SH 83 Safety and Operations Analysis:
Bayou Gulch to El Paso County Line
MP 30.20 – MP 53.88
Project Code 23008

Appendix C – Operational Analysis

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March 2022

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EXISTING OPERATIONAL EVALUATION

Geometric characteristics and traffic volumes from both current counts and predictive models were used to estimate how well the roadway accommodates traffic demand compared to its capacity. This estimation is expressed using a Level of Service (LOS) scale, ranging from LOS A, which are the best possible operating conditions to LOS F, where demand exceeds capacity. LOS D is generally considered an acceptable level of service with LOS E acceptable during the peak hours of operation.

For analyses purposes, the corridor was divided into 35 segments of various lengths. The existing conditions for SH 83 can be summarized as follows below. For a detailed breakdown by segment see Appendix C for the HCM Analysis.

- Segment type: passing constrained and passing zone
- Existing typical section: two lane – four lane rural roadway
- Roadway type: Class I highway
- Existing lane width: 12 feet
- Existing shoulder width: 0 to 6 feet
- Posted speed limit: 55 to 65 mph
- Access point density: 0 to 8 points/mile

Two-Lane Highways

The Highway Capacity Manual (HCM) Methodologies for Two-Lane Highways were followed using the Highway Capacity Software, Version 7. Level of service for two-lane highways are based off two main measurements, the average travel speed (ATS) and the percent time spent following (PTSF), both of which try to gauge the expectations and frustrations that drivers may face on this type of roadway. Passing capacity and passing demand are both related to flow rates. As the levels of platooning become more noticeable, the drivers experience reduced speeds and fewer opportunities to pass slow vehicles. This methodology was applied between MP 30.17 and 50.51, which is the unsignalized portion of the corridor. **Table C1** summarizes the level of service thresholds.

Table C1 Two-Lane Highways Level of Service Definitions

LOS	Average Travel Speed (ATS)	% Time Spent Following (PTSF)
LOS A	> 55	> 35
LOS B	> 50-55	> 35-50
LOS C	> 45-50	> 50-65
LOS D	> 40-45	> 65-80
LOS E	> 40	> 80
LOS F	Demand exceeds capacity	

Note: For Class I highways, LOS is determined by the worst case of ATS-based LOS and PTSF-based LOS.

The input data to evaluate the LOS in HCM is taken from a variety of assumptions, field measurements and collected or projected data. Northbound and southbound operations were evaluated separately and divided into segments of either passing zones or constrained passing (i.e. no-passing zone). Collected data for each segments includes the segment length, lane width, paved shoulder width, pavement condition, and total truck percentage.

For segments with a horizontal curve, a conservative input for the minimum radius was determined based on the procedure outlined in the *AASHTO, A Policy on Geometric Design of Highways and Streets*, 7th Edition. Using the design speed of 55 mph, the maximum side

friction value of 0.13, and the maximum super elevation value of 8%, **Table C2** gives a minimum radius of 960 feet. This radius value was applied to every segment in the HCS evaluation that includes a horizontal curve.

Table C2 AASHTO Table 3-7. Minimum Radius Using Limiting Values of *e* and *f*

Design Speed (mph)	Maximum *e* (%)	Maximum *f*	Calculated Radius (ft)	Rounded Radius (ft)
55	8.0	0.13	960.3	960

24-hour Average Daily Traffic (ADT) counts were not available, so for the purposes of the HCM analysis, data was procured from the Denver Regional Council of Governments (DRCOG) Focus Travel Model for existing conditions, 2020 and future conditions, 2050. This model proves the best approximation of existing traffic volumes in the area that do not include impacts of the I-25 South Gap project (currently under construction), while also consistently projecting volumes for the 2050 future condition. According to CDOT's Online Transportation Information System (OTIS), there are no permanent traffic counters located along this roadway, however downloadable hourly ADT data from seven short duration counts since 2012 were available. Analysis of this data resulted in average, hourly, directional factors that were applied to the DRCOG model ADT data. The resultant directional volumes for the AM and PM peak hours were used in the HCM evaluation. The same factors were applied to the 2050 DRCOG model for the future condition. Percentage of truck volumes were taken from OTIS as well. The predominant traffic pattern is traveling northbound in the AM peak hour and southbound in the PM peak hour.

Google Earth was used to estimate the grade and the average access density for each segment.

The detailed results of the HCM analysis are included in **Appendix C**, as well as on each corresponding location line-item entry in the mitigation table. **Table C3** is a high-level summary:

Table C3 HCM Analysis Summary – 2020 Existing Condition

	AM Peak	PM Peak
Southbound	LOS A	LOS A or B
Northbound	LOS A or B	LOS A or B

Note: PM Peak Southbound adjacent to SH 86 operates at LOS C, likely as a result of traffic volumes

Signalized Intersections

The methodology for evaluating signalized intersections was followed using Synchro Microsimulation Software Version 11, to analyze traffic operations in the signalized portion of the corridor. This includes the three traffic signals between MP 50.51 and 54.00, which are SH 83 and Bayou Gulch Road, SH 83 and Castle Oaks Drive, and SH 83 and SH 86. The temporary signal at SH 83 and East Palmer Divide Avenue was not included in the analysis because this intersection has already been identified to be replaced with a roundabout intersection. At signalized intersections an overall LOS is reported, representing a weighted average vehicle delay for all movements, as well as the LOS for each approach direction. The 95th percentile queue was also reported, which is an estimate of how long the queue for that approach would be when volumes are at 95% of their maximum.

Geographic inputs such as segment lengths, lane geometries and lengths, link speeds and right turn on red style were collected using Google Earth. Existing timing parameters, phasing and signal timing plans were provided by CDOT Region 1. Existing 2-hour turning movement counts for AM, Mid-day and PM were collected at 10 locations along the corridor on Wednesday, July 14 and Tuesday, July 20, 2021 and are included in **Appendix D**.

The results of the Synchro evaluation are included in **Appendix E**, as well as on each corresponding location line-item entry in the mitigation table. In summary, for the 2020 existing condition AM and PM peak periods, each intersection is operating at or better than LOS C. None of the 95th percentile queue estimates exceed capacity calculations, indicating that none of the signals are operating over capacity.