# Grand Canyon National Park
# Dynamic Message Sign (DMS)/Highway Advisory Radio (HAR) Pilot Deployment/Evaluation

***Final Report***


Prepared by

Jaime Eidswick, Research Engineer

Zhirui Ye, Ph.D., Research Scientist

Steve Albert, Director

of the

Western Transportation Institute
College of Engineering
Montana State University

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Federal Lands Highway Division

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# EXECUTIVE SUMMARY

During the summer of 2008, a pilot shuttle bus program was implemented from Tusayan, Arizona, to the Canyon View Information Plaza in Grand Canyon National Park (GRCA). The program offered visitors an opportunity for car-free travel to the park. As part of the pilot shuttle bus program, a traveler information system was deployed that included Portable Dynamic Message Signs (PDMS), Highway Advisory Radio (HAR), and HAR static signs in the cities of Valle and Tusayan. The Concept of Operations for the devices was for the HAR and PDMS to function in tandem with the purpose of increasing the influence on visitors' mode choices, increasing transit usage, improving parking management, alleviating traffic congestion at the South Entrance, and improving visitor experience through better dissemination of traveler information. An Operations Plan was created to:

- establish procedures for using the PDMS/HAR systems;
- outline the protocols required for the design, implementation, maintenance, and administration of the PDMS/HAR Systems; and
- develop data collection plans and evaluation methods for the PDMS/HAR systems.

In order to learn from the traveler information system pilot study, an evaluation of the traveler information system was conducted that included three components: mode choice analysis, visitor surveys and focus groups. The specifics and findings are contained in the report.

Based on the pilot shuttle bus program and traveler information system pilot study purpose and objectives the findings for this report are as follows:

- **Increase opportunities for visiting the park without the use of a personal vehicle—** Shuttle ridership was more than 100,000 people for the duration of the pilot shuttle bus program. With half of the riders having a vehicle that could have been used to transport them into the park, the shuttle provided a *vehicle-mile reduction of more than 250,000 miles and a fuel savings of over 10,000 gallons. Between twenty five and thirty seven percent of this savings was due to the deployment of the HAR/PDMS systems.*
- **Reduce vehicle congestion on park roads and parking areas—**Focus group participants said that wait times were reduced at the GRCA gate and that there was essentially no congestion at the gate during the summer of 2008; however, this was attributed to the park recently adding another gate and lane at the entrance a*nd not necessarily due to the pilot shuttle bus program implementation.* They also said that parking seemed to be smoother this year, even though there was no notable decrease in parking demand.
- **Improve visitor experience by providing accurate traveler information—**Survey respondents said that the *PDMS and HAR were accurate* (94 and 86 percent respectively).
- **Improve shuttle bus and park and ride lot use—**An analysis of ridership data from the pilot shuttle bus program estimated that the HAR/PDMS had a positive effect, *increasing shuttle ridership by 368 riders per day, and that the signs increased the mode share of*

*transit by 32 to 46 percent, depending on analysis method used.* Focus group participants said that parking ran smoother this year although there was no notable decrease in parking demand.

- **Successfully collaborate with Tusayan Community—**Stakeholders from the Tusayan community said that the *2008 pilot shuttle bus program was a success* and should be continued.

- **Evaluate the effectiveness of PDMS and HAR—**The PDMS and HAR contributed to *32 to 46 percent of shuttle riders shifting their mode of travel* from private automobile to public transportation, depending on analysis method used.

- **Keep the operations and maintenance of PDMS and HAR simple—**To keep operations and maintenance for GRCA simple, the maintenance of the PDMS was the responsibility of the PDMS subcontractor, Bob's Barricade. The operations and maintenance of the HAR was the responsibility of the HAR subcontractor, Info Guys. GRCA was only responsible for scripting and pre-approving the messages for the HAR and PDMS and for changing the message on the PDMS as needed.

- **Recommend an appropriate PDMS/HAR system based on the results of the study—**In the future, the PDMS should be utilized in real-time in order to provide more benefit to travelers. To keep operations and maintenance of devices simple for GRCA, it is recommended that, rather than purchasing permanent HAR, *GRCA consider leasing permanent systems from a vendor.*

Based on the data gathered and our observations, the following recommendations are provided:

Short-term (immediately to one year)

- *Deploy a Permanent Traveler Information System*—For inclusion in the permanent traveler information system, it is recommended that GRCA purchase two PDMS and lease one HAR. The costs as well as the benefits and drawbacks of leasing versus purchasing this equipment are shown in Table 4. The HAR and one of the PDMS should be located in Tusayan at the traveler information system pilot study locations with the focus of continuing to encourage mode shift during the shuttle operation. The other PDMS should be located within the park with a focus of providing travelers with better parking availability information. The advantage of PDMS is that they can be moved to new locations as needs arise to allow for real-time information. To facilitate parking availability collection, GRCA should utilize the remainder of its budget to purchase three to six pan-tilt zoom cameras. Location suggestions for these cameras are discussed below in the "Village Area Parking Management System" recommendation.
- *Utilize PDMS and HAR more actively by providing real-time, rather than static, information*—This can be accomplished in a number of ways; including providing additional information/content on the HAR/PDMS such as weather, parking information, road conditions, construction alerts, park hours and fees, and activities in the park. To further help accomplish this goal, it is recommended that GRCA deploy a static sign with solar powered flashing beacons for the HAR in Tusayan so the PDMS can also be used

for real-time information without continuously having to inform travelers of the presence of the HAR. The static sign should be either a blue guide sign with a white border and text or a brown recreational sign with a white border and text (the brown sign would require approval from Arizona Department of Transportation to be used outside the park). The static sign should have no more than four rows of text. With the addition of flashing beacons, the sign should also include a yellow warning sign with a black border and text. While the flashing beacons may increase usage of the HAR, the "urgent" text option may cause travelers to misunderstand the sign and believe that a message is only playing when the beacons are flashing. Another consideration is that if one of the first two options is chosen, a threshold for when the message is "urgent" will need to be created. GRCA should also be careful to ensure that the HAR and therefore the flashing beacons are not continuously activated or travelers will become complacent to the flashing beacons and believe the signs are untrustworthy. Due to the fact that the HAR will be portable, the static sign with flashing beacon that is purchased should also be portable, as well as have remote capabilities for activating and deactivating the beacons. Power and communications will be necessary for the beacons and therefore solar power and cellular communications should be investigated. The cost for a static sign with flashing beacons is approximately $5000 (1).

- *Consider a partnership with Arizona Department of Transportation*—This would allow GRCA to display public transportation information (DMS, HAR, 511) farther away from the park to increase mode shift and allow visitors to consider alternatives as they drive to GRCA.

Medium-term (one year to five years)

- *Intelligent Transportation Systems Architecture and Strategic Deployment Plan*—As the integration of traveler information, parking management, transit utilization and coordination with organizations and agencies outside the park become an increasing need, park officials should consider developing an ITS Architecture and Strategic Deployment Plan. The plan typically includes the following topics being addressed:
    - Vision - stakeholder perspectives, mission, goals/ objectives, strategic direction
    - System Architecture – physical, logical, communications
    - Implementation priorities
    - Costs – capital, operations and maintenance, time frame
    - Funding opportunity – state, regional, partnering
    - Future direction

- *Village Area Parking Management System*—Parking management systems are used to gain real-time data on parking lot availability that can be provided to travelers through the ITS devices, allowing them to seek out alternative parking areas. The purpose of a parking management system is to enhance visitors' experience by helping them find parking spots. This is accomplished by utilizing traffic detectors to record the number of vehicles that are using a specific parking lot and calculating available parking spots. This availability or lack of parking spots as well as alternative parking areas is then communicated to visitors through traveler information systems such as HAR and PDMS.

Based on 2006 data collected on parking activities in the South Rim study a number of parking lots are candidates for parking management. Parking management systems can take many forms and applications including parking garage monitoring systems with signing to indicate full, open and closed, or, lots with one entry and exit (closed system) with signing to indicate full, open and closed or park and ride transit lots that provide real-time signing for available remaining parking spaces (California BART Park and Ride). In each of these typical systems, lots can be monitored by individual parking space sensors, detection devices at points where traffic enters/exits, or a closed circuit television camera (with or without video image processing system) that is automated to provide space availability. For GRCA, the individual parking space sensor would be cost prohibitive due to the number of parking spaces. Detection devices at points of entry is also not an optimal option for GRCA due to each parking lot having two (or more) entries/exits and therefore requiring that the detectors have a very high accuracy, which is usually an issue with some detectors such as loops. Therefore GRCA should consider the closed circuit television camera alternative with two cameras per parking lot to obtain as large an area of coverage as possible. Prior to deployment, further study should be done to determine installation locations and to ensure that two cameras will be sufficient for parking lot length and obstacles (e.g., trees). A strategy that Park officials may want to consider is developing a Village Area Parking Management System that is focused on Lot D and Bright Angel Lodge lots. These two lots are at or near capacity, 78 percent full and 100 percent full respectively. The Parking Management System would include monitoring and diversion/wayfinding signing that would direct motorists to Lot E, when Lot D and Bright Angel Lodge lot are near or at capacity. Signs that provide direction and space availability would be placed on Village Drive westbound upstream of the Lot D turnoff road and also on Hermit Road eastbound upstream of the Lot E turnoff road.