National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Current Condition of Standards from the Denali Park Road Vehicle Management Plan

2022 Summary Report



ON THE COVER

Passengers aboard a transit bus watch a golden grizzly bear cross in front of them on the Denali Park Road. NPS Photo.

Current Condition of Standards from the Denali Park Road Vehicle Management Plan

2022 Summary Report

Natural Resource Report NPS/DENA/NRR—2022/XXXX

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Executive Summary

We collected data related to the interaction of the visitor, natural, and transportation systems at Denali National Park and Preserve (DENA) for 2022 (May 28–September 15). A total of 9,640 vehicles entered the controlled section of roadway where conditions of six indicators from the *Denali Park Road final vehicle management plan and environmental impact statement (VMP)* were monitored. We also calculated the probability of observing the "big five" wildlife species (caribou, grizzly bear, moose, sheep, and wolf) from a bus. This is the first year since 2019 that NPS staff have collected data from the public bus system due to the SARS-CoV-2 (COVID-19) pandemic. Here we: (1) compare current conditions of the VMP indicators to the 1–year VMP standards; (2) use 2018–2022 data to assess 5–year VMP standards (when possible[1]); (3) recommend monitoring method improvements when appropriate; and (4) provide recommendations for meeting desired conditions as described by the VMP and measured by the indicators.

The six VMP indicators for which we collected data are: (1) Number of vehicles stopped for wildlife in the same place at one time (i.e., wildlife stops); (2) number of vehicles parked at rest stops at one time; (3) number of vehicles visible in established viewscapes at one time; (4) hourly 10–minute gaps in traffic at sheep crossing locations (i.e., sheep gaps); (5) nighttime (2200–0600) traffic rates; and (6) lengths of time a hiker waits for a bus (i.e., hiker wait time). The method for monitoring standards for a seventh indicator, large vehicle traffic (> 80,000 pounds gross vehicle weight rating), has not been implemented.

Assessment of the 1–year VMP standards:

1.) Rest stop standards for total vehicles and total number of buses were met at all sites.

2.) Viewscape standards were met at the only site along the road section open to traffic, mile 26, Teklanika Flat.

3.) Sheep gap standards were met at all sites (Hogan and Tattler creeks) in the section open to traffic.

4.) Nighttime traffic standards were met at all sites.

5.) Hiker wait time standards were met.

Assessment of the 5–year VMP standards (2018–2022):

1.) All wildlife stop 5–year standards were met.

2.) All 5–year standards were met.

3.) Sheep gap standards were not met at either sheep gap site located on the section of roadway open to traffic: Hogan and Tattler creeks.

[1] Some 5–year VMP indicators were not fully collected during peak pandemic years. Nonetheless, statistics will be reported by the appropriate five-year date range (i.e., 2018-2022) and any data gaps will be noted.

4.) All hiker wait time 5–year standards were met.[2]

Summer 2022 was an operational change to the park road affecting the VMP unlike anything the park has experienced since the road was completed in the 1930s. This operational change was not without its challenges: fewer wildlife viewing opportunities and longer hiker wait times to board buses back to the park entrance. First, overall wildlife viewing opportunities decreased in 2022 compared to 2019 and previous years, from an average of 14 wildlife to an average of six. This is likely due to not traveling as far into the park and getting exposed to as much of the desirable habitat of Denali's megafauna rather than a specific biological or environmental condition. Second, the road closure necessitated a shift in bus timing to provide better service for end-of-day hikers to catch rides to the park entrance. While the VMP hiker wait time standard was met, the percentage of visitors waiting longer (>60 minutes) increased three-fold compared to 2019. The data show that an expanded "peak" bus schedule may alleviate many instances of these longer wait times. We recommend this approach to 2023.

That said, summer 2022 was also not without its success stories. The road closure at Pretty Rocks was expected to increase pressure on VMP desired conditions by concentrating traffic over a shorter length of roadway. Moreover, consistently meeting VMP desired conditions at sheep gaps has been a management challenge since 2013. In addition to adjusting the Transit and Tour schedules to improve our ability to meet VMP standards, we implemented a new management strategy that required all vehicles to stop at sheep gap locations if they arrived during the first 10–minutes of any hour. At 10 minutes past the hour, vehicles could continue traveling. Hogan Creek met VMP standards for this first time since 2015 and analyses indicate that it would not have met the standard without required stopping.

The ethos of the VMP has always been rooted in data-driven decision making. Analyses conducted in 2021 led to operational changes in 2022 that positively affected Denali's ability to meet VMP goals and park and NPS missions.

[2] There are no data from buses and/or JV dispatch from 2020 and 2021 due to the SARS-CoV-2 (COVID-19) pandemic.

Acknowledgments

Funding for this study was provided by the National Park Service, Denali National Park and Preserve, AK, USA. Additional thanks to our partners and concessionaire for cooperating with data collection efforts. Peer review was provided by Denali management.

Introduction

Annual monitoring related to the *Denali Park Road final vehicle management plan and environmental impact statement* (VMP) will be reported in the format herein: results will be reported in this stand-alone document while a background narrative including definition of standards is available at https://irma.nps.gov/DataStore/Reference/Profile/2258362. VMP methods and analysis protocols are available at https://irma.nps.gov/DataStore/Reference/Profile/2258367 and https://irma.nps.gov/DataStore/Reference/Profile/2258369, respectively. Any changes to methods or analysis protocols will be documented in their respective documents.

The primary objective of this report is to compare the current conditions of the indicators to their standards (i.e. desired conditions) as defined in the VMP. The results will help inform adaptive management strategies to affect the transportation system to achieve desired conditions. This report summarizes data for six of seven Denali Park Road VMP tier–1 indicators: (1) Number of vehicles stopped at wildlife at one time (i.e. wildlife stops); (2) number of vehicles at rest stops; (3) number of vehicles visible in viewscapes; (4) hourly 10–minute gaps in traffic at sheep crossing locations (i.e. sheep gap spacing); (5) average hourly nighttime vehicle traffic; and (6) hiker wait time. The methodology used to monitor the seventh standard, large vehicle traffic, has not been implemented.

Background

From 2013 through 2019, VMP monitoring took place under relatively stable conditions (e.g., visitation patterns, bus schedules, etc.). However, the SARS-CoV-2 (COVID-19) pandemic changed visitor behavior and vehicle access beginning in 2020. Additionally, in August of 2021 the Denali Park Road was closed at mile 45 due to an acceleration in the movement a large rock glacier (e.g., landslide). For 2022, the road was closed to vehicle access beyond mile 43 for the entire year. In response, DENA designed changes to vehicle limits and timing to ensure VMP desired conditions were maintained. Due to reduced infection rates and readily available vaccines, government employees rode public buses again for the first time since 2019: Ride-Observe-and-Record (ROAR) data from Transit or Tour buses were collected in 2022.

Results

Data Collection Effort

The Road Ecology Program sampled 145 Transit trips using the Ride Observe and Record (ROAR) protocol and 19 regulatory days of sampling using the National Park Service Observation (NPSO) protocol (Table 1). We completed 2,121 observations of VMP conditions stratified throughout the day (Table A-1).

Table 1. VMP indicator observations were made throughout the Early, Peak, and Late subseasons of the summer on the Denali Park Road (Denali National Park and Preserve, Denali Park, Alaska USA).

Samples	Early (20 days)	Peak (63 days)	Late (29 days)	Total
ROAR	27	100	18	*145*
NPSO	2	9	8	*19*
Observations per day	1.5	1.7	0.9	–
Total	–	–	–	***164***

Number of Vehicles at Wildlife Stops

Observers recorded 782 wildlife stops in the section of roadway open to vehicle traffic. The majority (81%) of wildlife stops occurred in Wildlife Viewing Subzone (WVS) 2 and 19% occurred in WVS 1 (Table).[3]

Table 2. The number of ROAR observations recorded in three subzones during the 2022 regulatory year on the Denali Park Road. The number of stops was normalized to Subzone lengths (miles) to report stops per mile. Most wildlife observations occur in WVS2.

Year	WVS 1	WVS 2	WVS 3
2022	147	635	83
Average Stops per mile	7.0	16.7	4.5

All wildlife stop measures met VMP 1–year standards in all subzones (

[3] WVS 3 is not accessible to the bus system during the Pretty Rocks road closure. However, WVS 3 was sampled (*n* = 83) by government staff when collecting road-adjacent animal behavior observations along the vehicle-closed section of the road corridor.

Table). In 2022, a maximum of five vehicles was observed on four occasions to view moose (twice), sheep, and a bear. The 5–year (2018–2022) standard for wildlife stops was also met for all three wildlife viewing subzones (Table).

Table 3. Average traffic volume conditions as a percentage of time *x* or fewer (≤) vehicles were observed at a wildlife stop on the Denali Park Road in 2022. All wildlife stop 1–year standards were met. The standard was met when the 'GOV ROAR 2022' value is greater than the 'Standard' value.

	Wildlife Subzone 1			Wildlife Subzone 2			Wildlife Subzone 3		
Method	**% ≤ 3 vehicles**	**% ≤ 4 vehicles**	**% ≤ 5 vehicles**	**% ≤ 2 vehicles**	**% ≤ 3 vehicles**	**% ≤ 4 vehicles**	**% ≤ 1 vehicles**	**% ≤ 2 vehicles**	**% ≤ 3 vehicles**
Standard	70	85	90	70	85	90	70	85	90
GOV ROAR 2022	98.0	99.3	100	94.7	98.6	99.5	96.4	100	100

Table 4. The 5–year VMP standards for number of vehicles at a wildlife stop was met for all criteria on the Denali Park Road. This metric mixes two similar sampling methods, ROAR, which has been utilized since 2013 and GOV ROAR, which has been utilized since 2020 due to the pandemic. The 5–year standard was met for the 2018-2022 period. The standard was met when the '2018-2022' value is greater than the 'Standard' value.

	Wildlife Subzone 1			Wildlife Subzone 2			Wildlife Subzone 3		
Method	**% ≤ 3 vehicles**	**% ≤ 4 vehicles**	**% ≤ 5 vehicles**	**% ≤ 2 vehicles**	**% ≤ 3 vehicles**	**% ≤ 4 vehicles**	**% ≤ 1 vehicles**	**% ≤ 2 vehicles**	**% ≤ 3 vehicles**
Standard	75	90	95	75	90	95	75	90	95
2018-2022	94.0	97.7	99.3	85.4	94.7	98.1	80.2	94.8	98.9

Number of Vehicles at Rest Stops

Observers collected 629 traffic volume samples using the ROAR protocol, and 304 samples using the NPSO protocol at Teklanika and the East Fork Bridge[4]. Total vehicle maximums and bus maximums all met VMP desired conditions (Table , Table 6, Table 7, Figure 1).

Table 5. Maximum (and sample size, *n*) number of buses and vehicles parked at one time at the Teklanika and the East Fork Bridge during the 2022 regulatory years on the Denali Park Road. The standard is met when the '2022 NPSO' and '2022 ROAR' value is less than the 'Standard' value.

	Teklanika			East Fork Bridge		
Method	**bus max**	**vehicle max**	***n***	**bus max**	**vehicle max**	***n***
Standard	*12*	*16*	–	--	--	–
2022 NPSO	4	5	260	1	1	44
2022 ROAR	6	6	429	3	3	200

[4] East Fork Bridge is not a rest stop as defined within the VMP and therefore does not enjoy a defined bus or vehicle maximum. However, we used it as an unofficial sampling location to gather additional data because of the location's limited physical capacity and the road closure scenario.

Table 6. Mean (and standard deviation, SD, and sample size, *n*) number of total buses parked at one time at the Teklanika and the East Fork Bridge for 2022 on the Denali Park Road.

	Teklanika		East Fork Bridge	
Method	**mean (SD)**	***n***	**mean (SD)**	***n***
NPSO	1.5 (1.1)	260	0.1 (0.3)	44
ROAR	2.3 (1.1)	429	1.3 (0.5)	200

Table 7. Mean (and standard deviation, SD, and sample size, *n*) number of total vehicles parked at one time at the Teklanika and the East Fork Bridge for the 2022 regulatory year on the Denali Park Road.

	Teklanika		East Fork Bridge	
Method	**mean (σ)**	***n***	**mean (σ)**	***n***
NPSO	1.6 (1.2)	260	0.1 (0.3)	44
ROAR	2.3 (1.1)	429	1.3 (0.5)	200

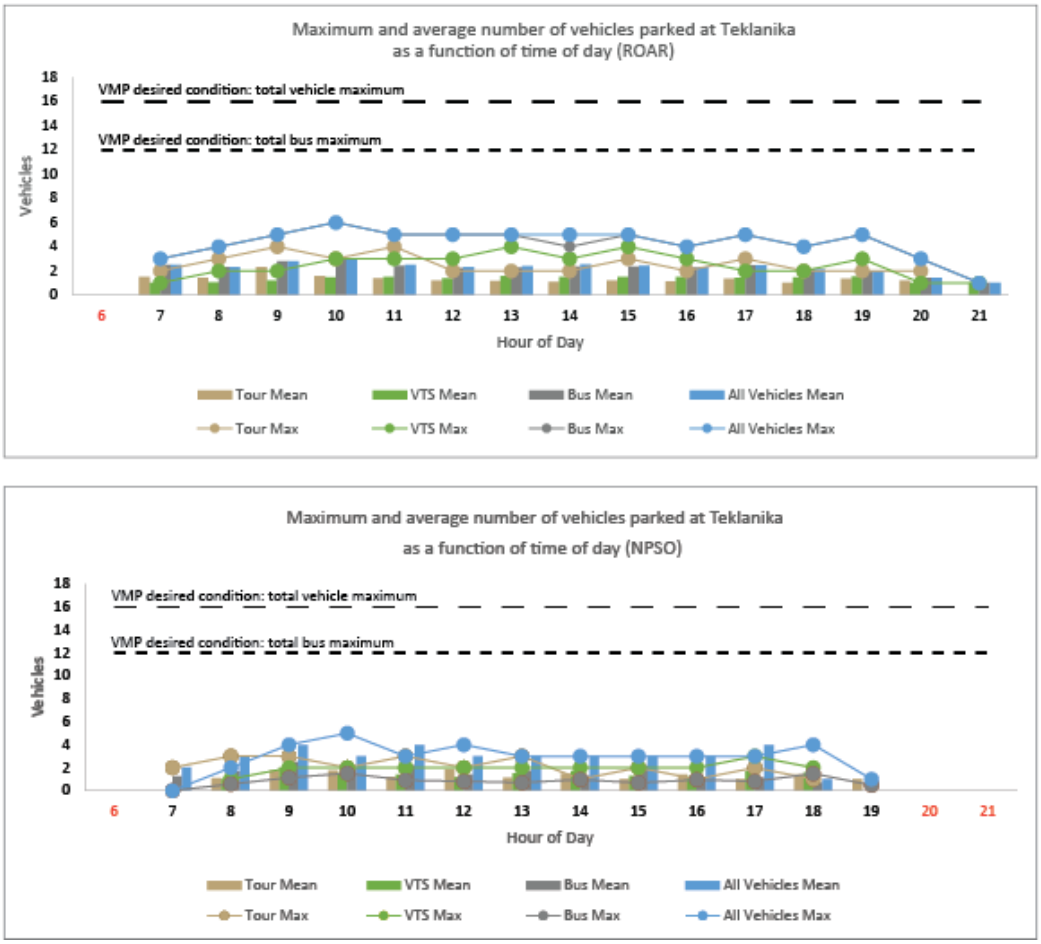


Figure 1. Maximum and average number of vehicles parked at the Teklanika rest stop based on the NPSO (a) and ROAR (b) protocols used on the Denali Park Road. Both total bus and total vehicle maximums at the Teklanika rest stop met VMP standards for 2022. The standard is met when the line plot values are less than (below) the hashed lines for the respective vehicle types.

Number of Vehicles in Viewscapes

Observers collected 25 20-minute viewscape observations at the one viewscape within the vehicle-accessible section of roadway at mile 26, Teklanika Flat. Both the 1–yr and 5–yr VMP standards for vehicle visibility were met (Table). In 2022, the maximum number of vehicles observed (four vehicles) occurred during the 1100-hour block on 8 July (Figure 2).

Table 8. Traffic conditions measured as a percent of time *x* or fewer (≤) vehicles were observed within a viewscape on the Denali Park Road. VMP viewscape standards for mile 26 (Teklanika Flat) met the 1-yr and 5-yr standard. The standard is met when the '2022 NPSO' value is greater than the 'Standard' value.

	Mile 26 1-yr		Mile 26 5-yr	
Method	**% ≤ 3 vehicles**	**% ≤ 4 vehicles**	**% ≤ 3 vehicles**	**% ≤ 4 vehicles**
Standard	80	90	85	95
2022 NPSO	98.8	100	94.5	97.4

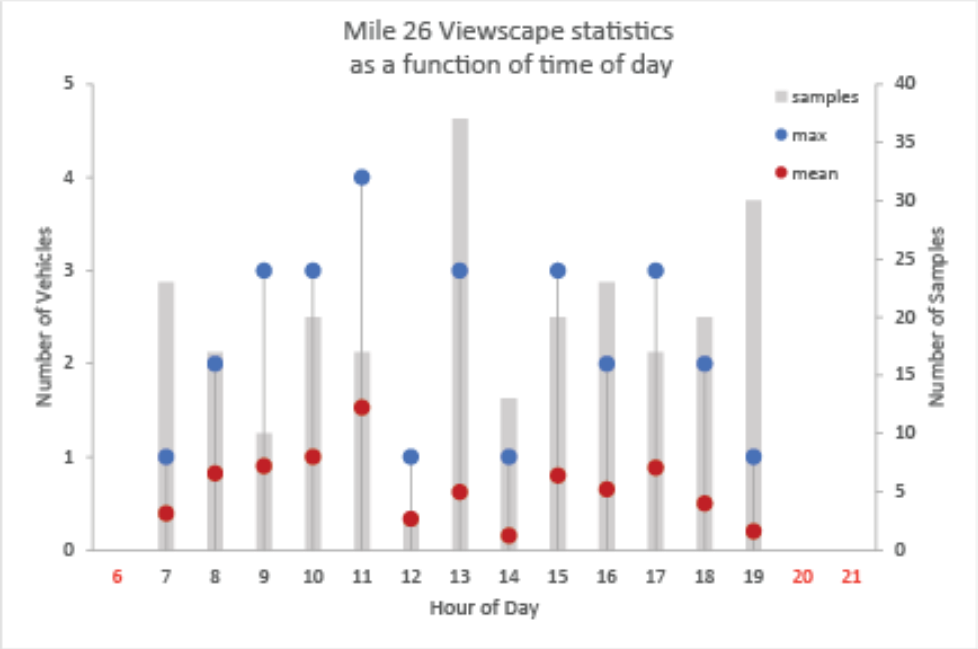


Figure 2. The maximum and mean number of vehicles visible at one time at the mile 26 viewscape on the Denali Park Road. Bars show the number of observations (i.e., sample size) for that site and hour. Red numbers indicate no observations were made during those hours.

Sheep Gap Spacing

We administered 54 one-hour observations of traffic conditions at important animal migratory locations along the Denali Park Road corridor in 2022. The percentage of hours with at least one 10–minute gap in traffic was met at both sites open to public vehicle traffic, mile 21.6 (Hogan Creek) and mile 37.6 (Tattler Creek). The mile 21.6 site (Hogan Creek) met the standard for the first time since 2015 (

Table **9**). Despite their success in 2022, both sites failed to meet the 5-year standard based on their 2018–2022 weighted average samples (Table 10).

Table 9. The percentage of hours (and number of samples, n) with at least one 10–minute gap in traffic at each of the two sheep gaps established along the vehicle-accessible section of the Denali Park Road. Both sites met VMP desired conditions in 2022. The standard is met when the '2022 NPSO' value is greater than the 'Standard' value.

Protocol	Mile 21.6 % hours	Mile 37.6 % hours
Standard	90	90
2022 NPSO	96.6 (*n* = 29)	100 (*n* = 25)

Table 10. The 5–year sheep gap standards were not achieved at either sites along the Denali Park Road for the period 2018-2022. The standard is met when the '2018-2022' value is greater than the 'Standard' value.

Protocol	Mile 21.6 % hours	Mile 37.6 % hours
Standard	95	95
2018-2022	*83.8** (*n* = 215)	*93.0** (*n* = 199)

* Failed VMP standard (also shown in italicized font).

Nighttime Traffic

Nighttime traffic data were collected along the controlled section of road open to vehicle traffic for the entire regulatory period in 2022. The traffic counters experienced short interruptions in data collection (**Error! Reference source not found.**3). Nighttime traffic standards for both percentage of nights that averaged three or fewer vehicles per hour and the percentage of nights with six or fewer vehicles passing in any one hour were met at all sites in 2022 (Table 11).

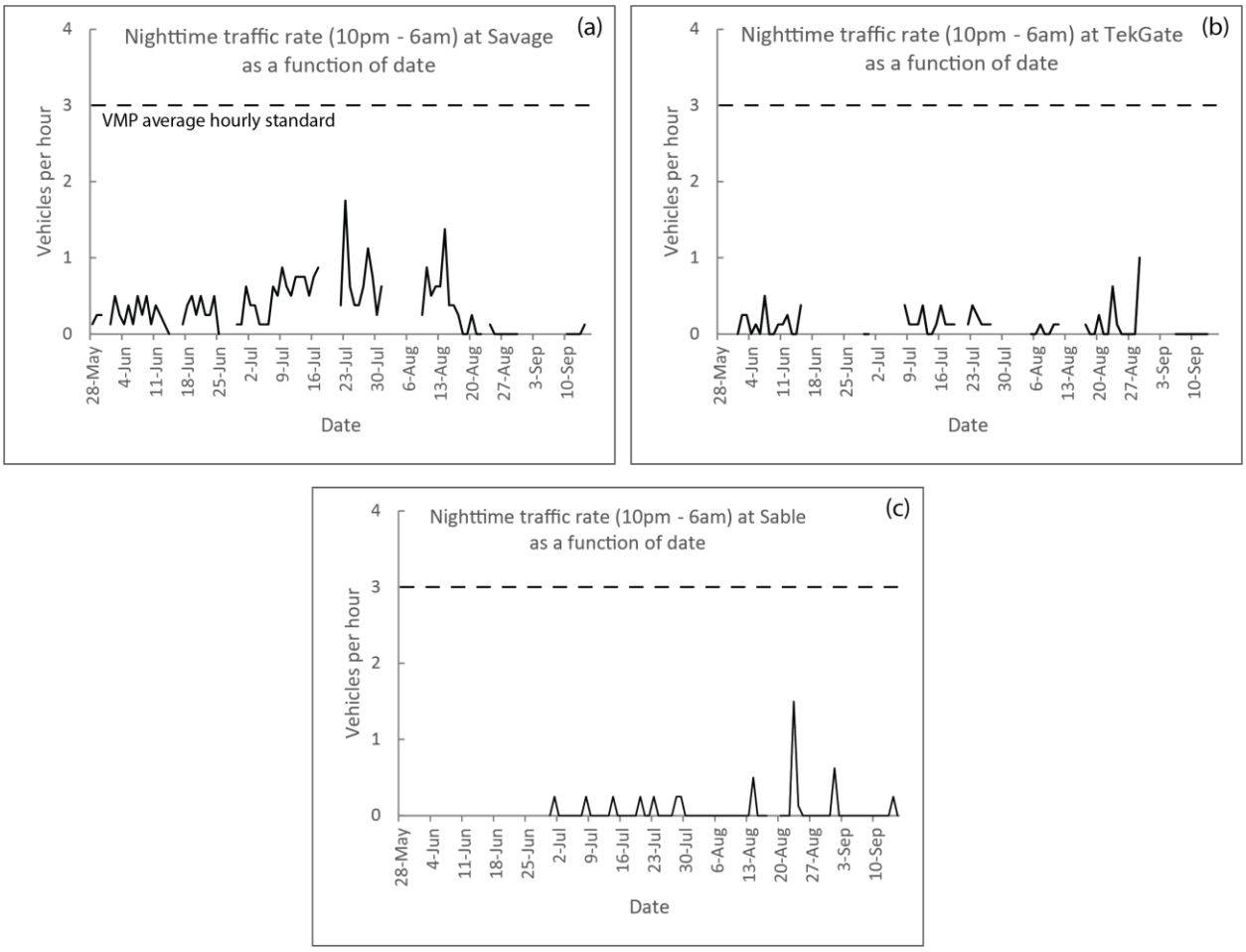


Figure 3. Average nighttime (2200–0600) traffic rates (west and eastbound combined) for (a) Savage, (b) TekGate, and (c) on the Denali Park Road.

Table 11. Summary of nighttime (10pm–6am) traffic on the Denali Park Road. All sites achieved the coarse– (≤ 3 vehicles/hour over the night time period) and fine–scale (≤ 6 vehicles in any hour) VMP standards in 2022. The standard is met when the 'Mile 15', 'Mile 32', and 'Mile 41' values in the percentage (%) of nights columns are greater than the 'Standard' value.

Site	% nights ≤ 3 vehicles per hour	Number of nights with >3 vehicles per hour	% nights 6 vehicles per hour	Number of nights with >6 vehicles per hour
Standard	95%	--	95%	--
Mile 15	100	0	98.9	1
Mile 32	100	0	100	0
Mile 41	100	0	100	0

Hiker Wait Time

We collected data of the length of time hikers waited for a bus on the return from a day or overnight hike on the gravel portion of the road from three sources, Transit drivers, East Fork Bridge dispatch, and ROAR. The annual standard was met for percentage of hikers waiting < 30 minutes, < 60

minutes, and < 90 minutes (Table 12). The 5–year standard was met during the periods 2018–2022 (Table 13).

Table 12. Hiker wait times as reported by Transit bus drivers, concessioner dispatch at the East Fork Bridge, and ROAR on the Denali Park Road. The standard is met when the 'Overall' value is greater than the 'Standard' value.

Method	% Time <30 min	*n*	% Time <60 min	*n*	% Time <90 min	*n*
Standard	70%	—	93%	—	98%	—
Transit Drivers	95.9	19,222	98.5	536	99.2	138
EFB Dispatch	*69.7**	10,988	*92.7**	3,620	98.7	948
ROAR	82.8	269	98.8	53	99.9	3
Overall	84.1	30,479	95.7	4,209	98.7	1,089

* Failed VMP standard (also shown in italicized font). However, the overall metric was met when considering the entire dataset.

Table 13. The 5–year standard for hiker wait time met all standards for the periods 2018–2022 on the Denali Park Road. The standard is met when the '2018-2022' value is greater than the 'Standard' value.

Five-year Period	% Time <30 min	% Time <60 min	% Time <90 min	*n*
Standard	75%	95%	99%	–
2018-2022	85.9	97.0	99.1	120,186

Vehicle Statistics

In 2022, 9,640 vehicle entrances were documented on the controlled section of roadway, of which 8,047 are counted by the Denali General Management Plan (GMP). The maximum number of vehicle entrances was 108 (June 28, Figure 4). Daily averages vehicle entrances were 86.8. Since the VMP was signed in 2012, the total number of vehicle entrances peaked in 2015 and was its lowest in the first year of the pandemic, 2020 (Figure 5).

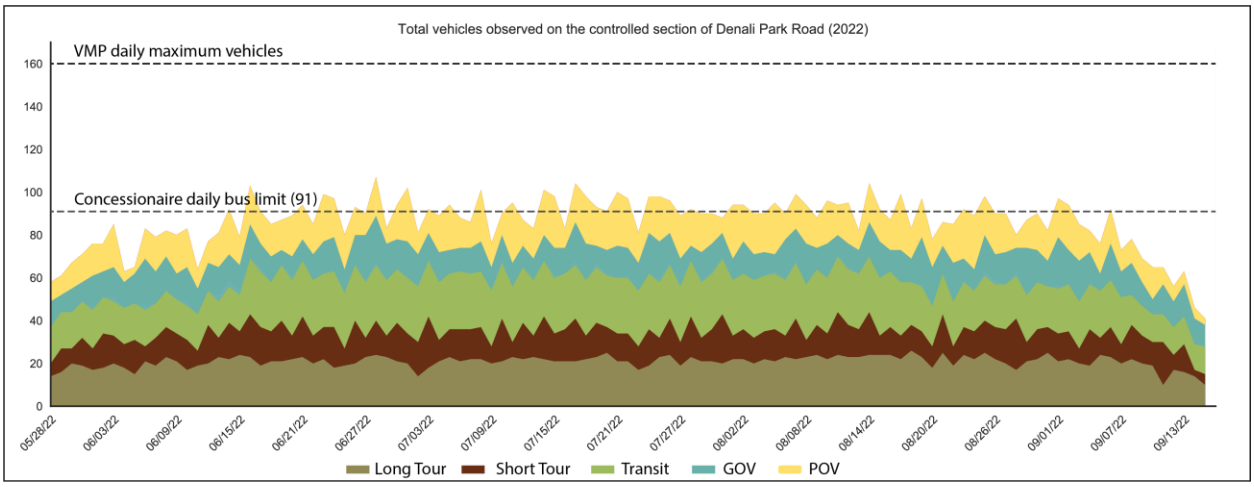


Figure 4. The VMP daily capacity limit was never exceeded in 2022—the maximum number of vehicles on the Denali Park road in a day was 108 (June 28).

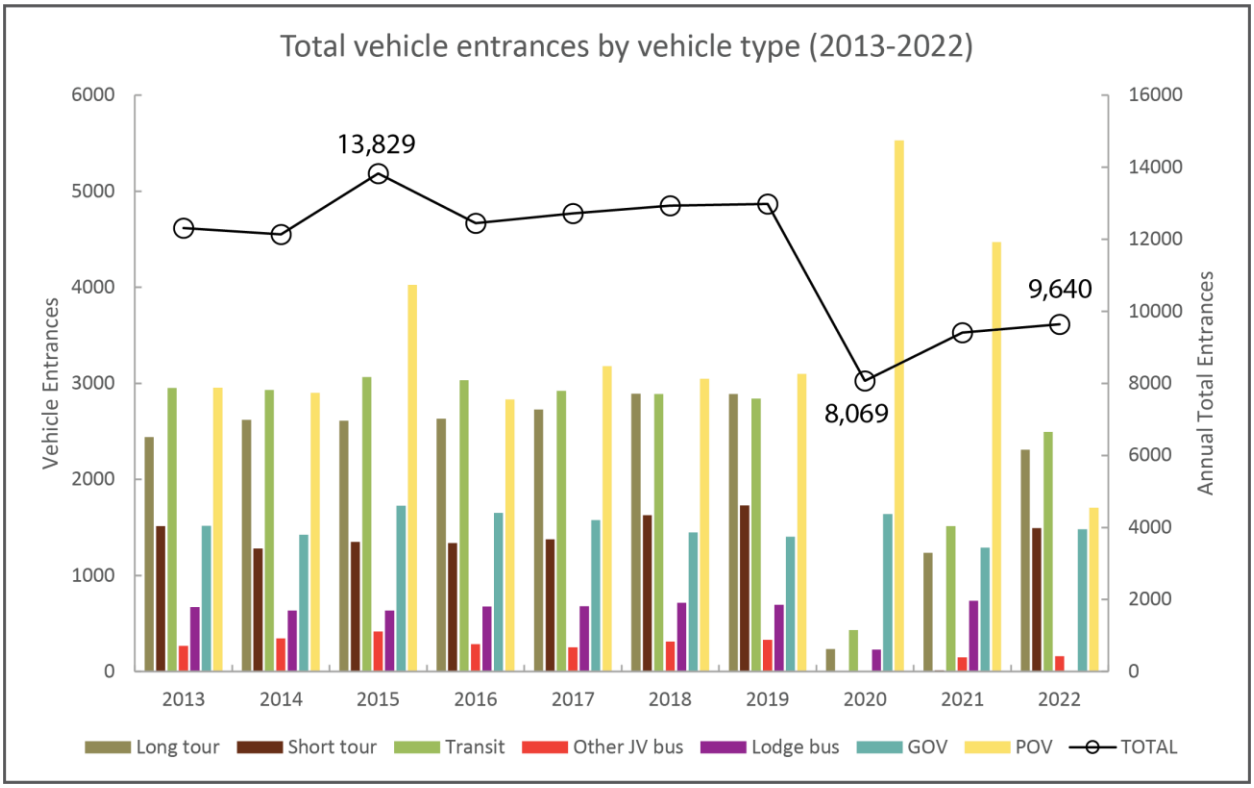


Figure 5. Vehicle entrances by vehicle type on the Denali Park Road (2013–2022). Contractor vehicle permits are included as POVs. The General Management Plan (GMP) does not include certain vehicle types in the total count of entrances.

Table 14. Vehicle entrance statistics for the Denali Park Road in 2022 compared to the previous year and compared to the last year prior to the Vehicle Management Plan being in effect (2012).

Vehicle Type	Total 2022 Entrances	% Share of 2022 Entrances	% Change from 2012 Entrances
Long tour	2,310	24	3
Short tour	1,494	15	-10
Transit	2,493	26	-13
Other JV bus	158	2	-36
Lodge bus	0	0	-100
GOV	1,481	15	-12
POV	1,704	18	-45

Wildlife Sighting Probability

This is the first year of a probability metric for seeing one of the "big five" wildlife species from a Transit bus when Transit buses terminate at the East Fork Bridge (Figure 6).

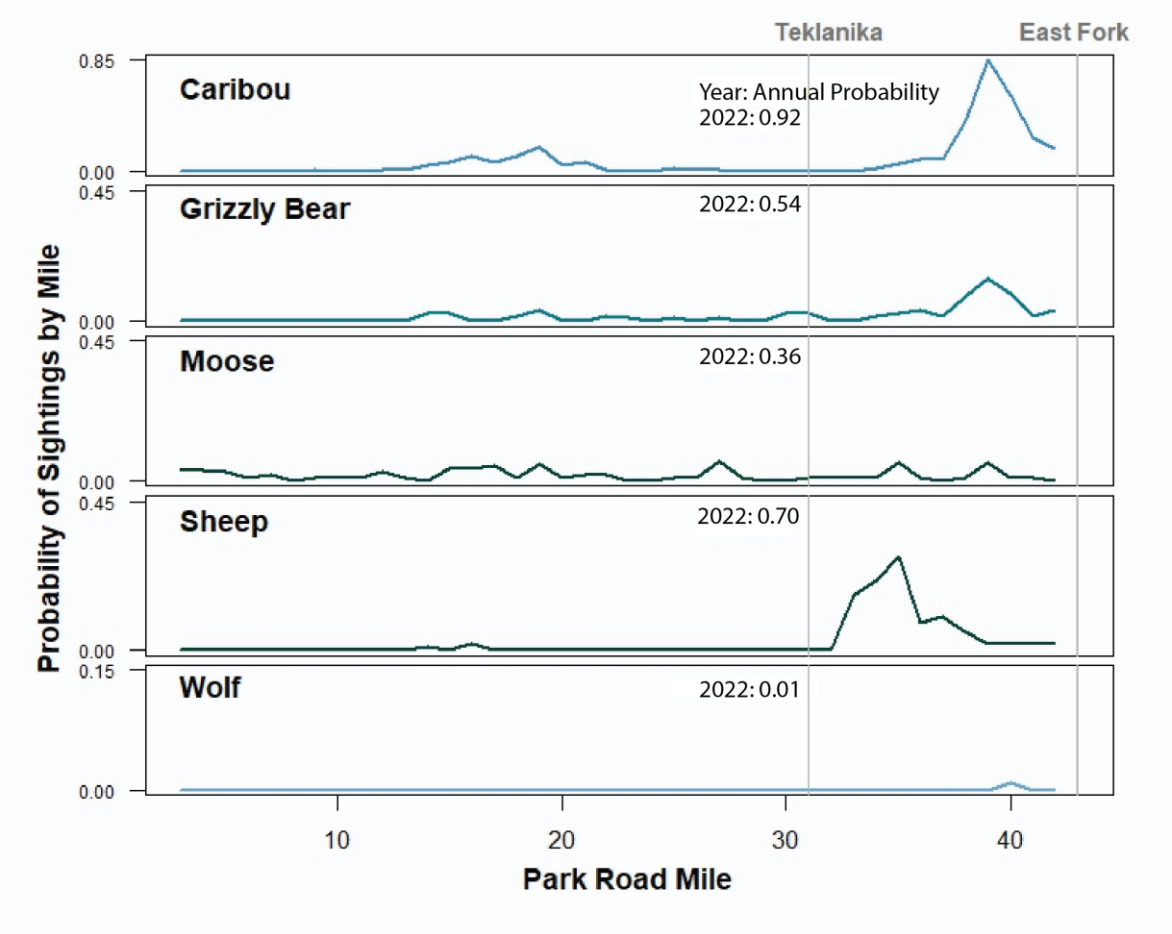


Figure 6. The probability of seeing one of the "big five" wildlife species (caribou, grizzly bear, moose, Dall sheep, and wolf) on the Denali Park Road. It is difficult to compare the viewing probabilities observed in 2022 due to the vehicle road closure at mile 43. Most visitors had the opportunity to view caribou, sheep, and grizzly bears on the Denali Park Road, few saw moose, and it was rare to see a wolf.

Discussion

The Road Ecology Program (REP) measured 22 metrics related to the Vehicle Management Plan (VMP) indicators in 2022 – all 22 met the VMP standard. We often use this space to compare current conditions to results from previous years but this is difficult in 2022 because for the first time on record, the Denali Park Road was not open to vehicle traffic to Kantishna for an entire summer season. Analyses conducted in the fall of 2021 suggested that due to a shortened road significant changes to the Transit and Tour bus schedules may be needed to meet VMP standards. Traffic volume being equal, a shorter road length causes several effects to traffic conditions. First, vehicle return intervals (the time between when a vehicle passes a location heading west into the park and when it passes that location again heading east out of the park) are shortened. Shorter vehicle return intervals: (1) decrease the opportunities for breaks in traffic, which could conflict with meeting sheep gap standards and (2) increase vehicle encounter rates at destinations like rest stops. Second, a shortened road reduces bus retention time within the road system. Because the length of the bus operating day was not altered from previous years, shortened bus retention times would create fewer opportunities for hikers to intercept buses to return to the park entrance particularly late in the day. To address these issues, Transit buses were scheduled further apart to increase coverage and Tour schedules were changed to a staggered schedule to decrease concurrence on the road system.

Number of Vehicles at Wildlife Stops

The number of vehicles at wildlife stops is the only VMP indicator that is directly at the intersection of the natural and transportation systems. Thus, the number of vehicles at a wildlife stop may offer important insight into park socio-biological dynamics and potential human-wildlife conflicts.

In 2022, all 1–year and all 5–year wildlife stop standards were met, while providing for approximately 9,640 vehicle entrances on the controlled section of roadway. The majority (94%) of all observed wildlife stops were occupied by either one or two vehicles. Only 1.4% of all observed wildlife stops had greater than three vehicles present at one time. The number of vehicles at wildlife viewing opportunities decreased in 2022 compared to other years in the record. Because of the vehicle closure at mile 43, there was a reduction in the number of vehicles accessing the road with no right-of-way access to properties in Kantishna, including no lodge buses accessing Kantishna businesses. Additionally, there were fewer Transit and Tour buses scheduled in order to meet VMP goals. Fewer vehicles at wildlife stops is a side-effect of these operational changes.

There were fewer wildlife viewing opportunities (adjusted for REP effort) in 2022 compared to 2019 and earlier years. This is also not unexpected because much of the most desirable habitat for common Denali wildlife occurs west of the vehicle road closure. In 2022, REP observed an about six wildlife viewing events per patrol compared to about 14 in 2019.

Number of Vehicles at Rest Stops

Rest stop standards were met at Teklanika, the only vehicle-accessible rest stop that is responsive to the VMP. Observations at the East Fork Bridge were also collected but not reported here. The average number of buses and total vehicles observed at Teklanika decreased compared to 2019. This

is not surprising because the vehicle access closure has eliminated other vehicle types that may have used the Teklanika rest stop in the past.

In contrast to previous years, the share of vehicle traffic at Teklanika was evenly distributed both as a function of day and time of day (Figure A-1). This may be the result of the new staggered Tour bus schedule proposed by the NPS and adopted by the concessionaire.

Maximum number of vehicles at rest stops observed using the ROAR protocol is consistently greater than that observed using the NPSO maximum (McKenny et al. 2017, McKenny et al. 2014, Clark 2016, Clark 2018(a), Clark 2018(b), Clark 2021). We hypothesize this is caused by the difference in sampling behavior between the two protocols. The ROAR protocol is inherently tied to the bus network because the observer is travelling within the network. Network behavior is imposed on the ROAR observer's sampling schedule. The NPSO observer may travel, and sample, in a nonlinear fashion—the NPSO observer imposes *their* behavior on the sampling schedule. We believe the ROAR protocol better captures the visitor experience at rest stops.

Number of Vehicles in Viewscapes

The viewscape standard was met at mile 28, the only vehicle-accessible viewscape that is responsive to the VMP. Due to the shortened road length, Short Tours (i.e., Denali Natural History Tour, DNHT) did not travel through the mile 28 viewscape in 2022. Regardless, viewscapes have consistently met VMP standards.

Sheep Gap Spacing

The 1–year sheep gap standard was met at mile 21.6 (Hogan Creek) and mile 37.6 (Tattler Creek), the only vehicle-accessible sheep gap locations that are responsive to the VMP. The 5–year standard at both sites failed for the period 2018-2022 because past year's failures outweighed 2022 success. This is the first year that the Hogan Creek site met the VMP standard since 2015. Two factors have contributed to this success. The first, management implemented a mandatory stopping strategy at the two sheep gap sites. This decision was critical to meeting the VMP standard at Hogan Creek in 2022. An analysis of the immediate 60 seconds following the top of the hour showed that at least three (and up to five) successful sheep gap hours when a successful 10-minute gap occurred during the mandatory stopping time would have had a vehicle travel through during the first 10-minute gap. This would have turned a 96.6% success rate to a 86.2% success rate, which fails to meet the minimum success rate standard. A second, lesser factor, is that DNHT buses were terminated at mile 19 instead of mile 27 due to the shortened road length. This change eliminated an average of 27 daily vehicle passes (13.5 vehicles) through the Hogan Creek site.

Nighttime Traffic

Data collection for nighttime traffic continued to experience outages related to equipment. New equipment may be required within the roadbed in the near future. These systems are not typically designed for use in gravel road systems and may experience failure earlier in their lifecycle because of the more difficult conditions to which they are exposed. The effect of nighttime traffic on next–day wildlife sightings is still under analysis. The road closure presents an opportunity for the park to

investigate differences in wildlife pattern and quantity due to differing traffic treatments. While not directly a “quiet-night” study, results of the research may be relevant.

Hiker Wait Time

The hiker wait time indicator is the most direct performance measure of the transportation system's primary purpose as a transit service. All hiker wait time measures were within VMP standard in 2022. However, we recorded conflicting data as to whether hiker wait times are trending up (easier and/or quicker to access services) or down (more difficult to access services). First, we observed the lowest rate of instances that buses were too full to pick up passengers since we began recording these data in 2016. In contrast, while ROAR and bus driver data suggest hiker wait times standards were met in 2022, the EFB dispatch data did not meet standard for the >30 and between 30 and 60 minute categories. EFB dispatch data tend to be the most accurate since they record arrival and departure times of each passenger. An analysis of the distribution (by day) of the EFB dispatch data suggest that expanding the peak season schedule (i.e., when the most Transit buses are operating) could help mitigate longer wait times (Figure A-2).

Large Vehicle Traffic

The VMP defines large vehicles as vehicles > 80,000 pounds gross vehicle weight rating (a concessionaire bus is 36,000 pounds). To assess weight, park management could employ Weigh–In–Motion (WIM) technology, which does not require a vehicle to stop to be measured. However, the research suggests the technology is expensive and problematic for Denali’s site. As such, park management determined that large vehicle will not be directly measured and this standard will continue to be refined.

Vehicle Statistics

With 9,640 vehicle entrances, the single day, 160 entrance VMP limit was not exceeded. Due to the vehicle road closure, most vehicle types experienced a year-over decrease in their number of entrances.

Wildlife Sighting Probability

The probability of sighting most species changed significantly in 2022. Most of this change is likely caused by the changes to access along the park road rather than biological or environmental conditions. Data from 2023 and beyond will help illuminate if further factors have caused some of the big five to be more elusive along the Denali Park Road.

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Appendix A. 2022 Sampling

Table A-1. The 2022 sampling was stratified through times of day and season on the Denali Park Road.

Mile	Indicator	Time Block					Total
		6–9	9–12	12–15	15–18	18–22	
21.6	Sheep Gap	5	5	9	4	6	29
26	Viewscape	4	5	5	6	5	25
30	Tek Rest	4	6	6	5	5	26
37.6	Sheep Gap	4	7	4	5	5	25
53.5	Toklat Rest	na	na	na	na	na	na
52.8	Sheep Gap	na	na	na	na	na	na
55	Viewscape	na	na	na	na	na	na
60.6	Sheep Gap	na	na	na	na	na	na
62	Viewscape	na	na	na	na	na	na
66	Eielson Rest	na	na	na	na	na	na
68	Viewscape	na	na	na	na	na	na
68.5	Sheep Gap	na	na	na	na	na	na

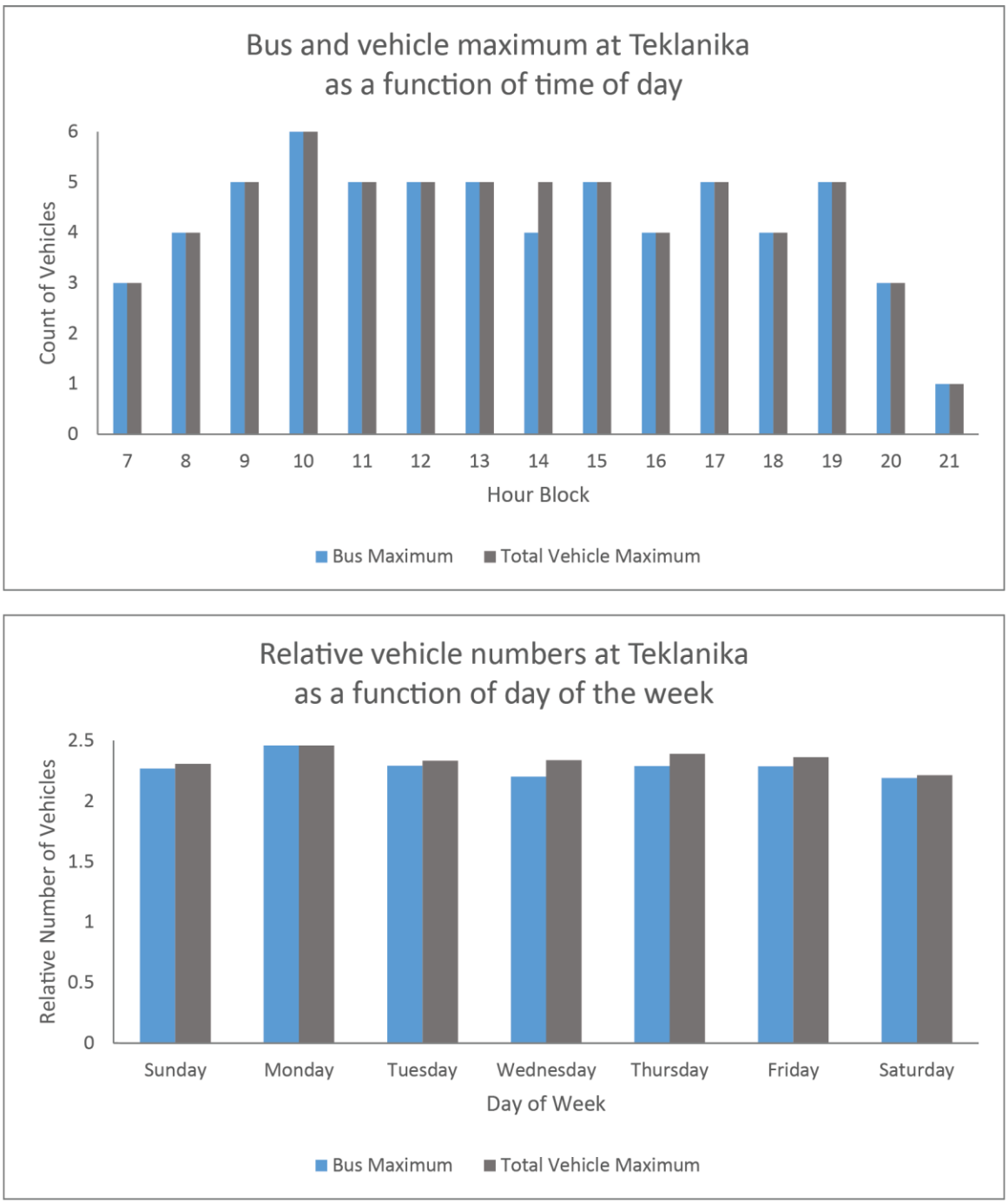


Figure A 1. Hourly and day-of-week vehicle trends at the Teklanika rest stop in 2022 on the Denali Park Road, Denali National Park and Preserve. In contrast to previous years, the distribution of both buses and total vehicles is even throughout the day and throughout the week.

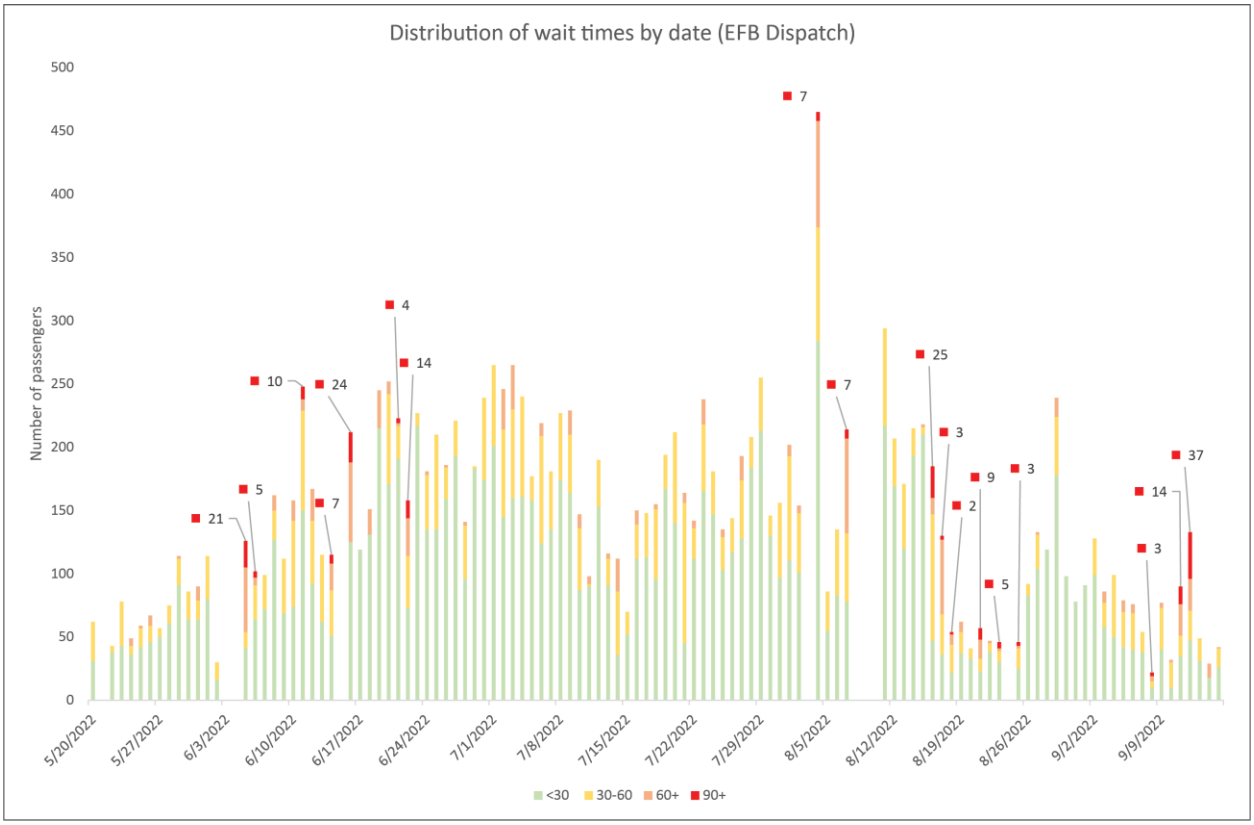


Figure A 2. Hiker wait times (by passenger numbers) through the 2022 VMP regulatory year. Most long waits times (labeled, red) occurred either before or after the “peak” bus schedule was in effect.

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