Analysis of Multimodal Level of Service

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Kellogg Honors College Capstone Project

Introduction:

Measuring Level of Service (LOS) has been a long standing practice for transportation engineers. What LOS is, is a means to grade a piece of roadway, highway, bikeway, or pedestrian walkway on a scale from A to F based on traffic density. Level of Service has become a very good tool used to evaluate roads for their ability to allow car traffic flow, even in areas where bikers, bus transit, and pedestrians share the road with passenger cars. Because this tool is very effective in letting cars go faster, many of our streets have grown to allow much faster passenger car movements, which in return tends to be unsafe for use by the other modes of transit listed above. While this was not a problem in the past, the current cost of gas and toll that driving daily in traffic has on the environment has encouraged many to try biking, walking, or taking mass transit such as bus or train to work. However, because roads are not friendly for these other modes of transit, many do not feel safe to change their mode of transit to more economical and environmentally friendly forms. This is where Multimodal Level of Service comes in. Multimodal Level of Service is a grading criteria that takes into account not only the traffic density of passenger cars, but also bike transit, walking, and multimodal transit when evaluating a road. In this experiment, Multimodal Level of Service was Examined to see how different modes of transit react to one another when a roadway is changed to benefit one mode of transit more than another.

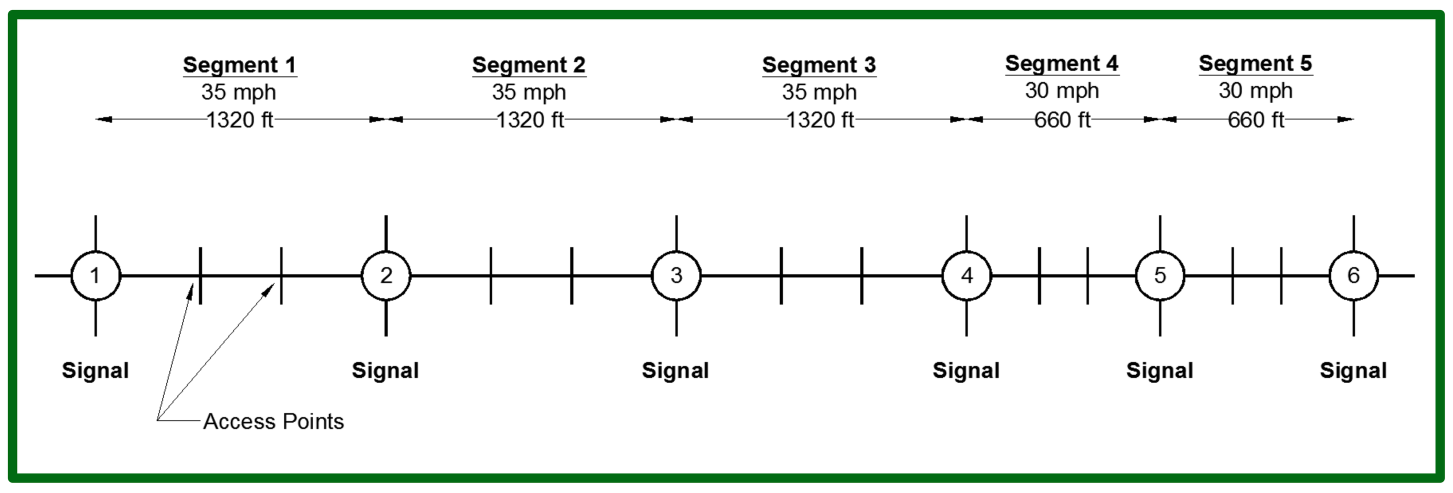

Figure 1: Sahana Ave Project Overview

Scope:

For this project, an imaginary road, Sahana Avenue was evaluated for its Multimodal Level of Service . The road consists of 6 intersections with two access points along each intersection as can be seen in figure 1. The road also had existing geometric characteristics as well as existing multimodal densities that can be seen in Table 1 and Table 2 below. Two alternatives were considered, leaving the width of the street as is, to see how the Level of Service changes for passenger cars, pedestrians, bikes, and bus transit when geometric changes intended to increase other transportation LOS were taken into account. In order to consider the alternatives, consistent traffic data was used at each section. The numbers used can be seen in Table 3.

Table 1: Existing Geometry

	Segments 1-3	Segments 4-5
Segment Length (ft)	1320	660
Speed Limit (mph)	35	30
# of access points per segment	2	2
Area Use	Commercial/ Shopping	Shopping
Curb	Yes	Yes
Lanes/Direction	2	2
Curb and Gutter (ft)	1.5	1.5
Left Turn Storage (ft)	200	200
Shared Right Lane	Yes	Yes
Sidewalk (ft)	6	6
Fixed Objects on Sidewalk	No	No
Midsegment Pedestrian Crossing	Yes	Yes
Bicycle Lanes	No	No
Parking	No	No
Pavement Condition Rating	3.5	4.5
Curbed Cross Section	Yes	Yes
Cross-Street Lane Width (ft)	12	12
Corner Radius (ft)	6	6
Crosswalk Width (ft)	12	12
Buffer	0	0

Table 2: Multimodal Traffic Data

	Segments 1-3	Segments 4-5
Heavy Vehicles (%)	3	3
Grade	Level	Level
Parking Allowed	No	No
Local Bus Volume(bus/hr)	3	3
Segment Length With Curb (%)	94	88
Walkway With Low Wall (%)	25	10
Walkway With Building (%)	0	35
Walkway With Window (%)	0	15
Pedestrian Volume (ped/hr)	100	300
Bicycle Volume (bike/hr)	1	1
Bus Stop Interval (mi)	.25	.25
Dwell Time (sec)	20	20
Bench	Yes	Yes
Shelter	No	No
Load Factor (passenger/seat)	0.8	0.8
Arrive Within 5 min of schedule (%)	75	75

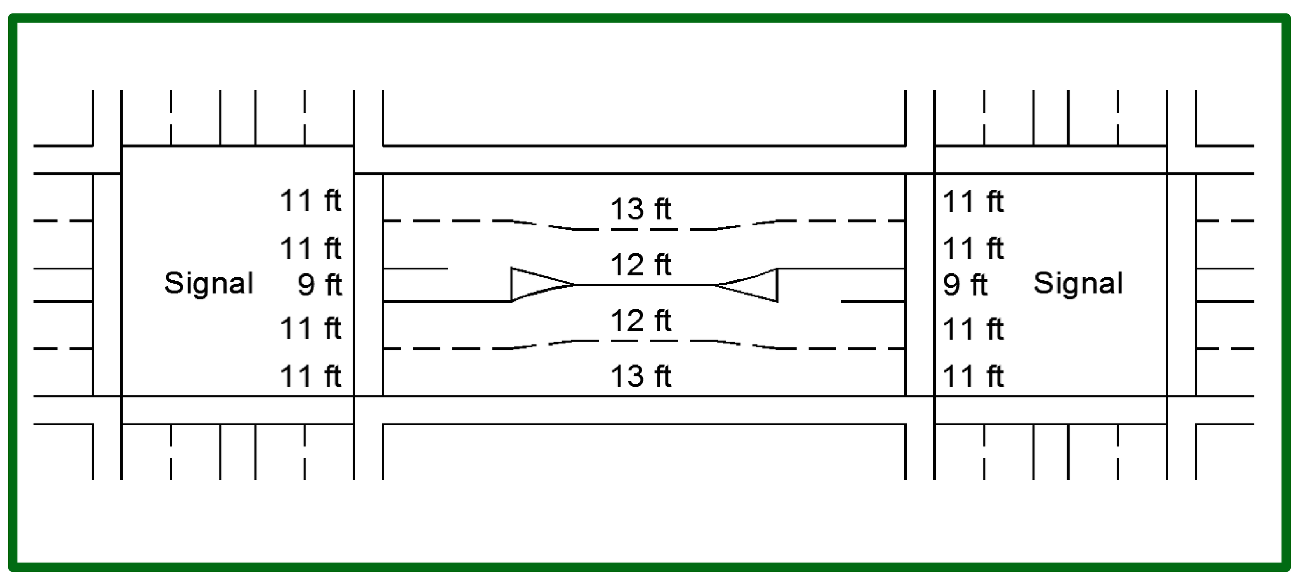

Figure 2: Existing Roadway Segment Geometry

Analysis:

The Existing Roadway as well as the two alternatives were run through the streets software HCS 2010 Streets. Using the changes shown in Table 4 below for each alternative, results were obtained for LOS for the entire facility in terms of passenger cars, pedestrian, bike, and Transit. These results are shown in table 5.

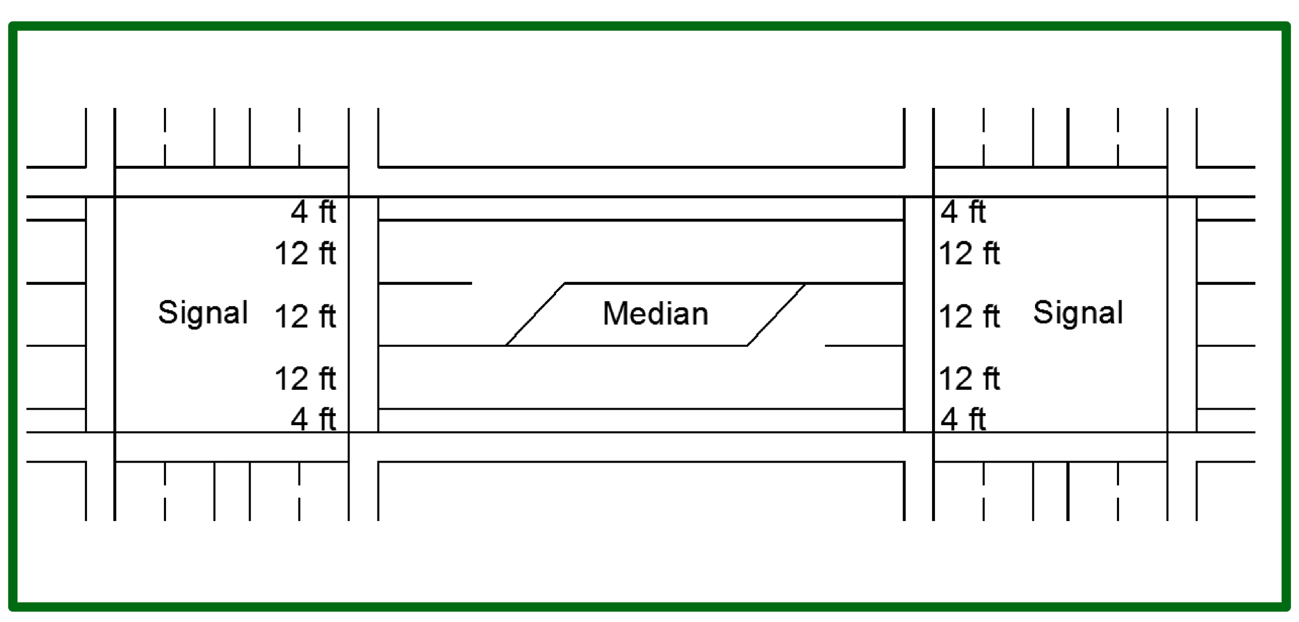

Figure 3: Alternative 1 Segment Geometry

Table 3: Intersection Turn Movements

PHF = 1

	Signal	Access Point 1	Access Point 2	Signal
EBL	80	38	39	80
EBT	640	684	702	640
EBR	80	38	39	80
WBL	80	39	38	80
WBT	640	702	684	640
WBR	80	39	38	80
NBL	60	49	48	60
NBT	480	0	0	480
NBR	60	48	49	60
SBL	60	48	49	60
SBT	480	0	0	480
SBR	60	48	49	60

Table 4: Alternative Geometry Changes

	Existing	Alternative 1	Alternative 2
Lanes/Direction	2	1	1
Sidewalk (ft)	6	9	7
Bicycle Lane Width (ft)	0	4	0
Parking Bay Width (ft)	0	0	9.5
Median Width	0	12	12
Buffer	0	3	0

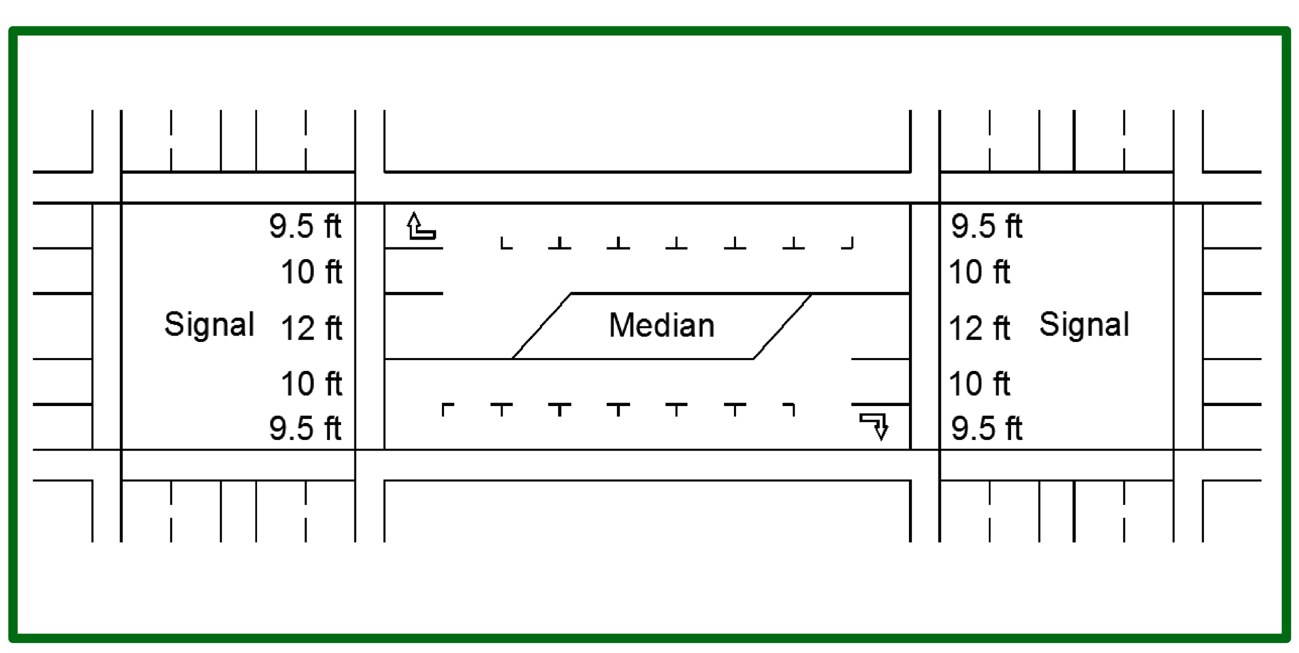

Figure 4: Alternative 2 Segment Geometry

Conclusion:

This test was designed to evaluate the changes to LOS that can occur for all modes of transit on a given street. The results show trends that were expected. The existing roadway provided acceptable LOS grades for all transportation modes except pedestrian. Because of this, the Alternatives were geared more towards increasing the LOS for this mode of transportation. As was expected, an increase in pedestrian LOS hindered the Passenger Car LOS. The same was true for increasing bicycle LOS, although the attempt to raise LOS in alternate 1 showed little difference because very few bikers were assumed to use the road. Transit remained similarly stagnant through out the process due to the assumption that increased traffic would not increase delay times.

Because there was no alternative which could bring up pedestrian LOS without lowering another LOS to a point where it was unacceptable, the suggested mitigation for this particular road would be to increase the width of the street by acquiring Right of Way and maintaining the same number of lanes while adding parking bays, bike lanes, medians and other such features aimed to increase safe and easy pedestrian and bike use along the street.

Table 5: Results

	Passenger Car	Pedestrian	Bike	Bus Transit
Existing Facility LOS	C	F	D	C
Alternative 1	F	D	D	C
Alternative 2	F	D	E	C