USING AUTOMATED TRAFFIC SIGNAL PERFORMANCE MEASURES TO IMPROVE SIGNAL TIMINGS

Final Report

PROJECT 304-881

Oregon Department of Transportation

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by

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16. Abstract

This report describes the use of automated traffic signal performance measures for Oregon Department of Transportation. The report presents case studies of signal coordination and running yellow and red lights.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3
~NOTE: Volumes greater than 1000 L shall be shown in m^3.				
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit	(F-32)/1.8	Celsius	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
m^2	meters squared	1.196	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
ml	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius	1.8C+32	Fahrenheit	°F

*SI is the symbol for the International System of Measurement

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I would like to acknowledge the support from ODOT Research Section.

DISCLAIMER

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1.0 INTRODUCTION

1.1 BACKGROUND

Oregon Department of Transportation (ODOT) has started to work on the Automated Traffic Signal Performance Measures (ATSPMs), for example, integrated ATSPMs into the Advanced Traffic Management System named MaxView. The ATSPMs provide signal performance measures, such as split monitor and Purdue Coordination Diagrams, from the traffic controller data. The ATSPM help diagnose issues of existing signal timing and make adjustments.

The objective of this study is to use ATSPMs, which is relatively new, to help ODOT signal timings.

1.2 COMPARISON OF SYNCHRO AND ATSPM

ODOT has used Synchro for over twenty years in the traffic signal project planning and development and also uses it for signal operations, such as producing signal timing coordination on arterial roadways. Synchro is a widely used traffic signal timing optimization and modeling software. Synchro estimates traffic performance by using deterministic models while SimTraffic in the same software package uses computer simulations. Synchro also needs inputs of hourly traffic volumes.

ATSPMs are different from Synchro. ATSPMs are produced from data collected by a signal controller, which is a device installed at the signalized intersection. ATSPMs are reported in real-time and can be produced for a selected time range, such as the last week. ATSPMs are suitable for monitoring the signal timing performance and diagnosing problems, so the problems can be solved proactively to improve driver experience and reduce delays.

ODOT uses MaxView software to report ATSPMs, which include the following parameters: Purdue phase termination, split monitor, pedestrian delay, preemption details, turning movements counts, Purdue coordination diagram, approach volume, approach delay, arrivals on red, yellow and red actuations, and Purdue split failure. These parameters are described in the North Carolina DOT Guide on ATSPMs (Tanaka et al, 2019). The ATSPMs are reported in graphs for easier understanding and diagnosis.

2.0 CASE STUDIES

2.1 SIGNAL COORDINATION ON ARTERIAL ROADWAYS

This case study evaluated two intersections: OR34 and 53rd, OR34 and Technology Loop.

The signals of these two intersections were coordinated. The ATSPMs were reviewed for the week of January 21, 2020. Figure 1 is the Purdue Coordination Diagram that shows about 87% of the going-through vehicles on OR34 arrived on green at the intersection of Technology Loop. Shown on split-monitor graphs, such as Figure 2, of the signal phases for nights and weekends, most of the signal phases were gap out when the two intersections' signals were not coordinated. Figure 3 shows that Phase 1 had only 2% of Purdue split failure, which reports how often vehicles are left unserved at the end of a phase. The ATSPMs show that the signal timings at the intersections were good during that week.

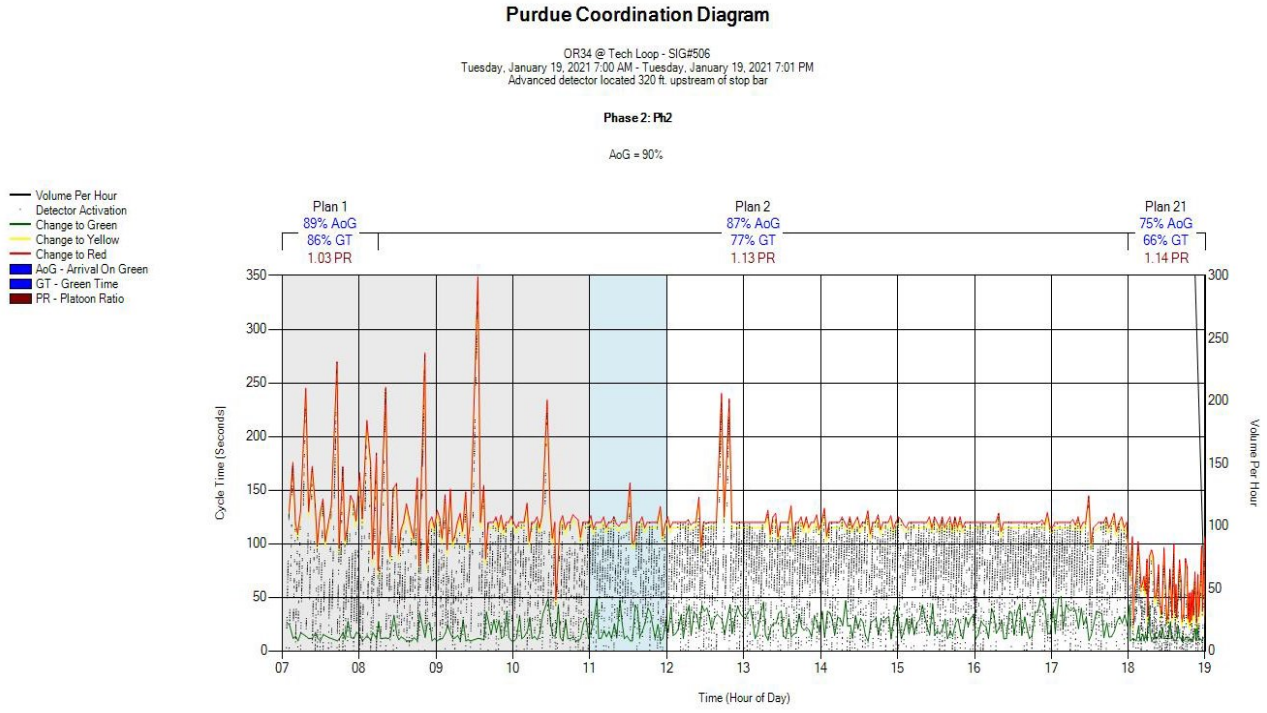

Figure 2.1: Purdue coordination diagram of Phase 2

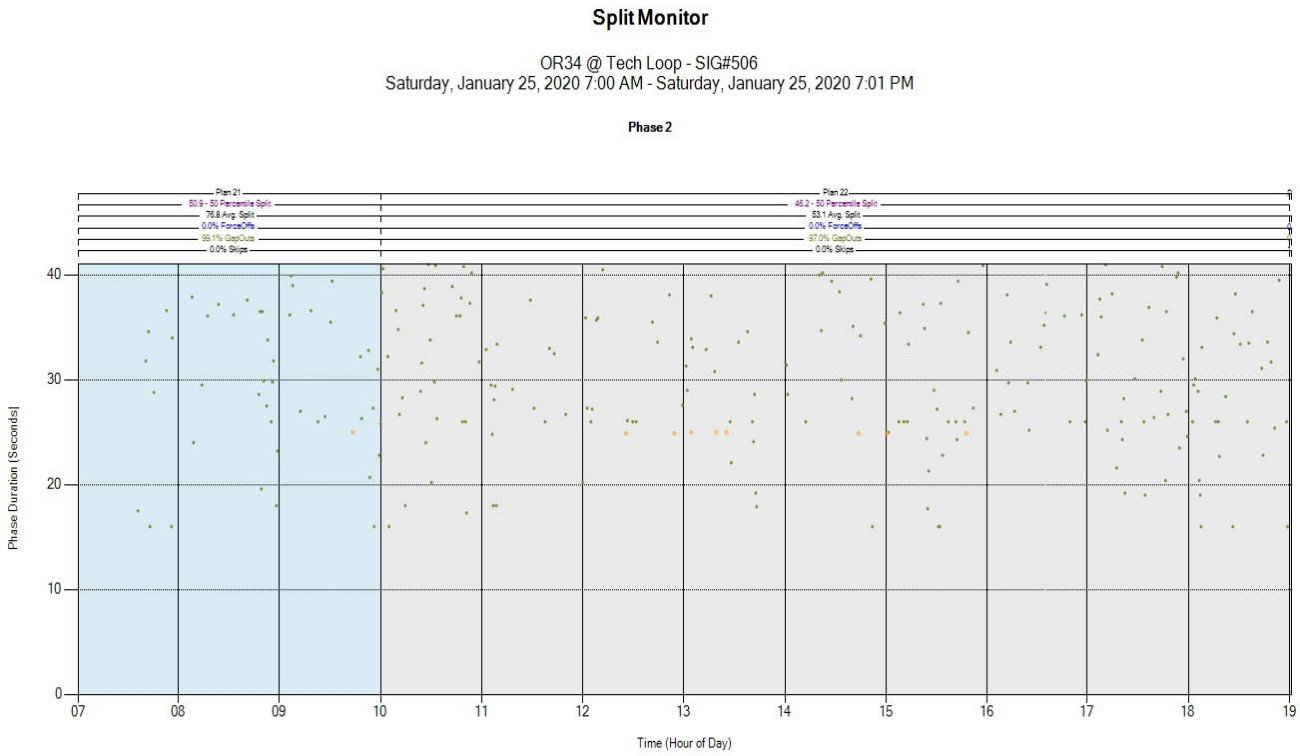

Figure 2.2: Split monitor of Phase 2

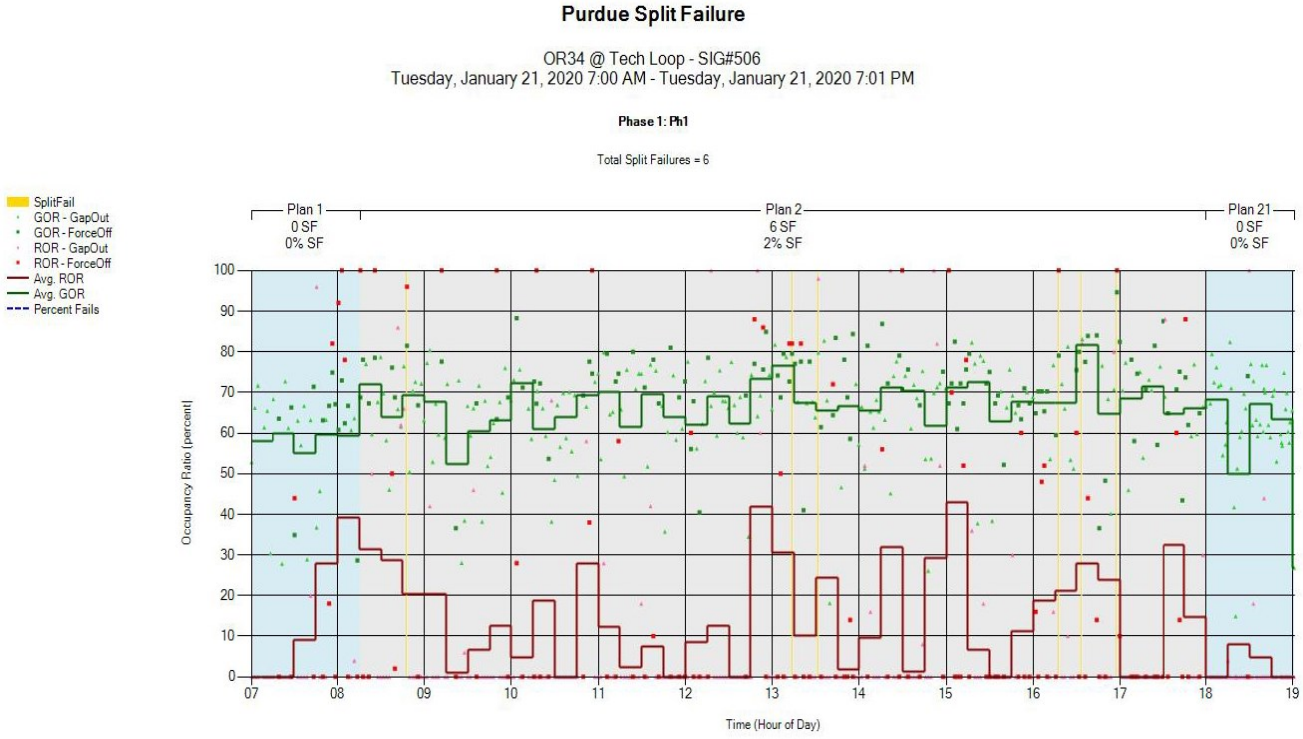

Figure 2.3: Purdue split failure of Phase 1

2.2 RUNNING YELLOW AND RED LIGHTS

The measure Yellow and Red Actuations report the counts of vehicles running yellow and red lights, but do not report vehicles' identification information. Figure 4 shows the Yellow and Red Actuations for a signal phase at the intersection of OR99E and 17th Street. The percentage of violations is very low. If the number of violations was high, it would raise a concern.

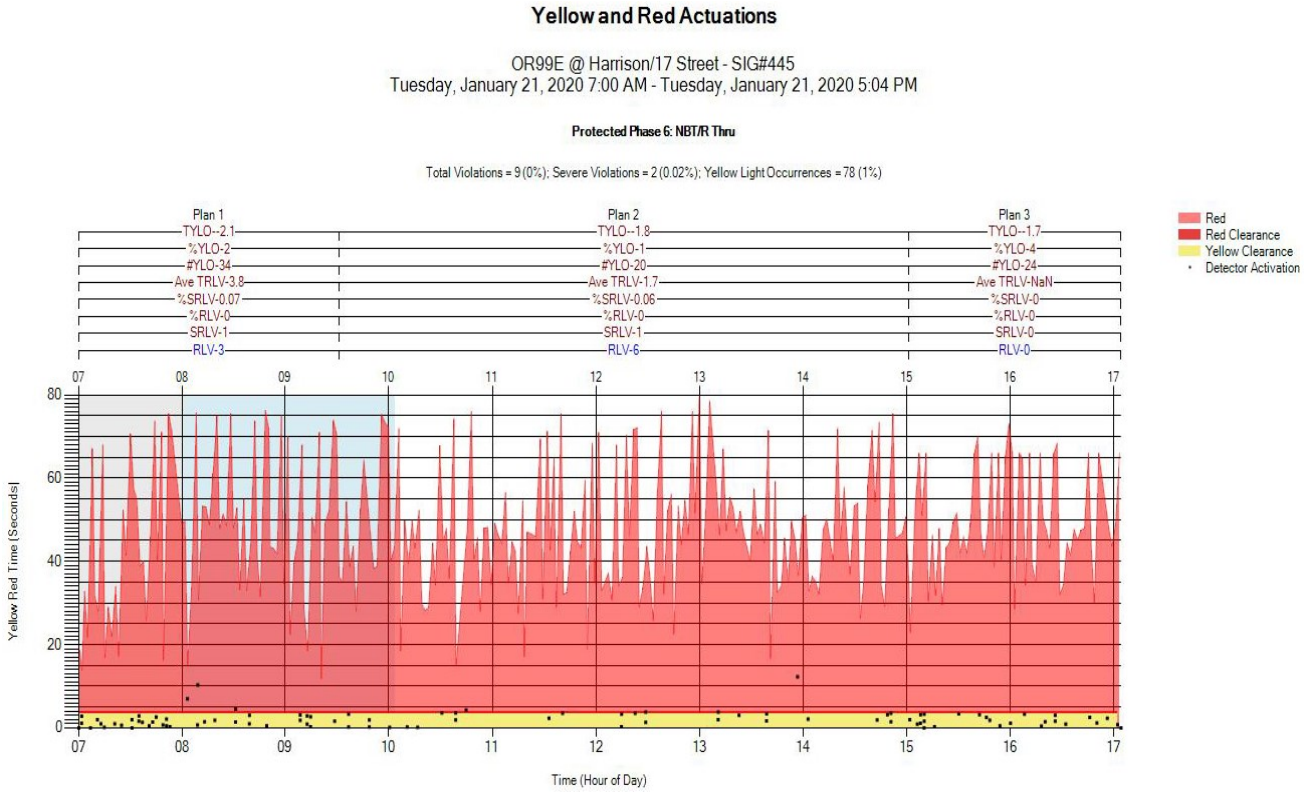

Figure 2.4: Yellow and red actuations of Phase 6

3.0 REFERENCES

Tanaka, A., Schroeder, B., Trask, L., & Chase, T. (2019) *NCDOT guide on automated traffic signal performance measures*. Portland, OR: Kittelson & Associates. Retrieved from https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/NCDOT%20Guide%20on%20ATSPM.pdf