Appendix C
Operations Analysis Methods and Assumptions Memorandum

SH-44, I-84 TO STAR ROAD

OPERATIONS ANALYSIS METHODS AND ASSUMPTIONS

February 10, 2025

This memorandum documents the methodology and key assumptions to be used in the traffic analysis for the SH-44, I-84 to Star Road Planning and Environmental Linkages (PEL) study. The topics covered in this memorandum include project study area, analysis years and scenarios, mobility and performance standards to be measured against, analysis software and methodologies, and data collection and volume development processes.

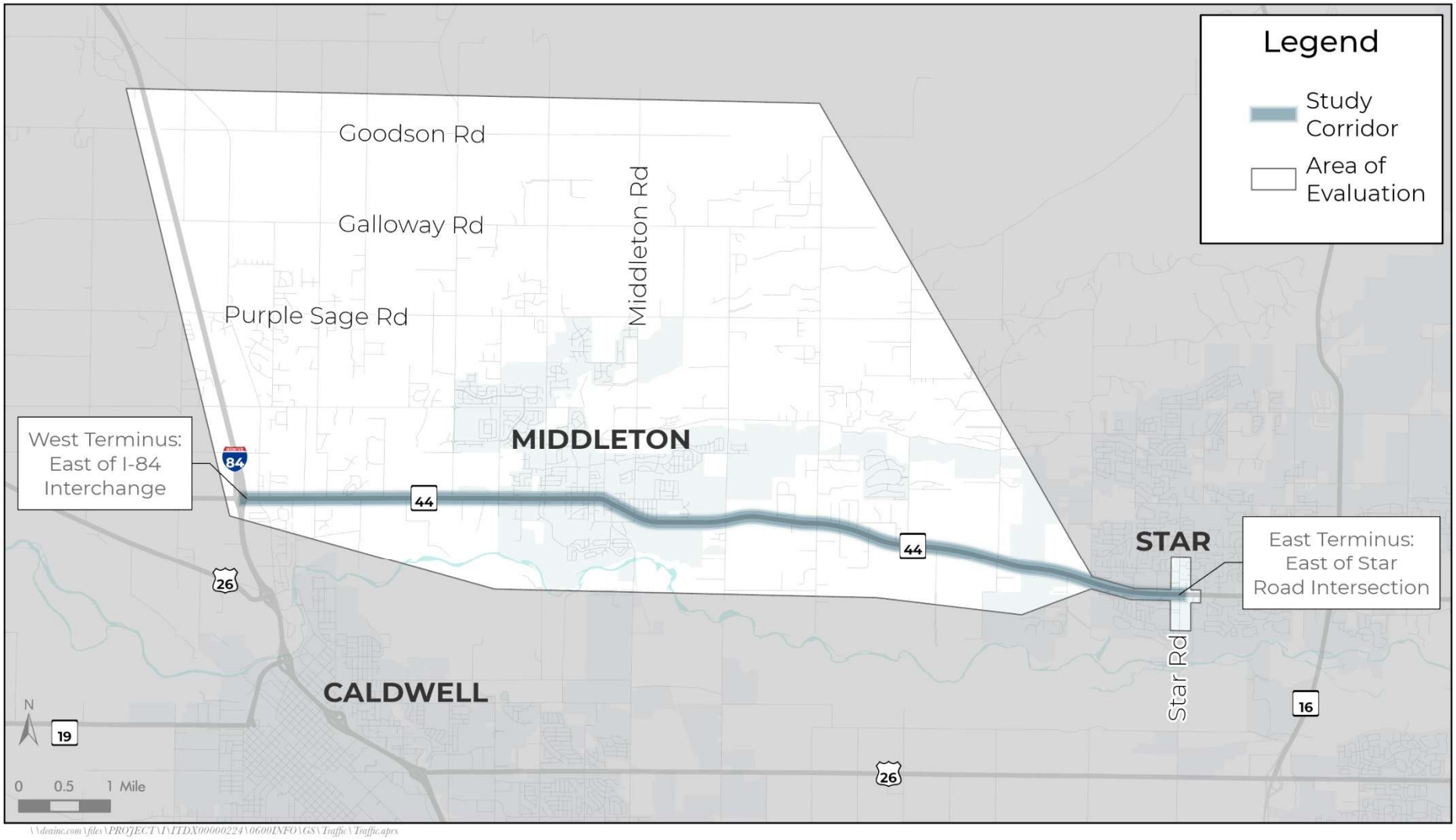
Study Area

The 10.4-mile SH-44 corridor study limits are just east of the I-84 east ramps through the N. Star Road intersection in the City of Star. The study corridor is located in Canyon and Ada Counties. The county line is approximately along Can-Ada Road. SH-44 passes through the City of Middleton and the City of Star within the study area. Beyond the study corridor, the study may evaluate potential alternate alignments for the SH-44 highway within a broader area generally bordered by Goodson Road to the north and the Boise River to the south. The study corridor and broader area of evaluation are illustrated in **Figure 1.**

SH-44 is a two-lane highway at the western end of the study corridor. It continues as a two-lane highway heading east until Emmett Road where it becomes a three-lane road (one travel lane in each direction with a center turn lane). Approximately half way between N. Middleton Road and Duff Lane, the road returns to a two-lane cross section. From N. Can Ada Road to N. Star Road, the road widens to a five-lane cross section (two travel lanes in each direction with a center turn lane). There are left-turn and right-turn lanes at various intersections along the study corridor.

The posted speed limit along the SH-44 study corridor is generally 55 miles per hour (mph) in the two-lane sections of the highway. It gradually transitions to 25 mph in the City of Middleton and the City of Star. At the western end of the study corridor, the posted speed limit is 45 mph approaching I-84.

Figure 1. Alternatives Development and Evaluation Process



This study includes the analysis of 20 intersections along the corridor. The 20 study intersections include four signalized intersections and 16 two-way STOP sign-controlled intersections. The four traffic signals along the SH-44 study corridor are located at Hartley Lane and S. Middleton Road in the City of Middleton, and at S. Highbrook Way and N. Star Road in the City of Star.

- Old Highway 30
- Stone Lane
- River Road
- Freezeout Road
- Channel Road
- Canyon Lane
- Emmett Road
- Hartley Lane
- Cemetery Road
- Hawthorne Drive
- Dewey Avenue
- S. Middleton Road
- N. Middleton Road
- Duff Lane
- Lansing Lane
- Kingsbury Road
- Blessinger Road
- Can Ada Road
- Highbrook Way
- Star Road

Data Collection

Traffic Volumes

Turning movement traffic counts at the 20 study intersections along SH-44 were collected by ITD on September 12 – 14, 2023 (Tuesday through Thursday). Turning movement counts were captured in 15-minute intervals for a continuous duration of about 36 to 48 hours.

At the intersection of SH-44 and Hawthorne Drive, the ITD traffic count equipment malfunctioned and did not successfully capture the traffic counts in September 2023. Therefore, a previous traffic count collected in April 2018 was used for this intersection and turning movement volumes were adjusted to balance and match the 2023 volumes at the adjacent intersections.

Seasonal Factors

The 2023 morning (AM) and evening (PM) peak hour traffic volumes were identified from the traffic counts between the time periods of 6 – 9 AM and 3 – 6 PM. The peak hour volumes were converted to the 30th highest hour volume (30HV) using seasonal factors. ITD's Automatic Traffic Recorders (ATR) provide the historical Monthly Average Daily Traffic (MADT) and AADT volume data. The closest ATR to the study area, ATR #157, is located on SH-44 about 2.8 miles east of the SH-44 and N. Star Road intersection. This ATR location was used for determination of seasonal factors.

Monthly Seasonal Factors (MSF) for each month for the past five years (2018 – 2022) were calculated using the MADT and AADT. The peak month for each year as well as the month corresponding to the traffic count months (September and April) were noted. Next, the highest and lowest peak month MSF and count month MSF across the five years were removed and the average was determined for the remaining three MSFs. The seasonal adjustment factor is the average peak month MSF divided by the average count month MSF,

and in this case it was calculated to be 1.03 for the September counts and 1.06 for the April counts. The seasonal adjustment factor calculation is summarized in **Table 1**.

Table 1: Seasonal Adjustment Factor

	2022	2021	2020	2019	2018	SEASONAL ADJUSTMENT FACTOR
Peak Month	1.11	1.08	1.10	1.06	1.07	
Count Month - September	1.10	1.00	1.09	1.02	1.03	1.03
Count Month - April	1.04	1.04	0.82	1.00	1.04	1.06

Seasonally adjusted traffic volumes for the SH-44 study corridor were balanced between intersections where arrival or departure traffic volumes from one intersection and the next one showed significant differences that could not be reasonably accounted for. Peak hour traffic volumes were rounded to the nearest five. Traffic volumes of less than three vehicles were left unchanged and not rounded to zero.

Travel Time

Weekday morning and evening peak travel times were observed in the field along the SH-44 corridor using the "average car" method in October 2023. The highest observed travel times along SH-44 from Old Highway 30 to N. Star Road were:

- AM peak hour in the westbound direction: 16 minutes, 30 seconds
- AM peak hour in the eastbound direction: 18 minutes, 24 seconds
- PM peak hour in the westbound direction: 17 minutes, 20 seconds
- PM peak hour in the eastbound direction: 15 minutes, 17 seconds

Origin-Destination

An origin-destination analysis was conducted using the Streetlight Insight platform to understand traffic flow along the corridor. Streetlight Insight is a "big data" web platform that measures traffic volumes and travel patterns using data from connected devices. The origin-destination analysis in Streetlight Insight allows users to understand the travel routes and patterns between areas and locations.

To help identify the existing vehicular traffic flows along the SH-44 study corridor, Origin-destination analyses were conducted—two in the eastbound direction and two in the westbound direction. The analyses were conducted based on data from April 1, 2021, to May 31, 2021 and from September 1, 2021 to October 31, 2021, the most current and recommended range of dates available. The discussions below summarize the weekday (Monday to Thursday), peak morning (6 AM - 10 AM) and peak evening (3 PM - 7 PM) data results.

Multimodal

The bicycle and pedestrian Strava Heatmap was used to examine different levels of concentrations of bicyclists and pedestrians traveling within the SH-44 study corridor. Strava is a smartphone application commonly used by bicyclists and pedestrians to track the transportation routes they use during morning and evening commutes, recreation, and

exercise. Strava users log their activity through the application and the geospatial data from their sessions are recorded. The geospatial data of Strava users is aggregated into a heatmap providing a visualization of frequently-used bicycle and pedestrian routes.

It should be noted that not all bicyclists and pedestrians use Strava or activate the application during every trip, so the Strava heatmap provides a limited picture of multimodal transportation patterns, focusing more on recreational trips. However, it is a powerful tool in visualizing the existing concentration of bicyclist and pedestrian activity and the routes they choose to use, and it is updated monthly.

Traffic Analysis

Traffic analysis will be conducted for the AM and PM peak hours for the following study years and scenarios:

- Existing year 2023 (volumes seasonally adjusted to represent 30HV)
- Planning year 2050 No-Build (DHV with programmed improvements consistent with Community Planning Association of Southwest Idaho (COMPASS) MPO's adopted 2050 Community in Motions travel demand model, except improvements along the SH-44 study corridor)
- Planning year 2050 Build (DHV with programmed improvements consistent with COMPASS MPO's adopted 2050 Community in Motions travel demand model and each alternative considered for the SH-44 study corridor)

The following traffic analysis will be performed to evaluate the various operational metrics:

- Intersection LOS (based on average delay) and volume-to-capacity (v/c) ratio
- Travel time based on microsimulation

Software

Synchro software version 11 will be used to analysis intersections operations. Highway Capacity Software (HCS) version 7 will be used to analyze segment level operations. Synchro analysis at signalized and STOP-controlled intersections will be reported based on *HCM 6th Edition* methodology. HCS analysis are based on *HCM 6th Edition* methodologies.

Intersection Level of Service

In the intersection operational analysis for both STOP-controlled and signalized intersections, LOS for motorized vehicles is a function of delay. LOS at signalized intersections can be determined for the entire intersection, each intersection approach, and each lane group. At STOP-controlled intersections, LOS is determined for each minor-street movement or major street left-turn movements.

LOS criteria for signalized intersections and STOP-controlled intersections are based on control delay established in *HCM 6th Edition* (Chapter 19 for signalized control and Chapter 20 for Two-way STOP-controlled). The LOS criteria for signalized and STOP-controlled intersections are summarized in **Table 2**.

Table 2. Intersection LOS Definitions

LEVEL OF SERVICE	TRAFFIC SIGNAL AVERAGE TOTAL DELAY (SEC/VEH)	UNSIGNALIZED INTERSECTION AVERAGE TOTAL DELAY (SEC/VEH)
A	≤ 10	≤ 10
B	> 10 - 20	> 10 – 15
C	> 20 - 35	> 15 – 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50

Section 335.06 of the ITD Design Manual recommends a minimum level of service for rural arterials and freeways of LOS B and a minimum level of service for urban arterials and freeways of LOS C. For local roads and collectors, the recommended level of service is D. In many urban areas and intersections, it is not possible to achieve LOS B or C for high-volume signalized intersections and minor street left-turn movements at unsignalized intersections. Therefore, a minimum level of service of LOS D with a volume-to-capacity (V/C) ratio of 0.90 is proposed for the rural intersection analysis and a minimum of LOS E with a lane group V/C ratio of 1.00 is proposed for the urban intersection analysis. If an intersection has a lane group V/C ratio of 1.00 or greater, a multiple period analysis in accordance with HCM 6 will be conducted. These recommended levels of service will be used as guidelines for determining locations where deficiencies may exist.

Travel Time

There are various methods for measuring traffic operations of roadways and intersections. Based on *Highway Capacity Manual* (HCM) process and methodologies, LOS is based on a measurement of vehicular density in highway segment analysis and vehicular delay in intersection operational analysis. These two measurements and other performance measures are briefly described below.

LOS is a commonly used qualitative descriptor of traffic operations based on traffic density or delay. LOS grades ranging from A to F are assigned to represent various operating conditions. LOS on multilane highway segments is a function of vehicular density in passenger cars per mile per lane (pc/mi/ln) and LOS on two-lane highways are a function of follower density based on the HCM-defined criteria as summarized in Table 4.

Volume-to-Capacity Ratio

Volume-to-capacity (v/c) ratio is a common measurement of effectiveness for roadway and intersection operations. A v/c ratio of less than 1.0 indicates that the traffic volume is less than the available capacity, or that there is enough capacity to serve the volume. A lower v/c ratio indicates traffic conditions with little congestion and low delays or densities. As the v/c ratio approaches 1.00, traffic becomes more congested with longer delays and higher densities. A v/c ratio greater than 1.00 represents traffic volumes that exceed the available road or intersection capacity. When referring to future forecast volumes, v/c ratio is sometimes referred to as demand-to-capacity (d/c) ratio.

Travel Demand Forecasting

Future Condition (2050) Volumes

Land use and travel demand forecasting data were provided by Community Planning Association of Southwest Idaho (COMPASS). COMPASS is the Metropolitan Planning Organization (MPO) for the Treasure Valley-area of Southwest Idaho including Ada and Canyon Counties.

The land use and travel demand forecasting data are from the latest adopted Regional Long-Range Transportation Plan, Communities in Motion (CIM) 2050. The plan forecasts growth to the year 2050 using adopted land use assumptions in number of households and number of jobs.

COMPASS completed a household travel survey in fall 2021 to provide updated data about how residents travel throughout the region. The data is collected to calibrate and validate the travel demand model. The data collected for the area surrounding the SH-44 study corridor were evaluated for this study to identify trip characteristics. The Middleton/Star area is defined in the survey data as I-84 to the Ada/Canyon County line, and the Boise River to the Canyon/Gem County line.

Planning year 2050 design hourly volumes (DHV) will be developed by adding existing year 30HV and post-processed growth volumes calculated from travel demand model output. COMPASS MPO's adopted 2050 Communities-In-Motions (CIM) travel demand models will be used to determine the model-based growth volumes.

Travel demand model volume post-processing procedures will follow NCHRP Report 255 and 765 guidelines. The model-based growth estimate will be determined from the difference between the base year (2023) model and the planning year (2050) model. The forecasted link volumes will reference the NCHRP Report 765 spreadsheet to determine the future year turning movement volumes and the volumes will be rounded to the nearest five vehicles and balanced in Synchro. Two commonly used methods to process and calibrate model-based growth are the percent method and the difference method. The two methods will be compared, and a suitable growth based on one method or the average of the two will be applied to determine the future growth volume and added to the existing year 30HV to arrive at the 2050 DHV. Where model-based growth are not available due to missing network link, historical data will be used to develop a future year growth factor.

Multimodal

The evaluation for multimodal comfort will include a Level of Traffic Stress analysis performed using Ada County Highway District (ACHD) Livable Streets Performance Measures. The LTS methodology reflects relative comfort of roads for pedestrians and for bicyclists. The methodology was developed from other national practices and adapted to reflect local experience.

The LTS evaluation will be applied along the corridor alternatives with an overall score determined by the weakest link principle, meaning that the least comfortable quality of a roadway determines the score for the roadway.

Safety Evaluation

The safety analysis will be conducted using a five-year crash history review from the crash data provided by ITD and an assessment of the potential crash reduction for changes with the corridor alternatives, including reduction in crashes involving pedestrians and bicyclists.

The five-year crash history review will identify characteristics, severity, and observed crash rate for both intersection and roadway segments to help determine possible safety issues at specific locations and corridor as a whole.