2019-2020 Parking Study Report

2022

Human Dimensions Work Group
City of Boulder Open Space & Mountain Parks

Acknowledgements

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Project Manager: Anna Reed, Human Dimensions Sr Analyst

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Introduction

The purpose of this 2019-2020 Parking Study was to collect baseline utilization data of Open Space and Mountain Parks (OSMP)-managed parking lots. This study was broken down into two phases. Phase 1 measured occupancy of 34 lots from June 2019 to March 2020 to understand parking demand and supply, including when and how frequently lots reach capacity. Phase 2 of the study took place from May to July 2021 and focused on a subset of these trailhead lots to better understand the causes and impacts of congestion, including parking duration, number of single occupancy vehicles, and number of failed parking attempts. This report provides methods and results of Phase 1.

Background

Prior to this effort, a system-wide parking study had not been conducted for OSMP-managed trailhead parking lots. Parking and congestion emerged as management issues in the 2005 Visitor Master Plan (City of Boulder, 2005), and were once again highlighted in the 2019 OSMP Master Plan (City of Boulder, 2019) and during management response to the COVID-19 pandemic. Areas of concern include congestion, safety, parking availability and accessibility, increased visitor use, and capacity. In addition to supporting other departmental efforts (e.g., infrastructure provision and design, maintenance operations, ranger patrols), this study primarily contributes to Master Plan strategy Responsible Recreation, Stewardship and Enjoyment (RRSE) Strategy 1: Assess and Manage Increasing Visitation (Tier 1) and RRSE 4: Encourage Multimodal Access to Trailheads (Tier 2) by providing baseline data that will help the department make decisions.

Methods

Timeline and COVID-19 Impacts

This study was originally intended to collect baseline parking data over the course of a year, from June 2019 through May 2020. Impacts from COVID-19 started in mid-March 2020 with a local emergency declaration, shifted priorities, and reduced staff capacity. Most data collection stopped at this time. However, some data continued to be collected at a handful of locations with automated equipment installed. These results will be analyzed and shared separately.

Sampling and Data Collection

All designated OSMP-managed trailhead parking lots were included in this study except for Fourth of July trailhead due to its distance from the rest of the system. Parking in non-OSMP managed areas, such as neighborhoods and other areas outside of formal parking lots were also outside of the scope of this study. OSMP partners with city and county transportation departments, the city's Community Vitality department, and other adjacent jurisdictions on locations where visitors park outside OSMP-managed trailheads to access OSMP land.

A mixed-methods approach was used to accommodate the various shapes and sizes of OSMP-managed trailheads. This consisted of a combination of vehicle counters (inductive loop and pneumatic tube), trail counters, field cameras, and direct observation. The most efficient method for long-term data collection is vehicle counters, but it is only feasible to install them on a small subset of trailheads (described below). Once they are installed and running, they provide nearly continuous data collection. Other methods, such as cameras, can only be installed for short periods of time due to more limited battery and storage capacities and extensive data cleaning and management requirements.

Vehicle Counters

Two types of vehicle counters were used for this study: Diamond Traffic Products Traffic Tally 200™ for buried inductive loops and Diamond Traffic Products Road Runner 3 for pneumatic road tubes (Figure 1). Both types are best used at trailheads that have a relatively long entrance (like a long driveway) that vehicles are unlikely to stop on. Inductive loops were buried underground at locations with natural surfaces and pneumatic tubes were installed at locations with asphalt surfaces. Both units count the number of vehicles passing over them and the direction of travel, which estimate average daily traffic. Vehicle counters were in place through most of the study period with counts aggregated to hourly intervals.

Figure 1. Types of vehicle counters used in the study. Top row: Diamond Traffic Products Road Runner 3 with pneumatic road tubes. Bottom row: Diamond Traffic Products Traffic Tally 200™ with inductive loops.

Trail Counters

Trail counters were considered for locations where installing a vehicle counter was not feasible. Three passive infrared trail counter types were used for this study: Eco-Counter PYRO, Eco-Counter PYRO-Box, and TRAFx Generation III (Figure 2). Most of the Eco-Counter PYRO units were already installed for a separate long-term visitation monitoring effort. The Eco-Counter PYRO-Box and TRAFx units were installed for this study and are intended for shorter-term use. At these locations hourly trail counts can be paired with human observed vehicle counts. Where there are strong relationships between trail counts and vehicle counts, relative trail visits can provide an estimate for percent lot occupancy. This additional analysis is done on a site-by-site basis as feasible based on the strength of the correlation between trail and vehicle counts. Trail counters were in place through most of the study period with counts aggregated to hourly intervals.

Figure 2. Types of passive infrared trail counters used in the study. From left to right: Eco-Counter PYRO, Eco-Counter PYRO-Box, TRAFx Generation III.

Cameras

Cuddeback Black Flash J-1422 cameras were installed where vehicle counters or trail counters were not feasible (e.g., lots with multiple or wide entrances and locations where visitors tend to disperse after parking; Figure 3). Field cameras were installed for six nine-day periods of five weekday days and four weekend days and were set to take photos every 15 minutes. Images were coded by adapting an Access database developed by Colorado Parks and Wildlife for wildlife coding ("CPW Photo Warehouse"). Visibility was sometimes limited at night, but the camera method still generally provided 24-hour data for the time periods in which they were installed. This method requires much more maintenance and data processing time.

Figure 3. Cuddeback Black Flash J-1422 camera used in the study.

Observations

Roving observations were conducted at all sites where cameras were not installed. Observation data were collected by staff visiting the site and recording the number of vehicles parked. These were conducted by splitting the system into five routes that each took approximately one hour to complete. Start times were randomly selected during daylight hours and stratified by weekdays and weekends (33-42% weekend). Each route was completed four times for each session, with the new route starting at the top of the following hour. Approximately 25 four-hour shifts were conducted per site, providing around 100 data points per site.

Although this method was fairly time intensive, it provides valuable information not captured through other methods such as horse trailer, Americans with Disabilities Act (ADA) accessible, unauthorized, and occasional overflow parking data. These data can additionally be paired with the continuous data collected through trail and vehicle counters as “eyes-on-the-ground” validation.

Overall Methods

Although the different data collection methods provide varying levels of detail, all can lead to an estimate of occupancy. Observation and camera data require the least amount of interpretation but are more limited in temporal sampling coverage due to a more extensive data collection process. Vehicle and trail count data provide increased temporal coverage but require more interpretation and can have higher levels of error. Taken together these methods provide a more complete picture of occupancy than one single method. A list of locations and the data collection methods used at each location is provided in Table 1 below.

Table 1. Trailhead parking lots included in the study and the data collection methods used for each site.

#	Trailhead Location	Vehicle Counters	Trail Counters	Cameras	Observations
1	Bobolink		X		X
2	Boulder Valley Ranch	X	X		X
3	Buckingham Park			X	
4	Centennial		X		X
5	Chapman Drive			X	
6	Chautauqua		X		X
7	Cherryvale			X	
8	Cottonwood		X		X
9	Crown Rock			X	
10	Doudy Draw		X		X
11	Dry Creek		X		X
12	Eagle	X	X		X
13	E Boulder Trail White Rocks			X	
14	Enchanted Mesa			X	
15	Flagstaff Summit	X			X
16	Flatirons Vista		X		X
17	Foothills		X		X
18	Fourmile Canyon Creek	X	X		X
19	Greenbelt Plateau	X	X		X
20	Gregory Canyon		X		X
21	Halfway House			X	
22	Joder Ranch	X			X
23	Left Hand		X		X
24	Lost Gulch Overlook			X	
25	Marshall Mesa	X	X		X
26	Panorama Point			X	
27	The Peoples' Crossing			X	
28	Realization Point			X	
29	Sawhill Ponds	X			X
30	South Boulder Creek West		X		X
31	South Mesa	X	X		X
32	Teller Farm North	X			X
33	Teller Farm South	X			X
34	Wonderland Lake		X		X

Data Analysis

Lot capacity

Not all trailhead parking areas have designated parking spots, and the capacity of the lot can vary due to variations in vehicle size, where vehicles park (both authorized and unauthorized spaces), and how close together they park. In determining lot capacity, staff used a variety of resources to come up with the

typical capacity for a standard-sized vehicle to legally park (this excludes "special use" spaces such as ADA, OSMP maintenance/ranger, and horse trailer designated parking spaces). Lot capacity was generally defined by the number of standard spaces available inside the formal lot. In some cases, the lot capacity reflects the intended capacity as indicated by the number of spaces delineated by paint or wheel stops. In other cases, capacity was determined based on how vehicles were typically observed to park. For example, although there are six wheel stops at the Joder Ranch trailhead, they are wider than those installed at other lots, and it is more common to observe the lot at capacity with eight vehicles parked as opposed to six. In lots that do not have parking delineations and were never observed at capacity, capacity was derived by estimating the length of the unmarked area and calculating the number of standard-sized vehicles that would be able to park there. Lot composition for all locations is provided in Table 2 below and in Appendix A: Parking Lot Composition.

Table 2. Estimated OSMP lot composition in 2019-2020.

Trailhead Location	Standard	ADA	OSMP	Horse Trailer
Bobolink	22	2	0	0
Boulder Valley Ranch	14	1	1	0
Buckingham Park	24	1	1	0
Centennial	31	2	1	0
Chapman Drive	15	0	1	0
Chautauqua	48	0	4	0
Cherryvale	17	2	0	10
Cottonwood	16	1	1	0
Crown Rock	6	1	0	0
Doudy Draw	40	2	1	3
Dry Creek	17	2	1	0
Eagle	23	0	1	0
E Boulder Trail White Rocks	9	0	0	0
Enchanted Mesa	9	1	0	0
Flagstaff Summit	89	7	1	0
Flatirons Vista	29	2	1	3
Foothills	22	0	1	0
Fourmile Canyon Creek	36	4	1	0
Greenbelt Plateau	25	1	1	0
Gregory Canyon	37	0	0	0
Halfway House	11	1	0	0
Joder Ranch	8	0	0	2
Left Hand	36	0	1	0
Lost Gulch Overlook	24	0	0	0
Marshall Mesa	45	3	1	4
Panorama Point	14	1	1	0
The Peoples' Crossing	26	1	0	0
Realization Point	16	0	0	0
Sawhill Ponds	19	1	1	0
South Boulder Creek West	29	2	1	3

Trailhead Location	Standard	ADA	OSMP	Horse Trailer
South Mesa	55	3	1	0
Teller Farm North	41	1	1	0
Teller Farm South	32	1	1	0
Wonderland Lake	19	2	1	0

Systemwide Results

In total, OSMP manages approximately 904 standard, 45 ADA accessible, 26 OSMP maintenance/ranger, and 25 horse trailer designated parking spaces as of this study (2020). Approximately 427 standard parking spaces are free to all visitors, 420 require a fee or permit for vehicles registered outside of Boulder County, and 57 require a seasonal fee (Chautauqua and Enchanted Mesa).

The heatmap table in Table 3 shows percent occupancy data for all trailhead parking lots between 9 a.m. and 5 p.m. The highest relative average percent occupancies are highlighted in orange, mid-range occupancies are highlighted in green, and the lowest occupancies are highlighted in blue. While staff collected data that extends beyond these hours, 9 a.m. to 5 p.m. is the most comparable time for all locations. These data show “eyes-on-the-ground” counts from observation and camera data collections, and provide a quick comparative look at how the different OSMP trailheads relate to each other.

For example, the Chautauqua trailhead is often near capacity throughout the day, regardless of the day of week, but is particularly busy between 10 a.m. and 3 p.m. Sites such as The Peoples' Crossing are equally busy on weekdays and weekends, while sites like Doudy Draw and Eagle are much busier on weekends compared to weekdays. Sites like Dry Creek and Boulder Valley Ranch are busier earlier in the day, while Lost Gulch and Panorama Point are busier later in the day. An additional figure showing percent occupancy at 9 a.m. and 12 p.m. is provided in Appendix B: Additional Systemwide Results to help visualize these differences.

Appendix B also contains a heatmap table that shows the average number of vehicles parked, as opposed to percent occupancy. The darker shades of blue represent a higher number of vehicles parked, while the lighter shades represent fewer vehicles parked. In comparing the two tables the reader can identify some relationships between lot size and use. For example, while Crown Rock is on average approximately two-thirds full during the day, this only represents an average of four vehicles at one time. While Gregory Canyon often reaches 20 vehicles during the day, on average it is below 50% occupancy.

This relationship is further described in the Figure 4 map (below), which spatially shows average percent occupancy (color) and lot capacity (circle size). The largest circle on the map is Flagstaff Summit with 89 standard spaces. This represents all spaces, including pull-offs, that are past the gate at Realization Point. Examples of lots with relatively larger parking areas with lower average occupancy include Flagstaff Summit, Marshall Mesa, and Teller Farm North. Relatively smaller lots with higher average occupancy include Bobolink and Dry Creek.

Table 3. Average trailhead parking lot percent use by hour and weekday/weekend (June 2019 through March 2020).

Location	Estimated Capacity	Average Percent Occupancy by Hour								Average		Weekday	Weekend
		9am	10am	11am	12pm	1pm	2pm	3pm	4pm				
Chautauqua	48	89	95	97	97	97	96	91	88	95		92	99
Centennial	31	76	82	87	79	76	65	70	67	76		66	90
The Peoples' Crossing	26	59	69	74	76	76	74	68	58	69		69	69
Realization Point	16	43	57	69	72	69	64	63	54	61		48	78
South Mesa	55	56	65	70	79	61	55	54	38	61		43	85
Crown Rock	6	36	55	66	68	68	69	67	57	61		51	73
Dry Creek	17	70	69	71	55	49	59	56	32	59		51	76
Bobolink	22	44	63	64	62	61	65	54	45	59		49	80
Enchanted Mesa	9	53	61	63	59	56	52	41	25	51		48	55
Flatirons Vista	29	51	50	61	68	44	30	24	17	44		32	62
Gregory Canyon	37	49	50	47	41	40	36	39	45	43		32	59
Wonderland Lake	19	20	43	48	36	43	42	53	50	42		38	50
Boulder Valley Ranch	14	60	63	53	34	30	31	26	30	42		29	67
Doudy Draw	40	48	43	48	54	35	34	29	16	39		16	72
Joder Ranch	8	39	40	45	38	27	21	16	19	33		18	58
Lost Gulch	24	6	12	22	29	35	39	43	43	29		20	39
Panorama Point	14	12	20	30	32	35	31	33	32	28		21	37
S Boulder Creek W	29	28	28	27	32	31	32	28	14	28		20	40
Eagle	23	38	38	35	25	17	16	19	17	27		14	51
Halfway House	11	9	13	19	24	28	31	35	43	25		19	33
Four Mile Creek	36	17	21	27	22	27	27	27	27	25		24	27
Sawhill Ponds	19	27	29	20	19	26	32	21	14	24		19	33
Chapman	15	25	29	28	26	26	24	18	10	23		25	22
Marshall Mesa	45	37	36	33	26	15	17	12	11	23		17	33
Cottonwood	16	21	21	32	25	23	14	16	10	21		21	22
Teller Farm South	32	24	33	20	16	13	15	23	13	20		13	31
Teller Farm North	41	17	21	23	18	17	21	17	11	19		13	29
Buckingham	24	12	15	18	19	22	21	17	15	17		11	26
Flagstaff Summit	89	11	23	20	18	16	21	11	8	17		10	26
Foothills	22	14	15	16	19	10	9	9	12	14		6	26
Left Hand	36	18	18	19	17	9	4	5	3	13		6	24
Greenbelt Plateau	25	17	16	17	12	7	6	4	2	10		5	18
White Rocks	6	9	9	9	9	7	9	6	5	8		6	10
Cherryvale	17	4	5	4	5	4	5	5	4	5		5	5

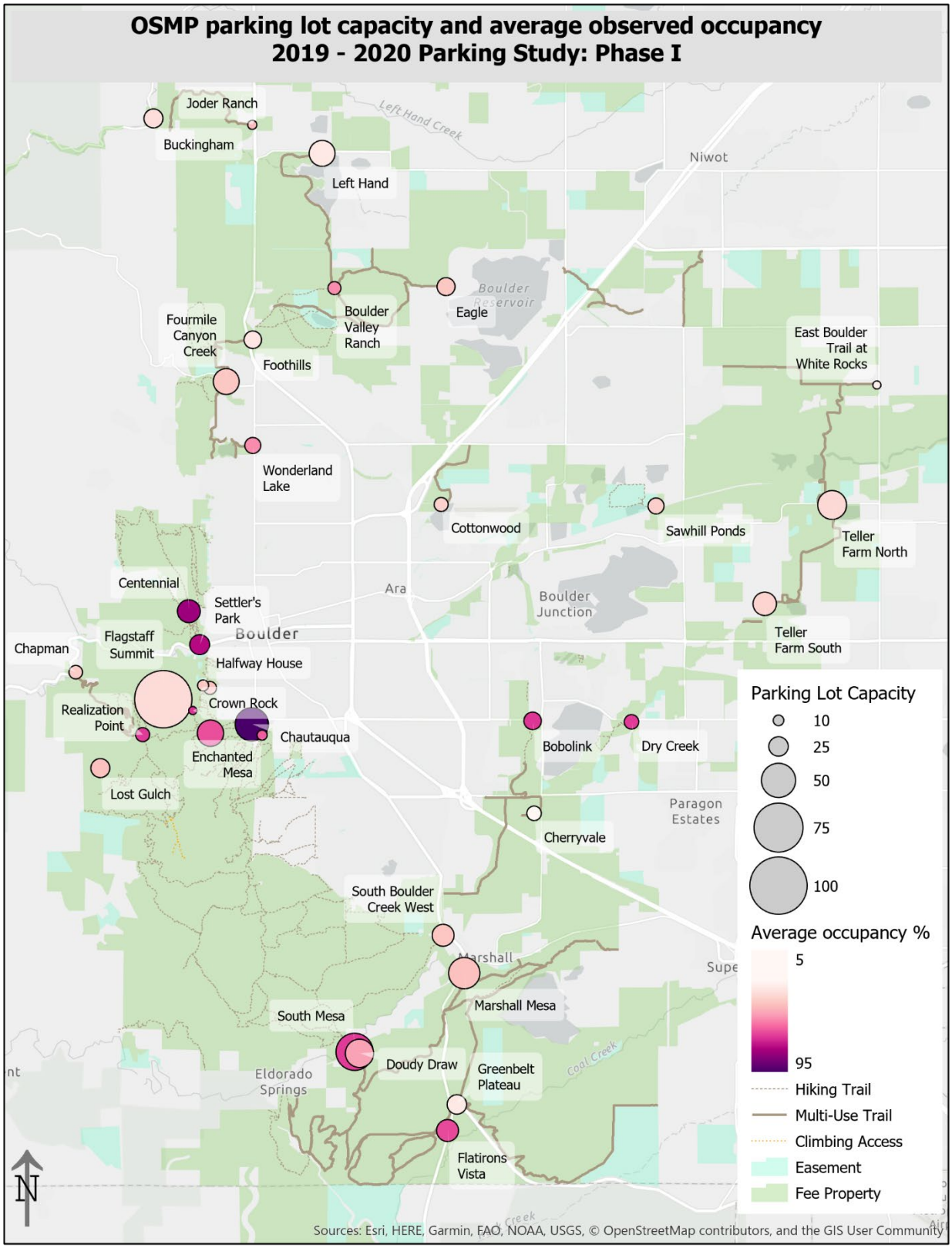


Figure 4. Lot Size and Average Percent Occupancy from 9 a.m. to 5 p.m. Shows data collected from June 2019 through March 2020.

Site-Specific Results

A higher level of detail can be obtained on a site-by-site basis. For example, Figure 5 below shows hourly occupancy data for South Mesa for hours with at least two data points. Based on these data, South Mesa was observed to be at 57% occupancy with 31 vehicles parked during the day on average. This slightly differs from the 61% listed in Table 3 above because it is based on data from 8 a.m. to 7 p.m. as opposed to 9 a.m. to 5 p.m. (the timeframe with which staff can most accurately compare sites to each other). For locations where cameras were installed, 24-hr data are provided, as well as weekday and weekend variations because sufficient datapoints were collected to provide that level of detail (e.g., Lost Gulch Overlook in Figure 6). Overall occupancy estimates for observations were restricted to 7 a.m. to 6 p.m., since these were the typical daylight hours during the study period (June through March).

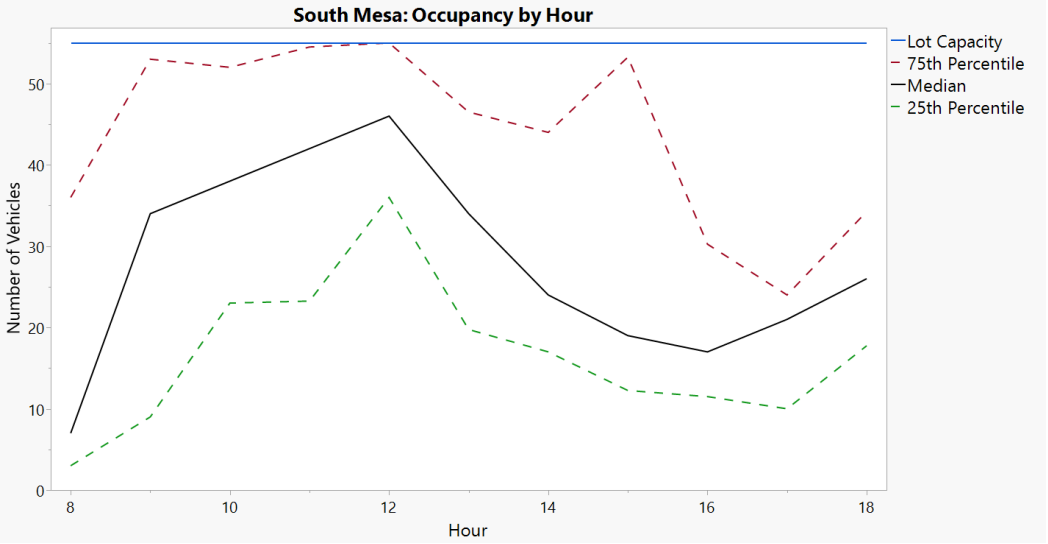


Figure 5. Hourly occupancy data for South Mesa for hours with at least two data points. Shows data collected from June 2019 through March 2020.

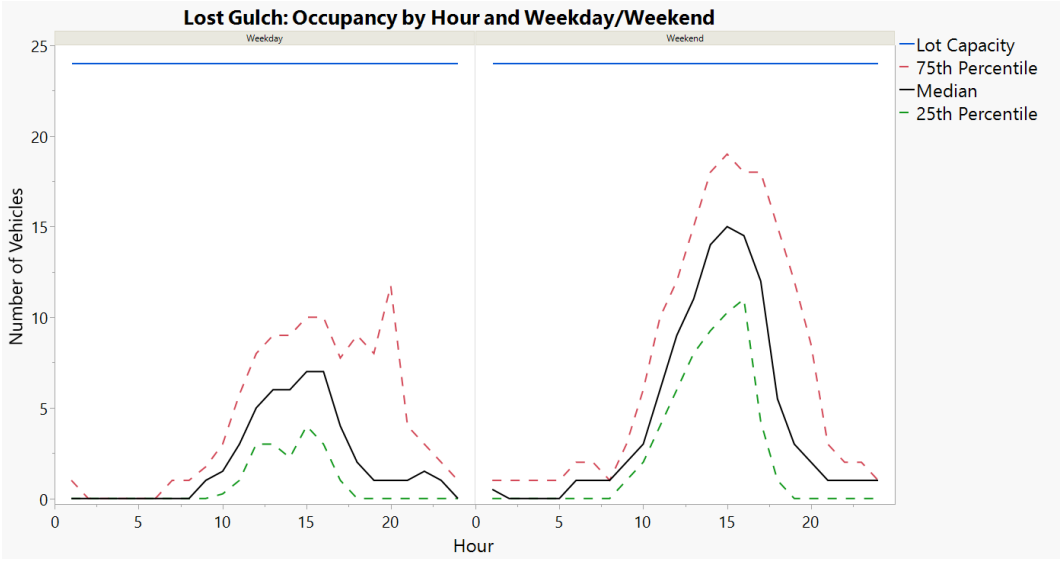


Figure 6. Hourly and weekday/weekend occupancy data for Lost Gulch Overlook. Shows data collected from June 2019 through March 2020.

At locations where vehicle and trail counters were installed, relative use can be estimated by day of the week in terms of the percent of vehicle and trail counts by day of the week (Figure 7 and Figure 8).

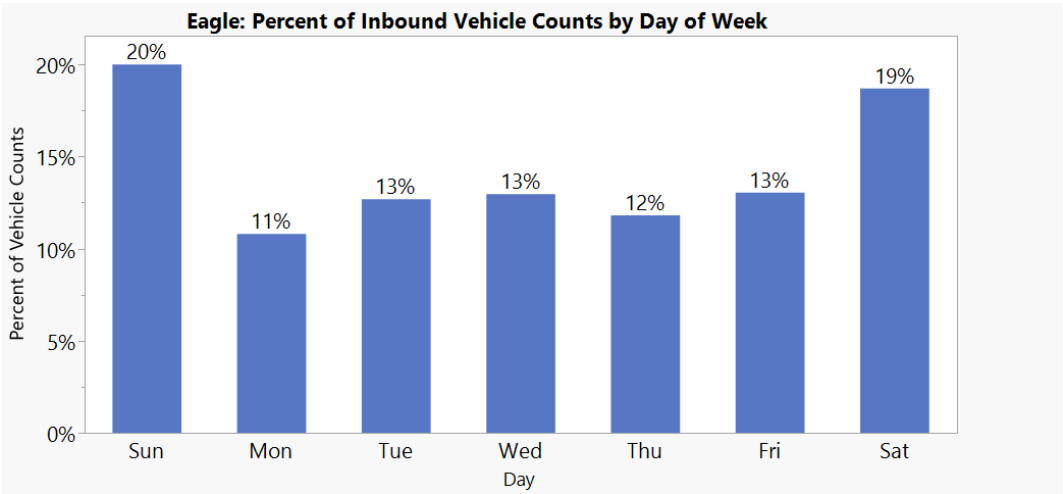


Figure 7. Percent of inbound vehicle counts by day of week at Eagle. Shows data collected from June 2019 through March 2020.

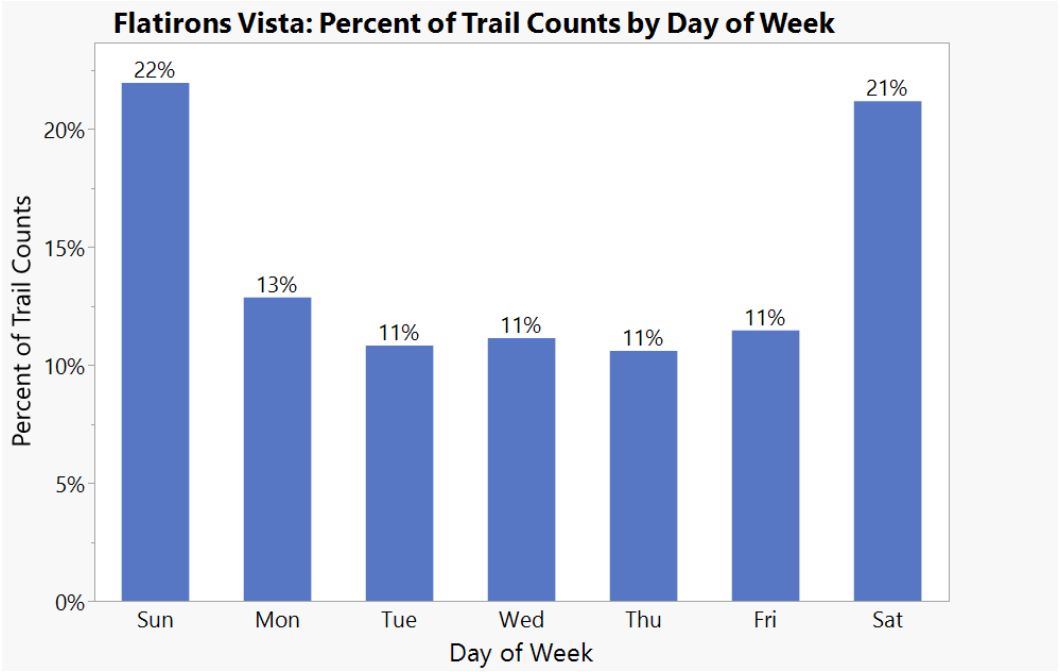


Figure 8. Percent of trail counts by day of week at Flatirons Vista. Shows data collected from June 2019 through March 2020.

An hourly comparison of the five highest percent occupancy lots is shown in Figure 9 below. Note how the distribution for The Peoples' Crossing looks very similar for weekdays and weekends, while the other locations show more variation. A site-specific summary of each location can be found in Appendix C: Results by Location.

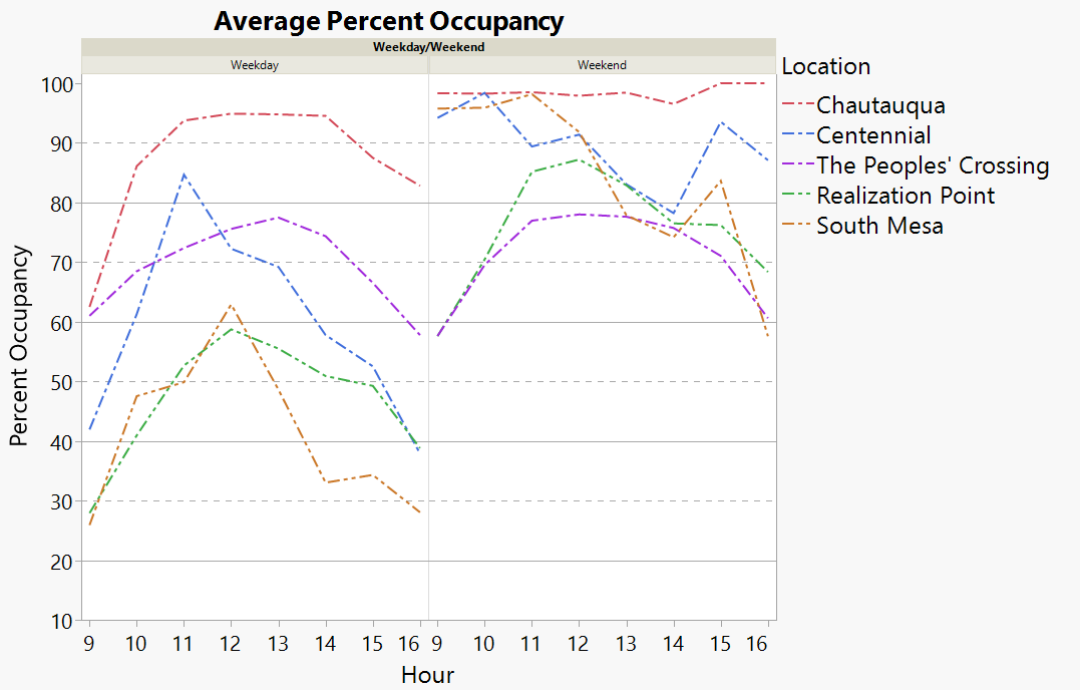


Figure 9. Hourly average percent occupancy by weekday and weekend. Shows data collected from June 2019 through March 2020.

Ongoing Data Collection and Combining with Other Datasets

Data will continue to be collected at trailheads that have more permanent infrastructure installed (inductive loop vehicle counters and select trail counters). Human Dimensions staff plans to semi-automate the data collection and analysis process to quicken the turnaround and increase the utility of these data. This ongoing collection will support staff in managing visitor access by monitoring trends and measuring impacts of potential management actions.

These data can also be integrated with other existing datasets such as trail counter and survey data, including the 2021-2023 Public Opinion and Visitor Experience Survey effort. Example questions these paired datasets will help inform include:

- How does occupancy relate to perceived parking congestion, crowding, and experiences?
- How does occupancy relate to arrival mode or potential arrival mode?
- How does occupancy relate to trip durations?
- To what extent does a full lot impact visitation numbers?
- Where does parking demand exceed lot supply, and how does this relate to trail use?
- To what extent does Doudy Draw serve as overflow parking for South Mesa?

- Are visitors from outside Boulder County more or less likely to use fee parking lots compared to Boulder County residents?

Conclusion

Parking can be an important part of the visitor experience. Collecting baseline data on where and when congestion occurs is the first step required to address it. The data from this study provide staff with a better understanding of how OSMP trailhead parking lots are utilized and will help the department make data-informed management decisions. These data support multiple OSMP Master Plan strategies, including RRSE.1) Assess and Manage Increasing Visitation (Tier 1), RRSE.4 Encourage Multimodal Access to Trailheads (Tier 2), and RRSE.9) Develop a Learning Laboratory Approach to Recreation (Tier 3).

The Master Plan also outlines potential steps for identifying visitation thresholds at specific sites, where appropriate. In combination with other datasets, these data will be instrumental in determining which locations and thresholds to consider, and how to maintain positive visitor experiences while sustaining ecosystem health. Additionally, these data will help staff assess what, if any, congestion reduction strategies would be most likely to be effective for a given location, whether it is a shuttle, public bus stop, reservations, fees, time limits, cameras, or another strategy.

This dataset is also intended to:

- Help visitors plan their trips by knowing when trailheads lots tend to reach capacity,
- Inform the feasibility of potential visitor use management approaches such as concentrating or dispersing visitor use, encouraging multi-modal access, and supporting area management plans,
- Inform OSMP staff of where and when trailhead lots are likely overflowing and impacting surrounding areas,
- Inform OSMP rangers where and when illegal or unsafe parking likely occurs,
- Inform OSMP staff of which trailheads would benefit most from additional management strategies, and which to continue monitoring,
- Explore how expanding, reducing lot size or reconfiguring would likely impact visitation numbers,
- Inform future lot modifications and design,
- Quantify the extent that horse trailer and ADA accessible parking spaces are utilized,
- Collaborate with neighboring jurisdictions and communities/associations to help manage OSMP adjacent parking,
- Determine which trailheads and months see the highest levels of night use, and

- Help understand how the COVID-19 pandemic affected parking occupancy.

References

City of Boulder. (2005). Visitor Master Plan. Boulder, CO: City of Boulder Open Space and Mountain Parks. Retrieved from: https://bouldercolorado.gov/media/2428/download?inline

City of Boulder. (2019). OSMP Master Plan. Boulder, CO: City of Boulder Open Space and Mountain Parks. Retrieved from: https://bouldercolorado.gov/media/2666/download?inline

Appendix A: Parking Lot Composition

The following pages depict the method(s) used for each site, equipment installation locations, and lot composition in 2019-2020.

Spaces that are demarcated with wheel stops or paint are referred to as “marked”; spaces without this demarcation are listed as “unmarked” and were estimated using observed parking numbers and/or the length of the available area to park.

Vehicles parked outside of the formal lot were recorded at some locations (e.g., Boulder Valley Ranch, Dry Creek). These areas are listed as “informal” parking and are generally outside of the study area. While these vehicles were sometimes counted and these data are available, they are excluded from capacity and occupancy calculations as the focus of the study was to measure occupancy for the formal parking areas.

This appendix was compiled by Katie Wilson, Human Dimensions Research Technician.

Contents

Bobolink .....

Boulder Valley Ranch .....

Buckingham Picnic Area .....

Centennial .....

Chapman Drive .....

Chautauqua .....

Cherryvale .....

Cottonwood .....

Crown Rock .....

Doudy Draw .....

Dry Creek .....

Eagle .....

Enchanted Mesa .....

Flagstaff Summit – East .....

Flagstaff Summit – Nature Center .....

Flagstaff Summit – West .....

Flagstaff Summit Road – Lower .....

Flagstaff Summit Road – Pull-Offs (1) .....

Flagstaff Summit Road – Pull-Offs (2) .....

Flatirons Vista .....

Foothills .....

Fourmile .....

Greenbelt Plateau .....

Gregory Canyon .....

Halfway House .....

Joder Ranch .....

Lefthand .....

Lost Gulch .....

Marshall Mesa .....

Panorama Point .....

The Peoples' Crossing .....

Realization Point .....

Sawhill Ponds .....

South Boulder Creek West .....

South Mesa .....

Teller Farm North .....

Teller Farm South .....

White Rocks .....

Wonderland Lake .....

Bobolink

1/6 Northeast Roving Route
South Boulder Creek Eco-Counter

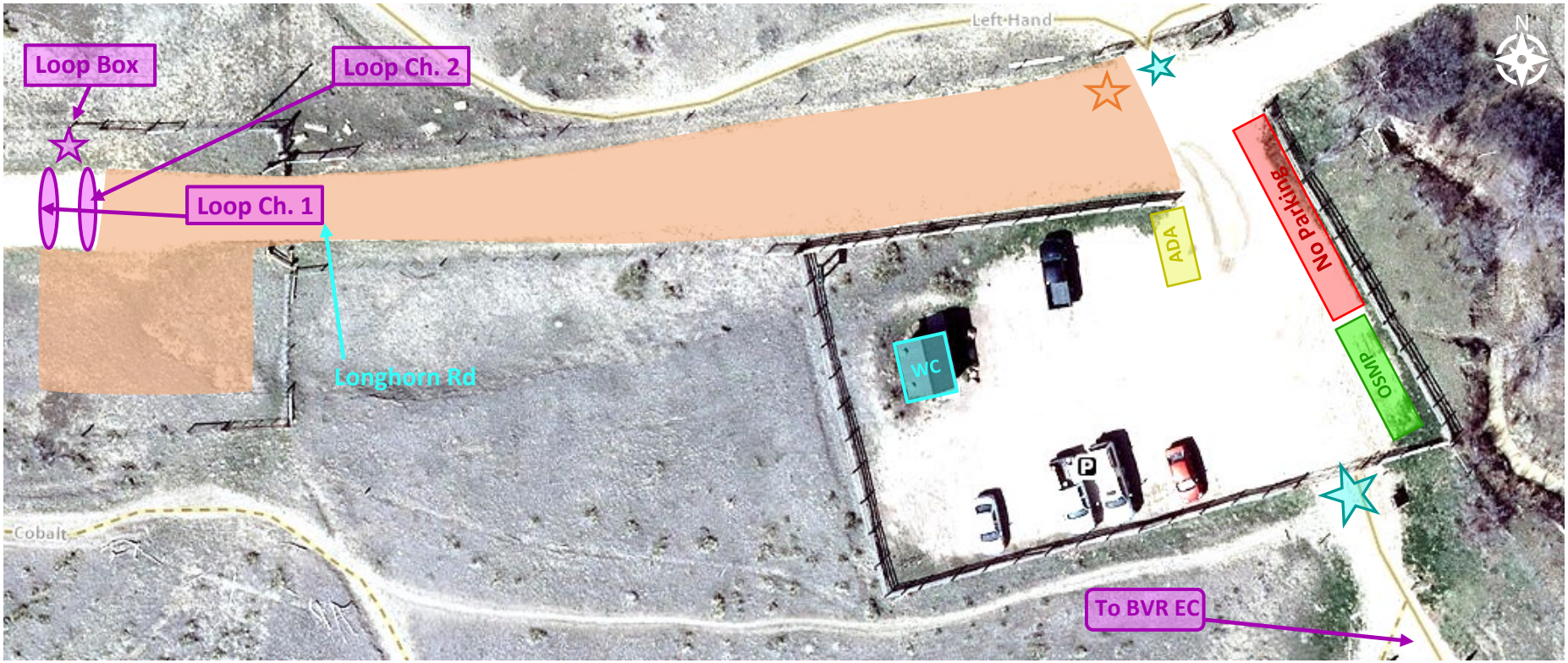
Lot Composition
Capacity – 22
(21 marked, 1 unmarked)

Boulder Valley Ranch

5/6 North Roving Route
BVR Inductive Loop
Boulder Valley Ranch Eco-Counter

Lot Composition
Capacity – 14 (inside)
(14 unmarked)
Informal – 17 (outside)

Access Pt / TH
Informal Parking
HD Equipment



Buckingham Picnic Area

Buckingham Cam

Access Pt / TH

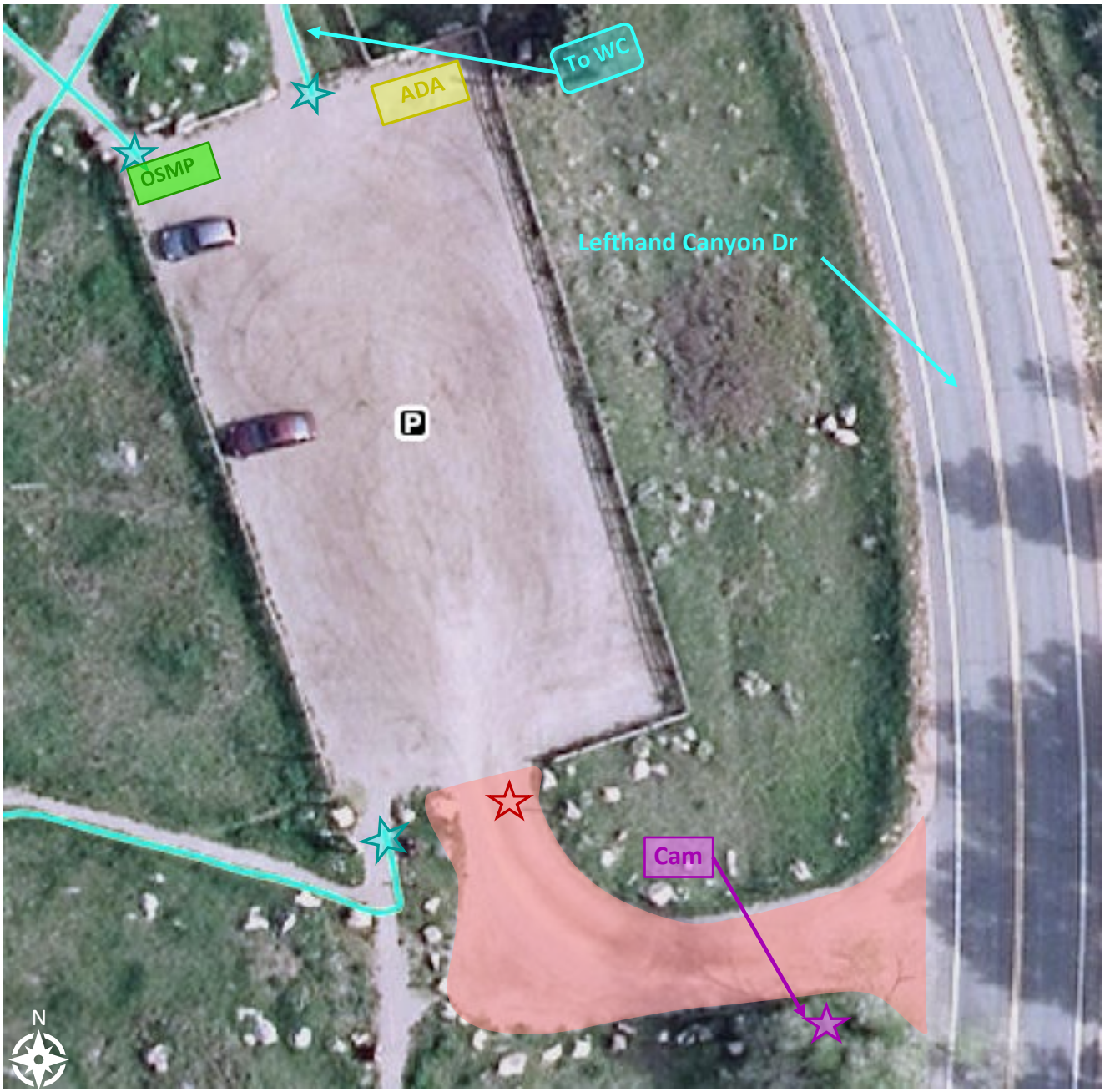
HD Equipment

No Parking

Lot Composition

Capacity – 24

(24 marked)



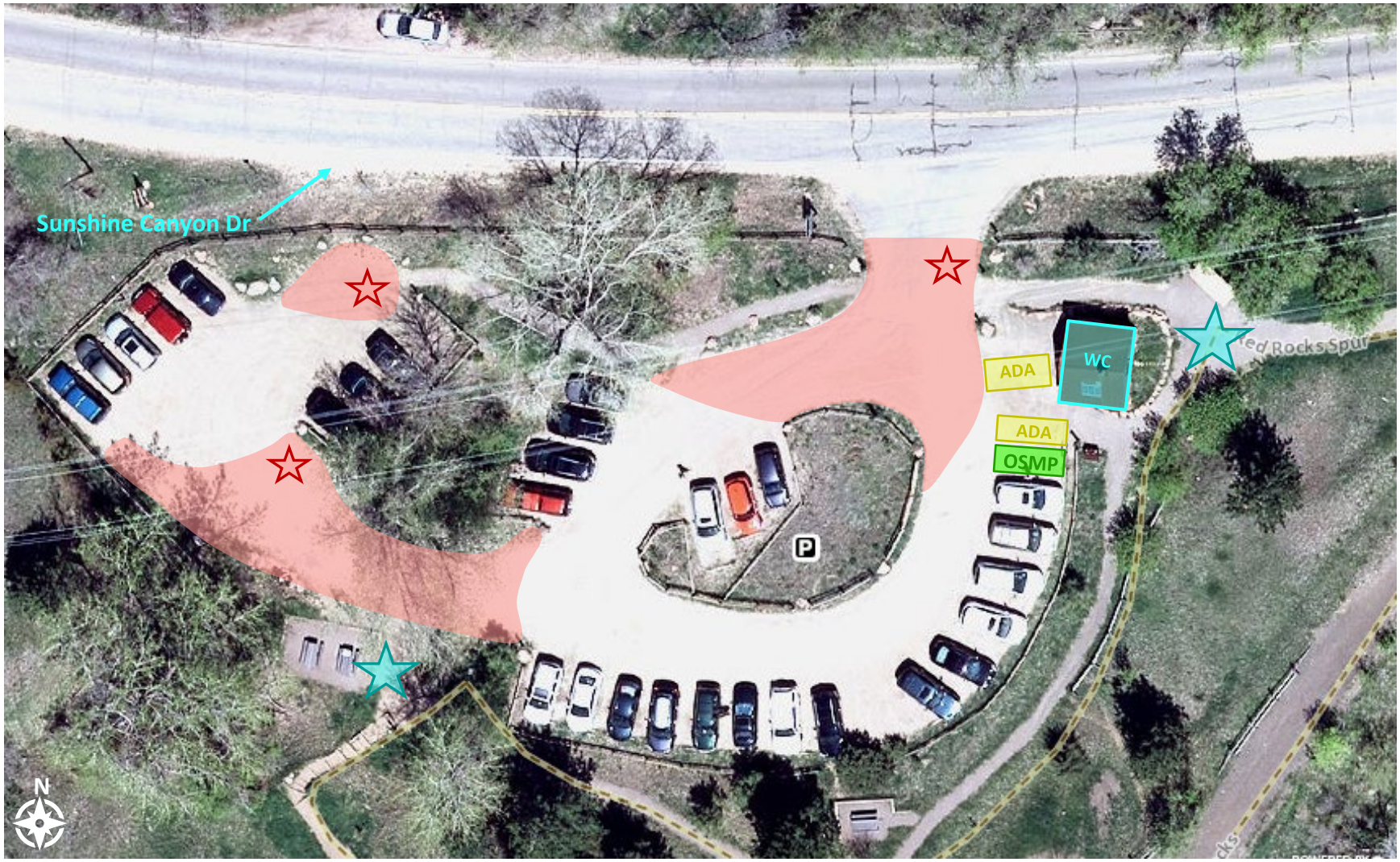
Centennial

3/3 Northwest Roving Route
3/5 Northwest-West Roving Route

Lot Composition
Capacity – 31
(30 marked, 1 unmarked)

Access Pt / TH

No Parking



Chapman Drive

Chapman Cam

Lot Composition
Capacity – 15
(10 marked, 5 unmarked)

Chautauqua

1/7 West Roving Route
4/5 Northwest-West Roving Route
Chautauqua Eco-Counter

Lot Composition
Capacity – 48 (marked)

Cherryvale

Cherryvale North Cam
Cherryvale South Cam

Access Pt / TH

HD Equipment

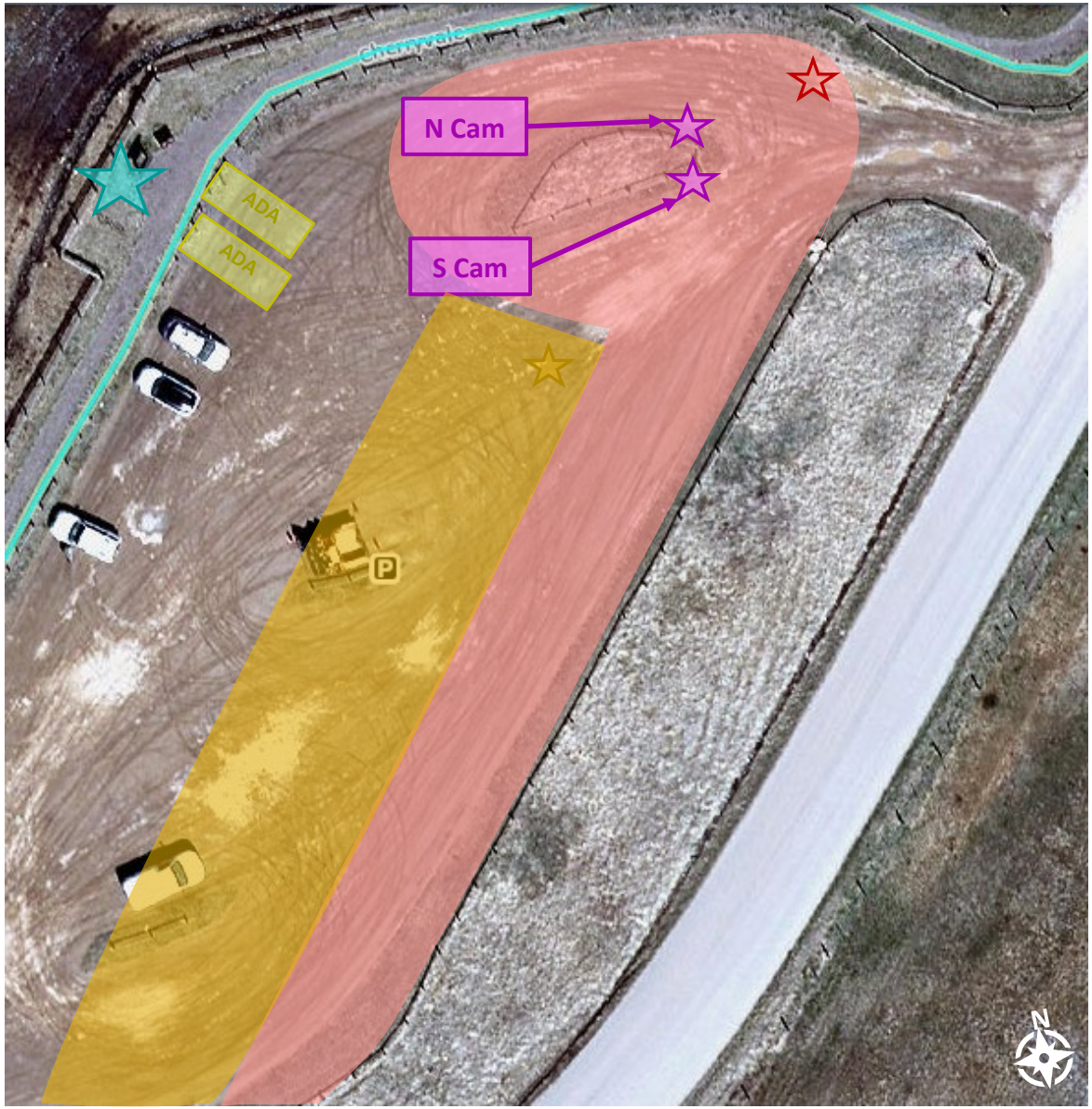
No Parking

Horse Parking

Lot Composition

Capacity – 17 (marked)

Horse – 10 (unmarked) Note: there is approximately 160 feet available in the designated horse trailer area. This estimate allows around 16 feet width per trailer.



Cottonwood

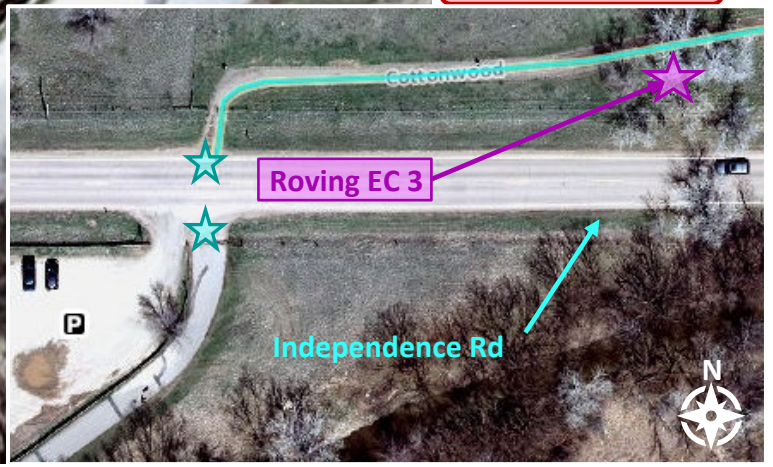
1/6 North Roving Route
Roving Eco-Counter 3

Lot Composition
Capacity – 16
(9 marked, 7 unmarked)

Access Pt / TH

HD Equipment

No Parking



Crown Rock

Crown Rock Cam

Access Pt / TH

HD Equipment

Lot Composition

Capacity – 6

(6 marked)

Doudy Draw

3/7 South Roving Route
Doudy Draw Eco-Counter

Access Pt / TH

Horse Parking

No Parking

Lot Composition
Capacity – 40
(36 marked)
Horse – 3
(3 marked)

Dry Creek

2/5 Northeast Roving Route
Dry Creek TRAFx

Lot Composition
Capacity – 17 (inside)
(19 marked, but multiple vehicles can't fit in corner)
Informal – 17 (outside)

Access Pt / TH

HD Equipment

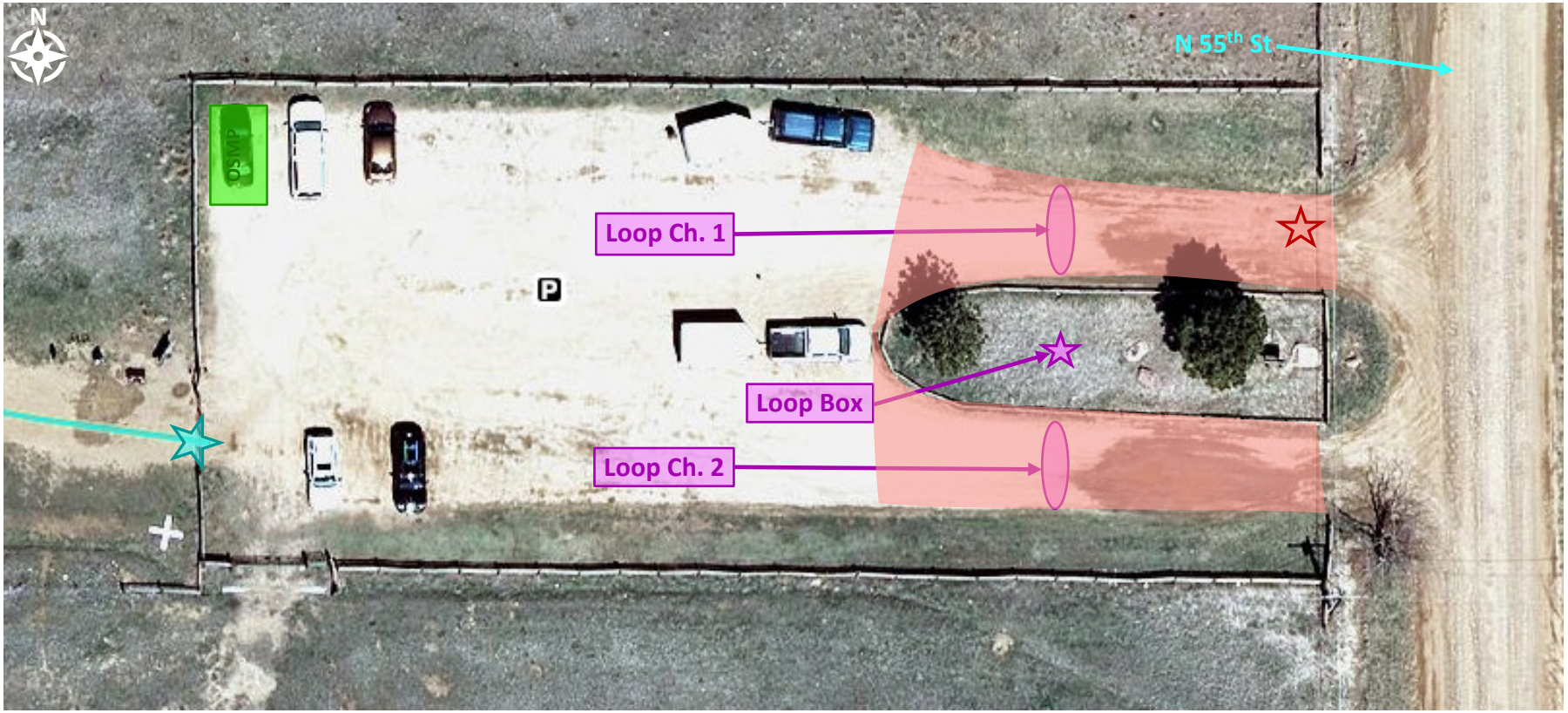
Informal Parking

Eagle

2/6 North Roving Route
Eagle Inductive Loop
Eagle Eco-Counter

Lot Composition
Capacity – 23
(23 unmarked)

Access Pt / TH
HD Equipment
No Parking



Enchanted Mesa

Enchanted Mesa Cam

Access Pt / TH

HD Equipment

No Parking

Lot Composition

Capacity – 9

(5 marked, 4 unmarked)

Flagstaff Summit – East

6/7 West Roving Route

Access Pt / TH

No Parking

Not Included

Lot Composition
Capacity – 12
(12 marked)

Flagstaff Summit – Nature Center

5/7 West Roving Route

Access Pt / TH

No Parking

Lot Composition

Capacity – 35

(35 marked)

Flagstaff Summit – West
7/7 West Roving Route

Lot Composition
Capacity – 16
(11 marked, 5 unmarked)

Flagstaff Summit Road – Lower

3/7 West Roving Route

No Parking

Lot Composition

Capacity – 10

(10 marked)

Flagstaff Summit Road – Pull-Offs (1)

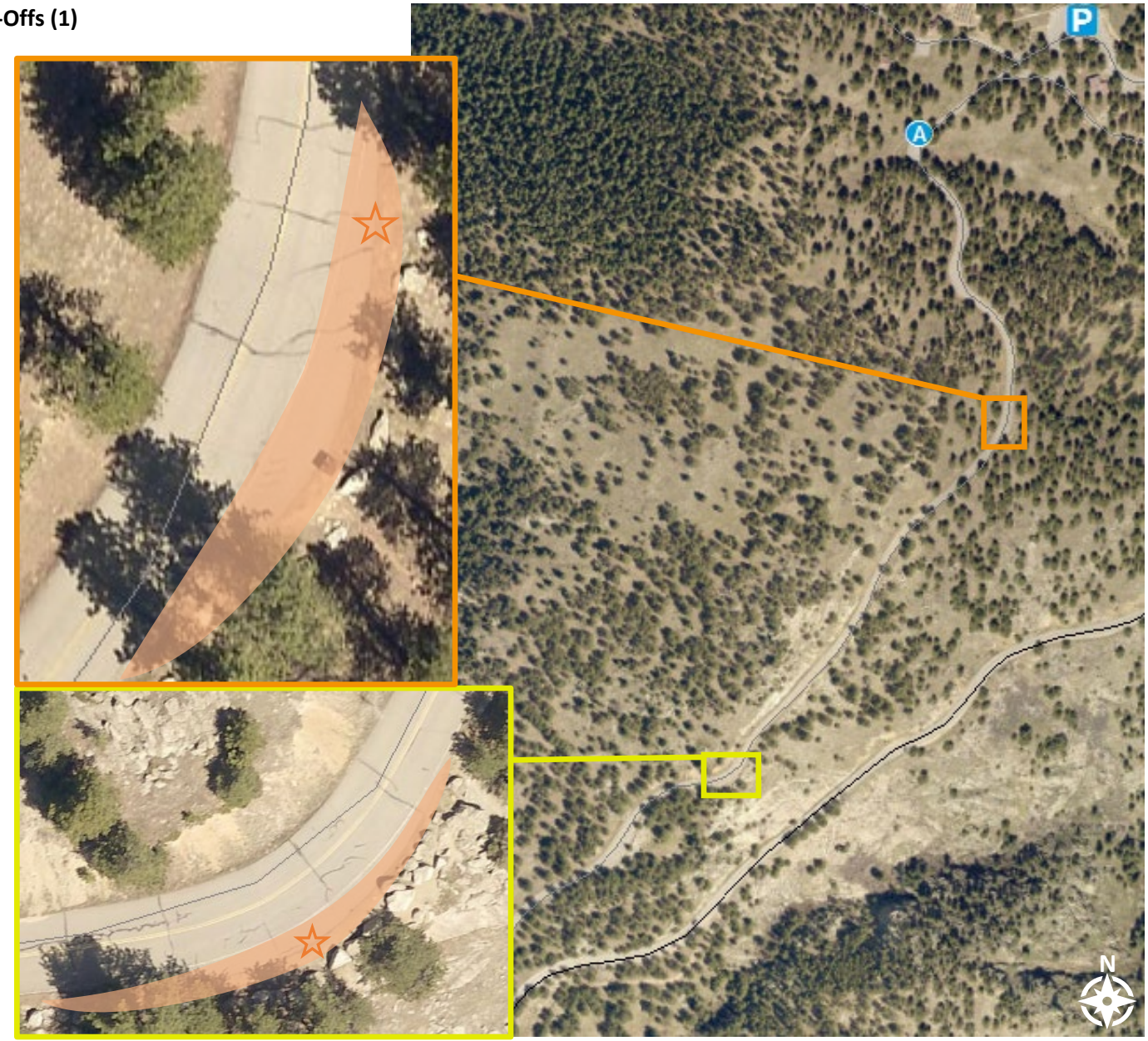
4/7 West Roving Route

Informal Parking

Lot Composition (1 + 2)

Capacity – 8

(8 unmarked)



Flagstaff Summit Road – Pull-Offs (2)

4/7 West Roving Route

Access Pt / TH

Informal Parking

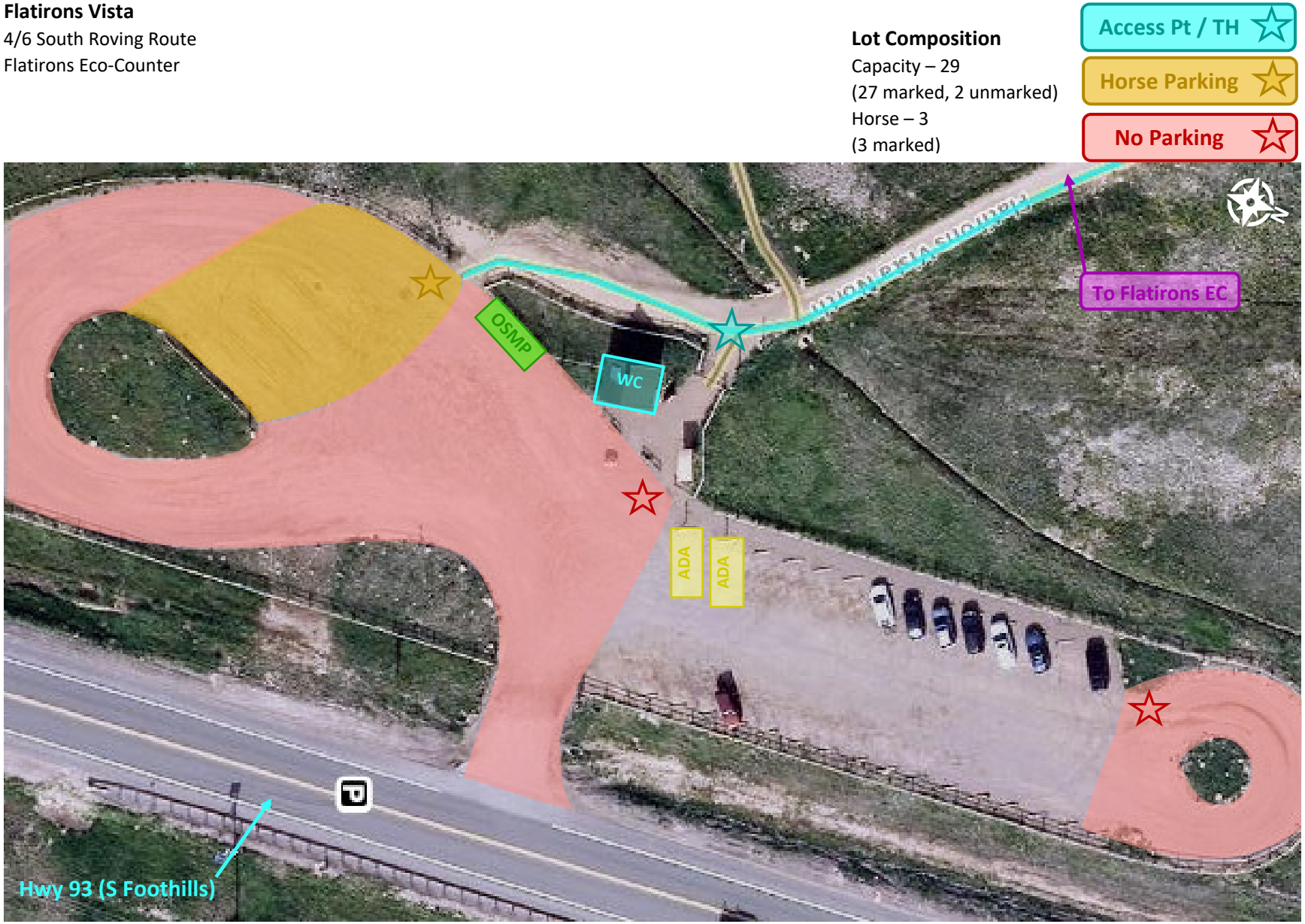
Lot Composition (1 + 2)

Capacity – 8

(8 unmarked)

Flatirons Vista
4/6 South Roving Route
Flatirons Eco-Counter

Lot Composition
Capacity – 29
(27 marked, 2 unmarked)
Horse – 3
(3 marked)



6/6

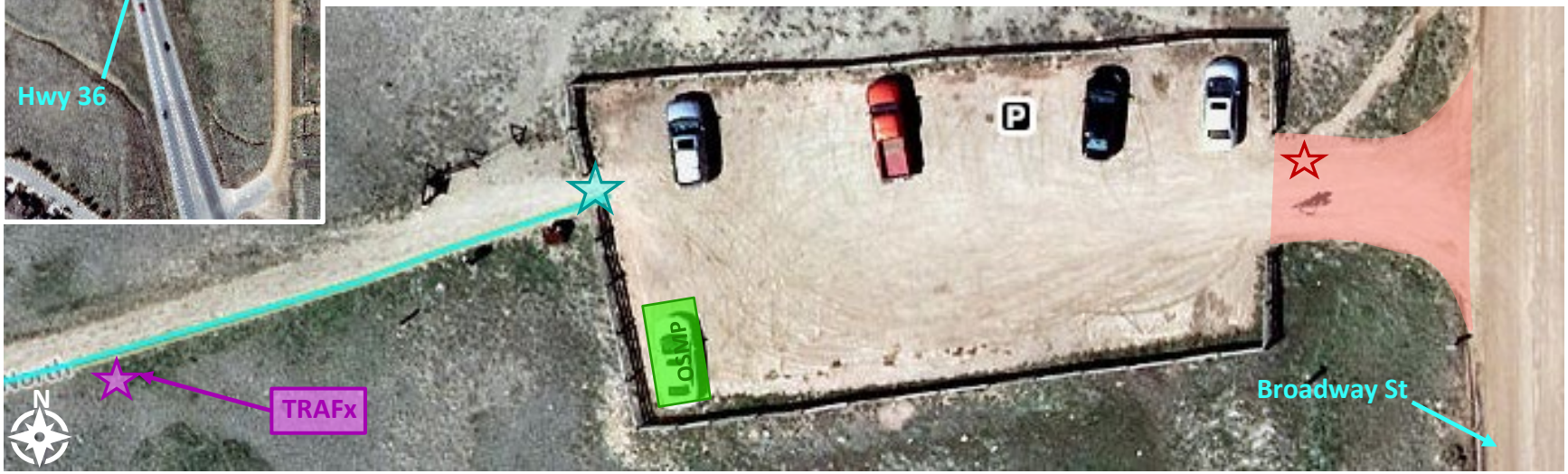
Foothills
North Roving Route
Foothills (Highway 36) TRAFx

Lot Composition
Capacity – 22
(22 marked)

Access Pt / TH

HD Equipment

No Parking



Fourmile

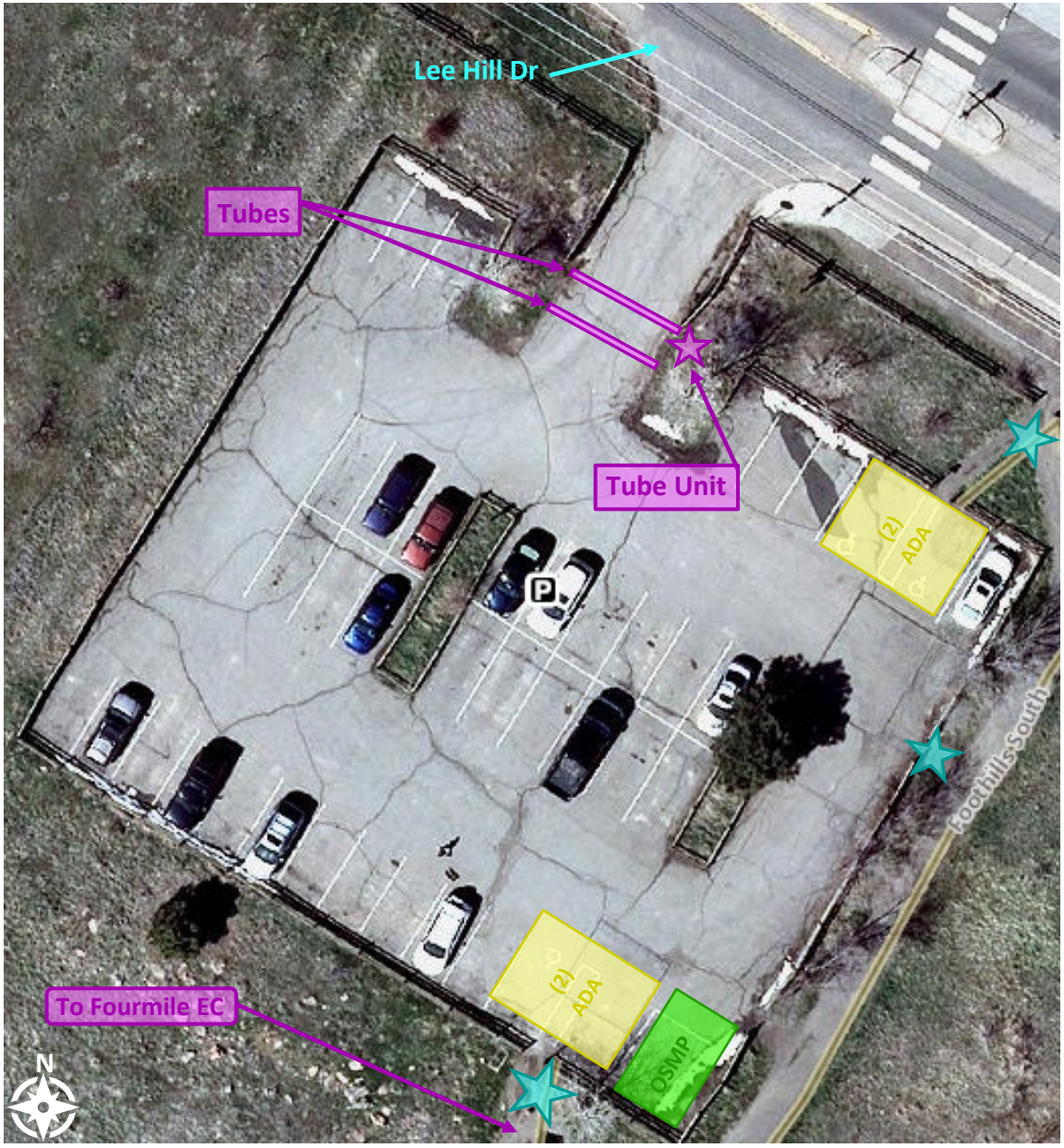
1/3 Northwest Roving Route
1/5 Northwest-West Roving Route
Fourmile Tubes
Fourmile Eco Counter

Access Pt / TH

HD Equipment

Lot Composition

Capacity – 36
(36 marked)



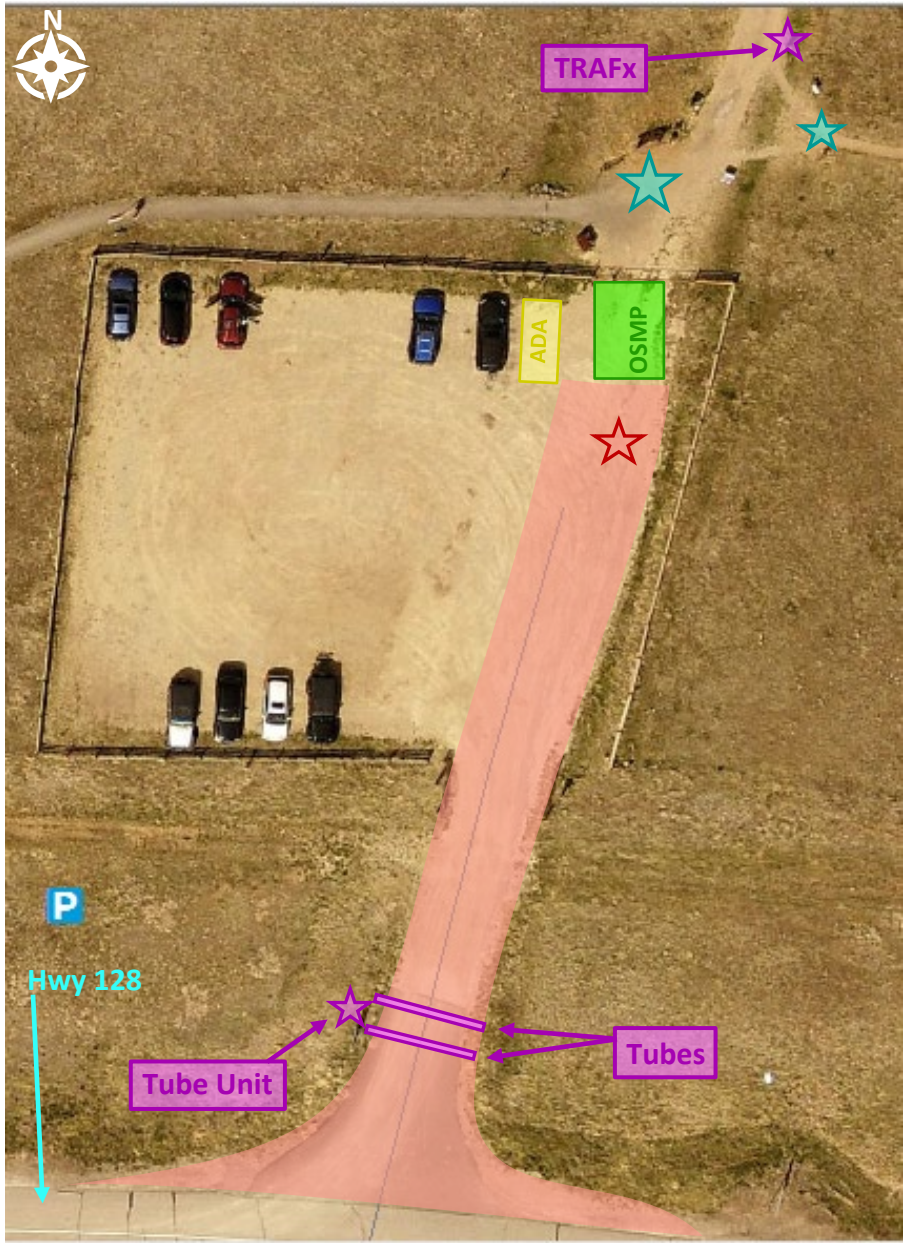
Greenbelt Plateau
5/6 South Roving Route
Greenbelt Tubes
Greenbelt TRAFx

Access Pt / TH

HD Equipment

No Parking

Lot Composition
Capacity – 25
(25 unmarked)



Gregory Canyon
2/7 West Roving Route
5/5 Northwest-West Roving Route
Gregory Canyon TRAFx

Lot Composition
Capacity – 37
(7 marked, 30 unmarked)

Halfway House

Halfway Cam

Access Pt / TH

HD Equipment

No Parking

Lot Composition

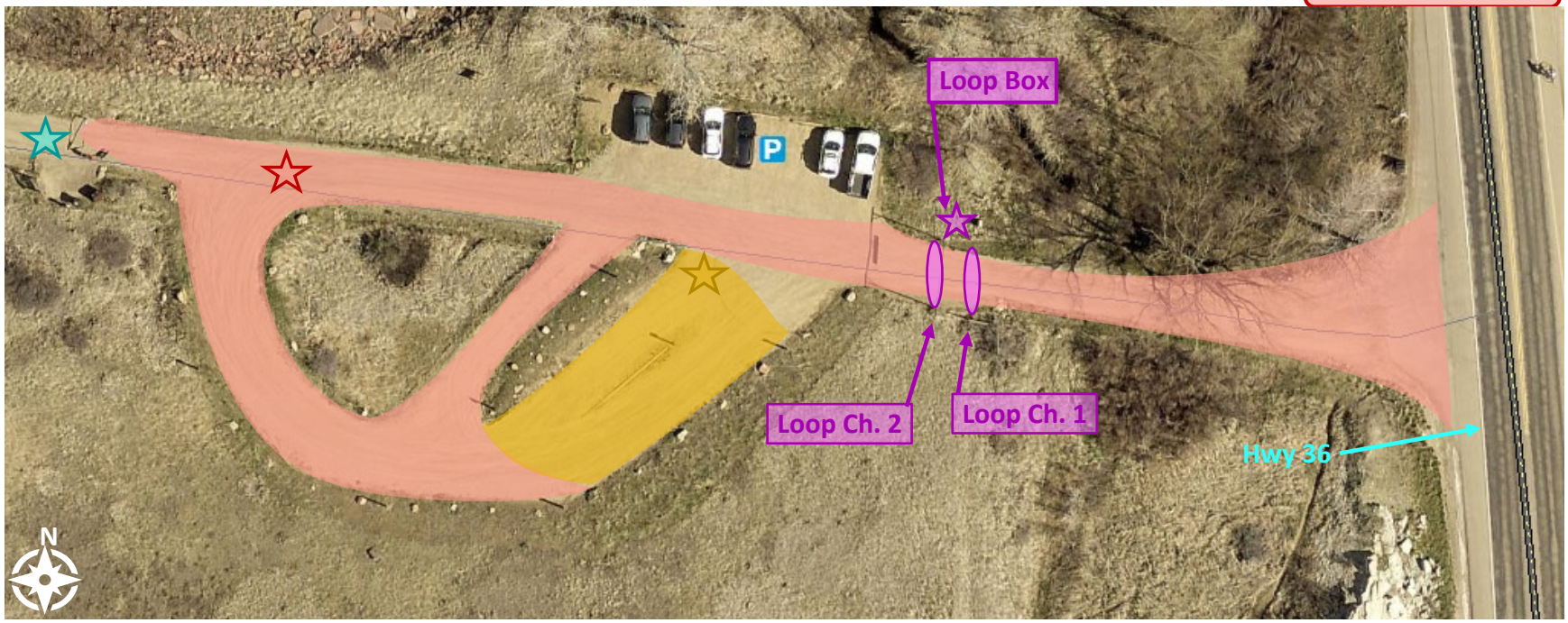
Capacity - 11

(11 marked)

Joder Ranch
4/6 North Roving Route
Joder Inductive Loop

Access Pt / TH
HD Equipment
Horse Parking
No Parking

Lot Composition
Capacity – 8
(6 marked, 2 unmarked)



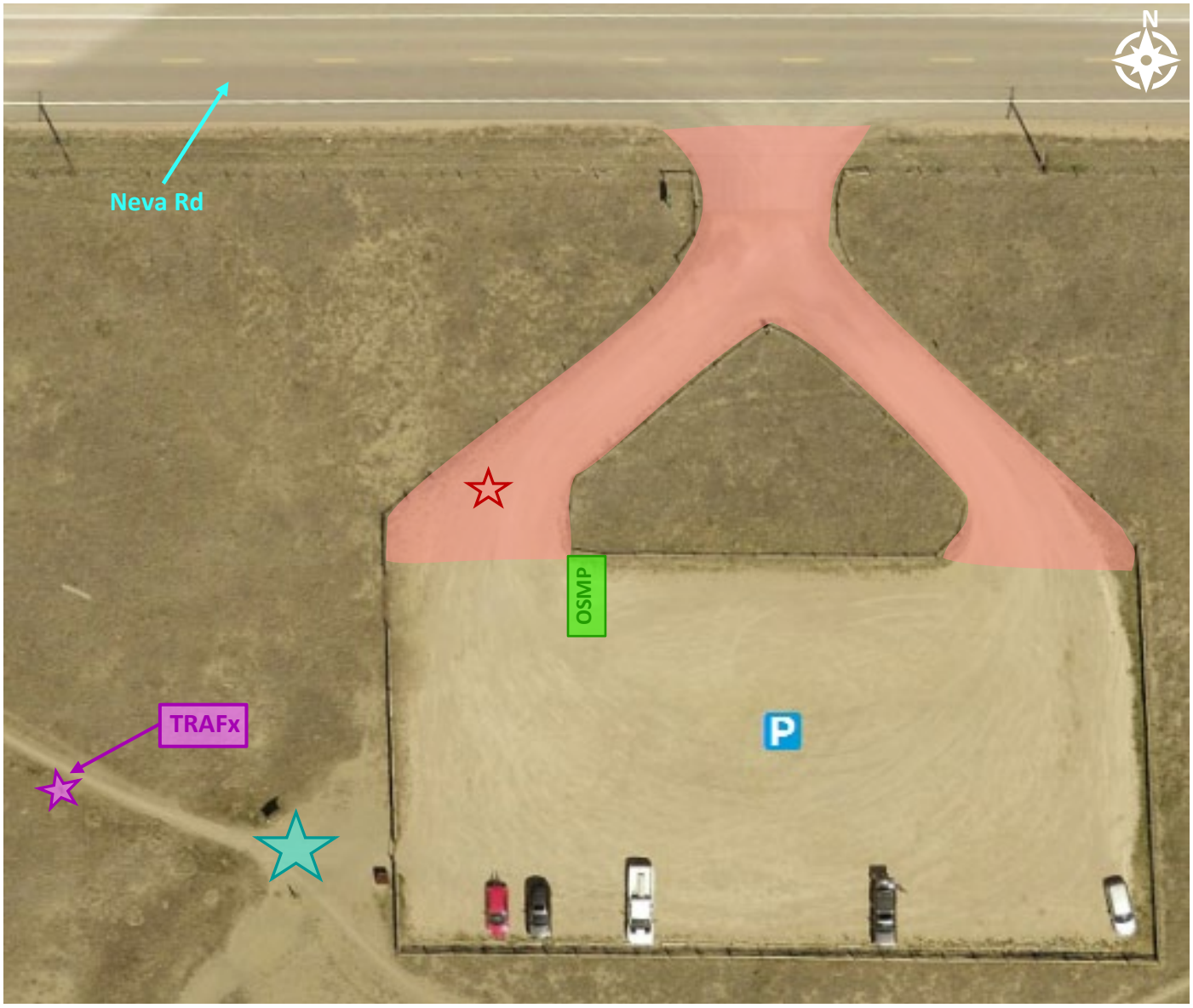
Lefthand
3/6 North Roving Route
Lefthand TRAFx

Access Pt / TH

HD Equipment

No Parking

Lot Composition
Capacity – 36
(16 marked,
20 unmarked)



Lost Gulch

Lost Gulch East Cam

Lost Gulch West Cam

Access Pt / TH

HD Equipment

Informal Parking

Lot Composition

Capacity – 24

(24 unmarked)

Marshall Mesa

6/6 South Roving Route
Marshall Mesa Tubes
Coal Seam TRAFx
Marshall Valley TRAFx
Coal Seam Eco Counter

Lot Composition

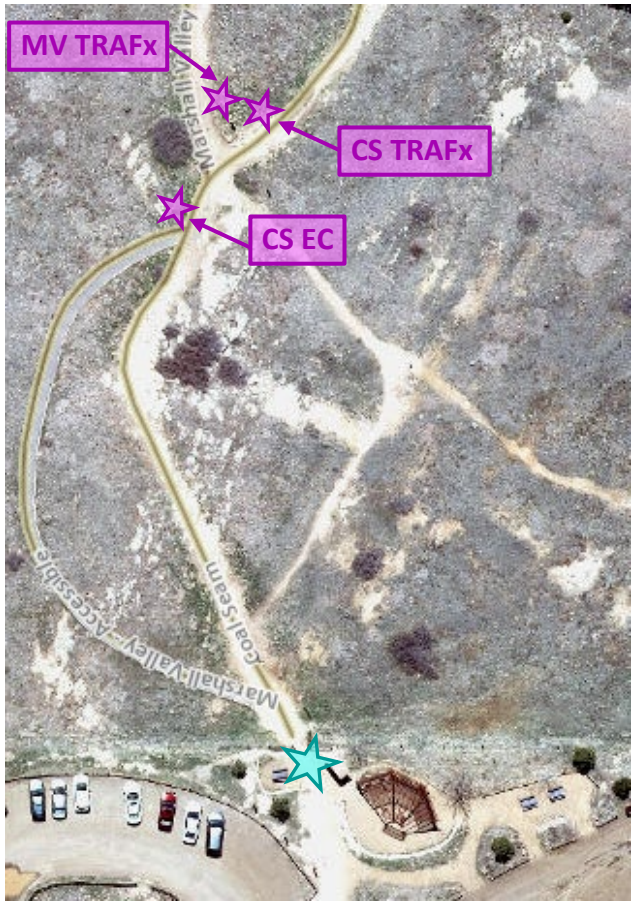
Capacity – 45
(45 unmarked)

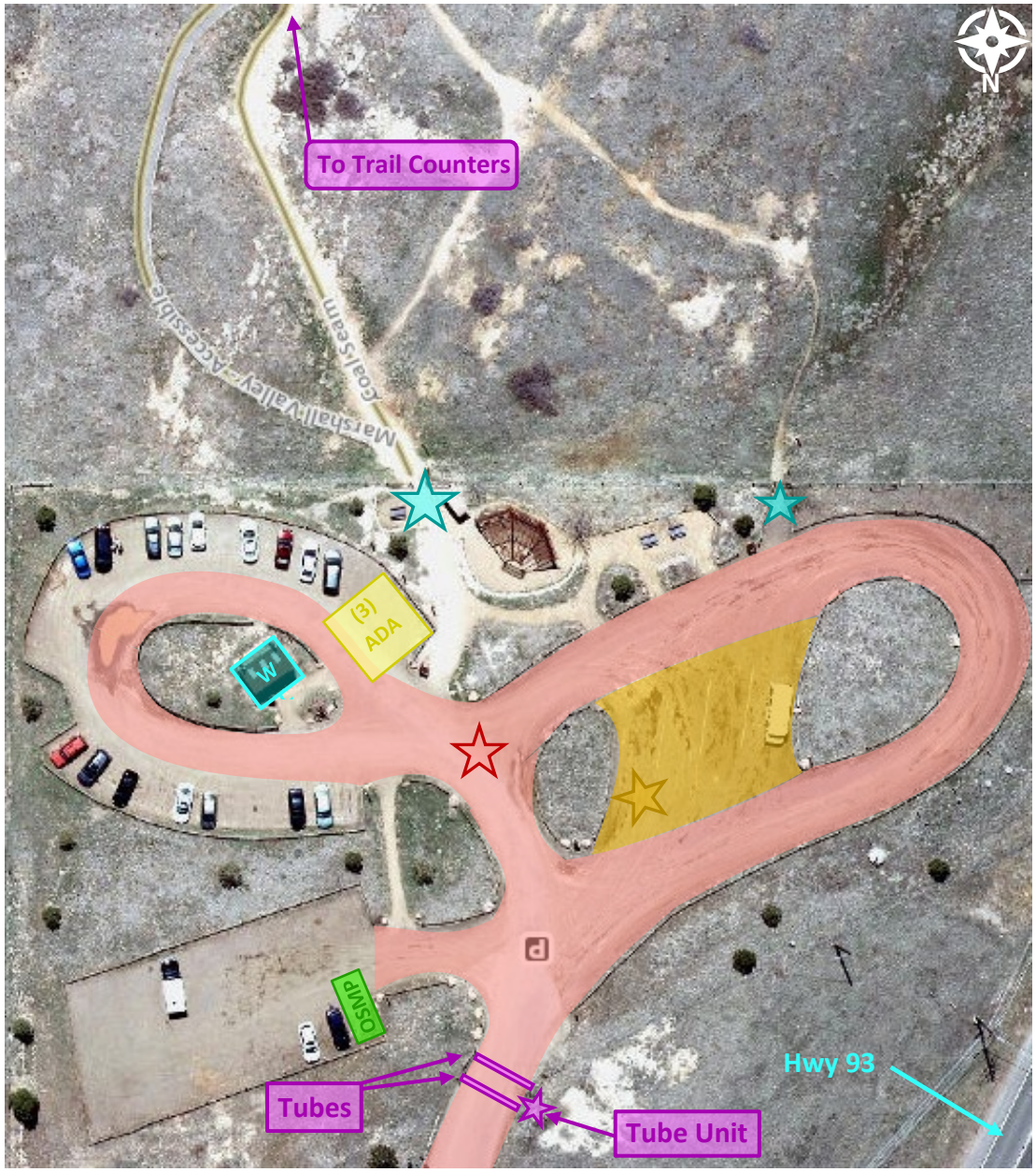
Access Pt / TH

HD Equipment

Horse Parking

No Parking





Panorama Point
Pano North Cam
Pano South Cam

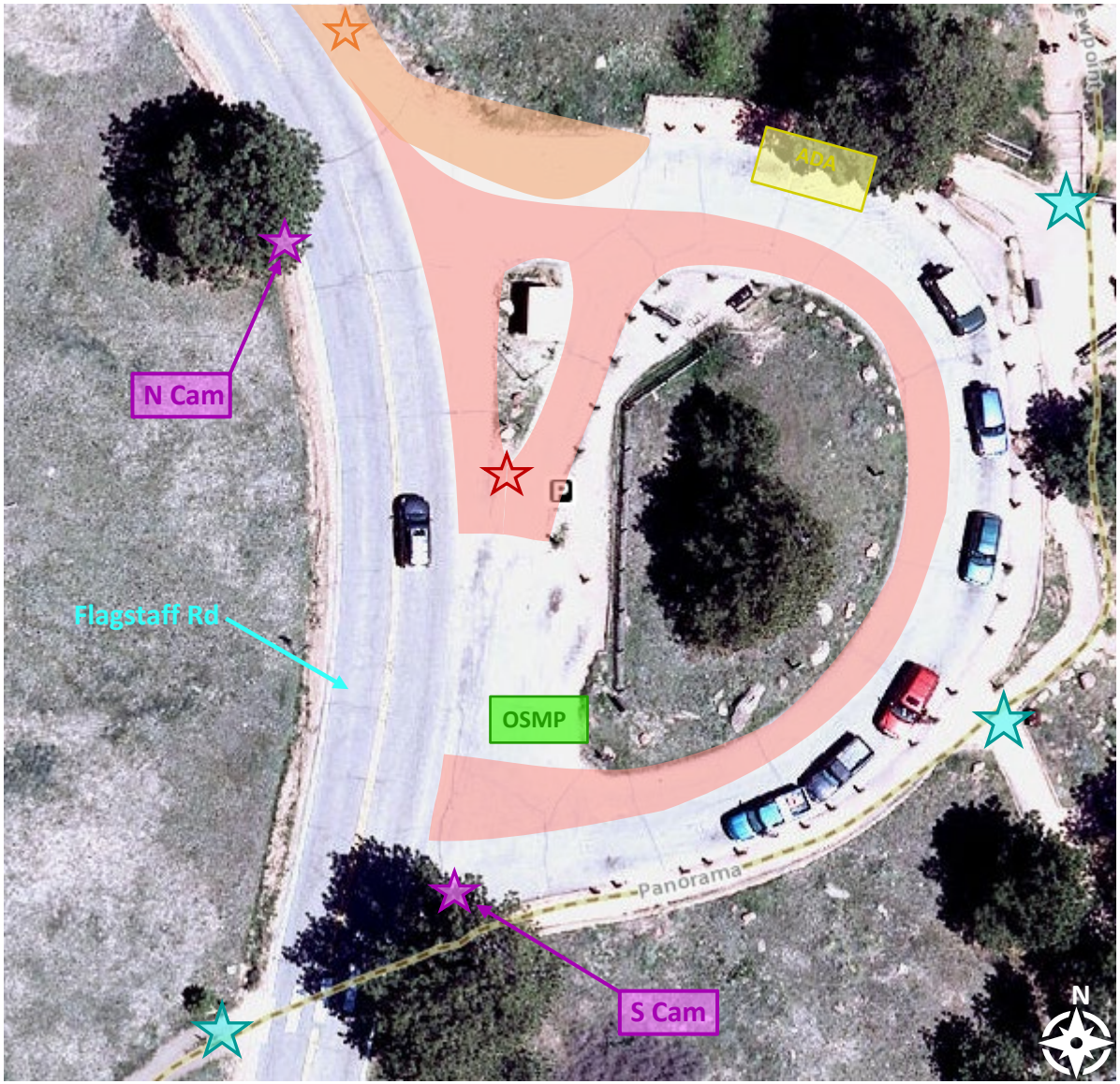
Access Pt / TH

HD Equipment

Informal Parking

No Parking

Lot Composition
Capacity – 14
(9 marked, 5 unmarked)



The Peoples' Crossing
Settler's East Cam
Settler's West Cam

Access Pt / TH

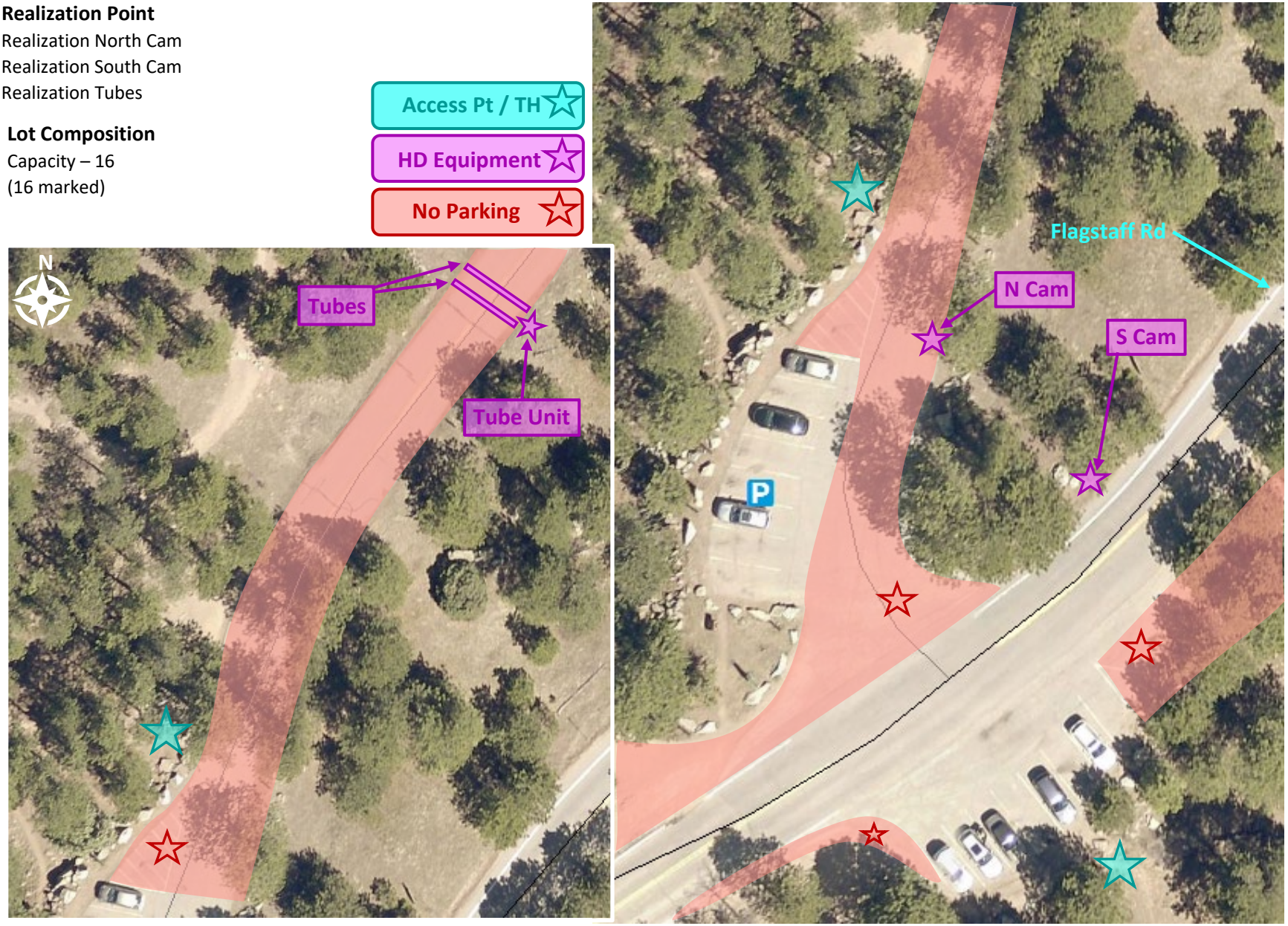
HD Equipment

No Parking

Lot Composition
Capacity – 26
(26 marked)

Realization Point
Realization North Cam
Realization South Cam
Realization Tubes

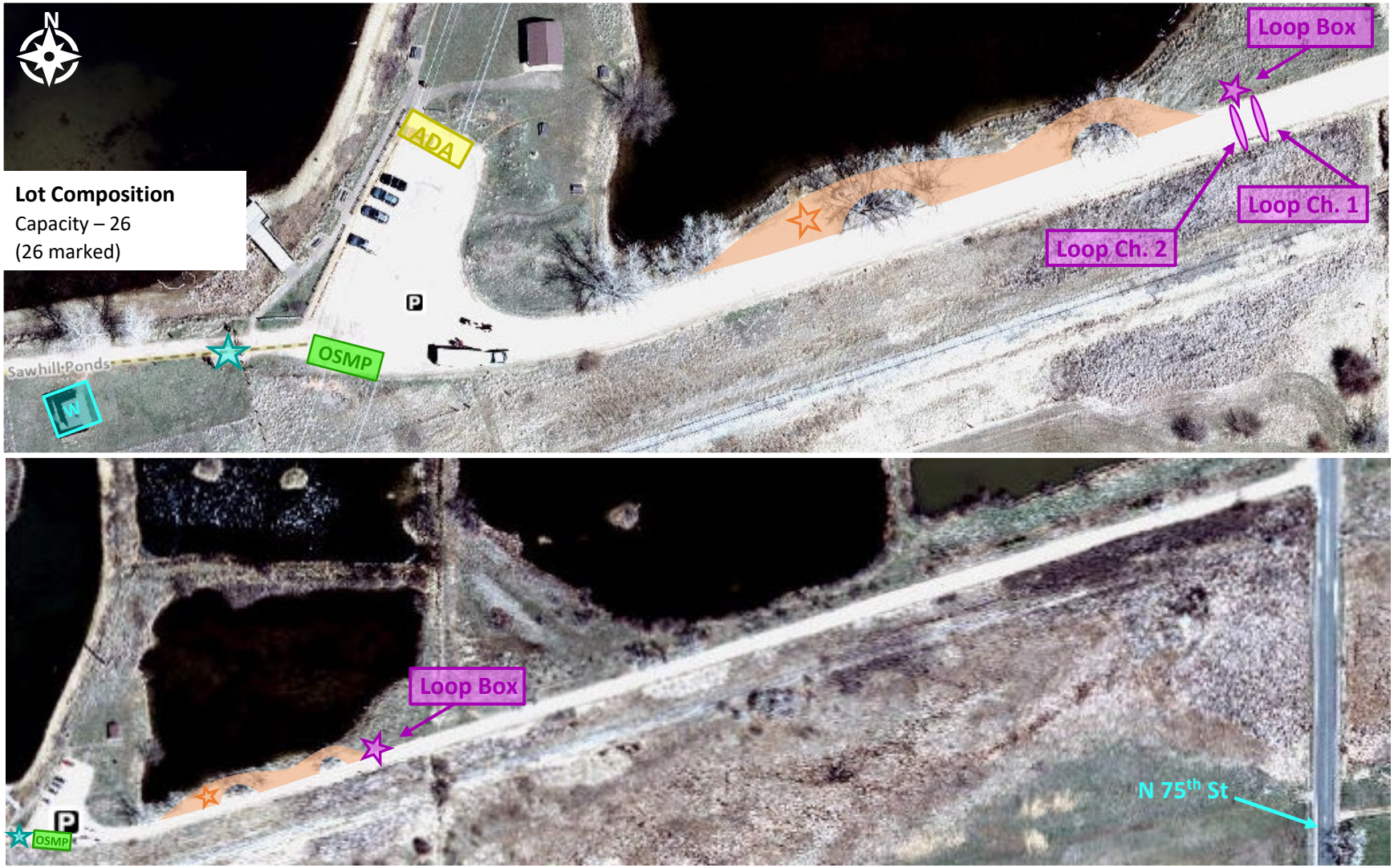
Lot Composition
Capacity – 16
(16 marked)



Sawhill Ponds
5/5 Northeast Roving Route
Sawhill Inductive Loop

Lot Composition
Capacity – 27
(11 marked, 8 unmarked inside, 8 unmarked outside)

Access Pt / TH
Informal Parking
HD Equipment



South Boulder Creek West
1/6 South Roving Route
SBCW TRAFx

Lot Composition
Capacity – 29, Horse – 3
(29 marked)

Horse Parking
Access Pt / TH
Informal Parking
HD Equipment
No Parking

South Mesa
2/6 South Roving Route
South Mesa Inductive Loop
South Mesa Eco-Counter

Lot Composition
Capacity – 48-55
(29 marked, 19 unmarked / 55 observed)

Teller Farm North

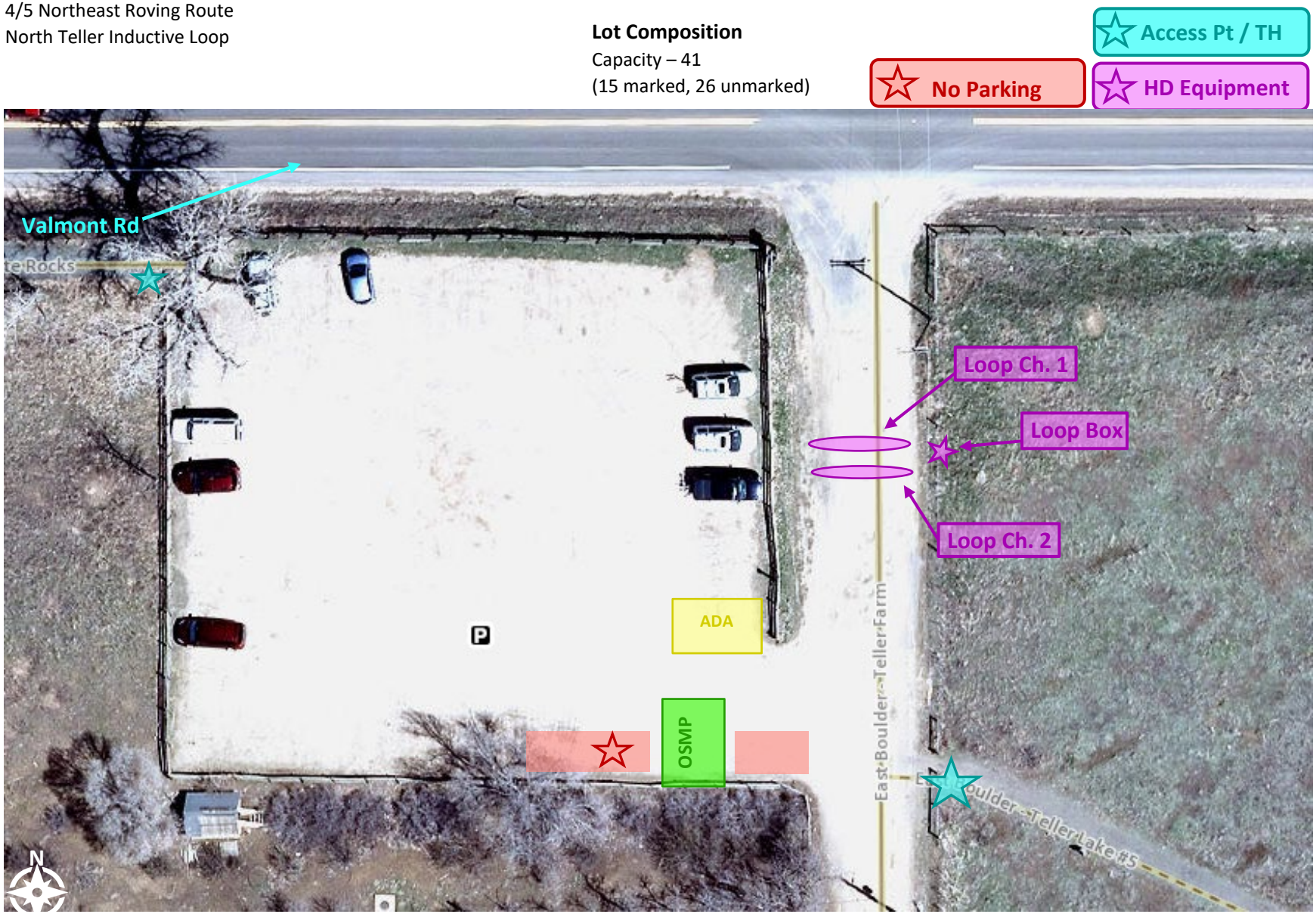
4/5 Northeast Roving Route

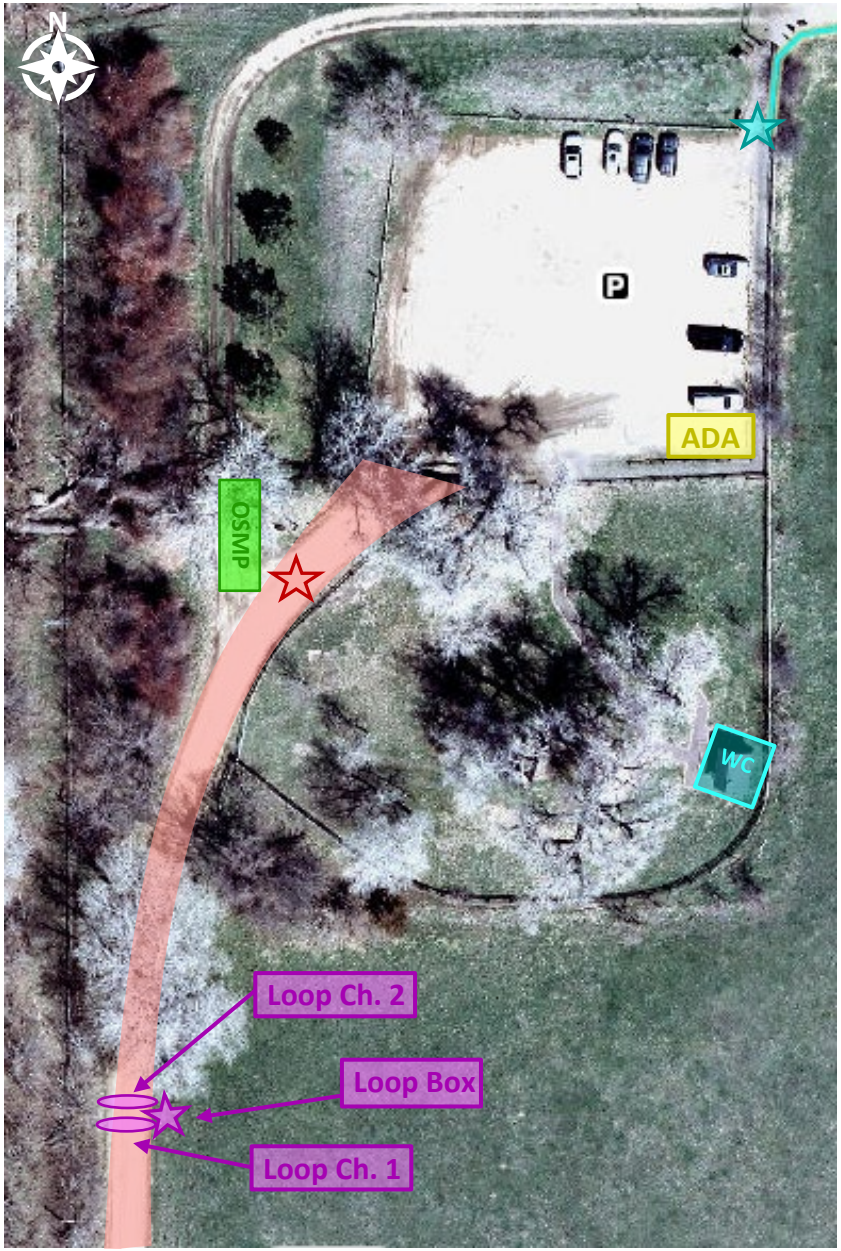
North Teller Inductive Loop

Lot Composition

Capacity – 41

(15 marked, 26 unmarked)





Teller Farm South
3/5 Northeast Roving Route
South Teller Inductive Loop

Access Pt / TH

HD Equipment

No Parking

Lot Composition
Capacity – 32
(9 marked, 23 unmarked)

White Rocks

White Rocks Cam

Access Pt / TH

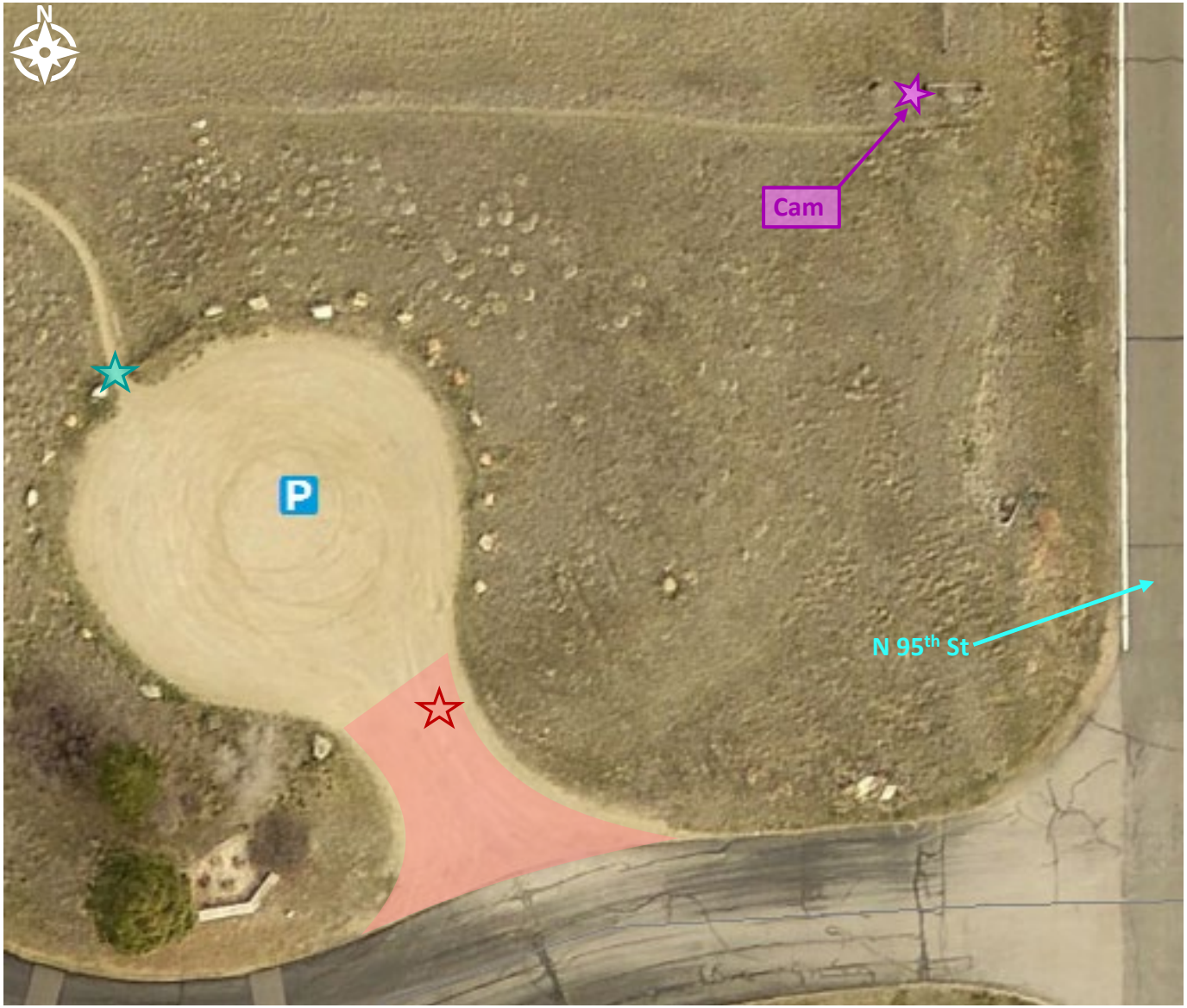
HD Equipment

No Parking

Lot Composition

Capacity – 9

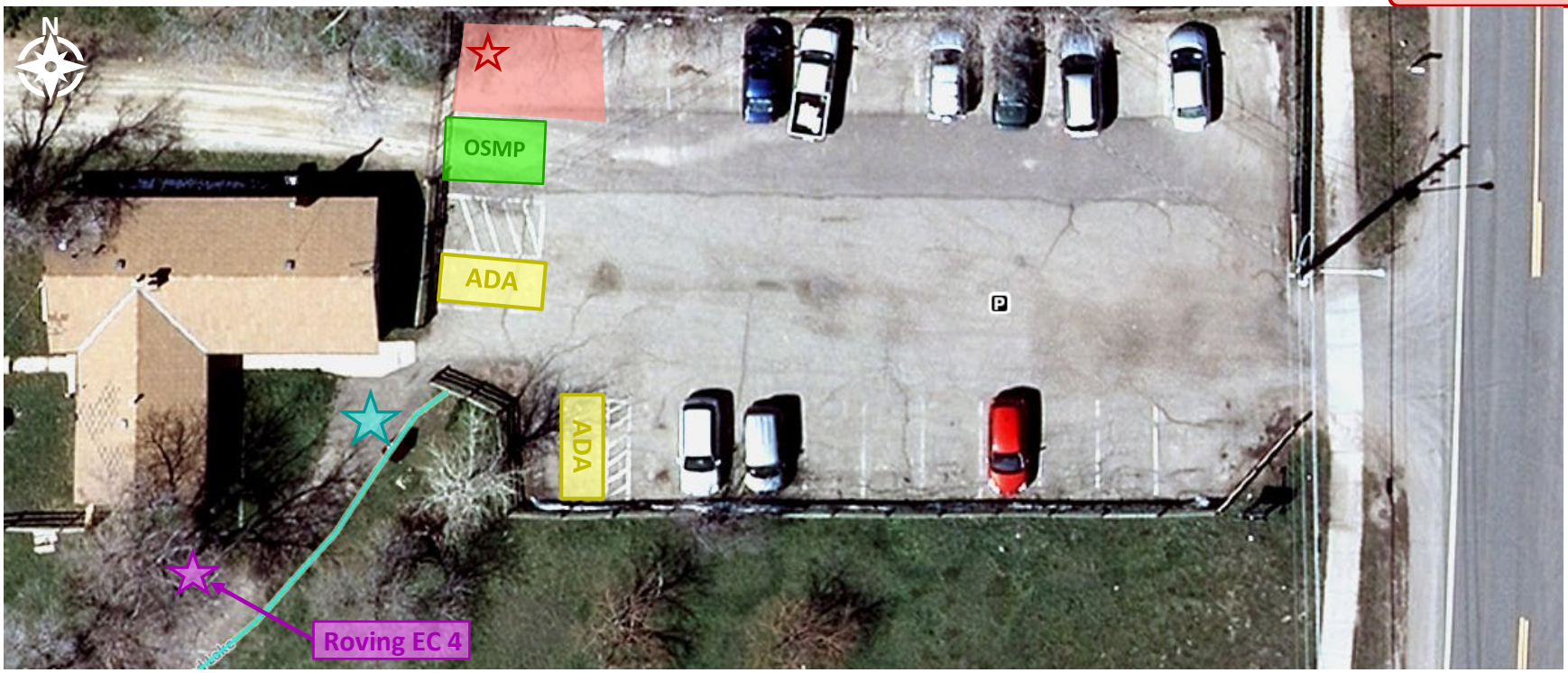
(9 unmarked)



Wonderland Lake
2/3 Northwest Roving Route
2/5 Northwest-West Roving Route
Roving Eco-Counter 4

Lot Composition
Capacity –19
(19 marked)

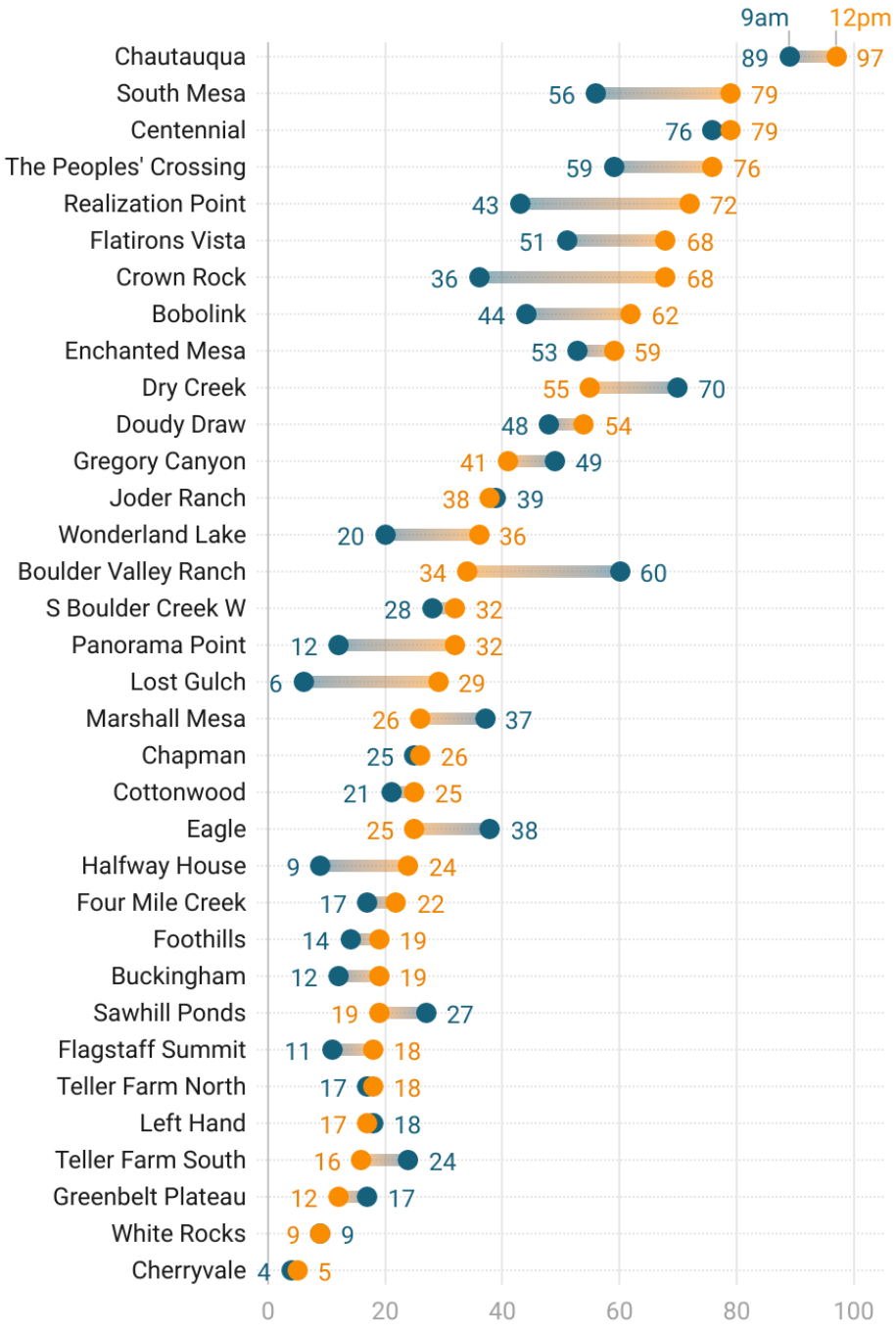
Access Pt / TH
HD Equipment
No Parking



Appendix B: Additional Systemwide Results

Average Trailhead Parking Lot Use at 9 am and 12 pm

Numbers are percent occupancy.



Created with Datawrapper

Location	Estimated Capacity	Average Number of Vehicles Parked by Hour								Average		Weekday	Weekend
		9am	10am	11am	12pm	1pm	2pm	3pm	4pm				
Chautauqua	48	42	45	46	46	47	46	43	42	45		44	48
South Mesa	55	31	36	39	43	34	29	29	20	33		23	48
Centennial	31	25	26	27	25	23	20	21	19	23		20	28
Gregory Canyon	37	24	23	22	20	19	18	19	17	20		15	27
The Peoples' Crossing	26	15	18	19	20	20	20	18	15	18		18	18
Flatirons Vista	29	15	18	22	24	18	11	10	7	16		11	25
Flagstaff Summit	89	10	20	18	16	14	18	10	8	15		9	23
Doudy Draw	40	19	19	21	22	13	8	6	5	15		8	26
Bobolink	22	11	14	15	13	13	13	12	10	13		11	18
Marshall Mesa	45	16	17	16	15	9	10	8	7	13		9	19
Dry Creek	17	12	12	12	9	8	10	10	5	10		9	13
Realization Point	16	7	9	11	11	11	10	10	8	10		8	12
Four Mile Creek	36	8	10	10	9	10	10	10	9	10		8	11
Wonderland Lake	19	5	9	9	7	8	8	10	9	8		7	10
S Boulder Creek W	29	8	8	8	9	9	9	8	4	8		6	12
Teller Farm North	41	9	10	10	7	7	8	7	4	8		5	13
Teller Farm South	32	13	12	7	5	4	5	7	4	7		4	12
Lost Gulch	24	1	3	5	7	8	9	10	10	7		5	9
Eagle	23	9	9	8	7	4	4	4	4	6		3	12
Boulder Valley Ranch	14	8	9	8	5	4	4	4	4	6		4	9
Enchanted Mesa	9	5	6	6	5	5	5	4	2	5		5	5
Sawhill Ponds	19	5	5	4	4	5	6	4	3	4		3	6
Left Hand	36	8	8	7	5	2	1	2	1	4		2	9
Buckingham	24	3	4	4	5	5	5	4	4	4		3	7
Panorama Point	14	2	3	4	4	5	4	5	4	4		3	5
Crown Rock	6	2	3	4	4	4	4	4	3	4		3	4
Chapman	15	4	4	4	4	4	4	3	1	4		4	3
Cottonwood	16	3	3	5	4	4	3	3	2	4		4	4
Greenbelt Plateau	25	4	4	5	4	3	2	2	1	3		1	6
Halfway House	11	1	1	2	3	3	3	4	5	3		2	4
Foothills	22	3	3	4	4	2	2	2	3	3		1	6
Joder Ranch	8	3	3	4	3	2	2	1	2	3		1	5
Cherryvale	17	1	1	1	1	1	1	1	1	1		1	1
White Rocks	6	1	1	1	1	0	1	0	0	1		0	1

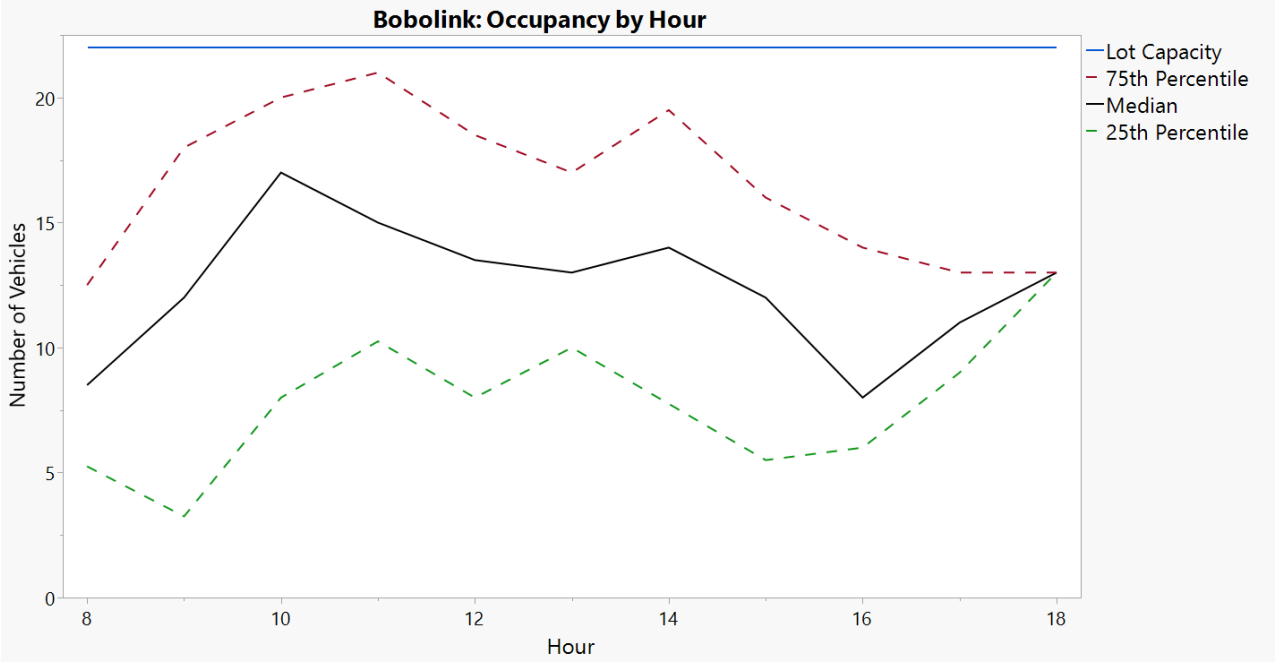
Appendix C: Results by Location

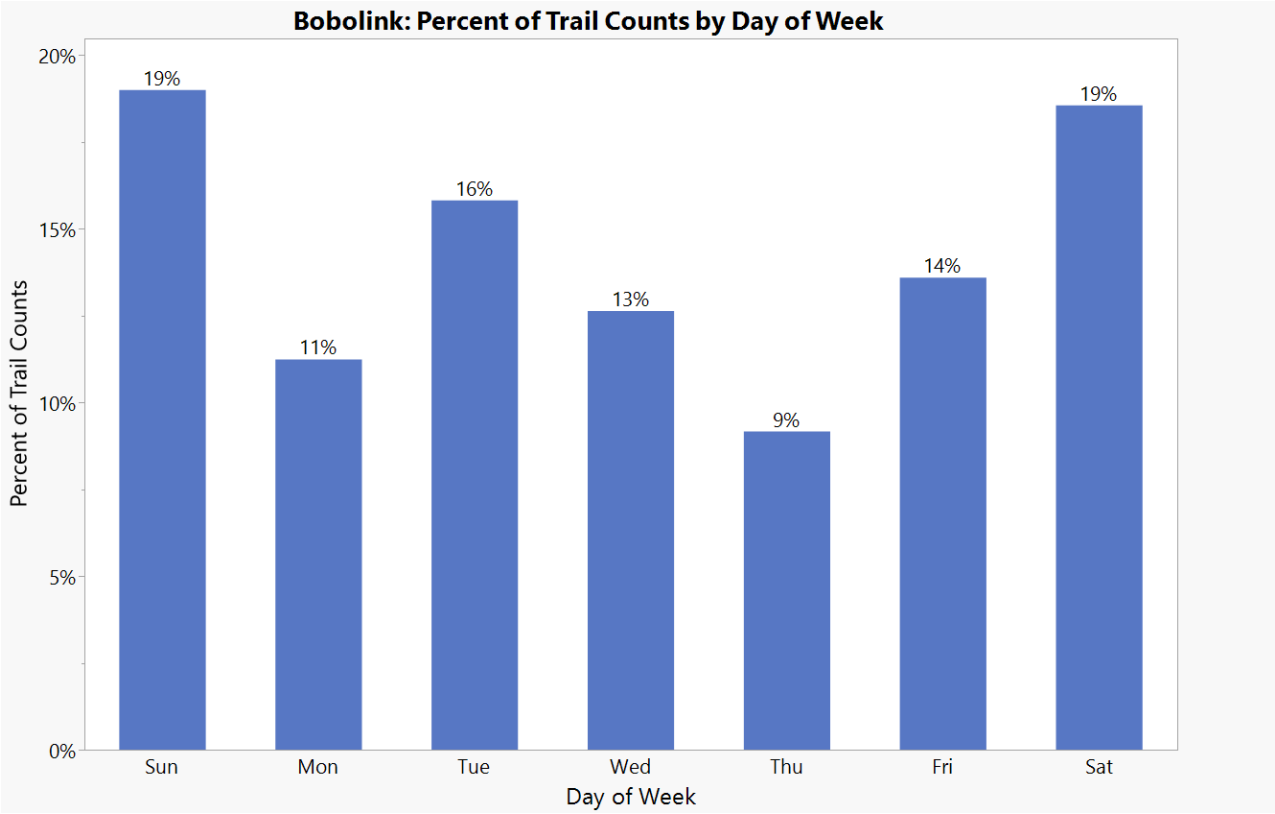
Multiple sources of data were used to collect baseline occupancy for OSMP-managed parking lots: direct observations, cameras, vehicle counters, and trail counters. The following location summaries depict a selection of some of the best available data for that site. The level of detail varies based on the method used.

Bobolink

Key Results

On average, Bobolink was observed to be at **58%** occupancy with 13 vehicles parked during the day (2019-2020). This ranged from 49% on weekdays (11 vehicles) to 75% on weekends (17 vehicles). The lot was observed to be completely full 8 out of 100 observations (8%).

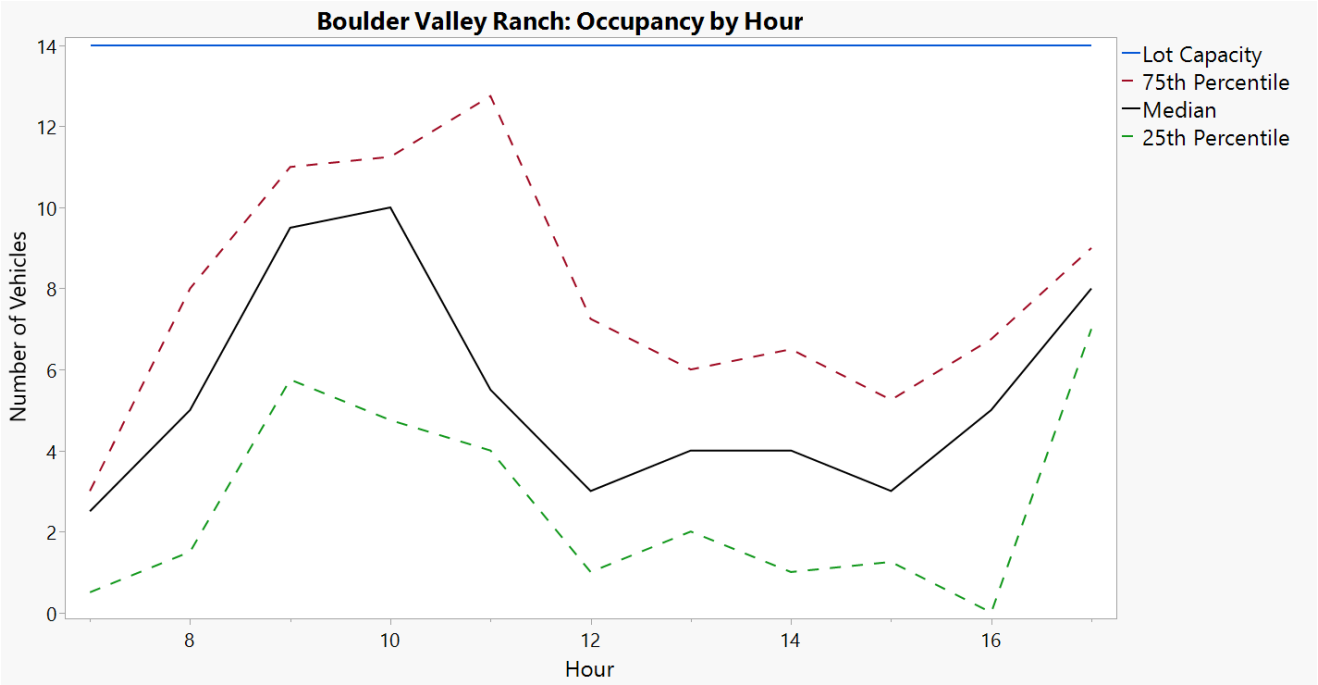


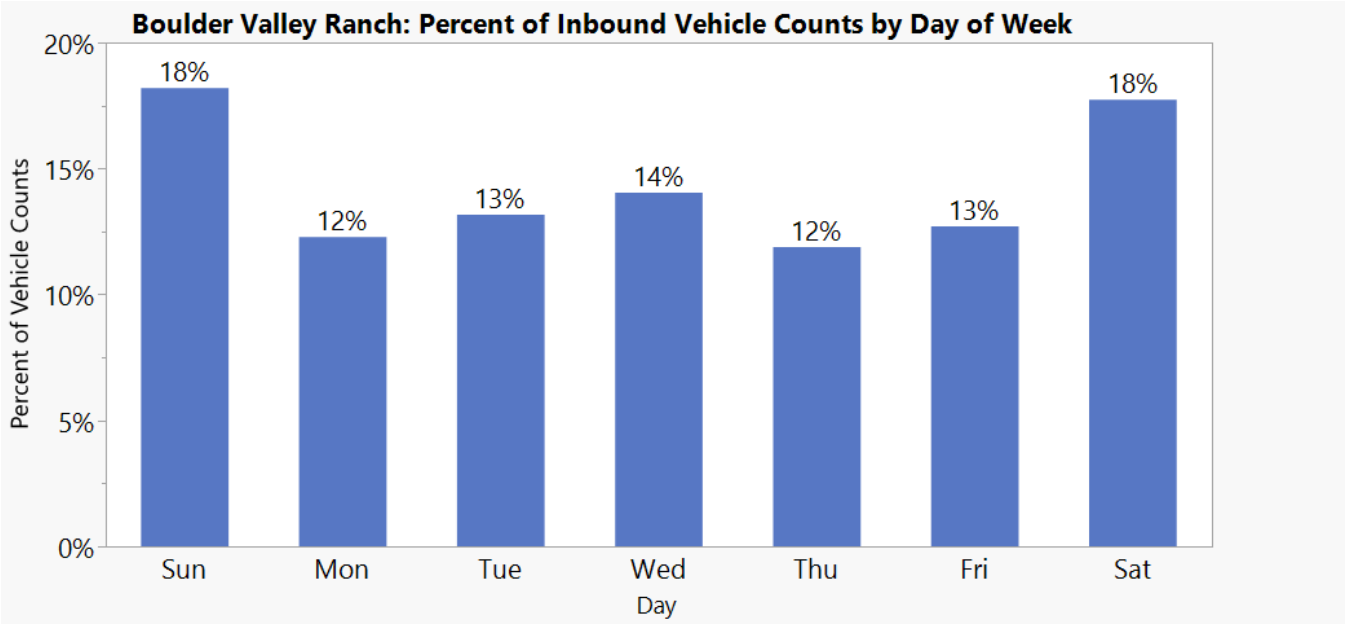


Boulder Valley Ranch

Key Results

On average, Boulder Valley Ranch was observed to be at **41%** occupancy with 6 vehicles parked in the formal lot during the day (2019-2020). This ranged from 29% on weekdays (4 vehicles) to 58% on weekends (8 vehicles). The lot was observed to be completely full 6 out of 100 observations (6%). Up to 20 vehicles were observed parked outside of the main parking lot, but these were excluded from the occupancy analysis. Note: The vehicle counter was installed on Longhorn Road, so average daily traffic counts include vehicles going to the ranch.

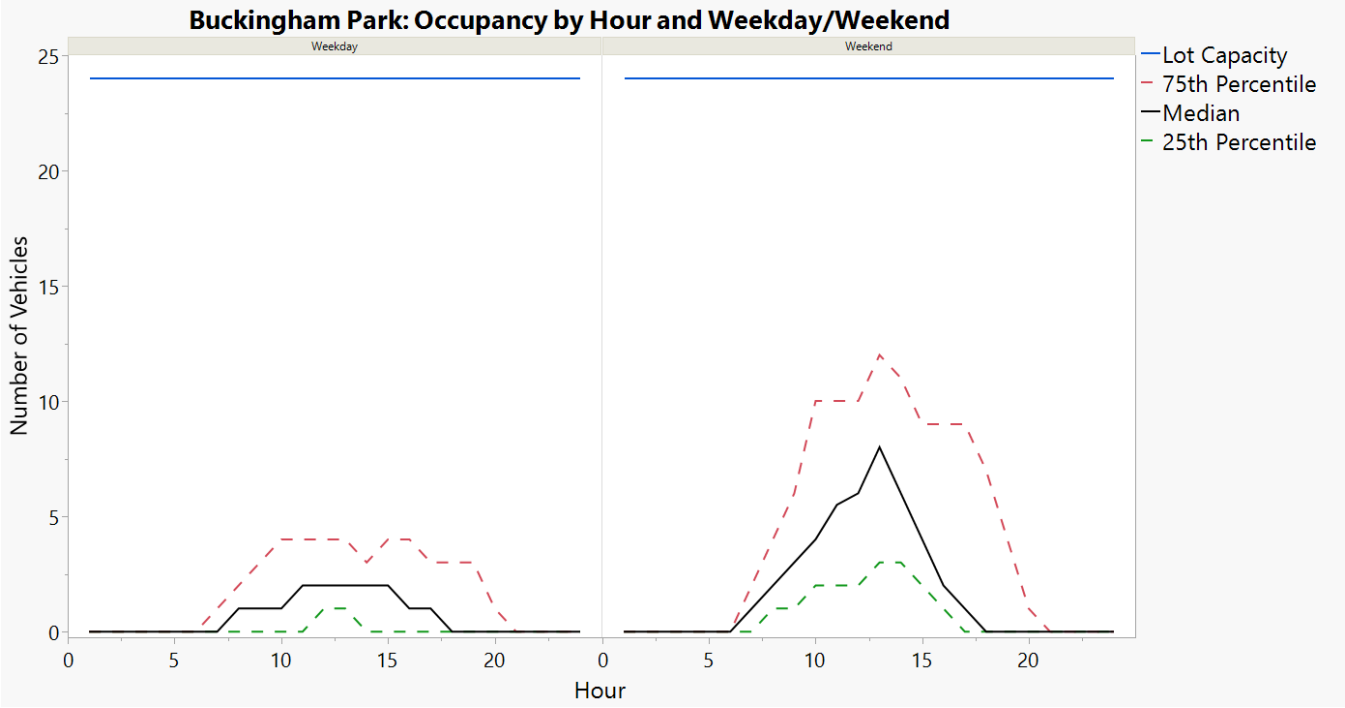


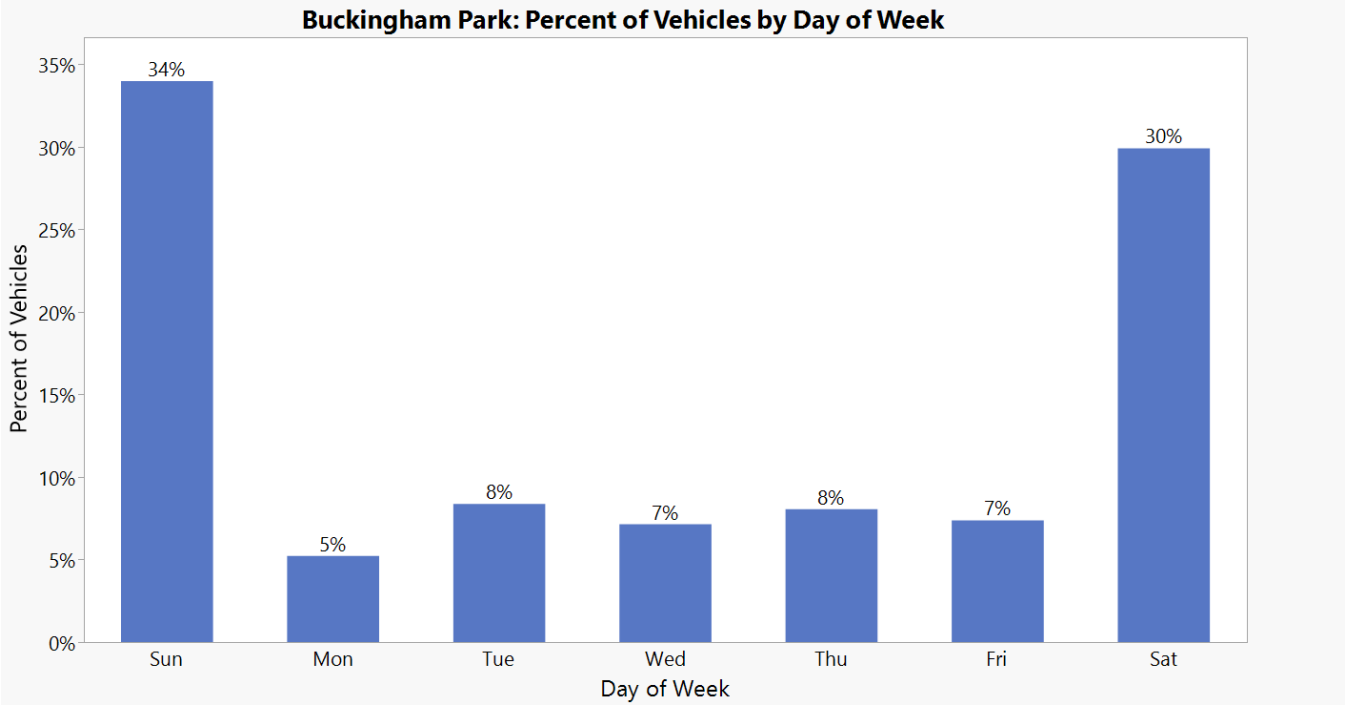


Buckingham Park

Key Results:

On average, Buckingham Park was observed to be at **14%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 9% on weekdays (2 vehicles) to 21% on weekends (5 vehicles). Up to 22 vehicles were observed in the lot.

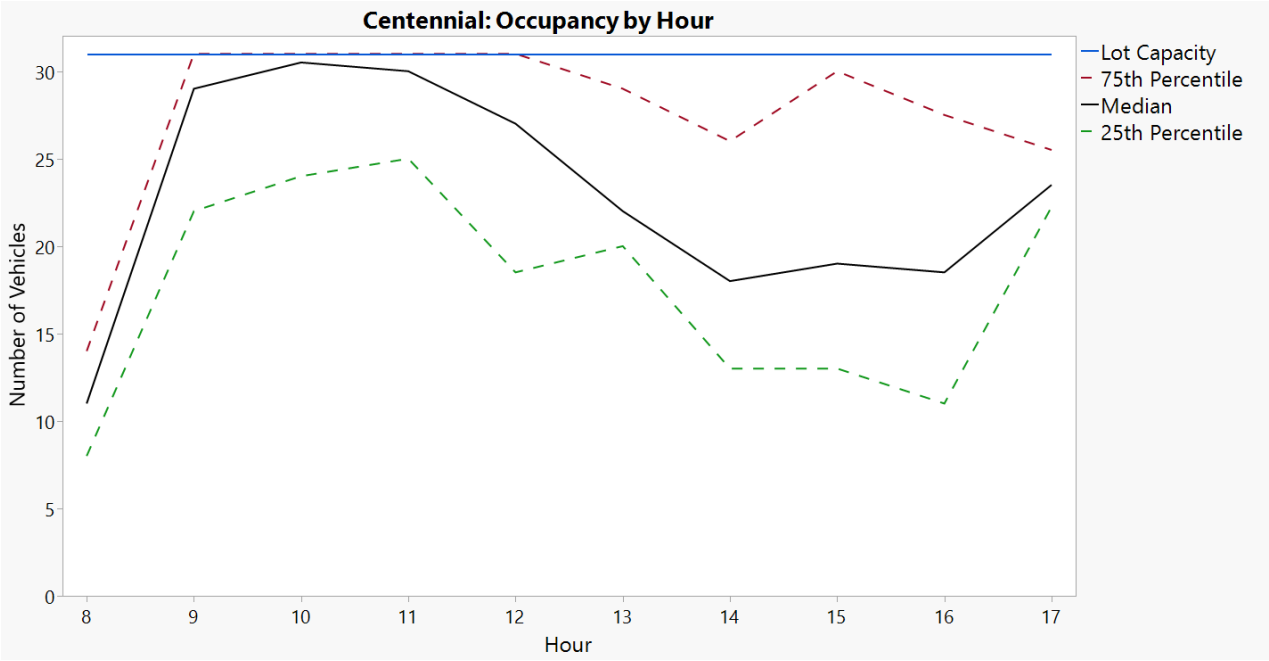


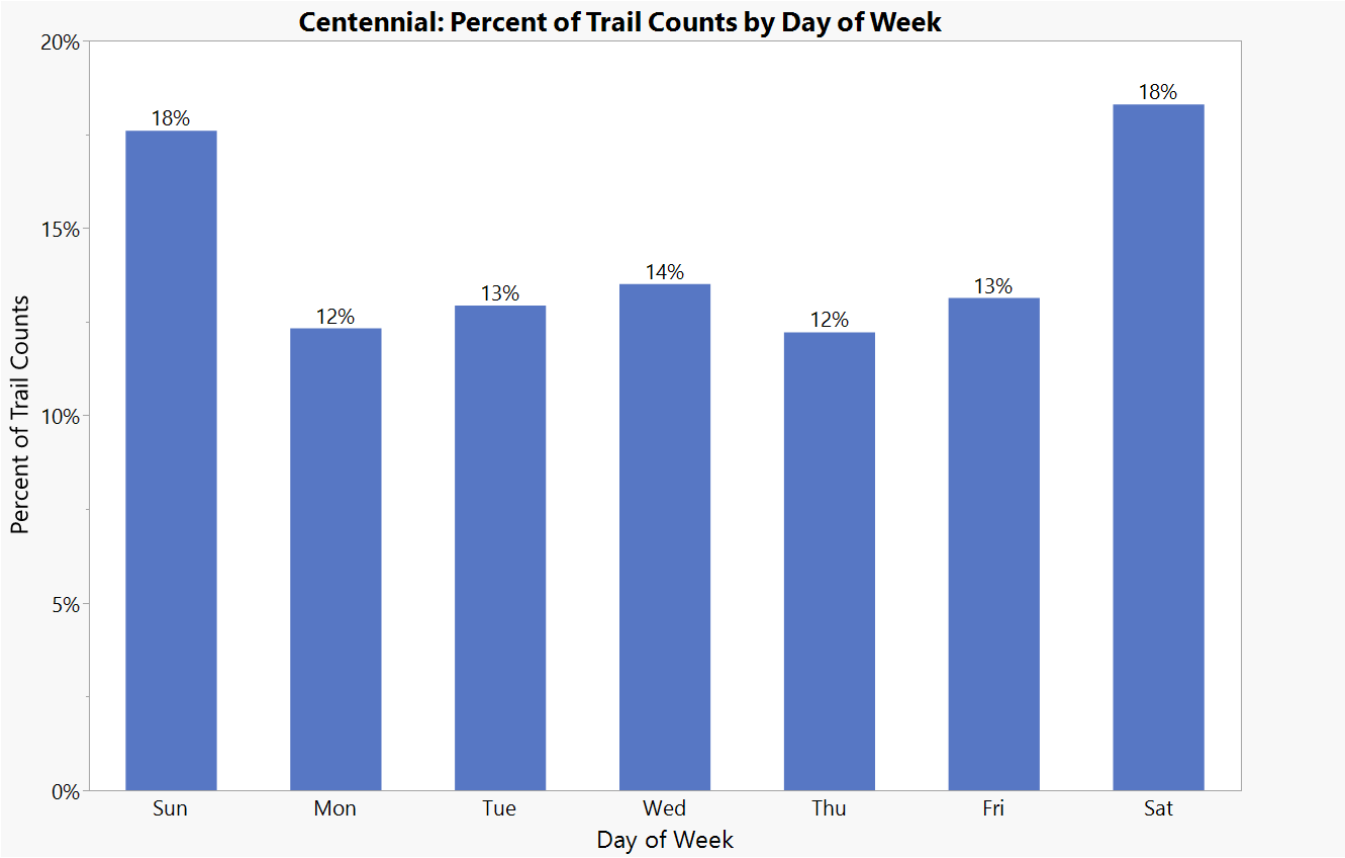


Centennial

Key Results:

On average, Centennial was observed to be at **74%** occupancy with 23 vehicles parked during the day (2019-2020). This ranged from 64% on weekdays (20 vehicles) to 88% on weekends (27 vehicles). The lot was observed to be completely full 22 out of 104 observations (21%).

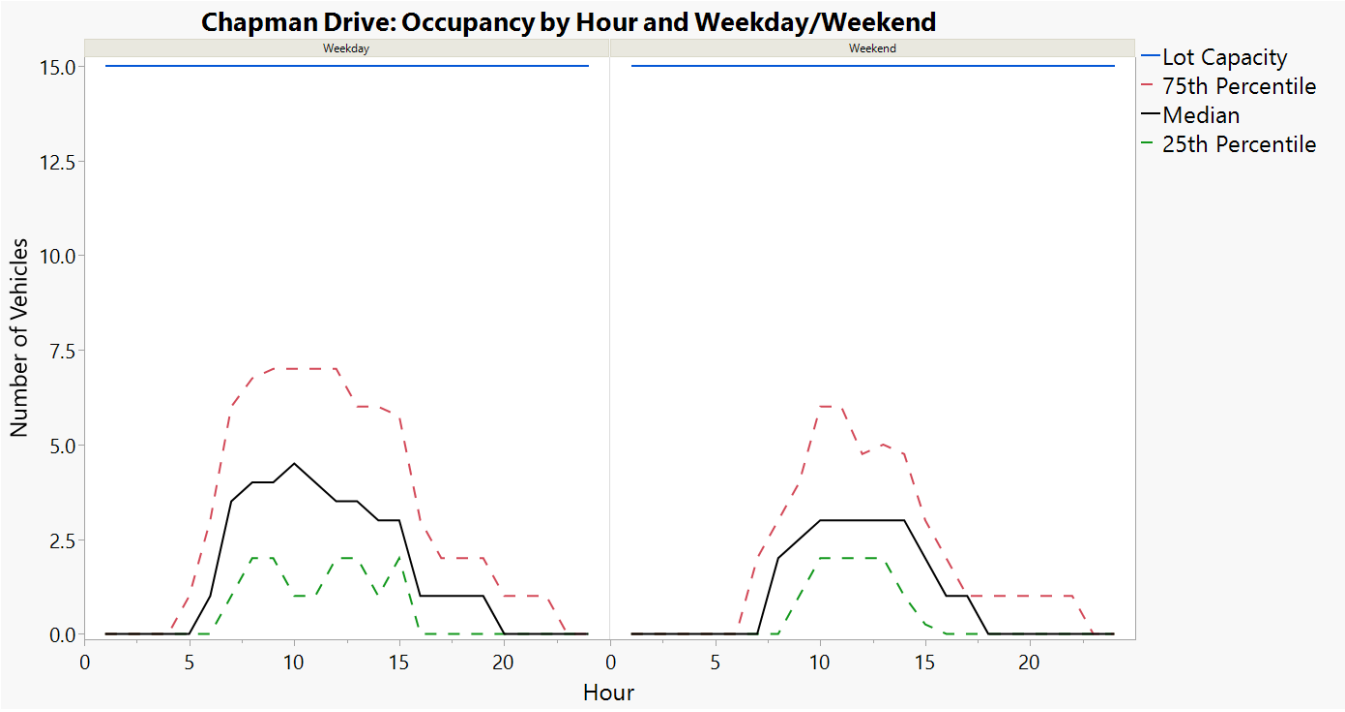


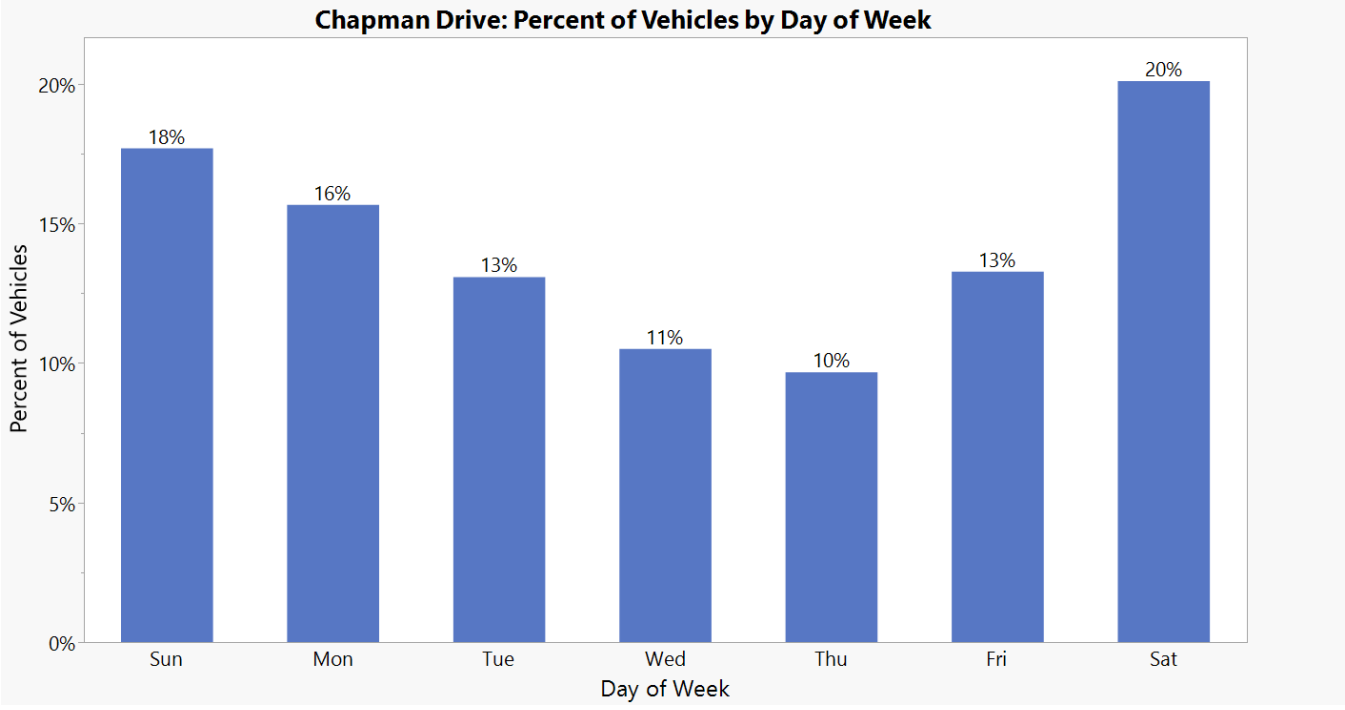


Chapman Drive

Key Results:

On average, Chapman Drive was observed to be at **20%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 17% on weekends (2.6 vehicles) to 22% on weekdays (3.3 vehicles). Up to 16 vehicles were observed in the lot.

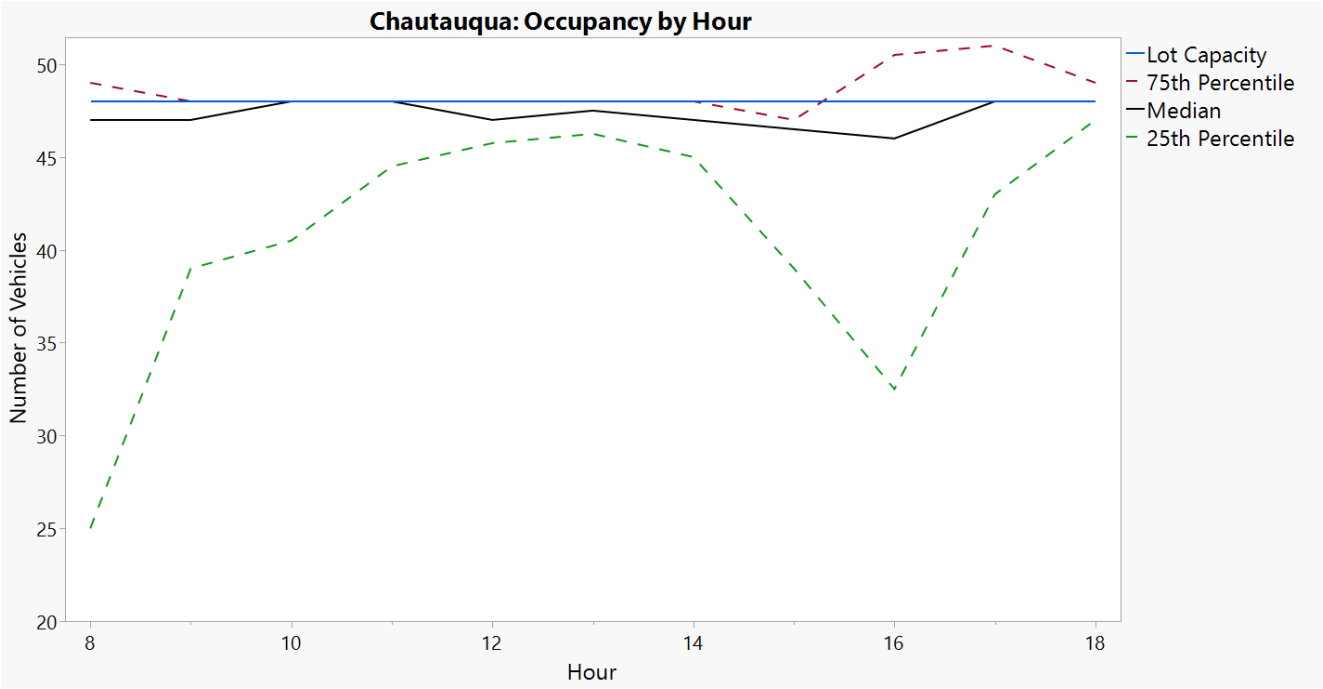


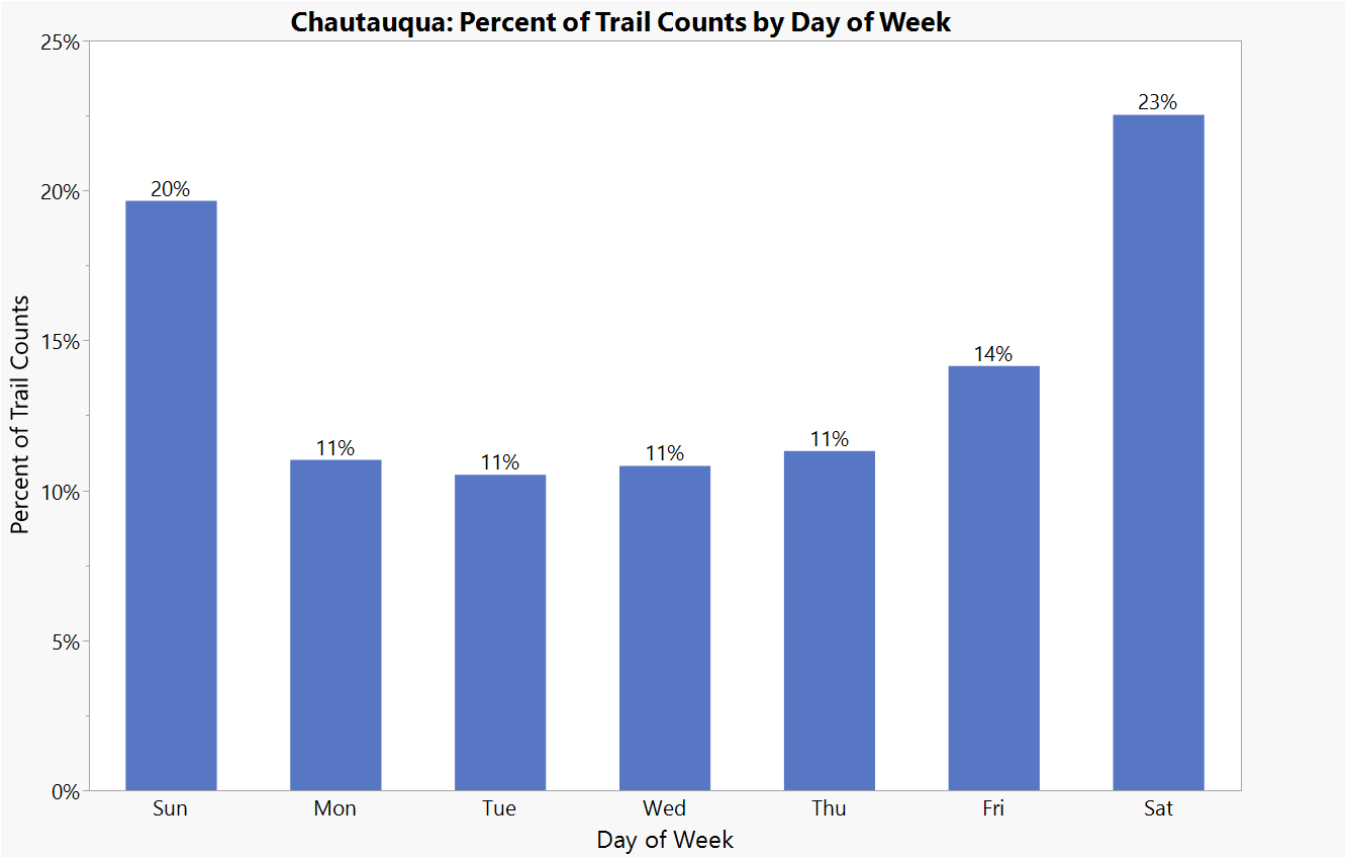


Chautauqua

Key Results:

On average, Chautauqua was observed to be at **94%** occupancy with 45 vehicles parked during the day (2019-2020). This ranged from 91% on weekdays (44 vehicles) to 98% on weekends (47 vehicles). The lot was observed to be completely full 37 out of 88 observations (42%).

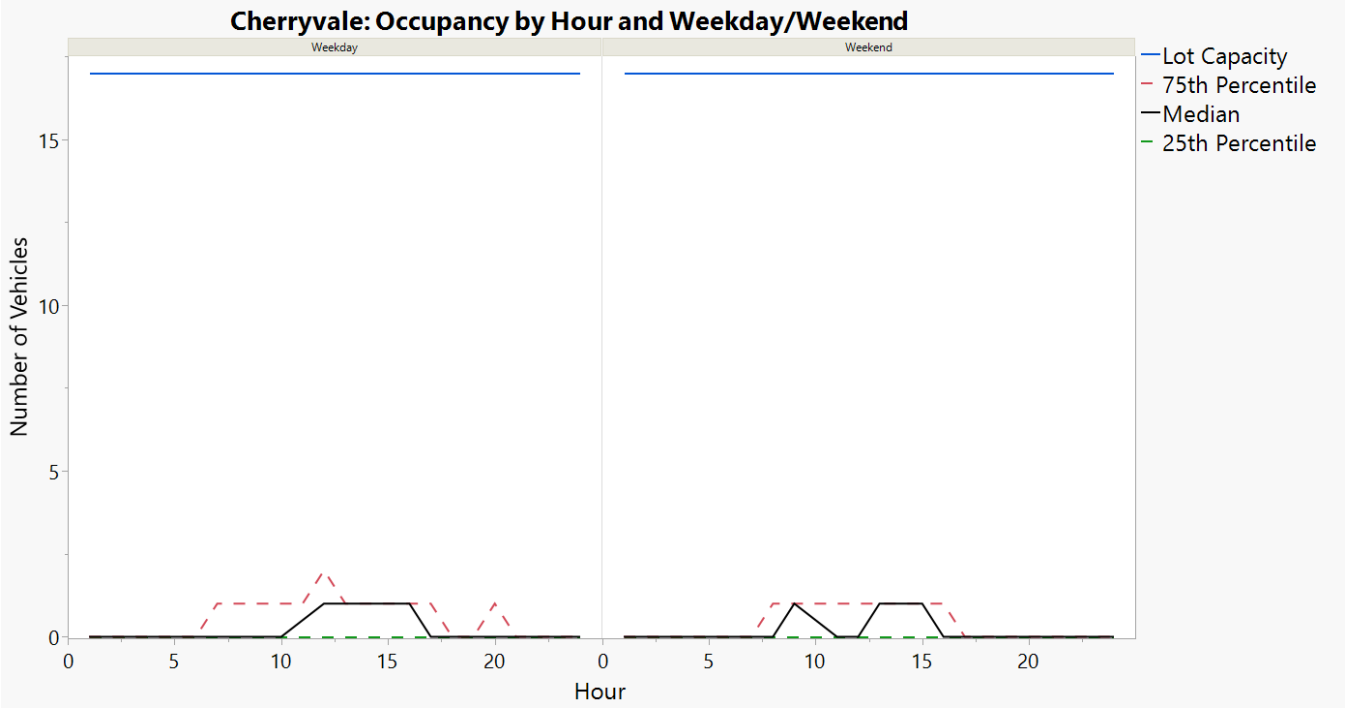


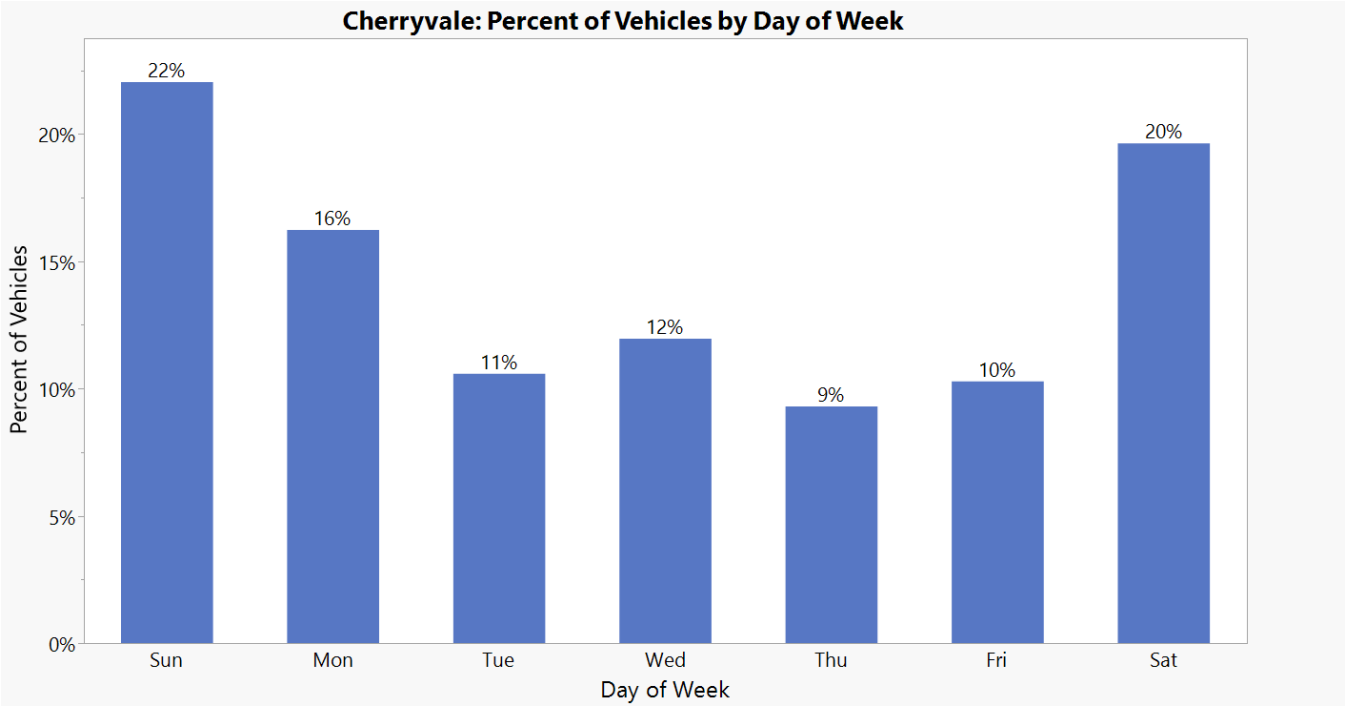


Cherryvale

Key Results:

On average, Cherryvale was observed to be at **4%** occupancy with 1 vehicle parked during the day (2019-2020). This ranged from 3.7% on weekends (0.6 vehicles) to 4.1% on weekdays (0.7 vehicles). Up to 6 vehicles were observed in the lot.

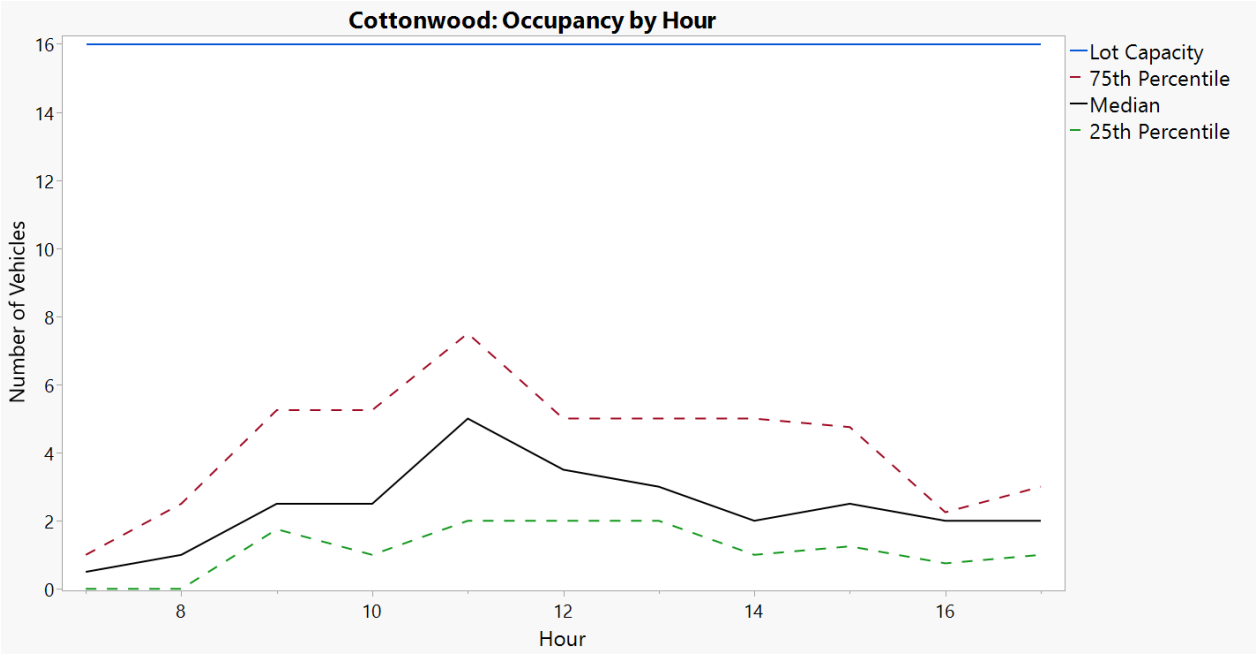


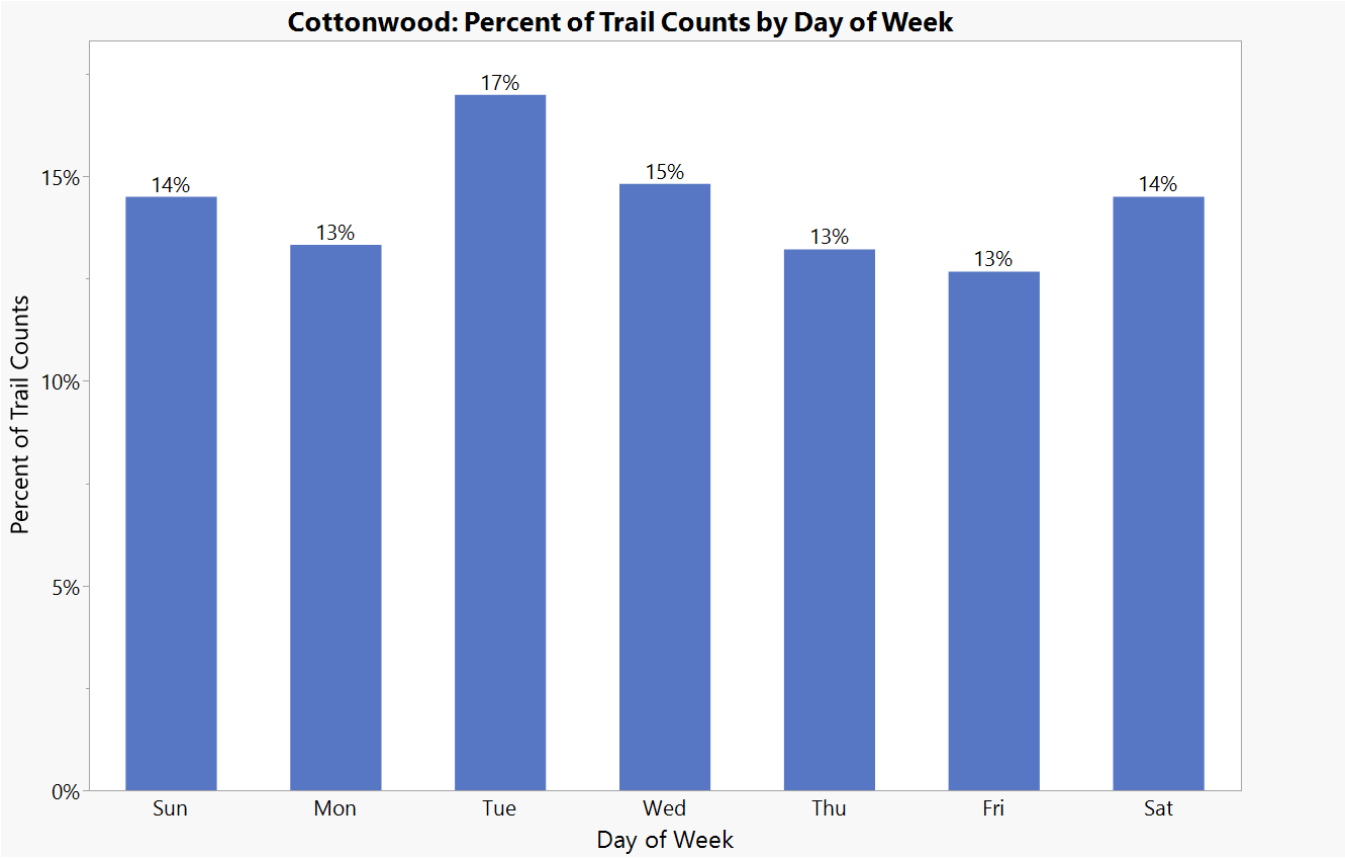


Cottonwood

Key Results:

On average, Cottonwood was observed to be at **20%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 21% on weekdays (3 vehicles) to 18% on weekends (3 vehicles). The lot was never observed to be completely full 100 observations. Up to 12 vehicles were observed in the lot.



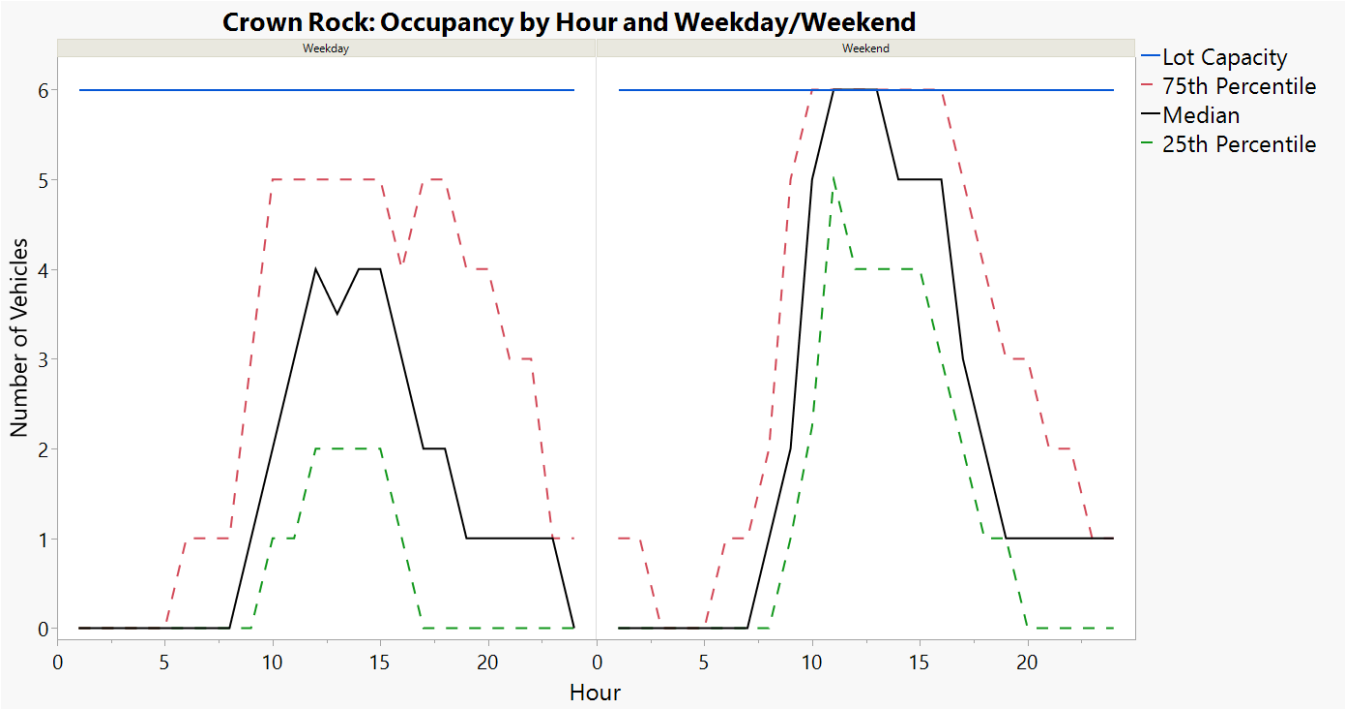


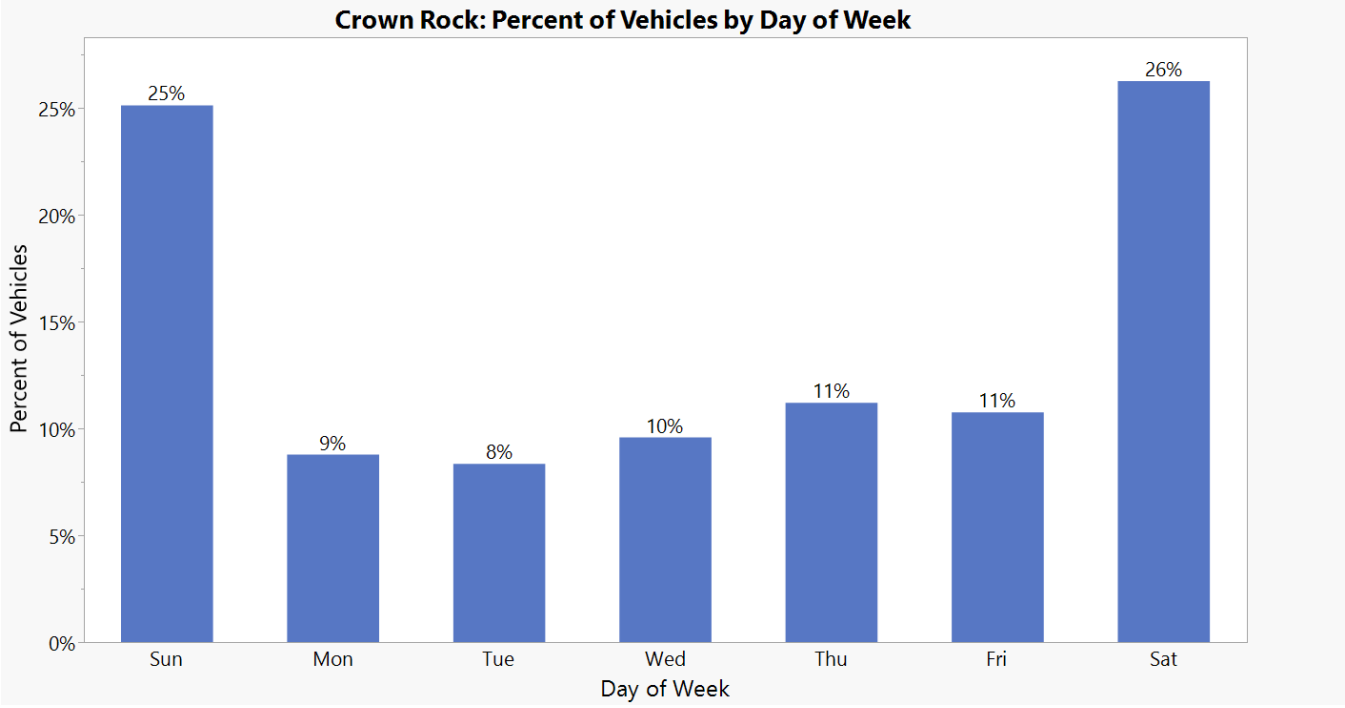
Note: There was a poor relationship between trail counts and number of vehicles parked in the Cottonwood Lot.

Crown Rock

Key Results:

On average, Crown Rock was observed to be at **51%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 44% on weekdays (3 vehicles) to 60% on weekends (4 vehicles). Up to 7 vehicles were observed in the lot.

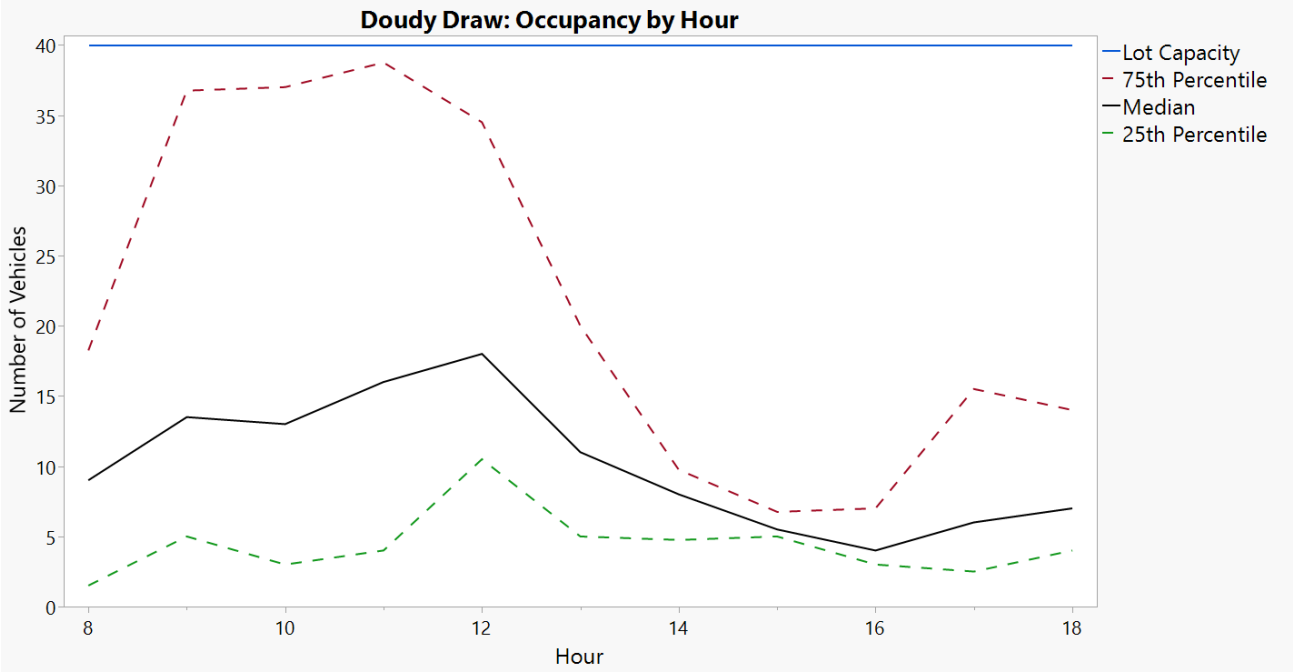


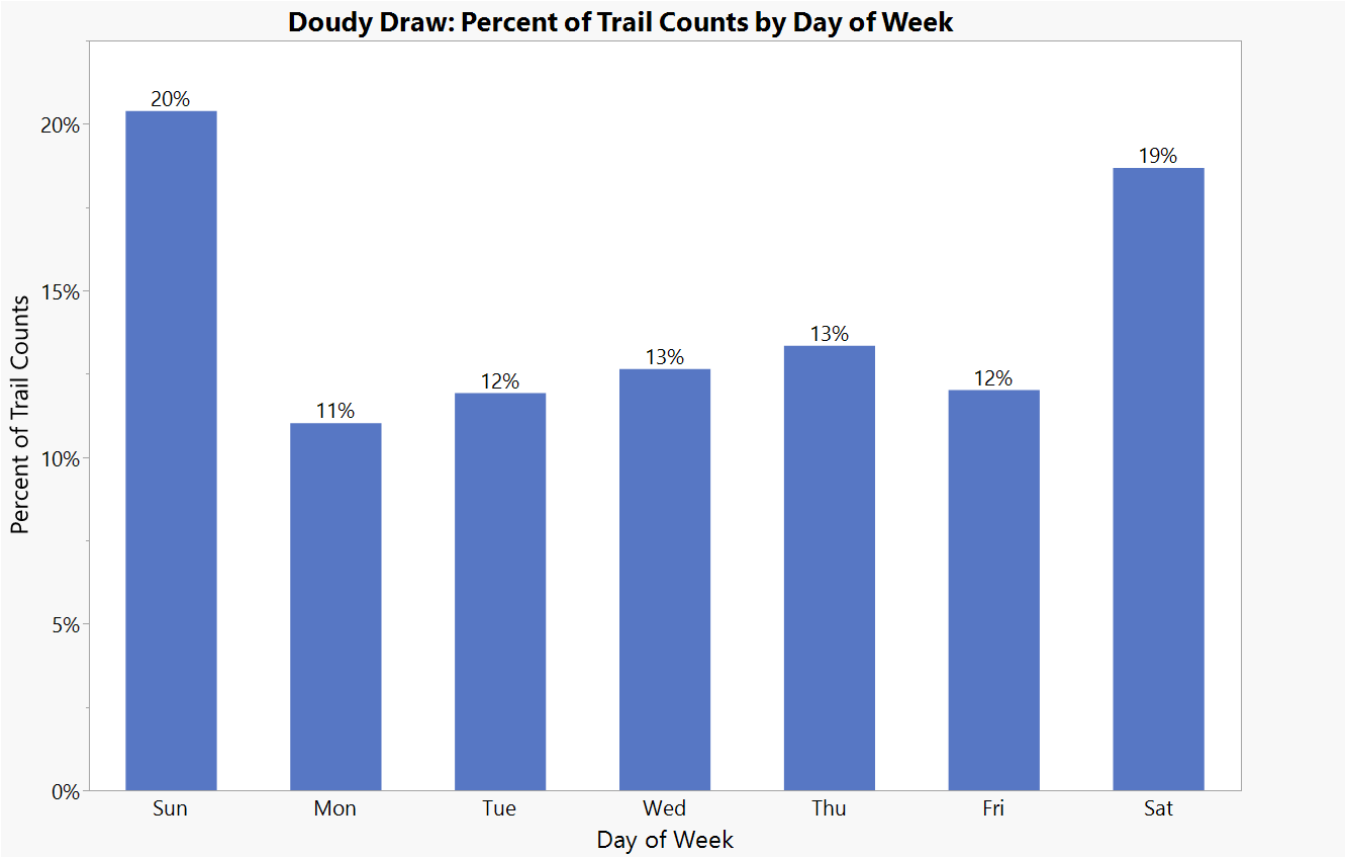


Doudy Draw

Key Results:

On average, Doudy Draw was observed to be at **35%** occupancy with 14 vehicles parked during the day (2019-2020). This ranged from 19% on weekdays (8 vehicles) to 62% on weekends (25 vehicles). The lot was observed to be completely full 9 out of 87 observations (10%). Up to two horse trailers were observed on 3 out of 21 observation days (14%).

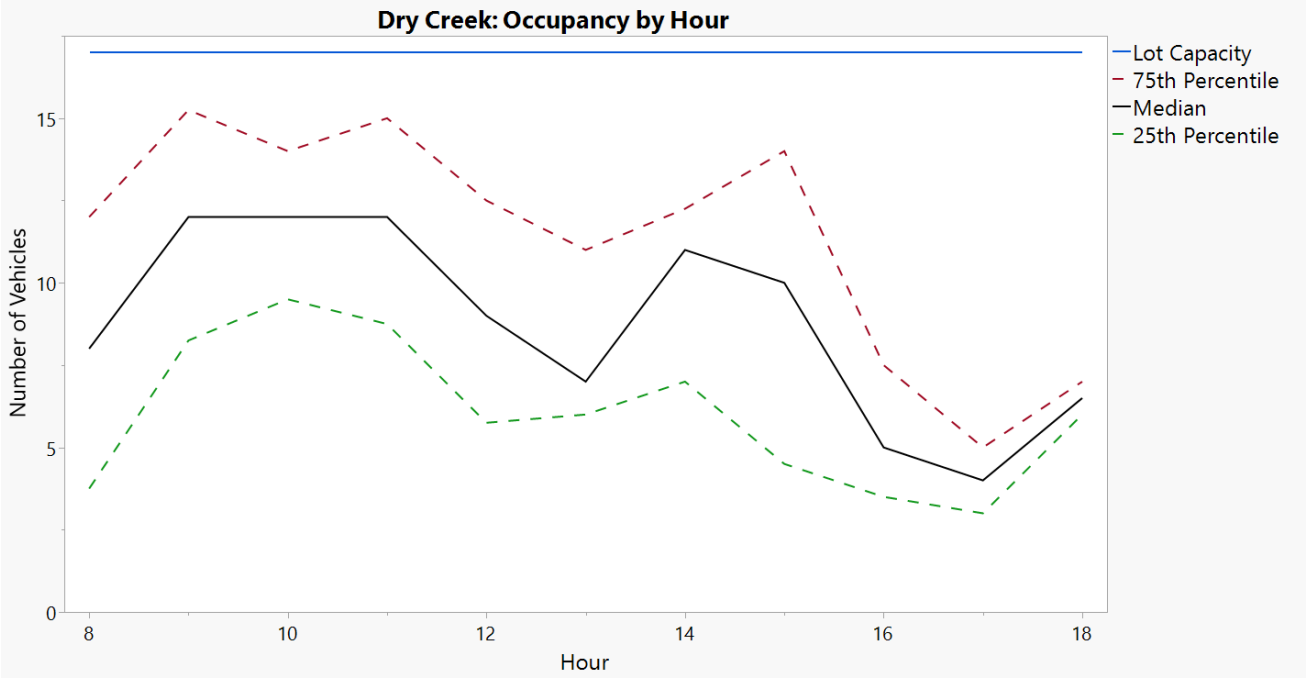


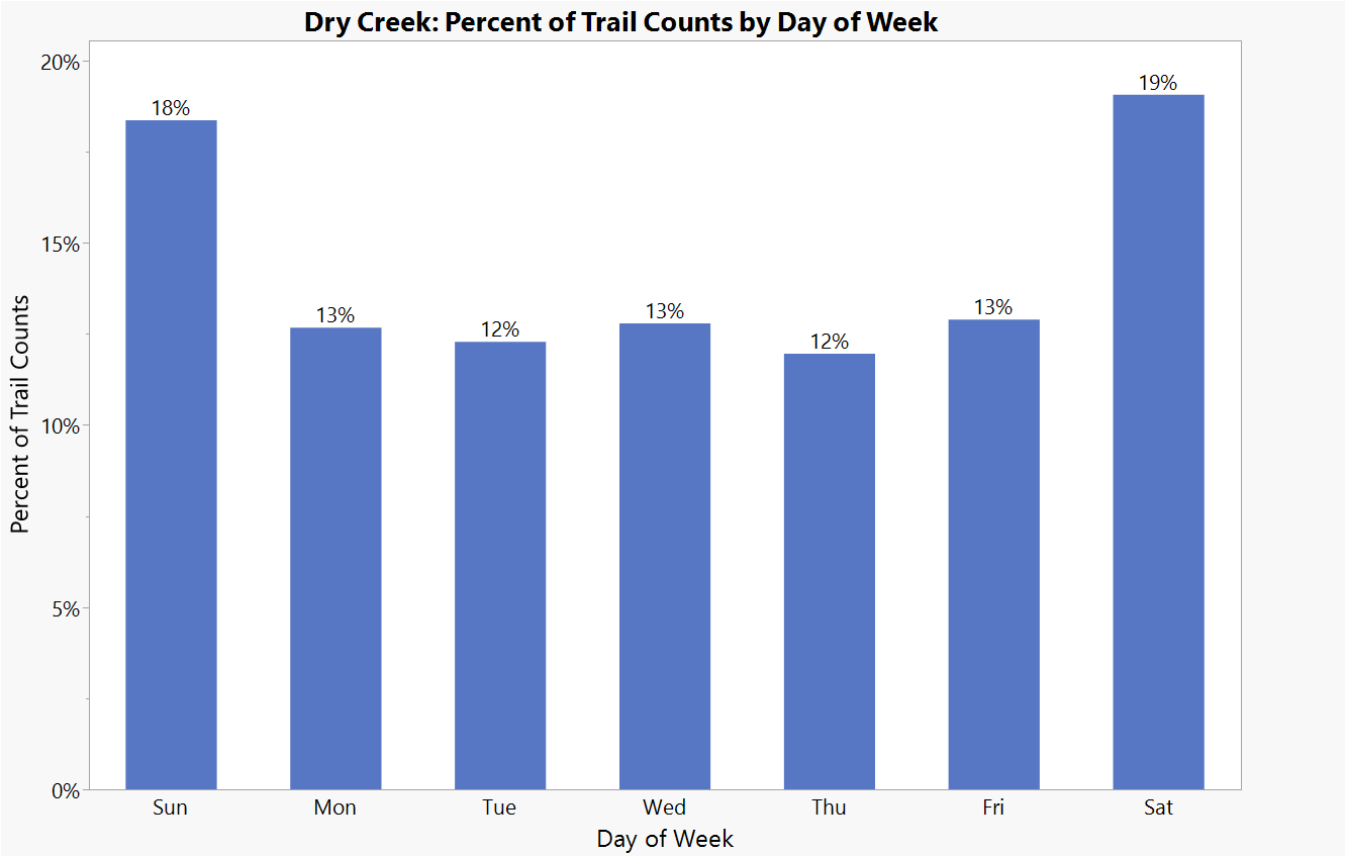


Dry Creek

Key Results:

On average, Dry Creek was observed to be at **57%** occupancy with 10 vehicles parked during the day (2019-2020). This ranged from 49% on weekdays (8 vehicles) to 71% on weekends (12 vehicles). The lot was observed to be completely full 4 out of 100 observations (4%). Up to 18 vehicles were observed parked outside of the main parking lot, but these were excluded from the occupancy analysis.

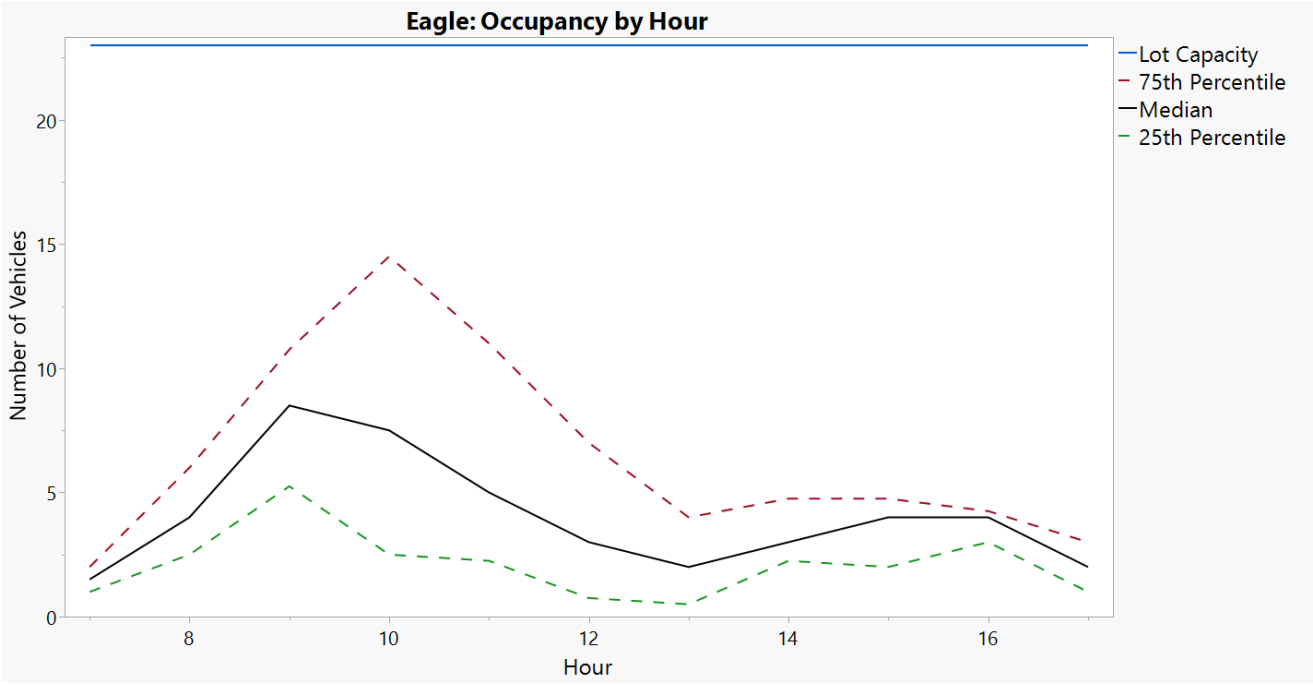


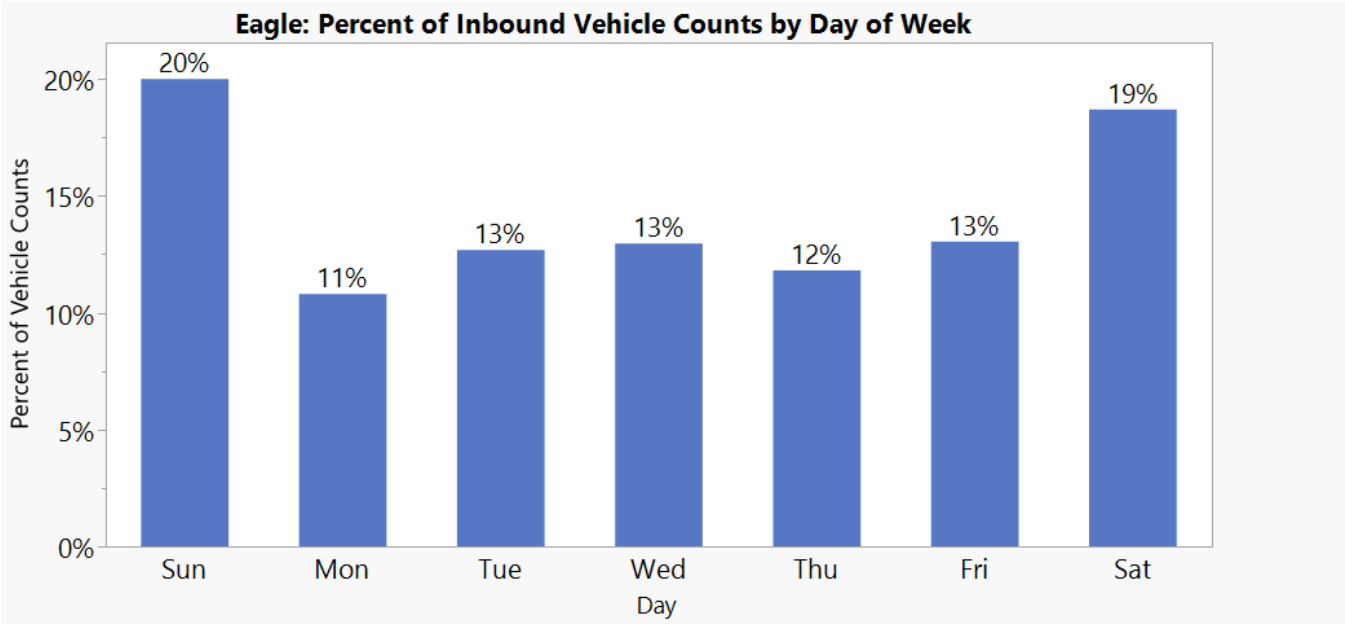


Eagle

Key Results:

On average, Eagle was observed to be at **25%** occupancy with 6 vehicles parked during the day (2019-2020). This ranged from 13% on weekdays (3 vehicles) to 44% on weekends (10 vehicles). The lot was observed to be completely full 3 out of 100 observations (3%).

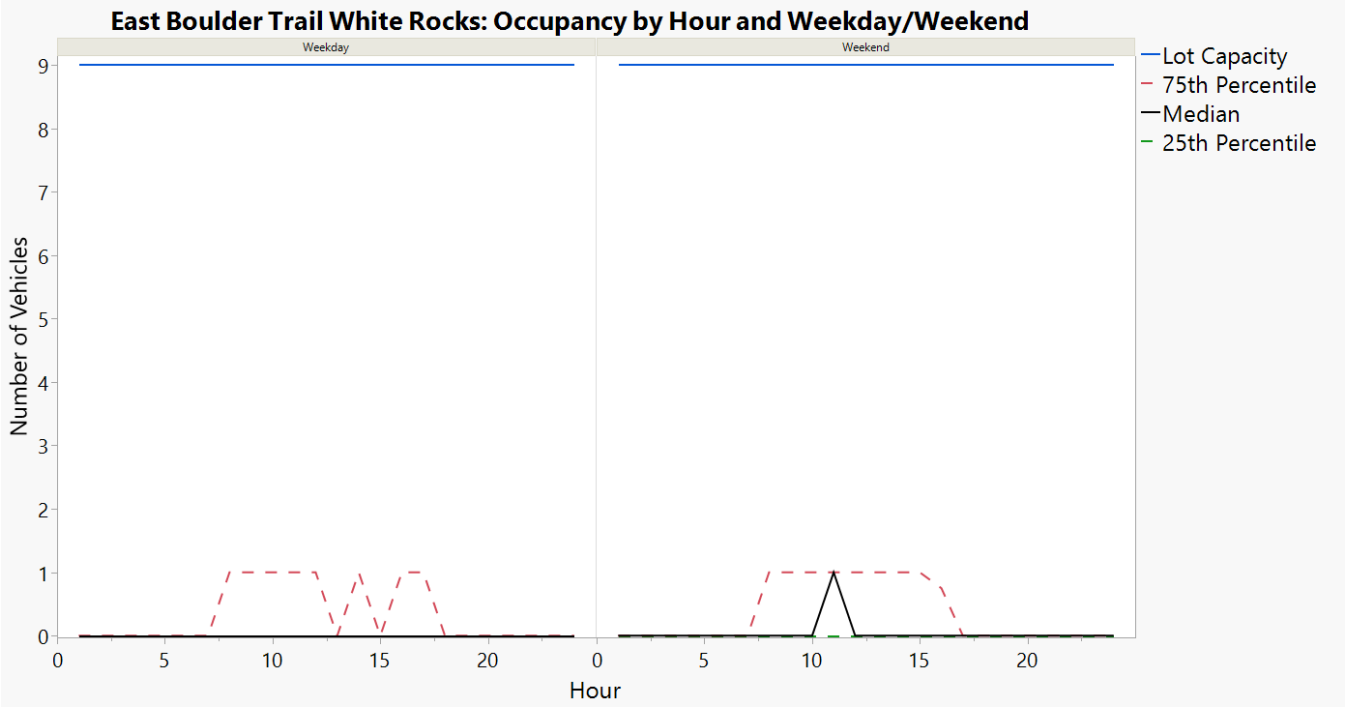


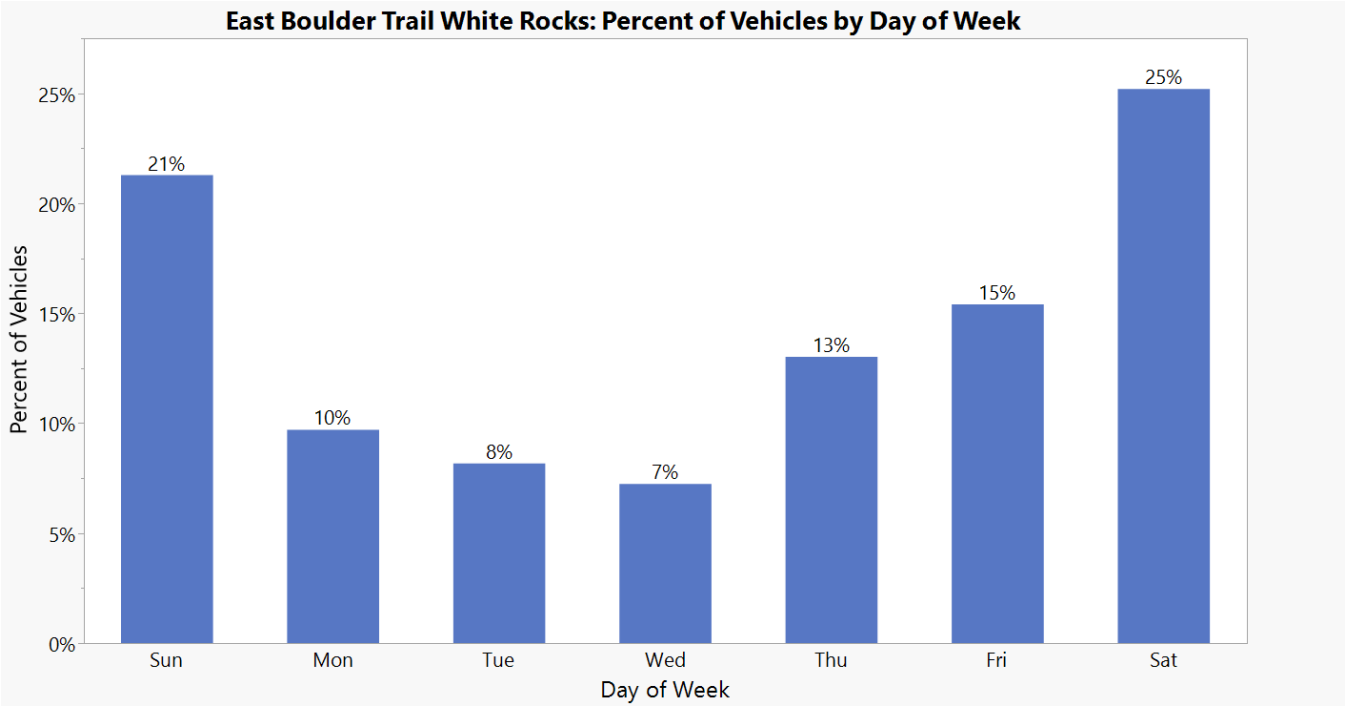


East Boulder Trail White Rocks

Key Results:

On average, East Boulder Trail White Rocks was observed to be at **5%** occupancy with 0.4 vehicles parked during the day (2019-2020). This ranged from 4% on weekdays (0.4 vehicles) to 5% on weekends (0.5 vehicles). Up to 6 vehicles were observed in the lot.

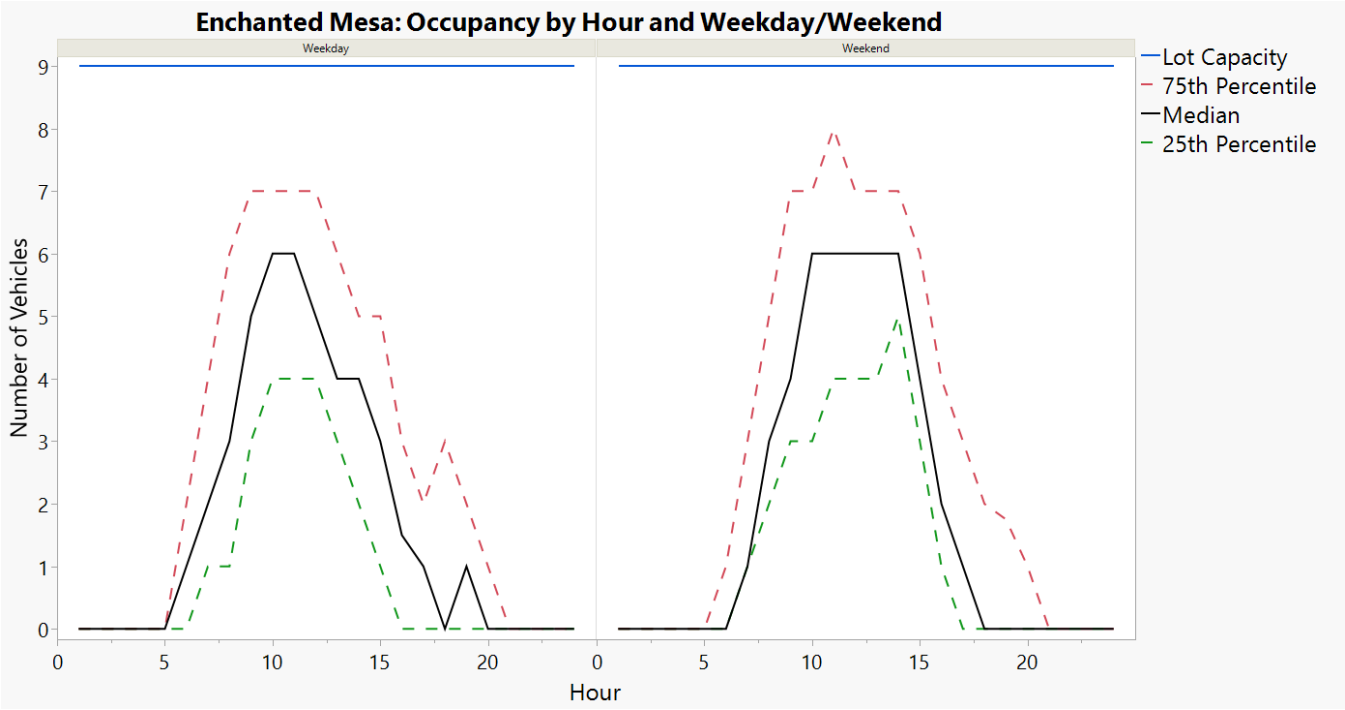


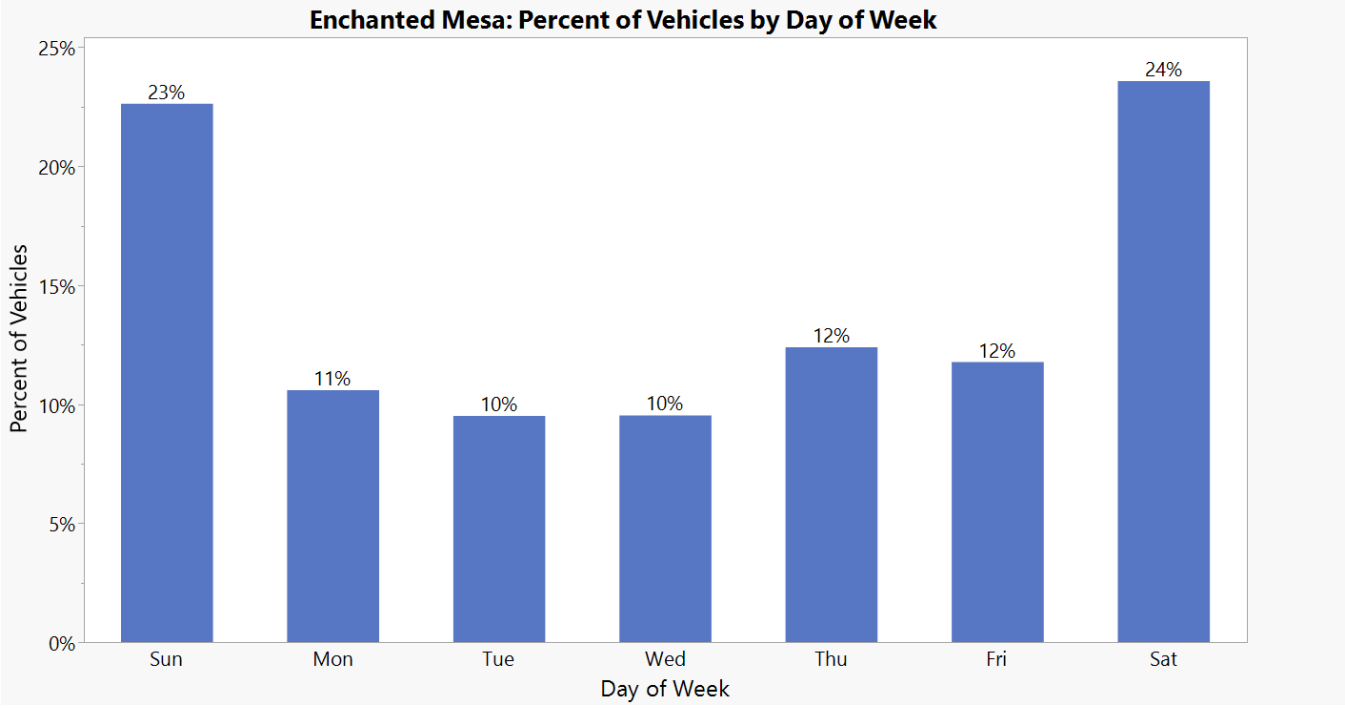


Enchanted Mesa

Key Results:

On average, Enchanted Mesa was observed to be at **42%** occupancy with 4 vehicles parked during the day (2019-2020). This ranged from 41% on weekdays (3.6 vehicles) to 45% on weekends (4.0 vehicles). Up to 10 vehicles were observed in the lot.

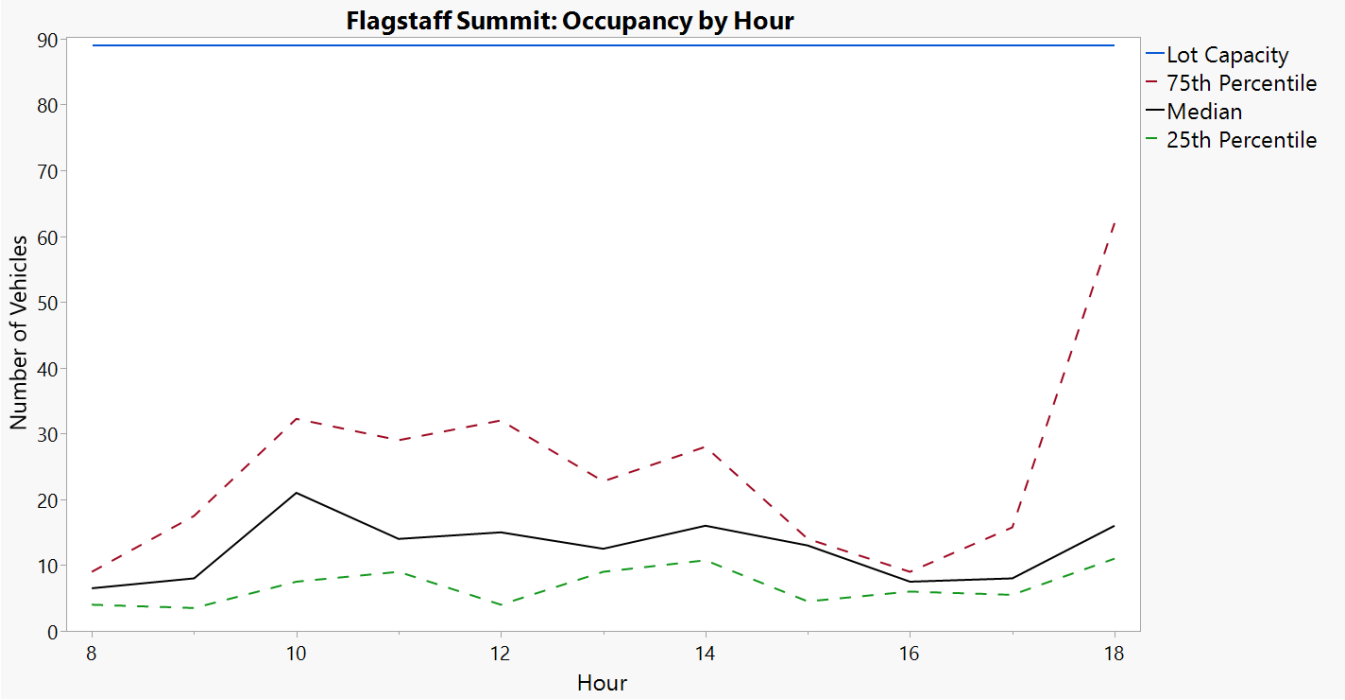


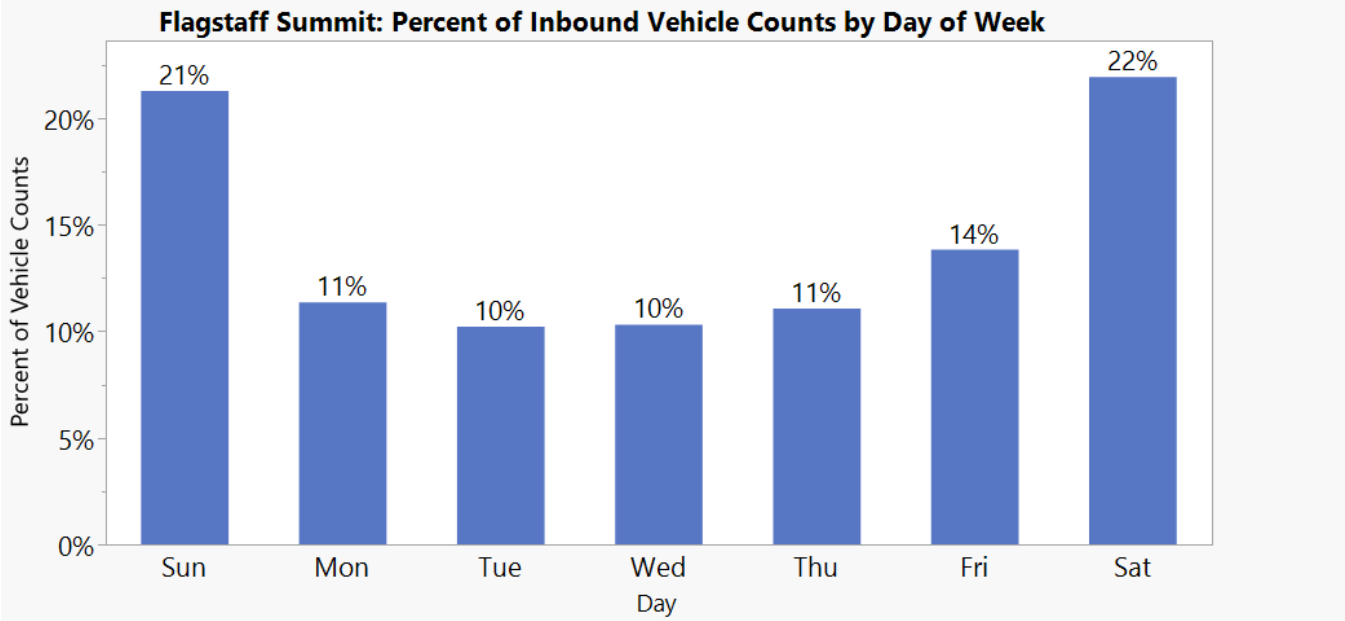


Flagstaff Summit

Key Results:

On average, the Flagstaff Summit area[1] was observed to be at **17%** occupancy with 15 vehicles parked during the day (2019-2020). This ranged from 12% on weekdays (11 vehicles) to 24% on weekends (21 vehicles). The area was never observed to be completely full out of 52 observations. Events were occurring during three of the observation sessions. Data collection occurred from July 2019 through October 2019 to align with when the gate was open to the public.



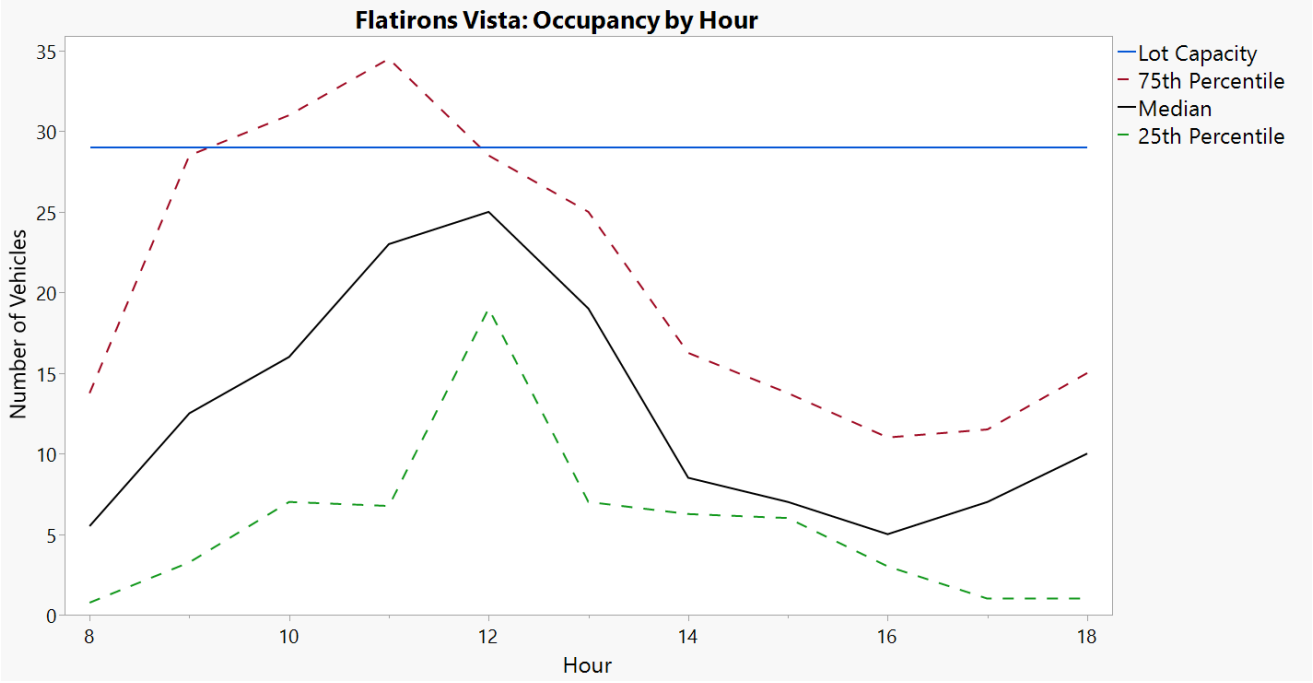


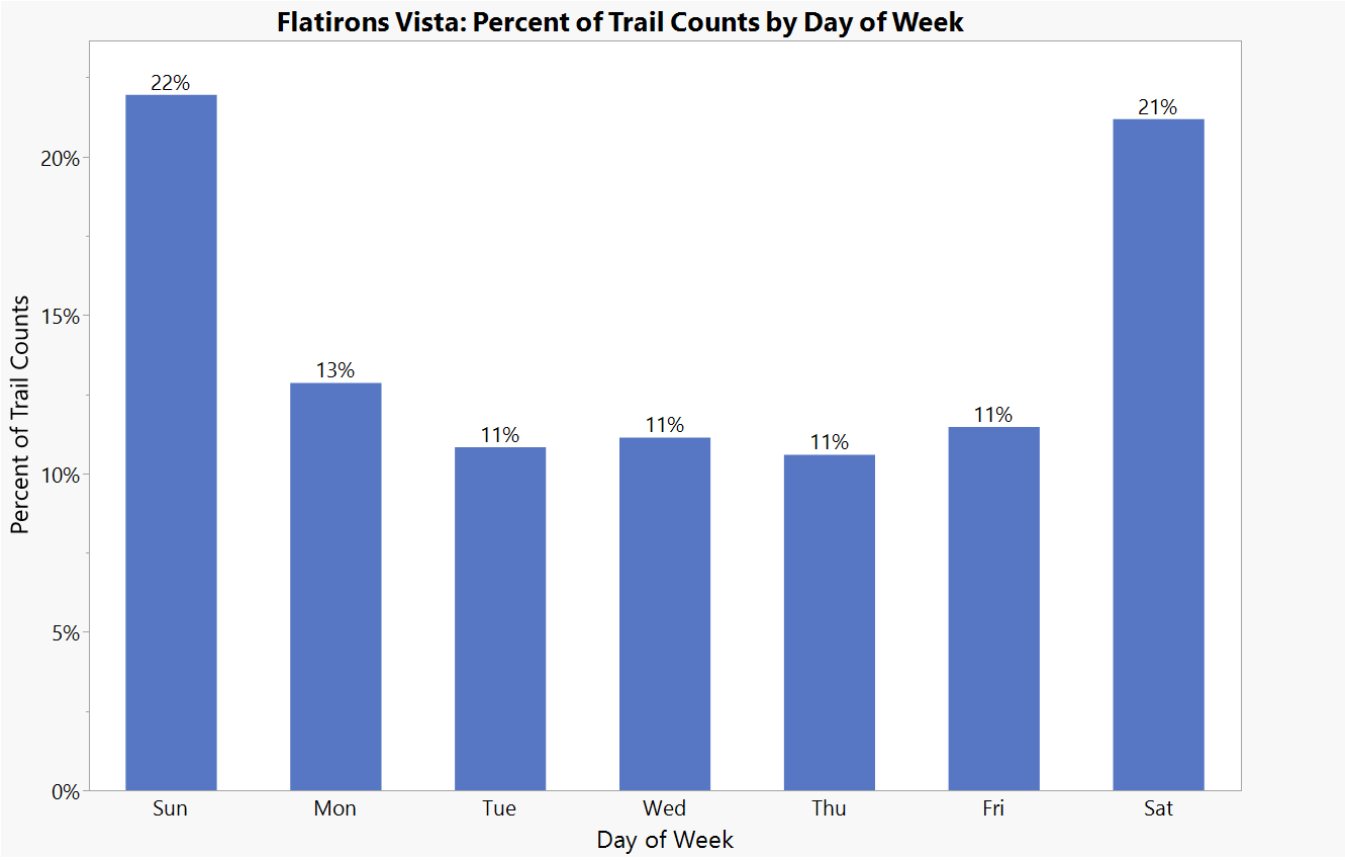
[1] Flagstaff Summit lot composition includes all spots, including pull-offs, available past the gate at Realization Point.

Flatirons Vista

Key Results:

On average, Flatirons Vista was observed to be at **52%** occupancy with 15 vehicles parked during the day (2019-2020). This ranged from 34% on weekdays (10 vehicles) to 85% on weekends (24 vehicles). The lot was observed to be completely full 4 out of 87 observations (5%). Up to two horse trailers were observed on 4 out of 21 observations days (19%).



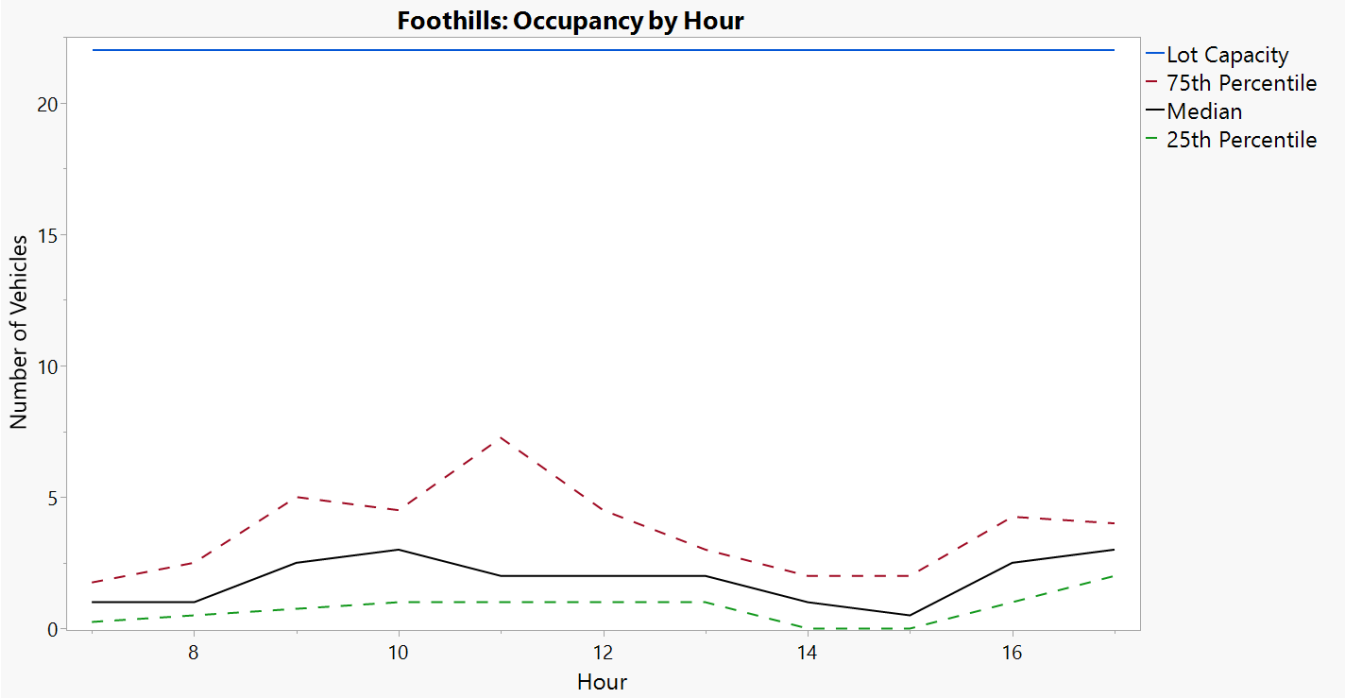


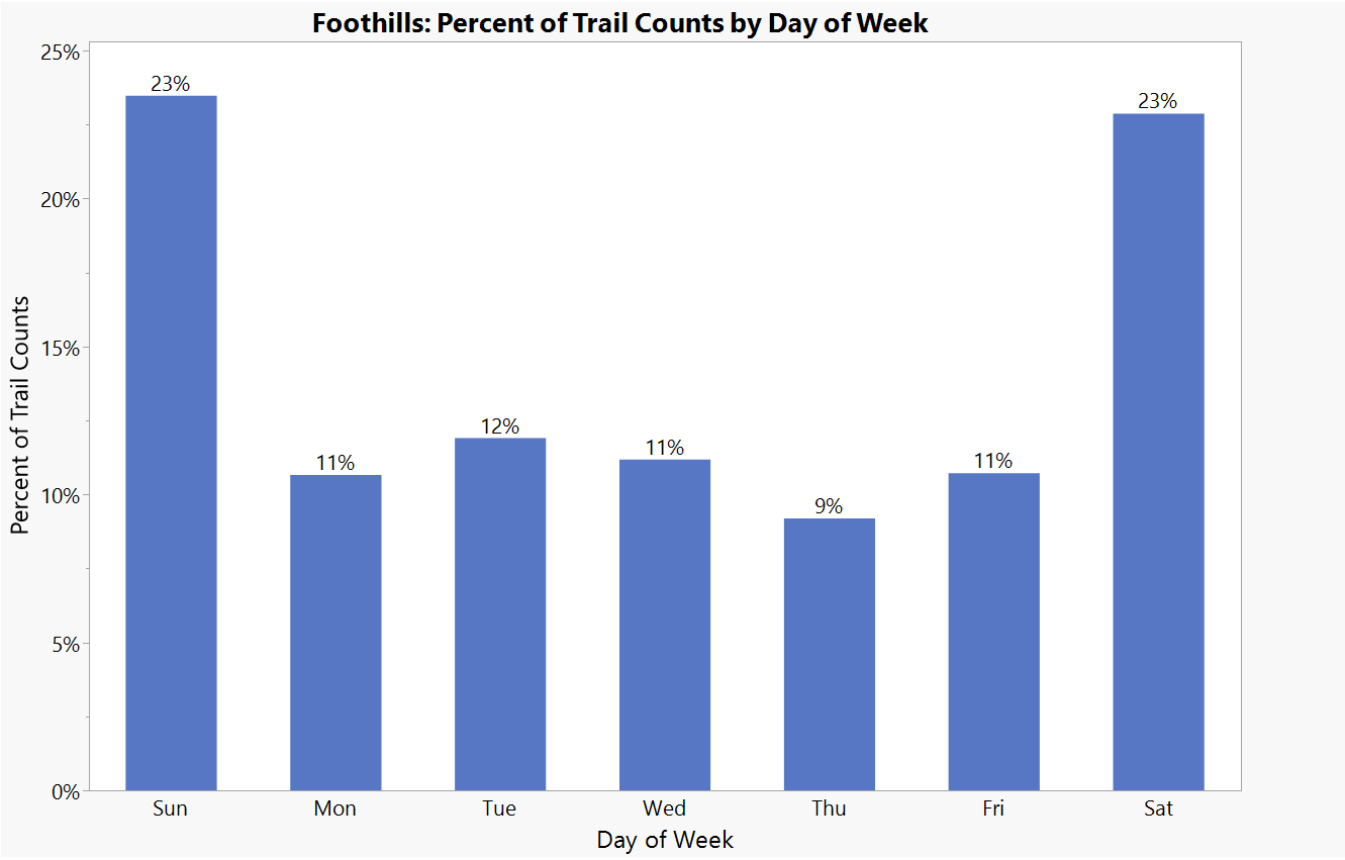
Foothills

Key Results:

On average, Foothills was observed to be at **12%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 6% on weekdays (1 vehicle) to 21% on weekends (5 vehicles).

The lot was never observed to be completely full out of 100 observations.

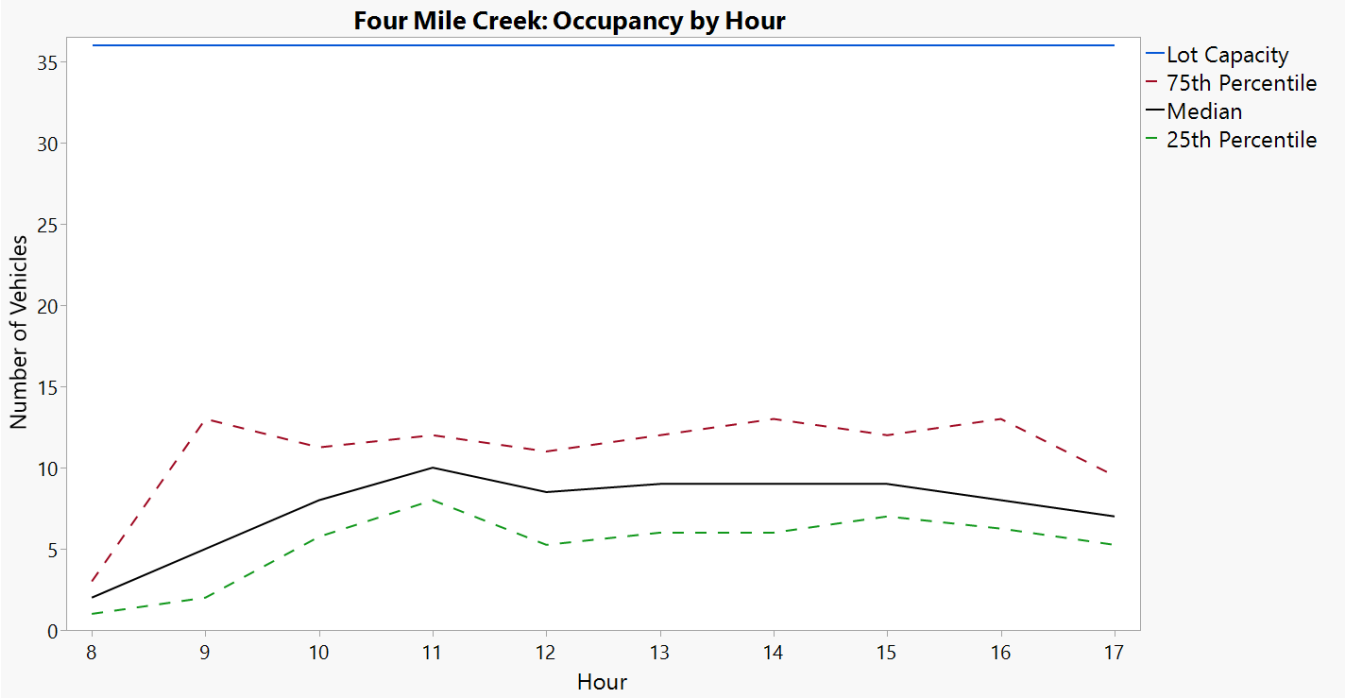


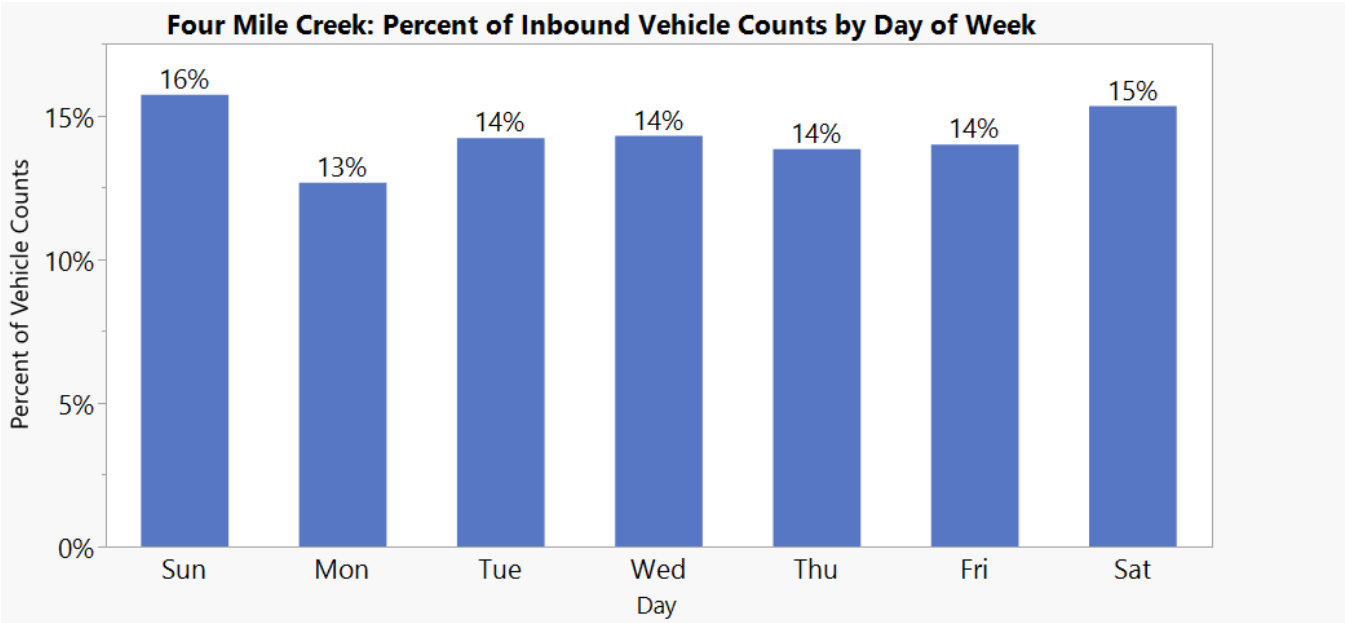


Four Mile Creek

Key Results:

On average, Four Mile Creek was observed to be at **26%** occupancy with 9 vehicles parked during the day (2019-2020). This ranged from 23% on weekdays (8 vehicles) to 30% on weekends (11 vehicles). The lot was never observed to be completely full out of 104 observations. Both trail counts and vehicle counts are provided below.

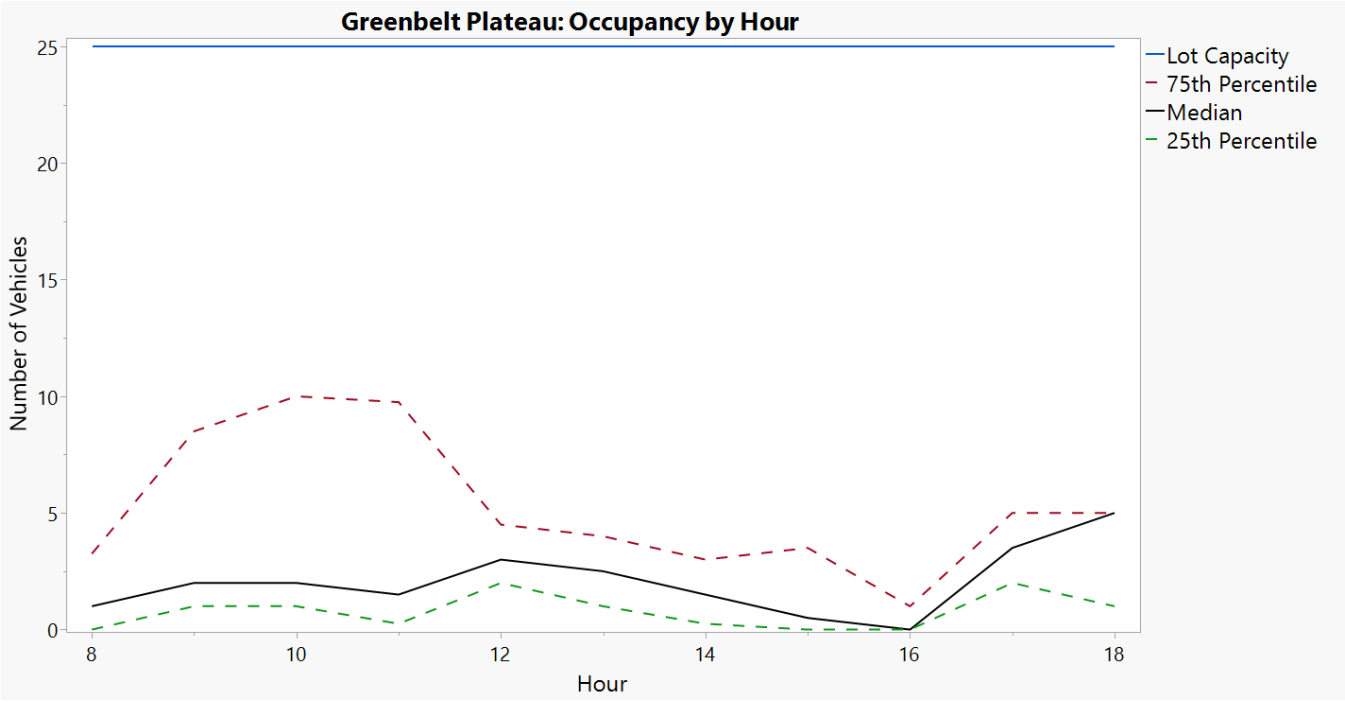


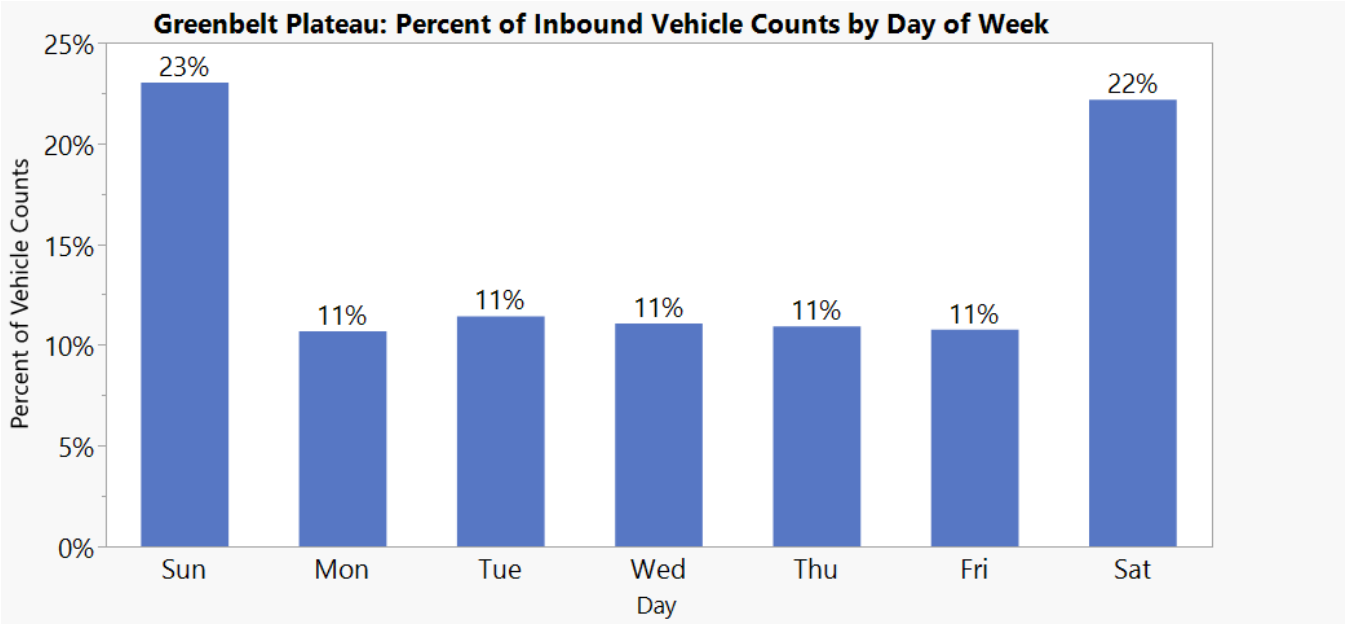


Greenbelt Plateau

Key Results:

On average, Greenbelt Plateau was observed to be at **12%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 7% on weekdays (2 vehicles) to 21% on weekends (5 vehicles). The lot was never observed to be completely full out of 87 observations.

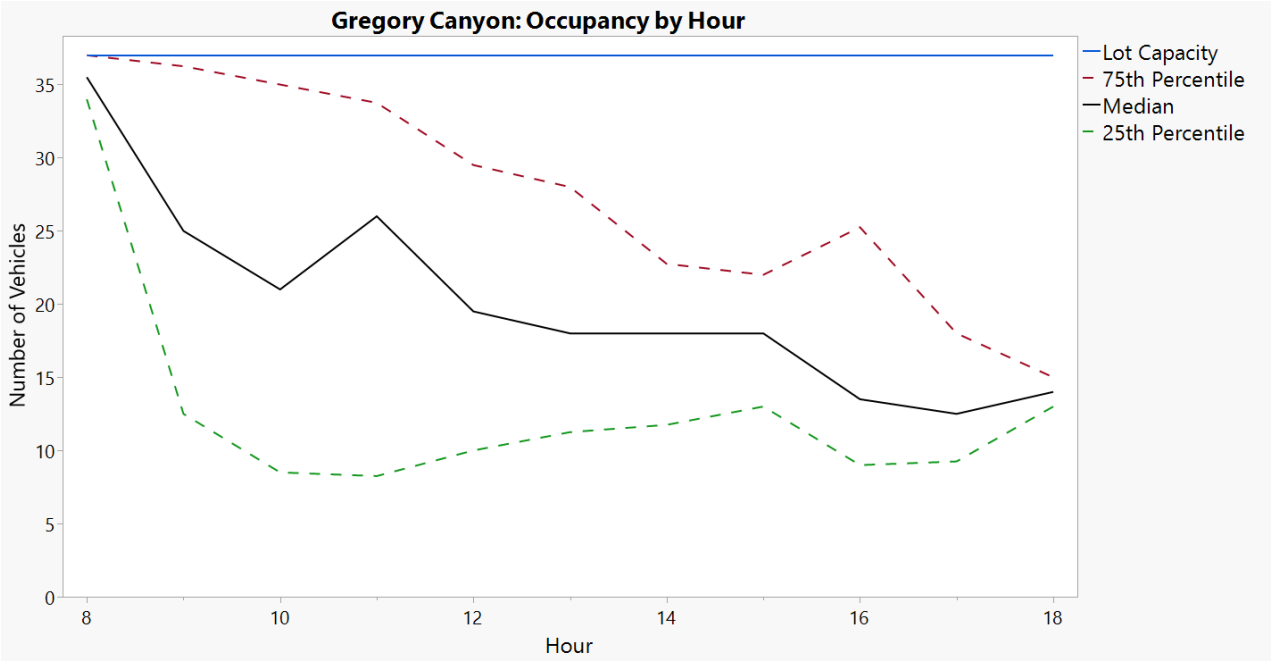


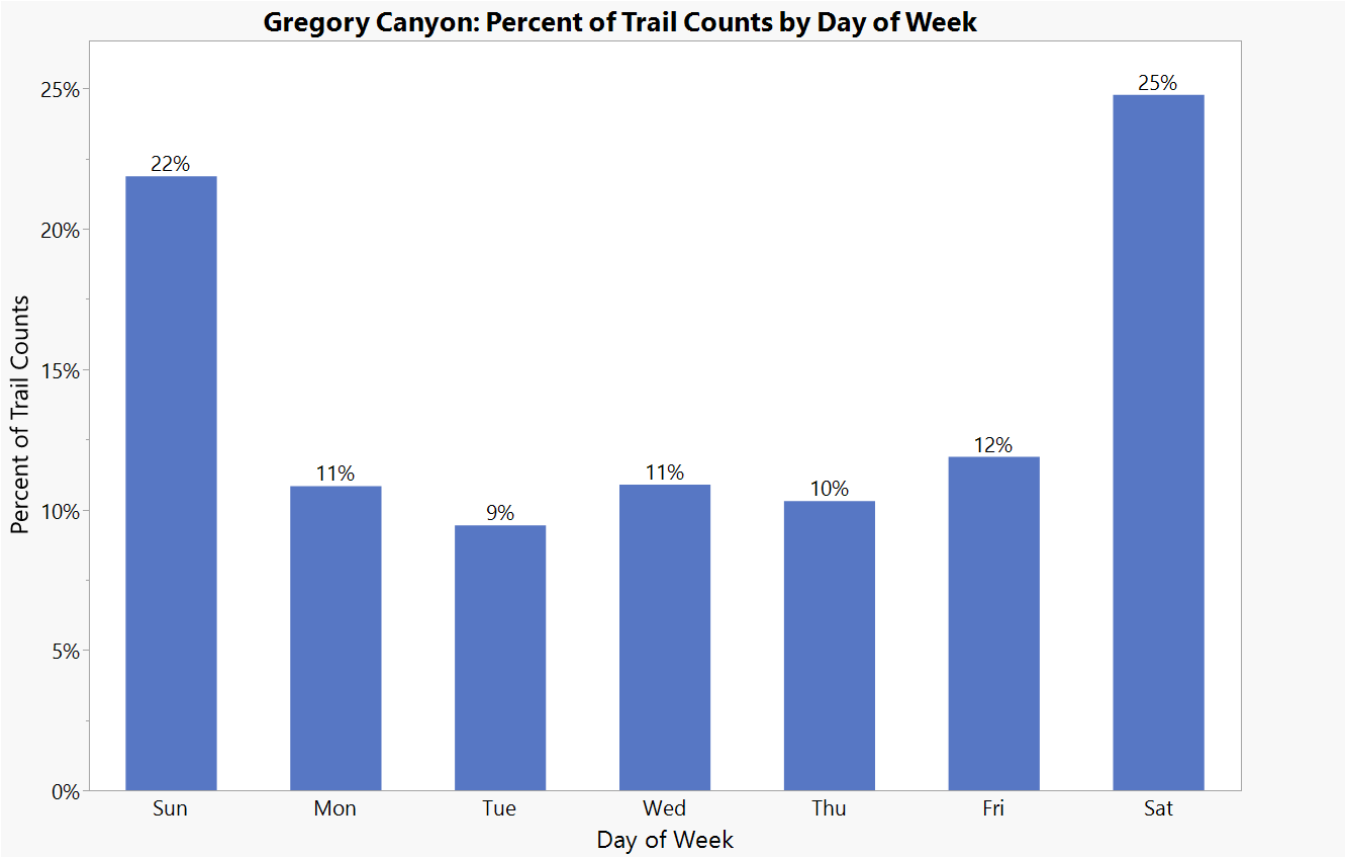


Gregory Canyon

Key Results:

On average, Gregory Canyon was observed to be at **54%** occupancy with 20 vehicles parked during the day (2019-2020). This ranged from 41% on weekdays (15 vehicles) to 75% on weekends (28 vehicles). The lot was observed to be completely full 8 out of 80 observations (10%).

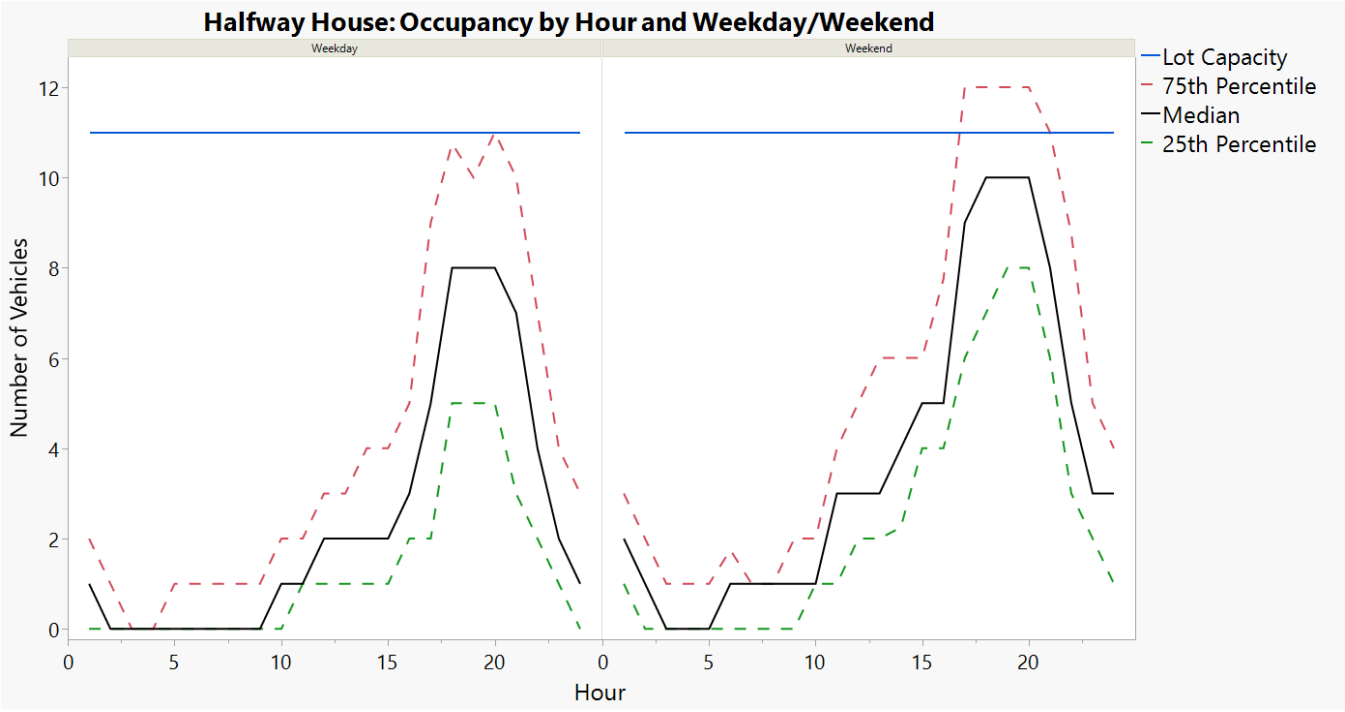


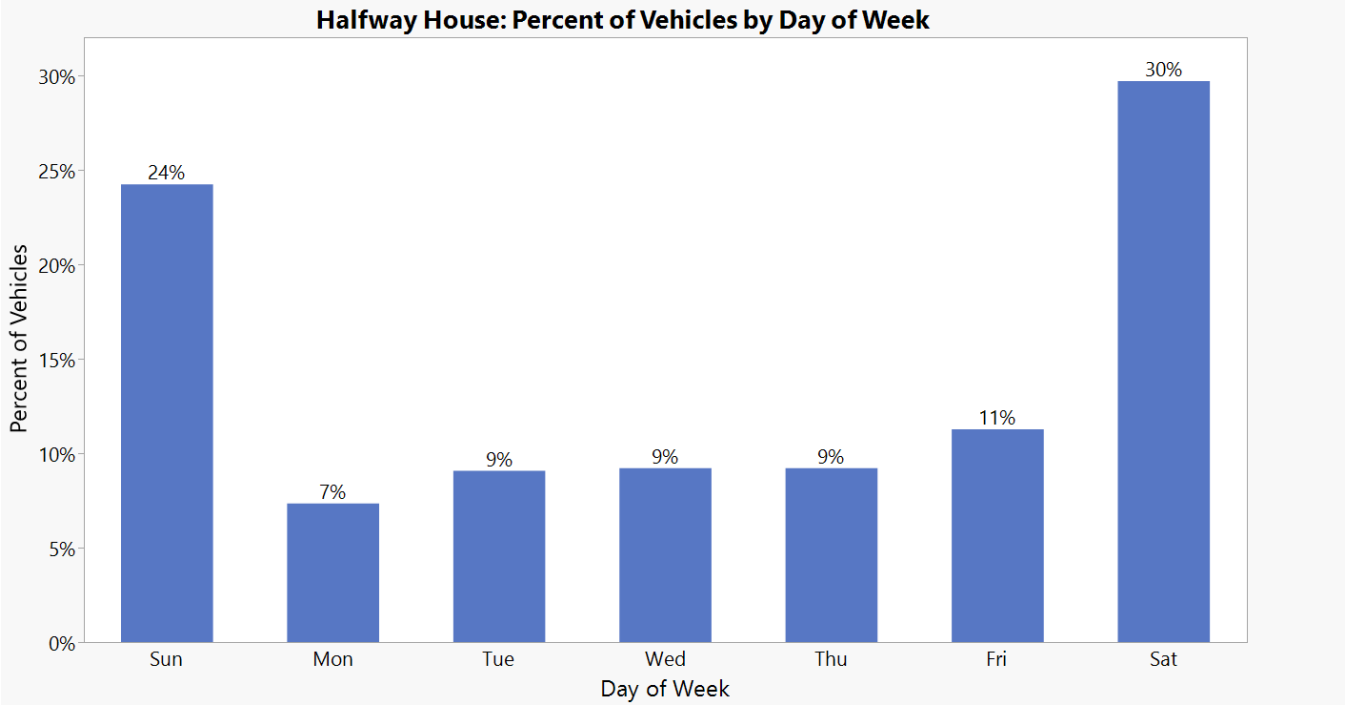


Halfway House

Key Results:

On average, Halfway House was observed to be at **30%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 24% on weekdays (3 vehicles) to 37% on weekends (4 vehicles). Up to 15 vehicles were observed in the lot.

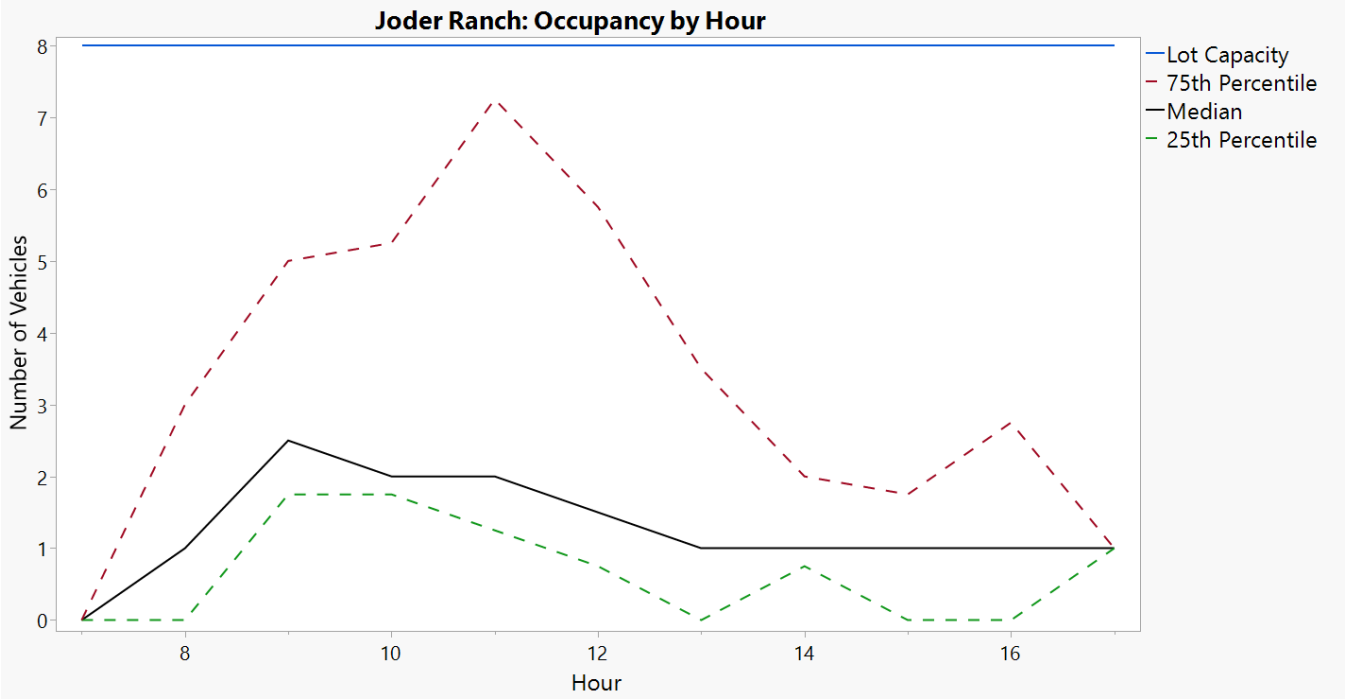


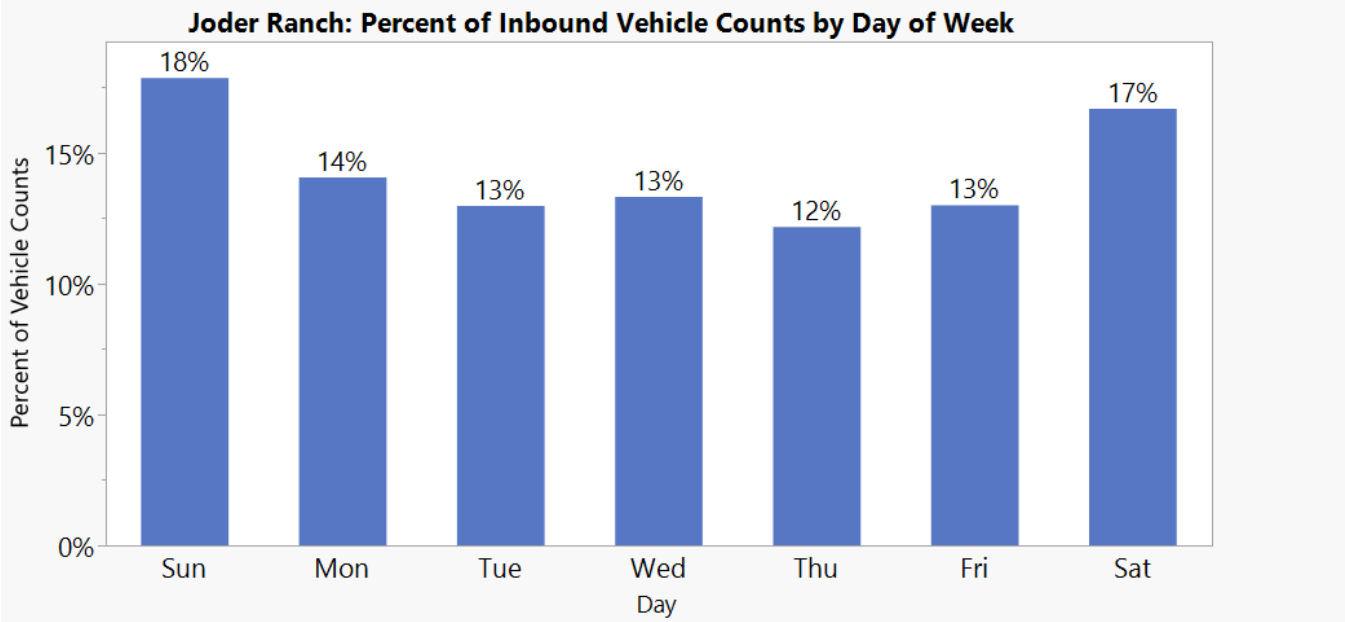


Joder Ranch

Key Results:

On average, Joder Ranch was observed to be at **29%** occupancy with 2 vehicles parked during the day (2019-2020). This ranged from 17% on weekdays (1 vehicle) to 48% on weekends (4 vehicles). The lot was observed to be completely full 5 out of 100 observations (5%). One horse trailer was observed on 1 out of 25 observation days (4%).

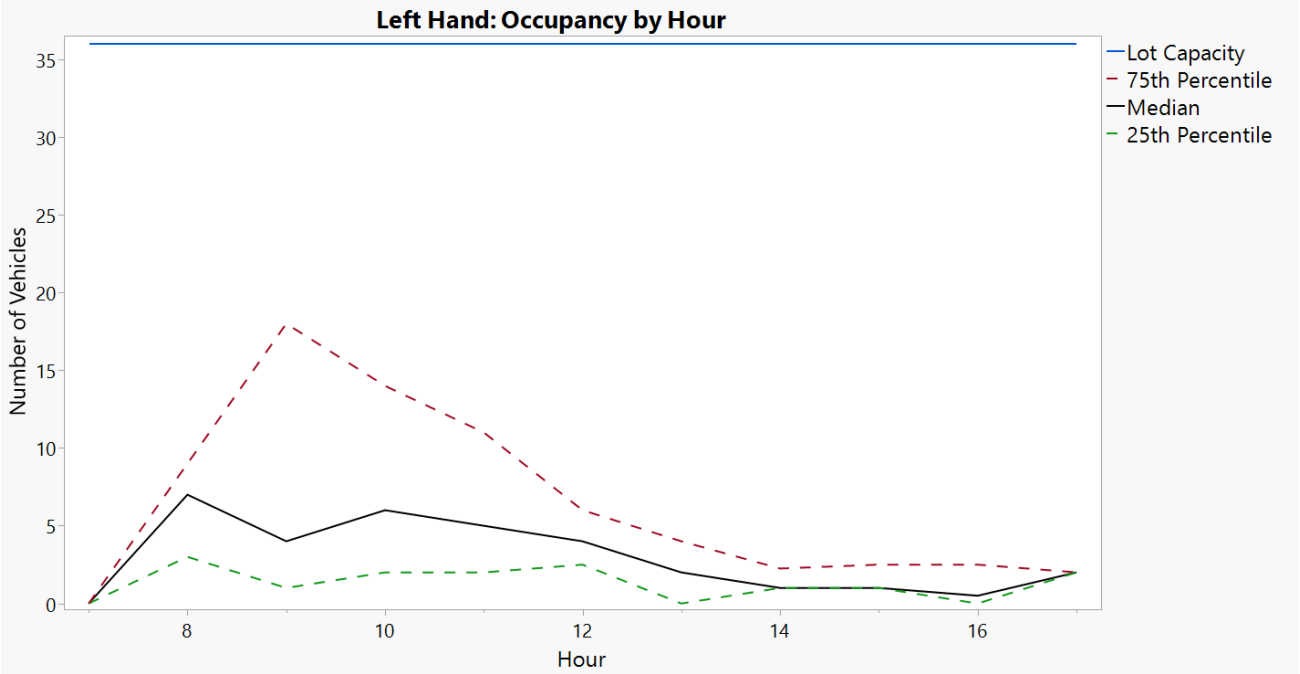


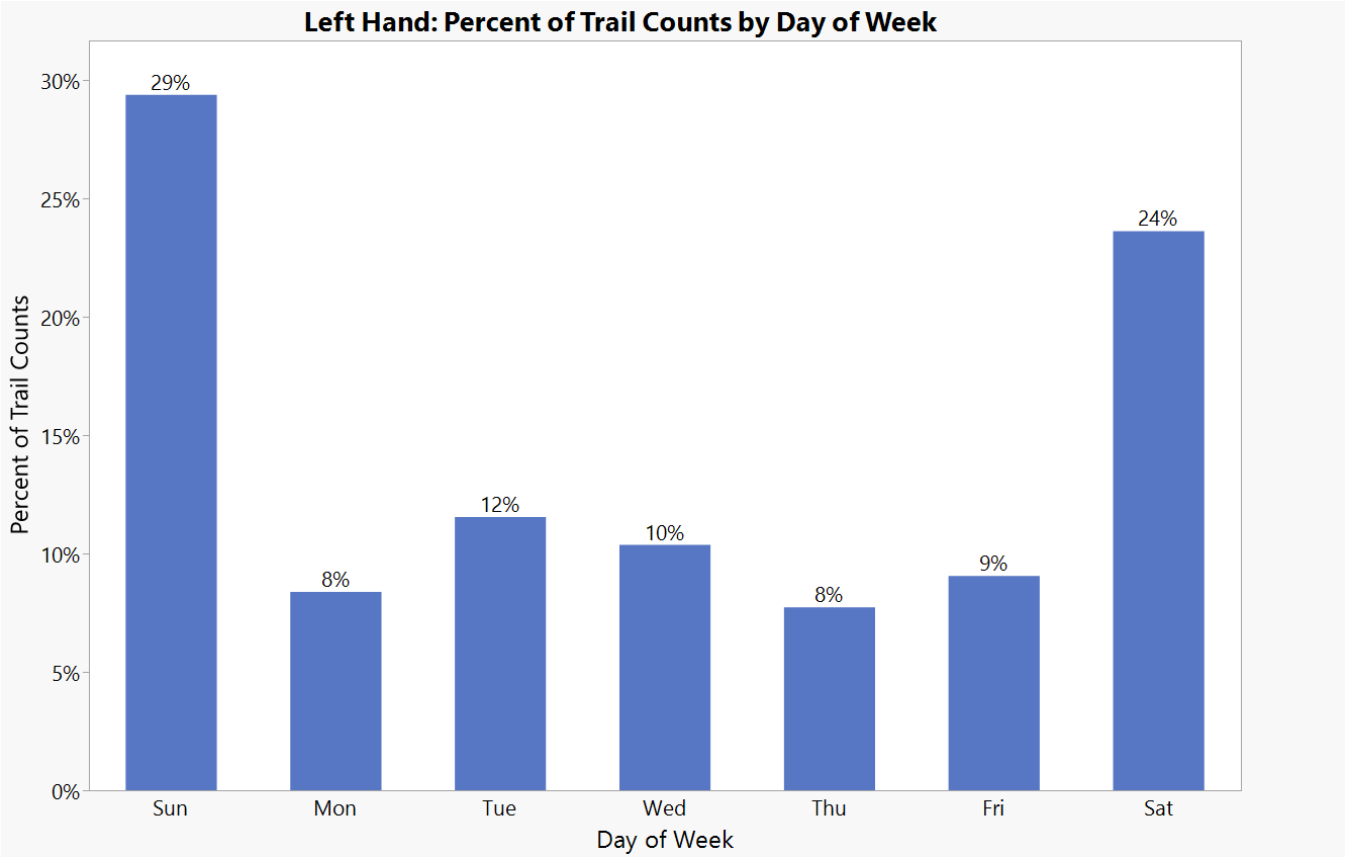


Left Hand

Key Results:

On average, Left Hand was observed to be at **12%** occupancy with 4 vehicles parked during the day (2019-2020). This ranged from 6% on weekdays (2 vehicles) to 20% on weekends (7 vehicles). The lot was never observed to be completely full out of 88 observations. Up to 3 horse trailers were observed on 6 out of 22 observation days (27%).

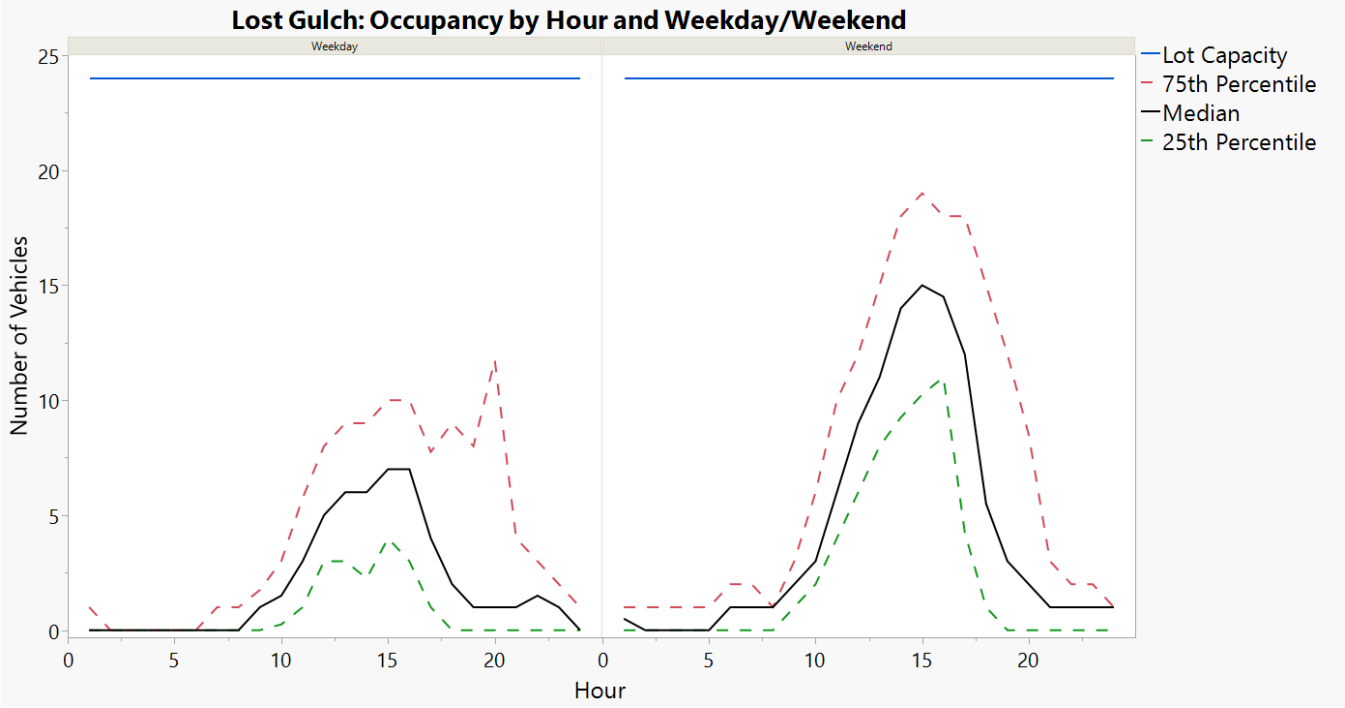


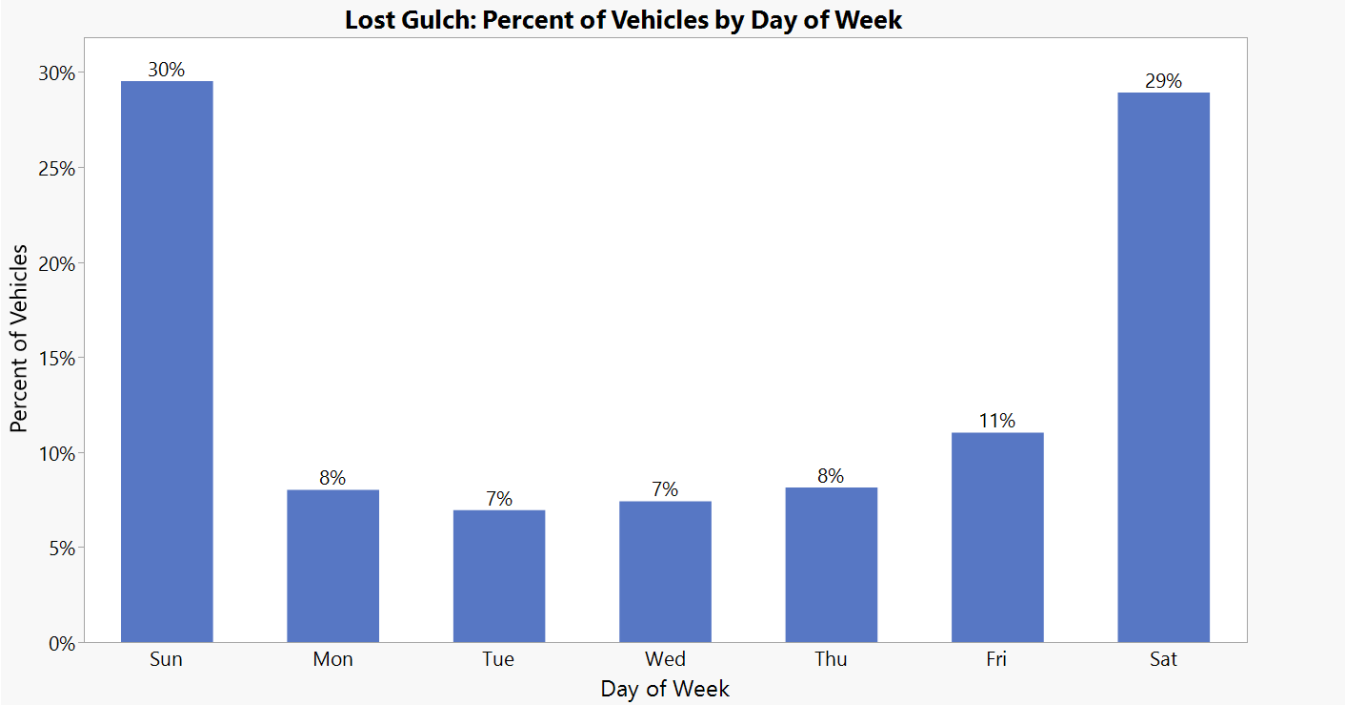


Lost Gulch Overlook

Key Results:

On average, Lost Gulch was observed to be at **25%** occupancy with 6 vehicles parked during the day (2019-2020). This ranged from 17% on weekdays (4 vehicles) to 34% on weekends (8 vehicles). Up to 28 vehicles were observed in the lot.



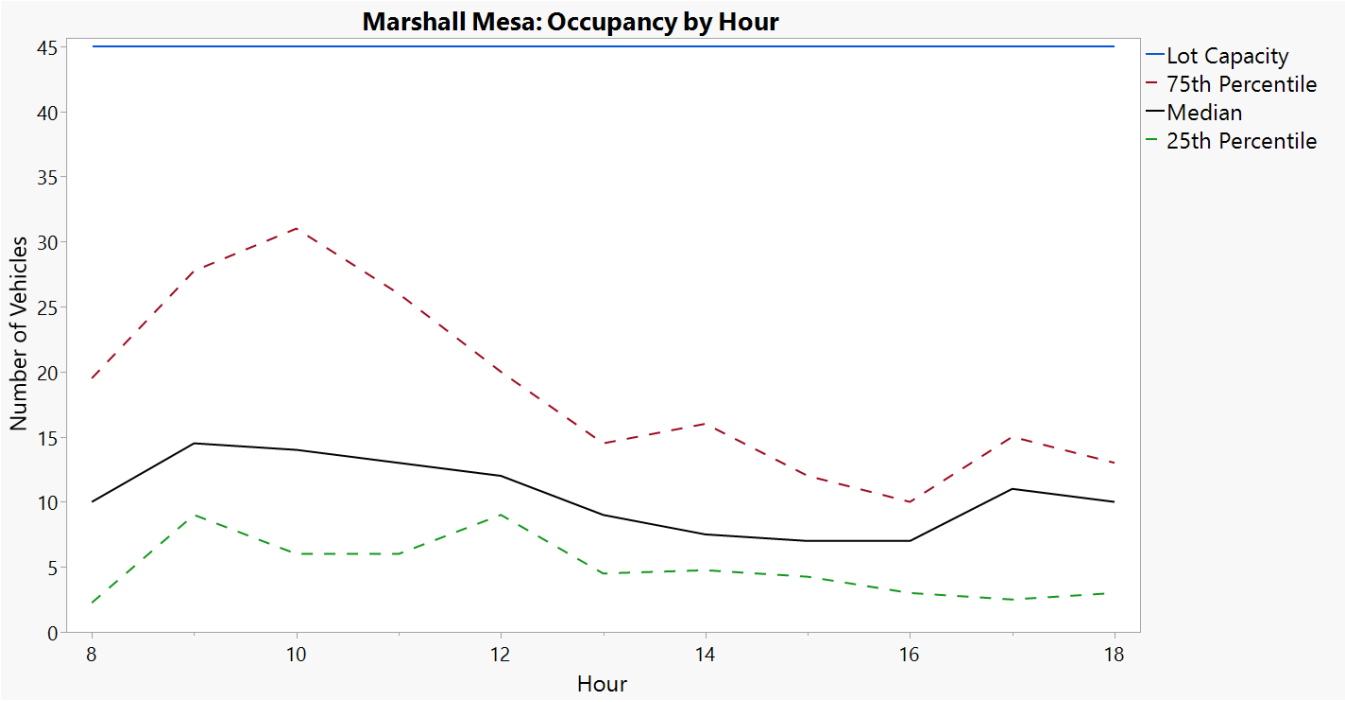


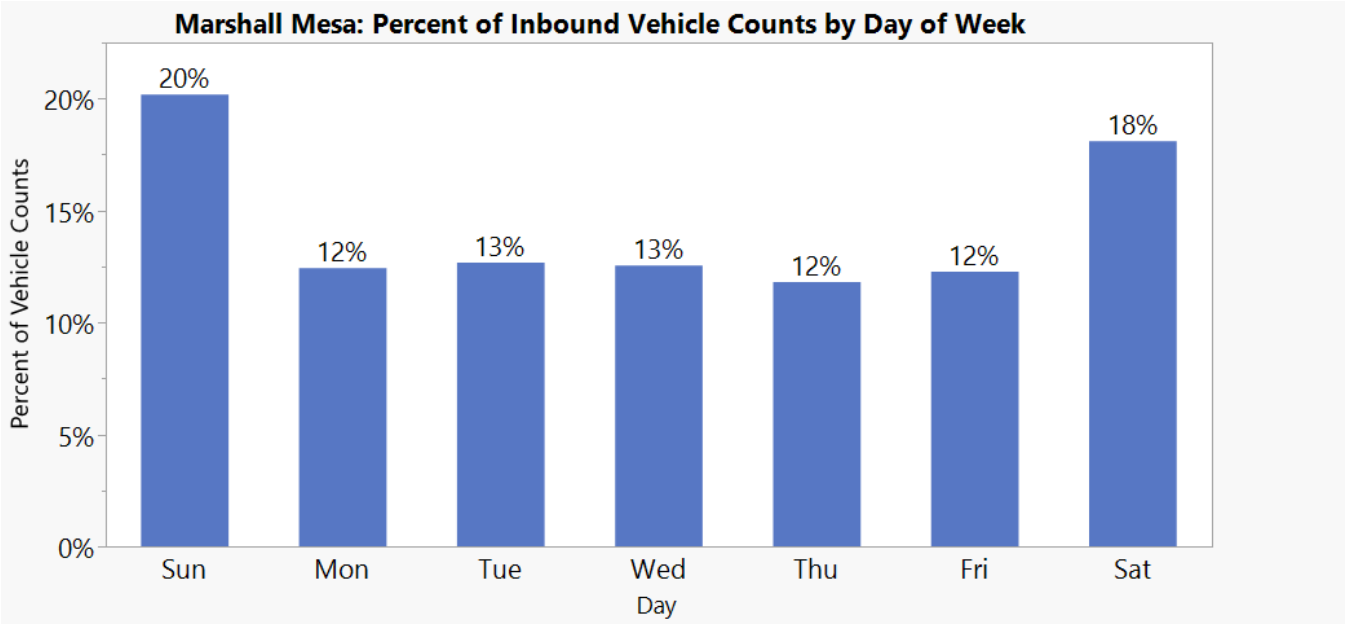
Marshall Mesa

Key Results:

On average, Marshall Mesa was observed to be at **27%** occupancy with 12 vehicles parked during the day (2019-2020). This ranged from 20% on weekdays (9 vehicles) to 40% on weekends (18 vehicles). The lot was never observed to be completely full out of 87 observations. Up to two horse trailers were observed on 1 out of 21 observation days (5%).

Methods used: Observation, vehicle counter, trail counter

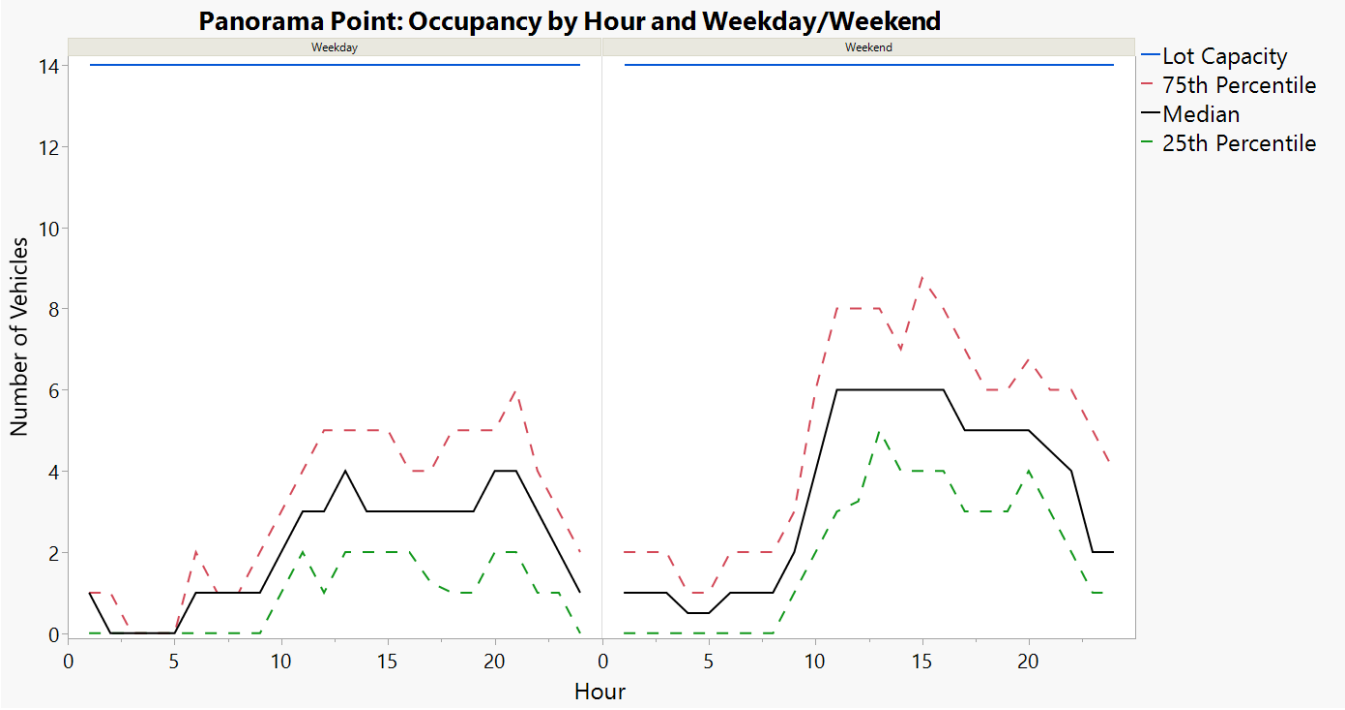


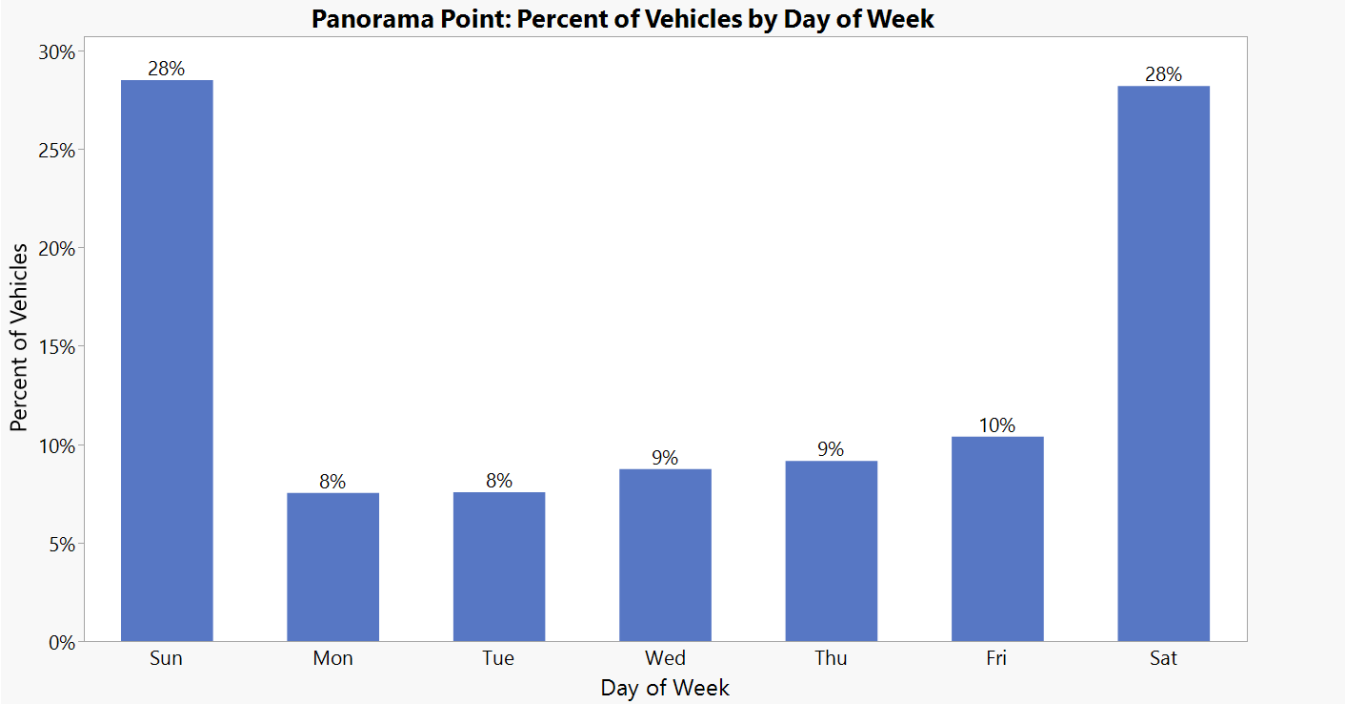


Panorama Point

Key Results:

On average, Panorama Point was observed to be at **25%** occupancy with 3 vehicles parked during the day (2019-2020). This ranged from 19% on weekdays (3 vehicles) to 32% on weekends (4 vehicles). Up to 15 vehicles were observed in the lot.

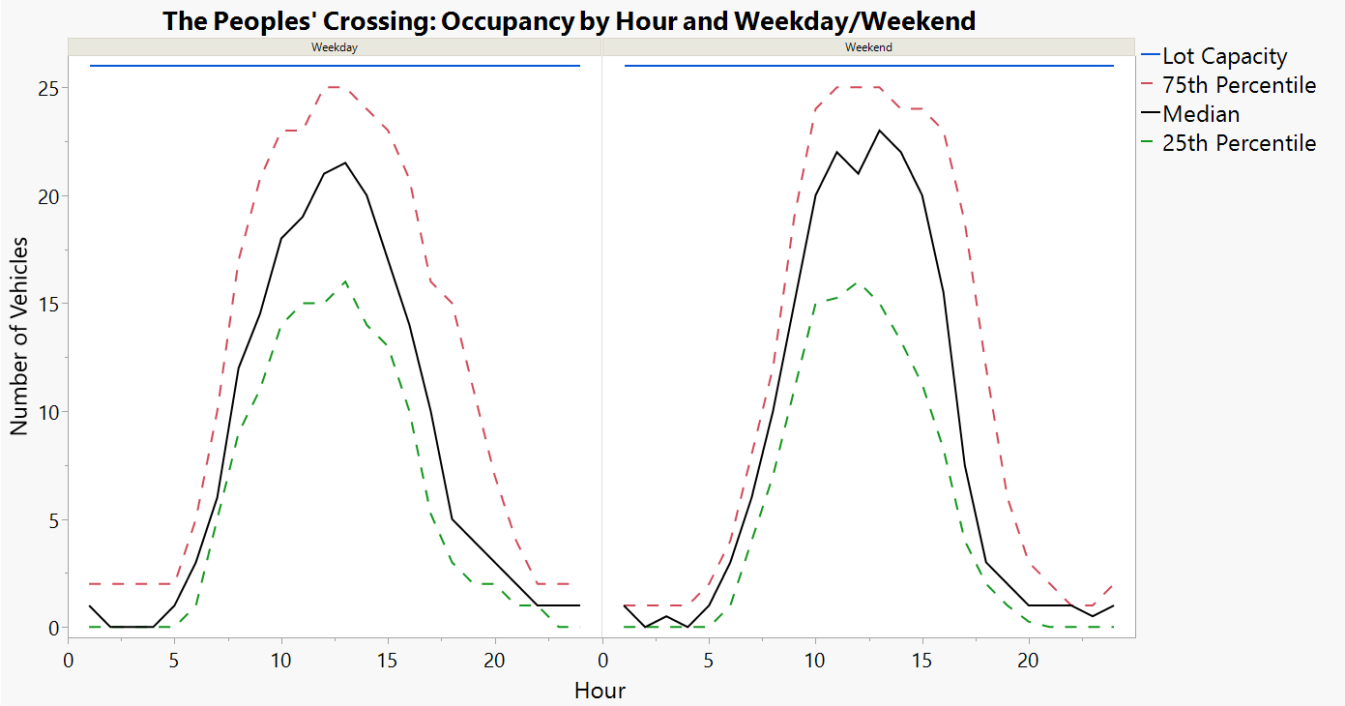


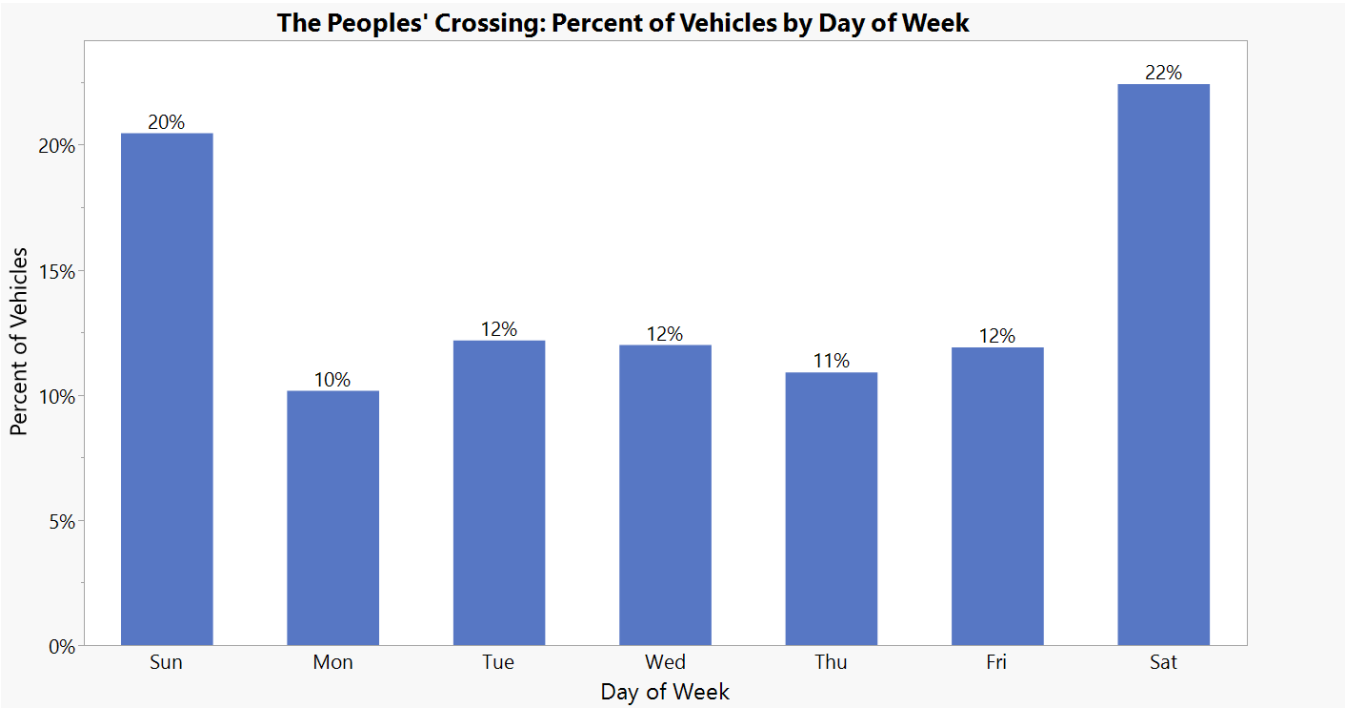


The Peoples' Crossing

Key Results:

On average, The Peoples' Crossing was observed to be at **59%** occupancy with 15 vehicles parked during the day (2019-2020). This ranged from 58% on weekends (15.0 vehicles) to 59% on weekdays (15.4 vehicles). Up to 29 vehicles were observed in the lot.

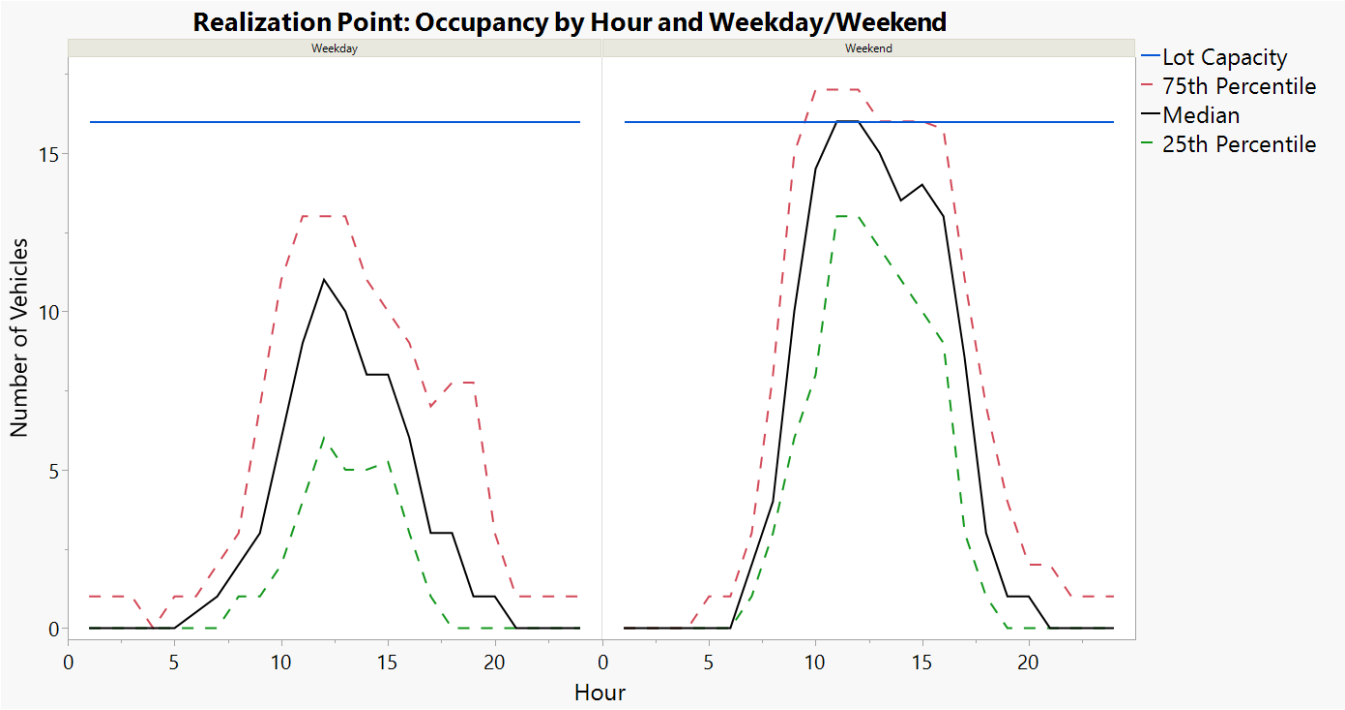


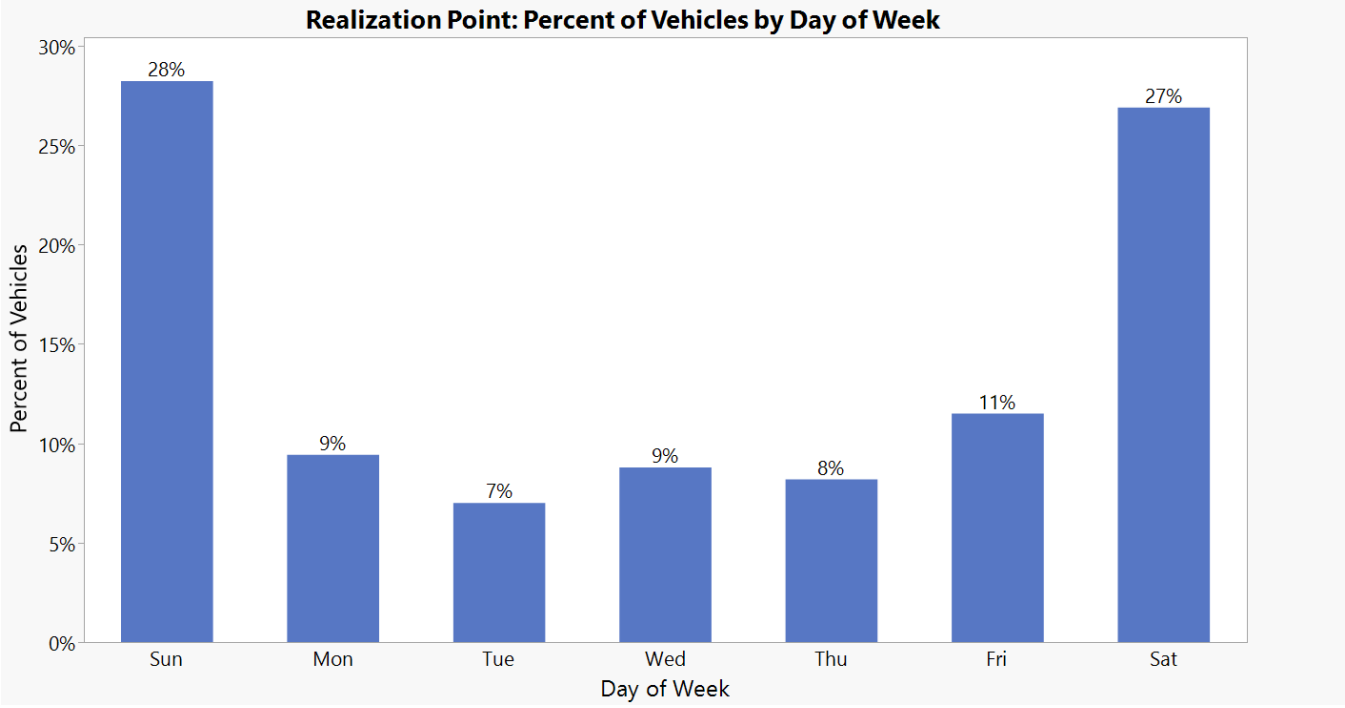


Realization Point

Key Results:

On average, Realization Point was observed to be at **50%** occupancy with 8 vehicles parked during the day (2019-2020). This ranged from 39% on weekdays (6 vehicles) to 64% on weekends (10 vehicles). Up to 19 vehicles were observed in the lot.

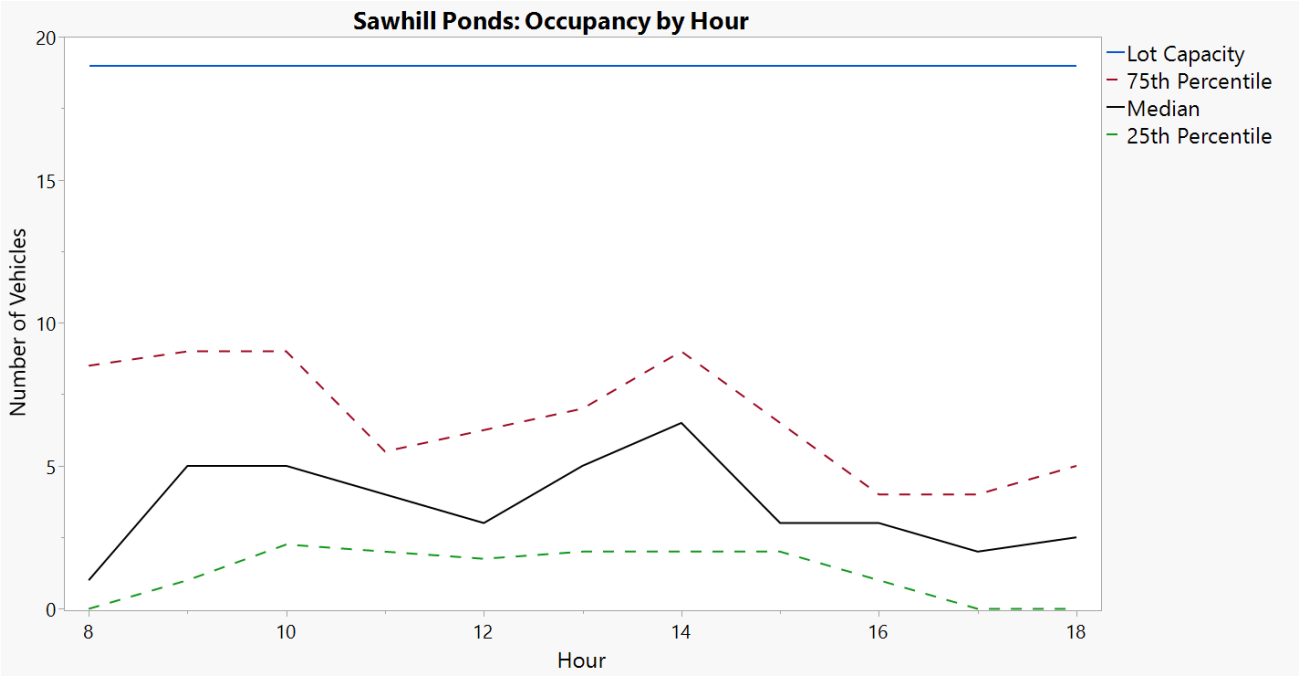


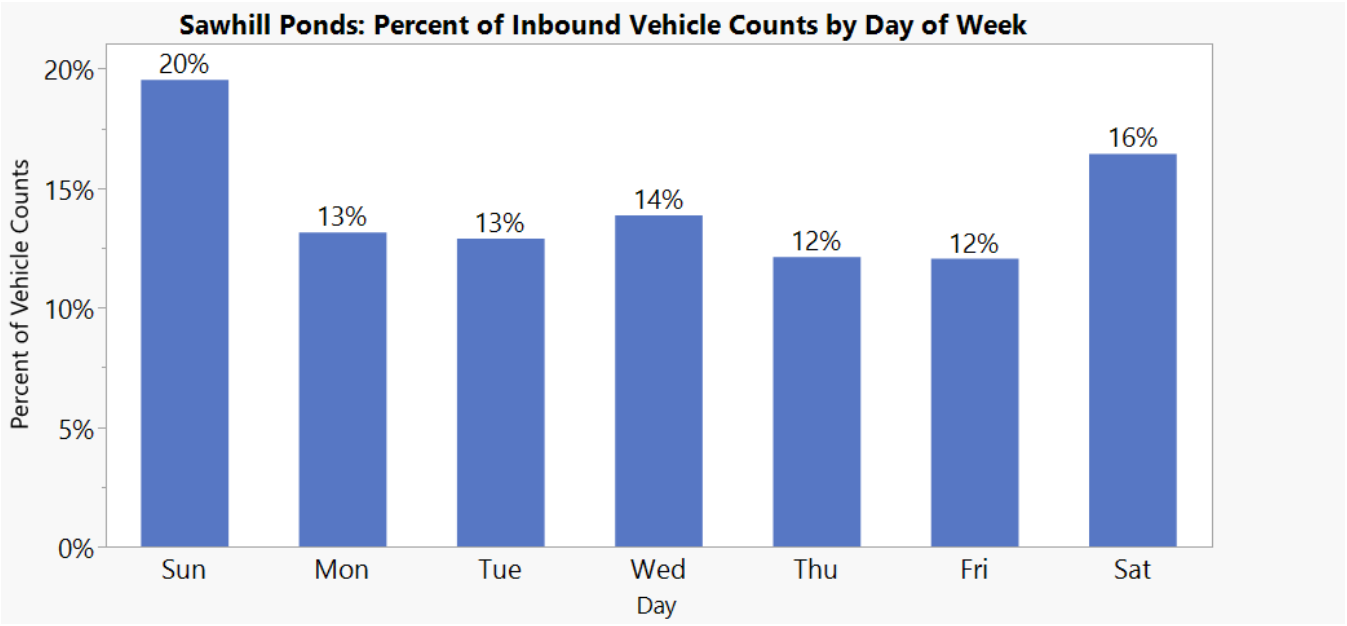


Sawhill Ponds

Key Results:

On average, Sawhill Ponds was observed to be at **23%** occupancy with 4 vehicles parked during the day (2019-2020). This ranged from 17% on weekdays (3 vehicles) to 32% on weekends (6 vehicles). The lot was never observed to be completely full out of 96 observations. Up to 5 vehicles were observed in the pull-offs parked outside of the main parking lot, but these were excluded from the occupancy analysis.

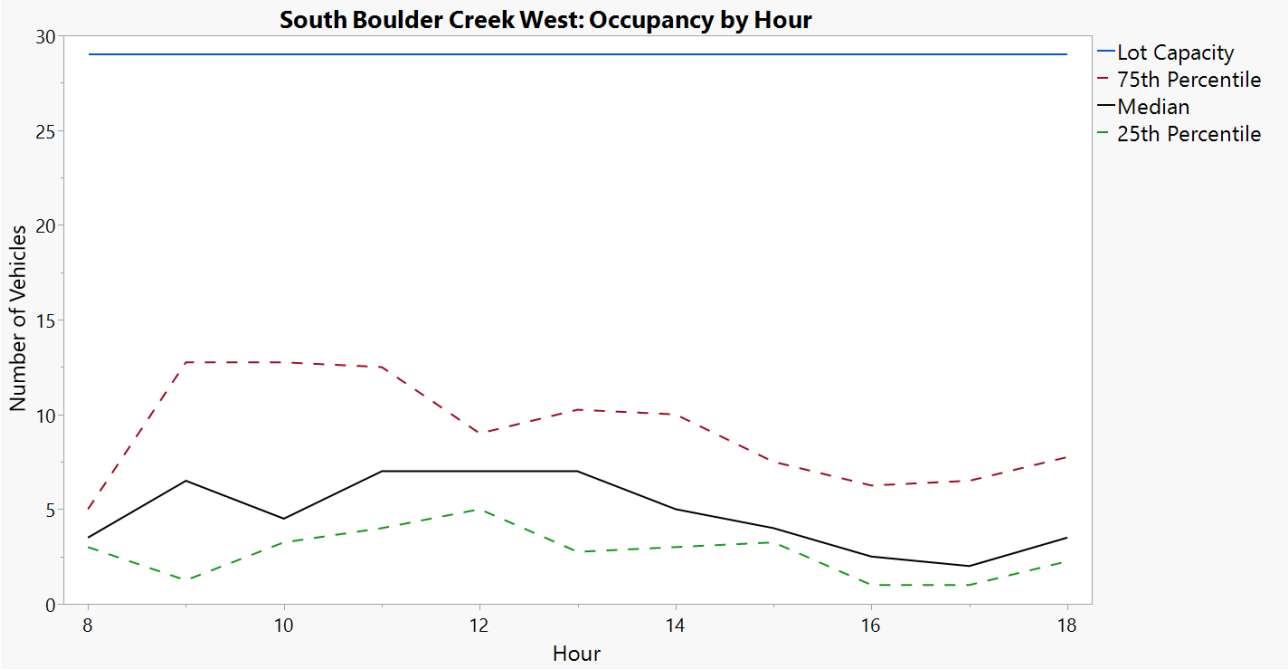


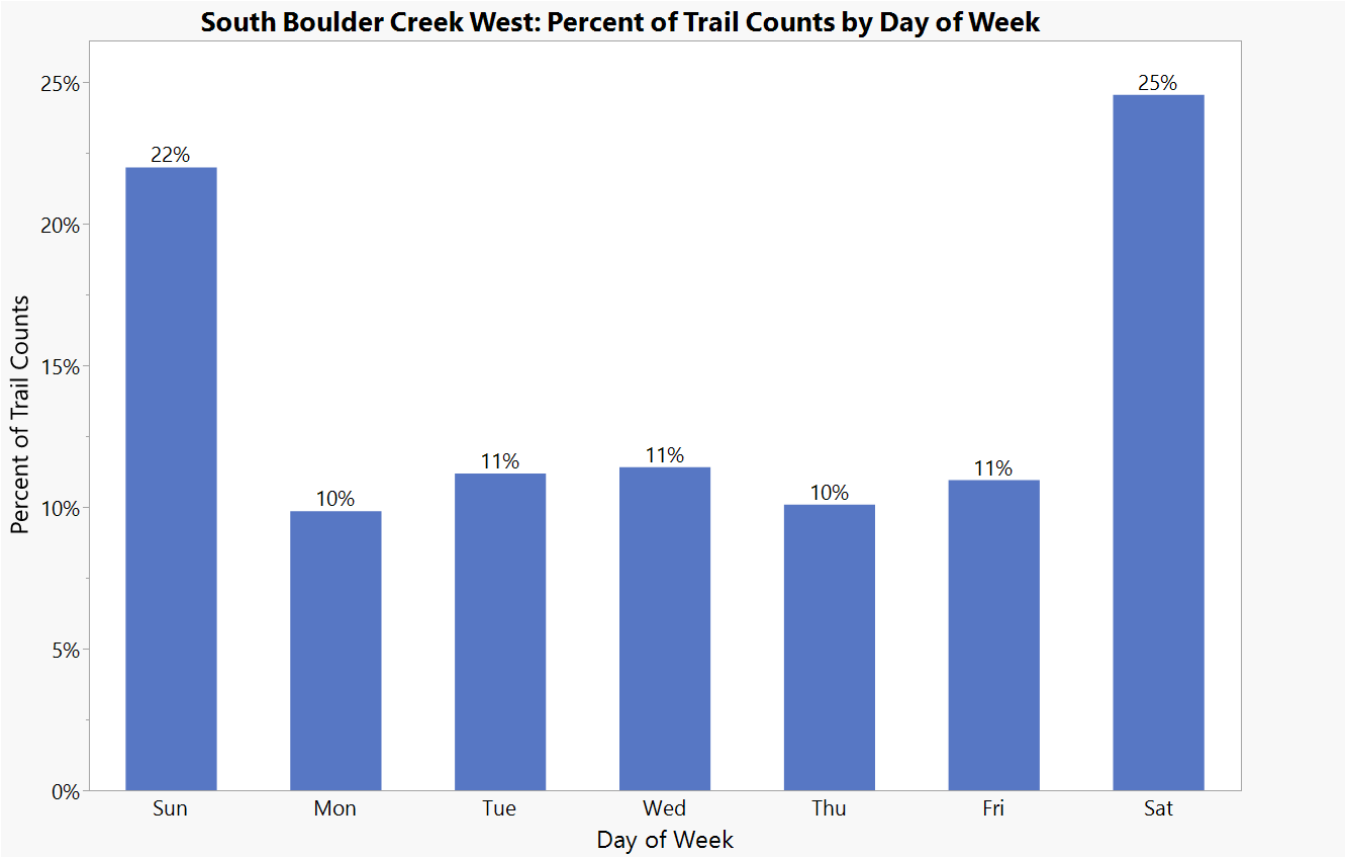


South Boulder Creek West

Key Results:

On average, South Boulder Creek West was observed to be at **25%** occupancy with 7 vehicles parked during the day (2019-2020). This ranged from 18% on weekdays (5 vehicles) to 38% on weekends (11 vehicles). The lot was observed to be completely full 3 out of 107 observations (3%). Up to 3 horse trailers were observed on 2 out of 26 observation days (8%).

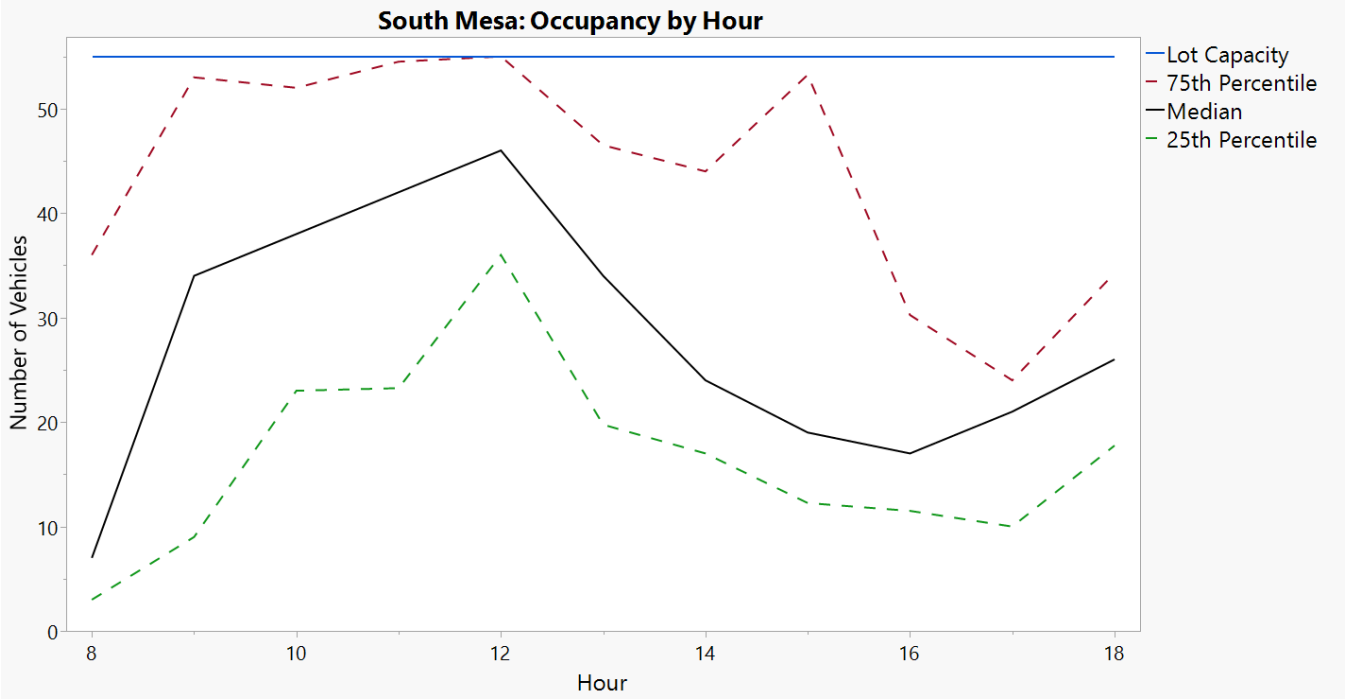


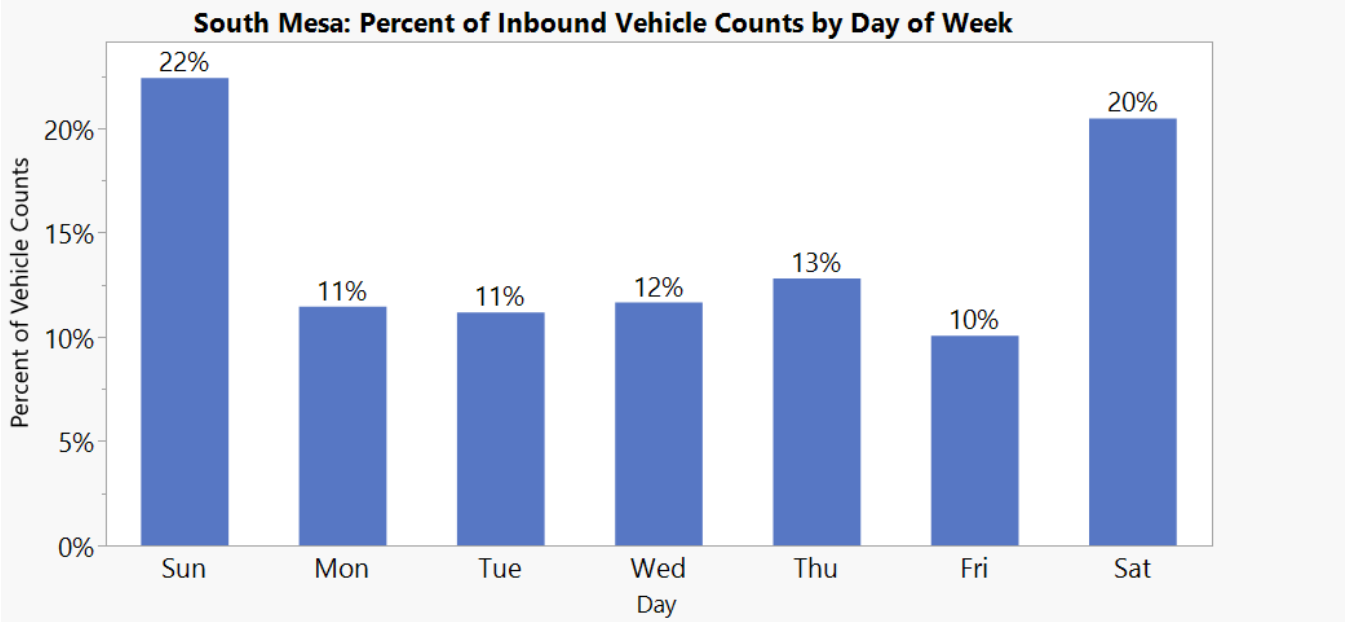


South Mesa

Key Results:

On average, South Mesa was observed to be at **57%** occupancy with 31 vehicles parked during the day (2019-2020). This ranged from 39% on weekdays (22 vehicles) to 85% on weekends (47 vehicles). The lot was observed to be completely full 25 out of 103 observations (24%).

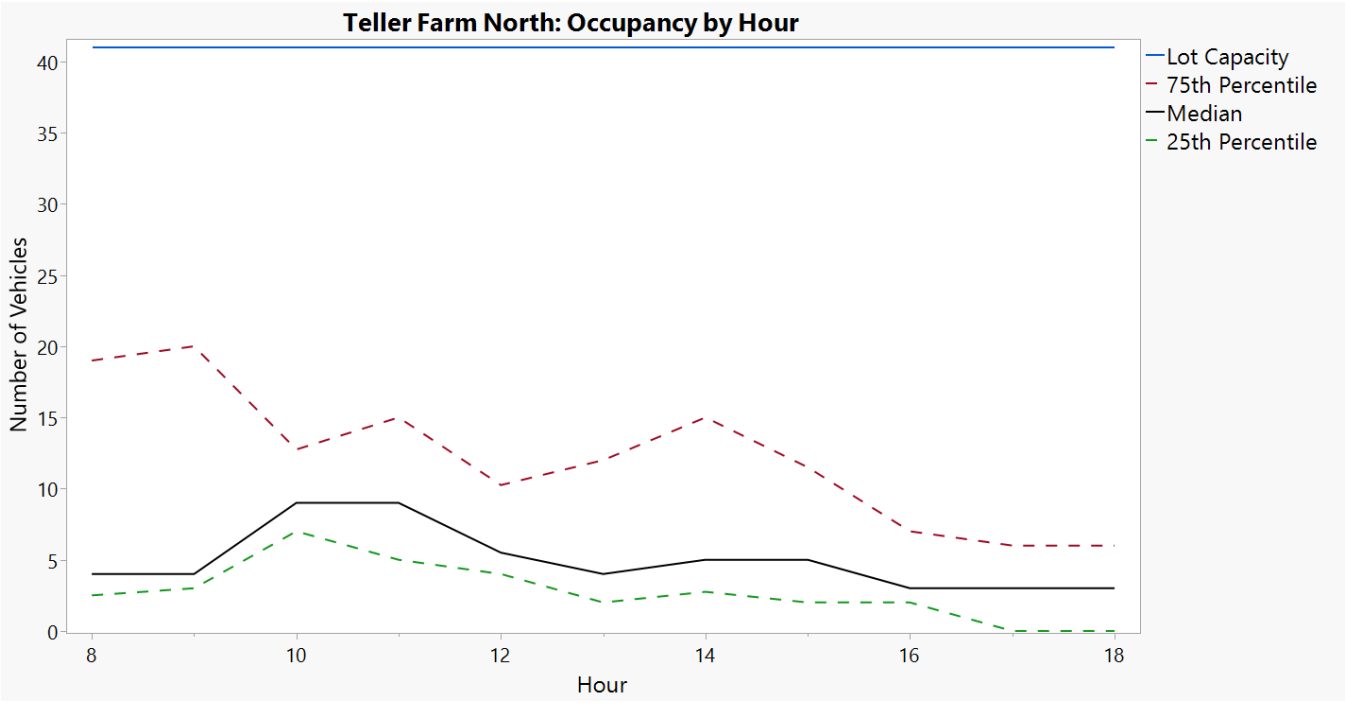


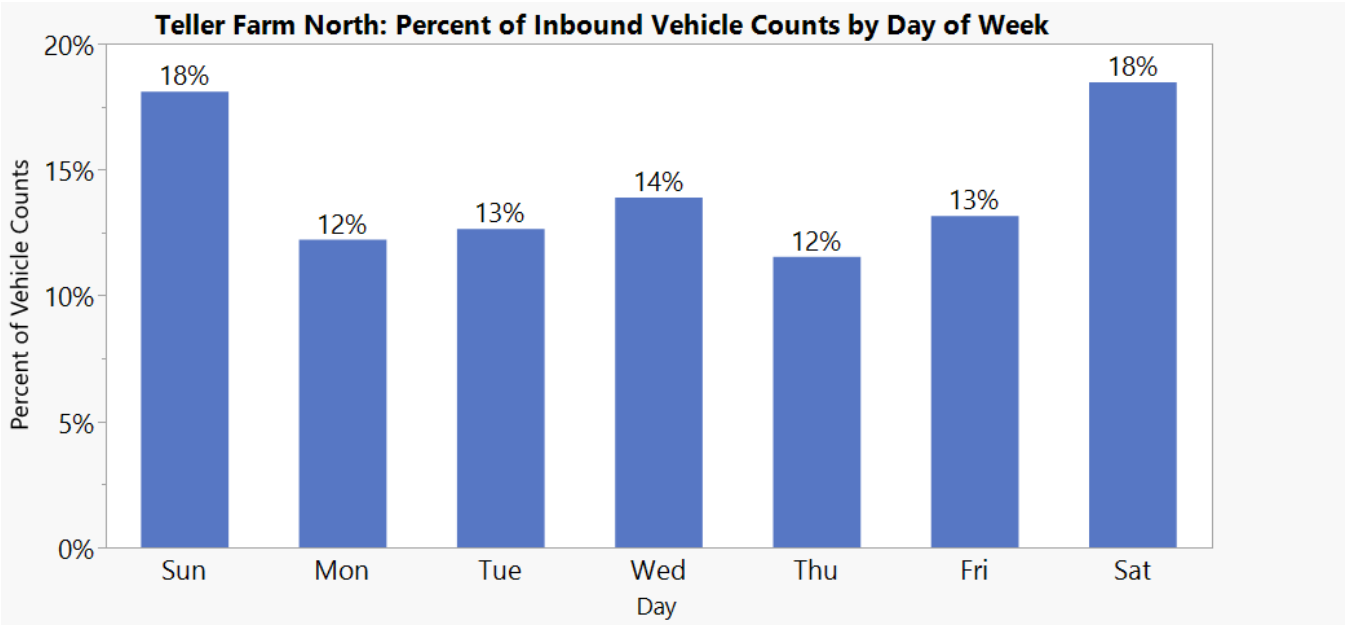


Teller Farm North

Key Results:

On average, Teller Farm North was observed to be at **19%** occupancy with 8 vehicles parked during the day (2019-2020). This ranged from 13% on weekdays (5 vehicles) to 29% on weekends (12 vehicles). The lot was never observed to be completely full out of 96 observations. One horse trailer was observed on 3 out of 24 observation days (13%).



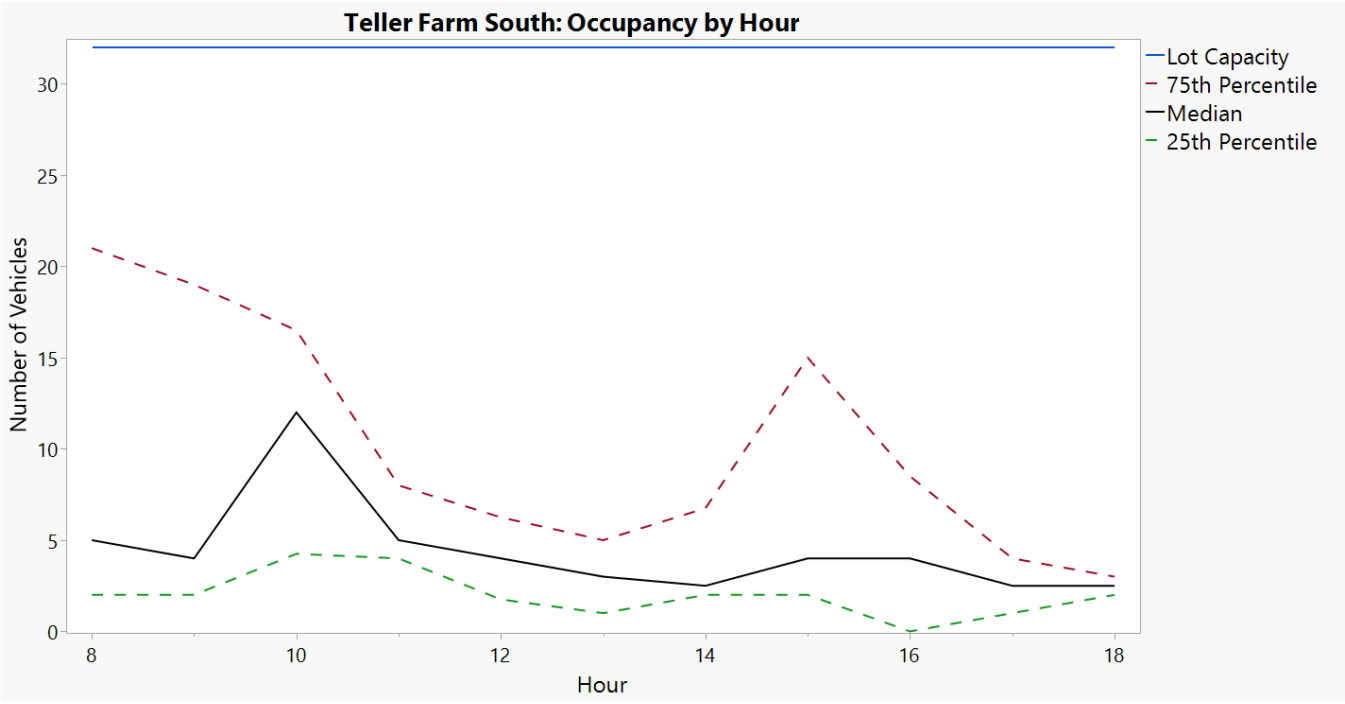


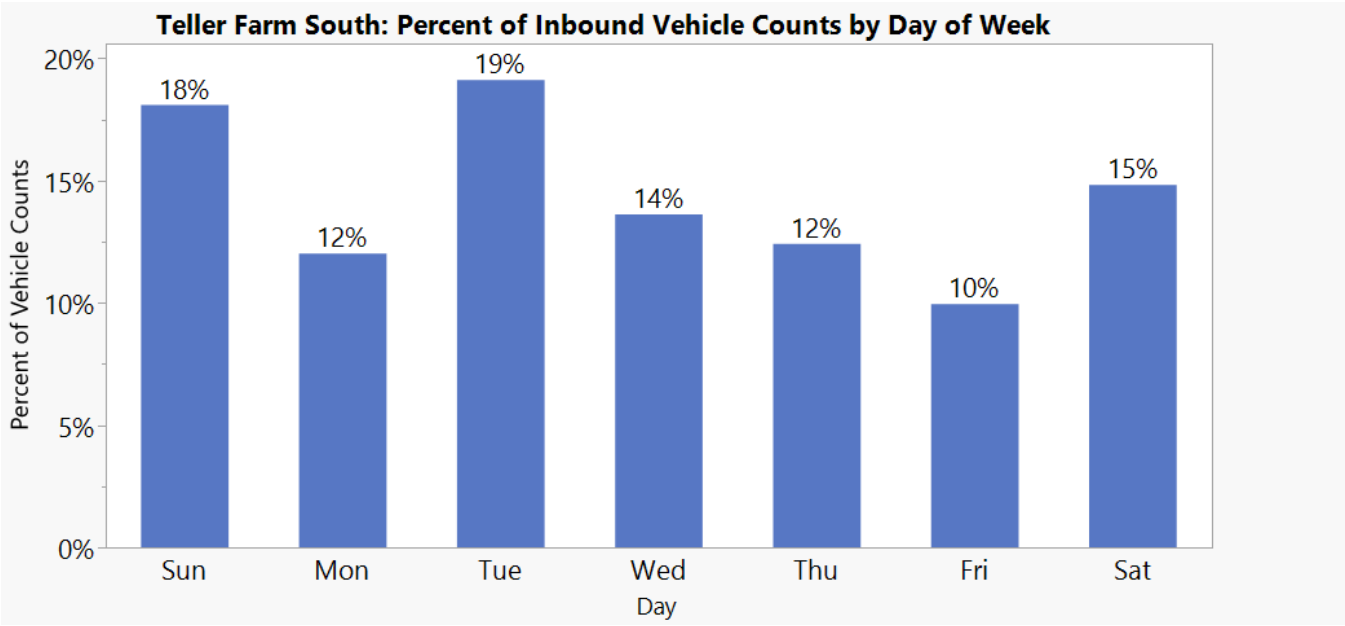
Teller Farm South

Key Results:

On average, Teller Farm South was observed to be at **21%** occupancy with 7 vehicles parked during the day (2019-2020). This ranged from 13% on weekdays (4 vehicles) to 35% on weekends (11 vehicles). The lot was never observed to be completely full out of 96 observations.

Methods used: Observation, vehicle counter





Wonderland Lake

Key Results:

On average, Wonderland Lake was observed to be at **43%** occupancy with 8 vehicles parked during the day (2019-2020). This ranged from 36% on weekdays (7 vehicles) to 53% on weekends (10 vehicles). The lot was observed to be completely full 6 out of 104 observations (6%).