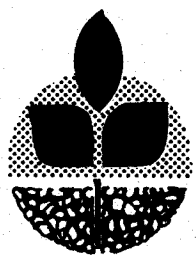
Visitor Congestion at Oregon Caves National Monument



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ABSTRACT

This study analyzes various alternative solutions to visitor congestion at Oregon Caves National Monument. Alternatives considered range from providing more information about waiting times to potential visitors to using some type of mass transit system to reduce parking problems at the Monument. It appears that a "full information system," as described in this report, is most likely to serve the public interest during the immediate planning period.

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VISITOR CONGESTION AT OREGON CAVES NATIONAL MONUMENT

R. N. Shulstad and H. H. Stoevener*

INTRODUCTION

Visitation to the Oregon Caves National Monument has been increasing continually over the last decade. During peak periods, more people desire to visit the Monument than can be immediately accommodated. 1/ Extended waiting, and automobile and visitor congestion at the Monument have resulted.

Visitors arrive at the Monument at various times throughout the day to tour the caves. A concessioner-run tour system requires a minimum of time between each tour. Because of physical limitations of the caves, it is possible to serve only a finite number of visitors per tour. When visitors arrive faster than the cave tour system can serve them, the visitors must wait.

Visitors to the Oregon Caves usually concentrate in the developed chateau-chalet area while waiting for their tour. Once the rate of visitation increases beyond a given point, the capacity of the parking lots at the Monument is also exceeded. Arriving visitors are then forced to wait in a queue along the highway until parking in the lots becomes available.

The National Park Service believes three factors to be primary contributors to the congestion problems: the uneven distribution of public demand, the limited capacity of the cave to accommodate visitors, and an inadequate supply of facilities and personnel needed to operate the cave at its maximum capacity. Excessive waiting periods for either the tour or for both parking and the tour are believed to detract from the overall quality of a visitor's experience at the Monument.

Physical Characteristics of the Monument

Oregon Caves National Monument is a 480-acre tract of mountainous terrain in the Siskiyou National Forest in the southwest corner of Oregon. Surrounding regions of Oregon and California are outstanding recreational areas. Visitors can easily enjoy the scenic coastlines, Redwood National Park, and Crater Lake

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* The authors gratefully acknowledge the assistance of Ted Davis, Assistant Superintendent, Oregon Caves National Monument, U.S. National Park Service, and Mr. Harry Christiansen, General Manager of the Oregon Caves Company. It was through their cooperation and that of their staffs that the data used in this analysis were collected.

1/ This review of the visitor congestion problem prior to 1973 draws heavily on research conducted by the National Park Service. It was reported in the August, 1971, master plan for Oregon Caves National Monument.

National Park in conjunction with a visit to Oregon Caves. In addition, the Shakespearian Festival in Ashland, Oregon, and the Wildlife Safari of Winston, Oregon, attract visitors into the general area.

U.S. 199, from Crescent City on the California coast to Grants Pass, Oregon, receives heavy vacation traffic. Oregon Caves visitors leave Highway 199 at Cave Junction and travel 20 miles along Highway 46 to its termination in the parking lot of the Monument (Figure 1). The first 12 miles, over the valley floor, are rapidly covered. The remaining 8 miles are a continual climb up a curvy mountain road, and trailer travel is not recommended. Departing visitors return to Cave Junction along the same road.

The trip from Cave Junction to Oregon Caves takes approximately 40 minutes. Alert visitors have an opportunity to stop in Cave Junction at an information station operated by the Oregon Caves Company. The station, painted with the colors of Standard Oil Company of California, is on a corner of the gas station's parking lot at the junction of U.S. 199 and Oregon 46. Both National Park Service and concessioner brochures are provided to visitors, as well as information concerning travel times, tour times, and waiting times for a tour. Most visitors do not stop at the information booth.

At the Monument, visitors park their cars and wal 0.2 miles from the main parking lot to the ticket office in the chateau-chalet area (Figure 2). Most visitors to the Monument take the cave tour; others wait outside while members of their party go through the cave. A small percentage of people visit the Monument for the sole purpose of having dinner at the chateau or enjoying hiking trails in the area.

Cave visitors arrive in moderate numbers during the early hours of the June-through-August tourist season. The arrival rate increases as the day advances, and by late morning, people must wait before being called to join a tour group. Waiting times for tours during peak visitation have equaled three hours.

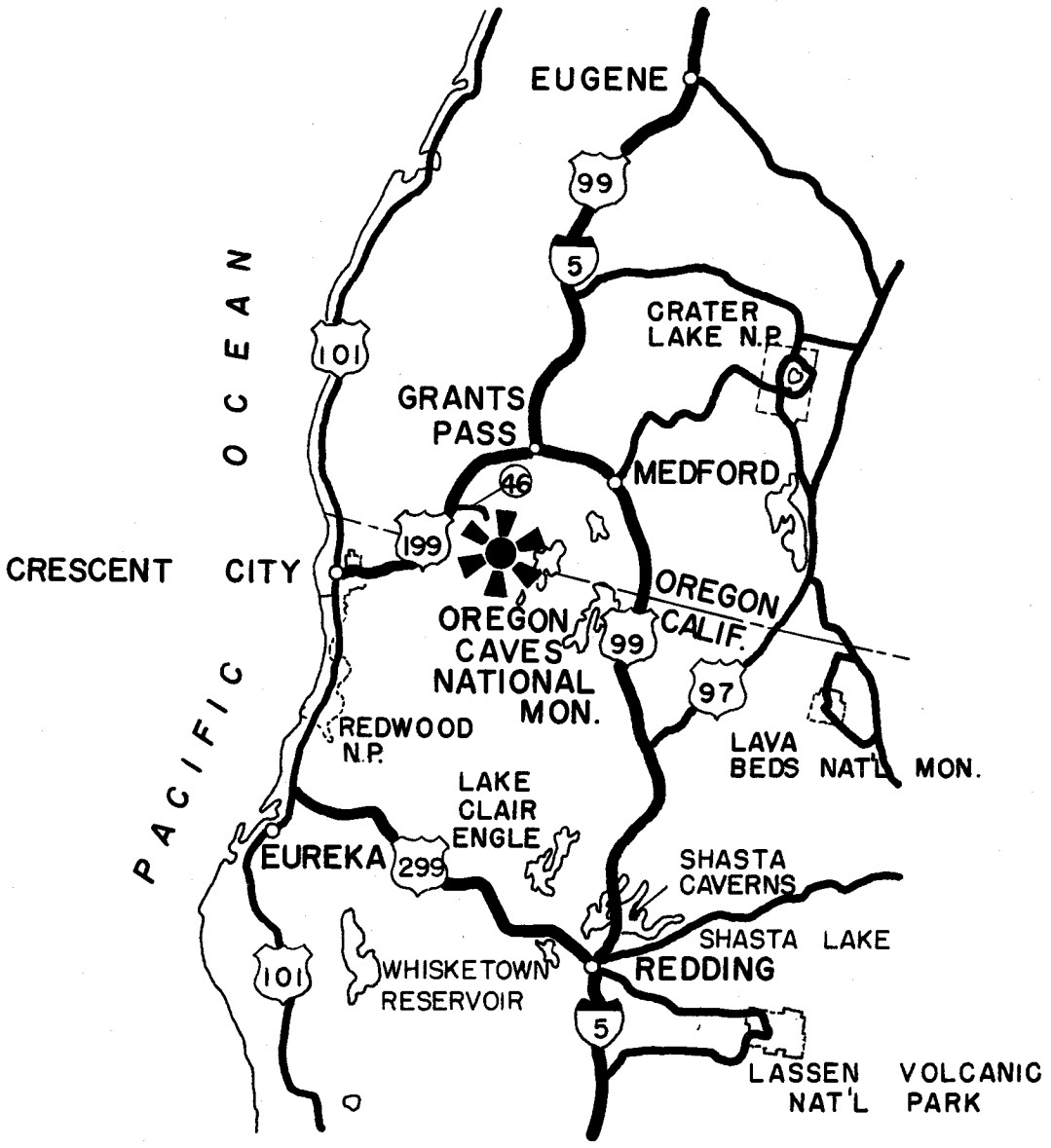
Visitors concentrate in the developed chateau-chalet area while waiting for tours. They patronize the curio shop, coffee shop, and dining room, watch and feed the wildlife, and relax while enjoying the forest scenery. Most read the interpretive panels explaining the cave geology and highlighting the wildlife of the area. While several good hiking trails are available in the area, they are little used by individuals waiting for tours.

The geography of the Monument imposes limitations on the availability of visitor waiting areas and parking lots; the physical characteristics of the cave and the availability of service personnel determine the minimum amount of time required to serve visitors. These limitations, in conjunction with the increasing number of visitors, are the basis of the congestion problem.

It is the objective of this study to:

(1) define the minimum service time for the cave tour system,

(2) determine the attitude of visitors toward waiting during periods when visitors arrive faster than the system can serve them, and

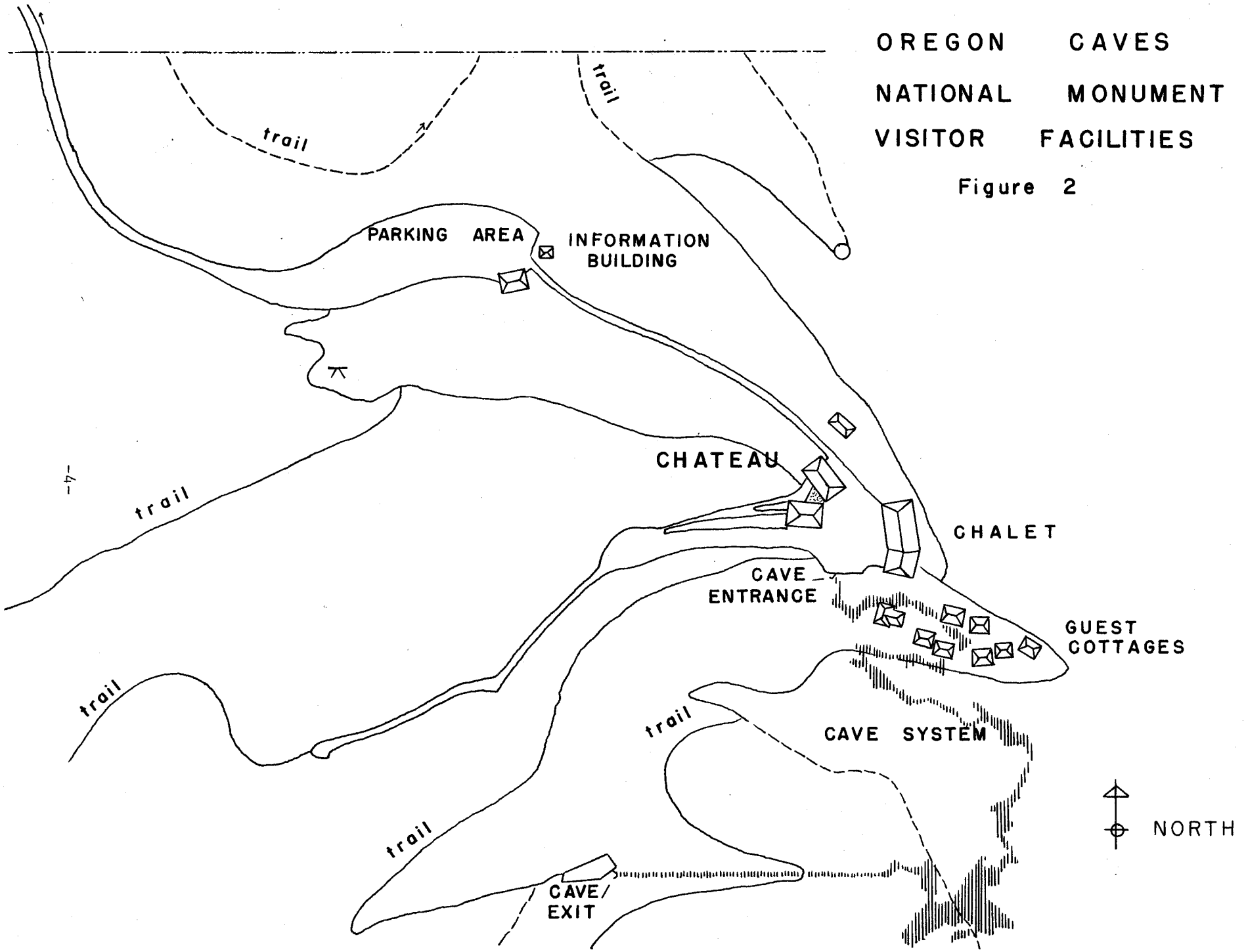


OREGON CAVES NATIONAL MONUMENT ACCESS MAP

NORTH

Figure 1

SOURCE: National Park Service, Oregon Caves Master Plan



SOURCE : National Park Service, Oregon Caves Master Plan

(3) evaluate various alternative systems as to how they would affect visitors, the National Park Service, and the Oregon Caves Company.

The cave tour system includes the cave itself, the parking lots, and the pedestrian-holding area in the chateau-chalet area. In the following section, information will be provided on the evaluation of the tour system: the maximum number of people that can be conducted through the cave with the end result being a quality experience to each participant; the adequacy of the parking area in relation to the capacity of the cave; and the capacity and quality of the pedestrian-holding area in the developed chateau-chalet area.

In the following sections, the visitor's reaction toward waiting in the chateau-chalet area will be evaluated. A determination of a visitor's general attitude toward waiting will be made. Various alternatives which could be introduced to alleviate the congestion problem will be evaluated. Finally, limitations of this study will be pointed out.

THE CAVE TOUR SYSTEM

Maximum Capacity of the Cave, Consistent with a Quality Experience for Each Visitor

One group of up to 16 visitors and one guide can complete an interesting and informative tour in one hour and 12 minutes. Two bottlenecks exist where two or more groups overlap. The first occurs becaise pf the lighting system. While the lead group is experiencing total darkness in the Joaquin Miller Chapel, the following group, then at the Grand Column, also has its lights turned off. This spill-over effect does not detract from the tour. In fact, most visitors appear to perceive this as an added attraction.

The second overlap occurs at the Ghost Room, where as many as four groups may be queued. The presentation at Paradise Lost appears to be the limiting factor. If discontentment is felt on the tour, it usually occurs in the Ghost Room. Presentations by tour guides vary in quality. With four tours occupying different corners of the Ghost Room simultaneously, visitors have an opportunity to hear another guide's story. Reactions of some visitors were, "Why didn't my guide tell us that?" The primary difference between guides arises on coverage of the physical formations - some guides concentrate on the geologic processes of how formations were formed; others point out how formations resemble items from everyday life.

Results of interviews with visitors and tour guides show almost unanimous satisfaction with the tour. Most visitors do not have any background in speleology and, with the exception of their encounter with more knowledgeable guides in the Ghost Rooms, accept their guides as respected sources of information.

Dissatisfaction has been voiced by some individuals who do not feel that the strenuous nature of the tour has been emphasized enough, and who leave at the 110 exit, regretting their decision to make the tour. The National Park Service brochure does point out that the tour is strenuous, but not all visitors receive this brochure. Only two additional warnings are posted on small printed signs

in the lower window of the information booth and the ticket office. The signs can be overlooked easily by those most in need of the information. The strenuous nature of the tour is pointed out by tour guides during their initial speech. However, most individuals have committed themselves to making the tour by then.

The limit of 16 visitors per tour is imposed by the capacity of various rooms on the tour. The spacing of six minutes between groups is dependent on the physical fitness of visitors and the characteristics of the cave.

The capacity of the cave must be accepted as the limiting factor in providing a quality experience to each Monument visitor. The maximum number of people that can be conducted through the cave, consistent with a high-quality experience, is believed to be 16 visitors per group, starting every six minutes, or 1,760 cave visitors per 11-hour operating day.

The only means of increasing the daily capacity of the cave while maintaining the operating hours is to shorten the average time between tours or increase the number of people per tour. Given the physical characteristics of the cave, this could be accomplished only by starting two or more tours simultaneously, and each taking a different route through the cave. There would be a maximum of 16 visitors per tour.

A possible alternative route has been suggested. The tour following this second route would begin at the Exit Grotto and explore the presently untoured south end of the Ghost Room, the large South Room, the Sand Room, and the connecting passages. A considerable amount of back-tracking would be required unless a second exit tunnel was drilled. The elevation would vary from 4,100 feet to 4,195 feet, or a climb of 95 feet, not including the descent and climb in the exit tunnel. This compares to a climb of 140 feet on the present tour. While exploration of the main floor of the Ghost Room would be desirable, excessive congestion would result in the Ghost Room and on the stairs from the Ghost Room to the exit tunnel if tours were coming from both directions.

The second tour would involve less time within the cave itself and expose visitors to fewer natural wonders. Thus, there would have to be a price differential between the tours. Total time commitment would depend on the time required for the average tourist to hike from the chateau-chalet area to the Exit Grotto. This is a steep trail, but the trip could be made at the visitor's leisure.

The use of two simultaneous tours would effectively increase the capacity of the cave and decrease the waiting time for tours. Additional materials describing the tours would have to be available so visitors could decide which tour to take.

No information is available on the estimated cost of developing this second route.

The same effect of increasing capacity and decreasing waiting periods could be accomplished by beginning all tours at the 110 Exit. One tour would lead north and the other south, each following the present tour route. Each tour would be only a portion of the present tour in length. This method would avoid

additional development costs, but would imply a decrease in maximum visitor-satisfaction with the cave tour. In terms of the visitor's overall experience, this decrease may be offset by the increase in satisfaction gained from not having an excessive wait.

Either of the above methods could be used to decrease waiting time and increase the capacity of the cave. However, as will be developed later, no changes in the present tour are believed to be necessary, as the flow of visitors to the cave is believed to be controllable by using an improved information system.

Adequacy of the Parking Area in Relation to the Capacity of the Cave

The lower parking lot accommodates 135 vehicles. Assuming four visitors per vehicle, there are 540 visitors at the Monument when this parking lot is full. From 1965 to 1972, an average of 66 percent of Monument visitors went through the cave. The remaining one-third did not participate in the tour, either because of age, physical disability, or having been through the cave before. Thus, the lower parking lot actually represents only 356 cave visitors. These 356 visitors are divided into 23 tours, with a maximum of 16 visitors per tour. With the cave tour system operating at maximum capacity, a tour enters the cave every six minutes. If all 356 cave visitors were to arrive simultaneously, those individuals in the last group to enter the cave would have a maximum wait of two hours and 12 minutes, since they would be required to wait 6 minutes for each of the 22 tours ahead of them.

Many visitors arrive at the Monument when the tour system is in full operation. Assume they arrive when 356 cave visitors are at the Monument - that is, when the lower parking lot is full. If it takes approximately 30 minutes for visitors to return to their vehicles and leave the Monument after completing the tour, the equivalent of 5 tours will have seen the cave. With the average tour lasting one hour and 12 minutes, 12 tours would be in the cave. Thus, only 6 tours would be waiting. This implies that a minimum waiting time of 36 minutes would be required of visitors, once they purchased their tickets, provided the tour system operated at maximum capacity and the lower parking lot had just filled when they arrived.

Under the present system of traffic management, approximately 30 parking spaces are available for cave visitors in the upper parking lot. These may be used until approximately 3:30, when they are reserved for overnight guests. Rangers, using a system of walkie-talkie communications, direct cars to the upper lot from approximately 10:30. Vehicles moving to the upper lot travel along the same roadway as pedestrian cave visitors who have parked in the lower lot. A 5 mph speed limit is in effect and people do drive cautiously, but the common route represents a major confrontation between automobile and pedestrian traffic.

Use of the upper lot expands parking so 165 vehicles can be parked without visitors waiting for a parking space. A visitor arriving at the Monument when both the lower and the upper lots have just filled can expect to wait a minimum of 66 minutes once his ticket is purchased.

Without the availability of the 30 parking spaces in the upper lot, the last visitor would have to wait 30 of those 66 minutes in his car, inching his way up

to the parking lot, provided one member of his party went to purchase tickets while the driver waited in the car. 2/

In effect, the use of the upper lot decreases the size of the lineup along the highway by 30 vehicles. Once both lots are filled, cars line up in the driving lane of Highway 46. Rangers inform them of the waiting period, provide an official brochure, and instruct one member of each party to walk to the ticket window and purchase tickets. Waiting time for the cave tours increases by 6 minutes for every 6 vehicles lined up on the roadway. This factor is not taken into account in informing visitors of their waiting time.

If visitors seeking a parking space prefer to wait in the developed chateau-chalet area instead of waiting in their car, the quality of their experience will be increased through use of the upper parking lot. However, the quality of the experience of visitors who must compete with vehicles on the roadway to the upper parking lot is reduced.

If some visitors prefer to turn around without seeing the cave rather than wait for parking, both visitation and waiting times will increase through use of the upper parking lot.

Use of both the upper and the lower parking lots to capacity, without a line-up of cars on Highway 46, implies a waiting period in the range of 66 to 162 minutes, depending on distribution of visitor arrivals. If only the lower lot were used, a waiting period of 36 to 132 minutes would be required. The tour guide system is assumed to be operating at maximum capacity consistent with visitor demand. These figures emphasize the importance of an even visitor demand. It is surges of visitors after periods of less than capacity operation which extend the waiting time to somewhere between the minimum time and the maximum time. The maximum time corresponds to a surge of vehicles equal to the capacity of the parking system all arriving when the cave system is empty. However, once the system is in full operation, the last arrival in the parking lot will have a wait corresponding to the minimum time.

Waits in excess of the minimum time imply that the complete tour system is not working to capacity. During August, 1973, while both parking lots were in use, a maximum wait of 66 minutes should have existed for the last visitor to enter the parking lot. In fact, a 105-minute wait was typical. Thus, the complete system was operating at only 63 percent of capacity. The cave may not have been full, either because of insufficient guides during the previous hour and 12 minutes of operation, or there may have been a surge of visitation which filled the cave after a period of less than maximum operation. The assumptions on which full service capacity are based may also have been violated during this time period. Visitors, having completed their tour, may not be returning to their vehicles within half an hour, more than four visitors may have arrived per vehicle,

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2/ Of course, the overall waiting period is not affected by the timing of the ticket purchase if visitors purchase tickets in the same order as they arrive at the Monument. The present system of encouraging one person in each car to purchase tickets for all passengers in the car as soon as the car joins the queue assures that visitors will tour the cave in the same order as they arrive at the Monument.

or more than 66 percent of all visitors may have toured the cave. All, or any one of these, would result in waiting times in excess of projected waiting times.

The longest wait required of any cave visitor occured in August, 1972 - three and one-half hours. This represented a one-hour wait for parking and a two and one-half hour wait for the tour, once parked. If visitor demand had been even, and the tour system staffed so that the complete system was operating at maximum capacity, no wait for parking would have been required.

Selection of the optimum parking lot capacity would imply selection of the optimum waiting period. The present capacity of the parking system implies a wait of 66 minutes once both lots are full. A wait of this length is believed to be consistent with a quality experience for the visitors.

Thus, the capacity of the present parking system is believed to be consistent with operations of the cave at maximum capacity, assuming an even visitor demand. It is toward this goal of a more even visitor demand that management practices should be directed.

Capacity and Quality of Pedestrian-Holding Area in the Developed Chateau-Chalet Area

The capacity of the pedestrian-holding area in the developed chateau-chalet area is difficult to measure. No rule of thumb has been developed which specifies the minimum number of square feet per visitor, consistent with a quality experience. There was undoubtedly enough space to handle the magnitude of visitation at the Monument in 1972, a level of congestion which the National Park Service hopes will not be repeated.

The question to be answered is whether enough space exists so that individuals do not feel crowded or uneasy. Are they comfortable and satisfied with the facilities, and what changes would be advantageous from the visitor's point of view?

General conclusions, based on observations of visitor "countenance" from the time their cars are parked until they leave the Monument, are as follows:

The vast majority are content to spend their waiting period in a leisurely manner, visiting the chalet and chateau, feeding the squirrels and chipmunks, and watching the trout. There is little use of hiking trails, perhaps because people do not have any idea of how long it will take them to take a particular hike. They stay in the immediate area so they will not miss their tour. In general, people make do with what facilities are available. Many find it a convenient time to have a meal, but because of the lack of picnic facilities at the Monument, visitors eat in their cars in the parking area. Interviews conducted on August 18 and 19, 1973, with visitors who were eating their lunches, found discontentment with the unavailability of picnic areas.

There are two other areas of dissatisfaction. Twenty-seven families with children under 6 years of age were informally interviewed. Eighty-five percent of those families were surprised and somewhat unhappy with the regulation that

their youngest family members could not go through the cave. Fifteen percent of the families elected not to go through the cave because of this regulation, and an additional 7 percent chose to have one adult member stay with younger children while another adult accompanied older children on the tour. All families felt this regulation was not publicized enough. In total, 19 potential visitors chose not to tour the cave because of the child regulation; they represent 1.5 percent of the total cave-visitor population.

Discontent was also voiced by the elderly who require the use of walking canes. The Park Service does not allow the use of canes, sticks, or tripods within the cave, to avoid accidental damage to formations. While the visitors understand the restriction, most said they would have liked to know of the restriction before making the trip to the Monument.

In total, 65 potential visitors turned around at the ticket window or requested refunds for tickets before tour time on August 18, 1973 (Table 1). This represents 5 percent of all those people who arrived at the ticket window with a desire to tour the cave. Only 26 were actual refunds, based primarily on individuals not wanting to wait the required time for the tour. 3/ Thus, only 2 percent of these visitors could have been induced to stay by providing additional facilities to occupy their time.

Table 1. Visitor Turnaround at Ticket Windows on August 18, 1973

	Number	Percent of turnaround	Percent of total visitors
Refunds - waiting time.....	26[a/]	40	2.0
Families - children under 6.....	19[b/]	29	1.5
Elderly.....	4[b/]	6	0.5
Unclassified.....	16[b/]	25	1.9
TOTAL.....	65	100	5.9

a/ Oregon Cave Company records.

b/ Observation and interview.

Visitors, for the most part, are content to make do with available facilities. However, there is a consensus among Park Service and concession employees that additional interpretive programs should be provided for visitors. A synchronized slide and tape presentation could be set up in one corner of the chateau lobby without inconveniencing the management or guests. Any interpretive program would have to be well coordinated with the guides' presentations so the visitor-guide relationship would not be upset. A greater Park Service input would be required in training tour guides.

3/ Daily records of refunds are kept by the Oregon Caves Company.

VISITORS' ATTITUDE AND REACTIONS TO WAITING

Visitors' reactions to waiting, under present conditions, can be divided into two separate situations: waiting at the Monument after they have parked their cars, and waiting in their vehicles for a parking space. As indicated earlier, observation of visitors' reactions to various waiting periods for their tours has found visitors to be quite content, once they have purchased their tour tickets and parked their cars. They realize they can wait in leisure and will be called when their tour is about to begin. Thus, the quality of their experience at the Monument is believed not to be adversely affected by extended waiting periods, once they have parked their car and are in the developed area of the Monument.

This finding is in general agreement with the experience of National Park Service personnel. That is, very few complaints have been received in relation to waiting in the developed chateau-chalet area.

To determine how people would react to waiting, given varying circumstances, informal interviews were conducted with visitors waiting in their vehicles for parking on August 19, 1973. The occupants of 48 vehicles were interviewed. This represents a 9 percent sample of all visitors to the cave on that day, and approximately a 50 percent sample of all visitors who were required to wait for parking.

The sample size was selected to give reliable results at the 10 percent level, based on a pretest of questions conducted on Saturday, August 18, 1973. Sunday, August 19, 1973, was selected as an appropriate sampling day because of the extreme unevenness of the visitation pattern historically exhibited on Sundays. It is the uneven distribution of visitation throughout the day which results in periods when visitation exceeds cave capacity and waiting is required. The relative distribution of daily visitation for a Wednesday and Sunday for an average week is presented in Figure 3. Sundays have usually been above average in overall visitation (Figure 4).

At the time of the interviews, the visitors were informed that a 105-minute wait would be required from the time they purchased their tickets until their tour would begin, and of a 5- to 15-minute wait for parking. An individual's behavior is highly dependent on the information available to him at the time a decision is made. To properly evaluate individual behavior it is necessary to determine what type of information has been provided.

Visitors were first asked if they had stopped at the information booth in Cave Junction. If their response was negative, their reason for not stopping was asked. If positive, they were asked what type of information they received.

Seventeen percent of those sampled had stopped at the information booth in Cave Junction and had expected the wait at the cave. None of the visitors had expected to wait for parking.

Information on travel time and distance to the Monument, as well as waiting times, was given to those who stopped at the information booth. When solicited, the time required for the tour was also given. When service personnel in the information booth could see cave restrictions would apply to the visitors, information on that restriction was also provided orally. Both the National Park Service and the Oregon Caves Company brochures were provided to all who stopped.

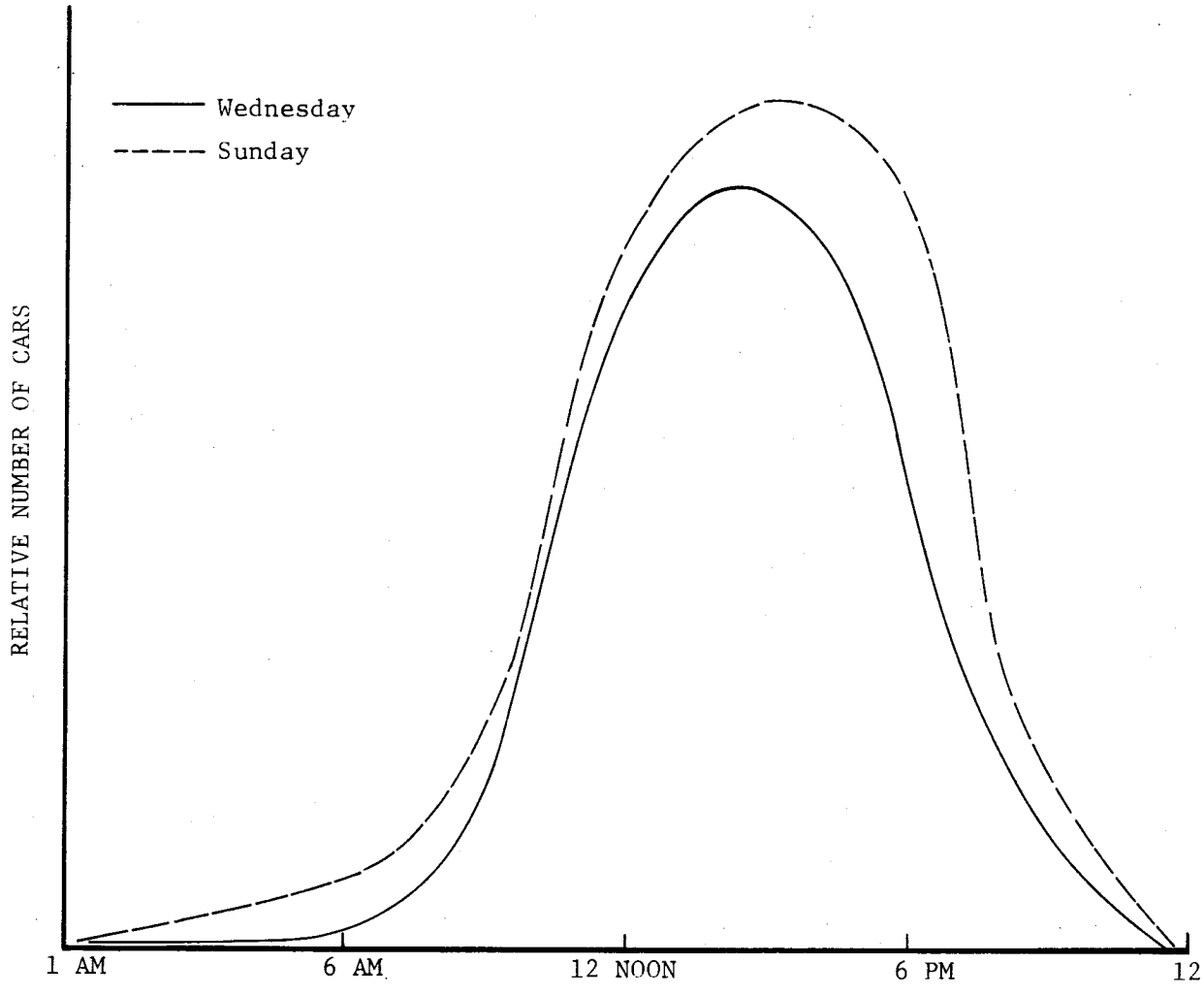

Figure 3. Hourly car count for Wednesday and Sunday during a typical week.

SOURCE: Hourly car count conducted by National Park Service.

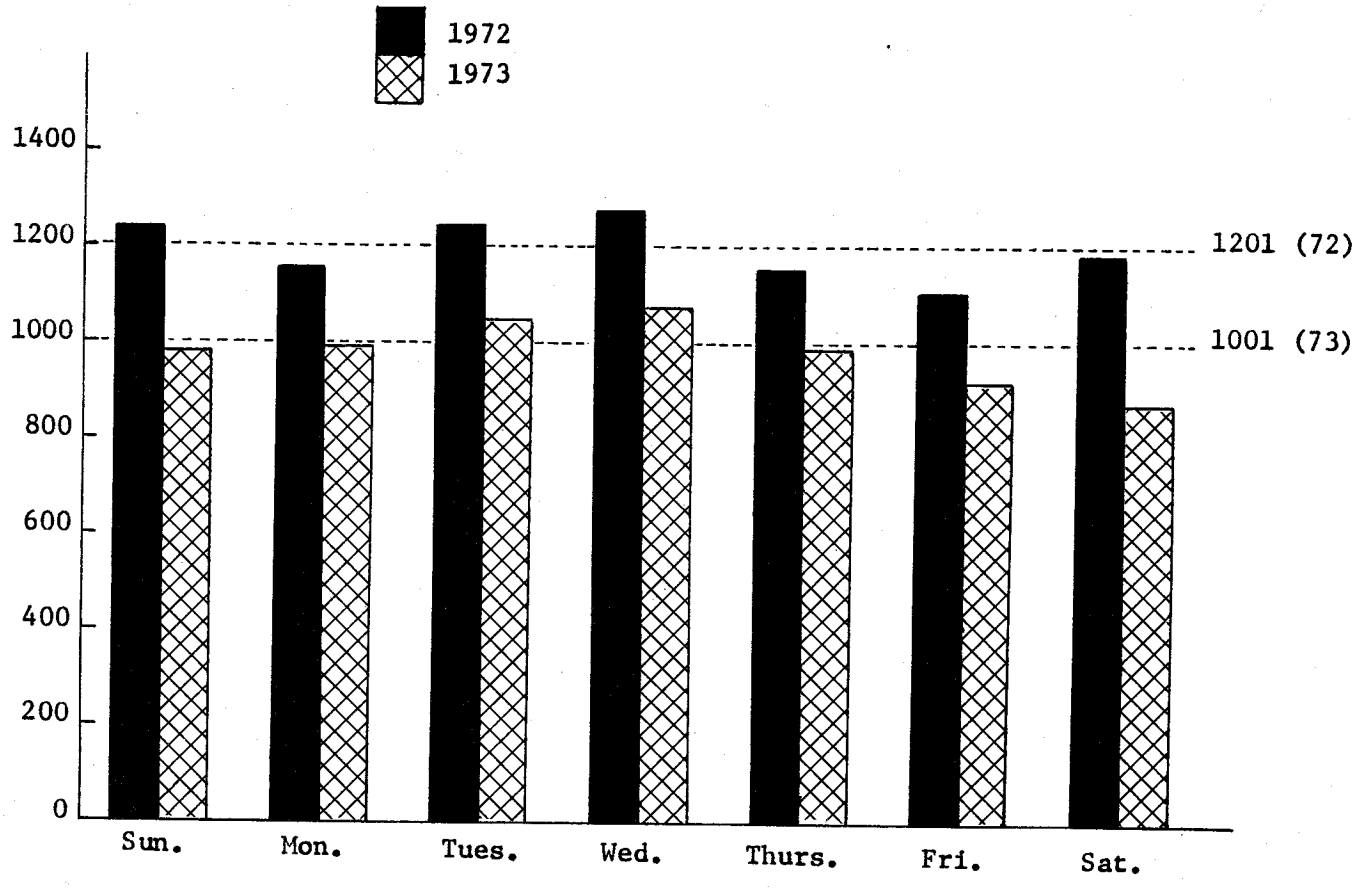

Figure 4. Average number of cave visitors during July and August, by day of week.

SOURCE: Oregon Caves Company records of ticket sales.

Eighty-three percent of the sampled visitors had not stopped at the information booth in Cave Junction. One-third of these visitors did not realize there was an information service in Cave Junction.

Of visitors who knew of the booth but did not stop, 26 percent felt it was not an official booth. The remaining 74 percent felt they had no need to stop. Most had area maps which showed the location of the cave and they felt they would like to see it. Only 10 percent of those visitors who did not stop at the information booth anticipated that a wait of one hour or more might be necessary to tour the cave.

An individual's attitude and behavior toward waiting are highly dependent on the availability of alternative activities to which he can devote his time. Having traveled from Cave Junction to the Monument, visitors have effectively eliminated some alternatives available to them at Cave Junction, because of the time required to make the round trip to the Monument. Thus, the reaction of visitors to information concerning travel time, tour time, and waiting time depend on where they receive this information.

The following question was asked of those individuals who did not stop at the information booth in Cave Junction: "If you had stopped for information in Cave Junction, and had been informed of the one and one-half hour wait for your tour once your ticket was purchased, and that the tour itself would take one hour and 12 minutes, would you have come up to visit the cave today?"

The occupants of 24 of the 40 vehicles, or 60 percent of the sampled visitors who did not stop for information, indicated that they would not have come to visit the cave. Thus, given a choice of devoting travel time, tour time, and waiting time to the cave tour or to an alternative activity, they would have chosen an alternative. Having arrived at the Monument, these individuals had already committed their travel time. However, 30 percent of these individuals actually did turn around when informed of the wait. Thus, the time required to wait for the tour and go on the tour was more valuable to these people if invested in an alternative activity.

Turnarounds at the parking lot represented 15 percent of the visitors who arrived at the Monument and were required to wait for parking. These sample results support the hypothesis that the turnaround rate of potential visitors will increase, the closer the information booth is to Cave Junction, provided everyone is required to stop for information.

A fourth question was asked of those visitors who would have, or did, elect to visit the cave with knowledge of the wait required: "Would you prefer to wait for your tour at the Monument (in the cave area), or in a newly developed area somewhere along Highway 46 on the way to the Monument?"

Seventy-nine percent of those questioned said they would prefer to wait in the cave area, 13 percent were indifferent between the two sites, and 8 percent expressed a preference for an alternative site over waiting at the cave site, provided the wait for parking would be eliminated. Nothing had been said concerning the relative wait for parking at the two alternative facilities.

One-third of those individuals who would have, or did, elect to visit the cave with the knowledge of the wait required, had stopped at the information booth in Cave Junction, and had received the brochure describing the cave area. For these individuals, this question involved a comparison of a situation with which they were already familiar to one with which they were not. Thus, there would be a tendency to favor the familiar. This problem may also be present in the response of the other individuals to the extent that they associate themselves with past visitors to the Monument.

A follow-up question was then asked, to determine the strength of visitors' preferences with regard to waiting in their cars or waiting at an area removed from the Monument: "If a newly developed visitor's center would eliminate the wait for parking, would you prefer to wait at the Monument or in the newly developed area?"

Sixty-two percent of the sampled visitors would prefer the use of a visitor's center if it would eliminate the wait for parking. At the time of the informal interviews, waiting time for parking varied from 5 to 15 minutes. The response of visitors to this question varied directly with their location in the waiting line. Visitors with a 10-minute or longer wait were around the bend from the parking lot and were able to see only other cars lined up in front of them. Again, the results of this question may be biased by the comparison of a familiar situation (in this case an unpleasant one) with an unfamiliar situation.

The results of the informal survey may be used to develop conditional probability estimates for the behavior of visitors under various conditions. The probability of an individual deciding not to visit the cave, given knowledge of travel time, tour times, and a one and one-half hour wait, is 60 percent if that information were provided in Cave Junction. On a "normal" operating day in July or August, both parking lots are usually full by one o'clock, and a one and one-half hour wait is required. Typically, 38 percent of the daily visitors have begun their cave tours by one o'clock. 4/ Thus, 62 percent of the visitors are serviced with waiting periods of one and one-half hours or more.

Under the present system, the probability (P) of a potential visitor not coming to the cave because of an extended waiting time equals 12.6 percent. That is, 12.6 percent of all visitors who turn on to Highway 46 with the desire to see Oregon Caves turn around either at the information booth when informed of the time required for the visit, in the line while waiting for parking at the Monument, or at the ticket window.

$$P(\text{Visitors' turnaround}) = P(\text{turn around at Cave Junction}) + P(\text{turn around at parking lot}) + P(\text{turn around at ticket window})$$

$$= P(\text{stop at Cave Junction})\,P(\text{turn around} \mid \text{stopped and wait})\,P(\text{wait for tours})$$

4/ This estimate is based on the number of tours conducted per hour in August, 1967. While there have been substantial increases in total visitors, their distribution throughout the day is believed to have remained stable.

+ P (didn't turn around at Cave Junction)P(wait for parking)P(turn around|wait for parking)

+ P (didn't turn around at Cave Junction or parking lot)P(wait for tour) P(turn around|wait for tour)

= (.17)(.60)(.62) + (.937)(.25)(.15) + (.902)(.62)(.05) = .063 + .035 + .028

= .126.

Thus, 87.4 percent of potential visitors visit the Monument.

If no information were available to potential visitors until they reached the Monument, 6.8 percent of all visitors could be expected to turn around without visiting the cave. At the other extreme is a full information system in the Cave Junction area. If all vehicles were required to stop at a visitation center where they would be provided with complete information on travel time, tour time, and waiting time, 37.2 percent of the potential visitors could be expected to turn around, choosing to invest their time in an alternative activity.

This probability of turnaround under a complete information system is equal to the product of the probability of an excessive wait time (.62) and the probability of turning around, given an excessive wait (.60).

Thus, (1-37.2), or 62.8 percent of all potential visitors would decide to visit the Monument. This represents a total daily visitation equal to 72 percent of the present levels. The quality of the Monument experience for those visitors who do decide to come should be increased through less congestion and shorter waiting periods.

If a full information system were provided which would reach 100 percent of potential cave visitors, the rate of daily visits would be expected to be only 72 percent of the rate observed under the present information system. What would this imply in regard to the congestion problems observed at the Monument over recent years? National Park Service personnel indicated that the 1973 level of visitation, while atypical of past years, would be a desirable level of visitation from their point of view.

Under the existing system, the distribution of visitation throughout the summer months is tending to even out. That is, visitation during June has increased 150 percent over the nine-year period 1965 through 1973, compared to 140 percent for July and 130 percent for August. Under a full information system, visitation would tend to even out at a more rapid rate.

Based on a linear projection of the trend in cave visitation from 1965 through 1972, it would not be until July 1977 that visitation equal to that of July 1973 would occur, given a full information system. 5/ Not until July 1985 would visitation equal to that of 1972 be reached.

These predictions are based on linear regression of visitation against time:

5/ Monthly data on cave visitation from 1965 through 1973 were obtained from the ticket sale records of the Oregon Caves Company.

$$V_{July} = 23,540 + 1,165.6 \text{ (time)}$$
$$R^2 = .88.$$

While the trend in visitation during August has not been strictly linear over time, a linear projection of this trend should serve to estimate the minimum number of years required for visitation to regain its 1972 level under a full information system:

$$V_{August} = 32,219 + 858 \text{ (time)}$$
$$R^2 = .53.$$

Based on this regression equation, nine years would be required for August visitation to regain its 1973 level. The extremely high rate of visitation recorded during the 1972 season is not predicted to repeat until the 1991 season.

An additional contribution to a full information system would be the presentation of the normal visitation pattern, which was depicted in Figure 3, in the National Park Service and Oregon Caves Company brochures. Many tourists pick up these brochures along vacation routes and could schedule their visits during those periods of the day when extended waits would not be expected. Daily visitation to the Monument could be increased if enough visitors were available to operate the tour system at full capacity throughout the day.

AN EVALUATION OF POSSIBLE ALTERNATIVES TO ALLEVIATE THE VISITOR CONGESTION PROBLEM

Various alternative policies could be implemented to deal with the congestion problem at the Monument. Each policy must be evaluated as to its effects on the primary decision-makers involved, the Monument visitor, the National Park Service, the Oregon Caves Company, and, to a lesser extent, the U.S. Forest Service and the citizens of Cave Junction.

Alternatives which will be considered include the provision of a full information system in the Cave Junction area; an information system in conjunction with a holding area; an information system, holding area, and mass transit to the Monument; an enlargement of existing Monument parking facilities; and a reservation system.

A Full Information System

No matter what type of solution is implemented, improvement in information flows to potential visitors must be forthcoming. Visitors' dissatisfaction with present Monument operations develops primarily from the extended waiting times and the fact that they were not adequately forewarned of these waiting times. As developed earlier, visitors' reactions to the prospect of extended waiting times, and the fact that they were not adequately forewarned of these waiting times, could serve to alleviate most of the congestion problems at the Monument.

A full information system would require that all potential visitors to the Monument stop at an information station in the Cave Junction area. Information should be provided concerning

- travel time to the cave
- waiting time for the tour
- time required for, and length of tour
- strenuous nature of tour
- regulations concerning minimum age for the tour, use of canes, sticks, or tripods within the cave, and availability of picnicking and camping facilities
- the restriction of trailer travel along the roadway to the Monument.

This information should be transmitted orally and/or through the use of large signboards. The use of brochures alone is not recommended. Trailer travel should be prohibited on the curvy stretch of Highway 46, and trailer parking should be available at the information station.

A minimum of facilities would be necessary to develop this information station. A booth with the National Park Service insignia would be located along the roadway, with a sign stating that all cave visitors must stop. To ssure 100 percent participation, tickets could be sold at the booth. A turnaround area would have to be provided.

Average daily traffic (A.D.T.) volume along Highway 46 varies from 2,800 vehicles per day at a point 100 yards east of Redwood Highway 199, to 310 vehicles just east of the Sucker Creek Road 12 miles from Cave Junction. 6/ This volume is then maintained to the Monument. Thus, on a yearly basis, only 11 percent of all traffic along Highway 46 in the immediate vicinity of the intersection of 46 and 199 is bound for the cave. Assuming local traffic is fairly constant throughout the year, and cave traffic is concentrated during the three summer months, approximately 33 percent of the summer traffic in the immediate vicinity of the intersection is bound for the Monument.

At a point 6.5 miles east of the intersection, average daily traffic decreases to 550 vehicles. Local traffic accounts for 140 of the A.D.T. If cave traffic is concentrated during the summer months, the A.D.T. for the cave during that period would equal 1,240. Thus, the A.D.T. during the summer months would be 1,380, with cave traffic representing 90 percent of all traffic. Given this large percentage, it may be possible to locate the information booth in the middle of the highway, with an auxiliary lane provided for local traffic.

The further the information booth is from Cave Junction, the greater the time commitment for those visitors who decide to turn around. Thus, from a visitor's standpoint, the closer the information booth is to Cave Junction, the better.

The effect of improved information flows would be to decrease visitation during peak periods. Initial losses were projected to be approximately 28 percent of present visitation. To the extent that visitors may decide to return another day

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6/ Based on average daily traffic for the year 1972, as provided by the Oregon State Highway Department.

during a less crowded period, a portion of this decrease in visitation could be regained.

The revenues to both the Oregon Caves Company and the National Park Service would be reduced. 7/ As presented in Table 2, the average revenue per cave visitor has been relatively constant throughout each year. Average revenues have not increased throughout each season with increases in waiting times. Thus, no effect on the average revenue per cave visitor is expected with an increase in information flows, and total revenues will vary proportionately with visitation.

Table 2. Average Revenue Per Cave Visitor

	1965	1966	1967	1968	1969	1970	1971	1972	1973
	dollars								
June.....	2.69	2.68	2.68	2.70	3.06	3.19	3.30	3.21	3.47
July.....	2.55	2.56	2.55	2.70	2.72	3.09	3.14	3.04	3.34
August.....	2.62	2.57	2.52	2.71	2.83	3.24	3.20	3.24	3.52

SOURCE: Oregon Caves Company.

The information system would be staffed with National Park Service personnel. However, staff requirements for excessive traffic management at the Monument would be expected to decline.

Full Information System and Holding Area

Interviews with National Park Service personnel found a generally satisfactory feeling with the visitation volume recorded during the 1973 season. While back-up along the highway did occur, from the Rangers' point of view operations were well in hand.

Based on the projections developed earlier, visitations equal to that of August, 1973, would not be expected to be duplicated until 1982, if a full information system were in effect. This being the case, a holding area would not be necessary at this time, assuming both the lower and upper parking lots at the Monument would be used.

If the upper parking lot were to be closed to visitor parking, a short queue on the highway could be expected, even with a complete information system, assuming the cave's tour system operated at full capacity. The 36-minute wait for the tour, if only the lower parking lot were used, is not believed to be enough to discourage a large percentage of potential visitors.

7/ Under the contract arrangement between the National Park Service and the Oregon Caves Company, the Park Service receives a fixed percentage of total revenue (5 percent in 1973).

If a holding area with picnic facilities and an interpretive center were available in addition to the information center, the percent of turnarounds could be expected to decrease. The present projections are based on visitors having information only of time required and restrictions. Few of the sampled visitors had any knowledge as to what type of facilities are available at the cave.

A complete visitor's center, located along Highway 46 on the valley floor, could present the benefits of the cave tour as well as the costs. Providing picnic facilities in a pleasant setting would help decrease turnarounds.

Given the limited time available for most vacationing families, the best that could be expected would be to maintain the present trend in the rate of visitation, which is 87.4 percent of all visitors who turn onto Highway 46 with the desire to see the Oregon Caves. Under a complete information system without the holding area, 62.8 percent of these potential visitors could be expected.

From the sample data it was determined that only 30 percent of those visitors who said they would not have come to the cave if they had received complete information in Cave Junction actually did turn around at the Monument without seeing the cave. This reaction is completely consistent. If the decision were made in Cave Junction not to visit the Monument, this would imply that the visitors would prefer to use the four and one-half hours required to see the cave and return to Cave Junction, plus expenses, on an alternative activity. Once the visitor arrives at the cave, his decision is whether he would prefer to see the cave or use three hours and 10 minutes, plus expenses, on an alternative activity. He has already invested time and money to reach the cave, and will have to invest more of each to return to Cave Junction, whether he sees the cave or not. Thus, the closer the potential visitor is to the cave when he receives complete information, the higher the probability that the visitor will decide to see the cave.

Thus, if the objective is to maximize visitation or revenue, given constant average revenue per visitor, it would be advantageous to provide the visitor with as little information as possible until he reaches the ticket window. This procedure forces the visitor to bear a large cost, however, a cost which some would not pay if they had been given the choice. Not having been given such a choice will lead to feelings of resentment on the part of some visitors.

From the standpoint of the visitor, complete information should be provided at a point as close to the junction of Highways 199 and 46 as possible, for it is at this point that the decision to visit the cave must be made. From that point on, both time and money are being expended by the visitor in an effort to see the cave.

A holding area with ticket sales would enable traffic flows to the Monument to be controlled without restricting traffic on the state highway. This would eliminate the necessity of Park Rangers serving as traffic controllers at the Monument and free this group for other duties.

Parking facilities at the Monument now are well matched to the present capacity of the cave. Visitor discontent at the Monument is primarily the result of waiting for parking. If a holding area can be managed in such a way as to control traffic flows to the Monument, waiting for parking would no longer be a problem.

If the holding area would allow traffic to flow to the Monument as rapidly as parking were available, average revenue per visitor would be expected to maintain its present trend. Visitors would have time to enjoy the atmosphere of the mountain, the chateau, and chalet before their tour without feeling rushed. Most visitors could be expected to depart from the Monument after their cave tour.

Information Center-Holding Area and Some Form of Mass Transit

A mass transit system would exclude the use of all private vehicles at the Monument. The only improvement believed to be associated with such a system would be a reduction of pollutants produced through automobile exhaust, and possible reduced litter on the roadway. Neither of these is considered to be a problem at this time nor envisioned as a potential problem.

It is believed that the cost of such a system would be prohibitive, since its operation would be limited to summer. Four to five times more land would be required in the Cave Junction area than would be required by an information and holding system without mass transit.

Net revenue to the Oregon Cave Company could be expected to decrease, as visitors would have less money to spend after paying for both the cave tour and the ride on the transit system. No increase in total visitation would be expected as the result of a mass transit system. The higher out-of-pocket costs to the visitor of reaching the Monument by a mass transit system than by personal automobile would also tend to discourage visitation. This assumes that the costs of such a mass transit system would be borne by the user and would not be subsidized from public funds.

The effect on the quality of a visitor's experience is difficult to measure. Visitor reaction to driving up the mountain is mixed. The only complaint which the Rangers have received was on the lack of signs along Highway 46 indicating the distance to the cave. The addition of more signs would be a more efficient means of correcting this source of visitor dissatisfaction.

The critical variable in assuring a quality experience to the visitor and maintaining cave operations at full capacity is the arrival rate of potential visitors. A holding system, with or without mass transit, would control surges of visitors at the Monument, but not at the holding area. Information must be dispensed to the potential visitor to encourage him to arrive at low use hours.

A Reservation System

To be effective, a reservation system would require wide publicity throughout both the Pacific Northwest and the nation. A minimum of two years would be required before information concerning the reservation system could be expected to become common knowledge. Thus, a great number of visitors would be disappointed.

On the basis of this study, there would be no need for a reservation system if information on potential waiting time were available to the public. If

visitation were permitted only after making a reservation, the rate of visitation would be expected to decrease below that projected for the full information system, at least during the first two years of operation. This is purely speculative, however.

An Enlargement of the Monument Parking Area

The enlargement of the present parking areas at the Monument would have the effect of extending waiting times. That is, the maximum wait for visitors, once parked, would increase by 6 minutes for every five additional parking spaces. To the extent that fewer visitors would turn around while waiting for parking, both visitation and waiting times would increase.

With the head of the household waiting a longer time in the developed chateau-chalet area instead of in his vehicle, the potential for increased revenue per visitor would be increased. However, historically, average revenue per visitor has not varied significantly with average waiting times.

An enlarged parking facility would require fewer man-hours to be devoted to parking management. These hours could be devoted to interpretive programs in the developed chateau-chalet area.

The present problem of soil creep above the parking lot to the northeast, and extending under the fill, may limit any development. Our qualifications preclude any assessment in this area, however.

RECOMMENDATIONS

As the result of this study, the following management techniques are suggested:

- Provision of a full information system, manned by National Park Service personnel, which would provide information concerning:
    - travel time to the cave
    - waiting time for the tour
    - time required for and length of tour
    - strenuous nature of tour
    - regulations concerning minimum age for the tour; use of canes, sticks, or tripods within the cave; and availability of picnicking and camping facilities
    - the restriction of trailer travel along the roadway to the Monument

- National Park Service training of all tour guides to assure uniform presentations consistent with the provisions of interpretive programs.

- Banning all trailer travel to the Monument on the mountainous stretch of Highway 46, and providing trailer parking.

- Provision of additional signs along Highway 46, indicating distance to the Monument.

- Including the normal distribution of waiting times in all Oregon Caves National Monument brochures.

LIMITATIONS OF THE STUDY

This study was conducted during the 1973 summer tourist season. Visitation to the Monument through August, 1973, had decreased 13 percent from the 1972 season. An increasing trend of yearly visitation, which began in 1970, had been continuing at an increasing rate. Two factors are believed to have contributed to the decrease in visitation. The most obvious factor would be the national gasoline shortage. The fear of closed gasoline stations may have decreased the general tourist level. The second is the reduction in roadside advertising which occurred between the 1972 season and the 1973 season.

If travel plans had been influenced by the gasoline shortage, a general decrease in traffic volume should have occurred along the Redwood Highway (U.S. 199). Monthly traffic data are available from a permanent traffic recorder station one mile north of the California-Oregon state line, along U.S. 199 (Table 3). While the trend in the number of cave visitors had paralleled the increases in the volume of traffic over the previous three-year period, in 1973, cave visits decreased despite continued increases in traffic along the Redwood Highway. While a general decrease in tourism is not indicated, there is another possible explanation. It could be that relatively more local and less out-of-state traffic passed over U.S. 199 during the 1973 summer season. A larger proportion of Oregonians who had visited the caves prior to 1973 would explain the divergence of traffic counts and visitation rates observed during 1973. The November 1973 issue of The Oregon Motorist (Automobile Club of Oregon) cites evidence to support this hypothesis.

It is also possible that individuals, fearing early closure of service stations, would be discouraged from leaving the main highway and making the trip to the cave. Bill Cawein, manager of the Chevron Oil Company service station at the intersection of Highways 199 and 46 in Cave Junction, believes the gas shortage did have an influence on visitors' decisions to visit Oregon Caves. While total tourist traffic in the area appears to be similar to past years, tourists stopping at his station expressed a reluctance to visit the cave during the afternoon hours for fear that service stations would be closed between Cave Junction and their evening destination. The Chevron station, like most stations in the area, was operating on an allotment based upon 1972 sales. Most station owners pro-rated their month's allotment of gas and closed their stations when a day's allotment was sold. There were times when the Chevron station closed at 3. With a high proportion of service stations closed after 6, travelers would have a greater desire to reach their evening's destination early, thus by-passing a visit to the Monument which requires a minimum of four and one-half hours during afternoons.

Table 3. Comparison of Cave Visitation and Traffic Volume Along the Redwood Highway, U.S. 199

		Cave visitors[a]		Average daily traffic volume,[b] O'Brien auto recorder, 1 mile north of California-Oregon state line	
		Number	Percent index	Number	Percent index
June	1970	16,399	100.0	2,136	100.0
	1971	15,709	95.8	2,023	94.7
	1972	17,783	108.4	2,590	121.2
	1973	15,913	97.0	3,019	141.3
July	1970	29,827	100.0	2,783	100.0
	1971	31,387	105.2	3,013	108.3
	1972	33,884	113.6	3,200	115.0
	1973	27,708	92.9	3,250	116.0
August	1970	33,940	100.0	3,022	100.0
	1971	38,608	113.8	3,049	100.9
	1972	39,917	117.6	3,250	107.5
	1973	34,298	101.0		

[a] Oregon Caves Company.

[b] Oregon State Highway Division.

A second factor which may have influenced the visitation rate was the removal of roadside billboards advertising the Oregon Caves. Five of 12 billboards available during the 1972 season were removed prior to the 1973 summer tourist season. These included the one remaining large billboard advertising the cave at the junction of Highways 101 and 199 at Crescent City, California, and three small billboards, one south of Eureka, California, one at the California-Oregon border on Highway 199, and one north of Grants Pass on I-5. Also removed was one-third of a large billboard at Sunny Valley, Oregon, owned by the Redwood Empire Association.

Of the seven remaining billboards, only one is in California, and it was expected to be removed before the 1974 season. This is significant because previous National Park Service studies found more than 50 percent of Monument visitors were from California. A check of visitors' origins was not made during the 1973 season.

The only forms of advertising used by the Oregon Caves Company are roadside billboards, brochures, and an occasional advertisement through local papers or radio. Thus, the removal of the billboards represents a significant decrease in the total advertising program. With total tourist traffic increasing along the Redwood Highway, the decreased visitation may be partially the result of

this decreased advertising. Under a new Oregon legislative ruling, further restrictions are placed on billboard advertising in the state.

While the 1973 season was not representative of the congestion problems experienced during the 1971 and 1972 seasons, it is believed that those visitors sampled in the process of developing this report are representative of the visitor population. Thus, the conclusions of this report are not believed to be biased from the decreased visitation observed in 1973.