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Performing Organization and Address	Sponsoring Agency and Address
Alberta Infrastructure Technical Standards Branch 2nd Floor, 4999 – 98 Avenue Edmonton, Alberta T6B 2X3	Alberta Infrastructure Technical Standards Branch 2nd Floor, 4999 – 98 Avenue Edmonton, Alberta T6B 2X3

Supplementary Notes

Abstract

In 1998, Alberta Transportation & Utilities installed a low power FM radio broadcast transmitter near Valleyview on Hwy 43 to warn travellers of inclement road and weather conditions, and construction or maintenance activities. This Highway Advisory Radio (HAR) broadcast transmitter had an 8-km range. Some technical difficulties with the broadcast volume and a potential security breach through the dialup connection were identified. The 1999 report (TM 99/01) is under "Research Documents" at http://aicm/Content/doctype255/production/TM9901.pdf.

Positive feedback from the local municipality and RCMP detachment in 1998/99 led to additional testing of a HAR at Whitecourt and Coleman. The report also recommended that a portable HAR be evaluated on moving construction/ maintenance projects.

This project follows up the recommendations made in report TM 99/01. It documents the use of a portable HAR system on six mobile highway construction projects in Alberta.

Key Words	Distribution
Highway Advisory Radio (HAR), Advanced Traveller Information System (ATIS), Road Weather Information System (RWIS)	Unlimited
	Project Co-ordinator Rick Kowalik

ALBERTA INFRASTRUCTURE

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HIGHWAY ADVISORY RADIO SYSTEM
Alberta Experience

HIGHWAY ADVISORY RADIO SYSTEM – Alberta Experience

1.0 What is a Highway Advisory Radio System?

The Highway Advisory Radio System (HARS) is a low power radio station designed to provide current information to motorists about local road conditions, closures, and delays. Motorists could obtain HAR information by tuning their FM car radios to a predefined frequency. The HAR could be used to broadcast:

- winter road conditions, i.e: snow cover, blowing snow, black ice, etc
- possible hazards, road delays or detours ie: snowplow operations, survey/testing crews, construction or maintenance crews, wildlife etc.
- road closures or delays due to an emergency situation,
  i.e. vehicle accident, forest fire, chemical spill, weather etc.
- advise motorists of future activities that may result traffic disruptions,
  i.e. due to construction and/or maintenance activities.
- temporary speed limit changes and safety information
  i.e. safety initiatives, Buckle Up, Drive Safely, Think and Drive, etc.

A properly operated HARS should have a positive impact on safety by increasing driver awareness and reducing frustration.

2.0 Background and Literature

The concept of a Highway Advisory Radio (HAR) system was introduced to the department in 1998 by Total Point Inc., a Whitehorse, Yukon based manufacturing and distribution company.

The departments Maintenance Process Management Group agreed to test a Highway Advisory Radio system in 1998 after Total Point Inc. agreed to provide a “loaner” system for testing purposes.

2.1 Alberta Experience

In December of 1998, Total Point supplied a 5-watt “InfoPoint 2000VRA” system complete with power supply and antenna. Alberta Infrastructure used the FM radio transmitter near Valleyview along Hwy 43. The Highway Advisory Radio (HAR) system was used to warn travellers of inclement road and weather conditions, and could also be used to warn motorists about construction and maintenance activities. A detailed report (TM 99/01) of the 1998 test project is published under “Research Documents” at http://aicm/Content/doctype255/production/TM9901.pdf.

Positive reactions from the local municipality and the local RCMP detachment led to the testing of a HAR system in Whitecourt and Coleman. Report TM 99/01 also recommended that a HAR be tested on moving construction/maintenance projects.

2.2 Virginia Experience

"In 1995, the Virginia Transportation Research Council (VTRC) reviewed previous research, examined the use of HAR in Virginia, and surveyed Virginia motorists to ascertain the public's perception of HAR. The results of this study were used to develop a set of Operational Guidelines. The Council concluded that:

- Proper HAR operation is personnel-intensive. Updating broadcasts with information of value to motorists takes time. Linking isolated HAR transmitter units into a coherent traveller information system requires a concerted effort to consolidate information between multiple agencies.
- Motorists want specific, up-to-date information on congestion and incidents that affect their travel. Situations that can be communicated with other traffic control devices or that do not affect motorists do not warrant HAR broadcasts.
- Motorists are not turning to HAR broadcasts. Many motorists do not understand when they are in an HAR broadcast area, and what information HAR offers them.
- Motorists currently get most of their traffic information from commercial radio traffic reports. VDOT does not have the resources to provide the level of information provided by commercial radio stations.
- Variable Message Signs (VMS) offer considerable advantage as advisory signing for HAR. HAR advisory signs offer single, inflexible attention statements to drivers. Flashing beacon signs face the same problem, and are confusing to some motorists. VMS can alleviate these problems, directing the message to the appropriate audience."

Source: An Investigation of Operational Procedures for Highway Advisory Radio System by Brain Smith et al. Virginia Transportation Research Council, 520 Edgemont Rd., Charlottesville, VA 22903-0817. Sept. 1995.

2.3 Minnesota Experience

In 1994 the Human Factors Research Laboratory at the University of Minnesota conducted an evaluation of a HAR system providing real-time information to drivers in cars equipped with a radio receiver that incorporates special features. A digital channel was added to the regular FM signal as a digital side band that carried the current traffic information received by a special in-vehicle "Delco" receiver. The device looks like a typical car radio system but with a modified scrolling text display with two lines of eight characters each. The results of the evaluation of safety, performance and public perception of the device are as follows:

- The device was difficult to understand and to operate correctly.
- Regional messages could be interpreted as current local traffic information since the receiver was capable of transmitting data accurately over a large metropolitan area.
- The receiver degraded driving performance compared to driving without using the receiver. Performance was based on factors such as lane drift, acceleration and deceleration changes, speed maintenance, braking and other typical driving tasks.
- Participants were not convinced that these systems provided better information than what is available by listening to traffic announcements on their car radios.

- Problems with the design of the software used in the control room for the assembly of traffic messages included priority data so that the most frequently entered data was on the top of the list.
- There was a need for human factor improvement to the information delivery system at the TMC's control room.

Source: Human Factors Evaluation of the Delco RDS Radio Receiver and the RDS Architecture, by Max Burrus, et al. (University of Minnesota, Human Factors Research Laboratory, 141 Mariucci Arena Operations, 1901 4th St., SE, Minneapolis, MN 55455) (August 1994) [TD100:MN95-01]

In 1995, the Minnesota DOT conducted a survey of 300 drivers who use the freeways in the metro area during morning rush hours in order to determine the traffic information needs of these drivers. The intent was to help Minnesota DOT measure its current radio broadcast effectiveness and provide input for future planning. The survey responses are as follows:

- Over 80 percent claim they have taken an alternative route as a result of a traffic report and only 2 percent did not know about traffic reports on various radio stations;
- Current radio broadcasts of traffic information were rated as being "very useful";
- Commercial radio station reporting continuous traffic conditions was preferred.
- Electronic signs, or VMS, on freeways alerting motorists to problems ahead were highly rated by respondents.
- Ideas that required more effort or disrupted routines (e.g., phone numbers to call or cable TV programs to watch at home before leaving) were not highly rated.
- The more important information relates to blocked or unduly slowed down lanes and to poor road conditions due to weather as opposed to information such as parking availability.

Source: Motorist Information Study for Minnesota Department of Transportation (Carmichael Lynch, 800 Hennepin Ave., Minneapolis, MN 55403) (Aug-Sept. 1995) [TD 100: MN 95-950801]

2.4 Other Highway Advisory Radio Users

The Yukon Highways department successfully used transmitters for approximately 6 years. Currently they have seven permanently installed transmitters and 2 portable ‘Talking Sign” units. The permanent units are deployed on various highways throughout the north for use as ‘Travel Advisory Radio” stations. The portable units are used to advise of summer construction/maintenance activities as well as for use in emergency situations.

Officials within the Yukon Highways department have noticed a significant decrease in the level of driver frustration when the HARS unit was used to provide advanced warning of construction activity or delay.

In March of 1998, Manitoba Highways installed 2 of the Road Advisory Radio Systems on the Trans Canada Highway.

In January of 1998 the Ontario Provincial Police (OPP) purchased a portable 'Talking Sign" unit which will be used to advise motorists of accident delays, or emergency road closures.

In July of 1998 the Sault Ste. Marie Police Service began using the portable SAR (Search and Rescue) unit. According to officials in Sault Ste. Marie, the system will be used in emergency situations such as toxic spills, ice storms and floods.

3.0 Use of HAR on Alberta's Construction Projects

3.1 Defining Criteria for Success

The primary goal of Alberta Infrastructure is to get motorists from point A to point B as quickly, conveniently, and cost-effectively as possible in as safe a manner as possible.

Highway signs are used to notify and prepare motorists for actual traffic conditions.

The HAR is designed to inform motorists of inconveniences and emergencies.

The design of the HAR system makes the following assumptions:

1. The motorist sees the sign that asks the motorist to tune into a HAR station.
2. The motorist has enough time to read and understand the sign.
3. The motorist believes that the "HAR" message is important.
4. The motorist reacts and easily tunes into the HAR station.

Motorists armed with construction information and changing traffic conditions should be better prepared to deal with changing highway conditions and thus will be more likely to have a safe trip. In addition it is hoped that road rage decreases as informed motorists will be able to understand the reason for delays and become safer drivers.

3.2 Evaluation Alternatives

The best way to evaluate a motorist's reaction to a HAR system would be to conduct a survey shortly after the motorist drove through a HAR system.

To stop motorists (who have already encountered unexpected construction delays and who are possibly late because of the delay) to conduct a HAR survey would, in the opinion of the author, be the very last thing the department would want to do. Stopping motorists to conduct surveys would greatly increase the risk of an accident and violate the primary goal of our industry.

In lieu of a survey, it is suggested that readers refer to the Virginia and Minnesota survey results as outlined in Section Two of this report.

3.2 Test Project Locations

During the summer of 2000 a portable HAR system was tested at six locations.

Location 1	Hwy 16:04	West of Edson chip seal,
Location 2	Hwy 16:06	East of Edson chip seal,
Location 3	Hwy 33:08:	Barrhead to Assiniboine chip seal,
Location 4	Hwy 2:32	North of Leduc Paving Project
Location 5	Hwy 4:02	Coutts to Lethbridge Re-construction.
Location 6	Hwy 23:06	Rail Road Crossing South of Vulcan - Detour

Why Locations 1 on Hwy 16:04, 2 on Hwy 16:06, and 3 on Hwy 33:08?

Every year, the department and contractors receive many complaints after motorists drive through "new" chip seal projects. Most complaints from angry motorists claim that poor signing and loose chips were responsible for their "broken" windshields. It was suggested that a HAR system could be used to warn motorists to:

- drive within posted speeds, to take extra precaution as to how and when they change lanes,
- maintain a greater distance between vehicles, and
- slow down for a few weeks after construction as loose chips may be present.

Locations 1 and 2 were on a divided highway and Location 3 was on a highway where motorists would be following pilot vehicles at a slow speed.

Why Location Number 4 Hwy 2:32 Paving and Side Slope Improvement?

This section was picked because of the high volume of high "speed" traffic entering a construction project on a major highway. A message would warn motorists to change lanes and to start merging before they entered the construction zone. A message could possibly reduce the risk of a high "speed" rear end collision.

Why Location Number 5 Hwy 4:02 by the US border?

The Coutts weigh scale on Hwy 4:02 was picked because truckers and holiday motorists were expected to encounter many delays and reduced speeds on extended sections of highway due to the large amount of construction on Hwy 4 between Coutts and Lethbridge. Placing the HAR inside the vehicle inspection station and running a cable to the outside antenna would provide additional security to test the HAR system on a 24-hour basis for four weeks. This location was also chosen because truckers would be slowing down to 5 km/hour as they drove through the inspection station.

Why Location Number 6 Hwy 23:06 Detour?

This location was picked because traffic was to be detoured during major repairs to a railway crossing on Hwy 23:06 South of Vulcan.

4.0 Field Evaluation

4.1 Details and Observations

4.1.1 Location Number 1 Hwy 16:04 West of Edson

On May 24th 2000 Alberta Infrastructure delivered the HAR system to Alliant Engineering & Consulting Ltd, project managers for Hwy 16:04, Hwy 16:06, and Hwy 33:08 chip seal construction projects. Alberta Infrastructure also demonstrated the HAR system and made arrangements for Alliant Engineering to set up signs and to change messages for a one-week period on the Chip Seal Projects.

The HAR system and the WindMaster signs were first set up and used on May 24th on the WBL of the divided section of Highway 16:04 West of Edson.

The HAR signs were almost impossible to read at normal highway speeds. For example, since I set up each sign, knew the exact wording on each sign and knew exactly where each sign was placed, I thought that it should be easy for me to read the message at the 110-km/h highway speed. Wrong!

Unfortunately, as I repeatedly drove past the HAR message signs at the posted speed limit of 110 km/hr I still could not read the entire message. If I could not read a sign, then motorists cannot read the sign. This means motorists do not tune in to the HAR.

Within an hour the easterly wind combined with truck traffic knocked down the WindMaster Sign Holders with the HAR signs. This problem was resolved by tying the WindMaster sign holders with the HAR signs to existing posts.

The effective range of the HAR message was 5 km west and 4 km east.

On May 25, the HAR signs were set up inside the 50 km/h “chip seal” work zone.

Motorists were observed from the baseline for an hour and it appeared that only 2 motorists out of 100 reached for the general area of the radio button. The observations were taken 100 to 250 metres after motorists saw HAR signs stating “For highway construction information tune in to 88.9 FM.”

In many cases one could see motorists grab the steering wheel with two hands as they entered the work zone and saw equipment. You could almost sense that the HAR sign was not visible to the motorist. The important sign was the “equipment” on the road. That reinforced the message on the large variable message board:

loose chips next 15 km.

This observation may suggest that only a very small percentage of motorists ever change radio stations.

The range for the May 25th broadcast was rated as very good up to 3.5 km west and started to weaken until 6.5 km where it was almost impossible to hear. The HAR broadcast message was rated as acceptable 5.0 km each side of the transmitter. Static was slightly reduced when the antenna was moved away from the changeable message board.

4.1.2 Location Number 2 Hwy 16:06 Chip Seal Project

On May 31, I drove out to the project and noted that the consultant was starting the HAR broadcast at 10:00 A.M. on station 88.9 FM inside the work zone on this divided highway. The consultant was using his truck battery because the contractor's power supply was not working properly. We then trouble shot the power supply and noticed that the battery was out of water and in poor condition.

The HAR system was then moved to the second message board and power unit. I helped the consultant set up the sign holders and upgraded signs with the slightly "larger" 88.9 FM letters. All signs were placed inside the 50 km/h zone.

I followed traffic through the work zone and noticed that everybody was driving below 65 km /h in the 50 km/h work area, 75- 80 in the 80 area, and 105 in the 110 area. The effective range of the HAR broadcast was 4 km.

4.1.3 Location Number 3 Hwy 33:08 Chip Seal Project

On June 1, the project manager moved the signs and the HAR unit to Hwy 32:08, a fairly low volume two lane highway south of Ft. Assiniboine. It took two of us more than an hour to record an acceptable message. (for some reason the short test message worked and the longer chip seal construction message would not)
A deep cycle battery was the only available power supply for a 7 hour period.

On June 1 and 2 the "Tune in to 88.9 FM signs" were placed close to the flag persons. Motorists waiting for the pilot vehicle had plenty of time to read the HAR signs and to tune in to 88.9 FM because of the strategic placement of the signs. Flag people also had the opportunity to obtain feedback from motorists waiting for pilot vehicles to arrive.

Observations and Feedback from the Hwy 33:08 Site

Flag persons informed the project consultant that many motorists were "ticked" off because they had to wait for the pilot vehicle and that the radio message was of little importance to them. Waiting and the idea of following other vehicles on loose chips were the key concern.

Furthermore, flag persons informed the project manager that some motorists tried to use the radio seek button and found that the radio seek function did not stop on 88.9 FM.

Later, I confirmed this observation by using my vehicle to check the range of a radio seek button. I found that my vehicle had to be within 500 m of the transmitter before the seek function picked up a strong enough signal to stop on the HAR station. The consultant found that the scan button in his vehicle stopped on the station at a distance of 1 km. It should also be pointed out that a steel bridge in the immediate area may have contributed to the range loss, but the bridge was a part of field conditions.

The effective range of the broadcast was 6.0 km in the construction zone area.

I followed motorists through this section a few times (loose chips, more loose chips) and found that motorists obeyed the pilot vehicle, which drove through the work area at 30–40 km/h.

The consultant volunteered to look after the HAR unit until the completion of this seal coat project. The consultant returned the HAR equipment to the Twin Atria on June 6.

Aluminium signs with large 300 mm high "88.9 FM" mm letters were ordered after the above observations and consultant suggestions were evaluated.

4.1.4 Location Number 4 Hwy 2:32 a 6 lane divided highway

On Friday June 16, 2000 the contractor was paving the NB truck lane of Hwy 2:32. The Construction signs were set up North of Leduc and the initial traffic signs were posted for 80 km/h. Two arrow-board signs were used to guide traffic onto the centre and passing lanes and to close the truck lane. Traffic appeared to be slowly moving through the construction area. This appeared to be a suitable location to evaluate the effectiveness of the HAR system.

I picked the weigh scale south of Leduc as a good place to set up the HAR because power was readily available and the unit would be in a secure location. In addition, motorists would be warned about delays before they entered the construction zone.

I drove past the construction equipment and estimated the average speed of motorists in the construction zone. My findings were:
Motorists slowed down to about 95 km per hour in the zone signed for 80 km/h.
Motorists started to change lanes, slow down to 50 km/h, and merge as they saw the first arrow board.

On one of the passes through the construction zone the merging created a bottleneck. Motorists slowed down to less than 30 km/hour during the merging phase and then slowly speeded up to 50 km/hour as they drove past the construction equipment.
I**t appears that some motorists did not have enough experience to merge at higher speeds, hence, they slowed down to merge and forced other traffic in the passing lane to slow down.**

Two additional passes through the construction area showed that motorists slowed down from 110 to 95 to 85 then to 45-55 km/h without problems.

On June 26th the larger aluminium signs were available for use. Alberta Infrastructure delivered the HAR system and demonstrated the use of the system to EBA Engineering's Project Manager at the weigh scale. The effective range of the HAR broadcast was 5 km west and 6 km to the east.

On June 27th, Alberta Infrastructure moved the HAR system to the Inland yards in Leduc to accommodate the consultant who already had a mobile trailer in the yards and had made arrangements with Inland to set up the HAR system in the maintenance yards.

The new "larger" aluminium signs were placed 4 km before the HAR system as the message was acceptable 4 km before and 4 km after the HAR unit.

On June 29th I checked the range of the HAR broadcast and rated it as good for 4.7 km before the HAR system and only 2.3 km after the HAR system. Motorists were exposed to a broadcast for a maximum of 4 minutes.

The effectiveness of HAR system was difficult to determine on this high speed and high traffic volume highway. On June 30th the HAR unit and signs were picked up by Alberta Infrastructure and moved on July 4th to Location Number 5.

4.1.5 Location Number 5 Hwy 4:02

On July 4th Technical Standards Branch delivered and demonstrated the HAR system to the Lethbridge Regional staff. Bill Montgomery was assigned with responsibility of updating messages and monitoring the HAR unit in the Southern Region.

Bill and myself then demonstrated the HAR system to the Inspection Officers at the Coutts weigh station. Bill recorded a message informing motorists to expect construction and delays on highway 4 between the border and Lethbridge. The Inspection Officers offered to check if the HAR system was working properly on a daily basis.

Bill and myself then set up the signs under very windy conditions. Problems were encountered while setting up and tying the WindMaster signs during the strong wind.

The next photograph shows a WindMaster sign holder and sign tied down to an existing post at the Coutts inspection station. This sign was placed in the area where truckers would be accelerating, but still moving slowly as they were leaving the scales.

Additional signs were also placed on the main alignment in an area where motorists were accelerating to highway speed from 50 km/h.

The range of the HAR broadcast was determined to be 10 km: unfortunately, there was a small valley at the midpoint where static was fairly noticeable.

On July 5th I rechecked the condition of the signs and the range of the HAR message. The effective range was rated at good for 4 km with static until 6 km. I also thought that today's broadcast had more static, but it should be noted that a different vehicle was used.

The HAR unit was left at the Coutts weigh scale on Hwy 4:02 until July 28.

Feedback from the Inspection Officers

A few times the HAR broadcast shut down for no apparent reason and had to be reset.
The HAR broadcast had too much static.

Observations at the Hwy 4:02 Site

One of the main reasons this location at the weigh station was picked was because **t**ruckers would be driving through the HAR area at 10 km/h. It was felt that strategically placed signs would be visible to all truckers entering Alberta. The message would warn motorists to expect delays because of the large amount of construction between the Coutts station and Lethbridge.

- The first week of July was very windy in the Coutts area. It is easy to underestimate the effect of many days of wind on signs in the Lethbridge area. Even though steps were taken to tie signs down, the wind after a few days placed enough stress on one of the signs to blow it into a farmer's field.

- On highways entering and leaving cities and towns and this location on Highway 4:02, motorists are flooded with signs. The photos below illustrate the messages northbound motorists on Hwy 4 were exposed to. The small HAR WindMaster sign became a small unimportant part of a motorist's mega-sign day and was probably missed by many motorists.

This small HAR sign **has to compete with many larger signs on Alberta highways**

I would like to suggest that most motorists barely have enough time to read and react to three or four of the very large signs. I would also suggest that it is unrealistic for us to expect every motorist to see and read every sign.

- This section of Hwy 4:02 already had very large signs asking motorists to tune in to a competing commercial HAR station.

4.1.6 Location Number 6 Highway 23:06 Detour

On August 11, 2000, the HAR unit was set up on Hwy 23:06 in southern Alberta. This site was to provide motorists with the reason for having to take a detour on Hwy 23:06. Bill Montgomery while checking the range of the HAR broad cast found that a radio station from the Calgary area interfered with the 88.9 FM HAR message when his vehicle was 2 km from the HAR unit. The transmission of the HAR message was aborted shortly after he noticed that the strong signal from a commercial 88.9 FM radio station interfered with the message on the HAR system. It is also possible that this 88.9 FM commercial radio station from Calgary also contributed to some of the static at the Hwy 4:02 location.

4.2 Technical Problems Raised

The range for an effective broadcast signal varied from 3 to 10 km. The location and height of the antenna was adjusted and readjusted on some of the projects in an attempt to maximize the range of the signal.

The technical problems and findings on this project generally agree with the findings documented in Rick Kowalik's ABTR/RD/TM-99/01 report. Namely:

- When in broadcast mode the system attaches an audio tone to the end of the broadcast message. Concerns have been raised about the volume of this 'end of message' tone. For some reason the volume of this tone is substantially higher than the volume of the message.

- The low system broadcast volume compounds this problem. To compensate for the low broadcast volume, drivers usually turn up the volume on their vehicle radios. When the vehicle's radio is turned up, the end of message tone is almost ear piercing. Unfortunately, the broadcast volume of the HARS message and 'end of message' tone were not user adjustable.

- It was discovered that very few touch-tone phones could use the remote access feature because many phones do not produce a tone of sufficient duration to allow the HARS unit to recognize it. This problem is not an issue with cell phones.

- System security is a concern. Remote access features are not protected by security codes or passwords. Therefore, anyone can dial into the unit and disrupt the operation. This is a critical issue. Because of this problem with system security the unit's phone number should not be circulated.

- Ideally, you would like to advertise a system so that people outside the broadcast area can check road conditions before they begin their trip. For instance people from Grande Prairie or Edmonton may wish to check the current road conditions on Hwy 43 before making the decision to travel.

- For the purpose of test projects special licensing was not required: however, CRTC and Industry Canada approval and licensing will be required at permanent installations.

4.3 Human Factors

4.3.1 Are there Potential Risks to Motorists using a HAR station?

Before one can improve highway safety and efficiency one must study and understand the human factors that address the physical, perceptual, and cognitive limitations of motorists. On the highway human factors have to deal with the many issues. Traffic control devices must stand out, be must visible, must be legible at the required distances, and must be understood by the majority of motorists.

The following example illustrates a motorist's limitations.

It takes a motorist about 10 to 20 seconds to tune a radio into the HAR broadcast. This means that the motorist is not completely concentrating on driving, the highway, and other motorists and vehicles in the immediate area.

Would survivors be too embarrassed to make the following accident statement…..
----------**as I was trying to tune in to the HAR station……crashhhhhhhh……..**

The following quotation taken from University of Minnesota study confirms that there is a need for all traffic control devices to address human factors:

- "The … receiver degraded driving performance compared to driving without using the receiver. Performance was based on factors such as lane drift, acceleration/deceleration changes, speed maintenance, braking and other typical driving tasks."

Asking motorists to tune in to a radio station also contradicts some highway driver manuals. Section 126 of the UK Highway Agency driving guide lines states:

Safe driving needs concentration. Avoid distractions when driving such as

- loud music (this may mask other sounds)
- trying to read maps
- inserting a cassette or CD or **tuning a radio …….**

4.4 Other Comments and Issues

Positive feedback was received from consultants and the construction contractors.

The radio seek function on most vehicles did not work very well with the HAR 88.9 FM signal. The HAR signal appears to be too weak for seek buttons on many vehicles to find and stop at the HAR station.

Static and radio range are a concern as we found that vehicle radio's lost messages or received a lot of static as part of the message whenever hills, valleys, and buildings were in the broadcast location.

It was easy to get twelve hours of broadcast out of the 180-amp deep cycle battery.

Many motorists today listen to CD players or listen to favourite radio stations.

Most motorists are in a hurry. From discussions with RCMP traffic officers on a Radar Drones Test Project, it was mentioned that many motorists lose track of where they are. For example, many people stopped for exceeding the posted speed limit can not answer simple questions such as what is the speed limit, how fast they were going, and where they were. Some people who simply do not know! This would tend to confirm that many motorists do not notice (all of the) signs.

Recently, I made a 7500km trip to and in the United States. I noticed that HAR systems were used to broadcast weather and tourist information. I found messages to be fairly generic and/or out of date and of little value. After a week I simply ignored them.

It should also be mentioned that passengers expressed their concerns whenever the radio was tuned into a HAR station. Even the children commented that the messages were of little value and "not important", please go back to the music station.

Commercial radio stations are very good at providing effective traffic information: for example, on 2000-12-04 as I was driving to work the local radio station informed motorists that an accident closed down 85 street. I avoided congestion by using 75 street.

Security and a safe broadcast location will always be a major concern.

Last, but not least, the HAR system requires a lot of time and effort to succeed. One must spend a lot of time keeping the message up to date and setting up signs. Moving and setting up signs increases the risk for an accident and is not as safe and easy as it looks.

5.0 Alternatives

CMS offers considerable advantage as advisory signing for HAR. Static HAR advisory signs offer a single, inflexible attention statement to drivers. Flashing signs face the same problem, and are confusing to some motorists. CMS can alleviate these problems, directing the message to the appropriate audience.

5.1 Is there a potential use for the HAR system?

The above comments and observations deal with what happens in the real world. Despite some of the shortcomings of the HAR the author believes that there is a place for the HAR system.

6.0 Conclusions

A portable HAR system is very labour intensive.

Thirty-second messages out of local radio stations are very effective.

People do not notice small signs and can not read small letters on signs at highway speeds. In some cases, people do not even see signs. (as past conversations with RCMP traffic officers show that many people when stopped for speeding do not even know where they were or how fast they were going). The following photograph compares the 88.9 FM HAR sign used this summer to signs used by other agencies.

Temporary HAR Sign Compared to Large Permanent HAR Signs Used by Other Agencies

7.0 Recommendations

The HAR System could be tried at the Leduc weigh scale during hot summer months where it can be used to broadcast messages for truckers to a use the passing lane and/or to stagger wheel paths. This would reduce pavement rutting and increase pavement life on sections of Hwy 2.

The department should review the placement of signs on highways. It is very easy to add more signs but the rule should be to "Keep it as Simple as Possible".

8.0 Executive Summary

HAR is both an opportunity and a significant challenge. HAR will probably play a role in Alberta's ITS deployment program.

At present, Alberta Infrastructure has HAR transmitters at Whitecourt and Coleman. Linking them and additional units into a provincial traveler information system will require a lot of effort to consolidate information between multiple government agencies and industry.

Providing accurate, real-time information to motorists is difficult. Moreover, updating broadcasts with information of value to motorists becomes very time intensive and expensive.

Proper HAR operation is personnel-intensive. Updating HAR messages must not be the secondary responsibility for personnel because they will generally have other, high-priority duties, especially in an incident.

Motorists are not turning to HAR broadcasts. Many motorists do not know when they are entering a HAR broadcast area, and what information HAR offers them.

Research shows that information provided on many HAR stations in North America is of limited value to motorists. Motorists want specific, up-to-date information on congestion and incidents that affect their travel. Situations that can be communicated with other traffic control devices that do not affect motorists do not warrant a HAR broadcast.

Motorists currently get most of their traffic information from commercial radio traffic reports. Commercial radio stations have decades of experience and effectively provide regional traffic information in urban areas throughout the country. Alberta Infrastructure and their partners do not have the expertise and manpower to provide a high level of information. Furthermore it is the author's opinion that Alberta Infrastructure should not attempt to compete in this market.

Therefore, the HAR should only be used in critical situations.

APPENDIX A

Observations - Supplied by Alliant Engineering and Consulting Ltd.

The following contains sections of a report that was completed by Alliant Engineering and Consulting Ltd.:

"Alliant Engineering & Consulting Ltd. tested the system for a few days on …chip seal projects on Hwy. 16 by Edson and Hwy. 33 North of Barrhead . The system was relatively easy to use…"

"Here is a list of some key observations from the job:"

"One of the most important parts of the entire system should be the signing. No matter how informative and helpful the radio message is, if the driver doesn't know about the required FM frequency, the message becomes useless. In the case of most projects, the signing should be placed outside the project limits, giving motorists ample time to tune in and hear the message. One drawback to this placement is that motorists travelling at regular highway speeds are moving too quickly to read the signs. It was found that even at slower speeds the lettering of the supplied signs was too small to read accurately. One recommendation is to have larger lettering on signs.

"The sign used in 2000 was basically too small. We need something that will catch the attention of drivers (maybe a new colour, shape, etc.) Also, more signs are needed."

"It was found that the transmitter was fairly sensitive to placement, and range could vary from 2 to 6 km. It would be beneficial to perhaps get a more powerful transmitter. After speaking with several motorists waiting in line with the flag person, it was found that the signal was not strong enough to be found by the radio's seek function, and motorists can not be bothered to tune in manually."

If we can't use stronger transmitters, then maybe we can strategically place the transmitters where they are most effective (i.e. One transmitter at each end of the work zones).

The radio handset was used to record the message however it was not very clear and the speaker's voice sounded slightly muffled. Perhaps a better method would be to take a pre-recorded message on tape and play it through the RCA jack provided….""

Thank you, Alliant Engineering and Consulting Ltd. for the above comments.

Appendix B

Recommendations for Sign Placement

On the whole, one of the best ways to ensure that the public actually hears useful highway, weather, emergency and/or visitor information a HAR provides is proper placement of the signs requesting motorists to tune in to the station.

First impressions are crucial.

That's why strategic placement of the signs announcing your HAR is key to its success. Signs in the wrong place perpetuate the frustration many listeners have with FM radio. If your signs are positioned poorly in relation to your radio waves, motorists are likely to think your station is not working and might be tempted to tune out. In these situations, would-be listeners often will not try re-tuning, even as they reach a stronger signal.

Action Plan for Positioning Signs:

1. Set up the HAR system, record the message, and broadcast the message.

2. Test the range of the HAR under local conditions by driving the HAR coverage zone with two different vehicles because HAR range is determined partly by the type of vehicle.

3. Note and record the location where reception is clear and where it starts to fade.

4. Use the average from two vehicle tests to select sites for sign placement.

The signs should usually be positioned 5 to 8 km before the HAR to ensure that motorists cruising at 100 km per hour can hear HAR messages clearly for about 5 minutes.

Remember to consider your environment.

Interference

Check for interference in reception quality (of your "sines") at least once a day, when the weather changes significantly and in the vicinity of cities. Commercial stations can change power levels and/or frequency, or a new station might develop in your city that interferes with the HAR. Commercial stations are generally 1,000 to 50,000 watts. The HAR has a 10-watt maximum. The bigger "sine" will always be in the foreground on passing receivers.

On the other hand, rural sites tend to have broader ranges simply because there are fewer interfering physical structures. It’s a good idea to run separate listening tests for separate transmitter sites, when you have more than one.

APPENDIX C

Typical HAR Message

Thank you for tuning in to 88.9 FM. Alberta Infrastructure is using this advisory station to provide Motorists with Highway 16 Driving Conditions for May 24.

You will encounter short delays as you drive through this chip seal construction project.
Please slow down as you approach and pass workers and construction equipment.
Please follow the vehicle in front of you at a safe distance.
Please follow posted speed limits and construction signs.

Some technical information:

Chip seal is a construction process that uses asphalt and crushed rocks to protect old pavements.
Chip seal improves highway safety by reducing vehicle-stopping distance in snow and rain.
Chip seal saves you, the taxpayer, money by extending the service life of the old pavement.

We apologize for the delay and wish you a safe journey.

Wind shied Protection Tip:

Unfortunately, since vehicles pick and throw chips for up to one year after a chip seal is placed, try to maximize the distance between your vehicle and other vehicles.

Also, please try to minimize lane changes, as during lane changes vehicles end to pick up and spray chips into windshields.

Pause

This highway advisory station is a test project. If you would like to comment on the value and effectiveness of this highway advisory radio program, please phone ……..
Once again, the phone number is (slowly).

References

1. Kowalik, Rick, "Highway Advisory Radio System Test Project", (TM 99/01), Alberta Infrastructure, April 1999.
   Report Number TM99/01 is published under "Research Documents" at http://aicm/Content/doctype255/production/TM9901.pdf.

2. Smith, Brian et al. Brian Smith et al., An Investigation of Operational Procedures for Highway Advisory Radio System Virginia Transportation Research Council, 520 Edgemont Rd., Charlottesville, VA 22903-0817. Sept. 1995.

3. Burrus, Max et al., Human Factors Evaluation of the Delco RDS Radio Receiver and the RDS Architecture. (University of Minnesota, Human Factors Research Laboratory, 141 Mariucci Arena Operations, 1901 4th St., SE, Minneapolis, MN 55455) (August 1994)

Thank you to

1. Darcy Paulichuk, Alliant Engineering & Consulting Ltd.

2. Ken Moelhoff, Alliant Engineering & Consulting Ltd.

3. George Trefanenko, EBA Engineering Consultants Ltd. and

4. Bill Montgomery, Alberta Infrastructure

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