

ENTERPRISE Transportation Pooled Fund Study TPF-5 (231)



HAR Best Practices and Future Direction

PROJECT SUMMARY REPORT

April 2014

Prepared by



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Project Champion

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Table of Contents

- 1. Introduction and Overview..... 1
- 2. HAR Background 1
 - 2.1 HAR Governance 1
 - 2.2 Functional Performance Authorized by FCC..... 1
 - 2.3 Allowable Information on HAR 2
- 3. Current HAR Uses..... 3
 - 3.1 Use of HAR by State 3
 - 3.2 Specific Uses of HAR..... 5
- 4. Value of HAR..... 12
 - 4.1 HAR Usage and Value 12
 - 4.2 Other Factors Impacting Value of HAR..... 13
- 5. HAR Technology and Operations 14
 - 5.1 Content Creation..... 14
 - 5.2 Content Delivery to HAR Sites 15
 - 5.3 Broadcast Approaches..... 16
 - 5.4 Promoting HAR Use..... 16
 - 5.5 Maintaining HAR 17
- 6. Conclusion 18

- Appendix A: PennDOT HAR Messaging GuidelinesA-1
- Appendix B: WSDOT HAR Message Library Samples.....B-1
- Appendix C: MH Corbin Preventive Maintenance Schedule.....C-1
- Appendix D: HAR Uses and Typical Technology Applications..... D-1
- Appendix E: References E-1

1. Introduction and Overview

This document presents the complete findings of the ENTERPRISE Highway Advisory Radio (HAR) Best Practices and Future Directions project. The overall intent of this project is to provide ENTERPRISE member states with guidance to help them better understand how they should pursue HAR technologies and approaches in the future. To accomplish this, the project goals are defined as follows:

- Goal #1: To help members understand how HAR is being used by transportation agencies today;
- Goal #2: To help members understand the potential value of HAR; and
- Goal #3: To help members understand the current and potential future state of HAR technology practices.

The remainder of this document presents a general background of HAR, a summary of HAR uses and value, as well as the current and potential future state of HAR technology practices. Information for this project was gathered through literature reviews and interviews with transportation agencies operating HAR and manufacturers of HAR systems.

2. HAR Background

HAR is a communication tool that has been used since the late 1970s by government organizations to deliver public information over short ranges by radio. Systems typically consist of a transmitter, antenna, recording device and power. Most modern systems use control software and wireless communication options that allow messages to be recorded or activated remotely. HAR is often used by departments of transportation, in particular, to deliver information about road conditions, construction and other traffic conditions.

2.1 HAR Governance

Although referred to as HAR by transportation agencies, the Federal Communications Commission (FCC) regulates and refers to this service as Travelers' Information Stations (TIS). In the remainder of this section, the terms TIS and HAR will be used interchangeably. The service was established in 1977 by the Report and Order in Docket 20509, FCC 77-414, 67 FCC 2d 917² and is further governed by Rule 47 CFR 90.242 Travelers' Information Stations.³ FCC mandates that TIS may only be used by governmental entities and park districts for noncommercial purposes. Specifically, they may be used to transmit noncommercial voice information pertaining to traffic and road conditions, traffic hazards and travelers' advisories, directions, availability of lodging, rest stops and service stations, and descriptions of local points of interest.

2.2 Functional Performance Authorized by FCC

The radio signal of a TIS is typically transmitted on the AM band between the 530-1700 kHz frequencies in 10 kHz increments. The physical broadcast range is constrained by the FCC to a 10 watt transmitter output power, an antenna height no greater than 15 meters (49.2 feet), and a coverage radius of 3 km (1.86 miles).

In 2000, the FCC also introduced the option for broadcasting on FM frequencies. Low-power FM (LPFM) broadcast content is still limited to noncommercial use and there are similar constraints on power, antenna height and broadcast ranges. Both the LPFM and AM physical restrictions are intended to limit interference with commercially broadcast radio stations and to maintain the intent of TIS for localized traveler information. LPFM is further governed by Rule 47 CFR 73.801 Broadcast Regulations Applicable to LPFM Stations.⁴

There is a formal licensing process through the FCC that must be followed before a TIS site can become operational. Filing for LPFM is limited to specific windows determined by the FCC, with the most recent filing window running from October 17 to November 14, 2013. During the filing process, information about the broadcasting equipment and site must be provided, along with analysis of the potential for interference with other commercial broadcasts within the vicinity of the proposed site. For the AM band, the FCC offers a search tool to facilitate a cursory search of site and frequency information. It is also common for vendors of TIS products to provide FCC licensing support services for their clients.

In the years since it was first established, the FCC has modified other performance parameters of TIS but the fundamental public information purpose of these stations has been retained. The most recent of these modifications, in July 2013, reiterated the permissible content under the TIS rules must continue to be relevant to travel, an emergency, or an imminent threat of danger. The Report and Order in Docket 09-19, FCC 13-98⁵ also refined its restrictions on so-called “ribbon” networks of TIS transmitters (i.e., multiple simulcast transmitters), requiring only that simulcast TIS transmissions be relevant to travelers in the vicinity of each transmitter in the network. This latest ruling on simulcasting is encouraging for transportation agencies wanting to provide traveler information along a continuous roadway network; for example, travel times along a corridor of interstate.

2.3 Allowable Information on HAR

TIS, or HAR, systems may be permanently installed or used on a portable basis depending upon the need. For example, permanent installations are commonly used to share recurring information such as traffic conditions. Portable deployments are often used for short-term special events to share information about parking or traffic. Regardless of whether a site is permanent or portable, the FCC requires the information broadcast must be noncommercial and highly localized in nature to support the original intent of HAR.

The FCC maintains in its July 2013 ruling that content must be relevant to travel, imminent danger and emergencies. The ruling also provides additional clarification on the broadcast of weather information as there have been some debates about when such information is relevant to travel or emergencies. The rule states that, “TIS operators may transmit weather alerts regarding difficult or hazardous conditions (whether or not “tone alerted”), as well as information regarding motor vehicle crashes, emergency points of assembly, road closures and construction, parking, current driving travel times, air flight status, truck weigh stations, driver rest areas, locations of truck services, and road closures.” The FCC ruling

contends that limiting TIS weather information to potentially hazardous conditions, drivers and other travelers will know immediately that they are receiving non-routine weather information that could negatively impact driving conditions.

3. Current HAR Uses

Research and discussions with a number of state departments of transportation (DOTs), toll authorities, and local agencies have identified a variety of HAR operational approaches currently in use. The number of HAR towers operated by the agencies researched for this project range from one to nearly 100. HAR broadcast sites are much like dynamic message signs, in that agencies select strategic locations for deployment based on transportation needs such as construction, route selection points, recurring congestion, or changing road weather conditions.

3.1 Use of HAR by State

Through the research for this project, two states were identified to operate 50 or more HAR sites. A larger number of states operate 10-50 HAR towers, and several states have less than 10 active deployment sites. There are also several states not actively using HAR at all. The following table briefly summarizes HAR use in 20 states.

In addition to those states using HAR, there are several not using the technology at all. Some states have challenging terrain that makes deployment and radio transmission difficult. Some view HAR as redundant to other traveler information services such as 511. Another common reason states have avoided or discontinued using HAR is the lesser quality of the broadcast that travelers hear, particularly over the AM frequency. West Virginia⁶, for example, noted that although they have a few county-operated HAR sites, their state does not utilize HAR for a variety of reasons. Some primary reasons are that due to topography making it very difficult to deploy HARs; they are using a statewide 511 system; and, they feel that HAR is too site-specific.

Table 1 Brief Summary of HAR Use by State

States	Deployment Descriptions
>50 HAR Sites	
Pennsylvania	Pennsylvania DOT operates 92 HAR towers. HAR use in Pennsylvania varies by district, with District 6 (around Philadelphia) operating no HAR, while District 2 operations multiple HAR along the I-80 corridor.
Washington	Washington State DOT operates close to 90 sites throughout the state, primarily at locations near key decision points, mountain passes, or areas prone to major events. Several of these sites also support the state's ferry operations.
10-50 HAR Sites	
Colorado	Colorado DOT operates 16 HAR sites (nine AM broadcasts on the East Slope of the Rocky Mountains and seven FM broadcasts on the west slope).
Connecticut	Connecticut operates 14 HAR (eight along the Connecticut Turnpike).
Florida	The Florida Turnpike operates 10 HAR along the Turnpike.
Idaho	Idaho Transportation Department identified that they will deploy 25 HAR in southern Idaho by summer 2014.
Illinois	Illinois DOT operates 10 HAR sites in the Chicago metropolitan area and nine sites in the East St. Louis area to advise of travel times, lane closures and weather conditions affecting travel.
Indiana	Indiana DOT operates 23 towers throughout the state.
Iowa	Iowa DOT operates 10 HAR towers, three of which are FM broadcasts, and one location utilizes Super HAR broadcast that extends the coverage area.
New Jersey	New Jersey has 13 HAR operational throughout the state, and they previously relied on these HAR more for traveler information before the 511 phone system was launched.
New York	New York State DOT operates 15 HAR throughout the state.
	The New York State Thruway Authority (NYSTA) operates more than 20 HAR along the Thruway.
Ohio	Ohio DOT operates 26 HAR towers clustered around the largest cities (seven near Cleveland, six near Columbus, four in Dayton, three in Cincinnati, and one in Akron).
Oregon	Oregon DOT operates approximately 24 HAR towers in key locations throughout Oregon.
Utah	Utah DOT operates about 12 HAR towers, primarily in the Salt Lake City valley and on roads to remote ski destinations.
<10 HAR Sites	
Alabama	Alabama DOT operates four mobile HAR units, primarily for hurricanes, incidents, and winter weather reports.
Montana	Montana DOT operates five HAR on mountain passes, typically one HAR on each side of the mountain pass.
New Hampshire	New Hampshire DOT operates two HAR towers along the Turnpike.
Tennessee	Tennessee DOT operates three HAR towers.
Texas	Texas DOT operates 21 HAR towers around San Antonio, Austin, El Paso and Amarillo to advise of lane closures, events and extreme weather conditions.

3.2 Specific Uses of HAR

This section describes specific uses of HAR that were researched as part of this project. This is not intended to be an all-inclusive list of HAR uses, but an illustration of several distinct uses of HAR that were identified during the project.

- HAR Use #1: Weather Related Emergencies and Other Major Incidents
- HAR Use #2: Lengthy, Detailed or Complex Information
- HAR Use #3: When Other Technologies are Temporarily Unavailable
- HAR Use #4: Dissemination of Metro-Wide Condition Summaries to Support Thru Traffic
- HAR Use #5: Traveler Information Coverage of Entire Metro Area or Region
- HAR Use #6: Traveler Alerts about Specific Corridors
- HAR Use #7: Disseminate Travel Times
- HAR Use #8: Temporary Locations
- HAR Use #9: Emergency Weather Radio Broadcasts
- HAR Use #10: National Park Traveler Information

3.2.1 HAR Use #1: Weather Related Emergencies and Other Major Incidents

A number of agencies use HAR to alert travelers to large scale weather emergencies or other long term incidents. These are real-time broadcasts of information that may change quickly, and therefore the agencies managing these reports typically have reliable communication mechanisms to the HAR broadcast towers (allowing them to update messages or terminate broadcasts quickly when situations change). Timeliness of broadcast is critical when HAR is used for emergencies or incidents. Early generation HAR technology where messages are recorded in the field or even recorded by calling the HAR station by cellular phone would present challenges for this use. Some examples of this use include:

- **Washington DOT (WSDOT) Winter Emergencies.** WSDOT uses their existing HAR towers to broadcast messages describing winter emergencies. These may describe road or mountain pass closures, delays due to landslides or avalanches, or general descriptions of current or pending weather events that are large scale. WSDOT also uses their HAR towers to broadcast information about large incidents. These would include long term incidents, expected to impact one or more roads for several hours.
- **Pennsylvania DOT (PennDOT) Long Term Incidents.** PennDOT uses HAR broadcasts to inform travelers of incidents with expected long term duration. The PennDOT HAR control software is currently separate from their Advanced Traffic Management System (ATMS) software but the plan is for the new ATMS software that PennDOT is developing to incorporate HAR control.
- **NYSTA Emergencies and Level 1 Events.** NYSTA reports all emergencies and level 1 events entered into their Condition Acquisition and Reporting System (CARS) through their more than 20 HAR towers. The condition reporting system automatically generates recommended HAR

messages, allowing operators to accept the recommended message and transmit to the HAR tower automatically.

3.2.2 HAR Use #2: Lengthy, Detailed or Complex Information

The Manual on Uniform Traffic Control Devices policy memorandum, Dynamic Message Sign (DMS) Recommended Practice and Guidance,⁷ issued by the Federal Highway Administration in July 2004 discourage lengthy messages on DMS, including displays that require travelers to read telephone numbers, websites, addresses or other lengthy information. The memorandum goes on to describe that in situations when there is a need to relay extensive information to motorists, it should be done using 511 phone systems, HAR or websites. Of these three options, HAR offers the benefit of location specific information that can be coupled with a flashing beacon and sign to alert travelers of urgent messages. A number of agencies use HAR broadcasts when messages are lengthy, detailed or complex. Often, the need for this type of message is related to a specific fixed location, such as a mountain pass where vehicles approaching the area are informed of tire chain requirements. Some specific examples of this use are:

- **WSDOT Mountain Pass Reports and Chain-up Explanations.** WSDOT uses HAR to advise travelers of mountain pass conditions and to describe current chain-up requirements (e.g. whether chains are required for all vehicles or specific types of vehicles), and to describe the available areas for vehicles to park and install chains. The department also works with area ski resorts to post messages that help manage local traffic.
- **Oregon DOT (ODOT) Chain-up Instructions.** ODOT uses HAR to describe chain-up restrictions and locations. In Oregon conditions on high elevation stretches of highway can be very different from lower elevations; therefore many vehicles would be caught off-guard if not for the HAR messages. Similarly, the rules for who is required to apply tire chains are complex and HAR messages explain these.
- **Montana Mountain Pass HAR Dissemination.** Montana DOT operates five HAR towers. There are two at Homestake Pass (I-90 near Butte), two at Bozeman Hill (I-90 near Bozeman), and one at Lookout Pass (I-90 at the Idaho State Line) to provide an area report of weather conditions. The approach is to locate one HAR on each side of the mountain pass for travelers approaching in either direction.
- **Amber Alert Messages.** Amber Alerts are a type of complex message that some agencies broadcast using their HAR systems. As shown in Figure 3, NYSTA operates blue HAR signs with a distinct beacon for traffic advisories and another distinct flashing beacon for Amber Alerts informing travelers which type of information the HAR broadcast is announcing.



Figure 1: NYSTA Traffic Advisory/Amber Alert Sign

- **Utah DOT (UDOT) Avalanche Messages.** UDOT operates two HAR towers at locations where travelers are leaving the Salt Lake City Valley and heading up the canyon roads to ski destinations. UDOT explained that there are small DMS located in these areas, but the small DMS do not have the space to explain the often complex messages regarding plans for road closures due to controlled avalanches or unplanned avalanches. UDOT operates under a policy that does not allow two or more phases to DMS displays, so the DMS is limited to only one phase and this is not sufficient to describe avalanche conditions. The HAR broadcasts are used as a supplement to advise travelers of further closure details.

3.2.3 HAR Use #3: When Other Technologies are Temporarily Unavailable

In many situations, HAR broadcast technologies have the advantage over 511 phone systems of not requiring cellular coverage to communicate to travelers (although some HAR technologies require cellular to communicate the message to the HAR tower). Therefore, state agencies faced with emergencies, such as flooding or power outages that eliminate cellular phones have successfully used HAR when cellular communications no longer allow travelers to access 511 phone systems while traveling. For example:

- **Iowa DOT (IADOT) Use of HAR during Flooding Events.** During major flooding events in Iowa, cellular towers were inoperable and large areas lost cellular connectivity. The flooding conditions were also times when travelers most needed the information from the department's 511 phone system. Fortunately, the HAR systems in Iowa remained operational and the same information that automatically feeds the 511 phone system is automatically created into a play list for the IADOT HAR systems. Iowa also used some portable HAR trailers to serve additional areas beyond those that were equipped with permanent HAR.

3.2.4 HAR Use #4: Dissemination of Metro-Wide Condition Summaries to Support Thru Traffic

Commercial vehicles and leisure travelers approaching metro areas often have multiple optional routes to select from as they pass through or around a metro region (e.g. beltways, parallel routes, etc.). One use of HAR broadcasts has been to provide information to these travelers as they approach the metro area, offering a summary of the travel delays or conditions on multiple roads. The extended messaging capabilities offered by HAR allow for the report to describe conditions more than would be possible solely using DMS, and the position of the HAR can be in a location such that travelers can hear and understand the report before key decision points. One example of this is as follows:

- **Texas DOT (TxDOT) HAR Messages to Commercial Vehicles.** TxDOT located a number of HAR towers on the routes approaching San Antonio. As thru traffic approaches San Antonio (i.e. on I-10, I-37, and I-35) drivers have the option to remain on their routes or to use the I-410 beltway around the metro area, resuming their needed route when appropriate. HAR towers were located and operated to disseminate messages describing the different situations on routes and allowing through traffic to select the best route through the metro area.

3.2.5 HAR Use #5: Traveler Information Coverage of Entire Metro Area or Region

The circular coverage area of HAR, combined with a coverage radius of several miles allows HAR coverage for large geographic areas. While most HAR towers are located roadside to a highway, allowing for travelers on one or more nearby routes to hear broadcasts, those are not the only approaches agencies have used to disseminate information. Agencies have also deployed HAR towers to cover entire cities or regions. These could include a series of parking garages or a downtown commuter area, allowing travelers to tune their car radio while still in the parking garage to understand delays on different alternate routes. An example of this use is as follows:

- ***Eugene, Oregon Citywide HAR Coverage.*** ODOT operates a few HAR towers within the city of Eugene. The intent of these HAR towers is to allow any driver in the city to tune their radio and hear urgent reports describing travel conditions between Eugene and Portland or between Eugene and the coast. Eugene is home to the University of Oregon. As a result, there are times when school events generate considerable traffic departing Eugene for Portland. Additionally, the roads to the Oregon Coast from Eugene are one lane in each direction and include mountain passes and other potential hazards. The HAR deployment allows travelers access to the information before they depart along either route, and provides ODOT the option of including details that could not be posted on DMS signs.

3.2.6 HAR Use #6: Traveler Alerts about Specific Corridors

For agencies that operate corridors with a geography or topology that creates hazards, or even roads traveling through isolated areas, there are unique risks for travelers to be stranded without alternate routes or services. Often, the unique road systems are vulnerable to closures, HAR technologies offer a mechanism to warn drivers of planned or real-time events on the corridor, ideally at a location where travelers can still turn around. Some examples include:

- ***UDOT Canyon Corridors to Ski Destinations.*** UDOT operates two HAR towers at locations where travelers are leaving the Salt Lake City Valley and heading up the canyon roads to ski destinations. UDOT regularly monitors the snow accumulation to predict avalanches. UDOT will also manually dislodge snow buildup in order to prevent large avalanches. For these reasons, there are many times when UDOT needs to convey messages to travelers as they approach the corridor, either to warn of current or very near-term closures, or to notify travelers of planned closures expected in the coming days. The HAR broadcasts are at locations where travelers could still turn around and choose to delay their trip or pursue an alternate route or destination.
- ***ODOT State Highways Accessing Coastal Communities.*** Travelers from Oregon's major population centers (i.e. Portland, Salem, Eugene) must cross the Pacific mountain range to reach tourist destinations along the coast. The roads over the mountain passes are typically two-lane highways with passing lanes located on uphill stretches, and are prone to snow and ice in the winter and the risk of fallen trees during all months of the year. An example is Highway 18 that travelers use from the Willamette Valley to Lincoln City, Oregon. ODOT has located HAR towers at both the east and west sides of the area known to be a 'snow zone.' The HAR towers flash

beacons when an alert is played. Travelers who learn of closures or hazardous conditions still have options to turn around and pursue other routes to or from the coast.

3.2.7 HAR Use #7: Disseminate Travel Times

There are transportation agencies that have enlisted HAR technologies to convey travel times to travelers. In these situations, travel times are either announced 24/7, during peak periods, or only when times exceed common travel times. This use is perhaps the most dramatic increase in HAR use since the 1980s. HAR offers some distinct advantages to DMS for travel time dissemination as a number of origins and destinations can be described, as opposed to the typical DMS approach of presenting times from the DMS to key landmarks.

- ***NYSTA Automated Travel Times during Peak Periods.*** NYSTA operates HAR towers that broadcast travel times during peak periods. NYSTA identified that HAR is effective for relaying travel times because of the flexibility in being able to describe multiple origins and destinations (whereas DMS typically report travel times from the DMS to a downstream landmark). NYSTA also noted that when there is an incident or emergency announced on HAR and the flashing beacons are on, they continue to broadcast the travel times, in hopes that travelers who tune in will become educated that travel times are on the HAR and use it on future days even if the flashing beacons are not activated.
- ***Illinois Metropolitan Area Travel Times.*** Illinois DOT operates automatic posting of travel times to HAR on highways around the Chicago and East St. Louis metropolitan areas. Travel times are updated every five minutes, and IDOT noted that travelers miss the messages and often complain if they are not operational. Other messages regarding construction, incidents and hazardous weather conditions are also disseminated using the system.

3.2.8 HAR Use #8: Temporary Locations

Portable units have allowed HAR broadcasts to be used in areas during temporary special events, where visitors need to learn about parking or directions to venues (e.g. golf tournaments, fairs, etc.), and during construction. Combining HAR with a portable DMS allows travelers to receive a brief message about the availability of more detailed information via HAR. Portability may only be limited by terrain that could limit radio frequency range.

- ***Using HAR for Winter Olympics in Utah.*** When Utah hosted the 2002 Winter Olympics in Salt Lake City, the DOT expanded their traveler information system to assist residents with navigating heavier than normal traffic and to support visitors to the games. CommuterLink included an integrated network of traffic sensors, closed-circuit television, variable message signs, freeway ramp meters, website, and HAR. Overall, the system performed well given the extreme demands of the 2002 Winter Olympics and although it is unlikely that the system will ever be required to function under this demand again, the extensive usage did highlight some technical issues with HAR to consider in other temporary deployments. For example, center to HAR communication was managed over the cellular telephone network to update messages. The increased cellular network traffic in the area during the games sometimes limited the

agency's ability to connect with HAR and update messages. The HAR units were also battery powered with a solar recharge capability. Because the units were transmitting for extended periods of time during the games, power was sometimes lost when consumption exceeded the available charging capacity of the solar panels. While some of these issues were unique to the heavy demands of the Olympic Games, similar issues could occur in other areas with extreme demands during catastrophic or large-scale event.⁸

- **Phoenix International Raceway Use of HAR in TDM Effort.** In an effort to decrease congestion and delay during racing events, the Phoenix International Raceway implemented a travel demand management effort that included HAR as a traveler information tool. Highlighted as a case study in the NCHRP 309 report, the Raceway is located in the Phoenix Valley and hosts several events annually with attendance ranging from several thousand to nearly 150,000 patrons. HAR was used to deliver special messages recorded by race drivers, encouraging travelers to use the system. During events, HAR was also used to direct traffic to park and ride lots. Although HAR was not individually evaluated, overall evaluation of the TDM strategies used by the Raceway suggests the strategies reduced congestion and delay. Looking at parking lot clearance in particular, in 1998 it took an average of 5.5 hours to clear them and, in 2000, that time was reduced to 3.5 hours on average. The public also provided positive feedback on the TDM strategies.⁹
- **HAR in New Mexico and Arkansas Construction.** In 2002, the FHWA ITS Joint Program Office conducted a cross-cutting study examining the application of ITS in work zones at sites in four states to share those experiences with other regions. Two of the states studied used HAR in their construction projects. The New Mexico State Highway and Transportation Department used HAR during the reconstruction of "The Big I" interchange in Albuquerque. HAR was used in conjunction with cameras, DMS, a project web site and media outlets to distribute information about traffic conditions in the work zone. The Arkansas State Highway and Transportation Department also used HAR in the 2000 reconstruction I-40 near its intersection with I-55. The project implemented an automated work zone information system that detected traffic conditions approaching the work zone and then used that information to deliver messages to travelers via three HAR sites that covered approximately 23 miles. The system was successfully used to help travelers choose between I-40 and I-55 based on congestion.¹⁰

3.2.9 HAR Use #9: Emergency Weather Radio Broadcasts

When weather impacts traveler or visitor safety in a park setting, HAR has been used to broadcast emergency weather information. Although routine weather information is prohibited content for HAR, the 2013 ruling by FCC introduced some degree of flexibility to the licensee to determine when what constitutes "imminent [threat to] safety-of-life or property," as well as when emergency conditions reach the level of a "hurricane, flood, earthquake or similar disaster." The ruling goes on to state, "Again, permissible use of the TIS in such conditions could include the transmission of evacuation routes and the location of shelters, health care and other emergency facilities, as well as weather or other conditions that may negatively impact driving conditions."

- Greater Yellowstone National Park Traveler and Weather Information.** A network of HAR and DMS were installed throughout the Yellowstone National Park in 2009-2010 to provide visitors and travelers along the main park corridor – US89 – with information about road conditions and changing weather conditions. A variety of permanent and portable HAR were used at park entrances, campgrounds and other key locations. Most unique was the use of 15 National Weather Service receivers tied to low-power AM transmitters at the park’s major campgrounds. This system acts as a low-cost alternative to a HAR, and even though it does not have the transmitting power (or distance) of a typical HAR, it provides adequate coverage to disburse traveler information within the campgrounds. The same information was also incorporated into the Idaho, Montana and Wyoming 511 traveler information systems to provide travelers with information from a greater distance and allow them to select alternate departure times or routes. This illustrates the potential for HAR and 511 services to coexist and complement one another.¹¹

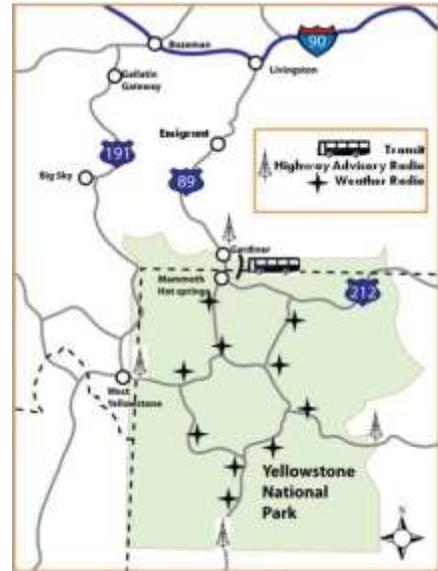


Figure 2: HAR Locations in Yellowstone National Park. Source: WTI

3.10 HAR Use #10: National Park Traveler Information

The country’s national parks attract thousands of visitors each year, generating unique traffic management conditions during peak periods. Compounding the challenge, travelers are often unfamiliar with the area they are visiting and unaware of how to obtain information about traffic, alternate routes, road conditions and other details that would make their individual trip smoother and minimize impacts on the collective travel of all visitors. As one of the governmental entities specifically called out by the FCC as potential users of TIS, many national parks have implemented broader scale traveler information systems that leverage the use of HAR in particular.

- HAR Used to Promote Transit in Grand Canyon National Park.** The Grand Canyon National Park applied for a grant through the Alternative Transportation for Parks and Public Lands (ATPPL) Program administered by the Federal Transit Administration to add HAR stations that would provide traveler information and ultimately support increased transit ridership. The system included a combination of HAR, DMS and static signs. An evaluation of the pilot project found that the presence of the system added 368 shuttle passengers per day, an increase of 45.7 percent in shuttle ridership.¹²

4. Value of HAR

Quantifying how often travelers use a system is challenging based on the nature of HAR as a radio broadcast. Although there are some qualitative market research-based studies that have been conducted around the value of HAR, many agencies simply know the value of the stations based on complaints received when a station is inactive or misreporting. This section summarizes the information gathered from individual states and other studies that have been conducted to estimate the value of HAR. It also presents some other factors that may impact the value of HAR in the future.

4.1 HAR Usage and Value

In November 2012, the National Cooperative Highway Research Program released a study that reviewed a variety of traveler information systems to understand agency practices, as well as traveler perspectives and use across the country. Regarding HAR, the NCHRP Project 08-82 report, *Deployment, Use and Effective of Real-Time Traveler Information Systems*¹³ noted, “Highway advisory radio (HAR) has a long history and general awareness by the public. The following findings were universal across cities [surveyed for this study]:

- Extremely negative response about the sound quality, usefulness, and timeliness of information.
- Many travelers never tried HAR because they have heard such negative comments from others who have tried it.
- Others have only tried HAR once and found the quality to be so lacking that they never tried it again.
- Interestingly, several individuals mentioned HAR having potential as a very useful medium (“everyone has a radio”) to reach travelers with important information while on the roadway, but the implementation was severely lacking.
- The surveys indicate that a fair number of travelers (~18%) across the 6 cities reported trying to use it en-route as part of their typical decision process. Note that this may be some confusion from other radio outlets (which had a very strong showing) or a reference to using highway advisor radio only in extreme cases.”

Although there were negative perceptions about the quality of HAR, the perception of HAR as useful tool for reaching travelers offers encouragement. These findings speak to the potential for HAR, as well as the importance of ensuring HAR sites are well-situated in terms of their broadcast range and the importance of ensuring that quality content is then broadcasted.

In other more localized studies of HAR use, traveler perceptions vary and can often reflect the nature of the deployment itself. For example, in 2005 Utah studied the use of four advanced traveler information systems, including HAR, to gauge their effectiveness and identify potential issues that need to be addressed. HAR is used to provide information concerning construction, road conditions and closures, special events, traffic information and, in some cases, tourism. During this study, a survey was conducted of 201 randomly selected licensed drivers at several locations in Salt Lake Valley. Of the four systems evaluated, HAR was the second most known and used among travelers, with 87% being aware

of and 55% having used HAR. Of those travelers who were aware of HAR, 67% indicated that they always, often or at least sometimes use the system to obtain information (when flashers on signs were activated). Travelers were further asked to comment on the information provided by HAR and just over 50% found it helpful. In this deployment, HAR sites were at fixed locations along key, daily travel routes. The traveler familiarity and quality of information broadcast from these sites likely contributed to the higher value travelers placed on them.¹⁴

In places where travelers are less familiar with the area or simply visiting, HAR may not be used as often but the information can still be highly valued by travelers. In the Yellowstone National Park HAR deployment highlighted in the previous section, travelers experienced a variety of permanent and portable HAR stations where road condition and weather information was broadcast. Sixty-nine percent of the 335 survey respondents saw signs noting “Visitor Information Tune to 1610 AM” but fewer than 33% indicated that they tuned into the radio station. The lower use of HAR in this case could be attributed to a lack of traveler familiarity with using HAR in general. However, for those who did tune in, when asked about the usefulness of the information broadcast, 84% rated the information as useful to some degree.

In addition to measuring traveler perceptions and use of HAR, value has also been measured in terms of crash reduction. In Tennessee, a low visibility warning system was installed on I-75 to address recurring fog-related crashes. The system consisted of environmental sensor stations, visibility sensors, and vehicle detectors; and used static signs with flashing beacons, variable speed limit signs, dynamic message signs and HAR to notify motorists of changing road conditions. Acknowledging that this deployment did not exclusively focus on HAR, it was found that it dramatically reduced crashes. While there had been over 200 crashes, 130 injuries and 18 fatalities on this section of I-75 since it opened in 1973, only one fog-related crash occurred on the freeway between 1994 and 2003, after the system was installed.¹⁵

Finally, in interviews with the Oregon and Illinois departments of transportation and the New York State Thruway Authority, it was noted that most feedback on the value of HAR is anecdotal. Many agencies simply know that HAR broadcasts are valued by travelers when they receive unsolicited positive comments and, when sites are unavailable, complaints about the lack of information.

4.2 Other Factors Impacting Value of HAR

In addition to selecting the appropriate use for HAR and ensuring quality broadcasts and content, there are number of other factors that will continue to impact the value of HAR. Foremost among these influences is the changing use of AM/FM radio. The introduction of broader multimedia options built directly into vehicles, proliferation of cell phones, portable audio devices, in-vehicle navigation, streaming music and satellite radio are all changing the way motorists use the audio functions in their vehicles. The Pew Research Center’s Project for Excellence in Journalism: The State of the News Media in 2013 – An Annual Report on American Journalism¹⁶ has tracked usage of a variety of media outlets, including radio, since 2004. In their latest report, there are both good and bad signs for the future of

HAR. On the positive side, the percentage of people who listen to the AM/FM radio each week remained essentially unchanged in 2012 when 92% of Americans age 12 or older listened to the radio at least weekly, nearly the same as it was 10 years ago at 94%. A more challenging sign for HAR, the report further notes that one of the biggest threats to AM/FM news in general is web-based listening which is growing. The desire for on-demand information that is offered by web-based radio does not bode well for HAR which must be listened to within a specific physical range and time to be of value. The report also notes 2012 data from Arbitron that shows 17% of cellphone owners have streamed online radio from their devices through their car stereos; up by more than a third since 2011.

As options grow for the audio functions in the vehicle, both preference and eventually the awareness of AM/FM radio could diminish and this would also impact the future value of HAR. However, there are organizations aimed at maintaining the quality and awareness of information based radio broadcasts like HAR. The American Association of Information Radio Operators¹⁷ (AAIRO) is a nonprofit organization of information radio station operators and licensees from public agencies across the country. A key aspect of the organization's mission is to support information radio as a medium for government to reach travelers with localized information. AAIRO was one of a handful of organizations that petitioned the FCC and prompted the 2013 ruling on TIS.

Finally, as the USDOT Connected Vehicle initiative gains momentum and vehicle manufacturers begin to introduce features that allow vehicles to communicate with roadside infrastructure (referred to as V2I communication), HAR use could evolve. For sites in strategic locations, the addition of a digital short range communication (DSRC) transmitter could create new uses for HAR and opportunities to expand its use.

5. HAR Technology and Operations

In addition to information gathered from agencies using HAR, two manufacturers of HAR systems were contacted for this project – Information Station Specialists¹⁸ (ISS) and MH Corbin.¹⁹ This section highlights agency and manufacturer insights on current HAR technology and operational practices used to create, deliver and broadcast content, promote and maintain HAR.

5.1 Content Creation

There are three significant factors that influence the quality of content created for HAR. First, the information available for HAR broadcasts has changed dramatically in recent years. As agencies have increased the amount of data gathered about the transportation system, the availability of more current, accurate and relevant information for travelers has also increased. This offers a greater variety and quality of information to share with travelers via HAR.

Second, rapidly evolving traveler information services have drawn greater agency attention to performance and customer needs. The introduction of 511, on-demand alerts, mobile apps and social media have also changed agency relationships with travelers as they can communicate in more ways and more often. Agencies often have operating guidelines describing when and how HAR messages

should be used as one way to ensure quality in the content of HAR messages. Figure 3 is an excerpt taken from the PennDOT guidelines for HAR messaging. In addition to describing the content of a well-structured message,

- A well-structured HAR message should include the following information:
- Agency identification
 - Location of incident (e.g. route and direction, county)
 - Description of incident
 - Duration and/or extent of congestion
 - Suggested alternate route(s), if available
 - Special driving instructions (e.g., the need to maintain a safe driving distance)
 - Date and time of recording
 - FCC call sign

Figure 3: Excerpt from PennDOT Guideline for HAR Messaging

the guidelines clearly explain the type of messages that may be used and the expectation for updating messages to maintain relevance. The complete PennDOT guideline is included in Appendix A. Additionally, some agencies create scripted or pre-recorded messages to ensure quality HAR content. For example, WSDOT maintains an extensive library of scripted messages to accompany their operational guidelines. The messages cover a variety of scenarios including default call sign and test messages, AMBER Alerts, special events and construction. Appendix B presents samples of these and other message scripts from the WSDOT HAR library.

The third factor influencing content quality is the way audio is created, loaded and activated. In the 1980s most agencies called recordings in via voicemail type systems. These messages often contained background noise and the process was cumbersome for operators to use during urgent situations. Today, agencies are playing audio files via digital connections that have greatly improved the sound of content broadcast on HAR. Digital audio files and HAR operating software allow operators to pick pre-recorded messages and activate them at multiple sites quickly and efficiently. Vendors have also made it easier for agencies to create higher quality sounding broadcasts for HAR by offering professional recording services. Sound and information quality have always been challenging factors in the content of HAR broadcasts. It is important to remember that travelers listen to HAR expecting the sound to be similar to other radio broadcasts that they hear. Operating guidelines, pre-recorded and scripted messages, and operating software can all be used to improve the sound and quality of information broadcast via HAR.

5.2 Content Delivery to HAR Sites

Just as the recording of content has changed, so too has the delivery of that content to individual HAR sites. In the early days of HAR, cassette tapes were recorded and had to be physically taken to the sites. Telephone interfaces were added next so that sites could be updated with a phone call remotely. Then software was added and it allowed a computer to make the phone calls. Today, HAR communication can be managed over digital networks, allowing multiple HAR sites to be updated with a few clicks of the mouse from an operations center.

There are also different approaches to managing the how the delivery of content occurs. Some agencies operate fully automated systems where the HAR broadcasts are fed by the same condition reporting system that feeds 511 telephone or traveler information websites. These automated systems often report information such as travel times, incidents and construction details. Other systems may rely on

an operator using a HAR user interface to select messages for broadcast by typing the words of the message or selecting phrases from drop-down lists. Messages are typically pre-recorded in a library of .wav files or text-to-speech functions can create the audio file that is broadcast at the HAR site. Most systems also allow operators to create original voice recordings as needed.

5.3 Broadcast Approaches

There are portable vs. permanent approaches to the physicality of where a broadcast is delivered. Both are viable and useful approaches, depending on the need being addressed by HAR. Pricing between the permanent and portable options is fairly comparable with location playing the biggest part in determining final cost. Portable systems can range from \$35,000-\$50,000 and a permanent system can range from \$25,000-\$55,000.

Permanent installations are generally selected to provide recurring information such as daily commute times. These sites are typically located at key decision points such as freeway interchanges. These locations also offer the benefit of power, landline communication and physical space for the pole mounted antenna and cabinet to house the HAR equipment. If traffic patterns change over time and a permanent site becomes less effective, an agency may wish to consider relocating or converting a permanent site. It is also possible to move a permanent installation from one location to another. It is also technically possible to convert a permanent installation into a portable station since the equipment modules are essentially the same between the two. However, the power, communication and housing changes required for this type of conversion may not be very cost effective as poles, cabinets and ground mounts from a permanent site often cannot be reused.

Portable deployments are used more often for mobile operations such as construction or emergencies. The physical equipment for a portable HAR is typically fitted to a trailer with solar power, wireless communication and a weather-proofed cabinet that allows the unit to essentially be taken anywhere it may be needed. These units are also often equipped with DMS which gives agencies the ability to both alert motorists of HAR and deliver the broadcast from one unit. Some agencies have also used portable equipment in semi-permanent locations; parking the trailers on concrete bases and using them on a daily basis until or unless an emergency requires them to be moved elsewhere. Portable HAR stations are also available in even smaller, suitcase-style deployments. These were developed and are most often used for emergency situations when speed and portability are critical. Portable or permanent, all of the deployments noted here require FCC licensing to establish a HAR broadcast.

5.4 Promoting HAR Use

Transportation agencies frequently promote HAR broadcasts using static blue service signs, often with flashing beacons that are activated when information is available. Many agencies also use DMS to alert travelers to messages broadcast on HAR. In situations where HAR offers continuous information (e.g. parking information near an airport) agencies may even rely solely on a static blue HAR sign with no flashing beacons.

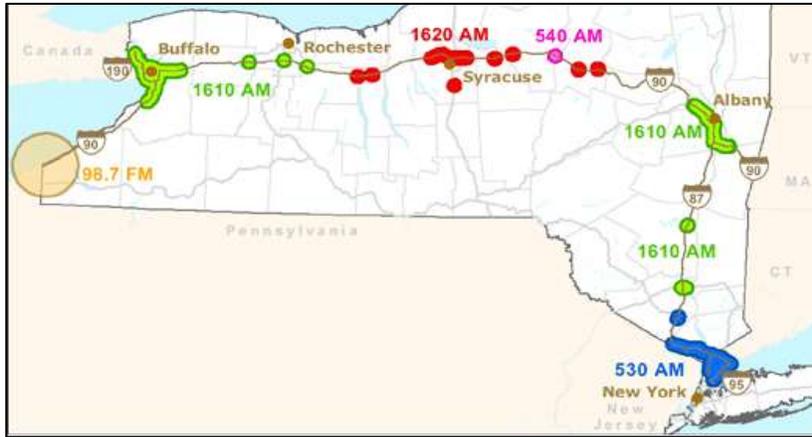


Figure 4: NYSTA HAR Frequency Clusters

In addition to roadside signing, agencies also promote the use of HAR by deploying sites with common frequencies within regions or along key corridors to help travelers consistently access HAR stations. For example, the New York State Thruway Authority (NYSTA) uses clusters of frequencies, as illustrated in Figure 4. Virginia DOT also clusters frequencies, where HAR towers use 1620 kHz

in VDOT’s Northern, Southwestern, and Central regions, and 1680 kHz in the Eastern Region.

Still other agencies are beginning to promote HAR by displaying broadcast messages with other traveler information on websites. Figure 5 illustrates this feature on the NYSTA website.²⁰ The site allows travelers to see HAR locations throughout the region and clicking on individual icons provides both a text and audio file of the HAR broadcast at that location. Similarly, the Central Texas Regional Mobility Authority plays HAR broadcasts via the MoPac construction project web site.²¹ They also use a consistent radio personality, “MoPac Man,” to make the broadcasts recognizable and entertaining for travelers.



Figure 5: NYSTA HAR Locations and Broadcasts Online

5.5 Maintaining HAR

In addition to suggestions that support improved daily HAR operation, there are maintenance factors that can influence successful HAR operation. The most prominent are FCC licensing and preventive maintenance of the physical HAR equipment.

The initial licensing process is complex and includes frequency searches, engineering studies, temporary assignments and filing with the FCC. Once granted, the initial license is effective for 10 years. Renewing the license then involves steps similar to those taken for initial licensing. Because of the unique requirements for licensing, HAR vendors offer support services to agencies specifically for this purpose.

In addition to licensing, there are periodic preventive maintenance steps that should be taken to ensure that HAR stations are functioning as they should. Regular site inspection of the equipment to ensure it is operating correctly is important and should include verification that the transmitter is operating within the requirements of the station's FCC license. One example of a preventive maintenance check list is provided in Appendix C, courtesy of MH Corbin.

6. Conclusion

In places where HAR is being successfully used, it is likely to continue to be an effective traveler information tool in the future. The threats of AM radio becoming obsolete and vehicle manufacturers no longer installing radios have been reported as the impending demise of HAR for years and yet neither has happened. The advent of the Connected Vehicle initiative could even create a whole new level of HAR use as existing stations could be retrofitted to serve as the V2I connection points. It is even conceivable that roadside deployments could broadcast information to portable devices in the vehicle. Perhaps HAR could provide vehicle to infrastructure communication points for both new and old vehicles, using AM radio to share information with older vehicles and DSRC to broadcast information to newer vehicles. Depending on the evolution of HAR, it is possible some states may consider starting or expanding HAR services.

This summary report has provided general background on HAR and an overview of current HAR operations and specific uses based on the research conducted for this project. Appendix D also offers a tabular view of the HAR uses and typical technology applications as a quick reference for the details provided in the report. The value of HAR and the state of HAR technology have also been summarized with the intent of helping ENTERPRISE member agencies understand opportunities for HAR within their organizations.

Appendix A: PennDOT HAR Messaging Guidelines

Appendix E- Highway Advisory Radio (HAR) Messaging

A Highway Advisory Radio (HAR) is a local government radio base station used to transmit non-commercial, voice information pertaining to travelers' information. HARs should be used in conjunction with DMSs when needed. There may be instances where certain events will not fit on DMS, or multiple events occurring simultaneously need to be conveyed to motorists. In such cases, a DMS may simply alert motorists to tune to the local HAR station for all messaging or to listen to lower priority events. In instances where two events are simultaneously occurring, the Message Prioritization hierarchy in Section 2.0 shall be followed.

Acceptable Messages

Below are specific types of messages permitted or prohibited for broadcast on HARs.

Permitted

- Traffic and road conditions
- Traffic hazard and travel advisories, including:
 - Emergency NOAA weather announcements
 - Current driving travel times
 - Availability of 511 service
 - Directions/detours
 - Special Events
- Availability of facilities, including:
 - Rest areas
 - Service stations
 - Welcome Centers
 - Parking information
 - Weigh stations
 - Lodging
- Communications related directly to the imminent safety-of-life or property, including:
 - Amber Alerts/MEPA Alerts
 - Emergency points of assembly
 - Locations of shelters, health care, and other emergency facilities

Prohibited

- Routine weather information
- Scheduled Safety Messages (SSMs)
- Non-emergency public safety messages

It is not permissible to identify the commercial name of any business establishment whose service may be available within or outside of the coverage area of the Highway Advisory Radio.

Structuring a Message

A standard HAR message on a DMS consists of "Tune Radio to XXXX AM" on the second phase. The first phase should provide a brief explanation of the event (e.g. I-95 Closed After Exit 19, Winter Weather Warning, Amber Alert).

A well-structured HAR message should include the following information:

- Agency identification
- Location of incident (e.g. route and direction, county)
- Description of incident
- Duration and/or extent of congestion
- Suggested alternate route(s), if available
- Special driving instructions (e.g., the need to maintain a safe driving distance)
- Date and time of recording
- FCC call sign

Listening time is limited to the range of a HAR transmission, which averages 2 to 3 miles or approximately 2 to 3¼ minutes while traveling at a speed of 55 mph. Clarity of reception is not always uniform within this range; however, a motorist should be able to hear the message twice, also allowing for "tuning in" time. Accordingly, a 60 second limit for HAR messages is recommended. A message shall not exceed 2 minutes in length.

Traffic advisory message should be updated within 15 minutes of a change in condition.

Additional Information

Additional information on the acceptable uses of HARs can be found in 47 C.F.R. §90.242 Travelers' Information Stations, 47 C.F.R. §90.405 Permissible Communications, 47 C.F.R. §90.407 Emergency Communications, and FCC 13-98.

Appendix B: WSDOT HAR Message Library Samples

Hatton Coulee Default Message (Do Not Delete or Modify)	This is station W, Q, K, M, 5, 0, 4 on the WSDOT highway advisory radio network in Hatton Coolie.
Portable Trailer at Keller Ferry Default Message (Do Not Delete or Modify)	This is W, N, V, A, 8, 1, 4 on the WSDOT highway advisory radio network.
AMBER ALERT WITH INFO	This is an activation of the Washington Statewide AMBER Alert Plan in response to the abduction of a child. The Washington State Patrol (or initiating local law enforcement agency's name) is asking for the public's assistance, in locating the following vehicle, (COLOR OF VEHICLE) (YEAR IF KNOWN) (MAKE, MODEL IF KNOWN & STYLE) (STATE & LICENSE PLATE NUMBER). If you have any information about this vehicle, please call 911 immediately
Pullman WSU Game Day Message	For those en route to Washington State University, alternate routes are available to avoid congested areas. If you are traveling south on one ninety five toward Pullman, you can stay right on one ninety five instead of taking two seventy east. Continue 2.5 miles on one ninety five, and turn left to go north on highway twenty seven. Either turn right on Bishop Blvd. to get to the stadium, or continue north on twenty seven to a park-and-ride, at Living Faith Fellowship Church near Crestview St. If you are traveling north on one ninety five toward Pullman, you can either turn right on Bishop to get to the stadium, or continue north on twenty seven to the park-and-ride, at Living Faith Fellowship Church at Crestview St.
Signals Test Message (Do Not Delete or Modify)	This is a test of the Spokane highway advisory radio system. Test number 9.
PSA #121 Seat Belts	The Washington State Department of Transportation would like to remind you, that a seatbelt is the single most important piece of safety equipment in your vehicle. In fact, if you're involved in a collision and not wearing a seatbelt your chance of being seriously injured or killed is 3 times higher than if you had been wearing a seatbelt. Those in law enforcement respond to numerous collisions where the inside of the vehicle is not badly damaged, but the driver is seriously injured. And the reason? The driver was not wearing a seatbelt! If you're involved in a collision, the impact to your body is enormous, particularly when driving at freeway speeds. But even in a 35 MPH collision, the impact is the same as if you had jumped from a third story window. So please, remember you're not invincible...wear your seatbelt on every trip. This message was jointly provided by the Washington State Patrol, the Washington Traffic Safety Commission and the Department of Transportation.

<p>PSA #124 Avoid Collisions</p>	<p>This is the Washington State Department of Transportation with a traffic safety message for travelers along the Interstate 90 corridor. As you probably know, your drive may be delayed because of traffic congestion, but did you know that about half of all delays are the result of automobile collisions? The Department of Transportation and the Washington State Patrol are working together to reduce the impact that collisions have on your travel time by implementing measures to clear accident scenes as rapidly as possible. You can help. If you are involved in a collision and your car is still drivable, please move it to the shoulder. The Washington State Patrol will be there shortly. Most of the collisions that occur on I-90 are "rear-end" and "merge-related" incidents. Here are a few things you as a motorist can do to help avoid a collision. Drive defensively. Be prepared for sudden stops, giving yourself enough room to brake should the vehicles in front of you slow down or stop. As traffic flows on and off the freeway, watch for sudden lane changes by other motorists. When merging, adjust your speed to match the traffic flow, use your turn signal, and be sure there is enough room to move over safely. Always merge only one lane at a time. For real-time traffic information please call 5 1 1 or visit our website at "www.w s d o t dot w a dot g o v". On behalf of the Department of Transportation and the Washington State Patrol, Please drive safely. Your patience and courtesy help make everyone's drive safer and quicker.</p>
<p>Francis Avenue Construction 2013</p>	<p>During the spring and summer of two thousand thirteen, several construction projects will take place on Francis Avenue. WSDOT is constructing a railroad bridge span, and City of Spokane has also closed Francis between Crestline and Market Streets. As a result, drivers should expect congestion and delays on the NSC three ninety five North Spokane Corridor and Francis Avenue - especially during the morning and afternoon commute hours. Motorists may wish to seek alternate routes for time-sensitive travels, especially during peak traffic times. Drivers should be alert for trucks entering the road way, and occasional train traffic that may cause delays.</p>

Appendix C: MH Corbin Preventive Maintenance Schedule



Preventive Maintenance Schedule

1 HAR Station

1.1 Check Quarterly

- 1.1.1 Visually inspect the HAR cabinet for any external damage.
- 1.1.2 Visually inspect the HAR antenna and mounting brackets to ensure all is mounted securely.
- 1.1.3 Visually inspect the area around the pole for any obstructions for the grounding system.
- 1.1.4 Open the HAR cabinet and visually inspect the electronics.
- 1.1.5 Ensure the AC power is turned on.
- 1.1.6 Check the BlackMax power supply and ensure it is turned ON and the AC light is GREEN.

1.2 Check Annually

- 1.2.1 Check the voltage meter on the power supply and ensure voltage is between 13.0 and 14.0 volts.
- 1.2.2 Once the equipment is operating properly on AC power, disconnect the plug from the AC outlet and the system should immediately change over to BATTERY power and the RED LED should come on. The system should continue to run without interruption.
- 1.2.3 Once all is tested, reconnect AC power and ensure the GREEN LED is on and the equipment is operating.
- 1.2.4 Visually inspect DRTXM2 transmitter to ensure it is turned ON
- 1.2.5 Ensure the POWER led light is ON and the TRANSMIT led light is ON. If the power light is not on, check that you have turned on the power switch. If the transmit light is not on, check the settings in the DR1500AM recorder/player to turn this on.
- 1.2.6 Slide the MEASURE switch up to VSWR. Follow the line to the rightmost numbers and take reading. NOTE: This should be 2.0 or lower. (*If reading is above 2.0, then tuning of the antenna is necessary. This will require a bucket truck/man lift to reach the top of the pole and adjust the antenna tip. Please contact Technical Services for more detailed instructions).
- 1.2.7 Slide the MEASURE switch to the middle position to FORWARD. Follow the line to the middle most numbers and take reading. NOTE: This should be around 10.0 watts.

8355 Rausch Drive Plain City Ohio 43064 000-380-1718 614-873-0095 fax



- 1.2.8 Ensure that the MODULATION lights are peaking around 80 to 100%. This provides the message over the air. If lights are not blinking, then check the DR1500AM recorder/player to ensure a message is broadcasting.
- 1.2.9 Tune car radio to frequency listed on transmitter and check for a clear audio signal. If message is not clear, recheck connections and possibly record a new message. If problems, please contact Technical Services.
- 1.2.10 Ensure the TELCO led light is on at the DR1500AM.
- 1.2.11 Ensure that the handset and telephone line are plugged into the DR1500AM. NOTE: The telephone line coming in from the phone company must be plugged into TELCO.
- 1.2.12 Visually inspect DRWX1 weather radio and verify that the green POWER led light on the DRWX1 is on.
- 1.2.13 Turn the volume knob clockwise until the weather signal is heard from the internal speaker. If static is heard, then turn off power, disconnect antenna, and slide the DRWX1 out of the BlackMax rack. Select a different weather tower frequency by sliding the dipswitch up (set only 1 up at the time). Reinstall the weather radio and connect antenna. Repeat test to ensure a weather signal is heard clearly. Once system is operating properly, turn volume knob fully counter-clockwise to turn speaker off.
- 1.2.14 Verify that the cellular phone is powered up and connected to the antenna.
- 1.2.15 Verify the signal led lights are on.
- 1.2.16 Using another phone, call the cellular phone number and verify that the HAR site answers.
- 1.2.17 Visually inspect DCC-1 digital communications controller to ensure it is turned to the ON position
- 1.2.18 Verify that the HEARTBEAT led light is flashing. Also verify that the BROADCAST, AC, BATTERY, HAR STATUS, and STATUS 1 led lights are ON and GREEN.
- 1.2.19 The DR1500 led light should be OUT if normal operation. If the light is RED, it means the computer cable is not connected either at the DCC or at the DR1500. Double-check cable.
- 1.2.20 If equipped with a GPS-1 module, turn the GPS-1 power switch to the ON position. Verify that the POWER led light is on (GREEN) GPS 10 MHz and the GPS 1 HZ led lights are on, also verify that the TRANSMITTER LOCK led light is on and GREEN.
- 1.2.21 Verify that a 12 volt DC battery is installed into the battery backup cabinet.
- 1.2.22 Verify that the HIS, Inc. supplied battery cable is installed properly. The fuse holder ended wire connect to +12 V (positive on the battery). The



black/white wires connect to the negative terminal on the battery. Check that the fuse is a 5 amp rated and in good condition.

2 Flashing Beacon Sign

2.1 Check Quarterly

- 2.1.1 Verify that there are two (2) beacon heads mounted to the sign structure.
- 2.1.2 Verify that the sign controller is plugged into a power source (either battery powered or AC powered) and turned on. If unit does not power up, check all fuses and power source. If problems, please contact Technical Services.
- 2.1.3 Verify that the antenna is connected to the sign controller.
- 2.1.4 Ensure that the 30 amp relay is connected to a power source (on one terminal) and also to the flasher circuit (on the other terminal).
- 2.1.5 Turn the manual switch ON and verify that the beacons flash.
- 2.1.6 Verify that the solar panel is mounted securely and facing South.

2.2 Check Annually

- 2.2.1 Using a digital voltmeter, set check the voltage coming from the back of the solar panel. (Meter should be set to DC Volts).
- 2.2.2 If checking the wires from the solar panel into the equipment, typically yellow wire is used for the + 12 volts (positive) and a black wire is used for the -12 volts (negative).
- 2.2.3 Verify that in sunlight, the voltage is between 12.0 and 19.0 volts. If voltage is less than 12.0 volts, recheck voltage directly on the solar panel terminals. If voltage is still below 12.0 v, contact Technical Services.
- 2.2.4 Using a digital voltmeter, check the battery voltage on the battery. This voltage should be between 11.9 and 13.8 volts. If voltage is less than 11.9, check the connection to the solar regulator and ensure that the solar panel is in direct sunlight. If the system is being checked at night, the solar panel will not be giving off any voltage and the battery system may be at a lower voltage.
- 2.2.5 If any problems, please contact Technical Services.

Appendix D: HAR Uses and Typical Technology Applications

HAR Use	HAR Technology			
	Content Creation	Content Delivery	Broadcast Approach	HAR Promotion
HAR Use #1: Weather Related Emergencies and Other Major Incidents	Dynamic content, often created by RWIS or other reporting systems.	Real-time delivery of content to HAR site is required.	<ul style="list-style-type: none"> • Permanent 	<ul style="list-style-type: none"> • Signs with beacons
HAR Use #2: Lengthy, Detailed or Complex Information	Some content (e.g. chain up rules) is pre-defined, and rarely changes. Other content (e.g. explanations of closure or detours) requires dynamic content creation, typically manually recorded.	Static content could be programmed to disseminate continuously. Static messages could be stored and selected remotely. Dynamic content could be delivered in real-time.	<ul style="list-style-type: none"> • Primarily Permanent, • Occasionally Portable 	<ul style="list-style-type: none"> • Signs with beacons • Portable DMS
HAR Use #3: When Other Technologies are Temporarily Unavailable	Dynamic content, created from various sources. These uses typically replace 511 phone systems and would need to disseminate a variety of messages.	Real-time delivery of content to HAR site is required.	<ul style="list-style-type: none"> • Permanent • Portable 	<ul style="list-style-type: none"> • Signs with beacons • Portable DMS
HAR Use #4: Dissemination of Metro-Wide Condition Summaries to Support Thru Traffic	Some content (e.g. travel times) is pre-defined, and rarely changes. Other content (e.g. incidents) requires dynamic content creation, typically manually recorded.	Static content could be programmed to disseminate continuously. Static messages could be stored and selected remotely. Dynamic content could be delivered in real-time.	<ul style="list-style-type: none"> • Permanent 	<ul style="list-style-type: none"> • Signs with beacons • Permanent DMS • Website broadcast
HAR Use #5: Traveler Information Coverage of Entire Metro Area or Region	Some content (e.g. travel times) is pre-defined, and rarely changes. Other content (e.g. incidents) requires dynamic content creation, typically manually recorded.	Static content could be programmed to disseminate continuously. Static messages could be stored and selected remotely. Dynamic content could be delivered in real-time.	<ul style="list-style-type: none"> • Permanent 	<ul style="list-style-type: none"> • Signs with beacons • Permanent DMS • Website broadcast

HAR Use	HAR Technology			
	Content Creation	Content Delivery	Broadcast Approach	HAR Promotion
HAR Use #6: Traveler Alerts about Specific Corridors	Some content (e.g. travel times) is pre-defined, and rarely changes. Other content (e.g. incidents) requires dynamic content creation, typically manually recorded.	Static content could be programmed to disseminate continuously. Static messages could be stored and selected remotely. Dynamic content could be delivered in real-time.	<ul style="list-style-type: none"> • Permanent 	<ul style="list-style-type: none"> • Signs with beacons • Permanent DMS • Website broadcast
HAR Use #7: Disseminate Travel Times	Some content (e.g. travel times) is pre-defined, and rarely changes. Other content (e.g. incidents) requires dynamic content creation, typically manually recorded.	Static content could be programmed to disseminate continuously. Static messages could be stored and selected remotely. Dynamic content could be delivered in real-time.	<ul style="list-style-type: none"> • Permanent 	<ul style="list-style-type: none"> • Signs with beacons • Permanent DMS • Website broadcast
HAR Use #8: Temporary Locations	Dynamic content, created from various sources.	Real-time delivery of content to HAR site is required.	<ul style="list-style-type: none"> • Portable 	<ul style="list-style-type: none"> • Signs with beacons • Portable DMS
HAR Use #9: Emergency Weather Radio Broadcasts	Dynamic content, often created by weather reporting system.	Real-time delivery of content to HAR site is required.	<ul style="list-style-type: none"> • Permanent • Portable 	<ul style="list-style-type: none"> • Signs with beacons • Portable DMS
HAR Use #10: National Park Traveler Information	Primarily static content.	Static content could be programmed to disseminate continuously. Static messages could be stored and selected remotely. Dynamic content could be delivered in real-time.	<ul style="list-style-type: none"> • Permanent 	<ul style="list-style-type: none"> • Signs with beacons • Permanent DMS • Website broadcast

Appendix E: References

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- ² Report and Order in Docket 20509, FCC 77-414, 67 FCC 2d 917. http://fjallfoss.fcc.gov/edocs_public/attachmatch/FCC-77-414A1.pdf.
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