# CHAPTER 7. Applications

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## 1. Introduction

[revise:] This chapter presents a set of case studies in which the HCM methods are applied and interpreted. The case studies are intended to illustrate ways in which the methods can be applied and interpreted in various situations commonly found in practice. In some cases you will use the computational engines that you developed in Chapters 2, 3, and 4. In other cases, you will use results generated by software tools that implement the HCM methods. You will also use the approach suggested by the HCMAG suggested by the HCMAG and adapted for use in this book.

No adjustment factors.

## 2. Studies of an AWSC Intersection

 With sensitivity analysis.

## 3. Studies of a TWSC Intersection

 With sensitivity analysis.

## 4. Studies of a Pretimed Signalized Intersection

 With sensitivity analysis.

## 5. Studies of an Actuated Controlled Signalized Intersection

 With sensitivity analysis.

## 6. Case Study

### Introduction

In this section, we consider a case study adapted from the Highway Capacity Manual Applications Guide (HCMAG) [xx]. While we have previously focused on the components of the HCM intersection analysis models and methods, this case study considers some of the issues that arise when we apply the methods to a real world problem and interpret the results produced by the methods. The HCMAG was developed to provide guidance to users of the HCM in the following three areas:

* Defining and scoping the problem to be addressed,
* Identifying and using the appropriate analysis tools, and
* Interpreting results and understanding what they mean.

### The Situation

The Idaho Transportation Department is responsible for the operation of U.S. 95, the major highway running north-south in the state of Idaho, from the Canadian border on the north to the Oregon border in the southwest part of Idaho, a distance of 540 miles. In the city of Moscow, U.S. 95 is the major north-south route, serving both local traffic within the city as well as through traffic originating and/or destined outside of the city.

 The intersection of U.S. 95 and Styner Avenue currently operates with stop control for Styner Avenue (the minor street) and no control on U.S. 95 (the major street). As traffic volumes have increased at the intersection, residents of the city have asserted that delays have increased and safety has been degraded. A school located near the intersection generates an increasing number of students crossing U.S. 95. Limited sight distance on Styner for drivers entering the intersection from the east further adds to the safety problem. In addition, a grade of xx percent on the NB approach presents problems for heavy trucks who would be required to stop and then restart on an upgrade, a possibly difficult maneuver during winter conditions. The city of Moscow, responding to citizen complaints, has request that ITD install a traffic signal so that traffic can be more effectively and safely controlled.

 U.S. 95 currently carries about xx,xxx vehicles per day through the city of Moscow. The city has a population of nearly 25,000 and is the home to the state’s land grant university, the University of Idaho, with a student population of nearly 12,000. Traffic on this section of U.S. 95 has been increasing at more than two percent per year. Traffic signals control the intersections to the immediate north and south of the U.S. 95/Styner intersection.

[figure of street system]

 The traffic engineer for the Idaho Transportation Department must consider the performance of the intersection under today’s conditions as well as how the intersection is predicted to perform in the future as she considers the city’s request to signalize the intersection. Both today’s control (TWSC) as well as two future control operations (signal control, AWSC) must also be considered in this evaluation.

### The Approach

Determining whether the existing intersection control is adequate or not depends on a number of factors, including:

* The delays experienced by users of the intersection,
* Analysis of crashes that have occurred at the intersection,
* The sufficiency of the intersection’s capacity to accommodate the traffic volumes, and
* [add].

While a complete analysis would include all of the factors listed above, as well as consideration of whether the warrants for signal control as specified by the Manual of Uniform Traffic Control Devices, we will focus our work on the operation of the intersection, both present and future, as measured by delay and by the sufficiency of capacity. We will consider the existing conditions under two-way stop-control, as well as present and future performance under all-way stop-control and signal control.

The analysis tools that we will use are the computational engines that we developed in earlier chapters in this book. Table 1 shows …

Table

|  |  |  |
| --- | --- | --- |
| Intersection control | Analysis tool | Performance measure |
| TWSC T-intersection |  | v/c ratio: movementDelay: approach/movementDelay: intersection |
| AWSC 4 legs |  | Degree of utilization: approachDelay: approachDelay: intersection |
| Signals-CMA (S2)Signals-Uniform delay (S3)Signals-Capacity (S1) |  | Capacity of approach (S1)Capacity utilization of intersection (S2, CE)Uniform delay: approach (S3, CE)Non-uniform arrivals (S6) |

[Scope and problem definition

Analysis methods used

Interpreting results

Location of current intersection

Effects of adjacent signalized intersection

Future traffic growth]

In short, the goal of this analysis is to help the state traffic engineer make a decision: keep the existing two-way stop-control or change to signal or all-way stop-control.

The data needed to perform this analysis:

* Traffic volumes, existing and future projections
* Intersection geometry
* Control type
* Data for adjacent intersections



### Problem 1 – Performance of Existing Intersection (TWSC)

* Data
* Analysis tool (and assumptions)
* Results
* Interpretations and key issues

|  |  |  |  |
| --- | --- | --- | --- |
|  | **NB** | **SB** | **EB** |
| v/c ratio | - | 0.27 | 0.66 |
| Delay, approach | 0 | 9.4 | 65.8 |
| Delay, intersection | 11.1 |

### Problem 2 – Performance with AWSC

* Data
* Analysis tool (and assumptions)
* Results
* Interpretations and key issues

|  |  |  |  |
| --- | --- | --- | --- |
|  | **NB** | **SB** | **EB** |
| Degree of utilization | 0.57 | 0.39 | 0.15 |
| Delay, approach | 13.3 | 10.6 | 9.6 |
| Delay, intersection | 11.9 |

### Problem 3 – Performance with Signal Control

* Data
* Analysis tool (and assumptions)
* Results
* Interpretations and key issues

Xc = 0.512

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Movement 1** | **Movement 3** | **Movement 4** | **Sum/Total** |
| Flow ratio, Y | 0.053 | 0.158 | 0.211 | 0.422 |
| Proportion | 0.1256 | 0.3744 | 0.5000 |  |
| Green split, sec | 11.3 | 33.7 | 45.0 | 90.0 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **NBTH** | **SBLT** | **EBLT** |
| Flow ratio, Y | 0.211 | 0.158 | 0.053 |
| Split proportion | 0.5000 | 0.3744 | 0.1256 |
| Split time | 33.7 | 33.7 | 11.3 |
| g/C | 0.5000 | 0.3744 | 0.1256 |
| Capacity | 950 | 711 | 239 |
| Volume | 400 | 300 | 100 |
| v/c ratio | 0.421 | 0.422 | 0.418 |
| Delay | 14.3 | 20.9 | 36.3 |

### Problem 4 – Performance with Future Conditions for Three Control Types

* Data
* Analysis tool (and assumptions)
* Results
* Interpretations and key issues

### Synthesis of Results, Issues, Discussions

Interpreting results.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **AWSC** | **TWSC** | **Signals** |
| EBLT | 9.6 | 65.8 | 36.3 |
| SBLT | 10.6 | 9.4 | 20.9 |
| NBTH | 13.3 | 0 | 14.3 |
| Intersection | 11.9 | 11.1 | 19.5 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **AWSC** | **TWSC** | **Signals** |
| EBLT | 0.15 | 0.66 | 0.42 |
| SBLT | 0.39 | 0.27 | 0.42 |
| NBTH | 0.57 | - | 0.42 |
| Intersection |  |  | 0.51 |

### Further Thoughts

## 7. Summary

## 8. Glossary

Table . Terms used in this chapter

|  |  |
| --- | --- |
| **Term** | **Definition** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Table . Variables used in this chapter

|  |  |  |
| --- | --- | --- |
| **Variable** | **Description** | **Units** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 9. References

## 10. Problems