Before-and-After Synchro Emissions Analysis

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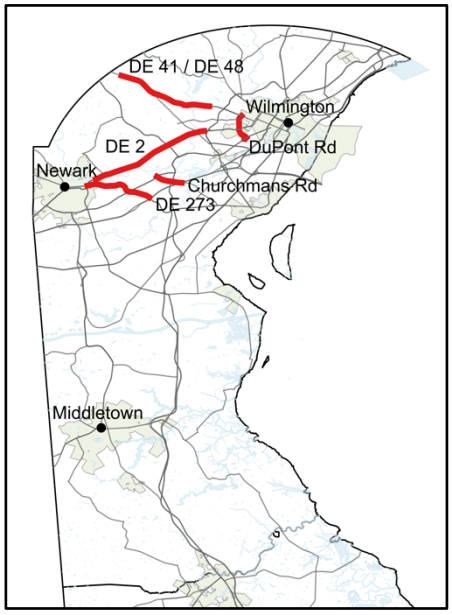
Purpose and Background

Rybinski Engineering (RE) studied the impacts of recent signal retiming projects on five corridors in Delaware using Synchro's SimTraffic microsimulation software. This memo quantifies the impacts of these corridor signal retimings by comparing emissions results from before and after the retiming projects.

Synchro Analysis

The locations of the retimed corridors analyzed in 2018 are shown in **Figure 1**.

Figure 1. Retimed Corridors in 2018



The results of the Synchro emissions analysis are shown in **Table 1** below.

Table 1. 2018 Synchro Emissions Results

Project Location	Peak	Pollutant	Before (kg)	After (kg)	Percent Change
Churchmans Rd	AM	CO	25.5	25.9	2%
		NOx	5.0	5.1	2%
		VOC	5.9	6.0	2%
	PM	CO	45.1	35.3	-22%
		NOx	8.8	6.9	-22%
		VOC	10.4	8.2	-22%
DuPont Rd	AM	CO	11.3	11.1	-1%
		NOx	2.2	2.2	-1%
		VOC	2.6	2.6	-1%
	PM	CO	12.3	12.2	-1%
		NOx	2.4	2.4	-1%
		VOC	2.8	2.8	-1%
Kirkwood Hwy	AM	CO	100.4	96.5	-4%
		NOx	19.5	18.8	-4%
		VOC	23.3	22.4	-4%
	PM	CO	164.3	127.3	-23%
		NOx	32.0	24.8	-23%
		VOC	38.1	29.5	-22%
DE 273	AM	CO	46.8	43.3	-7%
		NOx	9.1	8.4	-7%
		VOC	10.9	10.0	-7%
	PM	CO	54.6	54.6	0%
		NOx	10.6	10.6	0%
		VOC	12.6	12.6	0%
DE 41/DE 48	AM	CO	43.7	42.2	-3%
		NOx	8.5	8.2	-4%
		VOC	10.1	9.8	-3%
	PM	CO	45.6	44.1	-3%
		NOx	8.9	8.6	-3%
		VOC	10.6	10.2	-3%

As a result of the signal retimings completed along the five corridors above, there was an average decrease in CO, NOx, and VOC emissions of 10.4%, 10.4%, and 10.3%, respectively. Of the 10 analysis time periods and locations outlined in **Table 2**, only two—Churchmans Rd during the AM peak hour and DE 273 in the PM peak hour—saw their modeled emissions increase or remain the same.

These results are consistent with the results of RE's evaluation of 4 retimed corridors in 2017 which found signal retimings decreased net emissions in 6 out of 7 analysis time periods and an overall decrease in emissions on all 4 corridors. The results of RE's 2017 efforts are shown in **Table 2**.

Table 2. 2017 Synchro Emissions Results

Project Location	Peak	Pollutant	Before (kg)	After (kg)	Percent Change
DE 141	AM	CO	64.6	60.4	-6%
		NOx	12.6	11.8	-6%
		VOC	15.0	14.0	-6%
	PM	CO	83.5	73.7	-13%
		NOx	16.2	14.3	-13%
		VOC	19.4	17.1	-13%
DE 7 South	AM	CO	9.9	8.8	-11%
		NOx	1.9	1.7	-11%
		VOC	2.3	2.0	-12%
	PM	CO	11.1	10.4	-6%
		NOx	2.2	2.0	-6%
		VOC	2.6	2.4	-5%
DE 1 (Rehoboth)	SAT	CO	207.6	130.8	-37%
		NOx	40.4	25.5	-37%
		VOC	48.1	30.3	-37%
DE 20	AM	CO	10.1	9.8	-3%
		NOx	2.0	1.9	-2%
		VOC	2.3	2.3	-2%
	PM	CO	10.1	10.1	1%
		NOx	1.9	2.0	1%
		VOC	2.3	2.3	0%

It should be noted that based on available turning movement counts, the volumes used in these analyses are the same for the before and after scenarios. This means the changes in emissions observed in the Synchro model do not consider any changes to the nature of the peak hour traffic flow.

Summary and Recommendations

The signal retimings analyzed by RE in 2017 and 2018 resulted in net improvements to vehicle emissions on each corridor. In total, corridor CO, NOx, and VOC emissions decreased by 15.8%, 15.8%, and 15.9%, respectively, in the peak periods reviewed.

Reviewing the impacts of signal retimings using Synchro allows us to evaluate changes in emissions on an intersection and corridor level while holding volumes constant. When available, operations data should be incorporated into future analyses to account for actual changes in traffic patterns.