MOOSE-WILSON CORRIDOR USE LEVELS, TYPES, PATTERNS AND IMPACTS IN GRAND TETON NATIONAL PARK

TECHNICAL REPORT – SUMMER/FALL 2014 DATA

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EXECUTIVE SUMMARY

This report presents a summary of data from an interdisciplinary study designed to understand visitor use levels, the types of visitors, and visitor impacts associated with use in the Moose-Wilson corridor. This report includes a summary of descriptive findings from the Summer/Fall 2014 data collection season. Limited data for September are reported here, but it should be noted that portions of the Moose-Wilson corridor were closed to visitor use during September 2014 as a result of grizzly bear activity.

METHODOLOGY

The Summer/Fall 2014 data collection season consisted of six sampling periods developed from total vehicle use differences observed in previous studies: June 2nd-15th, June 16th-30th, July, August 1st-15th, a week in September (7th-14th), and a week in October (4th-12th). Whenever possible and appropriate, data are summarized based on these six sampling periods in order to examine any changes or patterns seen across the entire data collection season. Various field methodologies—some census-based and some sampling-based—were used simultaneously in order to get a more complete understanding of visitor use in the Moose-Wilson corridor. These methods included the use of vehicle tube counters, calibrated trail counters, motion-activated cameras, global positioning system (GPS)-tracking of various use types, vehicle traffic pattern analysis, and parking lot accumulation counts. Each method used is described in detail in the body of this report.

SIGNIFICANT FINDINGS

OVERALL USE LEVELS

Results from each data collection technique are reported independently. When generalized across all sampling periods, tube-counter results show the Moose-Wilson Road sees approximately 1,900 vehicles per day during the summer months of June through August. Since bicycle use makes up, on average, between 2%-4% of total use, approximately 60 bicycles use the Moose-Wilson Road per day. On average there were 2.8 people per vehicle. Total use was calculated to about 5,300 people (# of vehicles x avg. vehicle occupancy) entering the corridor each day averaged across all sampling periods. Side roads, which include Death Canyon and the Laurance S. Rockefeller (LSR) Preserve Center, each see approximately 200 vehicles per day and 500 vehicles per day, respectively, throughout the summer.

PEAK USE PERIODS

Although there was some variation based on sampling period, data from trail counters, vehicle tube counters, and parking lot turnover counts all indicate that the first half of August (1^{st}-15^{th}) was the busiest sampling period throughout the study. For the corridor as a whole, peak use generally occurs between 11am and 2pm/3pm. In general, weekends appear to be slightly busier than weekdays.

VEHICLE USE LEVELS

Results from tube counters, turning movement and automatic traffic recording cameras, and parking lot counts all suggest that peak use in the Moose-Wilson corridor occurs daily between 11am and 3pm, depending on location. Results from the turning movement cameras placed at the intersection of Moose-Wilson Road and Teton Park Road suggest that approximately 24% of traffic on Teton Park Road (from either direction) turns onto the Moose-Wilson Road. Taxi use in the corridor appeared to be minimal, making up just 0.4% of all license plates captured by the automatic license plate recognition (ALPR) data collection.

VEHICLE MOVEMENT PATTERNS

In general, traffic levels were nearly equal in both directions at all counters with northbound traffic being slightly higher on the Moose-Wilson Road. The most common movement pattern of vehicle travel was northbound through the Moose-Wilson corridor. Northbound through traffic was most common in the morning, making the north entrance the more used entrance of the Moose-Wilson Road. In the afternoon southbound through traffic peaked, making the Granite Canyon entrance the more used end of the Moose-Wilson Road. These patterns were driven by the increase in exits of the through traffic at each end of the road adding to overall traffic at that end of the road.

VEHICLE PARKING PATTERNS

Of all vehicles asked to participate in the GPS-based tracking portion of the study, 73% accepted. The most popular stopping area in the corridor was Sawmill Ponds Overlook, followed by the LSR Preserve parking lot. More visitors (with at peak use periods, three times as many vehicles) park in the "overflow" areas along the Death Canyon Road than park in the designated trailhead parking lot itself. The period when parking lots were fullest was between 11:00am and 2:00pm. Although it was the most popular stopping location, there was no discernable pattern of use at Sawmill Ponds. The LSR Preserve parking lot appeared to be busiest at midday.

USER TYPES

On average, across all sampling periods, 11% of vehicles in the corridor were visitors with local (Teton County – WY-22) license plates while the other 89% were considered non-local visitors (license plates other than WY-22 or WY-22 rental vehicles). In parking areas, on average and across all sampling periods, 24% of vehicles were local and 76% non-local. Overall the average percentage of local use in designated parking lots varied widely by parking lot and sampling period. Death Canyon had fairly consistent, high local use throughout the sampling periods compared to other parking areas.

TIME SPENT IN THE CORRIDOR

A large percentage of both bicycles (45%) and vehicles (36%) pass through the Moose-Wilson Corridor without stopping at a destination. On average, both vehicles and bicycles spend less than one hour total in the corridor. In many cases the total time in the corridor for vehicles is less than 30 minutes. For the minority of vehicles that did stop within the Moose-Wilson Corridor, Sawmill Ponds and the LSR Preserve (in that order) were the most popular stopping destinations.

GPS-tracking of vehicles indicates that the median duration time in the corridor is 28 minutes. For GPS-tracked bicycles the median time spent in the Moose-Wilson corridor is 45 minutes. Visitors who leave their cars and hike on trails spend on average 2 hours and 30 minutes recreating at their destination in the Moose-Wilson Corridor.

BICYCLE USE LEVELS, PATTERNS AND TYPES

Of all bicyclists asked to participate in the GPS-based tracking portion of the study, 74% accepted. Bicycle GPS tracking shows that 45% of bicyclists rode straight through the corridor without stopping, with most riders travelling northbound. Results from turning movement and automatic traffic recording cameras indicate that bicycles were between 2% and 3% of total use (depending on sampling period) entering at the Granite Canyon entrance and less than 1% of total use entering from the Moose-Wilson Road/Teton Park Road intersection. Like overall use, the highest level of bicycle use was observed during the first sampling period in August (1^{st}-15^{th}). The majority of bicyclists that enter the Moose-Wilson Road from the north end are doing so via the bike path. However, only 19% of bicyclists that use the bike path enter the Moose-Wilson Road Corridor. The majority of bicyclists that exit the Moose-Wilson Road at the north end exit and continue onto the bike path. Approximately half of those bicyclists travel west towards Jenny Lake, and the other half head east towards the Snake River. The most dominant type of bicyclist observed on both the Moose-Wilson Road, at the Teton Park Road and Moose-Wilson Road intersection, the Snake River Bridge pathway, and at the Granite Canyon entrance station was single-rider road cyclists.

PEDESTRIAN USE LEVELS, PATTERNS AND TYPES

Of all vehicles asked to participate in the GPS-based tracking portion of the study, 85% accepted. The highest pedestrian use was found on LSR Preserve Lake Creek trail to the bridge, with the next highest pedestrian use observed at the LSR Preserve parking lot footbridge. However, the LSR Preserve parking lot footbridge counter was not calibrated during this study, and therefore use at this location is likely an underestimate. The lowest level of visitor use was observed at the Huckleberry Point trail counter on the west side of Phelps Lake. Overall, the busiest pedestrian sampling period was the first half of August (August 1st-15th). In most cases visitor use levels were slightly higher on weekends.

The most popular pedestrian destination across all sampling periods was the Valley Trail section west of Phelps Lake Overlook, followed by the eastern shore of Phelps Lake. Across all sampling periods, only a few of the GPS-tracked visitors hiked to Open Canyon or accessed Teton Village via the Valley Trail. Sawmill Ponds was a key stopping destination for vehicle use, but once at the Sawmill Ponds parking lot visitors spent very little time there and rarely left the vicinity of the parking lot.

DIFFERENCES FROM KEY FINDINGS FROM SUMMER/FALL 2013 REPORT

In general, with only a couple of exceptions, the findings from the Summer/Fall of 2014 match the findings from the Summer/Fall of 2013. Vehicle use in the first half of August dropped slightly between 2013 and 2014. However, when compared to data from 2006, use in the Moose-Wilson Road corridor is continuing to increase. The percentage of vehicles and bicyclists traveling through the corridor without stopping decreased in 2014. An increase in use at the Sawmill Ponds parking area and on the LSR Preserve Road indicate that these may have been key stopping destinations during Summer/Fall 2014.

The remainder of this report contains basic methodology and detailed summaries of all findings from the Summer/Fall 2014 data collection season. Several appendices are referenced throughout the document, which contain supporting materials and maps to help illustrate the findings.

INTRODUCTION

This document is the technical report of findings from the Moose-Wilson Corridor Use Levels, Patterns and Impacts in Grand Teton National Park 2014 data collection effort. All data was collected and analyzed by Utah State University, with the exception of any trail counter and trail camera data, which was collected by Grand Teton National Park (GRTE) and analyzed by Utah State University. This document describes the methodologies used in the field and results from the 2014 data collection season, which occurred from June 2 through October 31. A summary of salient data findings is provided.

The Moose-Wilson corridor (MWC) in the southwest corner of GRTE is an outstanding representation of the park's major natural ecological communities, all of which are located within a geographical area that is about seven miles in length, five miles in width, and about 10,300 acres in size. These natural communities include alpine, subalpine, forests, sagebrush flats, wet meadows and wetlands, lakes, rivers, and ponds, and an associated diversity of fish and wildlife. The MWC is enclosed roughly by the Teton Range to the west, the Snake River to the east, the community of Moose to the north, and the park's Granite Canyon entrance to the south.

The corridor contains several primary visitor use areas, including Death Canyon and Granite Canyon trailhead parking areas, Laurance S. Rockefeller Preserve, White Grass Dude Ranch and Murie Ranch historic districts, and Sawmill Ponds overlook. Other visitor use areas include Poker Flats horse trails and the Snake River levee road. The Moose-Wilson Road is the primary access point to destinations within the corridor and extends 7.1 miles northward from the terminus of Wyoming 390 at the Park's Granite Canyon entrance to Teton Park Road at Moose. The narrow, winding, partially gravel road provides access to the south end of Grand Teton National Park and a rustic, slow driving experience for visitors looking for exceptional scenery and wildlife viewing opportunities. Some residents and visitors also use the road as an alternative route to the airport and other destinations within or beyond the park during the summer months. With increasing vehicle traffic volumes, congestion along this narrow, rustic country road has become common. This observation has raised concerns about the protection of wildlife and other resources, visitor safety, visitor experience, and the effectiveness of park operations. The road is open seasonally from approximately May 1 to October 31.

The goal of this project is to collect data about levels, types, patterns, and site-specific impacts of visitor activities in the corridor. These data will inform the park's planning process, which will assess the type and level of visitor use that can be accommodated while sustaining the desired resource conditions and visitor experience within the Moose-Wilson corridor. In that planning effort, the National Park Service will use this and other information to develop and evaluate a range of alternatives that considers a variety of management strategies within the corridor, aimed at achieving desired future conditions. The alternatives will be developed and evaluated through a planning process that engages the public and results in a long-term approach for corridor management.

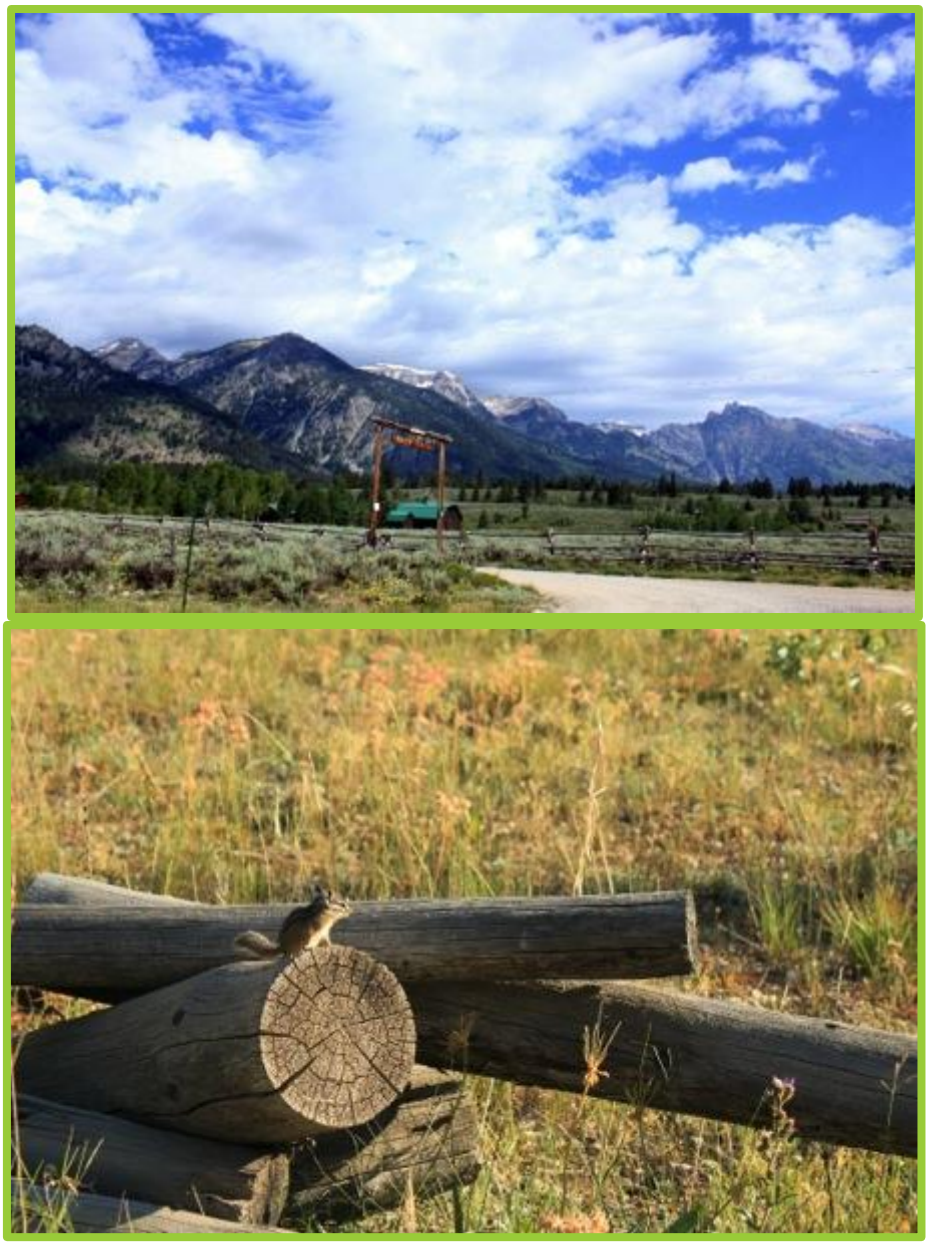


Figure 1: Top photo of Poker Flats Ranch. Bottom photo, a least chipmunk along Death Canyon Road (photos by Ashley D'Antonio).

STUDY AREA

The Moose-Wilson Road (Figure 2) extends 7.1 miles northward from the terminus of Wyoming 390 at GRTE's Granite Canyon entrance to the Teton Park Road at Moose. It contains the full extent of both the Moose-Wilson and Death Canyon Roads. Data collection types categorize specific study site locations. Both the extent of the project study area and the location of specific data collection activities were developed in consultation with National Park Service (NPS) staff and were fully vetted in the data collection plan (Monz, D'Antonio and Heaslip, 2014).

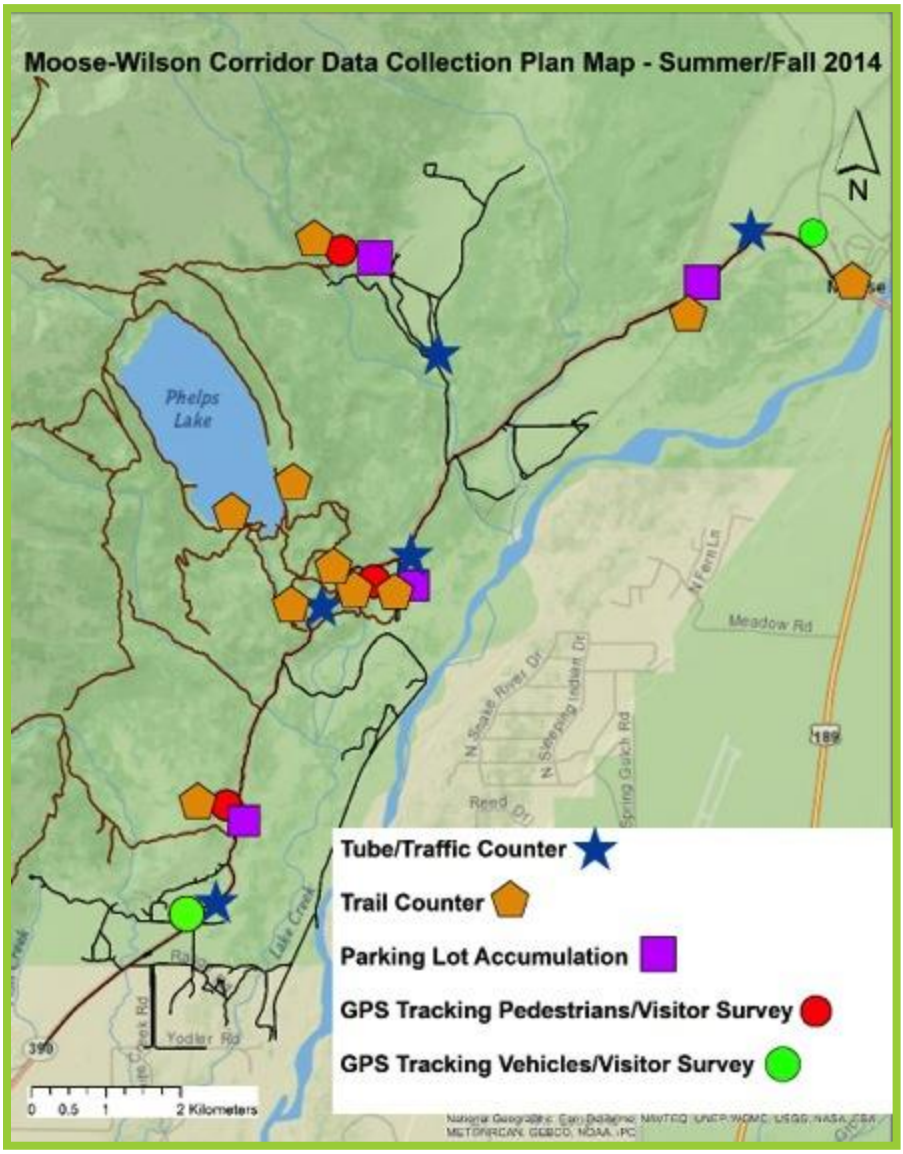


Figure 2: Data collection locations and needs for Moose-Wilson corridor study area (Summer/Fall 2014).

DATA COLLECTION NEEDS AND METHODS

SAMPLING PERIODS

Certain data collection approaches are more suitable for random sampling while other measures are continuous throughout the study from June 2 through October 31. (Table 1 lists specific details and locations of tasks). Periods of random sampling were selected to reflect seasonal variations in total use of the corridor based on previous studies (McGowen et al., 2009). Note that all data collection activities did not occur on all days in the sampling period, but results will be generalized to these periods as appropriate. See Appendix A for full sampling schedule. With the exception of continuous counts (such as those from vehicle tube counters and infrared trail counters), sampling intentionally did not occur on holidays. September field sampling ended a few days early due to grizzly bear activity, which closed portions of the Moose-Wilson Road.

Period 1: June 2-15 (12 random days during this period)

Period 2: June 16-30 (12 random days during this period)

Period 3: July 1-31 (24 random days during this period)

Period 4: August 1-15 (12 random days during this period)

Period 5: September 6-15 (7 random days, post Labor Day)

Period 6: October 4-12 (10 random days during this period)

DATA COLLECTION DETAILS

Table 1: Summary of all data collection, basic methodology and sampling approach for each data need, and data collection-specific site locations.

Information Need	Data Collection Approach	Time Frame	Locations
1. Number of Vehicles on Roads	Directional tube counters (MetroCount) & Electromagnetic Counters (TRAFx)	Continuous counts until road closure	▪ LSR Preserve Entrance Road ▪ Death Canyon Road at Y with White Grass Access Road ▪ On Moose-Wilson Road at: ▪ Granite Canyon Entrance ▪ Near Moose entrance (@ Teton Park Road (TPR) junction) ▪ Adjacent to the Woodland Trail crossing
2. Vehicle Type	Video Sampling (license plate recognition)	Stratified Random Sampling	▪ Granite Canyon Entrance ▪ Near Moose entrance (@ Teton Park Road (TPR) junction)
3. Vehicle Movement Patterns and Turning	GPS tracking Video Sampling	Stratified Random Sampling	▪ Granite Canyon Entrance (ATR) ▪ Near Moose entrance (@TPR junction)

Movements			▪ Turning Patterns at LSR preserve and near Moose entrance (@ TPR junction)
4a. Number of Bicycles in MWC	Video Sampling	Stratified Random Sampling	▪ Granite Canyon Entrance ▪ Near Moose entrance (@TPR junction)
4b. Number of Bicycles Park Shared-Use Path	Automated counters	Continuous	▪ East of Snake River Bridge @ Moose
5. Bicycle Use Types and Behavior	Video Sampling and Observation Motion Activated Camera (Pathway)	Stratified Random Sampling Stratified Random Sampling of Census Data (Pathway)	▪ Granite Canyon Entrance and near Moose entrance (@ TPR junction) ▪ Shared use pathway near Moose
6. Bicycle Movement Patterns	GPS Tracking	Stratified Random Sampling	▪ Granite Canyon Entrance ▪ Near Moose entrance (@ TPR junction)
7. Number of Pedestrians on Trails	Infrared trail counters (TRAFx and Diamond types)	Continuous	10 locations: ▪ Murie Ranch Trail (TRAFx) ▪ Sawmill Ponds Overlook Trail (TRAFx) ▪ Death Canyon Trailhead (TH) (Diamond) ▪ LSR Preserve Parking Lot (Footbridge) (TRAFx) ▪ LSR Preserve Trails (near waterfall) (Diamond) ▪ LSR Preserve Lake Creek Trail MWR crossing (Diamond) ▪ LSR Preserve Woodland Trail MWR Crossing (Diamond) ▪ LSR Preserve East Lake Trail (Diamond) ▪ LSR Preserve West Lake Trail (Diamond) ▪ Granite Canyon Trailhead (Diamond)
8. Pedestrian Movement Patterns and Use Densities	GPS Tracking	Stratified Random Sampling	▪ Granite Canyon TH ▪ LSR Preserve ▪ Death Canyon TH
9a. Parking Lot Accumulation	Observation	Stratified Random Sampling	▪ Granite Canyon TH ▪ LSR Preserve ▪ Death Canyon TH ▪ Sawmill Ponds/Overlook
9b. Overflow Parking Accumulation	Observation	Stratified Random Sampling	▪ Granite Canyon TH ▪ Death Canyon TH

Figure 3: Research sign used in Summer/Fall 2014 to inform visitors about the project (photo by Ashley D'Antonio).

DATA COLLECTION METHODOLOGY:

1. VEHICLE USE LEVELS

Number of vehicles on roads was recorded with MetroCount directional tube counters placed at each end, at intermediate points along Moose-Wilson Road, and on side roads to Death Canyon trailhead and the LSR Preserve (see Figure 2) (MetroCount, 2014; Xia and Arrowsmith, 2008). Data was collected 24 hours per day during the study period. Tube counters were provided and installed by Grand Teton National Park, but the data download and data summary were managed by Utah State University. MetroCount software was used to produce summary data that was then compiled by Utah State University. The MetroCount counter on the LSR Preserve Road was downloaded by GRTE and provided to Utah State University for summary.

2. VEHICLE TYPE

Video sampling was conducted with Miovision Scout cameras (Miovision, 2014; Xia and Arrowsmith, 2008). Turning movement counts and vehicle classifications (including bicycle counts) were conducted at the intersection of the Moose-Wilson Road and the Teton Park Road, the intersection of the LSR Preserve and the Moose-Wilson Road, and at the Granite Canyon entrance station. Video sampling used a stratified random sample at select times during the study period to ensure a representative sample of weekends, weekdays, and times of day. Data was analyzed using manual and automated video analysis methods to report vehicles by type. Automatic license plate recognition (ALPR) cameras were placed at each end of the Moose-Wilson Road, and four days of license plate data was collected during each sampling period. ALPR data was analyzed to summarize commercial vehicle use in the Moose-Wilson Corridor.

Figure 4: Field technician, Annie Weiler, downloading data from the tube counter on Death Canyon Road during Summer 2013. The same tube counters were used during Summer/Fall 2014 (photo by Ashley D'Antonio).

3. VEHICLE MOVEMENT PATTERNS

Vehicle movement/use patterns were determined using GPS-based methodologies (D'Antonio et al., 2010; Hallo et al., 2012). Garmin eTrex 100 units were deployed to a random sample of visitors in their vehicles as they entered the corridor from either end of the road. Sampling was conducted using a random sample, stratified by sampling period, to ensure representative samples of weekends, weekdays, and times of day. A set number of GPS units were handed out randomly during each sampling hour to ensure an even distribution of GPS units across the sampling day. Information about local versus non-local vehicle and rental vehicle status was recorded. Due to limitations in the size of the research staff,

vehicle tracking did not occur on days when pedestrian tracking was occurring. Motorists returned the GPS units upon leaving Moose-Wilson Road to field technicians or to drop boxes located at both road exits. Erroneous data points were eliminated from the GPS data before analysis. GPS-tracking methodology was combined with visitor surveys designed by Pennsylvania State University (PSU). Results from this survey are not included in this report and will be in a separate PSU-authored report. Turning patterns at the LSR Preserve and Teton Park Road intersections were determined by video data collection using the Miovision Scout units (Miovision, 2014). ALPR recognition was used to determine vehicle duration on the roadway.

Figure 5: Field technician, Dan Blair, intercepting a visitor at the Moose end of the Moose-Wilson Road in order to retrieve a GPS unit and administer a survey (photo by Ashley D'Antonio).

4. BICYCLE USE LEVELS

MOOSE-WILSON ROAD METHOD

Video sampling was used to determine bicycle use numbers. Miovision Scout cameras were placed at each end of Moose-Wilson Road, and sampling occurred using a stratified random approach throughout the study period (Miovision, 2014). This ensured a representative sample of weekends, weekdays, and times of day.

BIKE PATH METHOD

Automatic infrared counters were placed by GRTE on the bike path near Moose (Pettebone et al., 2010; TRAFx, 2014; Xia and Arrowsmith, 2008). These automatic counters ran continuously throughout the study period. A random sample of this census data, stratified by sampling period, was used to calibrate the counters using observational techniques in order to determine bicycle use type (see data collection method #5 below) and counter error. Calibrations were also used to distinguish estimates of bicycle use from pedestrian use and bicycle group size.

5. BICYCLE USE TYPE AND BEHAVIOR

MOOSE-WILSON ROAD METHOD

Video sampling, with Miovision Scout cameras (Figure 7) placed at each end of Moose-Wilson Road, was conducted to determine bicycle use type. Video sampling was conducted using a stratified random sample throughout the study period while ensuring a representative sample of weekends, weekdays, and times of day. A subsample of the ATR video was manually analyzed to determine bicycle use types.

BIKE PATH METHOD

In order to understand how bike path users interacted with the Moose-Wilson Road, observational techniques were used at the Teton Park Road and Moose-Wilson Road intersection (Figure 7). A field technician was positioned at the intersection to make note of the behavior of all visitors using the bike path at this intersection. User group information was also recorded.

Figure 6: Field technician, Annie Weiler, setting up a Miovision Scout camera at the Teton Park Road/Moose-Wilson Road intersection (photo by Ashley D'Antonio).

Figure 7: View of Moose-Wilson Road and Teton Park Road intersection in Moose, WY (photo from Miovision turning movement camera).

6. BICYCLE MOVEMENT PATTERNS

Bicycle use patterns were assessed using GPS-based methodologies (D'Antonio et al., 2010; Hallo et al., 2012). Unlike with vehicle and pedestrian tracking, a census of bicycle use in the Moose-Wilson corridor was attempted. Garmin eTrex 100 GPS units were handed out to all visitors on bicycles who were willing to participate in the study as they approached the corridor access points during vehicle sampling periods. Sampling was conducted using a stratified random sample to ensure a representative sample of weekends, weekdays, and times of day. Information about type of user and number in the cycling group was recorded. Bicyclists returned the GPS units upon leaving Moose-Wilson Road to field technicians or to a drop box which was located at both road exits. GPS tracks were cleaned of erroneous points before data analysis. GPS-tracking methodology was combined with visitor surveys designed by Pennsylvania State University (PSU). Results from this survey are not included in this report and will be in a separate PSU-authored report.

7. PEDESTRIAN USE LEVEL

Visitor use counts were collected using trail counters. Trail counters (both Diamond brand and TRAFx counters) were already in place at trailheads and at important trail junctions (Table 1) and provided by GRTE (Diamond Traffic Products, 2014; TRAFx, 2014; Xia and Arrowsmith, 2008). Trail counters (Figure 8) collected data continuously throughout the study period. Data was aggregated into hourly bins. Utah State University (USU) field technicians calibrated the counters in hourly periods, randomly, throughout the sampling periods (Pettebone et al., 2010). These observational calibration techniques were used to determine counter error. GRTE staff downloaded the trail counter data, and the raw data was delivered to USU for analysis.

Figure 8: TRAFx counter (on the back of the sign post) located on the LSR Preserve footbridge near the LSR Preserve parking lot (photo by Ashley D'Antonio).

8. PEDESTRIAN MOVEMENT PATTERNS

Pedestrian use patterns were examined using GPS-based methodologies (D'Antonio et al., 2010; Hallo et al., 2012). Garmin eTrex 100 GPS units were handed out to a random selection of day-use visitors at Granite Canyon Trailhead, Death Canyon Trailhead, and the LSR Preserve (past the Preserve Center where the Woodland and Lake Creek Trails split) when the visitors started their hike. Sampling was conducted using a stratified random sample to ensure representative sample of weekends, weekdays, and times of day. Due to limitations in research staff size, visitor GPS-tracking did not occur on days when vehicle GPS-tracking occurred. Pedestrians returned the GPS units upon leaving the trail system they were hiking on to research technicians or to drop boxes that were located at both road exits (same drop box for vehicle GPS-tracking). GPS tracks were cleaned of erroneous points before data analysis. GPS-tracking methodology was combined with visitor surveys designed by Pennsylvania State University (PSU). Results from this survey are not included in this report and will be in a separate PSU-authored report.

9. PARKING ACCUMULATION AND OVERFLOW

Data on level of use in key parking lots within the Moose-Wilson corridor were collected in accord with similar studies (Lawson et al., 2003). Designated parking lots are parking areas that were designated, installed, and maintained by GRTE. Overflow or visitor-created parking areas are locations where visitors are parked anywhere outside of this designated area. Resource condition summaries for informal and overflow parking areas are presented in the Summer/Fall 2013 report (Monz et al., 2014). Data collection protocols and instruments were designed to be similar to the current parking lot data collection occurring at the LSR Preserve so that comparisons can be made among all designated parking lots within the corridor. Parking lot data at the LSR Preserve designated parking lot was collected by the park and delivered to Utah State University for inclusion in this report. An hourly count of number of parked vehicles, number of local vehicles, number of bicycles present, and number of any overflow parking was collected at all designated parking areas along the Moose-Wilson Road corridor. At some designated parking lots, additional information was collected (see list below). Sampling days were determined using a stratified random sample to ensure a representative sample of weekdays, weekends, and times of day. The location and condition of maintenance features (fences, parking logs, etc.) at designated parking was recorded with a sub-meter Trimble XT GPS and described.

Designated Parking Lots Additional Data Collection:

- Granite Canyon Trailhead (photographs of the parking area and overflow parking when full)
- Death Canyon Trailhead (photographs of the parking area and overflow parking when full)
- Sawmill Ponds/Overlook Parking Area (documentation of visitor behavior was also recorded)

ADDITONAL DATA COLLECTION

WILDLIFE BRIGADE

In order to be able to relate vehicle movement and stopping patterns with the presence of wildlife jams, the GRTE Wildlife Brigade and LSR Preserve staff collected additional information as part of the project. The Wildlife Brigade is a crew of volunteers who help to manage human-wildlife interactions in GRTE; one of their main purposes is to manage crowds and vehicles at wildlife jams. USU provided the Wildlife Brigade and LSR Preserve staff (who also assisted with wildlife jams) with Trimble GPS units. At all wildlife jams in the Moose-Wilson Road corridor, the Wildlife Brigade or the LSR Preserve staff carried the GPS unit while working at the jam and also entered a few basic pieces of data for each jam into the GPS unit (including the type of animal, duration of jam, and visual estimation of the max number of vehicles in the jam).

RESULTS

1. VEHICLE USE LEVELS

Tube counters (Figure 1.1) were deployed by GRTE at the beginning of June and removed before the first snowfall at the end of October. Utah State University maintained the tube counters and analyzed all data.

Figure 1.1: Tube counter used to determine vehicle use levels on the Death Canyon Road (photo by Ashley D'Antonio).

PEAK HOUR FOR VEHICLE USE

The most frequent peak hour for each tube counter was determined using MetroCount software summaries (Tables 1.1-1.5). At some count locations, for some sampling periods, the peak hour varied each day. For these sampling periods, multiple peak hours are listed. For the northern-most tube counter, near Sawmill Ponds, the most frequent peak hour for weekdays varied mostly between the 3:00pm and the 6:00pm hours with the 5:00pm hour being most common (Table 1.1). At Sawmill Ponds during the June 1st-15th sampling period, the 9:00am hour was the weekday peak hour. On weekends the peak hour varied widely across sampling periods, especially during the June sampling periods at Sawmill Ponds. On Death Canyon Road the peak hour of use was most often the 3:00pm hour; this was true across all sampling periods (Table 1.2). The weekend day most frequent peak hour at Death Canyon ranged between the 4:00pm hour and the 5:00pm hour.

On the entrance road to the LSR Preserve, weekday peak hour was most often at 12:00pm, and on weekend days peak hour was most often during the 1:00pm hour (Table 1.3). At the counter placed near where the Woodland Trail crosses the Moose-Wilson Road, the peak hour for use on the road on weekdays and weekends was during the 11:00am hour (Table 1.4). For the tube counter near Poker Flats, the most southern tube counter, the 4:00pm and the 5:00pm hours were the most frequently observed weekday peak hours throughout all summer sampling periods (Table 1.5). At Poker Flats, on weekend days, the most frequently observed peak hour was the 4:00pm hour.

Table 1.1: Peak hour of the day for vehicular traffic at the tube counter on Moose-Wilson Road just north of Sawmill Ponds Overlook. The time reported in the table is the beginning of the peak hour and the value in parentheses is the number of times over the sampling period when that peak hour was observed.

Most Frequent Peak Hour: Sawmill		
Sampling Period	**Weekday**	**Weekend**
June 1-15	9:00am (5)	9:00am/10:00am/11:00am/1:00pm/4:00pm (1)
June 16-30	5:00pm (3)	11:00am/12:00pm/3:00pm/4:00pm (1)
July	4:00pm/5:00pm (5)	12:00pm/4:00pm (3)
August 1-15	3:00pm/4:00pm (3)	3:00pm (2)
August 16-31	4:00pm/5:00pm (3)	4:00pm (3)
September	5:00pm (6)	5:00pm (4)
October	5:00pm/6:00pm (5)	11:00am (3)

Table 1.2: Peak hour of the day for vehicular traffic at the Death Canyon Road tube counter (12hr time). Counter placed right before where Death Canyon Road turns to dirt. The time reported in the table is the beginning of the peak hour and the value in parentheses is the number of times over the sampling period when that peak hour was observed.

Most Frequent Peak Hour: Death Canyon		
Sampling Period	**Weekday**	**Weekend**
June 1-15	11:00am/3:00pm (2)	12:00pm (2)
June 16-30	3:00pm (4)	3:00pm (2)
July	12:00pm/2:00pm/3:00pm/4:00pm (4)	4:00pm (3)
August 1-15	3:00pm (4)	11:00am/3:00pm (2)
August 16-31	1:00pm (3)	11:00am/1:00pm (2)
September*	11:00am/5:00pm (2)	8:00am (1)
October*	N/A	N/A

* Counter malfunction beginning 9/6/14

Table 1.3: Peak hour of the day for vehicular traffic on the entrance road to the LSR Preserve (12hr time). The time reported in the table is the beginning of the peak hour and the value in parentheses is the number of times over the sampling period when that peak hour was observed.

Most Frequent Peak Hour: LSR Preserve Road		
Sampling Period	**Weekday**	**Weekend**
June 1-15	12:00pm (3)	1:00pm (3)
June 16-30	3:00pm (3)	12:00pm (2)
July	12:00pm (8)	11:00am (3)
August 1-15	11:00am (3)	1:00pm (3)
August 16-31	12:00pm (5)	11:00am/1:00pm (2)
September	1:00pm (7)	1:00pm (2)
October*	*	*

* No data—collection ended 10/3 upon closing of the LSR Preserve Center

Table 1.4: Peak hour of the day for vehicular traffic at the Woodland road counter (12hr time). Counter placed on the Moose-Wilson Road near where the Woodland trail crosses the Moose-Wilson Road. The time reported in the table is the beginning of the peak hour and the value in parentheses is the number of times over the sampling period when that peak hour was observed.

Most Frequent Peak Hour: Woodland		
Sampling Period	**Weekday**	**Weekend**
June 1-15	5:00pm (5)	3:00pm (3)
June 16-30	5:00pm (5)	11:00am (2)
July	4:00pm (5)	2:00pm/4:00pm (2)
August 1-15	11:00am/1:00pm (3)	11:00am (3)
August 16-31	11:00am (8)	11:00am/12:00pm (2)
September*	11:00am (6)	12:00pm (2)
October*	*	*

* Counter malfunction beginning 9/14

Table 1.5: Peak hour of the day for vehicular traffic near the Poker Flats parking lot (12hr time). Counter placed on Moose-Wilson Road just north of Poker Flats parking area. The time reported in the table is the beginning of the peak hour and the value in parentheses is the number of times over the sampling period when that peak hour was observed.

Most Frequent Peak Hour: Poker Flats		
Sampling Period	**Weekday**	**Weekend**
June 1-15	5:00pm (4)	3:00pm (3)
June 16-30	5:00pm (6)	4:00pm (2)
July	5:00pm (8)	4:00pm (3)
August 1-15	4:00pm/5:00pm (3)	4:00pm (3)
August 16-31	4:00pm (5)	12:00pm (3)
September	12:00pm (7)	11:00am (4)
October	4:00pm (6)	12:00pm/4:00pm (2)

Use at the tube counter just north of Sawmill Ponds ranged from an average of 629 vehicles per day in early June to 2,394 vehicles per day during the August 1st-15th sampling period (Table 1.6 and Figure 1.2). At Death Canyon Road, average vehicle use per day varied between 170 vehicles in early June to 281 vehicles per day during the August 1st-15th sampling period (Table 1.6 and Figure 1.3). Average daily use at the entrance road into the LSR Preserve varied between about 400 and 600 vehicles per day during the sampling periods. The lowest level of use at the LSR Preserve was observed during September with approximately 398 vehicles per day (Table 1.6 and Figure 1.4). Highest use on the entrance road to the LSR Preserve was observed during the August 1st-15th sampling period with 580 vehicles per day on average. The June 16th-30th sampling period had the highest average vehicles per day for the Woodland tube counter (1,909 vehicles/day). The tube counter just north of Poker Flats recorded peak use during the August 1st-15th sampling period (2,185 vehicles/day) and lowest average use during October (511 vehicles/day) (Table 1.6 and Figures 1.5 and 1.6).

Table 1.6: Average number of vehicles per day (± 1 standard deviation) at each tube counter location in the Moose-Wilson corridor reported by sampling period. Outliers that may be present on figures were removed before calculating these averages.

Sampling Period	Sawmill Ponds	Death Canyon	LSR Preserve+	Woodland	Poker Flats
June 1-15	265* (± 186)	170 (± 41)	436 (± 54)	1451 (± 225)	1413 (± 227)
June 16-30	2148 (± 136)	218 (± 40)	533 (± 56)	1909 (± 159)	1851 (± 172)
July	2236 (± 380)	269 (± 53)	548 (± 70)	2119 (± 262)	2006 (± 555)
August 1-15	2394 (± 175)	281 (± 59)	580 (± 40)	1817 (± 293)	2185 (± 214)
August 16-31	1920 (± 281)	213 (± 60)	481 (± 60)	1254 (± 227)	1674 (± 294)
September**	1035 (± 834)	205 (± 44)***	393 (± 169)	862 (± 467)****	1037 (± 464)
October	629 (± 348)	NA	NA	NA	511 (± 252)

*Counter malfunction resulting in days with missing data
**Road closed due to bear activity in the corridor starting 9/10 through 9/19
***Counter malfunction after 9/5/14.
****No Data after 9/14/15 due to counter malfunction.
+No Data for October due to closure of LSR Preserve Center

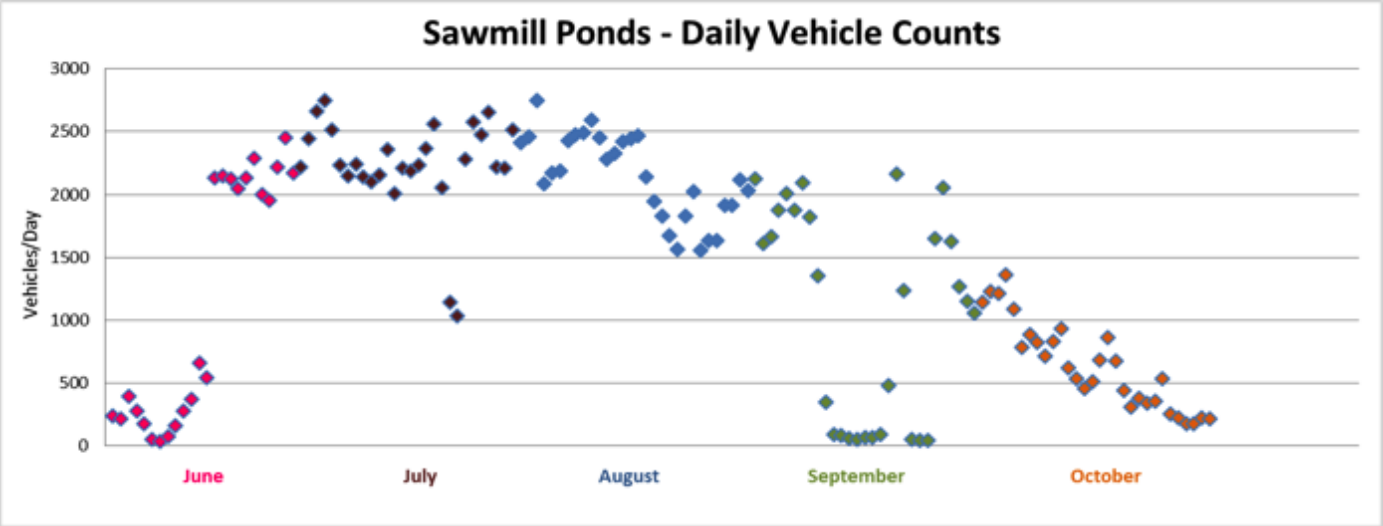


Figure 1.2: Daily vehicle counts across the study period for the tube counter placed just north of Sawmill Ponds. Low values observed in September were due to road closure as a result of grizzly bear activity.

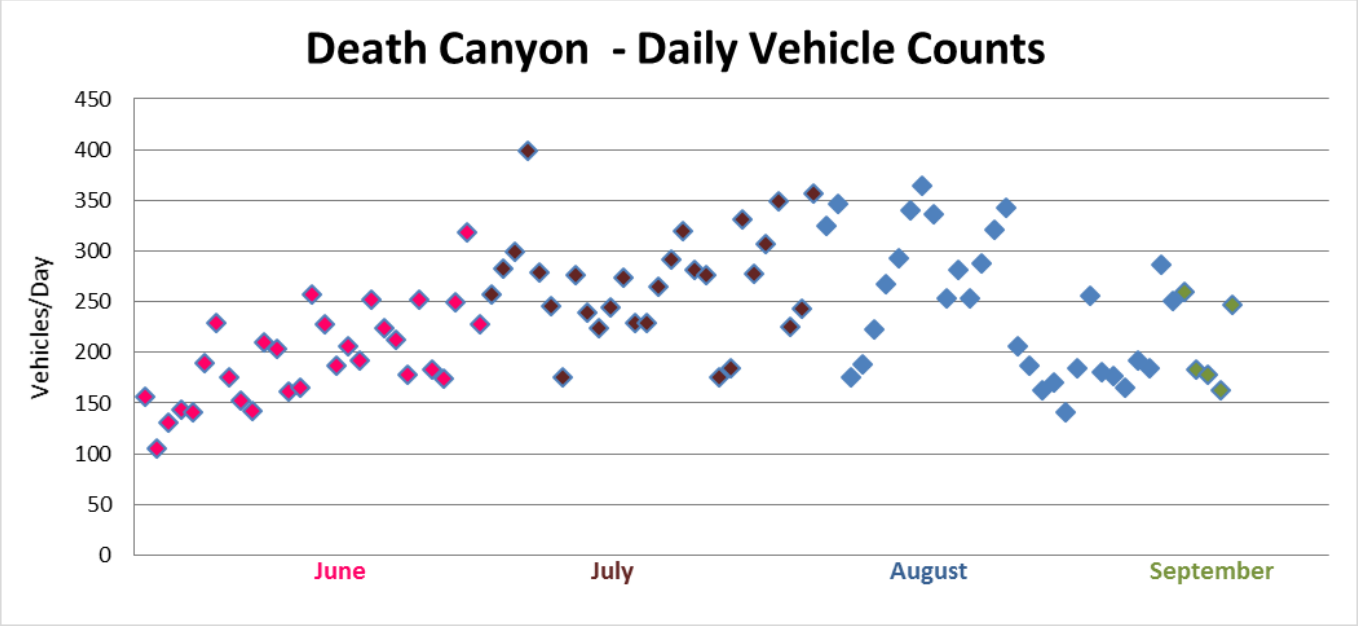


Figure 1.3: Daily vehicle counts across the study period for the tube counter placed just before the beginning of the dirt section of Death Canyon Road. No data for most of September and October due to counter malfunction.

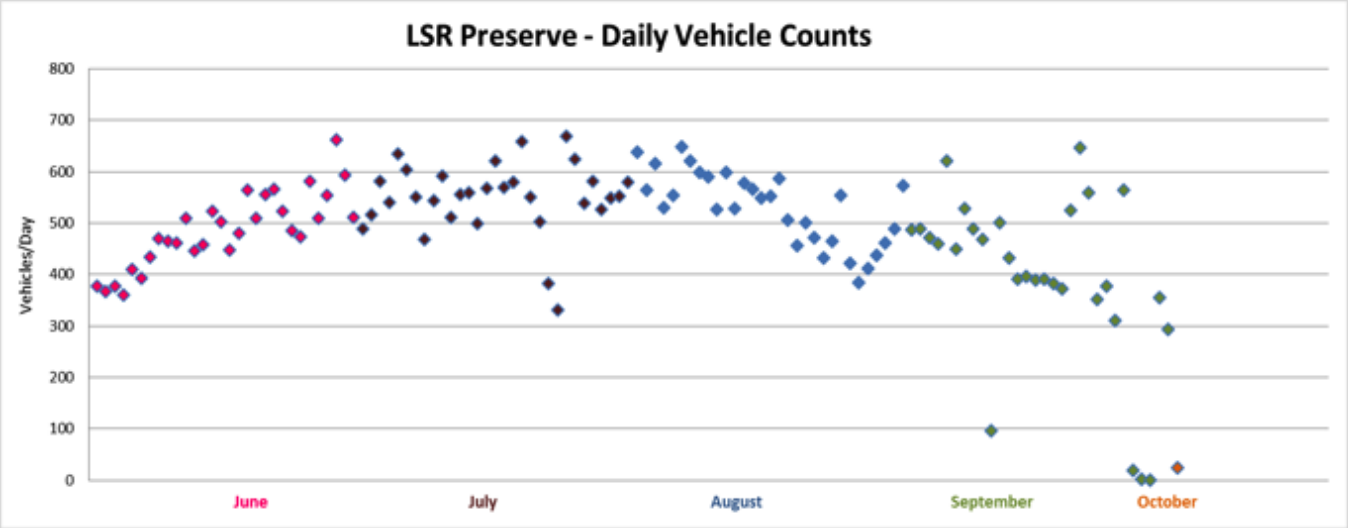


Figure 1.4: Daily vehicle counts across the study period for the tube counter placed on the LSR Preserve Road Entrance Road. GRTE only provided data through the end of September.

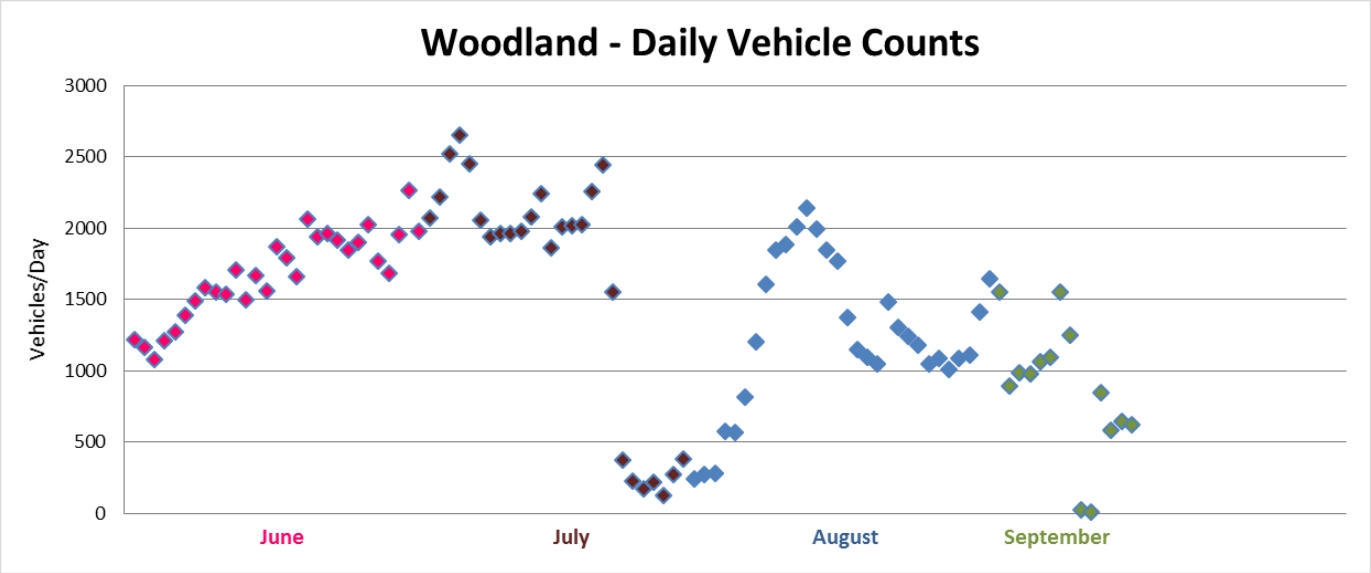


Figure 1.5: Daily vehicle counts across the study period for the tube counter placed on the Moose-Wilson Road near where the Woodland Trail crosses the road. No data after September 14th due to counter malfunction.

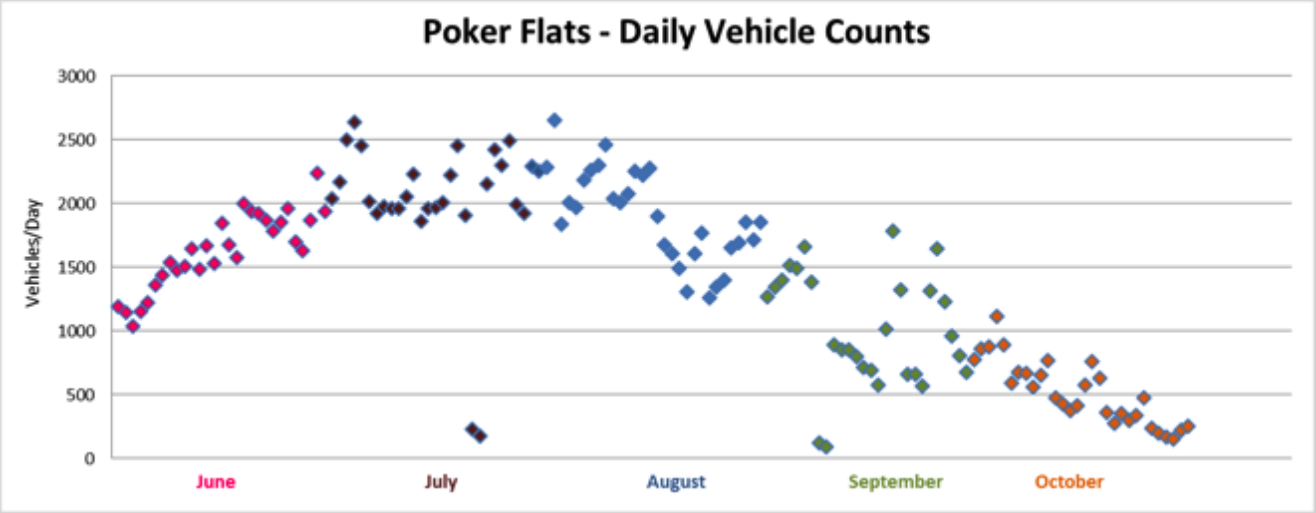


Figure 1.6: Daily vehicle counts across the study period for the tube counter placed on the Moose-Wilson Road just north of the Poker Flats horse parking area.

DIRECTIONAL TRAFFIC FLOW

Figures of daily directional flow for each individual counter along the Moose-Wilson and Death Canyon Roads for each sampling period can be found in Appendix B. Presented here are average hourly vehicle counts by direction (northbound and southbound) for all tube counters placed in the Moose-Wilson corridor (Figures 1.7 through 1.20). Across all sampling periods and both weekends and weekdays, on average northbound traffic on the Moose-Wilson Road was at its highest between approximately 8:00am and 10:00am, at which point northbound traffic levels began to decrease and southbound traffic began to increase. On average, southbound traffic levels were at their highest levels between 2:00pm and 4:00pm with use beginning to drop more dramatically at around 6:00pm. Average traffic to and from the LSR Preserve and up and down Death Canyon Road roughly mimicked that of the traffic on the Moose-Wilson Road, with traffic to these destinations peaking between 8:00am and 10:00am and traffic leaving these destinations peaking between 2:00pm and 6:00pm. The peaks at the LSR Preserve and Death Canyon Road were less dramatic than those peaks observed on the Moose-Wilson Road counter, and both counters had more even directional use during midday (10:00am-2:00pm).

Data from the tube counters placed on Moose-Wilson, LSR Preserve, and Death Canyon Roads were also separated by northbound and southbound (or eastbound and westbound in the case of the LSR Preserve and Death Canyon Roads) traffic for weekdays and weekend days across all sampling periods. In general, traffic levels were nearly equal in both directions at all counters during all sampling periods with just slightly more northbound traffic than southbound traffic (see Appendix B). Rarely was southbound traffic flow higher than northbound traffic flow. The most drastic example of southbound traffic being greater than northbound traffic was observed at the Woodland counter during the August

15th-31st sampling period. Although Death Canyon is a "dead-end" road, data from the tube counter indicates that for many days in the sampling periods, westbound (towards the trailhead) traffic levels were much greater than eastbound traffic levels (see Appendix B). Given the nature of Death Canyon Road being a dead-end, these results seem unlikely. The tube counters used in this study are designed to work on pavement; the Death Canyon Road tube counter had to be placed on a narrow road where the pavement met the dirt section of Death Canyon Road. The placement of the Death Canyon tube counter on the edge of the pavement may have resulted in some counter error, including the counter malfunctions that occurred in September and October. Therefore, while total counts from Death Canyon appear to be accurate, directional flow results may be less accurate when compared to tube counters placed on Moose-Wilson Road. Traffic on the LSR Preserve Entrance Road was also approximately equal each direction with westbound traffic (leaving the LSR Preserve) being slightly higher during most sampling periods. Like the Death Canyon Road, the LSR Preserve Entrance Road is a "dead-end" road, and any large discrepancies between west- and eastbound traffic is likely due to counter error.

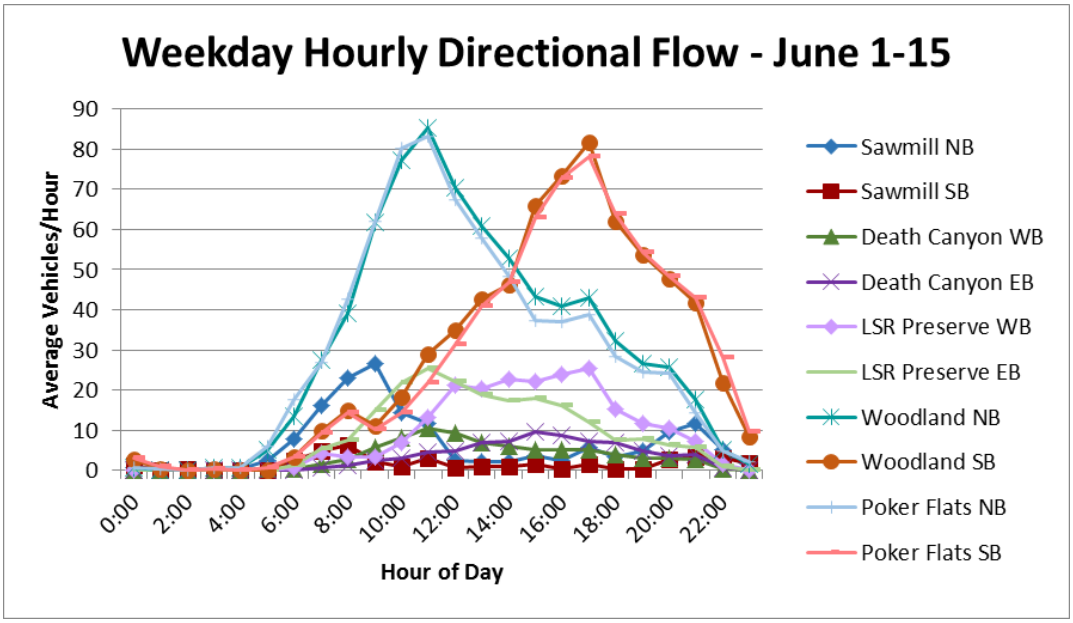


Figure 1.7: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in the first sampling period of June. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

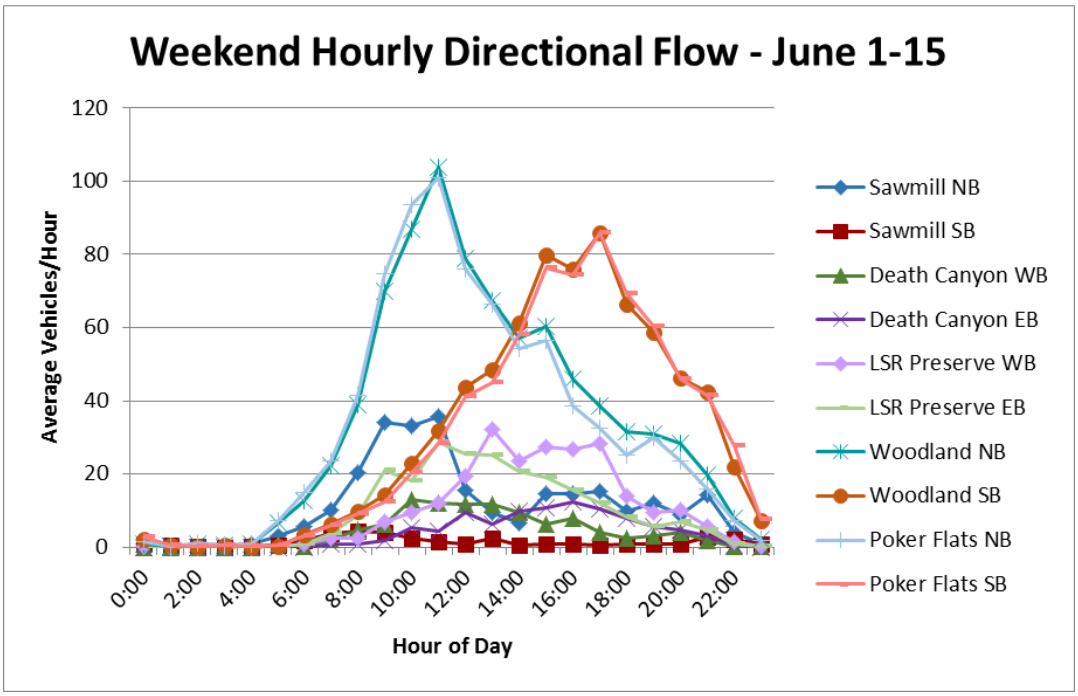


Figure 1.8: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekend days in the first sampling period of June. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

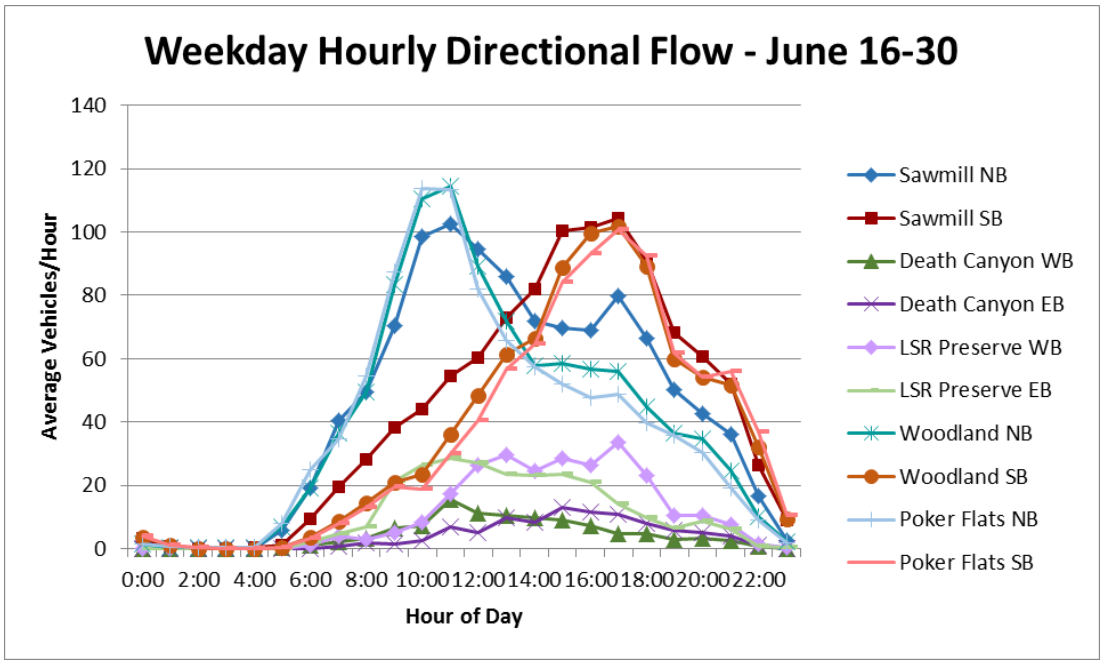


Figure 1.9: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in the second sampling period of June. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

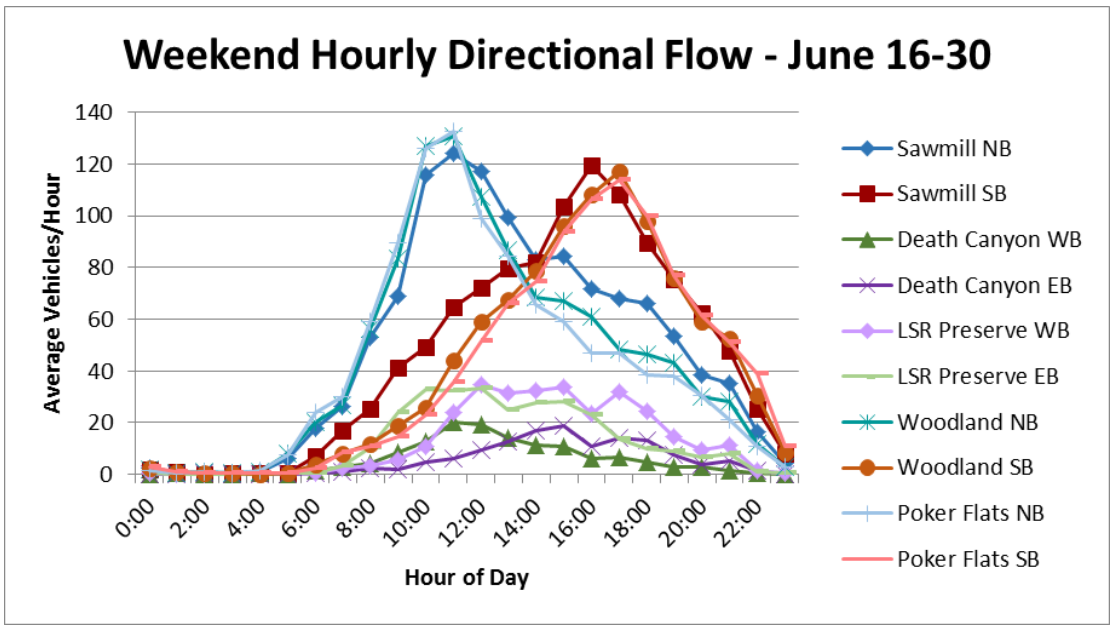


Figure 1.10: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekend days in the second sampling period of June. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

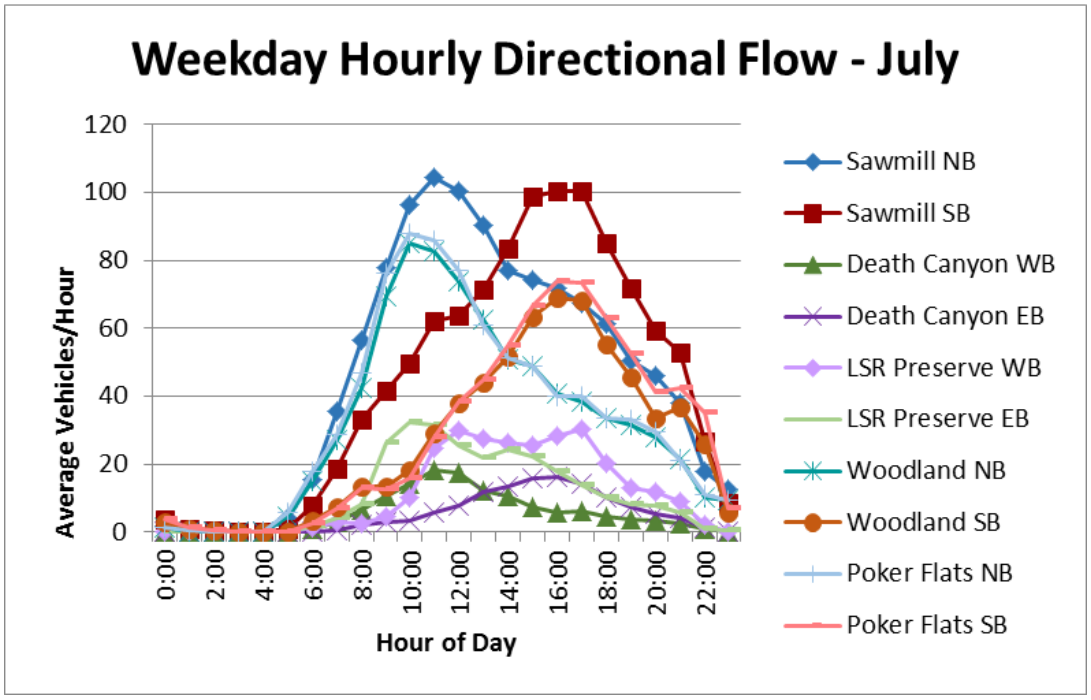


Figure 1.11: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in July. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

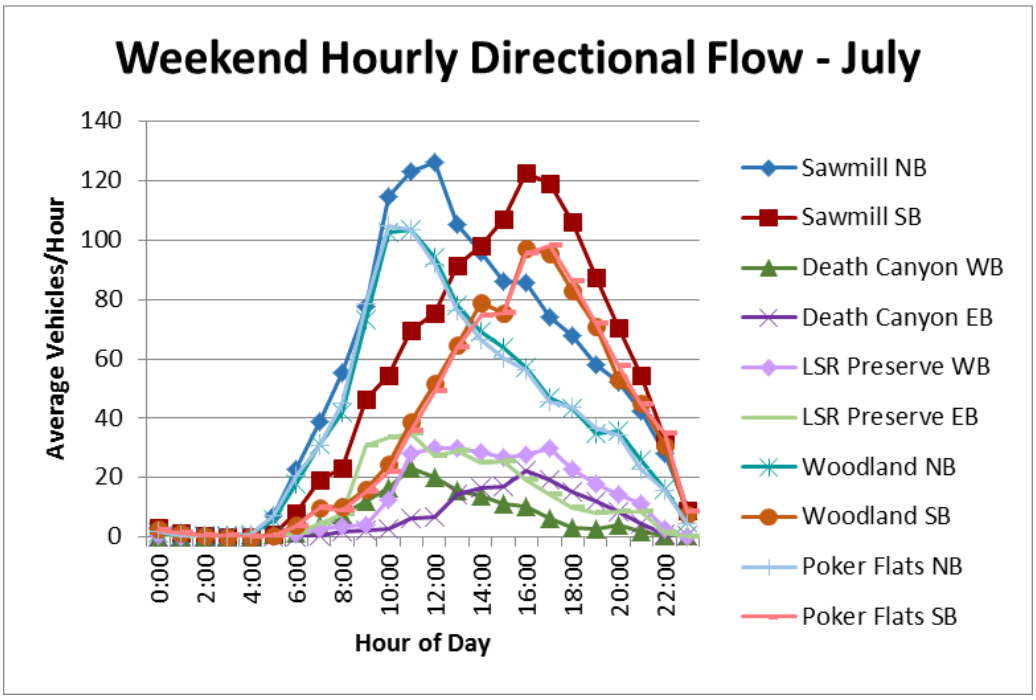


Figure 1.12: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekends in July. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

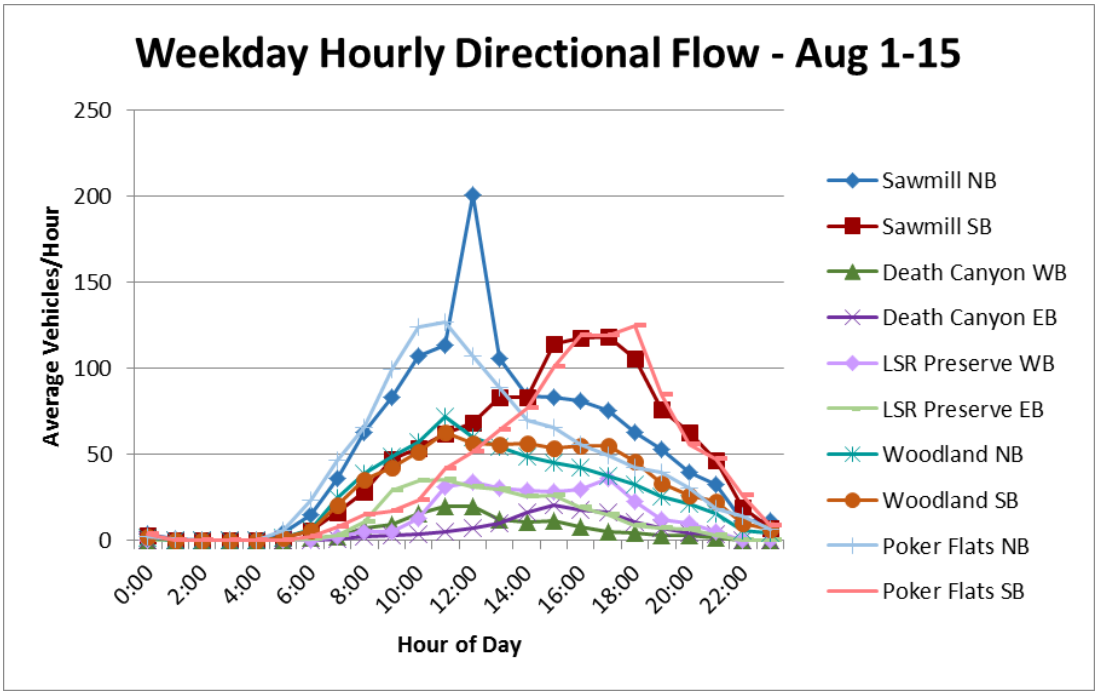


Figure 1.13: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in the first sampling period of August. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

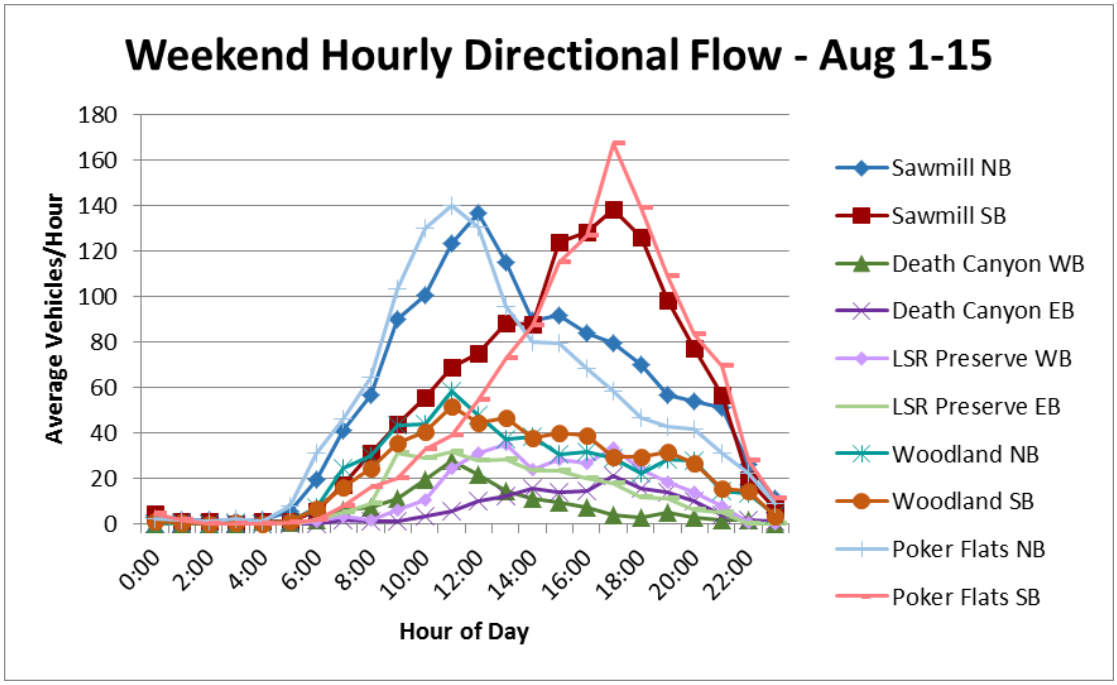


Figure 1.14: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekends in the first sampling period of August. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

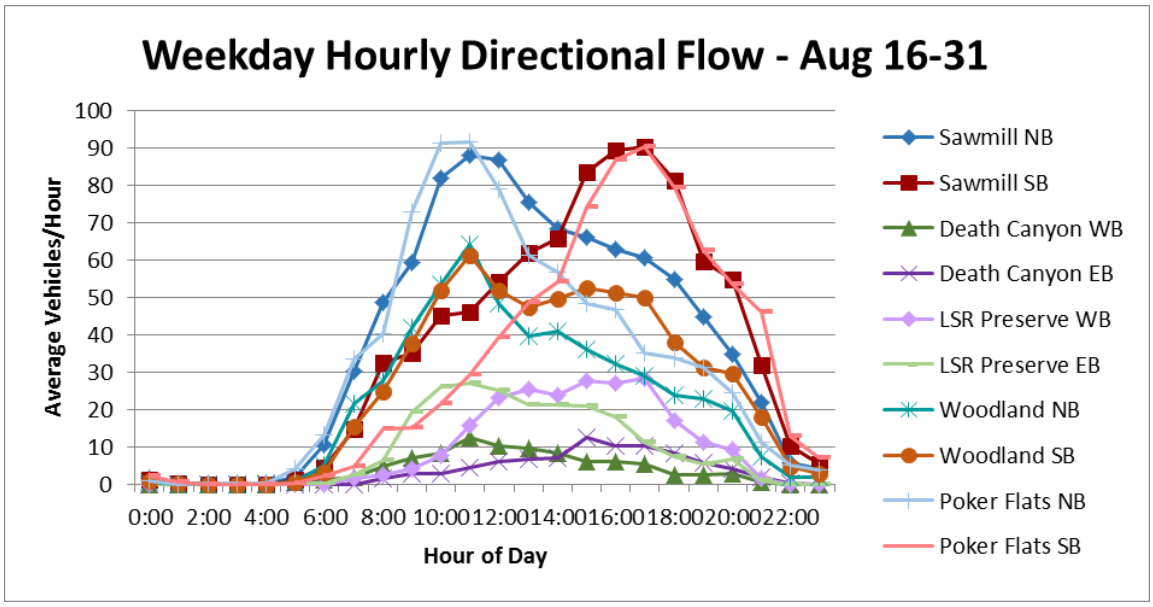


Figure 1.15: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in the second sampling period of August. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

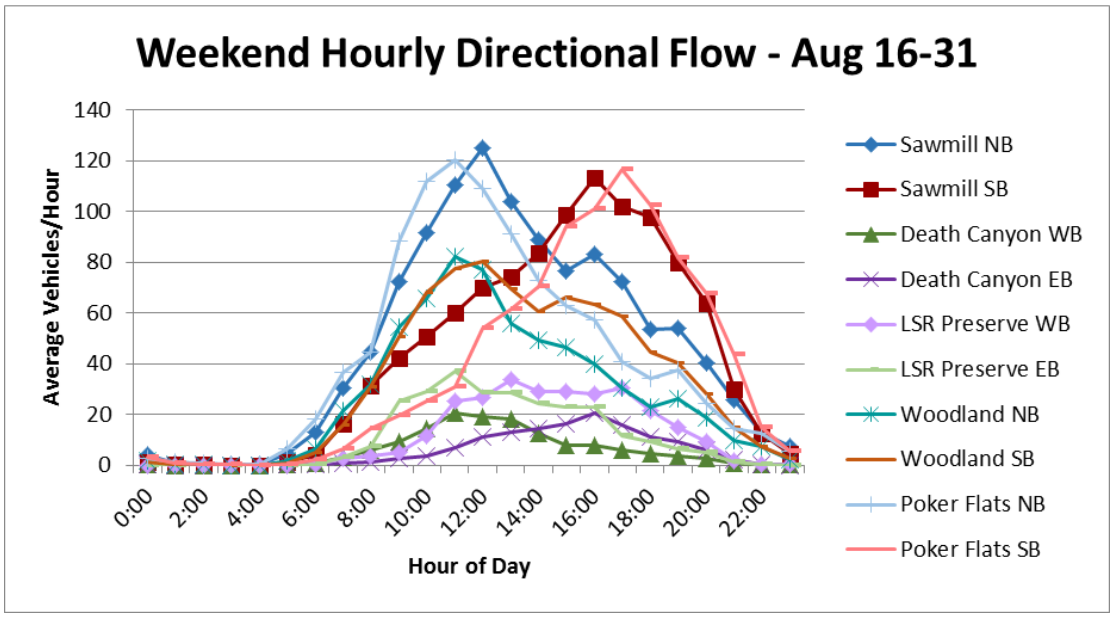


Figure 1.16: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekends in the second sampling period of August. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

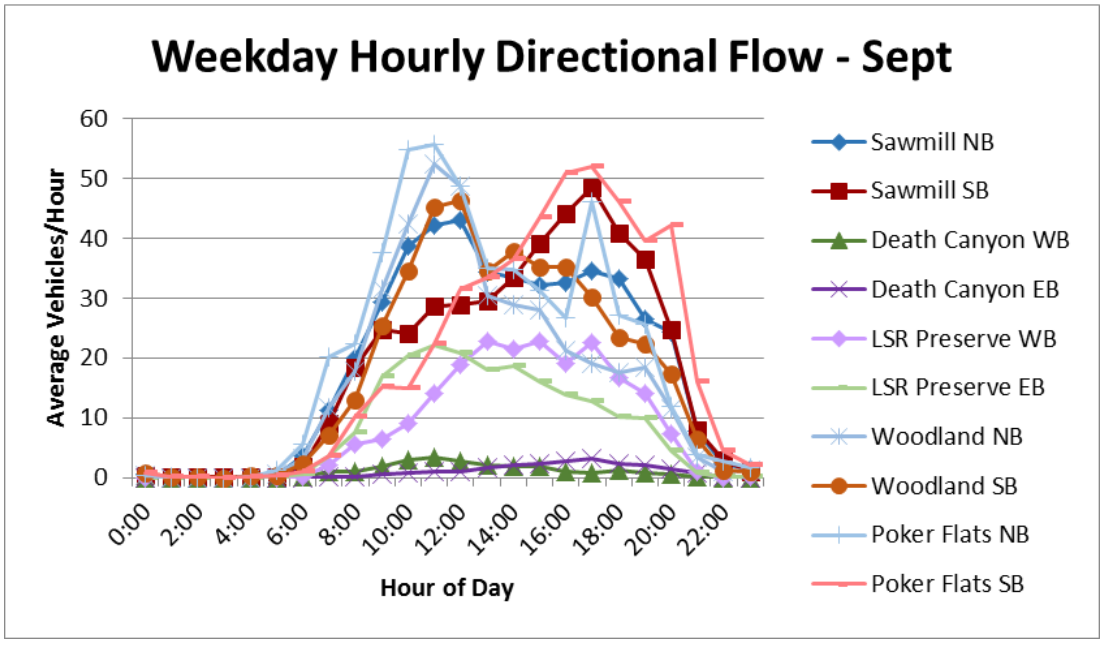


Figure 1.17: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in September. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

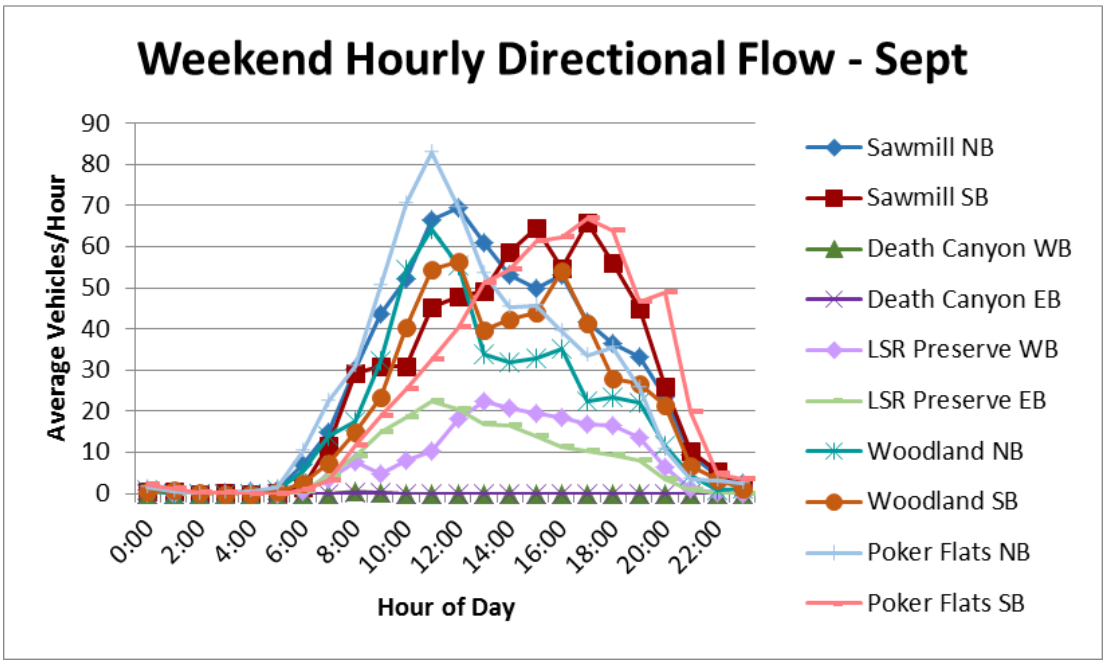


Figure 1.18: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekends in September. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

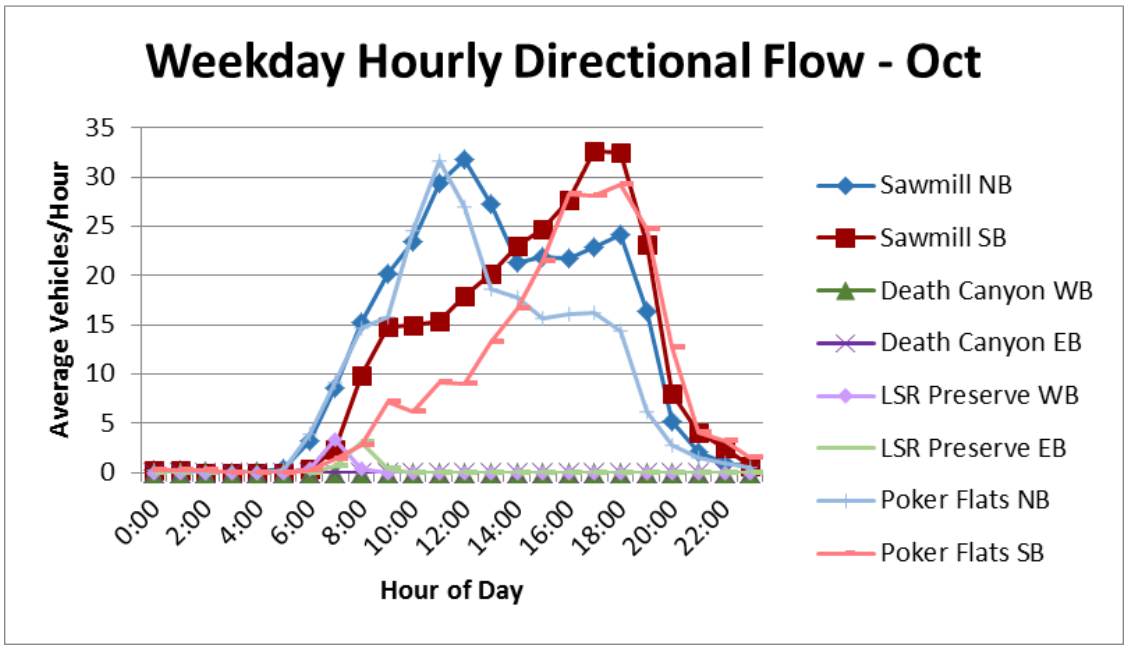


Figure 1.19: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekdays in October. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead, and "EB" for the LSR Preserve is towards the LSR Preserve parking lot.

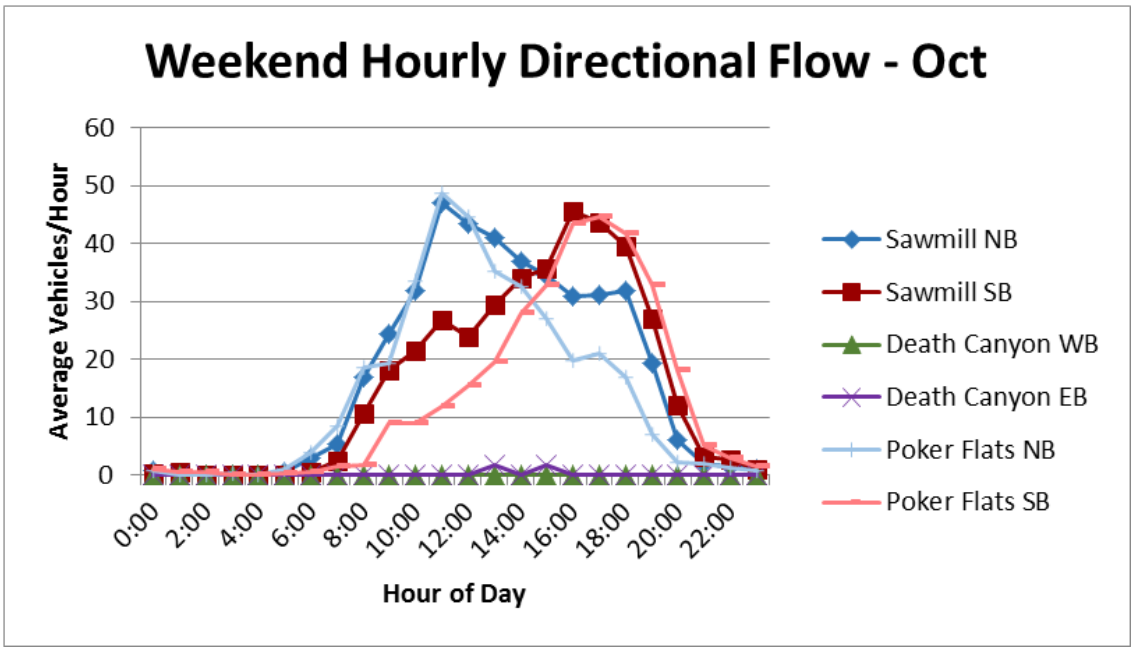


Figure 1.20: Average hourly directional counts for all tube counters in the Moose-Wilson Road corridor for weekends in October. NB = northbound, SB = southbound. "WB" for Death Canyon is towards the trailhead. The LSR Preserve Road did not have October data.

VEHICLE USE LEVEL CHANGES OVER TIME

Historical average vehicle use levels on the Moose-Wilson Road corridor were pulled from the Moose-Wilson corridor Adaptive Management Plan (McGowen et al., 2009). These values, from 2006 through 2008, were then compared to average daily vehicle use levels from similar locations on the Moose-Wilson Road from the summer of 2013 and summer 2014 sampling periods (Table 1.7). This comparison indicates that average use on the Moose-Wilson Road has increased over time for all sampling periods. There was a slight drop in visitor use between 2013 and 2014 (Table 1.8), but the overall trend indicates increasing use on the Moose-Wilson Road since 2006 (Figure 1.21).

Table 1.7: Percent change of average daily vehicle use levels on the Moose-Wilson Road over time.

	Average Daily Vehicle Use Counts*					Percent Increase	
Month	**2006**	**2007**	**2008**	**2013**	**2014**	**2006 to 2013**	**2006 to 2014**
June	1, 175	1, 311	1, 381	N/A	1,754	**N/A**	**49%**
July	1,668	1,740	1,870	2,094	2,120	**26%**	**27%**
August	1,616	1,695	1,170	2,102	1,875	**30%**	**16%**
September	1,110	1,267	1,355	1,772	978**	**59%**	**N/A**

*Data in 2006, 2007, and 2008 from counters 1, 4, and 5 in McGowen et al. (2009). Data collected in 2013 at similar locations (Sawmill Ponds, Woodland, and Poker Flats).

**Road closure during September due to grizzly bear activity & counter malfunction resulted in lower than expected average.

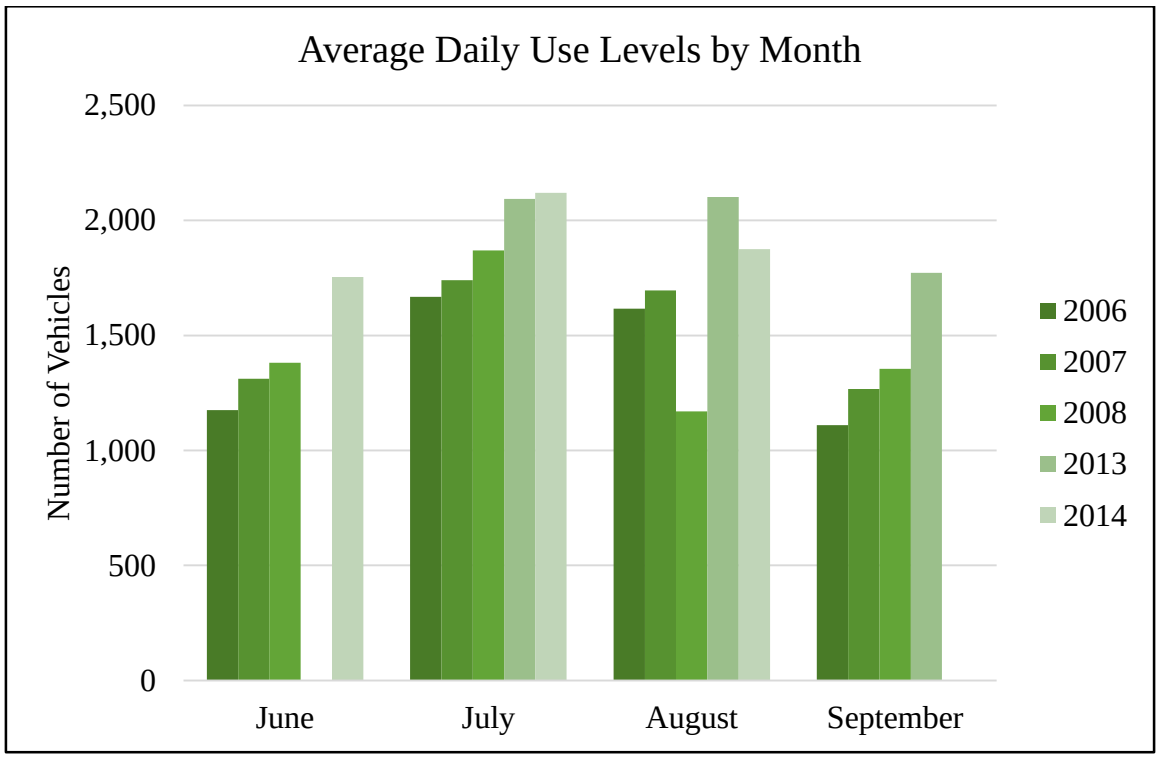


Figure 1.21: Average daily vehicle use levels on the Moose-Wilson Road over time. Historical data from McGowen et al., 2009. June data was not collected in 2013. Multiple road closures in September 2014 due to grizzly bear activity resulted in September data not being included in the comparison.

Table 1.8: Percent change of average daily vehicle use levels on the Moose-Wilson Road between years over time.

	Percentage Change in Daily Vehicle Use Level by Year			
Month	**2006-2007**	**2007-2008**	**2008-2013**	**2013-2014**
June	12%	5%	N/A	N/A
July	4%	7%	12%	1%
August	5%	-31%	80%	-11%
September	14%	7%	31%	N/A

2. VEHICLE TYPE

There were two turning movement count (TMC) locations and one automatic traffic recording (ATR) for volume count location. The two TMC locations were at the intersection of Moose-Wilson Road and Teton Park Road and the intersection of Moose-Wilson Road and the LSR Preserve entrance. The volume count was located near the entrance to Granite Canyon and was installed during the same periods as the TMC. Over the five-month study period, eighteen days were designated for TMC and ATR data collection, resulting in three days per sampling period (Table 2.1). For the TMC and ATR studies, a minimum of 12 hours of data was set to be collected for each location.

Table 2.1: Summary of TMC and ATR data collection days.

Sampling Period	TMC & ATR Data Collection Days
June 1-15	7, 8, 9
June 16-30	20, 21, 22
July	18, 19, 20
August 1-15	2, 3, 4
September	12, 13, 14
October	4, 5, 6

Figure 2.1: Photo taken with turning movement camera placed at the intersection of the Moose-Wilson Road with the LSR Preserve Road.

AUTOMATIC TRAFFIC RECORDING

The ATR was conducted north of the Granite Canyon entrance, capturing only northbound and southbound volumes (Tables 2.2-2.7). The following tables summarize the ATR collected for the Granite Canyon entrance. Cars include all forms of motorized vehicles. Across all of the sampling periods, the majority of use, both northbound and southbound, at Granite Canyon entrance was from vehicles. Bicycles typically accounted for 2% of northbound traffic and 2% to 4% of southbound traffic. (Tables 2.2-2.7).

Table 2.2: Summary of average use per day by ATR Volume Collection at Granite Canyon entrance for June 1-15.

June 1-15			
Northbound			
	Vehicle	**Bike**	**Total**
Average	689	18	707
%	98%	2%	100%
Southbound			
	Vehicle	**Bike**	**Total**
Average	591	23	614
%	96%	4%	100%

Table 2.3: Summary of average use per day by ATR Volume Collection at Granite Canyon entrance for June 16-30.

June 16-30			
Northbound			
	Vehicle	**Bike**	**Total**
Average	867	20	887
%	98%	2%	100%
Southbound			
	Vehicle	**Bike**	**Total**
Average	786	24	810
%	97%	3%	100%

Table 2.4: Summary of average use per day by ATR Volume Collection at Granite Canyon entrance for July.

July			
Northbound			
	Vehicle	**Bike**	**Total**
Average	1009	26	1,035
%	98%	2%	100%
Southbound			
	Vehicle	**Bike**	**Total**
Average	925	28	953
%	97%	3%	100%

Table 2.5: Summary of average use per day of ATR Volume Collection at Granite Canyon entrance for Aug. 1-15.

August 1-15			
Northbound			
	Vehicle	**Bike**	**Total**
Average	1014	15	1029
%	98%	2%	100%
Southbound			
	Vehicle	**Bike**	**Total**
Average	968	29	994
%	97%	3%	100%

Table 2.6: Summary of average use per day by ATR Volume Collection at Granite Canyon entrance for September.

September			
Northbound			
	Vehicle	**Bike**	**Total**
Average	405	10	415
%	98%	2%	100%
Southbound			
	Vehicle	**Bike**	**Total**
Average	395	11	406
%	97%	3%	100%

Table 2.7: Summary of average use per day by ATR Volume Collection at Granite Canyon entrance for October.

October			
Northbound			
	Vehicle	**Bike**	**Total**
Average	429	12	441
%	98%	2%	100%
Southbound			
	Vehicle	**Bike**	**Total**
Average	407	11	418
%	98%	3%	100%

ANALYSIS OF VEHICLE TURNING MOVEMENT

The first TMC peak-hour data presented is the intersection of Teton Park Road and Moose-Wilson Road, which is a four-leg un-signalized intersection with stop signs on the northbound and southbound directions. Moose-Wilson Road is a two-way road with two lanes at the approach of the intersection, while Teton Park Road is a three-lane road with a left turn lane on each eastbound and westbound direction.

Figures 2.3 through 2.9 illustrate the complete volume by study dates. Turning movements at this intersection did not vary much by sampling period. Of total average vehicle movement in the intersection, 60% of the traffic was eastbound and westbound "thru" movements on Teton Park Road. Of vehicles just traveling on the Teton Park Road, 76% drove straight through the intersection. Of the traffic turning onto the Moose-Wilson Road at the Teton Park Road intersection: on average 52% entered westbound, 43% entered eastbound, and 5% entered southbound. On average, 55% of the traffic northbound on Moose-Wilson Road made a right turn towards the visitor center and 38% made a left turn towards Jackson Lake.

Figure 2.2: View of the Moose-Wilson Road and Teton Park Road intersection from the TMC camera.

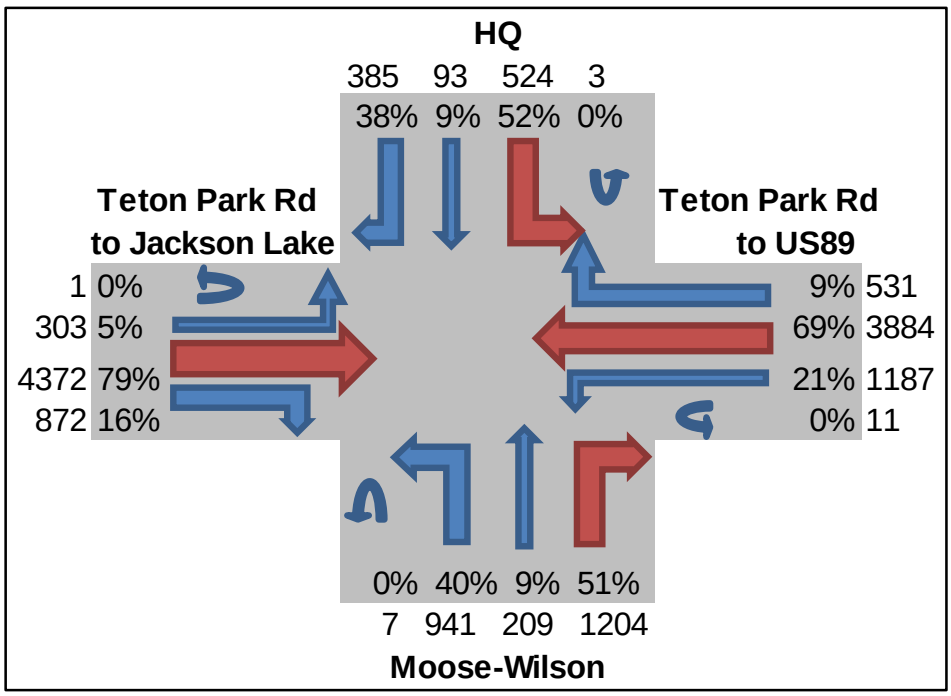


Figure 2.3: Total TMC Movement at Moose-Wilson Road and Teton Park Road for June 1-15. HQ = Park Headquarters.

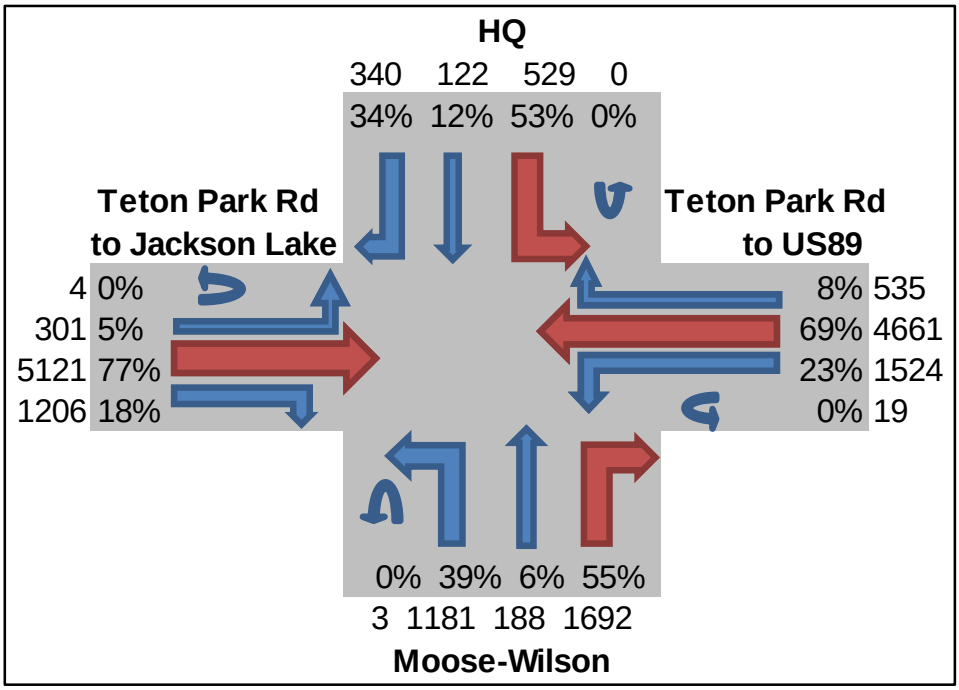


Figure 2.4: Total TMC Movement at Moose-Wilson Road and Teton Park Road for June 16-30. HQ = Park Headquarters.

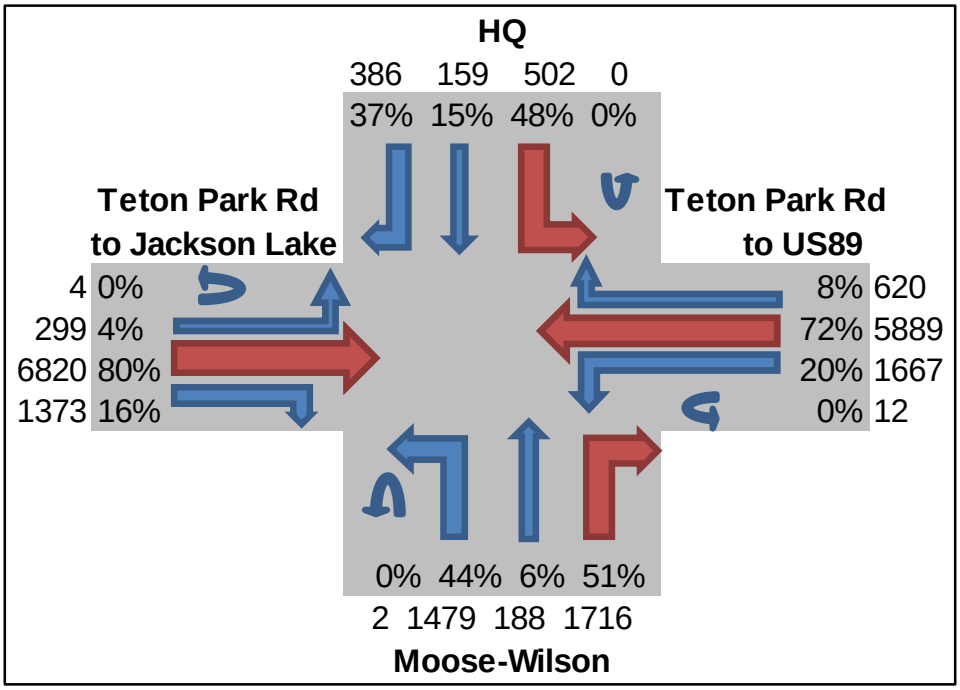


Figure 2.5: Total TMC Movement at Moose-Wilson Road and Teton Park Road for July. HQ = Park Headquarters.

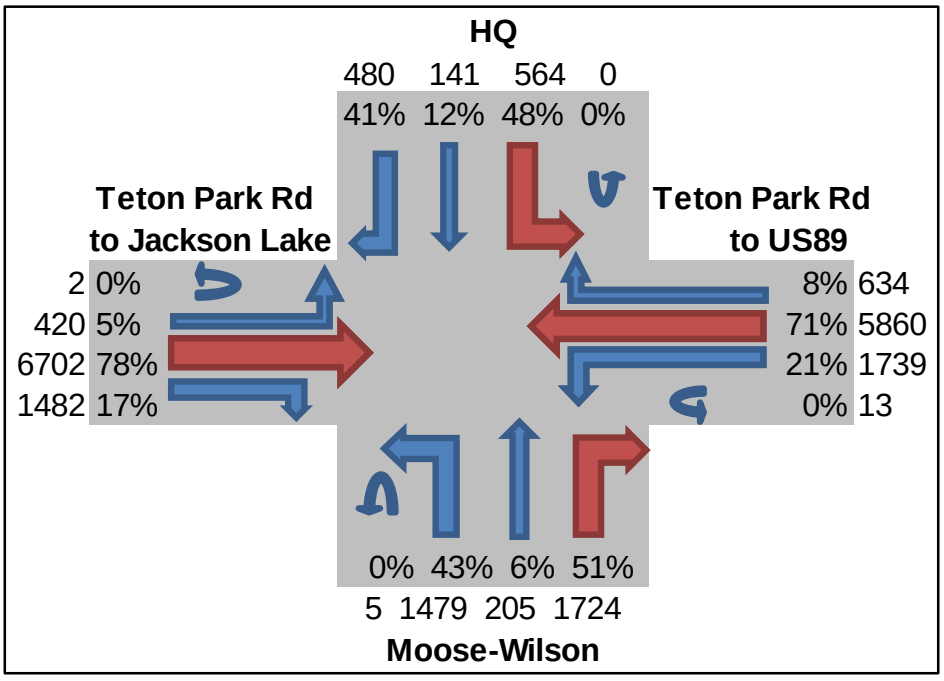


Figure 2.6: Total TMC Movement at Moose-Wilson Road and Teton Park Road for Aug 1-15. HQ = Park Headquarters.

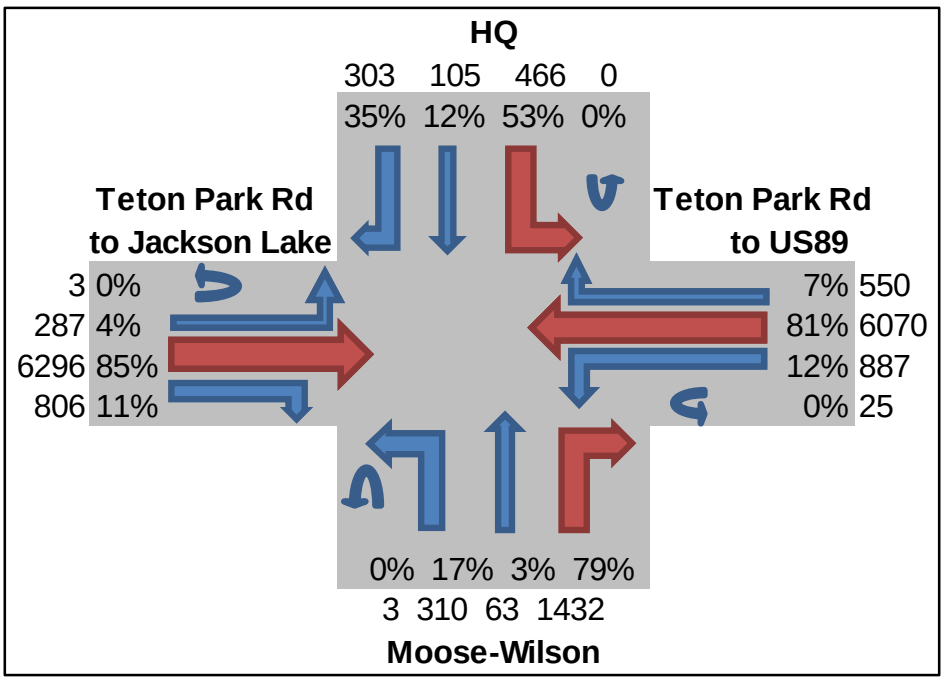


Figure 2.7: Total TMC Movement at Moose-Wilson Road and Teton Park Road for September. HQ = Park Headquarters.

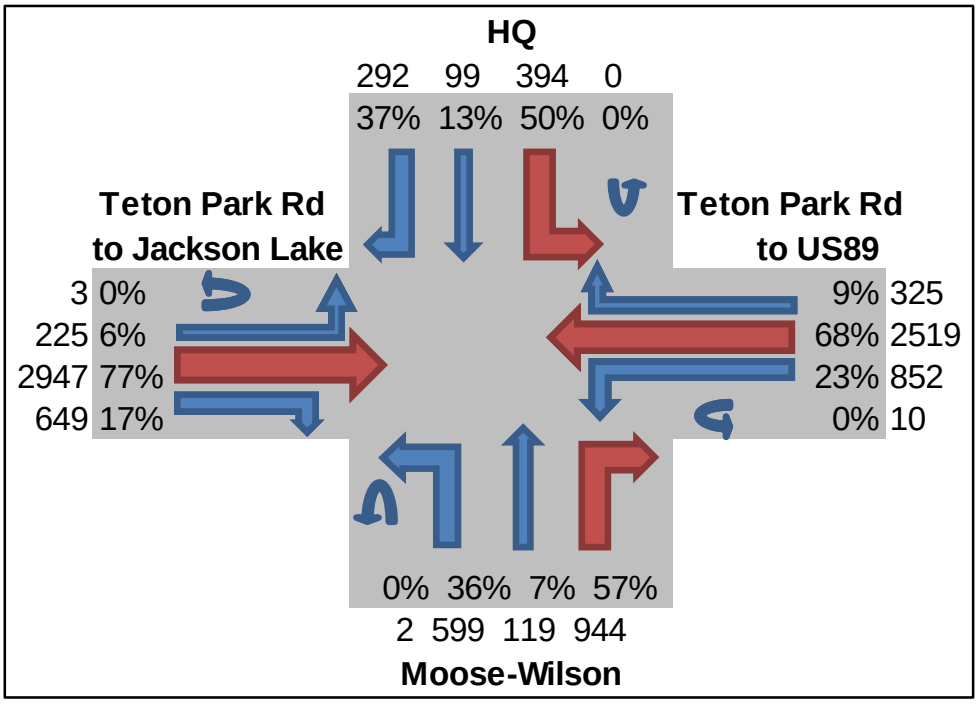


Figure 2.8: Total TMC Movement at Moose-Wilson Road and Teton Park Road for October. HQ = Park Headquarters.

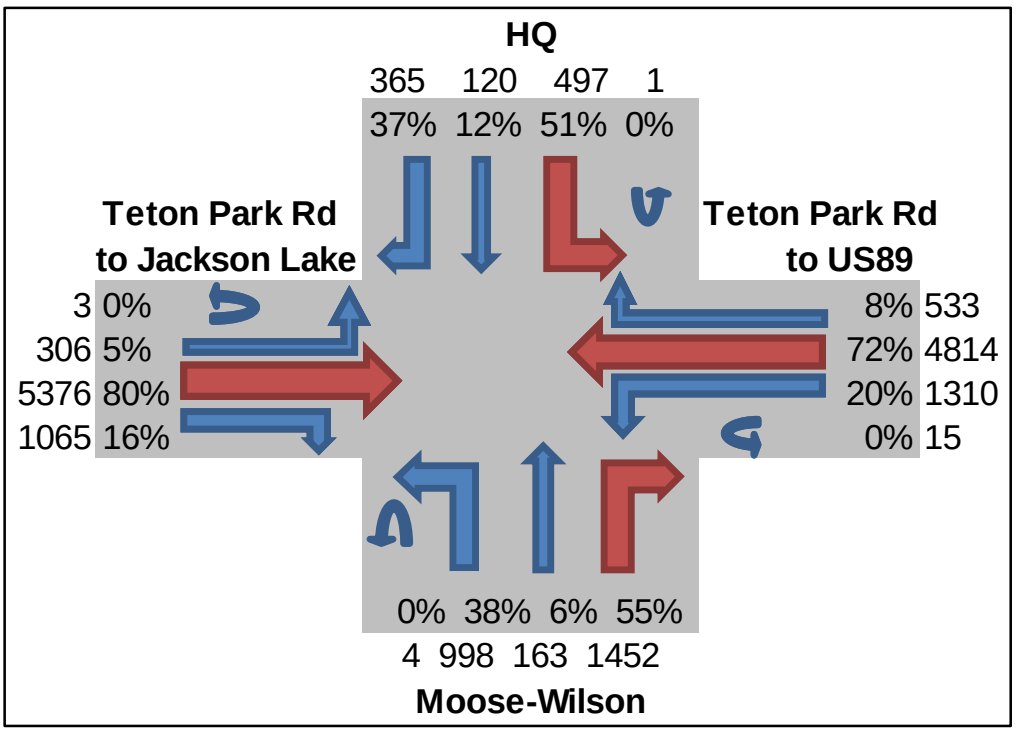


Figure 2.9: Total Average TMC Movement at Moose-Wilson Road and Teton Park Road for Study Duration. HQ = Park Headquarters.

The second TMC data presented is the intersection of Moose-Wilson Road and the LSR Preserve entrance. This intersection is a three-leg intersection with two lanes in the northbound and southbound direction and two lanes on the eastbound and westbound direction. The intersection has stop signs on the westbound approach, while the traffic remains free in the northbound and southbound direction.

Figures 2.10 through 2.17 illustrate the complete volume by designated study dates. Approximately 73% of the total movement in the intersection was through traffic on the Moose-Wilson Road. On average, 17% of the northbound traffic made a right turn into LSR Preserve, while 16% of the southbound traffic made a left turn into the LSR Preserve. Not including September, the traffic movement out of LSR Preserve showed, on average, 62% of vehicles making a right turn northbound heading towards the Teton Park Road and Moose-Wilson Road intersection while 38% of the traffic turned left southbound heading towards the Granite Canyon entrance.

During part of the September sampling period, the Moose-Wilson Road was closed north of Death Canyon Road due to grizzly bear activity in the Sawmill Ponds vicinity. As such, September TMC data from the Moose-Wilson Road and LSR Preserve entrance was an anomaly. The data from September showed 29% of vehicles making a right turn northbound heading towards the Teton Park Road and Moose-Wilson Road intersection while 71% of vehicles turned left southbound heading towards the Granite Canyon entrance.

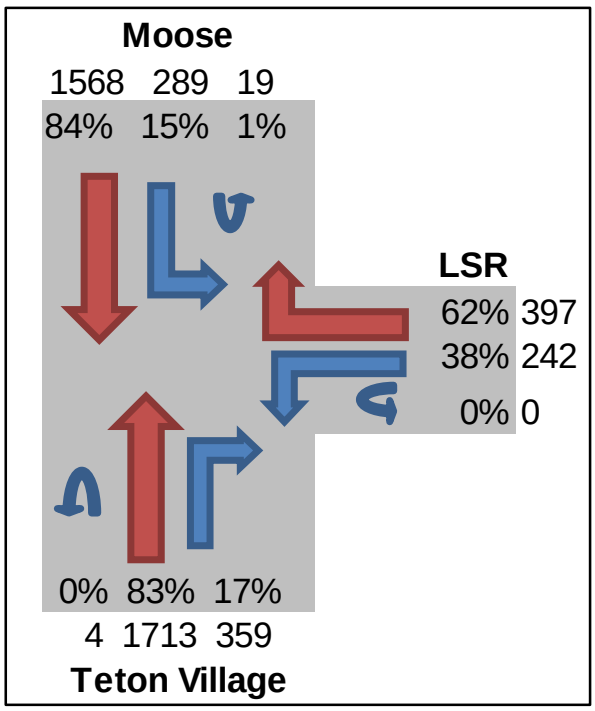


Figure 2.10: Total TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for June 1-15.

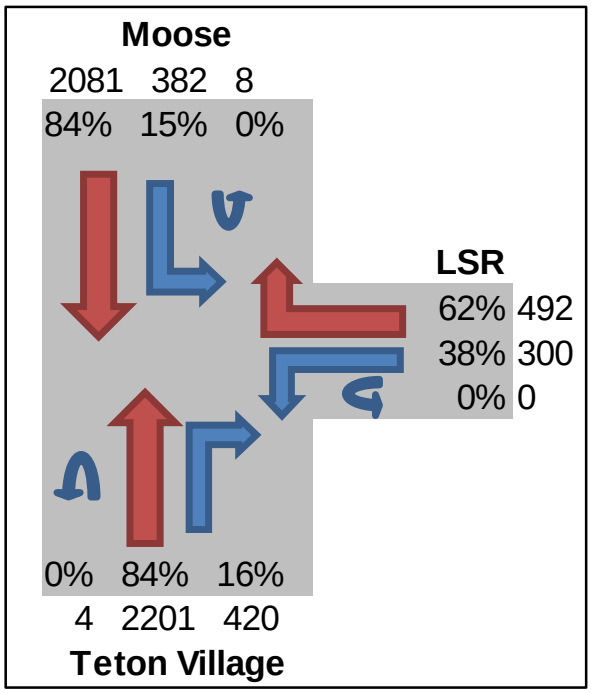


Figure 2.11: Total TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for June 16-30.

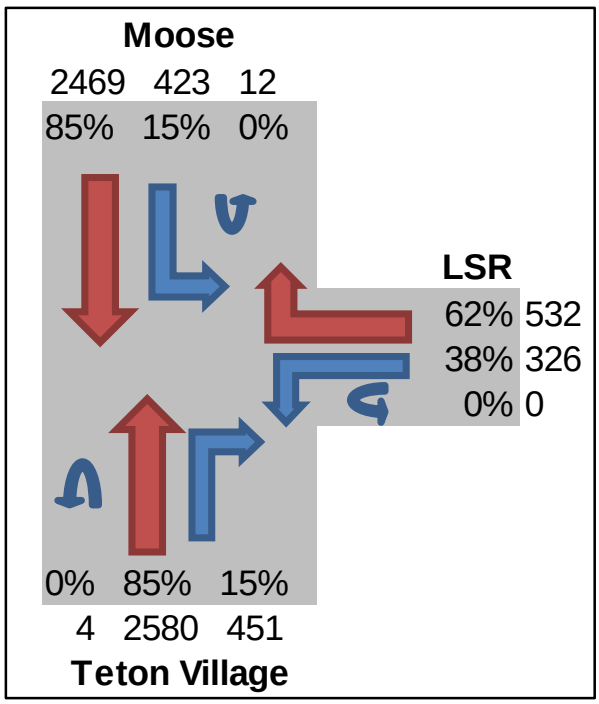


Figure 2.12: Total TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for July.

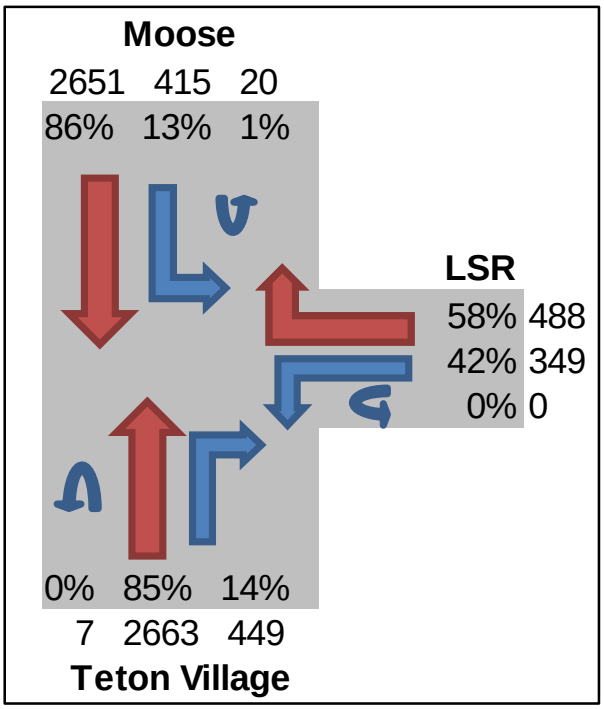


Figure 2.13: Total TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for August 1-15.

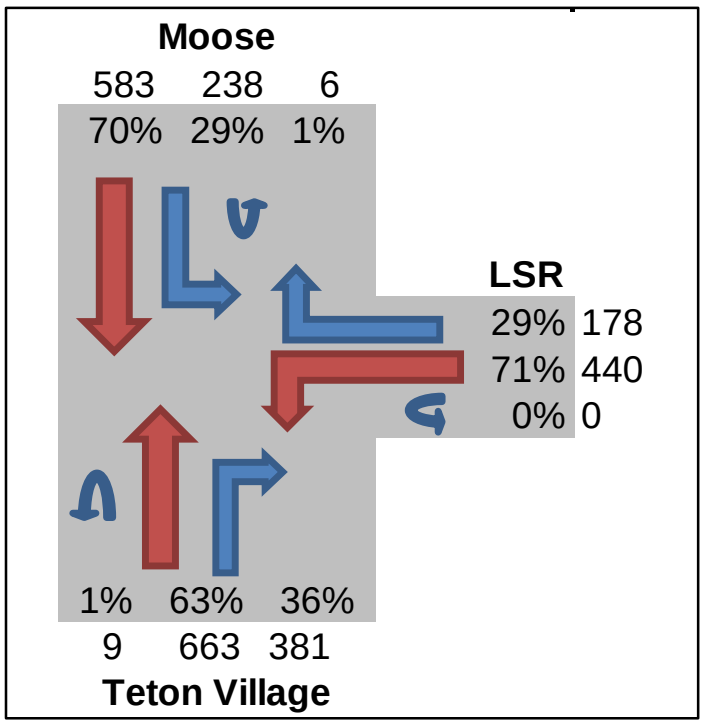


Figure 2.14: Total TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for September.

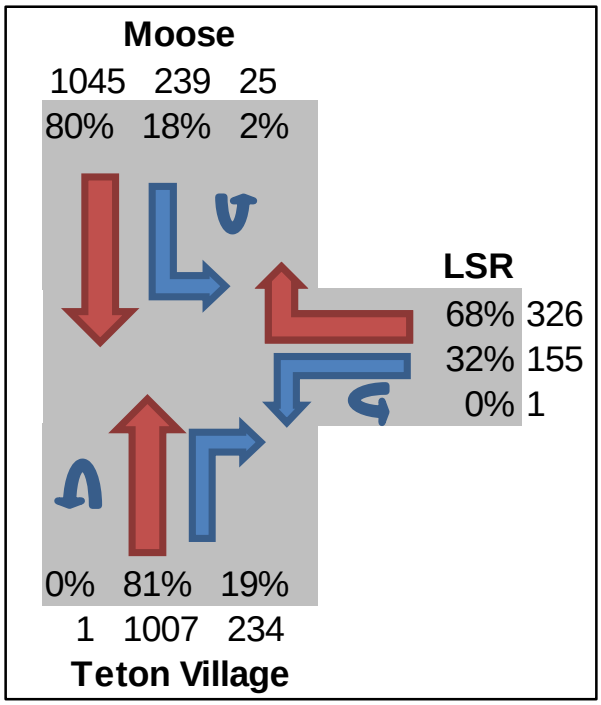


Figure 2.15: Total TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for October.

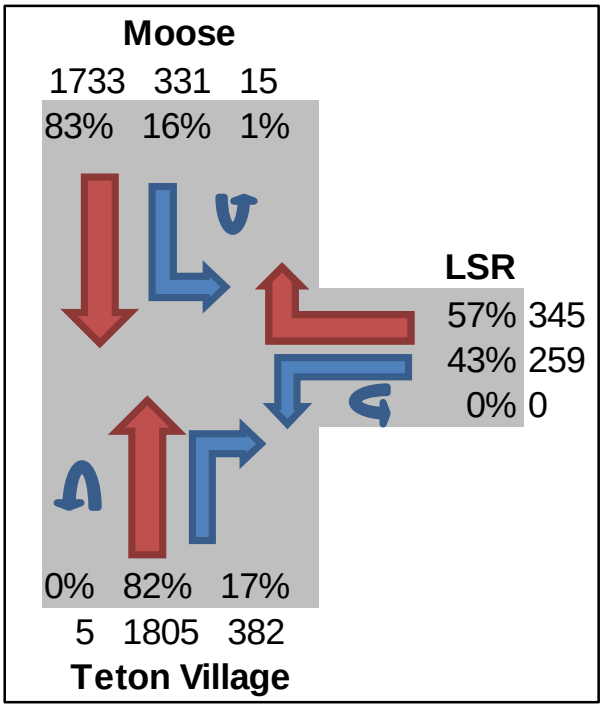


Figure 2.16: Total average TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for study duration.

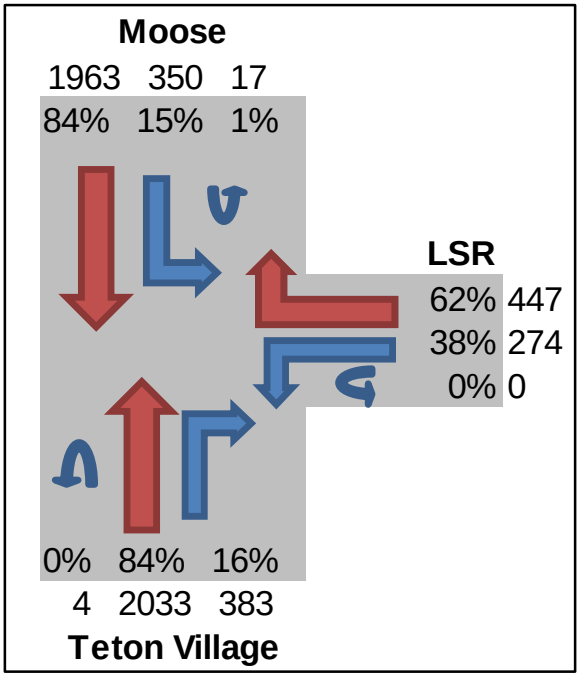


Figure 2.17: Total average TMC Movement at Moose-Wilson Road and LSR Preserve Entrance Road for study duration excluding September (road closure due to grizzly bear activity).

COMMERCIAL VEHICLE USE

Automatic license plate recognition (ALPR) was used at each end of the Moose-Wilson Road during each sampling period (Table 2.8) to summarize vehicle behavior and examine commercial use in the corridor. A list of registered taxi license plates was provided to USU by Teton County and the list was used for research purposes only. A total of 52,469 license plates were collected and, of this total number of license plates captured, 21,350 unique vehicles were captured. From this data set of 21,350 vehicles, the ALPR captured 55 instances of taxi use in the Moose-Wilson corridor across all sampling periods. The taxi data was cleaned so that only "valid" visits were summarized. A valid visit meant that no camera error occurred, and therefore the vehicle license plate was captured both when the vehicle entered and when the vehicle left the Moose-Wilson corridor. For example, camera error could lead to a vehicle being captured when it entered the Moose-Wilson corridor but not when it left the Moose-Wilson corridor. As part of the data cleaning of the ALPR data, valid visits were considered to be no longer than 12 hours or shorter than 5 minutes. The time that each taxi license plate spent in the corridor was summarized.

Overall, 29% of taxis visited the Moose-Wilson corridor twice during the ALPR data collection days. The most any one taxi license plate was captured was 6 times (Table 2.9). The overwhelming majority (81%) of taxis spent fewer than 30 minutes in the Moose-Wilson corridor (Table 2.12 and Figure 2.18). The average time spent by all captured taxis in the Moose-Wilson corridor was 1 hour and 3 minutes (+/- 2 hours and 16 minutes) (Table 2.10) with a median of 19 minutes. The mean and median for taxi use is similar to the mean and median of overall vehicle use in the Moose-Wilson corridor. The most common taxi behavior in the Moose-Wilson corridor for taxis captured by the ALPR cameras was northbound through (47%) followed by southbound through (38%) (Table 2.11).

Table 2.8: Summary of ALPR volume collection dates in the Moose-Wilson Road corridor for Summer/Fall 2014.

Sampling Period	ALPR Data Collection Days
June 1-15	14, 15, 16
June 16-30	26, 27, 28
July	10, 11, 12
August 1-15	8, 9, 10
September	6, 7, 8
October	10, 11, 12

Table 2.9: Summary of how many times an individual taxi's license plates were captured in the Moose-Wilson corridor by the ALPR cameras during all sampling days.

	Number of Visits to MW Corridor					
	1	**2**	**3**	**4**	**5**	**6**
Number of vehicles	3	7	5	4	3	2
Frequency	13%	29%	21%	17%	13%	7%

Table 2.10: Average duration of time (and standard deviation, median, and range) spent in the Moose-Wilson corridor for all taxis that were captured with the ALPR cameras.

	Average Time Spent in Corridor	**Standard Deviation**	**Median**	**Range**
All Vehicles	1 hr and 3 mins	2 hrs and 16 mins	19 mins	12 minutes – 12 hours

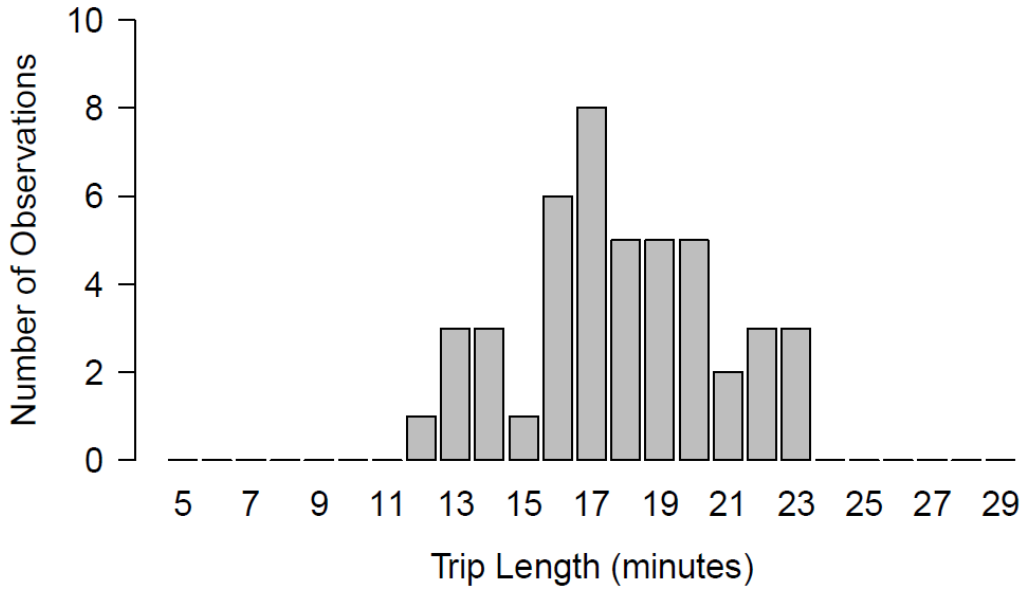


Figure 2.18: Frequency of individual visit lengths for taxi license plates captured by the ALPR for visits less than 30 minutes in time.

Table 2.11: Summary of taxi travel patterns into and out of the Moose-Wilson corridor for vehicles captured in the ALPR study with valid visits.

Vehicle Travel Pattern	Frequency
Northbound Through	47%
Southbound Through	38%
Enter and Exit North	9%
Enter and Exit South	6%

Table 2.12: Summary, counts and frequencies of the duration of time taxis spent in the Moose-Wilson corridor.

Duration of Stay	Count	Frequency
<30 minutes	43	81%
30-59 minutes	3	6%
1-3 hours	0	0%
>3 hours	7	13%

For a summary of the Summer 2013 ALPR results and the ALPR results for all vehicles in the Moose-Wilson corridor during Summer/Fall 2014, please see Appendix C.

3. VEHICLE MOVEMENT PATTERNS

GPS-TRACKING DATA COLLECTION SUMMARY

Garmin eTrex 100 units were handed out to a random sample of vehicles as they entered the Moose-Wilson Road from Moose (to the north) or at the Granite Canyon entrance fee station (Table 3.1). Visitors were instructed to keep the GPS unit in their vehicles for the duration of their trips in the Moose-Wilson corridor. Visitors returned the GPS units to researchers or to a drop box at the end of the trip in the Moose-Wilson corridor. Similar numbers of tracks were collected at each end of the road for a total of 854 collected useable tracks and a 73% acceptance rate (Table 3.1). The majority of the rejections were due to time constraints, and only 6% of all of the rejections were due to language

barriers. Erroneous points were removed from individual tracks before analysis. See Appendix D for maps of overall use patterns from the GPS-tracked vehicles and vehicle density maps.

"Local visitors" were defined as vehicles with a local (WY-22 county) license plate without a rental company sticker attached to the vehicle. Local rental car companies confirmed that they universally use a bar code sticker to identify vehicles and these vehicles are considered non-local visitors. All non-"WY-22" license-plated vehicles were considered non-local visitors. This methodology was used for all counts where local and non-locals were differentiated, including parking lot accumulation. Depending on the sampling period, between 3% and 15% of the GPS tracks collected came from individuals with WY-22 plates driving non-rental vehicles (defined as local visitors) (Figure 3.1). Non-local visitors (defined as any vehicle with any license plate *other* than a WY-22 plate or in a rental car with a WY-22 plate) made up the other 85-97% of the total vehicles sampled across the sampling periods.

Table 3.1: Total number of GPS-tracks collected from vehicles, stratified by month, for each sampling location. The response rate was 73% across all sampling periods and sampling locations.

Sampling Period	Granite Canyon Entrance	North End of Road at Moose	Total Sampled
June 1-15	70	89	159
June 16-30	75	74	149
July	130	160	290
August 1-15	55	82	137
September	14	26	40
October	32	47	79

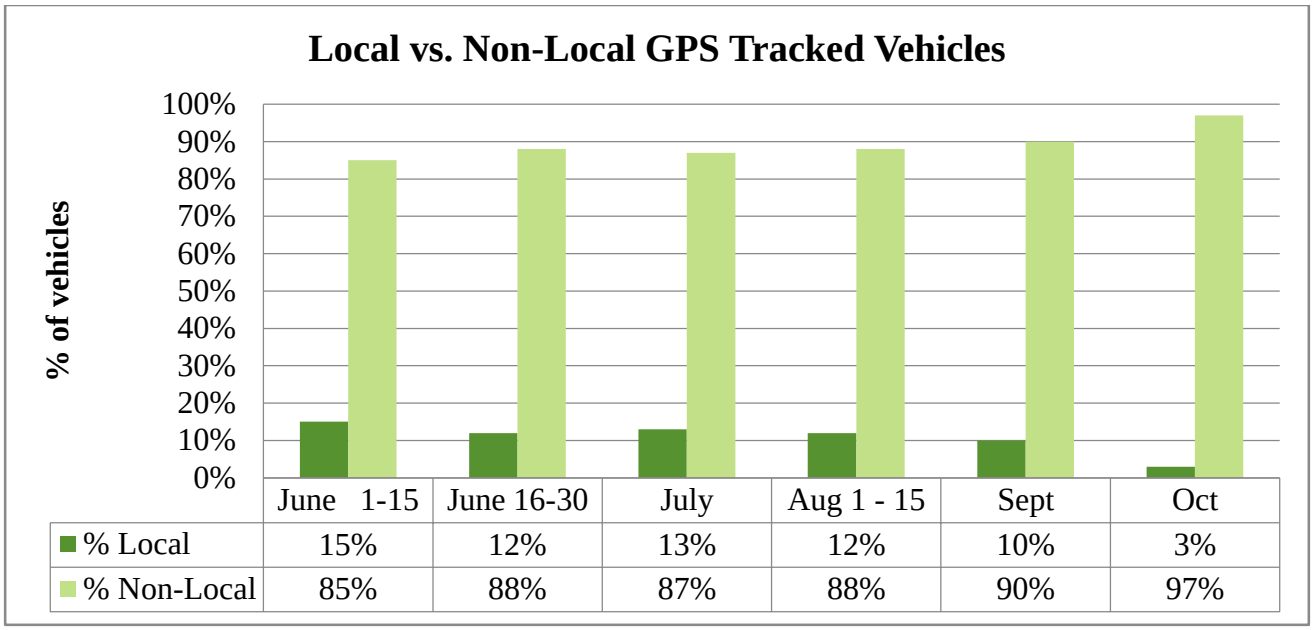


Figure 3.1: Percentage of local residents (WY-22, non-rental vehicles) and non-local (any vehicle plate other than WY-22) tracked with GPS units stratified by sampling period.

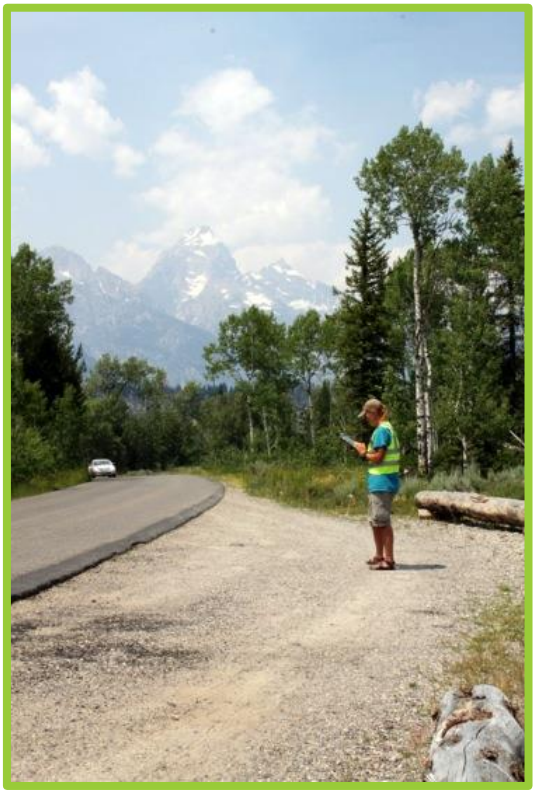
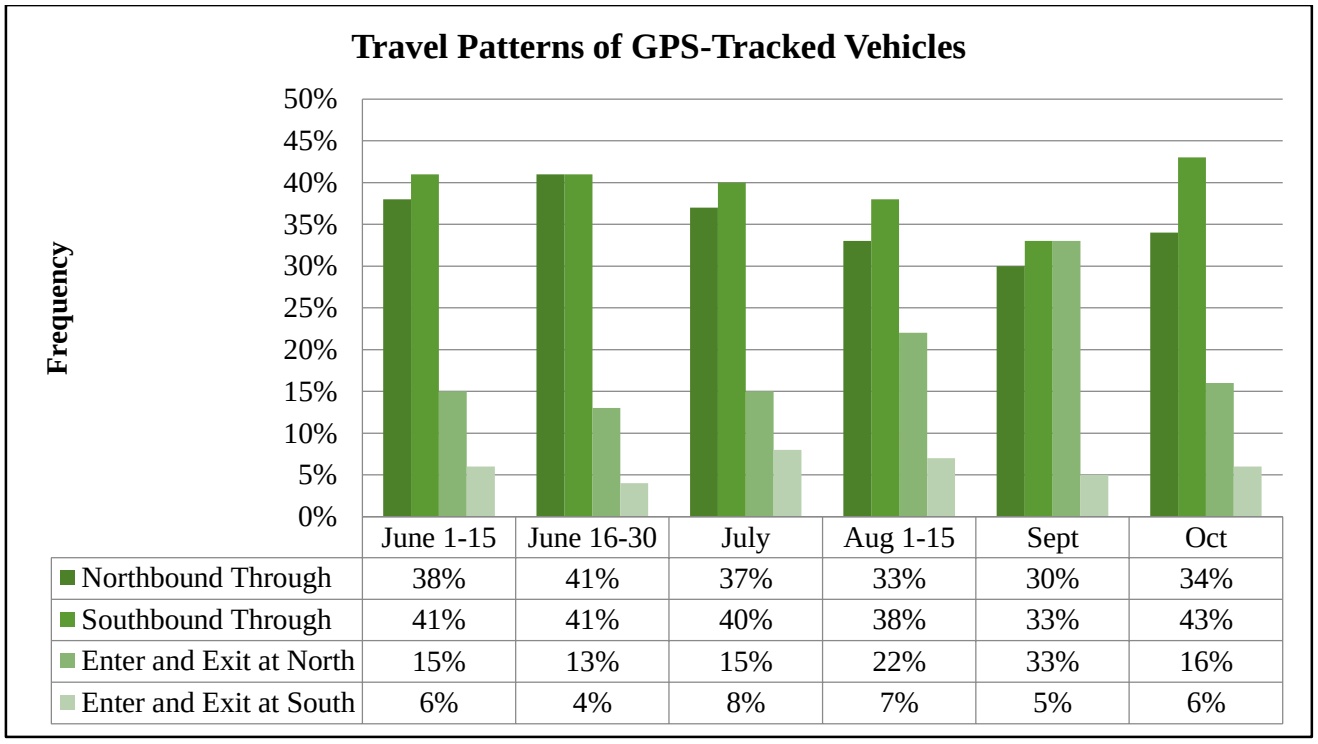


Figure 3.2: Field technician, Sara Hansen, prepared to intercept visitors for the GPS-tracking portion of the study at the Moose end of the Moose-Wilson Road (photo by Ashley D'Antonio).

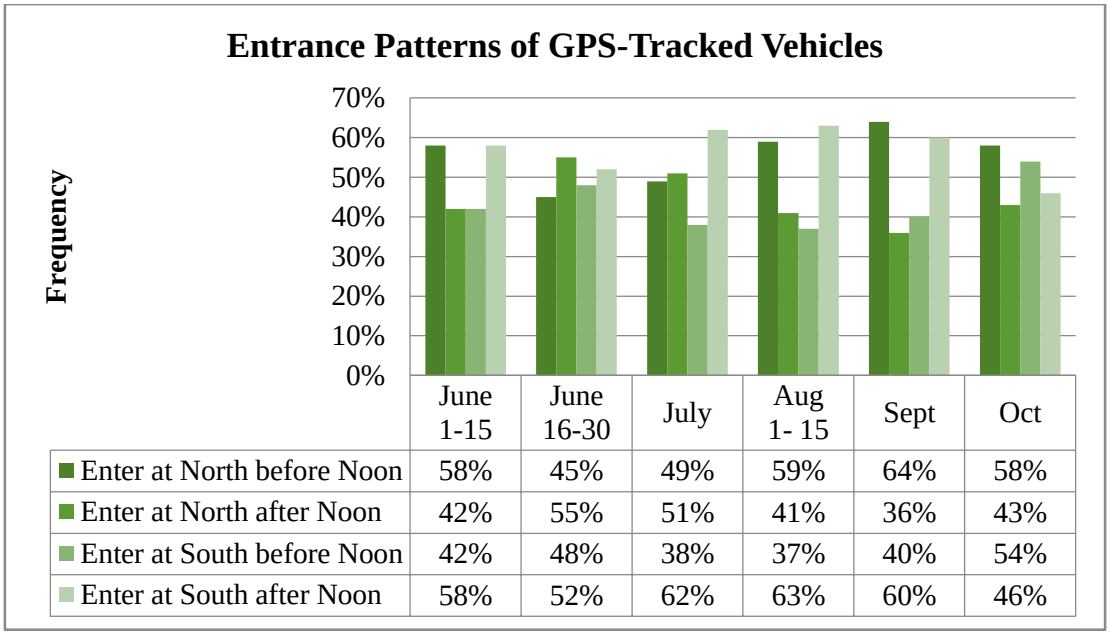
ENTRANCE AND EXIT PATTERNS OF GPS-TRACKED VEHICLES

Individual tracks were closely examined in a geographic information system (GIS) to better understand vehicle use patterns. The entrance and exit location and time of day at entrances and exits were examined for each GPS track for each vehicle and summarized (Figure 3.3). When examined individually, by track, the most common entrance and exit patterns across all sampling periods were southbound through and northbound through (Figure 3.3). Location and time of day for entrances of vehicles varied only slightly across sampling periods (Figures 3.4 and 3.5). With the exception of the second half of June sampling period, most vehicles that entered the corridor before noon entered via the north end of the Moose-Wilson Road. Across all sampling periods, vehicles that entered the corridor after noon were more likely to enter via the Granite Canyon entrance fee station (Figure 3.4). The same pattern was seen for vehicles exiting the corridor, with the majority of vehicles exiting the corridor before noon leaving via the north end of the Moose-Wilson Road and vehicles leaving the corridor after noon leaving via the Granite Canyon entrance fee station (Figure 3.5).



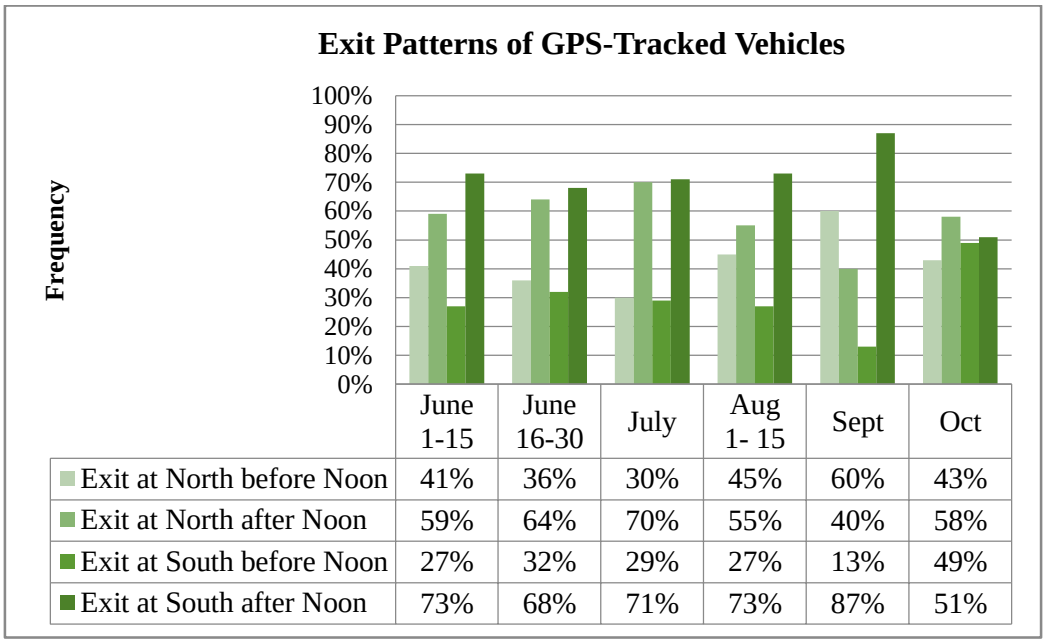
	June 1-15	June 16-30	July	Aug 1-15	Sept	Oct
Northbound Through	38%	41%	37%	33%	30%	34%
Southbound Through	41%	41%	40%	38%	33%	43%
Enter and Exit at North	15%	13%	15%	22%	33%	16%
Enter and Exit at South	6%	4%	8%	7%	5%	6%

Figure 3.3: Overall entrance and exit patterns of use for vehicles on the Moose-Wilson Road by sampling period, determined by examining the entrance and exit location of each individual track. North is the north end of the road at Moose and south is the Granite Canyon entrance.



	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
Enter at North before Noon	58%	45%	49%	59%	64%	58%
Enter at North after Noon	42%	55%	51%	41%	36%	43%
Enter at South before Noon	42%	48%	38%	37%	40%	54%
Enter at South after Noon	58%	52%	62%	63%	60%	46%

Figure 3.4: Patterns of use for vehicle entrances to the Moose-Wilson Road by time of day and sampling period, determined by examining the time stamp on GPS-tracks from vehicles and noting entrance location for that vehicle track. North is the north end of the road at Moose and south is the Granite Canyon entrance station.



	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
Exit at North before Noon	41%	36%	30%	45%	60%	43%
Exit at North after Noon	59%	64%	70%	55%	40%	58%
Exit at South before Noon	27%	32%	29%	27%	13%	49%
Exit at South after Noon	73%	68%	71%	73%	87%	51%

Figure 3.5: Patterns of use for vehicle exits off the Moose-Wilson Road by time of day and sampling period, determined by examining the time stamp on GPS-tracks from vehicles and noting exit location for that vehicle track. North is the north end of the road at Moose and south is the Granite Canyon entrance station.

VEHICLE STOPPING AND PARKING BEHAVIOR

Of the GPS-tracked vehicles, the most popular parking area across all sampling periods was Sawmill Ponds, followed by the LSR Preserve (Table 3.2 and Figure 3.6). Attended parking areas are those designated by the park, and unattended parking includes all visitor-created and overflow parking areas**.** Far more vehicles parked in the overflow or visitor-created parking areas of the Death Canyon Road rather than the Death Canyon designated parking lot. Between 8-10% of GPS-tracked vehicles stopped in the Granite Canyon parking area while 1-6% of GPS-tracked vehicles stopped in the Poker Flats horse parking area.

Vehicle tracks were examined by overall pattern of behavior while in the corridor, including individual stops and stopping at multiple locations (Table 3.3). Between 32-43% of vehicles drove straight through the corridor without stopping at any destinations. Depending on the sampling period, one-third to one-half of the vehicles tracked stopped at the Sawmill Ponds parking lot. Only 12-27% of the vehicles tracked stopped in multiple locations.

Table 3.2: Percentage of GPS-tracked vehicles that visited specific parking areas within the Moose-Wilson corridor. Vehicles could have stopped at multiple parking areas, and frequencies do not equal 100% since not all vehicles stopped while traveling the corridor. Attended parking areas are those designated by the park, and unattended parking includes all visitor-created and overflow parking areas. These percentages are based on ONLY those vehicles that stopped in the corridor. See Table 3.4 for overall frequencies of traveling behavior.

Parking Location	June 1-15	June 16-30	July	August 1-15	September	October
Sawmill Ponds	44%	53%	37%	34%	45%	51%
Death Canyon (Attended)	3%	1%	3%	4%	3%	5%
Death Canyon (Unattended)	9%	9%	9%	11%	8%	13%
LSR Preserve	28%	23%	25%	25%	20%	27%
Granite Canyon	10%	9%	9%	9%	8%	8%
Poker Flats	6%	5%	2%	2%	5%	1%

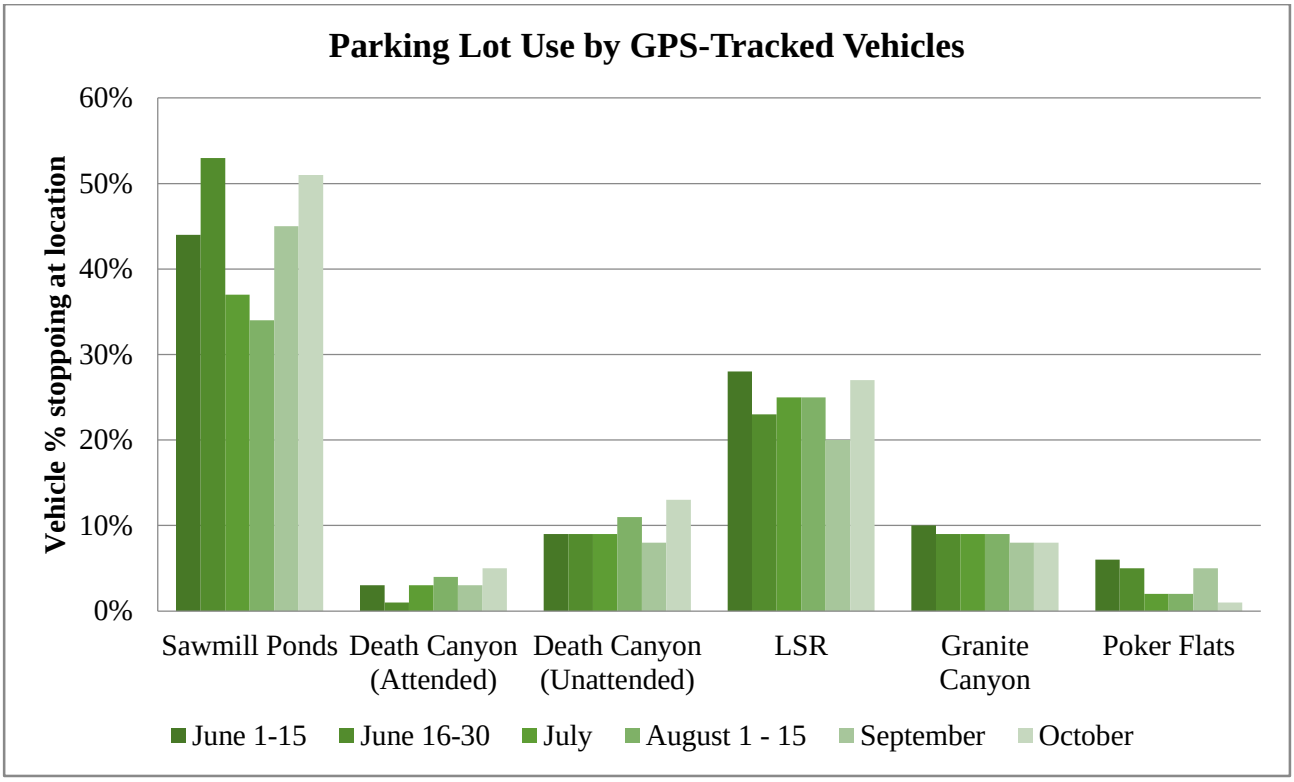
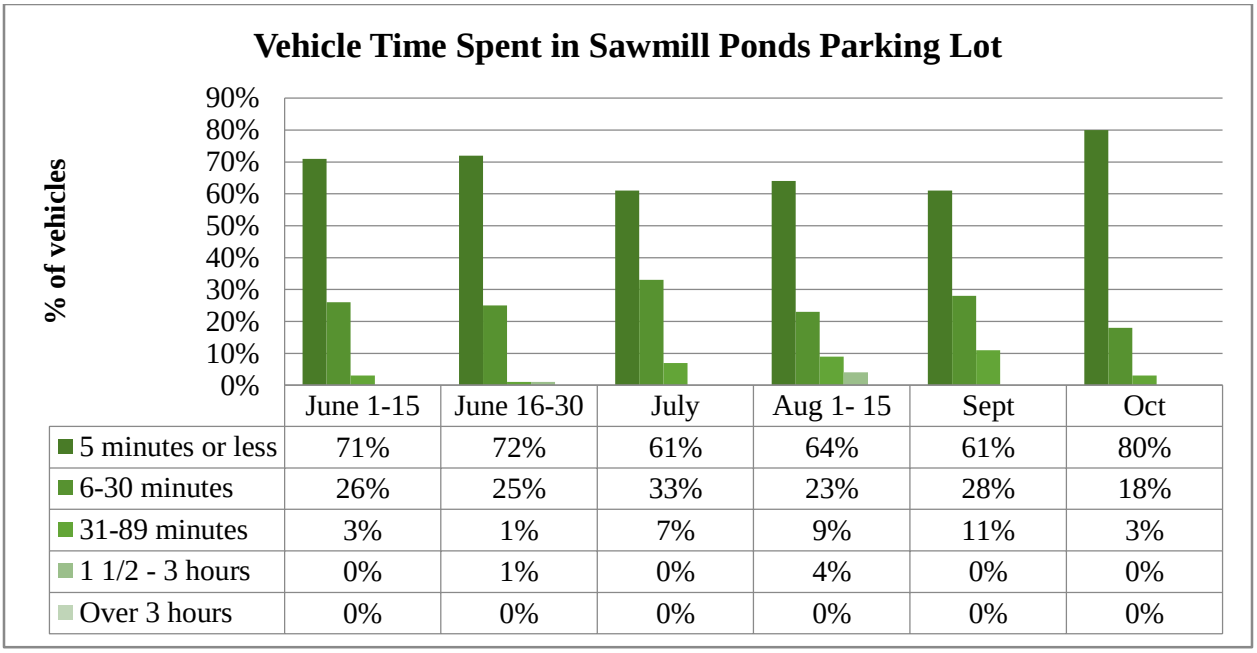


Figure 3.6: Percentage of GPS-tracked vehicles that visited specific parking areas within the Moose-Wilson corridor. Vehicles could have stopped at multiple parking areas, and frequencies do not equal 100% since not all vehicles stopped while traveling the corridor. Attended parking areas are those designated by the park, and unattended parking includes all visitor-created and overflow parking areas.

Table 3.3: Percentage of GPS-tracked vehicles that visited specific areas of interest within the Moose-Wilson corridor. Frequencies do not equal 100% since not all vehicles stopped while traveling the corridor, and some vehicles made multiple stops while within the corridor.

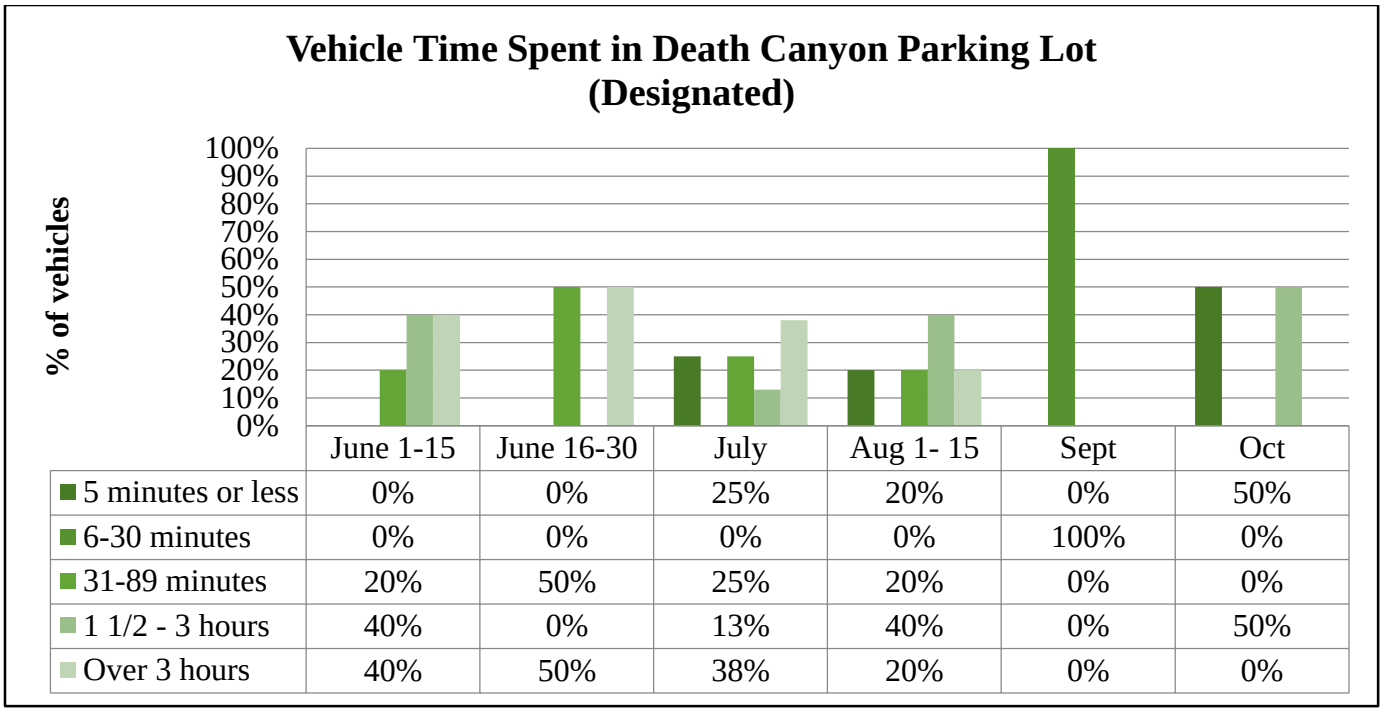
	Frequency of GPS-Tracked Vehicle Behavior					
Location	**June 1-15**	**June 16-30**	**July**	**August 1-15**	**September**	**October**
Sawmill Ponds	44%	53%	37%	34%	45%	51%
Death Canyon Trailhead	3%	1%	3%	4%	3%	5%
Death Canyon Unattended Parking	9%	8%	9%	11%	7%	13%
LSR Preserve	28%	23%	24%	25%	20%	27%
Granite Canyon	10%	8%	9%	9%	7%	8%
Poker Flats	6%	5%	2%	2%	5%	1%
Drive Straight Through	36%	33%	43%	41%	32%	32%
Stopped at Multiple Locations	27%	27%	22%	18%	12%	24%

For GPS-tracked vehicles that stopped in parking lot areas in the Moose-Wilson corridor, the total time the vehicle spent parked/stopped was calculated (Figures 3.7-3.12 and Table 3.4). The Sawmill Ponds and Poker Flat parking areas had the shortest duration of stay with most vehicles spending less than 5 minutes in these parking lots (Figures 3.7 and 3.12). The average amount of time vehicles spent in the Sawmill Ponds parking lot ranged from 5 minutes to 13 minutes across sampling periods, and on average visitors spent 1 minute in the Poker Flats parking lot (Figure 3.12 and Table 3.4). The majority of vehicles also spent less than 5 minutes in the Granite Canyon parking area; however, average duration time in the parking lot varied across sampling periods from 3 minutes to 40 minutes (Figures 3.11 and 3.13; Table 3.4). Duration of stay at the LSR Preserve parking area averaged 1 hour and 20 minutes (Figure 3.10 and Table 3.4), with most vehicles spending less than 5 minutes in the parking lot (Figure 3.13). However, use at the LSR Preserve parking area varied by sampling period. In the Death Canyon designated parking area (Table 3.4 and Figure 3.8), duration of stay averaged between 10 minutes and 3 hours. GPS-tracked vehicles spent, on average, less time stopped in unattended parking areas along the Death Canyon Road, with an overall average duration of about 1 hour. (Table 3.4 and Figure 3.9).



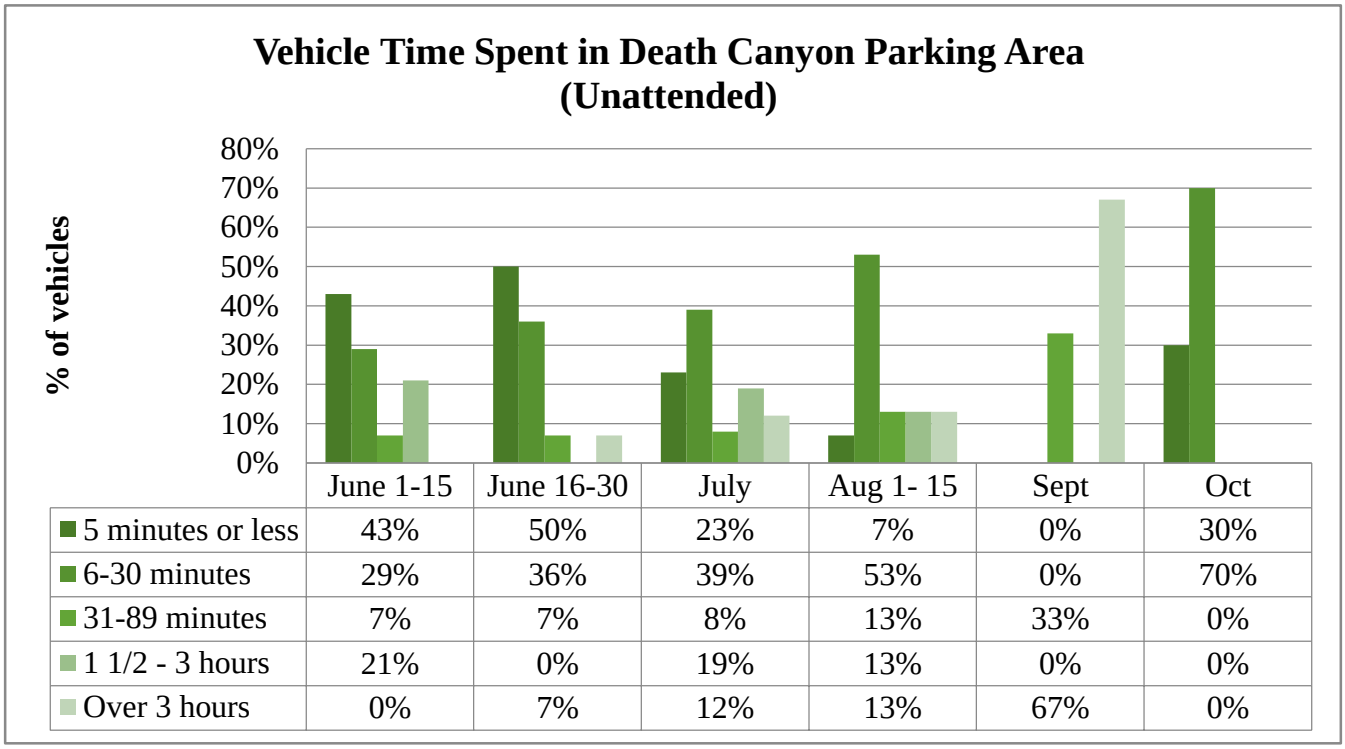
	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
5 minutes or less	71%	72%	61%	64%	61%	80%
6-30 minutes	26%	25%	33%	23%	28%	18%
31-89 minutes	3%	1%	7%	9%	11%	3%
1 1/2 - 3 hours	0%	1%	0%	4%	0%	0%
Over 3 hours	0%	0%	0%	0%	0%	0%

Figure 3.7: Frequencies of amount of time GPS-tracked vehicles spent in the Sawmill Ponds Parking Lot (N = 369).



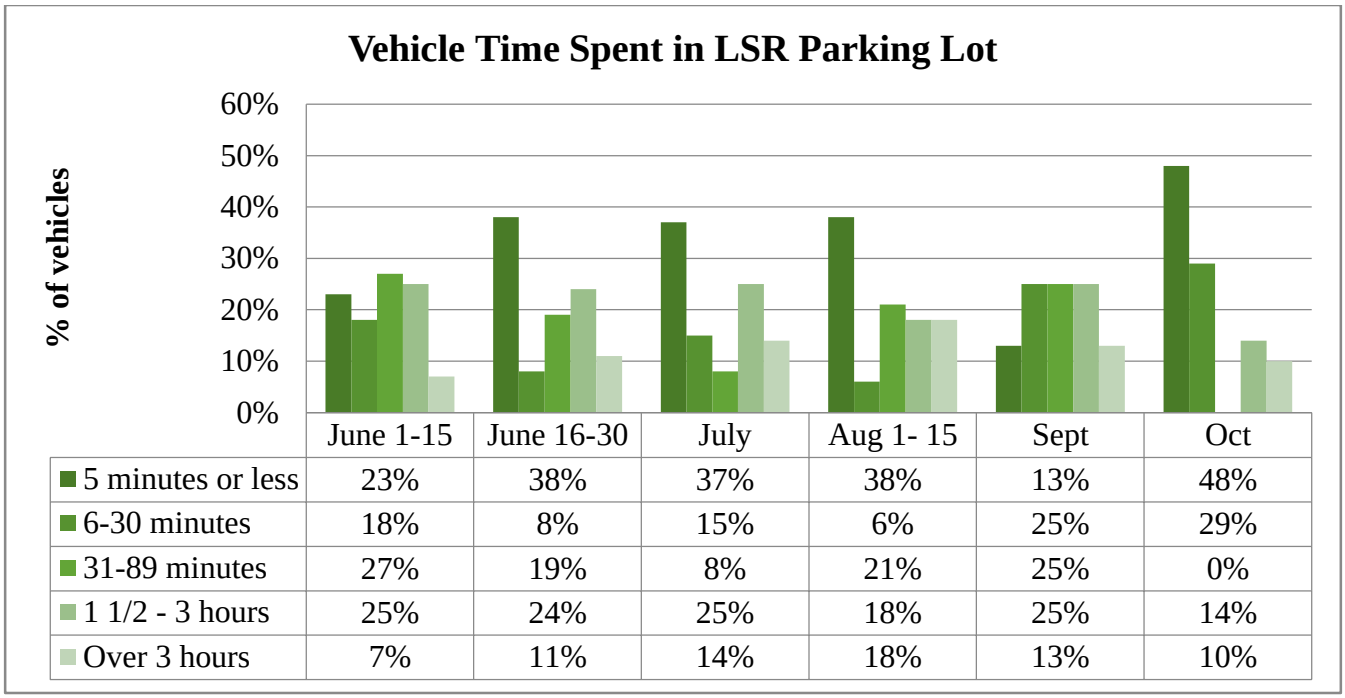
	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
5 minutes or less	0%	0%	25%	20%	0%	50%
6-30 minutes	0%	0%	0%	0%	100%	0%
31-89 minutes	20%	50%	25%	20%	0%	0%
1 1/2 - 3 hours	40%	0%	13%	40%	0%	50%
Over 3 hours	40%	50%	38%	20%	0%	0%

Figure 3.8: Frequencies of amount of time GPS-tracked vehicles spent in the designated Death Canyon Parking Lot (N = 25).



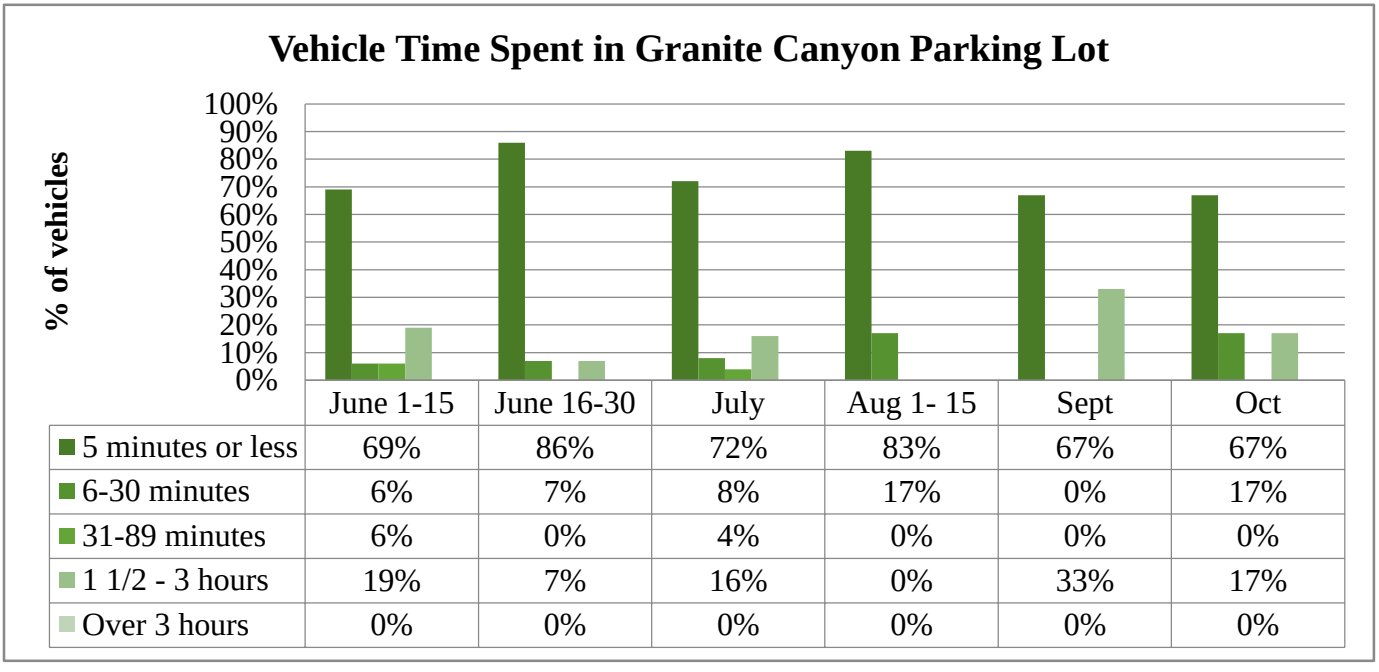
	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
5 minutes or less	43%	50%	23%	7%	0%	30%
6-30 minutes	29%	36%	39%	53%	0%	70%
31-89 minutes	7%	7%	8%	13%	33%	0%
1 1/2 - 3 hours	21%	0%	19%	13%	0%	0%
Over 3 hours	0%	7%	12%	13%	67%	0%

Figure 3.9: Frequencies of amount of time GPS-tracked vehicles spent in the unattended or visitor-created parking areas along Death Canyon Road (N = 82).



	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
5 minutes or less	23%	38%	37%	38%	13%	48%
6-30 minutes	18%	8%	15%	6%	25%	29%
31-89 minutes	27%	19%	8%	21%	25%	0%
1 1/2 - 3 hours	25%	24%	25%	18%	25%	14%
Over 3 hours	7%	11%	14%	18%	13%	10%

Figure 3.10: Frequencies of amount of time GPS-tracked vehicles spent in the LSR Preserve Parking Lot (N = 216).



	June 1-15	June 16-30	July	Aug 1- 15	Sept	Oct
5 minutes or less	69%	86%	72%	83%	67%	67%
6-30 minutes	6%	7%	8%	17%	0%	17%
31-89 minutes	6%	0%	4%	0%	0%	0%
1 1/2 - 3 hours	19%	7%	16%	0%	33%	17%
Over 3 hours	0%	0%	0%	0%	0%	0%

Figure 3.11: Frequencies of amount of time GPS-tracked vehicles spent in the Granite Canyon Trailhead Parking Lot (N = 75).

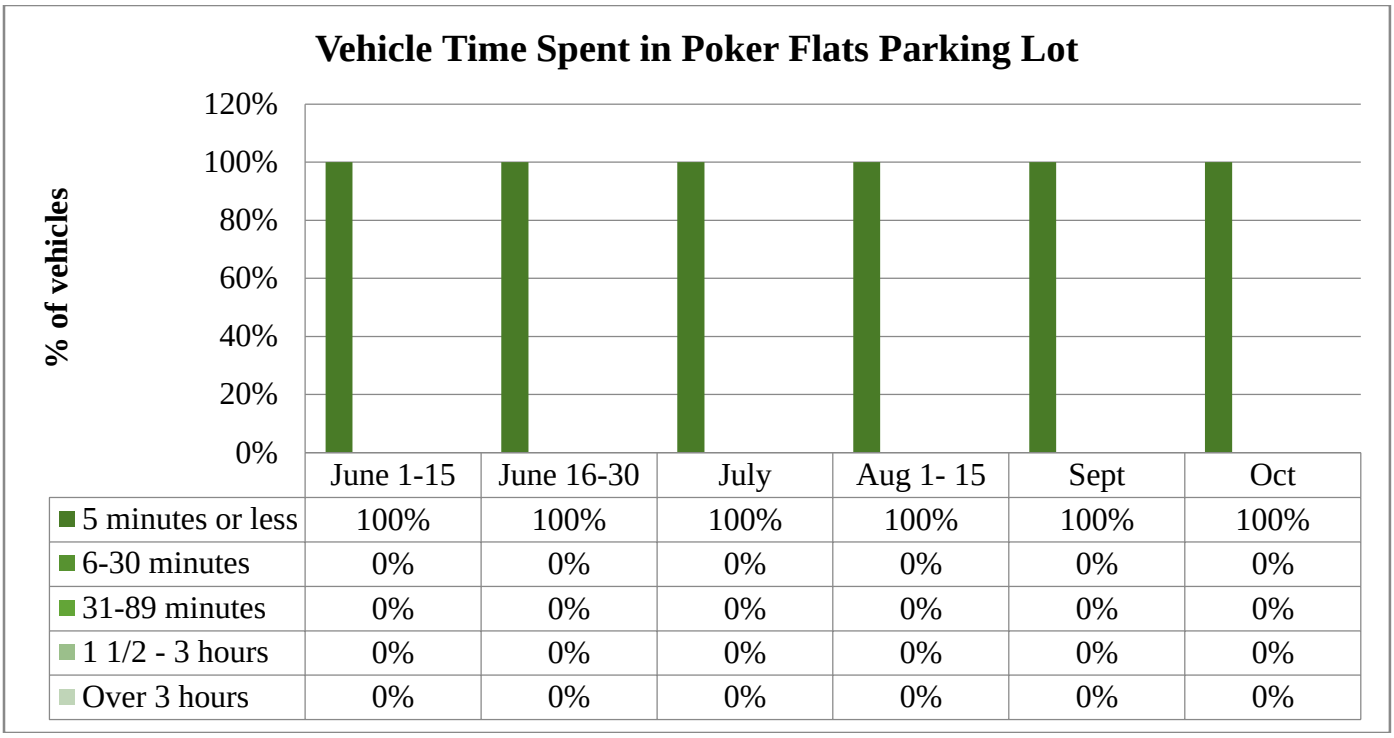


Figure 3.12: Frequencies of amount of time GPS-tracked vehicles spent in the Poker Flats Parking Lot (N = 28).

Table 3.4: Average amount of time (in minutes ± 1 standard deviation) GPS-tracked vehicles spent stopped/parked in parking lots within the Moose-Wilson corridor.

Parking Lot	June 1-15	June 16-30	July	August 1-15	September	October
Sawmill Ponds	6 (±8)	6 (±14)	8 (±13)	13 (±24)	11 (±17)	5 (±8)
Death Canyon Trailhead	187 (±102)	170 (±120)	165 (±177)	104 (±73)	8 (±0)	64 (±74)
Death Canyon Unattended	40 (±60)	32 (±71)	63 (±83)	63 (±75)	187 (±127)	10 (±8)
LSR Preserve	70 (±69)	77 (±92)	76 (±93)	74 (±86)	88 (±92)	41 (±70)
Granite Canyon	23 (±41)	14 (±39)	23 (±44)	3 (±4)	40 (±66)	21 (±44)
Poker Flats	1 (±.3)	1 (±1)	1 (±0)	2 (±1)	1 (±0)	1 (±0)

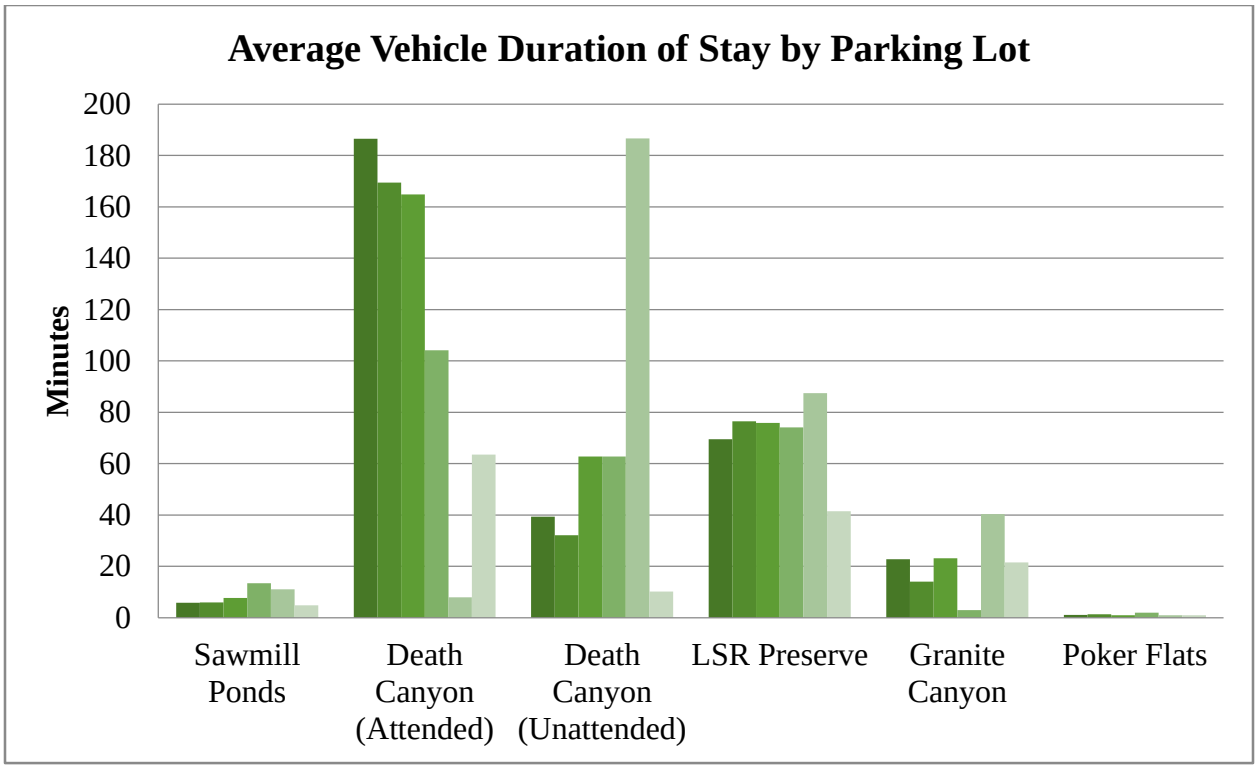


Figure 3.13: Average amount of time GPS-tracked vehicles spent stopped/parked in parking lots within the Moose-Wilson corridor. For Death Canyon, visitor-created parking areas were treated as part of the overall "parking lot."

TIME SPENT IN THE MOOSE-WILSON CORRIDOR

The total time each GPS-tracked vehicle spent in the Moose-Wilson corridor was calculated individually from the GPS track. For all sampling periods, the average time spent in the corridor was approximately 1 hour (Table 3.5). However, a wide range of variability was seen amongst tracks. The median value of time spent in the corridor ranged from 23-34 minutes (Table 3.6). Frequencies of time spent in the corridor show that, across all sampling periods, between 43-61% of the vehicles tracked spent less than 30 minutes within the Moose-Wilson corridor (Table 3.7). Of the vehicle trips less than 30 minutes, the most frequent trip time was 18 minutes (Figure 3.14).

Table 3.5: Average duration of time (± 1 standard deviation) spent in the Moose-Wilson corridor for all vehicles that were tracked with GPS units. Findings are stratified by sampling period. Overall average: 1 hour.

	June 1-15	June 16-30	July	August 1-15	September	October
All Vehicles	1 Hour, 2 Minutes (± 1 Hr, 5 Min)	49 Minutes (± 1 Hr, 3 Min)	1 Hour, 3 Minutes (± 1 Hr, 23 Min)	1 Hour, 2 Minutes (± 1 Hr, 15 Min)	1 Hour, 17 Minutes (± 1 Hr, 39 Min)	53 Minutes (± 49 Min)

Table 3.6: Median (and range) duration of time spent in the Moose-Wilson corridor for all vehicles that were tracked with GPS units. Findings are stratified by sampling period.

	June 1-15	June 16-30	July	August 1-15	September	October
All Vehicles	33 Minutes (12 mins – 6 hrs 11 mins)	25 Minutes (7 mins – 7 hrs and 29 mins)	25 Minutes (5 mins – 8 hrs and 53 mins)	23 Minutes (16 mins – 6 hrs and 11mins)	32 Minutes (17 mins – 5 hrs and 29 mins)	34 Minutes (15 mins – 4 hrs)

Table 3.7: Frequencies of duration of time in the Moose-Wilson corridor for GPS-tracked vehicles. Determined by examining the start and end time for the cleaned GPS-tracks.

Vehicle Duration of Stay	June 1-15	June 16-30	July	August 1-15	September	October
<30 minutes	46%	61%	59%	59%	43%	44%
30-59 minutes	25%	21%	16%	14%	20%	32%
1-3 hours	20%	13%	15%	18%	23%	20%
>3 hours	9%	5%	11%	9%	15%	4%

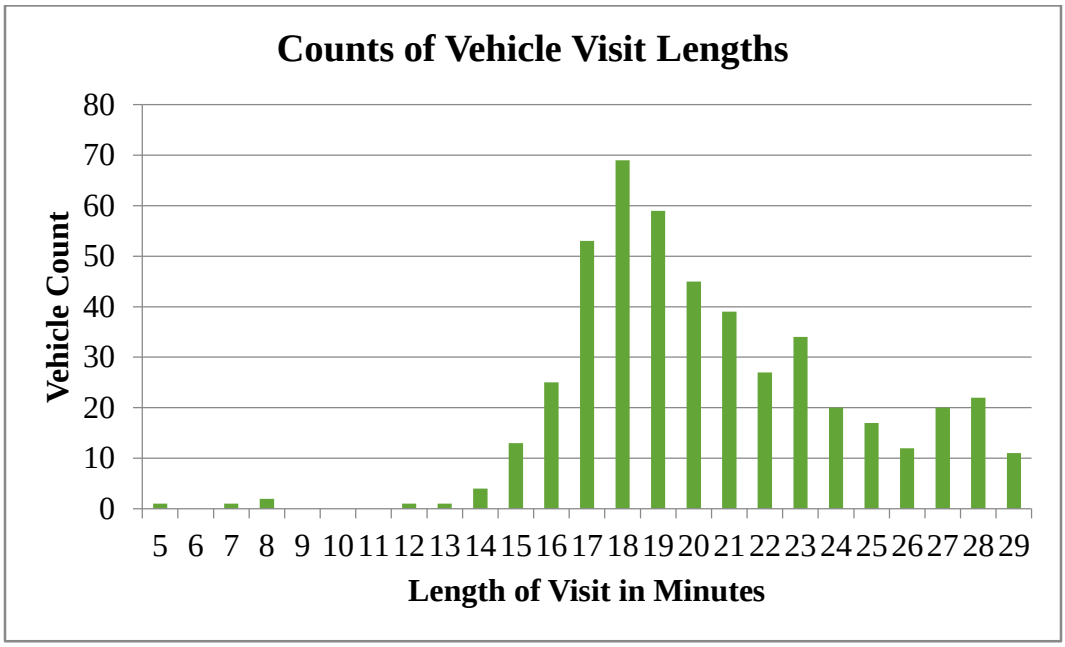


Figure 3.14: Counts of vehicle visit lengths (in minutes) that were less than 30 minutes for all GPS tracked vehicles across all sampling periods. Very short visits could result from visitors entering the Moose-Wilson corridor, turning around, and leaving the entrance they came in from.

Figure 3.15: Field technician Amy Rohman has just handed a GPS unit to a vehicle at the Granite end of the Moose-Wilson Road (photo by Ashley D'Antonio).

4. BICYCLE USE LEVELS

MOOSE-WILSON ROAD

Data collected by the TMC and the ATR studies included counts of bicycle use on the Moose-Wilson Road (Table 4.1). Results from TMC and ATR are re-summarized below to focus only on bicycle use levels on the Moose-Wilson Road. Please refer to Section 2 for more information about the TMC and ATR data collection, including specific sampling days and hours of sampling days.

The majority of bicycle users entering the Moose-Wilson Road were doing so from either the Granite Canyon entrance (503 total counts) or by bicycling through the Moose-Wilson Road and Teton Park Road intersection from park headquarters (289 total counts). It is important to note that the bike path is located on the park headquarters side of the intersection. Very few bicyclists entered the Moose-Wilson Road from Teton Park Road. More bicyclists exited the Moose-Wilson Road at the Teton Park Road intersection (161 total counts) versus heading southbound out of the Granite Canyon entrance station (117 total counts). The majority of bicyclists (605 total counts) exiting the Moose-Wilson Road did so at the Granite Canyon entrance station.

Table 4.1: Summary of bicycle use levels at the Moose-Wilson Road and Teton Park Road intersection. Data were collected using the TMC and ATR camera methodologies.

Sampling Period	MWR North-bound	MWR South-bound	Exiting Moose-Wilson Road	Entering from Park Headquarters Road	Entering Moose-Wilson Road from East	Entering Moose-Wilson Road from West
June 1-15	73	92	34	64	8	2
June 16-30	82	94	28	43	12	6
July	207	225	27	74	6	2
August 1-15	60	116	14	92	16	3
September*	31	33	9	14	3	0
October	50	45	5	2	17	10
Total	**503**	**605**	**117**	**289**	**62**	**23**

*Road closure during September due to grizzly bear activity on the Moose-Wilson Road.

BIKE PATH

A trail counter on the bike path (also known as the multi-use pathway) in Moose was used to observe visitor use levels. Both pedestrians and bicyclists and any other use group (such as roller-bladers) were captured with the trail counter. Visitor use on the bike path near the Snake River Bridge in Moose varied across sampling periods with the most total use observed in July and the lowest total use observed in October (Table 4.2). Average use per day during July was an estimated 491 visitors/day on the bike path and 50 visitors per day during October. In general, average weekend use was higher than average weekday use across all sampling periods.

Figure 4.1: Bike path heading towards Moose and the Snake River Bridge (photo by Ashley D'Antonio).

Table 4.2: Corrected visitor use levels for all user types observed on the Snake River Bridge location. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	5710[2]	190	160	259
June 1-15	5639	375	378	370
June 16-30	4479	298	273	364
July	15243	491	475	541
August 1-15	7226	483	450	571
August 16-31	4571	287	257	337
September	4645	155	152	166
October[3]	1568	50	36	91

[1]May sampling period began on the 2nd.

[2]Numbers are corrected estimates using the calibration weight value (2.76).

[3]October sampling period ended on the 31st.

5. BICYCLE USE TYPE

MOOSE-WILSON ROAD

The TMC cameras placed at the intersection of the Teton Park Road and Moose-Wilson Road and the intersection of the LSR Preserve Entrance Road and the Moose-Wilson Road also captured the turning movement of bicycles. Figures 5.1-5.9 illustrate the complete volume broken down for bicycles-only into their designated study dates. The majority of bicycles that entered the Moose-Wilson Road from the Teton Park Road intersection came from the park headquarters access road by traveling southbound; on average 77% of bicycles entering the Moose-Wilson Road came from the park headquarters access road.

The average movement for the entire TMC study for all bicycles at this intersection showed that approximately 51% of the bicycle movement in the intersection was due southbound through movements from the park headquarters access road to the Moose-Wilson Road (Figure 5.7). It is important to note that the multi-use pathway in Moose crosses the administration road. Bicycle movement from the pathway and onto the park headquarters access road could not be seen by the TMC cameras. In order to correct for this, observational data collection of bicyclist behavior at the intersection of the bike path and the park headquarters access road was conducted (see next subsection). Of the bicycles turning onto the Moose-Wilson Road from the Teton Pak Road intersection, on average 6%

entered westbound and 16% entered eastbound (Figure 5.7). On average, 59% of the bicycle traffic northbound on Moose-Wilson Road traveled “straight thru” to the park headquarters access road (and towards the pathway), 35% made a right turn towards the Craig Thomas Discovery and Visitor Center intersection, and 6% made a left turn towards the Moose entrance station (Figure 5.7).

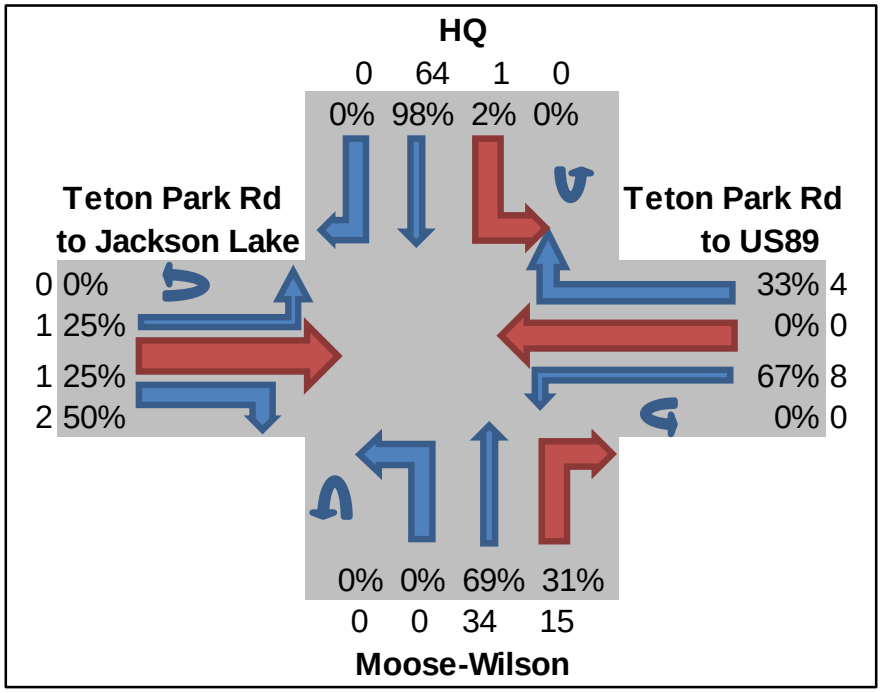


Figure 5.1: Moose-Wilson Road and Teton Park Road Bicycle Movement Volume for June 1-15. HQ = Park Headquarters.

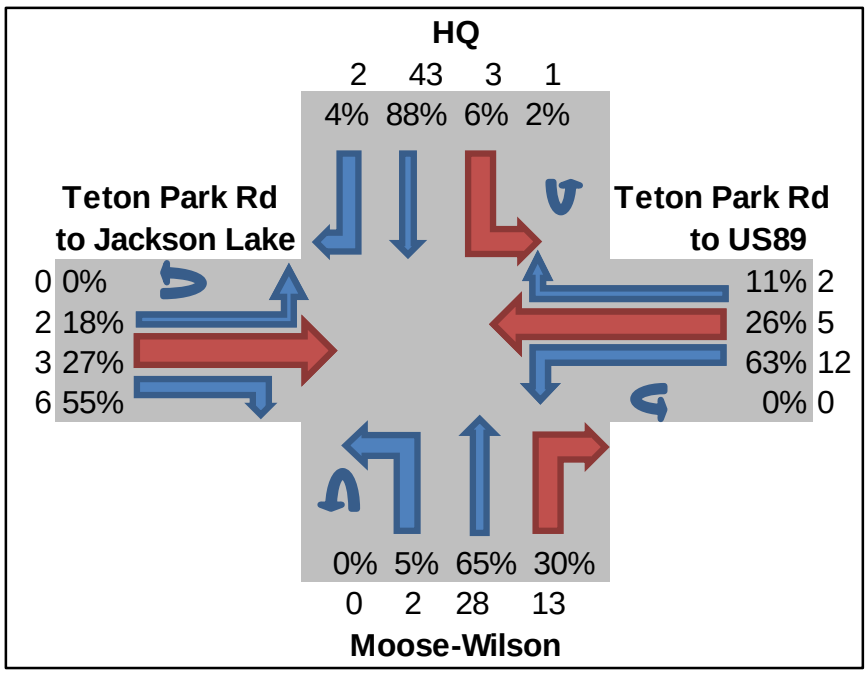


Figure 5.2: Moose-Wilson Road and Teton Park Road Bicycle Movement Volume for June 16-30. HQ = Park Headquarters.

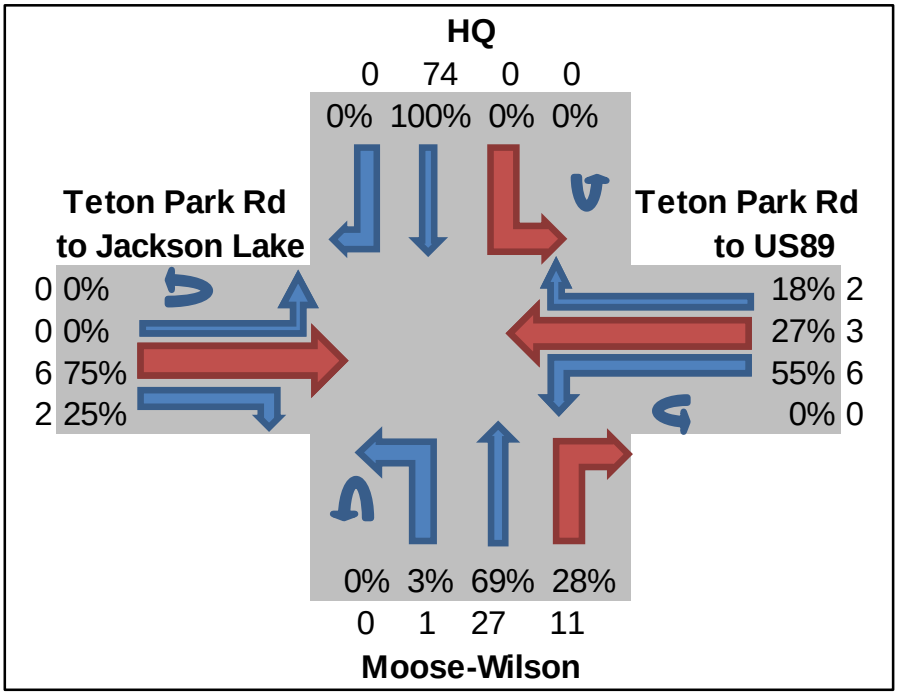


Figure 5.3: Moose-Wilson Road and Teton Park Road Bicycle Movement Volume for July. HQ = Park Headquarters.

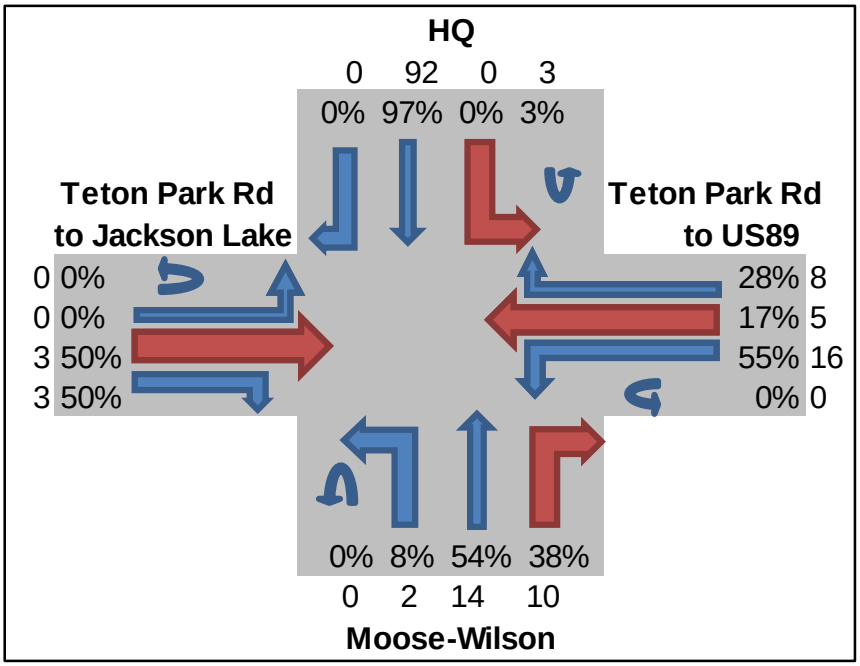


Figure 5.4: Moose-Wilson Road and Teton Park Road Bicycle Volume Movement for August 1-15. HQ = Park Headquarters.

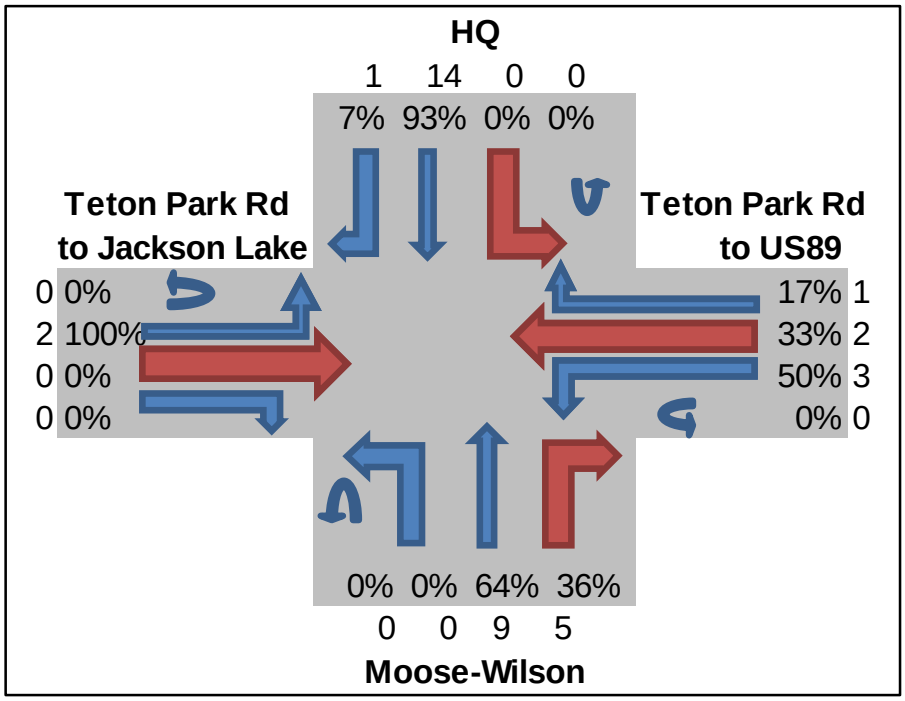


Figure 5.5. Moose-Wilson Road and Teton Park Road Bicycle Movement Volume for September. HQ = Park Headquarters.

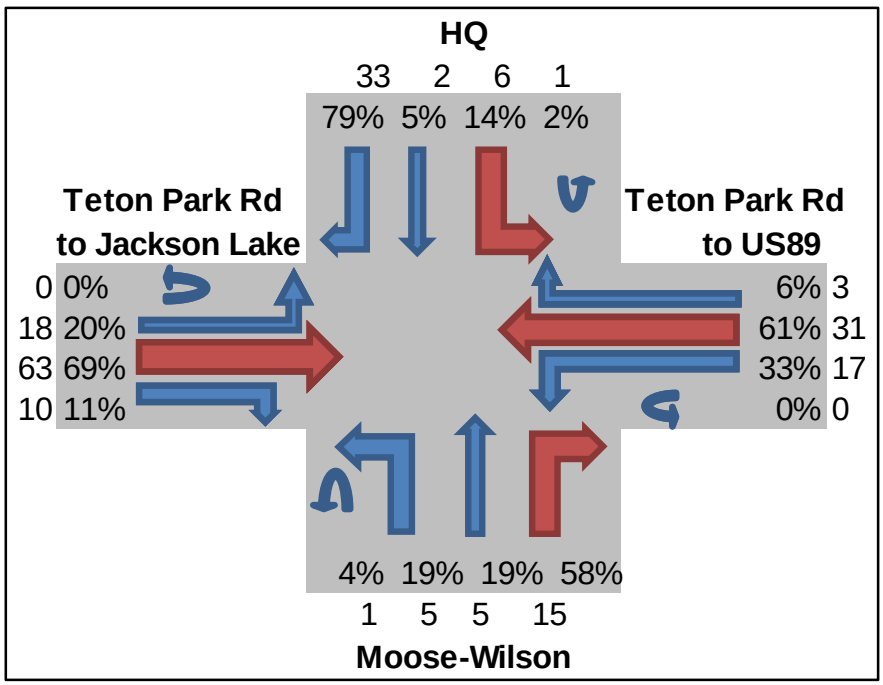


Figure 5.6. Moose-Wilson Road and Teton Park Road Bicycle Movement Volume for October. HQ = Park Headquarters.

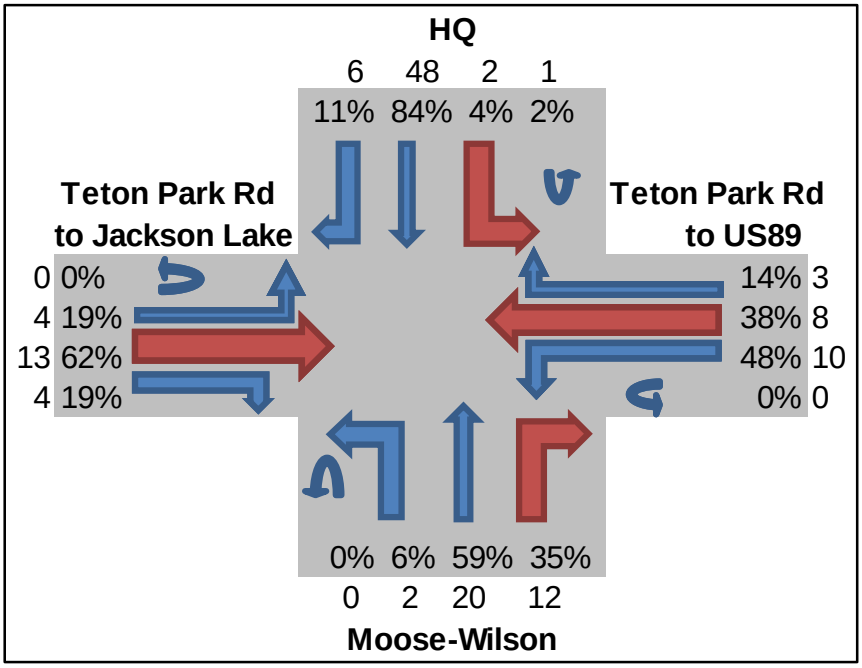


Figure 5.7. Moose-Wilson Road and Teton Park Road – Average Bicycle Movement Volume. HQ = Park Headquarters.

The second TMC data presented is the intersection of Moose-Wilson Road and the LSR Preserve Entrance Road. Figures 5.8 through 5.14 illustrate the complete volume broken down for bicycles into their designated study dates. The majority of the bicycle volume was shown to have a movement of northbound and southbound as approximately 86% of the bicycle traffic on the Moose-Wilson Road was through traffic. (Figure 5.14). On average, 7% of the northbound bicycle traffic made a right turn onto the LSR Preserve Entrance Road, while 10% of the southbound bicycle traffic made a left turn onto the LSR Preserve Entrance Road. The average bicycle traffic movement out of the LSR Preserve showed 60% making a right turn northbound heading towards the Teton Park Road and Moose-Wilson Road intersection, while 40% turned left southbound heading towards the Granite Canyon entrance. The ATR video from the Granite Canyon entrance station was manually analyzed to categorize bicycles by use type. The majority of bicyclists ending the Moose-Wilson corridor from the Granite Canyon entrance station were single bikes, and July was the busiest sampling period for bicycle use at the entrance station.

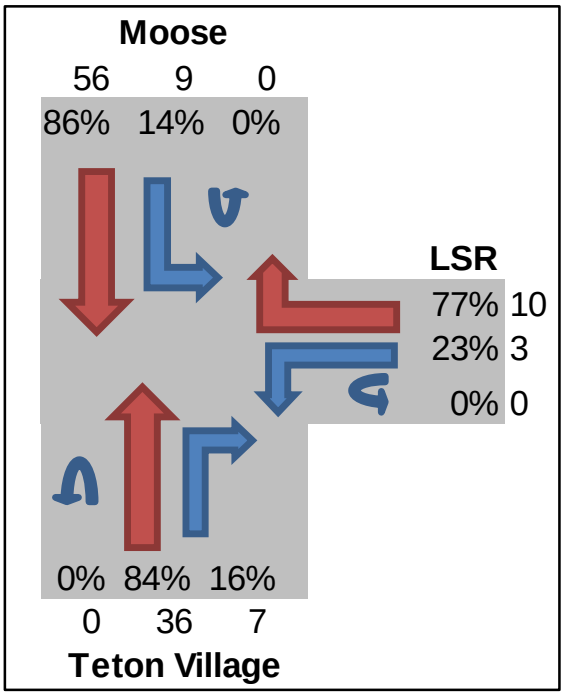


Figure 5.8. Moose-Wilson Road and LSR Preserve Entrance Road Bicycle Movement Volume June 1-15.

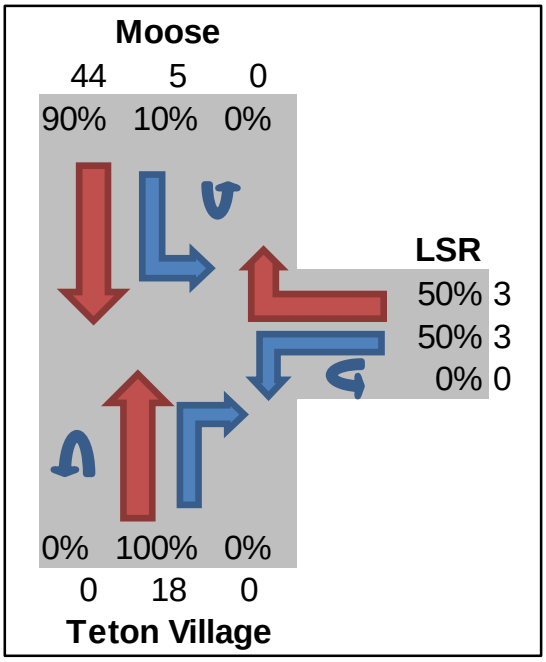


Figure 5.9. Moose-Wilson Road and LSR Preserve Entrance Road Bicycle Movement Volume June 16-30.

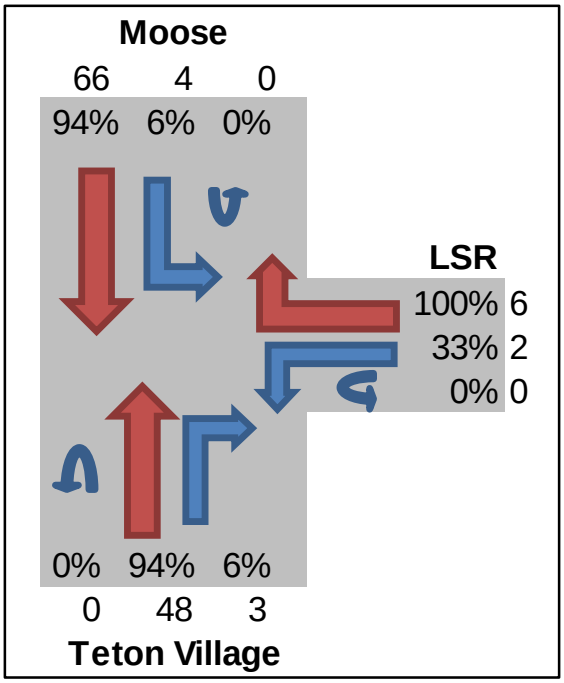


Figure 5.10. Moose-Wilson Road and LSR Preserve Entrance Road Bicycle Movement Volume for July.

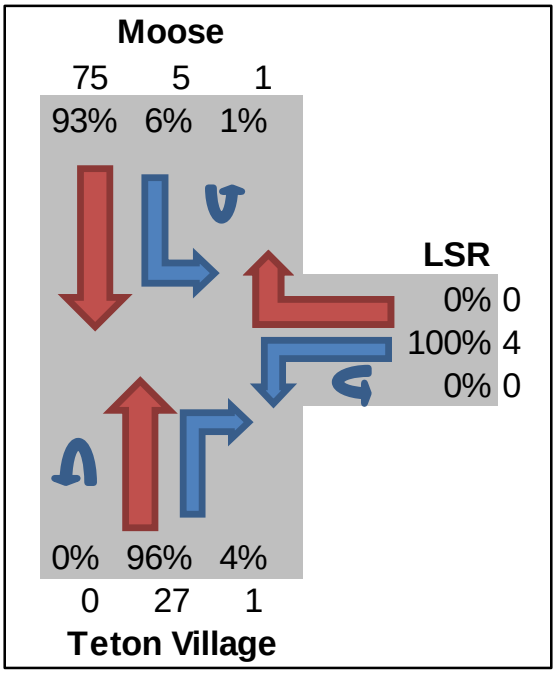


Figure 5.11. Moose-Wilson Road and LSR Preserve Entrance Road Bicycle Movement Volume for August 1-15.

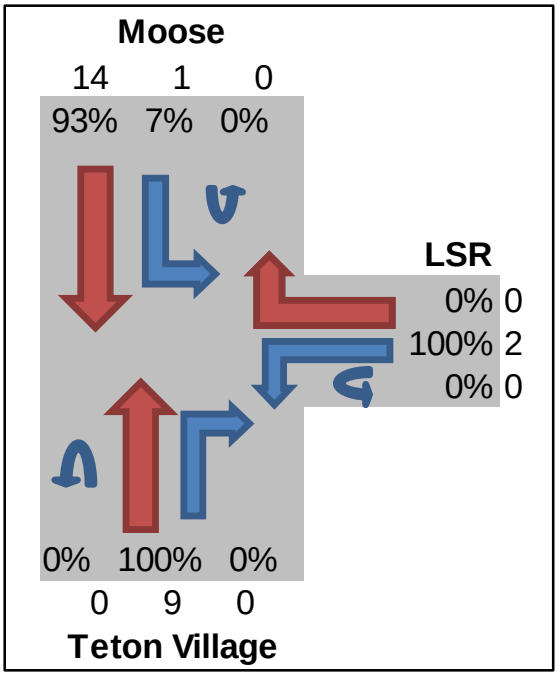


Figure 5.12. Moose-Wilson Road and LSR Preserve Entrance Road Bicycle Movement Volume for September.

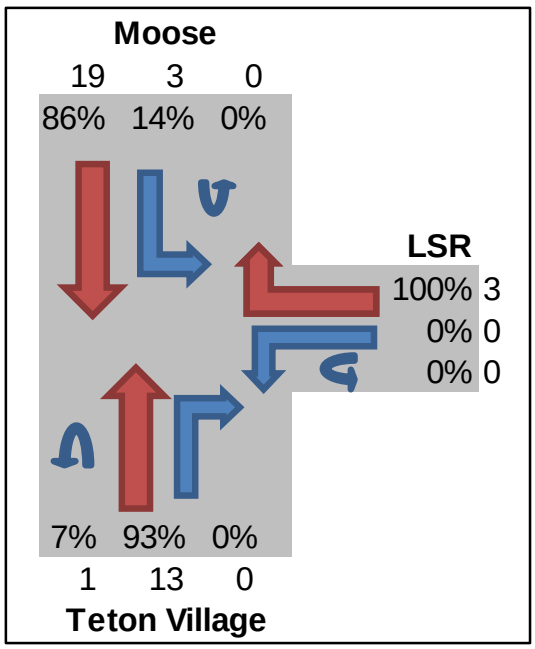


Figure 5.13. Moose-Wilson Road and LSR Preserve Entrance Road Bicycle Movement Volume for October.

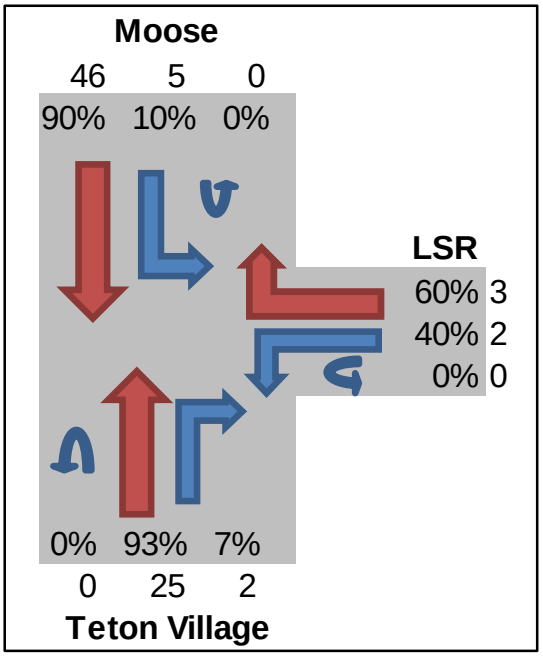


Figure 5.14. Moose-Wilson Road and LSR Preserve Entrance Road – Average Bicycle Movement Volume.

Table 5.1: Summary of ATR video from the South Fee Station at the south end of the Moose-Wilson Road. Video was manually analyzed and bicycle use type summarized.

Moose-Wilson Road	Single Bike	Bike Group of 2-3	Bike Group of 4-6	Bike Group of 7+	Bicycling Adults w/Children	Total Bike Groups Observed
June 1-15	110	23	1	0	1	135
% of total	81%	17%	1%	0%	1%	
June 16-30	116	26	0	0	2	144
% of total	81%	18%	0%	0%	1%	
July	240	67	4	0	12	323
% of total	74%	21%	1%	0%	4%	
August 1-15	81	34	5	0	2	122
% of total	66%	28%	4%	0%	2%	
September	30	10	1	1	0	42
% of total	71%	24%	2%	2%	0%	
October	55	20	0	0	0	75
% of total	73%	27%	0%	0%	0%	

BIKE PATH

Observations of bicycle behavior at the intersection of the Moose-Wilson Road, Teton Park Road, the park headquarters access road, and the bike path was conducted during summer and fall of 2014 (see Figure 5.15 for intersection diagram). The behavior of any bicyclists observed was recorded, as well as the bicycle use type. A total of 2,711 bicyclists were observed at the intersection, and the majority were single road cyclists (Table 5.3). The majority of bicyclists interacted with this intersection via the bike path (Table 5.2). Of the bicyclists that entered the area via the bike path, the majority remained on the bike path and traveled through the intersection, not interacting with the Moose-Wilson Road or Teton Park Road. Of the bicyclists exiting the Moose-Wilson Road, the majority (52%) traveled through the Teton Park Road intersection and continued onto the bike path (Table 5.3). Approximately 25% of bicyclists that exited the Moose-Wilson Road turned directly onto Teton Park Road. See Appendix E for full flow diagrams of bicycle turning behavior at the intersection by sampling period.

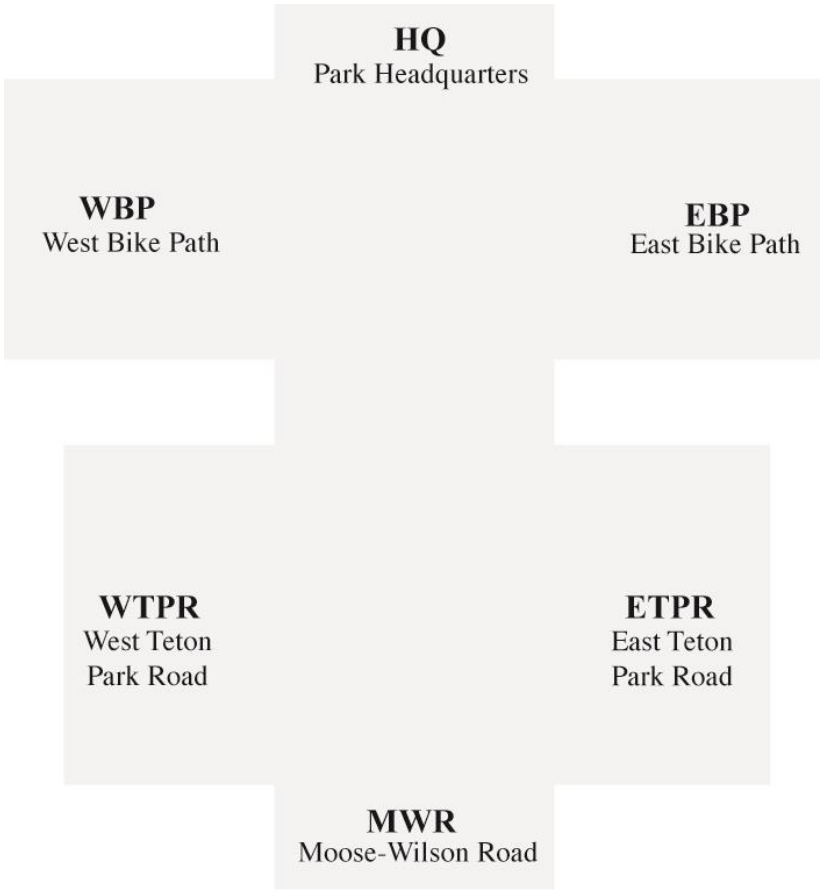


Figure 5.15: Diagram of Moose-Wilson Road and Teton Park Road, including the location of the bike path. Observations of bicyclists observed at the intersection were recorded to better understand how bike path users interacted with the Moose-Wilson Road. See Table 5.2 for summary of bicycle movements. See Appendix C for turning behavior details.

Table 5.2: Summary of bicycle observations at the Moose-Wilson Park Road, Teton Park Road, park administration access road, and the bike path. August and September observations did not take place due to unexpected circumstances during field work, including road closure due to grizzly bear activity in September. See Figure 5.14 for abbreviation descriptions. "Enter from" describes the area of the intersection used to enter and "Exit to" describes the area of the intersection the bike traveled to.

	Exit to WTPR	Exit to WBP	Exit to Admin	Exit to EBP	Exit to ETPR	Exit to MWR	
Enter from WTPR							**Total**
June 1-15	0	0	0	1	0	1	2
June 16-30	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0
Oct	0	0	1	0	0	1	2
Enter from WBP							
June 1-15	0	0	10	243	1	12	266
June 16-30	0	0	5	90	1	8	104
July	1	0	45	830	3	53	932
Oct	0	0	4	22	0	2	28
Enter from Admin							
June 1-15	0	17	0	5	1	7	30
June 16-30	0	9	0	2	1	0	12
July	0	34	0	2	0	5	41
Oct	5	3	1	8	1	0	18
Enter from EBP							
June 1-15	0	273	3	2	0	27	305
June 16-30	0	95	3	1	0	22	121
July	6	640	13	0	2	31	692
Oct	3	27	2	1	0	6	39
Enter from ETPR							
June 1-15	0	0	0	0	0	8	8
June 16-30	0	0	0	0	0	1	1
July	0	0	0	1	0	2	3
Oct	0	3	1	0	0	0	4
Enter from MWR							
June 1-15	2	6	5	13	4	0	30
June 16-30	0	3	2	5	4	0	14
July	5	17	4	10	12	1	49
Oct	1	2	4	3	0	0	10

Analysis and calibration of the data collected at the counter on the bike path near the Snake River Bridge indicated that the majority of visitors using the pathway were bicyclists (Table 5.3). Across all sampling periods, between 4-8% of bike path users were pedestrians. Pedestrian use was highest in October. Of the bicyclists using the bike path, the majority were single bicyclists or small groups of 2-3 bicyclists (Table 5.4). During June and July, approximately half of bike path users were single bicyclists. During October, 82% of bike path users were single bicyclists.

Table 5.3: Summary of observation counts for the Moose-Wilson Road/ Teton Park Road intersection. August and September observations did not take place due to unexpected circumstances during field work, including road closures due to grizzly bear activity in September.

MWR-TPR Intersection	Single Bike	Bike Group of 2-3	Bike Group of 4-6	Bike Group of 7+	Bicycling Adults w/Children	Total Groups Observed
June 1-15	231	141	19	1	6	398
% of total	58%	35%	5%	0%	2%	
June 16-30	110	43	5	2	3	163
% of total	67%	26%	3%	1%	2%	
July	521	384	57	7	17	986
% of total	53%	39%	6%	1%	2%	
October	57	17	2	0	0	76
% of total	75%	22%	3%	0%	0%	

Table 5.4: Summary of calibration techniques (observational counts) for trail counter located on the bike path in Moose to the east of the Snake River Bridge. August and September observations did not take place due to unexpected circumstances during field work, including road closures due to grizzly bear activity in September.

Snake River Bridge	Single Bike	Bike Group of 2-3	Bike Group of 4-6	Bike Group of 7+	Bicycling Adults w/Children	Single Pedestrian	Pedestrian Group 2-3	Total Bike Groups Observed	Total Ped. Groups Observed	Total Groups Observed
June 1-15	26	20	0	0	3	2	0	49	2	51
% of total	51%	39%	0%	0%	6%	4%	0%	96%	4%	
June 16-30	120	89	2	3	20	8	6	234	14	248
% of total	48%	36%	1%	1%	8%	3%	2%	94%	6%	
July	153	127	1	0	12	12	4	293	16	309
% of total	50%	41%	<1%	0%	4%	4%	1%	95%	5%	
October	42	5	0	0	0	4	0	47	4	51
% of total	82%	10%	0%	0%	0%	8%	0%	92%	8%	

GPS-TRACKING DATA COLLECTION SUMMARY

All bicyclists that entered the Moose-Wilson corridor during the vehicle GPS-tracking sampling days were approached and asked to carry a GPS unit. Of all bicyclists approached, 74% accepted a GPS unit (Table 6.1). The most common reason for rejection was that bicyclists did not have time to stop and participate in the study. A total of 42 bicycle tracks were collected during Summer/Fall 2014.

Figure 6.1: Photo of the GPS unit drop box at the Granite Canyon entrance where visitors could return the GPS units if they were unable to locate the field technicians (photo by Ashley D'Antonio).

Table 6.1: Total number of GPS tracks collected from bicyclists, stratified by month, for each sampling location. The response rate was 74% across all sampling periods and sampling locations.

Sampling Period	Granite Canyon Entrance	North End of Road at Moose	Total Sampled
June 1-15	3	0	3
June 16-30	4	5	9
July	13	8	21
August 1-15	2	5	7
September	1	0	1
October	0	1	1

ENTRANCE AND EXIT PATTERNS OF GPS-TRACKED BICYCLISTS

Individual bicycle GPS tracks were examined to determine entrance and exit locations (Table 6.2). Bicycle entrance and exit behavior varied widely across sampling periods (Table 6.2). During the June 1-15 and July sampling periods, the majority of GPS-tracked bicyclists traveled northbound through the Moose-Wilson corridor (Table 6.2). During the June 16-30 and August 1-15 sampling periods, the majority of bicyclists traveled southbound through the Moose-Wilson corridor.

Table 6.2: Frequencies of use for bicycle entrances and exits to the Moose-Wilson Road by sampling period, determined by noting entrance and exit location for each individual bicycle track. North is the Moose entrance and south is the Granite Canyon entrance.

GPS-Tracked Bicycles	June 1-15	June 16-30	July	August 1-15	September	October
Northbound Through	67%	22%	38%	14%	100%	0%
Southbound Through	0%	56%	33%	71%	0%	0%
Enter and Exit at North	0%	0%	5%	0%	0%	0%
Enter and Exit at South	33%	22%	24%	14%	0%	100%

BICYCLE STOPPING BEHAVIOR

Each individual bicycle track was examined to determine what destinations in the Moose-Wilson corridor were visited by the bicyclist (Table 6.3). During the June 16-30, July, and August 1-15 sampling periods, the majority of bicyclists rode straight through the Moose-Wilson corridor without stopping. For bicyclists that did stop, Sawmill Ponds was the most popular stopping location (Table 6.3). During the June 1-15 sampling period, 67% of the bicyclists tracked stopped at multiple locations in the Moose-Wilson corridor.

Table 6.3: Percentage of GPS-tracked bicycles that visited specific areas of interest within the Moose-Wilson corridor. Frequencies do not equal 100% since not all bicyclists stopped while traveling the corridor, and some bicycles made multiple stops while within the corridor.

Parking Lot Location	June 1-15	June 16-30	July	August 1-15	September	October
Sawmill Ponds	67%	22%	38%	14%	100%	100%
Death Canyon Trailhead Parking	33%	0%	5%	0%	0%	0%
Death Canyon Road Parking (Unattended)	33%	0%	5%	0%	0%	100%
LSR Preserve Parking	33%	11%	5%	14%	0%	0%
Granite Canyon Trailhead Parking	0%	11%	10%	0%	0%	0%
Poker Flats Horse Trailer Parking	0%	0%	0%	0%	0%	0%
Rode Straight Through	33%	67%	52%	71%	0%	0%
Stopped at Multiple Locations	67%	11%	9%	0%	0%	100%

TIME SPENT IN THE MOOSE-WILSON CORRIDOR

The total time each GPS-tracked bicycle spent in the Moose-Wilson corridor was calculated individually from the GPS track (Tables 6.4-6.6). For all sampling periods, the average time spent in the corridor was 48 minutes (Table 6.4). The median time spent in the Moose-Wilson corridor ranged from 16 minutes to 1 hour and 37 minutes (Table 6.5). Frequencies of time spent in the corridor show that, with the exception of the June 1-16 sampling period, most bicyclists spend between 30 minutes and an hour in the Moose-Wilson corridor (Table 6.6). During the June 1-15 sampling period, 67% of the bicyclists tracked spent between 1 and 3 hours in the Moose-Wilson corridor.

Table 6.4: Average duration of time (± 1 standard deviation) spent in the Moose-Wilson corridor for all bicycles that were tracked with GPS units. Findings are stratified by sampling period (overall average = 48 minutes). During September and October, only one bicyclist was sampled in each sampling period.

	June 1-15	June 16-30	July	August 1-15	September	October
All Bicycles	84 Minutes (± 32 min)	39 Minutes (± 20 min)	52 Minutes (± 55 min)	37 Minutes (± 25 min)	48 Minutes (± N/A)	16 Minutes (± N/A)

Table 6.5: Median (and range) for time spent in the Moose-Wilson corridor for all bicycles that were tracked with GPS units. Findings are stratified by sampling period. During September and October, only one bicyclist was sampled in each sampling period.

	June 1-15	June 16-30	July	August 1-15	September	October
All Bicycles	97 Minutes (47 mins – 1 hr and 48 mins)	41 Minutes (8 mins – 1 hr and 18 mins)	37 Minutes (12 mins – 3 hrs and 46 mins)	30 Minutes (15 mins – 1 hr and 31 mins)	48 Minutes (N/A)	16 Minutes (N/A)

Table 6.6: Frequencies of duration time in the Moose-Wilson corridor for GPS-tracked bicycles. Determined by examining the start and end time of GPS-tracks.

Bicycle Duration of Stay	June 1-15	June 16-30	July	August 1-15	September	October
<30 minutes	0%	33%	33%	43%	0%	100%
30-59 minutes	33%	56%	52%	43%	100%	0%
1-3 hours	67%	11%	5%	14%	0%	0%
>3 hours	0%	0%	10%	0%	0%	0%

See Appendix F for maps of overall use patterns from the GPS-tracked bicycles and bicycle density maps.

7. PEDESTRIAN USE LEVEL

CALIBRATIONS

Pedestrian counters were placed throughout the Moose-Wilson corridor trail system by GRTE staff (see Figure 2). The data from these counters were downloaded by park staff, and the raw data was provided to Utah State University for analysis and summary. During each sampling period, Utah State University calibrated each counter to determine the level of error associated with the counter. Calibration techniques involved manually counting pedestrians at each counter and comparing the manual counts to the electronic counts from the counter. A correction value was calculated for each counter, with the exception of the counter at the LSR Preserve parking lot bridge, and used to weight the total counts provided by the park. A weight value was calculated for each trail counter for each calibration period by dividing the number of visitors observed by the number recorded by the counter during the calibration periods. These weight values were then averaged for a final correction value specific to each counter. The weight value was then used to correct for any counter error by multiplying the weight value and the counter estimates. Correction values close to 1 mean the counter has low error, values below 1 mean the counter is overestimating use, and values above 1 indicate that the counter is underestimating use. Calibrations do not correct for directional travel; in other words, visitors who passed the counter twice would be counted twice. Therefore the values reported are representative of "total hits on the counter." Calibration rank values are included as a footnote on each counter table (Tables 7.2-7.11). Raw values and the calibration weight calculations can be found in Appendix G.

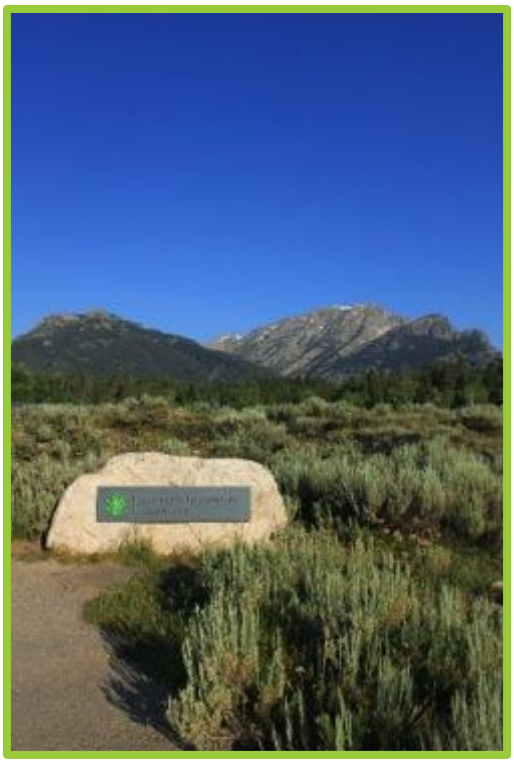


Figure 7.1: The LSR Preserve; an automatic counter was placed near the parking lot of the LSR Preserve to help estimate visitor use to this destination (photo by Ashley D'Antonio).

USE LEVELS

Tables 7.2 through 7.10 show total use, average use, and average weekend and weekday use at each counter in the study. Table 7.1 shows a ranking of counter locations by calibration corrected visitor use level. The raw values and values adjusted by the correction values (from Table 7.1) are both included in the tables. Data collection for most, but not all, counters lasted from May through early November. Data for collection periods outside of the official sampling periods were included in the tables since the data was provided to Utah State University.

The counter located at the bridge just past the LSR Preserve Center (Table 7.4) received the highest average level of use while the counter placed on the west side of Phelps Lake near Huckleberry Point (Table 7.9) received the lowest level of use. For all counters—with the exception of the Sawmill Ponds and the Granite Canyon Trailhead counters—the first sampling period in August (1^{st}-15^{th}) had the highest level of average visitors per day. For Sawmill Ponds (Table 7.2), the second half of June was the busiest month while July had the highest average use at Granite Canyon Trailhead. For most counters, September or October had the lowest average use per day. One notable exception was the counter on the old road trail near Sawmill Ponds where August 1^{st}-15^{th} had the lowest overall average use. A consistent pattern was observed between weekday and weekend use levels; weekends were generally busier than

weekdays at all counters. However, most of these differences were relatively small, indicating that in most cases visitor use levels do not vary much from weekdays to weekends. Sawmill Ponds was the only location where large differences were observed between average weekday and average weekend use.

A trail counter, calibrated by Utah State University, was placed on the trail between the Murie Ranch and the Craig Thomas Discovery and Visitor Center. August 1st-15th was the busiest sampling period for use on the trail. However, use levels were consistent across all sampling periods with an average of about 50-60 visitors passing the counter per sampling period (Table 7.11). There was not a substantial difference seen between weekday and weekend use, and whether weekend use or weekday use was greater varied by sampling period. Overall, use on the trail averaged between 18 and 58 visitors per day.

Table 7.1: Rank of counters based on *calibration corrected* visitor use levels with 1 = counter with highest use level and 9 = counter with lowest use level.

Rank	Counter Location
1	LSR Preserve Lake Creek Trail to Bridge
2	LSR Preserve Parking Lot Footbridge
3	Death Canyon Trail
4	Lake Creek Trail
5	Woodland Trail
6	Sawmill Ponds
7	Granite Canyon Trail
8	Phelps Lake East
9	Huckleberry Point

Table 7.2: Corrected visitor use levels observed on the old road trail near Sawmill Ponds. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
June 1-15	3325[1]	220	200	270
June 16-30	4655	310	350	210
July	3435	110	105	125
August 1-15	935	60	85	0
August 16-31	4350	270	280	255
September	7980	265	215	400
October[2]	5010	160	120	280

[1]Numbers are corrected estimates using the calibration weight value (5).

[2]October sampling period ended on the 31st.

Table 7.3: Corrected visitor use levels observed on the Death Canyon trail. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	1464[2]	209	200	233
June 1-15	4416	294	273	337
June 16-30	5784	386	331	536
July	17300	558	522	661
August 1-2015	9720	648	608	757
August 16-31	6363	398	319	529
September[3]	6026	201	199	206

[1] May sampling period began on the 25th.

[2] Numbers are corrected estimates using the calibration weight value (1.25).

[3] Sampling ended on September 30th.

Table 7.4: Visitor use levels observed at the LSR Preserve parking lot footbridge. This counter captures use to the LSR Preserve Center and the LSR Preserve trail system. Data was collected by a trail counter, summarized by sampling period, but not calibrated by Utah State University; as such, these values are likely underestimations of total use.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	5351	173	169	181
June 1-15	8548	570	551	608
June 16-30	11775	785	764	843
July	25784	832	833	829
August 1-15	12642	843	842	845
August 16-31	11497	719	668	803
September	13163	439	442	430

[1]May sampling period began on the 1st.

Table 7.5: Corrected visitor use levels observed at the LSR Preserve Lake Creek trail to the bridge counter. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	1985[2]	331	301	482
June 1-15	9536	636	626	654
June 16-30	12652	843	812	929
July	29028	936	915	997
August 1-15	14153	944	932	975
August 16-31	12008	751	713	812
September	12675	422	423	421
October[3]	4675	161	133	235

[1]May sampling period began on the 26th.

[2]Numbers are corrected estimates using the calibration weight value (1.32).

[3]October sampling period ended on the 29th.

Table 7.6: Corrected visitor use levels observed on the Lake Creek trail after it crossed Moose-Wilson Road. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	283[2]	47	40	83
June 1-15	1801	120	131	99
June 16-30	3858	257	275	209
July	10420	336	338	330
August 1-15	5451	363	359	376
August 16-31	5263	329	343	306
September	7317	244	260	201
October[3]	1552	78	91	45

[1]May sampling period began on the 26th.

[2]Numbers are corrected estimates using the calibration weight value (1.09; this value is based on 2013 use levels).

[3]October sampling period ended on the 20th.

Table 7.7: Corrected visitor use levels observed on the Woodland trail right after the trail crosses the Moose-Wilson Road. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	587[2]	98	92	129
June 1-15	3132	209	206	215
June 16-30	3714	248	237	278
July	10201	329	320	355
August 1-15	5188	346	335	375
August 16-31	3969	248	230	278
September	3956	132	130	136
October[3]	1460	50	39	80

[1]May sampling period began on the 26th.

[2]Numbers are corrested estimates using the calibration weight value (0.96).

[3]October sampling period ended on the 29th.

Table 7.8: Corrected visitor use levels observed on the Phelps Lake East trail. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
June 1-15	1438[1]	96	93	102
June 16-30	1462	97	92	113
July	6203	200	185	245
August 1-15	3142	209	187	270
August 16-31	1982	124	112	144
September[2]	1497	50	48	55

[1]Numbers are corrected estimates using the calibration weight value (1.10).

[2]September sampling period ended on the 30th.

Table 7.9: Corrected visitor use levels observed at the counter on the Huckleberry Point trail. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
June 1-15	1780[1]	119	117	122
June 16-30	1897	126	117	153
July	4426	143	137	159
August 1-15	2447	163	162	165
August 16-31	2074	130	115	155
September[2]	2318	77	75	83

[1]Numbers are corrected estimates using the calibration weight value (1.22).

[2]September sampling period ended on the 30th.

Table 7.10: Corrected visitor use levels observed at Granite Canyon Trailhead. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
May[1]	749[2]	107	107	106
June 1-15	2028	135	125	157
June 16-30	2761	184	183	187
July	6637	214	224	187
August 1-15	2721	181	176	196
August 16-31	1952	122	110	141
September[3]	3256	109	110	103

[1] May sampling period began on the 25th.

[2] Numbers are corrected estimates using the calibration weight value (1.21).

[3] Sampling ended on September 30th.

Table 7.11: Visitor use levels observed on the trail to Murie Ranch from the Craig Thomas Discovery and Visitor Center. Data was collected by a trail counter, summarized by sampling period, calibrated by Utah State University, and raw data was provided by the park.

Sampling Period	Total Use (# of visitors)	Overall average (visitors/day)	Weekday Average (visitors/day)	Weekend Average (visitors/day)
June 1-15	738[1]	50	46	54
June 16-30	846	56	60	44
July	1598	52	52	50
August 1-15	884	58	64	48
August 16-31	808	50	58	40
September	1438	48	52	56
October[2]	534	18	14	26

[1]Numbers are corrected estimates using the calibration weight value (2).

[2]October Sampling period ended on the 31st.

GPS-TRACKING DATA COLLECTION SUMMARY

Garmin eTrex 100 GPS units were handed out to a random sample of pedestrians planning on hiking within the Moose-Wilson corridor. GPS units were handed out at Granite Canyon Trailhead, Death Canyon Trailhead, and the LSR Preserve (just past the LSR Preserve Center) (Table 8.1). Backpackers were excluded from the study due to logistical difficulties with GPS battery life and complications with field logistics and data analysis. Upon completion of their day hike, pedestrian visitors returned the GPS units to field technicians at the trailhead or to GPS drop boxes located on each end of the Moose-Wilson Road. GPS tracks were cleaned of any obvious outliers, and calibration techniques were used to determine the level of positional error associated with the Garmin eTrex 100 units. Overall average error was determined to be 5.7 (+/- 7.4) meters. A total of 800 useable GPS tracks were collected during the summer/fall 2014 field season with an acceptance rate of 85%. The majority of rejections were due to time constraints or a desire to avoid the survey portion of the study. The greatest number of tracks were collected during July, and half of the tracks collected came from the LSR Preserve.

Table 8.1: Total number of GPS tracks collected from pedestrians (hikers), stratified by month, for each sampling location. Acceptance rate of 85% across all locations and sampling periods.

Sampling Period	Death Canyon	LSR Preserve	Granite Canyon	Total Sampled
June 1-15	48	82	28	158
June 16-30	47	71	21	139
July	98	121	44	263
August 1-15	47	67	7	121
September	24	40	3	67
October	11	38	3	52

PEDESTRIAN VISITATION BEHAVIOR

The most frequently visited location by pedestrians, across all sampling periods, was any section of the Valley Trail (almost half of all visitors tracked found themselves on the Valley Trail at some point during their hike during most sampling periods) (Table 8.2 and Figure 8.2). During all sampling periods, the Phelps Lake area (primarily the eastern shoreline) was the second most popular location for hikers to visit. Approximately half of all visitors tracked visited Phelps Lake Overlook across all sampling periods. The least visited location was Open Canyon, followed by the section of the Valley Trail which terminates at Teton Village. At most, only one visitor tracked entering Open Canyon during any of the sampling periods. The majority of visitors spent between 1 and 3 hours hiking at their destination in the Moose-Wilson corridor (Table 8.3 and Figure 8.3). The average amount of time spent hiking in the Moose-Wilson corridor by GPS-tracked pedestrians was approximately 2 hours and 30 minutes (Table 8.4). During October, on average, tracked visitors hiked for slightly less than 2 hours (Table 8.4).

Figure 8.1: Visitors at Phelps Lake Overlook, a popular hiking destination in the Moose-Wilson Corridor (photo by Ashley D'Antonio).

Table 8.2: Percentage of GPS-tracked pedestrians that visited specific areas of interest within the Moose-Wilson corridor. Frequencies do not equal 100% since pedestrians could have visited multiple locations. The "Valley Trail" destination includes any section of the Valley Trail in the corridor while the "Valley Trail (Teton Village)" destination includes just the section of the Valley Trail which terminates at Teton Village.

Destination	June 1-15	June 16-30	July	Aug 1-15	Sept	Oct
Phelps Lake Overlook	32%	32%	37%	38%	36%	19%
Phelps Lake Southern Shore Area	44%	45%	45%	55%	58%	52%
"Jump Rock" (east side of Phelps Lake)	23%	8%	17%	23%	7%	10%
Valley Trail (west of Phelps Lake Overlook)	54%	49%	58%	52%	46%	29%
Granite Canyon	17%	15%	16%	6%	4%	6%
Open Canyon	0%	0%	0.4%	0%	0%	0%
Death Canyon Trail	25%	19%	26%	31%	19%	10%
Valley Trail (Teton Village)	1%	0%	0.4%	1%	1%	0%

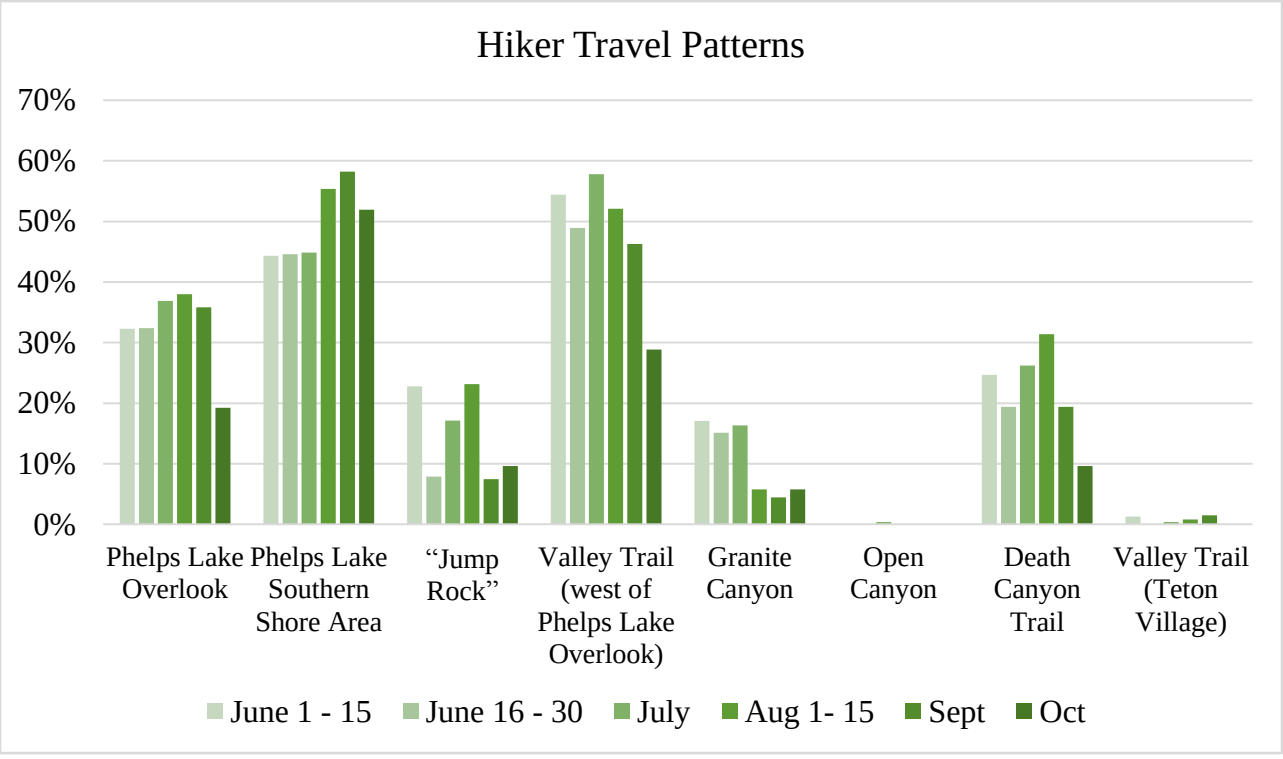


Figure 8.2: Percentage of GPS-tracked pedestrians that visited specific areas of interest within the Moose-Wilson corridor. Frequencies do not equal 100% since pedestrians could have visited multiple locations. The "Valley Trail" destination includes any section of the Valley Trail in the corridor while the "Valley Trail (Teton Village)" destination includes just the section of the Valley Trail which terminates at Teton Village..

Table 8.3: Frequency of duration of time that GPS-tracked pedestrians spent hiking in the Moose-Wilson corridor across sampling period.

Hiker Duration of Stay	June 1-15	June 16-30	July	Aug 1-15	Sept	Oct
<30 min	3%	5%	4%	1%	1%	8%
30 min-59 min	4%	7%	4%	6%	3%	10%
1-3 hours	61%	62%	60%	60%	73%	70%
>3 hours	32%	26%	32%	33%	22%	12%

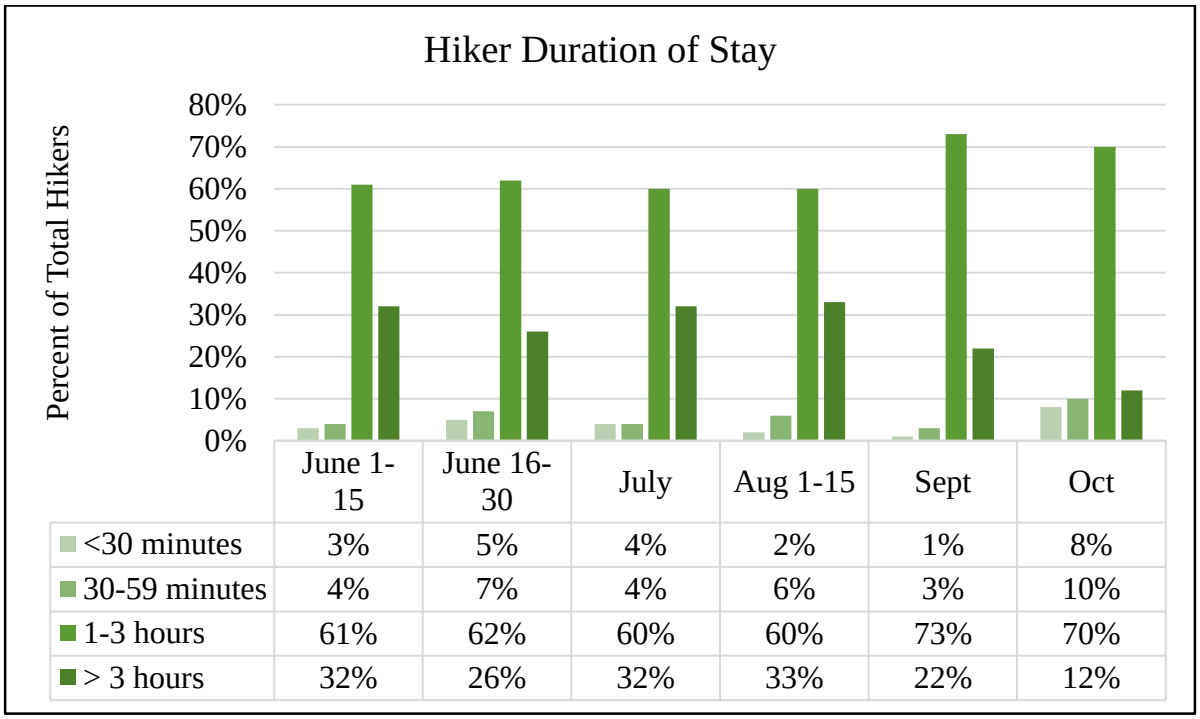


Figure 8.3: Frequency of duration of time that GPS-tracked pedestrians spent hiking in the Moose-Wilson corridor across sampling period.

Table 8.4: Average duration of stay for GPS-tracked pedestrians in the Moose-Wilson corridor.

	June 1-15	June 16-30	July	Aug 1-15	Sept	Oct
Duration of Stay	2 hrs 38 min (± 1 hr 34 min)	2 hrs 21 min (± 1 hr 37 min)	2 hrs 41 min (± 1 hr 52 min)	2 hrs 38 min (± 1 hr 33 min)	2 hrs 17 min (± 1 hr 25 min)	1 hr 56 min (± 1 hr 05 min)

See Appendix H for maps of overall patterns of GPS-tracked pedestrian use and hiker densities.

9. PARKING LOT ACCUMULATION AND OVERFLOW

Designated parking lots are parking areas that were designated, installed, and maintained by GRTE. Overflow or visitor-created parking areas are locations where visitors are parked anywhere outside of this designated area. See Figure 9.1 for map of designated parking areas. The LSR Preserve parking lot is the only parking lot in the Moose-Wilson corridor with a maximum capacity of approximately 54-55 vehicles, depending on how close vehicles are parked. The Poker Flats parking area was designed for horse trailer use and does not have a formal capacity but at times held as many as 5 horse trailers at one time. Data collection at the Poker Flats parking area did not occur in 2014. The Sawmill Ponds parking area and Granite Canyon Trailhead parking area also do not have a formal capacity but can accommodate approximately 15 to 25 vehicles. The formal parking area at the end of Death Canyon Road can accommodate approximately 30 vehicles; however, the entire length of the road is used for informal parking. These informal parking areas have an approximate capacity of between 70 and 90 vehicles. Once designated parking lots reach their formal capacity, there is potential for visitors to park in overflow or visitor-created parking areas or to be displaced to other destinations in the corridor. Parking lots were sampled on the hour, every hour, during times when GPS tracking of pedestrians occurred.

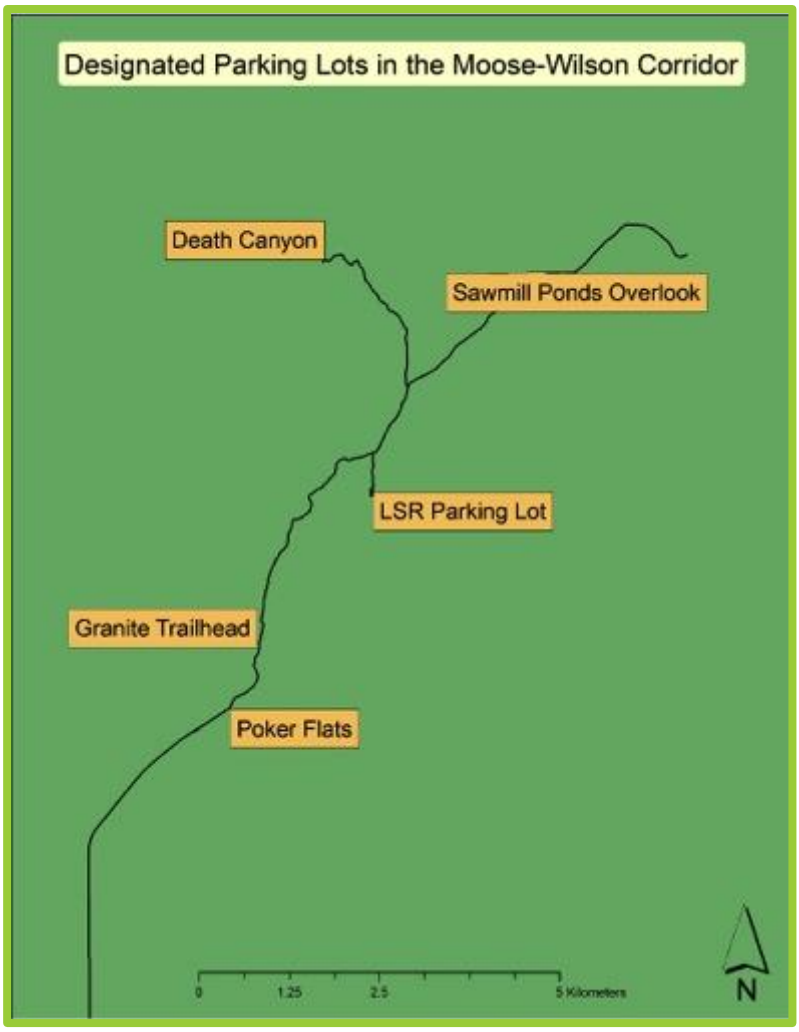


Figure 9.1: Locations of designated parking lots where data was collected for this study. Poker Flats data was only collected in 2013 and not in 2014.

TOTAL WEEKDAY AND WEEKEND AVERAGES FOR DESIGNATED PARKING LOTS

The total number of vehicles observed in each parking lot each day was stratified by weekend and weekdays and then averaged across sampling period (Tables 9.1-9.4 and Figures 9.3-9.6). With a few exceptions, especially at Sawmill Ponds, weekends were busier than weekdays (Figure 9.3). At Sawmill Ponds and Death Canyon parking lots, July was the busiest sampling period (Tables 9.1 and 9.2). For Granite Canyon and the LSR Preserve parking lots (Tables 9.3 and 9.4), the August 1st-15th sampling period was the busiest. This data can indicate levels of use at each parking lot across the study period. The designated parking lot at the LSR Preserve had the highest observed average of vehicles for both weekends and weekdays (Table 9.3). Average total use on weekdays ranged from 10-45 vehicles and on weekends ranged from 19-48 vehicles at the LSR Preserve (Figure 9.5).

Figure 9.2: Overflow parking along the Death Canyon Road on a busy weekday day (photo by Ashley D'Antonio).

Table 9.1: Average number of vehicles observed (± 1 standard deviation) in Sawmill Ponds designated parking area per day for each study period stratified by weekdays and weekends.

Sawmill Ponds	Weekdays	Weekends
June 1-15	4 (±3)	7 (±5)
June 16-30	6 (±4)	4 (±4)
July	4 (±2)	3 (±2)
Aug 1-15	4 (±3)	6 (±4)
September	N/A	N/A
October	2.8 (±2)	N/A

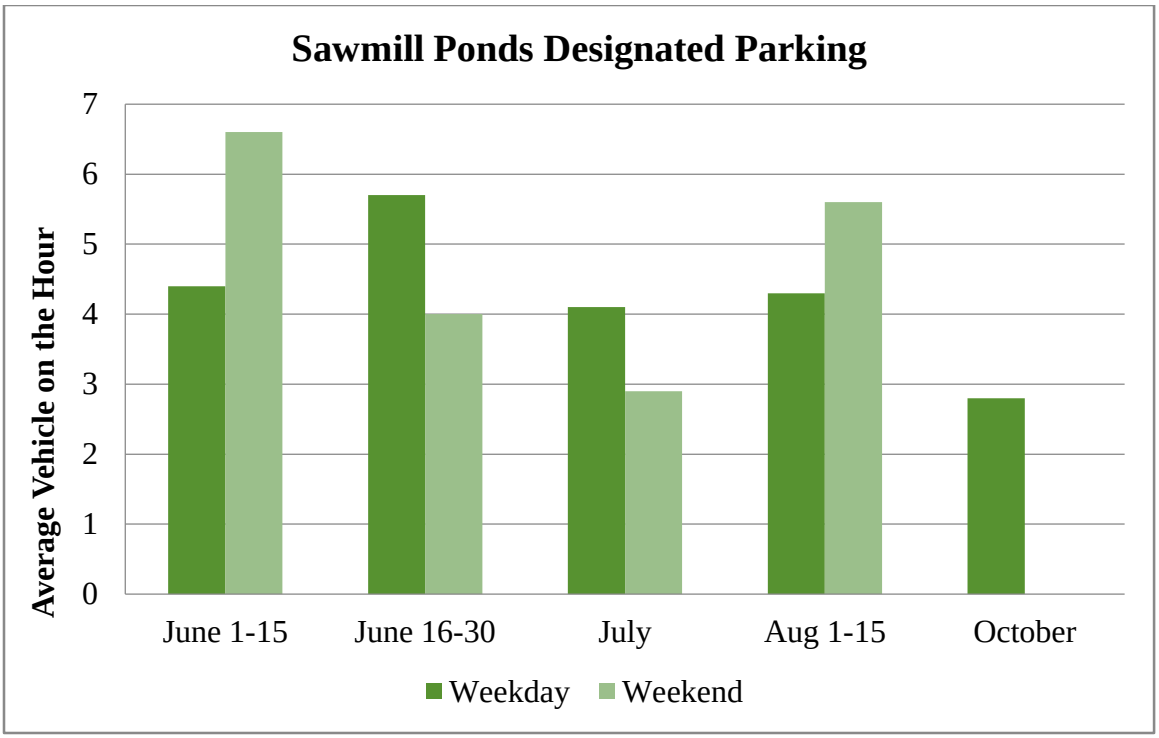


Figure 9.3: Average number of vehicles observed in Sawmill Ponds designated parking area per day for each study period stratified by weekdays and weekends.

Table 9.2: Average number of vehicles observed (± 1 standard deviation) in Death Canyon designated parking area per day for each study period stratified by weekdays and weekends.

Death Canyon	**Weekdays**	**Weekends**
June 1-15	8 (±3)	14 (±4)
June 16-30	9 (±5)	12 (±6)
July	16 (±6)	20 (±7)
Aug 1-15	16 (±6)	24 (±3)
September	10 (±4)	11 (±4)
October	N/A	9 (±5)

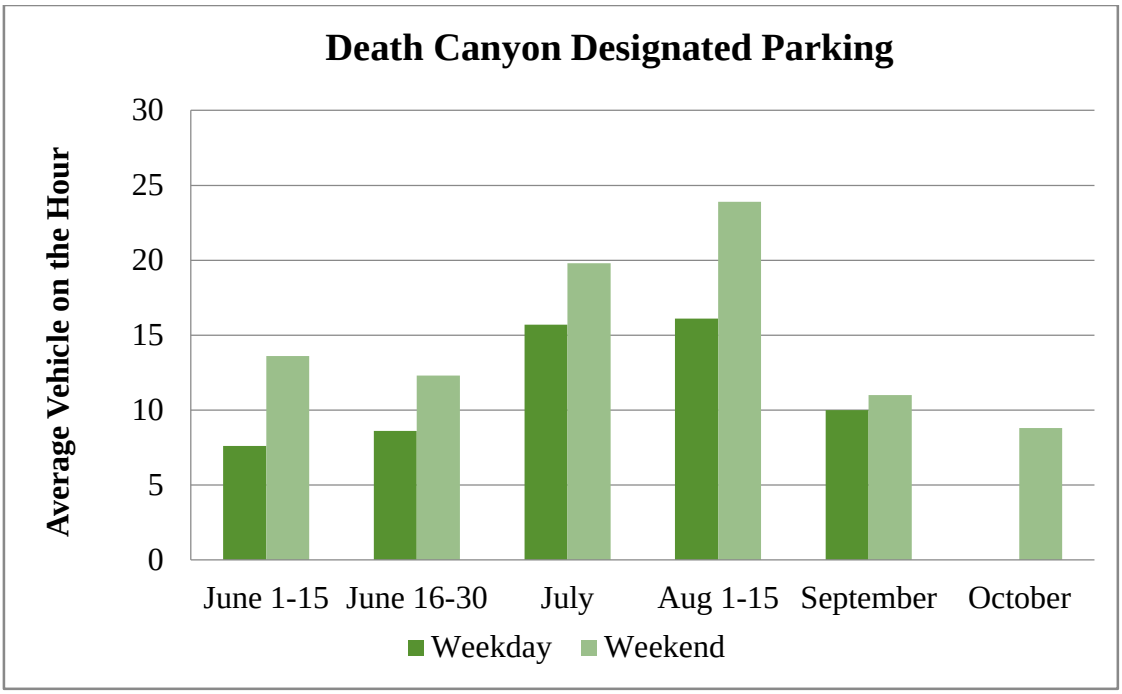


Figure 9.4: Average number of vehicles observed in Death Canyon trailhead designated parking area per day for each study period stratified by weekdays and weekends.

Table 9.3: Average number of vehicles observed (± 1 standard deviation) in LSR Preserve designated parking area per day for each study period stratified by weekdays and weekends.

LSR Preserve	Weekdays	Weekends
June 1-15	36 (±12)	39 (±11)
June 16-30	41 (±13)	44 (±12)
July	45 (±11)	48 (±9)
Aug 1-15	44 (±12)	46 (±11)
September	36 (±13)	38 (±13)
October	11 (±4)	19 (±10)

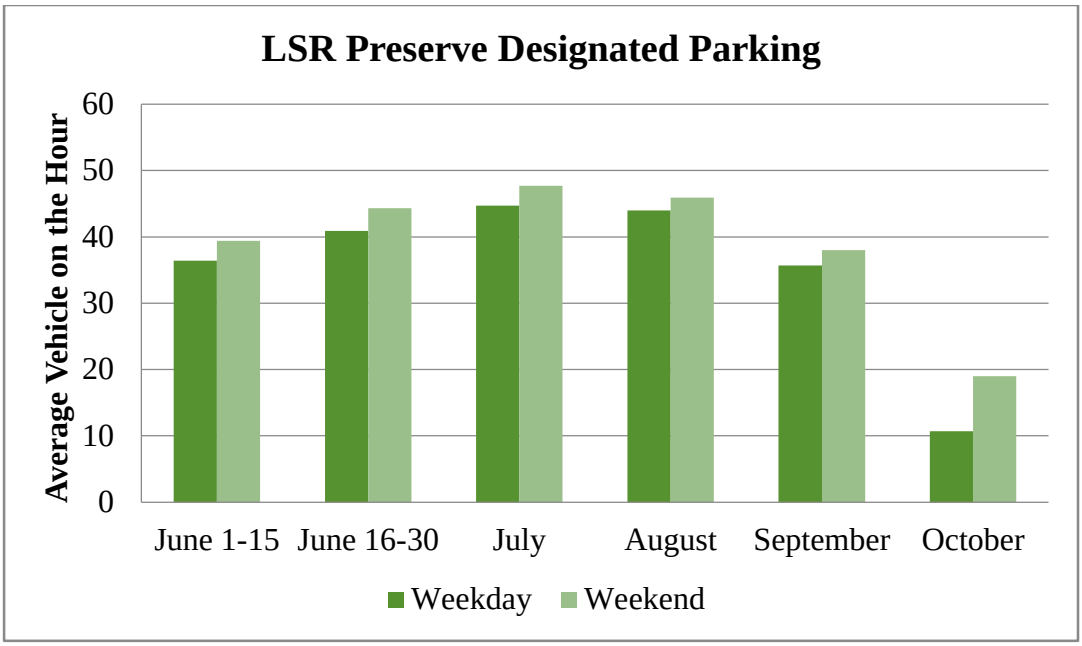


Figure 9.5: Average number of vehicles observed in LSR Preserve designated parking area per day for each study period stratified by weekdays and weekends.

Table 9.4: Average number of vehicles observed (± 1 standard deviation) in Granite Canyon designated parking area per day for each study period stratified by weekdays and weekends.

Granite Canyon	Weekdays	Weekends
June 1-15	7 (±3)	10 (±5)
June 16-30	11 (±4)	13 (±4)
July	15 (±3)	17 (±4)
Aug 1-15	12 (±3)	N/A
September	N/A	10 (±2)
October	1 (±1)	N/A

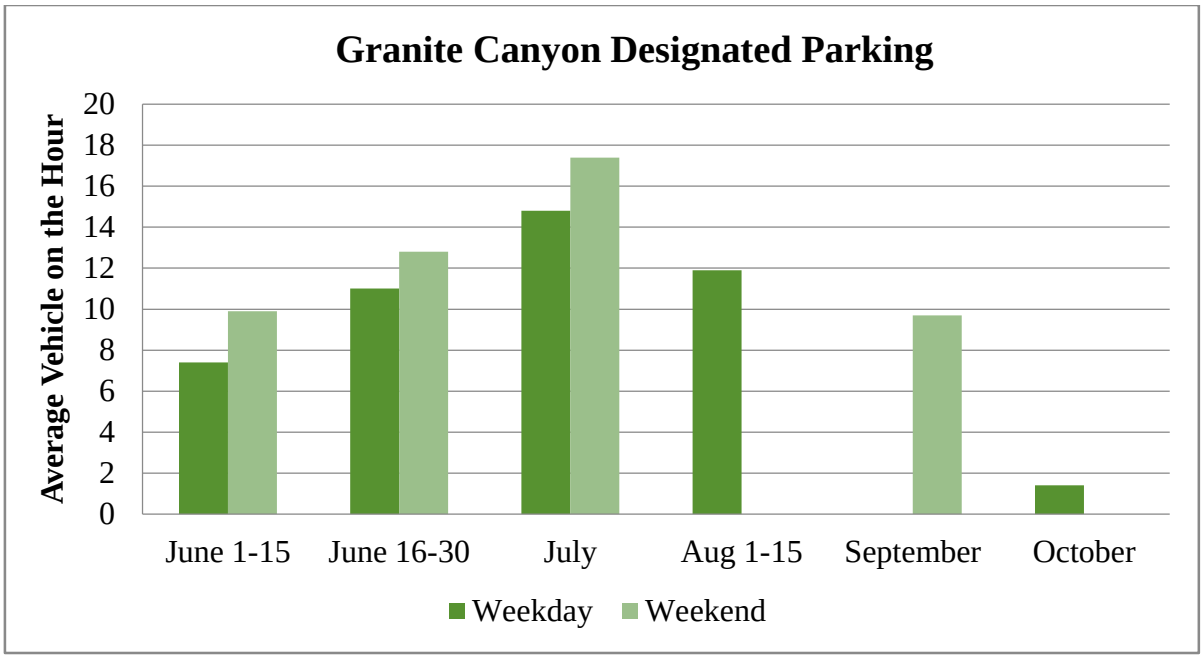


Figure 9.6: Average number of vehicles observed in Granite Canyon designated parking area per day for each study period stratified by weekdays and weekends.

MAXIMUM USE OF DESIGNATED AND OVERFLOW PARKING AREAS:

The maximum number of vehicles observed at one time within a sampling period for both designated and overflow/visitor-created parking areas was noted (Tables 9.5 and 9.6). The LSR Preserve designated parking area showed the highest observed number of vehicles parked at one time with 61 vehicles during July. This maximum of 61 vehicles was due to 10 motorcycles parked in the parking lot as vehicle capacity is between 52 and 56 vehicles. Sawmill Ponds had the lowest observed number of vehicles at one time (max ranging from 10 to 16 vehicles). Death Canyon had the highest observed number of vehicles parking in overflow or visitor-created parking with 85 vehicles observed at one time during the August 1st-15th sampling periods (Table 9.6). There were significantly more cars parked in the visitor-created overflow parking areas along Death Canyon Road than were in the designated trailhead lot; sometimes three times as many. All other parking areas had much lower maximum observed parking in overflow or visitor-created areas. Granite Canyon had no overflow parking observed during September and October.

Table 9.5: Maximum number of vehicles observed at one time in the designated parking lots.

Parking Lot	June 1-15	June 16-30	July	August 1-15	September	October
Sawmill Ponds	16	14	10	13	n/a	11
Death Canyon	21	24	30	28	18	17
Granite Canyon	19	20	23	17	13	3
LSR Preserve	53	54	61	59	55	32

Table 9.6: Maximum number of vehicles observed at one time in overflow parking areas.

Parking Lot	June 1-15	June 16-30	July	August 1-15	September	October
Sawmill Ponds	2	7	5	1	n/a	1
Death Canyon	33	28	62	85	33	17
Granite Canyon	8	3	9	1	0	0

Figure 9.7: Sawmill Ponds Overlook designated parking lot during a time of high use (photo by Ashley D'Antonio).

LOCAL USE IN DESIGNATED AND OVERFLOW PARKING AREAS

Vehicles with WY-22 license plates were noted while recording parking lot accumulation counts (Table 9.7). The percentages of local vehicles observed during the entire sampling period were summarized by designated parking areas. Use of designated parking areas by locals (defined by the presence of WY-22 plates and no rental sticker) varied by parking lot and by sampling period. The Death Canyon trailhead designated parking lot had the highest level of local use across all sampling periods with the exception of September.

Table 9.7: Total percent of local vehicles observed in designated parking areas by sampling period.

Parking Lot	June 1-15	June 16-30	July	August 1-15	September	October
Sawmill Ponds	14.2%	22.3%	4.7%	4.3%	N/A	2%
Death Canyon	36.1%	22.8%	28.4%	26.6%	24.6%	57.9%
Granite Canyon	22.5%	16.8%	18.2%	16.9%	33.8%	0%
LSR Preserve	17%		19%	17%	14%	31%

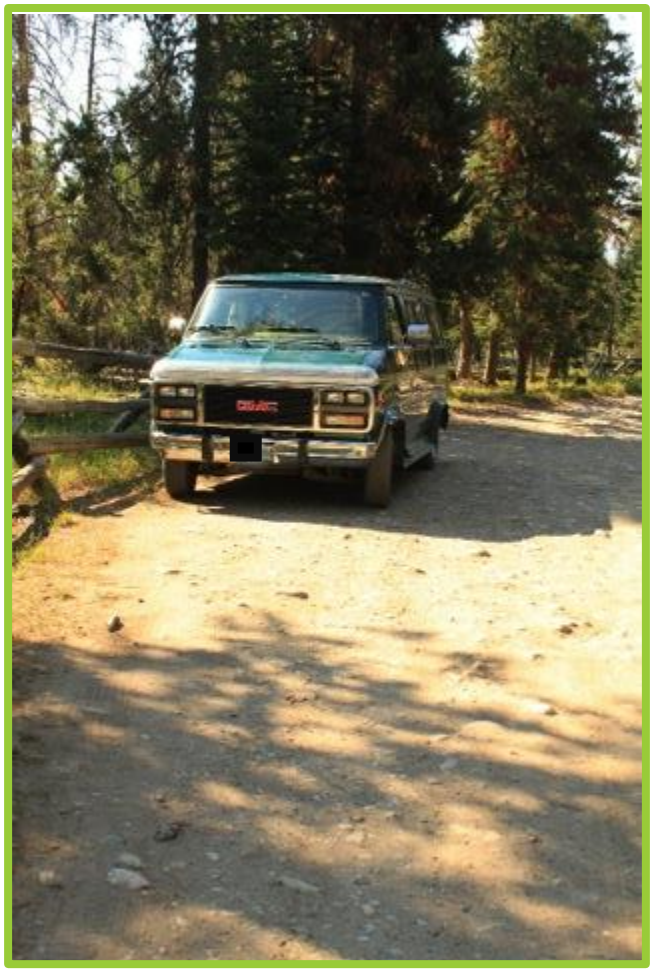
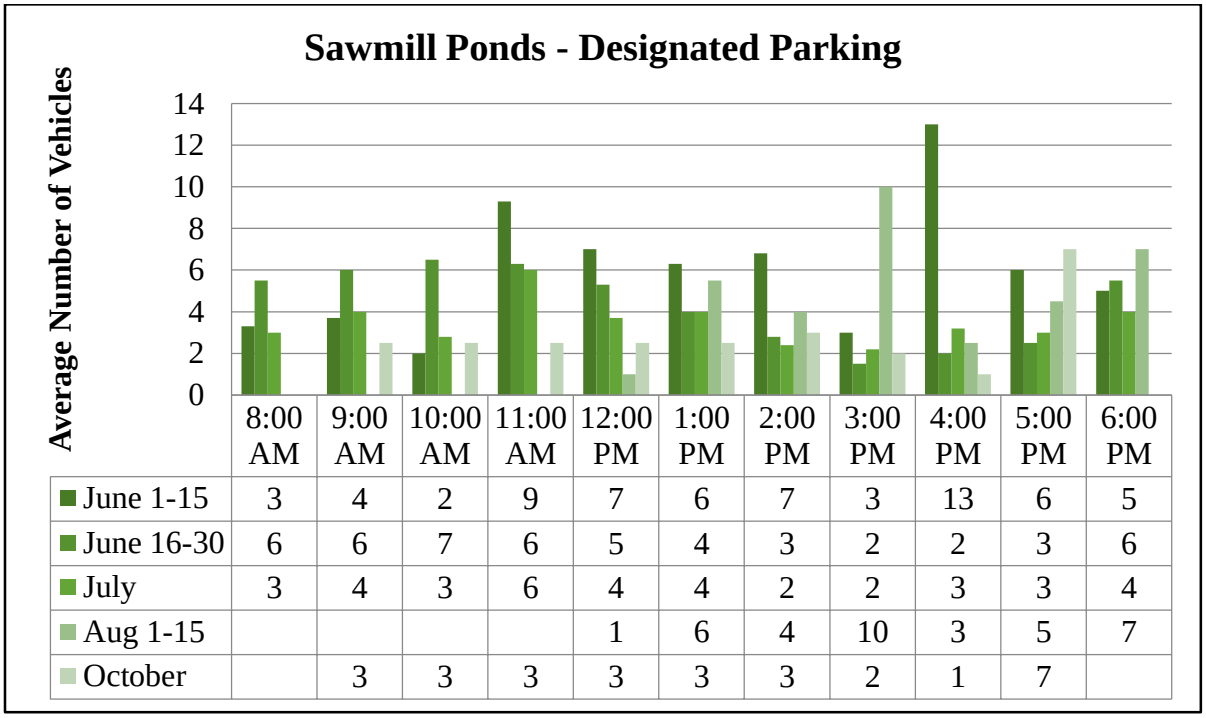


Figure 9.8: A local vehicle parked along Death Canyon Road. Death Canyon had the highest percentage of local use compared to other parking areas (photo by Ashley D'Antonio).

PARKING LOT USE BY HOURS OF THE DAY

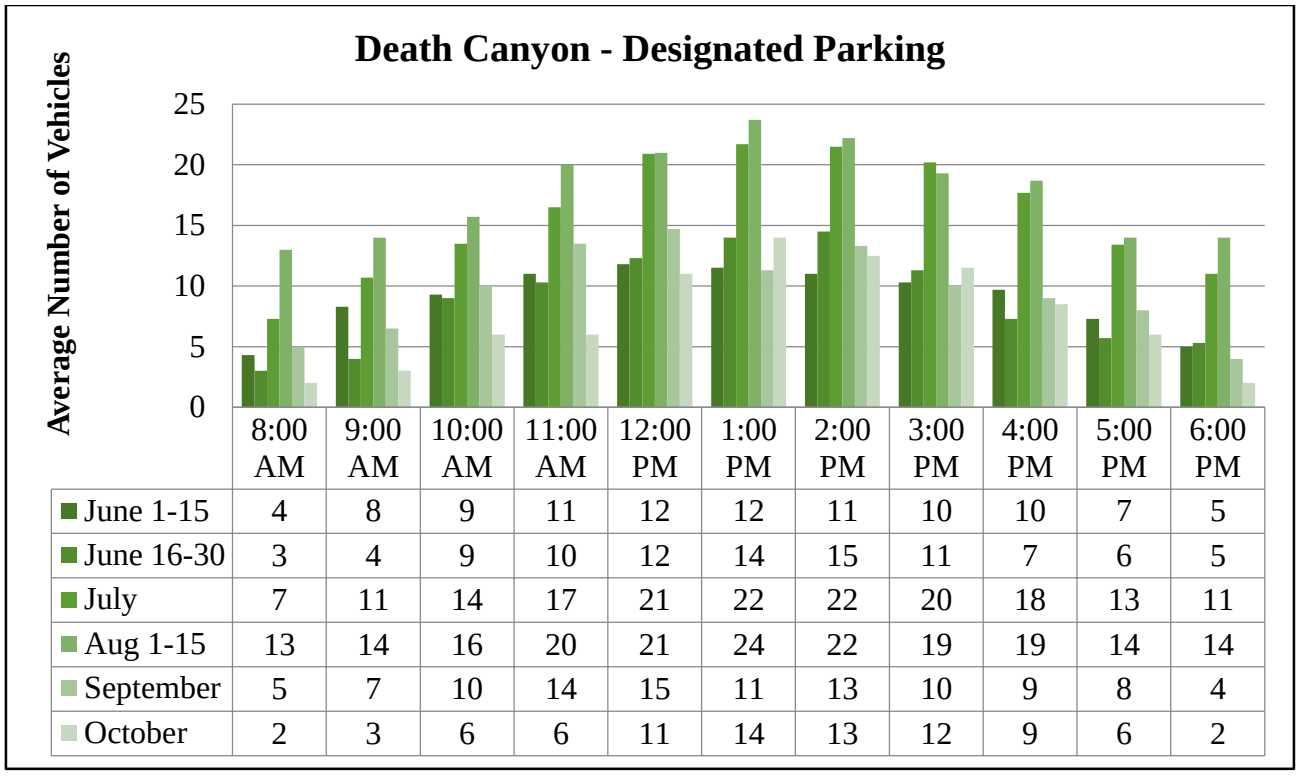
At each hour, the total number of vehicles was recorded. These totals were averaged across the sampling period to show how use of both designated and visitor-created parking areas varied across a day (Figures 9.9 through 9.14). Across all sampling periods in both Death Canyon parking areas (designated and overflow) and the Granite Canyon trailhead, parking lot use was highest between 11:00am and 3:00pm. The busiest sampling period for parking lot use at Death Canyon and Granite Canyon was July (Figures 9.9, 9.10, and 9.13). At Sawmill Ponds, use was not consistent, and no obvious pattern can be seen. Overflow parking of 1 or 2 cars was observed once per sampling period at Sawmill Ponds. At the LSR Preserve, use increased until 11am, remained high, and dropped off only slightly after 3pm (Figure 9.12). The July and August sampling periods showed the highest average vehicle use in the LSR Preserve parking lot.

For Death Canyon (Figure 9.10) and Granite Canyon (Figure 9.14), hourly use of overflow and visitor-created parking was also examined. Hourly use of overflow parking areas at Granite Canyon (Figure 9.14) and Death Canyon appeared to peak in the afternoons (from approximately noon-3pm). Additionally, at Death Canyon high levels of use of overflow and visitor-created parking areas were observed throughout the August 1st-15th sampling period. The tables accompanying the graphs are shown with standard deviations in Appendix I.



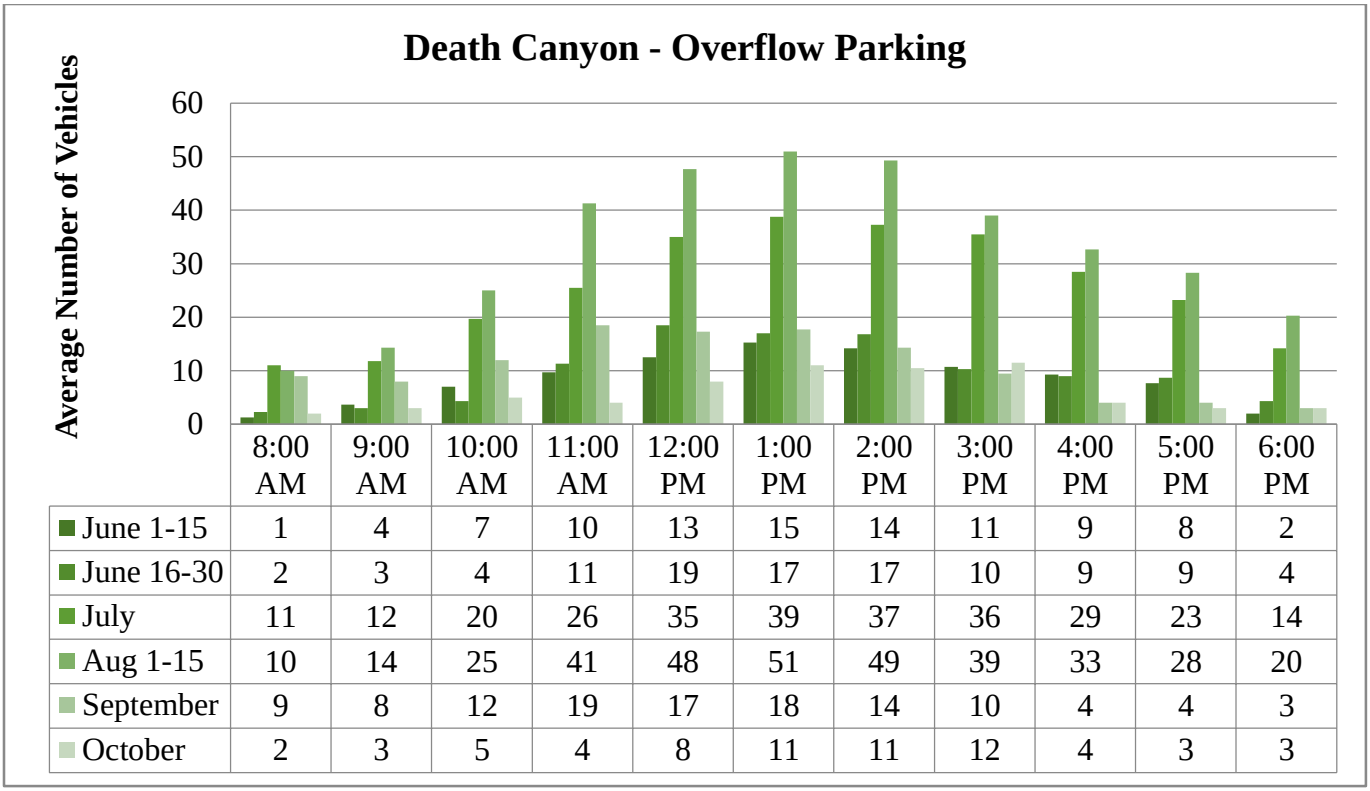
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
June 1-15	3	4	2	9	7	6	7	3	13	6	5
June 16-30	6	6	7	6	5	4	3	2	2	3	6
July	3	4	3	6	4	4	2	2	3	3	4
Aug 1-15					1	6	4	10	3	5	7
October		3	3	3	3	3	3	2	1	7	

Figure 9.9: Average number of vehicles observed at each hour of the day in designated parking area by sampling period for Sawmill Ponds parking area. Blanks indicate that we had missing data for that time period during that sampling period.



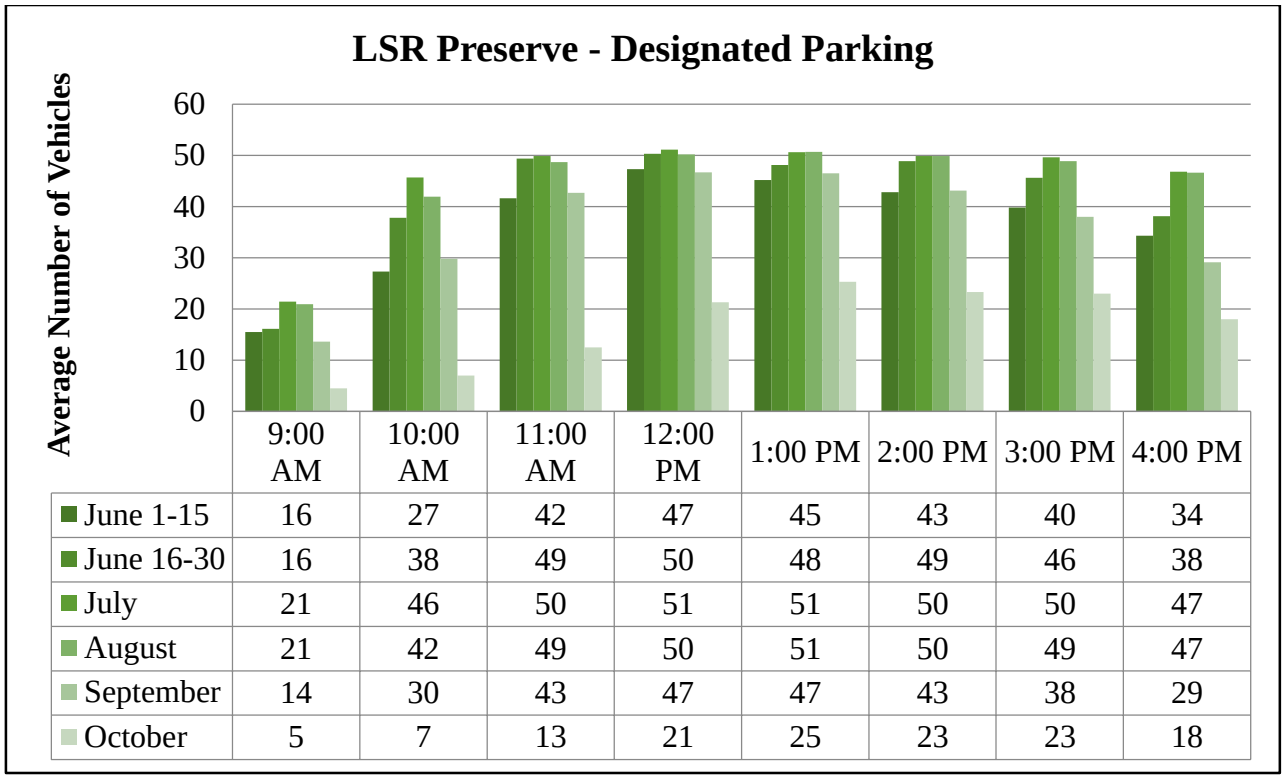
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
June 1-15	4	8	9	11	12	12	11	10	10	7	5
June 16-30	3	4	9	10	12	14	15	11	7	6	5
July	7	11	14	17	21	22	22	20	18	13	11
Aug 1-15	13	14	16	20	21	24	22	19	19	14	14
September	5	7	10	14	15	11	13	10	9	8	4
October	2	3	6	6	11	14	13	12	9	6	2

Figure 9.10: Average number of vehicles observed at each hour of the day in designated parking area by sampling period for Death Canyon trailhead parking area.



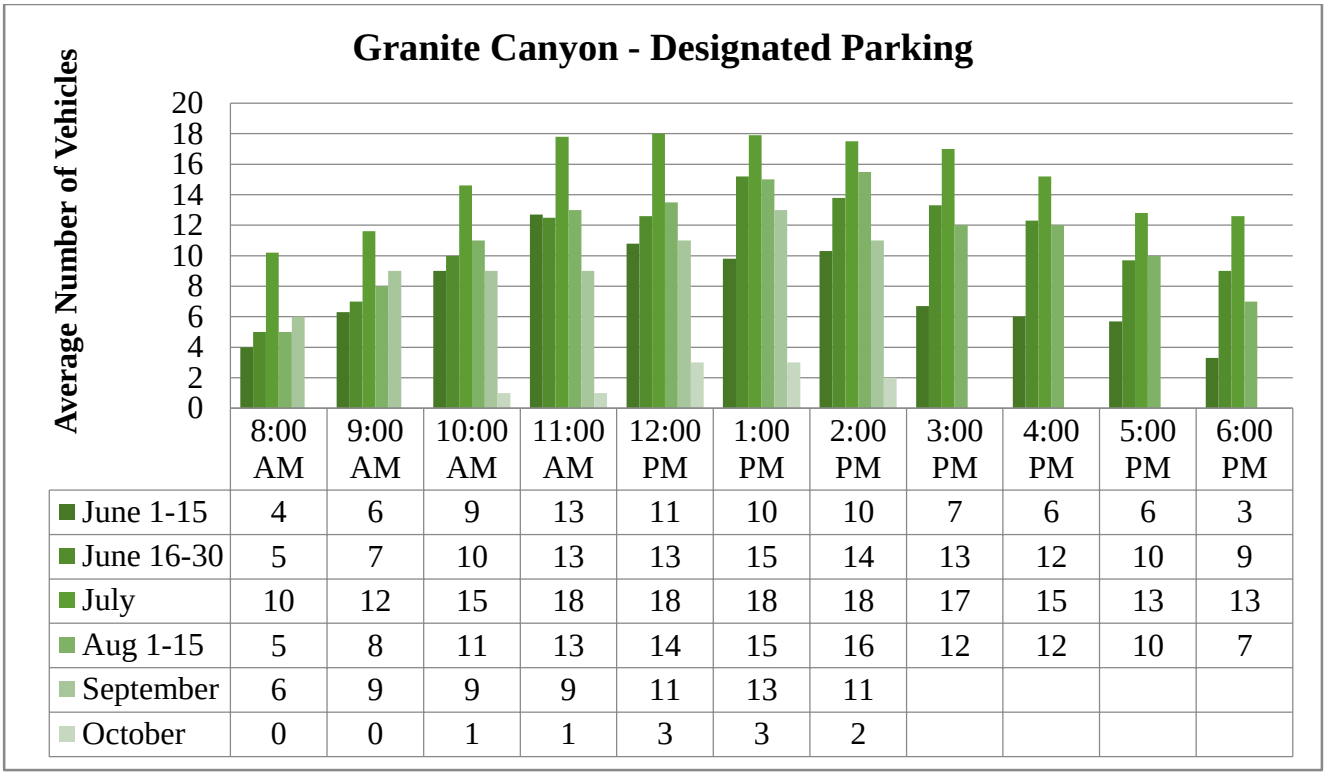
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
June 1-15	1	4	7	10	13	15	14	11	9	8	2
June 16-30	2	3	4	11	19	17	17	10	9	9	4
July	11	12	20	26	35	39	37	36	29	23	14
Aug 1-15	10	14	25	41	48	51	49	39	33	28	20
September	9	8	12	19	17	18	14	10	4	4	3
October	2	3	5	4	8	11	11	12	4	3	3

Figure 9.11: Average number of vehicles observed at each hour of the day in overflow and visitor-created parking areas by sampling period for Death Canyon Road.



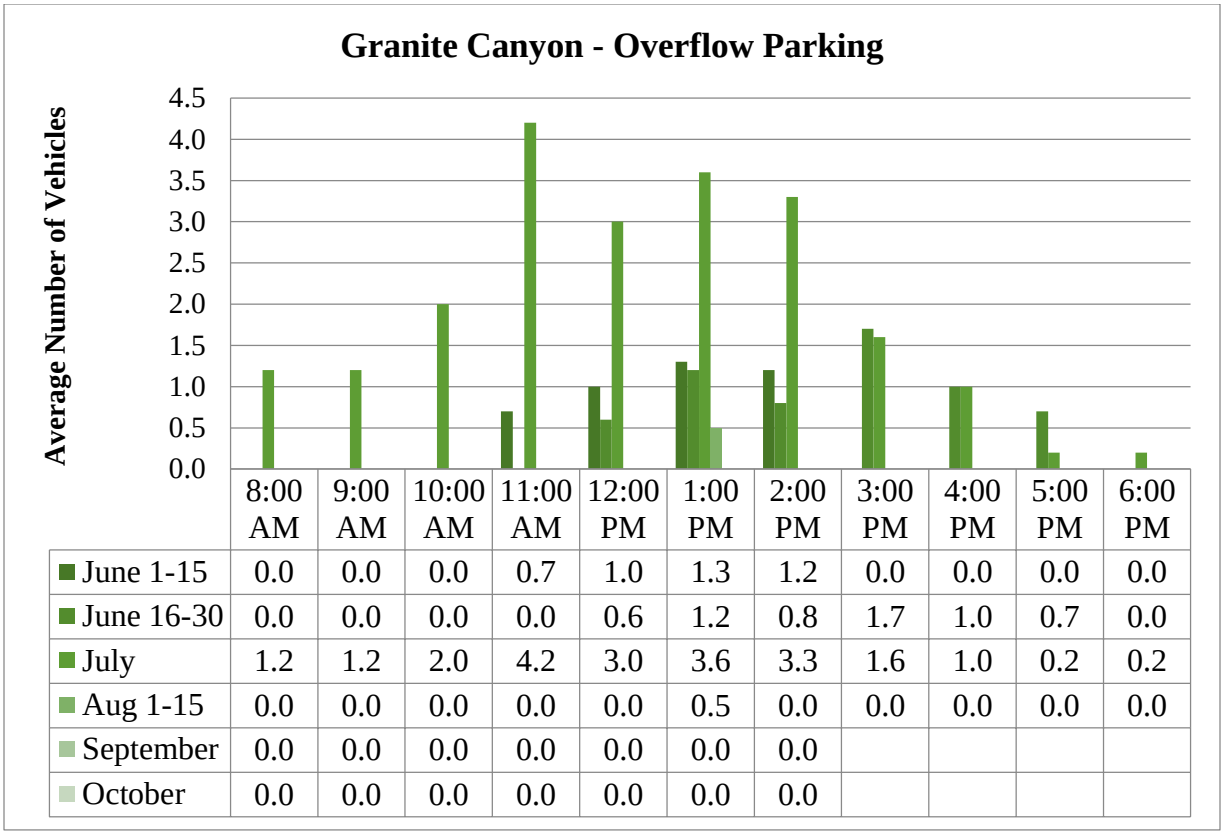
	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM
June 1-15	16	27	42	47	45	43	40	34
June 16-30	16	38	49	50	48	49	46	38
July	21	46	50	51	51	50	50	47
August	21	42	49	50	51	50	49	47
September	14	30	43	47	47	43	38	29
October	5	7	13	21	25	23	23	18

Figure 9.12: Average number of vehicles observed at each hour of the day in designated parking area by sampling period for LSR Preserve parking area. The LSR Preserve parking lot data was collected by GRTE staff and therefore sampling only occurred during LSR Preserve Center hours.



	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
June 1-15	4	6	9	13	11	10	10	7	6	6	3
June 16-30	5	7	10	13	13	15	14	13	12	10	9
July	10	12	15	18	18	18	18	17	15	13	13
Aug 1-15	5	8	11	13	14	15	16	12	12	10	7
September	6	9	9	9	11	13	11				
October	0	0	1	1	3	3	2				

Figure 9.13: Average number of vehicles observed at each hour of the day in designated parking area by sampling period for Granite Canyon trailhead parking area.



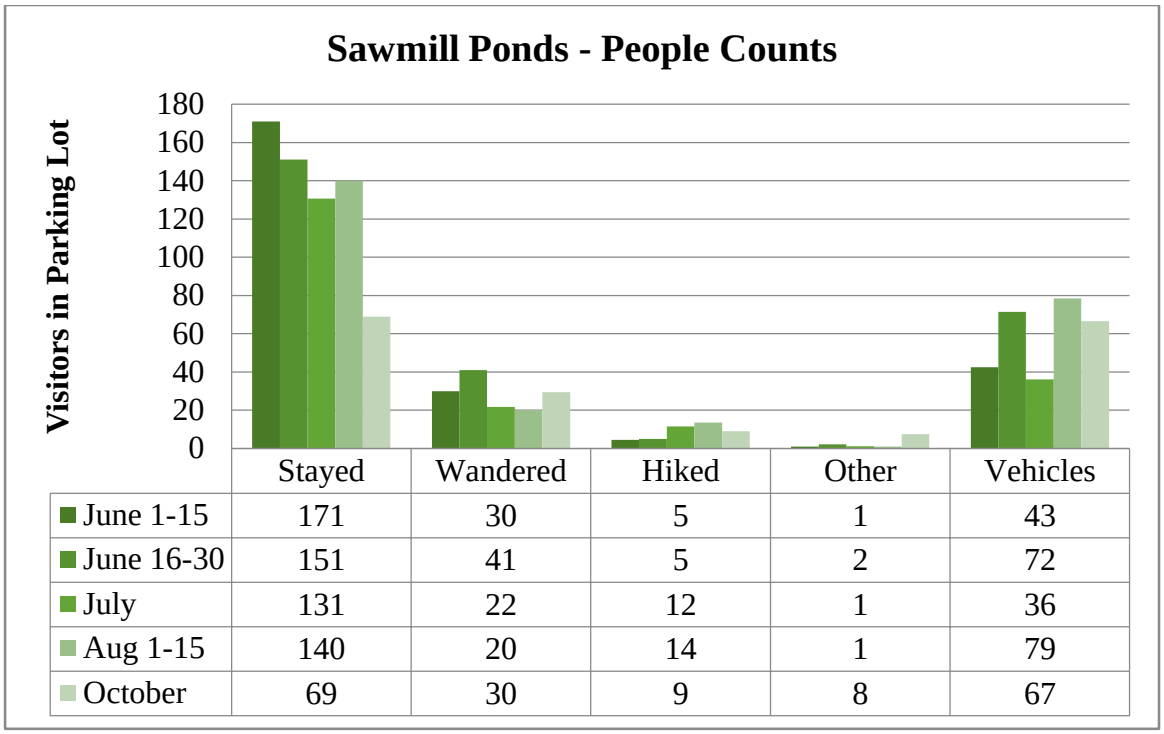
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
June 1-15	0.0	0.0	0.0	0.7	1.0	1.3	1.2	0.0	0.0	0.0	0.0
June 16-30	0.0	0.0	0.0	0.0	0.6	1.2	0.8	1.7	1.0	0.7	0.0
July	1.2	1.2	2.0	4.2	3.0	3.6	3.3	1.6	1.0	0.2	0.2
Aug 1-15	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
September	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
October	0.0	0.0	0.0	0.0	0.0	0.0	0.0				

Figure 9.14: Average number of vehicles observed at each hour of the day in overflow and visitor-created parking areas by sampling period for Granite Canyon trailhead.

ADDITIONAL DATA COLLECTION AT LSR PRESERVE AND SAWMILL PONDS

At Sawmill Ponds, additional observational data was collected to better understand how the designated and overflow parking areas were being used by visitors. At Sawmill Ponds, the behavior of any visitor that entered the parking lot was documented and summarized (Figure 9.15). The majority of visitors using Sawmill Ponds either did not leave their vehicle or did not travel far from their vehicle while using the Sawmill Ponds area. The tables accompanying the Sawmill Ponds graph is shown with standard deviations in Appendix I.

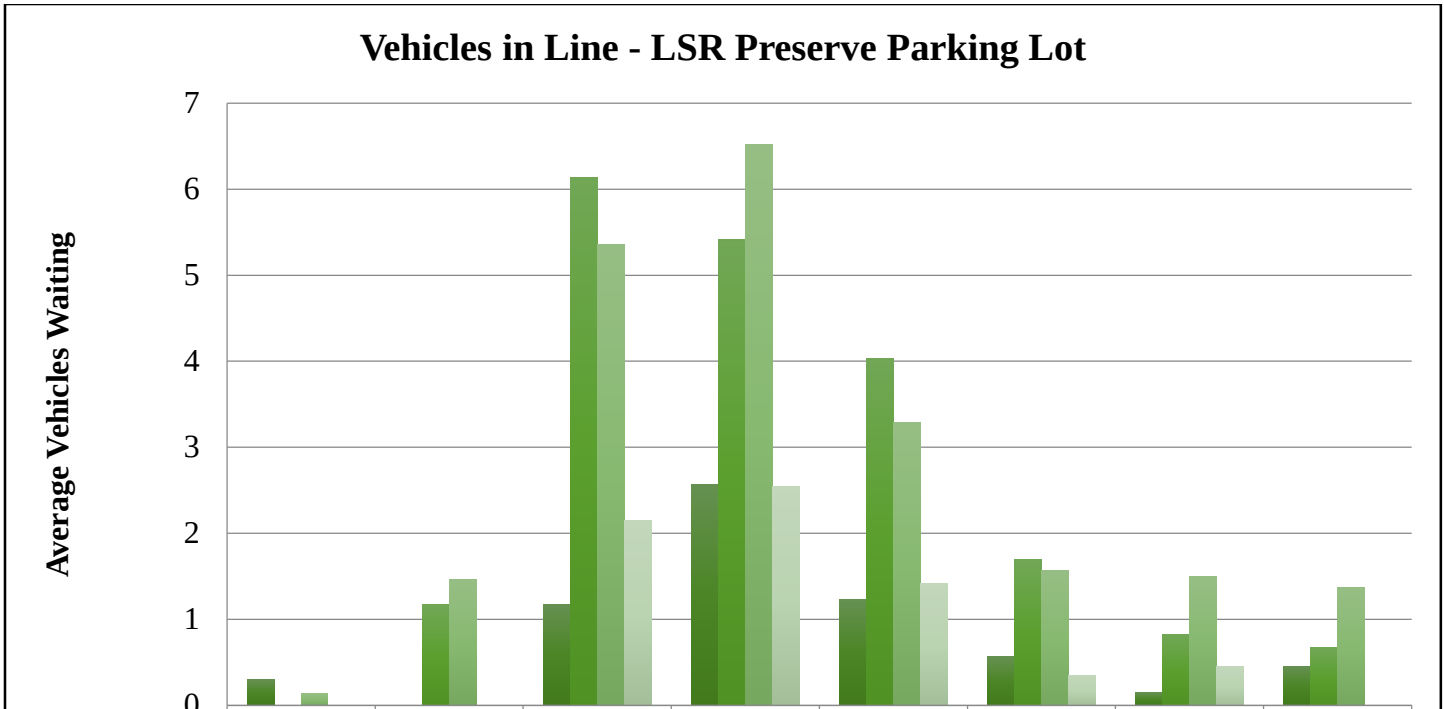
At the LSR Preserve parking lot, staff recorded a count of the number of vehicles that were in the queue waiting for a parking spot to open up. The number of vehicles in line was recorded on the hour with other parking lot counts (Figure 9.17). The average number of vehicles in line peaked between 11:00am and 12:00pm during all sampling periods at about 6-7 vehicles waiting for a spot (Figure 9.17).



	Stayed	Wandered	Hiked	Other	Vehicles
June 1-15	171	30	5	1	43
June 16-30	151	41	5	2	72
July	131	22	12	1	36
Aug 1-15	140	20	14	1	79
October	69	30	9	8	67

Figure 9.15: Additional data collected related to visitor use emanating from the Sawmill Ponds parking area. "Stayed" indicates visitors who remained within the boundaries of the parking lot area. "Wandered" indicates visitors who left the parking lot area but remained on the perimeter. "Hiked" indicates visitors who left the parking area and hiked down the "old road" trail, and "Vehicle" indicates vehicles that pulled into the Sawmill Ponds parking area and either did not fully park or parked briefly and then left.

Figure 9.16: Sawmill Ponds is a popular destination for wildlife viewing, especially for visitors looking for Moose (photo by Abigail Kidd).



	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM
June	0.3	0.0	1.2	2.6	1.2	0.6	0.2	0.5
July	0.0	1.2	6.1	5.4	4.0	1.7	0.8	0.7
August	0.1	1.5	5.4	6.5	3.3	1.6	1.5	1.4
September	0.0	0.0	2.2	2.5	1.4	0.4	0.5	0.0

Figure 9.17: Average number of vehicles in queue for parking spots in the LSR Preserve parking lot per hour across all sampling periods.

ADDITIONAL DATA COLLECTION

10. WILDLIFE BRIGADE

USU provided the Wildlife Brigade and staff at the LSR Preserve with Trimble GPS units. At all wildlife jams in the Moose-Wilson Road corridor, the Wildlife Brigade or LSR Preserve staff members carried the GPS units while working at the jam and also entered a few basic pieces of data for each jam into the GPS unit (including the type of animal, duration of jam, and visual estimation of the max number of vehicles in the jam). The GPS data and associated attributes were downloaded by USU, and wildlife jam activity on the Moose-Wilson Road from June through October was summarized. The sampling periods with the highest number of wildlife jams was the first part of June, July, and September (Figure 10.1). The majority of wildlife jams that occurred in early June and September were due to bear activity; grizzly bears in June and black bears in September (Figures 10.2 and 10.6). In July,

the majority of wildlife jams were caused by moose (Figure 10.4). Overall, moose caused the most wildlife jams across the entire sampling season (Figures 10.7 and 10.8). The size and duration of the wildlife jams varied widely (Figures 10.9 and 10.10). However, most jams lasted between 15 and 30 minutes (Figure 10.9), and the most common estimated size of jams was less than 20 cars (Figure 10.10). Maps of the location and density of the wildlife jams recorded by the park can be found in Appendix J.

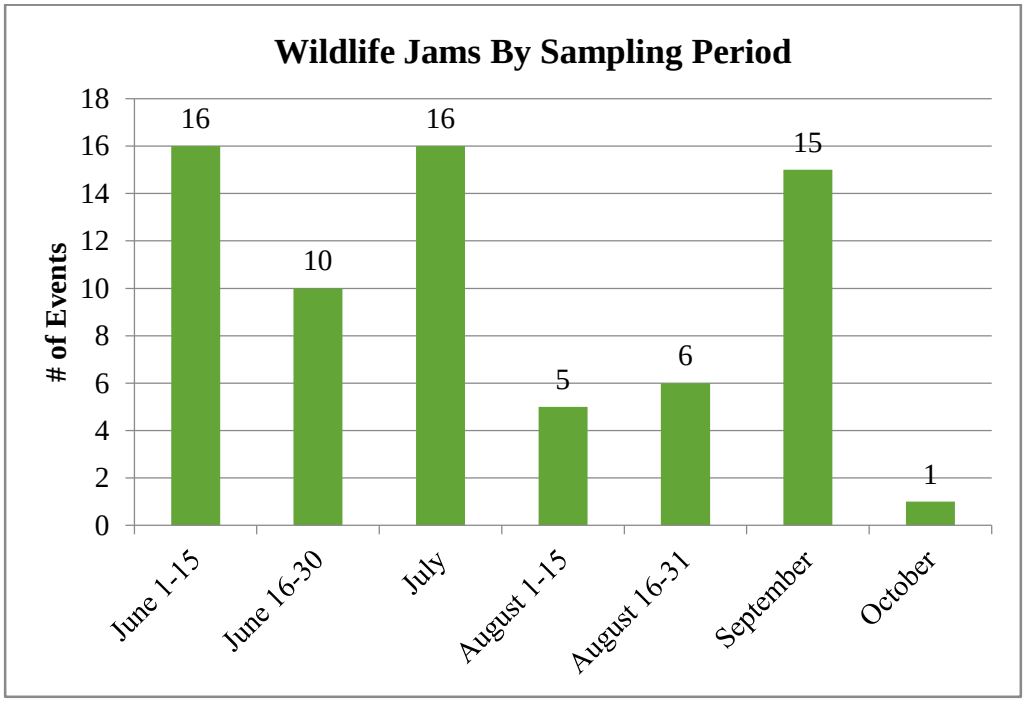


Figure 10.1: Total number of wildlife jams recorded by the park by sampling period for the Moose-Wilson Road. The single wildlife jam in October was due to a black bear.

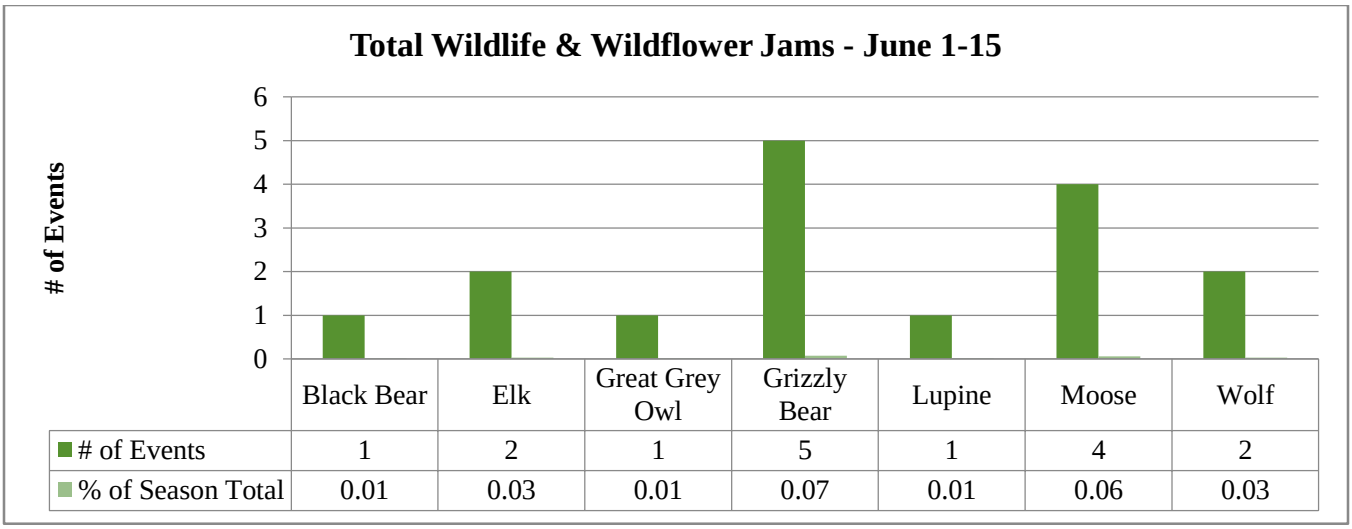


Figure 10.2: Total number and frequency of wildlife and wildflower jams by species recorded by the park in June 1-15 for the Moose-Wilson Road.

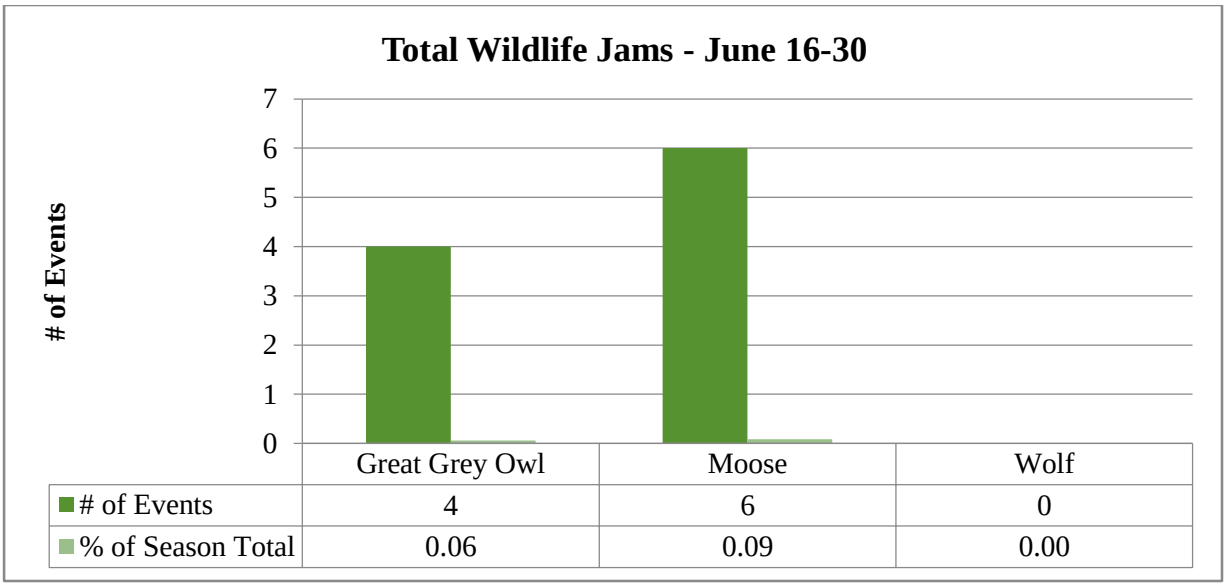


Figure 10.3: Total number and frequency of wildlife jams by species recorded by the park in June 16-30 for the Moose-Wilson Road.

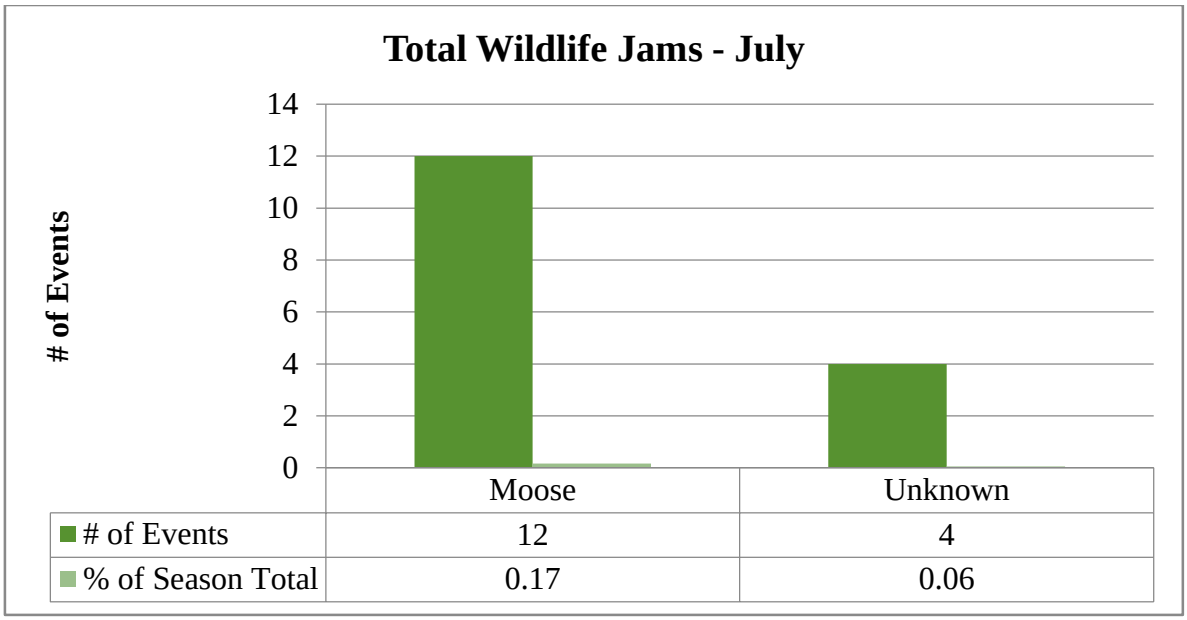


Figure 10.4: Total number and frequency of wildlife jams by species recorded by the park in July for the Moose-Wilson Road.

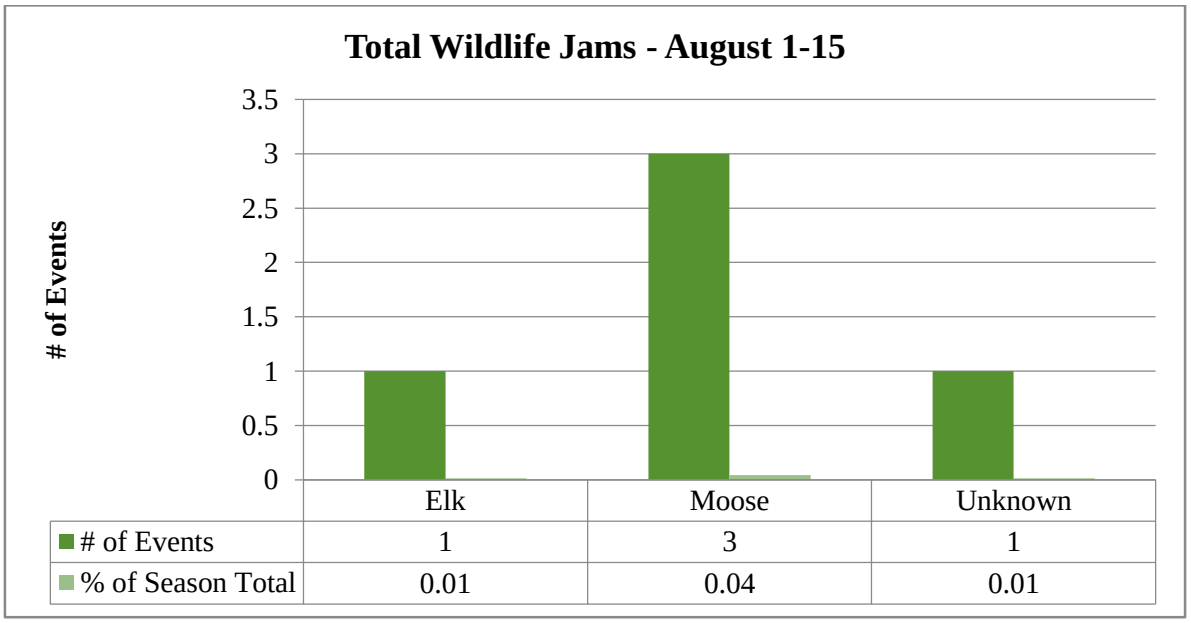


Figure 10.5: Total number and frequency of wildlife jams by species recorded by the park in the first half of August for the Moose-Wilson Road.

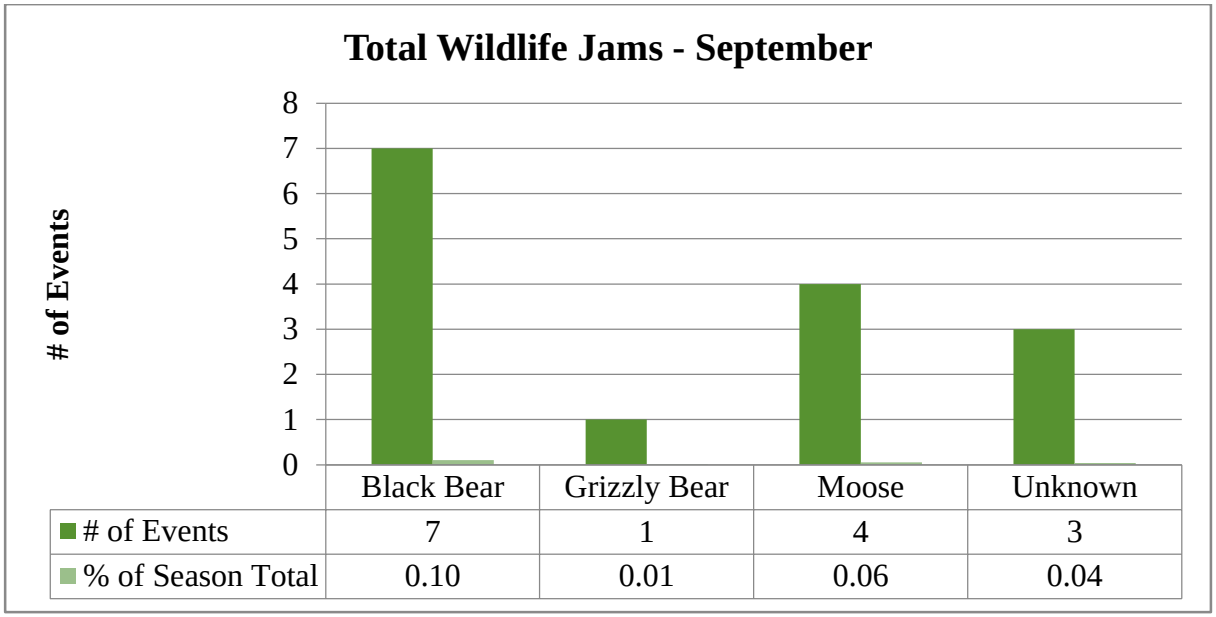


Figure 10.6: Total number and frequency of wildlife jams by species recorded by the park in September for the Moose-Wilson Road.

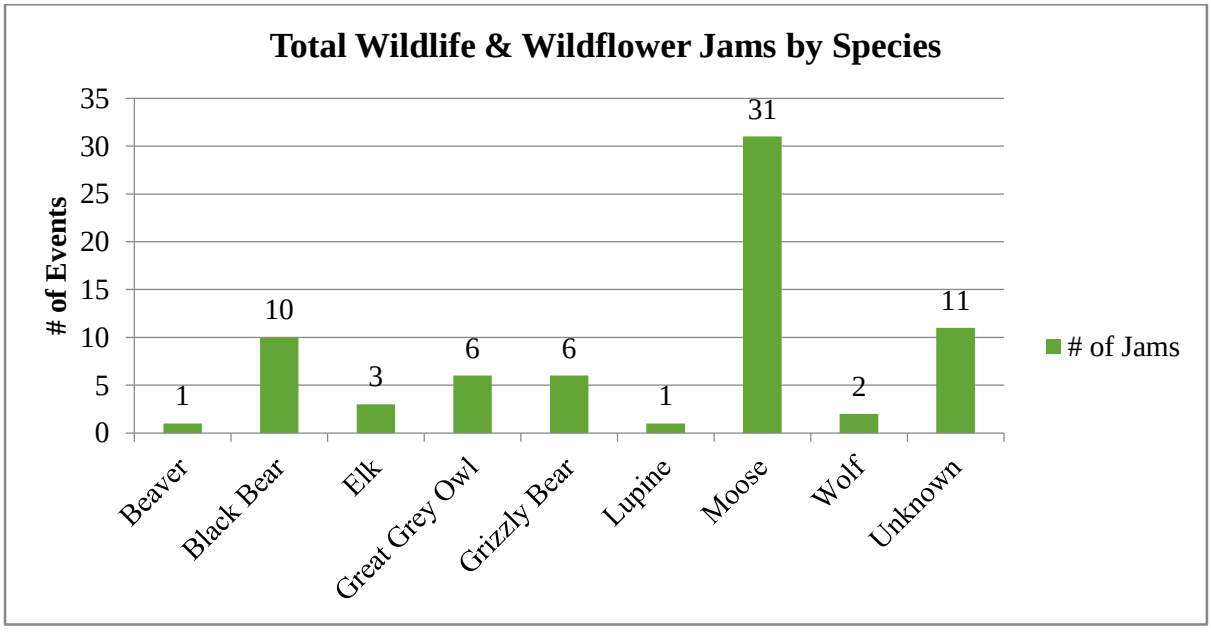


Figure 10.7: Total number of wildlife and wildflower jams by species recorded by the park for the entire sampling season for the Moose-Wilson Road.

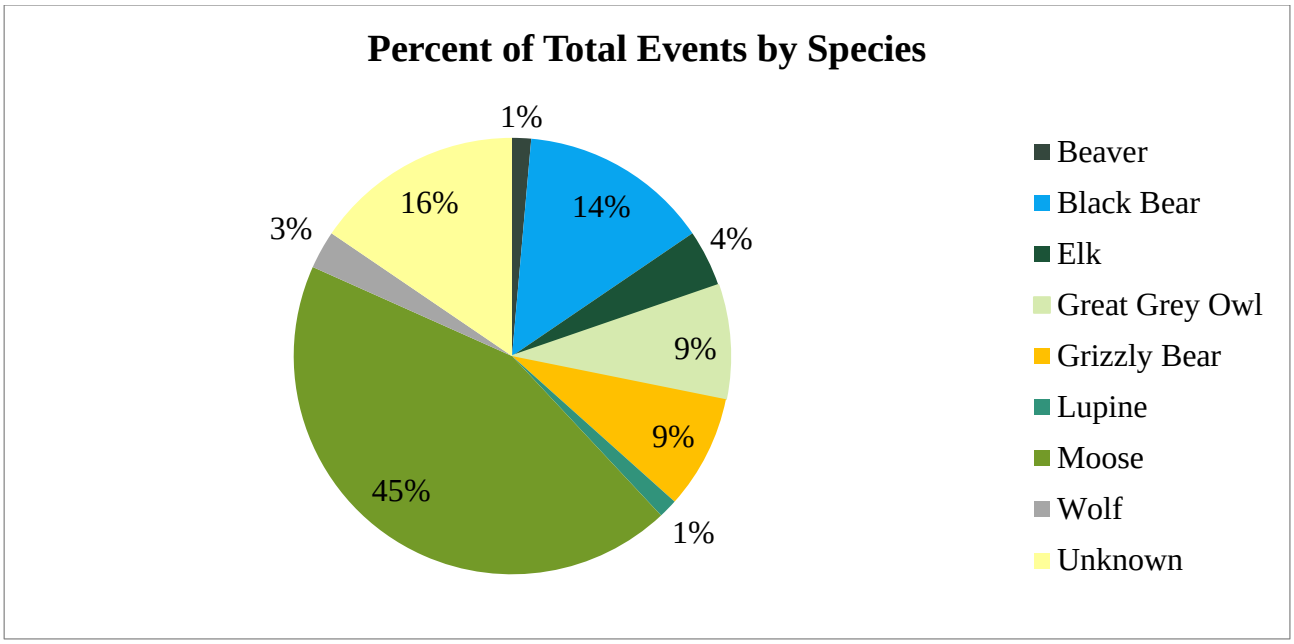


Figure 10.8: Frequency of wildlife and wildflower jams by species recorded by the park for the entire sampling season for the Moose-Wilson Road.

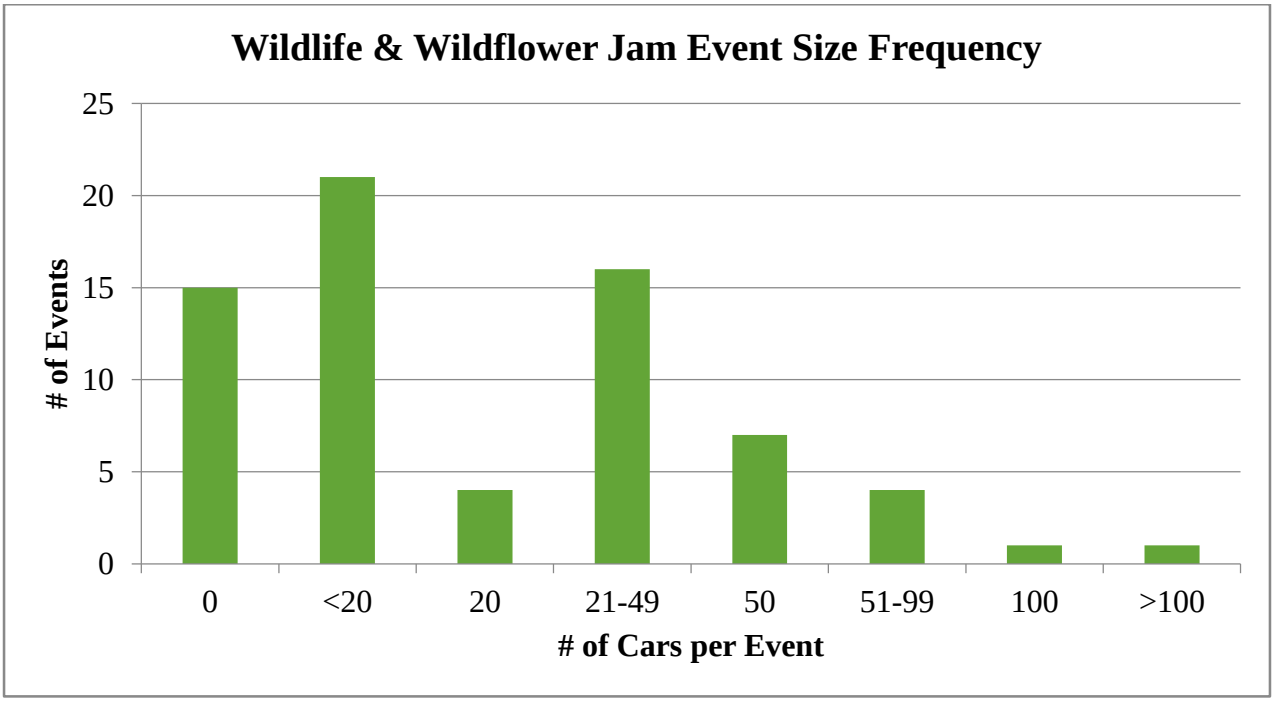


Figure 10.9: Frequency of wildlife and wildflower jam size recorded by the park for the entire sampling season for the Moose-Wilson Road. The jams listed as having "0" cars are wildlife or wildflower jams where we have missing event size data.

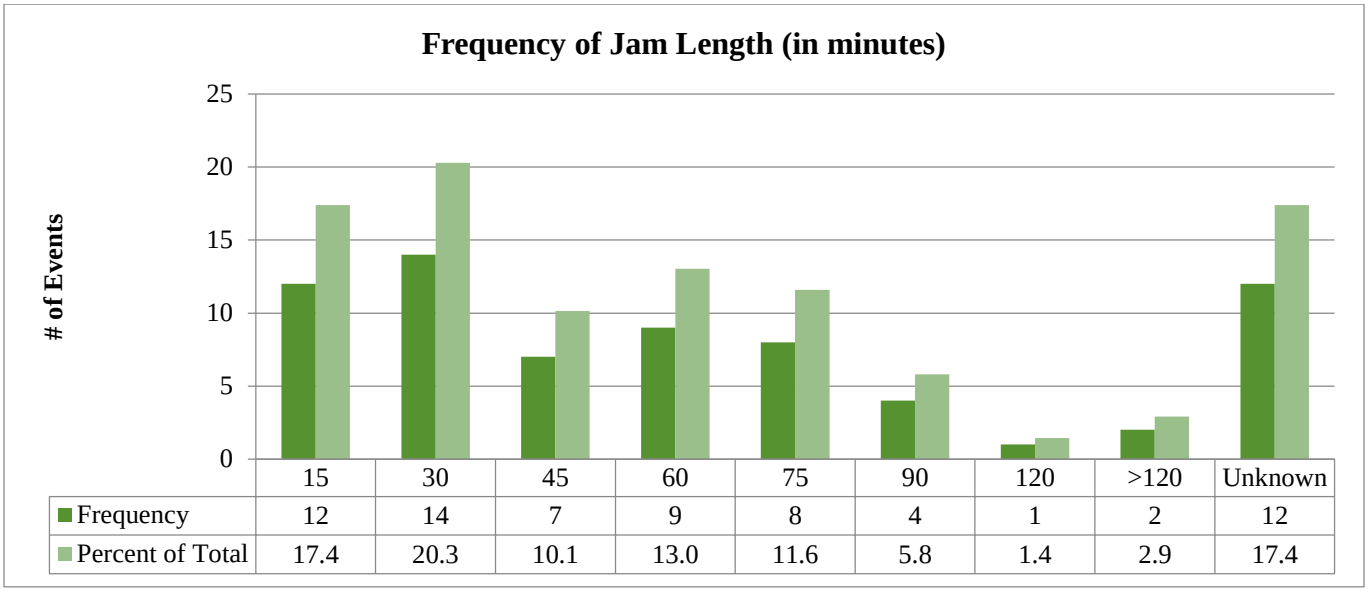


Figure 10.10: Frequency of wildlife and wildflower jam length recorded by the park for the entire sampling season for the Moose-Wilson Road.

Figure 10.11: Black bears, such as those in this photo. caused 15% of the wildlife jams in the Moose-Wilson Corridor (photo by Abigail Kidd).

SUMMARY OF FINDINGS

- *Overall Use:* The first half of August (1st-15th) was the busiest sampling period throughout the study when looking at pedestrian use on trails and parking lot use. However, vehicle traffic on the road itself peaked in July. During the summer season (June through August), the Moose-Wilson Road experiences approximately 1,900 vehicles per day with side roads having less use; Death Canyon Road has use levels of approximately 200 vehicles per day, and the LSR Preserve Entrance Road has use levels of approximately 500 vehicles per day. Given that, on average, each vehicle contains 2.8 visitors, total use on the Moose-Wilson Road per day can be estimated at approximately 5,300 visitors. Bicycle use makes up between 2-4% of total use in the Moose-Wilson Corridor, resulting in approximately 60 bicycles using the Moose-Wilson Road per day. Peak use in the Moose-Wilson corridor occurs between 11am and 2pm-3pm. At the intersection of Moose-Wilson Road and Teton Park Road, on average, 24% of traffic from Teton Park Road turns onto the Moose-Wilson Road.

- *Vehicle Use Patterns:* Approximately 36% of visitors in vehicles using the Moose-Wilson corridor drive through the corridor without stopping, spending less than 30 minutes total in the corridor. Vehicles have median use time of approximately 18 minutes, with 45 minutes for bicyclists. Large volumes of northbound traffic on the Moose-Wilson Road before noon made the north end of the road a popular exiting location before noon. In the afternoon, southbound traffic on the Moose-Wilson Road reached a peak, thus the Granite Canyon entrance station exhibited a rise in vehicle exits. Overall though, the most common travel pattern across all sampling periods was northbound through travel. Of vehicles that stopped within the Moose-Wilson corridor, Sawmill Ponds was the most popular stopping location. Visitors who stopped at Sawmill Ponds tended to spend less than 5 minutes at this destination and rarely traveled far from their vehicle. The LSR Preserve was the second most popular stopping destination, but only 27% of vehicle traffic on the Moose-Wilson Road turned into the LSR Preserve.

- *Bicycle Use Levels/Patterns:* The majority of bicyclists traveled through the corridor without stopping. The frequency of northbound and southbound travel through the Moose-Wilson corridor was almost equal for bicyclists. Bicyclists who travel on the bike path through Moose have the option to enter the Moose-Wilson corridor. However, 81% of bicycle traffic on the bike path at the Moose-Wilson Road/Teton Park Road intersection remained on the bike path. Of the bicyclists exiting the Moose-Wilson corridor, 59% traveled through the intersection and entered the bike path. The Granite Canyon entrance station was a more popular entry point for bicycles; bicycle use made up between 2-3% of all traffic at the Granite Canyon entrance station. Of the bicyclists that stopped at a destination, Sawmill Ponds was the most popular destination. Most bicyclists spent between 30 minutes and 1 hour in the Moose-Wilson corridor.

- *Comparison to Key Findings from 2013:* The majority of findings from the Summer/Fall of 2014 are consistent with the findings from the Summer/Fall 2013. However, a few key differences

were observed. Slightly lower vehicle use in the Moose-Wilson corridor was measured early August in 2014 as compared to early August 2013. However, overall use as compared to Western Transportation Institute data from 2006-2008 indicates that use in the Moose-Wilson corridor is increasing across all sampling periods. Although the most popular travel pattern in the Moose-Wilson corridor is still through traffic, the percentage of through travel fell slightly in 2014. At the same time, an increase in use at the Sawmill Ponds parking area was observed. Like 2013, visitors are not spending much time at Sawmill Ponds, but it is a popular, short-stopping destination. Additionally, vehicle use on the LSR Preserve Entrance Road, the LSR Preserve parking lot, and at Phelps Lake increased in 2014, indicating that more visitors were choosing to stop at these locations in 2014 as compared to 2013. A greater percent of visitors stopping at locations and potentially exiting their vehicles to hike led to a slight increase in use at the trail counters throughout the corridor.

Figure 12: Field crew training at the beginning of the Summer 2013/2014 field season (photo by Ashley D'Antonio).

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APPENDICES

- A: Moose-Wilson Corridor Use Study Sampling Schedule
- B: Directional Traffic Flow from Tube Counters
- C: Detailed Tables from Additional ALPR Analysis (including 2013 data)
- D: Overall and Density Maps from GPS-tracked Vehicles
- E: Turning Movement Diagrams for Bicyclists at Moose-Wilson Road/Teton Park Road
- F: Overall and Density Maps from GPS-tracked Bicycles
- G: Summary of Counter Calibrations, Raw Values, and Hourly Use
- H: Overall and Density Maps from GPS-tracked Pedestrians
- I: Averages and Standard Deviations from Parking Lot Graphs
- J: Summary Maps of Wildlife Jams

REFERENCES

Conlon, K. (2014). Investigating the Relationship between Trail Conditions and Visitor Behavior Using the Camera Trap Method. Thesis. North Carolina State University.

D'Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., & Courtemanch, A. (2010). GPS-based measurements of backcountry visitors in parks and protected areas: Examples of methods and applications from three case studies. Journal of Park and Recreation Administration, 28(3).

D'Antonio, A., Monz, C., Newman, P., Lawson, S., & Taff, D. (2013). Enhancing the utility of visitor impact assessment in parks and protected areas: A combined social-ecological approach. Journal of Environmental Management, 124(30), 72-81.

Diamond Traffic Products (2014). Pedestrian/Trail Counting. Retrieved from: http://diamondtraffic.com/productlist/Pedestrian-Trail-Counting, 6 June 2014.

Hallo, J.C., Beeco, J.A., Goetcheus, C., McGee, J., McGehee, N.G., & Norman, W.C. (2012). GPS as a method for assessing spatial and temporal use distributions of nature-based tourists. Journal of Travel Research, 51(5), 591-606.

Hunt, L.M., & Hosegood, S. (2008). The effectiveness of signs at restricting vehicle traffic: A case of seasonal road closures on forest access roads. Canadian Journal of Forest Research, 38(8), 2306-2312.

Lawson, S., Manning, R., Valliere, W., & Wand, B. (2003). Proactive monitoring and adaptive management of social carrying capacity in Arches National Park: An application of computer simulation modeling. Journal of Environmental Management, 68, 305-313.

McGowen, S., Strong, C., Liang, L., Kack, D., Kumar, M., Akin, M., & Albert, S. (2009). Report: Moose-Wilson Corridor Adaptive Management Plan. Grand Teton National Park.

MetroCount (2014). MetroCount Traffic Data Specialists. Retrieved from: http://metrocount.com/, 6 June 2014.

Miovision (2014). Miovision: Rethink Traffic. Retrieved from: http://miovision.com/, 6 June 2014.

Monz, C.A., D'Antonio, A., & Heaslip, K. (2014). Moose-Wilson Corridor Use Levels, Types, Patterns and Impacts in Grand Teton National Park: Final Data Collection Plan Summer/Fall 2014.

Pettebone, D., Newman, P., & Lawson, S. (2010). Estimating visitor use at attraction sites and trailheads in Yosemite National Park using automated visitor counters. Landscape and Urban Planning, 97, 229-238.

Reconyx, Inc. (2014). Reconyx Products: Cameras. Retrieved from: http://www.reconyx.com/shop/Cameras/118, 6 June 2014.

TRAFx Research Ltd. (2014). TRAFx Products: Vehicle Counters. Retrieved from: http://www.trafx.net/products.htm#vehicle-counter, 6 June 2014.

Xia, J., & Arrowsmith, C.A. (2008). Techniques for counting and tracking the spatial and temporal movement of visitors. Monitoring, Simulation, and Management of Visitor Landscapes, 85-105.

Figure 13: Panoramic of the Teton Range as viewed from the Moose-Wilson Road (photo by Ashley D'Antonio).