National Park Service
U.S. Department of the Interior

Grand Teton Transportation and Visitor Movement Study

Final Report

ON THE COVER
Visitors at the Snake River Overlook
Photo by NPS

Grand Teton Transportation and Visitor Movement Study

Final Report

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Introduction

Project Purpose and Approach

Grand Teton National Park (GRTE) is located in northwestern Wyoming and includes the Teton Range's major peaks as well as the upper stem of the Snake River and numerous lakes. From 1993 through 2014, GRTE park visitation was relatively consistent from year to year and generally ranged between 2,300,000 and 2,800,000 annual recreation visits. In recent years, however, the park has experienced an unprecedented rise in visitation. The total number of annual recreation visits surpassed 3,000,000 in 2015, and between 2015 and 2021, that count increased by 23%, with a record-breaking annual total of over 3,800,000 park visits in 2021.

Increases in visitation are stressing park operations and infrastructure, park Fundamental Resources and Values, and visitor experiences and safety. Vehicle traffic on the park's transportation systems and visitor volumes at key destinations and trails are integral parts of these stressors. As such, the National Park Service (NPS) commissioned this project to gain a comprehensive understanding of transportation and visitor movements (TVM) to, through, and within GRTE and John D. Rockefeller Jr. Memorial Parkway (JODR). More specifically, the primary purposes of this project are to:

- Gather and summarize updated descriptive data measures of transportation and visitor use conditions in the park, including: (1) parkwide visitor travel patterns, (2) vehicle traffic volumes, (3) parking occupancy rate counts, and (4) observation-based trail counter calibration counts.
- Identify and estimate statistical relationships among key inputs of the park's transportation system (e.g., vehicles entering at park entrances) and indicators of transportation and visitor use conditions on key park roadways, in parking areas, and along trails.
- Develop an Excel-based statistical modeling tool to evaluate and visualize current transportation and visitor use conditions, and estimate conditions for transportation and visitor use management scenarios.

Each project purpose component feeds into the next, meaning, the descriptive data collected during summer 2021 as part of this study are used as inputs and indicators in regression models to estimate statistical relationships, and regression model results are programmed into the statistical modeling tool to estimate scenario-based transportation and visitor use conditions.

Organization of Report and Appendices

The remainder of this report is organized as follows:

- The Methods section describes the study area and period, as well as methods used to collect, clean, and analyze primary data, secondary data, and passive mobile data. The Methods section also explains methods for selecting final (i.e., best-fitting) statistical regression models.

- The Results section is broken down into subsections, where each subsection presents results of descriptive data and exploratory analyses within a smaller geographic subarea of the park. More specifically, the results presented in each of the subsections include: (1) descriptive and graphical and/or tabular summaries of summer 2021 traffic, parking, and/or trail use conditions for locations used as inputs and indicators in the statistical analyses; and (2) descriptive and tabular results of regression models that estimate relationships between inputs and indicators of transportation and visitor use conditions in the park. Each subsection concludes with a high-level summary of insights based on results of descriptive data and the exploratory analyses.

A separate appendices document was produced for this report. The contents of the appendices are as follows:

1. Appendix 1 presents the coordinates of 2021 data collection locations.
2. Appendix 2 presents the trail counter calibration form used for on-site data collection.
3. Appendix 3 presents scatterplots of regression variables with intercept and non-intercept linear models plotted for statistical analyses of regional highway and entrance station traffic volumes, and parkwide perimeter and entrance station traffic volumes.
4. Each of Appendix 4 through Appendix 8 is associated with a geographic subarea of the park and presents:
    a. Descriptive and graphical and/or tabular summaries of summer 2021 traffic, parking, and/or trail use conditions for locations that were not featured in the statistical analyses as key inputs or indicators
    b. Scatterplots of regression models estimated for the Excel-based tool and models estimated for exploratory purposes only.
5. Appendix 9 presents the parkwide parking dwell time distributions by place of interest using Wejo-inferred data.

Methods

This section of the report describes the study area, primary and secondary data collection methods, and methods for conducting exploratory analyses and statistical modeling for the GRTE TVM Study.

Study Area

Located in northwestern Wyoming's Teton County, GRTE is approximately 485 square miles and encompasses some of the most significant peaks in the Teton Mountain Range. GRTE is located just seven miles south of Yellowstone National Park (YELL). The JODR provides a link between the two national parks. GRTE is also located just a few miles north of the popular town of Jackson, Wyoming. **Figure 1** shows GRTE and the surrounding region.

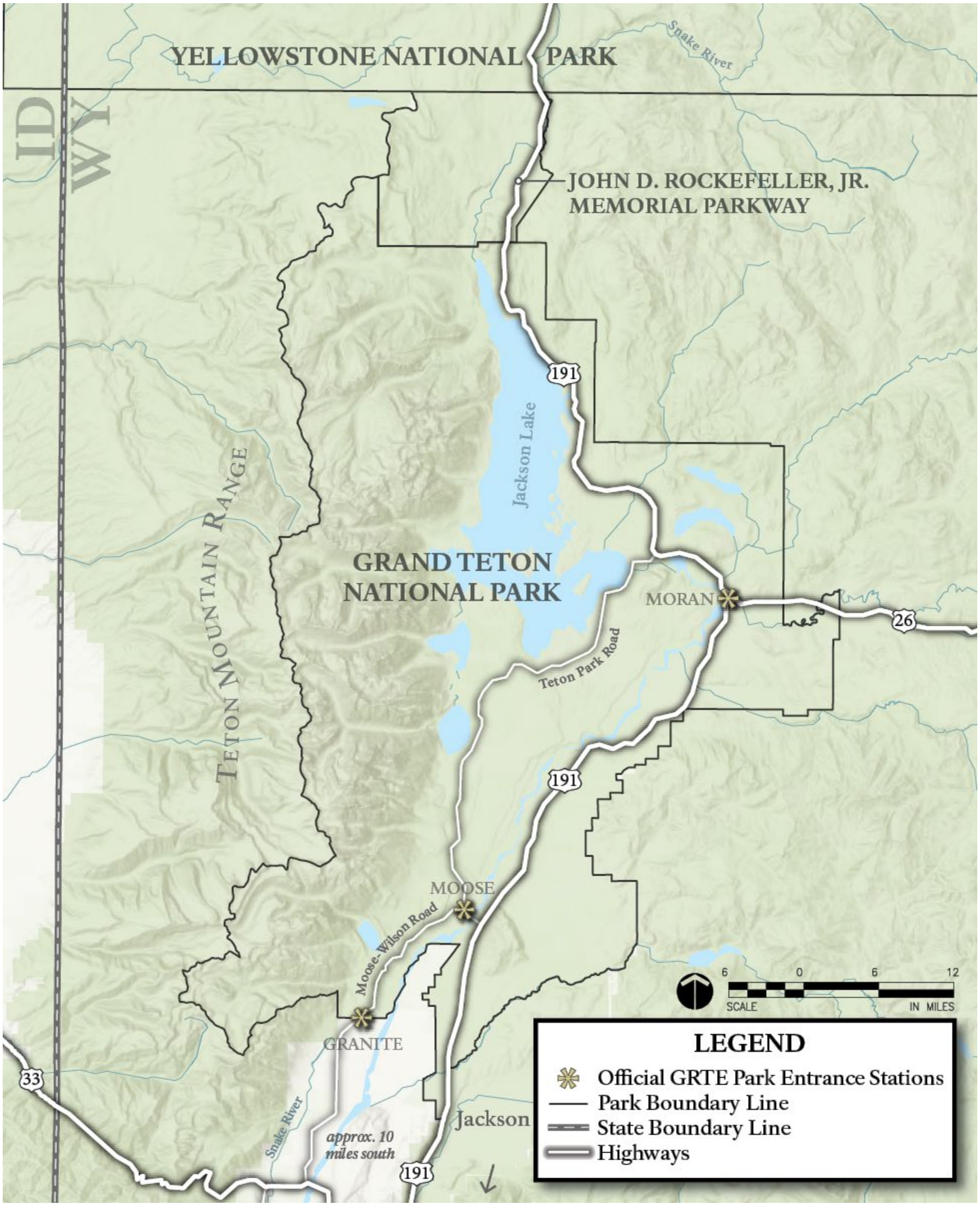

Figure 1. Grand Teton National Park and the surrounding region.

As previously mentioned, GRTE is close in proximity to Jackson, Wyoming and YELL, two major destinations for tourism. The park is also a five- to eight- hour drive from major cities such as Denver, Colorado, Salt Lake City, Utah, and Boise, Idaho. As such, an important component of this project is to assess not only how visitors travel within the park's boundary, but also how visitors access the park from the surrounding regional area. Park access options are outlined in the following paragraph.

Park visitors traveling north from or through Jackson, Wyoming cross GRTE's southern boundary before officially entering the park at the Moose Entrance Station. Visitors will also travel westbound on Highway 26, crossing GRTE's eastern boundary before officially entering the park via the Moran Entrance Station. Visitors can travel to GRTE directly from YELL, traveling south along the JODR and across GRTE's northern boundary. Visitors coming from YELL do not need to pass through an official park entrance station. Lastly, visitors can enter the park from the Granite Entrance Station.

Once they have entered the park, visitors can recreate at a variety of destinations, including lake and mountain overlooks, visitor centers, campgrounds, and hiking trails. Access to these destinations typically requires vehicle travel along key park roadways such as Highway 191, Teton Park Road, and Moose-Wilson Road.

Subareas

GRTE has a plethora of destinations to choose from, each with unique access roads and parking areas, and many of these park roadways, parking areas, and trails were studied as part of this project. As such, five subareas within GRTE were selected in consultation with park staff to provide a framework for organizing the study results and for structuring the exploratory analyses. These five subareas are depicted in **Figure 2** and are defined as: (1) Gros Ventre/Antelope Flats, (2) Moose-Wilson, (3) Moose to Signal Mountain, (4) Moran to Leeks Marina, and (5) JODR. The following subsection provides details about each of the subareas.

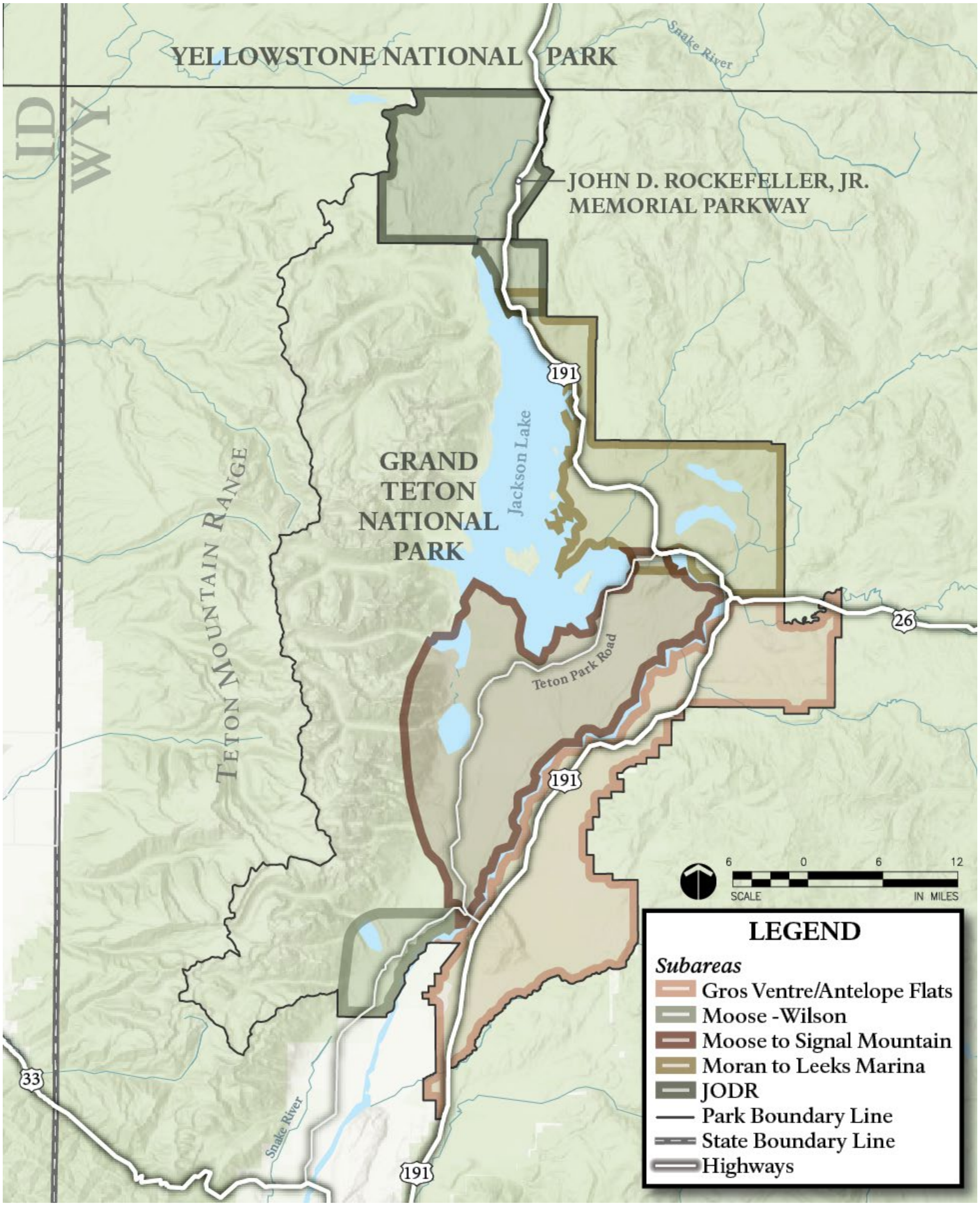

Figure 2. Geographic subareas of GRTE.

Gros Ventre/Antelope Flats

The Gros Ventre/Antelope Flats subarea is located in the southeast corner of the park, as depicted by the pink boundary in **Figure 2**. Visitors can access destinations in this subarea without passing through an official park entrance station, by way of Gros Ventre Junction or Highway 191. Major attraction sites within this subarea include the Gros Ventre Campground, the historic district of Mormon Row, the Snake River Overlook, Blacktail Butte, and Cunningham Cabin.

Moose-Wilson

The Moose-Wilson subarea is located in the southwest corner of the park, as depicted by the light gray boundary in **Figure 2**. The Granite Entrance Station offers prime access to destinations within this subarea. Major attraction sites within this subarea include the Laurance S. Rockefeller Preserve Center, Phelps Lake, and the Sawmill Ponds Overlook.

Moose to Signal Mountain

The Moose to Signal Mountain subarea is located in the central corridor of the park, as depicted by the dark red boundary in **Figure 2**. Visitors can pass through the Moose Entrance Station or Moran Entrance Station to access destinations within this subarea. This subarea contains some of GRTE's most prominent destinations, including but not limited to the Moose Visitor Center and Jenny Lake Visitor Center, the Jenny Lake Lodge and Campground, Jenny Lake Boating, the Jenny Lake Overlook, the Signal Mountain Lodge, the Signal Mountain Summit Overlook, and the Cascade Canyon Trail.

Moran to Leeks Marina

The Moran to Leeks Marina subarea is located in the northeast corner of the park, as depicted by the tan boundary in **Figure 2**. Visitors will typically pass through the Moran Entrance Station to access destinations within this subarea. Major attraction sites within this subarea include the Colter Bay Village, Jackson Lake Lodge, and Leeks Marina.

John D. Rockefeller Memorial Parkway

In 1972 Congress dedicated this parcel of land to John D. Rockefeller to recognize his contributions to U.S. National Parks. The JODR subarea is located between GRTE and YELL, as depicted by the dark gray boundary in **Figure 2**.[1] The major attraction site within this subarea is Flagg Ranch, where visitors can spend the night at Headwaters Lodge and participate in a variety of outdoor activities such as hiking or fishing in Snake River.

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[1] The southern boundary of the JODR subarea overlaps with the northern boundary of the Moran to Leeks Marina subarea because both subareas utilize Lizard Creek traffic volumes as a datapoint in the exploratory analysis.

Study Period

This subsection provides context for the July 16 through August 9, 2021, study period. **Figure 3** presents the total number of recreation visits to GRTE per year for 2000 through 2021, as reported by the NPS Visitor Use Statistics. The number of total annual recreation visitors has increased steadily from just over 2.5 million in 2000 to just under four million in 2021. Visitor numbers decreased slightly 2019–2020 likely due to COVID-19 health concerns and travel restrictions but rebounded sharply in 2021. As the data in **Figure 3** illustrate, the data collected as part of this study were collected during the busiest year at GRTE in the last two decades.

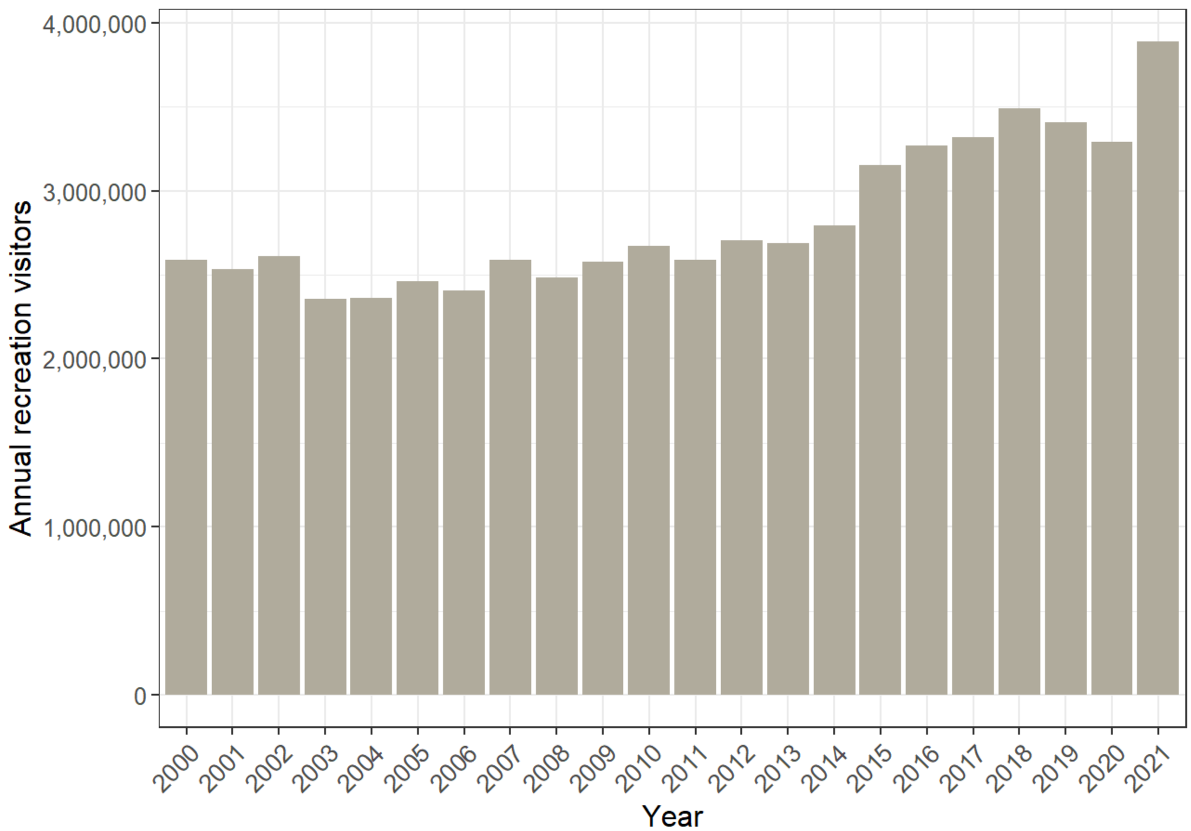

Figure 3. Total number of annual recreation visits to GRTE: 2000–2021.

Figure 4 presents the total number of recreation visits to GRTE by month in 2021. These results suggest the study period occurred during the peak period of visitor use (June through August). Correspondingly, the results presented in this study provide insight into transportation and visitor use conditions during the peak period of visitor use in GRTE during 2021.

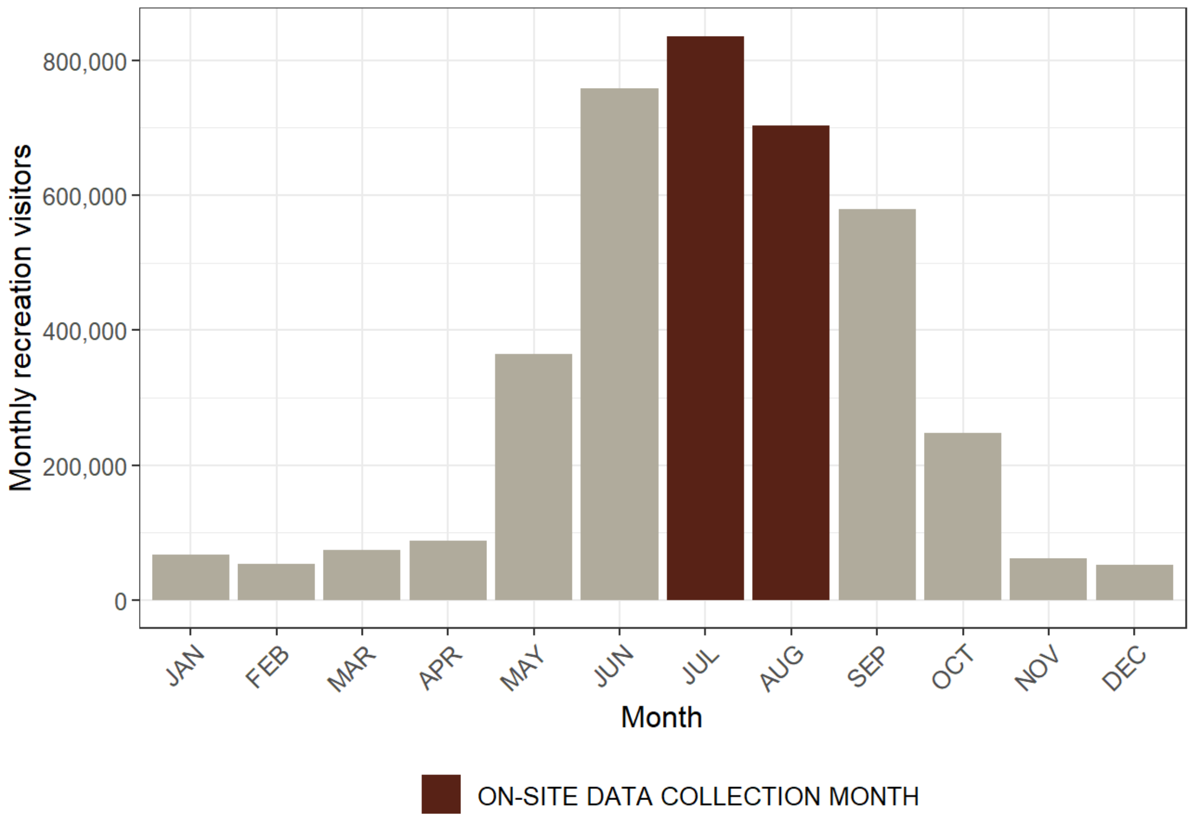

Figure 4. Total number of monthly recreation visits to GRTE in 2021.

On-Site Data Collection

Four types of data were collected in GRTE during the study period: (1) Bluetooth passive mobile data, (2) traffic counts, (3) number of vehicles parked counts, and (4) trail counter calibration counts. Data collection services included project planning and coordination, safety and operations oversight, equipment procurement, equipment deployment and retrieval, field data collection, and data processing. Resources, equipment, and current technologies were utilized to collect accurate data, with special attention to directing a safe, discreet, and environmentally responsible work effort in the park. Equipment was monitored and inspected at least every 24 hours to ensure it was operating properly and was secured to or near the roadway. Inoperable equipment was repaired or replaced as soon as vehicle traffic permitted safe access to the roadway.

The following subsections describe on-site data collection methods and analysis protocols for each of the four data types in more detail. Appendix 1 features a table of coordinates of on-site data collection locations from the 2021 study period. **Table 1** below summarizes major data sources collected as part of this study, as well as the quantity/sample size and the dates represented in the sample. **Figure 5** shows the locations of data collection devices that were deployed as part of the field work for this study. Data can be collected for different time periods and length of time and still provide valid results. All data collected is a snapshot in time. Some, such as Wejo connected vehicle data contain a bigger snapshot in time with a larger sample size, while others (Bluetooth, parking, etc.) are a smaller snapshot in time with a smaller sample size. However, all data sources, when evaluated collectively, are valuable in helping tell the overall transportation and visitor movement story.

Table 1. Major data sources collected for this study.

Data Source	Description	Quantity/ Sample Size	Dates
Wejo Connected Vehicles	Connected vehicle location data providing origin/destination, routing, speeds, and event data	Full Sample: 1.58m raw trips Detailed Sample: 80,000 trips	May - September, 2021
Traffic Counters	Temporary pneumatic tube counters that collect data on volumes of traffic	16 counters	August 6-8, 2021
Parking Video Monitors	Traffic Monitor video recording of parking lot entries/exits, calibrated to daily early AM parking counts; helps in assessment of the number of vehicles parked and turnover	22 parking locations	Colter Bay: July 16-26, 2021 All Others: August 6-8, 2021
Bluetooth Devices	Bluetooth device detectors provide passive mobile data source showing linked trip patterns within specific timeframes	22 detectors; 20,477 trips	August 6-8, 2021
Trail Counters	Calibrated trail counters	12 trail locations	July 15-August 15, 2021

Wejo Connected Vehicle Data

To supplement field data collection, passive mobile data were purchased from vendor Wejo for the period of May through September 2021. Wejo mobility data is derived from connected vehicles, which regularly upload both location data (GPS coordinates and timestamps of the vehicle at regular intervals) as well as event data (coordinates and timestamps of discrete events, such as power on/off, sudden braking, and hard acceleration). Wejo data is anonymized and provided at the trip level (beginning with a vehicle turning on and ending when the vehicle turns off). The data was aggregated across locations and time periods to ensure no individually identifiable information was included in this analysis. Based on these data sources, analyses of origin/destination travel patterns, parking patterns, traffic speeds, and potential safety-related indicators were developed by the project team.

Two versions of this data were used in developing analyses presented in this report. The full May-September data set (approximately 1.58 million raw trips) was used to generate parkwide parking

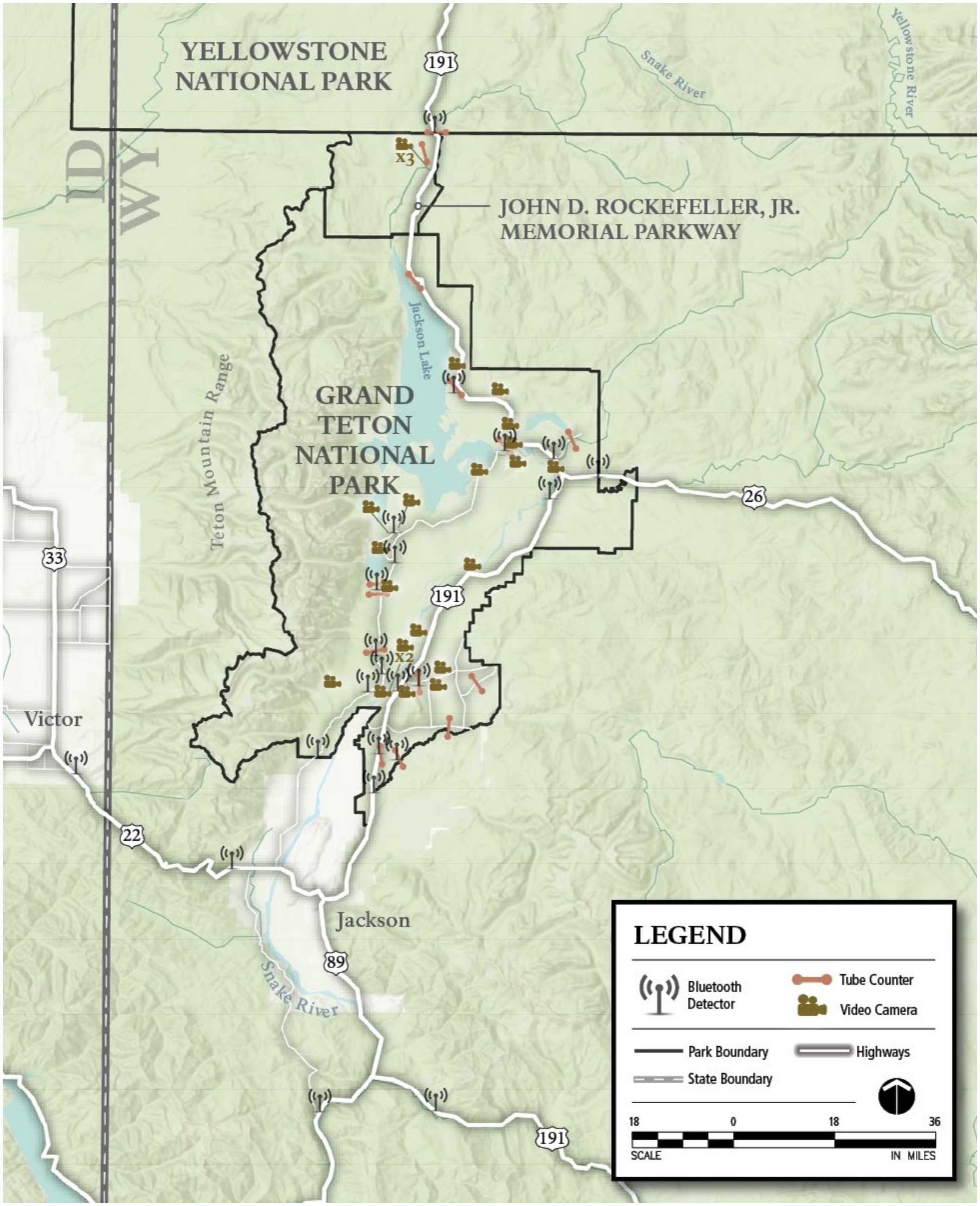

Figure 5. Locations of data collection devices.

activity/dwell time[2] estimates, as well as estimates of speeds, volumes, and safety-related incidents on the regional roadway network. A subset of this data (approximately 80,000 trips) was used for more detailed analysis of park-level origin/destination patterns, parking circulation, and other detailed analyses.

Traffic Volumes

Average Daily Traffic (ADT) counts were conducted at 16 locations using pneumatic tube counters between August 6 and August 8, 2021 (referred to hereafter as the “sampling period”). These data are supplemented by ADT data that the park is collecting with their tube counters. Hourly and daily traffic volumes, directional distributions, and vehicle classification was collected at each location.

A streamlined data cleaning process involving treatment of outliers and missing data was applied to all raw traffic datasets summarized in this report and used as inputs and indicators in the regression models. During the data cleaning process, raw datasets were screened for statistical (extreme) and substantive outlier values, which were removed from the datasets. For daily-level datasets, dates with five or more missing or outlier hourly counts were dropped. For dates with four or fewer missing or outlier hourly counts, hourly counts were imputed with values from all non-missing counts based on the average hourly count by location, day of week type (weekend/holiday vs. weekday), and hour of the day. Some raw traffic volume datasets contained large gaps of missing or suspiciously low count data. In cases when there were at least 24 hours of missing or low count data, the data were imputed with values from all or a subset of the non-missing data based on the average hourly count by location, day of week type (weekend/holiday vs. weekday) and hour of the day. Imputed values symbolized in yellow on descriptive figures of daily traffic volumes and in regression scatterplots in Appendix 3–Appendix 8.

Number of Vehicles Parked and Turnover

Travel Monitor video systems were used to record vehicle movements at 22 locations from 6:00 a.m. to 6:00 p.m. At the parking locations, the videos were processed to record vehicles entering and exiting a parking area. Baseline parking counts were also performed early in the morning (approximately 5:00 a.m. to 7:00 a.m.) on each day. This data was used with the vehicle volume data to calculate the number of vehicles parked and an estimated turnover rate. The turnover rate was estimated for the period from 10:00 a.m. to 4:00 p.m., roughly corresponding to the parkwide parking peak, rather than the entire day so the estimated turnover would not be underestimated by including periods of low parking activity. Parking capacities were obtained by comparing park-provided

[2] Wejo trip data does not directly allow measurement of parking durations or dwell times. In order to provide inferred dwell time estimates, vehicle-off, and subsequent vehicle-on events were spatially matched. This method provides estimated dwell time distributions for parking areas that pass reasonableness checks, since over- or under-estimates of trip duration due to mismatched trips should cancel each other out across large samples sizes. However, potential spatial errors (as well as privacy considerations) preclude using this approach to chain together trips into tours.

geographic information systems (GIS) location parking data. The capacities for each lot and the source for each are presented in **Table 2**.

Table 2. Locations of parking, capacities of each, and data sources for each.

Location	Capacity	Source
Flagg Ranch	252	Park GIS Data
Leek's Marina	84	Park GIS Data
Jackson Lake Lodge	650	Counted (GIS data did not include cottage parking)
Jackson Lake Dam (Lower)	22	Counted (GIS data refers to lots south of river)
Signal Mountain Lodge	300	Counted (GIS data did not include campground parking)
Pacific Creek Landing	24	Counted (GIS data included additional spaces)
Cathedral Group	24	Counted (GIS data included additional spaces)
String & Leigh **Lake**s	215	Park GIS Data
Jenny Lake Overlook	20	Counted (GIS data listed two spaces as large spaces that are used by multiple small vehicles)
South Jenny Lake Visitor's Center	412	Park GIS Data
Death Canyon	145	Based on highest parked vehicles observed since parking is designated but spaces are not delineated
Craig Thomas Discovery Center	178	Park GIS Data
GRTE **HQ Parking**	92	Park GIS Data
Moose **Boat Ramp**	39	Park GIS Data
Black Tail Butte	10	Park GIS Data
Mormon Row	40	Counted (Missing from GID data)
Schwabacher's Landing	16	Counted (Missing from GID data)
Deadman's Bar	30	Park GIS Data
Signal Mountain Summit	21	Park GIS Data

Bluetooth Detection Units

Bluetooth detection units were installed at 22 key locations across the park and surrounding area. These devices passively detect Bluetooth-enabled devices (such as smartphones and Bluetooth-enabled vehicle media systems) within approximately 500–1,000 feet and record a timestamp and unique device identifier for each device that is detected. Where a unique device ID is observed at multiple detectors across the park, trip patterns can be inferred. Coordinates of Bluetooth detector locations within the park are shown in Appendix 1. The total sample of trips detected within the study area was 20,477.

Bluetooth device tracking has played a pivotal role in the past in tracking travelers' patterns, such as for a similar study performed for YELL in 2016, though this type of data has dealt with increasingly greater limitations. The data relies on persistent device IDs to track the same user from point to point. However, in light of emerging privacy concerns, many newer Bluetooth devices change their own ID periodically, meaning that the same device could be detected in two locations, but due to differing device IDs would be registered as two unrelated observations. It is not clear the share of devices that shuffle their ID periodically, or the frequency of which the device IDs are changed. Therefore, there is reduced confidence in whether a short trip is truly the extent of the trip made by the owner of the device or if it was simply part of a larger trip that was cut off due to an ID change. This makes it difficult to make inferences about the trip patterns of visitors beyond short trip segments between two detection stations. Usability of passive Bluetooth detection data is also limited by the necessity of deploying detection units in fixed locations, which can make obtaining of meaningful data limited in a large area with various different routes and destinations. It was not feasible to place Bluetooth detection units at all the locations of interest as well as at intermediate locations along prominent corridors such as Teton Park Road or any of the highways. To address these limitations, additional secondary data were collected to get more representative trip pattern data across the park.

Trail Calibration

Field staff collected visitor use counts via direct observation for five hours at 13 trail counter locations July 16 through July 29, 2021 (see Appendix 1 for coordinates). The observation counts were recorded on site via a PC tablet using a log form developed in Qualtrics (see Appendix 2 for sample header and data collection entry pages from the log form). The direct observation counts (or "calibration counts") were used to correct and adjust as needed (i.e., calibrate) the raw trail counter data from 12[3] locations. Raw trail counter data were delivered by NPS and screened for statistical (extreme) and substantive outlier values, which were removed from the calibration regression and results summaries.

Regression analyses were conducted to model the relationships between raw trail counter data and the calibration counts collected via direct observation. These analyses were conducted to derive an empirical basis to convert raw trail counter data to estimates of actual visitor use. Separate regression models were estimated for each trail counter, with direct observation counts (or "calibration counts") as the dependent variable and corresponding trail counter data as the independent variable in each model to estimate correction factors (i.e., calibration multipliers) for the trail counter data.

The Results section presents the final regression models, as well as the calibrated daily (24-hour) and hourly visitor use volumes (arrivals and departures) for each trail counter location. These results are presented for July 15 through August 15, 2021. For daily summaries for each counter, all days with five or more hours of combined missing trail counter data or outlier values are excluded. All days with four or fewer combined missing data or outlier values are included in daily summaries using imputed values to replace missing and outlier values. Imputed values were calculated as the average of all calibrated counts by location, hour, and day of week category. Missing data or outlier values were excluded from hourly summaries (i.e., no imputed values were included).

[3] The String Lake Loop South trail counter malfunctioned during the calibration data collection period. Therefore, calibration results are presented for the 12 trail counter locations with available trail counter data.

Secondary Data Types and Sources

Not all data used in the GRTE TVM study were collected during the study period. The research team also employed regional data, data from other studies conducted in GRTE in 2021, and park-collected data, as described in the subsections below.

Regional Data

ADT data for the regional gateway highways and highways providing direct access to GRTE were gathered from two sources: Wyoming Department of Transportation (WYDOT) and Idaho Transportation Department (ITD). The regional ADT data provides a big picture view of the average level of traffic in and out of the region and it provides a comparison of which highways are traveled more than others.

Colter Bay Visitor Use and Experience Study – Number of Vehicles Parked Data

As part of the 2021 Colter Bay Visitor Use and Experience Study, hourly number of vehicles parked counts were collected in the Colter Bay parking lot between July 16 and July 26, 2021. These cleaned counts were used as a key indicator measure of parking occupancy rates in exploratory analysis and statistical modeling methods described in the next subsection and presented in the Results section of this report.

Taggart and Lupine Meadows Parking and Trail Counter Calibration Counts

During summer 2021, a study was conducted by Pennsylvania State University that included the collection of parking occupancy rates and trail counter calibration counts at Taggart and Lupine Meadows. Cleaned parking counts from both the Taggart and Lupine Meadows parking areas were used as key indicator measures of parking occupancy rates in exploratory analysis and statistical modeling methods described in the next subsection and presented in the Results section of this report. Additionally, the North Taggart trail counter calibration coefficient produced by this study was applied to raw North Taggart trail counts provided by NPS so that the calibrated trail counts could be used in the exploratory analysis and statistical modeling presented in this report. All other trail counter data presented in the report are calibrated with calibration counts collected as part of the larger project.

Park-Collected Data

GRTE collects a variety of data regarding transportation and visitor use patterns in the park and surrounding area. The park provided access to these data as part of this study. A subset of these data are summarized in the Results section and related appendices and were included in exploratory analyses and statistical modeling.

Park-owned traffic and trail counters were installed along key park roads and trails between 2015 and 2021[4] to better understand levels of transportation and visitor use in the park. These traffic and trail count data were delivered to the research team, and where applicable, descriptive summaries of these

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[4] Date ranges of traffic count data varied by counting location, and in some cases, there were periodic gaps in the data collected.

data are included in the Results section of this report. Furthermore, a subset of park-owned traffic and trail count data were used as inputs and indicators in relationships featured in exploratory analyses and statistical modeling.

Jenny Lake Boating provides shuttle services across Jenny Lake from the East Boat Dock near the Jenny Lake parking lot to the West Shore Dock, near Hidden Falls and Inspiration Point (**Figure 6**). The shuttle transports visitors in both the eastbound and westbound directions from 7:00 a.m. through 7:00 p.m. during the summer season. Park staff provided the research team with hourly Jenny Lake Boating shuttle ridership counts during the hours of operation from August 4 through August 11, 2021. The hourly counts are based on Jenny Lake Boating shuttle ticket sales and summarize the number of passengers traveling from the east shore to the west shore only. Descriptive summaries of the raw Jenny Lake Boating shuttle ridership counts are included in the Results section of this report. Jenny Lake Boating shuttle ridership count data were also used as inputs and indicators in a subset of relationships featured in exploratory analyses and statistical modeling.

Figure 6. Jenny Lake boating shuttle (Photo credit: Jackson Hole Traveler).

Exploratory Analyses and Statistical Modeling

A series of regression models was developed to evaluate relationships between transportation input variables and key indicator variables regarding traffic, parking, and trail use conditions in the park. All input and indicator variables were selected in consultation with park staff.

At the regional and parkwide scale, models were estimated with official entrance station inbound traffic volumes as the indicator variable (i.e., dependent) and regional highway and parkwide perimeter inbound traffic volumes as separate input variables (i.e., independent).[5]

Two categories of models were constructed for subarea relationships: 1) models estimated for exploratory purposes only, and 2) models estimated for the purposes of developing an Excel-based data visualization tool. Both sets of regression models used the same indicator variables (i.e., dependent variables). The exploratory models included a range of input variables (i.e., independent variables) specified at the hourly and daily level. Models estimated for the Excel-based tool included hourly parkwide or entrance station traffic volumes as the input variable (i.e., independent variable). Data from the selected input and indicator locations from June 1 through August 31, 2021 (referred to hereafter as the "counting period") between the hours of 6:00 a.m. and 8:59 p.m. were used to estimate all regression models.

For all models, preliminary hourly regression models were produced with varying lag times applied to the indicator variable (i.e., no lag, 1-hour lag, 2-hour lag) to account for potential impacts of travel time between the input and indicator variable locations. Models with and without a lag time were evaluated conceptually and statistically. Preliminary hourly regression models were also produced with and without an intercept term to account for potential impacts of overnight use in the park.

For the exploratory models, all hourly and daily regression model results are reported as linear regression models with intercept and included observed and imputed values in the analysis. **Table 3** provides a summary of imputed data used to estimate the exploratory models by data type, location, and date. These results are summarized in tabular form in separate subsections of this report, with scatterplot results presented in Appendices 3-8.

The regression models developed for the Excel-based data visualization tool were estimated using only observed values (i.e., imputed values were not included in the analyses). The following model fitting and selection steps were applied to select the final model for each regression model included in the Excel-based tool[6]:

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[5] Regressions with inputs of regional highway traffic volumes were produced with weekend and holiday dates only to eliminate impacts from weekday commuter patterns.

[6] Model fit refers to the degree to which the independent variable (x-axis variable) explains variation in the dependent variable (y-axis variable). The greater the amount of variation in the dependent variable that is explained by the independent variable, the better the model "fits" the data and supports data-driven insights about the

1. Produce linear and log-linear (logarithmic transformation to the dependent variable) scatterplots (see examples presented in **Figure 7** and **Figure 8**).

Table 3. Dates when imputed values in regression analyses, by data type, location, and direction

Data type	Location name	Direction	Dates with imputed values
Inbound traffic volumes	Poker Flats	Northbound	June 15-June 17; July 20-July 29; August 3-August 11
Inbound traffic volumes	Moose	Northbound	June 24-July 22
Inbound traffic volumes	South Gate of Yellowstone	Southbound	June 1-June 30; August 31
Interior roadway traffic volumes	Jenny Lake One Way	Southbound	June 20-July 9; July 23-August 26
Interior roadway traffic volumes	String Lake South	Eastbound	June 21-July 2
Interior roadway traffic volumes	String Lake South	Westbound	June 21-July 2; July 29-August 26
Interior roadway traffic volumes	String Lake South	Total	June 21-July 2; July 29-August 26

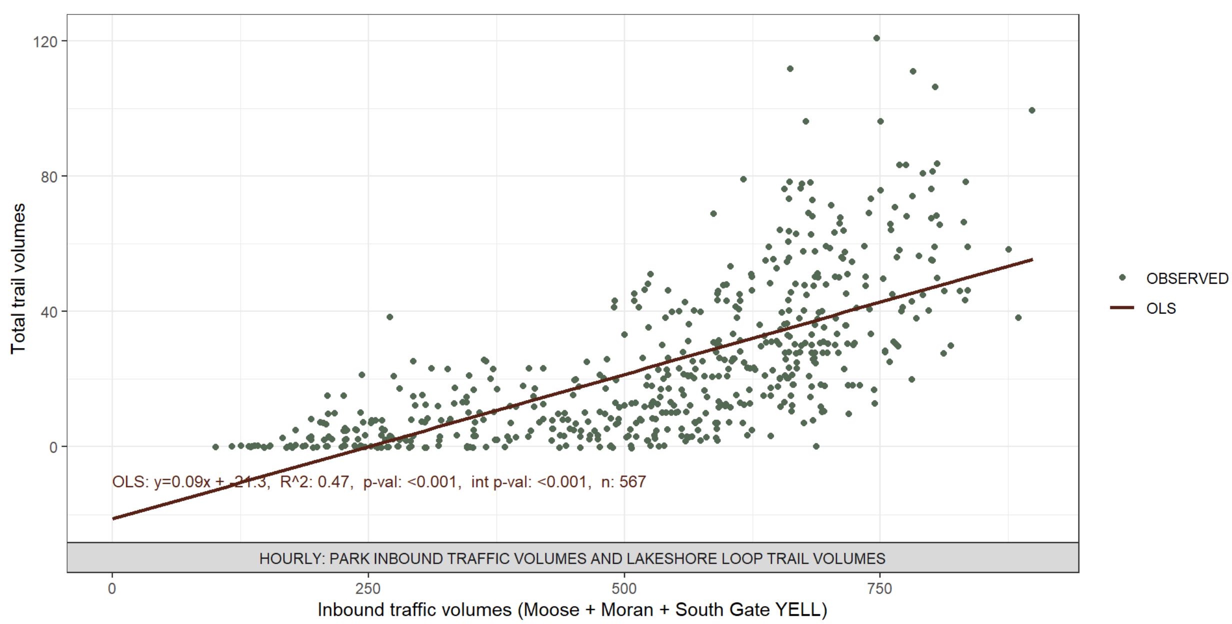

Figure 7. Example of scatterplot produced to examine if the relationship between the dependent and independent variable was linear in nature: Lakeshore Loop trail volumes and inbound traffic volumes.

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relationship between the two variables. Mean absolute prediction error is a key measure of model fit used in this study to help with model selection, as described below.

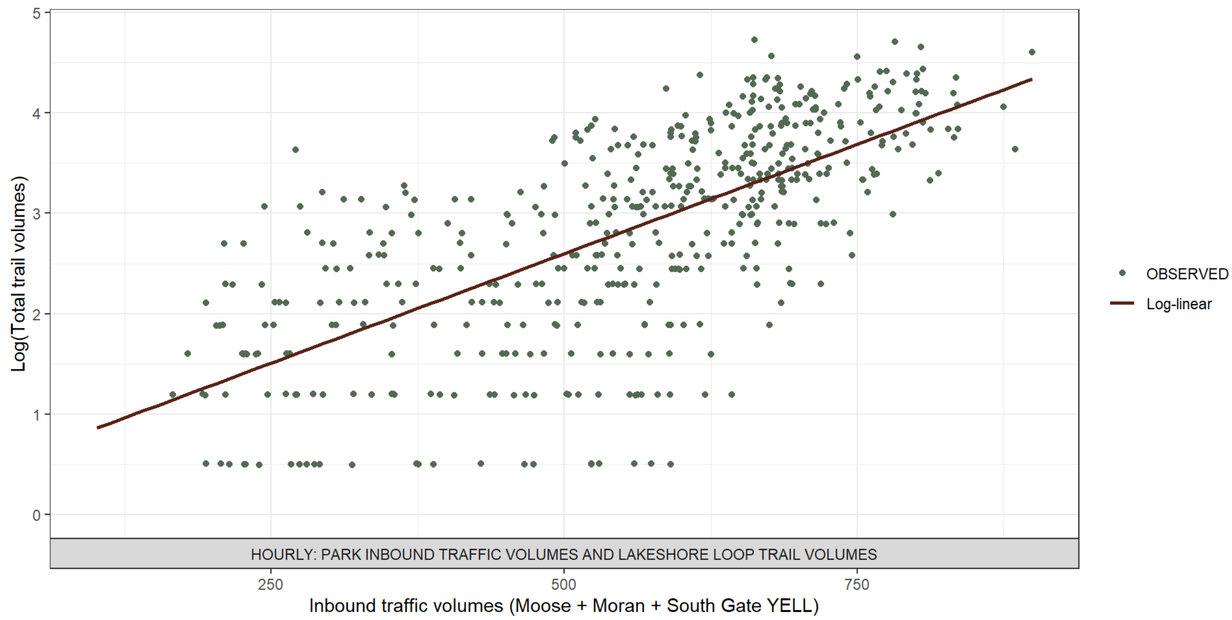

Figure 8: Example of scatterplot produced with log-transformed dependent and linear independent variable: Lakeshore Loop trail volumes and inbound traffic volumes.

2. If the linear scatterplot supports an ordinary least squares (OLS) linear regression model based on visual inspection, then estimate an OLS linear regression model with intercept.

3. If the linear scatterplot does not support an OLS linear regression model, and the log-linear scatterplot appears to produce a linear trend based on visual inspection, or if the estimated OLS linear regression model includes a significant, negative intercept then continue to estimate regression models using alternative specifications. For example, the shape of the scatterplot presented in Figure 6 does not support a linear model. The example scatterplot presented in Figure 7 appears to produce a linear trend after log-transforming the dependent variable.

4. Estimate Poisson and negative binomial regression models[7] as alternatives to OLS linear.

5. Compare all models using the mean absolute prediction error (MAE).[8] The example presented in **Table 4** indicates the Poisson regression model has the lowest prediction error across all candidate models and should be selected as the final model.

[7] Poisson and negative binomial regression models were selected as the best alternative models for count data with zero values, the best models to represent the relationship at the lower end of both scales, and the best models with an appropriate degree of complexity to avoid model overfitting.

[8] The mean absolute prediction error was calculated as the average of the absolute difference between the actual value of the dependent variable and the predicted value of the dependent variable.

Table 4. Model comparison based on mean absolute prediction error (MAE): Lakeshore Loop trail volumes and inbound traffic volumes.

Linear Regression	Negative Binomial	Poisson	Average Value of Dependent Variable
12.874	11.676	11.619	23.885

6. Select the Poisson regression model for ease of interpretation unless the negative binomial model has greater than 25% improvement (reduction) based on MAE.[9]

The results for models estimated for the Excel-based tool are summarized in narrative and tabular form in separate subsections of this report, with scatterplot results presented in Appendices 4-9).

Excel-Based Tool

The data collected as part of this study and specific models estimated above were used to develop an Excel-based data visualization tool. This tool was designed to visualize significant relationships among transportation inputs and select indicators of traffic, parking, and visitor use conditions throughout the park at the hourly level. The tool is interactive and can be updated to help park staff assess the impacts of potential transportation and visitor use management scenarios across a 24-hour period. This study included a series of training workshops, a two-day virtual workshop, and a user manual to present the Excel-based tool.

[9] The percent difference in the mean absolute prediction error compared across all candidate models for each combination of independent and dependent variables ranged from 0.3% to 12.2%.

Results

In this section of the report, tabular, graphical, and descriptive results from the GRTE TVM study are presented. The results are organized into six subsections by geographic location. The first subsection summarizes regional- and parkwide-related results, and the proceeding subsections present results for each of the five geographic subareas (i.e., Gros Ventre/Antelope Flats, Moose-Wilson, Moose to Signal Mountain, Moran to Leeks Marina, and JODR).

Regional and Parkwide

In this subsection, regional and parkwide traffic conditions and visitor use patterns are described and summarized in tabular format.

Regional

Traffic Conditions

Traffic volumes on major regional highways near the park are shown in **Table 5**. The ADT values are rounded to the nearest 100 and are based on a yearly average.

Table 5. Average daily traffic of regional highways.

Roadway	Location	ADT	Source
Hwy 26	South of Hoback Jct	4,900	WYDOT
Hwy 191	Southeast of Hoback Jct	2,600	WYDOT
Hwy 22	Teton pass in Wyoming	7,500	WYDOT
Hwy 22	Teton pass in Idaho	6,900	ITD
US 89/191	Between Hoback Jct and Hwy 22	11,800	WYDOT
Moose-Wilson Road	South of GRTE	4,700	WYDOT
Hwy 287	East of Moran Jct	1,600	WYDOT

Visitor Use Patterns

Our first analysis of travel patterns is based on distribution of trips through regional gateways, which are defined as major roadways providing access into and out of Teton County, Wyoming, as well as the Jackson Hole Airport. **Table 6** and **Figure 9** show the distribution percentages from each gateway into the region—note that these are not necessarily visitors to GRTE, but the total number of trips into the region from the six gateways. Table 6 and Figure 8 show values for both the Wejo data (based on the detailed subsample of approximately 80,000 trips in July 2021) and the Bluetooth data (based on 20,477 trips in August 2021)—all values are within 7% or less between the two data sources. Notably, the airport gateway location is associated with more than twice as large a proportion of trips in the Wejo dataset compared to Bluetooth; a potential explanation for this discrepancy is that a higher proportion of connected vehicles may be present in rental fleets frequently traveling to and from the airport compared to other gateways, creating the anomaly of a greater share of Wejo trips observed at this location.

Table 6. Regional gateway traffic distribution percentages – (comparison of Wejo and Bluetooth derived data).

Location	Percent of Wejo detected trips	Percent of Bluetooth detected trips
Hwy 26/89, south of Hoback	21%	14%
Hwy 191, south of Hoback	11%	11%
Teton Pass	30%	33%
Hwy 287, east of Moran	12%	14%
Airport	11%	5%
YELL	15%	22%

The values in the bullets below from Wejo data show the share of trips from regional gateways that end within GRTE without intermediate stops (trips that come directly into GRTE and end within the park boundaries without stopping somewhere else along the way). These values are also depicted in **Figure 10**. Unsurprisingly, trips from the Dubois area (Highway 287 east of Moran) and YELL end in the park at much higher rates than trips arriving from other gateways since there are very few areas for vehicles to stop from those gateways before arriving at GRTE. Meanwhile, trips originating from Hoback Junction or Teton Pass are likely to stop in Jackson, Wilson, or other small communities or intermediate destinations in the region before arriving at GRTE. Trips originating at the Jackson Hole Airport, which is located within GRTE, also tend to end outside of the park, reflecting likely patterns of airport travelers going to in-town accommodations prior to traveling to the park or other locations in the region. Because the Wejo connected vehicle data does not provide persistent vehicle IDs, this analysis is limited to individual trips (defined by the vehicle turning on and off) and does not reflect the proportion of trips from these gateways that ultimately enter the park after one or more intermediate stops. **Table 7** shows the percentage of trips from each gateway that end in GRTE (based on Wejo data).

Table 7. Percentage of trips from each gateway that end in GRTE (via Wejo).

Gateway	Share of Trips that End in GRTE
Highway 26/89, south of Hoback	8%
Hwy 191, south of Hoback	4%
Teton Pass	13%
Hwy 287 east of Moran	64%
Airport	11%
YELL	56%

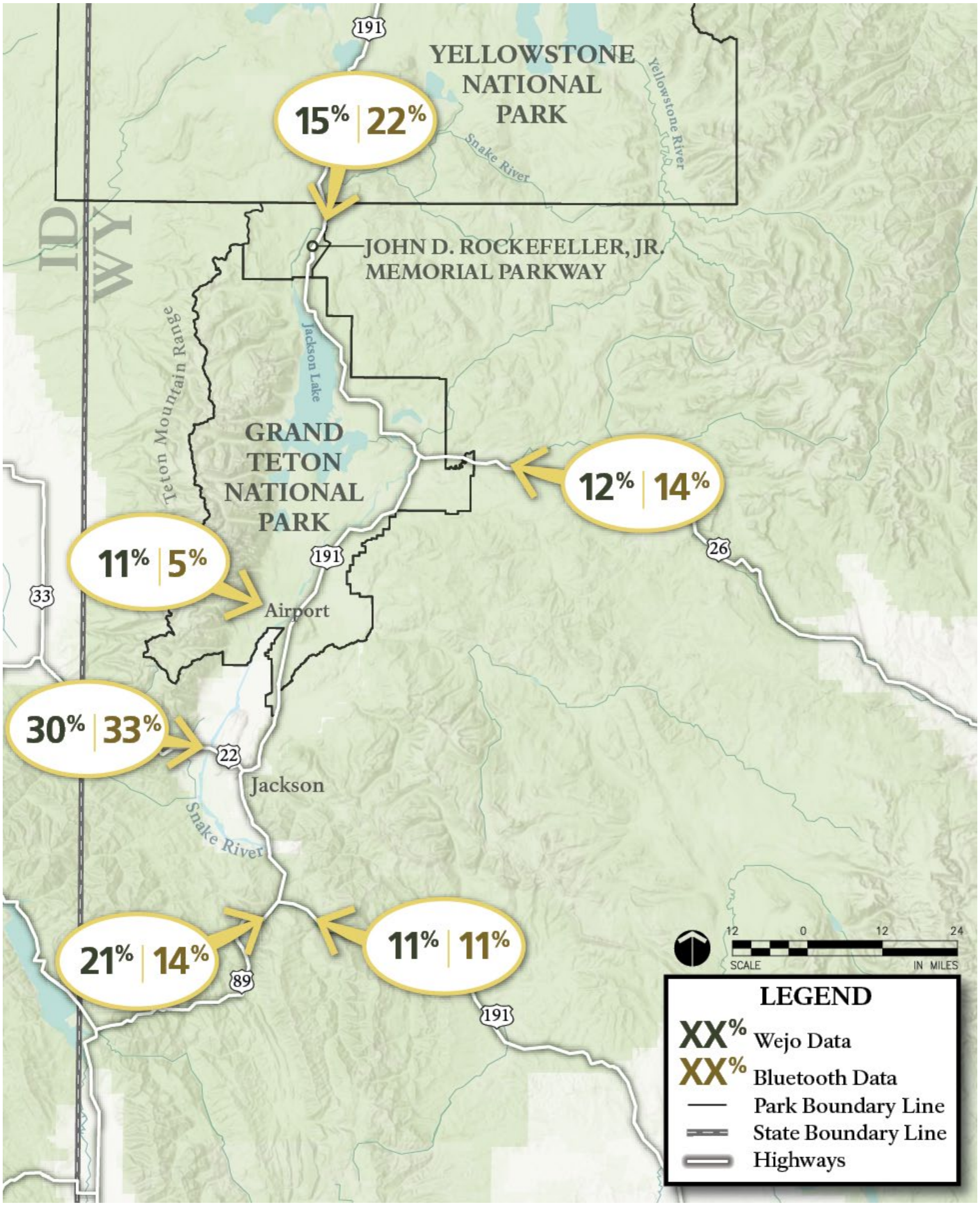

Figure 9. Percentages of trips entering the study area from gateways.

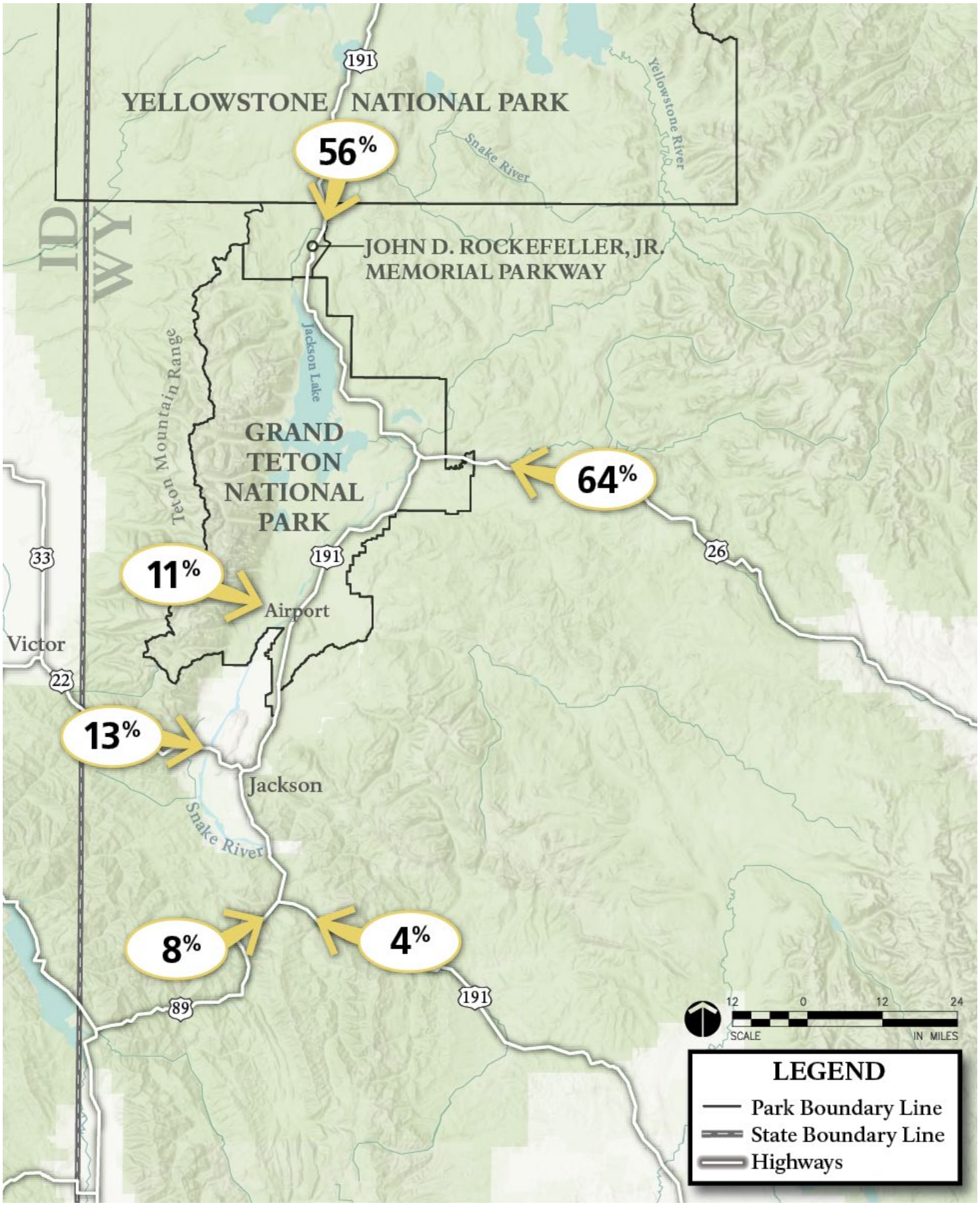

Figure 10. Share of trips from regional gateways directly entering GRTE.

Regional Trip Distribution—Wejo Data

The overall regional trip end distribution percentages from gateways, GRTE, and the town/county are shown in **Figures 11 through 18**. For each of these maps, the share of trips from a given gateway or subarea (park or town/county) to each of the other gateways or subareas is shown. It is important to note that these trips represent the path taken in one uninterrupted trip without the vehicle being turned off. For instance, if a vehicle originated from the Idaho side of Teton Pass, travels to the Town of Jackson, turns the vehicle off for a visit in town, then turns the vehicle on and continues their travel and ends their trip in GRTE – this "tour" is not represented in this data.

Figure 11 shows that of the 100% of trips originating from YELL, 56% ended their trip in GRTE and 28% ended their trip in Jackson or other non-park areas of Teton County.

Figure 12 shows that of the 100% of trips originating from GRTE, 70% ended their trip within GRTE and 20% ended their trip Jackson or other non-park areas of Teton County.

Figure 13 shows that of the 100% of trips originating from Jackson and non-park Teton County, 67% ended their trip within Jackson or other non-park Teton County, 13% ended their trip in GRTE, and 7% ended their trip on the Idaho side of Teton Pass.

Figure 14 shows that of the 100% of trips originating from Jackson Hole Airport, 72% ended their trip in Jackson or non-park Teton County, 11% ended their trip on the Idaho side of Teton Pass, and 11% ended their trip in GRTE.

Figure 15 shows that of the 100% of trips originating from the Idaho side of Teton Pass, 79% ended their trip in Jackson or non-park Teton County and 13% ended their trip in GRTE.

Figure 16 shows that of the 100% of trips originating from US-287 East (from the direction of Dubois), 64% ended their trip in GRTE and 26% ended their trip in Jackson or non-park Teton County.

Figure 17 shows that of the 100% of trips originating from US-191 South, 67% ended their trip in Jackson or non-park Teton County, 21% ended their trip somewhere south on US-89 in the direction of Alpine, and 7% ended their trip on the Idaho side of Teton Pass.

Figure 18 shows that of the 100% of trips originating from US-89 South, 78% ended their trip in Jackson or non-park Teton County, 10% ended their trip somewhere south on US-191 in the direction of Bondurant, and 8% ended their trip in GRTE.

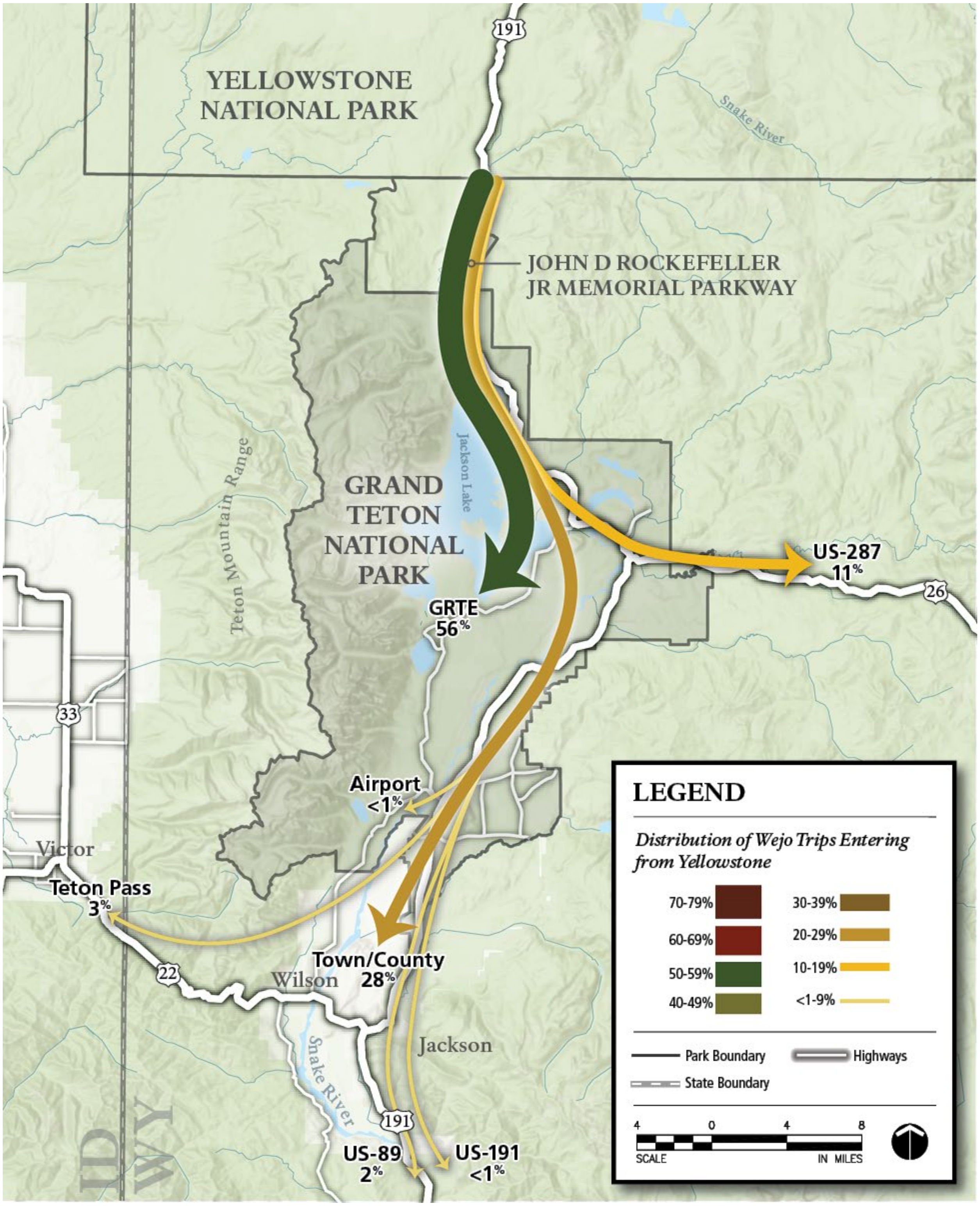

Figure 11. Regional trip distribution from YELL.

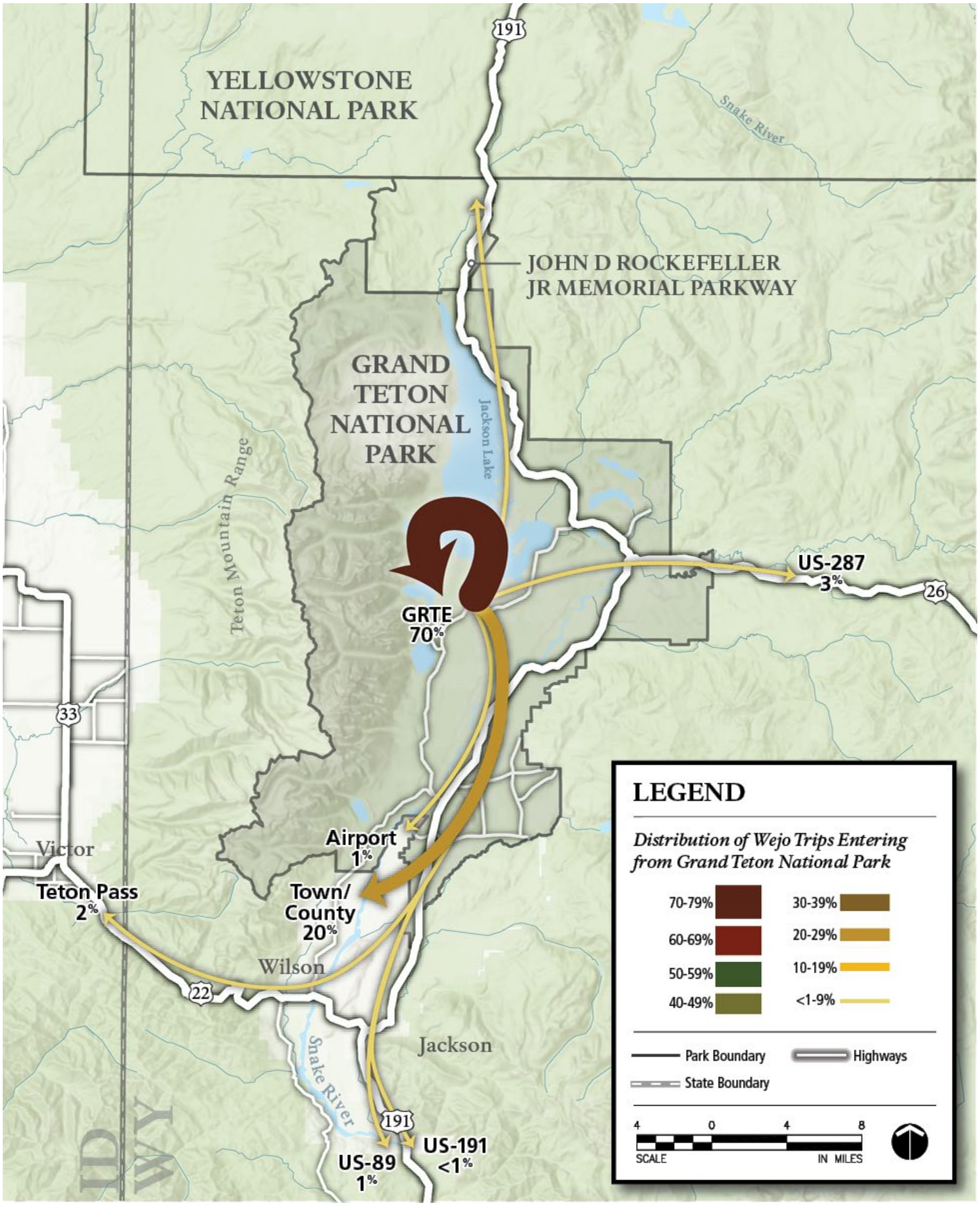

Figure 12. Regional trip distribution from GRTE.

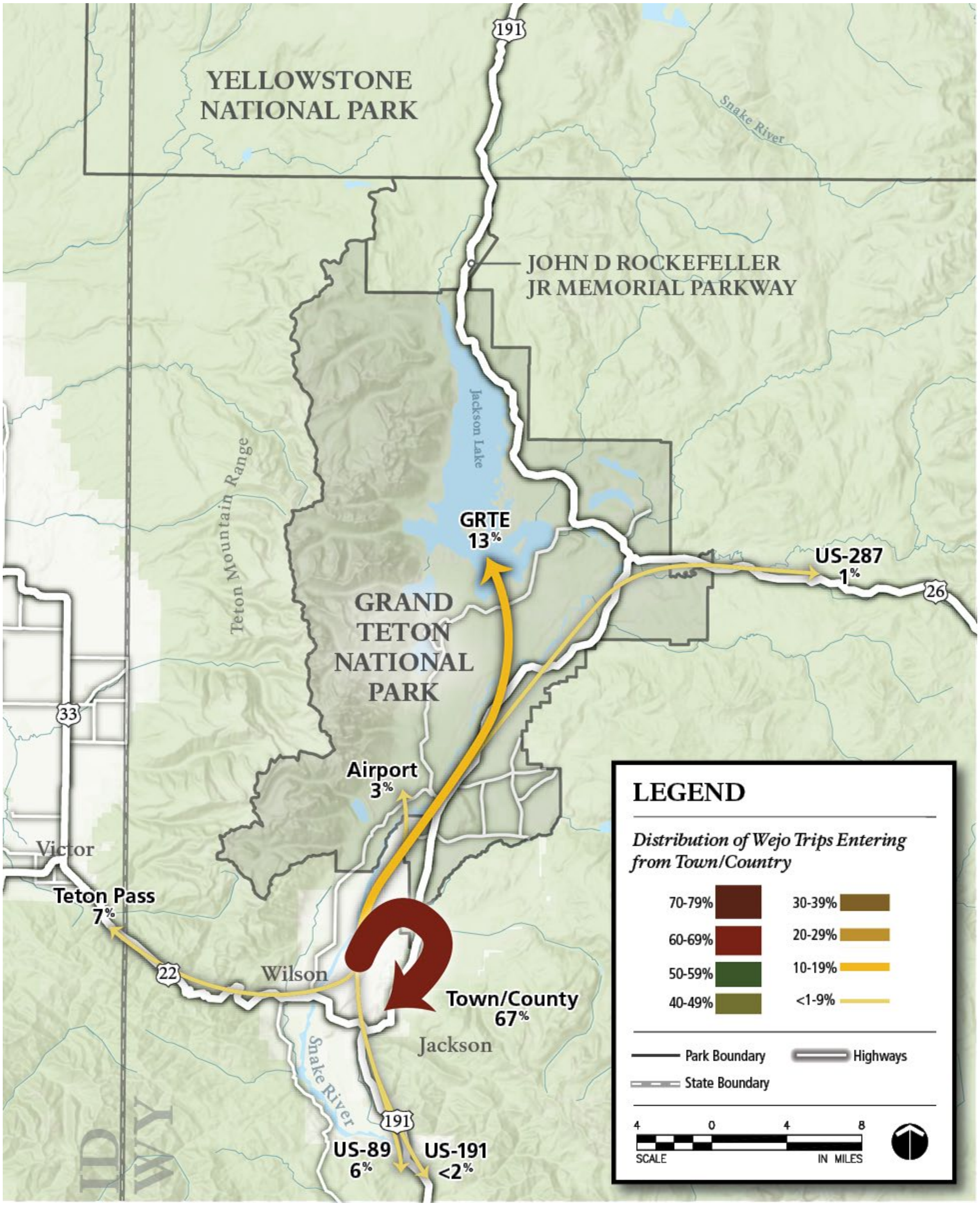

Figure 13. Regional trip distribution from Jackson and non-park Teton County.

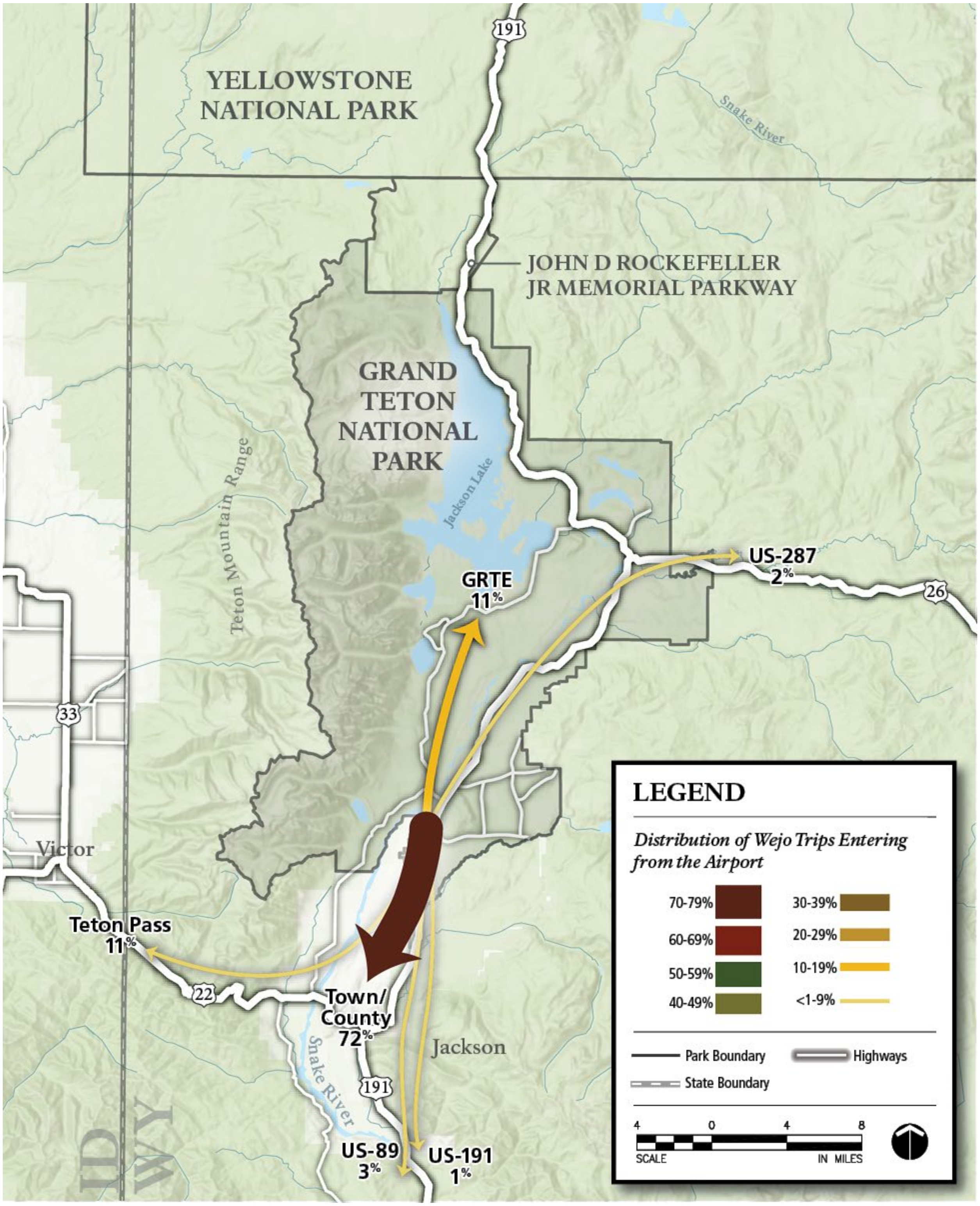

Figure 14. Regional trip distribution from Jackson Hole Airport.

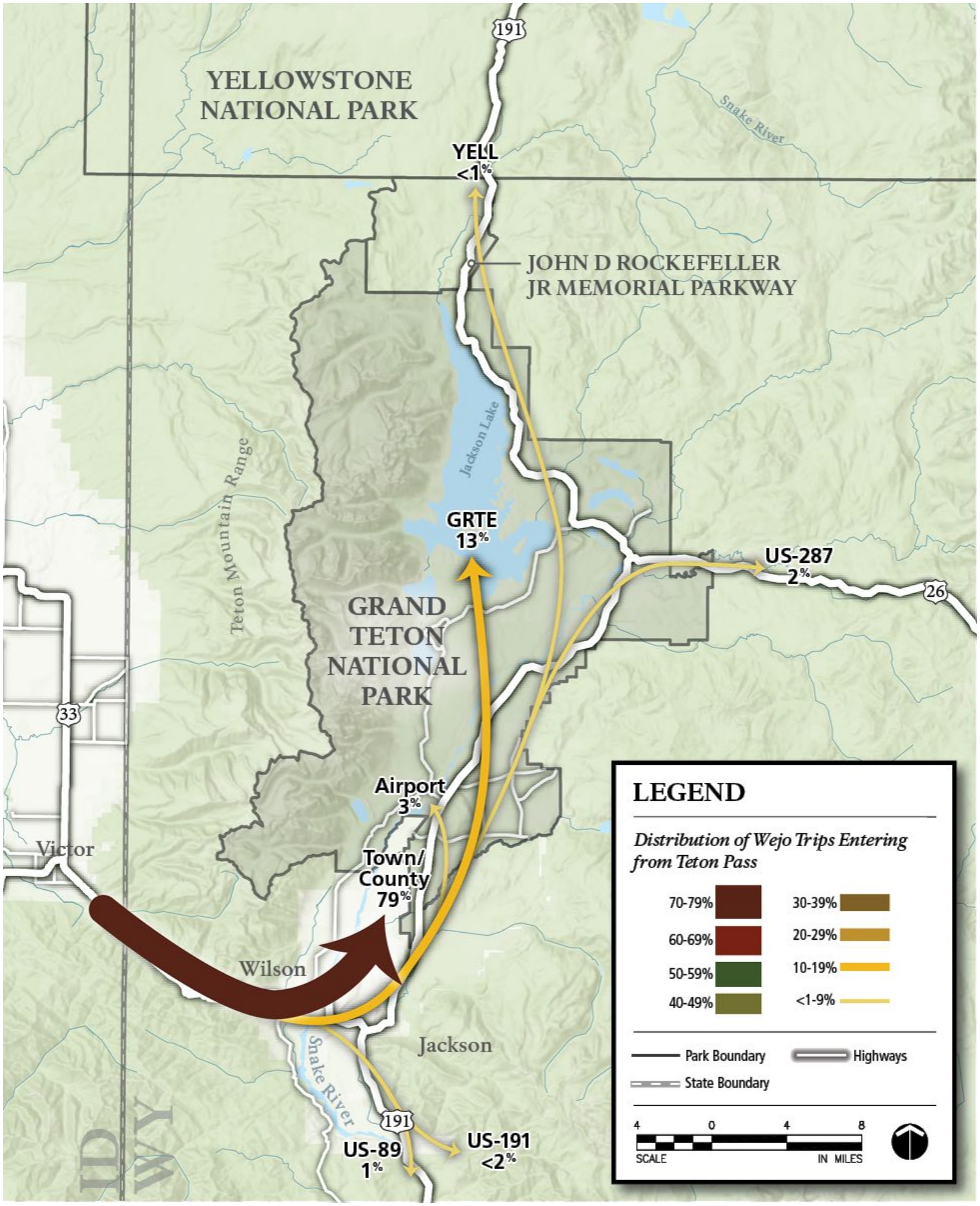

Figure 15. Regional trip distribution from Teton Pass.

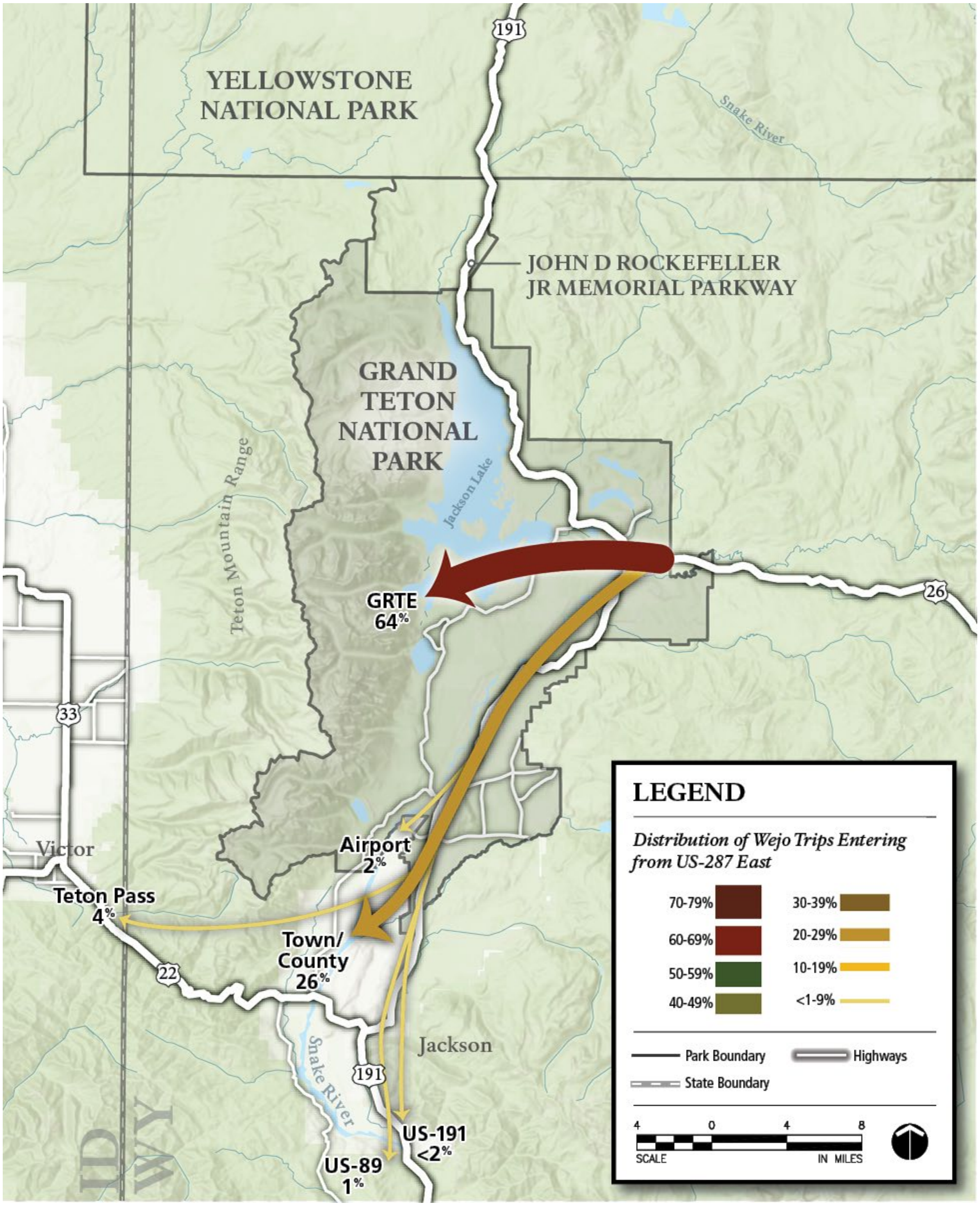

Figure 16. Regional trip distribution from US-287 East.

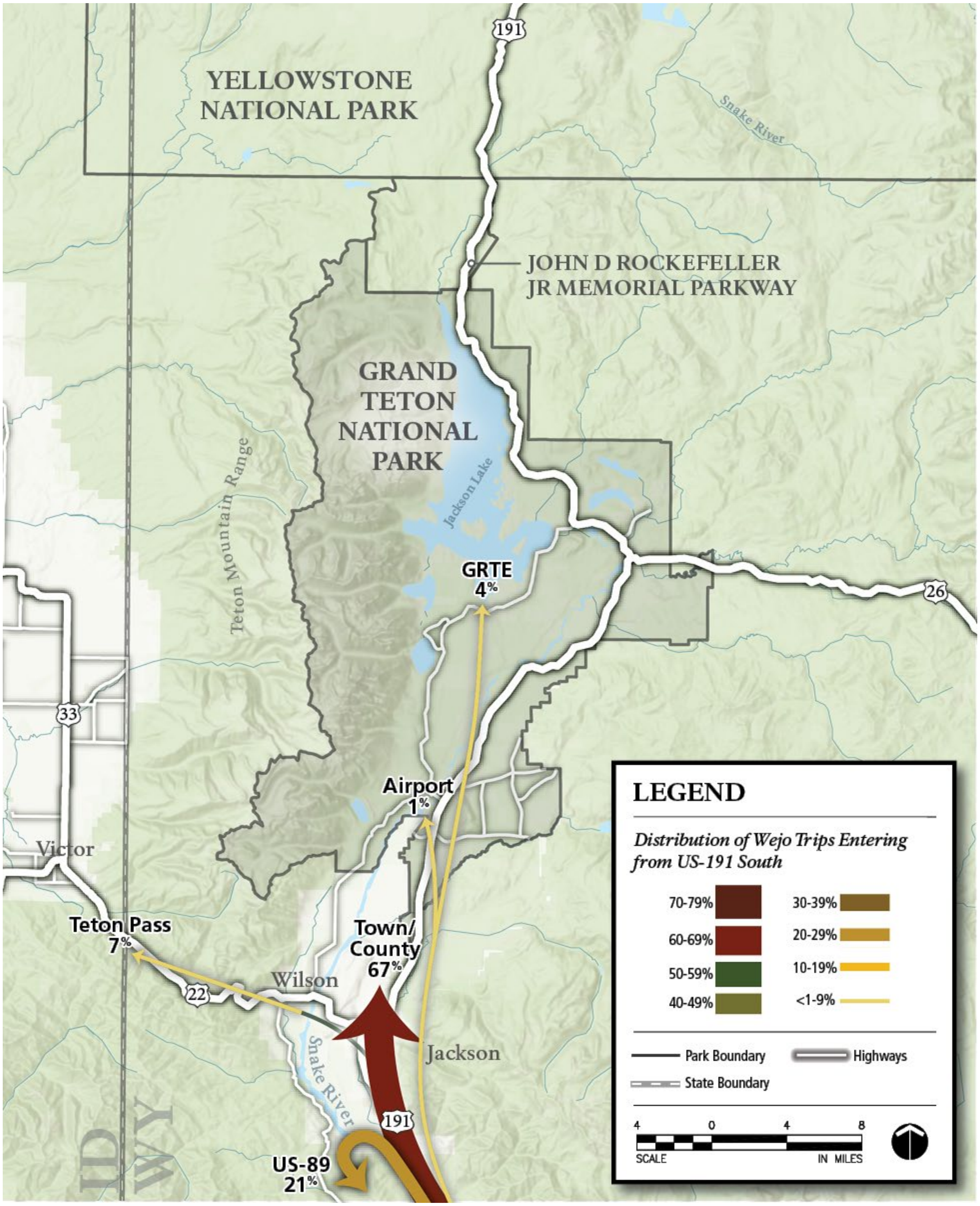

Figure 17. Regional trip distribution from US-191 South (Hoback Junction).

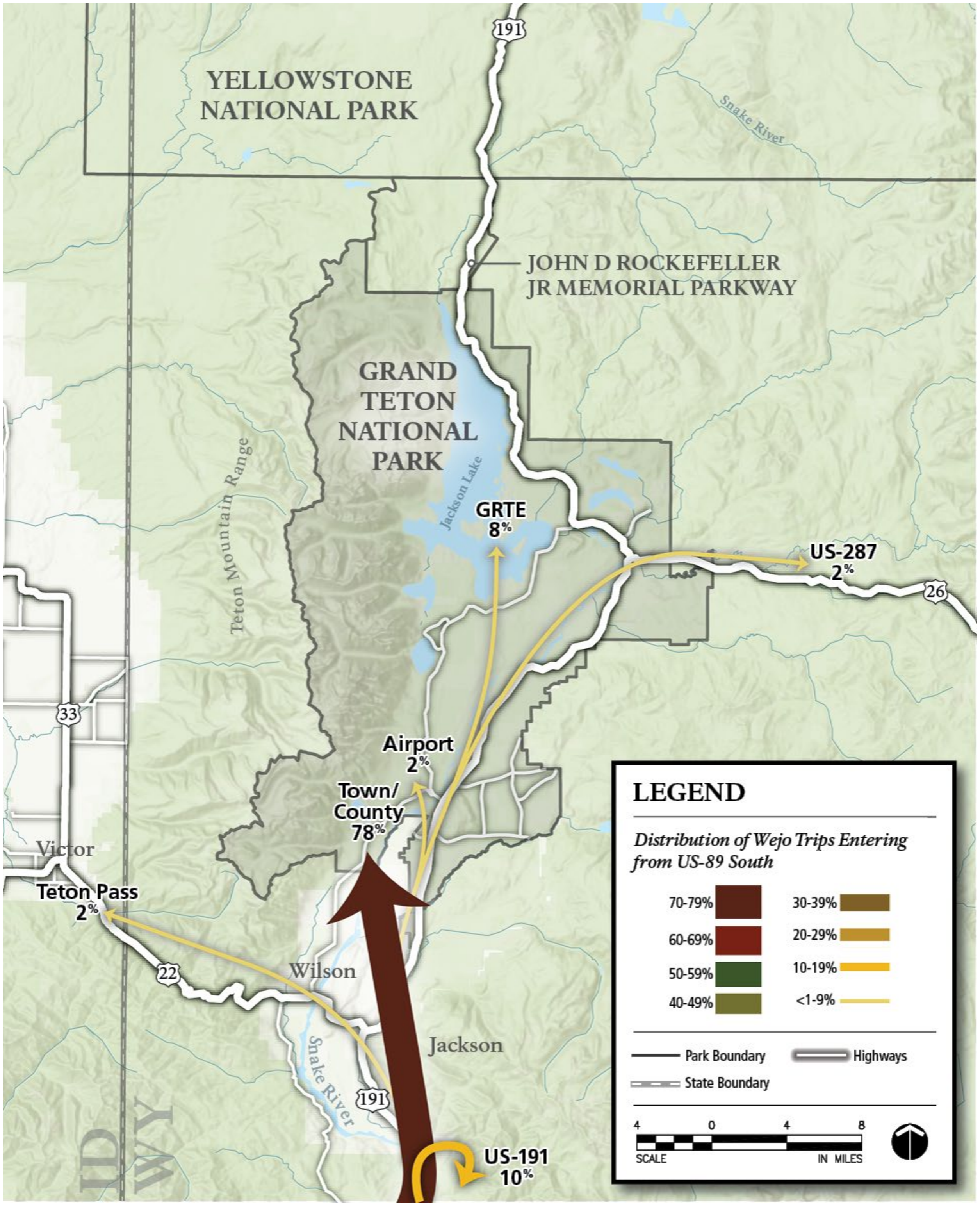

Figure 18. Regional trip distribution from US-89 South (Hoback Junction).

Regional Trip Distribution—Bluetooth Data

Bluetooth data was used to track general patterns of trips throughout the area over the course of a day. This data approximately tracks the travel patterns of visitors based on when their Bluetooth device is recognized with the Bluetooth stations. The full trip patterns, along with subsets for visitors passing through each park entrance (in either direction) or external gateway can be explored in an interactive portal at the following web address: https://flowmap.blue/1bropMxcisD6vNJnZXmD8NYYF0mTqOA693VL6BXMyb-o/baba278

This analysis was not intended to track specific paths throughout the park, because even the most common paths through the park accounted for a very small portion of the total trips observed by the Bluetooth sensors. This indicates that these paths are far from telling the full story, and the sample size of each path is small enough that they are rather sensitive to anomalies such as one large group with a large number of Bluetooth devices over representing one specific path. The data obtained from Wejo, while limited to only single trips, better addresses the question of matching origins and destinations (see Figures 11 through 18).

Figures 19 through 26 provide depictions of general patterns of trips in proximity to “stations” where Bluetooth devices were located. The number of trips that passed within range of each station that passed through Teton Park Road near Moose are presented in **Figure 19**. The most common stations visited on trips passing through Teton Park Rd near Moose are Teton Park Rd near Beaver Creek and Highway 89 South of Gros Ventre River, indicating that most trips entering the park near Moose continue through the Moose entrance, and most trips exiting the park near Moose continue south on Highway 89.

The number of trips that passed within range of each station that passed through the North entrance near Flagg Ranch are presented in **Figure 20**. The most common stations visited on trips passing through the North entrance near Flagg Ranch are Yellowstone, Moran entrance, then Highway 89 South of Moran Junction, indicating that most trips passing between Grand Tetons and Yellowstone are only using Grand Tetons as a passthrough.

The number of trips that passed within range of each station that passed through Moran entrance are presented in **Figure 21**. The most common stations visited on trips passing through Moran entrance are Highway 89 South of Moran Junction, Highway 89 at Blacktail Butte Rd, Yellowstone entrance, and Highway 89 South of Gros Ventre River, indicating that most trips using Moran entrance are using it as a passthrough.

The number of trips that passed within range of each station that passed through Granite entrance are presented in **Figure 22.** The most common station visited on trips passing through Granite entrance is Moose Wilson Rd, followed by Teton Park Rd near Beaver Creek, indicating that most trips that pass-through Granite entrance travel the length of Moose Wilson Rd between Granite entrance and Moose, many of which also come from / continue on to Teton Park Rd through Moose entrance.

The number of trips that passed within range of each station that entered or exited the study area through Highway 26 east of Moran Junction are presented in **Figure 23**. The most common stations visited are Highway 89 south of Moran Junction and Moran entrance, indicating that trips entering or exiting the study area on Highway 26 east of Moran Junction are split between trips through Grand Tetons and/or Yellowstone and passthrough trips between Highway 89 to the south and Highway 26 to the east.

The number of trips that passed in range of each station that entered or exited the study area through Highway 191 east of Hoback Junction are presented in **Figure 24**. The most common station visited is Highway 26 west of Hoback Junction, with substantial other trips visiting Highway 22 east of Teton Pass and Highway 89 south of Gros Ventre River and a smaller number of trips visiting Highway 89 at Blacktail Butte Rd and Moran Junction. This indicates that many trips that enter and exit the area through Highway 191 east of Hoback Junction enter or exit the county without approaching GRTE, and those that do visit GRTE locations are well dispersed.

The number of trips that passed in range of each station that entered or exited the study area through Highway 26 west of Hoback Junction are presented in **Figure 25**. The most common station visited is Highway 191 east of Hoback Junction, with substantial other trips visiting Highway 89 south of Gros Ventre River and a smaller number of trips visiting Highway 89 at Blacktail Butte Rd and Moran Junction. This indicates that many trips that enter and exit the area through Highway 26 west of Hoback Junction pass north and south, though it is unclear to what extent the drop off in visits to stations near Moran Junction and to the north is due to data loss from device ID scrambling or due to trips originating/ending in side locations.

The number of trips that passed in range of each station that entered or exited the study area through Highway 22 west of Teton Pass are presented in **Figure 26**. The most common station visited is Highway 22 east of Teton Pass near Wilson, with none of the other stations being nearly as commonly visited. This indicates that most trips entering and exiting Teton county through Highway 22 are local trips between Idaho and Wilson/Jackson.

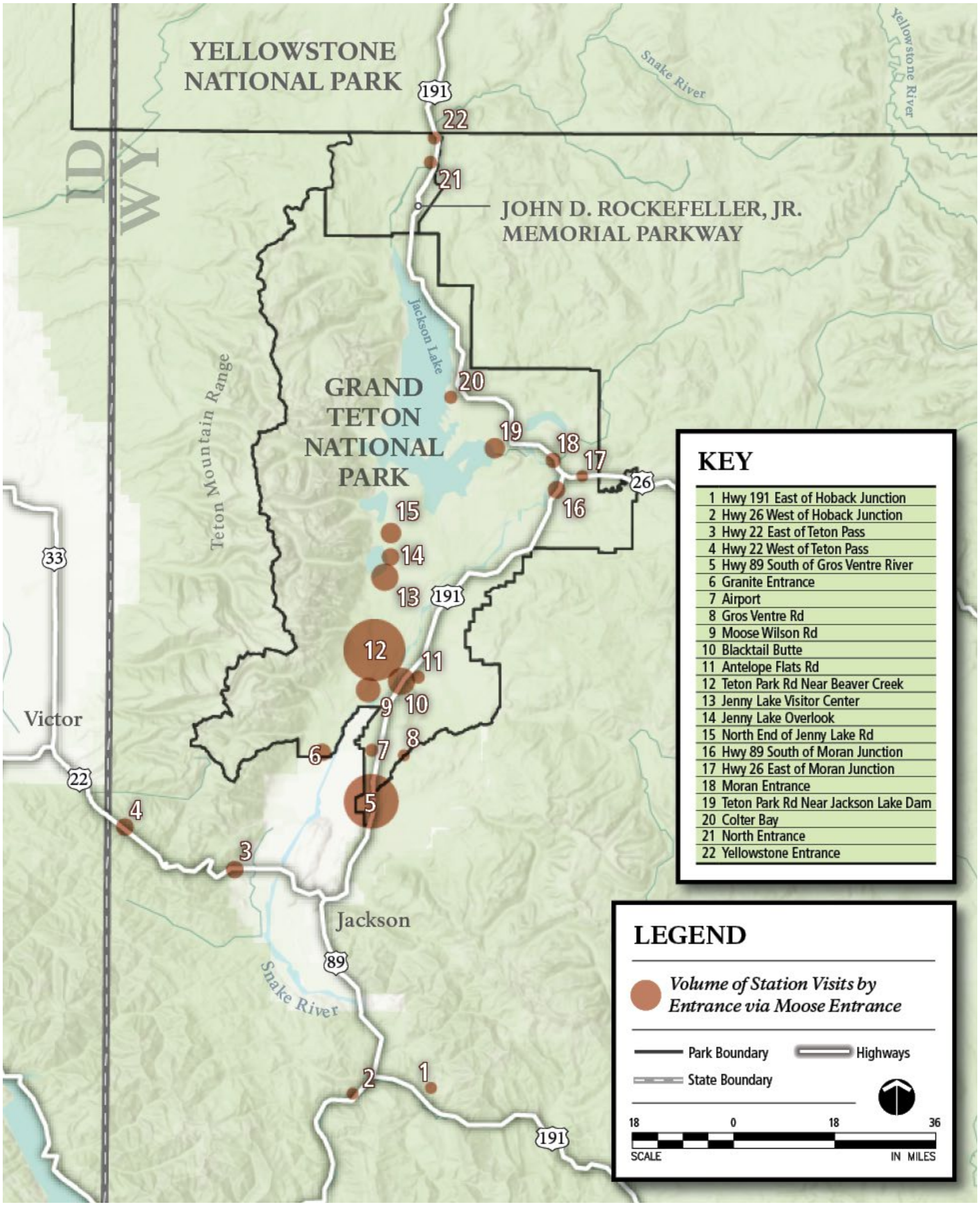

Figure 19. Number of visits to each station for trips passing in to / out of the park near Moose.

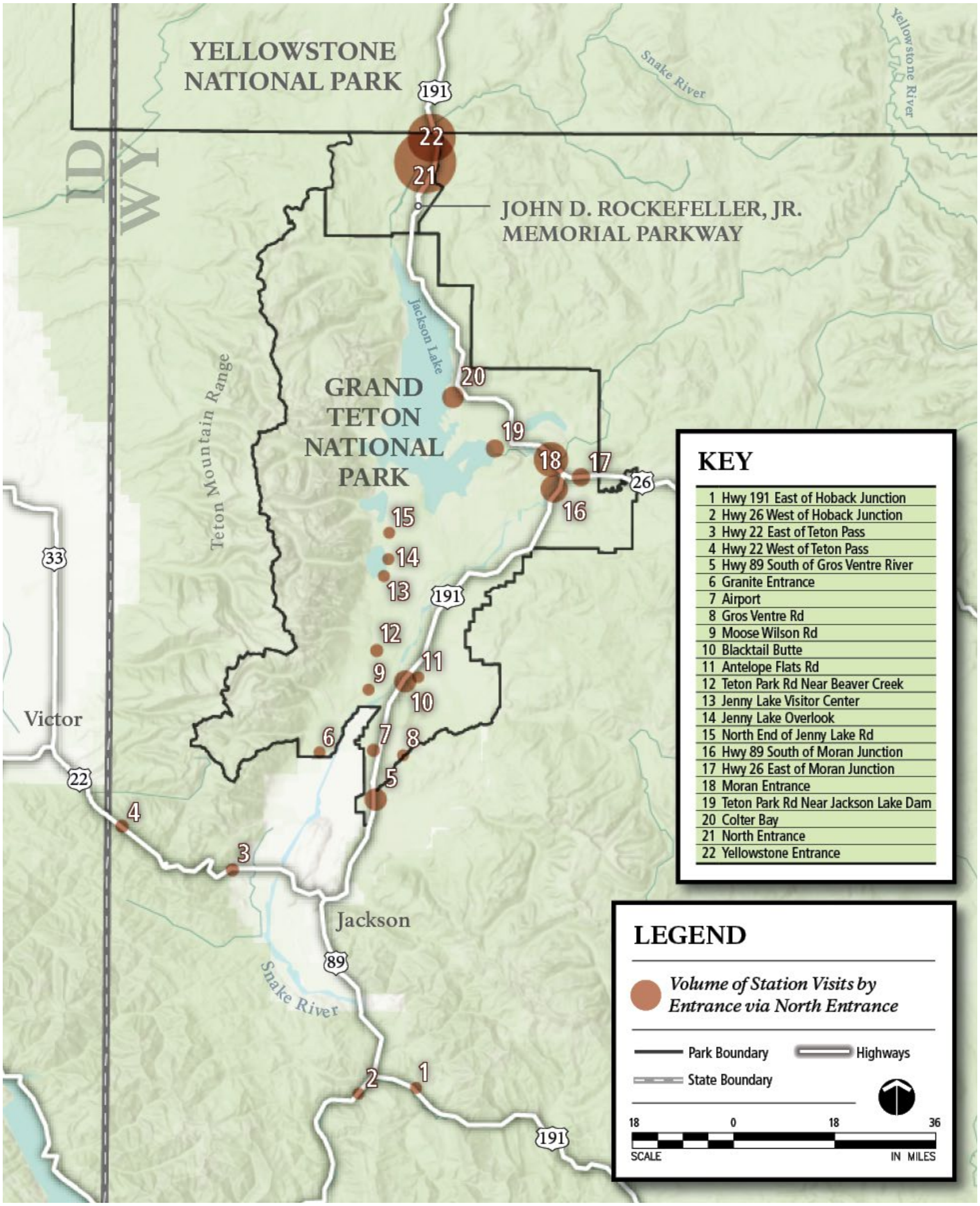

Figure 20. Number of visits to each station for trips passing through the North entrance.

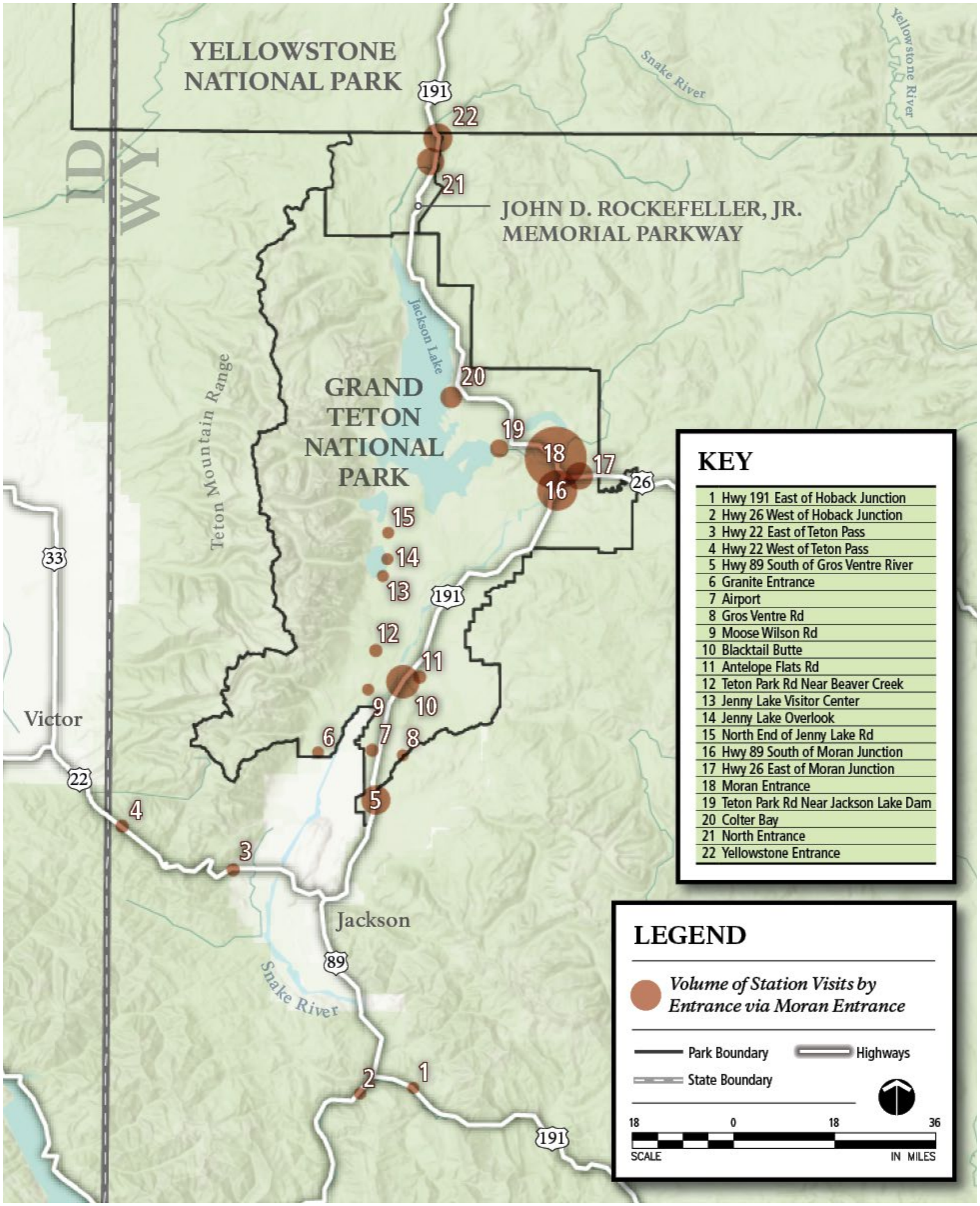

Figure 21. Number of visits to each station for trips passing through Moran entrance.

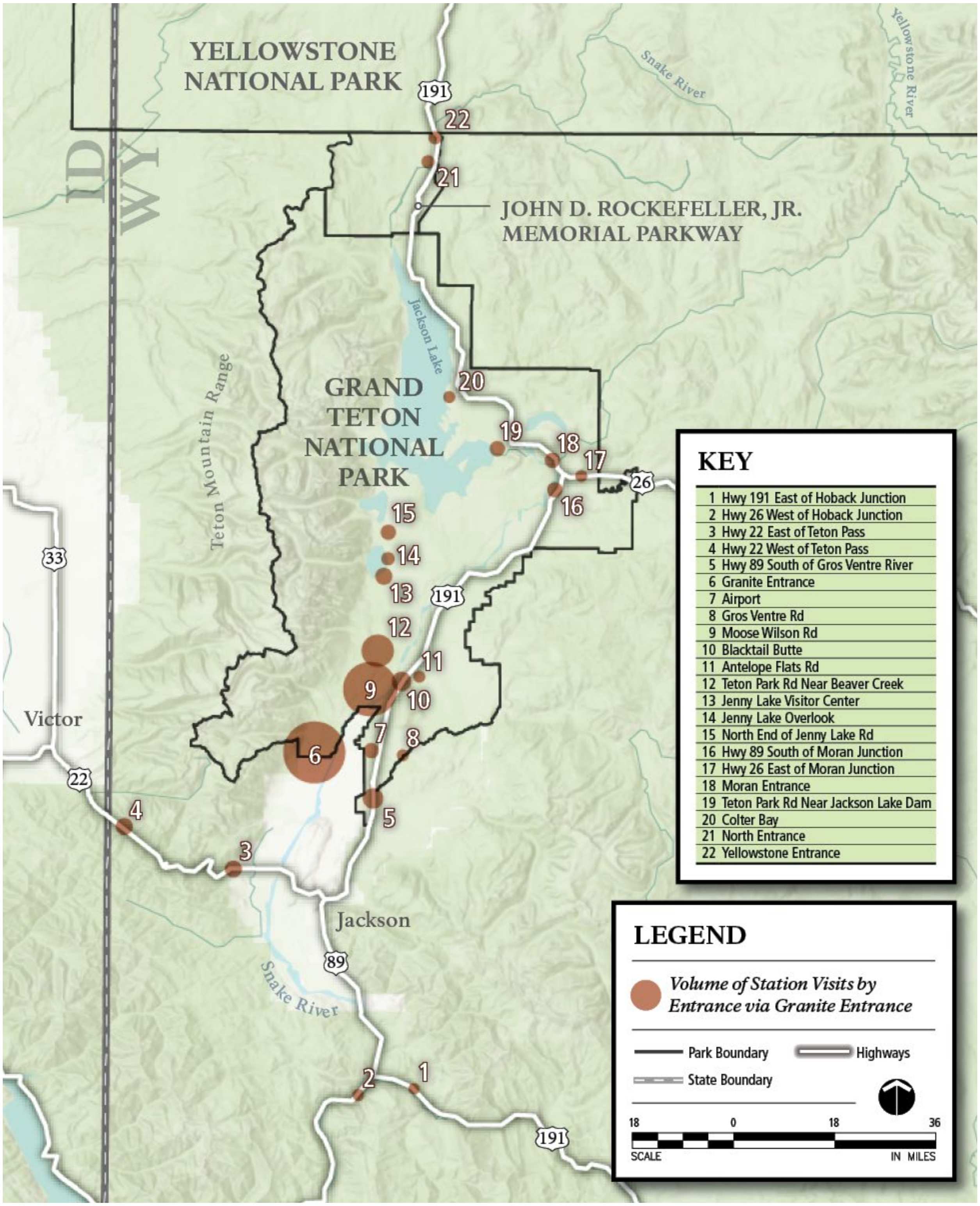

Figure 22. Number of visits to each station for trips passing through Granite entrance.

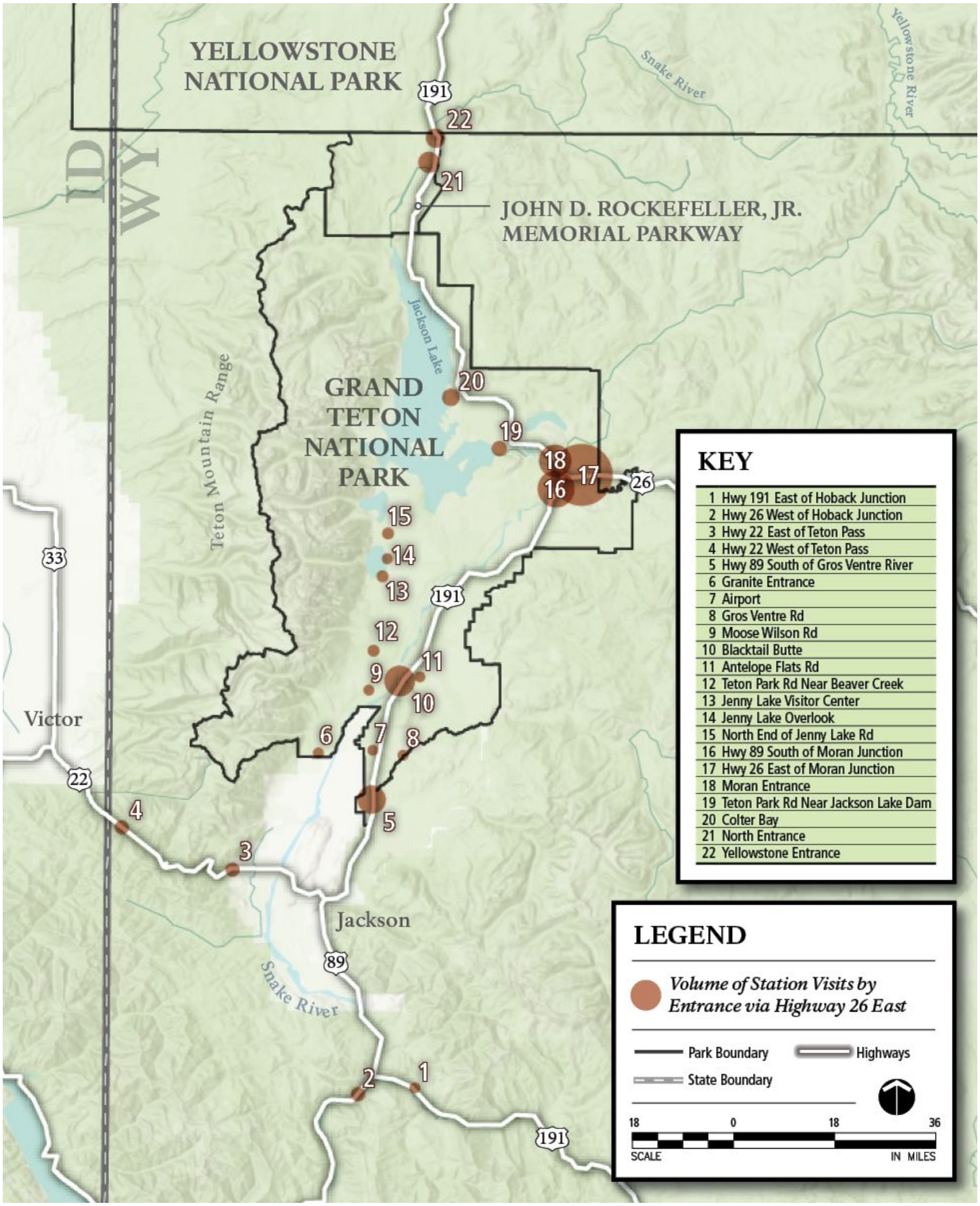

Figure 23. Number of visits to each station for trips entering/exiting through Highway 26 east of Moran Junction.

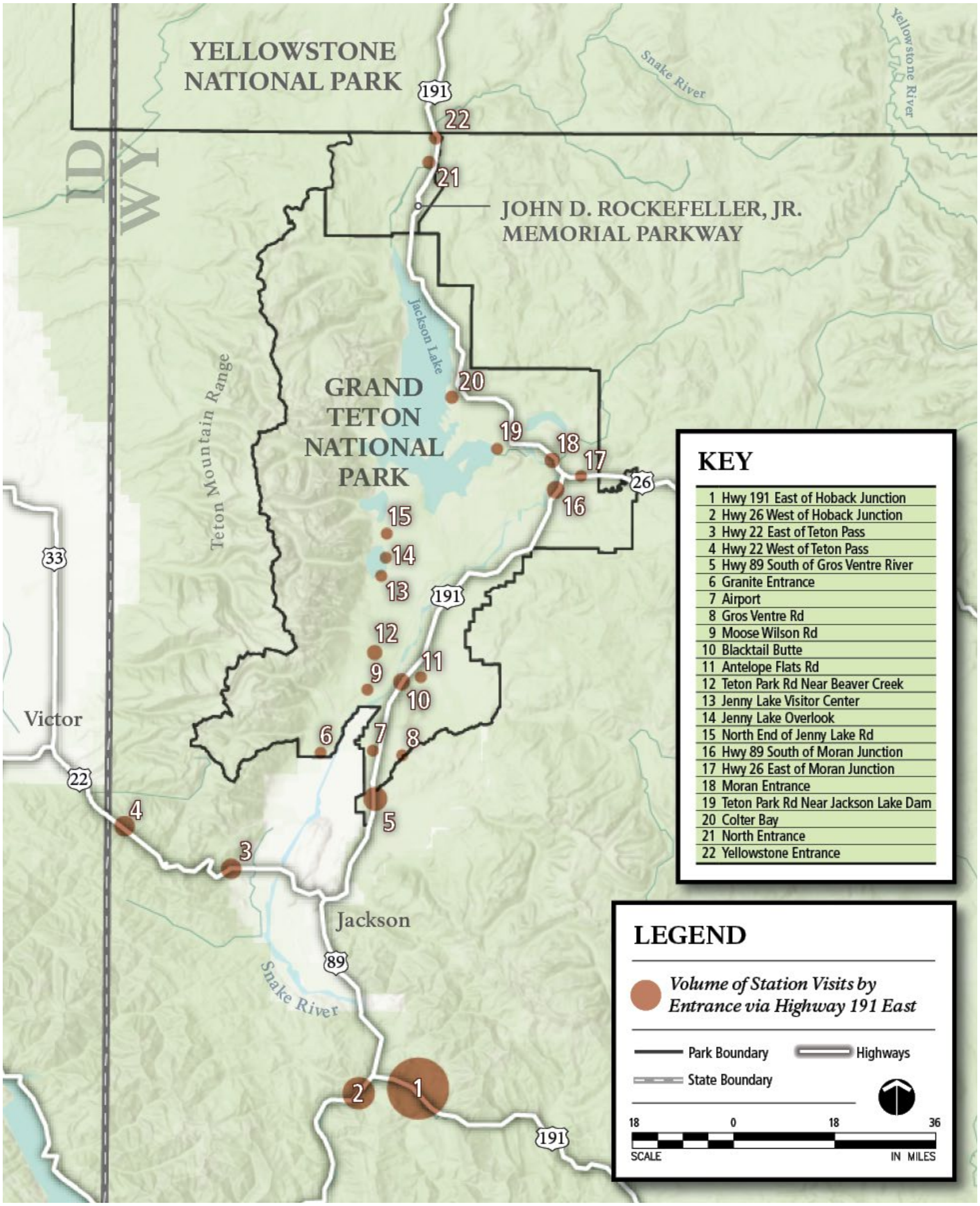

Figure 24. Number of visits to each station for trips entering/exiting through Highway 191 east of Hoback Junction.

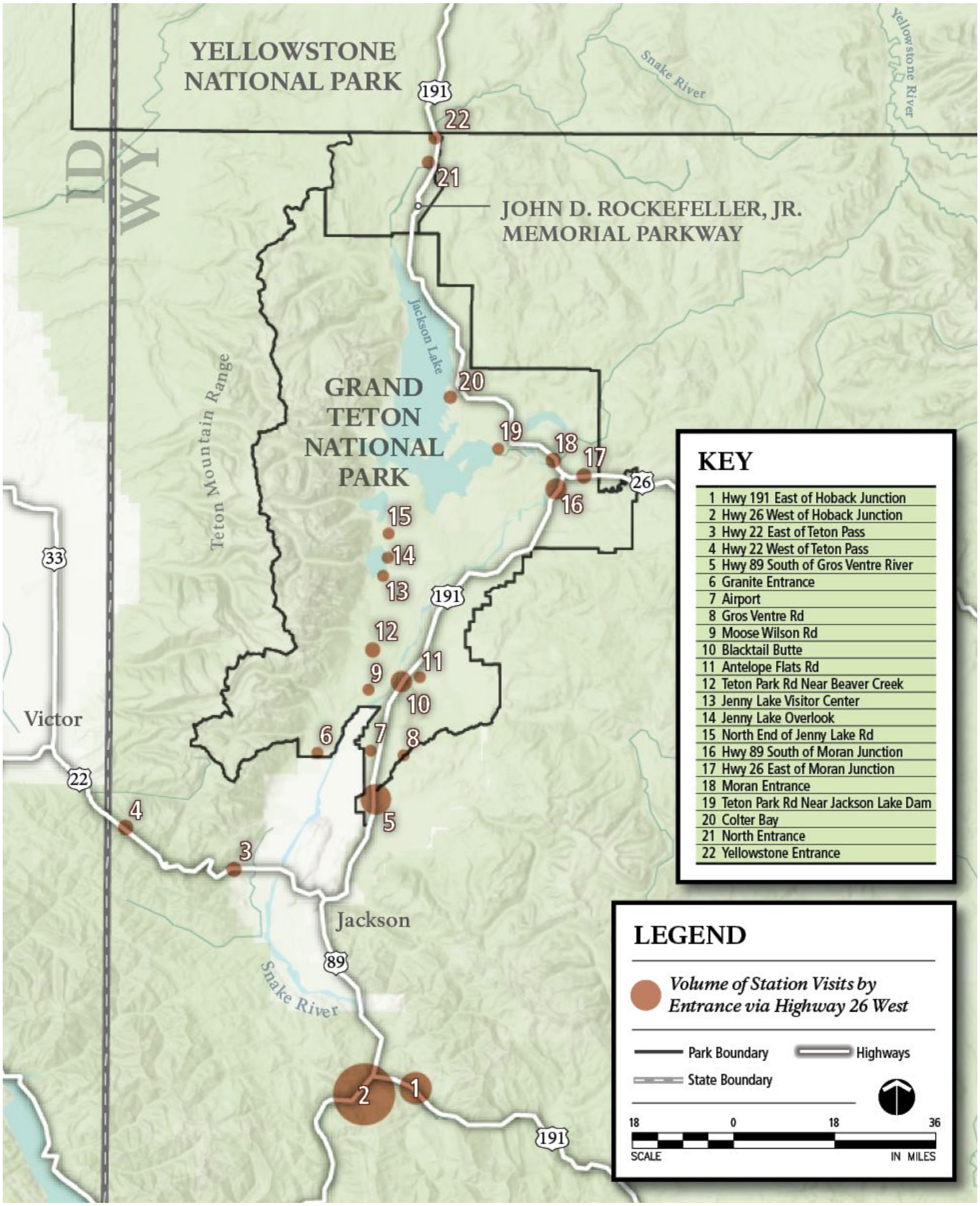

Figure 25. Number of visits to each station for trips entering/exiting through Highway 26 west of Hoback Junction.

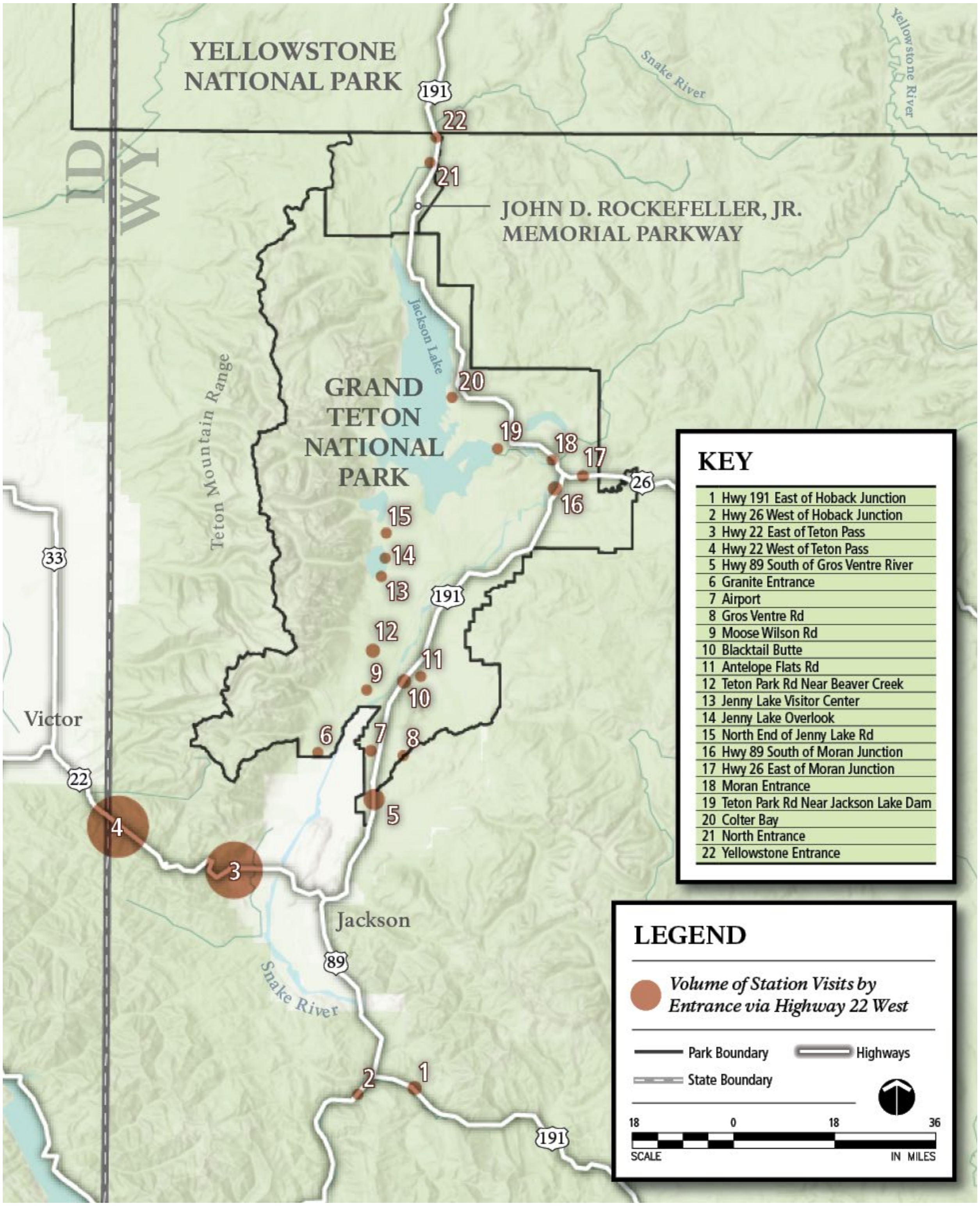

Figure 26. Number of visits to each station for trips entering/exiting through Highway 22 west of Teton Pass.

Parkwide

Traffic Conditions

Volumes on main roadways within the GRTE area are shown in **Table 8**. The ADT from WYDOT is based on annual volumes, while the ADT from GRTE or contractor counters are based on a 3-day average from August 6, 2021, through August 8, 2021.

Table 8. Average daily traffic of parkwide roadways.

Roadway	Location	ADT	Source
Hwy 89/191	South of Gros Ventre Jct	8,800	WYDOT
Hwy 89/191	Between Teton Park Rd and Moran Jct	6,600	GRTE Tube CounterWYDOT
Teton Park Road	Between Moose Entrance and Beaver Creek	6,100	Contractor Tube Counter
Hwy 89/191	Between Flagg Ranch and YELL	4,500	GRTE Tube CounterWYDOT
Teton Park Road	Between Jackson Lake Dam and Hwy 89/191	4,400	Contractor Tube Counter
Jenny Lake Scenic Road	On the one-way section	3,000	GRTE Tube Counter
Hwy 89/191	Between Moose Jct and Moran Jct	2,900	WYDOT
Gros Ventre Road	Between Hwy 89/191 and turnoff to Mormon Row	2,300	Contractor Tube Counter
Moose-Wilson Road	Near Death Canyon	2,300	GRTE Tube Counter
Antelope Flats Road	Between Hwy 89/191 and Mormon Row	1,800	Contractor Tube Counter
Gros Ventre Road	East of turnoff to Mormon Row	1,300	Contractor Tube Counter
Mormon Row Road	Between Gros Ventre Rd and Antelope Flats Rd	1,000	Imputed from Contractor Tube Counter
Pacific Creek Road	Near Hwy 89/191	500	Contractor Tube Counter
Ditch Creek Road	Near Antelope Flats Rd	150	Contractor Tube Counter

Visitor Use Patterns

Table 9 and **Figure 27** show the share of passthrough trips out of all observed trips entering or exiting the park in the Wejo data sample. Nine percent of observed trips entering or exiting the park were passthrough trips, while 91% of trips stopped at least once somewhere in the park. Of these passthrough trips, trips between Jackson and Dubois, or YELL and Jackson, accounted for a majority of observed trips.

In comparing the data from Figures 11-18 to the data in Figure 27, the following should be understood. The proportions of trips shown in Figures 11-18 are based on a distinct, but overlapping, subsample of the overall universe of Wejo-derived trips compared to that used in Figure 27. Trips in Figures 11-18 reflect the subset of trips that passed through at least one external gateway (such as Teton Pass or the YELL South Entrance). Trips in Figure 27 are based on a separate but overlapping subset of trips that entered GRTE at some point during that trip. Notably, many trips that start in southern Teton County (e.g., Jackson, Wilson, etc.) and enter the park (or vice-versa) are part of the subset used in Figure 27, but not in Figures 11-18, which reduces the relative share of pass-through trips in the Figure 26 subset.

How much confidence should we have in this data? Testing and validation was conducted with Wejo's data and it is deemed as a generally accurate and high-quality data source (compared to other industry-standard data collection options). In the GRTE context, it is possible that some trips at the north end of the park (where cell/data coverage is poor) are incorrectly coded as ending in the park, when they may actually be continuing through to a destination in the southern part of YELL. However, the low density of major attractions/stopping points from JODR to West Thumb indicates to us that any mis-coded trips in this area are unlikely to represent more than a small proportion of overall pass-through trips.

The data samples shown in **Table 10** and **Figure 28** were analyzed from the one-week sub-sample (July 11-17, 2021) using the Wejo data equaling approximately an 80,000-trip sample size. This time period was selected based on July being the peak month of visitation in order to assess peak (non-holiday) summer conditions. The top five most visited areas in the park overall include the following, which constitute approximately 30% of all trip ends (locations where visitors were observed turning off their vehicle) in the park—the prevalence of stops at all locations. The remaining 70% would include minor locations such as other overlooks, campgrounds, trailheads, etc. This is a good illustration that trip ends are well distributed throughout the park with only 12% making up the highest visited area (Colter Bay) and 70% making up the combination of smaller percentages from numerous other visited areas.

Table 9. Share of passthrough trips by location.

Location	Share of Passthrough Trips
Jackson – Dubois	45%
Jackson – YELL	29%
Dubois – YELL	10%
Jackson – Moose Wilson	10%
Dubois – Moose Wilson	3%
YELL – Moose Wilson	3%

Table 10. Top visited areas in GRTE.

Location	Share of GRTE Destinations
Colter Bay	12%
Jackson Lake Lodge	7%
South Jenny Lake	6%
Craig Thomas Discovery & Visitor Center	3%
Signal Mountain Summit Overlook	2%
Sawmill Ponds Overlook	2%
Jenny Lake Overlook	2%
Gros Ventre Campground	2%
Snake River Overlook	1%

Location	Share of GRTE Destinations
Bradley/Taggart Trailhead	1%
Other	63%

Additional analysis of the top destinations within GRTE accessed from individual park entrances was conducted with the same dataset. In **Table 11** through **Table 15**, the top destinations reflect the first location accessed by a vehicle after passing (in either direction) through a defined park entrance. Only 29% to 42% of trips that pass through each entrance end at a "top five" destination, with the remaining 58% to 71% of trips going to various other destinations within the park. This reflects the dispersed nature of recreation and visitation within the park.

Because some locations within the park are located outside of the area controlled by the park's formal entrance stations (such as destinations along US 26/89/191 between Jackson and Moran), trips to these locations are not well represented in these analyses, unless they are the first stop after leaving a certain gate.

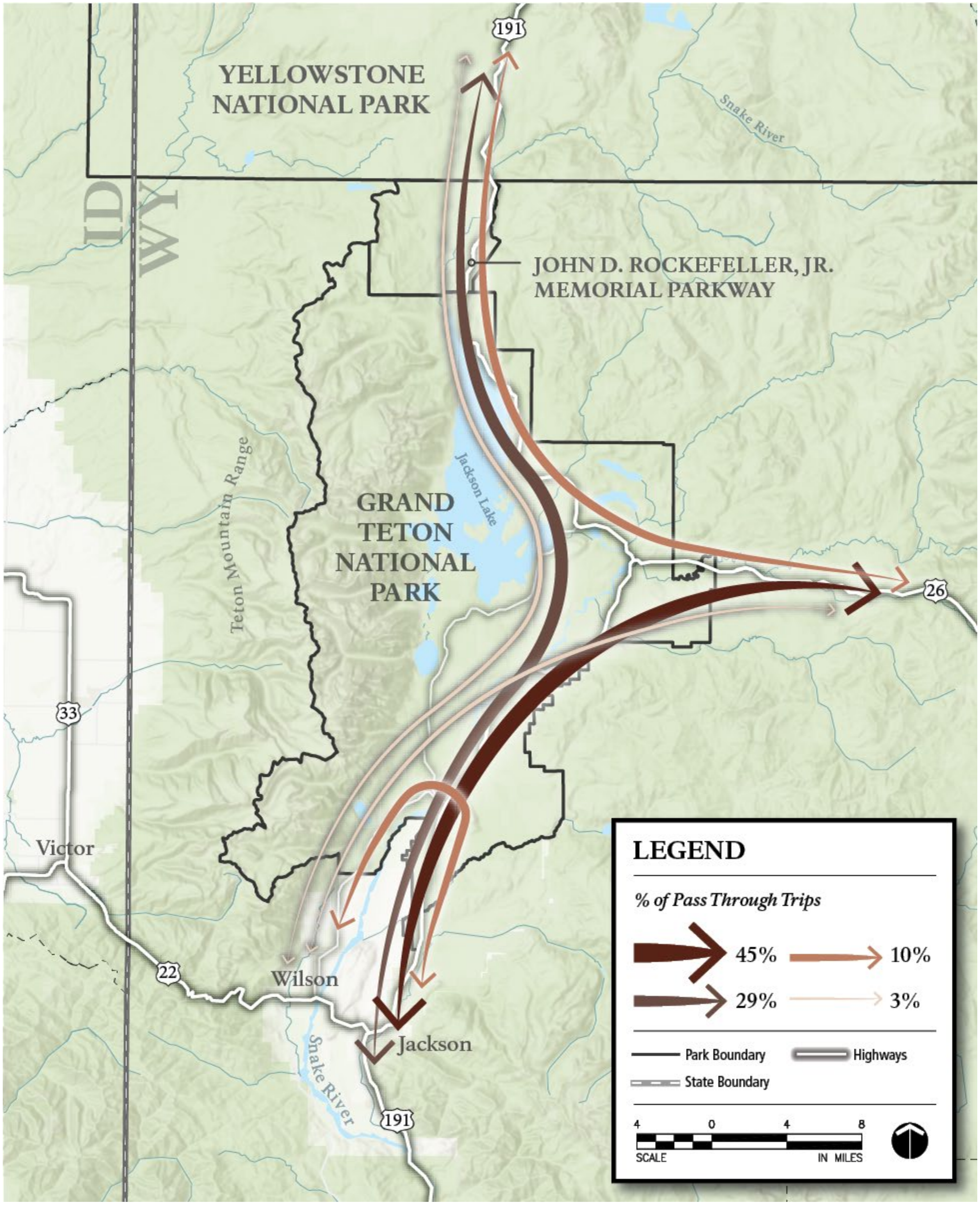

Figure 27. Pass-through trip patterns through GRTE.

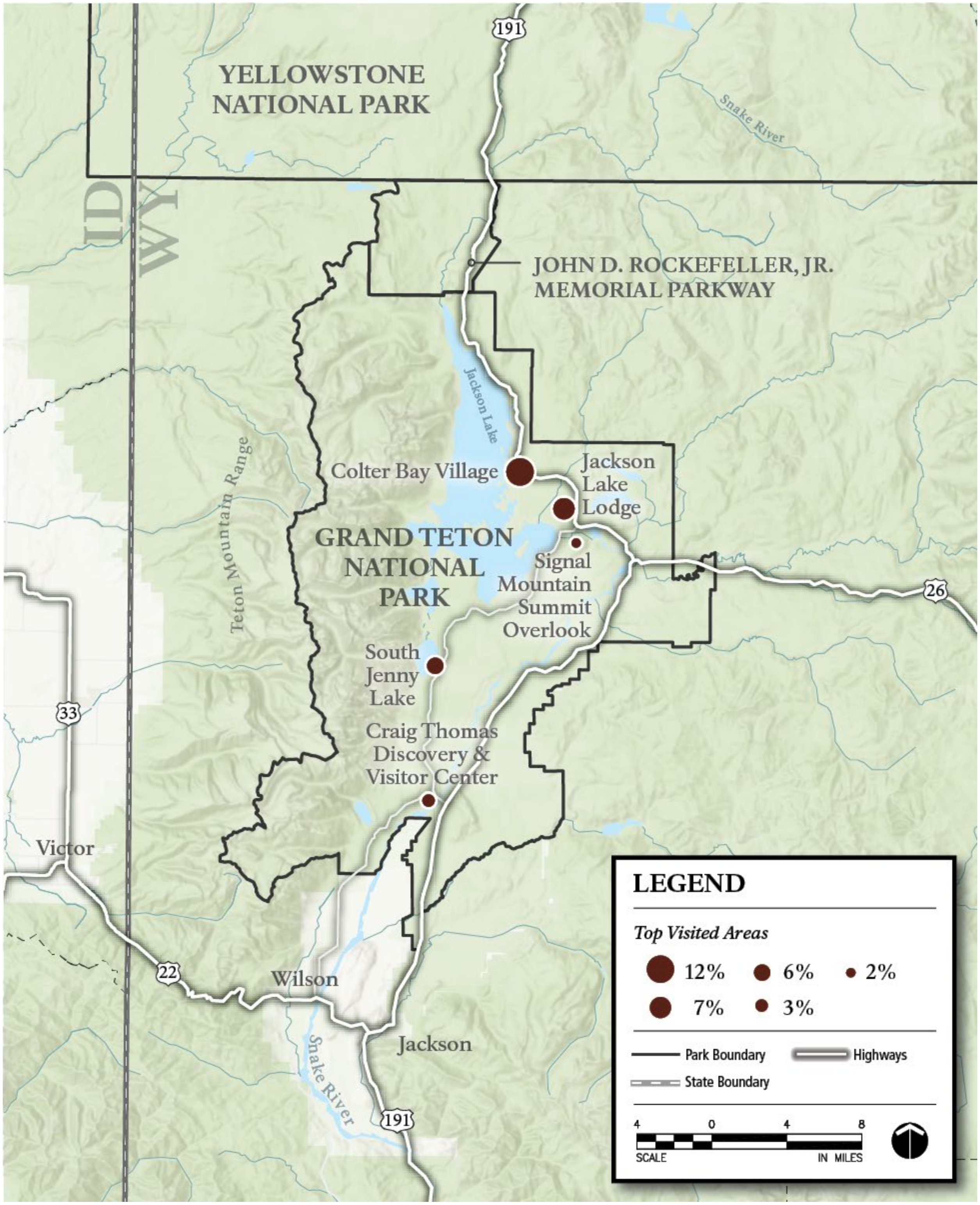

Figure 28. Top trip destinations within GRTE.

Table 11. Top destinations from Granite Entrance (sample size = 566).

Rank	Location	Share of GRTE Destinations
1	Sawmill Ponds Overlook	20%
2	South Jenny Lake	11%
3	LSR Parking	4%
4	Discovery/Visitor Center	4%
5	String Lake	3%
6	Bradley/Taggart Trailhead	3%
6	Lupine Meadows Trailhead	3%
8	Death Canyon Trailhead	2%
9	Jackson Lake Lodge	1%
10	Chapel of The Transfiguration	1%
10	Colter Bay	1%
10	Granite Canyon Trailhead	1%
10	Windy Point Turnout	1%
	Other	45%

Table 12. Top destinations from Moose Entrance (sample size = 1,697).

Rank	Location	Share of GRTE Destinations
1	South Jenny Lake	24%
2	Bradley/Taggart Trailhead	7%
3	Discovery/Visitor Center	4%
4	String Lake	4%
5	Jenny Lake Overlook	3%
6	Windy Point Turnout	3%
7	Lupine Meadows Trailhead	3%
8	Chapel of The Transfiguration	3%
9	Sawmill Ponds Overlook	2%
10	Cottonwood Creek Picnic Area	2%
10	Mormon Row	2%
10	Teton Glacier Turnout	2%
	Other	42%

Table 13. Top destinations from Moran Entrance (sample size = 1,451).

Rank	Location	Share of GRTE Destinations
1	Colter Bay	10%
2	Jackson Lake Lodge	8%
3	Snake River Overlook	4%
4	Oxbow Bend Turnout	4%
5	Teton Point Overlook	3%
6	Jackson Lake Overlook	2%
7	South Jenny Lake	2%

Rank	Location	Share of GRTE Destinations
8	Cunningham Cabin	1%
9	Moran Entrance Station Turnout	1%
10	Elk Ranch Flats Turnout	1%
10	Upper Willow Flats Turnout	1%
	Other	62%

Table 14. Top destinations from YELL (sample size = 470).

Rank	Location	Share of GRTE Destinations
1	Colter Bay	19%
2	Jackson Lake Overlook	10%
3	Jackson Lake Lodge	8%
4	South Jenny Lake	4%
5	Mount Moran Turnout	3%
6	Teton Point Overlook	2%
6	Upper Willow Flats Turnout	2%
8	Snake River Overlook	1%
9	Oxbow Bend Turnout	1%
10	Gros Ventre Campground	1%
10	Jenny Lake Overlook	1%
10	Mountain View Turnout	1%
10	Pacific Creek Boat Launch	1%
10	Signal Mountain Lodge	1%
	Other	45%

Table 15. Top destinations from Jackson Hole Airport (sample size = 65).

Rank	Location	Share of GRTE Destinations
1	Colter Bay	8%
2	Discovery/Visitor Center	5%
3	Jackson Lake Lodge	5%
4	Jenny Lake Overlook	3%
5	Sawmill Ponds Overlook	3%
6	South Jenny Lake	3%
7	Teton Point Overlook	3%
9	Chapel of The Transfiguration	2%
9	Gros Ventre Campground	2%
9	Jenny Lake Lodge	2%
9	Other Teton Co North of Moose	2%
9	Sleeping Indian Turnout	2%
9	Snake River Overlook	2%
	Other	62%

Speed and Safety Indicators

An evaluation of parkwide speed, hard braking, and hard acceleration events was conducted based on May–September 2021 Wejo data assigned to the OpenStreetMap (OSM) network within Teton County. Speeds are inferred based on the distance and time elapsed between subsequent data points and are reported based on 85^{th} percentile speeds, while hard braking and hard acceleration are discrete events that are individually reported where they occur. **Figure 29** shows 85^{th} percentile speeds based on Wejo data.

On a parkwide basis, the highest speeds occur at the easternmost periphery of the park on US 26/287 east of Buffalo Valley Road, where one segment shows 85^{th} percentile speeds in excess of 70 miles per hour. Other locations with high observed speeds include US 26/287 near Pinto Ranch Road, and US 26/89/191 south of Snake River Overlook. Numerous segments of US 26/89/287 have 85^{th} percentile speeds in the 60–65mph range, which exceeds the posted speed limits of 55mph or lower on all park roads.

Hard acceleration events are concentrated primarily around intersections and junctions in the park, whereas hard braking events are more dispersed through the park. **Table 16** shows top hotspots for hard acceleration events, and **Table 17** shows top hotspots for hard braking events. **Figure 30** shows locations of hard acceleration events. **Figure 31** shows locations of hard braking events.

Table 16. The top five hard acceleration areas in GRTE.

Location	Hard Acceleration Events
Hwy 89 South of Airport Road	781
Hwy 89 South of Teton Park Road	697
Teton Park Road East of Highway 89	660
Airport Road East of Highway 89	591
Sagebrush Drive (eastbound lane, east approach to Ventre Junction roundabout)	310

Table 2. The top five hard braking areas in GRTE.

Location	Hard Braking Events
Hwy 89 (southbound lane, north approach to Gros Ventre Junction roundabout?	493
Hwy 89 South of Airport Road	305
Hwy 89 North of Moran Junction	256
Hwy 89 South of Blacktail Ponds Overlook	249
Hwy 89 South of Teton Park Road	233

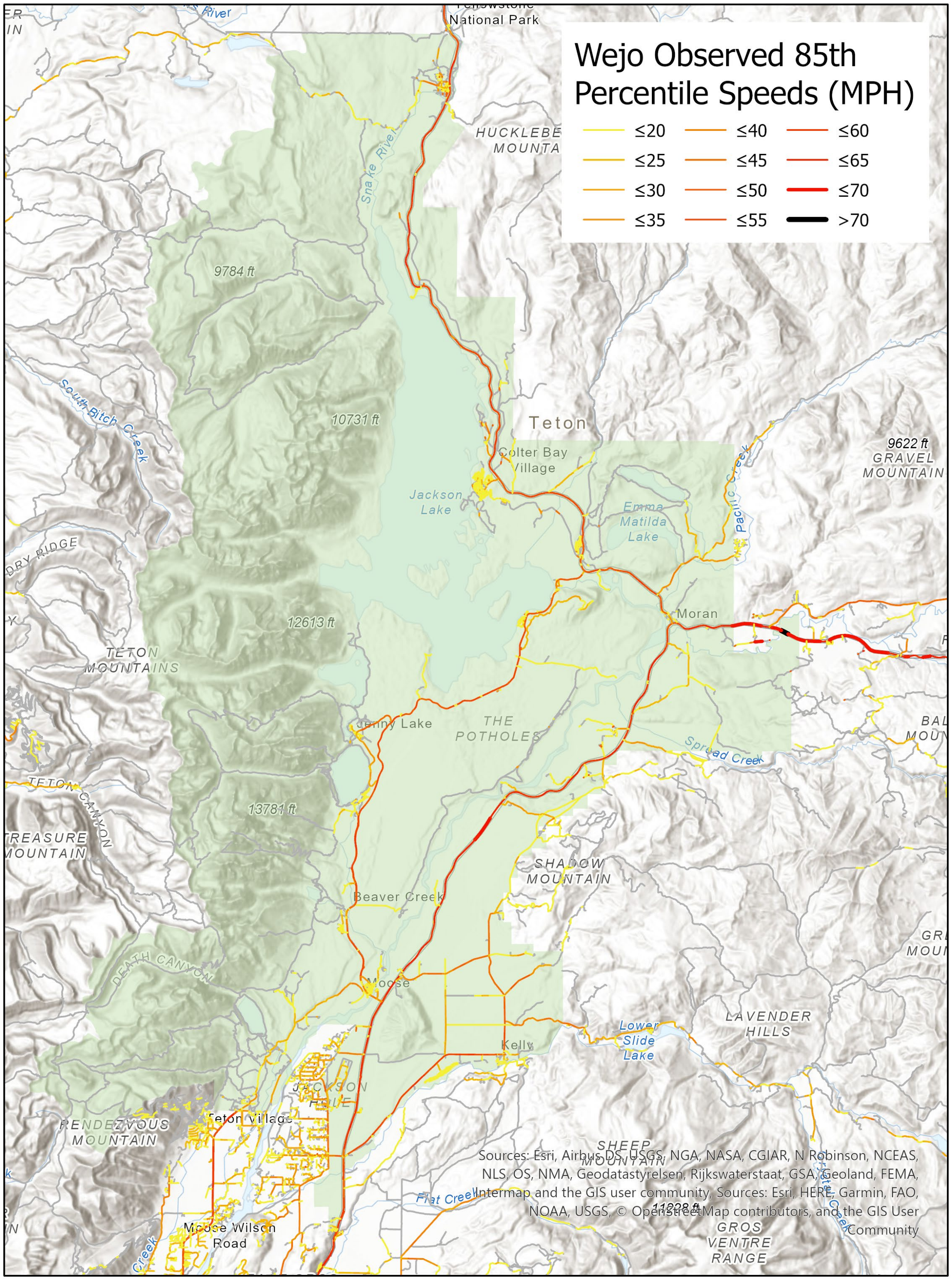

Figure 29. 85th percentile speeds based on Wejo data.

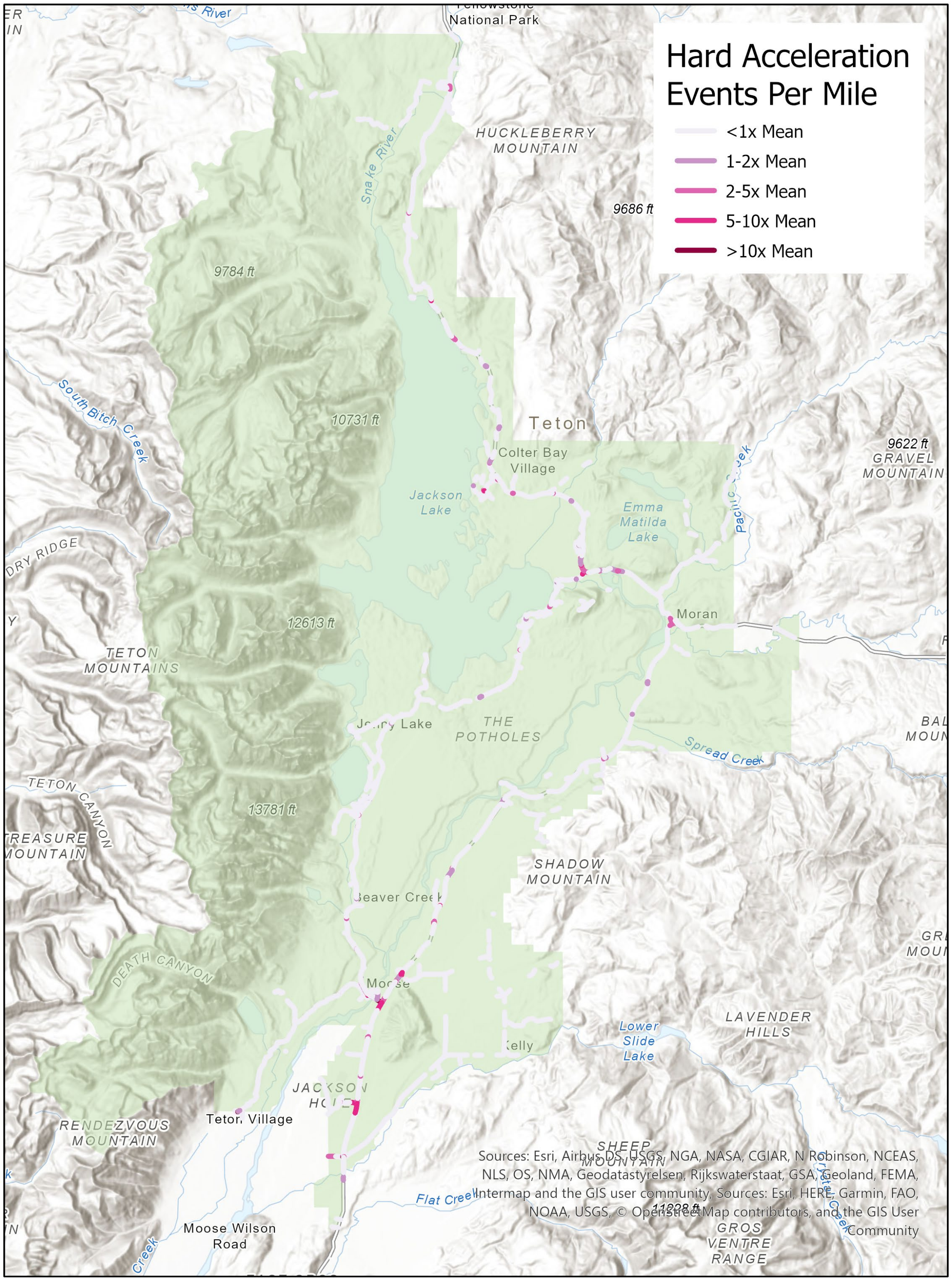

Figure 30. Locations of hard acceleration events.

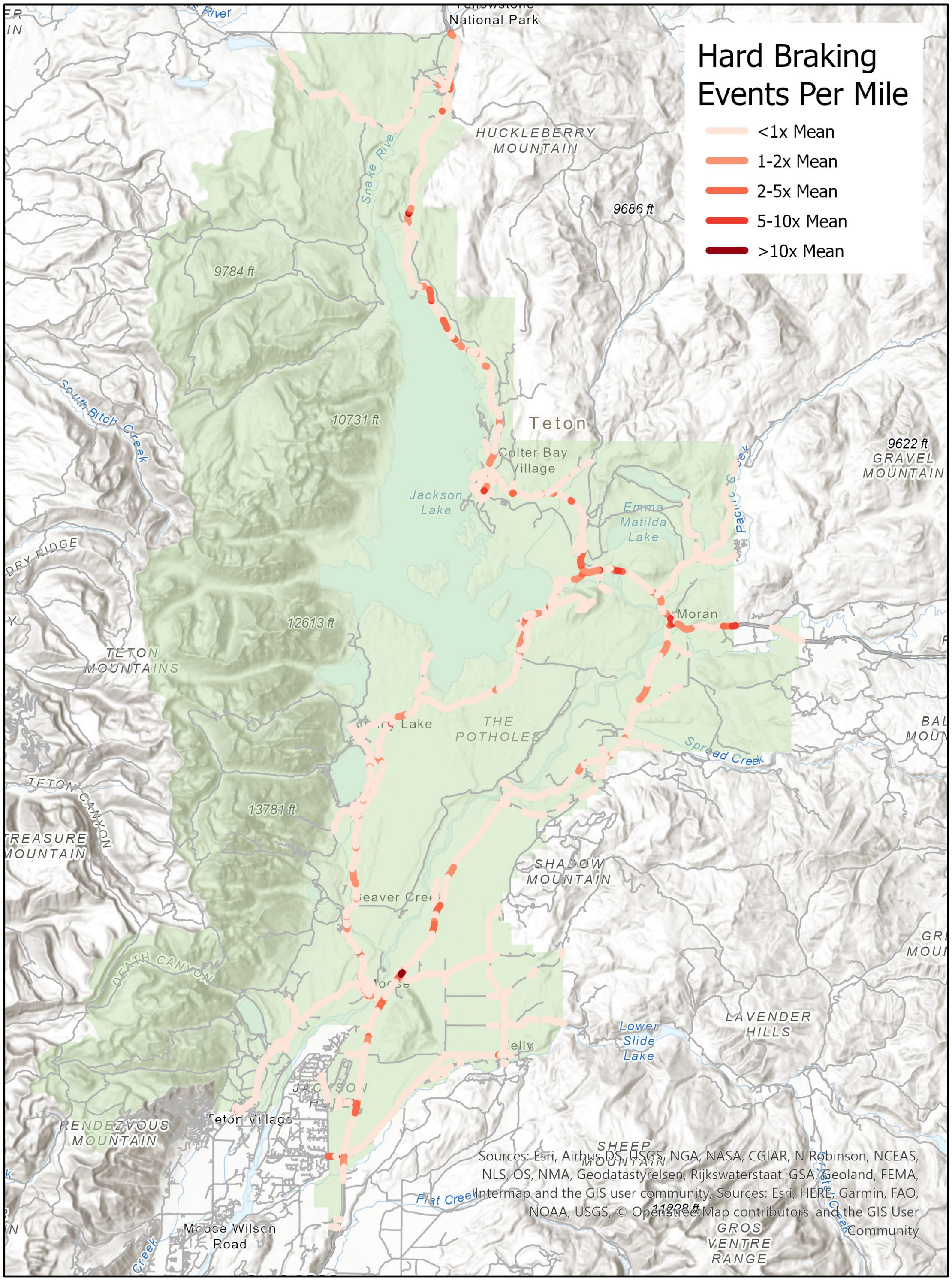

Figure 31. Locations of hard braking events.

Parking Circulation

Parking circulation analysis was conducted for three key locations of interest within the park: South Jenny Lake (**Table 18**), String Lake (**Table 19**), and Colter Bay (**Table 20**). In each of these locations, trips entering the parking area were evaluated to determine if they ended (parked) in the parking area they initially entered, in an alternate parking location (e.g., along Teton Park Road near South Jenny Lake), or left the area without parking. These proportions provide a possible indicator of how often visitors to these high-traffic areas are unable to find parking in the primary parking area, as well as whether they typically find alternate parking options or continue to another area of the park.

The majority of trips that enter the South Jenny Lake parking lot park in the lot, while a sizeable portion of trips leave the lot without parking. Roughly half of those who leave without parking then park roadside, while the remainder that leave without parking likely do so because they entered the area by mistake, they entered the area solely for a quick visit such as a pick-up or drop-off, or they were unable to find suitable parking and left the area entirely.

Most trips that enter the String Lake parking area leave without parking. Those who leave without parking tend to circle between lots more often than those who park in the area, though a substantial portion of those who leave without parking only enter one lot, suggesting that these trips may primarily be driven by short trips such as pick-ups or drop-offs and by those entering the area by mistake, rather than being unable to find parking.

For Colter Bay the number of loops was defined as the distance travelled inside the parking area divided by 3,500 feet (roughly corresponding to the distance from the entrance to the parking area to the furthest edge). An example of what would constitute a full loop and multiple loops is shown in **Figure 32**. Most trips that enter Colter Bay parking area also leave the area without parking. There are a number of reasons for people to make a short trip without turning off their vehicle in Colter Bay, such as visiting the bathroom or other communal facilities, picking up or dropping off, or making a wrong turn into the parking lot. Those who leave the Colter Bay parking area without parking, on average, travel slightly farther within the lot, though more of those trips still leave the parking lot without travelling the length of the parking lot, suggesting their trip to Colter Bay was not to park.

It should be noted that these analyses are based on vehicle on/off events, such that a vehicle that parks for a short period of time while idling may be categorized as having left the area without parking.

Table 3. South Jenny Lake parking circulation evaluation (two connected lots).

South Jenny Lake	Parked in Lot	Parked Roadside	Left Area Without Parking
Percent of Trips	66%	15%	19%

Table 19. String Lake parking circulation evaluation (three separate lots).

String Lake	Parked in Lot	Left Area Without Parking
Percent of Trips	27%	73%
Average # of Lots Visited	1.2	1.4
% Entering 1 lot	85%	71%
% Entering 2 lots	6%	18%
% Entering all 3 lots	9%	11%

Table 20. Colter Bay parking circulation evaluation (four connected lots).

Colter Bay	Parked in Lot	Left Area Without Parking
Percent of Trips	38%	62%
Average # of Loops per Trip	0.59	0.61
% Doing less than 1 loop	86%	87%
% Doing 1 or more loop but less than 2	11%	9%
% Doing 2 or more loops	3%	4%

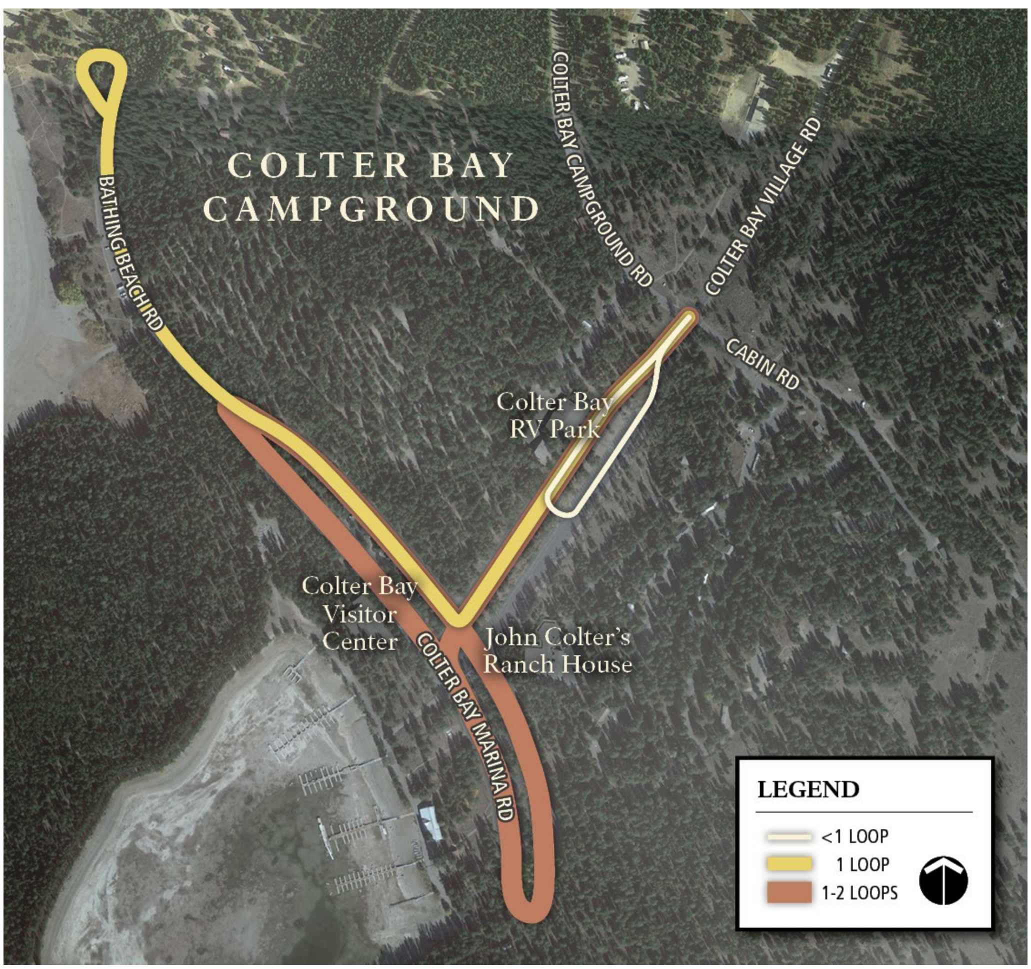

Figure 32. Examples of loops at Colter Bay.

For information on the parkwide parking dwell time distributions at key places of interest, see Appendix 9.

Overlook Utilization

Table 21 shows the percent of traffic on the adjacent roadway that stops at the respective overlook locations. For example, this shows that 41% of the traffic traveling on Jenny Lake Loop Road stopped at the Jenny Lake Overlook; while only 8% of the traffic traveling on Highway 89 stopped at the Elk Ranch Flats Overlook. The Elk Ranch Flats Overlook location is likely more driven by the presence of wildlife than by vistas so when wildlife is not present there is less incentive for visitors to stop at this overlook. Unlike the analysis of parking areas, this analysis does not rely on vehicle on/off events, since field observations indicate that overlook users frequently stop at scenic viewpoints without turning off their vehicles. Instead, this analysis uses a screenline analysis approach to separate vehicles that enter the overlook area from those that continue on the adjacent roadway.

Table 21. Overlook utilization.

Location	Percent of Trips on Adjacent Roadway Accessing Overlook
Jenny Lake Overlook	41%
Jackson Lake Overlook	21%
Snake River Overlook	14%
Elk Ranch Flats Overlook	8%
Oxbow Bend Overlook	13%
Willow Flats Overlook	13%

Exploratory Analysis

This subsection presents the results of exploratory regression models that estimate relationships between (1) regional highway inbound traffic volumes, and official entrance station inbound traffic volumes; and (2) parkwide perimeter inbound traffic volumes, and official entrance station inbound traffic volumes. The GRTE TVM Report Appendix 3 contains scatterplots of regression inputs and indicators with final fitted models.

Regional Highway Inbound Traffic Volumes and Entrance Station Inbound Traffic Volumes

Table 22 and **Table 23** present results of hourly and daily exploratory regression models that estimate relationships between regional highway inbound traffic volumes, and official entrance station inbound traffic volumes.[10] All models are significant, with p-values ranging from less than 0.001 to 0.034 and R^2 values from 0.17 to 0.66. In consultation with park staff, inputs of regional highway inbound traffic volumes were defined as the sum of traffic volumes from Dubois

[10] Regional highway traffic volume patterns show that there is a regular weekday commuter pattern on these roadway segments. As such, regressions with inputs of regional highway traffic volumes were produced with weekend and holiday dates only to eliminate impacts from weekday commuter patterns.

(Westbound), Snake River (Northbound), Bondurant (Northbound), and Teton Pass Road (Southeast-bound).[11] The locations of the four regional highway traffic volume inputs are depicted in **Figure 33**.

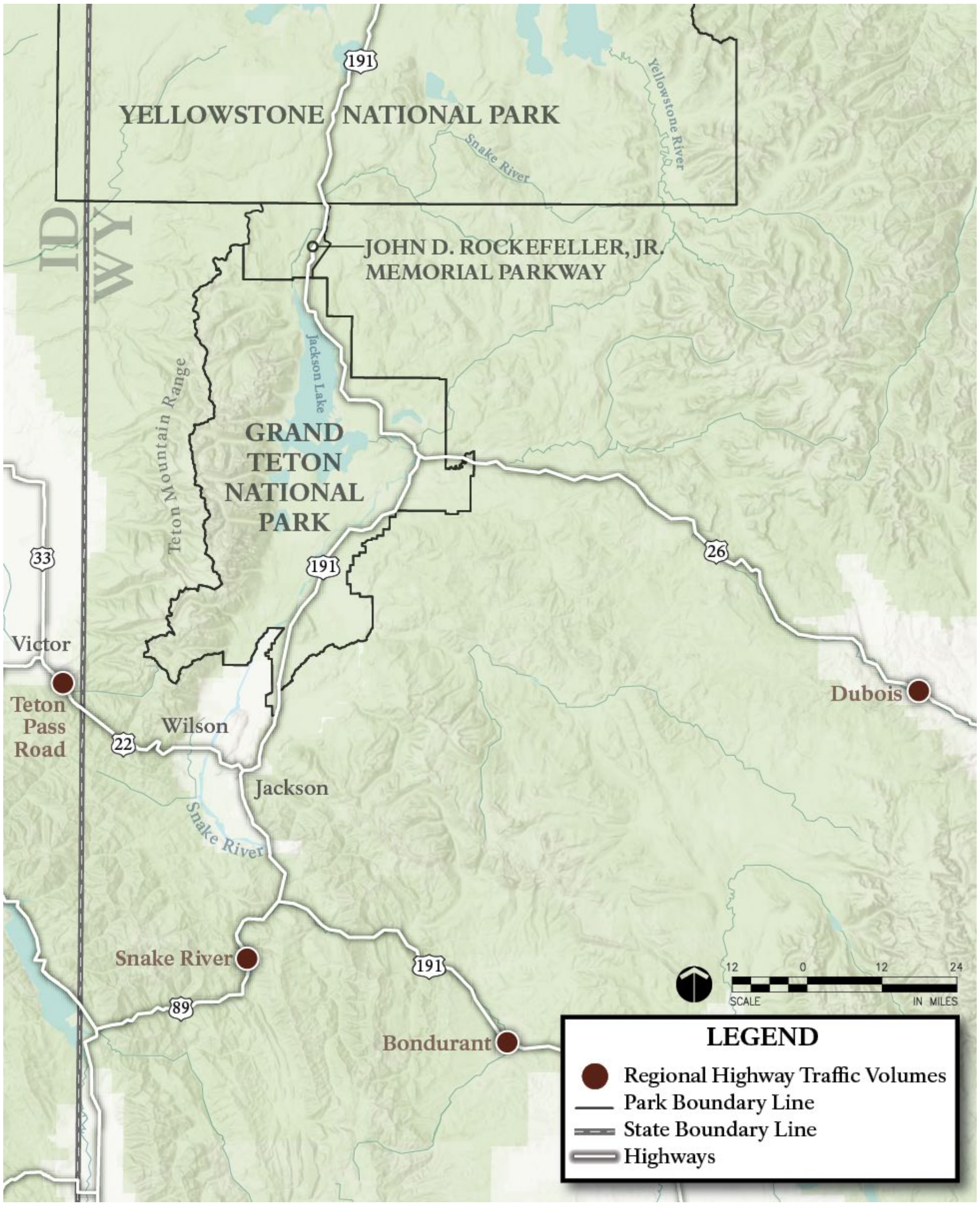

Figure 33. Regional highway traffic counter locations near GRTE.

[11] For regressions with the Granite Entrance Station as the indicator, the Dubois counter was dropped from the sum of regional highway input counters because it is not spatially proximate to this entrance station.

Table 22. Hourly regression model specifications: Regional highway inbound traffic volumes and entrance station inbound traffic volumes.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R2	N
Granite Entrance Station traffic volumes	Linear	1-hour lag	-53.6*	0.23*	< 0.001	< 0.001	0.58	311
Moose Entrance Station inbound traffic volumes	Linear	1-hour lag	-52.6*	0.41*	0.006	< 0.001	0.44	311
Moran Entrance Station inbound traffic volumes	Linear	1-hour lag	-38.8*	0.35*	0.002	< 0.001	0.58	311
Moran + Moose + Granite Entrance Station inbound traffic volumes	Linear	1-hour lag	-144.6*	0.94*	< 0.001	< 0.001	0.66	311

For the Granite Entrance Station indicator, the associated input is computed as the sum of traffic volumes from Snake River (N), Bondurant (N), and Teton Pass Road (SE). For all other indicators in the table, the input is computed as the sum of traffic volumes from Dubois (W), Snake River (N), Bondurant (N), and Teton Pass Road (SE). Asterisks (*) denote significance at $p < 0.05$.

Table 4. Daily regression model specifications: Regional highway inbound traffic volumes and entrance station inbound traffic volumes.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Granite Entrance Station traffic	Linear	No lag	-605	0.21*	0.1	< 0.001	0.49	26
Moose Entrance Station traffic	Linear	No lag	1592.7*	0.15*	0.034	0.034	0.17	26
Moran Entrance Station traffic	Linear	No lag	-279.5	0.33*	0.679	< 0.001	0.49	26
Moran + Moose + Granite Entrance Station traffic	Linear	No lag	704.5	0.65*	0.593	< 0.001	0.5	26

For the Granite Entrance Station indicator, the regional highway traffic volume input is computed as the sum of traffic volumes from Snake River (N), Bondurant (N), and Teton Pass Road (SE). For all other indicators in the table, the regional highway inbound traffic volume input is computed as the sum of traffic volumes from Dubois (W), Snake River (N), Bondurant (N), and Teton Pass Road (SE). Asterisks (*) denote significance at $p < 0.05$.

Parkwide Perimeter Inbound Traffic Volumes and Official Entrance Station Inbound Traffic Volumes

Table 24 and **Table 25** present results of hourly and daily exploratory regression models that estimate relationships between parkwide perimeter inbound traffic volumes, and official entrance station inbound traffic volumes are presented below. In consultation with park staff, inputs of parkwide perimeter inbound traffic volumes were defined as the sum of traffic volumes from Gros Ventre Junction (Northbound), Granite (Northbound), U.S. Highway 89 (Westbound), and South Gate of Yellowstone (Southbound). Refer to **Figure 34** for locations of parkwide perimeter and inbound traffic volume (entrance stations) inputs. Average daily traffic volumes on parkwide roadways are depicted in **Figure 35.**

Table 24. Hourly regression model specifications: Parkwide perimeter inbound traffic volumes and entrance station inbound traffic volumes.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Moose Entrance Station inbound traffic volumes	Linear	No lag	-61.4*	0.3*	< 0.001	< 0.001	0.53	1380
Moran Entrance Station inbound traffic volumes	Linear	No lag	-18*	0.25*	< 0.001	< 0.001	0.82	1365

Regression model input: Parkwide perimeter inbound traffic volumes, as the sum of traffic volumes from Gros Ventre Junction (N), Granite (N), U.S. Highway 89 (W), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$

Table 25. Daily regression model specifications: Parkwide perimeter inbound traffic volumes and entrance station inbound traffic volumes.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Moose Entrance Station traffic	Linear	No lag	563.7*	0.18*	< 0.001	< 0.001	0.32	92
Moran Entrance Station traffic	Linear	No lag	-1050*	0.31*	< 0.001	< 0.001	0.78	91

Regression model input: Parkwide perimeter inbound traffic volumes, as the sum of traffic volumes from Gros Ventre Junction (N), Granite (N), U.S. Highway 89 (W), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

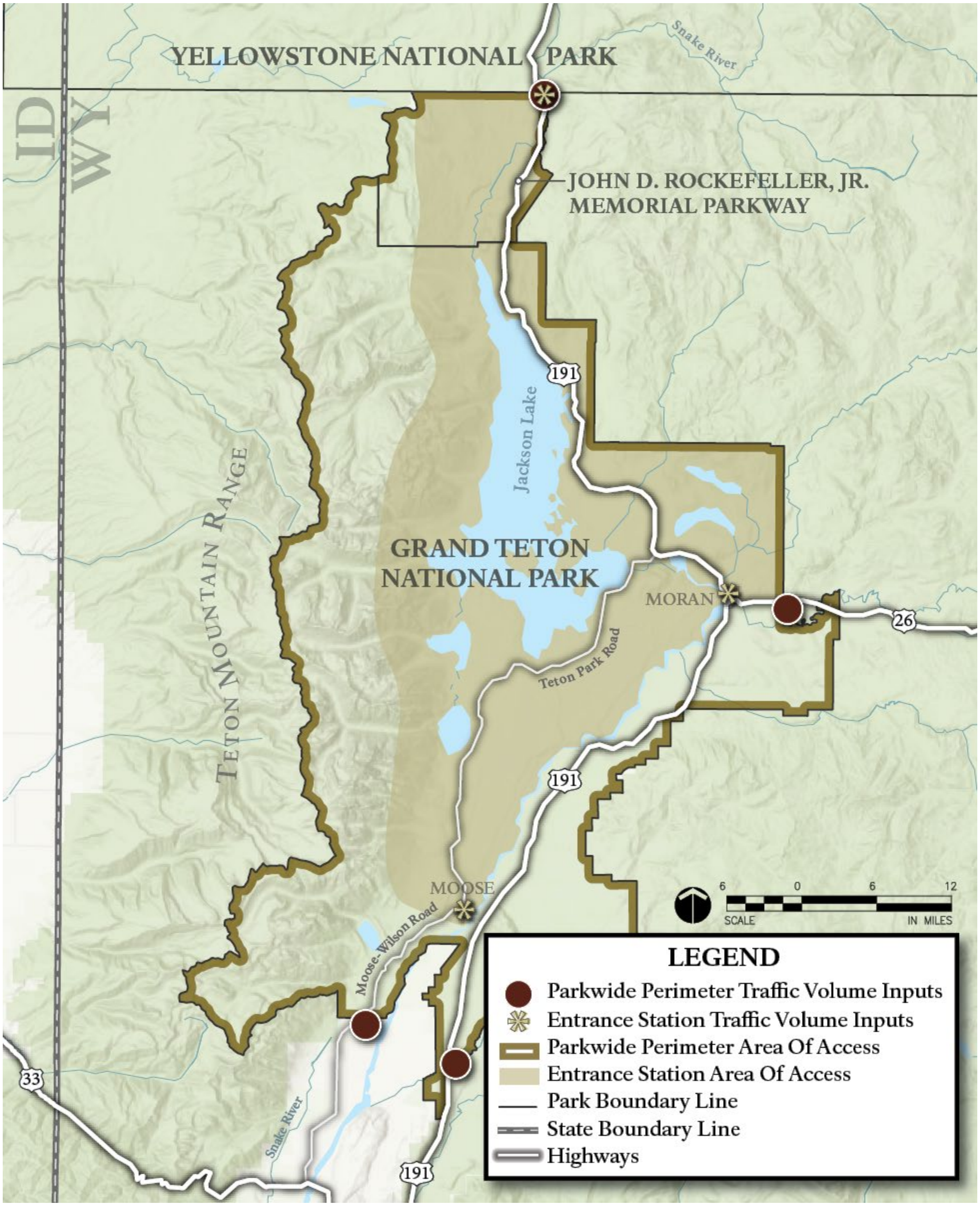

Figure 34. Parkwide perimeter and entrance station traffic volume input locations.

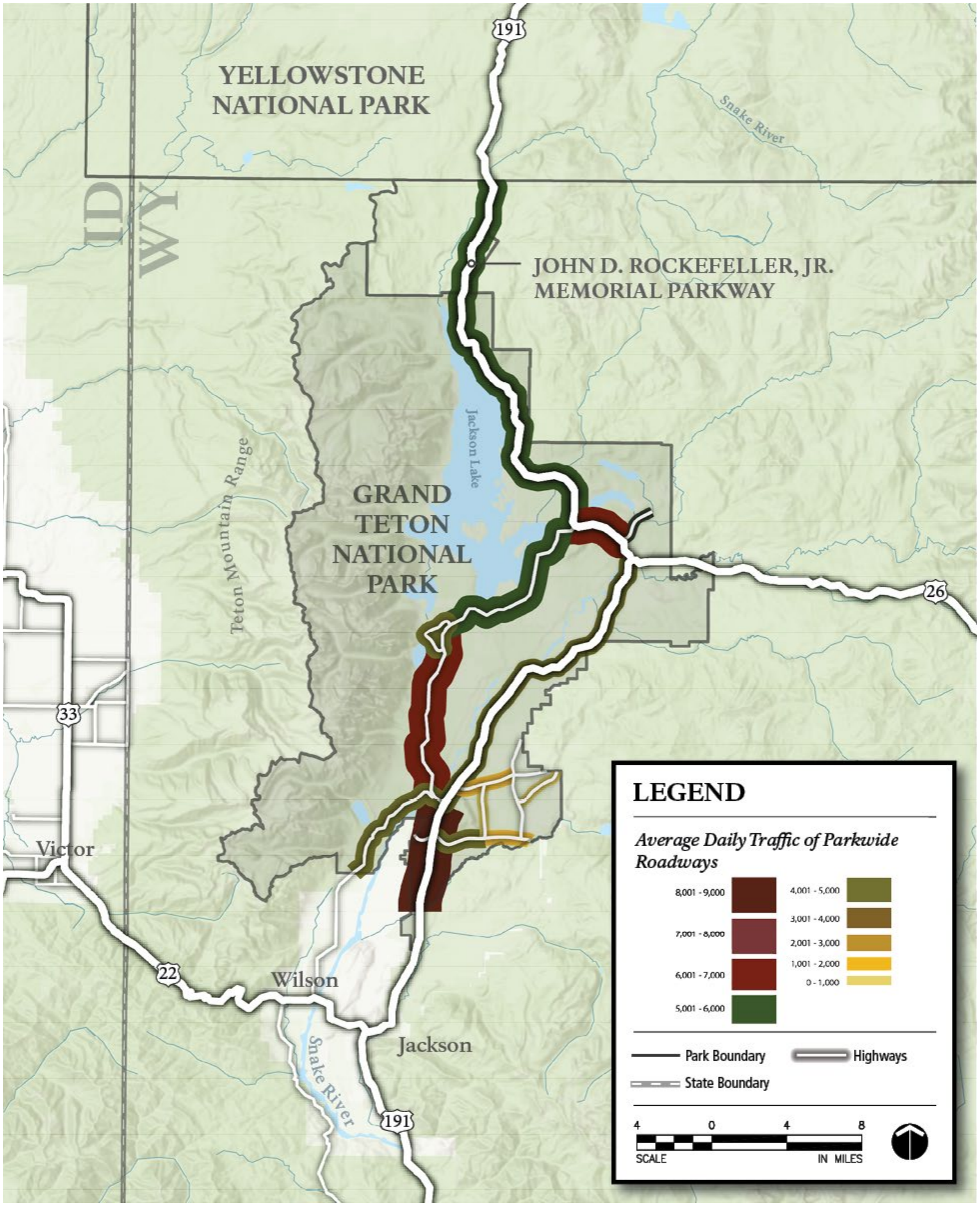

Figure 35. Average daily traffic of parkwide roadways.

Conclusion

This subsection offers concluding insights related to regional and parkwide results:

- Across the calendar year and among the regional highways near the park, average daily traffic is highest on Highway 89/191 between Hoback Junction and Highway 22 and on Teton Pass Road. Annual average daily traffic is lowest on Highway 287 east of Moran Junction and on Highway 191 southeast of Hoback Junction.

- Wejo data results suggest that, during May through September, one-third (33%) of vehicles travel into the region surrounding GRTE from south of Hoback Junction on US-191 and US-89, about one-third (30%) travel into the region from Teton Pass, and the remainder (38%) travel into the region from east of Moran, the airport, or YELL.

- Wejo data results suggest the vast majority of vehicles traveling on regional highways in the direction of GRTE during May through September make stops somewhere along their journeys other than in GRTE. A subset of these travelers may ultimately be destined for GRTE after making one or more intermediate stops outside the park, and the rest do not stop in the park. That said, just over half (56%) of vehicles traveling southbound from YELL and about two-thirds (64%) of vehicles traveling westbound on Highway 187 east of Moran stop in GRTE before stopping anywhere else.

- Within the park and among the road segments included in the study, average daily traffic is highest on Highway 89/191 south of Gros Ventre Junction with 8,800, Highway 89/191 between Teton Park Road and Moran Junction with 6,600, and on Teton Park Road between the Moose Entrance and north of Beaver Creek with 6,100. Average daily traffic is also relatively high on Highway 89/191 between Flagg Ranch and YELL with 4,500 and on Teton Park Road between Jackson Lake Dam and Highway 89/191 with 4,400.

- Wejo data results suggest very few (9%) vehicle-based travelers pass through the park during May through September without stopping and turning off their vehicles' engines. Of those that do make passthrough trips, almost half (45%) passthrough between Jackson and Dubois and about one-quarter (29%) passthrough between Jackson and YELL.

- Wejo data results suggest the most common destinations in the park for visitors traveling in vehicles during July (defined as where they stop and turn off their vehicles' engines) are Colter Bay, Jackson Lake Lodge, and South Jenny Lake. That said, these top three locations make up only 25% of all observed stops made by visitors where they turned off their vehicles' engines. This finding suggests vehicle-based visitors may travel through the park in an "auto-touring" style punctuated with numerous stops at pullouts, overlooks, trailheads, and other locations parkwide.

- Wejo data results suggest a majority (66%) of vehicle trips that enter the Jenny Lake parking area park in the lot and another 15% park on the roadside. In contrast, a majority of vehicle trips that enter the String Lake (73%) and Colter Bay (62%) parking areas leave without parking. Although some of these vehicles may be leaving without parking due to not finding suitable parking, a large portion of those trips do not appear to be circling for parking and are instead making quick visits to the area due to either entering the area by mistake or picking up / dropping off in the lot without turning off the vehicle.

- Wejo data results suggest almost half (41%) of vehicle trips on Jenny Lake Road stop at the Jenny Lake Overlook and about one-fifth (21%) traveling on US-89/191 stop at the Jackson Lake Overlook. Smaller shares of vehicles traveling on adjacent roadways stop at the other pullouts included in the analysis.

- There are statistically significant relationships between the amount of vehicle traffic traveling on highways into the region surrounding GRTE and the number of vehicles that enter the park. For example, for every 3,000 vehicles that travel inbound on highways into the region per day, approximately 2,655 vehicles travel inbound into the park at the Moran, Moose, and Granite entrance stations combined.

Gros Ventre/Antelope Flats Subarea

This section of the report presents descriptive results for select subarea inbound traffic volumes and indicators of parking conditions, as well as the results from exploratory analyses of relationships between transportation inputs and parking conditions in the Gros Ventre/Antelope Flats subarea of GRTE. Key conclusions are presented at the end of this section. The locations of the select subarea inbound traffic volumes and indicators of parking conditions for the Gros Ventre/Antelope Flats subarea are depicted in **Figure 36** and include:

- Gros Ventre Junction (Northbound) traffic volume
- South of Moran Junction (Southbound) traffic volume
- Mormon Row parking lot

See Appendix 4 for additional descriptive results for this subarea.

Traffic Conditions

Figure 37 and **Figure 38** present total daily subarea inbound traffic volumes for select traffic counter locations in the Gros Ventre/Antelope Flats subarea, by day of week category and date during the counting period. These data suggest:

- Daily subarea inbound traffic volumes at Gros Ventre Junction (Northbound) typically ranged from approximately 6,000 to around 8,750 vehicles per day during the counting period. On a few days, the daily traffic volume exceeded 9,000 vehicles per day **(Figure 37**).
- In general, daily subarea inbound traffic volumes at Gros Ventre Junction (Northbound) tended to be slightly higher on weekdays compared to weekend days and holidays, but the differences were not pronounced (**Figure 37**).
- Daily subarea inbound traffic volumes at South Moran Junction (Southbound) typically ranged from just under 3,000 to around 3,750 vehicles per day during the counting period. On a few days, the daily traffic volume reached or exceeded 4,000 vehicles per day. Daily traffic volumes during the second half of August 2021 were notably lower compared to volumes during the rest of the counting period (**Figure 38**).
- In general, daily subarea inbound traffic volumes at South Moran Junction (Southbound) tended to be slightly higher on weekend days and holidays, compared to weekdays (**Figure 38**).
- Overall, Gros Ventre Junction (Northbound) receives roughly twice as much traffic as South Moran Junction (Southbound) on both weekdays and weekend days and holidays (**Figure 37**, **Figure 38**).

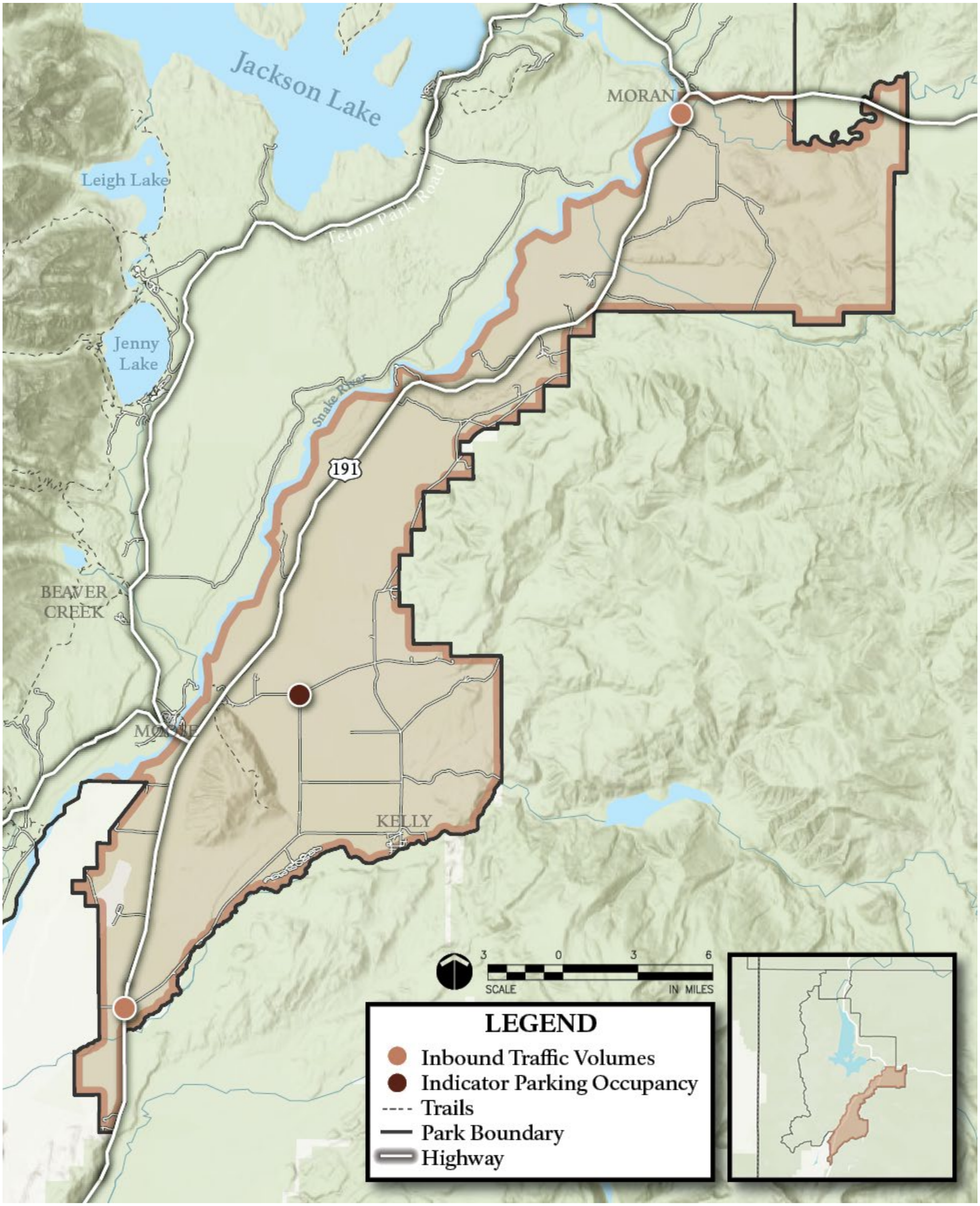

Figure 36. Input and indicator traffic and parking locations – Gros Ventre/Antelope Flats subarea.

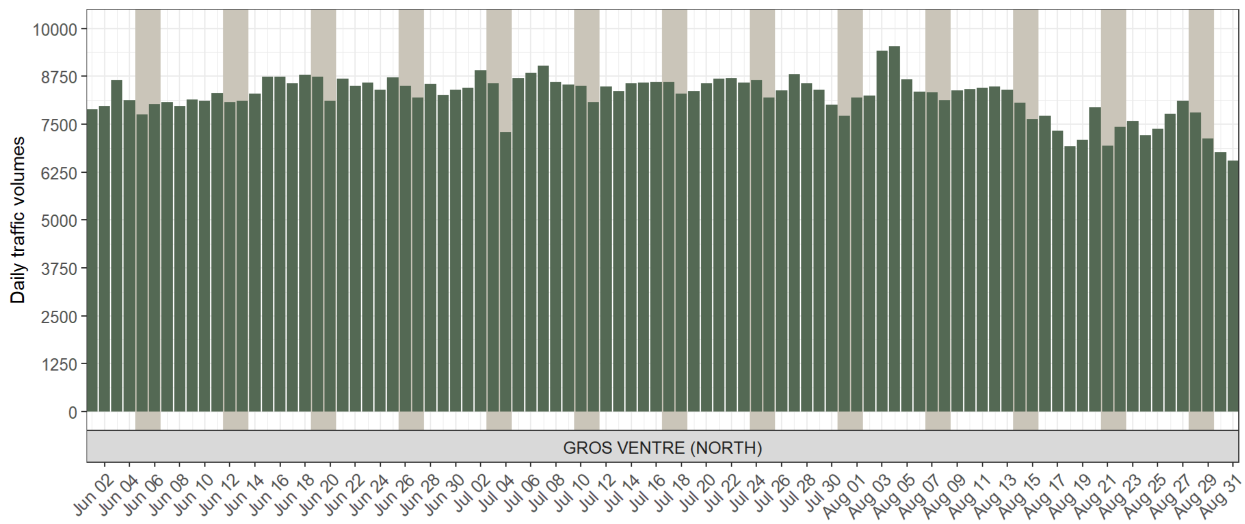

Figure 37. Daily subarea inbound traffic volumes: Gros Ventre Junction Northbound (gray shading indicates weekends/holidays).

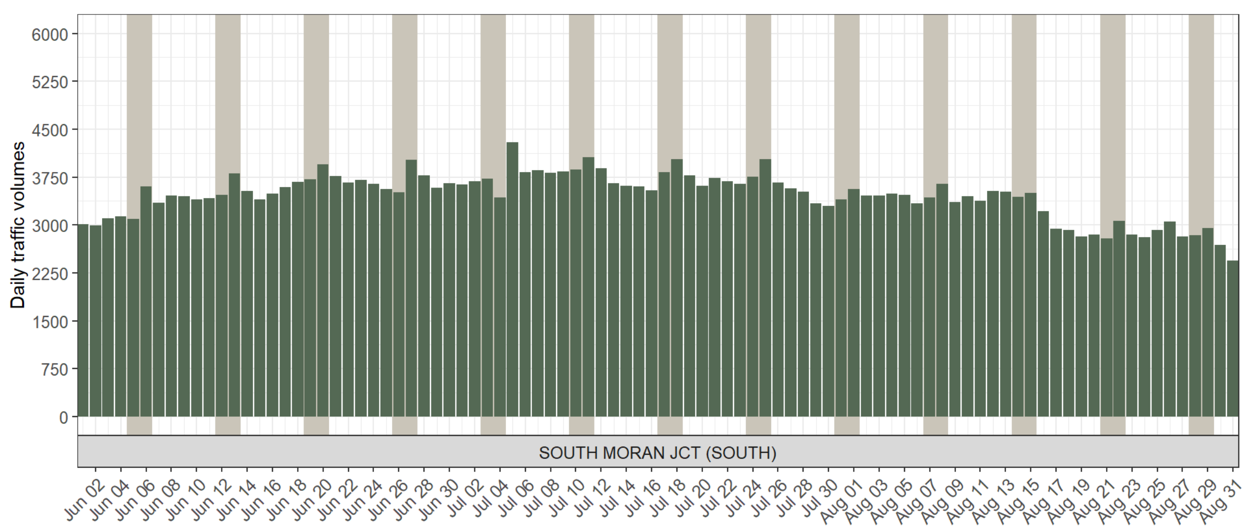

Figure 38. Daily subarea inbound traffic volumes: South Moran Junction Southbound (gray shading indicates weekends/holidays).

Figure 39 and **Figure 40** present mean hourly subarea inbound traffic volumes for select traffic counter locations in the Gros Ventre/Antelope Flats subarea, by day of week category during the counting period. These data suggest:

- Mean hourly subarea inbound traffic volumes at Gros Ventre Junction (Northbound) increased fairly sharply starting at about 4:00 a.m. until reaching a peak of approximately 690 vehicles at 9:00 a.m. on weekdays, and approximately 700 vehicles at 11:00 a.m. on weekend days and holidays (**Figure 39**).

- Mean hourly subarea inbound traffic volumes at Gros Ventre Junction (Northbound) were similar on weekdays and weekend days and holidays, but the peak hour on weekdays was two hours earlier than the peak hour on weekend days and holidays (**Figure 39**).

- Mean hourly subarea inbound traffic volumes at South Moran Junction (Southbound) increased fairly sharply starting at around 5:00 a.m. and increased steadily until an initial peak of around 250 vehicles at 11:00 a.m. on both weekdays and weekend days and holidays. Mean subarea inbound traffic volumes decreased at 12:00 p.m., before increasing to reach a peak at 3:00 p.m. of approximately 300 vehicles on weekdays and approximately 340 vehicles on weekend days and holidays (**Figure 39**).

- Mean hourly subarea inbound traffic volumes at South Moran Junction (Southbound) were similar on weekdays and weekend days and holidays during the early morning and evening, but were slightly higher from 9:00 a.m. through 7:00 p.m. on weekend days and holidays compared to weekdays (**Figure 40**).

- Between the two traffic counter locations, mean hourly subarea inbound traffic volumes increased sharply in the morning at Gros Ventre Junction (Northbound), compared to the late afternoon peak at South Moran Junction (Southbound). On average, hourly traffic volumes were also roughly twice as high at Gros Ventre Junction (Northbound) compared to hourly traffic volumes at South Moran Junction (Southbound) (**Figure 39**, **Figure 40**).

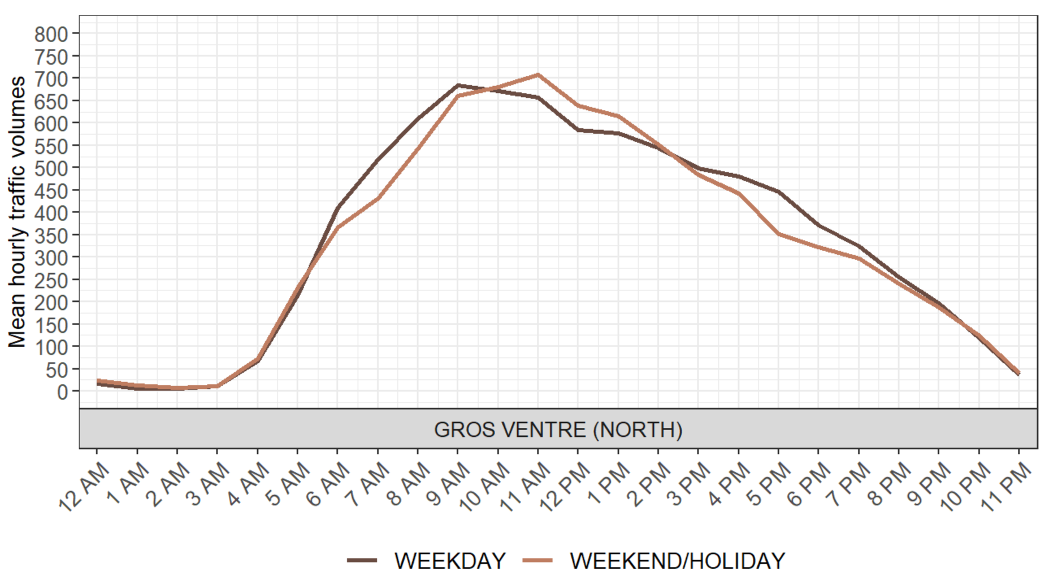

Figure 39. Mean hourly subarea inbound traffic volumes: Gros Ventre Junction (Northbound).

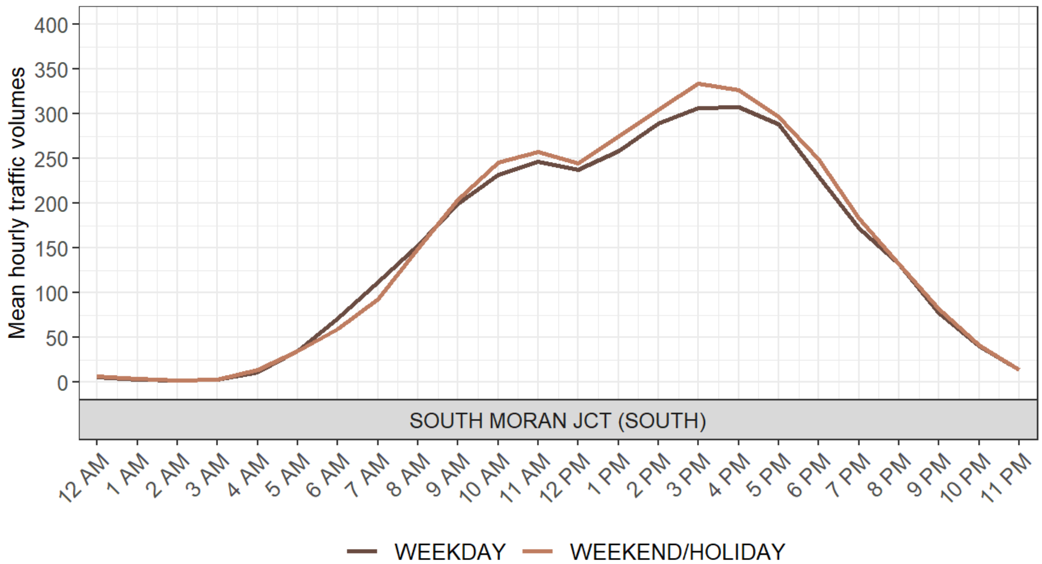

Figure 40. Mean hourly subarea inbound traffic volumes: South Moran Junction (Southbound).

Hard Braking and Hard Acceleration Events

An evaluation of hard braking and hard acceleration events was conducted based on May–September Wejo data. On a subarea basis, the hard braking and hard acceleration events are concentrated at the following locations:

- Hard braking: north and south legs of Gros Ventre roundabout, US 89/191 south of Airport Road, US 89/191 north and south of Antelope Flats Loop Road, US 89/191 south of Moose Junction
- Hard acceleration: US 89/191 south of Airport Road, US 89/191 south of Moose Junction, Teton Park Road west of Moose Junction, Airport Road east of US 89/191

Parking Conditions

Table 26 through **Table 29** report the minimum and maximum hourly number of vehicles parked, the hourly parking occupancy rates, the peak parking hours (10:00 a.m.–4:00 p.m.) parking turnover rate, and the inferred vehicle arrival distribution by date for the select parking areas in the Gros Ventre/Antelope Flats subarea. **Table 26** also reports the parking lot capacity (i.e., total number of identified parking spaces) for parking area.

Unlike other locations for which parking data is reported, counts reported below reflect conditions on Sunday, August 8th only; counts were collected on the preceding Friday and Saturday but were unusable due to an equipment malfunction.

Mormon Row data suggest:

- Parking occupancy rate trends show that vehicles arrive early (likely for the sunrise) and then occupancy rates remain at a consistent rate throughout the day without extreme highs or lows (**Table 27**).
- Parking turnover is defined as the estimated number of vehicles that use each parking stall throughout the peak parking hours (10:00 a.m.–4:00 p.m.). The average turnover rate during the peak parking hours is 1.92. This means that, on average, Mormon Row observes 1.92 vehicles per hour per stall (**Table 28**).
- Wejo-inferred arrival pattern suggests the majority (54%) of vehicle trips arrive at Mormon Row between 9:00 a.m. and 3:00 p.m., which corresponds to the very slightly elevated peak of number of vehicles parked (**Table 29**).
- The median dwell time in the Mormon Row parking lots was 11 minutes, based on Wejo-inferred data (sample size = 618), while the 15th percentile dwell time was 5 minutes and the 85th percentile dwell time was 25 minutes.

Table 26. Minimum and maximum hourly number of vehicles parked by date – Mormon Row.

Location	Sunday Low	High	Capacity
Mormon Row	9	25	40

Table 27. Hourly parking occupancy rates by date – Mormon Row.

Time	Sunday
06:00 AM	38%
07:00 AM	43%
08:00 AM	43%
09:00 AM	45%
10:00 AM	35%
11:00 AM	43%
12:00 PM	58%
01:00 PM	43%
02:00 PM	53%
03:00 PM	25%
04:00 PM	33%
05:00 PM	30%
06:00 PM	33%

Table 28. 10:00 a.m.–4:00 p.m. parking turnover rate – Mormon Row.

Location	3-Day Average
Mormon Row	1.92

Table 29. Wejo-inferred time of day distribution of parking arrivals, by time period – Mormon Row.

Location	Number of Observations	Midnight–6am	6am–9am	9am–noon	Noon–3pm	3pm–6pm	6pm–9pm	9pm–Midnight
Mormon Row	618	6%	19%	27%	27%	15%	6%	0%

Exploratory Analysis

This subsection presents results of final hourly[12] regression models that estimate relationships between inbound traffic volumes, and the key indicator variable in the Gros Ventre/Antelope Flats subarea: parking occupancy rates at Mormon Row. Two groupings of input traffic volumes, (1) parkwide perimeter inbound traffic volumes, and (2) subarea inbound traffic volumes, were measured against the subarea's key indicator variable. The following subsections present tabular results of final regression models for each of the input traffic volume groupings. The GRTE TVM Report Appendix 4 contains scatterplots of regression inputs and indicators with final fitted models.

Regression Model Input: Parkwide Perimeter Inbound Traffic Volumes

Table 30 presents results of a final hourly regression model produced for the Excel-based tool that estimated the relationship between the parkwide perimeter inbound traffic volume, and the key indicator variable regarding parking in the Gros Ventre/Antelope Flats subarea. In consultation with park staff, the parkwide perimeter inbound traffic volume input was defined as the sum of inbound traffic volumes from Gros Ventre Junction (Northbound), Granite (Northbound), U.S. Highway 89 (Westbound), and South Gate of Yellowstone (Southbound). The final hourly regression model was not significant.

Table 30. Hourly regression model specifications: Gros Ventre/Antelope Flats subarea, with the parkwide perimeter inbound traffic volume as the model input.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Mormon Row maximum parking occupancy rate[13]	Linear	No lag	12.3*	0.003	< 0.001	0.455	0.06	12

Regression model input: The parkwide perimeter inbound traffic volume, as the sum of traffic volumes from Gros Ventre Junction (N), Granite (N), U.S. Highway 89 (W), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

[12] No daily-level exploratory analyses were produced because only a single day of Mormon Row parking counts were supplied.

[13] Based on visual inspection, there is no correlation ($R^2 = 0.06$) between the dependent and independent variable. Therefore, the basic OLS linear regression results are present, but the final, non-significant model was not included in the Excel-based tool.

Regression Model Input: Subarea Inbound Traffic Volumes

Table 31 presents results of an exploratory hourly regression model that estimated the relationship between the inbound traffic volume around the perimeter of the Grose Ventre/Antelope Flats subarea, and the key indicator variable regarding parking in the subarea. The subarea inbound traffic volume for the perimeter of the Gros Ventre/Antelope Flats subarea is computed as the sum of traffic counts from Gros Ventre Junction (Northbound) and South Moran Junction (Southbound). The final hourly regression model was not significant.

Table 31. Hourly regression model specifications: Gros Ventre/Antelope Flats subarea, with subarea inbound traffic volumes as the model input.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Mormon Row maximum parking occupancy **rate**	Linear	No lag	12.1*	0.004	0.014	0.425	0.06	12

Regression model input: The subarea inbound traffic volume, as the sum of traffic volumes from Gros Ventre Junction (N) and South Moran Junction (S). Asterisks (*) denote significance at $p < 0.05$.

Conclusion

This subsection offers concluding insights based on traffic and parking conditions for the Gros Ventre/Antelope Flats subarea, as well as the results of the exploratory analysis:

- Daily Northbound traffic volumes at Gros Ventre Junction are relatively stable across days of the week and weeks of the months of July and August. Hourly volumes rise and reach peaks during the morning hours. Generally speaking, northbound traffic at Gros Ventre Junction is nominally higher on weekdays than on weekend days and holidays. These results suggest Northbound traffic at Gros Ventre Junction may tend slightly more toward commuter traffic than recreation-related travel, but there is not enough evidence to conclude this with certainty from the data.

- Daily Southbound traffic volumes at South Moran Junction tend to be slightly higher on weekend days and holidays than on weekdays. Southbound traffic there is relatively consistent from week to week in July and early August and then declines somewhat in the second half of August. Hourly traffic volumes climb to an initial peak during the morning hours, decline somewhat mid-day, and then reach a daily peak during the late afternoon/early evening. These results suggest Southbound traffic at South Moran Junction may tend slightly more toward recreation-related travel than commuter traffic.

- Number of vehicles parked was estimated for one weekend day at Mormon Row, during which the maximum number of vehicles parked was estimated to be well below the parking capacity there. This result suggests parking shortages may not be an issue at Mormon Row, but further monitoring may be warranted.

- There is no statistically significant relationship between the hourly volume of vehicles entering GRTE from the park's perimeter and the number of cars parked at Mormon Row in the same hour. There is also no statistically significant relationship between the hourly volume of vehicles entering the Gros Ventre/Antelope Flats subarea and the number of cars parked at Mormon Row. These results suggest a large share of the vehicle traffic entering the park and entering the subarea are destined for locations (inside and outside of the park) other than Mormon Row.

Moose-Wilson Subarea

This section of the report presents descriptive results for select subarea inbound traffic volumes and indicators of traffic, parking, and trail use conditions, as well as the results from exploratory analyses of relationships between transportation inputs and traffic, parking, and trail use conditions in the Moose-Wilson subarea of GRTE. Key conclusions are presented at the end of this section. The locations of the select subarea inbound traffic volumes and indicators of traffic, parking, and trail use conditions for the Moose-Wilson subarea are depicted in **Figure 41** and include:

- Moose-Wilson (Southbound)[14] traffic volume
- Poker Flats (Northbound) traffic volume
- Death Canyon (Westbound) traffic volume
- Death Canyon (Total) traffic volume
- Laurance S. Rockefeller (LSR) Preserve (Eastbound) traffic volume
- LSR Preserve (Total) traffic volume
- Death Canyon parking occupancy rates
- Death Canyon trail volumes
- Granite Canyon trail volumes
- LSR Preserve Center trail volumes

See Appendix 5 for additional descriptive results for this subarea.

Traffic Conditions

Figure 42 through **Figure 47** present total daily subarea inbound traffic volumes and interior roadway traffic volumes for select traffic counter locations in the Moose-Wilson subarea, by date during the counting period. These data suggest:

- Daily subarea inbound traffic volumes at Moose-Wilson (Southbound) typically ranged from approximately 750 to around 1,250 vehicles per day during the counting period. On five days, the daily traffic volume exceeded 1,500 vehicles per day. Daily inbound traffic volumes decreased sharply for a two-day period in mid-June, late July, and late August 2021, which was likely due to road closures for grading/maintenance work. (**Figure 42**).

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[14] Sawmill Ponds (Southbound) traffic counter data were used as proxy counter for the Moose-Wilson (Southbound) traffic volume.

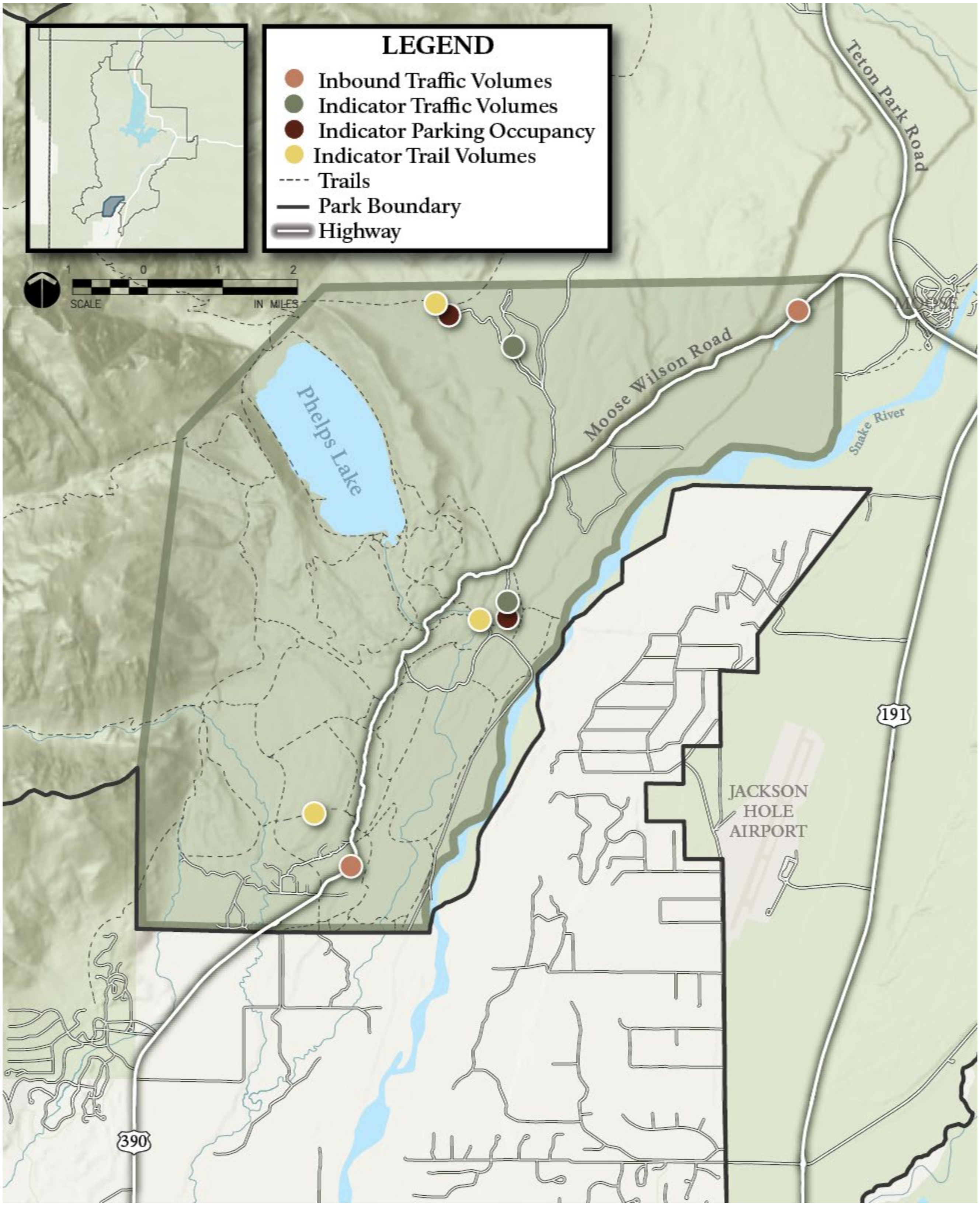

Figure 41. Input and indicator traffic, parking, and trail locations – Moose-Wilson subarea.

- At Moose-Wilson (Southbound), daily subarea inbound traffic volumes tended to be slightly higher on weekend days and holidays compared to weekdays, but these differences were not pronounced (**Figure 42**).

- Daily subarea inbound traffic volumes at Poker Flats (Northbound) typically ranged from approximately 800 to around 1,125 vehicles per day during the counting period. On a few days, the daily traffic volume exceeded 1,250 vehicles per day. Daily inbound traffic volumes during the second half of August 2021 were notably lower compared to volumes during the rest of the counting period (**Figure 43**).

- At Poker Flats (Northbound), daily subarea inbound traffic volumes tended to be slightly higher on or near weekend days and holidays compared to weekdays, but these differences were not pronounced (**Figure 43**).

- Daily interior roadway traffic volumes at Death Canyon (Westbound) typically ranged from about 175 to around 225 vehicles per day during the counting period. On a few days, daily interior roadway traffic volumes exceeded 250 vehicles per day (**Figure 44**).

- At Death Canyon (Westbound), daily interior roadway traffic volumes tended to increase leading up to most weekend days and holidays and remained high through the weekend days and holidays, compared to most weekdays (**Figure 44**).

- Daily interior roadway traffic volumes at Death Canyon (Total) overall typically ranged from about 350 to around 450 vehicles per day during the counting period. On a few days, daily interior roadway traffic volumes exceeded 500 vehicles per day (**Figure 45**).

- Similar to Death Canyon (Westbound), daily interior roadway traffic volumes at Death Canyon (Total) overall tended to increase leading up to most weekend days and holidays and remained high through the weekend days and holidays, compared to most weekdays (**Figure 45**).

- Daily interior roadway traffic volumes at LSR Preserve (Eastbound) typically ranged from approximately 275 to around 325 vehicles per day during the counting period. On a few days, the daily interior roadway traffic volume approached 400 vehicles per day (**Figure 46**).

- At LSR Preserve (Eastbound), daily interior roadway traffic volumes tended to increase leading up to most weekend days and holidays and remained high through the weekend days and holidays, compared to most weekdays (**Figure 46**).

- Daily interior roadway traffic volumes at LSR Preserve (Total) overall typically ranged from approximately 575 to around 650 vehicles per day during the counting period. On a few days, daily interior roadway traffic volumes approached 800 vehicles per day (**Figure 47**).

- Similar to LSR Preserve (Eastbound), daily interior roadway traffic volumes at LSR Preserve (Total) overall tended to increase leading up to most weekend days and holidays and remained high through the weekend days and holidays, compared to most weekdays (**Figure 47**).

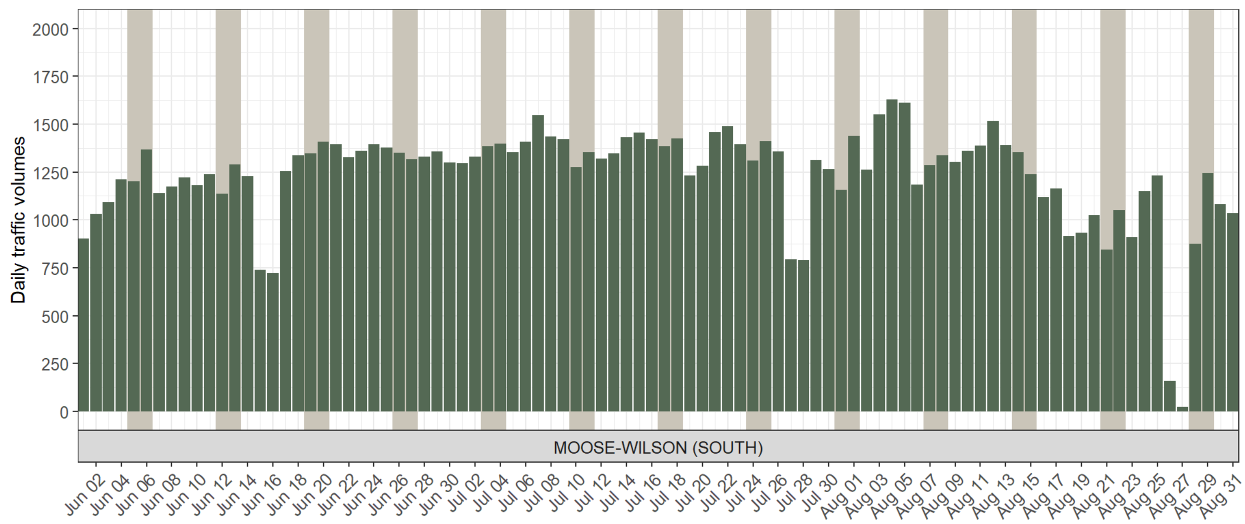

Figure 42. Daily subarea inbound traffic volumes: Moose-Wilson Road (Southbound; gray shading indicates weekends/holidays).

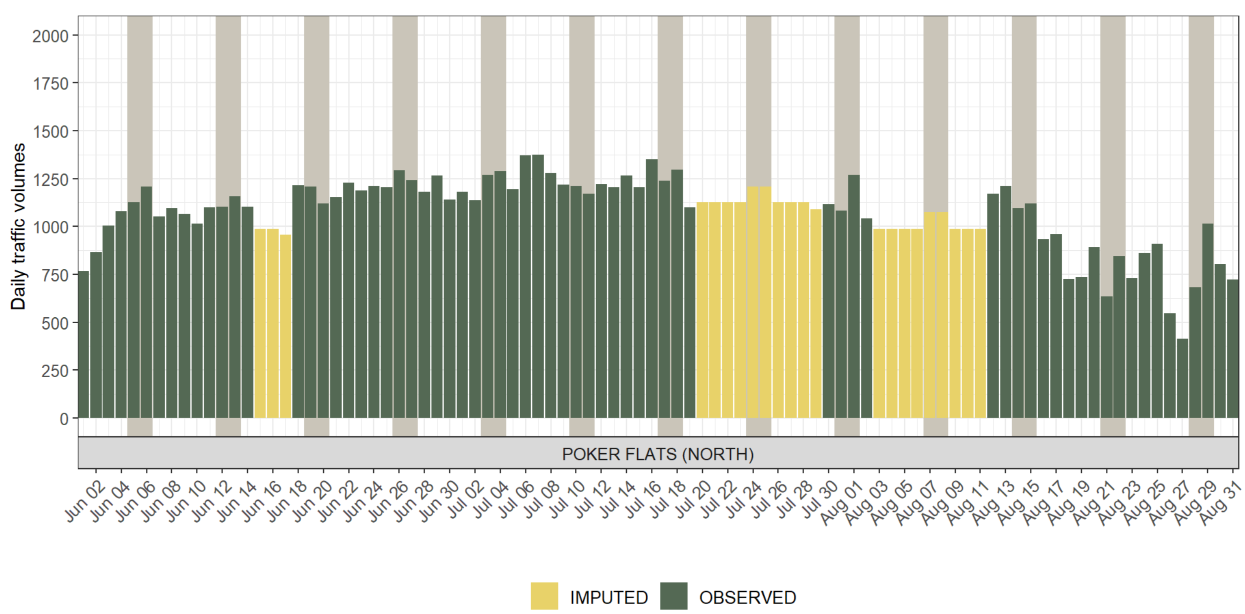

Figure 43. Daily subarea inbound traffic volumes: Poker Flats (Northbound; gray shading indicates weekends/holidays).

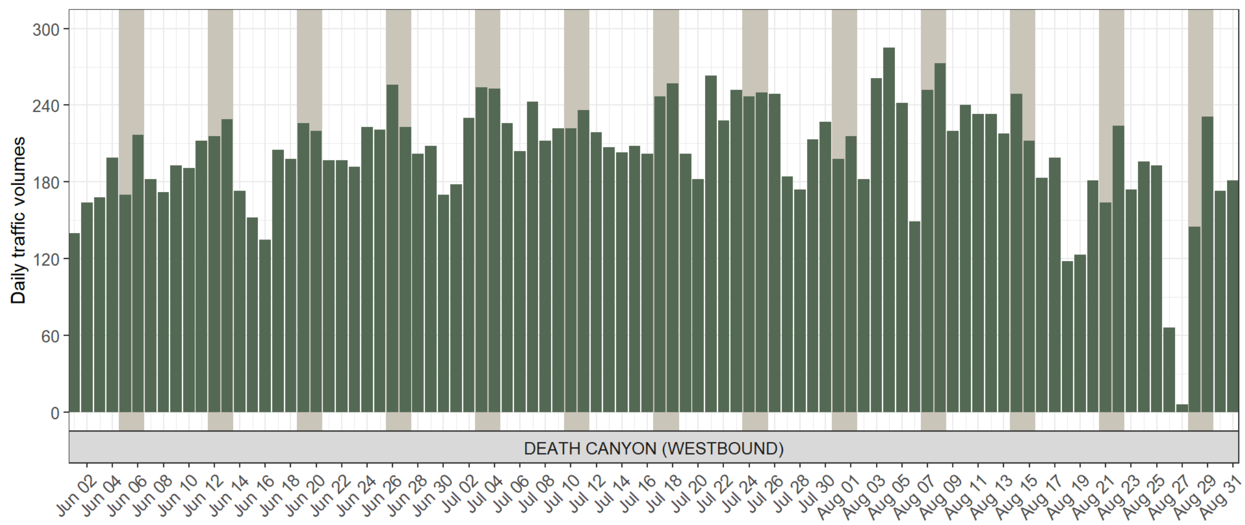

Figure 44. Daily interior roadway traffic volumes: Death Canyon (Westbound; gray shading indicates weekends/holidays).

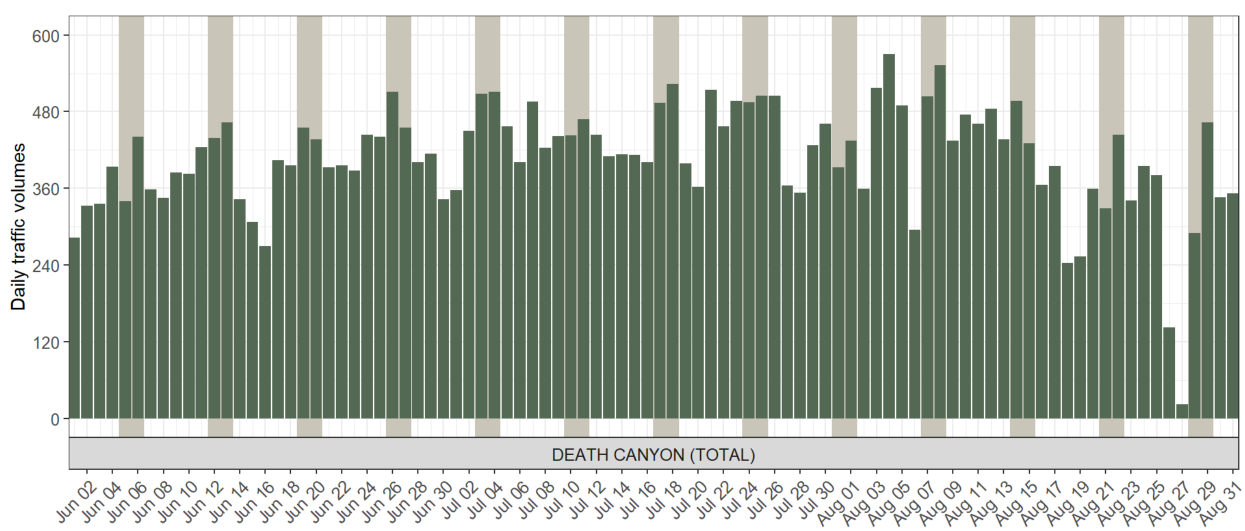

Figure 45. Daily interior roadway traffic volumes: Death Canyon total (gray shading indicates weekends/holidays).

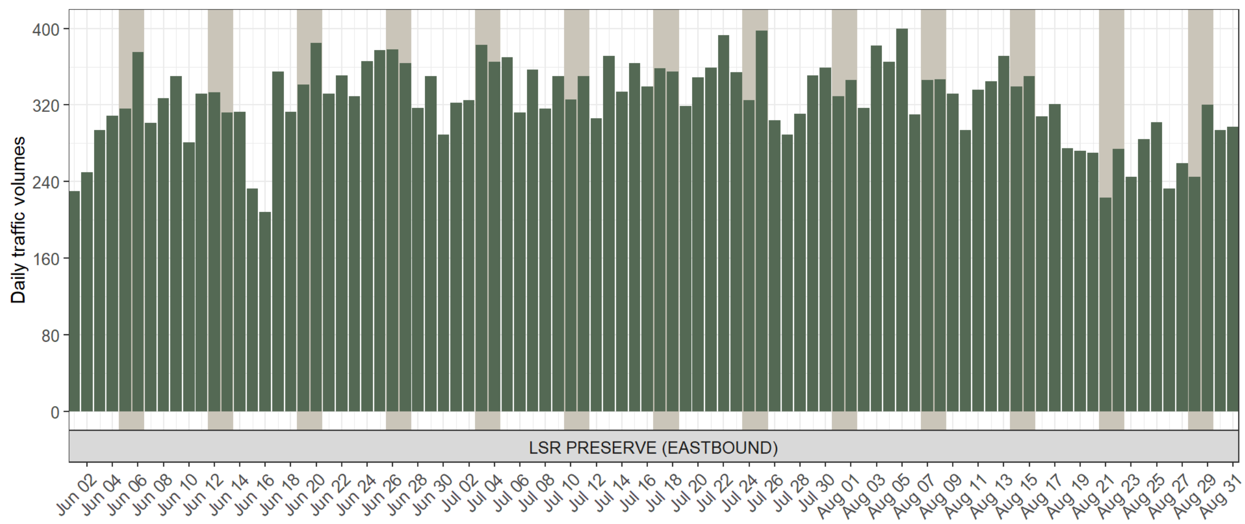

Figure 46. Daily interior roadway traffic volumes: LSR Preserve (Eastbound; gray shading indicates weekends/holidays).

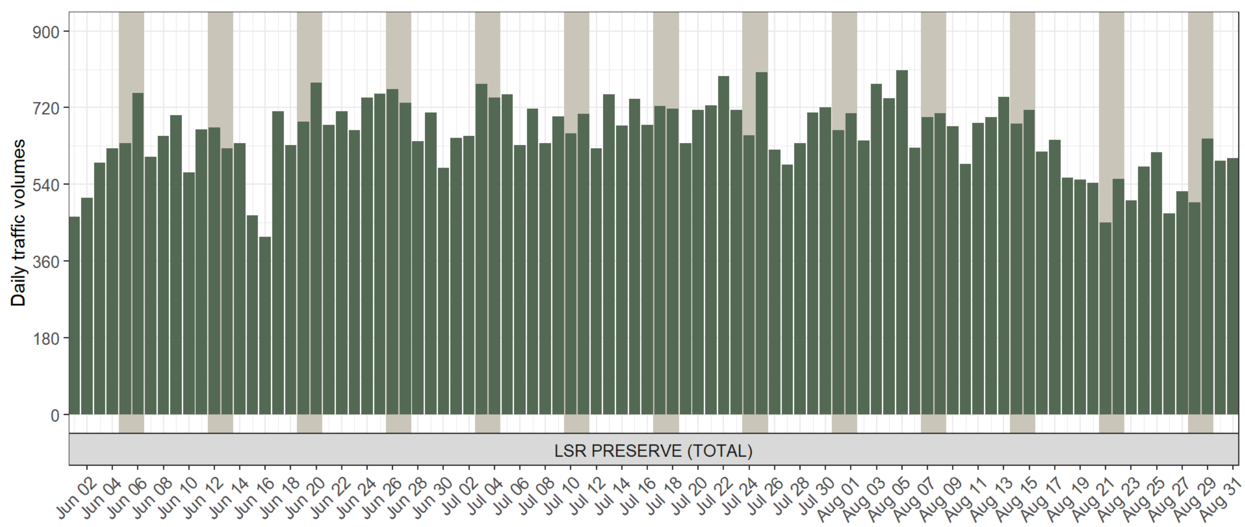

Figure 47. Daily interior roadway traffic volumes: LSR Preserve (Total; gray shading indicates weekends/holidays).

48 through **Figure 53** present mean hourly subarea inbound and interior roadway traffic volumes for select traffic counter locations in the Moose-Wilson subarea, by day of week category during the counting period. These data suggest:

- Mean hourly subarea inbound traffic volumes at Moose-Wilson (Southbound) increased sharply starting at around 6:00 a.m. and increased steadily until reaching a peak of just over 125 vehicles at 4:00 p.m. on weekend days and holidays. The peak was delayed by one hour (5:00 p.m.) on weekdays but was similar in magnitude (**Figure 48**).

- Mean hourly subarea inbound traffic volumes at Moose-Wilson (Southbound) were similar on weekdays and weekend days and holidays up to 9:00 a.m., when hourly traffic volumes on weekend days and holidays exceeded hourly traffic volumes on weekdays until 4:00 p.m. At that time, hourly traffic volumes on weekend days and holidays dropped below inbound traffic volumes on weekdays from 5:00 p.m. through approximately 7:00 p.m. (**Figure 48**).

- Mean hourly subarea inbound traffic volumes at Poker Flats (Northbound) increased fairly sharply starting at around 5:00 a.m. and increased sharply until reaching a peak of approximately 110 vehicles at 10:00 a.m. on both weekdays and weekend days and holidays. Mean hourly traffic volumes began decreasing at 10:00 a.m. on weekdays and at 11:00 a.m. on weekends and holidays and continued to steadily decrease through the remainder of the day on both weekdays and weekend days and holidays (**Figure 49**).

- Mean hourly subarea inbound traffic volumes at Poker Flats (Northbound) were similar on weekdays and weekend days and holidays up to 10:00 a.m., when hourly traffic volumes on weekend days and holidays exceeded hourly traffic volumes on weekdays until 6:00 p.m. (**Figure 49**).

- In general, mean hourly inbound traffic volumes increased sharply in the morning at Poker Flats (Northbound) (**Figure 49**), compared to the early evening peak at Moose-Wilson (Southbound) (**Figure 48**).

- Mean hourly interior roadway traffic volumes at Death Canyon (Westbound) increased fairly sharply starting at around 6:00 a.m. and increased steadily until reaching a peak at 11:00 a.m. of around 23 vehicles on weekdays and approximately 28 vehicles on weekend days and holidays. Mean hourly interior roadway traffic volumes began to steadily decrease after 11:00 a.m. on weekend days and holidays, while the decrease in hourly interior roadway traffic volumes was less pronounced on weekdays (**Figure 50**).

- Mean hourly interior roadway traffic volumes at Death Canyon (Westbound) were higher on weekend days and holidays compared to weekdays from 5:00 a.m. through 5:00 p.m., but only by approximately five vehicles per hour at most (**Figure 50**).

- On both weekdays and weekends and holidays, mean hourly interior roadway traffic volumes at Death Canyon (Total) increased fairly sharply starting at around 6:00 a.m. and increased steadily until 11:00 a.m., when they stabilized before decreasing at 3:00 p.m. From 11:00 a.m. through 3:00 p.m., hourly interior roadway traffic volumes stabilized at around 35 vehicles per hour on weekdays and ranged from 40–45 vehicles per hour on weekend days and holidays (**Figure 51**).

- Mean hourly interior roadway traffic volumes at Death Canyon (Total) were higher on weekend days and holidays compared to weekdays from approximately 8:00 a.m. through 9:00 p.m., but only by approximately seven vehicles per hour at most (**Figure 51**).

- Mean hourly interior roadway traffic volumes at LSR Preserve (Eastbound) increased fairly sharply starting at around 6:00 a.m. and increased sharply until 9:00 a.m., when hourly interior roadway traffic volumes stabilized before decreasing at 12:00 p.m. on weekdays and at 1:00 p.m. on weekend days and holidays. From 9:00 a.m. through midday, hourly interior roadway traffic volumes stabilized at just over 30 vehicles per hour on weekdays and weekend days and holidays (**Figure 52**).

- Mean hourly interior roadway traffic volumes at LSR Preserve (Eastbound) were only slightly higher on weekend days and holidays compared to weekdays from approximately 8:00 a.m. through 7:00 p.m., but always by less than five vehicles per hour at most (**Figure 52**).

- Mean hourly interior roadway traffic volumes at LSR Preserve (Total) increased fairly sharply starting at around 6:00 a.m. and increased steadily until 12:00 p.m., before decreasing slowly until 4:00 p.m. and then decreasing steadily for the remainder of the day on weekdays and weekend days and holidays. Hourly interior roadway traffic volumes peaked at approximately 63 vehicles at 12:00 p.m. on weekdays and at 1:00 p.m. on weekend days and holidays (**Figure 53**).

- Mean hourly interior roadway traffic volumes at LSR Preserve (Total) differed only slightly between weekdays and weekend days and holidays, with hourly traffic volumes on weekend days and holidays only slightly higher from 8:00 a.m. through 9:00 p.m. (**Figure 53**).

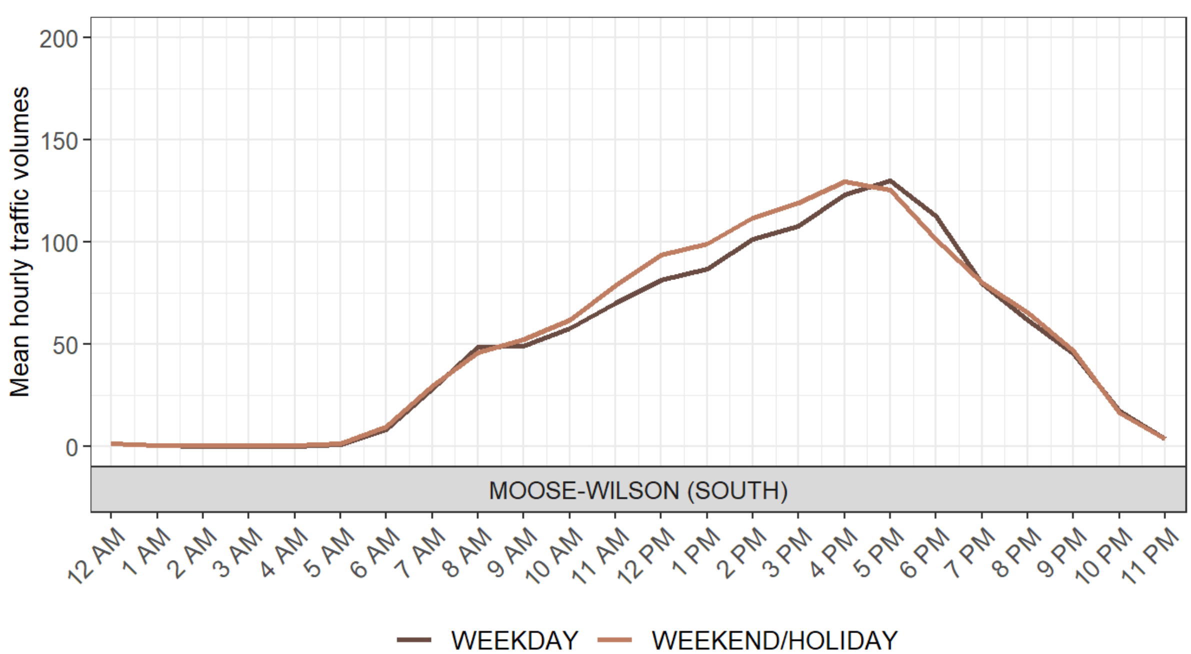

Figure 48. Mean hourly subarea inbound traffic volumes: Moose-Wilson Road (Southbound).

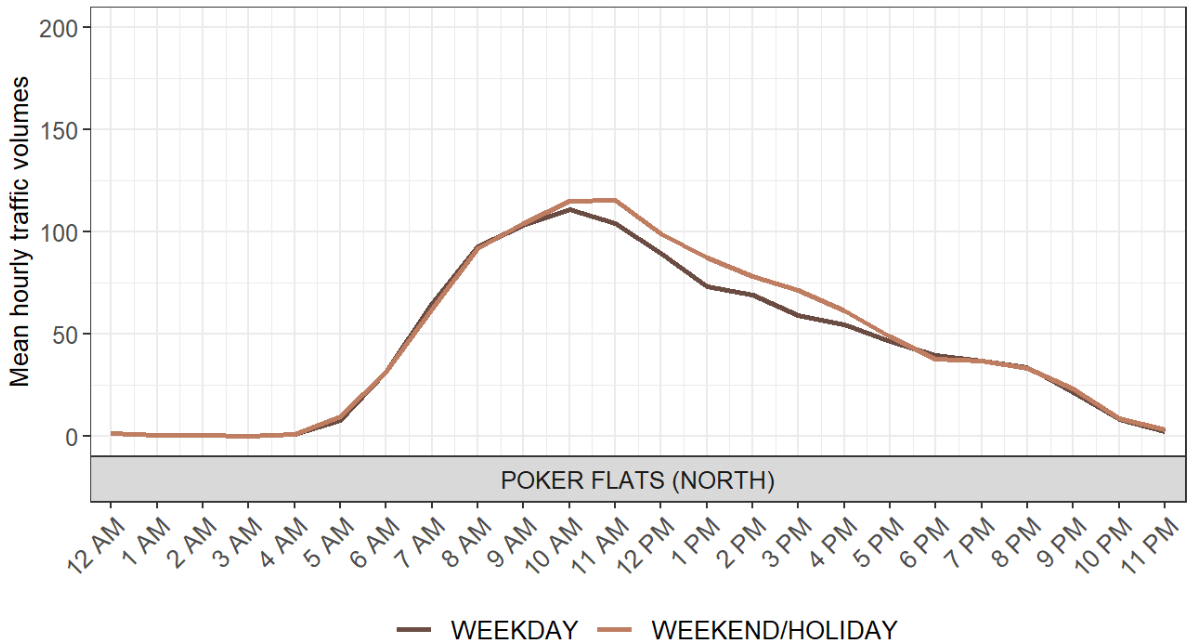

Figure 49. Mean hourly subarea inbound traffic volumes: Poker Flats (Northbound).

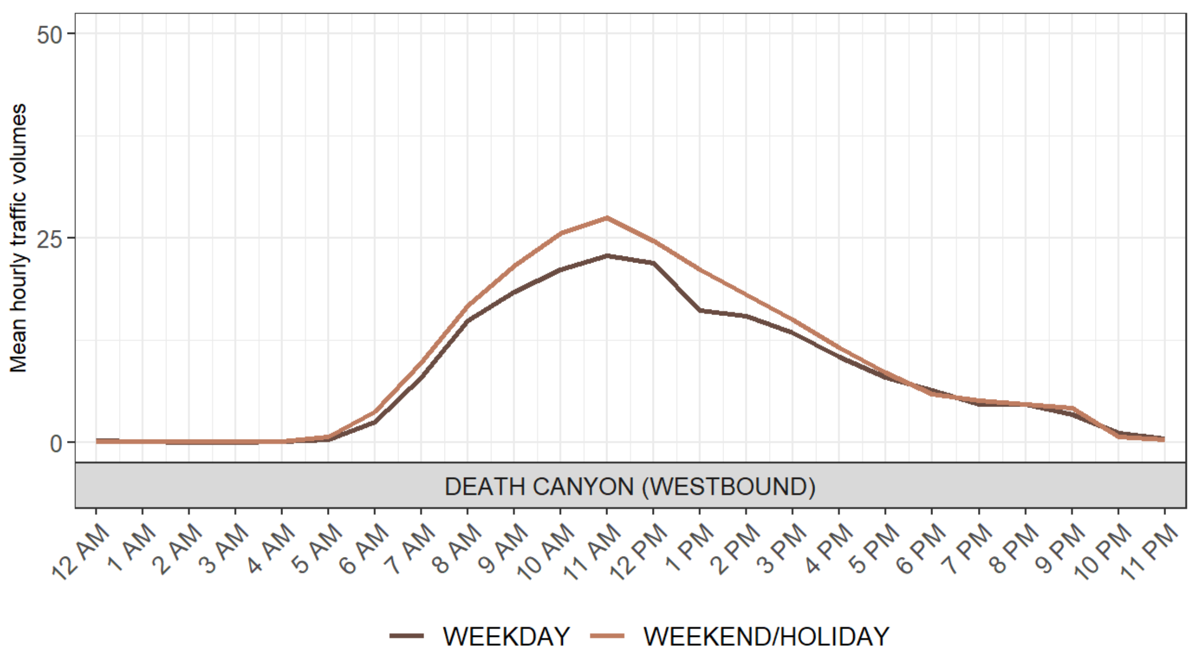

Figure 50. Mean hourly interior roadway traffic volumes: Death Canyon (Westbound).

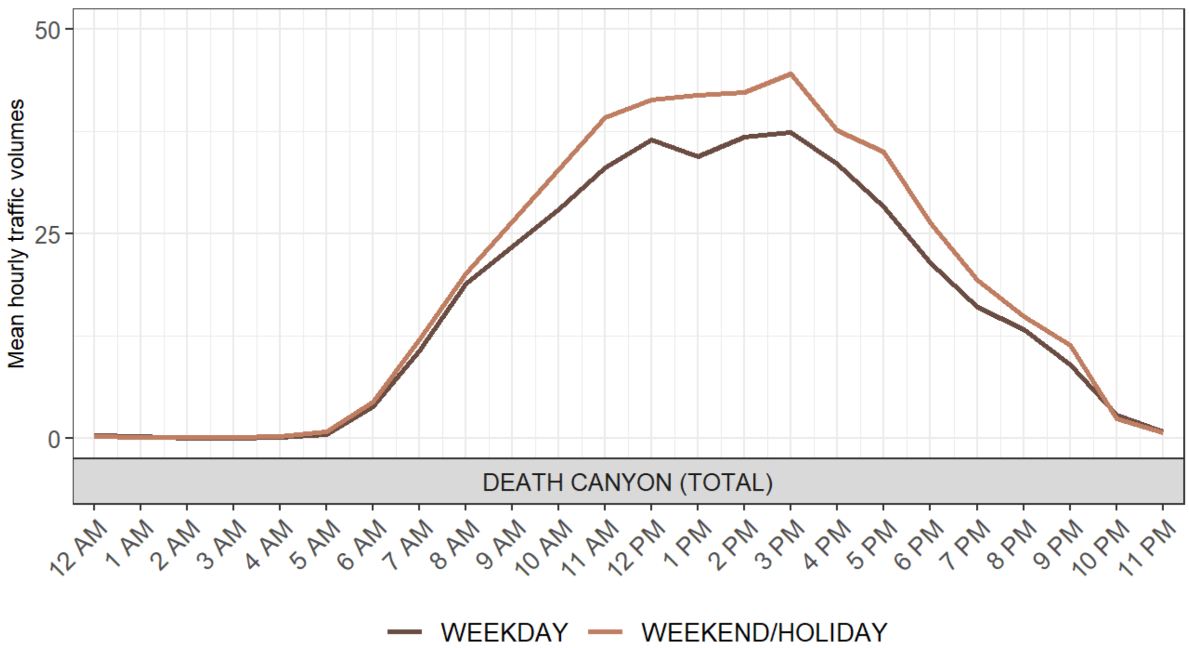

Figure 51. Mean hourly interior roadway traffic volumes: Death Canyon (Total).

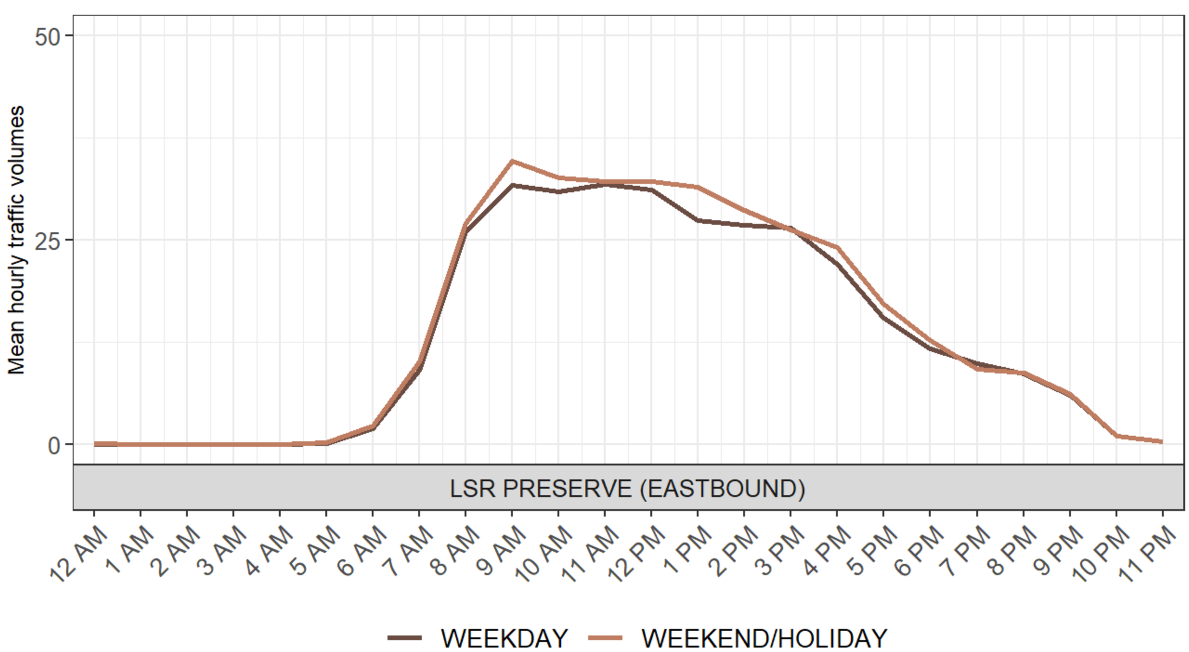

Figure 52. Mean hourly interior roadway traffic volumes: LSR Preserve (Eastbound).

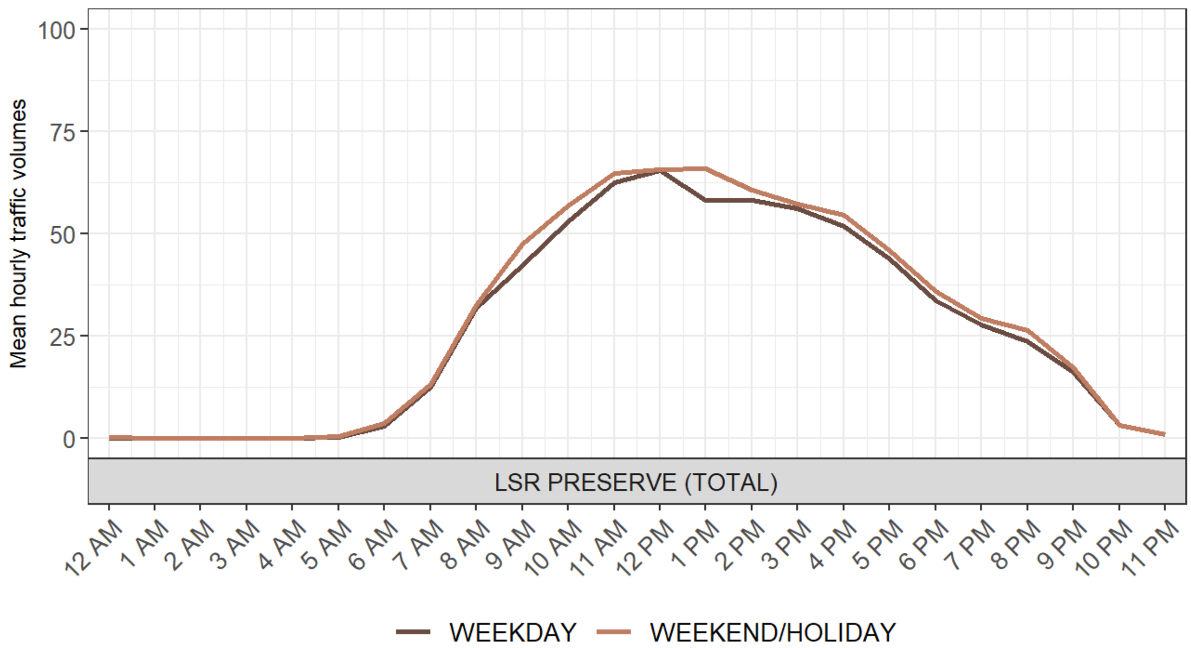

Figure 53. Mean hourly interior roadway traffic volumes: LSR Preserve (Total).

Hard Braking and Hard Acceleration Events

An evaluation of hard braking and hard acceleration events was conducted based on May–September Wejo data. On a subarea basis, the hard braking and hard acceleration events are concentrated at the following locations:

- Hard braking: Moose-Wilson Road south of Teton Park Road, Moose-Wilson Road approximately 0.7 mile south of Teton Park Road, Moose-Wilson Road south of Lake Creek
- Hard acceleration: Moose-Wilson Road south of Teton Park Road, Moose-Wilson Road south of Granite Canyon Entrance

Parking Conditions

Table 32 through **Table 34** report the minimum and maximum hourly number of vehicles parked, the hourly parking occupancy rates, the peak parking hours (10:00 a.m.–4:00 p.m.) parking turnover rate, and the inferred vehicle arrival distribution by date for the select parking areas in the Moose-Wilson subarea. **Table 32** also reports the parking lot capacity (i.e., total number of identified parking spaces) for the select parking area.

Death Canyon data suggest:

- This location sees higher accumulation on the weekends. Because of the nearby trailhead with overnight options, there were always vehicles parked at this location during observations (**Table 32).**

- Parking occupancy rate trends show that visitors arrive early (likely to start their hikes early) and then occupancy rates peak at mid-day, likely from day hiker activity (**Table 33**).

- Parking turnover is defined as the estimated number of vehicles that use each parking stall throughout the peak parking hours (10:00 a.m.– 4:00 p.m.). The average turnover rate during the peak parking hours is 0.14. This means that, on average, Death Canyon observes 0.14 vehicle per hour per stall (**Table 34**).

Table 32. Minimum and maximum hourly number of vehicles parked by date – Death Canyon.

Location	Friday Low	High	Saturday Low	High	Sunday Low	High	Capacity
Death Canyon	4	38	31	145	29	143	145

Table 33. Hourly parking occupancy rates by date – Death Canyon

Time	Friday	Saturday	Sunday	3-Day Average
06:00 AM	4%	17%	16%	12%
07:00 AM	8%	28%	27%	21%
08:00 AM	12%	42%	41%	31%
09:00 AM	10%	54%	52%	39%
10:00 AM	16%	67%	66%	49%
11:00 AM	23%	86%	84%	64%
12:00 PM	23%	98%	97%	73%
01:00 PM	26%	91%	90%	69%
02:00 PM	21%	81%	79%	60%
03:00 PM	21%	80%	79%	60%
04:00 PM	7%	63%	61%	44%
05:00 PM	6%	43%	42%	30%
06:00 PM	3%	32%	30%	22%

Values in red indicate hours where lot is over 95% occupancy.

Table 34. 10:00 a.m.– 4:00 p.m. parking turnover rate – Death Canyon.

Location	Friday	Saturday	Sunday	3-Day Average
Death Canyon	0.10	0.16	0.16	0.14

Trail Use Conditions

Table 35 reports the calibration regression model specifications for trail counter data from select locations in the Moose-Wilson subarea. In all cases, coefficients from regression models with no intercept were used to calibrate the trail counter data for each location. The GRTE TVM Report

Appendix 5 contains trail counter calibration scatterplots with intercept and no intercept linear regression models plotted.

Table 35. Calibration regression model with no intercept results for select trail counter locations in the Moose-Wilson subarea.

Location	Coefficient Estimate	P-value
Death Canyon	1.266*	< 0.001
Granite Canyon	0.899*	< 0.001
LSR Preserve Center	1.366*	< 0.001

Asterisks (*) denote significance at $p < 0.05$.

Figure 54 through **Figure 56** present total calibrated daily trail volumes (arrivals and departures) for select trail counter locations in the Moose-Wilson subarea, by date. These data suggest:

- Daily trail volumes at Death Canyon typically ranged from approximately 750 to less than 1,000 per day. On a few days, daily trail volumes approached or exceeded 1,250 per day (**Figure 54**).
- Daily trail volumes at Granite Canyon typically ranged from approximately 125 to 150 per day. On a few days, daily trail volumes exceeded 175 per day (**Figure 55**).
- Daily trail volumes at LSR Preserve Center typically ranged from approximately 750 to 1,125 per day. On a few days, daily trail volumes exceeded 1,250 per day (**Figure 56**).
- In general, daily trail volumes at Death Canyon (**Figure 54**) and Granite Canyon (**Figure 55**) tended to be higher on weekend days and holidays compared to weekdays, but the differences were not pronounced. No discernable differences exist in daily trail volumes on weekdays compared to weekend days and holidays at LSR Preserve Center (**Figure 56**).

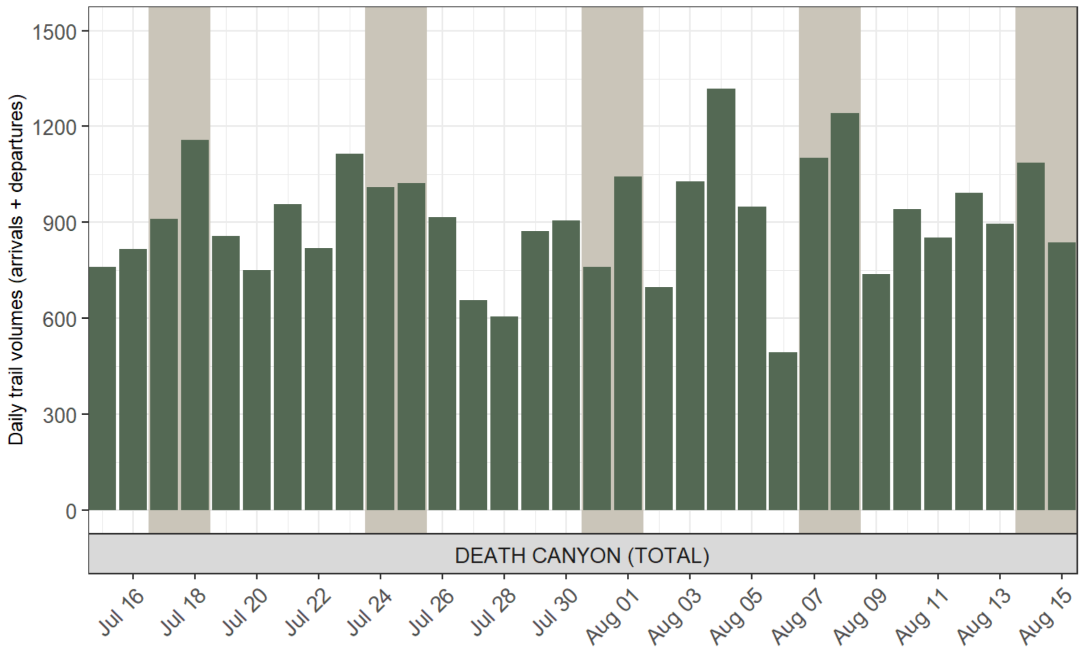

Figure 54. Daily trail volumes: Death Canyon (gray shading indicates weekends/holidays).

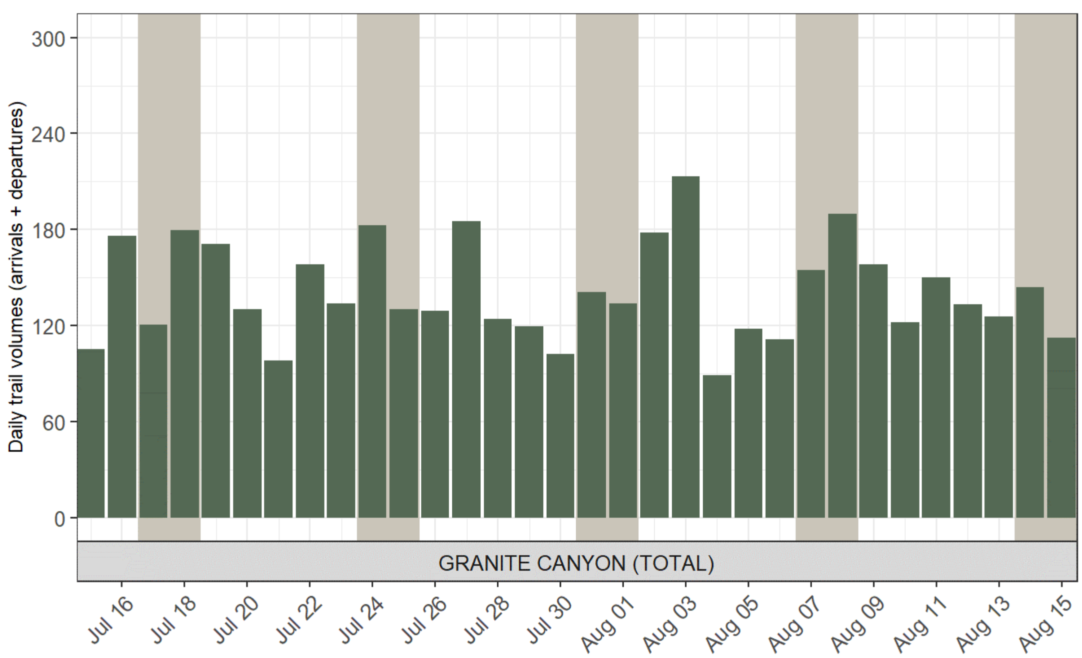

Figure 55. Daily trail volumes: Granite Canyon (gray shading indicates weekends/holidays).

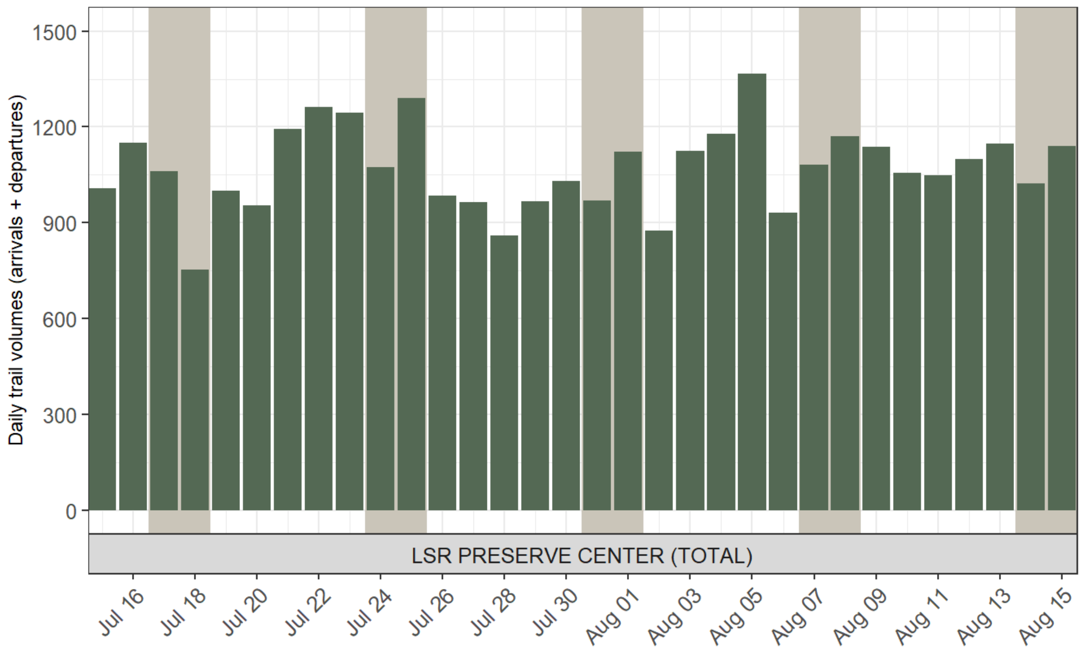

Figure 56. Daily trail volumes: LSR Preserve Center (gray shading indicates weekends/holidays).

Figure 57 through **Figure 59** present mean hourly calibrated trail volumes (arrivals and departures) for select trail counter locations in the Moose-Wilson subarea, by day of week category. These data suggest:

- Mean hourly trail volumes at Death Canyon increased starting at 6:00 a.m., stabilized during a peak period midday, and decreased steadily through the afternoon and evening. Mean hourly trail volumes were slightly higher on weekend days and holidays compared to weekdays for most of the day, and peaked at around 125 on weekend days and holidays compared to around 100 on weekdays (**Figure 57**).
- Mean hourly trail volumes at Granite Canyon increased sharply from 6:00 a.m. to a peak of around 20 at 11:00 a.m. on weekdays, and 25 at 12:00 p.m. on weekend days and holidays. Mean hourly trail volumes decreased steadily through the afternoon and evening. Mean hourly trail volumes were slightly higher on weekend days and holidays during the peak and early afternoon, but by approximately 3–10 per hour at most (**Figure 58**).
- Mean hourly trail volumes at LSR Preserve Center increased sharply from 6:00 a.m. to 8:00 a.m., then briefly decreased before increasing again and stabilizing at a peak of about 100–110 from 11:00 a.m. through 4:00 p.m. Mean hourly trail volumes decreased through the late afternoon and evening. Mean hourly trail volumes were slightly higher on weekdays during the peak period of the day but were lower during the late afternoon and evening compared to mean hourly trail volumes on weekend days and holidays; however, the

differences in mean hourly trail volumes on weekdays compared to weekend days and holidays were not pronounced (**Figure 59**).

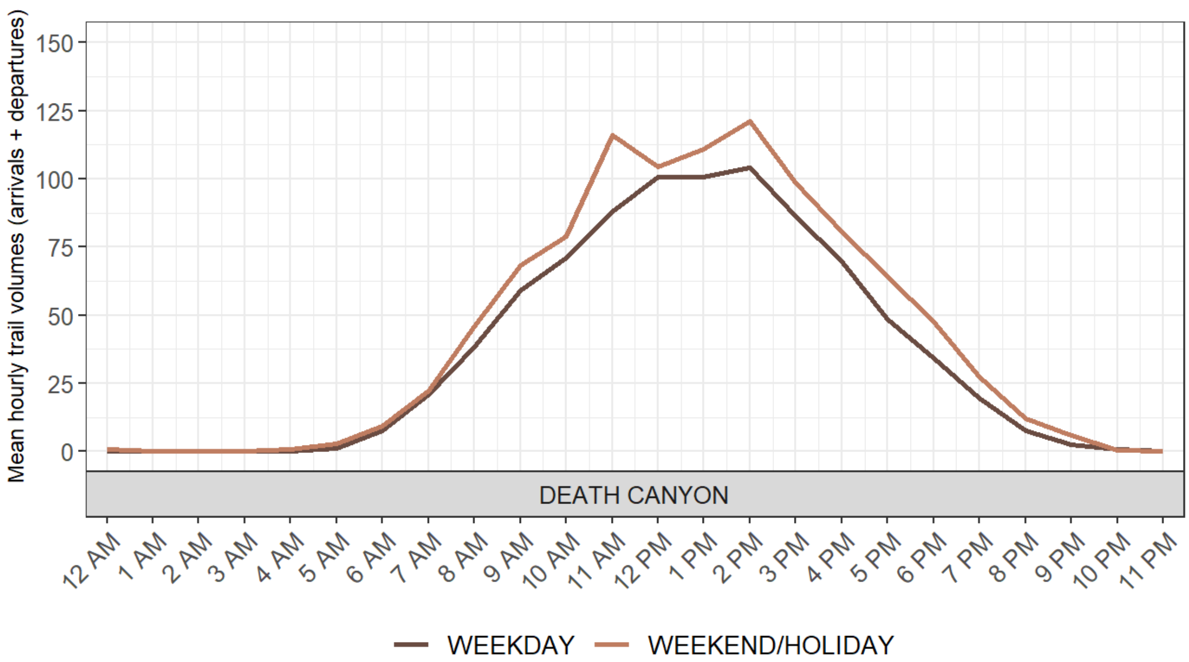

Figure 57. Mean hourly trail volumes: Death Canyon.

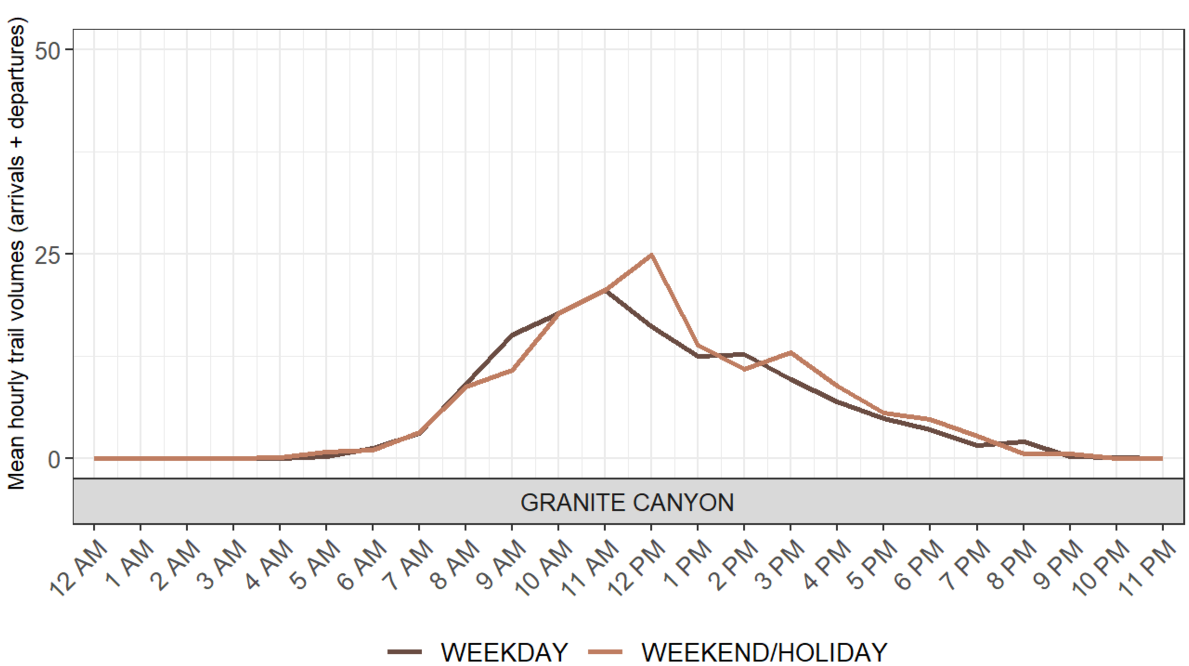

Figure 58. Mean hourly trail volumes: Granite Canyon.

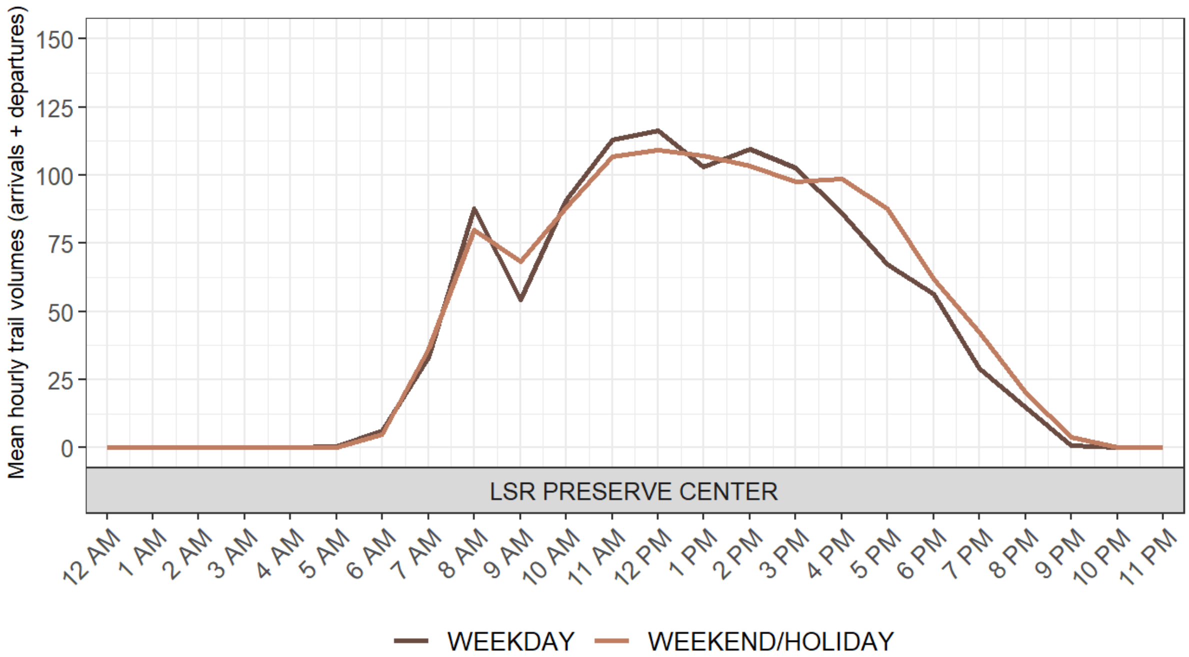

Figure 59. Mean hourly trail volumes: LSR Preserve Center.

Exploratory Analysis

This subsection presents results of final regression models that estimate relationships between inbound traffic volumes, and key indicator variables regarding traffic, parking, and trail use in the Moose-Wilson subarea. Three groupings of input traffic volumes, (1) parkwide perimeter inbound traffic volumes, (2) subarea inbound traffic volumes, and (3) interior roadway traffic volumes, were measured against the subarea's key indicator variables. The following subsections presents tabular results of final regression models for each of the three input traffic volume groupings. Narrative results are also provided for each regression model estimated for the Excel-based tool that had a significant relationship. The GRTE TVM Report Appendix 5 contains scatterplots of regression inputs and indicators with final fitted models.

<u>Regression Model Input: Parkwide Perimeter Inbound Traffic Volumes</u>

Table 36 presents results for models[15] estimated for the Excel-based tool and **Table 37** present results of exploratory regression models that estimate relationships between parkwide perimeter inbound traffic volumes, and key indicator variables regarding traffic, parking, and trail use in the Moose-Wilson subarea. In consultation with park staff, inputs of parkwide perimeter inbound traffic

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[15] Models involving Death Canyon parking occupancy rates were not estimated due to limited availability of observed traffic data. As a result, Death Canyon parking occupancy rates were not included in the Excel-based tool.

volumes were defined as the sum of inbound traffic volumes from Gros Ventre Junction (Northbound), Granite (Northbound), U.S. Highway 89 (Westbound), and South Gate of Yellowstone (Southbound). Results from each of the final hourly regression models estimated for the Excel-based tool with a significant relationship (**Table 36**) suggest:

On average, for every 100 parkwide perimeter inbound vehicles per hour[16]:

- There are approximately four additional vehicles per hour on both lanes of the Death Canyon roadway that same hour, or a 16% increase in the traffic volume based on an average of 26 vehicles per hour.
- There are approximately seven additional vehicles per hour on both lanes of the LSR Preserve roadway that same hour, or an 18% increase in the traffic volume based on an average of 42 vehicles per hour.
- There are approximately 14 additional visitor arrivals and departures on the Death Canyon trail that same hour, or a 27% increase in the total trail volume based on an average of 50 per hour.
- There are approximately three additional visitor arrivals and departures on the Granite Canyon trail that same hour, or a 30% increase in the total trail volume based on an average of 9 per hour.
- There are approximately 14 additional visitor arrivals and departures on the LSR Preserve Center trail that same hour, or a 22% increase in the total trail volume based on an average of 65 per hour.

Table 36. Hourly regression model specifications: Moose-Wilson subarea, with parkwide perimeter inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Death Canyon traffic volumes	Poisson	No lag	1.870204178986*	0.001586553818*	< 0.001	< 0.001	NA	642
LSR Preserve traffic volumes	Poisson	No lag	2.202188374971*	0.001759924876*	< 0.001	< 0.001	NA	642
Death Canyon trail volumes	Poisson	No lag	1.515123063827*	0.002685232992*	< 0.001	< 0.001	NA	642

[16] The strength of the statistical relationship varies among the regression models and the bulleted summary statements should be interpreted as general rather than exact.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Granite Canyon trail volumes	Poisson	No lag	-0.48821267554*	0.002978233473*	< 0.001	< 0.001	NA	643
LSR Preserve Center trail volumes	Poisson	No lag	2.232564389667*	0.002198908335*	< 0.001	< 0.001	NA	637

Regression model input: Parkwide perimeter inbound traffic volumes, as the sum of traffic volumes from Gros Ventre Junction (N), Granite (N), U.S. Highway 89 (W), and South Gate of Yellowstone (S). R-squared is a goodness of fit statistic that only applies in the case of linear models and therefore does not apply to the Poisson models reported in the table. Goodness of fit is evaluated for a Poisson model only based on comparison with another model. Asterisks (*) denote significance at $p < 0.05$.

Table 37. Daily regression model specifications: Moose-Wilson subarea, with parkwide perimeter inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Death Canyon traffic volumes	Linear	No lag	-166.6	0.04*	0.115	< 0.001	0.24	92
LSR Preserve traffic volumes	Linear	No lag	82*	0.04*	< 0.001	< 0.001	0.23	92
Death Canyon trail volumes	Linear	No lag	-1136.7*	0.15*	< 0.001	< 0.001	0.36	92
Granite Canyon trail volumes	Linear	No lag	64.3*	0.004	< 0.001	0.187	0.02	92
LSR Preserve Center trail volumes	Linear	No lag	-500.6	0.12*	0.177	< 0.001	0.36	92

Regression model input: Parkwide perimeter inbound traffic volumes, as the sum of traffic volumes from Gros Ventre Junction (N), Granite (N), U.S. Highway 89 (W), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Regression Model Input: Subarea Inbound Traffic Volumes

Table 38 and **Table 39** present results of hourly and daily exploratory regression models that estimate relationships between inbound traffic volumes around the perimeter of the Moose-Wilson subarea, and key indicator variables regarding traffic, parking, and trail use in the subarea. The subarea inbound traffic volume for the perimeter of the Moose-Wilson subarea is computed as the sum of traffic counts from Poker Flats (Northbound) and Moose-Wilson Road (Southbound).

Table 38. Hourly regression model specifications: Moose-Wilson subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Death Canyon traffic volumes	Linear	No lag	-5.2*	0.22*	< 0.001	< 0.001	0.64	1380
LSR Preserve traffic volumes	Linear	No lag	-5.5*	0.33*	< 0.001	< 0.001	0.61	1380
Death Canyon parking occupancy rate	Linear	No lag	-44.2	0.68*	0.117	< 0.001	0.33	37
Death Canyon trail volumes	Linear	No lag	-27.7*	0.54*	< 0.001	< 0.001	0.54	1380
Granite Canyon trail volumes	Linear	No lag	-1.0*	0.07*	< 0.001	< 0.001	0.18	1380
LSR Preserve Center trail volumes	Linear	No lag	-16.2	0.56*	0.074	< 0.001	0.54	1373

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Poker Flats (N) and Moose-Wilson Road (S). Asterisks (*) denote significance at p < 0.05.

Table 39. Daily regression model specifications: Moose-Wilson subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Death Canyon traffic volumes	Linear	No lag	15.5	0.17*	0.588	< 0.001	0.67	92
LSR Preserve traffic volumes	Linear	No lag	284.4*	0.16*	< 0.001	< 0.001	0.57	92
Death Canyon maximum parking occupancy rate	Linear	No lag	-1021.8	0.51	0.254	0.323	0.87	3
Death Canyon trail volumes	Linear	No lag	-252.1*	0.47*	0.004	< 0.001	0.62	92
Granite Canyon trail volumes	Linear	No lag	127.3*	0	< 0.001	0.99	0	92
LSR Preserve Center trail volumes	Linear	No lag	294.8*	0.31*	< 0.001	< 0.001	0.46	92

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Poker Flats (N) and Moose-Wilson Road (S). Asterisks (*) denote significance at p < 0.05.

Regression Model Input: Interior Roadway Traffic Volumes

Table 40 and **Table 41** present results of final hourly and daily regression models that estimate relationships between interior roadway traffic volumes within the Moose-Wilson subarea and key indicator variables regarding parking and trail use in the subarea. Interior roadway traffic volume inputs include Death Canyon (Northbound) and LSR Preserve (Eastbound).

Table 40. Hourly regression model specifications: Moose-Wilson subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Death Canyon (N) traffic volumes	Death Canyon parking occupancy rate	Linear	No lag	9.2	3.4*	0.393	< 0.001	0.52	37
Death Canyon (N) traffic volumes	Death Canyon trail volumes	Linear	No lag	8.6*	3.23*	< 0.001	< 0.001	0.55	1380
LSR Preserve (E) traffic volumes	LSR Preserve Center trail volumes	Linear	No lag	13.8*	2.44*	< 0.001	< 0.001	0.54	1373

Asterisks (*) denote significance at p < 0.05.

Table 41. Daily regression model specifications: Moose-Wilson subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Death Canyon (N) traffic volumes	Death Canyon maximum parking occupancy rate	Linear	No lag	-86.4	0.87	0.233	0.105	0.97	3
Death Canyon (N) traffic volumes	Death Canyon trail volumes	Linear	No lag	-241.3*	5.11*	< 0.001	< 0.001	0.85	92
LSR Preserve (E) traffic volumes	LSR Preserve Center trail volumes		No lag	-85.8*	3.34*	< 0.001	< 0.001	0.6	92

Asterisks (*) denote significance at p < 0.05.

Conclusion

This subsection offers concluding insights based on traffic and parking conditions for the Moose-Wilson subarea, as well as the results of the exploratory analysis:

- Daily traffic volumes on Moose-Wilson Road and Poker Flats inbound into the Moose-Wilson subarea are relatively consistent across days of the week and across weeks of the month from late June through early August. Traffic volumes are generally somewhat lower during early June and late August than during the late June through early August period. These results suggest the summer peak period of daily inbound traffic into the Moose-Wilson Road subarea runs from about mid-June through early August.

- Hourly traffic volumes on Moose-Wilson Road and at Poker Flats suggest traffic flows predominantly in the Northbound direction from population centers and through Poker Flats in the morning, and flows in the Southbound direction from interior park locations and through Moose-Wilson in the afternoon and evening.

- Daily vehicle traffic on the interior park roads of Death Canyon and the LSR Preserve within the Moose-Wilson subarea are generally higher on weekends and holidays than on weekdays. Hourly traffic volumes at these locations display “typical” recreation use patterns, with traffic into these locations increasing fairly sharply in the morning hours, reaching peaks by late morning/early afternoon, and then declining in the afternoon and evening hours.

- On the two weekend days for which number of vehicles parked was estimated for Death Canyon, the estimated peak number of cars parked reached the parking capacity. This suggests some visitors who want to park at Death Canyon on summer weekend days may not be able to find a place to park. The number of vehicles parked estimates for the one weekday included in the study suggest there is more than ample parking available for visitors on weekdays during the summer peak, but further monitoring may be warranted.

- Total (arrivals and departures) daily trail use volumes at Death Canyon and the LSR Preserve Center are similar in magnitude and range from about 750 to about 1,000 per day. Total daily trail use at Granite Canyon is substantially lower and ranges from about 125 to 250. At all three locations, daily trail use volumes tended to be higher on weekend days and holidays than on weekdays. Hourly trail use at all three locations peaks around noon. Trail use remains steady at LSR Preserve Center through the early evening hours before declining, while trail use at the other two locations starts to decline mid- (Granite Canyon) to late- (Death Canyon) afternoon.

- There are statistically significant relationships between the hourly and daily volumes of vehicles entering GRTE from the park’s perimeter and the amount of vehicle traffic, parking, and trail use in the Moose-Wilson subarea. The one exception is with respect to daily trail use volumes at the Granite Canyon Trailhead. There are also statistically significant relationships between the hourly and daily volumes of vehicles entering the Moose-Wilson subarea and the amount of vehicle traffic, parking, and trail use at most all of the “indicator locations” in the subarea. The results suggest a slightly larger share of the parkwide and local vehicle traffic destined for the Moose-Wilson subarea travels to the LSR Preserve Center, with somewhat less headed to Death Canyon, and substantially less visiting Granite Canyon.

Moose to Signal Mountain Subarea

This section of the report presents descriptive results for select subarea inbound traffic volumes and indicators of traffic, parking, and trail use conditions, as well as the results from exploratory analyses of relationships between transportation inputs and traffic, parking, and trail use conditions in the Moose to Signal Mountain subarea of GRTE. Key conclusions are presented at the end of this section. The locations of the select subarea inbound traffic volumes and indicators of traffic, parking, and trail use conditions for the Moose to Signal Mountain subarea are depicted in **Figure 60** and include:

- Moose (Northbound) traffic volume
- Teton Park Road (Westbound)[17] traffic volume
- Jenny Lake One Way (Southbound) traffic volume
- Lupine Meadows (Westbound) traffic volume
- Lupine Meadows (Total) traffic volume
- String Lake South (Westbound) traffic volume
- String Lake South (Total) traffic volume
- Jenny Lake parking occupancy rates
- Lupine Meadows parking occupancy rates
- String and Leigh Lakes parking occupancy rates
- Taggart parking occupancy rates
- Cascade Canyon trail volumes
- Jenny Lake Southwest trail volumes
- Lupine Meadows trail volumes
- String Lake Loop South trail volumes
- String Lake North trail volumes
- String Lake South trail volumes

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[17] Teton Park Road (Westbound) is located just southwest of the Moran Junction.

- North Taggart trail volumes
- Jenny Lake Boating shuttle ridership

See Appendix 6 for additional descriptive results for this subarea.

Traffic Conditions

Figure 61 through **Figure 67** present total daily subarea inbound traffic volumes and interior roadway traffic volumes for select traffic counter locations in the Moose to Signal Mountain subarea, by date during the counting period.[18] These data suggest:

- Daily subarea inbound traffic volumes at Moose (Northbound) typically ranged from approximately 2,500 to around 3,250 vehicles per day during the counting period. On several days, the daily traffic volume reached or exceeded 3,500 vehicles per day (**Figure 61**).
- At Moose (Northbound), daily subarea inbound traffic volumes tended to be slightly higher on most weekend days and holidays compared to weekdays (**Figure 61**).
- Daily subarea inbound traffic volumes at Teton Park Road (Westbound) varied slightly during the sampling period and ranged from just over approximately 2,000 to just under 2,500 vehicles per day (**Figure 62**).
- Daily interior roadway traffic volumes at Jenny Lake One Way (Southbound) typically ranged from approximately 1,250 to under 1,500 vehicles per day during the counting period. On several days, the daily interior traffic volume exceeded 1,500 vehicles per day; these days tended to be weekend days and holidays (**Figure 63**).
- Daily interior roadway traffic volumes at Lupine Meadows (Westbound) varied during the sampling period and ranged from approximately 475 to around 665 vehicles per day. Daily interior roadway traffic volumes were higher on weekend days compared to the weekday (**Figure 64**).
- Daily interior roadway traffic volumes at Lupine Meadows (Total) overall varied during the sampling period and ranged from approximately 800 to around 1,500 vehicles per day. Daily interior roadway traffic volumes were higher on weekend days and holidays compared to the weekday (**Figure 65**).
- Daily interior roadway traffic volumes at String Lake South (Westbound) typically ranged from approximately 750 to just under 1,000 vehicles per day during the counting period. On a few days, daily interior traffic volumes approached or exceeded 1,000 vehicles per day (**Figure 66**).

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[18] Traffic volume data were collected at Teton Park Road (Westbound) and at Lupine Meadows (Westbound and Total) during the 3-day sampling period and are presented as total daily traffic volumes during the sampling period.

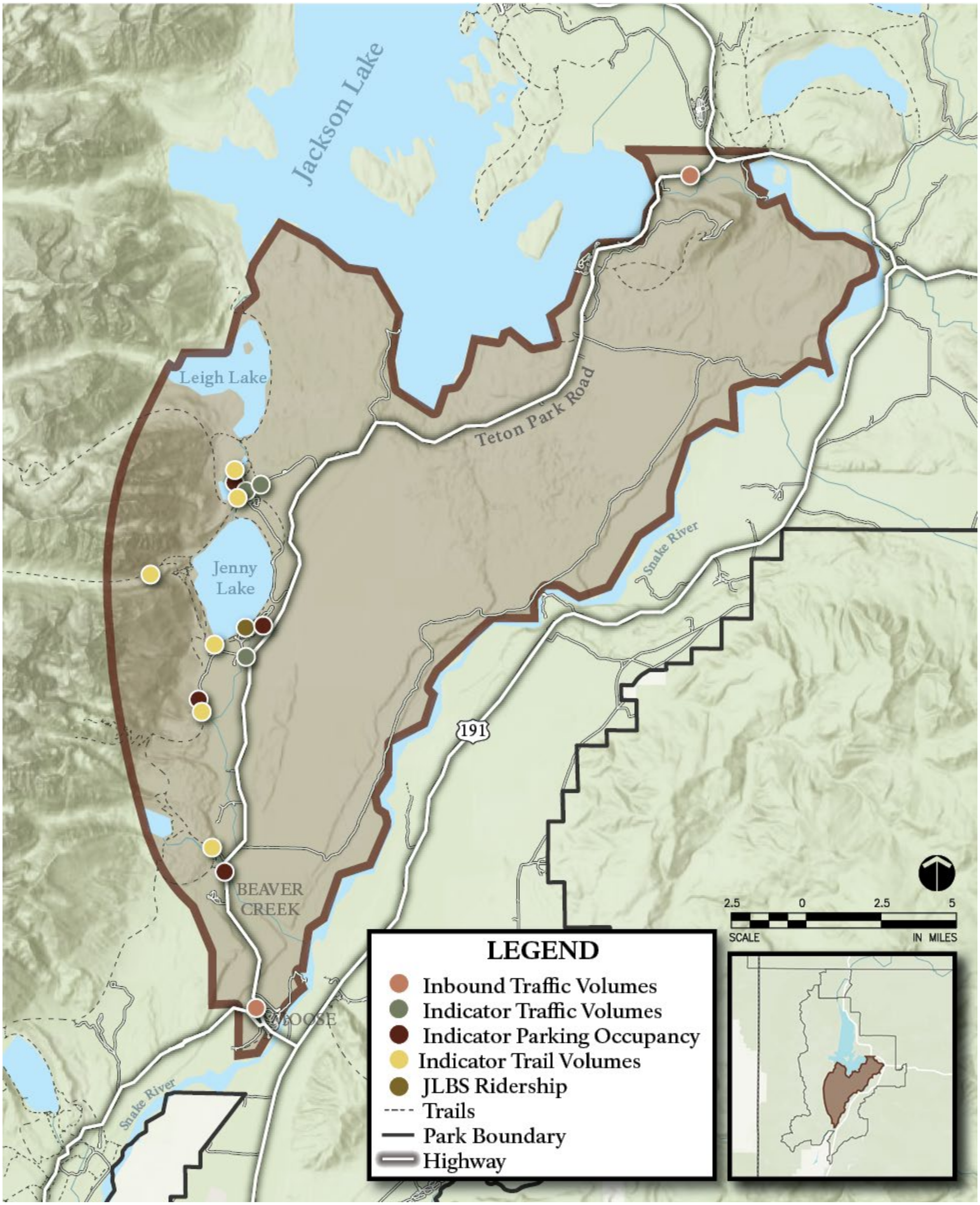

Figure 60. Input and indicator traffic, parking, and trail locations – Moose to Signal Mountain subarea.

- Daily interior roadway traffic volumes at String Lake South (Total) overall ranged from approximately 1,625 to just under 2,000 vehicles per day during the counting period. On a few days, daily interior traffic volume approached or exceeded 2,000 vehicles per day (**Figure 67**).
- At String Lake South (Westbound) (**Figure 66**) and String Lake South (Total) (**Figure 67**) overall, daily interior roadway traffic volumes tended to increase leading up to most weekend days and holidays and remained high through the weekend days and holidays, compared to most weekdays.

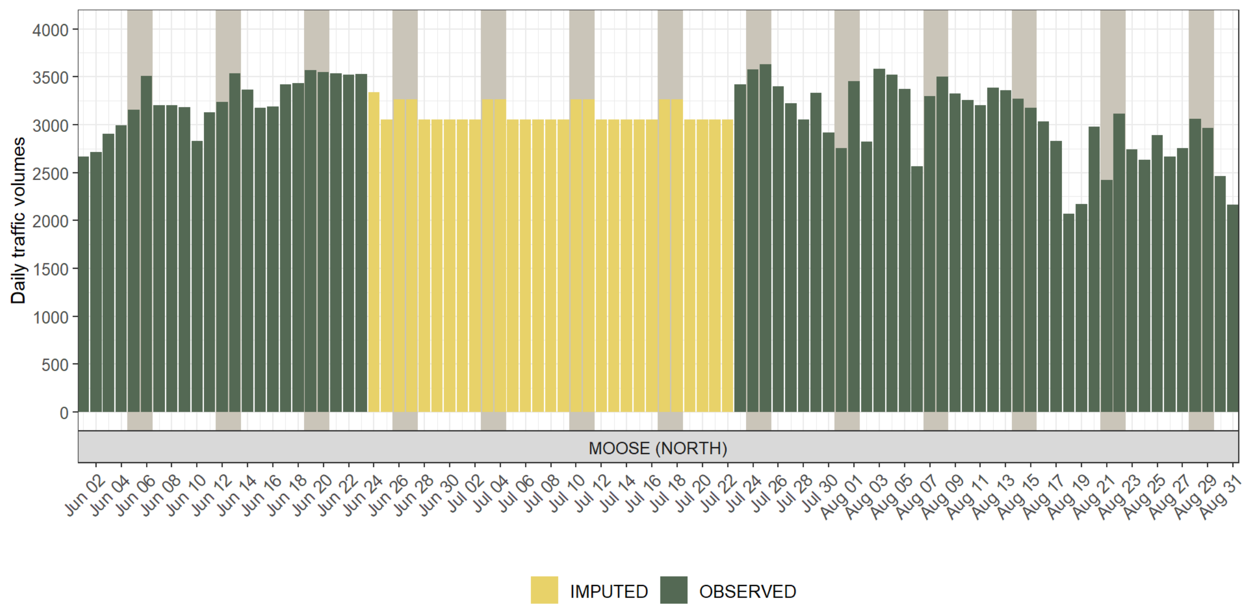

Figure 61. Daily subarea inbound traffic volumes: Moose (Northbound; gray shading indicates weekends/holidays).

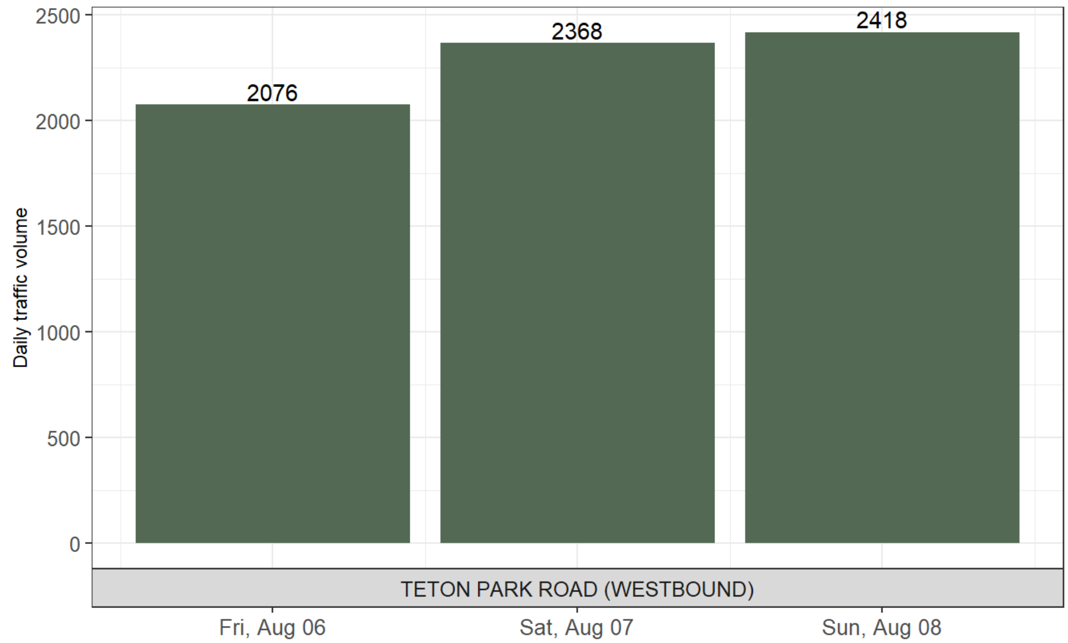

Figure 62. Daily subarea inbound traffic volumes: Teton Park Road (Westbound).

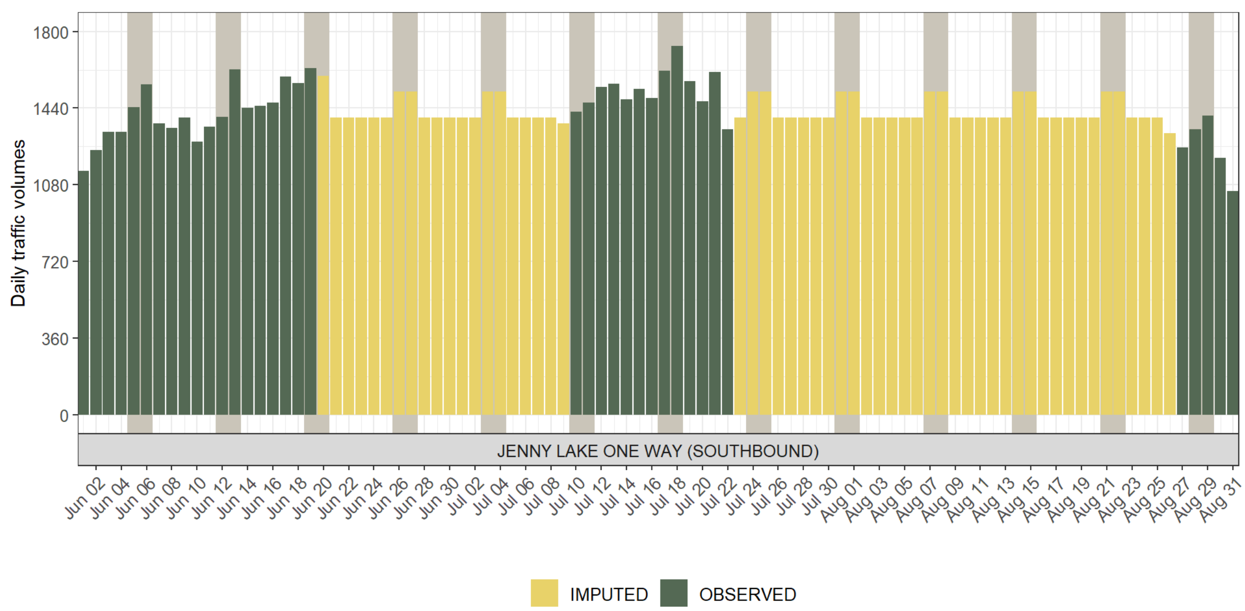

Figure 63. Daily interior roadway traffic volumes: Jenny Lake One Way (Southbound; gray shading indicates weekends/holidays).

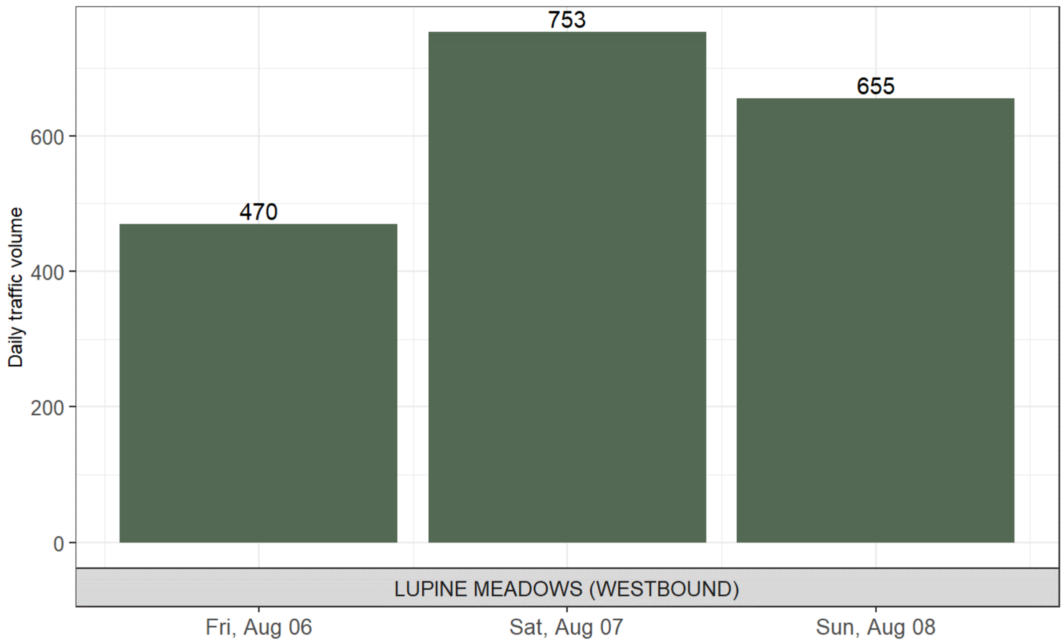

Figure 64. Daily interior roadway traffic volumes: Lupine Meadows (Westbound).

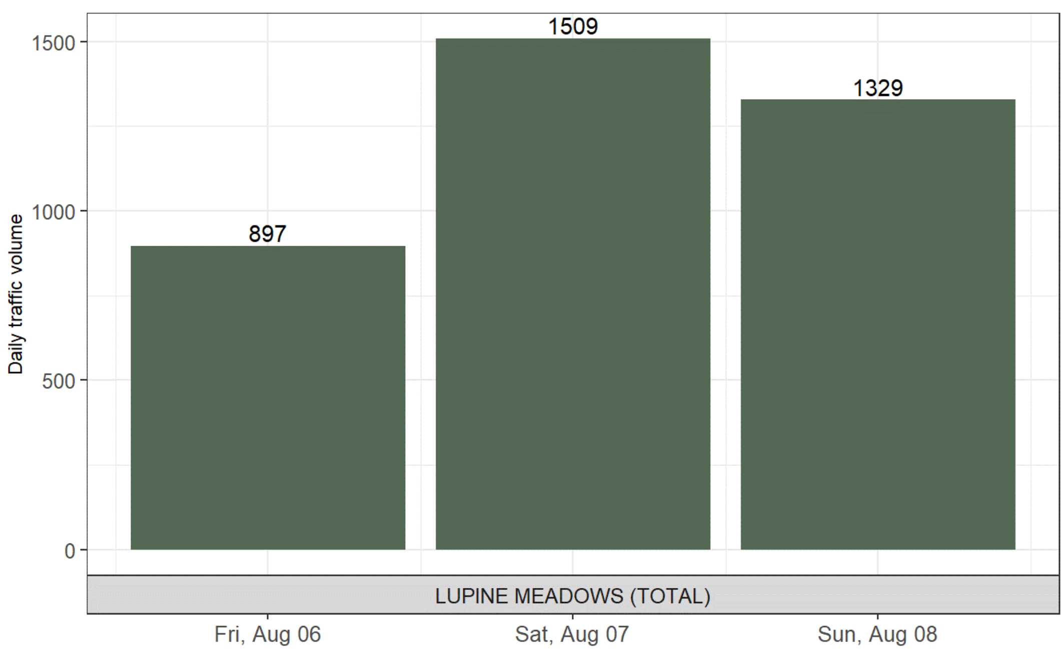

Figure 65. Daily interior roadway traffic volumes: Lupine Meadows (Total)

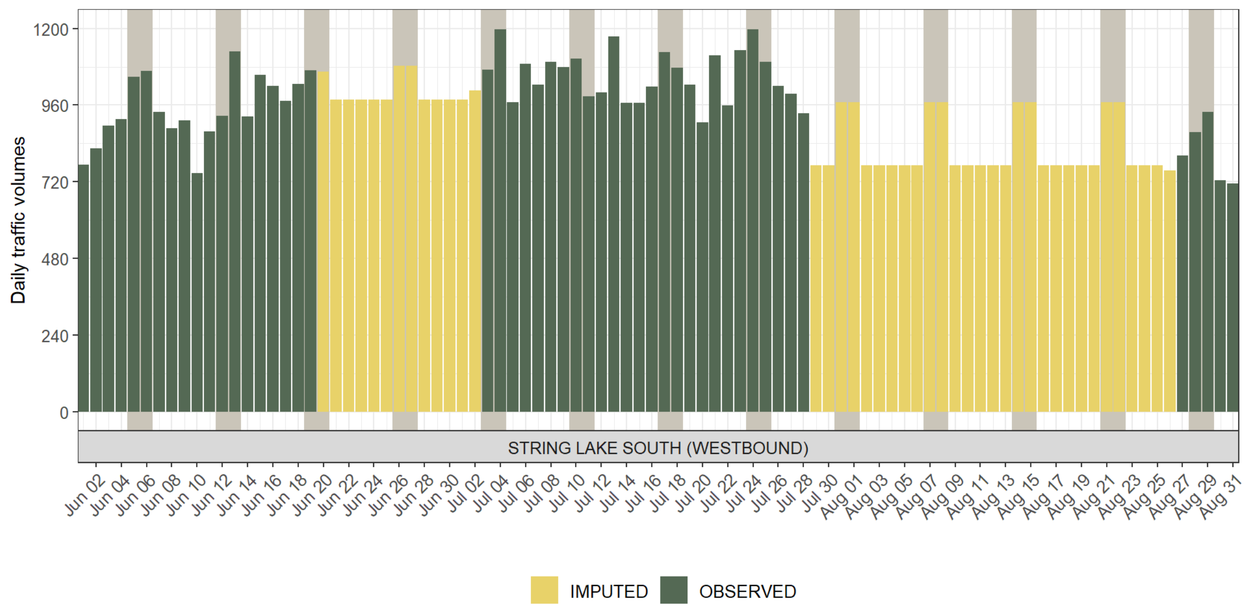

Figure 66. Daily interior roadway traffic volumes: String Lake South (Westbound; gray shading indicates weekends/holidays).[19]

[19] String Lake South (Westbound) traffic volumes from June 20-July 2, 2021 were imputed with mean traffic volumes recorded on "adjacent dates" between June 1-June 19 and July 2-July 28, 2021, by hour and day of week type. String Lake South (Westbound) traffic volumes from July 29-August 26, 2021 were imputed with mean traffic volumes recorded on "adjacent dates" between July 25-July 28 and August 27-August 31, 2021, by hour and day of week type.

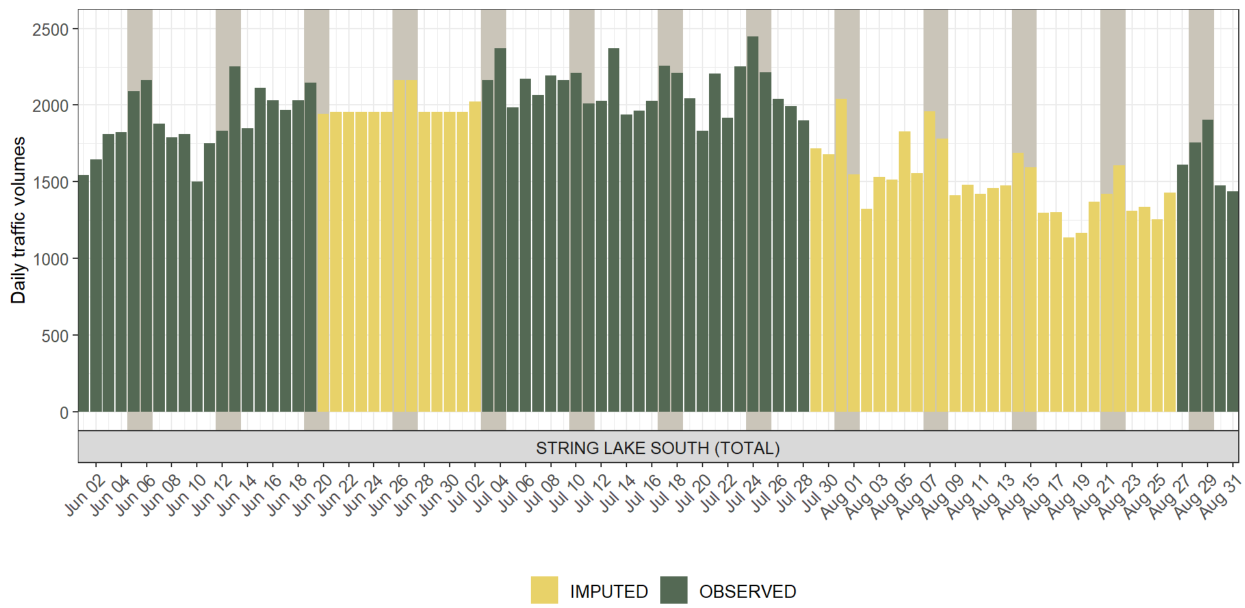

Figure 67. Daily interior roadway traffic volumes: String Lake South (Total; gray shading indicates weekends/holidays).[20]

Figure 68 through **Figure 74** present mean hourly inbound and interior roadway traffic volumes for select traffic counter locations in the Moose to Signal Mountain subarea, by day of week category during the counting period. [21] These data suggest:

- Mean hourly subarea inbound traffic volumes at Moose (Northbound) increased fairly sharply starting as early as 3:00 a.m. and increased steadily until reaching a peak later in the morning. Traffic volumes peaked at around 280 vehicles per hour between 8:00 a.m. and 10:00 a.m. on weekdays and peaked at approximately 315 vehicles at 10:00 a.m. on weekend days and holidays. Mean hourly subarea inbound traffic volumes decreased steadily after 10:00 a.m. on weekdays and weekend days and holidays (**Figure 68**).

- Mean hourly subarea inbound traffic volumes at Moose (Northbound) were similar on weekdays and weekend days and holidays up to 8:00 a.m., at which point hourly traffic

[20] String Lake South (Total) traffic volumes from June 20-July 2, 2021 are the sum of imputed traffic volumes from String Lake South (Westbound) and imputed traffic volumes from String Lake South (Eastbound), which explains the uniform pattern of traffic volumes during this date range. String Lake South (Total) traffic volumes from July 29-August 26, 2021 are the sum of imputed traffic volumes from String Lake South (Westbound) and observed traffic volumes from String Lake South (Eastbound), which explains the variable pattern of traffic volumes during this date range.

[21] Traffic volume data were collected at Teton Park Road (Westbound) and at Lupine Meadows (Westbound and Total) during the 3-day sampling period, and are presented as total hourly traffic volumes per day instead of the average of the 3-day sampling period by day of week category.

volumes on weekend days and holidays exceeded hourly traffic volumes on weekdays by up to 50 vehicles per hour on weekdays until 5:00 p.m. (**Figure 68**).

- At Teton Park Road (Westbound), hourly subarea inbound traffic volumes increased steadily at 6:00 a.m. and reached a peak of just over 250 to just under 300 vehicles per hour at 11:00 a.m., before decreasing gradually through the remainder of the day (**Figure 69**).

- In general, hourly subarea inbound traffic volumes increased earlier in the morning hours at Moose (Northbound) (**Figure 68**) and peaked an hour earlier, compared to Teton Park Road (Westbound) (**Figure 69**). The post-peak decrease in hourly subarea inbound traffic volumes was similar at both locations.

- Mean hourly interior roadway traffic volumes at Jenny Lake One Way (Southbound) increased fairly sharply starting at 7:00 a.m. and increased steadily until reaching a peak of around 165 vehicles on weekdays and approximately 180 vehicles on weekend days and holidays at 1:00 p.m. Mean hourly interior roadway traffic volumes decreased slowly until 4:00 p.m. and decreased more sharply after 4:00 p.m. until the end of the day (**Figure 70**).

- Mean hourly interior roadway traffic volumes at Jenny Lake One Way (Southbound) overall were higher on weekend days and holidays compared to weekdays from 12:00 p.m. through 9:00 p.m., but only by approximately 15 vehicles per hour at most (**Figure 70**).

- At Lupine Meadows (Westbound), hourly interior roadway traffic volumes increased slowly during the early morning hours but increased sharply from 5:00 a.m. to 7:00 a.m. and reached a peak of around 40 to 80 vehicles per hour at 7:00 a.m. depending on the day. Hourly interior roadway traffic volumes decreased slightly or remained stable (depending on the day) through 3:00 p.m. before decreasing gradually for the remainder of the day (**Figure 71**).

- Overall at Lupine Meadows (Total), hourly interior roadway traffic volumes increased slowly during the early morning hours, but increased sharply from 5:00 a.m. to 7:00 a.m. Hourly interior roadway traffic volumes continued to increase gradually before reaching a peak of around 80 to just under 150 vehicles per hour at 3:00 p.m., depending on the day. Hourly interior roadway traffic volumes decreased steadily for the remainder of the day (**Figure 72**).

- Mean hourly interior roadway traffic volumes at String Lake South (Westbound) increased fairly sharply starting at 6:00 a.m. and increased steadily until reaching a peak of just over 100 vehicles at 12:00 p.m. on weekdays and just over 115 vehicles at 1:00 p.m. on weekend days and holidays. Mean hourly interior roadway traffic volumes decreased slowly until 3:00 p.m. and decreased more sharply after 3:00 p.m. until the end of the day (**Figure 73**).

- Overall at String Lake South (Total), mean hourly interior roadway traffic volumes increased fairly sharply starting at 6:00 a.m. and increased steadily until reaching a peak of just over 175 vehicles at 12:00 p.m. on weekdays and just over 200 vehicles at 1:00 p.m. on weekend days and holidays. Mean hourly interior roadway traffic volumes decreased gradually until 4:00 p.m. and decreased more sharply after 4:00 p.m. until the end of the day (**Figure 74**).

- Mean hourly interior roadway traffic volumes at String Lake South (Westbound) (**Figure 73**) and String Lake South (Total) (**Figure 74**) overall were slightly higher on weekend days and holidays compared to weekdays for most of the day (7:00 a.m. through 9:00 p.m.), but only by around 15–25 vehicles per hour at most.

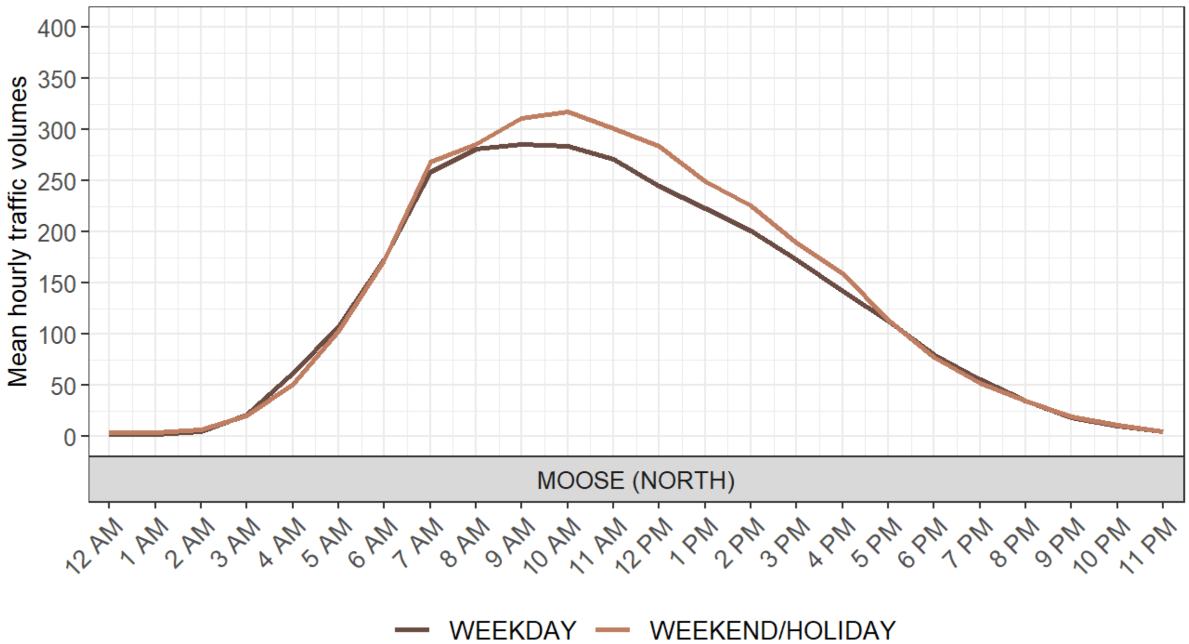

Figure 68. Mean hourly subarea inbound traffic volumes: Moose (Northbound).

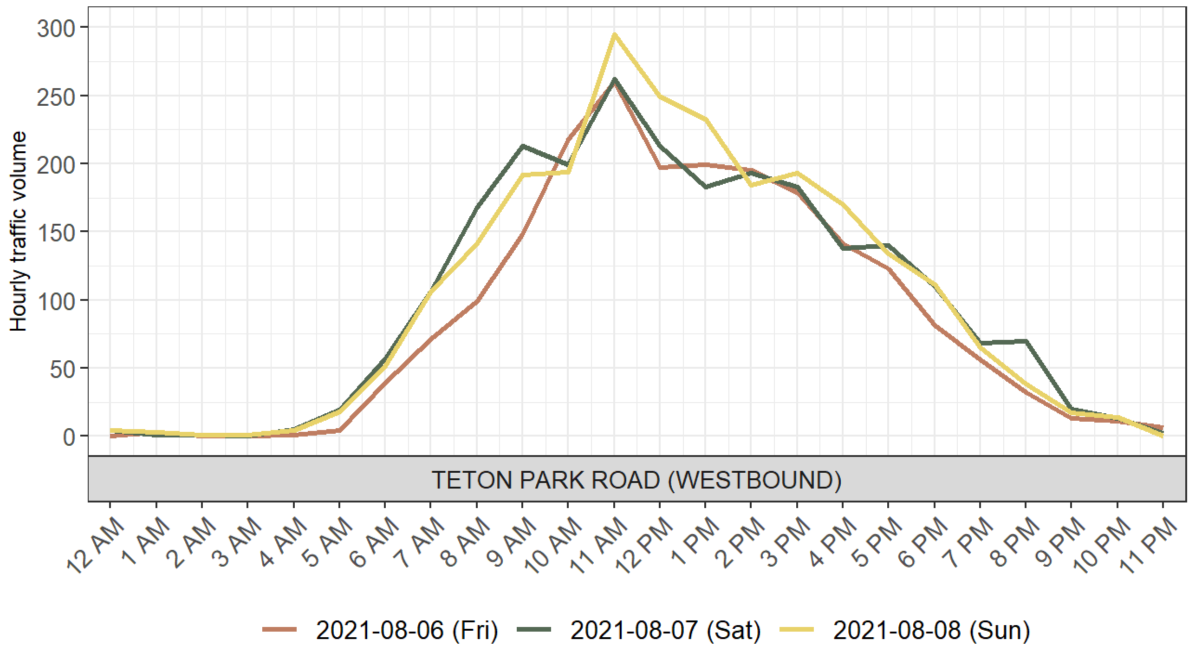

Figure 69. Hourly subarea inbound traffic volumes: Teton Park Road (Westbound).

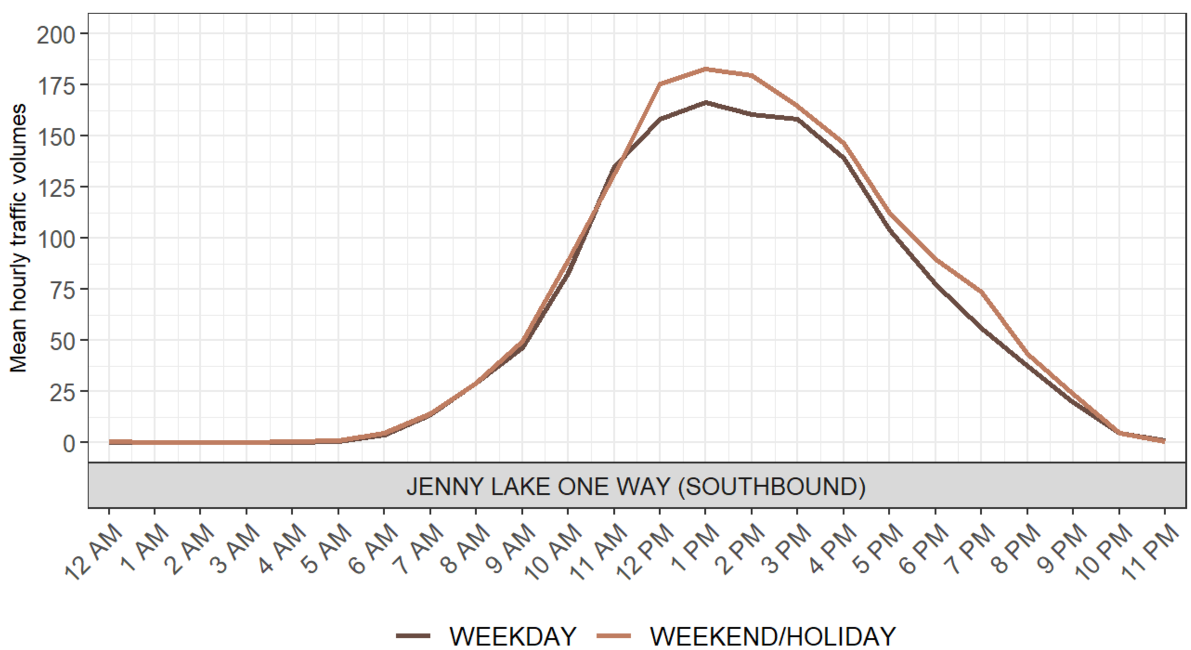

Figure 70. Mean hourly interior roadway traffic volumes: Jenny Lake One Way (Southbound).

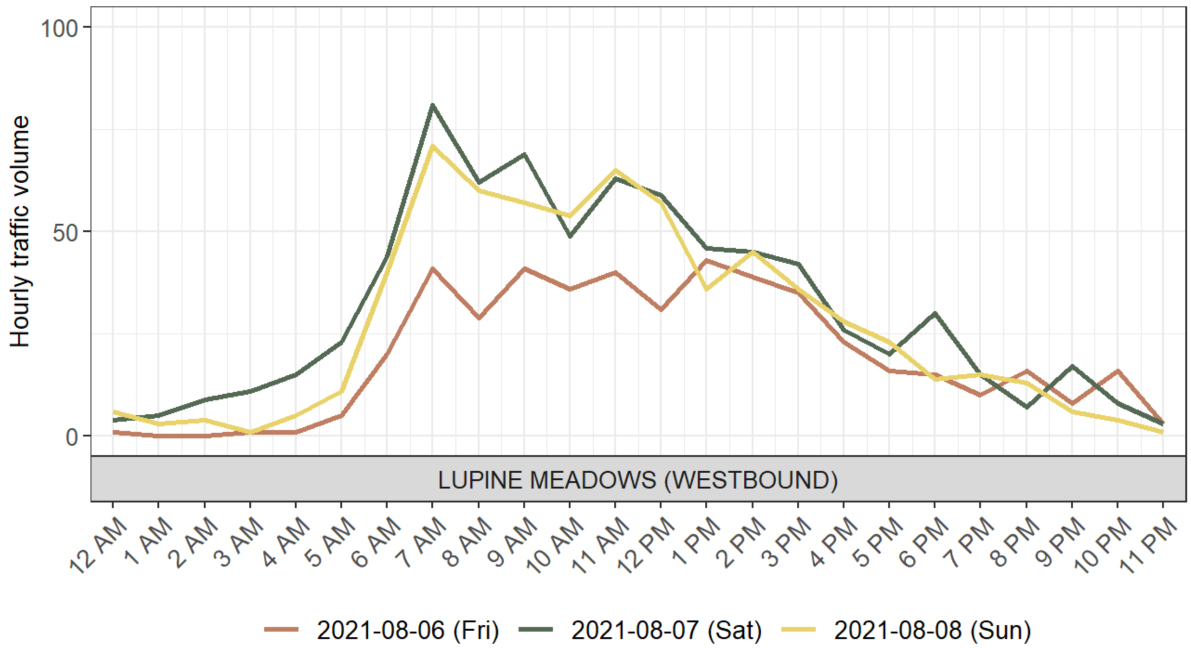

Figure 71. Hourly interior roadway traffic volumes: Lupine Meadows (Westbound).

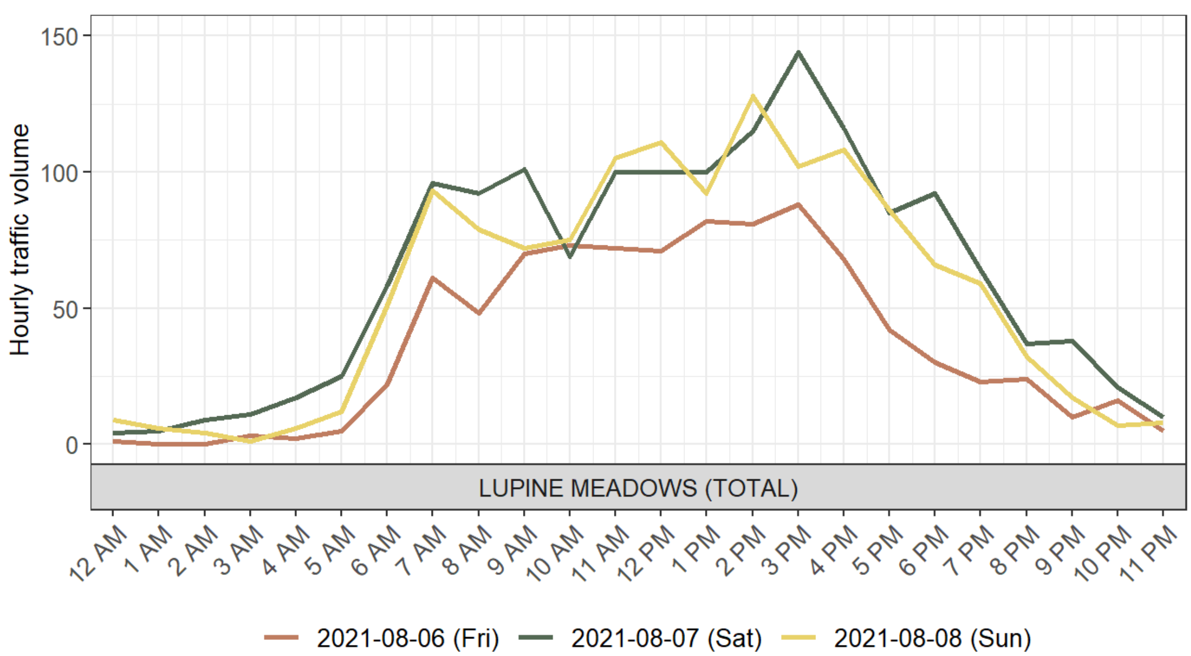

Figure 72. Hourly interior roadway traffic volumes: Lupine Meadows (Total).

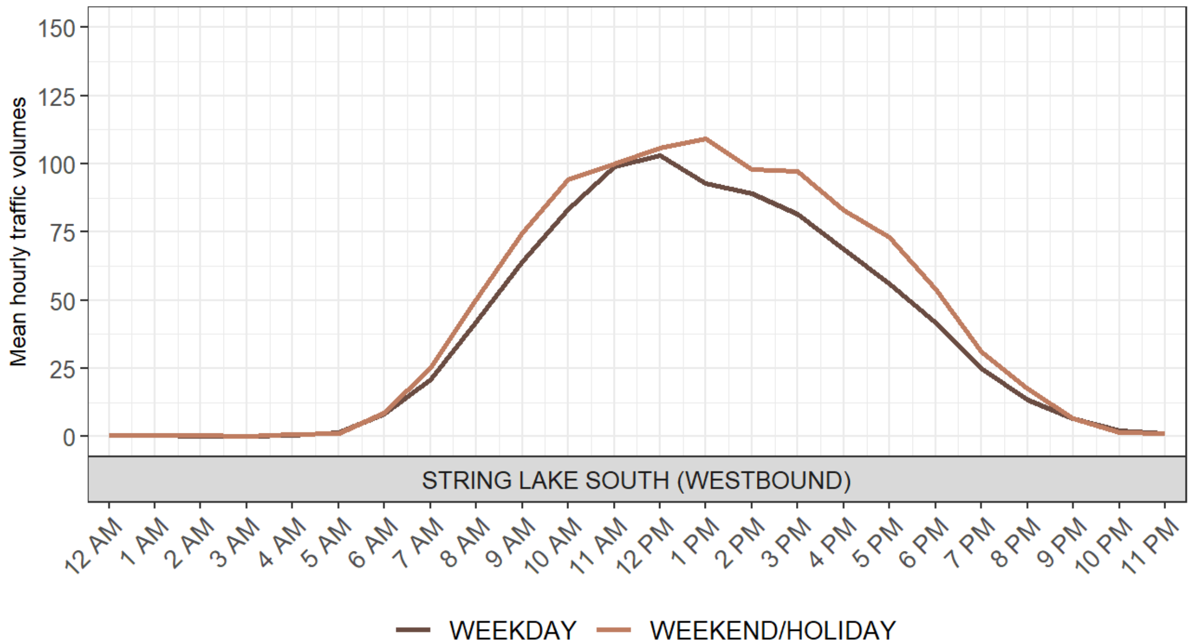

Figure 73. Mean hourly interior roadway traffic volumes: String Lake South (Westbound).

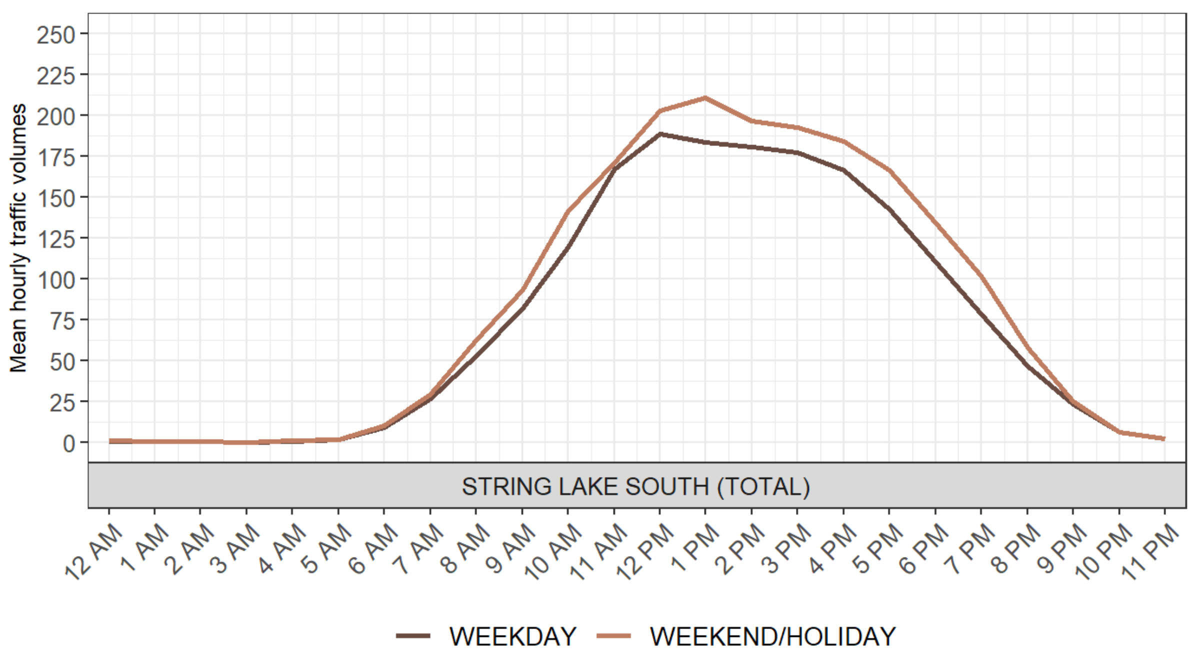

Figure 74. Mean hourly interior roadway traffic volumes: String Lake South (Total).

Hard Braking and Hard Acceleration Events

An evaluation of hard braking and hard acceleration events was conducted based on May–September Wejo data. On a subarea basis, the hard braking and hard acceleration events are concentrated at the following locations:

- Hard braking: Teton Park Road east of Moose-Wilson Road, Teton Park Road at Jackson Lake Junction, Teton Park Road at Catholic Bay Turnout
- Hard acceleration: Teton Park Road at Jackson Lake Junction, Teton Park Road east of Moose-Wilson Road

Parking Conditions

Table 42 through **Table 49** report the minimum and maximum hourly number of vehicles parked, the hourly parking occupancy rates, the peak parking hours (10:00 a.m.–4:00 p.m.) parking turnover rate, and the inferred vehicle arrival distribution by date for the select parking areas in the Moose to Signal Mountain subarea.[22] **Table 42** and **Table 46** also report the parking lot capacity (i.e., total number of identified parking spaces) for the select parking areas.

South Jenny Lake Visitor's Center data suggest:

- This location sees extremely high accumulation on the weekends. Because of the nearby trailhead with overnight options, there were always vehicles parked at this location during observations (**Table 42**).
- Parking occupancy rate trends show that parking occupancy rates begin to increase mid-morning and starts to decrease late afternoon (**Table 43**).
- Parking turnover is defined as the estimated number of vehicles that use each parking stall throughout the peak parking hours (10:00 a.m.– 4:00 p.m.). The average turnover rate during the peak parking hours is 0.48. This means that, on average, South Jenny Lake Visitor's Center observes 0.48 vehicle per hour per stall (**Table 44**).
- Wejo-inferred arrival pattern suggests the majority (53%) of vehicle trips arrive at South Jenny Lake Visitor's Center between 9:00 a.m. and 3:00 p.m., which corresponds to the timeframe of greatest number of vehicles parked (**Table 45**).
- The median dwell time in the South Jenny Lake Visitor's Center parking lot was 64 minutes, based on Wejo-inferred data (sample size = 3,473), while the 15th percentile dwell time was 7 minutes and the 85th percentile dwell time was 247 minutes.

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[22] Results for the Taggart and Lupine Meadows parking areas are not presented in this report because these data were collected and analyzed by Pennsylvania State University.

Table 42. Minimum and maximum hourly number of vehicles parked by date – South Jenny Lake Visitor's Center.

Location	Friday Low	High	Saturday Low	High	Sunday Low	High	Capacity
South Jenny Lake Visitor's Center	4	400	79	463	62	450	412

Table 43. Hourly parking occupancy rates by date – South Jenny Lake Visitor's Center.

Time	Friday	Saturday	Sunday	3-Day Average
06:00 AM	5%	9%	11%	8%
07:00 AM	10%	25%	22%	19%
08:00 AM	22%	58%	63%	48%
09:00 AM	30%	93%	92%	71%
10:00 AM	50%	103%	101%	85%
11:00 AM	64%	107%	106%	92%
12:00 PM	86%	112%	108%	102%
01:00 PM	93%	111%	108%	104%
02:00 PM	96%	111%	107%	105%
03:00 PM	91%	111%	105%	102%
04:00 PM	70%	101%	91%	87%
05:00 PM	34%	80%	64%	59%
06:00 PM	8%	43%	36%	29%

Values in red indicate hours where lot is over 95% occupancy.

Table 44. 10:00 a.m.– 4:00 p.m. parking turnover rate – South Jenny Lake Visitor's Center.

Location	Friday	Saturday	Sunday	3-Day Average
South Jenny Lake Visitor's Center	0.49	0.47	0.48	0.48

Table 45. Wejo-inferred time of day distribution of parking arrivals, by time period – South Jenny Lake Visitor's Center.

Location	Number of Observations	Midnight–6am	6am–9am	9am–noon	Noon–3pm	3pm–6pm	6pm–9pm	9pm–Midnight
South Jenny Lake Visitor's Center	3,473	3%	27%	26%	28%	14%	2%	0%

String and Leigh Lakes data suggest:

- This location sees extremely high accumulation on the weekends. Because of the nearby trailhead with overnight options, there were always vehicles parked at this location during observations (**Table 46**).
- Parking occupancy rate trends show that parking occupancy rates begin to increase mid-morning and start to decrease late afternoon (**Table 47**).
- Parking turnover is defined as the estimated number of vehicles that use each parking stall throughout the peak parking hours (10:00 a.m.–4:00 p.m.). The average turnover rate during the peak parking hours is 0.57. This means that, on average, String and Leigh Lakes observes 0.57 vehicle per hour per stall (**Table 48**).
- Wejo-inferred arrival pattern suggests the majority (56%) of visitors arrive at String and Leigh Lakes between 9:00 a.m. and 3:00 p.m., which corresponds to the timeframe of greatest number of vehicles parked (**Table 49**).
- The median dwell time in the String and Leigh Lakes parking lots was 58 minutes, based on Wejo-inferred data (sample size = 1,472), while the 15th percentile dwell time was 5 minutes and the 85th percentile dwell time was 256 minutes.

Table 46. Minimum and maximum hourly number of vehicles parked by date – String and Leigh Lakes.

Location	Friday Low	High	Saturday Low	High	Sunday Low	High	Capacity
String and Leigh Lakes	67	185	83	255	75	258	166

Table 47. Hourly parking occupancy rates by date – String and Leigh Lakes.

Time	Friday	Saturday	Sunday	3-Day Average
06:00 AM	32%	28%	21%	27%
07:00 AM	35%	42%	30%	36%
08:00 AM	40%	56%	55%	50%
09:00 AM	41%	82%	86%	70%
10:00 AM	48%	105%	104%	86%
11:00 AM	59%	109%	107%	92%
12:00 PM	76%	114%	118%	103%
01:00 PM	80%	116%	115%	104%
02:00 PM	84%	117%	109%	103%
03:00 PM	83%	113%	106%	101%
04:00 PM	71%	110%	98%	93%
05:00 PM	36%	100%	74%	70%
06:00 PM	35%	83%	58%	59%

Values in red indicate hours where lot is over 95% occupancy.

Table 5. 10:00 a.m.– 4:00 p.m. parking turnover rate – String and Leigh Lakes

Location	Friday	Saturday	Sunday	3-Day Average
String and Leigh Lakes	0.36	0.47	0.49	0.44

Table 49. Wejo-inferred time of day distribution of parking arrivals, by time period – String and Leigh Lakes.

Location	Number of Observations	Midnight–6am	6am–9am	9am–noon	Noon–3pm	3pm–6pm	6pm–9pm	9pm–Midnight
String and Leigh Lakes	1,472	3%	22%	28%	28%	17%	3%	0%

Trail Use Conditions

Table 50 reports the calibration regression model specifications for trail counter data from select locations in the Moose to Signal Mountain subarea. In all cases, coefficients from regression models with no intercept were used to calibrate the trail counter data for each location. The GRTE TVM Report Appendix 6 contains trail counter calibration scatterplots with intercept and no intercept linear regression models plotted.

Table 506. Calibration regression model with no intercept results for select trail counter locations in the Moose to Signal Mountain subarea.[23]

Location	Coefficient Estimate	P-value
Jenny Lake Southwest	1.619*	< 0.001
String Lake North	1.404*	< 0.001
String Lake South	1.051*	0.002

Asterisks (*) denote significance at $p < 0.05$.

[23] The North Taggart trail counter calibration coefficient estimate reported by Penn State University was used to calibrate the North Taggart trail counter data.

Figure 75 through **Figure 81** present total daily trail volumes[24] (arrivals and departures) for select trail counter locations in the Moose to Signal Mountain subarea, by date. These data suggest:

- Daily trail volumes at Cascade Canyon varied from around 1,000 to under 1,500 per day in July. Daily trail volumes were higher in early August and ranged from just under 1,500 to just under 1,750 per day, with a few days approaching or exceeding 2,000 per day. Daily trail volumes at Cascade Canyon tended to be slightly higher on some weekend days and holidays compared to weekdays, but the differences were not pronounced (**Figure 75**).

- Daily trail volumes at Jenny Lake Southwest typically ranged from 2,000 to 2,500 per day. On a few days, daily trail volumes approached or exceeded 3,000 per day. Trail volumes were frequently higher on weekdays compared to weekend days and holidays (**Figure 76**).

- Daily trail volumes at Lupine Meadows varied from around 500 to approximately 900 per day. On a few days, daily trail volumes approached or exceeded 1,000 per day. Trail volumes were typically higher on weekend days and holidays compared to weekdays (**Figure 77**).

- Daily trail volumes at String Lake Loop South ranged from 200 to less than 300 per day. Daily trail volumes approached or exceeded 350 per day on two days. No discernable differences exist in daily trail volumes on weekdays compared to weekend days and holidays at String Lake Loop South (**Figure 78**).

- Daily trail volumes at String Lake North ranged from 750 to around 1,000 per day. Daily trail volumes approached or exceeded 1,250 per day on three days. Daily trail volumes were sometimes lower on weekend days and holidays compared to weekdays, but the differences were not pronounced (**Figure 79**).

- Daily trail volumes at String Lake South ranged from 750 to around 1,000 per day. Daily trail volumes exceeded 1,250 per day on four days. Daily trail volumes were sometimes higher on weekend days and holidays compared to weekdays, but the differences were not pronounced (**Figure 80**).

- Daily trail volumes at North Taggart ranged from 1,000 to 1,250 per day. Daily trail volumes exceeded 1,250 per day on a number of weekend days and holidays. Daily trail volumes were often higher on weekend days and holidays compared to weekdays (**Figure 81**).

[24] Calibrated data are presented for Cascade Canyon, Jenny Lake Southwest, String Lake North, String Lake South, and North Taggart trail counter locations. Data presented for the following trail counter locations were not calibrated: Lupine Meadows, String Lake Loop South.

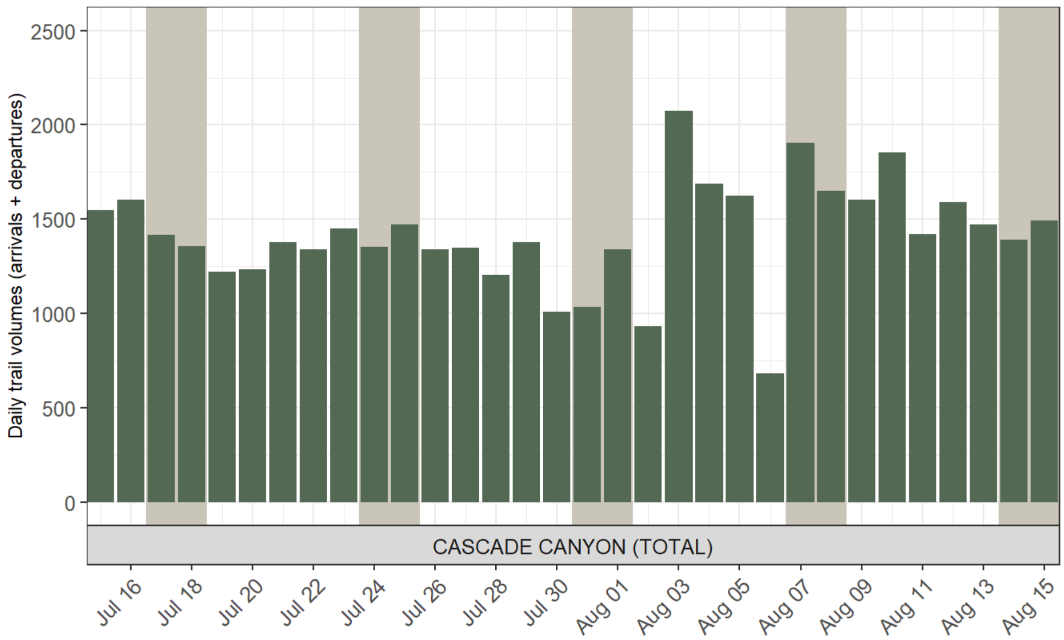

Figure 755. Daily trail volumes: Cascade Canyon (gray shading indicates weekends/holidays).

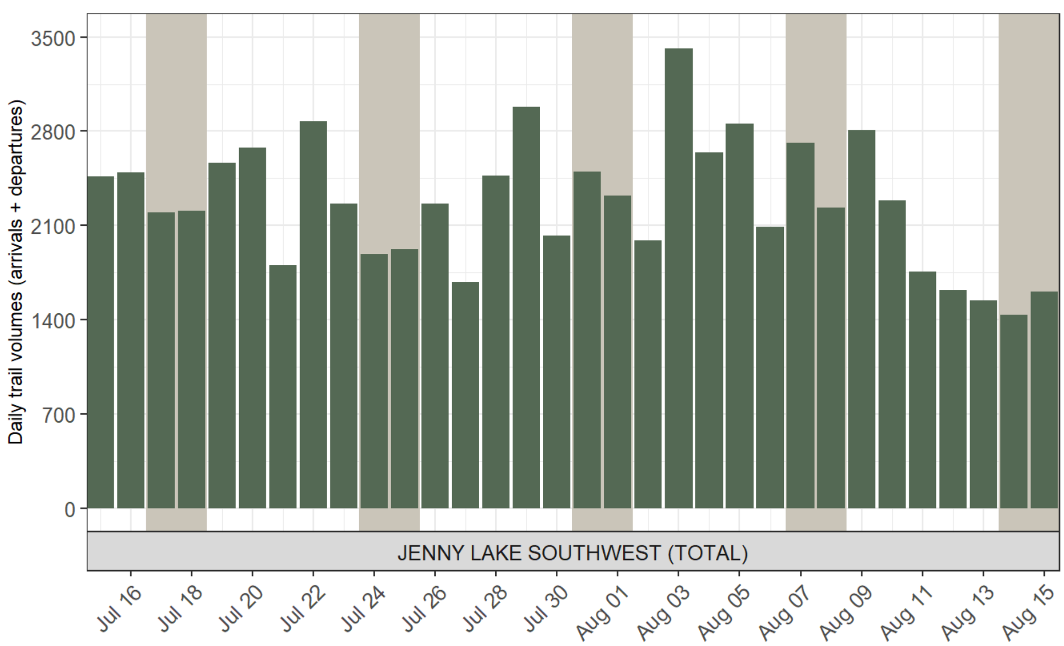

Figure 6. Daily trail volumes: Jenny Lake Southwest (gray shading indicates weekends/holidays).

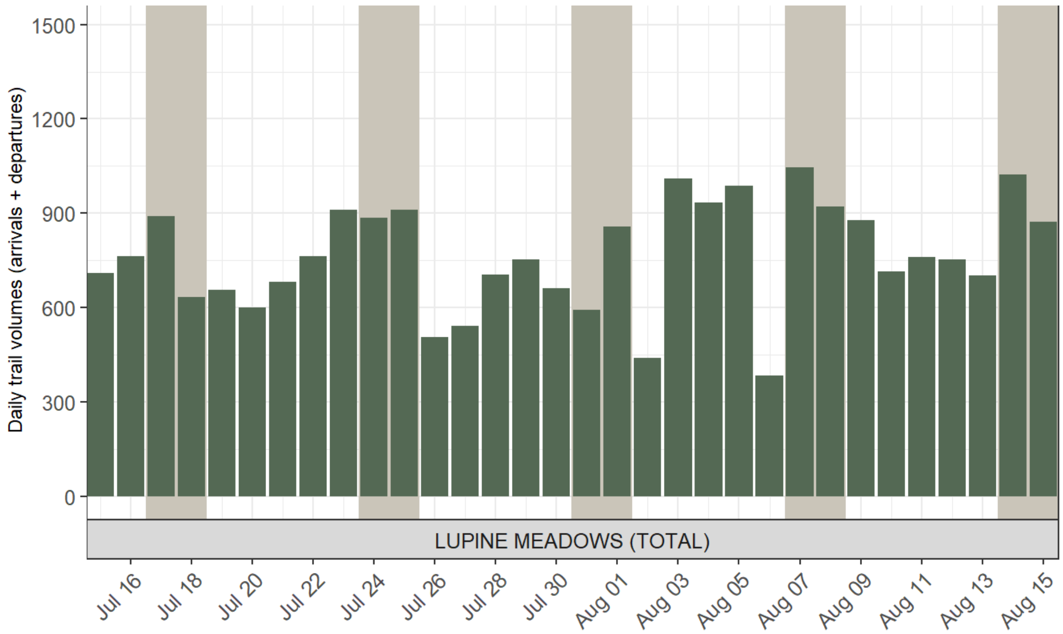

Figure 77. Daily trail volumes: Lupine Meadows (gray shading indicates weekends/holidays).

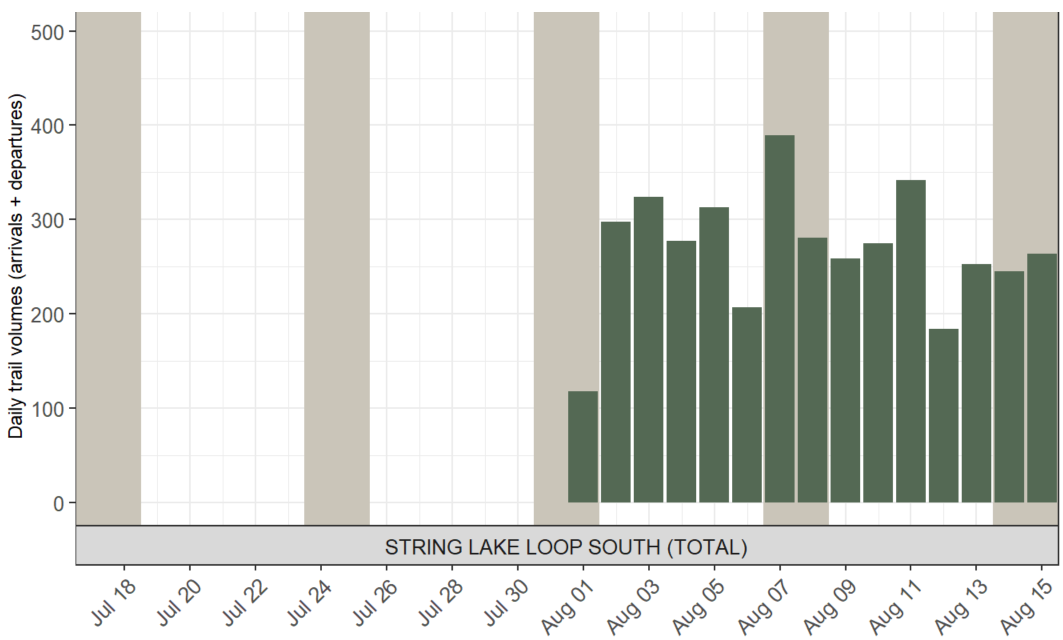

Figure 78. Daily trail volumes: String Lake Loop South[25] (gray shading indicates weekends/holidays).

[25] The String Lake Loop South trail counter malfunctioned, and no data are available for July 2021.

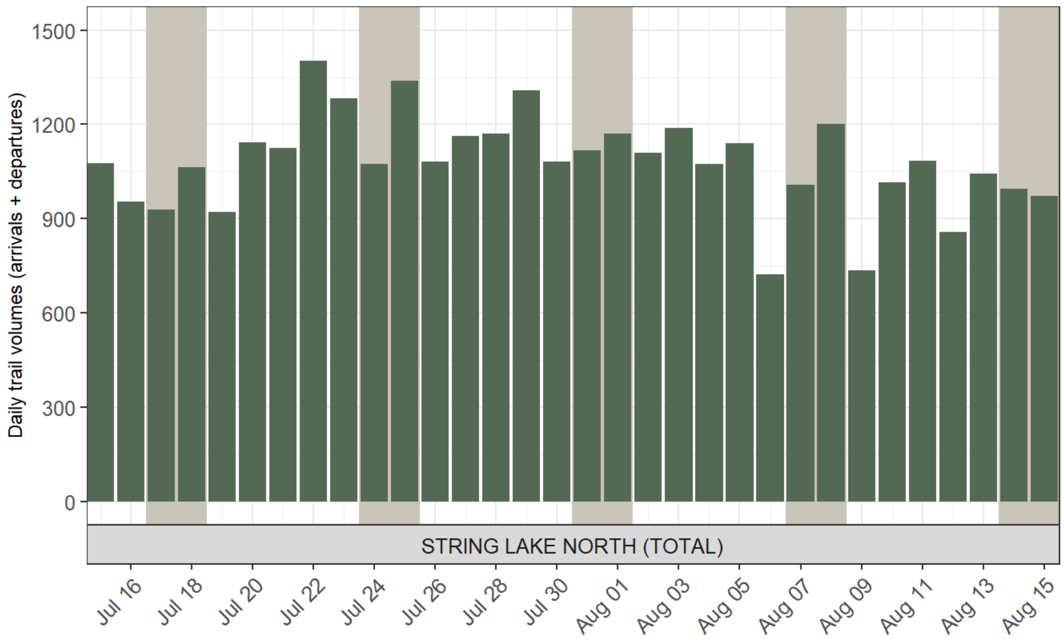

Figure 79. Daily trail volumes: String Lake North (gray shading indicates weekends/holidays).

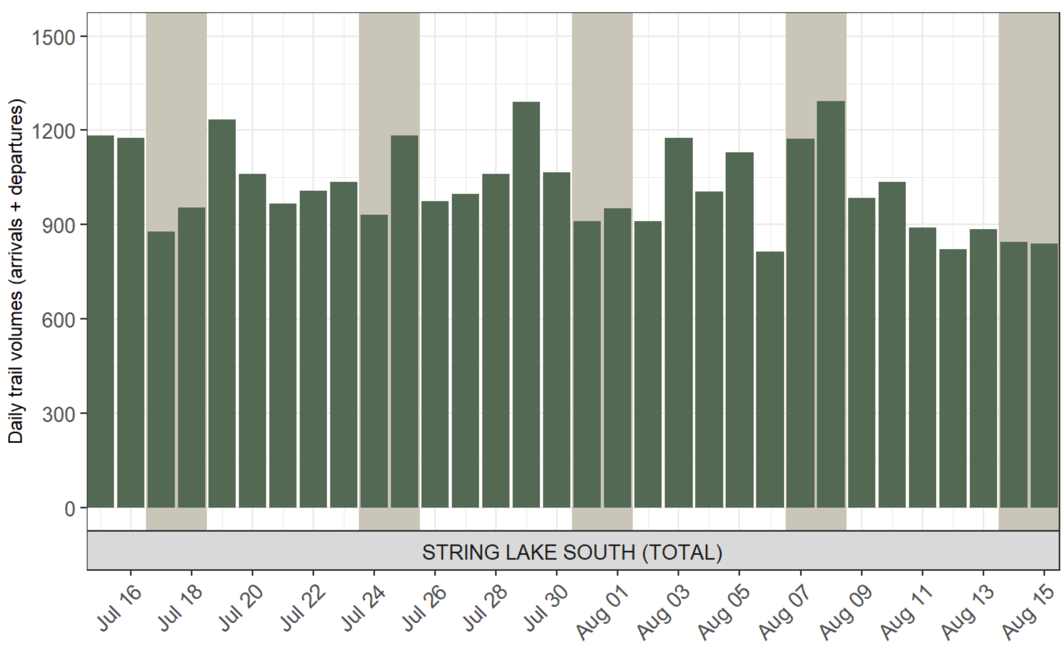

Figure 80. Daily trail volumes: String Lake South (gray shading indicates weekends/holidays).

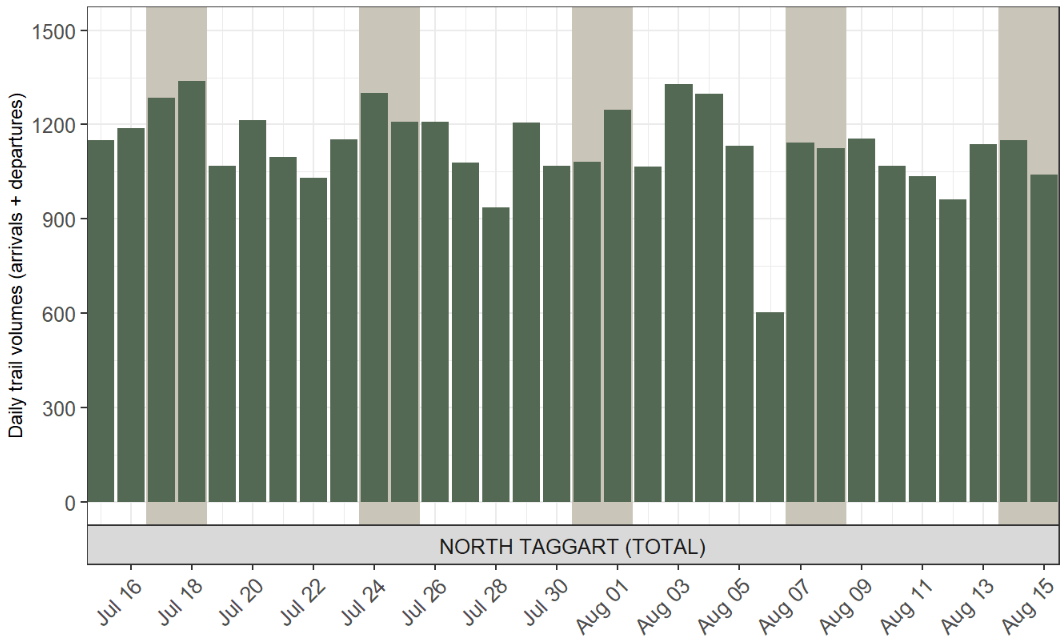

Figure 81. Daily trail volumes: North Taggart (gray shading indicates weekends/holidays).

Figure 82 through **Figure 88** present mean hourly trail volumes[26] (arrivals and departures) for select trail counter locations in the Moose to Signal Mountain subarea, by day of week category. These data suggest:

- Mean hourly trail volumes at Cascade Canyon increased sharply from 6:00 a.m. to a peak of approximately 200 at 11:00 a.m. on weekdays and weekend days and holidays. Mean hourly trail volumes decreased slowly through 4:00 p.m. and decreased steadily through the remainder of the day. Mean hourly trail volumes were similar on weekdays compared to weekend days and holidays (**Figure 82**).

- Mean hourly trail volumes at Jenny Lake Southwest increased sharply from 6:00 a.m. through 9:00 a.m. and then increased more gradually to a peak of just under 250 on weekend days and holidays, and a peak of just over 250 on weekdays at 12:00 p.m. Mean hourly trail volumes decreased steadily through the afternoon and evening. Mean hourly trail volumes were slightly higher on weekdays from 9:00 a.m. through 5:00 p.m. by approximately 10–50 per hour (**Figure 83**).

- Mean hourly trail volumes at Lupine Meadows increased sharply from 5:00 a.m. to a peak at 8:00 a.m. of approximately 75 on weekdays and just under 90 on weekend days and holidays.

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[26] Calibrated data are presented for Jenny Lake Southwest, String Lake North, and String Lake South trail counter locations. Date presented for the following trail counter locations were not calibrated: Cascade Canyon, Lupine Meadows, String Lake Loop South, and North Taggart.

Hourly trail volumes decreased from 8:00 a.m. through 1:00 p.m. On weekdays, hourly trail volumes increased slightly again to just over 50 per hour at 2:00 p.m. and then decreased starting at 3:00 p.m. through the remainder of the day. On weekend days and holidays, hourly trail volumes increased steadily to around 70 per hour at 4:00 p.m. and then decreased through the remainder of the day. Mean hourly trail volumes were slightly higher on weekend days and holidays compare to weekdays through the majority of the day by approximately 10–25 per hour (**Figure 84**).

- Mean hourly trail volumes at String Lake Loop South increased steadily starting at 6:00 a.m. on weekdays and weekend days and holidays. Hourly trail volumes on weekdays peaked at just over 35 per hour at 11:00 a.m. and then decreased sharply until 12:00 p.m. before decreasing more gradually through the afternoon and evening. On weekend days and holidays, mean hourly trail volumes fluctuated between approximately 22–30 per hour from 9:00 a.m. through 1:00 p.m. before reaching a peak of 35 per hour at 2:00 p.m. and then decreasing through the afternoon and evening. Peak mean hourly trail volumes on weekdays occurred three hours earlier than peak mean hourly trail volumes on weekend days and holidays and were slightly higher (**Figure 85**).

- Mean hourly trail volumes at String Lake North increased sharply from 6:00 a.m. through 9:00 a.m. on weekdays and weekend days and holidays. Hourly trail volumes fluctuated between 9:00 a.m. and 3:00 p.m. at just over 105 to just under 120 per hour on weekdays, and at 90 to just over 105 per hour on weekend days and holidays. Hourly trail volumes decreased sharply starting at 3:00 p.m. through the remainder of the day on both weekdays and weekend days and holidays. Mean hourly trail volumes were slightly higher during 9:00 a.m.–3:00 p.m. on weekdays compared to weekend days and holidays (**Figure 86**).

- Mean hourly trail volumes at String Lake South increased starting at 5:00 a.m. to a peak of approximately 110 at 11:00 a.m. on weekdays. The peak was similar in magnitude (110) but delayed until 12:00 p.m. on weekend days and holidays. Hourly trail volumes decreased gradually following the peak until 3:00 p.m., and then decreased steadily through the remainder of the day. Mean hourly trail volumes were slightly higher from 10:00 a.m. through 3:00 p.m. on weekdays, compared to weekend days and holidays (**Figure 87**).

- Mean hourly trail volumes at North Taggart increased sharply from 6:00 a.m. to a peak of approximately 140 at 11:00 a.m. on weekdays, and just under 150 at 12:00 p.m. and weekend days and holidays. Mean hourly trail volumes decreased slowly through 1:00 p.m. and decreased steadily through the remainder of the day. Mean hourly trail volumes were slightly higher on weekend days and holidays, compared to weekdays, but by approximately 10 per hour at most (**Figure 88**).

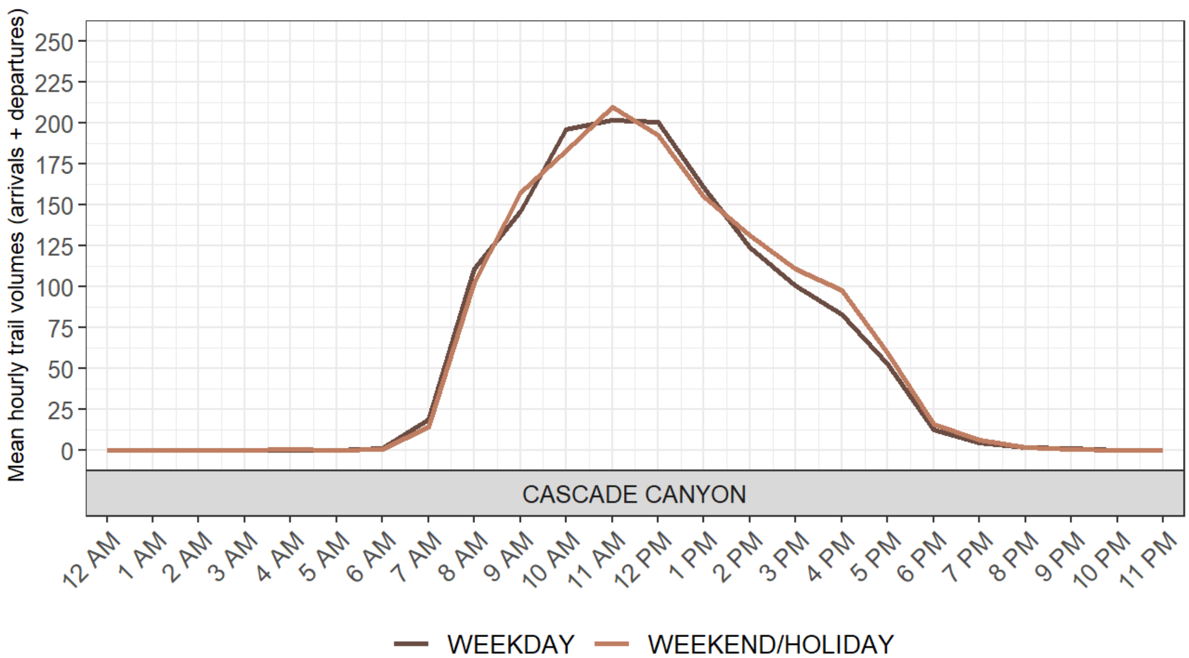

Figure 82. Mean hourly trail volumes: Cascade Canyon.

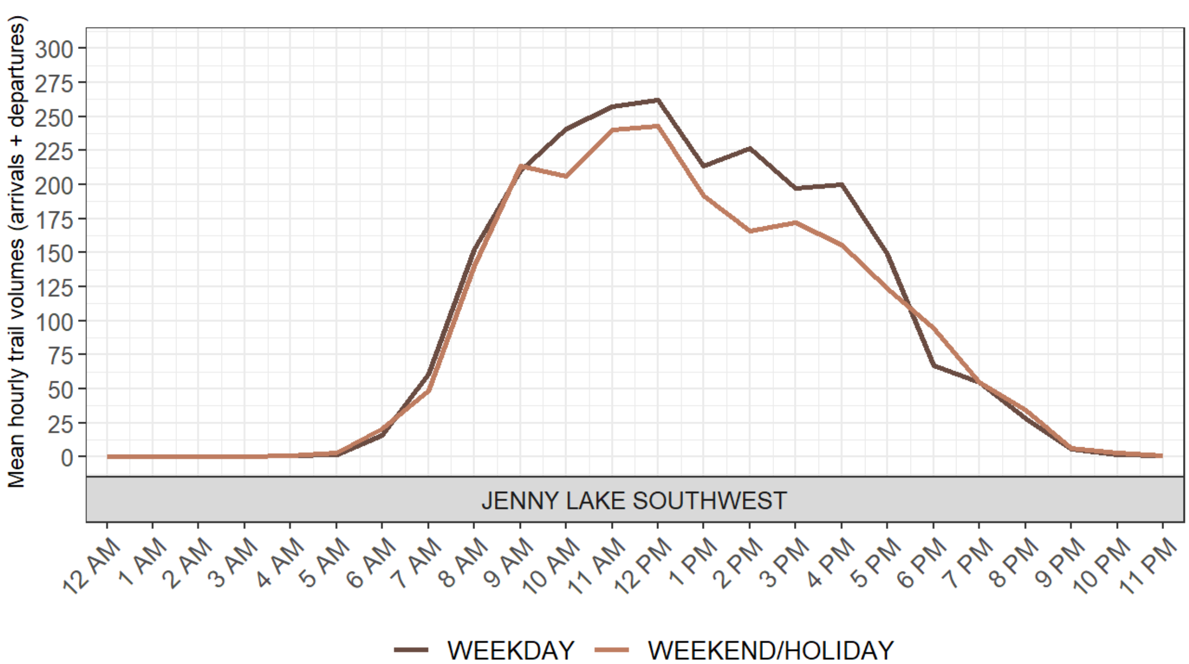

Figure 83. Mean hourly trail volumes: Jenny Lake Southwest.

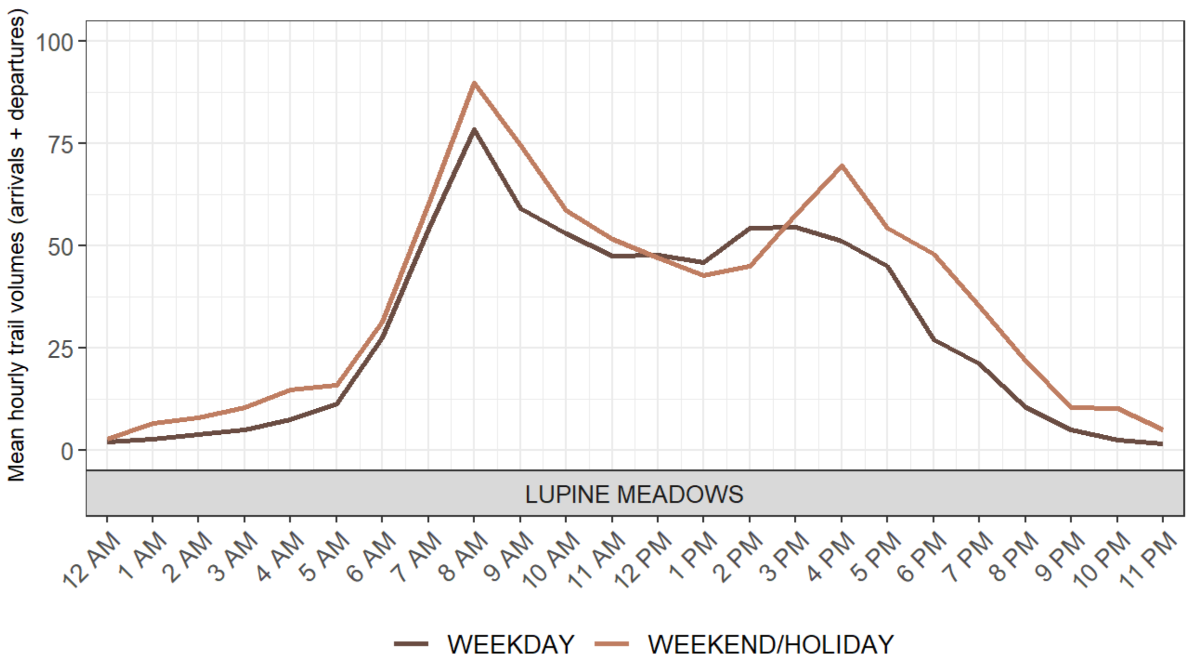

Figure 84. Mean hourly trail volumes: Lupine Meadows.

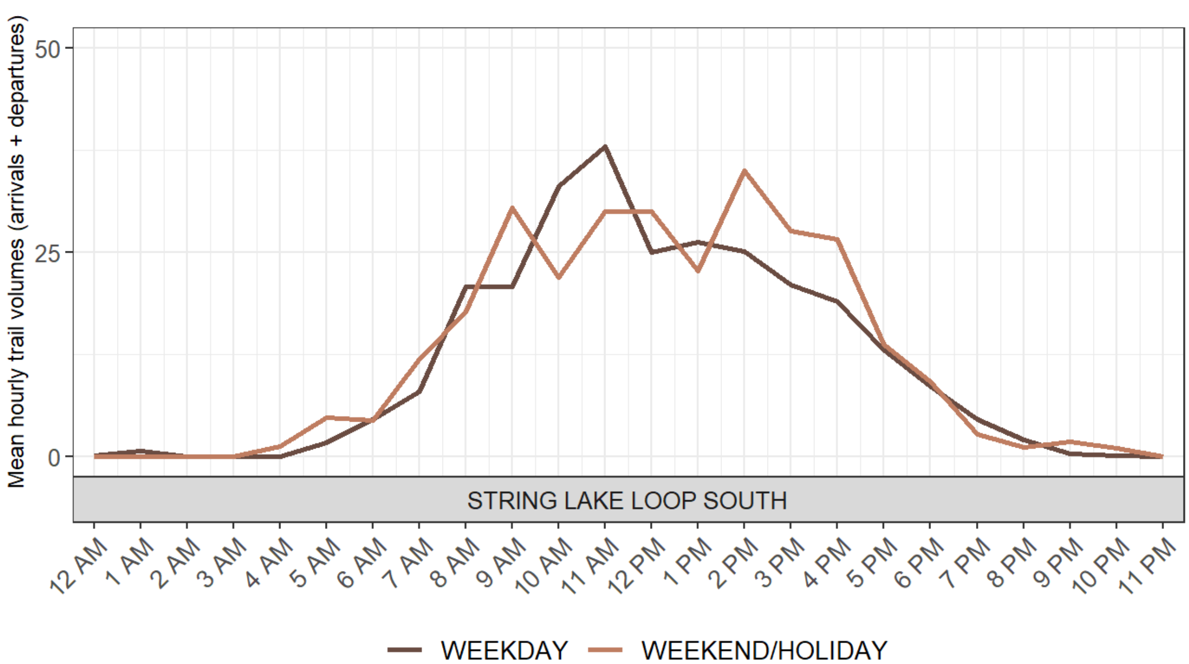

Figure 85. Mean hourly trail volumes: String Lake Loop South.

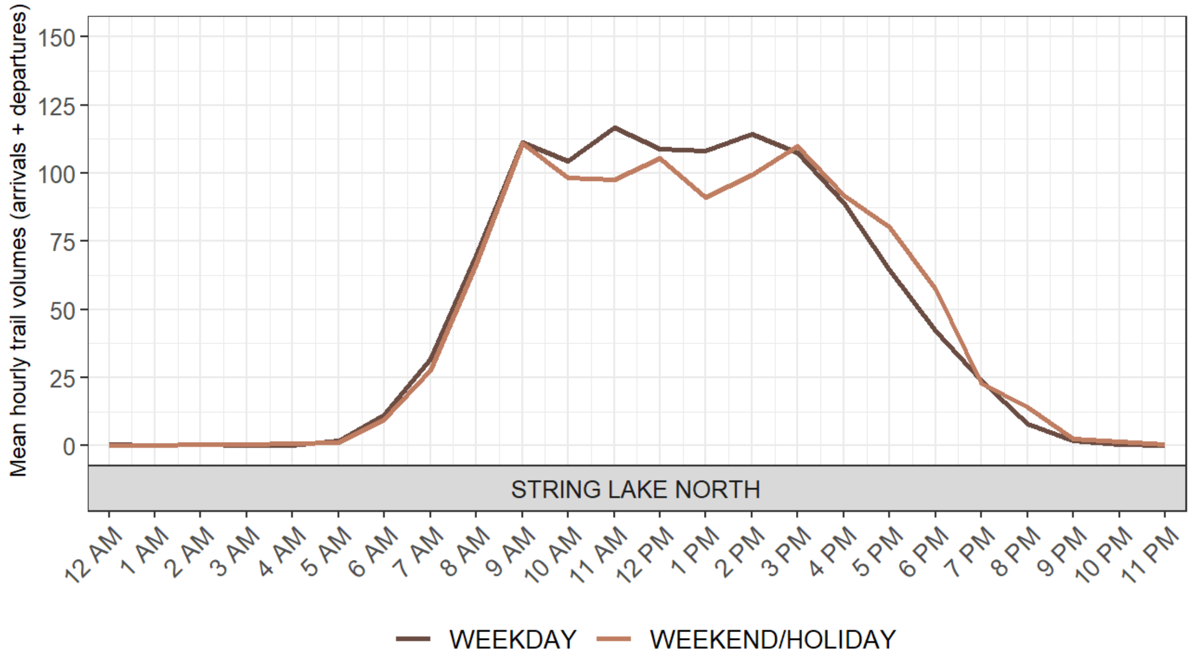

Figure 86. Mean hourly trail volumes: String Lake North.

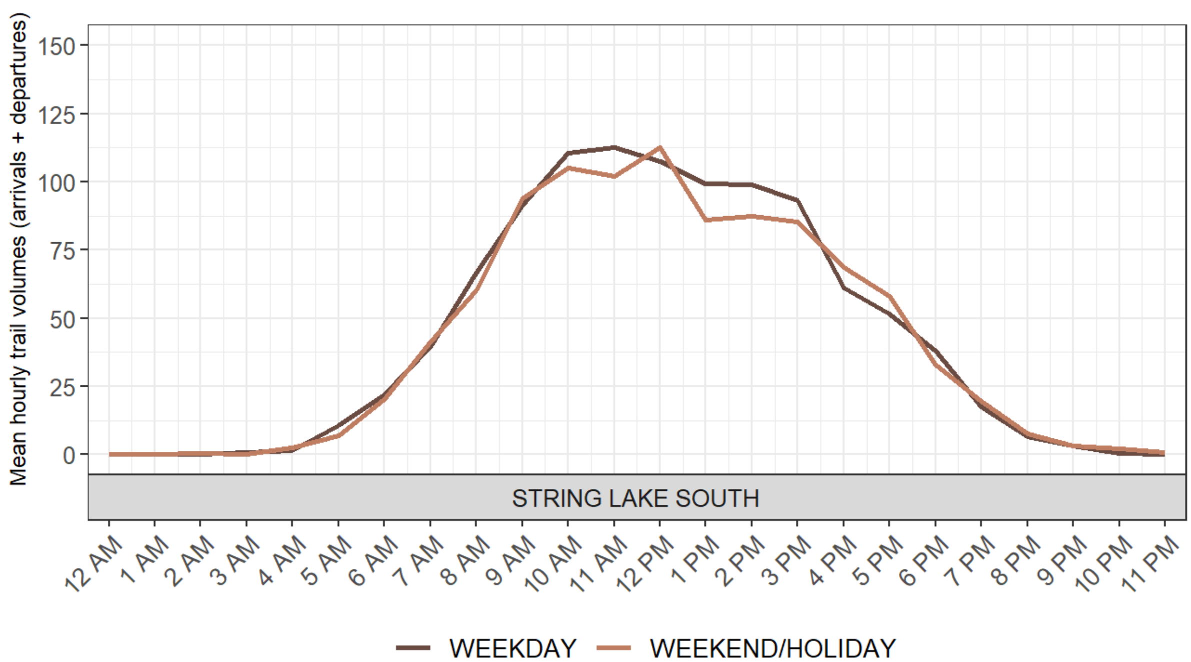

Figure 87. Mean hourly trail volumes: String Lake South.

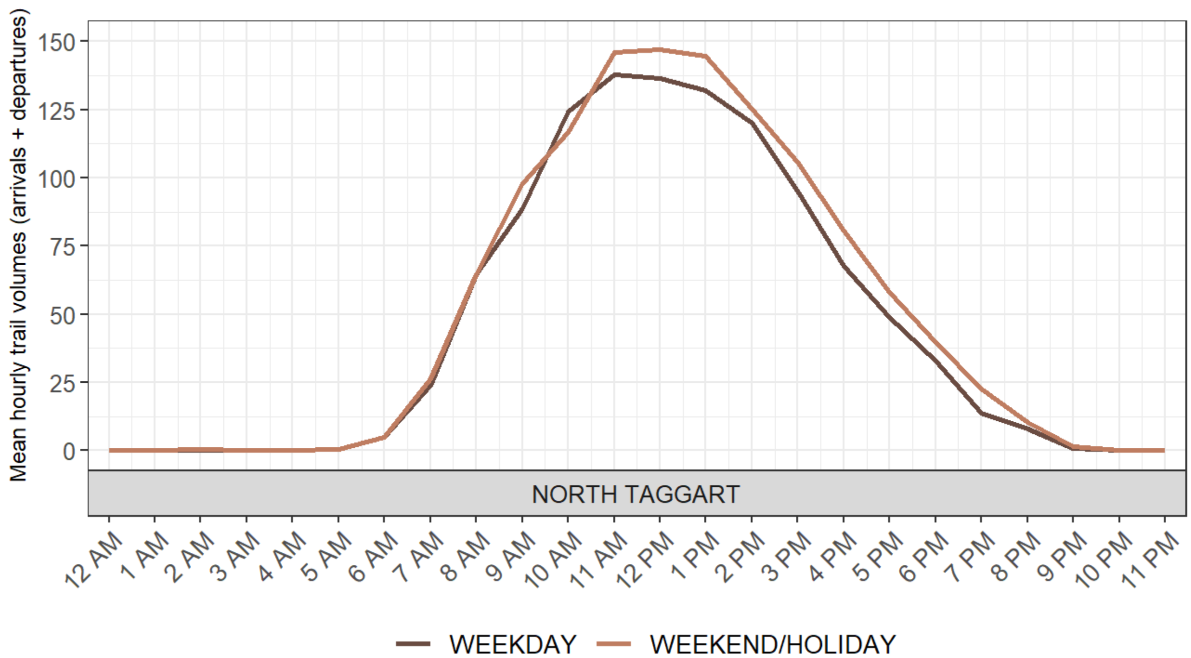

Figure 88. Mean hourly trail volumes: North Taggart.

Jenny Lake Boating Shuttle Ridership

Figure 89 presents total daily ridership on the Jenny Lake Boating shuttle service for data collected August 4 through August 11, 2021. As noted, the shuttle service operates from 7:00 a.m. to 7:00 p.m. during the summer. There are a total of seven boats carrying up to 250 passengers from the east to west shore operating from 7:00 a.m. through 6:59 p.m. each day, equating to a total daily capacity of 3,000 passengers. **Figure 90** presents hourly ridership on the Jenny Lake Boating shuttle, by day and day of week category. These data suggest:

- Daily ridership on the Jenny Lake Boating shuttle (Westbound) typically ranged from 2,000 to 2,250 per day for select days in early August 2021. On two days, daily ridership exceeded 2,250. On August 6, 2021, the park experienced stormy weather, which explains the notably low ridership on this date (**Figure 89**).

- Hourly ridership on the Jenny Lake Boating shuttle (Westbound) was consistently between 175–250 per hour from 7:00–10:00 a.m. on all but one weekday. Hourly ridership varied day to day from 11:00 a.m.–3:00 p.m. and ranged from 150 to just under 300 per hour. Hourly ridership decreased steadily starting around 3:00 p.m. No discernable difference exists in hourly ridership on weekdays compared to weekend days in early August 2021 (**Figure 90**).

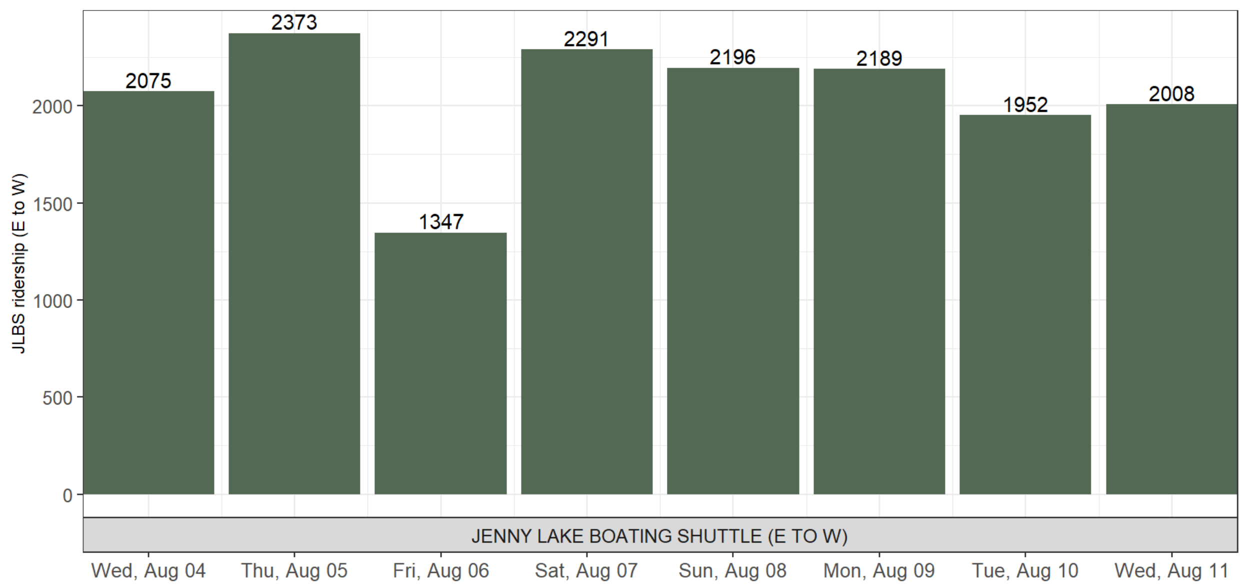

Figure 89. Daily Jenny Lake Boating shuttle (Westbound) ridership.[27]

[27] August 6, 2021 had missing counts in the 7:00 a.m., 4:00 p.m., 5:00 p.m., and 6:00 p.m. hours, so the data were imputed at the daily level. Furthermore, existing counts on this date were low due to stormy weather, which explains the low daily count in this plot.

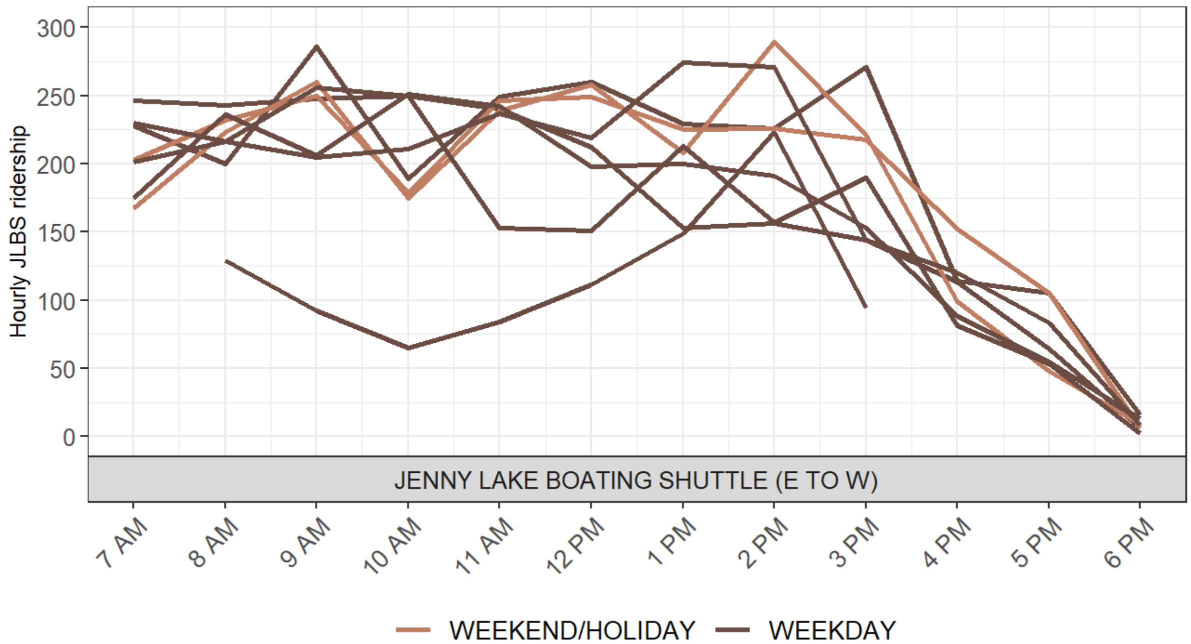

Figure 90. Hourly Jenny Lake Boating shuttle (Westbound) ridership on days.

Exploratory Analysis

This subsection presents results of final regression models that estimate relationships between inbound traffic volumes, and key indicator variables regarding traffic, parking, and trail use in the Moose to Signal Mountain subarea. Three groupings of input traffic volumes, (1) entrance station inbound traffic volumes, (2) subarea inbound traffic volumes, and (3) interior roadway traffic volumes, were measured against the subarea's key indicator variables. The following subsections present tabular results of final regression models for each of the three input traffic volume groupings. Narrative results are also provided for each regression model estimated for the Excel-based tool that had a significant relationship. The GRTE TVM Report Appendix 6 contains scatterplots of regression inputs and indicators with final fitted models.

Regression Model Input: Entrance Station Inbound Traffic Volumes

Table 51 presents results for models estimated for the Excel-based tool and **Table 52** presents results of exploratory regression models that estimate relationships between entrance station inbound traffic volumes, and key indicator variables regarding traffic, parking, and trail use in the Moose to Signal Mountain subarea are presented below. In consultation with park staff, inputs of entrance station inbound traffic volumes were defined as the sum of park inbound traffic volumes from the Moose Entrance Station (Northbound), Moran Entrance Station (Northbound), and South Gate of Yellowstone (Southbound). Results from each of the final hourly regression models estimated for the Excel-based tool with a significant relationship **(Table 51**) suggest:

On average, for every 100 entrance station inbound vehicles per hour[28]:

- There are approximately 23 vehicles on the Jenny Lake One Way (Southbound) roadway, 12 vehicles on both lanes of the Lupine Meadows roadway, and 25 vehicles on both lanes of the String Lake South roadway that same hour.
- There are approximately 98 additional vehicles parked at Jenny Lake that same hour, or a 32% increase in the number of parked vehicles based on an average of 310 parked vehicles per hour.
- There are approximately 26 additional vehicles parked at String and Leigh Lakes that same hour, or a 20% increase in the number of parked vehicles based on an average of 176 parked vehicles per hour.
- There are approximately 40 vehicles parked at Lupine Meadows and nine vehicles parked at Taggart that same hour.
- There is a total volume (arrivals and departures) of approximately 16 visitors on the Lupine Meadows trail that same hour.
- There are approximately 42 additional visitor arrivals and departures on the Cascade Canyon trail the following hour, or a 45% increase in the total trail volume based on an average of 93 per hour.
- There are approximately 48 additional visitor arrivals and departures on the Jenny Lake Southwest trail that same hour, or a 36% increase in the total trail volume based on an average of 132 per hour.
- There are approximately 31 additional visitor arrivals and departures on the North Taggart trail the following hour, or a 46% increase in the total trail volume based on an average of 68 per hour.
- There are approximately seven additional visitor arrivals and departures on the String Lake Loop South trail the following hour, or a 38% increase in the total trail volume based on an average of 18 per hour.
- There are approximately 25 additional visitor arrivals and departures on the String Lake North trail the following hour, or a 36% increase in the total trail volume based on an average of 69 per hour.

[28] The strength of the statistical relationship varies among the regression models and the bulleted summary statements should be interpreted as general rather than exact.

- There are approximately 22 additional visitor arrivals and departures on the String Lake South trail the following hour, or a 34% increase in the total trail volume based on an average of 65 per hour.

Table 51. Hourly regression model specifications: Moose to Signal Mountain subarea, with entrance station inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Jenny Lake One Way traffic volumes	Linear	No lag	-19.8	0.23*	0.215	< 0.001	0.45	65
Lupine Meadows traffic volumes	Linear	No lag	15.4	0.12*	0.067	< 0.001	0.55	60
String Lake South traffic volumes	Linear	No lag	-5.6	0.25*	0.629	< 0.001	0.49	156
Jenny Lake parking occupancy rate	Poisson	No lag	3.745233401724*	0.003146580721*	< 0.001	< 0.001	NA	36
Lupine Meadows parking occupancy	Linear	No lag	29.6*	0.1*	0.001	< 0.001	0.53	52
String and Leigh Lakes parking occupancy rate	Poisson	No lag	3.889175816282*	0.002040422389*	< 0.001	< 0.001	NA	35
Taggart parking occupancy rate	Linear	No lag	-3.8	0.09*	0.62	< 0.001	0.55	53
Cascade Canyon trail volumes	Poisson	1-hour lag	1.863508731169*	0.004509427529*	< 0.001	< 0.001	NA	569
Jenny Lake Southwest trail volumes	Poisson	No lag	2.765369929309*	0.003638812188*	< 0.001	< 0.001	NA	568
Lupine Meadows trail volumes	Linear	No lag	8.6*	0.07*	< 0.001	< 0.001	0.31	569
North Taggart trail volumes	Poisson	No lag	1.483249252284*	0.004600513964*	< 0.001	< 0.001	NA	570
String Lake Loop South trail volumes	Poisson	No lag	0.716942019103*	0.00378704475*	< 0.001	< 0.001	NA	427
String Lake North trail volumes	Poisson	No lag	2.162920480246*	0.003573999268*	< 0.001	< 0.001	NA	563

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
String Lake South trail volumes	Poisson	No lag	2.225797115383*	0.003359860885*	< 0.001	< 0.001	NA	569

Regression model input: Entrance station inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N), Moran Entrance Station (N), and South Gate of Yellowstone (S). R-squared is a goodness of fit statistic that only applies in the case of linear models and therefore does not apply to the Poisson models reported in the table. Goodness of fit is evaluated for a Poisson model only based on comparison with another model. Asterisks (*) denote significance at $p < 0.05$.

Table 52. Daily regression model specifications: Moose to Signal Mountain subarea, with entrance station inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Jenny Lake One Way traffic volumes	Linear	No lag	836.6*	0.07*	< 0.001	< 0.001	0.20	91
Lupine Meadows traffic volumes	Linear	No lag	-1714.1	0.36	0.166	0.217	0.70	4
String Lake South traffic volumes	Linear	No lag	-600.1*	0.29*	< 0.001	< 0.001	0.41	91
Jenny Lake maximum parking occupancy rate	Linear	No lag	98.2	0.04	0.565	0.450	0.58	3
Lupine Meadows maximum parking occupancy rate	Linear	No lag	70.4	0.001*	0.931	0.026	0.66	7
String and Leigh Lakes maximum parking occupancy rate	Linear	No lag	-257.3	0.06	0.791	0.271	0.83	3
Taggart maximum parking occupancy rate	Linear	No lag	80.1	0.002	0.45	0.450	0.12	7
Cascade Canyon trail volumes	Linear	No lag	-257.7	0.21*	0.446	< 0.001	0.22	91
Jenny Lake Southwest trail volumes	Linear	No lag	-1613.6*	0.47*	< 0.001	< 0.001	0.31	91
Lupine Meadows trail volumes	Linear	No lag	-147.9*	0.09*	< 0.001	0.002	0.10	91
North Taggart trail volumes	Linear	No lag	-858.5*	0.24*	0.011	< 0.001	0.62	91
String Lake Loop South trail volumes	Linear	No lag	103.8*	0.02	< 0.001	0.139	0.08	30
String Lake North trail volumes	Linear	No lag	-143.1*	0.15*	< 0.001	< 0.001	0.28	91
String Lake South trail volumes	Linear	No lag	95.2*	0.11*	0.005	< 0.001	0.22	91

Regression model input: Entrance station inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N), Moran Entrance Station (N), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Regression Model Input: Subarea Inbound Traffic Volumes

Table 53 and **Table 54** present results of hourly and daily exploratory regression models that estimate relationships between inbound traffic volumes around the perimeter of the Moose to Signal Mountain subarea, and key indicator variables regarding traffic, parking, and trail use in the subarea are presented below. The subarea inbound traffic volume for the perimeter of the Moose to Signal Mountain subarea is computed as the sum of traffic counts from the Moose Entrance Station (Northbound) and Teton Park Road (Southbound).

Table 53. Hourly regression model specifications: Moose to Signal Mountain subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Jenny Lake One Way traffic volumes	Linear	No lag	25*	0.20*	< 0.001	< 0.001	0.29	60
Lupine Meadows traffic volumes	Linear	No lag	31.9*	0.14*	< 0.001	< 0.001	0.51	60
String Lake South traffic volumes	Linear	No lag	36	0.23*	0.124	< 0.001	0.32	60
Jenny Lake parking occupancy rate	Linear	No lag	-16.9*	0.81*	0.044	< 0.001	0.55	36
Lupine Meadows parking occupancy rate	Linear	No lag	36.6*	0.13	< 0.001	0.094	0.46	7
String and Leigh Lakes parking occupancy rate	Linear	No lag	56.4	0.29*	0.05	< 0.001	0.40	35
Taggart parking occupancy rate	Linear	No lag	32.5*	0.05	0.02	0.05	0.28	14
Cascade Canyon trail volumes	Linear	1-hour lag	-42.8*	0.39*	< 0.001	< 0.001	0.52	59
Jenny Lake Southwest trail volumes	Linear	No lag	-6.3*	0.48*	< 0.001	< 0.001	0.47	60
Lupine Meadows trail volumes	Linear	No lag	19.1*	0.09*	< 0.001	< 0.001	0.34	60
String Lake Loop South trail volumes	Linear	No lag	-6.3*	0.07*	< 0.001	< 0.001	0.51	60
String Lake North trail volumes	Linear	No lag	-4.7*	0.21*	< 0.001	< 0.001	0.61	57
String Lake South trail volumes	Linear	No lag	-14.5	0.24*	0.088	< 0.001	0.69	60
North Taggart trail volumes	Linear	No lag	-32.4	0.28*	0.085	< 0.001	0.72	60
Jenny Lake Boating shuttle (W) ridership	Linear	1-hour lag	20.2	0.38*	0.515	< 0.001	0.41	44

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N) and Teton Park Road (S). Asterisks (*) denote significance at $p < 0.05$.

Table 54. Daily regression model specifications: Moose to Signal Mountain subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Jenny Lake One Way traffic volumes	Linear	No lag	1147.4	0.05	0.098	0.544	0.21	4
Lupine Meadows traffic volumes	Linear	No lag	-874.5	0.39	0.544	0.082	0.84	4
String Lake traffic volumes	Linear	No lag	644.1	0.21	0.306	0.263	0.54	4
Jenny Lake maximum parking occupancy rate	Linear	No lag	188.8	0.05	0.395	0.317	0.77	3
String and Leigh Lakes maximum parking occupancy rate	Linear	No lag	-101	0.06	0.397	0.138	0.95	3
Taggart maximum parking occupancy rate	Linear	No lag	-1851.3	0.33	NA	NA	1	2
Cascade Canyon trail volumes	Linear	No lag	-2827.7	0.8	0.226	0.119	0.78	4
Jenny Lake Southwest trail volumes	Linear	No lag	445.2	0.38	0.119	0.397	0.36	4
Lupine Meadows trail volumes	Linear	No lag	-1472.6	0.42	0.836	0.052	0.9	4
String Lake Loop South trail volumes	Linear	No lag	-108.4	0.07	0.11	0.339	0.44	4
String Lake North trail volumes	Linear	No lag	-872.2	0.35*	0.052	0.013	0.97	4
String Lake South trail volumes	Linear	No lag	-525.6	0.30	0.115	0.087	0.83	4
North Taggart trail volumes	Linear	No lag	-1299.3	0.43*	0.397	0.041	0.92	4
Jenny Lake Boating shuttle (W) ridership	Linear	No lag	-2059	0.77*	0.157	0.047	0.91	4

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N) and Teton Park Road (S). Asterisks (*) denote significance at $p < 0.05$.

Asterisks (*) denote significance at $p < 0.05$.

Table 55 and **Table 56** present results of final hourly and daily exploratory regression models that estimate relationships between interior roadway traffic volumes within the Moose to Signal Mountain subarea and key indicator variables regarding parking and trail use in the subarea are presented below. Interior roadway traffic volume inputs include Jenny Lake One Way (Southbound), Lupine Meadows (Westbound), and String Lake South (Westbound).

Table 55. Hourly regression model specifications: Moose to Signal Mountain subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Jenny Lake One Way (S) traffic volumes	Jenny Lake parking occupancy rate	Linear	No lag	103.1*	1.86*	0.005	< 0.001	0.57	36
Lupine Meadows (W) traffic volumes	Lupine Meadows parking occupancy rate	Linear	No lag	42.9	1.16	0.545	0.06	0.54	7
String Lake South (W) traffic volumes	String & Leigh Lakes parking occupancy rate	Linear	No lag	10.3*	2.28*	< 0.001	< 0.001	0.76	35
Jenny Lake One Way (S) traffic volumes	Cascade Canyon trail volumes	Linear	1-hour lag	-11*	1.13*	< 0.001	< 0.001	0.66	1376
Jenny Lake One Way (S) traffic volumes	Jenny Lake Southwest trail volumes	Linear	No lag	53.4*	1.03*	< 0.001	< 0.001	0.37	1377
Lupine Meadows (W) traffic volumes	Lupine Meadows trail volumes	Linear	No lag	27*	0.6*	< 0.001	< 0.001	0.25	60
String Lake South (W) traffic volumes	String Lake Loop South trail volumes	Linear	No lag	0.1*	0.32*	0.044	< 0.001	0.46	457
String Lake South (W) traffic volumes	String Lake North trail volumes	Linear	No lag	-1.3*	1.22*	< 0.001	< 0.001	0.71	1358
String Lake South (W) traffic volumes	String Lake South trail volumes	Linear	No lag	3.2*	1.05*	< 0.001	< 0.001	0.61	1379
Jenny Lake parking occupancy rate	Jenny Lake Boating shuttle (W) ridership	Linear	1-hour lag	-7.1	0.52*	0.798	< 0.001	0.62	31
Jenny Lake Boating shuttle (W) ridership	Cascade Canyon trail volumes	Linear	No lag	38.4*	0.55*	0.0223	< 0.001	0.31	92

Asterisks (*) denote significance at p < 0.05.

Table 56. Daily regression model specifications: Moose to Signal Mountain subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Jenny Lake One Way (S) traffic volumes	Jenny Lake maximum parking occupancy rate	Linear	No lag	-287.4	0.5	0.359	0.157	0.94	3
String Lake South (W) traffic volumes	String & Leigh Lakes maximum parking occupancy rate	Linear	No lag	-95.7	0.36*	0.077	0.023	1	3
Jenny Lake One Way (S) traffic volumes	Cascade Canyon trail volumes	Linear	No lag	449	0.69*	0.294	0.024	0.05	92
Jenny Lake One Way (S) traffic volumes	Jenny Lake Southwest trail volumes	Linear	No lag	1162.3*	0.77	0.024	0.9	0.02	92
Lupine Meadows (W) traffic volumes	Lupine Meadows trail volumes	Linear	No lag	-664.8	2.4*	0.158	0.003	0.99	4
String Lake South (W) traffic volumes	String Lake Loop South trail volumes	Linear	No lag	203.4*	0.06	0.003	0.615	0.01	31
String Lake South (W) traffic volumes	String Lake North trail volumes	Linear	No lag	506	0.64*	0.19	< 0.001	0.17	92
String Lake South (W) traffic volumes	String Lake South trail volumes	Linear	No lag	690.9*	0.35*	0.012	0.005	0.08	92
Jenny Lake Boating shuttle (W) ridership	Cascade Canyon trail volumes	Linear	No lag	-535.1	1.02*	0.363	0.008	0.72	8

Asterisks (*) denote significance at p < 0.05.

Conclusion

This subsection offers concluding insights based on traffic and parking conditions for the Moose to Signal Mountain subarea, as well as the results of the exploratory analysis:

- Daily traffic volumes inbound into the Moose to Signal Mountain subarea from Moose tend to be slightly higher on weekend days and holidays than on weekdays, and generally range between 2,500 and 3,250 vehicles per day. The three days of traffic count data for the Teton Park Road near its junction with Highway 191 suggest a similar pattern for weekend days and holidays versus weekdays, but further monitoring may be warranted. Traffic volumes into the Moose to Signal Mountain subarea are generally somewhat lower during early June and late August than during the late June through early August period.

- Hourly traffic volumes into the Moose to Signal Mountain subarea from Moose increase from early morning hours to a late-morning peak throughout the days of the week. The peak hour of inbound traffic at Moose is slightly higher and slightly later on weekend days and holidays than on weekdays. Inbound traffic at Moose declines through the afternoon and evening hours of the day. Hourly traffic volumes into the Moose to Signal Mountain subarea from the Teton Park Road near its junction with Highway 191 reach their peak around noon and then decline through the afternoon and evening hours. These results suggest the Moose to Signal Mountain subarea of the park "loads" concurrently from the northern and southern ends of the Teton Park Road through the morning hours, and peaks during the later morning and early afternoon. This contrasts with the Gros Ventre/Antelope Flats and Moose Wilson subareas where inbound traffic predominates in one direction during the morning hours, and then predominates in the other direction in the afternoon hours. This could potentially result in intensive visitation pressure at key locations throughout the Moose to Signal Mountain subarea during the middle of the day.

- Daily vehicle traffic on the interior park roads of Jenny Lake Road, Lupine Meadows Road, and String Lake Road within the Moose to Signal Mountain subarea are generally higher on weekends and holidays than on weekdays. The three-day hourly traffic volumes on Lupine Meadows Road suggests there is an early morning wave of inbound vehicle traffic there, followed by a mid-morning lull, and then a peak of vehicle traffic during the mid-afternoon. Inbound vehicle traffic on String Lake Road displays a "typical" recreation use pattern, with traffic into this location increasing fairly rapidly in the morning hours, reaching a peak by early afternoon, and then declining through the mid-afternoon and evening hours. The hourly inbound vehicle traffic pattern on Jenny Lake Road is similar to that on String Lake Road, but is shifted slightly (by about an hour) later.

- The number of vehicles parked estimates for the three-day study period at South Jenny Lake Visitor Center and String and Leigh Lakes suggest that there are parking shortages in these areas throughout the day on weekends. The results also suggest parking shortages may be a problem during the middle of the afternoon on weekdays at String and Leigh Lakes. Further monitoring and adaptive management of parking conditions at these locations may be warranted.

- Daily patterns of trail use vary from location to location within the Moose to Signal Mountain subarea. For example, daily trail use at Jenny Lake Southwest tends to be higher on weekdays than on weekend days and holidays, while it tends to be higher on weekends and holidays than on weekdays at Lupine Meadows and Cascade Canyon. Trail use at String Lake and North Taggart does not demonstrate a consistent day of week pattern; the highest use days fluctuate across days of the week during the course of the summer season.

- Hourly visitor use volumes on most of the trails in the Moose to Signal Mountain subarea display “typical” recreation use patterns, with trail use in these locations increasing fairly sharply in the morning hours, reaching peaks by late morning/early afternoon, and then declining in the afternoon and evening hours. The one notable exception to this pattern is with respect to trail use volumes at Lupine Meadows. Hourly trail use at Lupine Meadows picks up quickly during the early morning hours and reaches a peak by about 8:00 a.m. Hourly trail use at Lupine Meadows drops somewhat during the late morning and early afternoon hours, and then increases again to a secondary peak in the late afternoon/early evening.

- There are statistically significant relationships between the hourly and daily volumes of vehicles entering GRTE from the park’s entrance stations and the amount of vehicle traffic, parking, and trail use in the Moose to Signal Mountain subarea. There are also statistically significant relationships between the volumes of vehicles entering the Moose to Signal Mountain subarea and the amount of vehicle traffic, parking, and trail use at all but one of the “indicator locations” in the subarea at the hourly level, and for a limited set of “indicator locations” in the subarea at the daily level. The results suggest the largest share of the parkwide and local vehicle traffic destined for the Moose to Signal Mountain subarea travels to Jenny Lake. A moderate share of vehicle traffic into the subarea heads to String and Leigh Lakes, and smaller shares visit Lupine Meadows and Taggart Lake.

Moran to Leeks Marina Subarea

This section of the report presents descriptive results for select subarea inbound traffic volumes and indicators of traffic, parking, and trail use conditions, as well as the results from exploratory analyses of relationships between transportation inputs and traffic, parking, and trail use conditions in the Moran to Leeks Marina subarea of GRTE. Key conclusions are presented at the end of this section. The locations of the select subarea inbound traffic volumes and indicators of traffic, parking, and trail use conditions for the Moran to Leeks Marina subarea are depicted in **Figure 91** and include:

- Moran (Northbound) traffic volume
- Lizard Creek (Southbound) traffic volume
- Teton Park Road (Eastbound) traffic volume
- Colter Bay Village Road (Westbound) traffic volume
- Colter Bay Village Road (Total) traffic volume
- Colter Bay parking occupancy rates
- Heron Pond trail volume
- Lakeshore Loop trail volume

See Appendix 7 for additional descriptive results for this subarea.

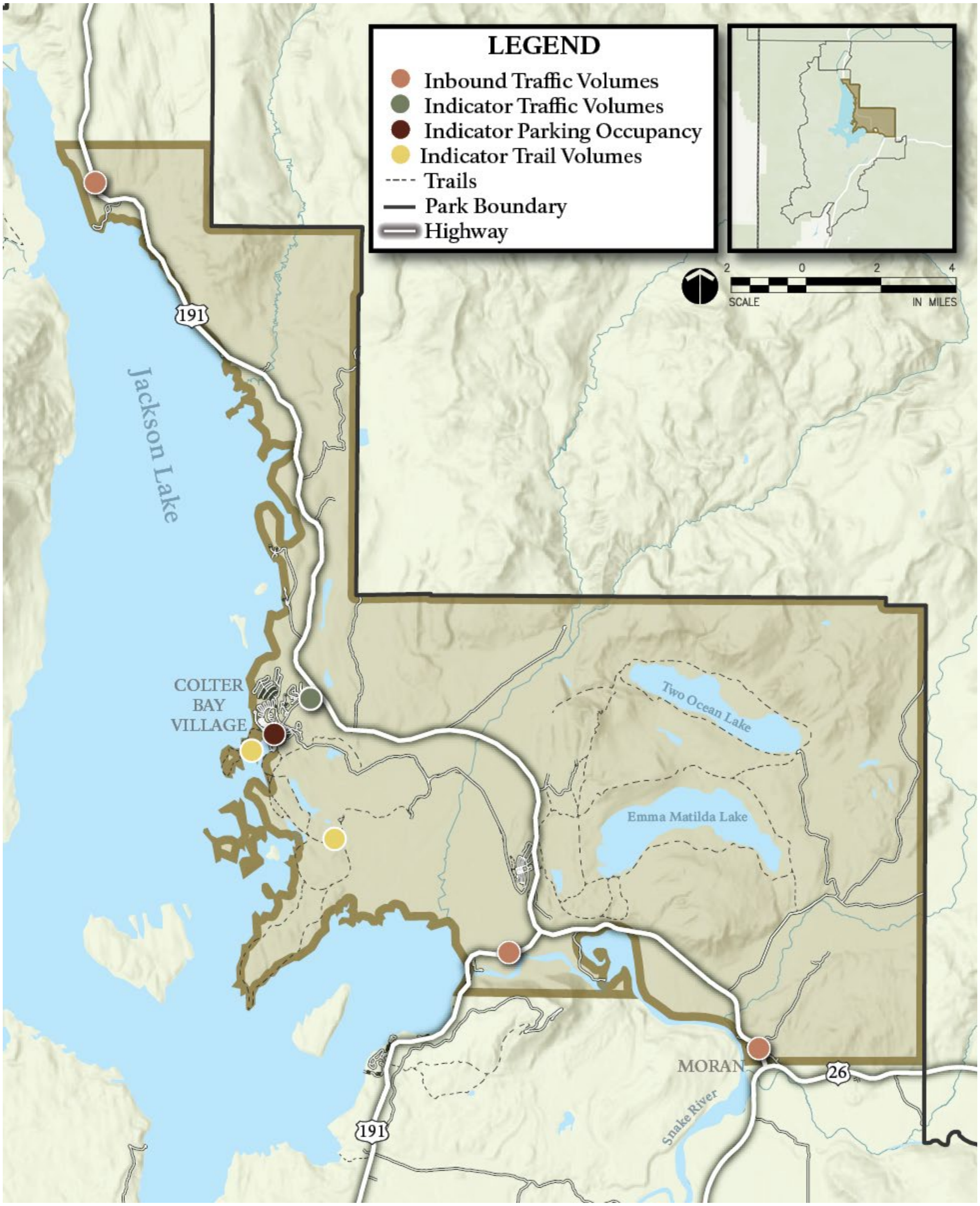

Figure 7. Input and indicator traffic, parking, and trail locations – Moran to Leeks Marina subarea.

Traffic Conditions

Figure 92 through **Figure 96** present total daily subarea inbound traffic volumes and interior roadway traffic volumes for select traffic counter locations in the Moran to Leeks Marina subarea, by date during the counting period.[29] These data suggest:

- Daily subarea inbound traffic volumes at Moran (Northbound) typically ranged from around 2,750 to 3,250 per day. However, on several days in June and July, daily traffic volumes approached or exceeded 3,500. Daily traffic volumes were lower overall during the second half of August compared to June and July (**Figure 92**).
- Daily subarea inbound traffic volumes at Lizard Creek (Southbound) typically ranged from approximately 2,500 to 3,000 per day. On a few days, daily traffic volumes approached or exceeded 3,000. Daily traffic volumes were lower overall during the second half of August compared to June and July (**Figure 93**).
- Daily subarea inbound traffic volumes at Teton Park Road (Eastbound) ranged from a low on Friday of just over 1,750 vehicles per day to a high of approximately 2,250 vehicles per day on Saturday and Sunday (**Figure 94**).
- Daily interior roadway traffic volumes at Colter Bay Village Road (Westbound) varied slightly during the sampling period and ranged from just over approximately 2,250 to just under 2,500 vehicles per day (**Figure 95**).
- Daily interior roadway traffic volumes at Colter Bay Village Road (Total) overall varied slightly during the sampling period and ranged from just over approximately 4,500 to under 5,000 vehicles per day (**Figure 96**).

[29] Traffic volume data were collected at Teton Park Road (Eastbound) and at Colter Bay Village Road (Westbound and Total) during the 3-day sampling period and are presented as total daily traffic volumes during the sampling period.

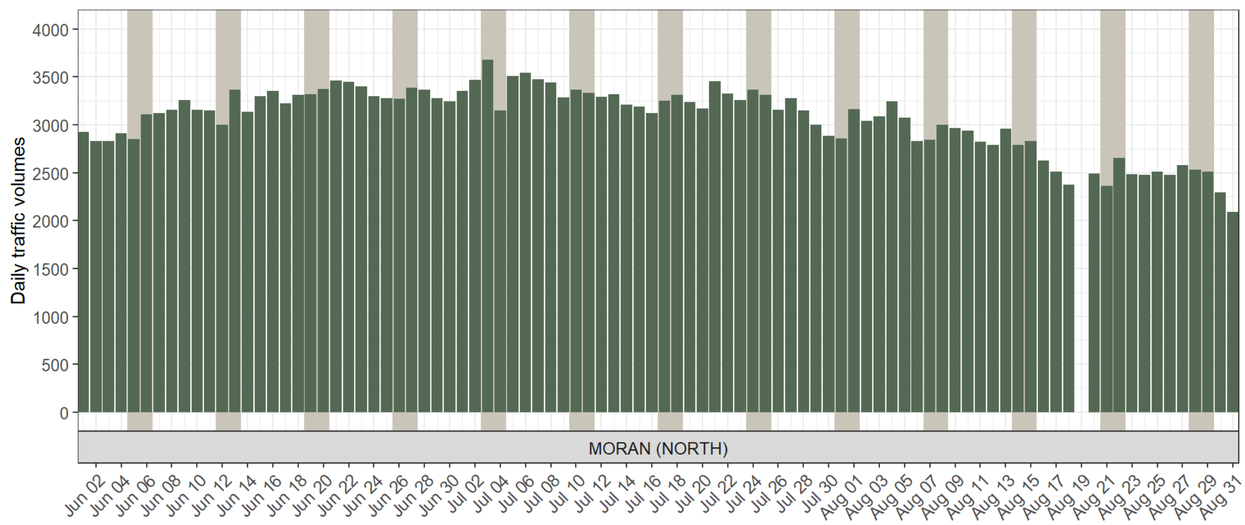

Figure 92. Daily subarea inbound traffic volumes: Moran (Northbound; gray shading indicates weekends/holidays).[30]

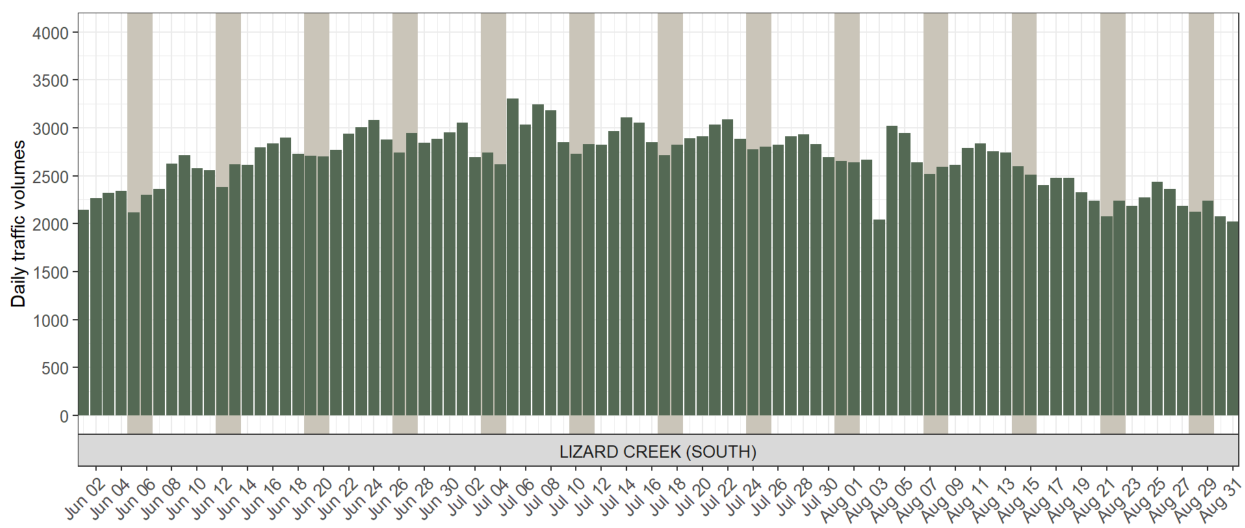

Figure 93. Daily subarea inbound traffic volumes: Lizard Creek (Southbound; gray shading indicates weekends/holidays).

[30] The raw Moran Entrance Station traffic count dataset sourced from WYDOT had missing counts for all hours of the day on August 19, 2021.

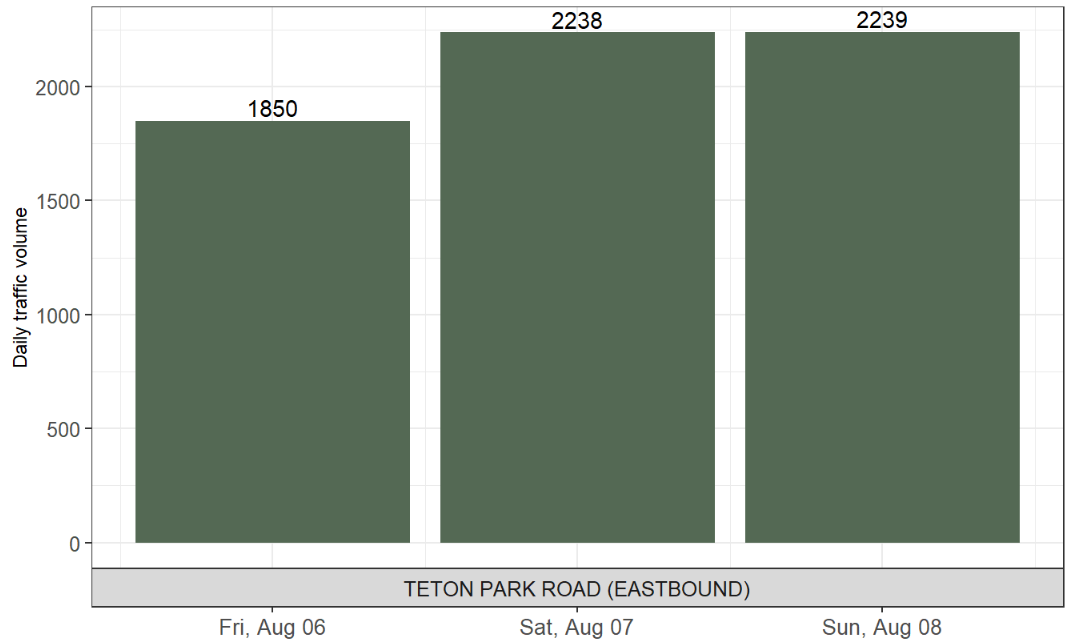

Figure 94. Daily subarea inbound traffic volumes: Teton Park Road (Eastbound). Daily subarea inbound traffic volumes.

Figure 95. Daily interior roadway traffic volumes: Colter Bay Village Road (Westbound).

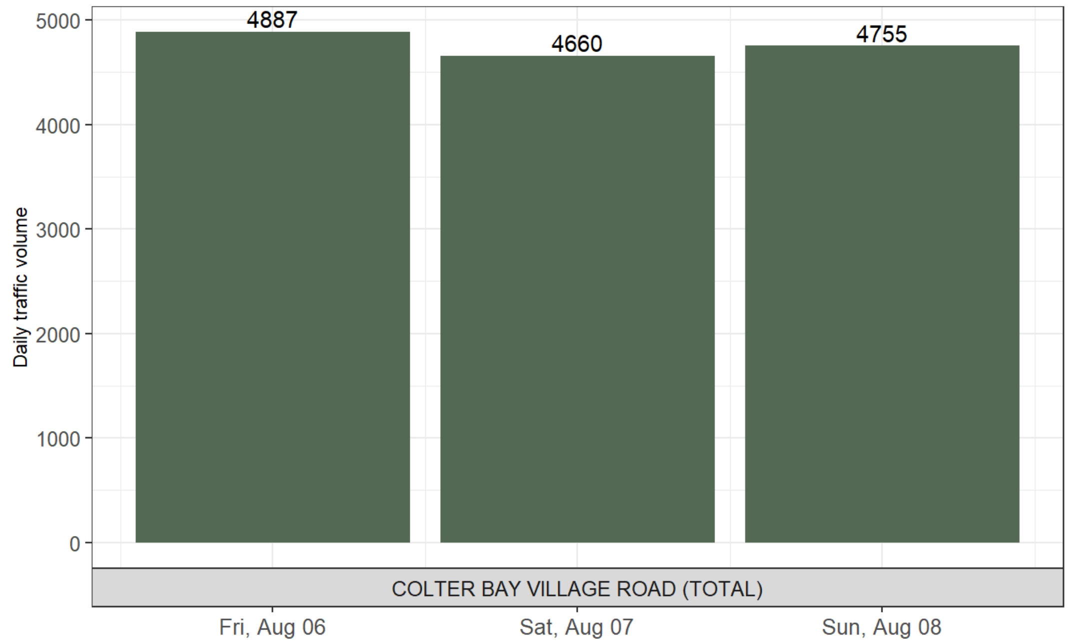

Figure 968. Daily interior roadway traffic volumes: Colter Bay Village Road (Total).

Figure 97 through **Figure 101** present mean hourly inbound and interior roadway traffic volumes for select traffic counter locations in the Moran to Leeks Marina subarea, by day of week category during the counting period.[31] These data suggest:

- Mean hourly subarea inbound traffic volumes at Moran (Northbound) increased fairly sharply starting at 5:00 a.m. and increased steadily through 8:00 a.m., then increased more gradually until reaching a peak of around 265 at 10:00 a.m. on weekdays, and a slightly higher peak of around 280 at 11:00 a.m. on weekend days and holidays. Mean hourly traffic volumes decreased slowly until 4:00 p.m. and then decreased steadily through the remainder of the day (**Figure 97**).

- Mean hourly subarea inbound traffic volumes at Moran (Northbound) were slightly higher during the morning (6:00–10:00 a.m.) on weekdays, while mean hourly traffic volumes were slightly higher during the afternoon (11:00 a.m.–4:00 p.m.) on weekend days and holidays. The differences in mean hourly volumes by day type ranged from approximately 10–50 per hour at most (**Figure 97**).

[31] Traffic volume data were collected at Colter Bay Village Road (Westbound and Total) and at Teton Park Road (Eastbound) during the 3-day sampling period and are presented as total hourly traffic volume per day instead of the average of the 3-day sampling period.

- Mean hourly subarea inbound traffic volumes at Lizard Creek (Southbound) increased fairly sharply starting at 5:00 a.m. and increased steadily to an initial peak of around 220 vehicles per hour at 11:00 a.m. on weekdays and weekend days and holidays. Mean hourly traffic volumes decreased slightly over the next hour, and then increased gradually to a peak of approximately 250 vehicles at 4:00 p.m. on weekdays, and a peak of around 220 vehicles per hour at 4:00 p.m. on weekend days and holidays. Mean hourly subarea inbound traffic volumes decreased steadily through the remainder of the day (**Figure 98**).

- Mean hourly subarea inbound traffic volumes at Lizard Creek (Southbound) were slightly higher on weekdays compared to weekend days and holidays from 1:00 p.m. through approximately 9:00 p.m. (**Figure 98**).

- In general, mean hourly subarea inbound traffic volumes peaked earlier in the day at Moran (Northbound) (**Figure 97**) and decreased through the remainder of the day, compared to mean hourly subarea inbound traffic volumes at Lizard Creek (Southbound) (**Figure 98**), which remained high through the middle of the day and peaked later in the afternoon.

- Hourly subarea inbound roadway traffic volumes at Teton Park Road (Eastbound) increased gradually from 6:00 a.m. to 12:00 p.m. and ranged from around 150 to just under 300 vehicles per hour from 1:00 p.m.–4:00 p.m. depending on the day. Hourly subarea inbound traffic volumes decreased steadily through the remainder of the day (**Figure 99**).

- At Colter Bay Village Road (Westbound), hourly interior roadway traffic volumes increased steadily from 6:00 a.m. to 10:00 a.m. and stabilized from approximately 11:00 a.m. through 4:00 p.m. at 175 to 225 vehicles per hour, depending on the day. Hourly interior roadway traffic volumes peaked at approximately 225 vehicles per hour from 4:00 p.m.–5:00 p.m., depending on the day, and then decreased steadily through the remainder of the day (**Figure 100**).

- Hourly interior roadway traffic volumes at Colter Bay Village (Total) overall increased steadily from 5:00 a.m. to 11:00 a.m. and stabilized at around 350 to 500 vehicles per hour from 11:00 a.m. through 5:00 p.m., depending on the day. Hourly interior roadway traffic volumes decreased steadily through the remainder of the day (**Figure 101**).

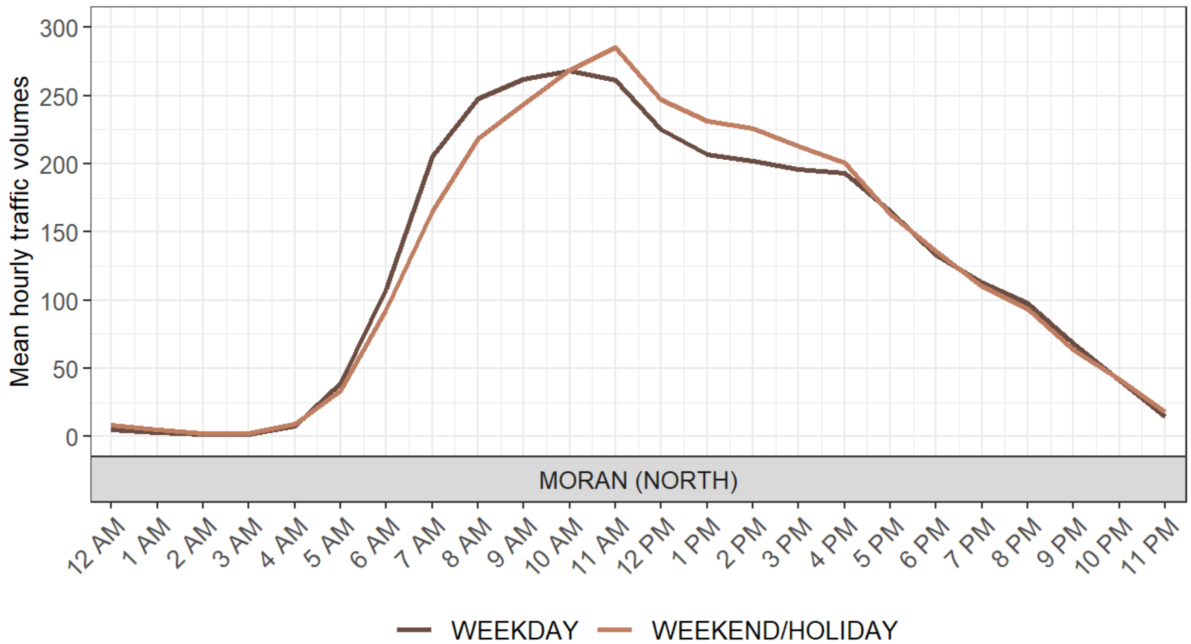

Figure 97. Mean hourly subarea inbound traffic volumes: Moran (Northbound).

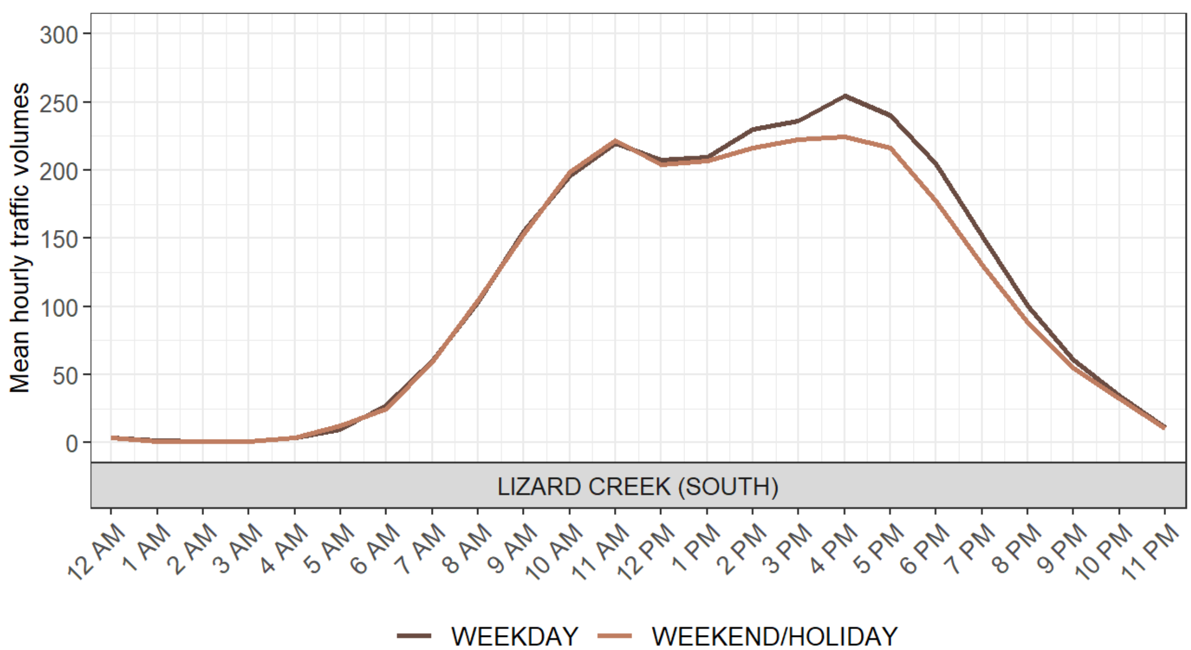

Figure 98. Mean hourly subarea inbound traffic volumes: Lizard Creek (Southbound).

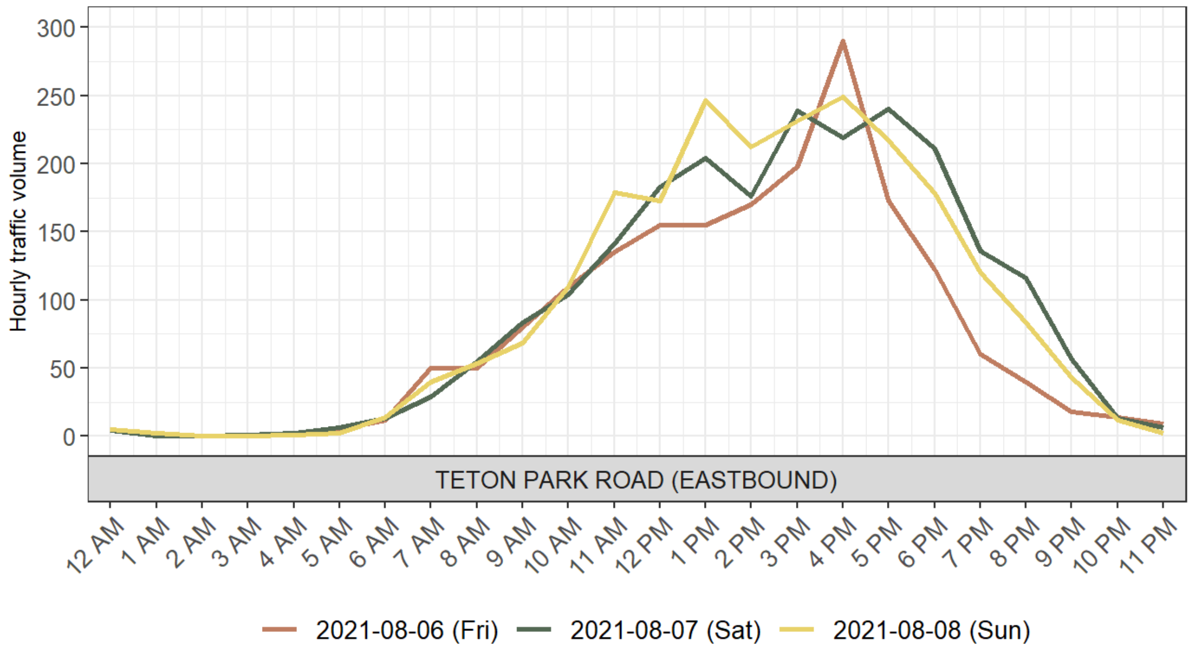

Figure 99. Hourly subarea inbound traffic volumes: Teton Park Road (Eastbound).

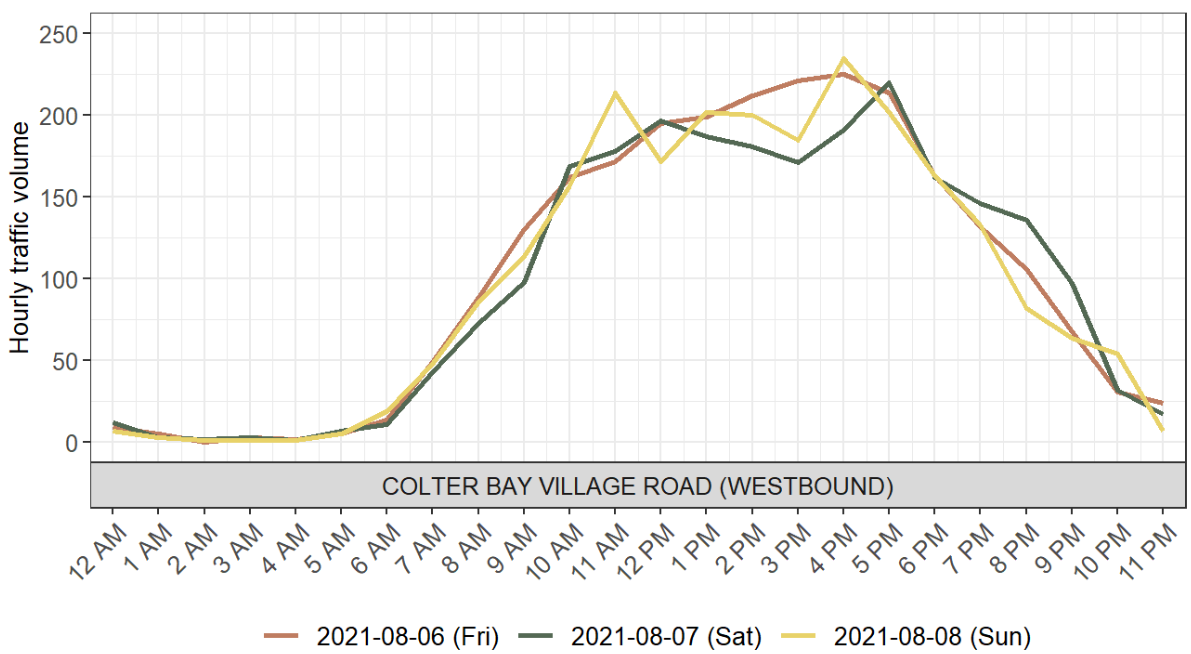

Figure 100. Hourly interior roadway traffic volumes: Colter Bay Village Road (Westbound).

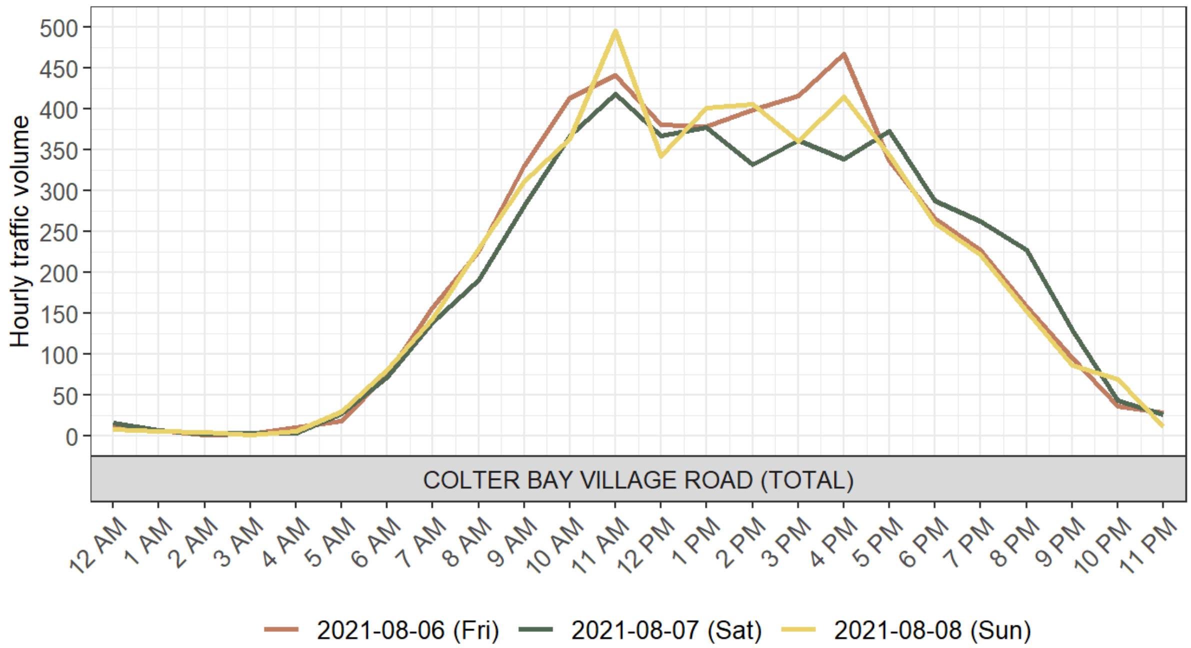

Figure 101. Hourly interior roadway traffic volumes: Colter Bay Village Road (Total).

Hard Braking and Hard Acceleration Events

An evaluation of hard braking and hard acceleration events was conducted based on May–September Wejo data. On a subarea basis, the hard braking and hard acceleration events are concentrated at the following locations:

- Hard braking: Highway 89/191 at Jackson Lake Overlook, Highway 89/191 north of Moran Junction
- Hard acceleration: Highway 89/191 at Jackson Lake Overlook, Highway 89/191 north of Moran Junction

Parking Conditions

See the GRTE TVM Report Appendix 7 for parking conditions details for Jackson Lake Lodge, Leeks Marina, and Pacific Creek Landing.[32]

Trail Use Conditions

Table 57 reports the calibration regression model specifications for trail counter data from select locations in the Moran to Leeks Marina subarea. In all cases, coefficients from regression models with no intercept were used to calibrate the trail counter data for each location. The GRTE TVM

[32] Descriptive results for the Colter Bay parking area are not presented in this report or the appendix because these data were collected and analyzed as part of the Colter Visitor Use and Experience Study.

Report Appendix 7 contains trail counter calibration scatterplots with intercept and no intercept linear regression models plotted.

Table 57. Calibration regression model with no intercept results for select trail counter locations in the Moran to Leeks Marina subarea.

Location	Coefficient Estimate	P-value
Heron Pond	1.340*	0.001
Lakeshore Loop	1.652*	< 0.001

Asterisks (*) denote significance at $p < 0.05$.

Figure 102 and **Figure 103** present total daily trail volumes (arrivals and departures) for select trail counter locations in the Moran to Leeks Marina subarea, by date. These data suggest:

- Daily trail volumes at Heron Pond varied from around 300 to around 450 per day. Daily trail volumes decreased toward the end of July and were higher in early August, with just a few days approaching or exceeding 500 per day. Daily trail volumes at Heron Pond tended to be slightly higher on some weekend days and holidays compared to weekdays, but the differences were not pronounced (**Figure 102**).
- Daily trail volumes at Lakeshore Loop typically ranged from around 400 to 500 per day. On a few days, daily trail volumes exceeded 600 per day. No discernable differences exist in daily trail volumes at Lakeshore Loop on weekdays compared to weekend days and holidays (**Figure 103**).

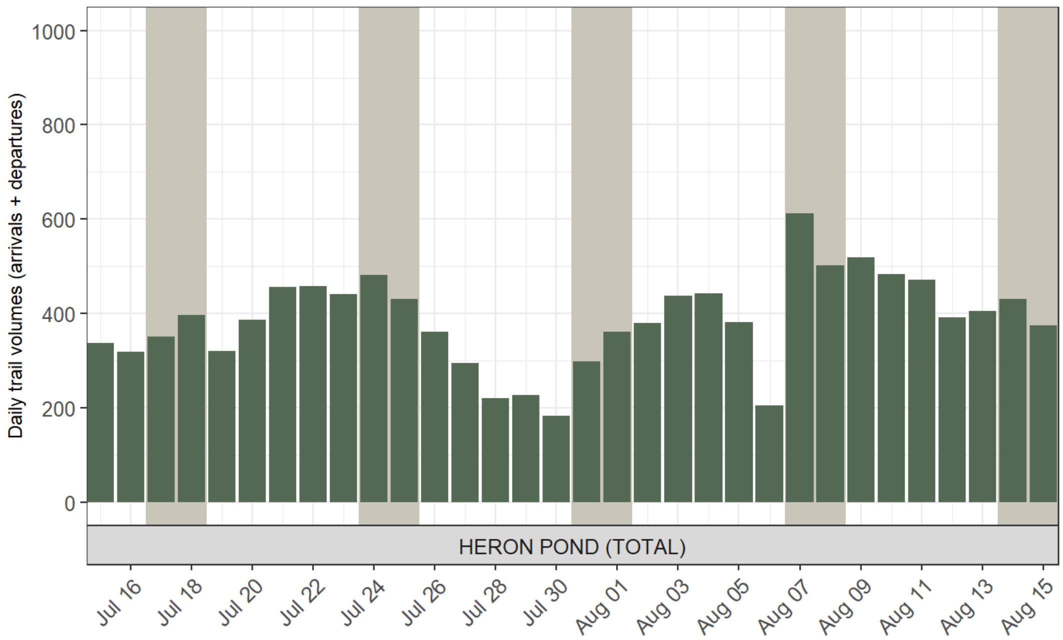

Figure 102. Daily trail volumes: Heron Pond (gray shading indicates weekends/holidays).

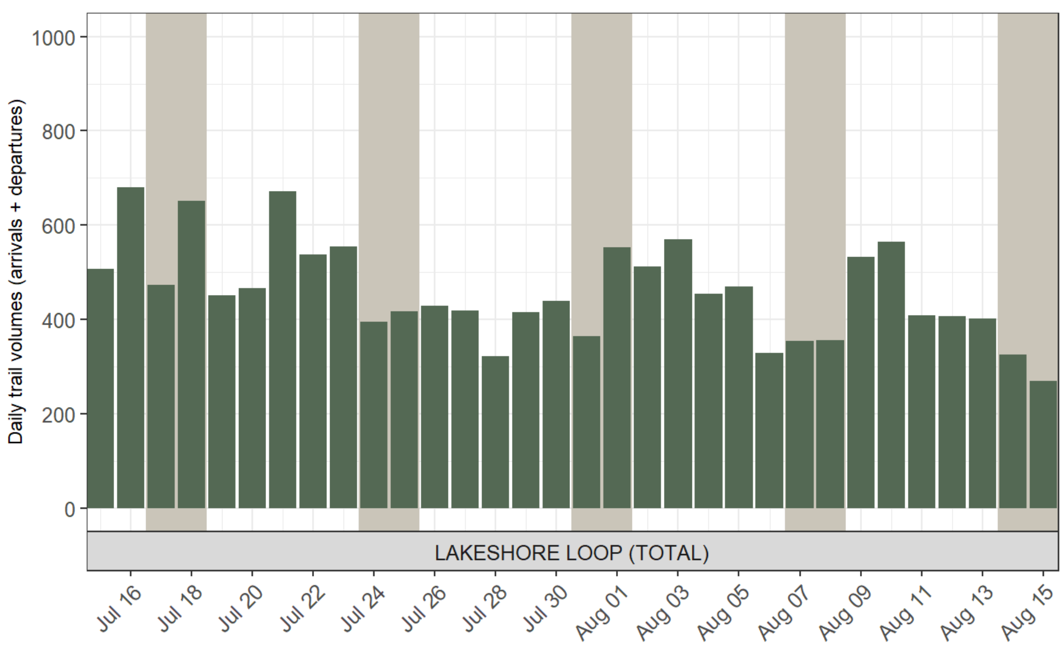

Figure 103. Daily trail volumes: Lakeshore Loop (gray shading indicates weekends/holidays).

Figure 104 and **Figure 105** present mean hourly trail volumes (arrivals and departures) for select trail counter locations in the Moran to Leeks Marina subarea, by day of week category. These data suggest:

- Mean hourly trail volumes at Heron Pond increased starting at 7:00 a.m. and reached an initial peak of around 60 at 10:00 a.m. on weekends and holidays, and an initial peak of approximately 45 at 11:00 a.m. on weekdays. Mean hourly trail volumes decreased through 12:00 p.m. and then increased sharply to a peak at 2:00 p.m. of around 75 on weekdays and a peak of around 90 on weekend days and holidays. Mean hourly trail volumes decreased sharply from 2:00 p.m. through 4:00 p.m. and then decreased more gradually through the remainder of the day. Mean hourly trail volumes were slightly higher during peak hours on weekend days and holidays compared to weekdays (**Figure 104**).

- Mean hourly trail volumes at Lakeshore Loop increased sharply starting at 7:00 a.m. and reached a peak at 11:00 a.m. of approximately 60 on weekends and holidays and 75 on weekdays. Mean hourly trail volumes decreased steadily after 11:00 a.m. and through the remainder of the day. Mean hourly trail volumes were slightly higher on weekdays from 9:00 a.m. through 3:00 p.m., but only by 15 at most (**Figure 105**).

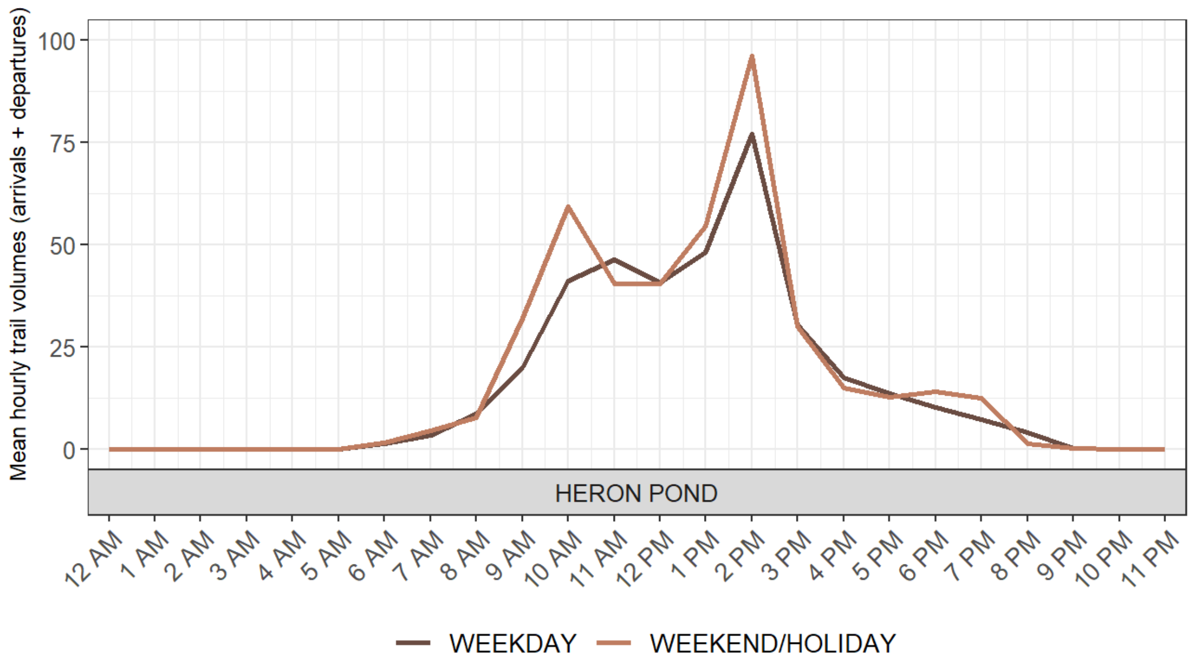

Figure 104. Mean hourly trail volumes: Heron Pond.

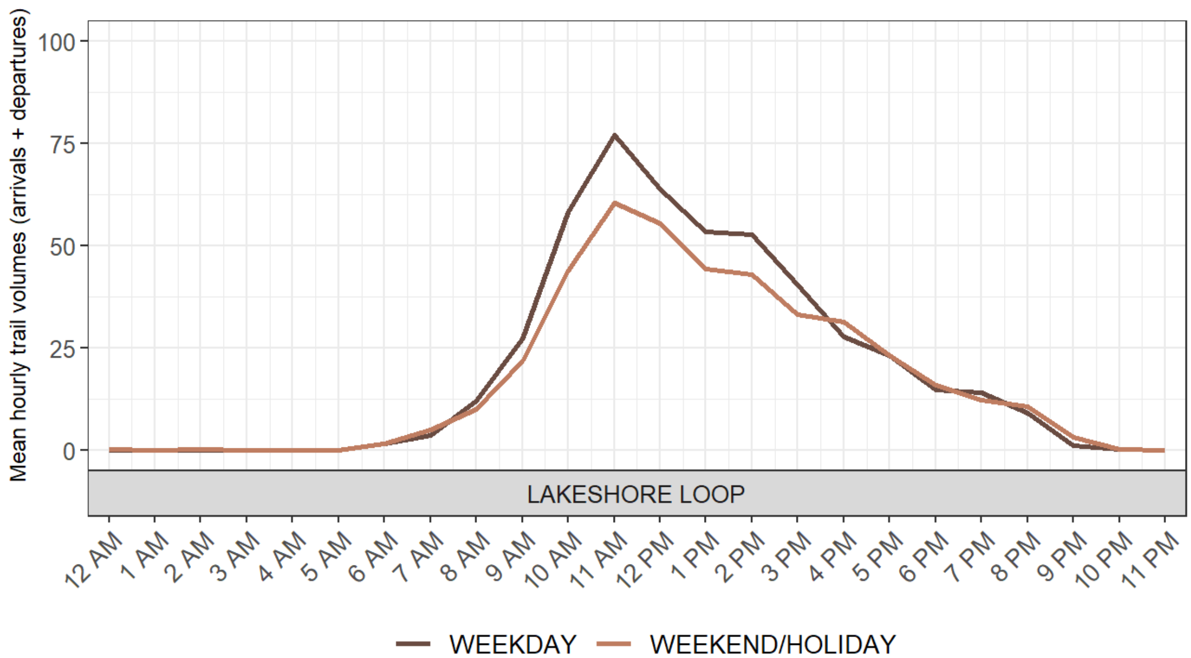

Figure 105. Mean hourly trail volumes: Lakeshore Loop.

Exploratory Analysis

This subsection presents results of final regression models that estimate relationships between inbound traffic volumes, and key indicator variables regarding traffic, parking, and trail use in the Moran to Leeks Marina subarea. Three groupings of input traffic volumes, (1) entrance station inbound traffic volumes, (2) subarea inbound traffic volumes, and (3) interior roadway traffic volumes, were measured against the subarea's key indicator variables. The following subsections present tabular results of final regression models for each of the three input traffic volume groupings. Narrative results are also provided for each regression model estimated for the Excel-based tool that had a significant relationship. The GRTE TVM Report Appendix 7 contains scatterplots of regression inputs and indicators with final fitted models.

<u>Regression Model Input: Entrance Station Inbound Traffic Volumes</u>

Table 58 presents results for models estimated for the Excel-based tool, and **Table 59** presents results of exploratory regression models that estimate relationships between parkwide perimeter inbound traffic volumes, and key indicator variables regarding traffic, parking, and trail use in the Moran to Leeks Marina subarea are presented below. In consultation with park staff, inputs of entrance station inbound traffic volumes were defined as the sum of park inbound traffic volumes from the Moose Entrance Station (Northbound), Moran Entrance Station (Northbound), and South Gate of Yellowstone (Southbound). Results from each of the final hourly regression models estimated for the Excel-based tool with a significant relationship (**Table 59**) suggest:

On average, for every 100 entrance station inbound vehicles per hour[33]:

- There are approximately 54 vehicles traveling on both lanes of the Colter Bay Village Road that same hour.
- There are approximately eight additional visitor arrivals and departures on the Heron Pond trail the following hour, or a 36% increase in the total trail volume based on an average of 24 per hour.
- There are approximately 11 additional visitor arrivals and departures on the Lakeshore Loop trail that same hour, or a 47% increase in the total trail volume based on an average of 24 per hour.

Table 58. Hourly regression model specifications: Moran to Leeks Marina subarea, with entrance station inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Colter Bay Village Road traffic volumes	Linear	No lag	9.2	0.54*	0.663	< 0.001	0.79	60
Colter Bay parking occupancy rate[34]	Linear	No lag	372.3*	0.11	< 0.001	0.433	0.01	66
Heron Pond trail volumes	Poisson	1-hour lag	1.06433624974*	0.003599805142*	< 0.001	< 0.001	NA	568
Lakeshore Loop trail volumes	Poisson	No lag	0.40922947135*	0.004649405558*	< 0.001	< 0.001	NA	567

Regression model input: Entrance station inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N), Moran Entrance Station (N), and South Gate of Yellowstone (S). R-squared is a goodness of fit statistic that only applies in the case of linear models and therefore does not apply to the Poisson models reported in the table. Goodness of fit is evaluated for a Poisson model only based on comparison with another model. Asterisks (*) denote significance at $p < 0.05$.

[33] The strength of the statistical relationship varies among the regression models and the bulleted summary statements should be interpreted as general rather than exact.

[34] Based on visual inspection, there is no correlation ($R^2 = 0.01$) between the dependent and independent variable. Therefore, the basic OLS linear regression results are present, but the final, non-significant model was not included in the Excel-based tool.

Table 59. Daily regression model specifications: Moran to Leeks Marina subarea, with entrance station inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Colter Bay Village Road traffic volumes	Linear	No lag	4079.9*	0.07	0.053	0.83	0.03	4
Colter Bay maximum parking occupancy rate	Linear	No lag	456.7	0.01	0.282	0.80	0.01	10
Heron Pond	Linear	No lag	-280*	0.08*	< 0.001	< 0.001	0.27	91
Lakeshore Loop	Linear	No lag	-1018.9*	0.19*	< 0.001	< 0.001	0.37	91

Regression model input: Entrance station inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N), Moran Entrance Station (N), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Regression Model Input: Subarea Inbound Traffic Volumes

Table 60 and **Table 61** present results of final hourly and daily exploratory regression models that estimate relationships between inbound traffic volumes around the perimeter of the Moran to Leeks Marina subarea, and key indicator variables regarding traffic, parking, and trail use in the subarea are presented below. The subarea inbound traffic volume for the perimeter of the Moran to Leeks Marina subarea is computed as the sum of traffic counts from the Moran Entrance Station (Northbound), Lizard Creek (Southbound), and Teton Park Road (Eastbound).

Table 60. Hourly regression model specifications: Moran to Leeks Marina subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Colter Bay Village Road traffic volumes	Linear	No lag	19.6	0.59*	0.131	< 0.001	0.91	60
Heron Pond trail volumes	Linear	1-hour lag	-28.9*	0.12*	0.003	< 0.001	0.42	59
Lakeshore Loop trail volumes	Linear	No lag	-15.6*	0.08*	< 0.001	< 0.001	0.48	60

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Moran Entrance Station (N), Lizard Creek (S), and Teton Park Road (E). Asterisks (*) denote significance at $p < 0.05$.

Table 61. Daily regression model specifications: Moran to Leeks Marina subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Colter Bay Village Road traffic volumes	Linear	No lag	1809.4	0.38	0.522	0.352	0.42	4
Heron Pond trail volumes	Linear	No lag	-131.2	0.08	0.959	0.829	0.03	4
Lakeshore Loop trail volumes	Linear	No lag	-715.8	0.15	0.829	0.07	0.86	4

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Moran Entrance Station (N), Lizard Creek (S), and Teton Park Road (E). Asterisks (*) denote significance at $p < 0.05$.

Regression Model Input: Interior Roadway Traffic Volumes

Table 62 and **Table 63** present results of final hourly and daily exploratory regression models that estimate relationships between interior roadway traffic volumes in the Moran to Leeks Marina subarea and key indicator variables regarding parking and trail use in the subarea are presented below. The interior roadway traffic volume input is the Colter Bay Village Road (Westbound).

Table 62. Hourly regression model specifications: Moran to Leeks Marina subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Colter Bay Village Road (W) traffic volumes	Heron Pond trail volumes	Linear	1-hour lag	-14.6	0.28*	0.117	< 0.001	0.31	59
Colter Bay Village Road (W) traffic volumes	Lakeshore Loop trail volumes	Linear	No lag	-9.7*	0.23*	< 0.001	< 0.001	0.46	60

Asterisks (*) denote significance at $p < 0.05$.

Table 63. Daily regression model specifications: Moran to Leeks Marina subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Colter Bay Village Road (W) traffic volumes	Heron Pond trail volumes	Linear	No lag	2132.6	0.75	0.378	0.463	0.29	4
Colter Bay Village Road (W) traffic volumes	Lakeshore Loop trail volumes	Linear	No lag	-592.1	0.43	0.463	0.158	0.71	4

Asterisks (*) denote significance at $p < 0.05$.

Conclusion

This subsection offers concluding insights based on traffic and parking conditions for the Moran to Leeks Marina subarea, as well as the results of the exploratory analysis:

- Daily traffic volumes inbound into the Moran to Leeks Marina subarea from Moran tend to be fairly consistent across days of the week and generally range between 2,750 and 3,250 vehicles per day. Daily traffic volumes from Lizard Creek into the Moran to Leeks Marina subarea are generally of a similar magnitude to those from Moran, typically ranging between about 2,500 and 3,000. Inbound traffic volumes at Lizard Creek tend to be moderately higher on weekdays than on weekend days and holidays. Overall, traffic volumes into the Moran to Leeks Marina subarea from Moran and Lizard Creek are generally somewhat lower during early June and late August than during the late June through early August period. The three-day daily counts of vehicle traffic on the Teton Park Road into the Moran to Leeks Marina subarea suggest that daily vehicle traffic there may be slightly lower on Friday than on Saturday and Sunday, but further traffic monitoring may be warranted to assess and establish patterns.

- Hourly traffic volumes into the Moran to Leeks Marina subarea from Moran display a "typical" recreation use pattern, with inbound traffic from this location increasing fairly rapidly in the morning hours, reaching a peak by late morning/early afternoon, and then declining through the mid-afternoon and evening hours. The inbound traffic from Moran starts to occur fairly early in the morning, with noticeable activity occurring by 6:00 a.m. Inbound traffic from Moran decreases beginning in early afternoon, but only begins to decrease at a more rapid pace after about 5:00 p.m. Hourly traffic volumes into the Moran to Leeks Marina subarea from Lizard Creek have a different pattern than those from Moran. Inbound traffic from Lizard Creek starts a bit later in the morning than at Moran, with noticeable activity occurring by about 7:00 or 8:00 a.m. and remaining steady at or near its peak from about 11:00 a.m. through about 5:00 p.m. Inbound traffic from Lizard Creek decreases fairly sharply after about 6:00 p.m. The three-day hourly traffic volumes at Teton Park Road suggest traffic into the Moran to Leeks Marina subarea from there ramps up slowly and steadily through the morning and early afternoon hours and reaches its peak late in the afternoon or early evening. Inbound traffic at Teton Park Road declines fairly sharply after 6:00 p.m.

- The three-day daily counts of vehicle traffic on the Colter Bay Village Road suggest that daily vehicle traffic there is generally consistent Friday through Sunday and tends to range right around 2,250 inbound (Westbound) vehicles per day. Additional monitoring of vehicle traffic volumes may be warranted at both of these locations to further assess and establish daily traffic patterns.

- The three-day hourly traffic volumes on Colter Bay Village Road suggest inbound traffic there increases rapidly from about 6:00 or 7:00 a.m. through the morning hours, remains steady at or near its peak from about 11:00 a.m. through about 5:00 or 6:00 p.m., and then declines fairly sharply in the evening hours.

- Daily patterns of trail use at Heron Pond and Lakeshore Loop vary from week to week through July and August. At both trail locations, there appear to be higher levels of trail use on weekend days than weekdays for some weeks, while the reverse is true other weeks of the summer. Daily trail use tends to be higher at Heron Pond in early August than in July, while daily trail use tends to be higher in mid-July than in late July and August at Lakeshore Loop.

- Hourly trail use at Heron Pond displays a morning wave of activity, starting around 7:00 a.m. and peaking at about 10:00 a.m., and a second wave of higher use starting around 1:00 p.m. and peaking between 2:00 and 3:00 p.m. Hourly trail use at Lakeshore Loop display a "typical" recreation use pattern, with trail use increasing fairly sharply in the morning hours, reaching its peak by late morning/early afternoon, and then declining in the afternoon and evening hours.

- There are statistically significant relationships between the hourly and daily volumes of vehicles entering GRTE from the park's entrance stations and the amount of trail use in the Moran to Leeks Marina subarea. There are also statistically significant relationships between the hourly volumes of vehicles entering the Moran to Leeks Marina subarea and the amount of vehicle traffic and trail use at the "indicator locations" in the subarea.

John D. Rockefeller Memorial Parkway Subarea

This section of the report presents descriptive results for select subarea inbound traffic volumes and indicators of traffic and parking conditions, as well as the results from exploratory analyses of relationships between transportation inputs and traffic and parking conditions in the JODR subarea of GRTE. Key conclusions are presented at the end of this section. The locations of the select subarea inbound traffic volumes and indicators of traffic and parking conditions for the JODR subarea are depicted in **Figure 106** and include:

- South Gate of Yellowstone (Southbound) traffic volume
- Lizard Creek (Northbound) traffic volume
- Flagg Ranch (Northbound) traffic volume
- Flagg Ranch (Total) traffic volume
- Flagg Ranch parking occupancy rates

See Appendix 8 for additional descriptive results for this subarea.

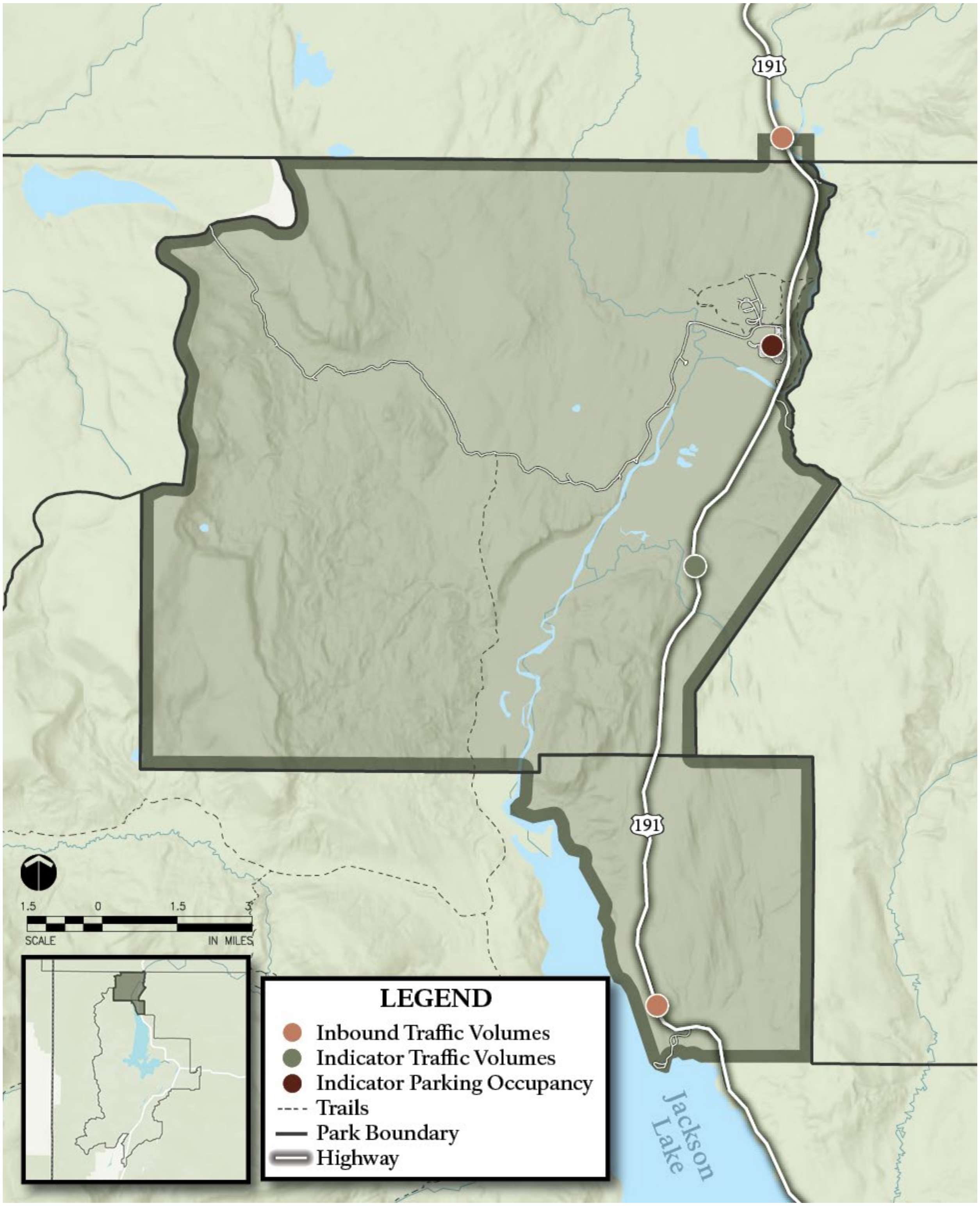

Figure 106. Input and indicator traffic and parking locations – JODR subarea.

Traffic Conditions

Figure 107 through **Figure 110** present total daily subarea inbound traffic volumes and interior roadway traffic volumes for select traffic counter locations in the JODR subarea, by date during the counting period.[35] These data suggest:

- Daily subarea inbound traffic volumes at South Gate of Yellowstone (Southbound) typically ranged from around 2,500 to 2,750 per day. Daily inbound traffic volumes were typically higher on weekdays compared to weekend days and holidays, with daily traffic volumes approaching or exceeding 3,000 per day on several weekdays in July (**Figure 107**).

- Daily subarea inbound traffic volumes at Lizard Creek (Northbound) typically ranged from approximately 2,250 to just over 2,500 per day. On a few days, daily traffic volumes approached or exceeded 3,000. Daily inbound traffic volumes tended to be higher on weekdays compared to weekend days and holidays, and were lower overall in August compared to June and July (**Figure 108**).

- Daily interior roadway traffic volumes at Flagg Ranch (Northbound) varied slightly during the sampling period and ranged from just over approximately 2,250 to just under 2,500 vehicles per day (**Figure 109**).

- Daily interior roadway traffic volumes at Flagg Ranch (Total) overall were consistent around 4,500 per day during the sampling period (**Figure 110**).

[35] Traffic volume data were collected at Flagg Ranch (Northbound and Total) during the 3-day sampling period and are presented as total daily traffic volumes during the sampling period.

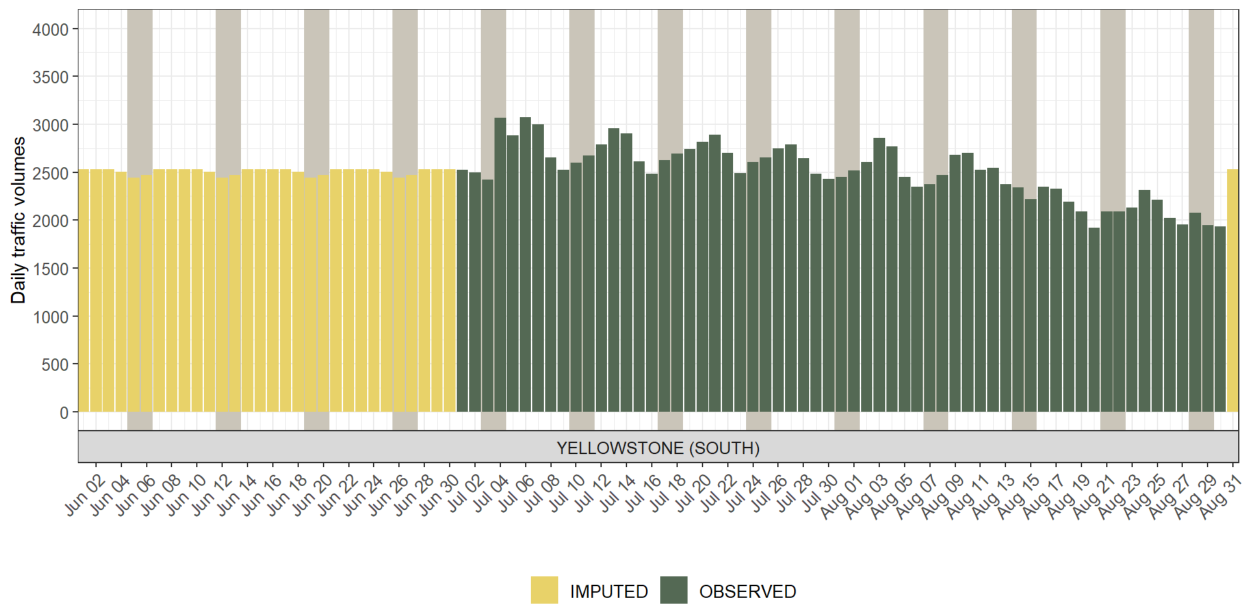

Figure 107. Daily subarea inbound traffic volumes: South Gate of Yellowstone (Southbound; gray shading indicates weekends/holidays).

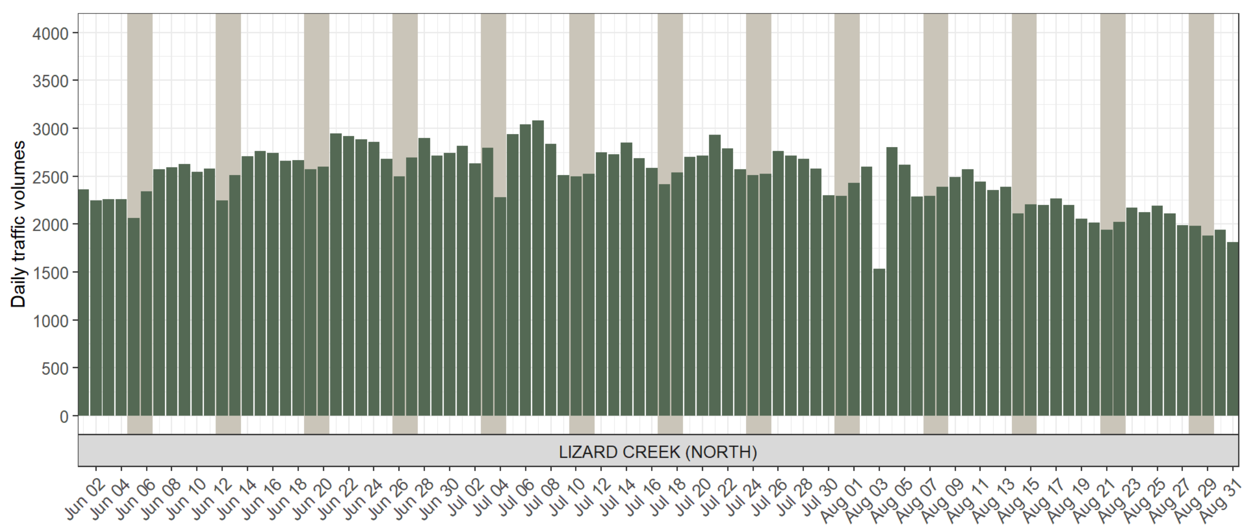

Figure 108. Daily subarea inbound traffic volumes: Lizard Creek (Northbound; gray shading indicates weekends/holidays).

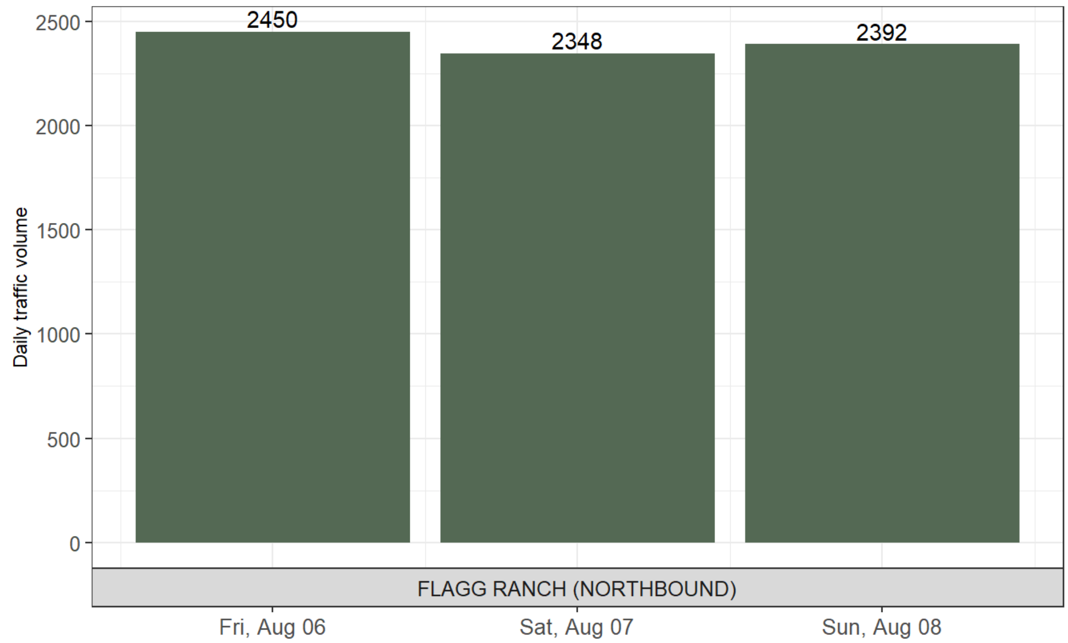

Figure 109. Daily interior roadway traffic volumes: Flagg Ranch (Northbound).

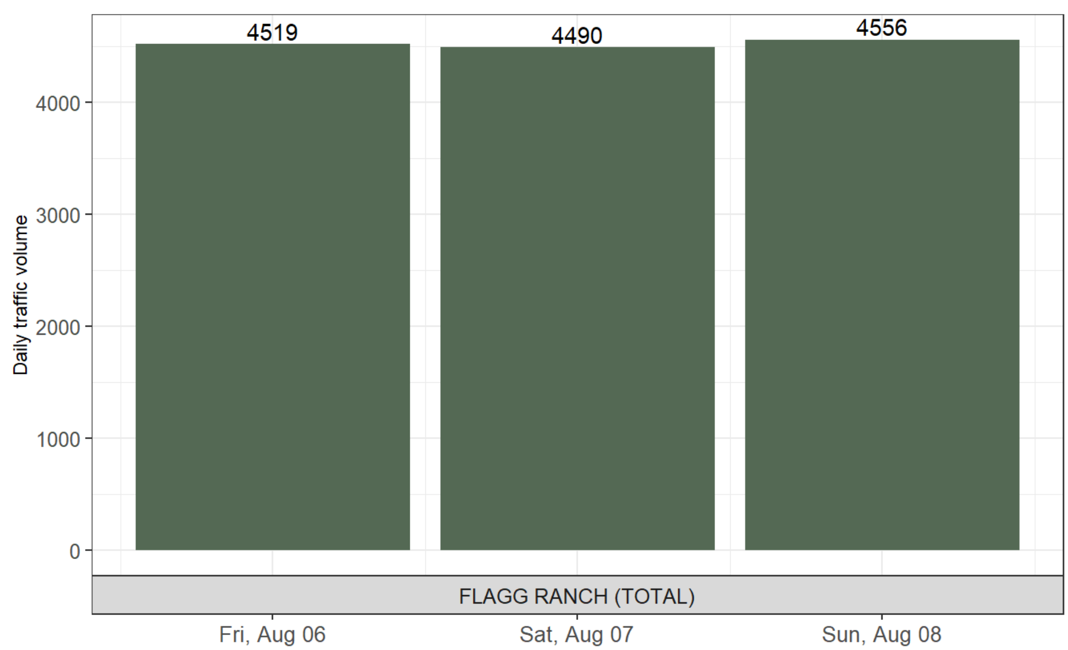

Figure 110. Daily interior roadway traffic volumes: Flagg Ranch (Total).

Figure 111 through **Figure 114** present mean hourly inbound and interior roadway traffic volumes for select traffic counter locations in the JODR subarea, by day of week category during the counting period.[36] These data suggest:

- Mean hourly subarea inbound traffic volumes at the South Gate of Yellowstone (Southbound) increased fairly sharply starting at 6:00 a.m. and increased steadily to an initial peak of around 200 vehicles per hour at 11:00 a.m. on both weekdays and weekend days and holidays. Mean hourly traffic volumes stabilized over the next few hours, and then increased gradually to a peak of approximately 250 vehicles at 4:00 p.m. on both weekdays and weekend days and holidays. Mean hourly traffic volumes decreased sharply through the remainder of the day (**Figure 111**).

- No discernable differences exist in hourly subarea inbound traffic volumes on weekdays compared to weekend days and holidays at the South Gate of Yellowstone (Southbound).

- Mean hourly subarea inbound traffic volumes at Lizard Creek (Northbound) increased fairly sharply starting at 5:00 a.m. and increased steadily through 8:00 a.m., before increasing more gradually to a peak of around 250 vehicles at 10:00 a.m. on weekdays, and a peak of around 215 vehicles at 11:00 a.m. on weekend days and holidays. Mean hourly traffic volumes decreased gradually until 5:00 p.m. and then decreased steadily through the remainder of the day (**Figure 112**).

- Mean hourly subarea inbound traffic volumes at Lizard Creek (Northbound) were higher on weekdays compared to weekend days and holidays from 7:00 a.m. through approximately 11:00 a.m. by approximately 25–50 vehicles per hour.

- At Flagg Ranch (Northbound), hourly interior roadway traffic volumes increased steadily from 6:00 a.m. to 11:00 a.m. and fluctuated between 150 to just over 250 per hour from 11:00 a.m. to 5:00 p.m., depending on the day. Hourly interior roadway traffic volumes decreased steadily starting at 5:00 p.m. and continued to decrease through the remainder of the day (**Figure 113**).

- Hourly interior roadway traffic volumes at Flagg Ranch (Total) overall increased steadily from 6:00 a.m. to 11:00 a.m. to a peak of 400 to 450 vehicles per hour depending on the day. Hourly interior roadway traffic volumes decreased slightly at 12:00 p.m. before fluctuating between 325 and 425 vehicles per hour from 1:00 p.m. to 5:00 p.m. Hourly interior roadway traffic volumes decreased steadily starting at 5:00 p.m. and continued to decrease through the remainder of the day (**Figure 114**).

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[36] Traffic volume data were collected at Flagg Ranch (Northbound and Total) during the 3-day sampling period and are presented as total hourly traffic volume per day instead of the average of the 3-day sampling period by day of week category.

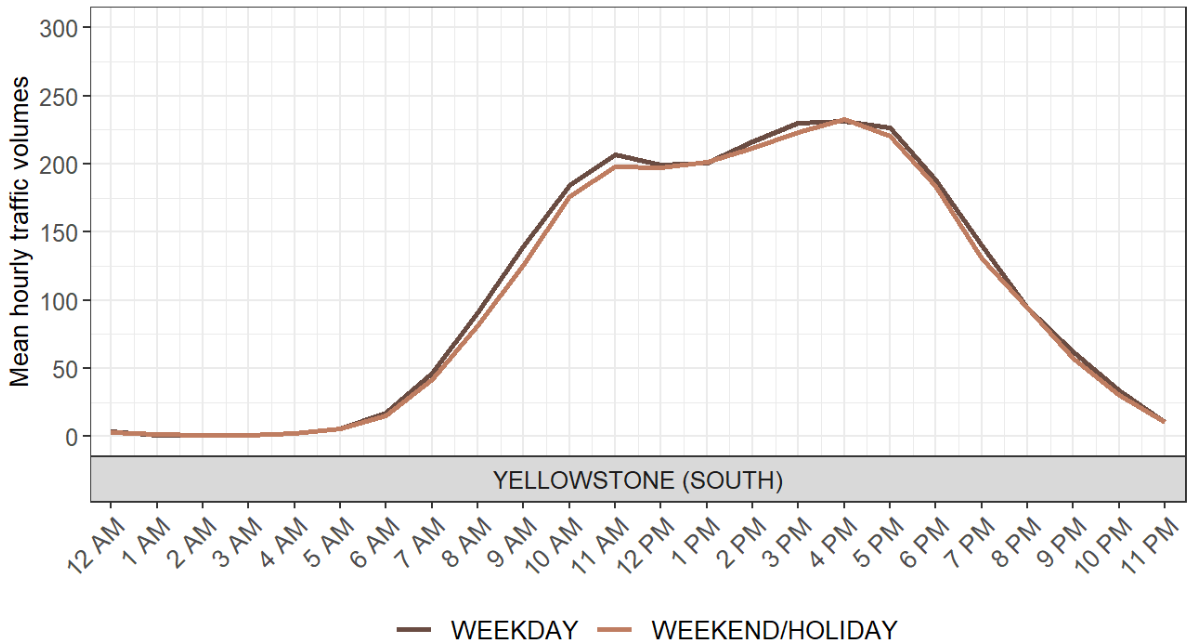

Figure 111. Mean hourly subarea inbound traffic volumes: South Gate of Yellowstone (Southbound).

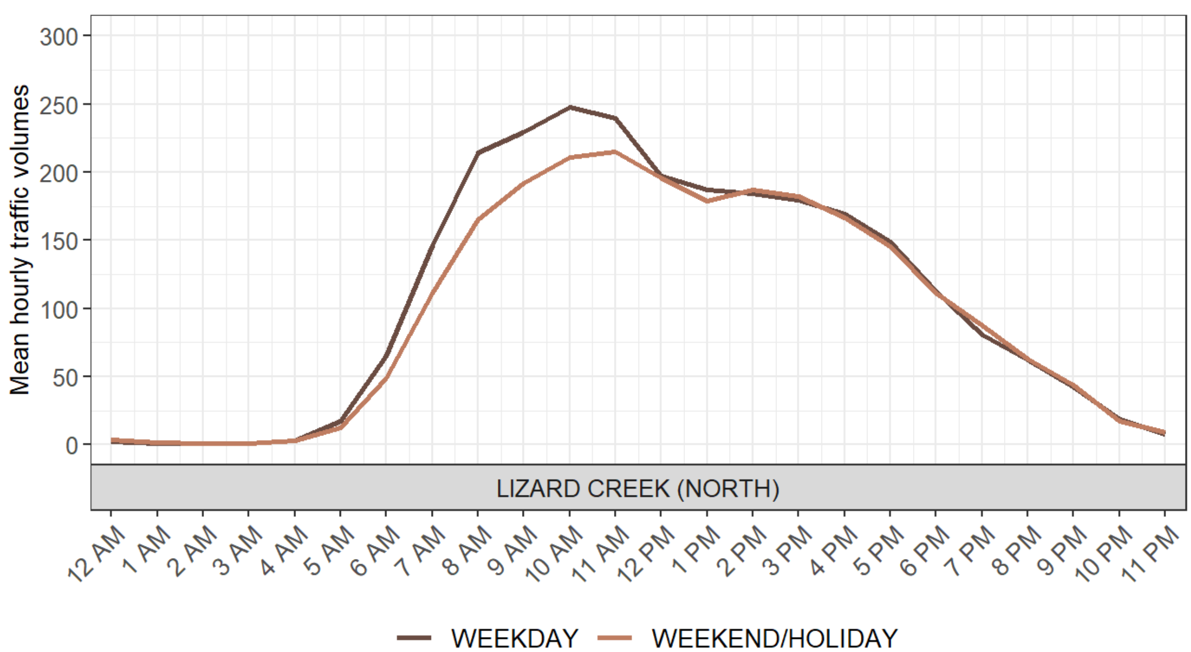

Figure 112. Mean hourly subarea inbound traffic volumes: Lizard Creek (Northbound).

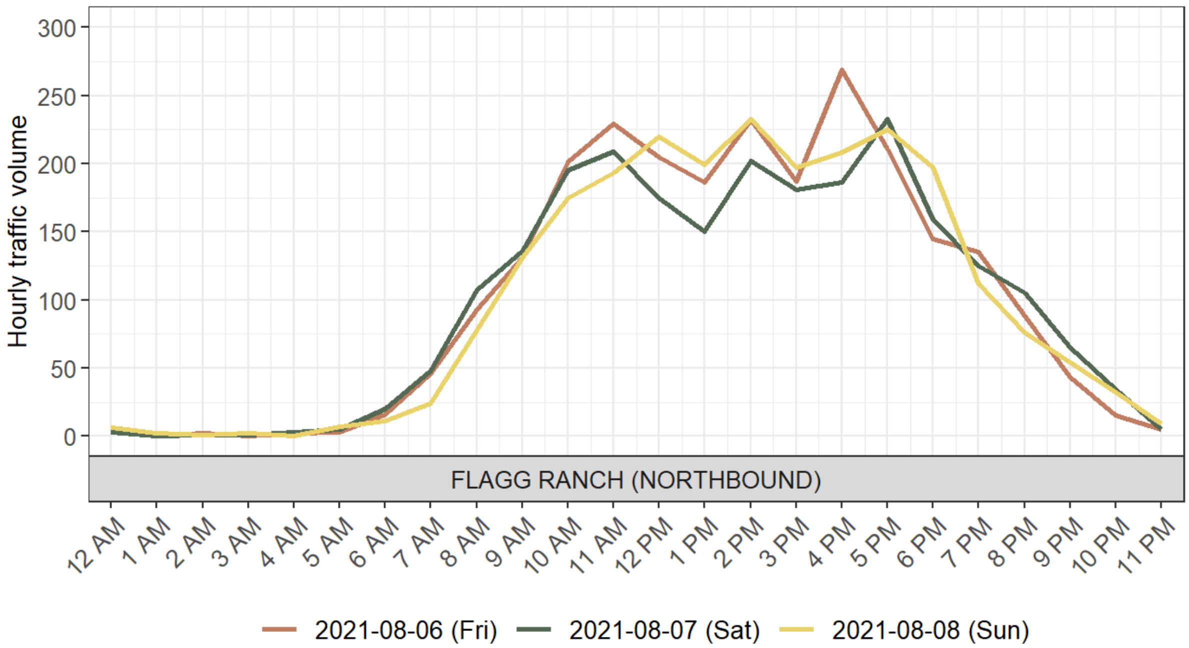

Figure 113. Hourly interior roadway traffic volumes: Flagg Ranch (Northbound).

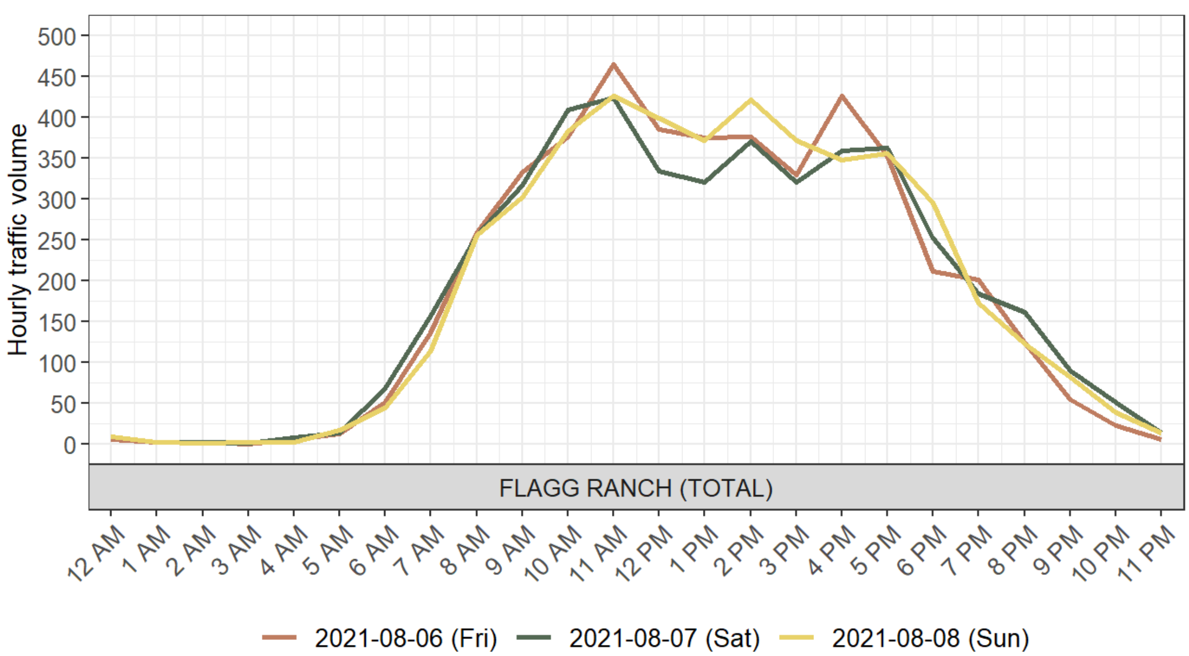

Figure 114. Hourly interior roadway traffic volumes: Flagg Ranch (Total).

Hard Braking and Hard Acceleration Events

An evaluation of hard braking and hard acceleration events was conducted based on May–September Wejo data. On a subarea basis, the hard braking and hard acceleration events are concentrated at the following locations:

- Hard braking: Highway 89/191 immediately south of JODR/GRTE boundary, Highway 89/191 north of Flagg Ranch junction
- Hard acceleration: Highway 89/191 immediately south of JODR/GRTE boundary, Highway 89/191 south of Flagg Ranch junction

Parking Conditions

Table 64 through **Table 67** report the minimum and maximum hourly number of vehicles parked, the hourly parking occupancy rates, the peak parking hours (10:00 a.m.–4:00 p.m.) parking turnover rate, and the inferred vehicle arrival distribution by date for the Flagg Ranch parking area in the JODR subarea. **Table 65** also reports the parking lot capacity (i.e., total number of identified parking spaces) for the parking area at Flagg Ranch.

Flagg Ranch data suggest:

- This location sees modest accumulation on all days (**Table 64**).
- Parking occupancy rate trends show that vehicles arrive early, with parking occupancy rates persisting at modest levels throughout the day (**Table 62**).
- Parking turnover is defined as the estimated number of vehicles that use each parking stall throughout the peak parking hours (10:00 a.m.–4:00 p.m.). The average turnover rate during the peak parking hours is 0.16. This means that, on average, Flagg Ranch observes 0.16 vehicle per hour per stall (**Table 63**).
- Wejo-inferred arrival pattern suggests that just under the majority (44%) of vehicle trips arrive at Flagg Ranch between 9:00 a.m. and 3:00 p.m. The lack of a major timeframe when most vehicle trips arrive corresponds to the spread-out number of vehicles throughout the day (**Table 64**).
- The median dwell time in the Flagg Ranch parking lots was eight minutes, based on Wejo-inferred data (sample size = 5,376), while the 15th percentile dwell time was 3 minutes, and the 85th percentile dwell time was 30 minutes.

Table 7. Minimum and maximum hourly number of vehicles parked by date – Flagg Ranch.

Location	Friday Low	High	Saturday Low	High	Sunday Low	High	Capacity
Flagg Ranch	21	58	15	59	22	51	252

Table 8. Hourly parking occupancy rates by date – Flagg Ranch.

Time	Friday	Saturday	Sunday	3-Day Average
06:00 AM	10%	8%	9%	9%
07:00 AM	13%	10%	13%	12%
08:00 AM	17%	16%	17%	17%
09:00 AM	19%	23%	19%	21%
10:00 AM	19%	17%	16%	17%
11:00 AM	17%	14%	13%	15%
12:00 PM	19%	18%	19%	19%
01:00 PM	20%	15%	15%	17%
02:00 PM	16%	15%	16%	16%
03:00 PM	13%	14%	12%	13%
04:00 PM	10%	12%	11%	11%
05:00 PM	15%	13%	15%	14%
06:00 PM	18%	17%	15%	17%

Table 9. 10:00 a.m.–4:00 p.m. parking turnover rate – Flagg Ranch.

Location	Friday	Saturday	Sunday	3-Day Average
Flagg Ranch	0.17	0.15	0.17	0.16

Table 10. Wejo-inferred time of day distribution of parking arrivals, by time period – Flagg Ranch.

Location	Number of Observations	Midnight–6am	6am–9am	9am–noon	Noon–3pm	3pm–6pm	6pm–9pm	9pm–Midnight
Flagg Ranch	5,376	2%	20%	25%	20%	23%	10%	1%

Exploratory Analysis

This subsection presents results of final regression models that estimate relationships between inbound traffic volumes, and key indicator variables regarding traffic and parking in the JODR subarea. Three groupings of input traffic volumes, (1) entrance station inbound traffic volumes, (2) subarea inbound traffic volumes, and (3) interior roadway traffic volumes, were measured against the subarea's key indicator variables. The following subsections present tabular results of final regression models for each of the three input traffic volume groupings. Narrative results are also provided for each regression model that was estimated for the Excel-based tool and had a significant relationship. The GRTE TVM Report Appendix 8 contains scatterplots of regression inputs and indicators with final fitted models.

<u>Regression Model Input: Entrance Station Inbound Traffic Volumes</u>

Table 68 presents results of final regression models estimated for the Excel-based tool and **Table 69** presents results of exploratory regression models that estimate relationships between entrance station inbound traffic volumes, and key indicator variables regarding traffic and parking in the JODR subarea are presented below. In consultation with park staff, inputs of entrance station inbound traffic

volumes were defined as the sum of park inbound traffic volumes from the Moose Entrance Station (Northbound), Moran Entrance Station (Northbound), and South Gate of Yellowstone (Southbound). Results from each of the final hourly regression models estimated for the Excel-based tool with a significant relationship (**Table 68**) suggest:

On average, for every 100 entrance station inbound vehicles per hour[37]:

- There are approximately 54 vehicles traveling on both lanes of the Flagg Ranch roadway that same hour.
- There are approximately 2 vehicles parked at Flagg Ranch that same hour.

Table 68. Hourly regression model specifications: JODR subarea, with entrance station inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Flagg Ranch traffic volumes	Linear	No lag	9.2*	0.54*	0.049	< 0.001	0.79	60
Flagg Ranch parking occupancy rate	Linear	No lag	26.3*	0.02*	< 0.001	0.011	0.16	39

Regression model input: Entrance station inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N), Moran Entrance Station (N), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Table 69. Daily regression model specifications: JODR subarea, with entrance station inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Flagg Ranch traffic volumes	Linear	No lag	2410.6*	0.26	< 0.001	0.56	0.19	4
Flagg Ranch maximum parking occupancy rate	Linear	No lag	60.4	0.001	0.8	0.931	0.01	3

Regression model input: Entrance station inbound traffic volumes, as the sum of traffic volumes from Moose Entrance Station (N), Moran Entrance Station (N), and South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Regression Model Input: Subarea Inbound Traffic Volumes

Table 70 and **Table 71** present results of final hourly and daily exploratory regression models that estimate relationships between inbound traffic volumes around the perimeter of the JODR subarea,

[37] The strength of the statistical relationship varies among the regression models and the bulleted summary statements should be interpreted as general rather than exact.

and key indicator variables regarding traffic and parking in the subarea are presented below. The subarea inbound traffic volume for the perimeter of the JODR subarea is computed as the sum of traffic counts from Lizard Creek (Northbound) and the South Gate of Yellowstone (Southbound). The final daily regression models were not significant.

Table 70. Hourly regression model specifications: JODR subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Flagg Ranch traffic volumes	Linear	No lag	2.3	0.97*	0.853	< 0.001	0.92	60
Flagg Ranch parking occupancy rate	Linear	No lag	29.1*	0.03*	< 0.001	0.025	0.13	39

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Lizard Creek (N) and the South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Table 71. Daily regression model specifications: JODR subarea, with subarea inbound traffic volumes as model inputs.

Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Flagg Ranch traffic volumes	Linear	No lag	-2037.9	1.42	0.486	0.112	0.79	4
Flagg Ranch maximum parking occupancy rate	Linear	No lag	187.7	-0.03	0.437	0.54	0.44	3

Regression model input: Subarea inbound traffic volumes, as the sum of traffic volumes from Lizard Creek (N) and the South Gate of Yellowstone (S). Asterisks (*) denote significance at $p < 0.05$.

Regression Model Input: Interior Roadway Traffic Volumes

Table 72 and **Table 73** present results of final hourly and daily exploratory regression models that estimate relationships between interior roadway traffic volumes in the JODR subarea and key indicator variables regarding parking and trail use in the subarea are presented below. The interior roadway traffic volume input is Flagg Ranch (Northbound). The final daily regression model was not significant.

Table 72. Hourly regression model specifications: JODR subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Flagg Ranch (N) traffic volumes	Flagg Ranch parking occupancy rate	Linear	No lag	24.3*	0.09*	< 0.001	< 0.001	0.28	39

Asterisks (*) denote significance at $p < 0.05$.

Table 73. Daily regression model specifications: JODR subarea, with interior roadway traffic volumes as model inputs.

Input	Indicator	Model	Lag	Intercept	Coefficient	Intercept p-value	Coefficient p-value	R^2	N
Flagg Ranch (N) traffic volumes	Flagg Ranch maximum parking occupancy rate	Linear	No lag	113	0.03	0.777	0.876	0.04	3

Asterisks (*) denote significance at $p < 0.05$.

Conclusion

This subsection offers concluding insights based on traffic and parking conditions for the JODR subarea, as well as the results of the exploratory analysis:

- Daily traffic volumes inbound into the JODR subarea from the South Gate of Yellowstone tend to be higher on weekdays than on weekend days and holidays and generally range between 2,500 and 2,750 vehicles per day. Similarly, daily traffic volumes from Lizard Creek into the JODR subarea tend to be somewhat higher on weekdays than on weekend days and holidays and tend to range between about 2,250 and 2,500 vehicles per day. Overall, traffic volumes into the JODR subarea generally peak during the month of July and decline moderately through the month of August.

- Hourly traffic volumes into the JODR subarea from the South Gate of Yellowstone increase fairly rapidly starting at about 7:00 a.m. and reach an initial peak around 11:00 a.m. Hourly inbound traffic from the South Gate of Yellowstone continues to increase, but at a slower rate, to its peak at about 5:00 p.m. and then starts to decline through the evening hours. Hourly vehicle traffic into the JODR subarea from Lizard Creek has an earlier start, with inbound vehicles increasing sharply from 5:00 a.m. to an hourly peak during the late morning. Hourly inbound traffic from Lizard Creek declines moderately through the afternoon and then declines more sharply after 5:00 p.m.

- The three-day daily counts of vehicle traffic at Flagg Ranch suggest that daily vehicle traffic there is generally consistent Friday through Sunday and tends to range right around 2,500 inbound (Northbound) vehicles per day. Additional monitoring of vehicle traffic volumes may be warranted to further assess and establish daily traffic patterns.

- The three-day hourly traffic volumes at Flagg Ranch suggest inbound traffic there starts to increase around 7:00 a.m. to a late morning peak at about 11:00 a.m. Inbound traffic at Flagg Ranch remains steady at or near its peak from about 11:00 a.m. to 5:00 p.m. and then declines fairly sharply through the evening.

- The estimates of number of vehicles parked for the three-day study period at Flagg Ranch suggest that there is more than ample parking capacity there. The highest estimated number of vehicles parked during the three-day study period was 59 vehicles at one time, compared to an estimated parking capacity at Flagg Ranch of 252 vehicles.

- There is a statistically significant relationship between the hourly volumes of vehicles entering GRTE from the park's entrance stations and the amount of vehicle traffic in the JODR subarea at Flagg Ranch. There is also a statistically significant relationship between the hourly volumes of vehicles entering the JODR subarea and the amount of vehicle traffic at Flagg Ranch. The results suggest that for every 100 vehicles that enter the JODR subarea per hour, there are approximately 54 vehicles traveling the roadway that same hour and may be passing through the subarea on their way to destinations in other areas of the park or region.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.