Ohio Department of Transportation, District 3

2021 Signal Evaluation

Lorain SR 82, SLM 6.43

Station Road Intersection

By: Scott Ockunzzi, P.E. **Date:** January 2022

Signal Evaluation Background

The Ohio Manual of Uniform Traffic Control Devices (OMUTCD) requires that the operation of existing traffic signals to be analyzed every five years. The following report considers whether an existing signal is still warranted per OMUTCD signal warrants, and if any operational changes are required to ensure the signal is performing well.

Existing Signal

The following features are present at the existing signal constructed in 1989:

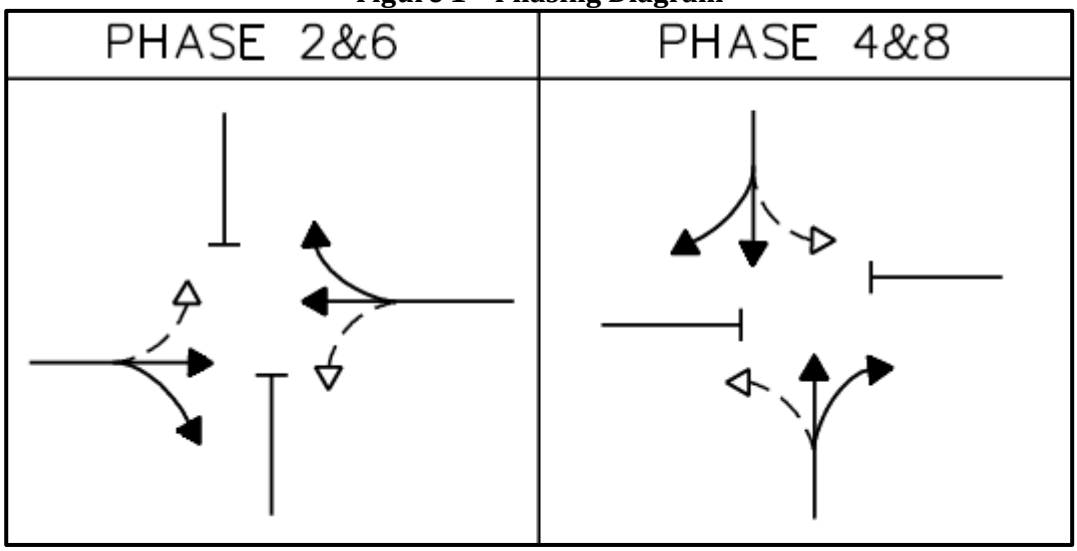
- Signal Type: Simple Span
- Signal Heads: Black Polycarbonate 12-inch LEDs with Reflective Backplates
- Controller: Cobalt with Ground-Mounted Cabinet and Battery Backup
- Turn Lanes: 155 ft Left Turn Lanes Eastbound and Westbound
- Detection: Minor-Road Stop Bar, Dilemma Zone All Approaches, Semi-Actuated
- Timing: See **Table 1** below.

Table 1 – Traffic Signal Timing

DATE: 9/28/2017			**OVERLAP**				**A**	**B**	**C**	**D**
FLASH MODE: ALL-RED			**PHASES**							
INTERVAL OR FEATURE			**CONTROLLER MOVEMENT No.**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
INTERSECTION MOVEMENT				**EB**		**SB**		**WB**		**NB**
MINIMUM GREEN (INITIAL)		(SEC)		20		10		20		10
PASSAGE TIME (GAP)		(SEC)		3		3		3		3
MAXIMUM GREEN		(SEC)		60		30		60		30
YELLOW CHANGE		(SEC)		5.0		5.0		5.0		5.0
ALL RED CLEARANCE		(SEC)		1.0		1.0		1.0		1.0
WALK		(SEC)		-		-		-		-
PEDESTRIAN CLEARANCE		(SEC)		-		-		-		-
RECALL	MINIMUM	(ON/OFF)		ON		OFF		ON		OFF
	MAXIMUM	(ON/OFF)		OFF		OFF		OFF		OFF
	PEDESTRIAN	(ON/OFF)		OFF		OFF		OFF		OFF
NON-LOCK		(ON/OFF)		OFF		ON		OFF		ON
ADDED INITIAL		(SEC)		-		-		-		-
MAXIMUM INITIAL		(SEC)		-		-		-		-
TIME TO REDUCE		(SEC)		-		-		-		-
TIME BEFORE REDUCTION		(SEC)		-		-		-		-
MINIMUM GAP		(SEC)		-		-		-		-

- Phasing: See **Figure 1** below.

Figure 1 – Phasing Diagram



- Photo: See **Image 1** below for a photograph of the intersection.

Image 1 – SR 82 & Station Rd Signal from the Southeast (December 2021)

- Speeds: 45 mph on SR 82 and Station Rd North, 55 mph on Station Rd South
- Traffic: Traffic was light on a mid-morning field review in December, but traffic on SR 82 has been known to be heavy at peak hours.
- Other Issues: Intersection skew and adjacent direct access create safety challenges.

Crash Data

Crashes were analyzed at the SR 82 & Station Rd intersection from January 1, 2016 through December 31, 2020. The reported crashes are summarized in **Table 2** below.

Table 2 – Crash Data

YEAR		SEVERITY		TYPE		ROAD CONDITION	
2016	0 (0%)	Fatal	0 (0%)	Rear End	5 (33%)	Dry	11 (73%)
2017	6 (40%)	Injury	6 (40%)	Left Turn	4 (27%)	Wet	3 (20%)
2018	2 (13%)	PDO	9 (60%)	SS-Passing	3 (20%)	Snow	1 (7%)
2019	3 (20%)			Fixed Object	2 (13%)		
2020	4 (27%)			Angle	1 (7%)		
TOTAL	**15 (100%)**						

- Of the 5 rear end crashes, 3 were southbound and two were westbound
- Of the 4 left turn crashes, 2 were eastbound, 1 was westbound, and 1 was southbound
- 3 of the crashes occurred in dark conditions

Supplemental Evaluations

The following additional studies were performed to ensure safe and efficient operation of the signal:

1. **Turning Movements:** A traffic count was requested to obtain updated traffic volumes for the intersection. The traffic count was performed on June 29, 2021 between the hours of 7:00 AM – 7:00 PM. The count information can be found in in **Table 3** below:

Table 3 – Turning Movement Count

Peak Hour (Start Time)	Station Rd Southbound				SR 82 Westbound				Station Rd Northbound				SR 82 Eastbound				Total
	R	T	L	Tot	R	T	L	Tot	R	T	L	Tot	R	T	L	Tot	
Total Count	522	808	1178	2508	1035	3507	456	4998	441	814	238	1493	200	3457	480	4137	13136
AM Peak (07:30)	46	54	155	255	65	271	25	361	51	89	20	160	9	396	45	450	1226
PM Peak (16:15)	75	133	129	337	155	448	59	662	35	83	32	150	41	346	57	444	1593

2. **Signal Warrant:** The signal warrant was analyzed at this intersection to verify if the existing signal should be retained. The OMUTCD Section 4C lists nine warrants for the installation of a signal. Warrants 1–3 (8-Hour Volume, 4-Hour Volume, Peak Hour Volume) were all analyzed based on the Turning Movement Count data. The intersection met the following signal warrants using the 70 percent volumes for signal retention as shown in **Table 4** below:

Table 4 – Signal Warrants

Warrant		Hours Needed	Hours Met	Warrant Met
1 - Eight Hour Vehicular Volumes		8	12	Yes
1B - Interruption of Continuous Traffic		8	12	Yes
1 A&B - Combination of Warrants	1A	8	12	Yes
	1B	8	12	
2 - Four Hour Volumes		4	12	Yes
3 - Peak Hour Volumes		-	-	Yes

3. **Clearance Interval Calculation:** Appropriate yellow and all-red clearance intervals are important to safe operation of a signal. Using the clearance interval calculation method provided by the ODOT Office of Traffic Operations, the calculated clearance intervals are shown in **Table 5** below:

Table 5 – Updated Clearance Intervals

INTERVAL OR FEATURE		CONTROLLER MOVEMENT No.							
		1	2	3	4	5	6	7	8
INTERSECTION MOVEMENT			EB		NB		WB		SB
YELLOW CHANGE	(SEC)		5.0		6.0		5.0		6.0
ALL RED CLEARANCE	(SEC)		1.0		1.0		1.0		1.0
PEDESTRIAN CLEARANCE	(SEC)		14.3		11.4		15.7		14.3

Pedestrian clearance intervals are met for all movements because the minimum green time plus yellow change interval is greater than the calculated required pedestrian clearance.

4. **Capacity Analysis:** Highway Capacity Software (HCS 7) was used to analyze the Level of Service (LOS) of each approach for existing timing at the intersection. The LOS is based on the calculated seconds of delay for each approach at an intersection using the Highway Capacity Manual (HCM) methodology. The results are summarized in **Table 6** below:

Table 6 – Existing Intersection Level of Service by Approach

Existing Delay s/veh and (LOS)	Intersection Approach				Intersection Combined Delay
	SR 82		Station Rd		
Period	EB	WB	NB	SB	
AM Peak	9.2 (A)	8.6 (A)	13.5 (B)	15.5 (B)	10.9 (B)
PM Peak	10.2 (B)	11.8 (B)	15.2 (B)	18.8 (B)	13.1 (B)

Signal Evaluation Recommendations

- Update northbound and southbound yellow change intervals from 5.0 to 6.0 seconds
- Add intersection lighting as a countermeasure to night-time crashes

The signal is currently operating well at peak periods. The existing signal will be replaced with PID 109059 D03 TSG FY2024, and intersection lighting is going to be added with that project.