

FINAL TRAFFIC REPORT
FOR
MONTEZUMA CASTLE NATIONAL MONUMENT
NPS Project No. NM-05-112018-16

Located in
Yavapai County Parcel No. 800-09-001D
Northeast of the City of Camp Verde

Prepared for
National Park Services
Montezuma Castle RD
Camp Verde, AZ 86322

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Introduction

Montezuma Castle National Monument (MCNM) is a National Monument under National Park Service jurisdiction. The site is known for the cliff dwellings and is also known for the large amount of rooms within the dwelling. The site is used for educational and destination visits from local residents and tourists. The site is located 5 miles north from the City of Camp Verde and is located along Beaver Creek. The access to the site is on a single two lane road that comes from the east and south into the current parking lot. National Park Services is proposing a new parking lot to the south of the current drive and parking lot. Site improvements for this project will include a new parking lot, picnic area, sidewalks and water mitigation.

Objective

The following sections will consider the traffic analysis and traffic design process for the Montezuma Castle Parking Lot Addition and Redesign. The objective of this Traffic Impact Analysis (TIA) and parking statement is to discuss the different vehicle types, their duration, stopping sight distance (SSD) and turning movements, pedestrian movements, parking lot demand, expected growth of MCNM, the parking lot design, site layout, and site signage.

Vehicle Type

A traffic analysis in relation to the types and amount of vehicles visiting Montezuma Castle National Monument was conducted on Saturday, February 3, 2018. The analysis took place between 9AM and 11AM, for a total of two hours during a special event at the site in an attempt to observe a period of activity. The study was conducted at this time because it was concluded as peak visitation for the park. The most common vehicle type was passenger cars. Other vehicle types include: buses, recreational vehicles, and motorcycles. Using the data from the 2-hour period, the business hours of the National Monument (8AM - 5PM), estimates for the number of vehicles parking at the National Monument for a typical business day were calculated. A summary of the raw and calculated data can be found below.

Table 1: Summary of Types and Amount of Vehicles

Vehicle Type	Vehicles in study period	Projected Vehicles in Business Day (8am-5pm)
Passenger Car	85	383
Bus	2	9
Recreational Vehicle	1	5
Motorcycle	1	5

Vehicle Duration

Simultaneously, a vehicle duration study was conducted on the same day, Saturday, February 3rd, 2018. The study took place from 9AM - 11AM. The study consisted of observing 60 vehicles from the time they entered the parking lot and ended when they left. Vehicles were identified by their make and model and observed to determine the average length of visit. This data can be used to make conclusions for how many cars would need to be in the parking lot at a given time. This will assist in the determination of the number of parking spots for the new proposed parking lot. Our results conveyed that most visitors were in the park for about 45-60 minutes. To maximize the capacity of the parking lot, 60 minutes will be used for design. The figure below graphically displays the data collected for the general duration vehicles are at the park on a peak day.

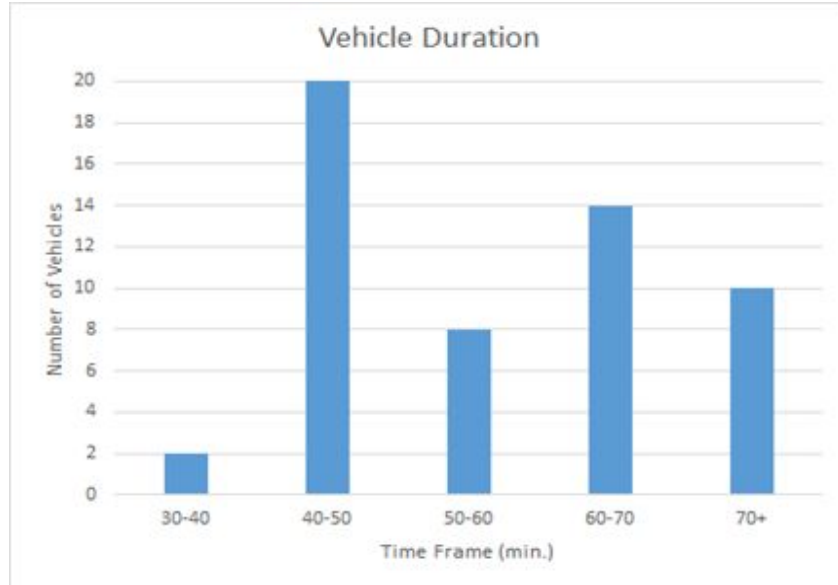


Figure 6: Visitor Travel Duration

Stopping Sight Distance and Turning Movements

On the same day of Saturday, February 3rd, 2018, the team analyzed the stopping sight distance and turning movements. Stopping sight distance is the sum of two values, the time it takes a driver to see and react to an approaching obstacle, and the time that it takes for the driver to safely stop at the posted speed. The driver should be able to see the full stopping distance required to safely react to their situation. Horizontal curve requirements are mandated by the American Association of State Highways and Transportation Officials’ Policy on Geometric Design of Highways and Streets, which establishes a relationship between speed and the radius of curvature.

The project involves the remodel and redesign of the parking lots that terminate Montezuma Castle Road. Since design is confined to the parking lots, the project limits are not beyond the service road and therefore stopping sight distance was not a consideration for the design of the parking lot. In a full traffic study of the roadway, it should be considered. The figure below shows a horizontal curve at the entrance to the parking lot that could prove to be an example of inadequate stopping sight distance upon further analysis.



Figure 7: Stopping Sight Distance Example

Turning movements also need to be observed to determine appropriate signage at intersections within the project limits. The intersection of the service road (minor) and Montezuma Castle Road (major) is the only intersection within the project limits. With existing signage, the minor approach has a stop sign and the major approach is a through movement. During a site visit one vehicle was observed turning from the minor roadway onto Montezuma Castle Road. Information from the client suggests that the current purpose of the roadway is restricted to employees only and demand is concentrated around employees.

Pedestrian Movements

The team conducted a study regarding the number of pedestrians walking on the provided sidewalks versus walking on the asphalt of the existing lot. The study was conducted concurrently with the vehicle type study and number of vehicles visiting the National Monument.

Table 2 below summarizes the number of visitors within the two-hour study period and their walking patterns. Pedestrians were counted both entering and exiting the park. Estimates for the number of visitors during a full business day (nine hours) was applied to raw data.

Table 2: Types of Pedestrian Movements and Paths

Pedestrian Movement	Pedestrians in study period*	Projected Pedestrians in Business Day (8am-5pm)
Sidewalk	121	545
Asphalt	303	1364

Of the pedestrian movements recorded, it was found that 71% of visitors at the national park are not using the existing sidewalks and walking in the middle of the existing parking lot. This is a direct indication that additional signage and sidewalks should be implemented into the parking lot remodel to make sure visitors are safe while they are on site.

Bus Visitor Movements

In relation to table above, there were numerous visitors arriving on buses during the 2-hour study period. The number of people within vehicles is significantly higher for buses than those who travel in passenger cars, RV’s, or motorcycles. The number of visitors who arrived on buses is summarized in the table below. Bus visitors were excluded from the total pedestrian count above. Bus visitors will be accommodated with the proposed bus drop off lane.

Table 3 : Number of visitors who arrived on buses.

	Pedestrians in study period	Projected Pedestrians in Business Day (8am-5pm)
Bus Visitors	16	72

Parking Lot Demand and Expected Growth

The observed pedestrian data (Section 2.4.4) and vehicle type and duration (2.4.1-2) over the two hour time period can be used to make assumptions necessary to determine the required parking lot capacity. Using the total visitors (297) and the total passenger cars (85) the calculated visitors per passenger car is 3.49. 3 visitors/vehicle will be used for design. The projected passenger cars per day is 497 and the design duration is 60 minutes. Based on the the visitor traffic at Montezuma Castle is at its highest in the months of March, April, and October. The number of observed visitors do not accurately represent this value.

National parks and monuments are a growing attraction in the United States due to a number of different factors. The social media age has provided more exposure to some of the most sacred natural wonders in the country. As people live in an increasingly urban environment, the desire to spend time in a structured outdoor setting continues to increase. The global climate of terrorism is keeping United States visitors traveling within the country and more specifically away from man made attractions, making a national park and monument vacation an even more appealing prospect. In a recent study conducted by Yale University, several of the larger parks have seen a growth of 100% since 1980. If decomposed, this correlates to a growth rate of approximately 2.5% a year. Assuming the same growth rate for Montezuma Castle, and designing the parking lot for expected 10-year growth, a total growth of 25% will be applied to current visitor counts for the final design capacity.

Table 4 below shows the calculations used to determine the capacity for the existing and proposed lot.

Table 4: Design Calculations by Vehicle Type

	Current Daily	Daily w/ Growth	Peak (Design)
		Current Daily x 1.25	Daily w/ Growth x 0.2
Passenger Cars	383	479	96
Large Vehicles	14	18	4
Motorcycles	5	6	1

The peak hours for the national monument range from 10AM-1PM provided by the client. During these times, an even distribution of 60% of the total visitors of the day (20% of the daily total per hour) and a growth of 25%, the parking lot capacity needs to accommodate a total of 96 passenger cars, 4 large vehicles (buses and RVs), and 1 motorcycles. The existing parking lot holds 64 passenger cars. By taking the difference between what the parking lot must have minus what already exists on site, numbers for the new parking lot were calculated. Therefore, the new proposed parking lot must accommodate an additional 32 passenger car spaces, 4 large vehicle spaces, and 1 motorcycle space. Table 5 below conveys these numbers.

Table 5: Additional Spaces Required

	Passenger Cars	Large Vehicles	Motorcycles
Existing	64	0	0
Needed Spaces	32	4	1

Parking Lot Design

The parking lot design was chosen to be user friendly, aesthetic, and low in construction cost. The intent of the design was to optimize efficiency while minimizing costs associated with construction and maintenance. The final design has a footprint with very minimal change in topography, which will also reduce the costs associated with cut and fill of material to the site. This final design can be seen on Improvement Sheet 2 within the complete set of construction documents. The site gradually slopes to the south, which will assist in drainage. Because of this slope, water will have an easier time flowing downward off the parking lot. The parking lot has two proposed landscape areas that will have native plants. This will allow water to infiltrate this area which is beneficial to the surrounding vegetation. Additionally, a detention basin was designed and will be placed just off the lowest elevation point on the parking lot. There are proposed pedestrian facilities from the new lot to the park entrance, such as sidewalks, and crosswalks, as seen on the plans.

Site Layout & Site Signage Plan

To further the design process of the existing and proposed parking lots, a site layout equipped with an adequate signage plan was developed. The construction document containing the Site Layout & Site Signage Plan is available on Improvement Sheets 1 & 2. Specific design aspects were implemented in order to keep traffic flowing and avoid congestion. In the existing parking lot, the current bus parking has been converted into a 15-minute maximum loading and unloading zone. This will alleviate traffic build up from busses that will now be required to park in the new proposed lot. The existing roadway to the proposed lot currently restricts all access to the public. This restricted access will be eliminated so that all visitors can utilize the roadway to access the new parking lot. Beyond the entrance of the parking lot, the road will still be restricted to visitors.

The new parking facility was designed to be one way only, similar to the existing lot. There are two rows of passenger car parking and two separate areas designated for bus and RV parking only. There is one spot for motorcycle parking only. Visitors of Montezuma Castle National Monument will enter the newly designed lot from the south side and will exit from the north side.

There will be two “Restricted Area” signs that only permit employee access beyond those points so that the road can continue to maintain functionality for its existing purpose. There is an existing stop sign that will serve as sufficient intersection control. Larger vehicles have a much larger turning radii; therefore, most of the large vehicles cannot safely navigate the right turn onto the main road to exit the property. Therefore, these vehicle types will be restricted from turning right to ensure safety of other vehicles. They will be required to turn left, travel through the existing parking lot, then continue straight to exit the monument.

Some of the existing signs will be kept, such as the speed limit of 15 MPH and the “No Parking Anytime” signs that are placed on the sides of the main road. There are four existing ADA parking stalls in the existing lot. Four of the current passenger car parking stalls in the existing lot will be converted into additional ADA spots in compliance with FHA Design Codes, resulting in minor restriping of the existing lot and eight total ADA spots at the front entrance.