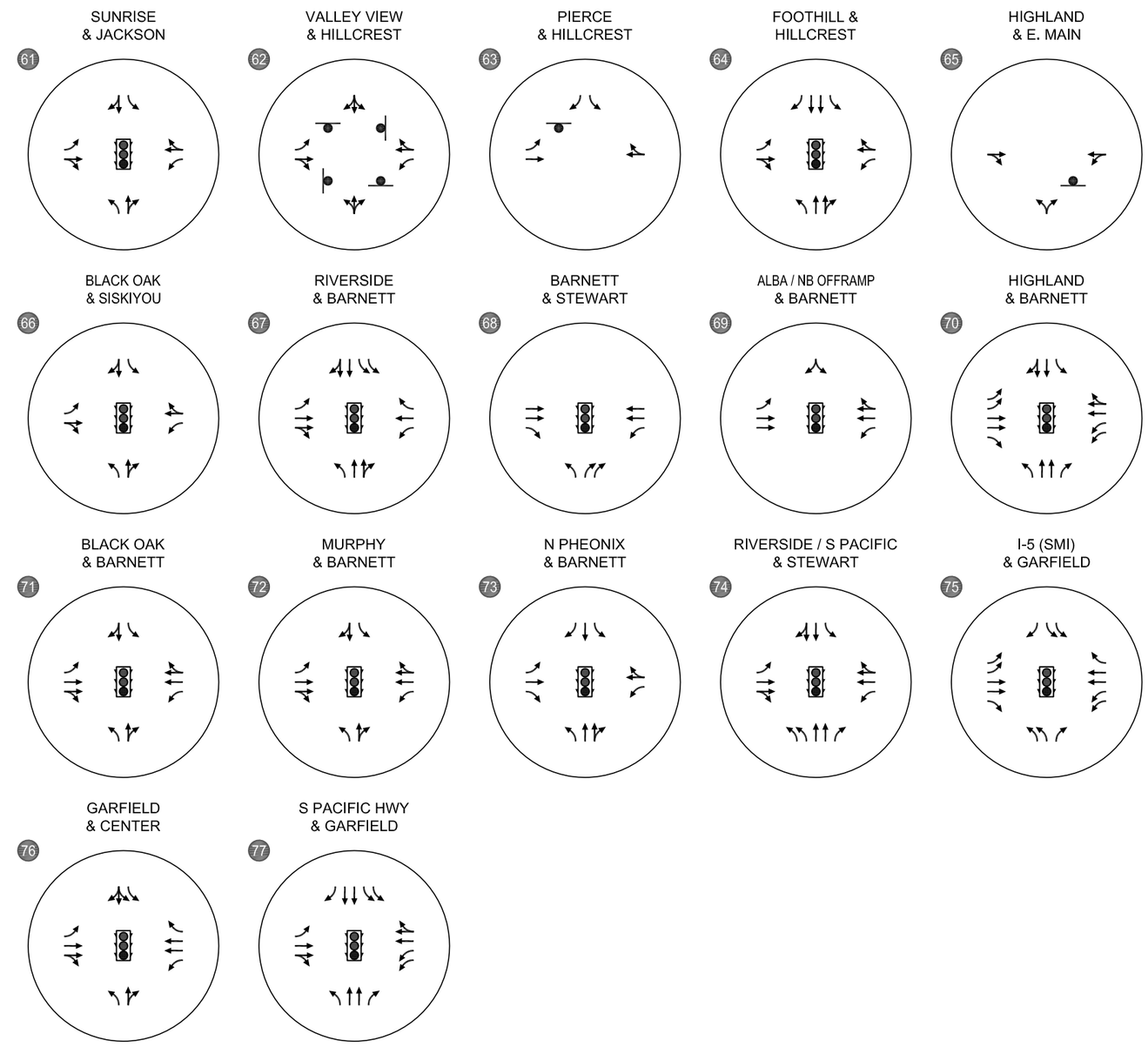

- STOP SIGN
- TRAFFIC SIGNAL

Year 2038 Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure 6J

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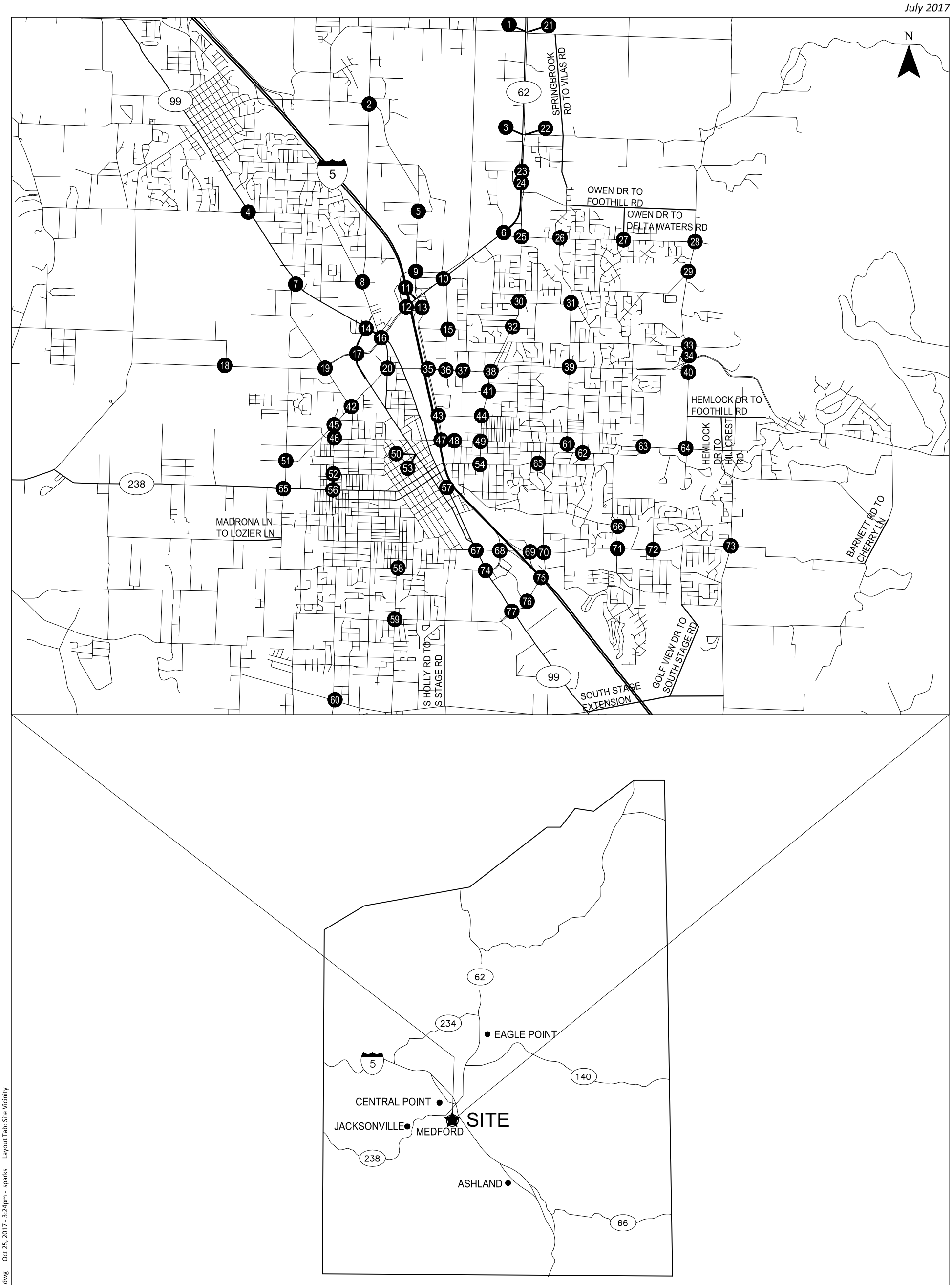

Sites & Vicinity Map
Medford, Oregon

Figure
7A

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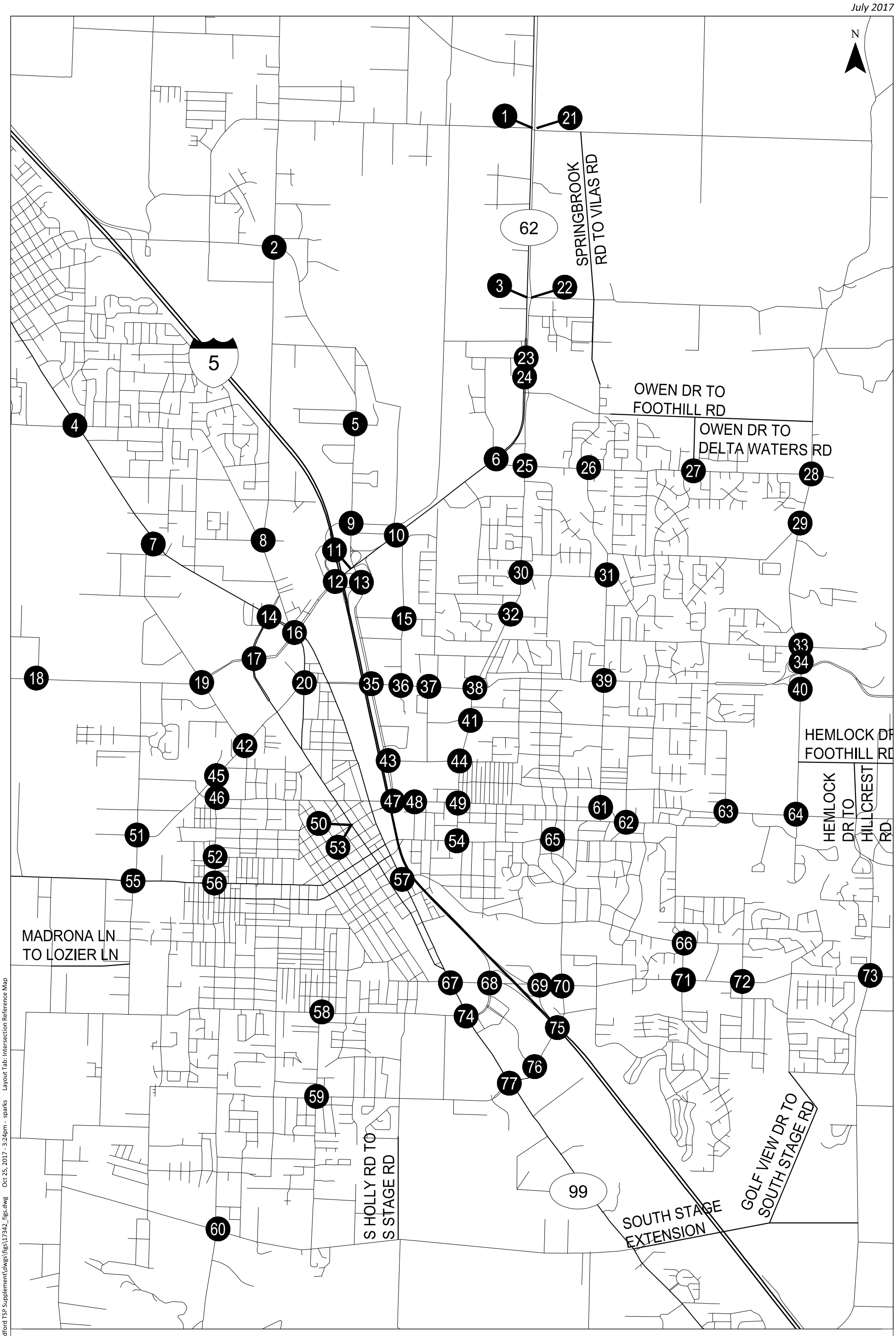

Study Intersection Reference Map
Medford, Oregon

Figure
7B

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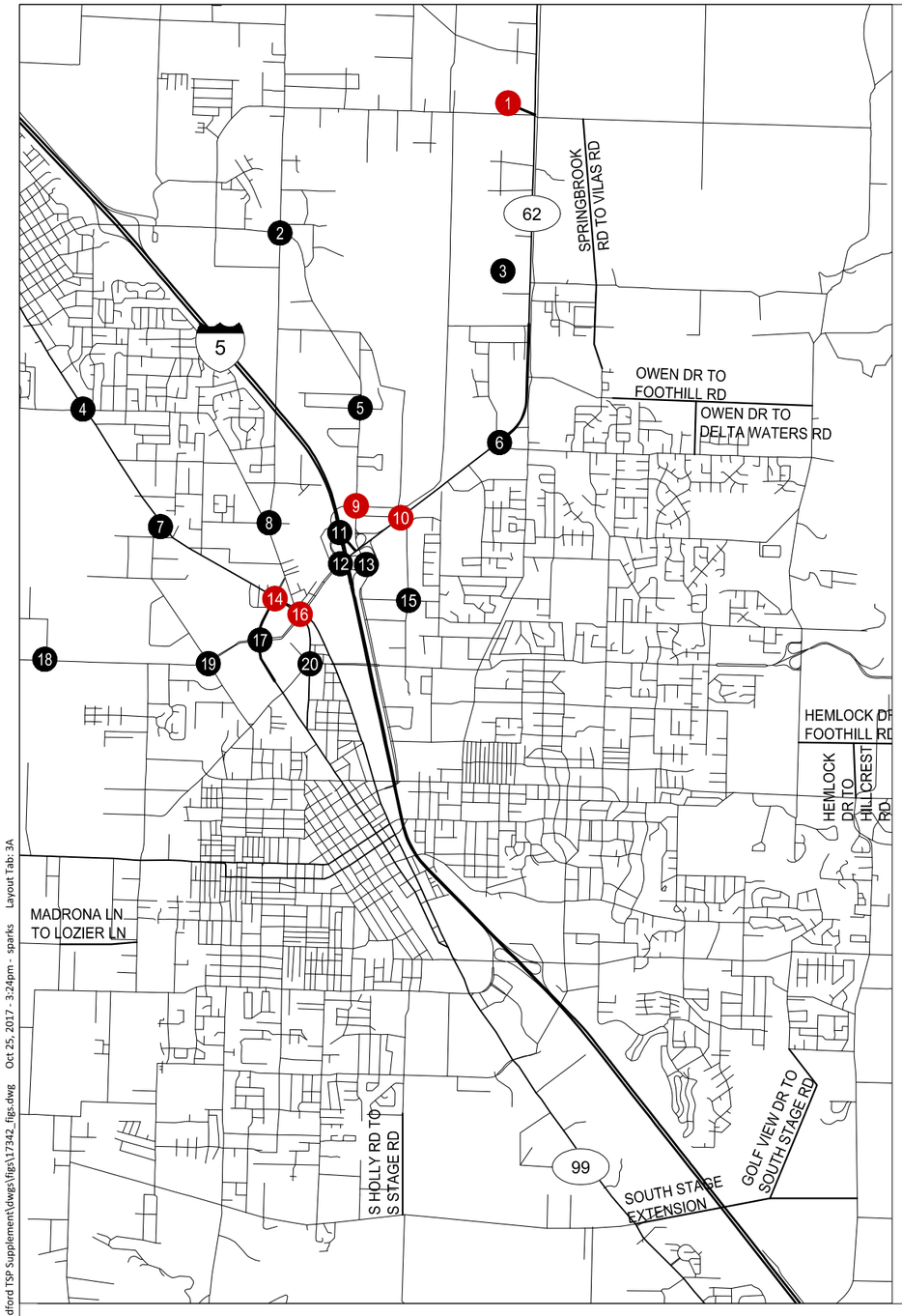
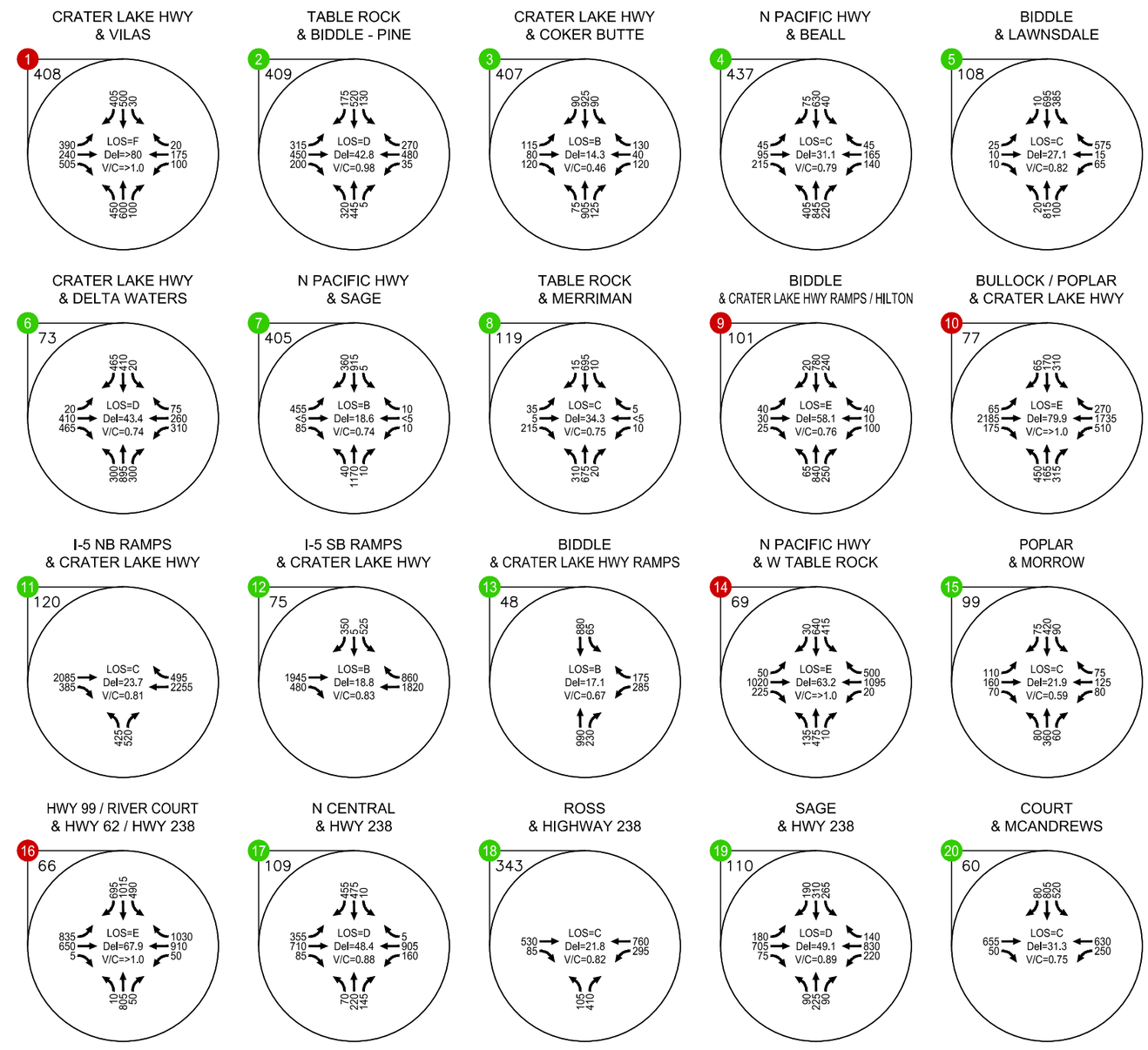




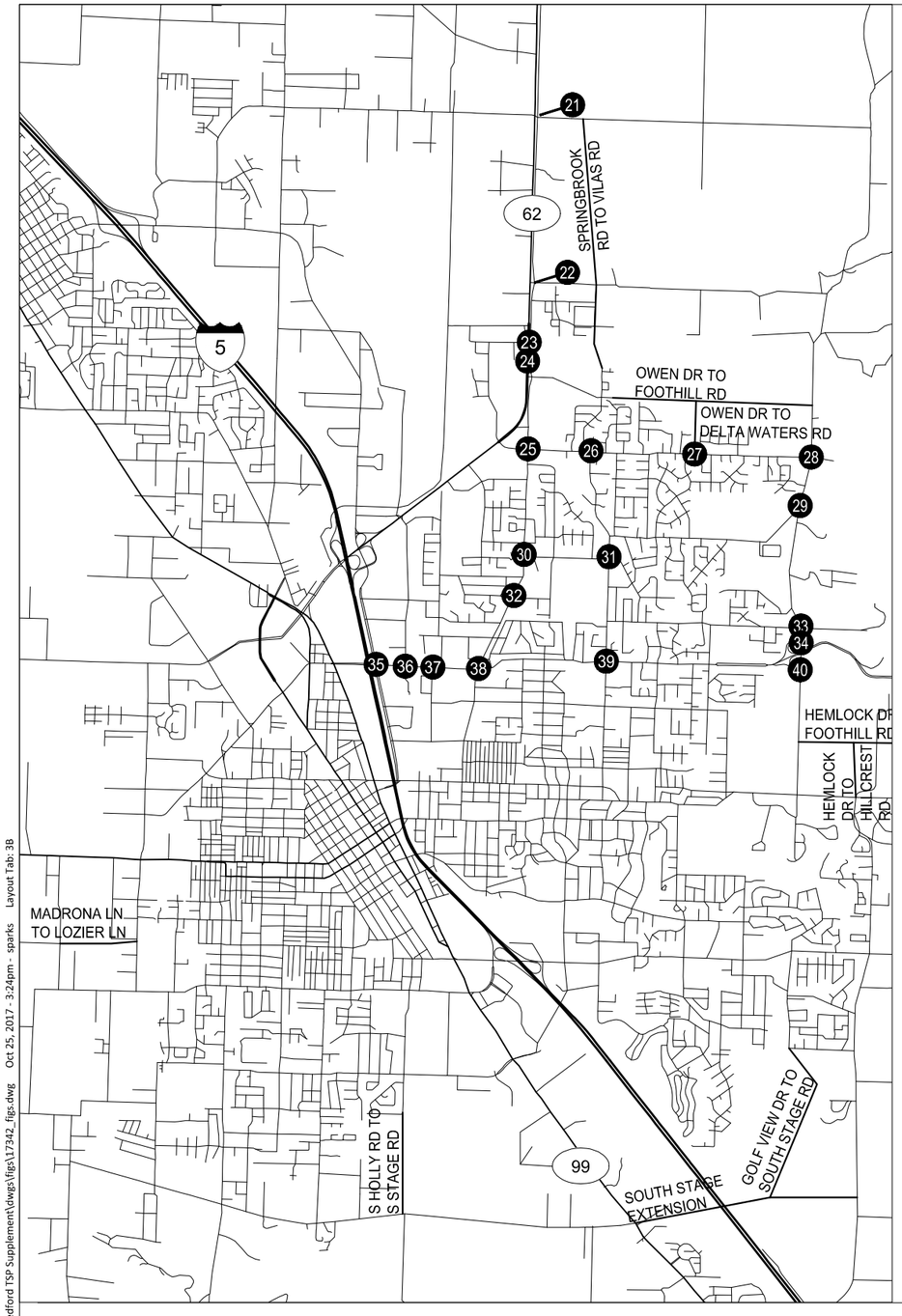
- Meets City of Medford Level of Service Requirements

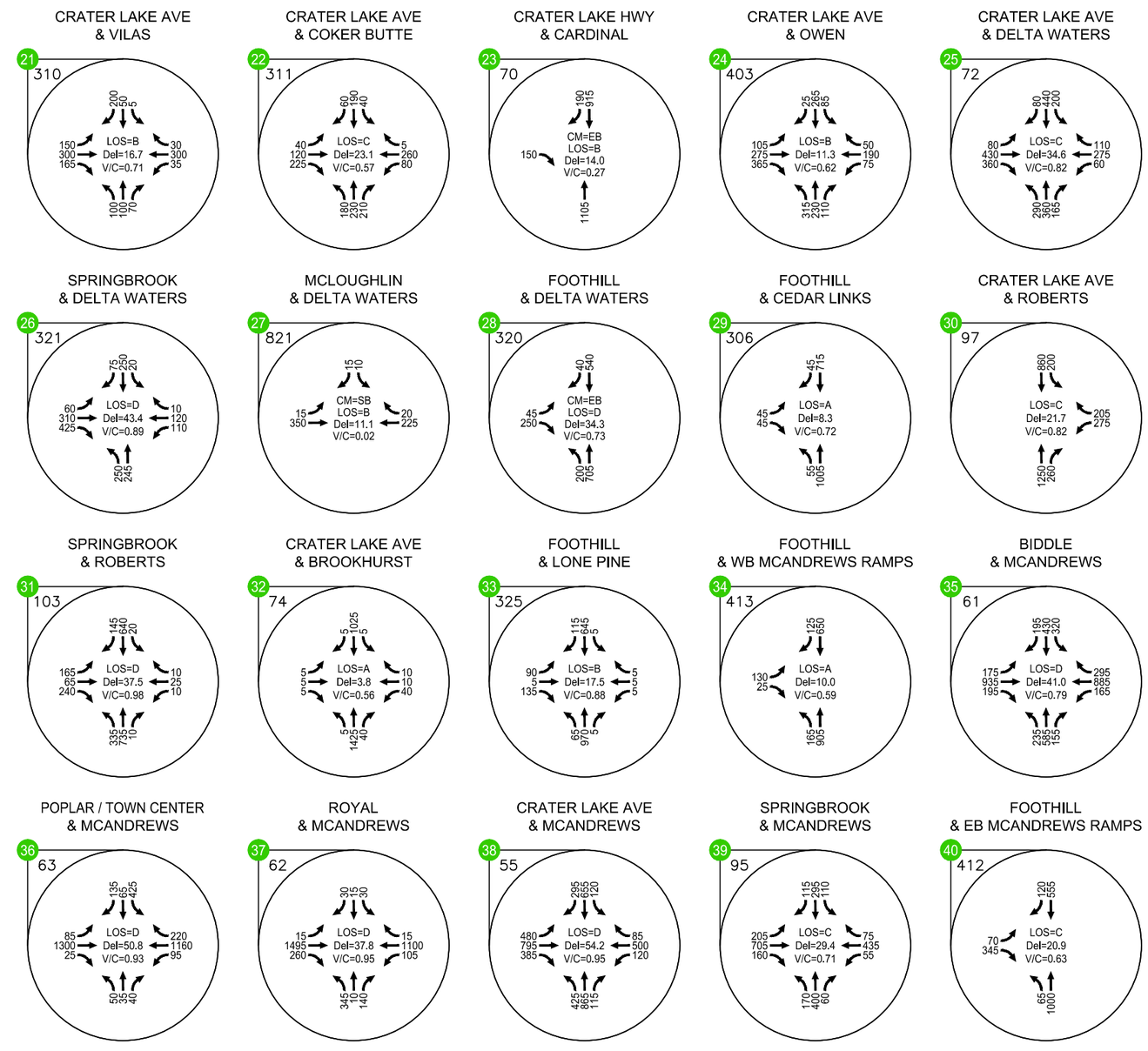
- Does not Meet City of Medford Level of Service Requirements

Year 2038 Mitigated Traffic Operations
Weekday PM Peak Hour
Medford, Oregon

Figure
7C

H:\21\21255 - City of Medford TSP Supplement\dwgs\figs\17342_figs.dwg Oct 25, 2017 - 3:24pm - sparks Layout Tab: 3A





- Meets City of Medford Level of Service Requirements

- Does not Meet City of Medford Level of Service Requirements

Year 2038 Mitigated Traffic Operations
Weekday PM Peak Hour
Medford, Oregon

Figure
7D

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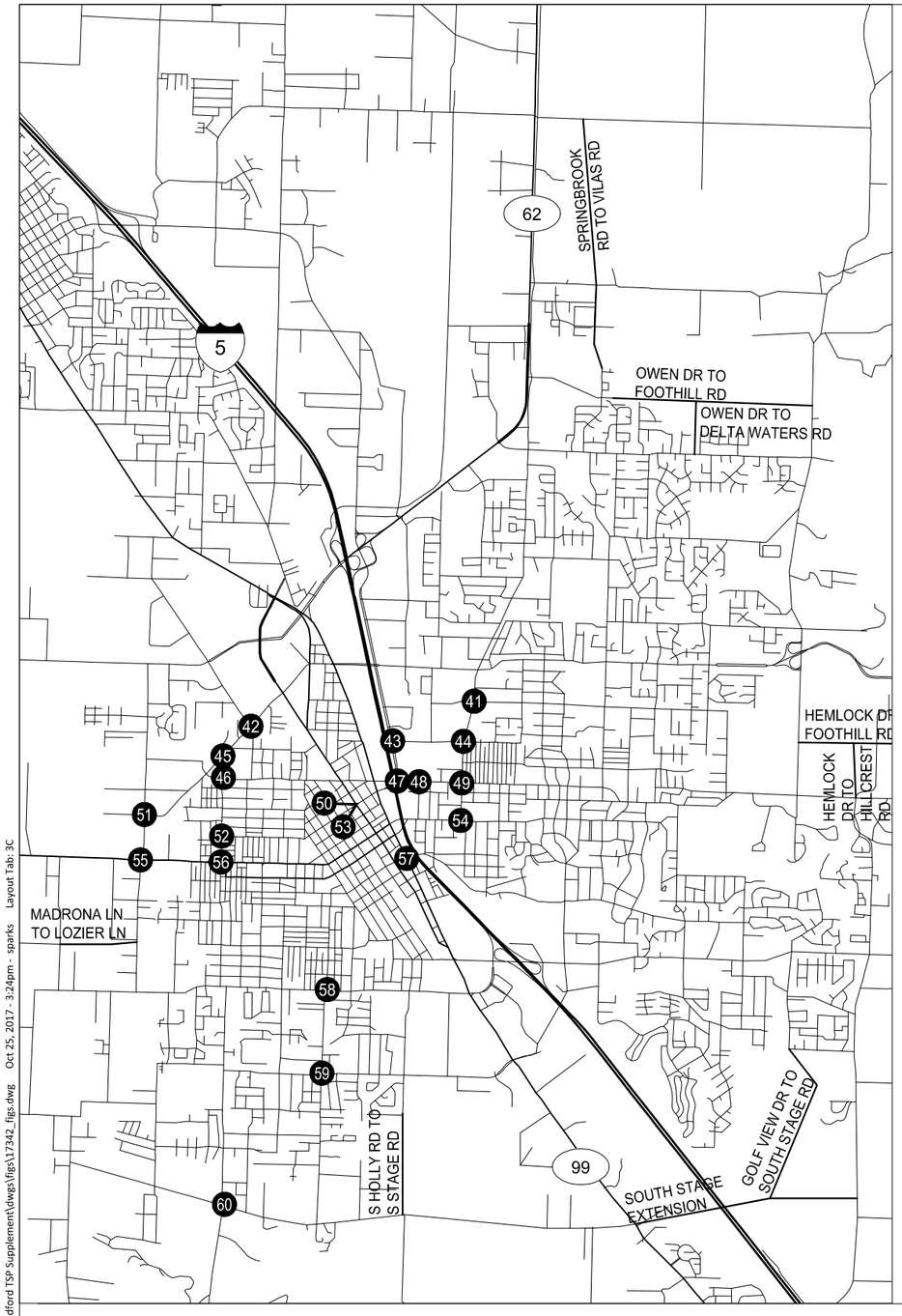

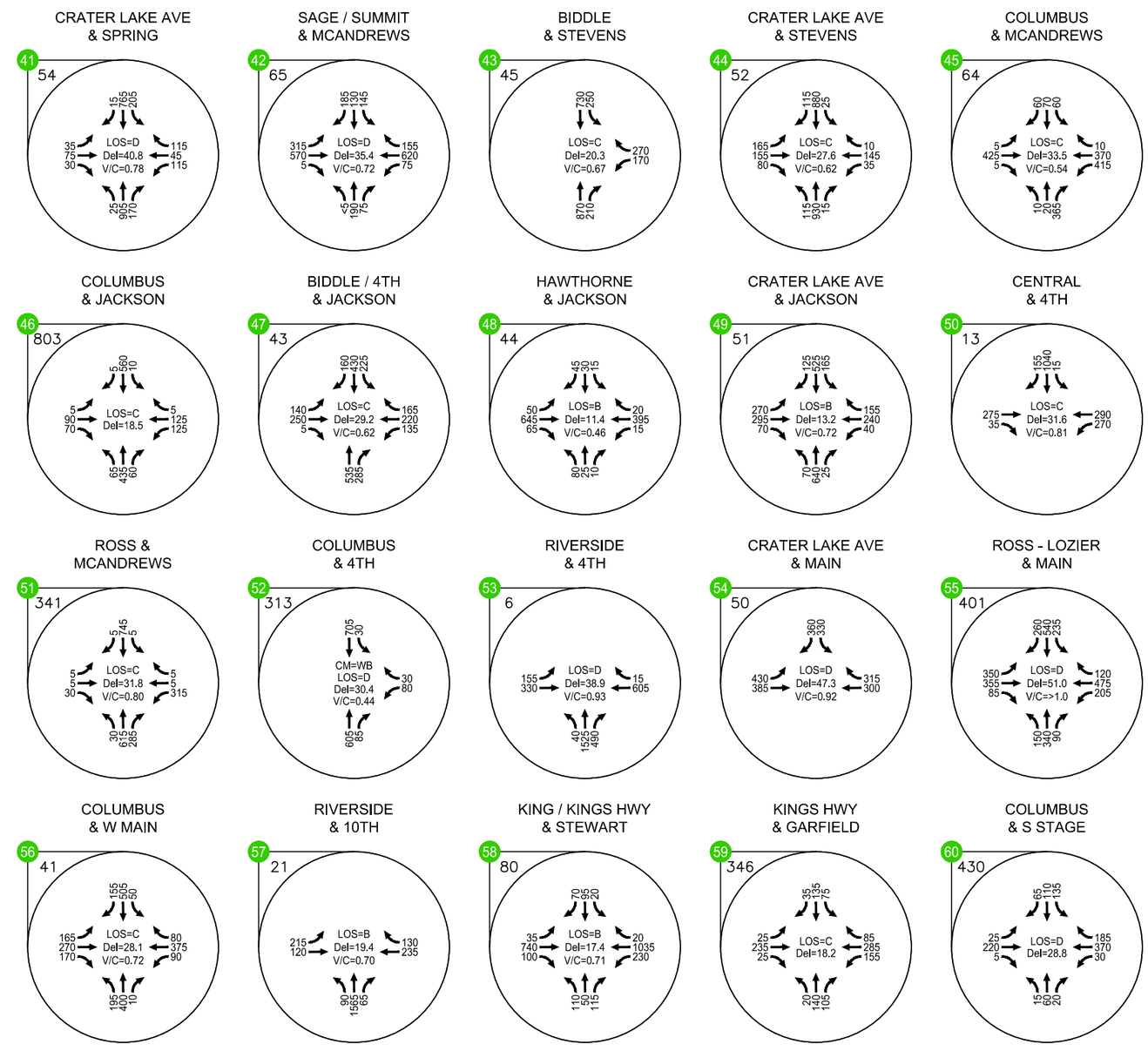

- Meets City of Medford Level of Service Requirements

- Does not Meet City of Medford Level of Service Requirements

Year 2038 Mitigated Traffic Operations
Weekday PM Peak Hour
Medford, Oregon

Figure
7E

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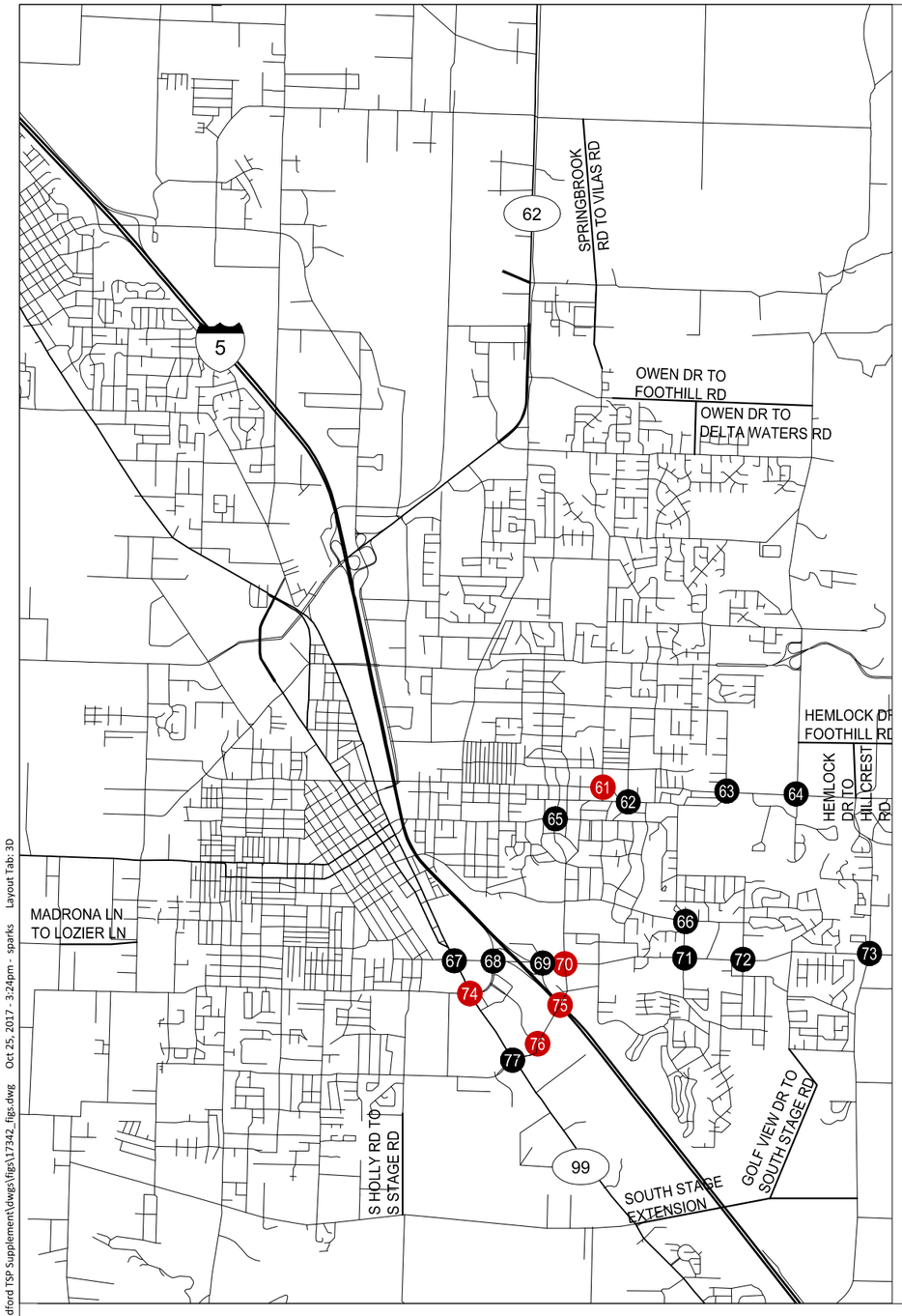

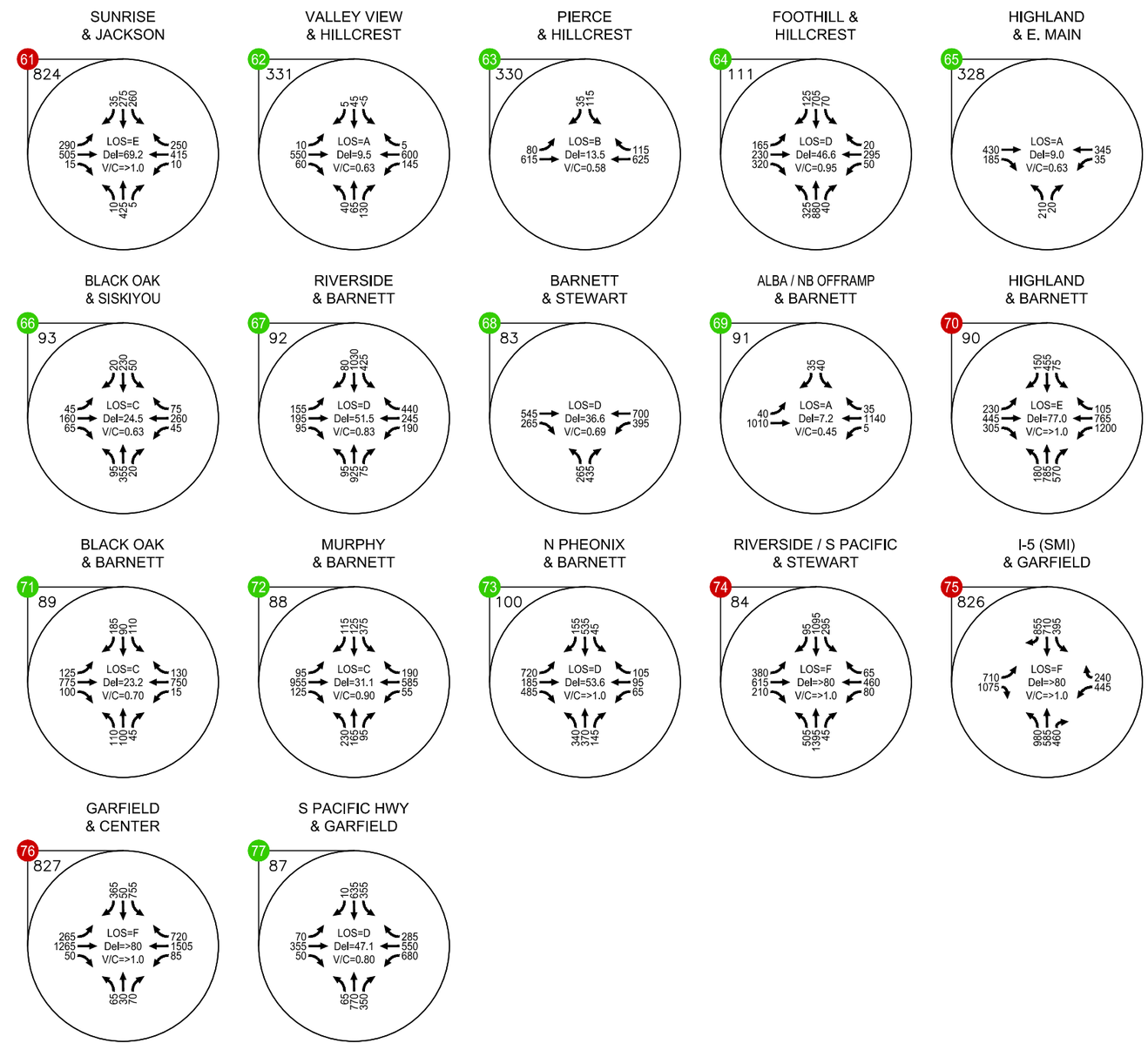

- Meets City of Medford Level of Service Requirements

- Does not Meet City of Medford Level of Service Requirements

Year 2038 Mitigated Traffic Operations
Weekday PM Peak Hour
Medford, Oregon

Figure
7F

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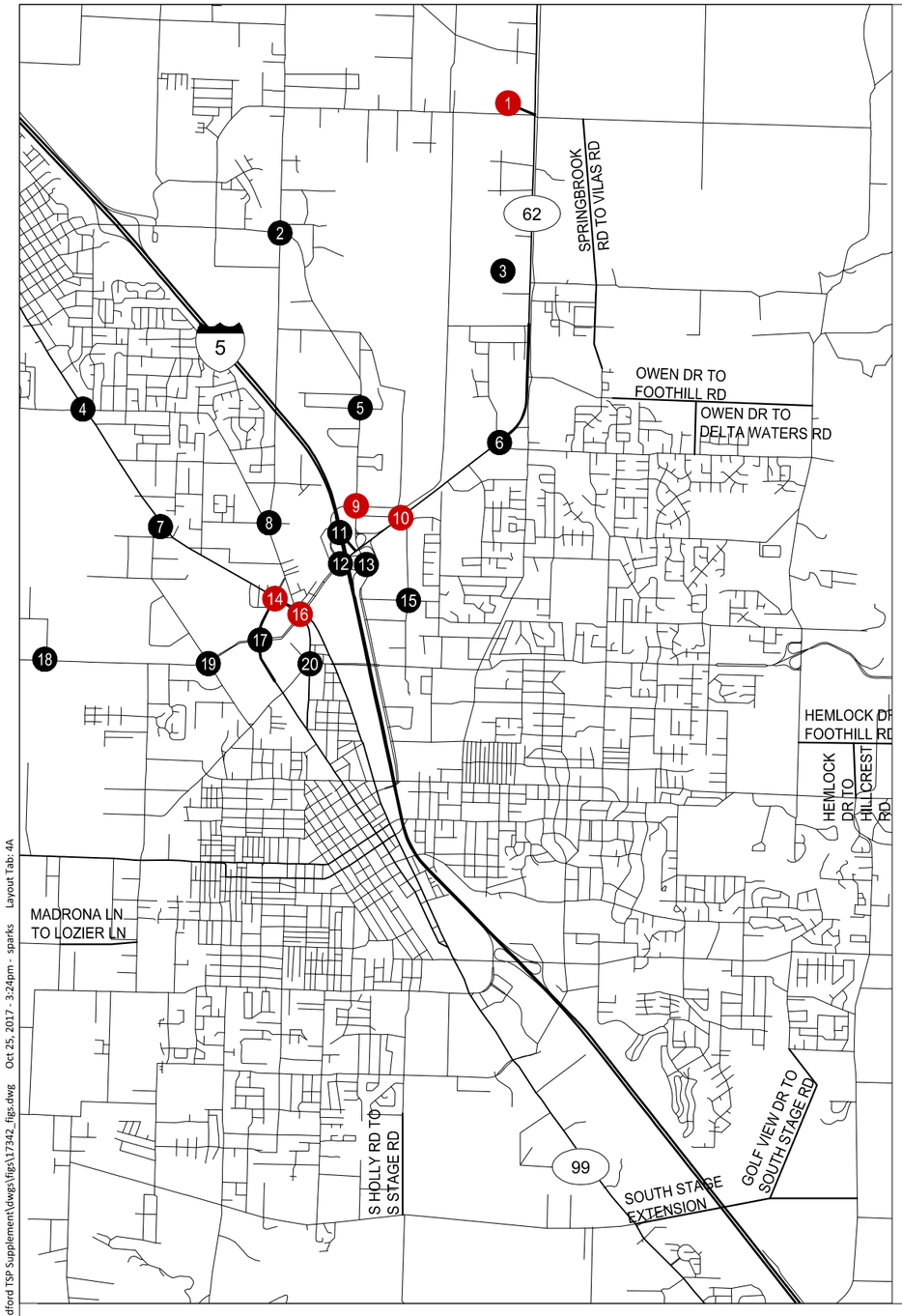
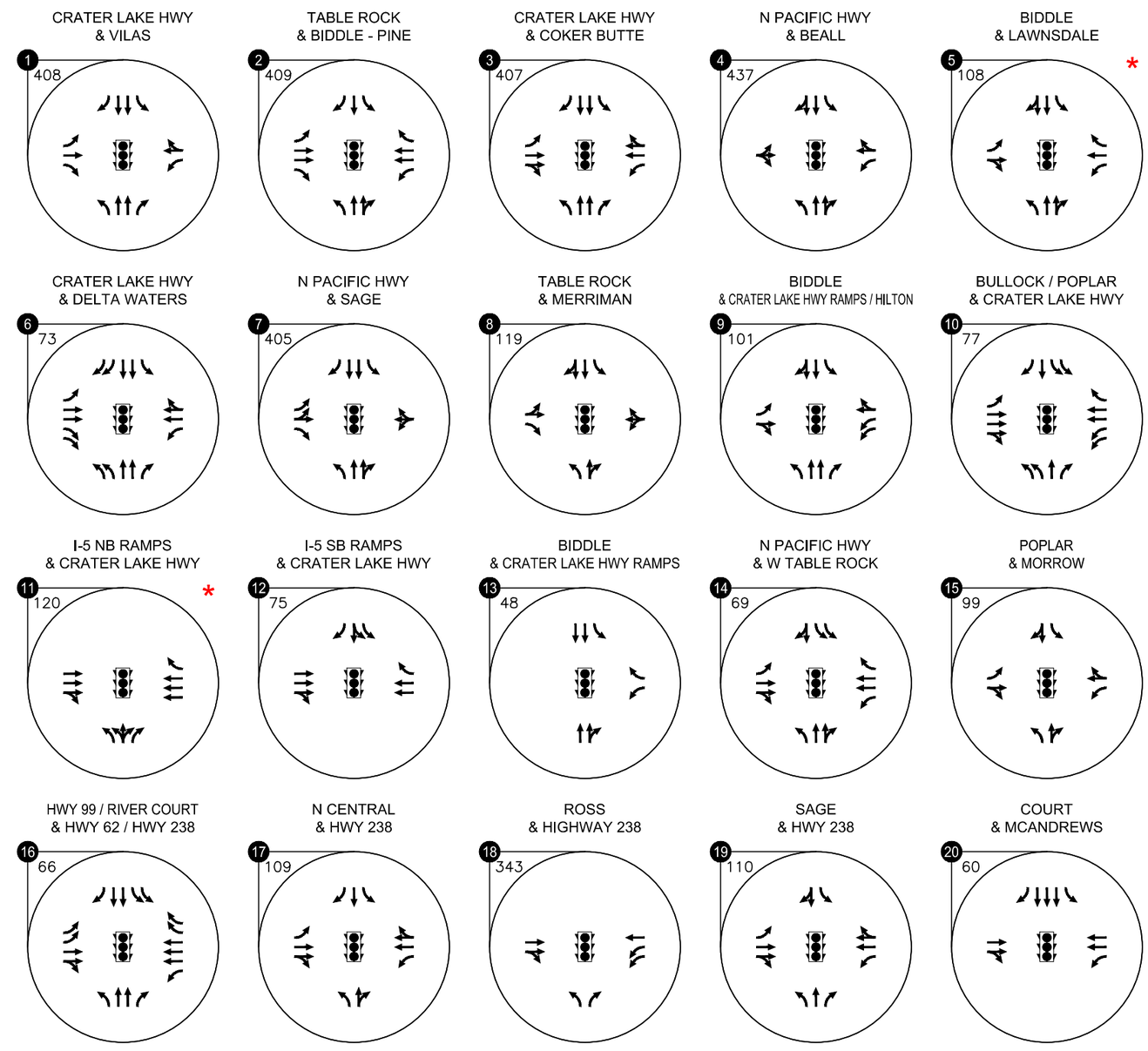


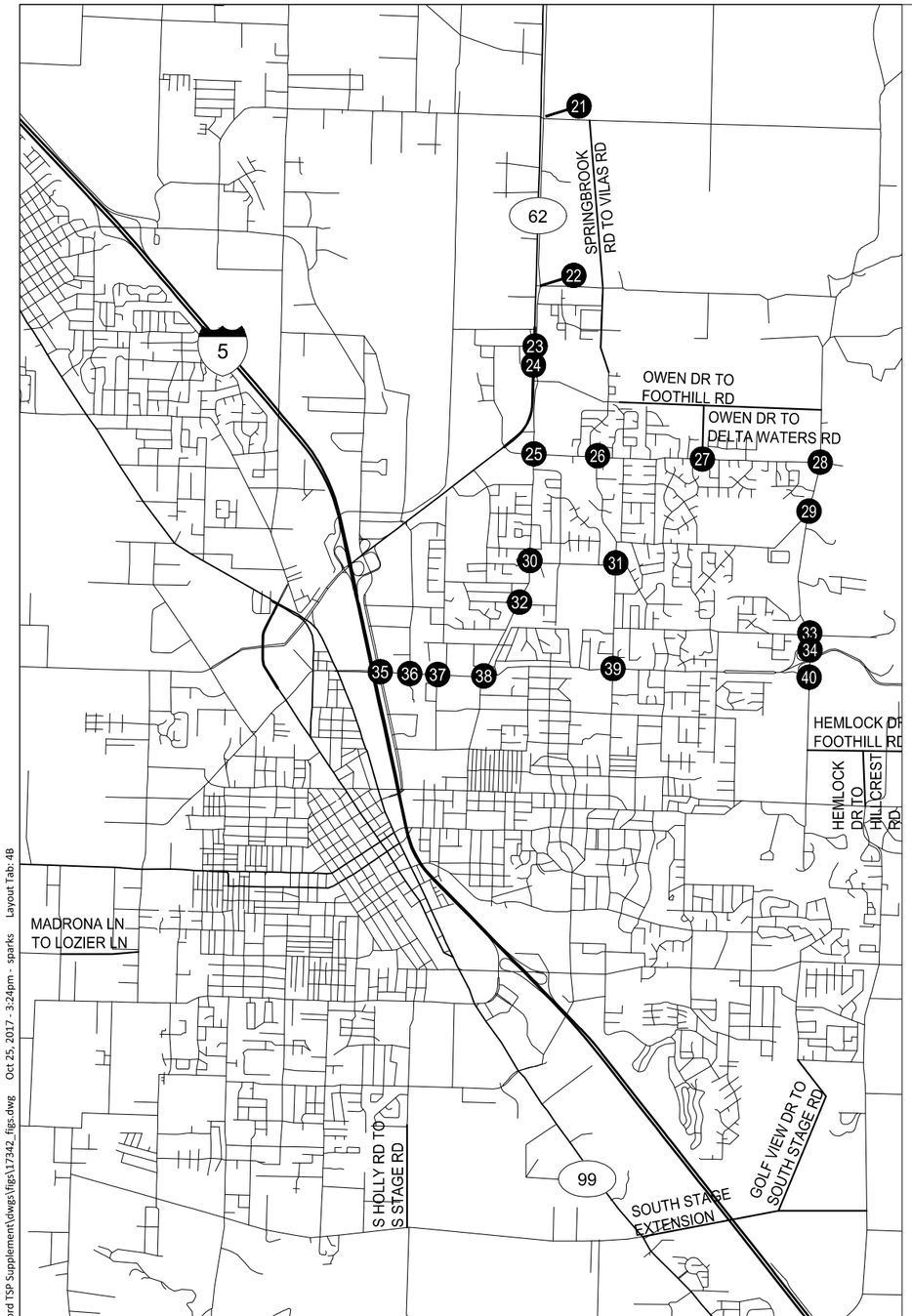


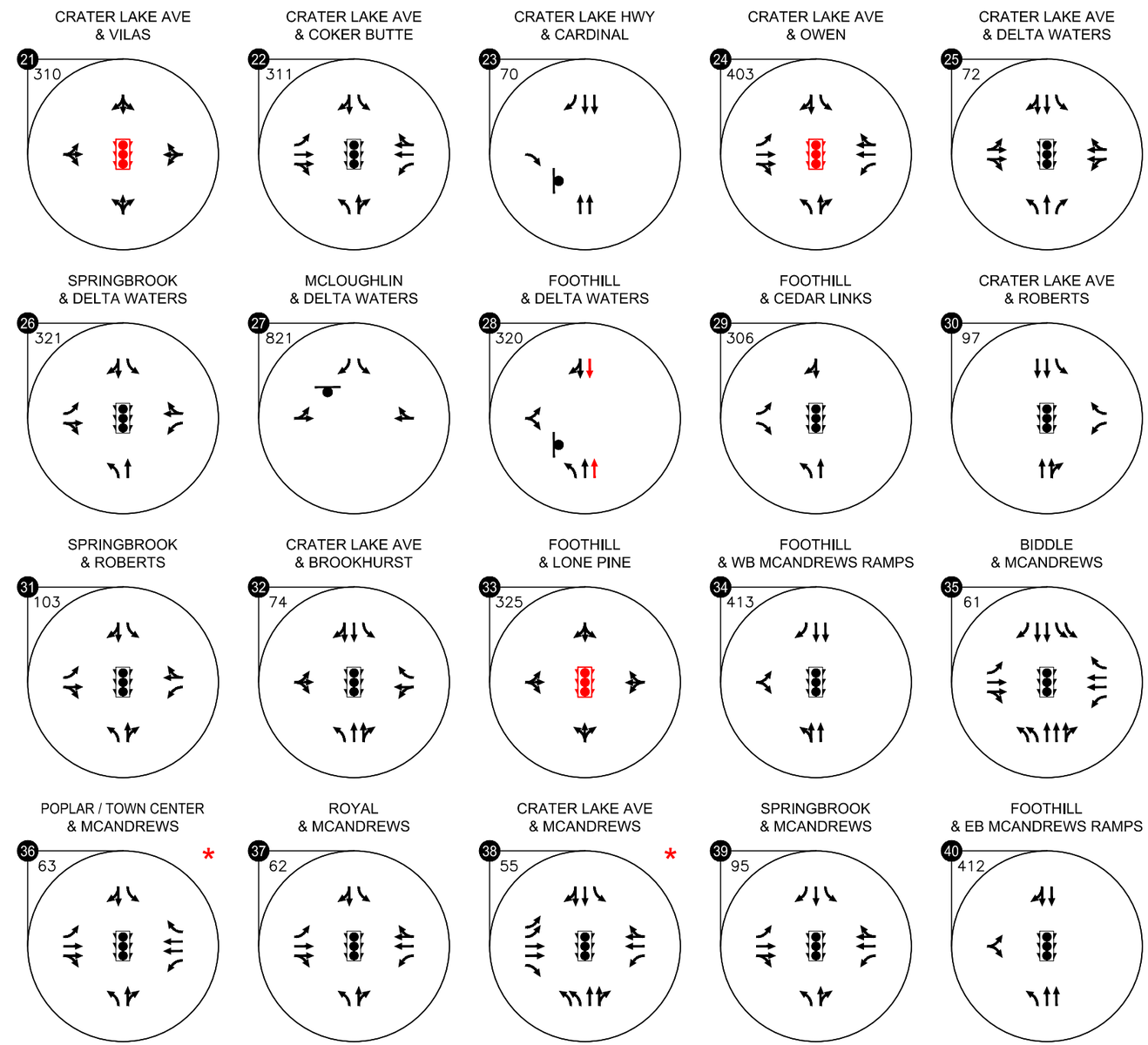
- STOP SIGN
- EXISTING TRAFFIC SIGNAL
- * - SIGNAL TIMING CHANGES/ OPTIMIZATION
- NEW LANE
- NEW TRAFFIC SIGNAL

Year 2038 Mitigated Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure 7G

H:\21\21255 - City of Medford TSP Supplement\dwgs\figs\17342_figs.dwg Oct 25, 2017 - 3:24pm - sparks Layout Tab: 4A





- STOP SIGN
- TRAFFIC SIGNAL

* - SIGNAL TIMING CHANGES/ OPTIMIZATION
- NEW LANE
- NEW TRAFFIC SIGNAL

Year 2038 Mitigated Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure
7H

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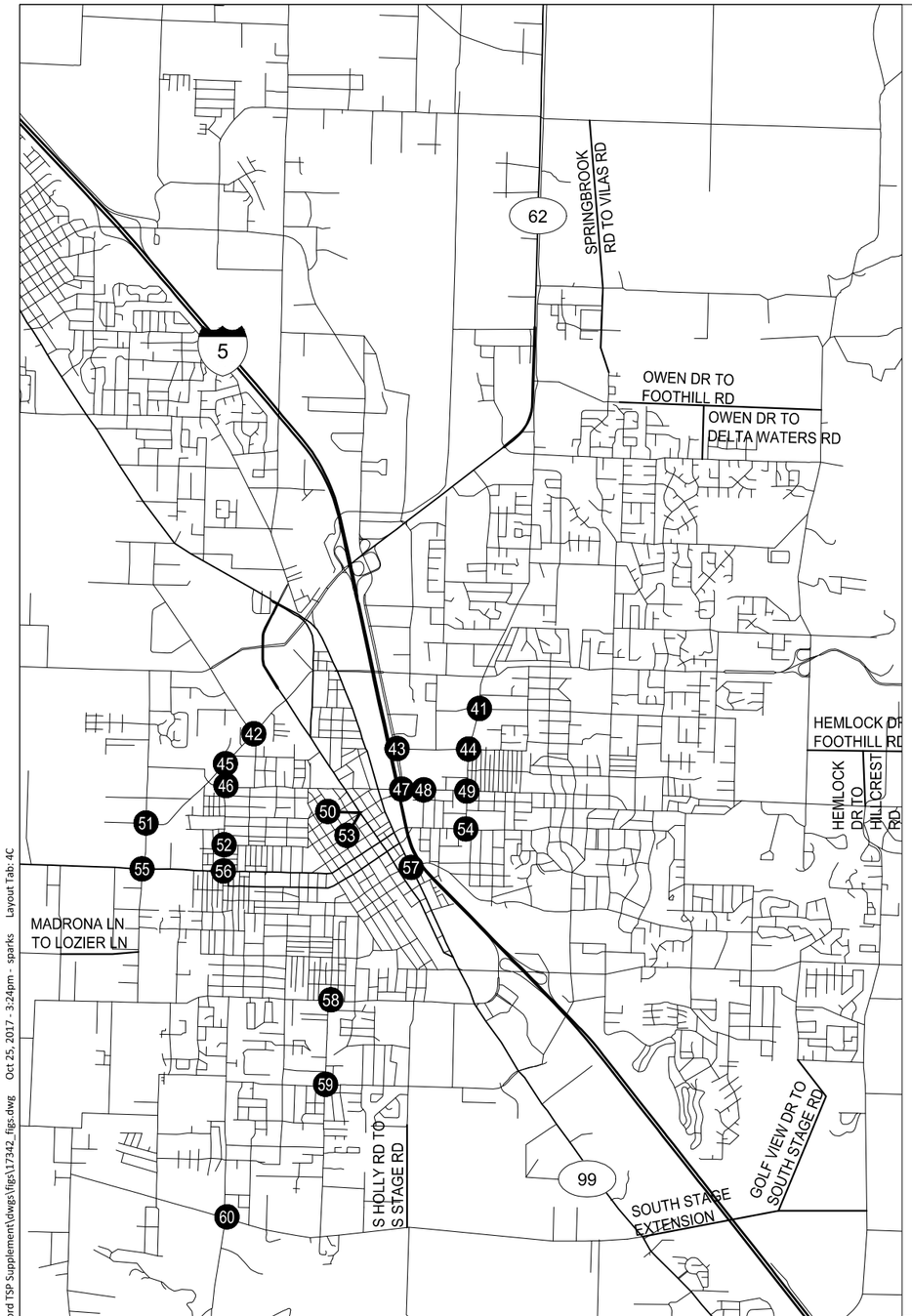
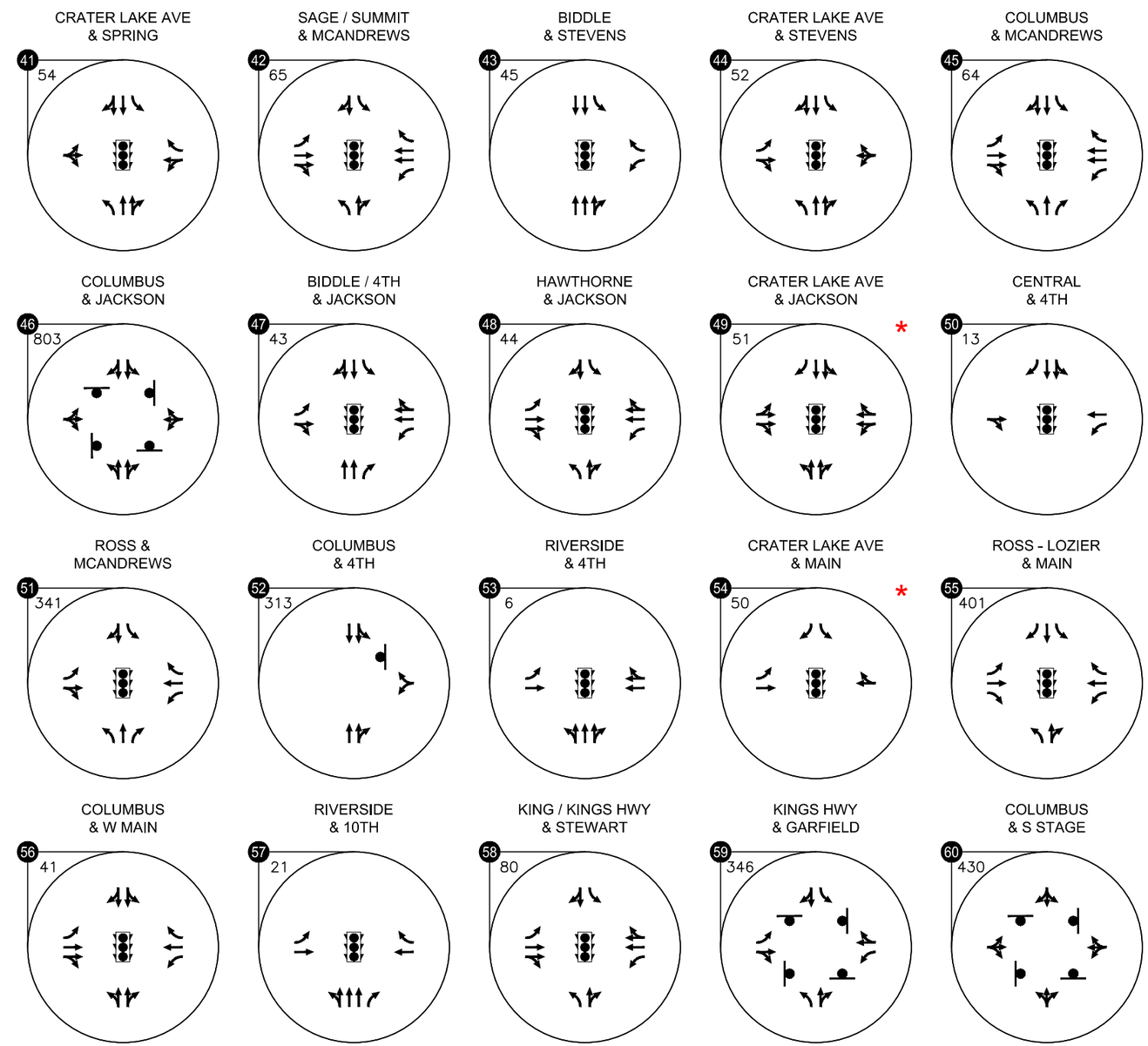




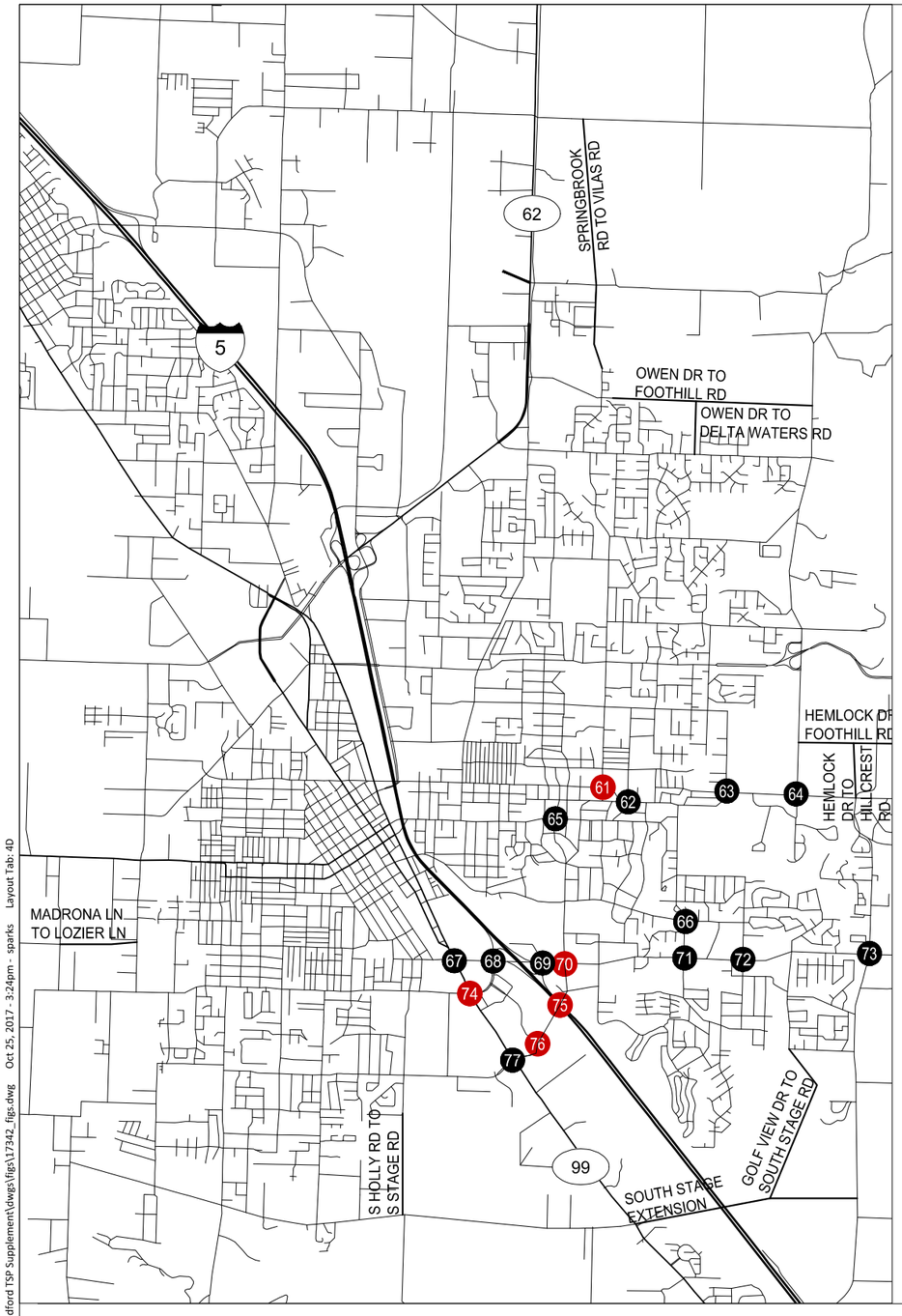
- STOP SIGN
- TRAFFIC SIGNAL

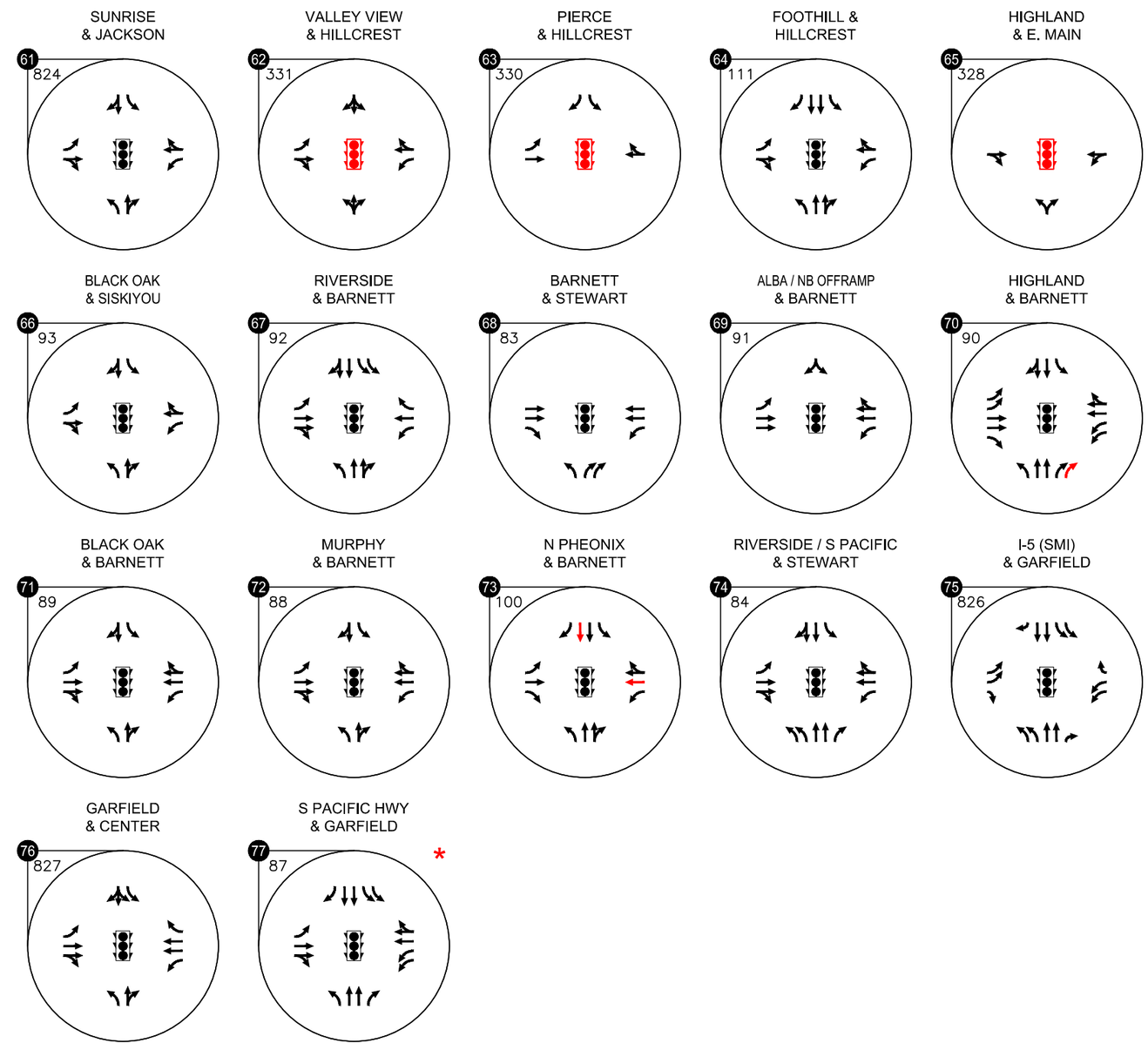
* - SIGNAL TIMING CHANGES/ OPTIMIZATION
- NEW LANE
- NEW TRAFFIC SIGNAL

Year 2038 Mitigated Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure 7I

H:\21\21255 - City of Medford TSP Supplement\dwgs\figs\17342_figs.dwg Oct 25, 2017 - 3:24pm - sparks Layout Tab: 4C





- STOP SIGN
- TRAFFIC SIGNAL

* - SIGNAL TIMING CHANGES/ OPTIMIZATION
- NEW LANE
- NEW TRAFFIC SIGNAL

Year 2038 Mitigated Lane Configurations
Weekday PM Peak Hour
Medford, Oregon

Figure
7J

H:\21\21255 - City of Medford TSP Supplement\dwgs\figs\17342_figs.dwg Oct 25, 2017 - 3:24pm - sparks Layout Tab: 4D