National Park Service

Yosemite National Park
Transportation Improvement Strategies Report

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EXECUTIVE SUMMARY

The Transportation Improvement Strategies Report (TISR) is a technical document that compiles a broad range of ideas about how to improve visitor transportation systems and services in and around Yosemite National Park. The TISR is not a transportation plan or a decision document. Rather, it is a technical resource that provides information and ideas that can inform other planning activities in the park. The strategies are conceptual in nature and would, if pursued, require additional levels of planning, analysis and environmental compliance. This executive summary highlights critical transportation issues facing the park and provides an overview of the strategies.

Current Conditions

Annual recreational visits to Yosemite National Park have increased by over 60% since 1980, the year that the park's General Management Plan (GMP) was completed, from approximately 2.5 million to over 4 million in 2010[1]. Park visitation reached a peak in 1996, but began growing again in 2004, and has been increasing at a more rapid rate (3.6% average annual growth) than during the period between 1980 and 1996 (3.1% average annual growth).

The challenges associated with intensive levels of visitation to the park are exacerbated by the fact that much of the park's visitor use is concentrated between Memorial Day and Labor Day weekends. Moreover, visitation during summer months has increased more rapidly than during other seasons, with the largest increase in visitation between 1979 and 2009 having occurred during the peak month of August.

Transportation-related impacts associated with this intensive visitation in Yosemite National Park are periodically significant, and include traffic congestion at park entrances and on park roads; parking shortages and associated visitor frustration and resource impacts from unendorsed parking; increased risk of pedestrian or bicycle and motor vehicle accidents; deterioration of transportation infrastructure not originally designed to accommodate current traffic volumes; and air quality and global climate impacts associated with vehicle emissions.

Transportation-related issues and associated impacts to park resources and visitor experience quality are particularly pronounced in Yosemite Valley throughout the summer season. There are at least twenty-five days during the peak summer season (i.e., the vast majority of summer weekend days), when roadway traffic congestion, parking shortages, and unendorsed overflow parking are particularly intensive. More specifically:

- In 2007, a benchmark was established for comparison purposes to track the number of busy, busier, and busiest days in the park. The number of days within the busier to busiest categories increased from 7 in 2007 to 48 in 2010, about half of the summer season.
- The number of vehicles in East Yosemite Valley on the 1st and 7th busiest days of the summer 2010 season exceeded the day use parking supply by as much as approximately 1,350 and 760 spaces, respectively. If parking along informal/gravel roadsides had been prohibited, and park rangers were not deployed to guide visitors, the shortage would have been approximately 1,900 and 1,300 spaces on the 1st and 7th days of 2010 respectively.
- On the busiest days, delays on Northside Drive between Sentinel Drive and Camp 4 increase by as much as 300% and the intersection of Northside Drive with the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing operates at Level of Service F (i.e., a "failing grade" on the primary traffic engineering measure of intersection performance).

[1] Yosemite National Park Website reported 4,047,880 visitors in 2010 http://www.nps.gov/yose/parkmgmt/statistics.htm

The park is employing intensive traffic and parking management techniques during the summer season in Yosemite Valley. However, the actions of the emergency traffic management response team are not enough, by themselves, to address the pronounced traffic congestion and parking shortages. Moreover, the actions are carried out without knowledge of how "filling" the valley's transportation infrastructure up to and beyond the limits of its physical capacity affects park resources and the quality and character of visitors' experiences driving the park roads and at recreation sites throughout the valley.

During the period between Memorial Day and Labor Day weekends, parking congestion is severe throughout all regions of the park causing resource impacts, greater risks of pedestrian/motor vehicle conflicts, impacted scenic vistas, and increased visitor frustration, including:

- Tuolumne Meadows: There are roughly 533 day use and overnight parking spaces in designated parking lots in Tuolumne Meadows. A study conducted in August 2006 showed an additional 453 vehicles on the ground in unendorsed roadside parking areas and on the fringe of parking lots during the peak use period.
- Mariposa Grove: The upper and lower parking lots are generally full by late morning at which point visitors are directed to drive 5 miles north to Wawona, park in Wawona, and take a shuttle bus back south along the same 5-mile route to Mariposa Grove.
- Wawona: Directing Mariposa Grove visitors to park in Wawona during the peak hours of peak season days exacerbates parking congestion, poor traffic circulation, and pedestrian/motor vehicle conflicts that occur in Wawona.

Other areas of the park have similar parking shortages including Glacier Point and Hetch Hetchy.

While parking overflow is the park's most pronounced transportation-related issue, traffic congestion and associated delays are problematic at a number of locations throughout the park, including at park entrance stations. During peak periods, entrance station queues and associated delays become so severe that park staff wave vehicles through without collecting entrance fees. Waving vehicles through the entrance stations helps to clear excessively long queues, but it also creates a surge of vehicle traffic into the park, which has significant downstream impacts on parking, traffic circulation, and crowding at visitor destinations.

A primary contributing factor to parking congestion and other transportation-related issues in the park is visitors' reliance on private vehicles as the predominant means of access to and within the park. The vast majority of visitors arrive to Yosemite in a private vehicle (84.4%), whereas relatively few enter the park via commercial tour bus (4.8%) or YARTS bus (1.3%). Once inside Yosemite, the vast majority of visitors (86.6%) travel through the park in their private vehicle at least part of the time. More than six in ten (62.1%) visitors, however, also travel within the park via the Yosemite Park Shuttle, with ridership highest among weekday visitors and those who participated in surveys in Yosemite Valley. Other factors that contribute to congestion include conflicts at intersections and pedestrian crossings; narrow, winding mountain roads; the lack of advanced traveler information, and confusing wayfinding.

Strategies

Strategies were identified through a comprehensive review of plans and studies, visitor surveys and data from the 1980 GMP through current initiatives. Strategies and issues were also compiled during technical fact finding meetings and a transportation roundtable conducted in September 2010 with agencies and other organizations involved in the planning and operation of the transportation system in Yosemite National Park and the surrounding region. An internal workshop was also conducted with park staff and managers in October 2010. In addition to contributing to the list of strategies, the meetings also laid the groundwork for continued coordination and cooperation between the park and the surrounding region in addressing shared transportation issues.

The transportation-related issues outlined in this report are made more complex by the National Park context in which they occur. Transportation solutions that might typically or more commonly be used to solve parking congestion, traffic circulation, safety and other transportation issues in an urban context may not be consistent with park management objectives. For these reasons, transportation improvement strategies developed for Yosemite National Park must not only be effective at addressing transportation-related issues, but must be consistent with park management objectives.

Given these challenges, it is not possible to address the park's transportation issues with one solution. Through development of the TISR over 100 ideas were identified that include roadway, parking, transit/shuttle, walk/bike and traveler information strategies for all areas of the park. The initial list of ideas was screened relative to potential benefits and challenges to identify the most effective and implementable strategies to address park transportation issues.

However, the TISR is not a transportation plan or a decision document. Rather, the TISR will be used as a resource for other planning and management activities in the park. Therefore, the strategies have been organized into the following broad themes described below to help park planners and managers sort through transportation options in the context of goals, alternatives and tradeoffs to be considered in other planning activities. A few strategy examples are provided for each theme.

- **Manage Access (Focus on People).** These strategies influence visitor and employee travel patterns relative to means of transportation (shuttle, regional transit, personal car, walking, bicycling, etc), travel time and/or location to reduce peak period traffic and parking congestion, improve visitor experience, and/or protect resources. These strategies focus on people and use information, service improvements and other approaches to encourage visitors and employees to make choices that help reduce driving and the related impacts.

Examples include:

- ***Provide real-time information for visitors and park staff.*** This strategy would provide information visitors can use to make informed decisions about where, when and how to travel to and within the park to avoid crowding, traffic congestion and parking shortages. Furthermore, a real-time information system can be used by park staff to proactively manage access consistent with visitor experience and resource protection goals; and to manage roadway incidents, shuttle operations and transit access. This strategy is a key-stone to managing visitor access consistent with visitor experience and resource protection goals because it integrates information about park conditions, visitors' travel decisions, and park management actions. The park is currently pursuing funding and implementation of several components of this strategy and should continue to actively upgrade its information technology capabilities.
- ***Manage day-use parking for recreational vehicles.*** This strategy would encourage day-use visitors arriving in recreational vehicles (RVs) to park in peripheral locations and use the shuttle system to visit attractions. Recreational vehicles require more room to maneuver and park; and this difficulty is compounded by drivers that lack experience operating large vehicles. As a result, RVs exacerbate congestion, cause potential safety issues, and occupy more space in parking lots than a typical personal car. Approximately 70 spaces would be required to accommodate day-use RV parking in Yosemite Valley, which in-turn would result in 90 additional parking spaces being made available for typical cars in locations where RVs currently park (primarily in the Day Use Lot and Yosemite Lodge).
- ***Develop an employee commute trip reduction program to reduce the use of single occupant vehicles for the commute to work.*** This strategy would reduce traffic and the need for parking by encouraging park staff to use carpools, transit, walking and bicycling for

travelling to and from work and telecommuting. A commute trip reduction (CTR) program could include rideshare/match services, guaranteed rides home, and financial incentives. This strategy would decrease the need for parking by 20-90 vehicles in Yosemite Valley. A CTR would effectively provide more parking spaces without any footprint and related resource impacts.

- **Optimize Mobility (Within Existing System):** These strategies improve the efficiency and/or safety of the existing transportation system (shuttles, regional transit, roadways, parking areas, multi-use paths, etc.) to serve visitor and employee travel needs without requiring a larger footprint or acquiring and operating new vehicles.

  Examples include:

  - ***Improve wayfinding information.*** Poor wayfinding contributes to traffic and parking congestion by increasing the amount of traffic re-circulating on park roads and disrupting traffic flow as drivers slow down or stop when they are lost. Specific suggestions to improve wayfinding include coordinating road and place names on the park brochure/map with roadway signs and renaming shuttles to better reflect their route and destination. Improvement to the brochure/map in particular, has the potential to reach almost 90% of visitors and could help reduce vehicle miles of travel caused by re-circulating traffic. The changes could be incorporated into the next update of the map/brochure and only minor changes to roadway signs should be necessary.
  - ***Allow two-way traffic on Southside Drive between Curry Village and El Capitan Crossover.*** This strategy would provide an alternate, and a potentially less congested route, for outbound valley traffic while also reducing delays and potential vehicle/pedestrian conflicts in Yosemite Village and at the Yosemite Lodge-Yosemite Falls Pedestrian crossing. The traffic circulation change has been implemented on both an experimental basis to test its viability, and has been used successfully during extended periods of construction on Northside Drive. This modified system is also used when needed in response to emergency conditions such as a rock fall that impacts Northside Drive. If implemented on a permanent basis, this traffic circulation change has a number of issues that must be carefully considered including potential design changes at intersections and access to pulloffs, roadside parking and other entrances along Southside Drive. Despite these challenges, this strategy has the potential to address one of the most severe traffic congestion and pedestrian access issues in the park.
  - ***Extend the Wawona-Mariposa Grove Shuttle to the Wawona Campground and Consider Increasing Shuttle Service Frequency.*** This strategy would extend the shuttle to the Wawona Campground located on Wawona Road approximately one mile north of the store. Extending the shuttle service would provide an alternate means of travelling to the store for campground visitors and may help free up parking spaces at Wawona. Extending the shuttle could also reduce the number of campground users that drive to and park at Mariposa Grove. Adding another bus to increase the frequency of the shuttle service should be considered as an option within this strategy. Increasing the frequency would encourage a higher parking turnover rate and could help further reduce parking demand and shortages at Wawona. This strategy has the potential to reduce, but would not eliminate, parking shortages at Wawona and Mariposa Grove.
- **Alter Transportation System Capacity:** These strategies decrease or increase the physical size and/or operating capacity of the transportation system. This theme includes strategies that would reduce the physical size and capacity of the transportation system to minimize visitor crowding and resource impacts such as: eliminating roadside parking, decreasing the size of parking lots or decreasing the frequency of shuttle service to crowded attractions. This theme also includes strategies that would address traffic congestion and parking shortages by increasing the size and footprint of roadways, parking lots or multi-use paths; or increasing the operating capacity of shuttle and transit service.

Examples include:

- ***Remove non-designated roadside parking in Tuolumne Meadows parking and replace it with consolidated lot parking (AC-1125).*** This strategy would alter transportation system capacity by eliminating unendorsed roadside parking and providing new parking spaces in a consolidated parking lot. Its purpose is to address parking shortages at Tuolumne Meadows while eliminating roadside parking. Based on data collected in 2006, nearly 450 vehicles were parked in unendorsed roadside parking areas and on the fringe of parking lots during the peak use period Consequently, parking shortages and associated unendorsed parking in Tuolumne Meadows are causing resource impacts, greater risks of pedestrian/motor vehicle crashes, degraded scenic vistas, and increased visitor frustration in this area of the park. This strategy could be implemented in conjunction with a parking management system for Tuolumne Meadows (strategy 1130), reducing overall day-use visitors to Tuolumne Meadows and/or significantly increasing the number of day-use visitors that arrive by shuttle, rather than personal vehicle may also be necessary (strategies 1035 and 1370); all of which will affect the number of parking spaces that need to be accommodated in the consolidated parking lot.
- ***Redesign roadside parking on Northside Drive along El Capitan Meadow (AC-1266).*** This strategy would change the capacity of the transportation system by redesigning roadside parking with an appropriate number of spaces while also minimizing impacts to El Capitan Meadow. The section of Northside Drive just west of El Capitan Crossover consists of two one-way westbound travel lanes and a paved roadside parking lane directly adjacent to El Capitan Meadow. The roadside parking extends for approximately 1,980 feet which can accommodate parking for about 80-100 typical cars (not including RVs). The roadside parking enables visitors to walk from their vehicles directly into El Capitan Meadow resulting in multiple social trails and related resource impacts. Data collected for the ITCA project indicate that the maximum number of cars in the roadside parking is 60 and 55 on the 1st and 7th busies days of 2010 respectively (including cars parked along El Capitan Crossover between the bridge and Northside Drive)[1]. These data suggest that the length of roadside parking could be reduced and a smaller parking facility could accommodate parking demand. Consolidating parking in one location would create an opportunity to develop a focused and appropriately designed trail that provides access to El Capitan Meadow while reducing resource impacts. The best location and configuration of the parking facility needs to be evaluated in a site planning process and should include barriers that prevent roadside parking where it is no longer necessary or desirable.
- ***Provide a park-and-ride lot at Mono County Visitor Center with Shuttle Service to Tuolumne Meadows.*** This strategy would decrease the number of vehicles entering through the Tioga Road Entrance to help alleviate the resource and visitor experience impacts of unendorsed parking. In addition, a park-and-ride facility at the Mono County Visitor Center could serve as a transfer point between the YARTS Hwy 120 route and ESTA's Hwy 395 service. Assuming the park-and-ride and shuttle attract 10-20% of the potential demand, this strategy would reduce parking in Tuolumne Meadows by 50 to 100 vehicles.

[1] Parking accumulation counts were collected in this area for the ITCA project on July 27 and July 28, 2007 and have been adjusted to reflect the 1st and 7th busiest days of 2010 based on the relationship of daily traffic volumes on Southside Drive at the Chapel in 2007 and 2010.

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1.0 INTRODUCTION

The Transportation Improvement Strategies Report (TISR) is a technical document that compiles a broad range of ideas about how to improve visitor transportation systems and services in and around Yosemite National Park. It is a technical resource that provides information and ideas that can inform other planning activities in the park and is not a decision document. The strategies are conceptual in nature and would, if pursued, require additional levels of planning, analysis and environmental compliance.

Strategies were identified by reviewing previous plans and studies, analyzing visitor surveys, and assessing the performance of the park's transportation system, the findings of which are synthesized in the following sections. Strategies and issues were also compiled during technical fact finding meetings and a transportation roundtable conducted in September 2010 with agencies and other organizations involved in the planning and operation of the transportation system in Yosemite National Park and the surrounding region. An internal workshop was also conducted with park staff in October 2010. In addition to contributing to the list of strategies, the meetings also laid the groundwork for continued coordination and cooperation between the park and the surrounding region in addressing shared transportation issues. This report was prepared by a consultant team in collaboration with National Park Service (NPS) planning staff. The park's leadership team was briefed as work on the TISR proceeded and provided direction at key points in the process.

Over one hundred preliminary strategy ideas are identified in all areas of the park to address undesirable impacts on resources and visitor experience due to traffic congestion, parking shortages, transit and shuttle operations, safety, bicycle and pedestrian access and other issues. The initial list of ideas was screened relative to potential benefits and challenges to identify the most effective and implementable strategies to address park transportation issues. However, the TISR is not a transportation plan. Rather, the TISR will be used as a resource for other planning activities in the park. Therefore, the strategies have been organized into the following broad themes to help park planners sort through transportation options in the context of goals, alternatives and tradeoffs to be considered in other planning activities: 1) manage access by influencing visitor and employee travel patterns; 2) optimize mobility by improving the efficiency and/or safety of the existing transportation system without requiring a larger footprint or acquiring and operating new vehicles; and 3) alter transportation system capacity to either reduce or increase its ability to move visitors and employees.

The TISR has three major sections. The background section describes the park and provides an overview of previous transportation planning efforts. The current conditions section describes the park's transportation system, visitation and the effect of transportation issues on resources and visitor experience quality. The final section of the report describes the characteristics and purpose of each strategy and provides a general assessment on effectiveness and potential challenges.

2.0 BACKGROUND INFORMATION

This section of the report provides an overview of Yosemite National Park and summarizes the major transportation planning efforts since completion of the General Management Plan in 1980.

2.1 Park Overview

Yosemite National park is located in California within the central Sierras and is approximately 50 miles north of Fresno (Figure 1). The park is known for its granite cliffs, waterfalls, clear streams, giant sequoia groves and biological diversity. Two Wild & Scenic Rivers, the Tuolumne and Merced rivers, begin in the park and flow west to the Central Valley. In 2010, the park attracted nearly 4 million recreational visitors.

The park is served by three major roadways. Hwy 41 connects Fresno and Oakhurst to the park through the South Entrance. Hwy 120 passes through the town of Groveland and enters the park at the Big Oak Flat Entrance. Highway 120 coincides with Big Oak Flat Road and then follows Tioga Road to the east as it travels through the park. Big Oak Flat Road continues southeasterly to Yosemite Valley. At the eastern boundary, Hwy 120 enters the park at the Tioga Pass Entrance and connects the park with the gateway community of Lee Vining. The segment of Tioga Road between the Tioga Pass entrance station and Crane Flat is closed from approximately November to late May due to snow. Another main access to the park is Hwy 140, approaching the western boundary from Mariposa through El Portal and entering at Arch Rock Entrance. There is also access to the park at Hetch Hetchy, but the Hetch Hetchy Road dead ends and does not connect with the rest of the park's road network.

There are five major attraction areas within the park, all of which are accessible by paved roads. These areas include Yosemite Valley, Glacier Point, Wawona/Mariposa Grove, Tuolumne Meadows, and Hetch Hetchy. The NPS also owns and operates an administrative site in El Portal.

2.1.1 Yosemite Valley

The seven-mile long, 1-mile wide Valley is the primary activity center of the park. The steep valley walls and floodplain restrict development and infrastructure. All roads coming into the park converge in the Valley and create a 12 mile loop on both sides of the Merced River from Pohono Bridge to Curry Village. A shuttle system has been implemented in the Valley and runs from the eastern end of the valley west to El Capitan Meadow. A wide range of visitor services are located along the shuttle bus route, including a visitor center, a general store for supplies, a medical clinic, wilderness center, dining facilities, and lodging (e.g., the Ahwahnee Hotel, Yosemite Lodge, and various campgrounds). According to a 2009 Visitor Study[1], the vast majority of visitors (70%) to the park spend at least some portion of their visit in the Valley.

2.1.2 Glacier Point

Glacier Point is a day use area at the south rim of Yosemite Valley. This site provides 360 degree views of the High Sierra as well as a bird's eye view of Yosemite Valley and nearby rock features such as El Capitan and Half Dome. Visitor services in this area include a parking area, bathrooms, a small store, and multiple trailheads. The primary park concessioner, Delaware North Parks and Resorts at Yosemite (DNC), offers a Glacier Point Tour which can be used for access between Yosemite Valley and Glacier Point. In the winter, Glacier Point road is closed to vehicular use beyond the Badger Pass Ski Area and the road is used for

[1] University of Idaho, *Yosemite National Park Visitor Study Summer 2009*, April 2010, page 42.

cross-country skiing and snowshoeing. There is a free shuttle that offers service twice daily between Yosemite Valley and the Badger Pass ski area from about mid-December to March. According to the 2009 Visitor Study, Glacier Point attracts 44% of the park's visitors.

2.1.3 Wawona

Wawona is a community in the southern part of the park on Wawona Road/Hwy 41 and is located near the Mariposa Grove of Giant Sequoias. One of California's oldest hotels—the Wawona Hotel—is also a popular attraction in the area. The community has approximately 800 residents, some full-time and others seasonal. There are also several in-holdings (privately owned parcels of land inside the park) located in the area. Community and visitor services include the Pioneer Yosemite History Center, a post office, school, general store, golf course, community hall, a public gas station (one of three public gas stations in the park), stables, fire station, and trailheads. According to the 2009 Visitor Study, Wawona attracts 33% of the park's visitors.

2.1.4 Tuolumne Meadows

Tuolumne Meadows is considered one of the largest subalpine meadows in the Sierra Nevada. This popular high country destination is located along Tioga Road/Hwy 120 in the northern part of the park. It is often considered 'the gateway to the Yosemite high-country' and is the activity center of this part of the park. The Tuolumne Wild and Scenic River passes through the area. Visitor services include camping, lodging, restaurant, general store, stables, visitor center, gas station and several trailheads. There are several NPS and concessioner housing units. Tuolumne Meadows has a free shuttle bus service that travels between the Tioga Pass Entrance Station and Olmsted Point, passing through Tuolumne Meadows along its route. In addition, the area can be accessed by private vehicle or transit bus from the eastern Sierra or Yosemite Valley. The DNC operates a Hikers' Bus that provides daily round-trip service for a fee from Yosemite Valley to Tuolumne Meadows. The Tioga Road is closed during winter due to snow; access is provided by cross-country skiing and snowshoeing only. According to the Summer 2009 Visitor Study, Tuolumne Meadows attracts 38% of the park's visitors.

2.1.5 Hetch Hetchy

Hetch Hetchy is a day-use area located in the northwest section of the park and is most noted for the Hetch Hetchy reservoir and the O'Shaughnessy Dam along the Tuolumne River. The reservoir and surrounding area are owned and operated by the City of San Francisco, but administrative duties are shared among the NPS and San Francisco Public Utilities Commission (SFPUC). NPS and City employees have offices and are housed in the area. Visitor services include a backpacker's campground, picnic area, and trailhead. As this is a day-use area, the gate is closed each evening. Hetch Hetchy provides an alternative visitor destination to overcrowded sites, particularly for backpackers, when the high country (via Tioga Road) is closed. During the spring and fall, the parking areas near the dam can become crowded. According to the 2009 Visitor Study, Hetch Hetchy attracts 6% of the park's visitors.

2.1.6 El Portal

El Portal is where most of the park's administrative offices and operations are located, and it is home to approximately 600 residents including NPS, park partner and school district employees. NPS employee housing, offices, and a wastewater treatment plant are located there. Community services include a post office, school, child care facility, general store, gas station, community hall, and fire station. Two hotels,

the Yosemite View (335 rooms) and Cedar Lodge (211 rooms) are located on non-federal land in El Portal. The YARTS bus makes several stops in El Portal en route between Merced and Yosemite Valley.

2.1.7 Gateway Communities

Several gateway communities neighbor the park including Mariposa along Hwy 140, Groveland on Hwy 120, Oakhurst on Hwy 41, and Lee Vining at the intersection of Hwy 120 and Hwy 395 (Table 1).

Table 1: Distances between Gateway Communities and Yosemite

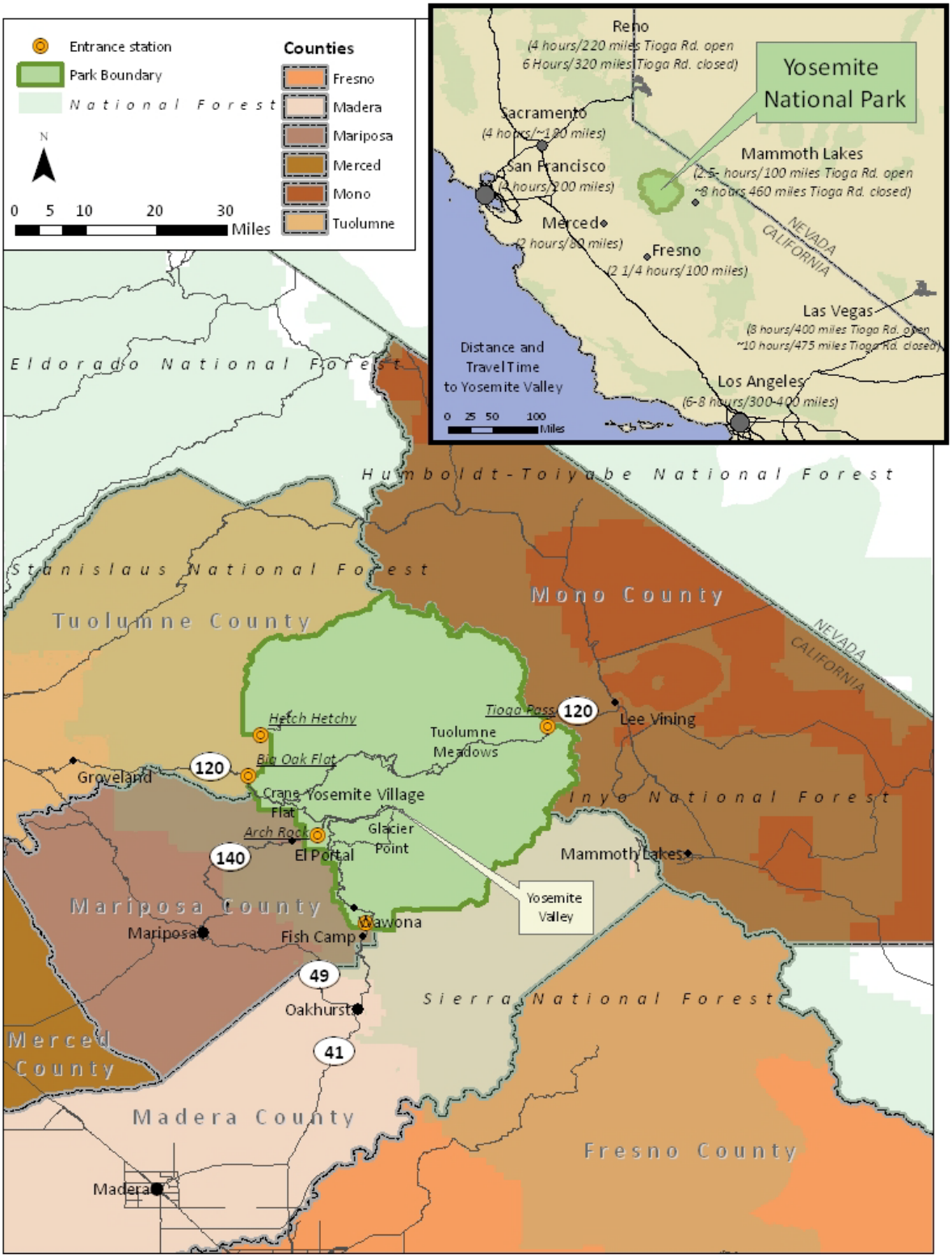
Gateway Community	Nearest Park Entrance		Distance between Gateway Community and Yosemite Valley *(miles)*
	Name	*Distance (miles)*	
Mariposa	El Portal	33	45
Oakhurst	South Entrance	16	47
Groveland	Big Oak Flat	26	50
Lee Vining	Tioga Pass	13	75

2.1.8 Regional Transportation Hubs

Regional transportation centers include:

1. Merced and Fresno, both with international airports located approximately 2 hours from Yosemite. Yosemite Area Regional Transportation System (YARTS) service originates in Merced and also connects with the Merced Airport and Amtrak there. Smaller public airports are also located in Mariposa, Modesto and near Groveland and Sonora.
2. The Bay Area (San Francisco, Oakland, and San Jose), is approximately 4 hours from Yosemite. All three cities have major international airports.
3. Sacramento is 4 hours from Yosemite and has a major international airport as well.
4. The community of Mammoth Lakes is located to the southeast of the park along Hwy 395 and is approximately 2.5 hours from Yosemite Valley. It has a tourism-based economy and a general aviation airport that also has two commercial airlines. Trails provide access for backpacking and stock trips into the Yosemite Wilderness via the Inyo National Forest. During summer months, YARTS service originates in Mammoth and continues to Yosemite Valley.
5. Reno is 4 hours from Yosemite in the summer when travelers can use Tioga Road. When Tioga Road is closed, the drive time is 6 hours. Transit service between Reno and Lee Vining and between Lee Vining and Yosemite Valley is available.

Figure 1: Regional context of Yosemite National Park



2.2 Transportation Planning in Yosemite

The 1980 General Management Plan (GMP) established guiding goals and policies for the management of the park. Key aspects of the GMP and other major planning efforts are summarized below.

The GMP serves as the foundational document for park policy and management. It identifies the purpose of the park as: 1) to preserve the resources that contribute to Yosemite's uniqueness and attractiveness; and 2) to make the varied resources of Yosemite available to people for the individual enjoyment, education, and recreation, now and in the future. The GMP also establishes five broad goals: 1) reclaim priceless natural beauty; 2) markedly reduce traffic congestion; 3) allow natural processes to prevail; 4) reduce crowding; and 5) promote visitor understanding and enjoyment. In addition to overall park policy, the GMP also identifies specific actions related to the transportation system considered further in subsequent planning studies.

The park has conducted numerous transportation studies, data collection efforts and visitor surveys in the intervening years since the GMP was completed. The transportation data and visitor surveys, referenced in this report, typically cover the entire park; while most of the transportation plans focus on one means of transportation such as transit/shuttles or walking/bicycling and are limited to a specific area of the park.

More recently, the park has initiated several transportation and user capacity studies that together comprise what is referred to as the Integrated Transportation and Capacity Assessment (ITCA) project. Key components of the ITCA project are:

- *Visitor Use Computer Simulation Modeling to Address Transportation Planning and User Capacity Management in Yosemite Valley, Yosemite National Park (2008 to present).* The study is identifying visitor-based standards of quality for crowding at popular attraction areas in Yosemite Valley and throughout the park and developing a relationship between the standards of quality and inbound traffic volumes at entrance stations.
- *Visitors' Perspectives toward Transportation Issues in Yosemite National Park* (2008). The results provide useful information on visitor means of transportation and analyzed their indicated level of importance against satisfaction of transportation modes.
- *Traffic and Quality of Visitors' Travel Experience Modeling (2006 to present)* The purpose of this project is to develop tools to address traffic congestion and provide quality visitor experiences. The four major project tasks consist of 1) transportation data collection; 2) visitor surveys to assess how visitors value the transportation system; 3) visitor surveys to identify potentially meaningful indicators to describe the quality of visitors' travel experience; and 4) visitor surveys to measure visitor-based standards for the indicators developed in task 3.

The ITCA project provides analytical tools that may be used in other planning work to aid in evaluating the transportation and user capacity issues of the conceptual strategies presented in the TISR.

The TISR is intended to be a resource from which future park planning efforts may draw ideas to improve transportation issues. For example, several strategies listed in this report may be pertinent to the Merced River Plan.

3.0 CURRENT SITUATION

This section of the report provides a general description of the major components of the existing transportation system and documents the critical transportation issues facing the park.

3.1 Overview of Existing Transportation System

The park's transportation system includes entrance stations, roadways, parking facilities, transit and shuttle service, commercial tour operators, bicycle and pedestrian facilities, and visitor/travel information systems.

There are five entrance stations that control access into the park: South Entrance on Wawona Road/Hwy 41, Arch Rock Entrance on El Portal Road/Hwy 140, Big Oak Flat Entrance on Big Oak Flat Road/Hwy 120, Hetch Hetchy Entrance on Hetch Hetchy Road, and the Tioga Entrance on Tioga Road/Hwy 120 on the eastern side of the park (Figure 2). During the summer season peak hour, Big Oak Flat and the South Entrance are the two busiest entrance stations and each serves about one third of the traffic entering the park. The Arch Rock and Tioga Pass entrances serve 18% and 15% of entering traffic respectively.

The park's roadways are the backbone of its overall transportation system. In addition to providing circulation and access to and within the park for personal vehicles, the roadways make transit and shuttle service possible, provide pull-offs with direct access to trails, scenic views and other attractions; and are used by pedestrians and cyclists. Outside of Yosemite Valley, the typical road includes one travel lane in each direction and narrow shoulders. Within Yosemite Valley, Southside Drive and Northside Drive form a one-way loop that is connected by crossings of the Merced River at the Pohono Bridge, El Capitan Crossover, Sentinel Bridge, and Stoneman Bridge (Figure 3). The one-way sections of Northside Drive and Southside Drive have two travel lanes; all other roads in the Valley provide one travel lane per direction. Between Memorial Day and Labor Day, average daily traffic volumes range between 2,600 and 4,000 vehicles per day outside of Yosemite Valley; and between 4,500 and nearly 6,000 vehicles per day within the Valley (Table 2). On the busiest days, traffic volumes increase by approximately 30%, and cause significant congestion, particularly at entrances and intersections.

There are several special purpose roads in the Valley which serve a mix of pedestrians, cyclists, shuttles, vehicles with a wheelchair emblem, and administrative vehicles. Examples include the Happy Isles Loop, the road to Mirror Lake, and a dedicated shuttle road at Yosemite Village. Northside Drive between Curry Village and the Day-Use Parking lot also has one lane dedicated for use by shuttles and emergency vehicles. With the exception of those on the floor of Yosemite Valley, the park's roads follow mountainous terrain and are steep and winding. While these characteristics are desirable especially in the context of a National Park, the grades and curves combined with narrow shoulders create challenges for managing traffic during incidents (bear jams, automobile crashes, or storms/inclement weather for example), and may be difficult to negotiate for inexperienced drivers (especially of RVs), and are not suitable for inexperienced cyclists.

Figure 2: Yosemite National Park Roadways and Entrances

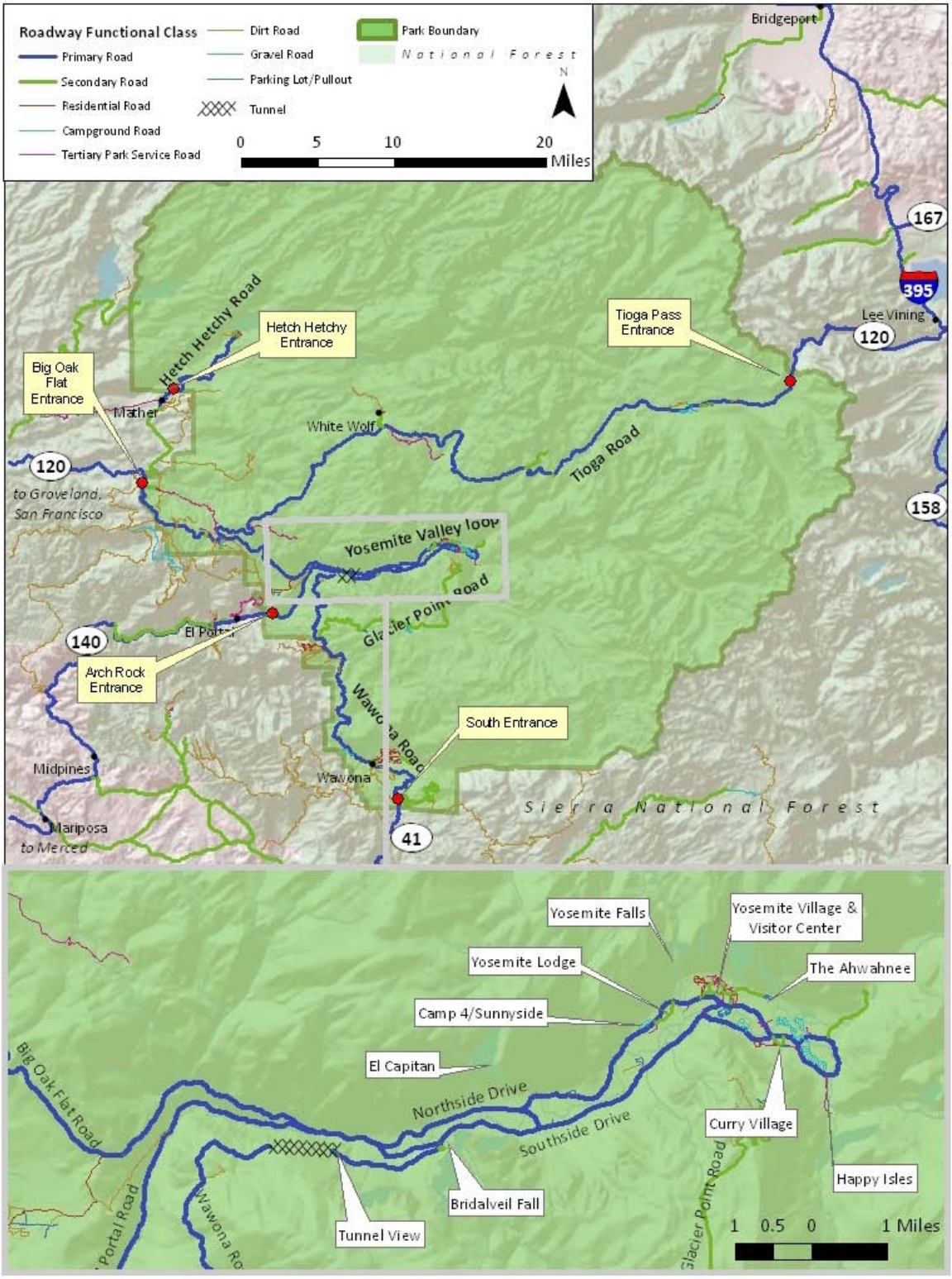


Figure 3: Circulation Pattern on Yosemite Valley Roads

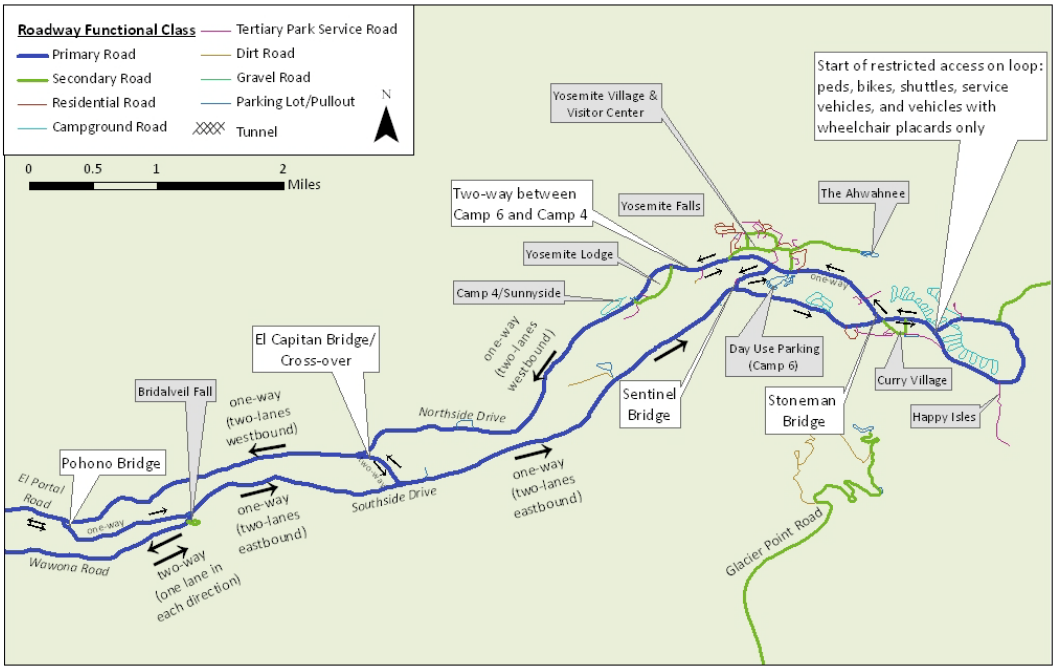


Table 2: Typical Park Roadway Characteristics and Traffic Volumes

Road	Number of Travel Lanes	Travel Lane Widths (feet)	Typical Shoulder Widths (feet)	Posted Speed Limit (mph)	2010 Summer Season Daily Traffic Volumes	
					50th Highest	*7th Highest*
Tioga Road	2	10-11'	0-2'	25-45	3,100	3,960
Hetch Hetchy Road	2	10'	0'	25	270	300
Big Oak Flat Road Entrance to Tioga Rd.	2	11-12'	1-2'	25-40	4,280	4,630
Big Oak Flat Road Tioga Road to El Portal Rd.	2	11-12'	1-2'	35	4,980	5,390
El Portal Road	2	11-12'	½-2'	35	3,790	4,110
Northside Drive at Camp 4	2 (one-way)	11-12'	½-2'	35	5,640	6,700
Southside Drive at Chapel	2 (one-way)	11-12'	½-2'	35	5,700	6,810
Wawona Road west of Southside Drive	2	11-12'	1-2'	35	4,530	4,900
Glacier Point Road at Badger Pass	2	11-12'	1-2'	35	2,630	2,840

Parking is provided for overnight visitors, day-use visitors, employees, and residents. Parking for overnight visitors is generally provided in lots adjacent to lodging or wilderness trailheads and within drive-in camp sites. Some lots are formalized and well-delineated being paved and striped while others are more informal and not well delineated having gravel/dirt surfaces. Because of their informal nature, it is difficult to determine the capacity of these gravel/dirt parking areas as it will vary according to the size and compositions of vehicles parking in these areas and according to parking behaviors.

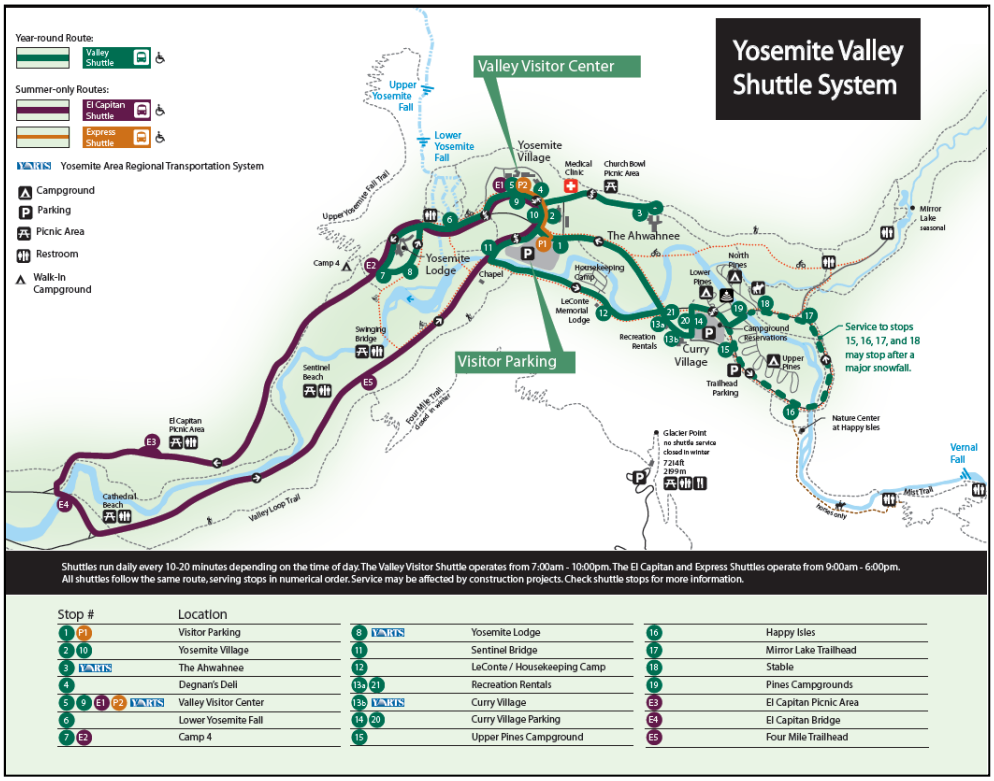
Day-use visitors park in lots and along roadsides. Like the overnight parking areas, day use areas are formal and non-formal in nature. The largest day-visitor lots in Yosemite Valley include the Day-Use Parking Lot adjacent to Yosemite Village (often referred to as Camp 6), Curry Village and the Village Store. Day-use lots are also available in Tuolumne Meadows, Glacier Point, Badger Pass, Wawona, Mariposa Grove, and Hetch Hetchy. The number of available parking spaces fluctuates based on whether or not rangers direct visitor parking, the types and sizes of visitor vehicles (RVs, cars, or motorcycles), configuration of the lot, or other site constraints. Some roadside locations have a paved parking lane or

wide shoulder and can accommodate parked vehicles safely without impacting resources. However, there are many "unendorsed" or non-formal roadside parking locations that create a negative impact on resources and/or unsafe conditions. Currently, the park relies on roadside parking for day-use visitor parking, despite the associated impacts. As discussed in greater detail below, even when considering roadside parking, all areas of the park experience significant parking space shortages during the peak visitor use season.

The largest single employee parking lot is located in El Portal at the administrative/maintenance complex. Other parking for NPS and concessioner employees is dispersed in lots and at residential areas throughout the park. Residents living in park housing, typically park adjacent to their house or in other designated employee parking areas. There is a shortage of parking spaces designated for residential parking at some locations (particularly concessioner group housing such as Huff House, Tecoya dormitory complex, Lost Arrow and Highland Court).

Yosemite National Park is served by multiple transit services including the Yosemite Valley shuttle system[1], concessioner operated tour/hiker buses, and the Yosemite Area Regional Transit System (YARTS). The Yosemite Valley Shuttle system serves over 2.6 million visitor trips per year, is free and provides three high-frequency routes on the Valley floor that connect the Yosemite Village/Visitor Center, Curry Village, the Day-Use Parking Lot, and Happy Isles Loop road in the east and El Capitan Crossover in mid-Valley (Figure 4).

Figure 4: Yosemite Valley Shuttle Route[2]



[1] The concessions management program uses the term "Visitor Transportation System" (VTS) in reference to the shuttle service operated by DNC under the concession contract. The term "shuttle" is used in this report to distinguish it from the regional transit and tour bus services.

[2] Map by NPS

During the summer season, the Yosemite Valley shuttle system serves approximately 26,000 riders per day. On a per mile basis, this level of use exceeds the ridership of transit systems in large western cities and is similar to the use encountered on San Francisco's transit system (Table 3). During several trips to the park in the summer and fall of 2010 and in April 2011, crowding was observed on shuttles from mid-morning to late afternoon and was characterized by standing room only conditions and passengers left behind. Shuttle drivers had difficulty directing passengers to use the proper entry and exit doors and were clearly frustrated. These urban-like, crowded conditions are contrary to a park setting and arguably have a negative effect on visitor experience quality.

Table 3: Comparison of Yosemite Valley Shuttle and Urban Transit System Ridership

City	Route Length	Daily Ridership	Riders Per Mile
Sacramento	37	58,000	1,568
Denver	35	66,000	1,886
Salt Lake City	20	45,000	2,250
San Diego (Light Rail)	54	123,000	2,278
Seattle	17	46,000	2,706
Portland	48	130,000	2,708
Los Angeles (Blue, Green and Gold)	55	153,000	2,782
Yosemite Valley	**6.5**	**26,000**	**4,000**
San Fransisco (Muni)	42	169,000	4,024

Source: "Transportation and Merced River Corridor, Existing Transportation Conditions in Yosemite Valley", DEA PowerPoint Presentation, Merced River Corridor Plan Transportation Workshop, April 26, 2011

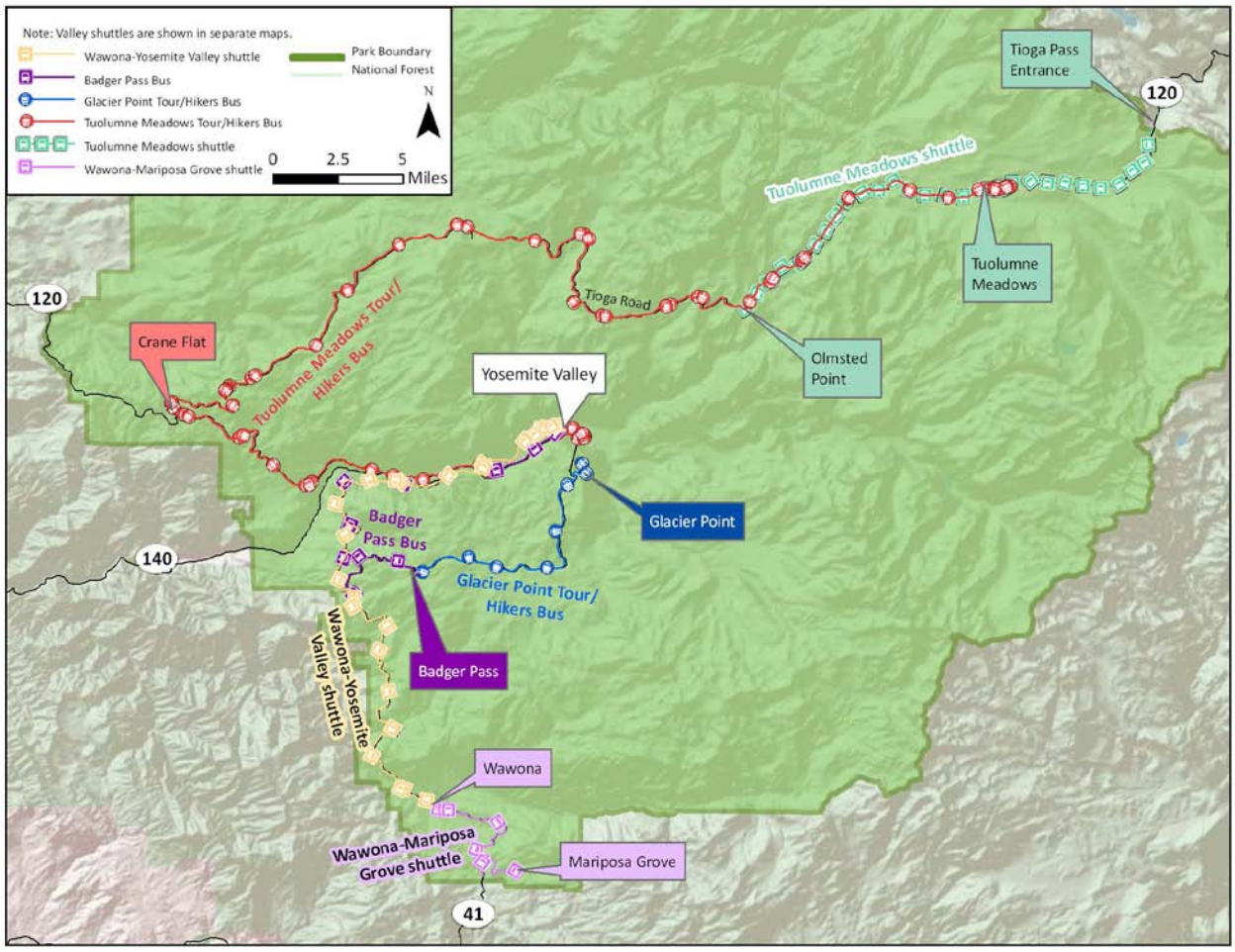
Shuttle buses are stored and maintained in a facility located in Yosemite Village on Village Drive (Figure 5). A challenge common to all strategies that suggest increasing shuttle frequency on existing routes to reduce crowding or expand the geographic extent of service is the limited amount of space available to maintain and park more shuttle buses (and commercial tour buses) when not in use. The shuttle maintenance facility has limited capacity to accommodate a significant increase in the number of buses it stores and maintains and is located in a prime spot in Yosemite Village that may be better suited to other uses.

Figure 5: Shuttle Storage and Maintenance Facility on Village Drive in Yosemite Village

Transit service also includes a Tuolumne Shuttle that serves attractions along Tioga Road, provides one free roundtrip per day between Yosemite Valley and Wawona, and the Wawona-Mariposa Grove shuttle that runs throughout the day (late spring through fall). Concessioner operated tour/hiker buses are available for a fee between Yosemite Valley and Glacier Point. Shuttle service decreases in the winter months although a free shuttle is provided between Yosemite Valley and Badger Pass (Figure 6).

YARTS provides service along the Hwy 140 corridor from Merced to Yosemite Valley throughout the year; and along Hwy 120/Tioga Road/US 395 from Yosemite Valley to Mammoth Lakes during the summer. Passengers may transfer between YARTS and Eastern Sierra Transit Authority (ESTA) services along the US 395 corridor, but due to scheduling differences, long layovers are required. YARTS also serves the surrounding region, as does ESTA. For greater distances, Amtrak, Greyhound and airlines provide access to the larger towns/cities near the park and beyond.

Figure 6: In-Park Shuttle Routes



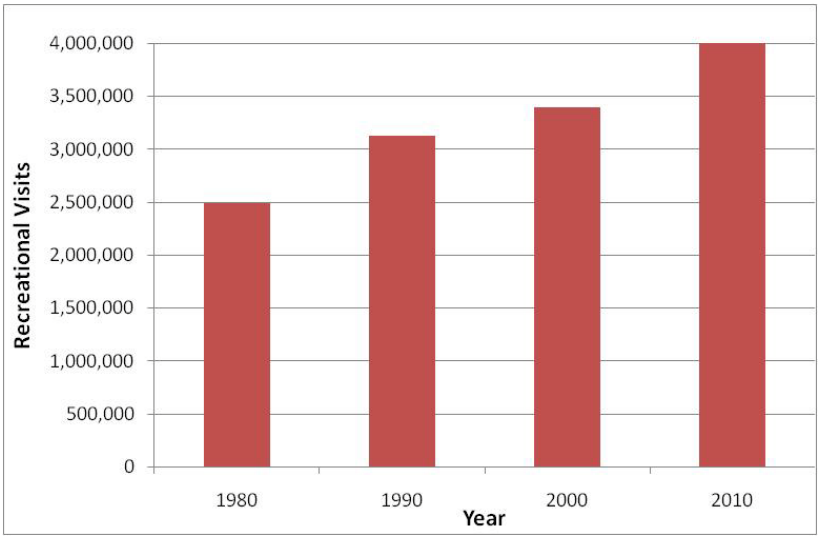
Most bicycling within the park occurs in the Valley because it experiences the largest number of visitors, has a multi-use path network, and bikes are available for rent at Curry Village and Yosemite Lodge. Bicycling outside of the Valley occurs, but is limited to experienced cyclists that are comfortable riding on roads with narrow lanes and shoulders and traffic. The multi-use path in the Valley provides access to the major lodging and camping facilities there and extends as far west as the Swinging Bridge and Yosemite Lodge. The path system currently connects most of the campgrounds and comes close to but does not actually connect to Camp 4. Other than the multi-use path network in the Valley there are no extensive sidewalk systems in the park.

Traveler information is currently provided in the park brochure/map, the Yosemite Guide, the park's website and on park partners' websites. Visitors also gather information while using the shuttle system. Advanced traveler information on approach and in the park is currently limited to that which can be found on the park's website and from a call-in number with a recorded message that is updated daily with reports on weather, road closures, and potential delays related to construction projects and other activities. The park is currently upgrading its communication infrastructure and has several initiatives underway that will expand its ability to provide real-time traveler information, and manage traffic congestion, parking shortages and crowding consistent with visitor experience and resource protection goals. Additional information on these initiatives is provided under the strategies section of the report (Section 4.0).

3.2 Park Visitation, Transportation Issues, and Effect on Park Resources and Visitor Experience Quality

Annual recreational visits to Yosemite National Park have increased by over 60% since 1980, the year that the park's General Management Plan was completed. More specifically, the number of recreational visits increased from approximately 2.5 million in 1980 to over 4 million in 2010[1] (Figure 7). Within this 30-year period, annual park visitation did decline modestly between 1996 and 2004; however, it remained near or above 3.5 million visitors during those years. Since 2004, park visitation has increased, and has done so at a more rapid rate (3.6% average annual growth) than during the period between 1980 and 1996 (3.1% average annual growth).

Figure 7: Yosemite National Park Visitation Trend, 1980-2010



Presently, the 4 million visitors accommodated in the park during 2010 ranks Yosemite as the third most heavily visited national park in the National Park System. The challenges associated with intensive levels of visitation to the park are exacerbated by the fact that much of the park's visitor use is concentrated between Memorial Day and Labor Day weekends, with 31 percent of all park visits occurring during the months of July and August. Moreover, visitation during summer months has increased more rapidly than during other seasons, with the largest increase in visitation between 1979 and 2009 having occurred during the peak month of August.

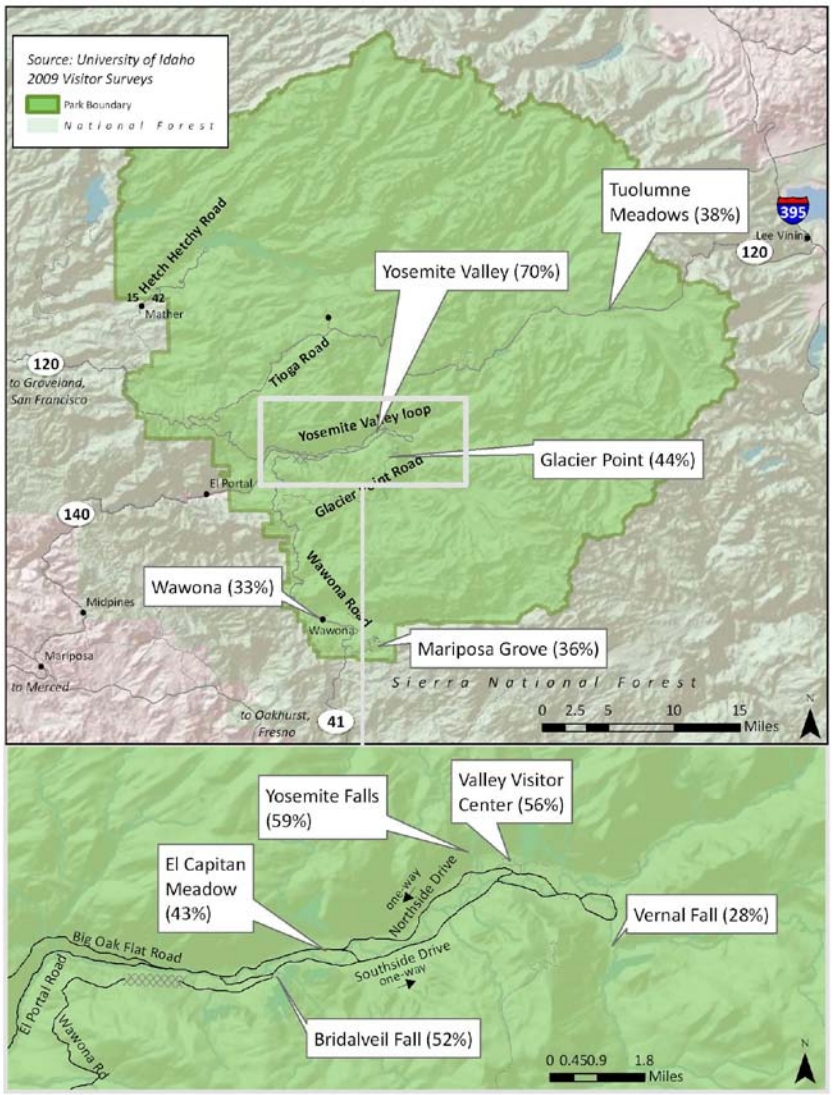
Transportation-related impacts associated with this intensive visitation in Yosemite National Park are periodically significant, and include traffic congestion at park entrances and on park roads; parking shortages and associated visitor frustration and resource impacts from unendorsed parking; increased risk of pedestrian or bicycle and motor vehicle crashes; deterioration of transportation infrastructure not originally designed to accommodate current traffic volumes; and air quality and global climate impacts associated with vehicle emissions.

[1] Yosemite National Park Website reported 4,047,880 visitors in 2010 http://www.nps.gov/yose/parkmgmt/statistics.htm .

3.2.1 Parking and Traffic Congestion - Yosemite Valley

Visitor use in Yosemite National Park is concentrated not only during the summer months, but in the relatively confined area of Yosemite Valley. The mile-wide, seven-mile long Yosemite Valley comprises merely four percent of the park's total area, yet the vast majority of park visitor use occurs in the valley (Figure 8). Consequently, transportation-related issues and associated impacts to park resources and visitor experience quality are particularly pronounced in Yosemite Valley throughout the summer season. In visitor surveys conducted during the summers of 1998 and 1999, respondents reported traffic congestion and difficulty finding parking as the most significant management issues in Yosemite Valley (Manning et al., 1998, 1999 According to the 2005 Yosemite National Park Visitor Study, 58% of visitor groups reported feeling very (19%) or somewhat crowded by vehicles. The most common locations where these visitors felt crowded were parking areas, Yosemite Valley and driving around. It is reasonable to assume that parking and traffic issues are even more pronounced now, given that visitation was even greater in 2009 and 2010 than in 1998, 1999 and 2005(NPS Public Use Statistics Office).

Figure 8: Proportion of Park Visitors who Visit Yosemite Valley Destinations



Transportation-related data collected as part of Yosemite National Park's Integrated Transportation and Capacity Assessment (ITCA) project provide evidence that is consistent with visitors' perceptions that parking shortages are among the park's most pronounced management issues. In particular, the number of vehicles in east Yosemite Valley on the busiest day in 2010 exceeded the estimated parking supply in that area of the park by approximately 1,350 vehicles (Figure 9 and Table 4). On the 7th busiest day of 2010, the number of vehicles in east Yosemite Valley exceeded the estimated parking supply by about 760 vehicles. This analysis takes into account the park's current practice of guiding visitors to parking spaces to maximize use of available lots and roadside parking areas (referred to as attended parking). This estimate includes roadside parking in approximately 130 paved and 470 informal/gravel roadside spaces. If parking had not been allowed in the informal/gravel roadside spaces, the shortages would have been an estimated 1,800 and 1,200 spaces on the 1st and 7th busiest days in 2010 respectively.

Attended parking maximizes the use of available parking. If the park relied solely on self directed parking by visitors, the shortages in east Yosemite Valley for 2010 would be an estimated 1,690 and 1,090 spaces on the 1st and 7th busiest days respectively. Similar to the discussion above, if parking had not been allowed in the informal/gravel roadside spaces and all visitors' parking was self directed, the shortages would have been an estimated 1,900 and 1,300 spaces on the 1st and 7th busiest days in 2010 respectively. For more than half of the summer, peak parking demand exceeded the number of self directed parking spaces by more than 560 spaces; or 800 spaces if parking in informal/gravel roadside locations had not been allowed.

Figure 9: Vehicle Accumulation and Parking Supply in East Yosemite Valley, 1st, 7th, and 50th busiest days of 2010

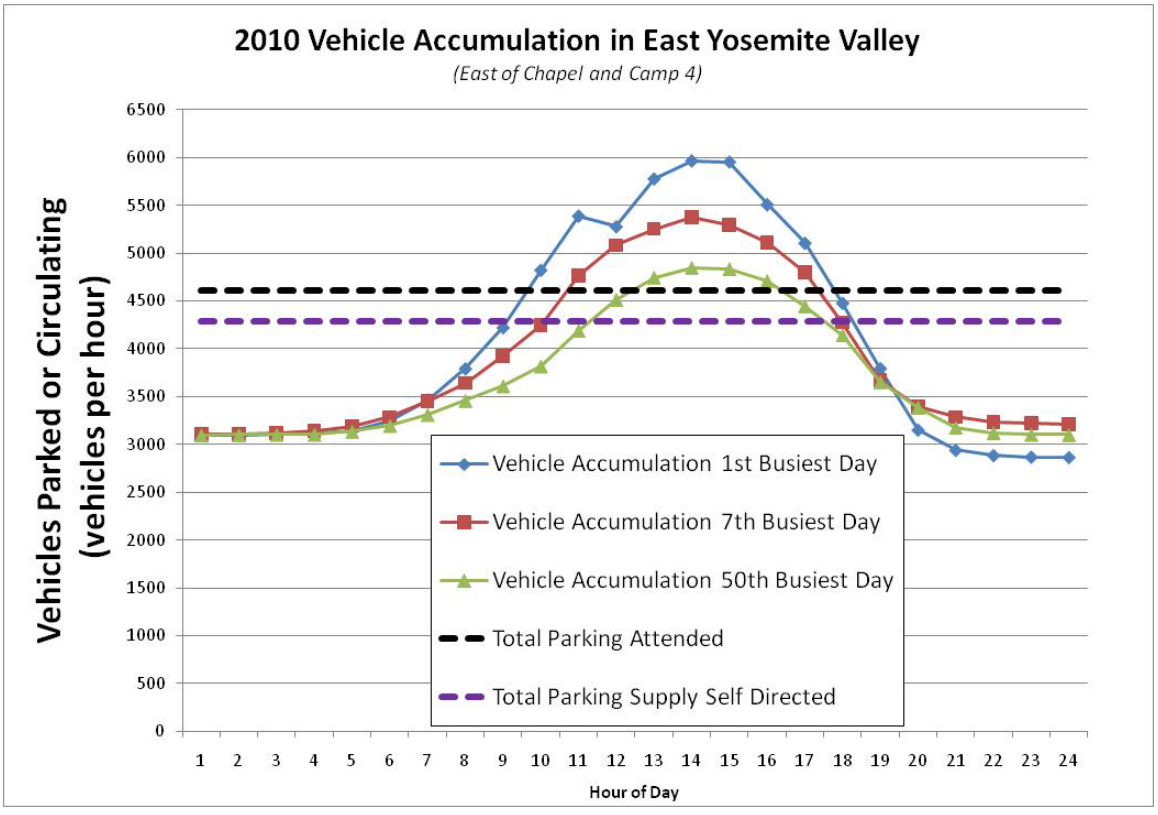


Table 4: Parking Shortage Estimates for East Yosemite Valley, Summer 2010

Scenario: With Attended Parking	**1st Busiest Day**	**7th Busiest Day**	**50th Busiest Day**
Peak Vehicle Accumulation	5,968	5,373	4,849
Total Attended Parking Supply	4,614	4,614	4,614
Parking Shortage w/ Informal Roadside Parking	1,354	759	235
Parking Supply w/out Informal Roadside Parking	4,146	4,146	4,146
Parking Shortage w/out Informal Roadside Parking	1,822	1,227	703

Scenario: With Self Directed Parking	**1st Busiest Day**	**7th Busiest Day**	**50th Busiest Day**
Peak Vehicle Accumulation	5,968	5,373	4,849
Parking Self Directed Parking Supply	4,283	4,283	4,283
Parking Shortage	1,685	1,090	566
Parking Supply w/out Informal Roadside Parking	4,046	4,046	4,046
Parking Shortage w/out Informal Roadside Parking	1,922	1,327	803

Moreover, the number of days that experience busy conditions has increased significantly over the last ten years. As part of the ITCA project, benchmarks for identifying the numbers of days that Yosemite Valley experiences busy, busier and busiest conditions were identified for comparison purposes as the 50th, 7th and 1st busiest days of 2007 respectively. These benchmarks were established based on the traffic entering the East Valley by the Chapel during the 2007 peak summer season. In 2010, there were 48 days when the number of vehicles in East Yosemite Valley exceeded the "2007 busier" condition benchmark (Table 5).

Table 5: Number of Busy, Busier and Busiest Days 2000 through 2010

Condition	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007** (Benchmark Year)	**2008**	**2010**
Less than Busy	60	58	54	42	47	16	64	51	47	14
Busy (50th Busiest in 2007)	33	37	36	50	46	61	29	43	50	40
Busier (7th Busiest in 2007)	8	5	10	8	7	17	8	6	4	47
Busiest (1st Busiest in 2007)	0	1	1	1	1	7	0	1	0	1
Total Days Memorial Day to Labor Day	101	101	101	101	101	101	101	101	101	102

1. Based on eastbound traffic entering the east Valley on Southside Drive by the Chapel

While transportation-related issues, in general, and parking shortages, in particular, are problematic in Yosemite Valley throughout the summer, they are particularly pronounced during summer weekends. Park staff have noted, and the data in Table 5 suggest, that there were at least forty days in 2010 during the peak summer season (including the vast majority of summer weekend days), when roadway traffic congestion, parking shortages, and unendorsed overflow parking were particularly intensive. For example, on the busiest days during the peak season, endorsed parking capacity is exceeded in the valley and visitors are directed to park their cars, among other places, on the Sentinel Drive bike path. Further, delays on Northside Drive between Sentinel Drive and Camp 4 increased by as much as 300% and the intersection of Northside Drive with the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing operates at Level of Service F (i.e., a "failing grade" on the primary traffic engineering measure of intersection performance).

Since 1999 to help manage traffic and parking congestion, Yosemite National Park employs a traffic management response team. The team's primary responsibility is for Yosemite Valley traffic, but currently they respond to traffic situations and congestion throughout the park as needed. The traffic management response team helps relieve traffic congestion in Yosemite Valley by providing visitor information, directing vehicles to parking locations, managing intersection vehicle and pedestrian traffic, and implementing the "shunt." The shunt temporarily detours day visitors from entering the east end of Yosemite Valley when parking is full and the two main intersections, one at the Yosemite Village day-use parking area use (informally referred to as Camp 6) and the other at Lower Yosemite Falls, are backed up. The following outlines the team's daily routine duties during the summer months:

- Guide visitors to parking spaces within the Day Use Parking Lot.
- After the Day Use Parking Lot is full, assist visitors to find parking by directing them to other formal and informal parking areas throughout Yosemite Valley (the Day Use Parking Lot fills daily by approximately 11:00 AM).
- Direct and manage traffic and pedestrians at the Day Use Parking Lot and Lower Yosemite Falls Intersections (at the Day Use Parking Lot Intersection, this typically is needed as the Day Use Parking Lot gets full and at the Lower Yosemite Falls Intersection, this is typically needed as visitors start to exit Yosemite Valley). Intersection management usually occurs between noon and 6:00 PM.
- Once the Day Use Parking Lot and surrounding roadside and parking lots are full, and during the time that both the Day Use Parking Lot and Yosemite Falls Intersections are managed but still backing up, the team will send staff to the El Capitan Crossover in the middle of Yosemite Valley to count inbound vehicles (usually between noon and 1:00 PM).
- If inbound traffic exceeds 50 vehicles per minute when parking is full and the two intersections are backing up, the team will deploy the "shunt" and detour vehicles across El Capitan Crossover instead of allowing them to proceed into the east end of Yosemite Valley.
- During the "shunt", drivers (day use visitors) are given cards so they can be allowed into the east end of Yosemite Valley after they have circled once around El Capitan Crossover, Northside Drive, Pohono Bridge, and back to Southside Drive. Overnight visitors with reservations and special event traffic such as weddings are allowed through without being diverted by the shunt.

Thus, the park is employing intensive traffic and parking management techniques during the summer season in Yosemite Valley. However, the actions of the traffic management response team are not enough, by themselves, to address the pronounced parking congestion and shortages documented in Figure 9 and related traffic congestion issues. Further, the traffic and parking management program in Yosemite Valley is reactive, in that it is carried out in reaction to whatever number of vehicles enter the valley and is ultimately unable to prevent intensively congested conditions during the summer season.

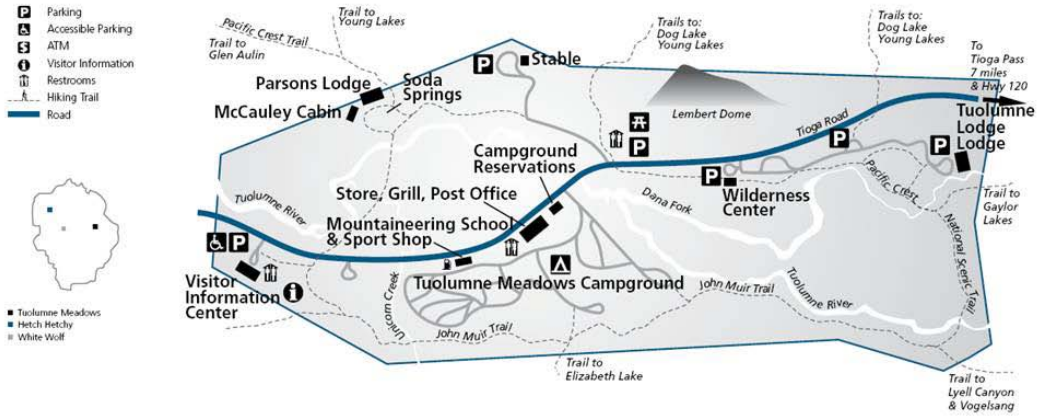
The park's reactive approach noted to managing peak season visitation and vehicle traffic into Yosemite Valley results not only in significant parking and traffic congestion, but also in levels of visitor use that overwhelm trails and attraction areas (e.g., the base of Yosemite Falls). Results of visitor surveys conducted during the summers of 1998 and 1999 identified crowding on trails and at attractions as the factor that detracted most from the quality of visitors' experiences in Yosemite Valley. More recently, a visitor use study conducted in 2007 found that the majority of the time there are more people at Lower Yosemite Falls than visitors prefer and more people at Bridalveil Fall than visitors think the National Park Service should allow. While the 2007 study results suggest crowding is less pronounced on the trail to Vernal Fall, about one-quarter of the time during typical summer days there are more people on the trail than visitors prefer.

3.2.2 Parking and Traffic Congestion – Park-wide

3.2.2.1 Tuolumne Meadows

Transportation-related issues associated with intensive park visitation are not limited to Yosemite Valley, but rather manifest throughout the park. For example, in Tuolumne Meadows there are roughly 533 day use and overnight parking spaces in designated parking lots. A study conducted in August 2006 showed an additional 453 vehicles on the ground in unendorsed roadside parking areas and on the fringe of parking lots during the peak use period (Figure 10). Some designated parking areas are paved and striped while others have a gravel/dirt surface and therefore do not have a fixed number of spaces. The number of available parking spaces fluctuates based on how efficiently visitors park and the types and sizes of their vehicles (RVs, cars, or motorcycles).

Figure 10: Map of Tuolumne Meadows



A parking study conducted in Tuolumne Meadows during August 2006 found that almost all of the parking lots observed were completely full or over capacity at sometime during the days on which the study was conducted. Further, during the weekend peak hour, the off-road parking lots included in the study in Tuolumne Meadows were occupied beyond their capacity and vehicles were parked in unendorsed roadside locations and surrounding the edges of existing lots. Consequently, parking shortages and associated unendorsed parking in Tuolumne Meadows are causing resource impacts, greater risks of pedestrian/motor vehicle conflicts, impacted scenic vistas, and increased visitor and employee frustration in this area of the park. Furthermore, because the designated parking lots are already over capacity during peak periods, unendorsed roadside parking cannot be eliminated without increasing the number of parking spaces in designated parking lots, reducing the amount of overall day-use visitors to Tuolumne Meadows, and/or significantly increasing the number of day-use visitors that arrive by shuttle, rather than personal vehicle. Additionally, parking use can be very transient due to the use of the Tioga Road as a major trans-Sierra highway. Approximately 69% of all day-use vehicles in Tuolumne Meadows park for 1 hour or less (DEA 2006).

3.2.2.2 Mariposa Grove and Wawona

As in other areas of Yosemite National Park, parking congestion at Mariposa Grove is pronounced during the peak season. Throughout the summer months, the primary parking lot that is directly adjacent to

Figure 11: Map of Mariposa Grove

Mariposa Grove generally fills to capacity by early to mid-morning (Figure 11). When this "upper lot" is full, a gate is closed on the Mariposa Grove Road near the South Entrance and visitors are directed to park in the "lower lot".

From the lower lot, visitors must walk in the roadway travel lane (because there is no shoulder) or take a shuttle bus approximately two miles uphill to reach the upper parking lot and start of the trails into Mariposa Grove. During the peak season, the lower lot generally fills to capacity by late morning, at which point visitors are directed to drive 5 miles north to Wawona, park in Wawona, and take a shuttle bus back south along the same 5-mile route to Mariposa Grove.

While parking management at Mariposa Grove helps to minimize unendorsed parking and traffic circulation issues in the upper and lower lots, directing Mariposa Grove visitors to park in Wawona during the peak hours of peak season days exacerbates parking congestion, poor traffic circulation, and pedestrian/motor vehicle conflicts that occur in Wawona (Figure 12). Furthermore, directing visitors to park in Wawona and ride a shuttle bus back to Mariposa Grove may cause visitor frustration and increases vehicle miles traveled in the park. Specifically, the combination of parking management and shuttle bus service between Wawona and Mariposa Grove requires visitors to travel 10 miles out of their way, including a 5 mile "backtrack" via shuttle bus, once the upper and lower parking lots at Mariposa Grove are full.

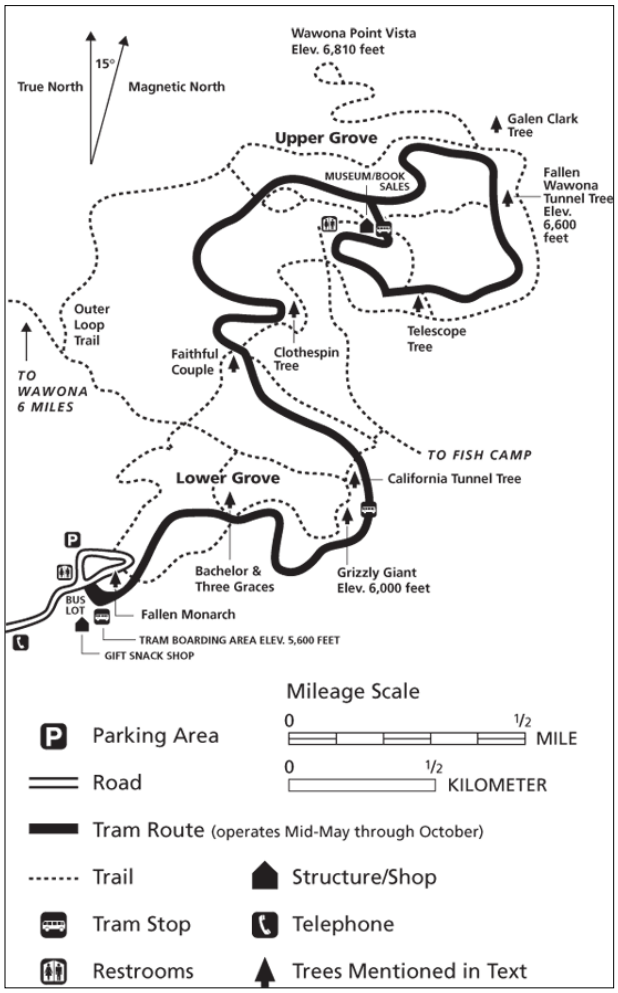
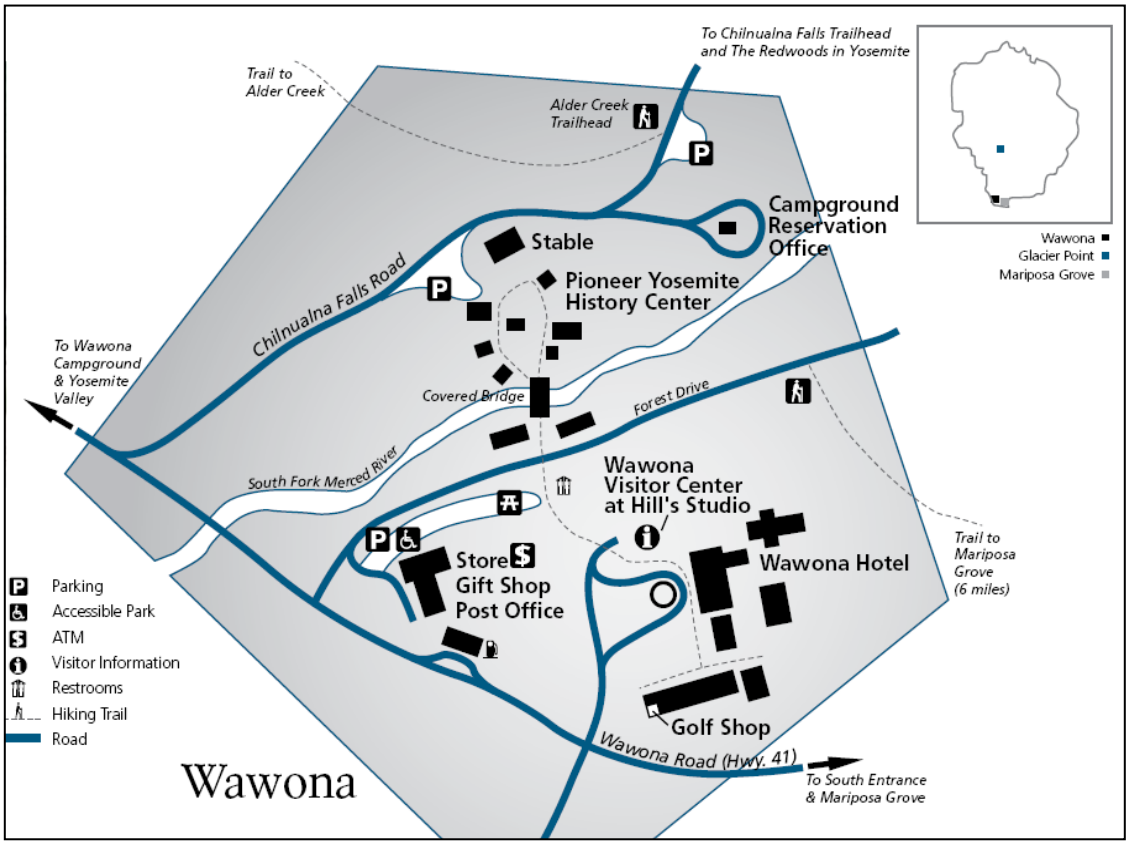


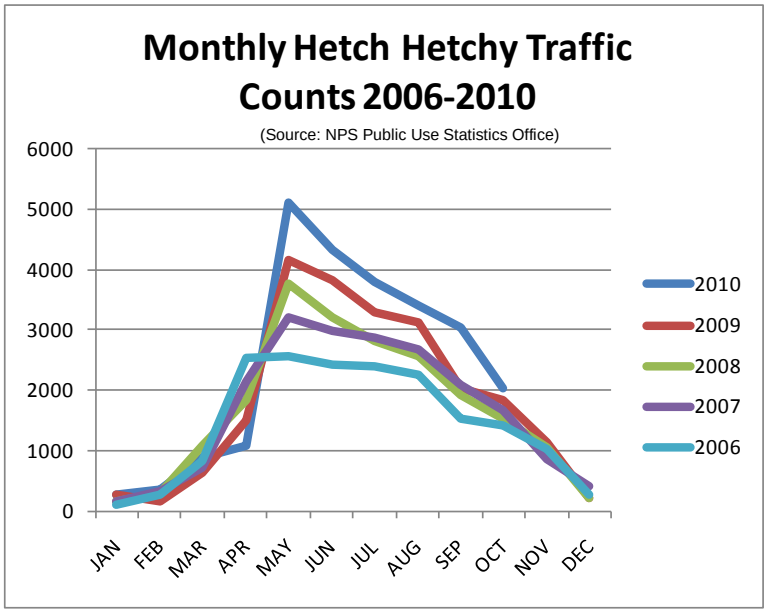
Figure 12: Map of Wawona



3.2.2.3 Other Key Areas of the Park

As noted, during the period between Memorial Day and Labor Day weekends, parking congestion is severe throughout all regions of the park, including Yosemite Valley, Mariposa Grove and Wawona, and Tuolumne Meadows. Information from visitor use studies and NPS traffic data suggest that other areas of the park have similar parking shortages. For example, results of visitors surveys conducted in 1999 at Glacier Point suggest that, when asked about their visit to Glacier Point, respondents identified traffic congestion and difficulty finding parking as the two most problematic management issues. As noted, it is reasonable to assume that parking and traffic issues are even more pronounced now, given that recreation visits were even greater in 2010 than they were in 1999. In Hetch Hetchy, peak monthly inbound vehicle traffic at the entrance station has roughly doubled between 2006 and 2010 (Figure 13). Thus, there appears to be little opportunity to shift parking demand during the peak season away from the park's primary destinations, such as Yosemite Valley, Mariposa Grove, and Tuolumne Meadows, to other areas of the park.

Figure 13: Monthly Traffic Volumes at Hetch Hetchy Entrance Station, 2006-2010



3.2.3 Queuing and Delays at Entrance Stations

While parking congestion is the park's most pronounced transportation-related issue, traffic congestion and associated delays are problematic at a number of locations throughout the park, including at park entrance stations. For example, as part of a transportation study conducted during a July weekend in 2007, a queue of over 100 vehicles was observed at the Big Oak Flat Entrance Station, stretching back from the entrance station about two-thirds of a mile. Long lines of vehicles waiting to pass through the entrance stations sometimes extend beyond the park boundary and create public safety concerns outside the park. In fact, during peak periods, entrance station queues and associated delays become so severe that park staff wave vehicles through without collecting entrance fees. At the Tioga Road Entrance Station, for instance, entrance station staff will, at times, block outbound traffic and allow cars to enter the park via both entrance station traffic lanes without stopping to pay the fee on their way into the park (Mike Yochim, personal communication, February 14, 2011). Waving vehicles through the entrance stations helps to clear excessively long queues, but it also creates a surge of vehicle traffic into the park, which has significant downstream impacts on parking, traffic circulation, and crowding at visitor destinations.

Despite documented long queues at entrance stations, a summer 2007 visitor survey reported that "on average, respondents reported spending less than three minutes waiting to enter the park. The fact that vehicles are waved through the entrance stations when queues become excessive explains, at least in part, the relatively low entrance station delays and high acceptability ratings for wait times reported by visitors. It is also likely that the high acceptability ratings observed in the study are due to the fact that visitors were not asked to evaluate the acceptability of entrance station wait times until later in their visit. Specifically, visitors were asked to complete the survey at one of several popular destinations in the park, away from the entrance stations and after enjoying some of the park's scenery and attractions, at which point their level of frustration with entrance station delays was likely to have dissipated. In any case, results of the 2007 traffic study, coupled with the fact that queues during peak periods commonly reach lengths that require park staff to wave visitors through without stopping them to pay the park entrance fee, suggest that queuing and delays at the entrance stations are problematic during peak periods.

3.2.4 Predominance of Private Vehicle Use

As noted, parkwide parking congestion is the most significant transportation-related issue in Yosemite National Park and traffic congestion is severe in several locations throughout the park. A primary contributing factor to parking congestion and other transportation-related issues in the park is visitors' reliance on private vehicles as the predominant means of access to the park. According to results of a visitor use and transportation study conducted in the park during summer 2007, the vast majority of visitors arrive to Yosemite in a private vehicle (84.4%), whereas relatively few enter the park via commercial tour bus (4.8%) or YARTS bus (1.3%) (Figure 14). Clearly, the visiting public does not utilize mass/alternative transportation to enter the park in any significant numbers.

Figure 14: Mode Split of Visitors Arriving at Yosemite National Park Summer 2007

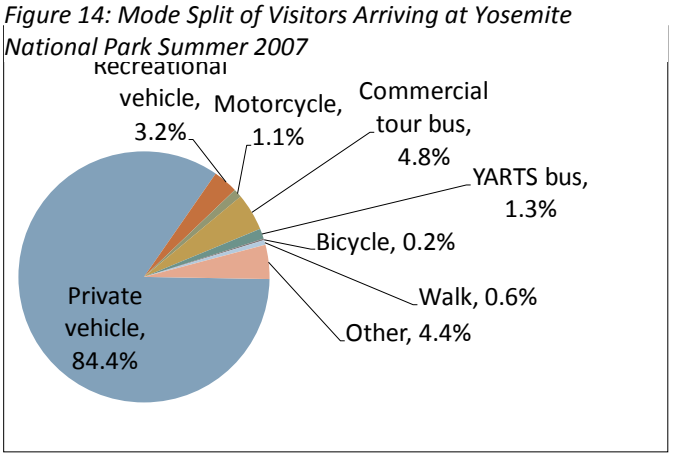
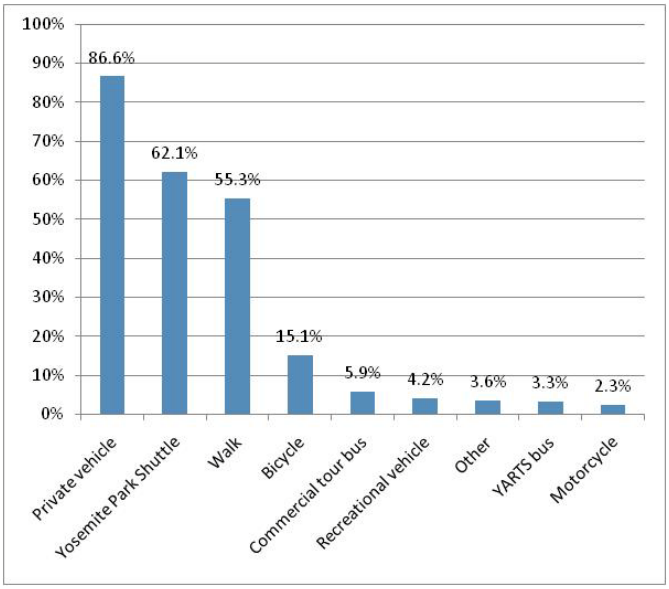


Figure 15: Transportation Modes Used by Visitors Traveling within Yosemite Summer 2007



The 2007 visitor use and transportation study results also suggest that once inside Yosemite, the vast majority of visitors (86.6%) travel though the park in their private vehicle at least part of the time (Figure 15). More than six in ten (62.1%) visitors, however, also travel within the park via the Yosemite Park Shuttle, with ridership highest among weekday visitors and those contacted in Yosemite Valley. That being said, the 2007 study results suggest that of those visitors that use both cars and buses to travel in Yosemite National Park, more than a third use their cars 75%-100% of the time.

Given persistent concerns over the negative effects on parking, traffic circulation, park resources, and visitor experience quality of the reliance on personal vehicles as the primary means of visitor travel to and within the park, the 2007 visitor use and transportation study assessed factors that influence visitors' transportation mode choices. The findings suggest that park visitors value their private vehicles for providing a sense of freedom, but recognize that parking difficulties, traffic congestion, and the associated stress and conflict are trade-offs. In contrast, findings suggest that visitors value the Yosemite Valley Shuttle Bus for providing a sense of ease of route finding, safety, affordability, and socializing. Despite the value visitors attribute to driving a car, the results indicate that the Valley shuttle also provides advantages related to visitor experience. For example, some visitors found that shuttles provides more freedom than driving because they don't have to

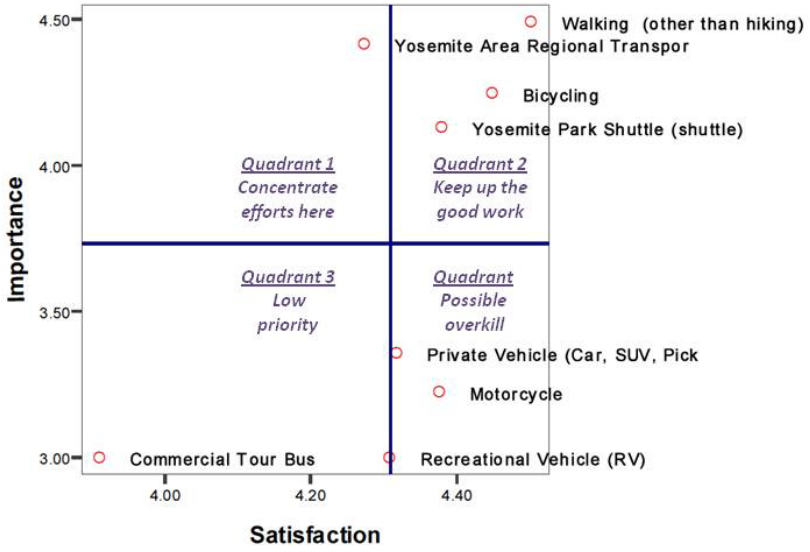
spend time looking for a parking space. Moreover, the survey found that significant learning experiences happen when visitors are out of their vehicles, which occurs more often when riding the shuttle. This implies that alternative transportation may be an effective tool for alleviating traffic congestion and reducing transportation-related environmental impacts without compromising visitor experience quality.

Finally, to help identify points of focus for transportation system planning, the 2007 visitor use and transportation study asked visitors to indicate the importance they placed on each transportation mode they used during their visit to the park, and their level of satisfaction with each. Responses to these questions were used to develop an importance-satisfaction matrix (Figure 16). It should be noted, horizontal and vertical reference lines in the importance-satisfaction matrix were placed at the overall mean scores for importance and satisfaction from the study results, rather than at the scale midpoints. This was done to avoid the common outcome in park and recreation studies of most attributes clustering in the high importance/high satisfaction quadrant, which tends to reinforce the status quo and limit the utility of information from studies of this kind.

As seen in Figure 16, items in the upper-right quadrant were rated relatively high in importance and satisfaction, and include walking as a form of transportation, bicycling, and the Yosemite Park Shuttle. Items in the upper left quadrant were rated by visitors as relatively high in importance, but relatively low in satisfaction; the only item in this quadrant is YARTS. Items in the lower right quadrant were rated relatively high in satisfaction, but relatively low in importance, and include private vehicles and motorcycles. The only item in the lower left quadrant is commercial tour buses, which were rated relatively low in satisfaction and importance.

Together, the results of the importance-satisfaction analysis suggest that YARTS should be a priority for transportation resources, and that support exists for continued improvements to bicycle and pedestrian infrastructure and the Yosemite Valley Shuttle. Furthermore, the results suggest there may be an overemphasis on investments in transportation resources that support visitor travel in the park via private vehicles, motorcycles, and recreational vehicles.

Figure 16: 2008 ASU Transportation Importance-Satisfaction Analysis



3.2.5 Other Contributing Factors – Wayfinding, Traveler Information, Roadway Design and Circulation

Transportation-related issues are further exacerbated in Yosemite National Park by the fact that wayfinding, particularly in Yosemite Valley, is challenging at best. Visitor surveys indicate that the park brochure/map is the information source most used by visitors, followed by the Yosemite Guide and shuttle bus service. However, the map is confusing to follow, references to places and road names are inconsistent, and the names for some shuttle routes do not reflect the route or destinations they serve. Poor wayfinding results in additional traffic and parking congestion by increasing the amount of traffic circulating on park roads and disrupting traffic flow as drivers slow down or stop when they are lost.

In addition, advanced traveler information on approach and in the park is currently limited to that which can be found on the park's website. While a 2009 visitor use study found that 51% of visitor groups use the website to obtain information about the park, there is no real-time information about crowding at attractions, parking congestion, or other park conditions that a visitor could use to make an informed decision about when, where and by what mode of transportation to travel to and within the park. Thus, the park's general lack of advanced, real-time traveler information limits park staff's ability to manage access in ways that could help alleviate traffic congestion, parking shortages, and visitor crowding.

There are also elements of the park's roadway system that contribute to the problems the park has with traffic circulation, parking congestion, and related resource and visitor experience impacts. For example, the one entrance and exit point to the Day Use Parking Lot occurs at a poorly aligned intersection with Northside Drive and Village Drive. The intersection receives a high volume of through traffic on Northside Drive, including tour buses and park shuttles, and is crossed by a large number of pedestrians walking between the Day Use Parking Lot, Visitor Center and other destinations in Yosemite Village. Furthermore, all traffic from points east of Sentinel Drive must pass through this intersection when exiting Yosemite Valley. Traffic congestion is exacerbated at this intersection due to its inefficient alignment and the interruptions necessary to allow pedestrians and cyclists to cross safely between the central Day Use Parking Lot and primary destinations in Yosemite Village.

Traffic congestion is even more severe on Northside Drive at the pedestrian crossing between Yosemite Lodge and Lower Yosemite Falls. While traffic control staff are deployed, as noted, to direct vehicle traffic and pedestrians at the intersection, delays and queues are unavoidable given the volume of traffic and pedestrians. For example, during the afternoon, when outbound vehicle traffic is at its highest, park staff have observed long queues on Northside Drive that extend from the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing as far back as Sentinel Drive. Consistent with these observations, the intersection of Northside Drive with the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing was rated as Level of Service F during the 7th and 1st busiest days of 2007 – this constitutes a "failing grade" on the primary traffic engineering measure of intersection performance.

3.3 Transportation Solutions in the Context of a National Park

The transportation-related issues outlined in this section of the report are made more complex by the National Park context in which they occur. That is, transportation solutions that might typically or more commonly be used to solve parking congestion, traffic circulation, safety and other transportation issues in an urban context may not be consistent with park management objectives. For example, changes to intersections may be constrained by resource management issues; extended/increased shuttle service into or within the park might support levels of visitation that cannot be accommodated at shuttle service destinations without unacceptable impacts to park resources and/or visitor experience quality; the use of electronic message boards to communicate roadway, parking, and visitor use conditions to manage visitor

access may not be consistent with the cultural, resource, and/or visitor experience landscape; and so forth.

For these reasons, transportation improvement strategies developed for Yosemite National Park must not only be effective at addressing transportation-related issues, but must be consistent with park management objectives. The set of strategies presented in this TISR were developed with this context in mind, and are discussed, in part, from the perspective of the context-specific constraints to implementing and fully realizing the benefits of each.

4.0 TRANSPORTATION IMPROVEMENT STRATEGIES

This section of the report briefly describes how a list of preliminary ideas was developed and screened to create a refined list of strategies. Strategy themes are defined and additional information is provided for each strategy on the refined list including its characteristics and purpose, and a general assessment on effectiveness and potential challenges.

4.1 Development and Screening of Strategies

A preliminary list of strategies was developed from input gathered during the external fact finding meetings and internal workshop with park staff, a review of previous plans and studies, and analysis of visitor and employee travel characteristics and the park's transportation system. The result was a list of more than 110 strategies for all areas of the park, and to a lesser extent, in the surrounding region. A conceptual feasibility analysis was conducted for each strategy based on a qualitative assessment of its potential benefits and implementation challenges using a scale that ranges from 1 to 9 (Table 6). A maximum score of 9 indicates that a strategy has potentially high benefits with only minor implementation challenges; while the minimum score of 1 indicates that a strategy has potentially low benefits and would be difficult to implement. The consultant team and NPS staff reviewed and discussed each strategy on the preliminary list and used their combined professional judgment, experience and institutional knowledge to score each one relative to its intended purpose and the extent to which they address the issues described above. Some strategies had fatal flaws and therefore were not scored. The refined list includes all strategies that have a potentially high benefit (7-9 points) and those with potentially medium benefits and only minor or moderate challenges (5-6 points).

Table 6: Conceptual Feasibility Scoring Matrix

Implementation Challenge	Potential Benefit		
	High	*Medium*	*Low*
Minor	9	6	3
Moderate	8	5	2
Significant	7	4	1

4.2 Strategy Themes and Descriptions

The TISR will be used as a technical resource for other planning activities in the park. Therefore, the strategies on the refined list have been organized into the following broad themes to help park planners sort through transportation options in the context of goals, alternatives and tradeoffs to be considered in other planning activities:

- **Manage Access (Focus on People).** Strategies that influence visitor and employee travel patterns relative to means of transportation (shuttle, regional transit, personal car, walking, bicycling, etc), travel time and/or location to reduce peak period traffic and parking congestion, improve visitor experience, and/or protect resources. These strategies focus on people and use

information, service improvements and other approaches to encourage visitors and employees to make choices that help reduce driving and the related impacts.

- **Optimize Mobility (Within Existing System):** Strategies that seek to improve the efficiency and/or safety of the existing transportation system (shuttles, regional transit, roadways, parking areas, multi-use paths, etc.) to serve visitor and employee travel needs without requiring a larger footprint or acquiring and operating new vehicles.
- **Alter Transportation System Capacity:** Strategies that decrease or increase the physical size and/or operating capacity of the transportation system. This theme includes strategies that would reduce the physical size and capacity of the transportation system to minimize visitor crowding and resource impacts such as: eliminating roadside parking, decreasing the size of parking lots or decreasing the frequency of shuttle service to crowded attractions. This theme also includes strategies that would address traffic congestion and parking shortages by increasing the size and footprint of roadways, parking lots or multi-use paths; or increasing the operating capacity of shuttle and transit service.

Within each theme, the strategies are organized into parkwide, Yosemite Valley and other areas of the park. The description of each strategy includes its basic physical and/or operational characteristics, how it fits within the overall theme, it's potential to address identified issues, and potential challenges. Strategies have been grouped when they are related and/or would be implemented together. Each strategy has been assigned a random identification number for the purpose of cross-referencing. The prefix assigned to each reference number indicates its theme (**MA** for Managing Access, **OM** for Optimizing Mobility and **AC** for Altering Transportation System Capacity). Strategies have not been prioritized and their order below, and reference numbers, does not suggest ranking nor does it constitute a transportation plan or decision document.

4.3 Strategies for Managing Access

4.3.1 Parkwide

Improve transportation and travel planning information available on the Yosemite National Park Website (MA-1025). This strategy would help manage access by providing information that allows visitors to make informed decisions about travelling to and within the park. Relative to transportation, the website currently provides information on road closures, weather, and schedules for the in-park shuttle; and links to websites with schedules for YARTS, Greyhound, Amtrak and major airports in northern California. An additional link should be provided to the Eastern Sierra Transit Authority (ESTA) website. ESTA operates a route along the US 395 corridor through Lee Vining from which it is possible to connect with YARTS during the summer season (although a one day layover is required). Providing direct links to the concessionaire website and to area events were also suggested during the fact finding meetings. For the most part, the information available on the park's website is static. Currently, there is no real-time information about crowding at attractions, parking availability, or other park conditions that a visitor could use to make informed decisions about travelling to the park. According to the 2009 Yosemite National Park Visitor Study, 51% of visitor groups reported using the website to obtain information about the park, and 74% would prefer to obtain information about the park from the website for future visits. In the short-term, providing improved traveler information on the website would reach between 50% and 75% of park visitors and could improve their experience by helping them avoid congestion, parking shortages and crowding at attractions and trails. The immediate impact of this strategy will be limited because it relies on static information and the voluntary actions of visitors. The effectiveness of this strategy will be enhanced further when real-time information becomes available when implemented as part of the real-time transportation information system strategy described in strategies MA-1070, MA-1075 and MA-1574 (see below), and other options for accessing the park are enhanced.

Allow vehicle access based on available parking spaces (MA-1066). This strategy would manage access by informing visitors when parking spaces are fully occupied in the area of the park they wish to visit, recommending the use of shuttles to reach their desired destination, or recommending other destinations where parking is available. It would be a component of an overall approach that provides parking supply consistent with user capacity and would be used to reduce overflow parking, eliminate unendorsed visitor parking, and reduce traffic congestion. Parking spaces could be allocated on a first come/first serve basis, through an advanced reservation system, or some combination of the two. The system should be integrated with the real-time transportation information system strategy described above and strategies to establish intercept parking lots served by shuttles. This strategy would address parking shortages in the park and related traffic congestion, but must be implemented in tandem with these other strategies to maintain access consistent with visitor experience and resource protection goals.

Provide real-time information for visitors on crowding at attractions, traffic congestion and parking availability; and real-time information to park staff for use in managing traffic, transit operations and user capacity (MA-1070, MA-1075 and MA01574). This strategy would manage access by providing information visitors can use to make informed decisions about where, when and how to travel to and within the park to avoid crowding, traffic congestion and parking shortages. Furthermore, a real-time information system can be used by park staff to proactively manage access consistent with visitor experience and resource protection goals. This strategy is the key-stone to managing visitor access consistent with visitor experience and resource protection goals because it integrates information about park conditions, visitor travel decisions, and park management actions.

The potential for Intelligent Transportation Systems (ITS) to deliver real-time information to visitors is currently being pursued by the park. Using ITS tools to collect real-time data, and then conveying it to visitors via methods such as roadside dynamic message signs, the park website, and smart phones can help operations by ensuring that everyone (visitors and staff) has accurate, up-to-date, and useful information about weather, travel times, parking availability and traffic congestion. A 2005 study[1] found that the four most important issues addressed by ITS solutions are:

1. Informing drivers about real-time congestion;
2. Providing information to help visitors to make informed decisions about transit;
3. Providing real-time information on traffic, weather, and park conditions; and
4. Using information systems to direct visitors to less crowded areas.

The following ITS initiatives are underway in the park and will be integrated to provide real-time traveler information for visitors and park staff:

- **Parkwide Data Communication Network.** The parkwide Communication Data Network links the six major geographic areas of the park and will provide reliable and flexible voice, video, and data services. The first of three project phases is funded and is currently underway. The second phase is funded but has not started yet. The third phase is not funded. Install parkwide Traffic Counter and Data Collection System: This project will install 22 traffic counters in 10 locations throughout the park. Locations include the five entrances, Southside and Northside Drives in Yosemite Valley, Crane Flat, and Glacier Point Road. Eight of these counters will have weather sensor capabilities. For purposes of traffic management, these counters will be able to transmit traffic and/or weather data to the park's 911/dispatch center. The project is funded and installation is anticipated in 2012.
- **Integrated parkwide Traffic Information System.** The purpose of this project is to use a recently developed traffic model and updated traffic counters to provide a web-based interface so that traffic information can be accessed in real time. The system will be tiered to the parkwide

[1] Gilworth, D., *The Relationship between Conditions and Attitudes: An Examination of Intelligent Transportation Systems*, 2005.

Communication Data Network and will provide the real time traffic information necessary to adequately manage traffic and prevent extreme traffic congestion during the peak visitor periods. Funding has been secured for a traffic management system for the southern part of Yosemite and the park is currently seeking funding for the two final components.

- **Transit Information Systems in the Southern Part of Yosemite National park.** This project will facilitate visitor access via transit to Mariposa Grove and Badger Pass as well as install a parking occupancy and information system for Glacier Point

Manage day-use parking for recreational vehicles (MA-1121). This strategy would manage access by encouraging day-use visitors arriving in recreational vehicles (RVs) to park in peripheral locations and use the shuttle system to visit attractions. RVs require more room to maneuver and park; and this difficulty is compounded by drivers that lack experience operating large vehicles. As a result, RVs exacerbate congestion, cause potential safety issues, and occupy more space in parking lots than a typical personal car. The challenge to implementing this strategy is locating appropriately designed and sited peripheral parking facilities with shuttle service. Therefore, this strategy should be incorporated with strategies that provide intercept parking facilities served by shuttle or regional transit service. There are currently 59 parking spaces designated for day-use parking of RVs in Yosemite Valley. Approximately 70 spaces would be required to accommodate day-use RV parking demand on the 7th busiest day[1]. Because RVs require more room than a typical passenger car, this strategy would effectively create up to 90 additional parking spaces in locations where RVs currently park (primarily in the Day Use Lot and Yosemite Lodge).

Provide visitor itineraries designed to disperse use during peak visitation (MA-1285). This strategy would manage access by encouraging visitors to alter the sequence and timing by which they visit attractions in the park to help reduce crowding, traffic congestion and parking shortages. When visitors arrive at an entrance station they would be given an itinerary that suggests an order and schedule for stopping at attractions/trail heads based on real time conditions in the park. A concern is that this strategy would diminish the visitors' experience of discovering the park's wonders on their own. However, this strategy would provide an adaptive management tool that could be used only during peak conditions to disperse use consistent with visitor experience and resource protection goals. The system would be enhanced if integrated with the real-time transportation information system strategy described above.

Develop an employee commute trip reduction program to reduce the use of single occupant vehicles for the commute to work (MA-1295, MA-1300). This strategy would manage employee access by encouraging park staff to use carpools, transit, walking and bicycling for travelling to and from work and telecommuting with the purpose of reducing parking demand and traffic congestion. A commute trip reduction (CTR) program could include:

- Rideshare services to match commuters with similar destinations, schedules and personal preferences that are important when sharing a ride. Rideshare programs typically provide carpool matching, vanpool sponsorship, and marketing programs.
- Guaranteed ride home to provide a ride to commuters who use alternative modes, but must return home in an emergency or have to work later than expected. Guaranteed ride home programs may use taxies, company vehicles or rental cars.
- Financial incentives to encourage use of non-auto modes such as the subsidized transit fares that are currently available to NPS employees, but not for DNC or other concession employees and park partners. Financial incentives may also include walking and bicycling reward programs that

[1] Based on the ratio of peak vehicle accumulation in the east valley on the 7th busiest day to total number of parking spaces. Assumes that RV parking demand is proportional to parking demand for all vehicles.

provide gift certificates to local businesses for commuters that walk or bike to work a certain number of days per month.

A CTR program requires staff support to manage the various services, support users and track participation. A comprehensive CTR program typically reduces peak-period automobile trips by 5-20% at a worksite[1]. During the peak summer season, there are approximately 2,900 people employed in the park (1,100 NPS and 1,800 DNC). About 2,000 of these employees work in Yosemite Valley. Accounting for the number of employees that live in the valley (approximately 1,400 in 2010), and assuming 75% work during peak periods, there are approximately 450 employees that have a car in the Valley during the critical time period. This approximation suggests a potential decrease of only 20-90 parked cars. While its contribution is relatively minor, CTR would effectively provide more parking spaces without any footprint and related resource impacts and could be part of the solution.

Provide interpretive services on public transportation systems (MA-1445). This strategy would manage access by encouraging more visitors to use transit and shuttles when travelling to and within the park to help decrease traffic and parking congestion and would also improve visitor experience. The interpretive services could be provided by rangers, videos or other technology. This strategy would be more practical on regional transit service into the park, and the in-park routes, because the trips are longer and the buses are not as crowded. By comparison, trips on the Valley shuttle are short and crowded and are therefore not suitable for this strategy. This strategy would require developing appropriate programs and hiring more staff. Providing interpretive services on YARTS needs to consider other passengers such as park employees and local residents that may prefer not to listen to the program. Interpretive programs could be limited to times of peak visitor travel to avoid coinciding with peak commuter flows. The immediate benefit of this strategy would be an improved experience for the 1.3% of all visitors that arrive in the park on YARTS[2]. Assuming this strategy could increase YARTS ridership by 5-10%, it would result in a net decrease of in-bound vehicles trips between 5-10 trips per day, and would decrease the need for the same number of parking spaces[3].

Provide transit service on a schedule consistent with employee travel needs (MA-1525). This strategy would manage access by encouraging more employees to use YARTS to help reduce demand for employee parking spaces and traffic congestion. During outreach meetings conducted by YARTS in preparation for its 2011 Short Range Transit Plan (SRTP), park employees noted several changes that would make the service more convenient and consistent with their commuting patterns. The 2011 SRTP includes the following service option changes and recommendations in response to employee suggestions:

- Provide an earlier Friday afternoon outbound bus to serve NPS employees. This change would be cost neutral and is recommended for implementation in fiscal year 2011/2012. This service modification is targeted at NPS employees in El Portal to better coincide with Friday work schedules. It supports continued use of NPS employees of transit for the Monday-Friday work week. Because it is focused on addressing employees at El Portal, it would not affect traffic or parking shortages in Yosemite Valley or other areas of the park.
- Provide an early morning run along the Hwy 140 corridor that could accommodate DNC employee shifts as well as hikers that wish to leave early in the morning. The service would depart Mariposa at 6:00 am or 6:30 am and leave the Valley at 2:30 pm. During winter months, the latest inbound Hwy 140 bus arrives in Yosemite Valley at 1:30 pm. This option would extend the latest inbound bus to arrive later in the evening (around 8:00 pm) to allow park employees to run errands in Mariposa and Merced and return to Yosemite Valley on the same day. This trip is

[1] Victoria Transport Policy Institute , *Online TDM Encyclopedia*, , May 9, 2010 http://www.vtpi.org/tdm/tdm9.htm

[2] Arizona State University, *2007 Yosemite National Park Visitor Survey of Transportation Issues Draft Technical Report*, January 2008, Page 13.

[3] Based on 1.3% of average daily park visitation in June, July and August 2010, and assuming vehicle occupancy of 3 persons per car.

currently possible with the summer/fall schedule. According the 2011 SRTP, 90% of the ridership on the proposed early morning run would be DNC employees. Assuming the bus is half full, approximately 20 parking spaces would be made available in Yosemite Valley for visitors or other uses.

- Implement a mid-day run between Yosemite Valley and Mariposa. Overall, the potential ridership benefits do not appear to justify the costs and this option is not recommended[1].

4.3.2 Yosemite Valley

Provide storage lockers in the Valley for use by day-use visitors arriving by transit (MA-1390). By making transit more convenient, this strategy would manage access by encouraging more visitors to use transit and shuttles to help decrease traffic and parking congestion. Day-visitors arriving by car have a ready-made storage facility for gear, supplies and other necessities; while day-use visitors arriving by bus must carry their supplies with them throughout the day. This strategy would remove this day use obstacle by providing storage lockers. This strategy would have the immediate benefit of improving the experience for the 1.3% of all visitors that currently use YARTS buses to enter the park. In the long-term, the added convenience may attract more riders. As noted previously, a 5-10% increase in the amount of visitors arriving by YARTS would reduce the need for 5-10 parking spaces.

4.4 Strategies to Optimize Mobility

4.4.1 Parkwide

Provide real-time information on construction delays to YARTS and tour bus operators (OM-1015). This strategy would optimize mobility by improving transit operations. YARTS and the tour bus operators currently receive information about roadway conditions from the "daily report" email published by the park and from communication with their own drivers. The park also maintains and updates daily a call-in number with a recorded message that describes the status of road closures and delays that should be anticipated where construction is on-going. This strategy would improve upon these existing methods by providing real-time information on delays, and possibly alternate routes. Its implementation will be facilitated by completion of the park's data communication upgrade and the integrated parkwide traffic management system (Strategies MA-1070, MA-1574 ad MA-1075). Approximately 6% of visitors enter the park on YARTS and commercial tour buses combined, and over 60% of visitors use the Yosemite shuttle system to travel within the park[2]. By reducing unexpected delays caused by construction or other incidents, this strategy would improve the experience for a significant number of visitors travelling by bus or shuttle. Arguably, most visitors do not anticipate additional delays caused by construction or other incidents when deciding whether or not to travel by car or bus. Thus, while this strategy could improve the experience of a significant number of visitors, it is unlikely to cause a measurable shift from personal vehicles to buses or shuttles. Therefore, no significant reduction vehicle trips or parking space use would result from this strategy.

Use "roving payment processing" to reduce delays and vehicle queues at entrance stations (OM-1090). This strategy would optimize mobility by increasing the efficiency of entrance stations to process

[1] Transit Resource Center and Transit Marketing and Innovative Paradigm, *YARTS Short Range Transit Plan, Volume I: Service, Institutional and Financial Plan*", February 2011, Pages 5-3 through 5-5.

[2] Arizona State University, *2007 Yosemite National Park Visitor Survey of Transportation Issues Draft Technical Report*, January 2008, Page 13-15.

visitors thereby reducing delays and vehicle queues. Entrance station queues and associated delays become so severe that park staff wave vehicles through without collecting entrance fees. Waving vehicles through the entrance stations helps to clear excessively long queues, but it also creates a surge of vehicle traffic into the park, which has significant downstream impacts on parking, traffic circulation, and crowding at visitor destinations. This strategy seeks to prevent excessively long queues and delays from happening in the first place. Park staff currently "walk the line" to provide information and answer questions; but visitors still have to pay the entrance fee at the station window. This strategy would make it possible for park staff to also accept payment of the entrance fee while in the queue using a hand held ticketing machine. Vehicles that have paid the fee while in line would not be allowed to bypass the queue, but this approach is expected to significantly reduce delays because it allows several cars per lane to be fully processed at the same time. This strategy could address a severe traffic congestion issue at locations that serve all visitors entering the park, and would help reduce the unintended downstream traffic and parking issues caused by the current practice of waiving vehicles through. Implementation could require hiring more staff and finding a suitable hand held device and related software that meets the operational and other requirements of the fee program. The potential operational capital cost costs may be off-set to some degree by recapturing entrance fees lost when cars are waived through.

Provide additional proactive, on the ground traffic and parking management (OM-1095). This strategy would optimize mobility by maximizing traffic flow efficiency, providing safe pedestrian circulation, and maximizing the use of informal, gravel/dirt parking areas in a proactive manner consistent with resource protection and visitor experience goals. As discussed above, the park is employing a full suite of traffic and parking management techniques during the summer season. Most of the existing traffic management is focused on Yosemite Valley. This strategy would expand the service to other areas of the park including Tuolumne Meadows, Wawona and Mariposa Grove. Challenges to this strategy include providing a stable funding source and recruiting personnel. The current program is staffed by temporary employees and recruitment of personnel is difficult. Attended parking increases the effective parking supply in the Day Use Parking Lot by nearly 20% (approximately 100 parking spaces)[1] and could be provided with similar results at other lots with gravel/dirt surfaces in the park such as the Curry Orchard or in Tuolumne Meadows.

Formalize designated/approved pullouts and "close" problematic pullouts (OM-1235, OM-1270 OM-1275). This strategy would optimize mobility by addressing safety, parking and resource impact issues at existing roadside pullouts. Problematic pullouts may have one or more deficiency such as, but not limited to: insufficient sight distance, a parking space shortage, used for longer term overflow parking, a size or configuration that leaves parked vehicles obstructing an adjacent travel lane or impacting adjacent resources, or a location on the "wrong side" of the road relative to the attraction. Examples of pullouts with sight distance and safety issues are the two locations between the tunnels on Big Oak Flat Road which both have poor sight distance and potentials for vehicle/pedestrian conflicts. There are several pullouts along Tioga Road in Tuolumne Meadows, and in the east part of Yosemite Valley that are impacted by unendorsed, long-term day-use parking. The overall strategy requires an inventory and assessment of all formal and informal pullouts. Pullouts that should remain could be paved or re-designed as necessary to address identified deficiencies. Pullouts that should be closed due to unacceptable resource impact, safety or other issues may be addressed using curbing or other physical barriers. The challenge will vary based on conditions at a specific location, but in many cases additional pavement to address resource impacts, and new curbing to prevent use of an undesirable location, are not difficult to implement. The potential benefits to addressing access and resource impacts associated with pullouts is

[1] Based on a parking space inventory conducted by DEA in 2003.

high because they support auto touring, cited by 87% of respondents to a 2006 visitor survey as the single most popular activity when visiting Yosemite.

Prioritize YARTS and tour bus passage through entrance stations when delays are excessive (OM-1350). This strategy would optimize mobility for YARTS and tour bus passengers by reducing delays at entrance stations. Waving buses through means forfeiting the entrance fee and may also occur in tandem with allowing other vehicles through. Therefore, this strategy should be considered as a temporary measure only until more effective approaches can be implemented to reduce delays and long queues at all entrance stations such as providing a means for remote processing of entrance fees (strategies OM-1351, OM-1352), using a roving processing (strategy OM-1090) or reconstruction of entrance stations to provide dedicated transit lanes This strategy would improve the travel experience for the 6% of visitors that enter the park on YARTS and commercial tour buses. A permanent solution that reduces delays for transit vehicles at entrance stations would encourage more ridership on YARTS, although it is unlikely to affect tour bus ridership. Assuming this approach increases YARTS ridership by 5-10%, the result would be a reduction of 5-10 vehicle trips and a reduction of parking need by 5-10 spaces. This strategy would also benefit visitors arriving by personal vehicle because they would not be delayed by the extra time it takes to collect entrance fees from YARTS and commercial tour buses.

Remove tour bus and YARTS processing function from entrance stations (OM-1351, OM-1352). By reducing transaction times for tour buses at entrance stations, this strategy would reduce delays and optimize mobility for all vehicles waiting at entrance stations. Tour buses must currently stop at entrance stations to pay the park entrance fees for its passengers/customers. Depending on the size of the vehicle, the transaction may require a driver to leave the bus, which increases the transaction time further. This strategy is well suited for tour bus operators because they are paid in advance by their customers and therefore know how many visitors they will be bringing into the park on any given day. The challenge will be developing a payment system that allows tour bus operators to purchase passes from the park and developing a way to quickly verify payment at the entrance station. This strategy would improve the travel experience for the 6% of visitors that enter the park on YARTS and commercial tour buses. The strategy assumes that the bus remains in the vehicle queue at the entrance, so the reduction in delay would not be as large as allowing buses to bypass the entrance (strategy OM-1350), and is unlikely to result in a shift from personal vehicles to buses. This strategy would also benefit visitors arriving by personal vehicle because they would not be delayed by the extra time it takes to collect entrance fees from YARTS and commercial tour buses.

Improve wayfinding information (OM-1420, OM-1425, OM-1440 and OM-1550). This strategy would optimize mobility by improving the ability of visitors to use the roadway, shuttle and transit systems efficiently. Poor wayfinding exacerbates traffic and parking congestion by increasing the amount of traffic re-circulating on park roads and disrupting traffic flow as drivers slow down or stop when they are lost. Confusion over shuttle and regional transit routes and schedules may discourage some visitors from using these services, further increasing the amount of traffic on park roads. Specific suggestions to improve wayfinding include coordinating road and place names on the park brochure/map with roadway signs, renaming shuttles to better reflect their route and destination, and requesting Google to correct an apparent error that directs visitors using GPS navigation to divert from Hwy 140 to Foresta Road. According to the 2009 Visitor Study, 87% of visitors use the park brochure/map and information available on the shuttles as sources of information about the park before their visit. Improvement to the brochure/map in particular, has the potential to reach most visitors and could help reduce vehicle miles of travel caused by re-circulating traffic. The changes could be incorporated into the next update of the map/brochure and only minor changes to roadway signs should be necessary.

4.4.2 Yosemite Valley

Develop and implement visitor and employee parking management program (OM-1120). This strategy would optimize mobility by facilitating the efficient use of existing parking spaces in Yosemite Valley. Different user groups occupy parking spaces at different times of the day and for varying lengths of time. A parking management program leverages these differences to more effectively use available parking spaces. For example, parking for overnight visitors peaks in the evening through the morning while parking for day-use visitor peaks during mid-day. The program could take advantage of this dynamic by making a limited amount of overnight spaces available to day-use visitors. The program should also address parking for employees that live outside the park, drive to work and sometimes compete with visitors for parking spaces. Parking for employees peaks in the morning, remains steady and decreases at the end of the day; and therefore coincides with peak parking demand of day-visitors. The parking management program would designate locations for employee parking away from the prime day-visitor locations. The program would augment the current management practices and would involve designating spaces by user groups and by parking duration. Its implementation would have to be supported by parking permits and enforcement and may therefore be difficult to implement on the ground. Parking regulation and shared parking strategies typically reduce parking demand between 10-30%[1]. This range is based on experiences in non-park settings which can take advantage of the different characteristics of uses such as an office, retail and restaurant which have significantly different parking patterns. Because uses within a park are not as diverse and parking patterns are similar, a more reasonable target is 2-3%, which would effectively reduce the need for 100-150 parking spaces in Yosemite Valley.

Provide an alternate route for pedestrians between the Day Use Lot and Yosemite Village (OM-1141). This strategy would optimize mobility by improving the pedestrian connection between the Day-Use Lot and Yosemite Village attractions and visitor services; and by reducing conflicts between vehicles and pedestrians on Northside Drive at its intersection with Village Drive and the entrance/exit to the parking lot. Pedestrians travelling between the Day-Use Lot and Yosemite Village must cross two roads to access the multi-use path on the northwest corner of the intersection. As a result, there are two conflict points created at an already poorly aligned intersection. In addition, all outbound traffic from points east of Sentinel Drive must pass through this intersection. Concentrating large numbers of pedestrians with turning and through vehicles in one location increases the opportunities for conflicts which impacts safety and causes delays for both modes of transportation. Regardless of its alignment, an alternate pedestrian route between the Day-Use Lot and Yosemite Village must cross Northside Drive at some point. There are numerous options that could be evaluated. The existing crossing could be improved and relocated to the eastbound approach of Northside Drive as part of a complete re-alignment of the intersection (see strategy 1255). The crossing could be relocated to an at-grade, mid-block location on Northside Drive between Village Drive and Sentinel Drive where pedestrians only need to be concerned with through traffic, rather than traffic turning from multiple approaches. The mid-block crossing could be enhanced with textured pavement or other design treatments consistent with a park context. A pedestrian underpasses or overpasses might also be considered; although the long approach ramps necessary to satisfy the Americans with Disabilities Act (ADA) standards for accessible design and other related structures could have notable visual and footprint impacts. All of these options have potential cultural and natural resource impacts that would need to be fully considered. There are approximately 6,000-7,000 pedestrian crossings of Northside Drive between the Day Use Lot and Yosemite Village per day during the

[1]Victoria Transport Policy Institute , *Online TDM Encyclopedia*,, May 9, 2010, Table 1: Summary of Parking Management Strategies, http://www.vtpi.org/tdm/tdm28.htm#_Toc128220496

summer season[1]. Each pedestrian is assumed to cross the road twice per day. Thus, by providing a safer and more efficient roadway crossing, this strategy would improve the experience for about 3,000-3,500 visitors each day.

Provide bike racks on shuttle buses (OM-1175). This strategy would optimize mobility by making biking convenient and attractive to more visitors. Based on data from the 2009 National Household Travel Survey (NHTS), the average bicycle length for a social/recreational trip is 2.2 miles[2]. By comparison, the total length of the multi-use path in Yosemite Valley is approximately 8.8 miles. Adding bike racks to shuttles will make cycling a more attractive travel choice to more visitors because it will increase their range and make it possible to access more destinations. Adding bike racks to shuttles would also make it possible for a visitor to reach destinations, such as El Capitan Meadow or Cathedral Beach that are not currently accessible along the multi-use path. Bike racks on shuttles also provide "mobility insurance" by offering a back-up option if a visitor has mechanical problems, becomes fatigued or for other reasons cannot continue using a bicycle. For all the same reasons, this strategy will improve the experience for the 15% of visitors that currently use a bicycle for travel within Yosemite (Figure 15). This strategy will help reduce traffic circulating in Yosemite Valley, although the reduction would not be significant. Potential issues include increased dwell times at shuttle stops to allow visitors to load and un-load bicycles and adding more riders to an already crowded shuttle system.

Allow two-way traffic on Southside Drive between Curry Village and El Capitan Crossover (OM-1215). This strategy would optimize mobility by using existing travel lanes to more efficiently accommodate outbound peak hour traffic flows. All traffic exiting east Yosemite Valley must currently travel westbound on Northside Drive where it conflicts with vehicle and pedestrian flows at the Day Use Parking Lot/Village Drive intersection, conflicts with traffic at Sentinel Drive and experiences severe delays at the Yosemite Lodge-Yosemite Falls pedestrian crossing. This strategy would provide an alternate, and a potentially less congested route, for outbound valley traffic while also reducing delays and potential vehicle/pedestrian conflicts in Yosemite Village and at the Yosemite Lodge-Yosemite Falls Pedestrian crossing. Because all exiting traffic, (including personal vehicles, YARTS and commercial tour buses) passes by these locations, this strategy has the potential to benefit all visitors to Yosemite Valley.

This traffic circulation change has been implemented on both an experimental basis to test its viability, and has been used successfully during extended periods of construction on Northside Drive. This modified system is also used when needed in response to emergency conditions such as rock fall that impacts Northside Drive. If implemented on a permanent basis, this traffic circulation change has a number of consequences that must be carefully considered.

Traffic congestion and delays on road segments should be evaluated. Southside Drive currently accommodates one-way inbound traffic on two travel lanes. Inbound traffic peaked on Southside Drive near the Chapel at approximately 990 vehicles per hour (vph) and 810 vph on the 1st and 7th busiest days of the 2010 summer season respectively. If two-way traffic is allowed on Southside Drive, all of this inbound traffic must be carried by one lane. The other lane would have to accommodate some amount of outbound traffic that would be diverted from Northside Drive. For a point of reference, if half of the traffic on Northside Drive is diverted to Southside Drive, the shift would result in a 25% increase in traffic volumes on Southside Drive during its peak hours on the 1st busiest day of the year, and 20% increase on the 7th busiest day (based on 2010 traffic data). The amount of traffic that would be diverted from

[1] Based on the number of attended parking spaces in the Day Use Lot (total of 621), an average parking duration of 3 hours, vehicle occupancy of 3 persons per car, 60% shuttle ridership and assumes each pedestrian crosses twice per day. The estimate is conservatively low because it does not account for pedestrians not associated with the Day Use Lot.

[2] The NHTS is a survey of American households and thus does not account for the travel characteristics of international visitors. According to the 2009 Visitor Study (University of Idaho, April 2010), 75% of the park's visitors are from the United States.

Northside Drive to Southside Drive could be estimated using the valley traffic simulation model developed for the ITCA project which could be used to demonstrate the effect on travel time for inbound and outbound vehicles.

Traffic congestion, delays and potential design changes at intersections should be evaluated. This traffic circulation change would affect turning movement patterns and would likely increase the amount of vehicles passing through the Southside Drive intersections with Curry 4-Way, Sentinel Drive, and El Capitan Crossover. It should reduce the amount of traffic along Northside Drive; but the effect on traffic operations due to changes in turning movement patterns at Northside Drive intersections with Sentinel Drive and El Capitan Crossover should be evaluated. The traffic simulation model could be used to estimate the turning movement changes and would be used to determine if modifications such as adding turn lanes might be necessary to mitigate congestion.

Access to pulloffs, roadside parking and other entrances should be evaluated. As noted, this roadway circulation change would increase traffic volumes significantly on Southside Drive. The increase in traffic volumes may make it more difficult to enter and exit roadside parking and pulloffs such as Chapel Straight and Swinging Bridge. It would also increase delays for traffic trying to enter Southside Drive from access points to the Chapel, Le Conte Memorial and Housekeeping Camp.

This strategy has the potential to address one of the most severe traffic congestion and pedestrian access issues in the park but its viability needs to be evaluated further so that the congestion problem it can help address is not transferred to another location.

Pave and stripe parking spaces at the Day-Use Parking Lot in Yosemite Village (OM-1140). This strategy would optimize mobility by maximizing the amount of self directed parking spaces within the existing footprint of the Day Use Parking Lot in Yosemite Village (Camp 6). This strategy would also provide an opportunity to improve circulation for pedestrians and shuttles through clear and more durable delineation of traffic lanes and pedestrian ways. The parking lot currently has a gravel surface and provides approximately 520 self directed parking spaces. When the traffic management response team is deployed to direct parking, 700-750 vehicles may be parked within the lot (Dave Henderson, June 3, 2010). Self directed parking is not efficient, especially without any officially marked parking spaces. Paving the lot and striping parking spaces would increase the official parking space count in the lot, although it is unlikely that 700-750 officially designated spaces would be achievable when laying out parking spaces, circulation aisles and roads, and pedestrian ways. Improving the efficiency of the existing lot may increase capacity by as much as 15% which would result in 75 more designated spaces in the Day Use Lot[1]. However, the potential increase in self-directed parking spaces will need to be determined through site planning. The feasibility of this strategy hinges on whether or not a hard surface will be allowed given the proximity of the Day Use Lot to the Merced River and the fact that it is within the Wild and Scenic River Boundary.

Redesign the Yosemite Lodge-Lower Yosemite Falls Northside Drive Pedestrian Crossing (OM-1220, OM-1225). This strategy would optimize mobility by reducing severe delays for vehicles and pedestrians at this location. The traffic management response team currently directs traffic and pedestrians at this location during the outbound peak hours. Even with traffic management, long queues form on Northside Drive from the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing as far back as Sentinel Drive. Consistent with these observations, the intersection of Northside Drive with the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing was rated as Level of Service F during the 7th and 1st

[1] Victoria Transport Policy Institute, *Parking Management: Strategies Evaluation and Planning*, February 11, 2011, Table 7, page 23.,

busiest days of 2007 – this constitutes a "failing grade" on the primary traffic engineering measure of intersection performance. This location is critical in Yosemite Valley because all outbound vehicle trips with an origin east of El Capitan Crossover must pass through this section of Northside Drive. One option to address congestion at this location, proposed in the 2000 Yosemite Valley Plan was to completely remove all through traffic by relocating Northside Drive to an alignment between Yosemite Lodge and the Merced River, from a point just east of the Yosemite Creek bridge to approximately Camp 4. This option would eliminate the conflict and associated congestion by providing a free flow route away from the pedestrian crossing. However, a road on a new alignment has potential impacts to resources that would need to be fully evaluated. Design options generally limited to the existing footprint of Northside Drive between the Yosemite Lodge-Lower Yosemite Falls pedestrian crossing and Yosemite Creek Bridge should also be considered. Site specific design options might include changing Northside Drive to one-way westbound at the pedestrian crossing. This change would provide two through lanes for outbound traffic which would reduce delays and vehicle queues at the pedestrian crossing. Such a change would affect vehicular access to and from Yosemite Lodge, would need to be studied carefully in a site planning process and may also have impacts to resources. A pedestrian underpasses or overpasses might also be considered; although the long approach ramps necessary to satisfy ADA design standards and other related structures could have notable visual and footprint impacts.

All traffic exiting the east Valley must pass through this intersection and, according to the 2009 Visitor Study, Yosemite Falls is one of the most visited sites in the park attracting 59% of visitor groups. During the June 2010 scoping trip, park staff noted that the traffic management response team often allows a queue of 200-300 pedestrians to form at the cross-walk while allowing vehicles to pass through. Thus, the potential benefits of this strategy are elimination of severe congestion that affects almost every vehicle exiting the east Valley and improving access and safety for a large number of pedestrians. However, the challenges to implementing an effective solution are also significant and need to be considered through site planning.

Reconfigure Northside Drive-Day Use parking-Village Drive intersection (OM-1255). This strategy would optimize mobility by redesigning the existing intersection to improve traffic flow and access for pedestrians, cyclists, shuttles and tour buses. Traffic congestion is exacerbated at this intersection due to the offset alignment of Village Drive and the entrance/exit to the Day Use Parking Lot and the interruptions necessary to allow pedestrians and cyclists to cross safely between the Day Use Parking Lot and primary destinations in Yosemite Village. The intersection is the one entry/exit point to the Day Use Parking Lot, accommodates a high volume of through traffic on Northside Drive, including tour buses and park shuttles, and is crossed by a large number of pedestrians walking between the Day Use Parking Lot, Visitor Center and other destinations in Yosemite Village. Furthermore, all traffic from points east of Sentinel Drive must pass through this intersection when exiting Yosemite Valley. The intersection also includes a right-turn slip lane from eastbound Northside Drive into the Day Use Parking Lot with advantages and disadvantages that should be considered. The right-turn slip lane softens the turning radius for vehicles entering from eastbound Northside Drive and may be necessary to accommodate the larger tuning radii requirements of shuttles. However, it creates an internal conflict point when it merges with the main entrance road, may encourage higher speeds for entering traffic and has isolated a 300 year-old tree in a traffic island. Alternate access points to the Day Use Parking Lot from Sentinel Drive should be considered in design options developed for this strategy. There are multiple traffic circulation permutations that should be evaluated if a new access point is provided on Sentinel Drive. The configurations would vary based on whether or not one or both access points would allow entering and exiting traffic, entering traffic only or exiting traffic only. The different access configurations need to be considered as part of this strategy because they will affect the amount of traffic using the existing Northside Drive intersection. The access configurations will also affect circulation patterns within the Day Use Parking Lot and traffic passing through the Northside Drive-Sentinel Drive intersection.

Improve parking and pedestrian access on Southside Drive through Bridalveil Straight (OM-1265). This strategy would optimize mobility by enhancing existing parking, pedestrian access and reducing the potential for crashes along Bridalveil Straight. The section of Southside Drive through Bridalveil Straight consists of two, one-way eastbound travel lanes and roadside parking/pull-out lanes on each side of the road. Bridalveil Straight provides dramatic views of El Capitan and Bridalveil Fall, and provides access to a trail leading to Bridalveil Fall. This section of Southside Drive carried an estimated 920 vph and 850 vph during the inbound peak hour on the 1st and 7th busiest days of 2010 respectively[1]. The estimated maximum roadside parking was approximately 60 and 50 parked cars during the inbound peak hour on the 1st and 7th busiest days of 2010 respectively[2]. Parking durations are short (10 minutes based on 2007 observations conducted for the ITCA project) which increases the frequency of vehicles entering and exiting the roadway, increasing the potential for crashes. On several trips during the summer and fall of 2010, pedestrians were observed crossing the roadway at random, multiple locations, often between parked cars to cross the two lane roadway. This strategy would redesign the road section to better control vehicular access to and from the roadside parking, to help reduce potential collisions and to provide strategically located, well designed crossings that provide for safe passage of pedestrians and alert drivers to their presence.

An option to consider is reducing the number of vehicular travel lanes from two to one and replacing the remaining pavement with parking and other enhancements. The change would reduce the roadway crossing distance for pedestrians, reduce potential conflicts with a second lane of traffic and could help encourage slower speeds. The impact of the lane reduction on congestion needs to be evaluated using the microsimulation traffic model developed for the valley as part of the ITCA project. This option and other configurations should be explored through a site design process.

Designate lanes on Happy Isles Loop Road for dedicated use of shuttles/special vehicles and bicycle/pedestrians (OM-1570). This strategy would optimize mobility by reducing potential conflicts between motorized vehicles and pedestrians and cyclists; and by improving operations and minimizing delays for shuttles. Between the entrance to the wilderness trailhead parking and the stables, Happy Isles Loop Road is restricted for use by shuttles, personal cars with wheelchair emblem placards, administrative vehicles, and pedestrians and cyclists. All users share two paved travel lanes that provide for one-way, counter-clockwise circulation for motor vehicles and two-way circulation for pedestrians and cyclists. This strategy involves designating one lane for exclusive use by shuttles and other permitted motor vehicles, and one lane for exclusive use by pedestrians and cyclists. It could be implemented using signs and striping, although some additional design treatments may be required at shuttle stops and near the wilderness trailhead parking lot and stables where Happy Isles Loop Road transitions from a two-way full-use roadway to a restricted use road. The minimum width for the shuttle/special use vehicle lane is 11 feet. The minimum width for a multi-use path is 10 feet, but should be evaluated relative trail construction and management standards. The Happy Isles Loop Road provides access to the Vernal Fall trailhead and Mirror Lake, which are visited by 28% and 20% of visitors respectively[3]. In addition, according to a 2000 study[4], Mirror Lake and Happy Isles Loop Road were among the sites most visited by cyclists in Yosemite Valley. Given the level of pedestrian and bicycle use along Happy Isles Loop Road and the number of

[1] Raw traffic volumes were collected for this section of Southside Drive for the ITCA project on July 22, 2007 and have been adjusted to reflect the 1st and 7th busiest days of 2010 based on daily traffic volumes collected on Southside Drive at the Chapel in 2007 and 2010.

[2] Parking accumulation counts were collected for this section of Southside Drive for the ITCA project on July 27 and July 28, 2007 and have been adjusted to reflect the 1st and 7th busiest days of 2010 based on the relationship of daily traffic volumes on Southside Drive at the Chapel in 2007 and 2010.

[3] University of Idaho, *Yosemite National Park Visitor Study Summer 2009*, April 2010, page 42.

[4] University of California, Davis , *A Study of Visitor Bicycle Use in Yosemite Valley,* April 2000, page 19.

visitors that use the shuttle system this strategy has the potential to improve the travel experience for a significant number of visitors.

4.4.3 Tuolumne Meadows

Implement a parking management system for Tuolumne Meadows (OM-1130). This strategy would optimize mobility by using a variety of techniques to provide maximize use of designated parking spaces while eliminating unendorsed roadside parking. Based on data collected in 2006, nearly 300 vehicles were parked in unendorsed roadside locations along Parsons Road and Tioga Road. Consequently, parking shortages and associated unendorsed parking in Tuolumne Meadows are causing resource impacts, greater risks of pedestrian/motor vehicle crashes, degraded scenic vistas, and increased visitor frustration in this area of the park. This strategy may utilize some combination of parking management staff, a parking permit system and/or physical barriers to prevent unendorsed roadside parking. However, because the designated off-road parking lots are already over capacity during peak periods, additional strategies such as reducing the amount of overall day-use visitors to Tuolumne Meadows, and/or significantly increasing the number of day-use visitors that arrive by shuttle, rather than personal vehicle may also be necessary.

4.4.4 Wawona Road Corridor/Hwy 41

Redesign parking lot and circulation pattern adjacent to the Wawona General Store (OM-1135). This strategy would optimize mobility by improving circulation for vehicles, pedestrians and buses and maximizing parking in the lot situated between the Wawona Store and Forest Drive. Pedestrian circulation within the parking area adjacent to the store is not well delineated and the parking lot layout could be more efficient; requiring additional management by park rangers. The pedestrian connections are also poor to the tour bus stop located on the opposite side of Wawona Road and to the Mariposa Grove-Wawona shuttle stop. The parking lot adjacent to the Wawona Store is over capacity because it serves the store, the Pioneer Yosemite History Center (PYHC) and is used as overflow parking for Mariposa Grove. Different site plans and circulation patterns should be evaluated. The parking area is located near the South Fork of the Merced River and is within the Merced Wild and Scenic River boundary. Therefore, any changes will need to be consistent with the Merced River Plan. A new site plan can address the pedestrian circulation patterns, but is unlikely to result in enough additional parking spaces to accommodate times of peak parking demand. An improved parking layout may increase the capacity of this lot by as much as 15%, resulting in 10-15 additional spaces. Sidewalks and enhanced pedestrians crosswalks would improve safety and access for pedestrians and shuttle riders. These improvements would serve the 33% of park visitors that visit Wawona[1].

Redesign South Entrance (OM-1520). This strategy would optimize mobility by improving safety, traffic circulation, pedestrian access, and reducing long queues at the south entrance station along Hwy 41/Wawona Road. The existing entrance station has two entering lanes and one exiting lane. The two entrance lanes do not have enough capacity to accommodate traffic entering at this station and a vehicle queue of approximately 2,000 feet was observed during data collection for the ITCA project during a July 2007 weekend. In addition, motorists approaching the Wawona Road-Mariposa Grove Road intersection from the south are sometimes confused by the stop sign on the Wawona Road southbound approach and occasionally travel through the intersection without stopping. A restroom and small parking lot are located adjacent to the entrance station on the south side of Mariposa Grove Road. There is also a parking lot on the north side of Mariposa Grove Road opposite the restroom that is used for overflow parking from

[1] University of Idaho, *Yosemite National Park Visitor Study Summer 2009*, April 2010, page 42.

Mariposa Grove. The configuration of the parking lots, location of restrooms, pedestrian circulation and design of the Wawona Road-Mariposa Grove intersection all should all be considered in the redesign of the South Entrance. The entrance serves about one-third of visitors entering the park and is also a gateway to Mariposa Grove. Reconstruction could help reduce vehicle queues and may be part of the solution to addressing the parking shortage at Mariposa Grove. Implementation challenges include site constraints, historic structures and the need to coordinate with potential changes at Mariposa Grove and Wawona.

Extend the Wawona-Mariposa Grove Shuttle to the Wawona Campground and Consider Increasing Shuttle Service Frequency (OM-1345). This strategy would optimize mobility by using an existing shuttle service to more effectively reduce parking demand and serve visitor travel needs. When parking at the Mariposa Grove and South Entrance fill up, visitors are directed to park in Wawona and take the shuttle. However, when parking in Wawona reaches capacity, there are no nearby locations that can accommodate the overflow. This strategy would extend the shuttle to the Wawona Campground located on Wawona Road approximately one mile north of the store. To the extent that campground users occupy parking spaces when visiting the store, extending the shuttle service would provide an alternate means of travelling to the store and may help free up parking spaces. Extending the shuttle could also reduce the number of campground users that drive to and park at Mariposa Grove. The Wawona-Mariposa Grove shuttle currently runs every 30 minutes between the Wawona General Store, parking at the South Entrance and parking at Mariposa Grove. Extending the shuttle to the campground and maintaining a 30 minute frequency is marginal (based on travel time estimates using Google maps), and needs to be verified based on actual operating conditions. Some modifications to the campground entrance may be necessary to accommodate the entrance and exit of the shuttle. Adding another bus to increase the frequency of the shuttle service should be considered as an option within this strategy. Increasing the frequency would encourage a higher parking turnover rate and could help further reduce parking demand and shortages at Wawona. This strategy has the potential to reduce, but would not eliminate, parking shortages at Wawona and Mariposa Grove.

4.5 Strategies for Altering Transportation System Capacity

There are no park-wide strategies under this theme. All strategies alter the physical size of roads, parking lots and other infrastructure or change the number of buses operating along a specific corridor. Therefore, all strategies are related to specific locations in the park.

4.5.1 Yosemite Valley

Build more parking in Yosemite Valley for day-use visitors (AC-1065). This strategy would alter the capacity of the transportation system by increasing the number of parking spaces in Yosemite Valley. Its purpose is to eliminate parking shortages, unendorsed parking and the related resource and visitor experience impacts by providing more parking spaces that are located and designed to provide efficient access consistent with visitor experience and resource protection goals

On the 7th busiest day of 2010, the number of vehicles in east Yosemite Valley exceeded the total parking supply by approximately 760 vehicles during the peak hour assuming attended parking was provided and that parking was permitted in informal/gravel roadside locations. If visitors were allowed to park without guidance from park staff, and parking was not allowed in informal/roadside locations, the shortage would have been approximately 1,300 spaces on the 7th busiest day in 2010(Figure 9). Parking lots are typically sized with 5-15% extra capacity to allow for the inefficiencies associated with maneuvering into and out of parking spaces, the time it takes to search for a space, and to ensure that a space is always available. If the all of the additional parking is provided in one consolidated location, the efficiency adjustment would

be on the low end of the range because there would be less turnover as visitors would leave their car in one location throughout their stay. A 15% efficiency factor should be applied if additional parking is dispersed in multiple locations to allow for a higher turnover rate and the inefficiencies with entering and exiting multiple parking spaces. Thus, approximately 1,400 spaces should be provided in one consolidated location or 1,500 spaces if dispersed locations are provided (assuming that the 7th busiest day is the desired design day).

If expanded parking is provided in one surface lot it would require approximately 11 additional acres of land to support 1,400 spaces[1]. It may be possible to provide some additional spaces at existing lots, but proximity to the Merced River and other constraints limit the potential for any significant increases. New sites would need to be evaluated. Relative to circulation, a new parking facility in the west end of the Valley would help divert traffic from the worst areas of congestion in the east Valley. However, a large new facility in the west end of the Valley would likely meet significant resistance due to the expansion of development that it would represent. In addition, for this facility to be most effective at diverting traffic from the most congested areas of the east Valley, additional shuttle service would be necessary, which comes with its own challenges such as the lack of space for storage and maintenance in the Valley. One or two smaller parking lots could be part of an overall approach to addressing the parking shortage, but finding appropriate sites that also satisfy resource protection and visitor experience goals while minimizing traffic circulation and congestion, particularly in the east end of the Valley, will remain an obstacle.

Extend the Valley Shuttle service to the west end of Yosemite Valley (AC-1100). This strategy would increase transportation system capacity by expanding shuttle service where it does not currently exist. Its purpose is to help reduce parking congestion, particularly at the Bridalveil Fall lot, and to reduce traffic circulating on Valley roads. There are three shuttle routes within the Valley: the year-round Yosemite Valley Shuttle (which circulates in the east Valley), the Express Shuttle (connects the Day Use parking lot and Visitor Center) and the summer-only El Capitan Shuttle. The El Capitan shuttle currently runs from Yosemite Village, west along Northside Drive, and returns via El Capitan Crossover, Southside Drive and Sentinel Drive. The service is provided by a single shuttle with headways at 30 minutes. On average, the shuttle is about half full[2]. The El Capitan Shuttle route could be extended west to Pohono Bridge from which it would return to the Visitor Center on Southside Drive and Sentinel Drive. A single shuttle between the Visitor Center and Pohono Bridge would require headways between 30-40 minutes. Reducing frequencies by half would nearly double the number of passengers per trip, resulting in almost 100% occupancy on an average day, and more during busier days. Occupancies would be even higher due to the additional passengers that would choose to use the shuttle if extended to the west end of the Valley. Therefore, two shuttles should be considered.

According to the 2009 Visitor Study, 52% of visitor groups visit Bridalveil Fall and data collected for the ITCA project indicate that the parking lot is often over capacity. Because all traffic entering Yosemite Valley must pass by Bridalveil Straight, this strategy would not necessarily reduce roadway traffic congestion in that location. Providing alterative access to Bridalveil Fall, and helping to reduce parking congestion, is the primary reason for this strategy. The shuttle stop would likely be located along Bridalveil Straight. Modifications to the roadway would be necessary to provide a safe and accessible shuttle stop at that location, and could be incorporated into a redesign of Bridalveil Straight (strategy 1265). Providing shuttle service to Bridalveil Fall is likely to increase the number of visitors accessing the site, which is now limited to some extent by available parking. Results from the 2007 ITCA study suggest

[1] This estimate assumes 325 square feet per parking space, Page 532, "Transportation Planning Handbook, 2nd Edition", Institute of Transportation Engineers, 1999

[2] Phone conversation with Gary Rosenfeld, DNC Transportation Manager, April 7, 2011.

that existing levels of visitation at Bridalveil Fall result in pronounced crowding issues (more so than at any of the other evaluated sites). Thus, re-design of the trail and viewing platform, or other mitigation, may be necessary in conjunction with an El Capitan shuttle route expansion.

An extension of the El Capitan shuttle could also stop at Valley View along Northside Drive. Passengers would disembark on the right side, and would need to cross Northside Drive to access the view and swimming. Modifications would be required to provide a suitable shuttle stop and a safer pedestrian crossing.

Expand the multi-use path network to the west side of the Valley (1185). This strategy would alter transportation system capacity by providing a new multiuse path and increasing accessibility, primarily for cyclists, in the west end of the Valley. When asked whether they thought there were bicycle paths and routes to all the places they wished to bike, 37% of survey respondents in a 2000 study of bicycling in Yosemite National park study said "no." The vast majority of those bicyclists wanted infrastructure extended to mid-Valley and western parts of the Valley such as El Capitan Meadow and Bridalveil Fall.

The Valley Loop Trail extends from the Pohono Bridge crossover in the west to Mirror Lake along the north and south sides of the Valley. At one point, the entire trail was paved and asphalt remnants can be found along all segments. The trail has remained unpaved in the western end, although if it were rehabilitated with an appropriate surface (hard pack gravel or pavement), it could provide an off-road connection for cyclists in the west end of the Valley.

Another option to provide west-Valley access for bikes is reducing the number of vehicular travel lanes on Northside Drive and/or Southside Drive from two to one and using the remaining paved travel way as a dedicated bike lane. There are several variations of this concept that could be evaluated such as:

- Provide one lane for motor vehicles and one lane for bicycles on both Northside Drive and Southside Drive between Curry Village and the Pohono Bridge;
- Allow two-way motor vehicle traffic on Southside Drive between El Capitan crossover and Curry Village in conjunction with a dedicated bike lane and a one-way motor vehicle travel lane on Northside Drive westbound between Yosemite Lodge and the Pohono Bridge (The issues associated with this circulation change are discussed in strategy 1215) ; or
- Allow two-way motor vehicle traffic on Southside Drive between El Capitan crossover and Curry Village, remove Northside Drive between Yosemite Lodge and El Capitan crossover and construct a new multi-use path in its place (this concept was included in the 1997 Yosemite Valley Implementation Plan and the 2000 Yosemite Valley Plan).

These concepts would change traffic patterns significantly and would need to be evaluated relative to traffic congestion impacts, emergency vehicle access, impacts to shuttle, YARTS and tour bus circulation, and resource impacts.

This strategy would improve access to Bridalveil Fall for visitors and could reduce parking congestion to some extent. Extending the multi-use bike path to the west end of the Valley would likely increase the number of visitors accessing Bridalveil Fall. Results from the 2007 ITCA study suggest that existing levels of visitation at Bridalveil Fall result in pronounced crowding issues (more so than at any of the other evaluated sites). Thus, re-design of the trail and viewing platform, or other mitigation, may be necessary in conjunction with additional visitors generated by a new multi-use path.

Redesign roadside parking on Northside Drive along El Capitan Meadow (AC-1266). This strategy would change the capacity of the transportation system by redesigning roadside parking with an appropriate number of spaces while also minimizing impacts to El Capitan Meadow. The section of Northside Drive just west of El Capitan Crossover consists of two one-way westbound travel lanes and a paved roadside parking lane directly adjacent to El Capitan Meadow. The roadside parking extends for approximately 1,980 feet which can accommodate parking for about 80-100 typical cars (not including

RVs). The roadside parking enables visitors to walk from their vehicles directly into El Capitan Meadow resulting in multiple social trails and related resource impacts. Data collected for the ITCA project indicate that the maximum number of cars in the roadside parking is 60 and 55 on the 1st and 7th busies days of 2010 respectively (including cars parked along El Capitan Crossover between the bridge and Northside Drive)[1]. These data suggest that the length of roadside parking could be reduced and a smaller parking facility could accommodate parking demand. Consolidating parking in one location would create an opportunity to develop a focused and appropriately designed trail that provides access to El Capitan Meadow while reducing resource impacts. The best location and configuration of the parking facility needs to be evaluated in a site planning process and should include barriers that prevent roadside parking where it is no longer necessary or desirable.

4.5.2 Highway 140/El Portal Road Corridor

Provide a park-and-ride lot in El Portal (AC-1045). The strategy would alter the capacity of the transportation system by adding parking spaces in a new facility located along the Hwy 140 corridor in El Portal. Its purpose would be to decrease the number of vehicles entering the park through the Arch Rock Entrance to help reduce parking demand and traffic congestion in the park. Given that Hwy 140 is a primary route for employees commuting into the park and that approximately 40-45% of visitors enter and exit through the Arch Rock Entrance[2], El Portal is a practical location for a park-and-ride Based on data collected for the ITCA project approximately 2,055 vehicles entered the park through the Arch Rock Entrance on the 7th busiest day in 2010. A park-and-ride is only practical for visitors that enter and exit through the same entrance station. As noted, about half of these vehicles both enter and exit through the Arch Rock Entrance creating a total potential demand of about 1,000 vehicles that might use a park-and-ride. Assuming 10-20% of visitors that enter and exit through the Arch Rock Entrance would choose to park their car and take a shuttle into the park, this strategy would reduce the need for 100 to 200 parking spaces and would remove the same number of vehicles from circulating on park roads.

A park-and-ride in El Portal would be able to take advantage of the existing YARTS Highway 140 route. However, the schedule is limited and does not accommodate the full demand along this corridor. To be most effective at diverting traffic from entering the park, an El Portal park-and-ride should be served by a higher frequency shuttle (strategy AC-1325). Use would be further enhanced by a real-time traveler information system that uses a roadside dynamic message sign prior to the park-and-ride, and other means, to inform travelers about actual parking and crowding conditions in the park (strategies MA-1070, MA-1574 and MA-1075).

Provide express transit service between El Portal and Yosemite Valley (AC-1325). This strategy would alter the capacity of the transportation system by increasing the frequency of transit service, and therefore its capacity, between El Portal and Yosemite Valley. Its purpose is to reduce traffic and parking in the park by making transit service more convenient and attracting more passengers. YARTS currently provides five inbound and six outbound runs between El Portal and Yosemite Valley[3]. Intervals between runs vary and there are gaps in service that make it inconvenient for many visitors and employees. For example, YARTS does not provide any inbound runs between 11:00 am and 7:30 pm between El Portal and Yosemite Valley during the summer season. This strategy would provide an express shuttle that picks up riders at one or two locations in El Portal and one or two stops in Yosemite Valley. Two vehicles would

[1] Parking accumulation counts were collected in this area for the ITCA project on July 27 and July 28, 2007 and have been adjusted to reflect the 1st and 7th busiest days of 2010 based on the relationship of daily traffic volumes on Southside Drive at the Chapel in 2007 and 2010.

[2] BRW, Inc ,*Yosemite National Park Vehicle Movement Study, Draft Technical Memorandum*, November 1993, Tables 2 and 3.

[3] YARTS provides a total of six inbound runs on the Highway 140 corridor, but one run does not currently stop in El Portal.

be required to provide one hour headways. This strategy has the potential to reduce the need for 100-200 parking strategies in combination with a park-and-ride in El Portal (see the discussion in strategy AC-1045).

Increase transit service in the 140 Corridor (AC-1325b). This strategy would alter the capacity of the existing transportation system by increasing transit service. Results of an importance-satisfaction analysis presented in the 2007 visitor use and transportation study suggests that YARTS should be a priority for transportation resources (Figure 5). YARTS currently provides six inbound runs and seven outbound runs along the Hwy 140 corridor during the summer season (May-October); and six inbound runs and six outbound runs during the rest of the year. The YARTS 2011 Short Range Transit Plan (SRTP) evaluated changes in service based on existing and future ridership potential, stakeholder input and market research, capital and operating costs, and funding source availability. It evaluates and recommends service reduction and efficiency changes that primarily affect the winter season and includes service option changes and recommendations for the summer season. The service options recommended in the 2011 YARTS SRTP that would affect the peak summer season are (1) providing an earlier Friday afternoon outbound bus to serve NPS employees, and (2) starting Run 2 at 5:18 am from the Merced Transpo center to serve hikers desiring an earlier morning bus[1]. A notable gap during the summer season is a lack of transit service during the afternoon. The 2011 SRTP notes that issue but concludes that the potential ridership benefits do not appear to justify the costs and an additional midday run is therefore not recommended[2]. The 2011 SRTP notes that the load factor[3] in July 2009 was 108% on Run 3 (departs Merced Transpo at 7:00 am and arrives at Yosemite Lodge at 9:55 am) and 95% on Run 9 (departs Curry Village at 3:40 pm and arrives at Merced Transpo at 6:24 pm). Consistent with these load factors, 86 and 28 passengers were left behind in July and August 2009 respectively. The 2011 SRTP also notes that the NPS discussed with YARTS the potential for supplemental service during the 25 peak visitation days. To address peak visitation, and to avoid leaving any passengers behind (30-90 per month during the summer season), the 2011 SRTP recommends adding 226 vehicles hours of service during peak days in the Summer/Fall of 2011.

4.5.3 Highway 120/Big Oak Flat Road Corridor

Provide transit service along the Hwy 120 corridor from Sonora and Groveland to the park (AC-1305, AC-1320). This strategy would alter the capacity of the transportation system by providing new transit service where none currently exists with the purpose of attracting more riders and reducing parking and traffic congestion. Ridership was estimated in the 2011 Transit Development Plan Update (TDP) for Tuolumne County Transit[4]. The TDP assumes transit service would be limited to one round trip on Saturdays only and would serve between 10 and 30 visitors during the summer months. This ridership would displace as much as 10 parking spaces. The TDP notes that daily ridership would be lower on other days of the week if service was provided beyond Saturdays. As noted previously, 1.3% of all visitors arrive in the park on YARTS. If this percentage is applied to the visitors entering the park from the Hwy 120 corridor through the Big Oak Entrance on the 7th busiest day in 2010, the result would suggest approximately 105 entering passengers per day reducing the need for about 35 parking spaces (based on 3 persons per car). The 1.3% share of visitors' travelling into the park is based on the current YARTS schedule, which provides week long routes six or seven times per day. This level of service is significantly

[1] Run 2 currently starts from Midtown Mariposa at 6:15 am

[2] Transit Resource Center, Transit Marketing and Innovative Paradigms, *YARTS Short Range Transit Plan, Volume I: Service, Institutional and Financial Plan*, February 2011, pages 5-3 through 5-5..

[3] Load factor is the number of passengers on a bus divided by its capacity

[4] Magic Consulting Group ,*Final Report Transit Development Plan Update for Tuolumne County*, February 2011

greater than the once-a-week service proposed in the Tuolumne County TDP for the Sonora-Groveland-Yosemite Valley route, but is useful in estimating the potential benefit of a more extensive transit service in the Hwy 120. One other characteristics of the Hwy 120 and Big Oak Flat entrance that increase the potential success of transit service in this corridor is that 52% of visitors that enter through the this location, also exit there[1], the highest percentage of all entrance in the park.

In the short term, efforts are under-way to initiate a Yosemite Shuttle Service from Sonora and Groveland to Yosemite Valley. Different service options have been proposed including weekend and holidays (33 days during the summer season) and for all 102 days of summer. Options are being considered for one or two shuttle runs per day. Fares are proposed at $15 from the Sonora and Jamestown area and $10 from Groveland.

4.5.4 Highway 41/Wawona Road Corridor

Provide a park-and-ride facility at Badger Pass with shuttle service to Glacier Point (AC-1055). This strategy would alter the capacity of the transportation system by increasing shuttle service along Glacier Point Road and providing an improved parking facility with a comfort station at Badger Pass. Its purpose is to reduce traffic and parking congestion at Glacier Point during its peak use in July and August.

According to the 2009 Visitor Study, Glacier Point attracts 44% of the park's summer visitors. Visitor surveys conducted in 1999 at Glacier Point suggest that traffic congestion and difficulty finding parking as the two most problematic management issues. It is reasonable to assume that parking and traffic issues are even more pronounced now, given that recreation visits were even greater in 2010 than they were in 1999. A park-and-ride lot at Badger Pass is well situated to serve visitors travelling to Glacier Point because they would not have to divert from their route. This strategy could be operated on a voluntary basis until parking approaches capacity at Glacier Point, after which all visitors travelling to Glacier Point would be diverted to the Badger Pass park-and-ride and shuttle service. Mandatory use of the park-and-ride at Badger Pass would probably only be necessary in July-August, and between 12:00 pm and 5:00 pm, the most common months and times of day that the Glacier Point lot fills beyond capacity

A challenge with closing off Glacier Point Road east of Badger Pass will be maintaining access to the Bridalveil Creek campground and other trailheads. Persons camping at the Bridalveil campground would be allowed to continue beyond Badger Pass by showing a special campground pass.

The Glacier Point Tour/Hikers shuttle provides three round trips per day during the summer season between Yosemite Lodge and Glacier point and is run by the concessionaire for a fee ($25 one-way and $41 roundtrip). Its cost and frequencies are not well suited to serve potential park-and-ride users.

A single bus could reliably provide 70-75 minute headways between Badger Pass and Glacier Point[2]. However, this frequency is unlikely to attract many riders voluntarily and may result in frustrating waits for visitors that are directed to take the shuttle if it were mandatory. In addition, the majority of vehicle stays at Glacier Point are relatively short (30- 45 minutes). Therefore, 35-40 minute headways should be considered which would require two buses. The park-and-ride should provide a comfort station and possibly other visitor services. However, Badger Pass does not currently have the infrastructure for additional water and wastewater facilities. In the short-term, an overflow parking area at Badger Pass could be accomplished with relatively little additional infrastructure. Temporary portable toilets would be necessary to reduce the impact to an insufficient waste-water system. This strategy would be enhanced

[1] BRW, Inc; *Yosemite National Park Vehicle Movement Study, Draft Technical Memorandum*, November 1993, Tables 2 and 3.

[2] The estimated travel time between Badger Pass and Glacier Point is 25 minutes based on Google Maps. Accounting for loading/unloading, driver breaks, etc suggests a roundtrip time of 70 minutes.

by a real-time traveler information system that uses a roadside dynamic message sign prior to the park-and-ride, and other means, to inform travelers about actual parking and crowding conditions at Glacier Point and information on arrival and departure times for the shuttle (strategies MA-1070, MA-1574 and MA-1075).

Reallocate or remove some amount of parking from Mariposa Grove and accommodate parking at an off-site location as required; and modify shuttle service as necessary (AC-1110). This strategy would alter the capacity of the transportation system with potential changes to the location and amount of parking spaces and related changes to the Wawona-Mariposa Grove shuttle. Its purpose is to address parking shortages at Mariposa Grove and the related impacts of overflow demand at parking lots at the South Entrance and Wawona. The strategy would improve the experience for the 36% of park visitors that visit the Grove (2009 Visitor Study). Parking congestion at Mariposa Grove is pronounced during the peak season. After the "upper lot" is full, typically by early to mid-morning, it is closed and visitors either park in the "lower lot" adjacent to the South Entrance or in Wawona, where they take a shuttle back to the Grove. Options could include reducing parking at the Grove, providing parking in a new site or possibly adding parking in Wawona with shuttle service as necessary. In addition to resource impacts and design issues for new parking locations, options would need to consider potential impacts to Wawona; reducing the "back tracking" that happens now when visitors are directed to park in Wawona and ride a shuttle back to the Grove; and coordination with possible design changes at the South Entrance (OM-strategy 1520).

Provide transit service along the Hwy 41 corridor from Fresno to the park (AC-1330). This strategy would alter the capacity of the transportation system by providing new transit where none currently exists with the purpose of attracting more riders and reducing parking and traffic congestion. The Fresno Council of Governments (COG) commissioned a study to determine the viability of implementing one or more transit routes between Fresno and Yosemite and Sequoia, and Kings Canyon National parks[1]. The Hwy 41 Fresno-Yosemite route would originate at the Fresno Greyhound Station, and serve the Fresno Amtrak station, Fresno-Yosemite International Airport, Fresno State University, North Fresno hotels, Chuckchansi Gold Resort-Casino, Oakhurst, Tenaya Lodge, Wawona, Curry Village, Ahwahnee Hotel, Yosemite Visitor Center and Yosemite Lodge. The first phase of recommended service would provide five inbound and five outbound runs from May through September. Subsequent phases would include off-season service and add more service during the summer. The conceptual schedule for the first phase indicates a travel time between the Fresno Greyhound Station to Yosemite Lodge is approximately 2 ½ hours. Ridership is expected to consist of visitor trips to the park, NPS and concession employee trips to the park, and a few intercity commuters (Fresno-Oakhurst) and casino trips (Fresno-Chukchansi Gold Resort Casino). High and low estimates of peak season ridership (July) are 9,100 and 7,200 per month. High and low estimates for off-peak season ridership are 3,500 and 2,600 per month. During the peak season, this ridership estimate equates to a reduction of approximately 50 and 40 entering vehicle trips per day[2].

4.5.5 Tuolumne Meadows

Provide a park-and-ride lot at Mono County Visitor Center with Shuttle Service to Tuolumne Meadows (AC-1035, AC-1370). This strategy would alter the capacity of the transportation system by utilizing parking spaces at the Mono County Visitor Center and providing a new shuttle service between the park-and-ride and Tuolumne Meadows. Its purpose is to reduce parking demand in Tuolumne Meadows to help alleviate the resource and visitor experience impacts of unendorsed parking. In addition,

[1] Fehrs & Peers, *Yosemite, Sequoia and Kings Canyon National Park Transit Market Assessment & Feasibility Study: Working Papers 1-4 Prepared for the Fresno Council of Governments*, January 2011.,

[2] This estimate assumes: all of the passengers are destined for the park, all of the passengers would have driven if transit service was not available, and an average vehicle occupancy of 2.9 people per car.

a park-and-ride facility at the Mono County Visitor Center could serve as a transfer point between the YARTS Hwy 120 route and ESTA's Hwy 395 service. As previously noted, there are roughly 533 day use and overnight parking spaces in designated parking lots, and studies of parking demand show an additional 453 vehicles on the ground in unendorsed roadside parking areas and on the fringe of parking lots during the peak use period in August 2006. The unendorsed parking causes resource impacts, greater risks of pedestrian/motor vehicle crashes, degraded scenic vistas, and increased visitor frustration in Tuolumne Meadows.

Based on data collected for the ITCA project approximately 1,800 vehicles entered the park through the Tioga Pass Entrance on its 7th busiest day in 2010[1]. A park-and-ride is only practical for visitors that enter and exit through the same entrance station. Approximately 24-29% of visitors that enter through the Tioga Pass Entrance also exit there[2]. Thus, there are approximately 500 vehicles for which a park-and-ride at the Mono County Visitor Center would be a practical alternative to driving. Assuming 10-20% of these visitors would choose to park their car and take a shuttle into the park; this strategy would reduce the need for 50 to 100 parking spaces at Tuolumne Meadows.

A Mono County Visitor park-and-ride with shuttle service to Tuolumne Meadows could support the other strategies suggested to address parking issues in Tuolumne Meadows including a parking management program (strategy MA-1130) and consolidating parking in a parking lot (strategy AC-1125). Considering the grade between Lee Vining and Tuolumne Meadows, a single bus could provide service on 75-90 minute headways. The advantage of using the Mono County Visitor Center is that it may be possible to utilize existing parking spaces, has restrooms, provides shelter and is an interesting place to wait for the next shuttle. The availability of parking spaces would need to be verified. The 2011 YARTS Short Range Transit Plan evaluates transit service between the Mono County Visitor Center and Tuolumne Meadows and concluded that four roundtrips could be provided each day using one bus.

Remove non-designated roadside parking in Tuolumne Meadows parking and replace it with consolidated lot parking (AC-1125). This strategy would alter transportation system capacity by eliminating unendorsed roadside parking and providing new parking spaces in a consolidated parking lot. Its purpose is to address parking shortages at Tuolumne Meadows while eliminating roadside parking. Based on data collected in 2006, nearly 450 vehicles were parked in unendorsed roadside parking areas and on the fringe of parking lots during the peak use period Consequently, parking shortages and associated unendorsed parking in Tuolumne Meadows are causing resource impacts, greater risks of pedestrian/motor vehicle crashes, degraded scenic vistas, and increased visitor frustration in this area of the park. This strategy could be implemented in conjunction with a parking management system for Tuolumne Meadows (strategy 1130), reducing overall day-use visitors to Tuolumne Meadows and/or significantly increasing the number of day-use visitors that arrive by shuttle, rather than personal vehicle may also be necessary (strategies 1035 and 1370); all of which will affect the number of parking spaces that need to be accommodated in the consolidated parking lot.

[1] This represents the 7th highest day of traffic entering the Tioga Road Entrance in 2010.

[2] BRW, Inc; *Yosemite National Park Vehicle Movement Study, Draft Technical Memorandum*, November 1993, Tables 2 and 3.

5.0 CONCLUSIONS

The Transportation Improvement Strategies Report is a technical document that compiles a broad range of ideas about how to improve visitor transportation systems and services in and around Yosemite National Park. It is a technical resource that provides information and ideas that can inform park planning activities in the park and is not itself a decision document. The strategies are conceptual in nature and would, if pursued, require additional levels of planning, analysis and environmental compliance.

The critical transportation issues facing the park include a high demand for and shortage of formal parking spaces in Yosemite Valley and at all other major attraction areas in the park. The result is overflow parking on roadsides and in lots that causes negative impacts to resources, safety, and visitor experience quality. The problem is particularly acute in Yosemite Valley where the gap between demand and safe, appropriately located and designed parking facilities is approximately 1,900 to 1,300 spaces on the 1st and 7th busiest days respectively (assuming if parking had not been allowed in the informal/gravel roadside spaces and all visitors' parking was self directed). Traffic congestion is also a critical issue impacting resources and visitor experience quality and is characterized by long vehicle queues at the four major entrances and excessive delays and long queues at critical circulation points in the Valley. A primary contributing factor to parking and traffic congestion and other transportation-related issues in the park is visitors' reliance on private vehicles as the predominant means of access to the park. Other contributing factors include conflicts at intersections and pedestrian crossings; narrow, winding mountain roads; the lack of advanced traveler information; and confusing wayfinding.

The transportation-related issues outlined in this report are made more complex by the National Park context in which they occur. Transportation solutions that might typically or more commonly be used to solve parking congestion, traffic circulation, safety and other transportation issues in an urban context may not be consistent with park management objectives. For these reasons, transportation improvement strategies developed for Yosemite National Park must not only be effective at addressing transportation-related issues, but must be consistent with park management objectives.

Given these challenges, it is not possible to address the park's transportation issues with one solution. The TISR identified and screened over 100 ideas that include roadway, parking, transit/shuttle, walk/bike and traveler information strategies for all areas of the park. Strategies were identified through a comprehensive review of previous plans, studies, surveys and data; and from technical fact finding meetings with NPS staff and agencies and other organizations involved in the planning and operation of the transportation system in Yosemite National park and the surrounding region. In addition to contributing to the list of strategies, the meetings also laid the groundwork for continued coordination and cooperation between the park and the surrounding region in addressing shared transportation issues.

The initial list of ideas was screened relative to potential benefits and challenges to identify the most effective and implementable strategies to address park transportation issues. However, the TISR is not a transportation plan or a decision document. Rather, the TISR will be used as a resource for other planning activities in the park. Therefore, the strategies have been organized into the following broad themes to help park planners sort through transportation options in the context of goals, alternatives and tradeoffs to be considered in other planning activities: 1) manage access by influencing visitor and employee travel patterns; 2) optimize mobility by improving the efficiency and/or safety of the existing transportation system without requiring a larger footprint or acquiring and operating new vehicles; and 3) altering the capacity of the transportation system to either reduce or increase its ability to move visitors and employees.

6.0 GLOSSARY OF TERMS

AMERICANS WITH DISABILITIES ACT (ADA): 1990 federal act provides a framework and approach for ending discrimination in employment and access to services against persons with disabilities. The goals of the ADA are to assure that persons with disabilities have equality of opportunity, a chance to fully participate in society, are able to live independently, and can be economically self-sufficient.

AVERAGE DAILY TRAFFIC (ADT): A means of expressing the volume of traffic on a roadway during a 24-hour period.

AVERAGE VEHICLE OCCUPANCY (AVO): A means of expressing the average number of people travelling in each vehicle on a given road or location.

CAPITAL FUNDS: Funding dedicated to new projects or projects to expand the capacity of the transportation system, including roadway widening, new parking lots, transit station improvements, new bicycle and pedestrian facilities, new buses. (Also see "operating funds.")

COMMUTE TRIP REDUCTION (CTR): A program that uses incentives and disincentives to encourage employees to use carpools, transit, walking and bicycling for travelling to and from work and telecommuting with the purpose of reducing parking demand and traffic congestion.

ENVIRONMENTAL ASSESSMENT (EA): A document prepared early in a planning process that evaluates the potential environmental consequences of a project or activity. An assessment includes the same topical areas as an EIS, but only assesses the effects of a preferred action, and in less detail than an EIS. An EA results in a decision, based on an assessment of the degree of impact of an action, that an EIS is necessary, or that an action will have no significant effect and a finding of no significant impact (FONSI) can be made.

ENVIRONMENTAL IMPACT STATEMENT (EIS): An EIS is a full disclosure, detailed report which, pursuant to Section 102(2)C of the National Environmental Policy Act (NEPA), establishes the need for the proposed action, identifies alternatives with the potential to meet the identified need, analyzes the anticipated environmental consequences of identified alternatives, and discusses how adverse effects may be mitigated. An EIS is prepared in two stages: a draft statement which is made available to the public for review and a final statement which is revised on the basis of comments made on the draft statement.

ENVIRONMENTAL PROTECTION AGENCY (EPA): The Federal agency charged with developing and enforcing national environmental policies. The EPA oversees Federal policy regarding air and water pollution, among other topics.

GENERAL MANAGEMENT PLAN (GMP): A document that provides the broadest level of NPS planning, outlining the goals and visions of a park. The GMP defines expected future resource conditions and visitor experiences envisioned for the park.

HOV LANES, BUS AND CARPOOL LANES, PREFERENTIAL LANES: A form of preferential treatment in which lanes on streets or highways are restricted for the exclusive use of high-occupancy vehicles during at least a portion of the day.

INTEGRATED TRAFFIC MANAGEMENT SYSTEM: The development and application of network-wide data collection and sharing of traffic information system. The system can integrate data and control systems from roadways, entrance stations and parking areas to provide real-time proactive traffic information and control. Implementation of the system would facilitate congestion management over the entire network across multijurisdictional boundaries. The system could provide incident detection, transit and emergency vehicle priority, and advance traveler information.

INTELLIGENT TRANSPORTATION SYSTEMS (ITS): Refers to the use of advanced technologies (such as traffic sensors and communications equipment) to improve the efficiency and safety of the transportation system.

INTERMODAL: A mode is a particular form of transportation, such as automobile, transit, carpool, ship, bicycle. Intermodal refers to connections between modes.

LEVEL-OF-SERVICE ANALYSIS (LOS): An analysis that describes the amount of traffic congestion in an area.

MODE: A particular form of travel, such as walking, bicycling, carpooling, bus, shuttle, train.

MODE SHIFT: The shift of people from one mode to another; for example, from single-occupancy vehicles to HOVs or vice versa.

MULTIMODAL: Facilities serving more than one transportation mode or a transportation network comprised of a variety of modes.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): Established by Congress in 1969, NEPA requires that Federal Agencies consider environmental matters when considering to carry out federal actions. This could include the preparation of environmental assessments (EAs) or environmental impact statement (EIS) for projects with the potential to result in significant effects on the environment.

OPERATING AND MAINTENANCE COSTS (O&M): Funds for day-to-day costs of running transportation systems. For transit, costs include fuel, salaries and replacement parts; for roads and parking lots, operating costs involve maintaining pavement, filling potholes and paying workers' salaries.

PARK-AND-RIDE LOT: A parking facility where individuals access public transportation as a transfer of mode, usually from private automobiles. Public transportation usually involves express bus service from the lot to a central business district or major activity center. A park-and-ride lot can also serve the dual function of a carpool location.

TELECOMMUTING: Communicating to work electronically (by telephone, computer, fax, etc.) with an office, either from home or from another site, instead of traveling to it physically

VMT: Vehicle miles traveled.

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