

Glacier National Park Site History: Avalanche



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1. Data and Reports Pertaining to the Avalanche Area

The reconstruction of the Going-to-the-Sun Road (GTTSR) in Glacier National Park (GNP) poses important questions about impacts on visitor behavior, use levels and patterns of use within GNP, before, during, and following the construction activity. A long-term study of visitor behavior on the GTTSR has been underway since 2005. The content of this site history is a compilation of data collected and reports generated over the course of this long-term study pertaining to the Avalanche area.

In 2006, observations were made at the high-use destination areas including Avalanche Creek, Logan Pass, McDonald Lake Lodge, as well as the lesser-used area of Sun Point. 110 interviews were conducted in the Avalanche parking lot and picnic area. Observations and interviews were part of a park-wide study to gather baseline data about existing use on the GTTSR. The 2006 research was designed to provide insight on potential shuttle use through interviews with visitors regarding their support for and likelihood of using a shuttle system on the GTTSR.

In an effort to reduce traffic and decrease wait times due to construction on the GTTSR, the shuttle system was implemented in 2007. Research conducted in the summer of 2007 examined the intersection of the experiences sought by park visitors and the experience of riding a shuttle in GNP. A sample of park visitors was drawn during pre-determined and randomly chosen sample locations, days, and times between August 18 and September 2, 2007, and visitors were administered an on-site questionnaire and a take-home questionnaire. However, the 2007 visitor use study did not specifically sample visitors at Avalanche.

In 2007, a stakeholder evaluation was conducted in the same year to provide a synthesis of stakeholders' comments regarding effects of implementing a park-operated shuttle system within GNP. Information was gathered from a variety of constituencies, including park visitors, local residents and concessionaires, park volunteers, shuttle drivers, traffic management personnel on the GTTSR construction team, and park staff.

In 2008, research focused on two roadside viewpoints: Avalanche Lake and Sunrift Gorge. Researchers observed visitors with the goals of comparing viewpoint usage before and after the shuttle service commenced and providing information regarding parking lot usage at these two areas, which had been recognized by Park staff as having parking and pedestrian/traffic flow issues. Observers gathered data on vehicle state of origin (including rental versus non rental vehicles when possible), number of visitors in a group, type of group (pair, family, friends, etc.), and the perceived types of activities the group participated in while parked at the site. All vehicles in the designated parking area during the sampling period were observed.

Research conducted in 2009 used three different surveys to examine how the shuttle was used. One survey focused on hikers at the Highline Trail, a backcountry hike that has been made more accessible by the shuttle. A second survey was given to shuttle riders and a third to non-shuttle riders. Surveys were implemented at Logan Pass and the Loop, which are busy roadside pullouts on the GTTSR and provide access to the Highline Trail. Parking lot usage was also observed at the Loop. As a result, very little information from 2009 research pertained to Avalanche and was used in this site history report.

A 2011 study gathered data on vehicles, visitors, and the types of activities in which visitors

engaged at Avalanche Lake trailhead parking lot (the parking area adjacent to the road, the picnic area, and trailhead). Additionally, the study included the calibration of eight trail counters installed to assess trail use levels, one of which was on the Avalanche Lake trail. Crew members placed themselves close to where the trail counter was installed to track in detail every visitor going in or out of the trail during the calibration period, which consisted of 7 days at Avalanche Lake.

In 2012, three different surveys were applied (hikers, shuttle riders, and non-shuttle riders) with the aim of providing an inventory and descriptive analysis of visitors' perceptions regarding management practices and visitor services in the park. The hiker survey administered in 2012 asked visitors to complete surveys about their hiking experience as they departed the Avalanche Lake, Loop, Highline, and Sunrift Gorge trails. A total of 1084 visitors were intercepted resulting in 826 completed surveys that were evenly distributed across the four sample sites. Overall, there were 7 sampling periods at the Highline trail, 10 sampling periods at the Loop trail, 5 sampling periods at the Avalanche Lake trail, and 10 sampling periods at Sunrift Gorge trail. These sampling periods were split between morning and afternoon sessions and between weekends and weekdays.

Additionally, 16 trail counters were installed throughout the park in 2012. On the Avalanche Lake trail, 142 days throughout the summer and fall were monitored.

Traffic counters were installed in the summer of 2012 and operated into the fall at 15 locations along the GTTSR Corridor, including four near the Avalanche parking area. Two counters were set up about a quarter mile south of the parking area. The other two counters were installed about a quarter mile north of the Avalanche parking area. Each installation location included vehicle counters that counted traffic traveling east and west.

2. Site Description

The Avalanche Lake parking area is a highly used and complex area to monitor since it includes several parking lots (Figure 1). There is a parking lot directly in front of the restroom facilities, a parking lot adjacent to the picnic area that includes a shuttle stop, and a parking lot in front of the Trail of the Cedars trailhead. There is also a parking area associated with the campground that we were not able to monitor and is not included in this data.



Figure 1: Avalanche Parking Area

The Avalanche Lake trail is approximately 2 miles one-way with a 730-foot elevation gain. The Trail of the Cedars is a wheelchair accessible boardwalk nature trail. It is a loop that begins and ends at the Avalanche parking area. The Avalanche Lake trailhead departs from the Trail of the Cedars (Figure 2).



Figure 2: Map of the Avalanche Lake Trail and Location of the 2011 Trail Counter

3. What are the Parking Patterns at Avalanche?

3.1 How Long do Visitors Stop at the Avalanche Lake Parking Lot?

Table 1 contains data for average stopping time at the Avalanche parking lot by year. In 2006, the mean duration of stops was 79 minutes with a median time of 58 minutes. Of cars parked in the lot, 25% stayed for 20 min or less and 25% stayed for just over 2 hours. In 2008, the mean duration of stops in the Avalanche parking lot was 84 minutes, and the median duration of stops was 47 minutes. 44% of observations exceeded the observation period. 25% of the vehicles remained in the parking lot for 17 minutes or less, and 75% of the vehicles stayed in the parking

lot for 119 minutes or less. The mean duration of stops at Avalanche in 2011 was 77 minutes with a median of 50 minutes. One-fourth (25%) of visitors who stopped at Avalanche stayed 14 minutes or less, and 25 percent were there for over two hours (mean for upper quartile 125 minutes).

Year	Mean	Median	Mode	Lower Quartile	Upper Quartile
2006	79	58	--	≤ 20	≥ 120
2008	84	47	--	≤ 17	$\geq$
2011	77	50	--	≤ 14	≥ 120

Table 1: Length of Stay in Minutes at Avalanche: Cross Year Comparison

Stopping time data for 2011 was segmented into specific areas at Avalanche Lake parking area (Table 2). The average length of stay at the main lot was 87 minutes, with a median of 60 minutes and a mode of 10 minutes. The mode was influenced by the frequent use of this location as a quick stop for restroom use. At the picnic area, the mean duration of a stop was 63 minutes, the median was 35 minutes, and the mode was 5 minutes. The mode here was dominated by the short time the shuttles stopped. The parking lot near the trailhead had a mean stop time of 90 minutes with a median of 52 minutes. The mode of this location was 3 minutes, which was explained by the quick stop made by visitors who were able to park, but were looking for information about the Trail of the Cedars, or by those who were picking up visitors coming from other parking lots or exiting the trail.

Site within the parking lot	Mean	Median	Minimum	Maximum	Mode
Main lot	87.09	60.00	1	355	10
Picnic and shuttle	62.66	35.00	0	356	5
Trailhead	89.60	52.00	1	304	3

Table 2: Length of Stay in Minutes at Avalanche Locations (2011)

Approximately 29% (594 observations) of the 2,073 vehicles observed at Avalanche in 2011 were parked longer than the 6-hour observation period. These vehicles were not included in the mean and median parking times. In addition, given the complexity of the area and the limitations of the personnel to cover the entire area the crew missed cars leaving the location 17% of the time.

3.2 When is the Avalanche Parking Lot Full?

In 2006, only the main roadside and picnic loop parking areas were observed. The parking lot was at or above capacity for 34% of the observation time. It began to fill around 10:30 AM and stayed full until around 4:00 PM.

The 2008 study showed that the Avalanche parking lots were at or above full capacity 40% of the time observed. All Avalanche parking lots were usually full by 11:00 AM and remained full

for several hours. The main roadside parking lot adjacent to the picnic areas was consistently full for the longest period of time. It generally filled between 9:00 AM and 9:30 AM and remained full until 4:00 PM or 5:00 PM. The picnic loop parking areas generally filled up by 10:00 AM and remained full until approximately 2:00 PM. The alternative roadside parking area, adjacent to the Trail of the Cedars, was often full by 10:30 AM and remained full until 3:00 PM or 4:00 PM. Often this lot was not completely full, but observers believed it to be full due to the spatial organization of parking. Therefore, many groups treated this lot as full when there were actually one or two spots available for creative parkers. The campground parking lot was full least often. Frequently, but not always, this lot was full from approximately 11:30 AM to 1:30 PM. It is also the least obvious parking lot from the road. Informal verbal assessments were conducted to find out how people who parked here knew about the lot. Approximately half of people who were informally surveyed said they had looked for a spot in the other lots and just decided to turn in and see if more parking was available when they found the other lots were full. The other half of visitors who were informally surveyed said they had been to GNP before and knew this lot was available and often was not full.

In 2011, the parking area was at or above capacity during 49% of the observation periods. The lot generally began to fill around 9:30 AM and remained mostly full until around 4:00 PM. The lot adjacent to the road was at capacity or close to capacity the majority of the time. However, since many people stayed for 10 minutes or less, there were often sites available and the lot was usually busy with the movement of cars. The high use of Avalanche's parking lot may have been the result of the restriction to use the GTTSR during the first two weeks of July in 2011, as Avalanche was a place from which visitors were able to access The Loop trail via a shuttle.

3.3 Where do Avalanche Visitors Park?

5% of hikers surveyed at Avalanche in 2006 indicated that they had left a car either at the horse trail between Lake McDonald Lodge and Avalanche (1 respondent), Avalanche Campground (1 respondent), or Apgar (1 respondent).

Data from the 2009 report shows that 74% of hikers sampled at The Loop and Highline Trailheads left a car somewhere else in the park (besides their starting location) while taking their hike to enable a one-way hike. Only 3.61% of hikers (who did not hike at Avalanche) left their car at the Avalanche parking lot.

Visitors in 2011 primarily used the main parking lot adjacent to the road in front of the restroom facilities (51.6%). That location, however, was mainly used as a quick stop for restroom use. Forty-two percent of the observations in Avalanche indicated that visitors left a car at the picnic area, especially when they were going to take the shuttle or hike. The parking lot in front of the Trail of the Cedars trailhead was only open for two of the nine days Avalanche was monitored. During those two days, only 5.5% of the visitors parked in that location. One of those days had heavy rain and that may have influenced the parking patterns.

There were several issues observed in the Avalanche area in 2006 that fall outside the scope of observing individual vehicles. First, the 2006 report noted that parking in the picnic area could be a problem. Because parking spots are not designated, visitors often parked in ways that either reduced the capacity of the lot or interfered with traffic flow. In addition, recreational vehicles (RVs) in the area presented some issues. For example, when RVs would park in the parking area

adjacent to the street, it was difficult for other vehicles to pull out of the lot safely. When RVs were parked in the picnic area, they often interfered with traffic flow. Although there are places for RVs to park safely in the picnic area, many of these spots were frequently taken by automobiles. The Avalanche area is also a turnaround location for RVs, which are not allowed to go past The Loop. This was, at times, problematic. When the parking area and picnic area were full, RVs would turn around on the road. This is a safety issue because the part of the road that RVs frequently used to turn around was also the location of 2 crosswalks. Red tour busses also created issues at Avalanche. Many tours make a stop at Avalanche to walk the Trail of the Cedars. Often, these busses would park behind cars in the parking area adjacent to the street. This required a great deal of shuffling when visitors wanted to leave the area.

4. What are the Traffic Flow Patterns Near the Avalanche Parking Area?

In 2012, 4 vehicle counters were installed on the GTTSR near the Avalanche parking area. They were set up for the purpose of analyzing traffic flow in the Avalanche trail parking area. Two counters were installed about a quarter mile south of the parking area; this location was named AV1. The other 2 counters were installed about a quarter mile north of the avalanche parking area; this location was named AV2. Each installation location included vehicle counters that recorded traffic traveling east and west. Vehicles counters that counted traffic traveling east were denoted with the letter 'A'. Vehicle counters that counted traffic traveling west were denoted with the letter 'B'.

The differences in vehicle counts among the four locations may be accounted for by vehicles that enter the park from the east or west entrance, yet turn around when they reach the Avalanche area. For example, only counters AV2A and AV2B would record a vehicle that enters from the east entrance, visits Avalanche Lake, and then departs back through the east entrance. Similarly, differences among the counters may also represent visitors that park at the Avalanche parking area and then board the shuttle.

Of the Avalanche area vehicle counters, the AV1A vehicle counter (recording east flowing traffic and located a quarter mile south of the Avalanche parking area) registered the highest average daily count with 1,532 vehicles. This was in contrast to 1,187 vehicles a day at AV2A, which also counted traffic flowing east but was located a quarter mile north of the parking area. The difference between the two was 345 vehicles. These results indicate that about 74% of vehicles continue past the Avalanche parking area when traveling east. Conversely, there was a much smaller loss for vehicles traveling east to west. The difference between daily averages between AV2B and AV1B was 34 (from 1,165 minus 1,131) indicating that the majority of vehicles traveling west (97%) traveled past the Avalanche parking area. The sections below present the data from each of the four Avalanche area trail counters in more detail.

4.1 What is the East-bound Traffic Flow South of the Avalanche Parking Area?

Counter AV1A recorded vehicles travelling east about a quarter mile south of the parking area. After calibration, an adjustment factor of 1.10981 was used to adjust for discrepancies between the vehicle counter and manual counts.

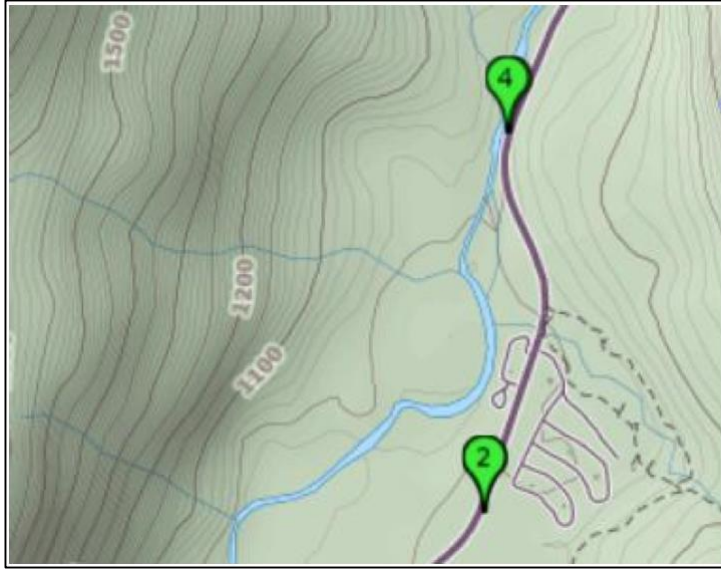


Figure 3: AV1 counters at Location 2 and AV2 counters at Location 4

Table 3 summarizes 130 days of data collection for the AV1A vehicle counter. A vehicle count of 3,841 was registered over the last 2 days of June. Based on the daily average, the total vehicle count for the entire month of June was estimated to be 57,615. The entire month of July was monitored, with a total vehicle count of 76,188 with an average daily count of 2,458 vehicles. The vehicle counter recorded data for all 31 days of August for a vehicle total of 73,078 and a daily average of 2,357 vehicles. September saw a drop in vehicle activity as 38,841 vehicles were recorded over the entire month for a daily average of 1,295 vehicles. The decline in use continued into October as 6,699 vehicles were recorded over the entire month. October averaged 216 vehicles a day. The first 5 days of November were monitored for a vehicle total of 499 vehicles. Based on the daily average it was estimated that about 2,994 vehicles traveled past the counter over the entire month of November. The total vehicle estimate at AV1A from the beginning of June to the end of November is 255,415.

Month	VC Data	# Days Monitored	Daily Average	Total estimate for month
June	3,841	2	1,921	57,165
July	76,188	31	2,458	76,188
August	73,078	31	2,357	73,078
September	38,841	30	1,295	38,841
October	6,699	31	216	6,699
November	499	5	100	2,994
Total	199,146	130	1,532 (avg.)	255,415

Table 3: AV1A Vehicle Counts (2012)

The AV1A vehicle counter registered an average of 1,531 vehicles a day over the course of the monitoring season. The median was 1,794 vehicles. The maximum vehicle count occurred on

August 6th with 3,133 vehicles recorded. The minimum vehicle count took place on October 27th with 70 vehicles recorded

Saturday and Sunday averaged the highest percent of weekly vehicle activity, averaging 14.9% and 15.5% of vehicle use by day of week respectively. The mean vehicle activity for Saturday was 1,593 and mean vehicle activity on Sunday was 1,663. Monday was the third most heavily used day of the week, averaging 1,549 vehicles, and comprising 14.5% of weekly vehicles. Tuesday averaged 14.1% of use by day of week with an average of 1,512 vehicles. Wednesday, Thursday and Friday ranked closely together with 13.8%, 13.7% and 13.5% of use by day of week.

The hourly average from 8 AM to 8 PM was 111 vehicles with a median of 116 vehicles. Activity tended to rise quickly in the morning beginning at 8 AM until it peaked at 11 AM. Vehicle activity tended to decline after 11 AM, but more gradually than it rose in the morning. Maximum vehicle activity typically occurred at 11 AM with an average maximum value of 184 vehicles for the hour.

For the purpose of the 2012 study, the summer season included 69 days of monitoring between June 29th (installation date) and September 5th. Total vehicle activity at the AV1A vehicle counter during the summer season was 164,369 (Table 4). This location averaged 2,382 vehicles a day with a median of 2,425 vehicles. Maximum daily vehicle activity occurred on July 6th with 2,230 vehicles registered for the day. Minimum daily vehicle activity occurred on September 5th with 1,616 vehicles recorded. Vehicle use was relatively steady through mid-August, when use began to experience a slight decline. Vehicle activity experienced a bump in use through Labor Day weekend.

Month	VC Data	# Days Monitored	Daily Average
June ¹	3,841	2	1,921
July	76,188	31	2,458
August	73,078	31	2,357
September ²	11,261	5	2,252
Total	164,269	69	2,382 (summer avg.)

Table 4: AV1A Vehicle Counter Statistics: Summer 2012.

¹Dates begin June 30th.

²Dates are through September 5th

Sunday and Monday registered the highest average vehicle use per day of week during the summer season with 15.4% and 15.2% of the average weekly vehicle activity, respectively. Sunday averaged 2,569 vehicles and Monday averaged 2,532 vehicles. Saturday accounted for 14.6% of weekly use over the summer season, averaging 2,437 vehicles. Wednesday and Friday experienced the lowest percent of average weekly vehicle activity with 13.5% and 13.3% respectively. Wednesday averaged 2,256 vehicles and Friday averaged 2,224 vehicles.

Fall data was collected over a 61-day period from September 6th to November 5th. The daily vehicle average for the fall period was 570 vehicles with a median of 306 vehicles. Total fall

vehicle activity was 34,778 vehicles. The maximum day of fall vehicle activity took place on September 16th, with 2,109 vehicles. The minimum vehicle count occurred on September 27th with 70 vehicles recorded. Saturday and Sunday received the largest chunks of fall vehicle use both averaging 16.5% of average weekly use respectively. Saturday averaged 656 vehicles and Sunday averaged 657 vehicles. Thursday and Friday averaged the second and third highest percent of vehicle activity by day of week with 15.2% and 14.9% respectively. Thursday averaged 603 vehicles and Friday averaged 592 vehicles. Tuesday and Wednesday ranked closely together, accounting for 12.7% and 12.8% of weekly use respectively. Monday ranked the lowest in terms of use by day of week accounting for 11.5% of weekly use and averaging 457 vehicles.

Table 5 summarizes 39 days of data collection for the AV1A vehicle counter in 2013. A vehicle count of 5,838 was registered over the last 3 days of June. Based on the daily average, the total vehicle count for the entire month of June was estimated to be 58,380. The entire month of July was monitored, with a total vehicle count of 70,007 vehicles and a daily average of 2,258. The vehicle counter recorded data for the first 5 days in August and registered 11,364 vehicles. Based on the daily average of 2,273 vehicles, the estimate for August is 70,457 vehicles. The vehicle counter was displaced from the site in early August and was not recovered until later in the season. The total vehicle estimate at AV1A from the beginning of June to the end of August was 198,844.

Month	VC Data	# Days Monitored	Daily Average	Total estimate for month
June	5,838	3	1,946	58,380
July	70,007	31	2,258	70,007
August	11,364	5	2,273	70,457
Total	87,209	39	2,236	198,844

Table 5: AV1A Vehicle Counts (2013)

The AV1A vehicle counter registered an average of 1,531 vehicles a day over the course of the monitoring season. The median was 2,247 vehicles. The maximum vehicle count occurred on August 5th and registered 3,066. The minimum vehicle count occurred on August 2nd and registered 1,288.

Sunday had the most use, averaging 2,503 vehicles and 16.2% of use. Monday was the second most used day, accounting for 15.4% of weekly use and an average of 2,387 vehicles per day. Saturday had an average of 2,215 vehicles per day and accounted for 14.3% of weekly use. Tuesday had an average weekly use of 14% and a vehicle average of 2,165 per day. Thursday averaged 2,142 vehicles per day and 13.8% of weekly use. Wednesday averaged 2,098 vehicles per day and 13.5% of weekly use. Friday was the least used day, accounting for 12.8% of weekly use and had an average of 1,980 vehicles per day.

The hourly average from 8 AM to 8 PM was 159 vehicles with a median of 153 vehicles. Activity rose quickly at 8 AM until it hit the maximum number of vehicles per hour at 11 AM (274 vehicles). Vehicle use tended to decline after 11 AM, but declined more gradually than it

rose before 11 AM.

4.2 What are the West-bound Traffic Flow Patterns South of the Avalanche Parking Area?

AV1B counted vehicle traffic traveling west on the GTTSR and was located about a quarter mile south of the Avalanche parking area. The counter was installed June 29th and data collection began June 30th. Data collection ended November 5th and the counter was removed November 6th. An adjustment factor of 1.012195 was derived by dividing the manual count by the vehicle counter data.

Table 6 summarizes 129 days of data collection for the AV1B vehicle counter. Data was collected on the final day of June with 1,958 vehicles recorded. Based on the daily average, it is estimated that the total vehicle count for the entire month of June was 58,740. However, this is a very rough estimate because there was only one day of data on which to base this estimate. The entire month of July was monitored, with a total vehicle count of 57,805 and an average daily count of 1,865 vehicles. The vehicle counter recorded data for all 31 days of August for a vehicle total of 52,855 and a daily average of 1,705 vehicles. September experienced a drop in vehicle activity with 27,841 vehicles recorded over the entire month and a daily average of 928 vehicles. The decline in use continued into October as 5,060 vehicles were recorded over the entire month. October averaged 163 vehicles a day. The first 5 days of November were monitored for a vehicle total of 376 vehicles and a daily average of 75 vehicles. Based on the daily average it is estimated that about 2,256 vehicles traveled past the counter over the entire month of November. The total vehicle estimate at AV1B from the beginning of June to the end of November is 204,557.

Month	VC Data	# Days Monitored	Daily Average	Total estimate for month
June	1,958	1	1,958	58,740
July	57,805	31	1,865	57,805
August	52,855	31	1,705	52,855
September	27,841	30	928	27,841
October	5,060	31	163	5,060
November	376	5	75	2,256
Total	145,895	129	1,131 (avg.)	204,557

Table 6: AV1B Vehicle Counts (2012)

The AV1B vehicle counter registered an average of 1,131 vehicles a day over the course of the monitoring season. The median was 1,373 vehicles. The maximum vehicle count occurred on July 6th with 2,230 vehicles recorded. The minimum vehicle count took place on October 28th with 53 vehicles recorded. Data indicate a steady high level of use through mid-August. Use begins to decline near the end of August, receiving a bump over Labor Day weekend, and then declining to very low levels after mid-September.

Saturday and Sunday accounted for the highest percent of weekly vehicle activity with 15.5% and 15.2% of vehicle use by day of week, respectively. The mean vehicle activity for Saturday was 1,225 and mean vehicle activity on Sunday was 1,202. Friday was the third most heavily

used day of the week, averaging 1,123 vehicles, and comprised 14.2% of weekly vehicle activity. Monday and Thursday ranked closely together with 13.9% and 14%, respectively. Tuesday and Wednesday both accounted for 13.6% of use by day of week. Tuesday averaged 1,075 vehicles and Wednesday averaged 1,079 vehicles.

The hourly average from 8 AM to 8 PM was 83 vehicles with a median of 88 vehicles. Vehicle activity tended to rise gradually until it peaked at 5 PM. Maximum vehicle activity typically occurred at 5 PM, averaging 137 vehicles for the hour. Vehicle use tended to decline quickly after 5 PM compared to the gradual increase in the earlier part of the day.

For the purpose of the 2012 study, the summer season included 68 days of monitoring between June 30th (installation date) and September 5th. Total vehicle activity at the AV1B vehicle counter during the summer season was 120,405 (Table 7). This location averaged 1,771 vehicles a day with a median of 1,781 vehicles. Maximum daily vehicle activity occurred on August 6th with 3,133 vehicles registered for the day. Minimum daily activity occurred on September 4th with 1,011 vehicles recorded. Vehicle use was relatively steady throughout the summer season. Use dipped slightly at the end of August, but experienced a bump in use through Labor Day weekend.

Month	VC Data	# Days Monitored	Daily Average
June ¹	1,958	1	1,958
July	57,805	31	1,865
August	52,855	31	1,705
September ²	7,787	5	1,557
Total	120,405	68	1,771 (summer avg.)

Table 7: AV1B Vehicle Counter Statistics: Summer 2012.

¹Dates begin June 30th.

²Dates are through September 5th

Saturday and Sunday registered the highest amount of average vehicle use per day of week during the summer season with 15.3% and 15% of the average weekly vehicle activity, respectively. Saturday averaged 1,898 vehicles and Sunday averaged 1,864 vehicles. Monday and Friday each accounted for an average of 14.5% of weekly vehicle activity. Monday averaged 1,792 vehicles, and Friday averaged 1,799 vehicles. Thursday averaged 14.2% of weekly use, averaging 1,761 vehicles. Tuesday and Wednesday rounded out the bottom, both averaging 13.2% of average weekly vehicle use.

Fall data was collected over a 61-day period from September 6th to November 5th. The daily vehicle average for the fall period was 418 vehicles with a median of 225 vehicles. Total fall vehicle activity was 25,490 vehicles. The maximum day of fall vehicle activity took place on September 16th, with 1,467 vehicles. The minimum vehicle count occurred on October 27th with 53 vehicles recorded. Saturday and Sunday received the largest chunks of fall vehicle use averaging 15.9% and 15.5% of average weekly use, respectively. Saturday averaged 476 vehicles and Sunday averaged 466 vehicles. Wednesday accounted for 15.4% of weekly vehicle use and averaged 461 vehicles. Thursday and Friday both accounted for an average of 14.9% of weekly

use. Monday and Tuesday averaged the lowest percentages of use by day of week with 11.2% and 12.2% respectively. Monday averaged 336 vehicles and Tuesday averaged 366 vehicles.

4.3 What is the East-bound Traffic Flow North of the Avalanche Parking Area?

AV2A counted vehicle traffic traveling east on the GTTSR for 129 days and was located about a quarter mile north of the Avalanche parking area. An adjustment factor of 1.00644 was derived by dividing the manual count by the vehicle counter data.

Table 8 summarizes 129 days of data collection for the AV2A vehicle counter. Based on this single day of data gathered in June, the total vehicle count for the entire month of June was estimated to be 55,980. However, this is a rough estimate due to the fact it is based on one day of data collection. The entire month of July was monitored, with a total vehicle count of 62,629 with an average daily count of 2,020 vehicles. The vehicle counter recorded data for all 31 days of August for a vehicle total of 60,260 and a daily average of 1,944 vehicles. Vehicle activity dropped in September with 26,584 vehicles recorded over the entire month for a daily average of 886 vehicles. The decline in use continued into October as 1,554 vehicles were recorded over the entire month. October averaged 50 vehicles a day. The first 5 days of November were monitored for a vehicle total of 185 vehicles and a daily average of 37 vehicles. Based on the daily average, it was estimated that about 7,720 vehicles traveled past the counter over the entire month of November. The total vehicle estimate at AV2A from the beginning of June to the end of November is 208,117.

Month	VC Data	# Days Monitored	Daily Average	Total estimate for month
June	1,866	1	1,866	55,980
July	62,629	31	2,020	62,629
August	60,260	31	1,944	60,260
September	26,584	30	886	26,584
October	1,554	31	50	1,554
November	185	5	37	1,110
Total	153,078	129	1,187 (avg.)	208,117

Table 8: AV2A Vehicle Counts (2012)

The AV2A vehicle counter registered an average of 1,187 vehicles a day over the course of the monitoring season. The median was 1,456 vehicles. The maximum vehicle count occurred on July 2nd with 2,686 vehicles recorded. The minimum vehicle count took place on 6 days late in the season with 0 vehicles recorded. July 18th experienced a major dip in vehicle activity, which can be accounted for by mudslides on the GTTSR, which closed sections of the road down. Use was highest from July through mid-August. Use began to decline after the middle of August, but experienced a boost in vehicle activity during Labor Day weekend. Vehicle numbers dropped dramatically after the road closed on September 17th.

Saturday and Sunday averaged the highest percent of weekly vehicle activity, averaging 14.8% and 15.7% of vehicle use by day of week, respectively. The mean vehicle activity for Saturday

was 1,233, and Sunday was 1,307. Monday and Tuesday ranked third and fourth in terms of average percent weekly use by day of week. Monday averaged 14.6% of weekly use and Tuesday averaged 14.4%. Thursday and Friday both accounted for 13.7% of weekly use. Thursday averaged 1,140 vehicles and Friday averaged 1,136 vehicles. Wednesday averaged the lowest amount of vehicle activity with 1,077 vehicles, accounting for 13% of weekly vehicle activity at the AV2A vehicle counter.

The hourly average from 8 AM to 8PM was 85 vehicles with a median of 96 vehicles. Vehicle activity tended to peak at 11 AM with an average of 142 vehicles for the hour. Vehicle use tended to decline at a slower rate in the afternoon than the rate at which it increased throughout the morning hours

For the purpose of the 2012 study, the summer season included 68 days of monitoring between June 30th (installation date) and September 5th. Total vehicle activity at the AV2A vehicle counter during the summer season was 134,092 (Table 9). This location averaged 1,972 vehicles a day with a median of 2,008 vehicles. Maximum daily vehicle activity occurred on July 2nd with 2,686 vehicles registered for the day. Minimum daily activity occurred on July 18th with 107 vehicles recorded. Vehicle use was relatively steady throughout the summer season. Use began to decline around the middle of August but experienced a bump in use through Labor Day weekend. As stated earlier, the sharp drop in vehicle use on July 18th can be attributed to mudslides that closed the road during that time period.

Month	VC Data	# Days Monitored	Daily Average
June ¹	1,866	1	1,866
July	62,629	31	2,020
August	60,260	31	1,944
September ²	9,337	5	1,864
Total	134,092	68	1,972 (summer avg.)

Table 9: AV2A Vehicle Counter Statistics: Summer 2012.

¹Dates begin June 30th.

²Dates are through September 5th

Sunday and Monday registered the highest average vehicle use per day of week during the summer season with 15.6% and 15.2% of the average weekly vehicle activity. Sunday averaged 2,159 vehicles and Monday averaged 2,095 vehicles. Saturday accounted for 14.8% of weekly use, averaging 2,037 vehicles. Tuesday and Friday both accounted for 14% of weekly use and Thursday accounted for 13.9%. Wednesday averaged the lowest amount of use by day of week, accounting for 12.5% of weekly use and averaging 1,723 vehicles.

Fall data was collected over a 61-day period from September 6th to November 5th. The daily vehicle average for the fall period was 311 vehicles with a median of 85 vehicles. Total fall vehicle activity was 18,986 vehicles. The maximum day of fall vehicle activity took place on September 16th, with 1,796 vehicles. The minimum vehicle count occurred on October 13th, 14th, 20th, 21st, 27th and November 3rd with 0 vehicles recorded. Thursday and Sunday received the largest chunks of fall vehicle use, averaging 17.1% and 16.7% of average weekly

use, respectively. Friday and Saturday both accounted for an average of 15.6% of weekly use with both days also averaging 339 vehicles. Monday, Tuesday, and Wednesday rounded out the lowest days of the week in terms of use averaging 10.6%, 12%, and 12.5%, respectively.

4.4 What is the West-bound Traffic Flow North of the Avalanche Parking Area?

AV2B counted vehicle traffic traveling west on the GTTSR and was located about a quarter mile north of the Avalanche parking area. The counter was installed June 29th and data collection began June 30th. Data collection ended November 5th and the counter was removed November 6th. An adjustment factor of 1.121951 was derived by dividing the manual count by the vehicle counter data.

Table 10 summarizes 129 days of data collection for the AV2B vehicle counter. Data was collected on the final day of June with 2,064 vehicles recorded. Based on the daily average, the total vehicle estimate for the entire month of June was 61,920. However, this is a rough estimate because it is based on a single day of data collection. The entire month of July was monitored, with a total vehicle count of 59,288 and an average daily count of 1,913 vehicles. The vehicle counter recorded data for all 31 days of August for a vehicle total of 58,714 and a daily average of 1,894 vehicles. Vehicle activity dropped in September with 27,949 vehicles recorded over the entire month for a daily average of 932 vehicles. The month of October recorded 2,011 vehicles. October averaged 65 vehicles a day. The first 5 days of November were monitored for a vehicle total of 204 vehicles and a daily average of 41 vehicles. Based on the daily average it was estimated that about 1,224 vehicles traveled past the counter over the entire month of November. The total vehicle estimate at AV2B from the beginning of June to the end of November is 211,106.

Month	VC Data	# Days Monitored	Daily Average	Total estimate for month
June	2,064	1	2,064	61,920
July	59,288	31	1,913	59,288
August	58,714	31	1,894	58,714
September	27,949	30	932	27,949
October	2,011	31	65	2,011
November	204	5	41	1,224
Total	150,230	129	1,165 (avg.)	211,106

Table 10: AV2B Vehicle Counts (2012)

The AV2B vehicle counter registered an average of 1,165 vehicles a day over the course of the monitoring season. The median was 1,572 vehicles. The maximum vehicle count occurred on September 2nd with 2,477 vehicles recorded. The minimum vehicle count took place on four days late in the season with zero vehicles recorded. July 18th experienced a major dip in vehicle activity, which can most likely be accounted for by the mudslides on the GTTSR that closed sections of the road down. Use was highest from July through mid-August. Use began to decline on August 20th, but experienced a boost in vehicle activity during Labor Day weekend. Vehicle

numbers dropped dramatically after the road closed just beyond the Avalanche parking lot on September 17th.

Saturday and Sunday averaged the highest percent of weekly vehicle activity, accounting for 15.4% and 15.2% of vehicle use by day of week, respectively. The mean vehicle activity for Saturday was 1,253 and mean vehicle activity on Sunday was 1,239. Monday, Thursday, and Friday ranked closely together, accounting for 14.4%, 14% and 14.3% of weekly vehicle use, respectively. Monday averaged 1,172 vehicles, Thursday averaged 1,143 vehicles, and Friday averaged 1,168 vehicles. Tuesday and Wednesday accounted for 13.9% and 12.7% of vehicle use, respectively.

The hourly average from 8 AM to 8 PM was 85 vehicles with a median of 98 vehicles. Vehicle activity tended to peak at 5 PM with an average of 140 vehicles for the hour. Vehicle use tended to decline at a faster rate in the afternoon than the rate in which it increased throughout the morning hours.

For the purpose of the 2012 study, the summer season included 68 days of monitoring between June 30th (installation date) and September 5th. Total vehicle activity at the AV2B vehicle counter during the summer season was 129,447 (Table 11). This location averaged 1,904 vehicles a day with a median of 1,944 vehicles. Maximum daily vehicle activity occurred on September 2nd with 2,477 vehicles registered for the day. Minimum daily activity occurred on July 18th with 89 vehicles recorded. Vehicle use was relatively steady throughout the summer season. Use began to decline around the middle of August, but experienced a bump in use through Labor Day weekend. As stated earlier, the sharp drop in vehicle use on July 18th can be attributed to mudslides that closed the GTTSR during that time period.

Month	VC Data	# Days Monitored	Daily Average
June ¹	2,064	1	2,064
July	59,288	31	1,913
August	58,714	31	1,894
September ²	9,381	5	1,876
Total	129,447	68	1,904 (summer avg.)

Table 11: AV2B Vehicle Counter Statistics: Summer 2012.

¹Dates begin June 30th.

²Dates are through September 5th

Saturday, Sunday and Monday registered the highest amount of vehicle use per day of week during the summer season, averaging 15.4%, 15.3% and 15% respectively. Saturday averaged 2,049 vehicles, Sunday averaged 2,041 vehicles and Monday averaged 1,996 vehicles. Thursday and Friday accounted for 14% and 14.7% of weekly use respectively. Tuesday and Wednesday averaged the lowest amount of use by day of week, accounting for 13.4% and 12.2% of weekly use, respectively.

Fall data was collected over a 61-day period from September 6th to November 5th. The daily vehicle average for the fall period was 341 vehicles with a median of 93 vehicles. Total fall

vehicle activity was 20,783 vehicles. The maximum day of fall vehicle activity took place on September 16th, with 1,701 vehicles. The minimum vehicle count occurred on October 13th, 14th, 27th and November 3rd with zero vehicles recorded. Thursday received the largest chunk of fall vehicle use, averaging 17.8% of weekly use. Thursday averaged 424 vehicles. Friday and Saturday accounted for 15.6% and 15.5% of weekly use, respectively. Friday averaged 371 vehicles and Saturday averaged 369 vehicles. Sunday accounted for 14.7% of weekly use with an average of 349 vehicles. Monday, Tuesday, and Wednesday rounded out the days of the week with the lowest average percent daily vehicle activity with 10.8%, 13%, and 12.6%, respectively.

5. How do Visitors Use and Experience the Shuttle?

In the 2007 Visitor Use Survey, of respondents interviewed within the corridor, 4.4% of visitors cited Avalanche Creek as the location where they boarded the shuttle. The most popular boarding locations were Apgar Transit Center (66.9%), St. Mary Visitor Center (12.7%), and Logan Pass (6.6%). Avalanche Creek was the 5th most popular shuttle boarding location within the corridor.

In the same survey, Avalanche Creek was the 3rd most popular shuttle departure stop, with 28% of visitors citing Avalanche Creek as the location where they disembarked. Logan Pass (84.6%) and Apgar Transit Center (36.3%) were the only shuttle departure locations more popular.

Of shuttle stop locations, Avalanche Creek was the 5th most popular location from which to begin a loop hike, with 10.8% of visitors surveyed indicating they began their loop hike from this location. The more popular shuttle stop locations from which to begin a loop hike were Logan Pass, St. Mary Falls, The Loop, and Siyeh Bend. Avalanche Creek was the 7th most popular shuttle location to end a loop hike, with 3.1% of visitors ending their loop hike at this location.

Stakeholder evaluations conducted in 2007 revealed some visitors' dissatisfaction with uncomfortably bumpy rides caused by inadequate suspension and poor road conditions. This was especially true for passengers seated at the back of the bus. Many shuttle drivers specifically cited the road between Avalanche and The Loop as a location where drivers needed to slow down and maneuver around bad spots in the road. Stakeholders also commented on the undesirability of having shuttle stops located on only one side of the road in certain locations, as is the case at Avalanche. Specifically, stakeholders cited safety concerns associated with visitors and buses needing to cross traffic to access shuttle stops.

The design of the Avalanche shuttle stop was the source of many safety concerns in the 2007 stakeholder evaluation. First, drivers traveling east along the GTTSR were required to cross traffic in order to access the shuttle stop. Furthermore, the barricades around the shuttle stop extended outside of the designated parking space thus reducing the amount of space available for shuttles to pull out of traffic. Once stopped, eastbound buses were positioned so that passengers were required to board and exit buses very close to GTTSR traffic. This problem was exacerbated when oversized vehicles parked in spots adjacent to the shuttle stop. Shuttle drivers suggested relocating the shuttle stop at Avalanche Creek to either the picnic loop or the campground area.

One of the goals of the 2008 study was to gain insight into how the shuttle system was

influencing visitor behavior at Avalanche. The study concluded that based on the average duration of stop (47 minutes) and the fact the 75% of visitors parked there for less than 2 hours, it does not seem likely that a large number of people are parking at Avalanche to ride the shuttle. It takes significantly more than 45 minutes (the mean parking time at Avalanche) to get from Avalanche to most other shuttle stops and back. In addition, it takes at least 2 hours for most people to hike to Avalanche Lake on the Avalanche Lake trail.

The results of the 2012 hiker survey showed that the shuttle was not a very popular transportation mode for hikers at the Avalanche Lake trail, where just 5% of the hikers used the shuttle. This could be the case for several reasons. The trail may be seen as a short hike in which people mostly return by the same route, so they prefer to have their cars with them in order to visit other destinations in the Park after hiking the Avalanche trail. There are also more parking places available in the Avalanche parking lots, compared to other parking lots at the other locations studied (The Loop, Highline, and Sunrift Gorge trailheads). Hikers often choose to have a picnic after hiking, and some hikers even left their relatives (mostly seniors and children) in the car while hiking. It was common to observe hikers being dropped off at the parking lot by another member of their group.

The 2012 hiker survey also asked respondents whether they left their car at another location in the park (a location other than the site at which they were surveyed). Park-wide, of those hikers who left their car elsewhere, 70% used the shuttle. However, the relationship between where hikers park and shuttle use is quite variable across trails. For example, at Avalanche only 4% of the respondents left their car in another place within the park whereas at The Loop, 60% of the hikers reported leaving their car elsewhere. The report shows that hikers at the Avalanche Lake trail had little diversity in places to park while hiking; Avalanche hikers most often parked at the Avalanche parking lot (72%), Apgar transit center (17%), Logan Pass (6%), and McDonald Lodge (6%). These results corroborate the finding that the shuttle was rarely used by hikers at the Avalanche Lake trail.

In 2012, approximately 60% of hikers park-wide decided on the hike they took with knowledge that they could use the shuttle to facilitate a point-to-point hike. Hikers sampled at The Loop (76%), Highline (66%) and Sunrift Gorge (57%) decided on their hikes with knowledge of the shuttle. In contrast, just 40% of the hikers at the Avalanche Lake decided on their hikes with knowledge of the shuttle.

5.1 How Does Ridership Change at Avalanche?

One factor that serves to increase activity at Avalanche is that it serves as a shuttle transfer point. The large Optima shuttles can only run from the Transit Center to Avalanche because the road is too tight beyond Avalanche. The Sprinters serve the entire route, but focus on Avalanche to Logan Pass. In addition, some people drive to Avalanche, park there, and take the shuttle.

Using shuttle ridership data we can analyze the pattern of shuttle use and the direction people are headed. Shuttle ridership data from July 20, 2012 to August 25, 2012 (37 days) was examined. July 17, 18, or 19 are not included because shuttles were not going to Logan Pass due to a landslide.

On average, 31 more people get on the shuttle (606) then off (575) each day at Avalanche (Table

12).

Time (24 hr)	Number of People Off at Avalanche	Number of People On at Avalanche	Net gain in ridership at Avalanche (on-off)
8:00	2.7	3.4	+.7
9:00	22.1	22.4	+.3
10:00	55.4	56.3	+.9
11:00	72.5	53.9	-18.6
12:00	77.1	63.6	-13.5
13:00	78.4	76.1	-2.3
14:00	73.6	85.2	+11.6
15:00	65.8	84.2	+18.4
16:00	57.5	76.2	+18.7
17:00	46.8	63.6	+16.8
18:00	13.3	17.5	+4.4
19:00	9.5	3.2	-6.3
20:00	.7	.3	-.4
Daily Avg.	575.4	605.9	+30.5

Table 12: Average¹ ridership at Avalanche (2012)

¹Average over 37 days

When directional data is examined we see that heading up toward Logan Pass 43 more people per day get off at Avalanche than get on. In addition, we have a net gain of 73 people on the shuttle heading down toward Apgar, primarily in the afternoon (Table 13).

Time (24 hr)	Off at Avalanche coming from below (Apgar)	On at Avalanche heading up toward Logan Pass	Net gain in ridership heading up (on – off)	Off at Avalanche coming down from above (Logan Pass)	On at Avalanche heading down toward Apgar	Net gain in ridership heading down (on – off)
8:00	2.6	3.4	+8	0	0	0
9:00	21.2	21.4	+2	.9	1.0	+1
10:00	48.4	51.1	+2.7	7.0	5.2	-1.8
11:00	62.6	45.0	-17.6	9.9	8.9	-1.0
12:00	61.5	45.7	-15.8	15.6	17.8	+2.2
13:00	56.4	48.7	-7.7	22.0	27.4	+5.4
14:00	43.5	34.5	-9.0	30.1	50.7	+20.6
15:00	25.7	25.3	-.4	40.2	58.8	+18.6
16:00	13.2	19.6	+6.4	44.2	56.6	+12.4
17:00	6.3	4.9	-1.4	40.6	58.7	+18.1
18:00	1.1	.1	-1	12.2	17.3	+5.1
19:00	0	0	0	9.5	3.2	-6.3
20:00	0	0	0	.7	.3	-.4
Daily Avg.	342.5	299.8	-42.7	232.8	306.2	+73.4

Table 13: Averages¹ of Ridership by Direction of Travel (2012)

¹Averages over 37 days.

Looking at the hourly data in table 13, it is shown that shuttle riders from 8:00 to 10:00 AM all seem to transfer and head up to Logan Pass, while from 11:00 AM to 2:00 PM only about 75% of the riders continue up the road (Column 3 versus Column 2). The other 25% were assumed to be hiking or using facilities at Avalanche. This is supported by the net gain in riders coming down toward Apgar between 2 and 5 (Column 7) giving them time to complete the hike.

6. What are the Characteristics of Avalanche Visitors?

6.1 What is the Typical Group Size and Composition of Avalanche Visitors?

In 2006, the mean visitor group size to Avalanche was 4.33 visitors. In 2008, the average group size was 3.15 visitors. Thirty-four percent visited with their family, 29% in pairs, 7% with family and friends, 6% visited alone, and 5% were with friends. Data recorded in 2011 indicated that the median party size was 2 and the mean party size was 3.29. 34% of those observed were in a group of two people. The second most common group size was 3 (15% of observations). In 13% of the observations, the crew was unable to observe the group size and these missing values were recorded as zero.

The 2008 study showed that families were the most common group type observed at Avalanche in this year (43% of groups observed), followed by pairs (29%). These 2 group types made up the majority of groups observed. Individuals, groups of friends, and mixed groups of friends and family were less than 10% each. The average group size observed at Avalanche in 2005 was 3.15 people.

2008 visitors were mostly from the United States, based on license plate observations (90%); the rest were from Canadian provinces. Many (35%) were from Montana. Washington was the next most common U.S. state (12%), followed by Idaho (5%). Whenever possible, rental cars were noted, as rental car license plates do not provide an accurate assessment of visitor state of origin. Approximately 17% of vehicles observed were rental cars.

In the 2011 study, visitors were characterized by one of the following categories: alone, couples, friends, family, family and friends, or clubs and organizations and other, which included organized groups. Couples referred to a pair of two people who seemed to have a formal relationship; friends and family members in groups of two were excluded from this category. Thirty-three percent of visitors observed were in a family group and 26% were couples. In addition, observers noted if visitors were part of an organized tour or group during their visit to the park. Less than 0.4% of visitors were observed as part of an organized group or tour. There were just 8 observations of organized groups among 2,073 observations made at Avalanche.

The top five vehicle types observed in 2011 were SUVs (38%), followed by cars (30%), shuttles (12%), pick-ups (9.5%), and vans (7%). The largest percentage of cars was from Montana (29.1%). However, this figure may have been affected by rental car license plates. The second largest group of vehicles observed was shuttles (12.3%), followed by cars from Washington (9.8%) and California (5.1%).

6.2 Why do Visitors Stop at the Avalanche Parking Area?

In 2006, 74% of visitors interviewed at Avalanche had planned to stop there, and 69% indicated a willingness to ride the shuttle. Of all visitors interviewed at this site, 65.5% stopped because they were starting a hike there; 18.2% needed to use the facilities, and 16.4% wished to look at this particular view. 8.2% said it was recommended by others. The top 5 activities observed at Avalanche were hiking (65%), restroom stop (27%), picnicking (14%), looking at the view (4%), and quick stop (3%).

In 2008, the highest percentage of visitors observed at Avalanche appeared to be parking there to begin a hike (56%). A bathroom stop was the second most frequently observed reason for stopping (11%). Only 6% of visitors observed parking in the Avalanche parking lots appeared to be parking there to have a picnic. Most of the visitors observed who parked in picnic areas did not park there to picnic but left their vehicles there to begin a hike or engage in other activities. As a result, many picnickers were observed parking in other Avalanche lots and carrying their picnic supplies to the picnic area.

The top 5 activities observed by visitors to Avalanche in 2011 were hiking (46.7%), quick stop (which included use of restroom facilities, short hike, or looking at view for less than 20 minutes) (12.7%), shuttle ride (6.2%), picnicking (3.3%), and other (including park staff activities or research groups). In addition, 3% of visitors were observed combining hiking with

other activities such as picnicking, biking, and riding the shuttle. The shuttle ride was one of the main activities observed at Avalanche during the first weeks of July because visitors could gain access to The Loop when the road was closed due to snow. However, due to the complexity of the Avalanche parking area, visitors to the area could not be monitored at all times, so visitor's activities were only noted in 24% of the observations. Therefore, observation data for activities was limited.

In 2011, part of the GTTSR was closed during the first few weeks of July, so observers noted that many visitors came to Avalanche to take a shuttle ride to The Loop while the remainder of the road was closed. However, hikers often arrived before the shuttle system started operations or after it finished during the day. Furthermore, hiking and riding the shuttle activities were observed together with other activities like picnicking, and biking. Late in the day visitors mostly came for a quick stop. In addition, during the times when the parking lots were full, many motorists circled the lots looking for a spot. Crew members repeatedly observed that visitors parked at the picnic area in ways that either reduced the capacity of the lot or interfered with traffic flow in the area. It was also observed that appropriate signage regarding the location of the Trail of the Cedars was absent from the shuttle stop. Many visitors asked a member of the research team how to get to the trailhead.

7. How do Hikers Use and Experience the Avalanche Lake Trail?

7.1 How Popular is Avalanche as a Hiking Destination?

In the 2006 survey, visitors were asked a series of questions about hiking from the Avalanche parking area. Visitors reported a mean estimated hiking time of 2.6 hours with a median estimate of 2.5 hours. (The mean hiking length was also 2.6 hours in 2012, with a standard deviation of 54 minutes). Ninety-five percent of 2006 visitors who planned to hike from the Avalanche area had an intended destination for their hike. These destinations included Avalanche Lake (49 respondents), Trail of the Cedars (29 respondents), and a fishing spot (1 respondent).

Of all visitors interviewed park-wide in the 2007 Visitor Use Survey, Avalanche was the second most popular anticipated destination, with 20.7% of visitors stating that they intended to hike at Avalanche. Only Hidden Lake was more popular, with 24.8% stating that Hidden Lake was their anticipated hiking destination.

The observations conducted in the Avalanche parking lot in 2011 noted that hiking was the most popular activity, with 46.7% of visitors participating in this activity. In addition, infrared trail counters were installed at eight trails along the GTTSR, specifically at Avalanche Lake, The Loop, Highline, Hidden Lake, St Mary and Virginia Falls, Siyeh Bend and Sunrift Gorge during the summer season. During the 2011 summer season, the Hidden Lake trail had the highest average daily use within the corridor (mean = 811 people per day) during the days it was accessible followed by Avalanche Lake (mean = 796) and the Highline trail (mean = 623). In contrast, the Siyeh Bend and Sunrift Gorge trails averaged 50 or fewer visitors per day in the summer.

Data from 2012 trail counters also demonstrate Avalanche to be the second most heavily used trail that was monitored. The Hidden Lake trail was the most heavily used with an average of

1,023 visitors per day, whereas Avalanche Lake had a daily average of 496 visitors. The third most heavily used trail was The Highline trail (daily average of 562 visitors), followed by St. Mary Falls (daily average of 506 visitors) and the Loop (daily average of 258 visitors).

7.2 How Many Hikers Use the Avalanche Lake Trail?

A trail counter at the Avalanche Lake trail was installed on July 18th, 2011 and taken down November 3rd, 2011. In 2012, a trail counter was installed May 24th and data collection began on May 25th. Data collection ended on October 31st and the counter was removed on November 1st. In 2013, a trail counter was installed on June 10th and taken down on October 24th.

The 2011 trail counter was located at the coordinates Northing 5395170, Easting 0293139, and Zone 12 UTM. It was installed at a 3 feet from the trail, and approximately 0.72 miles from the trailhead.

Since the trail counters are not 100% accurate, a person from the research crew was placed on the trail to calibrate the trail counter. That activity involved comparing visual counts recorded by an attentive person to those recorded by the counter over several hours. In 2011, the trail counts were multiplied by 1.13 to calibrate for accuracy. In 2012, they were multiplied by 1.11. In 2013, the counts were multiplied by 1.11 to calibrate for accuracy. Additionally, the counts were divided by two since the trail is a single out-and-back route.

Using trail counter data multiplied by the calibration factor, the 2011 estimate for total use on the Avalanche Lake trail during the five months monitored was 68,238 visitors. The highest use of the trail was estimated in July with a total of 30,566 visitors, followed by August (22,588), September (12,092), October (2,714), and November with 278 visitors (Table 14).

Month	TC Data	# Days Monitored	Daily Average	Total estimate for month
July	11,832	12	986	30,566
August	18,945	26	729	22,588
September	12,092	30	403	12,092
October	2,714	31	88	2,714
November	37	4	9	278
Total	45,620	103	443	68,238

Table 14: Estimated Visitation at Avalanche Lake Trail (2011)

In 2012, the trail counter was in place for 142 days (39 days longer than in 2011). After calibration, 2012 results generated an estimate of 87,848 visitors to the Avalanche Lake trail (Table 15), compared to the 2011 estimate of 68,238 visitors. Much of this increase is due to the longer time period that the 2012 counter was in place. The Avalanche trail averaged 496 visitors per day over the course of the 2012 monitoring season. The median visitation was 447 users per day. The maximum visitation count occurred on July 18th with 1,489 visitors recorded. The minimum visitation took place on October 23rd and 29th with 2 visitors recorded. There was a steady increase in visitation from May to the beginning of August, when use peaked. Use declined from about mid-August but remained steady at about 50% of peak levels throughout

September.

Month	TC Data	# Days Monitored	Daily Average	Total estimate for month
May	1,655	6	276	7,923
June	8,769	20	438	13,154
July	23,303	24	971	30,100
August	24,196	31	781	24,196
September	9,987	30	333	9,987
October	2,488	31	80	2,488
Total	70,398	142	496	87,848

Table 15: Estimated Visitation at Avalanche Lake Trail (2012)

In 2013, the trail counter was in place for 136 days (6 days shorter than in 2012). After calibration, 2013 generated an estimate of 86,609 visitors to the Avalanche Lake trail (Table 16), compared to the 2012 estimate of 87,848. The slight decrease is most likely due to the shorter period of time the counter was on the trail during the 2013 period. The Avalanche Lake trail averaged 556 visitors per day over the course of the monitoring period. The median visitation was 726 users per day. The maximum visitation was 1,270 users on July 9th. The minimum visitation was 0 and was recorded during several days in October.

Month	TC Data	# Days Monitored	Daily Average	Total estimate for month
June	14,559	21	693	20,799
July	29,555	31	953	29,555
August	25,600	31	826	25,600
September	10,107	30	337	10,107
October	407	23	18	549
Total	80,228	136	566	86,609

Table 16: Estimated Visitation at Avalanche Lake Trail (2013)

When the data from the 3 years are compared during a similar time frame, they show very similar daily averages: 456 visitors/day in 2011, 485 visitors/day in 2012, and 510 visitors/day in 2013 (Table 17).

Variable	2011	2012	2013
Period monitored	July 14 th – Nov. 1 st	July 14 th – Nov. 1 st	July 14 th – Nov. 1 st
Total number of days monitored	101	112	102
Total visitation registered	45,591	53,891	52,010
Daily average	456	485	510
Maximum visitation in a single day	1,185	1,489	1,114
Minimum visitation in a single day	8	2	0

Table 17: Avalanche Lake Trail Visitor Use Comparison (2011/2012/2013)

The figures below portray the daily trend during the complete season of the 2011 and 2012 trail counters' operation (Figures 4 and 5). In 2011, there were six days without data due to technical problems with the installation of the device. Demand for the Avalanche Lake trail declined steadily beginning around the end of July.



Figure 4: Daily Trail Use (2011)

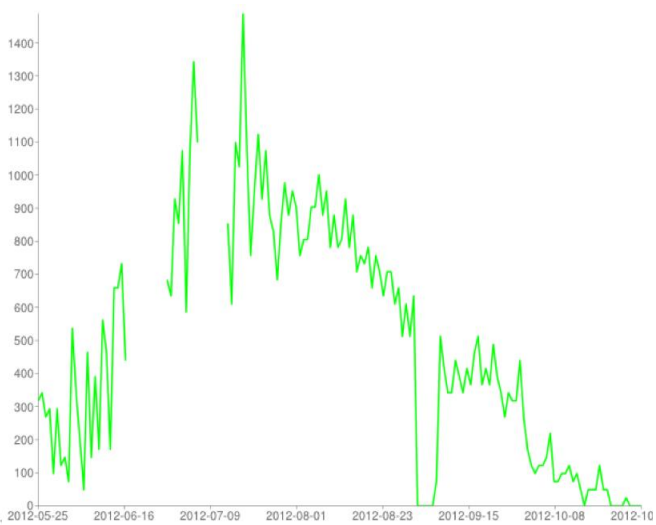


Figure 5: Daily Trail Use (2012)

During the full 103 days of operation in 2011, the trail counter registered most visitors during the weekend. Saturdays and Sundays registered 16.4% (mean 513) and 16.3% (mean 508) of the total visitors, respectively. Among the weekdays, Mondays and Thursdays showed the same amount of use with 14.9% (mean 465) of the visitors. The lowest visitation was on Wednesdays with 12.1% (mean 377).

Over the course of the monitoring season in 2012, Saturday averaged the largest percentage of visitation per week with 15.7% of average use by day of week and an average of 543 users on

that day. Thursday came in a close second with 15.6% of use by day of week, averaging 538 visitors. Tuesday and Friday averaged the lowest amount of use by day of week with 13.3% and 13.2% respectively. Tuesday averaged 460 visitors and Friday averaged 456 visitors.

7.3 How Does Use Vary Hourly at Avalanche?

Over the entire 2011 season, the average of visitation per hour was 19.1 people with a median of 4.3 people and a standard deviation of 23.3 people (demonstrating considerable variation throughout the days). Figure 6 shows that the maximum use occurred around 1 PM with 63.3 people per hour on average, followed by 60.4 people per hour at 12 PM and 58.6 people per hour at 2 PM. There were no visitors from 10 PM until 5 AM. The trail started to have considerable use around 10 AM and remained highly visited until 5 PM.

In 2012, the hourly average from 8 am to 8 pm was 42 visitors with a median of 40 visitors. Visitation tended to peak at 1 PM with an average of 70 visitors for the hour. The hourly use model on the Avalanche Lake trail is roughly normal beginning to rise at 8 AM, peaking at 1 PM, and then gradually declining until 8 PM (Figure 7).

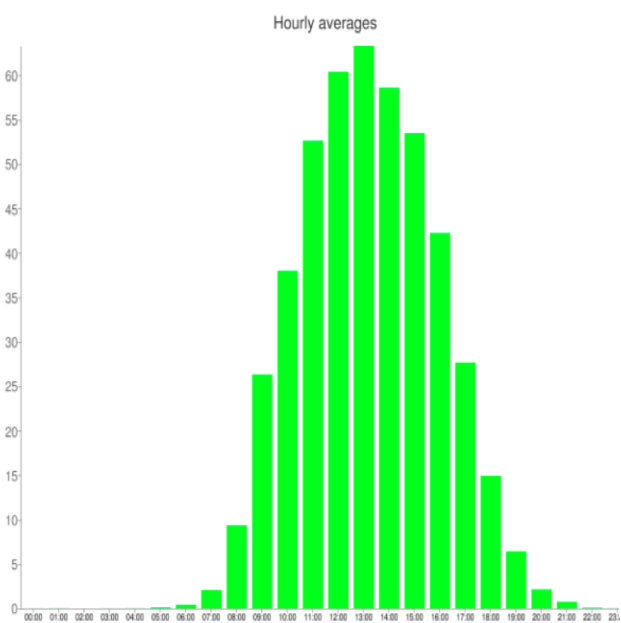


Figure 6: Hourly Use at Avalanche Lake Trail (2011)

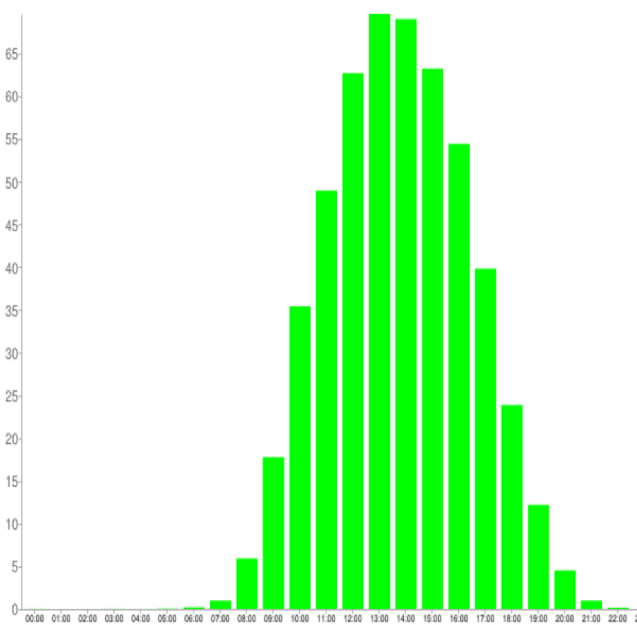


Figure 7: Hourly Use at Avalanche Lake Trail (2012)

7.4 How Does Use Vary Seasonally at Avalanche?

In 2011, the summer season began when the trail counter was installed (July 18th) and ended Labor Day weekend (September 5th). A total of 34,217 visitors were counted during that 43-day period. The average visitation per day during the summer was 796 people with a median of 831 people. The estimated visitation from July 1st to September 5th was 55,170 visitors. The maximum day of visitation registered by the trail counter was July 27th with 1,185 people. The minimum count for a single day was August 31st with 382 people. During the summer season, Thursdays were the most visited days with 15.2% of visitors (mean 841), followed closely by Sundays and Saturdays with 15.1% each and averaging 836 and 834 visitors, respectively.

Fridays had the lowest visitation averaging 701 people or 12.6% of the weekly use.

In 2012, the summer season for the Avalanche Lake trail included 86 days of data recorded between May 25th and September 5th. The total number of summer visitors counted during this period was 58,633. Average daily use was 682 visitors with a median of 731. The estimated visitation from July 1st to September 5th was 55,961 visitors. The maximum daily use was 1,489 users on July 18th, and the minimum daily summer use was 6 visitors on September 3rd. It is worth noting that Labor Day weekend experienced a sharp decline (dropping to 6-87 counts per day) in use and researchers were unable to determine the cause of this. It is worth noting because most areas experienced a large increase in use during Labor Day weekend. Thursday registered the highest percent average use by day of the week with 16.3%. Monday and Saturday registered the second and third most average use by day of week, averaging 14.8% and 14.7% respectively. Sunday and Friday consistently experienced the lowest visitation by day of week during the summer months with 13.4% for Sunday and 13.1% for Friday.

For the purpose of the 2011 report, the fall season at Avalanche included September 6th through November 3rd. There were a total of 59 fall days with a total of visitation of 11,403 people. The average per day use was 193 visitors with a median of 143 visitors. The estimated use (with calibration) during the complete fall season (September 6th to October 30th) was 13,068 visitors. On September 24th the trail counter registered the maximum visitation of the season with 525 people, while November 1st registered the lowest visitation, with only 8 people on the trail. During the fall, the visitation was highest on the weekends, with 19.9% (mean 271) and 15.5% (mean 220) of Avalanche Lake hikers visiting on Saturdays and Sundays, respectively. Friday was the next most popular with 14.1% (mean 192) of visitors hiking on this day. The lowest visitation day was Monday with 11.7% (mean 159). These findings may indicate a more local user group during the fall season.

In 2012, fall data was collected over a 55-day period from September 6th to October 31st. The daily use average during the fall period was 214 users with a median of 129 visitors. Total 2012 fall visitation was 11,765 visitors. The maximum day of fall visitation took place on September 8th 2012, with 527 visitors. Minimum visitation occurred on October 23rd and 29th with 2 visitors recorded on both days. The Avalanche Lake trail received the highest percent of 2012 fall season visitation during the weekend. Saturday received 19.7% average visitation and Sunday averaged 16.3%. The rest of the week received relatively similar percentages of average weekly use, ranging from 13.3% on Monday to the low of 12.2% on Tuesday.

7.5 What are the Long-term Trends in Avalanche Lake Trail Visitation?

Data from the trail counters installed on the Avalanche Lake trail in 2011 and 2012 demonstrated that hiker use patterns have changed significantly over the past two decades. A 1988 study conducted by Steve McCool and Amy Braithwaite of the University of Montana estimated that Avalanche lake trail received 26,200 visitors between May 21st and September 5th, 1988. According to the NPS Public Use Statistics Office, in 1988 the park received 1,817,733 visits and in 2011, just 35,831 more for a total of 1,853,564 visits. Based on the trail counter installed in 2012, the Avalanche Lake trail received approximately 71,550 visitors between May 25th and September 6th or 45,350 more visitors than in 1988. In 2013, Avalanche Lake trail received an estimated 88,510 from May 26th to September 5th, or 62,310 more visitors than in 1988. Thus, it appears that use levels on the Avalanche Lake trail have more than doubled (up 237%) since

last measured 24 years ago (Table 18).

Variable	2013	2012	2011	1988
Period monitored	June 11 th – Sept. 6 th	May 25 th – Sept. 5 th	July 1 st – Sept. 5 th	May 21 st – Sept. 6 th
# of days monitored	87	86	43	109
Total visitation estimated	88,510 ¹	71,550 ²	55,170	26,200
Daily average	835	675	796	240
% changed since 1988	+237%	+173%	-- ³	--

Table 18: Avalanche Lake Trail Visitor Use Comparison (2013/2012/2011/1988)

¹Calculated using the daily mean of 835 which was calculated over 87 days of sampling and extending it to the same 106 day period as the 1988 study

²Calculated using the daily mean of 675 which was calculated over 86 days of sampling and extending it to the same 106 day period as the 1988 study

³Dates not comparable with 1988 study

Population change is considered one of the most influential factors in relation to outdoor recreation (Cordell & Bowker, 2013), but an increasing population in the U.S has not lead to a dramatic increase in visitation at GNP since 1988. Instead, the over 235% increase in use of the Avalanche lake trail has likely stemmed from behavioral changes in visitors. Part of this behavioral change may be due to the preferences of the “baby boomer” generation. Largely responsible for the increase of backcountry use in the 1960s and 1970s, this group may be returning to the backcountry after retirement and family rearing (Robinson, Burns, Pierskalla, & Greafe, 2007). Although this older cohort considers itself healthy and physically able, their preferences may have shifted towards day-use backcountry experiences rather than longer overnight trips. This idea is supported by research in other wilderness areas where wilderness users are growing older and time spent on trips is growing shorter (Borrie & McCool 2007).

7.6 How and Why do Avalanche Hikers Plan their Trip?

During the 2012 hiker survey, 86% of the hikers said they had a specific destination when starting their hikes on the Avalanche Lake trail. Among those, the preferred destination was the Avalanche Lake with 90% of the responses. The mean hiking length was 158 minutes (2 hours, 38 minutes) with a standard deviation of 54 minutes.

Although the majority of Avalanche hikers had that particular destination in mind when they started their hike, the same survey found that 51% of Avalanche hikers chose this destination after they arrived at the park, which differs slightly from other destinations within the park. For example, 53% of hikers at the Loop and 58% of Highline hikers decided upon their hikes *before* they arrived at the park.

Additionally, 56% of hikers at the Avalanche Lake had no prior experience hiking on a trail of the same length or longer, while hikers at the Highline (68%) and Sunrift Gorge (61%) trails did have experience hiking the same length or longer.

Hikers from the 2012 survey were asked to rate a range of reasons for hiking at each location.

The most important reason for hikers at the Avalanche Lake trail was to “enjoy the scenery.” Other common reasons to take this trail were to “feel close to nature” and “spend time with friends or family.” In contrast, to “develop skills” and “meet new people” were considered the most unimportant reasons for hikers at the Avalanche location. Hikers said that “experiencing challenge” was neither an important nor an unimportant reason to take this hike. Interestingly, “solitude” as a reason for hiking was roughly evenly distributed split across the scale from “very unimportant” to “very important.” This finding suggests that there was a considerable group of hikers at the Avalanche Lake trail that were looking for a low number encounters with other groups (according to their own relative standards).

In the 2012 Hiker Survey, hikers were asked what they would most likely have done if they learned that the trail they hiked had been closed that day. The hikers were presented with three possible scenarios where they might have learned about the closure: at the park entrance, while riding the shuttle, and at the trailhead. If they were informed at the park entrance, hikers at the Highline, Avalanche Lake and Sunrift Gorge trails would be most likely to select another trail close by, while hikers at The Loop were evenly split among hiking another trail close by and hiking another trail within the GTTSR corridor. At Avalanche, 39.3% of hikers would select another trail close by, 29% would choose another trail along the corridor, 23.7% would ask park managers, 2.7% would visit a different area of the park, and 5.4% would choose to do something else.

If informed of a trail closure on the shuttle, hikers at Avalanche would be most likely to choose another trail along the corridor (45.5%), 18.2% would choose another trail close by, 18.2% would ask park managers, 18.2% would choose to do something else, and 0% would visit a different area of the park.

If Avalanche hikers were informed of a trail closure at the trailhead, 44.5% would choose another trail close by, 33.9% would choose another trail along the corridor, and 10% or fewer would ask a manager, choose to do something else, or visit a different area of the park.

7.7 How do Hikers Experience the Avalanche Lake Trail?

The 2012 survey indicated that encountering many other hikers detracted from the experience for 55% of hikers sampled, and seeing few other hikers had no effect on 56% of hikers sampled. To some extent, experiencing solitude added to the experience of 75% of those sampled at the Avalanche Lake trail.

Non-natural sounds had a varied impact on hikers, with 39% of hikers affected negatively, 34% of hikers experiencing no effect, and 27% of hikers affected positively. In addition, data regarding the impacts of the over-flights on hiker experience showed an even split among those being affected negatively and those experiencing no effect. More than 56% of hikers sampled at the Avalanche Lake trail expressed no concern about bears.

Sixty-five percent of hikers sampled in 2012 said they saw more than fifty hikers while hiking at the Avalanche Lake trail. Of those surveyed, 56% percent of the hikers said they had expected about the same number of people they encountered, while 27% said they had expected to encounter fewer hikers. In addition, 68% of the hikers said they would have liked to have seen fewer hikers, while, 31% of hikers said the number of people did not matter.

Many hikers surveyed in 2012 used some type of coping mechanism when something detracted from their experience. The most common response, used by 36% of Avalanche visitors, was that they “told themselves that there was nothing they could do about it and enjoyed the experience for what it was.” In addition, 32% hikers said that they often coped by “deciding that for this trail, the condition or situation was what it should be.” Other coping responses listed on the survey were not employed or not applicable to the conditions hikers found on this trail. These other coping responses included displacing to other sites or times of the year, talking with park personnel etc.

To assess whether there was some evidence of hikers experiencing displacement, repeated hikers at the park were asked which areas they visited less due the presence of three common undesirable conditions: too many people, restrictive regulations on recreational use, and environmental impacts. Among the hikers sampled in the four locations, Avalanche Lake and Logan Pass were the most frequently mentioned as being less visited due to undesirable conditions on the trails and parking lots. From a total sample of 852 hikers, only 363 hikers (43%) responded to whether they experienced displacement due overcrowding in certain areas in the Park. Of those, 31% stated that they currently visit some areas less frequent than they did in previous visits. The areas that hikers were most likely to avoid due to the presence of too many people were Logan Pass (5%) and Avalanche Lake (4%). No respondents indicated that they were less likely to visit Avalanche Lake due to restrictive regulations. From the total sample (852 hikers), 362 hikers (43%) answered the question regarding whether they visited some areas less often because the natural environment has been too highly impacted by recreational use. Of those that responded, 10% of hikers mentioned some areas that have been impacted by recreational use. Those areas most frequently mentioned were Logan Pass (1.2%), Avalanche Lake (1.1%) and Apgar (0.8%).

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