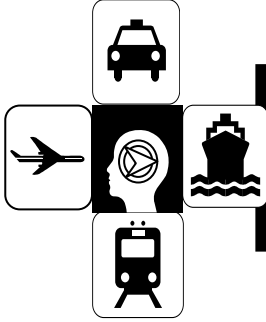


JERSEY DOT'S

"Turning Problems into Solutions"



Tech Brief

HIGHWAY ADVISORY RADIO (HAR) SYSTEMS

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FHWA/NJ-2002-001

December 2005

THE PROBLEM...

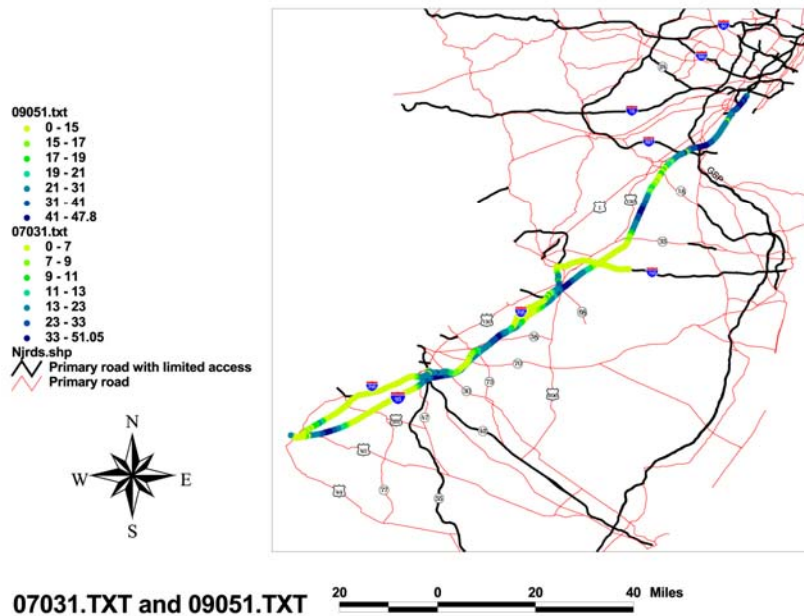
With increased numbers of motorists, the importance of disseminating information concerning delays, construction areas, and other hazards on the road became ever more important to ease congestion and to increase safety. One way to reach a large number of drivers is to utilize the commercial AM/FM broadcast receiver present in motorists' vehicles. Highway Advisory Radio (HAR) is a broadcasting system used by transportation agencies to disseminate vital real-time traffic information to motorists. Each transmitter is restricted by the rules and regulations of the Federal Communications Commission (FCC) to an average broadcast radius of three to five miles. However, for better coverage, multiple transmitters can be used. Most commonly these transmitters are located at major highway intersections, such that motorists may take alternate routes in case of congestion or emergencies.

WHAT WE DID...

All operational HAR transmitters in New Jersey were identified and their coverage zones were measured in terms of the signal to noise ratio at the receiver. Measurements were taken in a test vehicle equipped with a spectrum analyzer with antenna, portable GPS unit, and a laptop computer with specialized software. These experimental results were then compared to subjective qualitative audio reception, and detailed maps of HAR coverage zones along New Jersey highways were generated. Additionally, current deployments of HAR around the country, and information concerning availability and pricing by vendors, were compiled. Basic, mobile, and advanced transmitters were reviewed. Potential benefits of HAR systems were summarized considering state-of-the-art options of various configurations. Finally, recommendations for existing and future implementations of HAR systems in the State of New Jersey were made.

HAR COVERAGE MAPS...

Twenty three HAR transmitters in New Jersey and one HAR transmitter in Wilmington, Delaware were studied. Ten transmitters were operated by the NJ Turnpike Authority and nine by the NJ Department of Transportation. Coverage maps were generated for each of the HAR transmitters. An example of an HAR coverage map for a portion of the NJ Turnpike is shown on the next page. Blue color indicates the best reception; yellow, the weakest.



HAR Coverage Map: Seven Transmitters on the New Jersey Turnpike

FINDINGS...

✚ Although the basic idea of HAR has remained intact throughout the years, recent advances in electronics and refinement of operating procedures have changed the way HAR is utilized. These innovations have made significant advances in the way the HAR systems are managed, and have improved the quality of the service. Some of these advancements are outlined below:

- Wired and wireless access to change messages,
- Digital recorders to store received messages,
- Novel circuitry to eliminate noise and improve message quality,
- Computer controlled centralized operation,
- Remote diagnostic capabilities to expedite trouble shooting,
- Solar powered operation to reduce installation and maintenance costs,
- Mobile units to respond to emergency incidents,
- Synchronization between adjacent stations to eliminate co-channel interference,
- Antenna options for site specific needs,
- Better ground availability for more efficient operation at the antenna sites,
- Signs and messages for alerting motorists.

✚ Ten HAR transmitters are located along the **New Jersey Turnpike** at fairly regular intervals. They are located approximately at Exits 1, 3, 5, 7, 8A, 11, 13A, 14B, 16W, and north of Exit 18. All the transmitters have strong signals with large coverage areas, with the exception of the transmitter at Exit 16W, which has very poor radiation characteristics due to interference with a commercial broadcasting station. All transmitters south of Exit 7A on the turnpike can also be received on I-295.

✚ Signals from nine **NJDOT** HAR transmitters were measured. The five synchronized transmitters of the **MAGIC** traffic management system broadcast the same message and provide a fairly continuous coverage zone along I-80. For the **MAGIC** system, the HAR transmitter at I-80 and

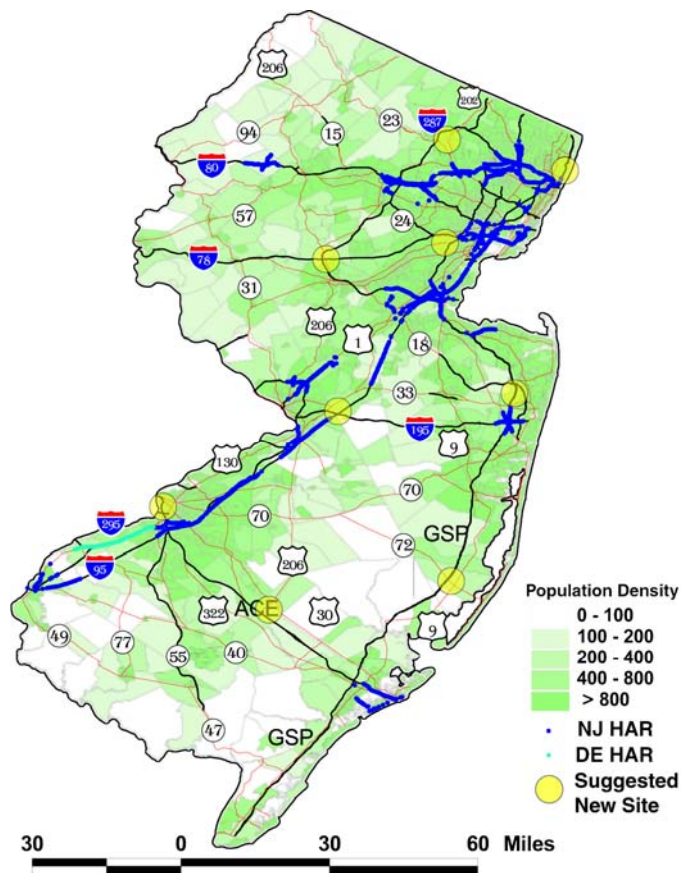
I-287 has fairly weak signal strength; coverage on Route 17 is poor, especially south of NJ-4, due to interference; and there is a weak coverage area of about one mile between the two transmitters in Parsippany. The I-80 transmitter in Allamuchy is not near any major intersections. No HAR signal was received for the Carney's Point transmitter due to an interfering commercial radio station. All other NJDOT transmitters had good range and were effective.

- ✚ **Other** transmitters at Garden State Parkway Exit 98, Newark International Airport, Pleasantville near Atlantic City, Route NJ-36 in Union Beach near Sandy Hook, and Wilmington, Delaware near I-295 and US-130 were effective with good range.
- ✚ The HAR site map on the last page shows all 24 HAR transmitters' coverage zones of adequate reception mapped against population density in New Jersey. Areas of blue indicate adequate HAR reception quality, and darker shades of green background indicate higher population densities. As can be observed in this map, most of the populated regions in New Jersey with major highway intersections are adequately covered with existing HAR systems.

RECOMMENDATIONS...

- ✚ The measurements indicate that reasonable coverage exists for New Jersey; however a few new HAR implementations and changes to existing systems could help to reduce congestion and improve safety on New Jersey's highways. The new HAR locations shown on the HAR site map (yellow circles with a radius of three miles) would significantly improve HAR coverage in New Jersey for heavily traveled roadways.
- ✚ HAR transmitters located at the intersections of I-78 with I-287 & with NJ-24 would serve a large number of motorists. These highways are heavily traveled, and often congested. Additionally, coverage at these sites would provide the information necessary for motorists to take advantage of alternate routes in the region.
- ✚ Also, coverage does not reach the intersection of I-195 with the New Jersey Turnpike where motorists need to make decisions about I-195. Either the transmitter at Exit 7 on the Turnpike could be moved about two to three miles north to encompass this region, or a new HAR transmitter could be installed to cover I-195.
- ✚ Currently there is no coverage at either the Walt Whitman or Ben Franklin Bridges leading to Philadelphia. Placing a new HAR transmitter between the bridges could possibly reach both bridges. If both bridges cannot be covered by one transmitter, it is recommended to place a transmitter at each bridge.
- ✚ A new HAR transmitter at the Garden State Parkway and the NJ-18 intersection could also encompass NJ-33, which is not included in the coverage zone of a southern transmitter at Exit 98.
- ✚ A new HAR transmitter is recommended for northern I-287 at the intersection of routes US-202 and NJ-23. Another area in northern New Jersey that could benefit from HAR is the Palisades Interstate Parkway, near the George Washington Bridge. This heavily traveled corridor currently has no HAR coverage; yet alternate routes to the George Washington Bridge offer various options for motorists.
- ✚ The Garden State Parkway near Exit 140 intersecting US-22 is another frequently congested area that could benefit from HAR coverage.

- ✚ Two southern areas of New Jersey that have been identified for new HAR systems are the Atlantic City Expressway intersecting with US-206 (actually NJ-54), and the Garden State Parkway and US-9 at NJ-72. The Atlantic City Expressway at US-206 (i.e., NJ-54) is a major highway intersection, and US-322 is a viable alternate route for southbound travelers. NJ-72 sees significant summer beach traffic, and there are many alternate routes, including the Garden State Parkway.
- ✚ Basic transmitters are the most logical and cost-effective solution for new transmitters. These basic transmitters should be equipped with cellular phones for convenience, and if necessary, solar power. Additional options that should be considered are battery backup systems and also synchronized systems, particularly along the I-78 corridor and the Garden State Parkway.
- ✚ The transmitters at interchange 16W of the New Jersey Turnpike and Carneys Point on I-295 have reduced coverage areas due to interference from local commercial stations. It is recommended to either move the location or change the operating frequencies of these stations to improve their coverage areas. Potential sites for new transmitters should be properly surveyed for potential interference before installation.
- ✚ The transmitters at I-80 in Allamuchy and at I-280 in Roseland have standard reflective signs. Signs with flashing lights are operational at all other HAR locations and are vital in notifying motorists of any emergency information. Therefore, it is recommended that new signing with flashing lights be installed in the coverage zones of these two transmitters. Also, many major and auxiliary roadways within the coverage areas of existing HAR systems, lack signs to alert motorists to the presence of these systems. By installing additional signs along these roadways, the efficiency of these HAR systems could be greatly improved.
- ✚ To provide traffic information to the public, the agencies that operate these HAR systems and the agencies that are responsible for the major and auxiliary roadways must work together. In northern New Jersey, this is accomplished through the work of TRANSCOM, a coalition of 17 transportation and public safety agencies in New Jersey, New York, and Connecticut. It is recommended that such coordination efforts be extended throughout New Jersey.
- ✚ Variable Message Signs (VMS) are also used within the State of New Jersey to relay traveler information and traffic data to motorists. The locations of these signs and the coordination of information on these signs and on HAR systems should be investigated to ensure that a consistent message is being relayed to the public. VMS are also particularly useful when used in conjunction with mobile HAR transmitters, for they can alert the public of the presence of the mobile HAR's.
- ✚ Low powered HAR transmitters and the purchase of commercial radio stations were investigated in this study. The advantages and disadvantages of implementing these systems were discussed. Circumstances in the future may make these systems more advantageous to implement. Therefore operating agencies within New Jersey may want to re-consider using such systems in the future.



Current and Suggested HAR Sites

FOR MORE INFORMATION CONTACT:

NJDOT PROJECT MANAGER:	Robert Sasor
PHONE NO.	609-530-5965
E-mail	Robert.Sasor@dot.state.nj.us
UNIVERSITY PRINCIPAL INVESTIGATOR:	Dr. Edip Niver
UNIVERSITY:	New Jersey Institute of Technology
PHONE NO.	973-596-3542
E-mail	niver@njit.edu

A final report is available online at
<http://www.state.nj.us/transportation/refdata/research>

If you would like a copy of the full report, please FAX the NJDOT, Bureau of Research, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for:

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