# I. Overview

Consultant A was retained by the Ohio Department of Transportation to conduct traffic signal timing analyses on approximately one mile of roadway on Sample Road between the Main Street and the Fourth Street intersections, in the City of Generic, Random County, Ohio. Sample Road is a heavily traveled east west principal urban arterial. The study includes analyses of the following signalized intersections:

1. Sample Rd. and Main St.
2. Sample Rd. and Second St.
3. Sample Rd. and Third St.
4. Sample Rd. and Fourth St.

A general location map is shown in *Figure-1* below:

## *Figure 1: General Location Map*



# II. Analysis

#### A. Signal Operational Analyses

Traffic modeling and analysis software, *Synchro v8,* was used for the signal operation analyses. Models were designed for the different peak conditions:

1. AM Peak model
2. Mid-day Peak model
3. PM Peak model
4. Off Peak model

*Synchro* is used to determine the Level-of-Service (LOS) defined in terms of delay. *Table-1* shows the definitions of each LOS.

### Table 1: Level of Service Criteria for Signalized Intersections

|  |  |  |
| --- | --- | --- |
| **Level of Service** | **Description** | **Delay** |
| A | Very low delay | <10 seconds per vehicle |
| B | Good Progression | 10-20 seconds per vehicle |
| C | Limit of acceptable delay | 20-35 seconds per vehicle |
| D | Start of traffic breakdown | 35-55 seconds per vehicle |
| E | High delay | 55-80 seconds per vehicle |
| F | Congested conditions, unacceptable delay | >80 seconds per vehicle |

Comparisons of the Level of Service and Control Delays for the studied intersections are presented for the pre-study and optimized timings in *Table 2*.

### Table 2: LOS (Delay, in sec)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Intersection | | Sample Rd. @ Main St. | Sample Rd. @ Second St. | Sample Rd. @ Third St. | Sample Rd. @ Fourth St. |
| AM | Pre-Study | C (30.7) | B (18.5) | B (12.4) | C (29.1) |
| Optimized | C (29.9) | B (15.7) | B (11.9) | C (28.9) |
| % Change | -3% | -15% | -4% | -1% |
| Midday | Pre-Study | D (35.1) | B (15.9) | A (9.0) | C (27.1) |
| Optimized | D (36.1) | B (12.0) | A (8.3) | C (23.2) |
| % Change | 3% | -25% | -8% | -14% |
| PM | Pre-Study | E (59.2) | C (24.4) | B (12.3) | D (35.2) |
| Optimized | E (56.9) | C (24.7) | B (11.5) | C (34.5) |
| % Change | -4% | 1% | -7% | -2% |
| Off | Pre-Study | C (32.9) | B (14.1) | A (9.0) | C (24.9) |
| Optimized | C (29.4) | B (13.0) | A (8.7) | C (24.4) |
| % Change | -11% | -8% | -3% | -2% |

The Synchro Files are provided with the electronic submittal.

#### B. Measures of Effectiveness (MOEs)

The overall network performance is indicated by measures of effectiveness (MOEs). Measures of effectiveness for the pre-study and optimized timings were compared for the analyses periods in terms of the following parameters:

* Travel Time (sec)
* Vehicle Delay (sec)
* Stopped Delay (sec)
* Stops/Vehicle
* Average Speed (mph)

The summary tables and graphical results of the travel time studies for the aforementioned parameters can be found below.

### Table 3: Cumulative Analysis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Timing** | | **Travel Time (sec)** | **Vehicle Delay (sec)** | **Stopped  Delay (sec)** | **Stops** | **Average Speed (mph)** |
| ***CUMULATIVE*** | | | | | | |
| Pre-Study | | 1564 | 352 | 222 | 7.5 | 36.4 |
| Optimized | | 1496 | 284 | 182 | 7.6 | 38.1 |
| ***% Change*** | | **-4%** | **-19%** | **-18%** | **1%** | **5%** |
|  |  |  |  |  |  |  |
|  | Reduction | |  |  |  |  |
|  | No Change | |  |  |  |  |
|  | Increase |  |  |  |  |  |
|  |  |  |  |  |  |  |
| *(Note: in the case of average speed, green means an increase in overall travel speed, whereas red means a reduction in overall travel speed)* | | | | | | |

### Table 4: Peak Hour Analysis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Timing** | **Direction** | **Travel Time (sec)** | **Vehicle Delay (sec)** | **Stopped Delay (sec)** | **Stops** | **Average Speed (mph)** |
| ***AM Peak*** | | | | | | |
| Pre-Study | EB | 277 | 75 | 65 | 2.0 | 33.9 |
| Optimized | EB | 265 | 63 | 43 | 2.0 | 35.4 |
| ***EB % Change*** | | **-4%** | **-16%** | **-34%** | **0%** | **4%** |
| Pre-Study | WB | 231 | 29 | 12 | 0.7 | 41.3 |
| Optimized | WB | 230 | 28 | 15 | 1.0 | 40.5 |
| ***WB % Change*** | | **0%** | **-3%** | **25%** | **43%** | **-2%** |
| ***MIDDAY Peak*** | | | | | | |
| Pre-Study | EB | 279 | 77 | 49 | 1.5 | 33.5 |
| Optimized | EB | 255 | 53 | 27 | 1.2 | 37.1 |
| ***EB % Change*** | | **-9%** | **-31%** | **-45%** | **-20%** | **11%** |
| Pre-Study | WB | 245 | 43 | 20 | 0.9 | 38.6 |
| Optimized | WB | 233 | 31 | 23 | 0.8 | 41.3 |
| ***WB % Change*** | | **-5%** | **-28%** | **15%** | **-11%** | **7%** |
| ***PM Peak*** | | | | | | |
| Pre-Study | EB | 240 | 38 | 12 | 0.7 | 39.0 |
| Optimized | EB | 229 | 27 | 18 | 0.7 | 41.0 |
| ***EB % Change*** | | **-5%** | **-29%** | **50%** | **0%** | **5%** |
| Pre-Study | WB | 292 | 90 | 64 | 1.7 | 32.0 |
| Optimized | WB | 284 | 82 | 56 | 1.9 | 33.2 |
| ***WB % Change*** | | **-3%** | **-9%** | **-13%** | **12%** | **4%** |
|  |  |  |  |  |  |  |
|  | Reduction | |  |  |  |  |
|  | No Change | |  |  |  |  |
|  | Increase |  |  |  |  |  |
|  |  |  |  |  |  |  |
| *(Note: in the case of average speed, green means an increase in overall travel speed, whereas red means a reduction in overall travel speed)* | | | | | | |
|

### Figure 2a: Sample Road, Travel Time

### Figure 2b: Sample Road, Vehicle Delay

### Figure 2c: Sample Road, Stopped Delay

### Figure 2d: Sample Road, Stops

### Figure 2e: Sample Road, Average Speed