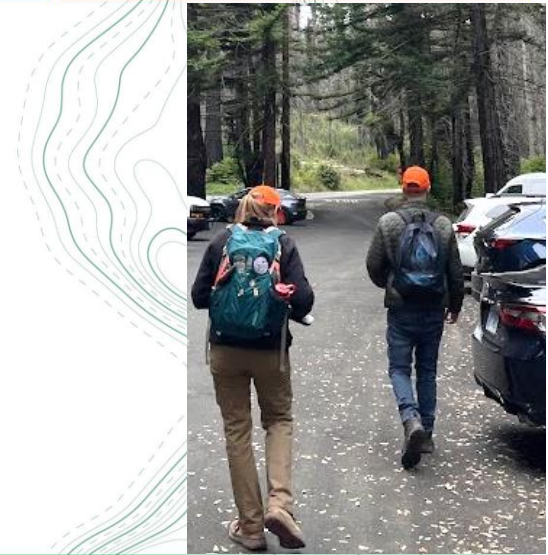




Oregon State University



Visitor Use Monitoring Protocol

# Parking Lot Chalking Protocol to Monitor Parking Lot Utilization & Turnover

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## Overview



This protocol is used to approximate turnover rates in parking lots. Knowing turnover rates can help parks to set the number of parking reservations available and may be a useful comparison for other visitor experience metrics. The parking lot is surveyed at consistent intervals. During each survey, a chalk mark is added to the back right tire of each car in the lot. As a result, the number of chalk marks on a vehicle indicate its length of stay in the lot (within the time interval). From this information, the number of cars that leave during each interval can

Figure 1. A tire with chalk marks.  
Photo: Conner Wanless.

be calculated, giving an estimate of length of stay. This protocol also produces data on parking lot utilization and other metrics covered in the Parking Lot Count Protocol.

## Considerations

- 1) **Which parking lots will you monitor?** Monitoring turnover can be fairly resource intensive, so we recommend prioritizing parking lots where results will be relevant to management decisions. For example, a lot with a new parking reservation system would be a high priority. If the parking lots you choose to monitor cannot be surveyed on the same day (e.g., they are located in separate areas of the park), you may need to monitor on separate days.
- 2) **What turnover interval is most useful in your context?** How frequently you survey the parking lot and add a chalk mark will depend on how precisely you wish to estimate turnover rate. For example, if you survey the lot every 30 minutes, you will be able to estimate turnover rate within 30-minute intervals (e.g., 30% of visitors stayed between 1 hour and 1.5 hours). The interval you choose may be informed by prior knowledge of visit length. You should also consider the time needed to walk the full parking lot, as you will not want to use an interval that is shorter than the time needed to complete a survey.

- 3) **Do you want to monitor turnover year-round or during a specific time of year?** You might choose to sample only dates during your park’s peak visitation season, or you may be interested in differences in turnover rate throughout the year. This consideration may also be impacted by staff availability. An important consideration when making this decision is that you want to ensure that the data you collect are representative of the time period of interest. For example, if you are collecting turnover data to set reservation limits during the high use season, we do not recommend collecting data outside of the high use season.
  
- 4) **What time period of the day will you survey?** This will depend on why you are gathering turnover data. In many cases, it may be most useful to survey during peak visitation. Another example would be to select the sampling time based on your reservation system. You will want to use a time period that is long enough to capture turnover rate (i.e., do not use a 2-hour time period if you expect visitors to stay up to 4 hours).
  
- 5) **Do you want to stratify your data by any variable?** If you expect that turnover rate differs based on day of the week, for example, you may wish to stratify your sampling dates into weekends and weekdays. This will ensure that you are able to compare results by the strata of interest.
  
- 6) **Consider scenarios that may arise during data collection and plan for them.** For example, will vehicles using ADA spots be combined into the lot total, or is it important to count these vehicles separately? Additionally, do visitors ever move parking spots or leave and come back? If so, is there a procedure you want to use to capture these events?



Figure 2. Two field technicians chalk tires and record data at Big Basin Redwoods State Park. Photo: Madeline Aberg.

It is important to note that some of the decisions listed above will be heavily impacted by staff availability. Our [Protocol Catalog Introduction](#) gives a more detailed overview of sampling strategies and considerations when making these decisions.

## Protocol

### Intervals

Define which intervals you will use for which parking lot.

An example for two parking lots in close proximity using 30-minute intervals:

Parking Lot 1 starts on the hour (:00) or half hour (:30)

Parking Lot 2 starts on the quarter hours (:15, :45)

### Steps for data collection

- 1) Arrive at the predefined starting location for chalking data collection (see map below).
- 2) Check with park staff to identify their vehicles. If possible, you do not want to include your own vehicles or the vehicles of park staff in your estimates of turnover rates. Exclude these vehicles from chalking when you can do so consistently.

*You may wish to add a note detailing which employees may be using the parking lot, as well as any volunteers (e.g., kiosk staff, docents, California Conservation Corps). You might also identify any additional areas where personal vehicles of contractors or volunteers are typically parked, as this may be useful for contextualizing your results.*

- 3) Record the following information on a Chalking Data Sheet (see below). If multiple data sheets are required for an observation session, complete this information on every sheet. In the list below, the fields are bolded, followed by definitions of the type of information to record.

*You might decide you want to collect additional data or to define these variables differently. The current definitions match the example datasheet.*

- **Name:** Your first and last name.
- **Date:** The date of your observation, MM/DD/YYYY
- **Sky Cover:** Check one, “Sunny,” “P Cloud” (partly cloudy), or “Overcast” depending on the predominant conditions during the data collection session
- **Precipitation:** Check one, “present” or “absent” depending on the predominant precipitation conditions during the data collection. *Note: If mist is common at your study site, you may want to add a third option.*
- **Temperature:** Check on (check boxes are provided in 10-degree Fahrenheit increments from 40 degrees to 90+ degrees) that represents your best estimate of the predominant temperature during the data collection event. *Note: In areas with no service, it may be helpful to carry a pocket or keychain thermometer if more precise estimates are needed.*

- 4) Record the start time for the chalking count, the number of vehicles with each number of chalk marks, and the end time for the survey in the appropriate fields. As you walk the parking lot, **add one chalk mark to the right tire of each vehicle**. Alternate chalk colors between rounds to make counting easier and to help you identify any mistakes. All vehicles in the parking lot should be included **except for your own vehicles and vehicles used by park staff**. Vehicles do not need to be parked in a designated space to be chalked.
  - **Parking Lot:** Use one row per lot. Use consistent naming for each lot.
  - **Chalk Start Time:** The start time (HH:MM, 24-hour clock) of the count.
  - **No chalk:** The number of vehicles present in the parking lot with **0** chalk marks.
    - **1 chalk:** The number of vehicles present in the parking lot with **1** chalk mark.
    - **2 chalks:** The number of vehicles present in the parking lot with **2** chalk marks.
    - *One column for each possible number of chalk marks up to the maximum number of chalk marks, which is determined by the number of intervals within your sampling period.*
    - **Chalk End Time:** The end time (HH:MM, 24-hour clock) of the parking lot count.
- 5) Use the **Comments** field to document any unusual conditions or events.
- 6) Between rounds or immediately following the survey period, complete a Survey123 form for the round. [insert link/QR code]. *Using an electronic data submission form, such as Survey123, may help to decrease errors and backup data. This step is optional.*

## Materials

- A storage clipboard
- A pencil or pen
- A wristwatch
- A fully charged smartphone (if using electronic survey forms)
- Chalk (multiple colors)
- Laminated maps or images of the monitoring zone
- Safety vest
- Paper datasheets

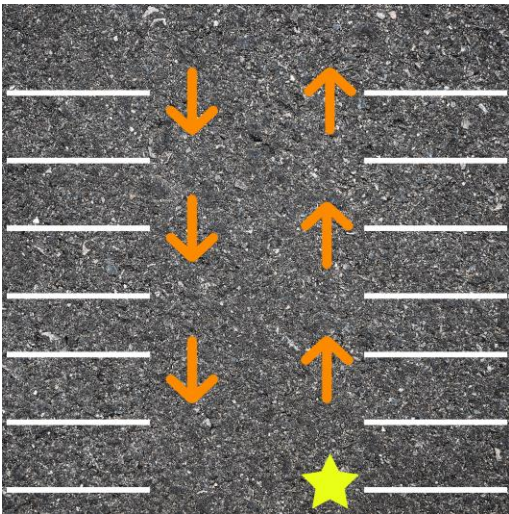
## Tips

- If a tire wall will not mark, use the tread.
- Prepare a script to explain the study to visitors who you encounter during data collection. Introduce yourself and explain why you are collecting this information.
- Have a plan for how to accommodate visitors who do not want their tires to be marked.
- Paper datasheets are useful for keeping a tally of the number of cars in each group, even if you are using an electronic data submission form.

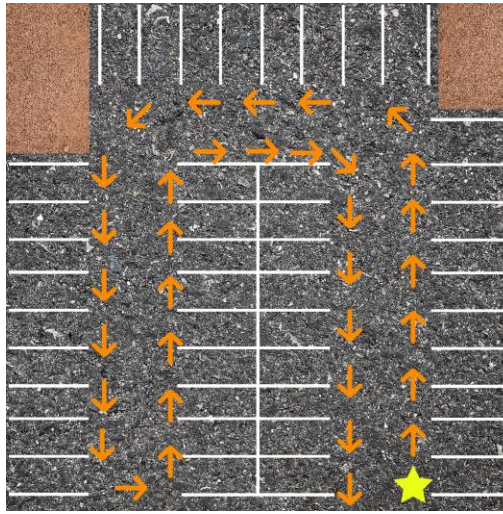


## Example Parking Lot Survey Maps

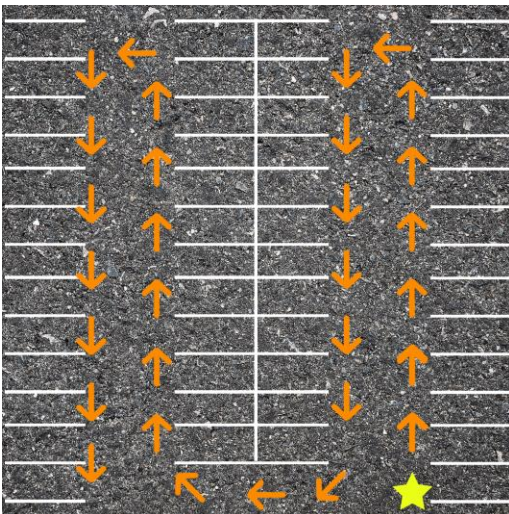
We recommend including maps of the parking lots that will be surveyed showing the survey route. Show starting location and direction. Only chalk and count one row of vehicles at a time. The following examples show how a route might be designed for various parking lot types.



Example: A square parking lot.



Example: A Closed "C" shaped parking lot.



Example: A "C" shaped parking lot.



## Data Analysis

### Possible Statistics

- Total cars in the lot at each interval
- Percent of the lot being utilized at each interval
- New cars in the lot at each interval (“No chalk”)
- Turnover rate: the percentage of vehicles that leave within each interval
  - e.g., 50% of vehicles leave between 30 and 60 minutes
- These statistics can be compared for time periods of interest.
  - e.g., Compare the number of new cars in the lot at 11:00 on weekends vs. weekdays.
  - This requires an adequate sample of all time periods being compared, which can be ensured by stratifying your sampling.

### To calculate turnover:

- 1) Start with the number of cars with each possible number of chalk marks for each time period in the survey. Below is a simplified dataset with up to four chalk marks. The example shows data collected for four surveys, spaced by 30 minutes (11:00, 11:30, 12:00, 12:30). In this example, each vehicle is marked with one additional chalk mark for each 30-minute interval. The number of new cars at each interval is the number of cars in the “No chalk” column.

**Table 1.** An example of data from the parking lot chalking protocol.

Date	Parking Lot	Chalk Start Time	No chalk	1 chalk	2 chawks	3 chawks	Chalk End Time
08/01/2023	A	11:00	5	4	7	2	11:16
08/01/2023	A	11:30	8	4	4	1	11:44
08/01/2023	A	12:00	7	6	2	3	12:15
08/01/2023	A	12:30	5	5	3	1	12:47

- 2) Calculate the number of cars that left the parking lot since the previous time period. Below is an example using the previous dataset. These are calculated using the following equations and are color-coded in the table (note that not all are shown).

$$\# \text{ who left in interval } 0 - 30 \text{ min} = (\# \text{ in No chalk at Time}_{i-1}) - (\# \text{ in 1 chalk at Time}_i)$$

$$\# \text{ who left in interval } 30 - 60 \text{ min} = (\# \text{ in 1 chalk at Time}_{i-1}) - (\# \text{ in 2 chawks at Time}_i)$$

$$\# \text{ who left in interval } 60 - 90 \text{ min} = (\# \text{ in 2 chawks at Time}_{i-1}) - (\# \text{ in 3 chawks at Time}_i)$$

**Example 1** (Highlighted in orange in the Table 2): Calculate the number of vehicles that left within 0 to 30 minutes from 11:00 to 11:30. There are 5 vehicles with no chalk at 11:00 (Time<sub>i-1</sub>) and 4 vehicles with 1 chalk at 11:30 (Time<sub>i</sub>). This means that 1 vehicle left the lot after 0 to 30 minutes.

**Example 2** (Highlighted blue): Calculate the number of vehicles that left after 30 to 60 minutes from 12:00 to 12:30. There are 6 vehicles with 1 chalk mark (in the lot 0 to 30 minutes) at 12:00 (Time<sub>i-1</sub>). At 12:30 (Time<sub>i</sub>), there are 3 vehicles with 2 chalk marks. This means that 3 vehicles left the lot after 30 to 60 minutes during the interval.

**Table 2.** Continued example from Table 1. Highlighted to show the data involved in the Example 1 and Example 2 calculations.

Date	Parking Lot	Chalk Start Time	No chalk	1 chalk	2 chawks	3 chawks	0min to 30 min	30 min to 60 min	60 min to 90 min
08/01/2023	A	11:00	5	0	0	0	0	NA	NA
08/01/2023	A	11:30	8	4	0	0	1	NA	NA
08/01/2023	A	12:00	7	6	2	0	2	2	1
08/01/2023	A	12:30	5	5	3	1	2	3	1

3) Use the number who leave during each time period to calculate the % of vehicles that stayed for an interval. For example, there are 25 total vehicles in the Table 3 (Total the “No chalk” columns, highlighted red). Of these 25 vehicles, 8% (2 vehicles, sum the column, highlighted grey) stayed between 60 to 90 minutes.

**Table 3.** Continued example from Tables 1 and 2. Data are highlighted to illustrate Step 3 above.

Date	Parking Lot	Chalk Start Time	No chalk	1 chalk	2 chawks	3 chawks	0min to 30 min	30 min to 60 min	60 min to 90 min
08/01/2023	A	11:00	5	0	0	0	NA	NA	NA
08/01/2023	A	11:30	8	4	0	0	1	NA	NA
08/01/2023	A	12:00	7	6	2	0	2	2	1
08/01/2023	A	12:30	5	5	3	1	2	3	1

**Analysis Notes:**

- These calculations start over for each new survey period.
- The number of vehicles with no chalk marks at the start of the survey period will be artificially high relative to other intervals because it includes vehicles that arrived at any time before the survey period.
- Use the number of cars left in the lot with the maximum number of chalk marks at the end of the survey period to gauge if the survey period is long enough. In the example in Tables 1 and 2, there is one vehicle left at the end of the survey (3 chawks at 12:30). There is a tradeoff between extremely long survey periods to capture all turnover precisely and the efficient use of staff time.



## RESOURCES

### Survey123

- One option for an electronic data collection form, which can help to reduce errors in data collection.
- Available from Esri
- Tutorial: <https://learn.arcgis.com/en/projects/get-started-with-arcgis-survey123/>
  - This tutorial covers creating a survey, completing the survey, analyzing survey data, and sharing survey data with an interactive map.

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## SUGGESTED PROTOCOL CITATION

Hall, T. E., D'Antonio, A., Aberg, M., and Wanless, C. (2023). Parking Lot Chalking Protocol to Monitor Parking Lot Utilization and Turnover. Protocol prepared for the Visitor Use Management Toolkit. Corvallis, OR: Oregon State University, Department of Forest Ecosystems & Society.