June 11, 2001

The Honorable Norman Mineta
Secretary of Transportation
US Department of Transportation
400 Seventh St., SW
Washington, DC 20590

RE: IVI Program Advice

Dear Secretary Mineta:

The Intelligent Transportation Society of America (ITS America) provides the following advice as a utilized Federal Advisory Committee regarding the future direction of the Intelligent Vehicle Initiative (IVI) program. This program advice is the combined product of deliberations of the four vehicle platform working groups: Light Vehicle, Heavy Vehicle, Transit Vehicle and Specialty Vehicle.

Background

In response to the December 1997 Request for Information on the technical, programmatic, and policy aspects of the IVI program, ITS America undertook an extensive consultative process, including the formulation of the four individual platform working groups. On August 5, 1998, ITS America provided an advice letter to the Secretary that outlined a series of policy issues and identified a series of focus areas for early emphasis in the IVI program. In the ensuing two years, based on the ITS America advice, the Department of Transportation initiated a number of research and demonstration projects to accelerate the deployment of IVI technologies focusing on safety benefits and deployment readiness. These projects were initiated across all platforms.

On July 21, 2000, the four platform working groups met again to review the progress over the past two years, to develop a set of specific goals consistent with the DOT's overall goals and to identify future needs and actions. The resulting recommendations of the individual platform working groups are attached.

The platform-specific recommendations laid out by each of the four working groups were reviewed and several common programmatic recommendations emerged. These shared recommendations address program planning, crosscutting and integration issues, and administrative procedures. The recommendations are combined in this advice letter. It has been reviewed and adopted by the ITS America Coordinating Council on April 17, 2001 and the ITS America Board of Directors on June 7, 2001.

Programmatic Advice

1) Seek balance and breadth in participants and stakeholders

A shared concern within all groups was the active involvement of a broad, balanced, and representative group of stakeholders. It is recommended that group composition be reviewed periodically to assure that all stakeholder entities are represented, and member recruitment is undertaken as needed.

This concern was most pronounced within the specialty vehicle group, which is seeking to engage a broader group of participants (states), and, in particular, to engage public safety stakeholders in their group. The light and heavy vehicle groups in prior meetings have already addressed this issue of balance, and both were satisfied with the mix of participants in the meetings and operational tests.

2) Foster information sharing and collaborative work across platforms

A related aspect of the above recommendation involves collaboration or communication among the four working groups. One group recommended that a forum be established for the assessment of crosscutting issues and transfer of technology across platforms. In particular, the transit vehicle group is seeking more and better collaboration with the heavy and specialty vehicle platforms. This is becoming more critical since, as several groups noted, some technologies are applicable to more than one platform, or require integration of vehicles and infrastructure.

Additionally, each of the groups spoke of cooperative systems requiring participation of the vehicle, infrastructure, and communications organizations. The specialty vehicle platform specifically mentioned that the platform provides a good test bed for technologies that may be applicable to other platforms. Establishing a formal mechanism to share knowledge across the platforms could accelerate the deployment of cross-platform and integrated systems.

In response to this need, ITS America proposes the creation of a Joint Working Group on Crosscutting IVI Issues. Each of the current platform working groups, ITSA and USDOT would have representatives on the new working group. The group would report to the existing platform working groups. The group's charter would be drafted and approved in the first meeting including a specific set of tasks.

3) Develop and update models for benefits, costs, and impact of deployments

The groups also highlighted the importance of using some form of benefit modeling or impact quantification. This includes estimating projected safety, cost, and societal benefits of IVI technologies, as well as collecting baseline data needed to evaluate future deployments. Development of these models would assist in setting objectives and evaluating the effect of technology and system deployment.

The heavy vehicle group, for example, supports development of cost models to demonstrate value and cost savings of deployments. Likewise, the transit group seeks a better understanding of economic and societal impacts. The specialty vehicle group wants to expand its goals beyond incident reduction, and also focus on operational benefits and cost savings. Lastly, the light vehicle group supports both modeling of future benefits and collection of current baseline data.

4) Expedite and simplify contracting process

Another shared concern is the need for simplified or expedited procurement processes that are more timely and responsive to the nature of the projects. The groups in which the program administration could be enhanced advanced specific ideas. For example, the light vehicle group seeks quicker contract negotiations and report publication and dissemination processes. The heavy vehicle group would prefer a general Broad Agency Announcement over a specific Request for Proposal. It was also desirable to have funding issues be addressed in time for new fiscal year planning and budgeting. Furthermore, the transit group called for the use of pooled funds across industry to attract dollars to the program.

5) Convene working groups more frequently

Lastly, the groups generally expressed support for more frequent meetings to keep dialogue open between program participants and stakeholders. The purpose of future meetings would include assessing ongoing activities, providing direction for future projects, and planning guidelines for performance specifications, operational tests, deployment planning, and system integration.

The four vehicle platform working groups are prepared to work with DOT to ensure the continued success of the IVI program. We thank you for the opportunity to help the US DOT formulate the future direction for the IVI program, and look forward to continuing to fulfill our responsibility as a utilized Federal Advisory Committee.

Sincerely,

David J. Hensing
President
ITS America

Larry Yermack
Chairman
ITSA Board of Directors

Attachments: Light Vehicle Platform Group Recommendations
Heavy Vehicle Platform Group Recommendations
Transit Vehicle Platform Group Recommendations
Specialty Vehicle Platform Group Recommendations

IVI LIGHT VEHICLE
PLATFORM RECOMMENDATIONS
Revised November 10, 2000

Background

The Light Vehicle Steering Committee prepared a survey questionnaire in the Spring, 2000 that was distributed to all members of the ITS-A AVCSS and S&HF committees, as well other interested personnel; ITS-A staff collated the results from this survey. The DOT IVI business plan and benefits modeling documents were distributed to Light Vehicle Steering Group members. A meeting of the Light Vehicle Steering Committee was then held on July 21, 2000 in Washington, D.C. in conjunction with the National IVI meeting. Following this meeting, draft recommendations were prepared and distributed to the Steering Committee members for review; changes were made to achieve consensus.

Platform Objectives

The objectives of the IVI Light Vehicle Steering Committee were to:

- Provide feedback to the US DOT on on-going IVI activities,
- Suggest to the US DOT future IVI opportunities, and
- Comment on the Sec. Slater's IVI deployment goals.

Recommendations

IVI Business Plan

The Committee is generally supportive of the U. S. DOT's IVI business plan, including the approach of an interactive partnership with industry. However, some deficiencies are:

- The business plan does not adequately address the use of telematics devices in vehicles. Both the benefits and the potential detrimental effects on safety must be understood. A comprehensive, long-term plan should be developed, with nearer-term deliverables to match the expected deployment.
- The contracting processes used by the DOT to execute the business plan are broken, with exceedingly long negotiations becoming common. Specifically, It appears that the NHTSA and FHWA contracts offices are perpetually under staffed. Since this issue affects the pace and quality of the program to the point where important and timely technical issues go unresolved, this issue requires priority attention. Also, the report publication and dissemination processes are inordinately lengthy.
- The Committee continues to see the need for naturalistic pre-crash driving data, to

serve as both as baseline data to describe the driving environment and to determine the causal and contributing factors for various crash types. A large-scale naturalistic data collection project is required to successfully address these issues and to lay the framework for the next generation of crash countermeasures. The project should include requirements from a variety of stakeholders groups to leverage collected data for as many useful purposes as practical.

- The business plan should also include a role for the U.S. DOT in promoting consumer awareness (e.g., through established consumer information programs, such as the NHTSA's Buying a Safer Car brochures) of the safety features of IVI systems as they are deployed by vehicle manufacturers.

Benefits Modeling

The DOT has estimated that the projected benefit of IVI-developed technologies that address rear-end, road-departure and lane-change crash warning systems (CWS) is the elimination of 1.1 million crashes per year if every vehicle on the road was equipped with all three systems. This would be a reduction of almost one-sixth of the total number of crashes and an equivalent number of injuries and fatalities. The attempt to model the benefits that would result from deployed CWS is replete with simplifying assumptions that make the problem tractable; such as the reactions of drivers to false alarms, risk compensation by drivers, the exclusive dependency by the drivers on the CWS, etc. Each model has an associated accuracy, and the fidelity of any model with respect to reality will almost never be tested before deployment. The committee supports the development of these models because it continues the refinement of the methodology and it elicits the types of questions we should be asking and the type of data we should be demanding. However, given the prior projections made concerning the benefits of safety systems versus the field data for systems such as center-high-mounted stop lights, airbags and ABS, the committee strongly recommends that future estimates also include the uncertainty range for these projections.

Cooperative Systems

One of the challenges put forth by Secretary Slater at the recent National IVI meeting was that "by 2010, 25 metropolitan areas will have deployed the infrastructure portion of a cooperative intersection collision warning system". The committee believes that if this goal is to be achieved, a complete system solution must be developed by bringing vehicle, infrastructure and communications organizations together. This could also be the basis for future cooperative systems, beyond intersection systems.

Deployment Goals

The other deployment goal set by Sec. Slater for light vehicle is that "10 % of new vehicles sold by 2010 should be equipped with one or more IVI systems". Given the plans for

automatic collision notification systems by Onstar , TeleAid, and Wingcast and the impending market introduction of adaptive cruise control systems, for example, the committee feels that this goal may be achievable.

Future Activity

The Committee is prepared to work with the DOT to address the recommendations and suggestions put forth above. In addition, the Light Vehicle Steering Committee is ready to assist the DOT in planning the necessary Performance Guidelines, Operational Tests and Evaluations and system integration guidelines for up-coming IVI systems.

A meeting was organized in late October to bring together the IVI Light Vehicle Steering Committee, Infrastructure Consortium and the US DOT to begin the development of a system solution to Intersection Collision Warning, including cooperative systems.

IVI HEAVY VEHICLE PLATFORM RECOMMENDATIONS

October 13, 2000

Background

The combined IVI Heavy Vehicle Platform Working Group and Steering Group met on July 21, 2000 in Washington DC at the National IVI Annual Meeting.

The group had initially formed in 1998 to provide input and recommendations for IVI user services and research needs related to commercial vehicles. The group at that time addressed policy issues, recommended activities, high priority IVI user services, and mechanisms for continued government-industry dialog.

The IVI Heavy Vehicle Platform Group met in July, 2000 to review the present state of the program, identify obstacles to deployment, to address future need and subjects for development, and finally to generate the framework of an Advice Letter to the Department of Transportation.

Jack Gemender of International Truck and Engine chaired the meeting in Washington. A follow up teleconference was conducted in September 2000 to review the meeting minutes and establish direction for the Advice Letter.

Present State of the IVI Program

A. Recommended User Services

The 1998 list of recommended user services included:

- Driver Condition Warning and Road Departure Prevention
- Longitudinal Control/Forward Collision Warning & Rear End Collision Avoidance
- Vehicle Diagnostics & Prognostics
- Vehicle Stability/Dynamics

There are three operational tests in the process of being deployed. Each of the tests involves participation among a Heavy Vehicle manufacturer, a fleet user, and a technology/product supplier. Research agencies provide support in experimental design, data reduction and analysis.

The three operational tests involve development and evaluation of:

- Adaptive Cruise Control with Forward/Side collision warning. Longitudinal control is

provided through automatic engagement of engine braking.

- Automatic Crash Notification coupled with the ease of an incident/risk location database, which provides messaging to the operator relative to location specific data history. Lane keeping technology is included as part of the evaluation data.
- Rollover and stability warning and control involving engine control interaction.

Policy Issues

Initial Heavy Vehicle Platform Group concerns over the recognition of the role of the trucking industry have been addressed. The capabilities of the trucking industry in developing plans and deploying technology in support of highway safety improvement has been recognized with the initiation of the three Heavy Vehicle development and test projects.

The three field operational tests have employed an efficient mix of participants - OEM, fleets, and system suppliers. Each of the tests are under the lead of an OEM.

Obstacles to Deployment

The steering committee reviewed and discussed obstacles to deployment in areas of procedure, technology acceptance, and institutional issues.

Recommendations to alleviate these obstacles included:

- Provide for independent evaluation of the contract and program to yield the optimum design of the development and test program.
- Provide for follow-on time and effort to take advantage of early learning but which would not necessarily demand a new program.
- Specifically call out for analysis of human behavior impacts from application of products and technology in the cab.
- Develop a cost model, which could be used to demonstrate value and cost savings. This model could make use of and be supported by tax relief, insurance reductions, and product pricing incentives to drive volume and the learning curve.
- Address concerns over data ownership and use, as part of the overall liability and legal barriers.

Future Needs and Technology Opportunities

The IVI Heavy Vehicle Platform identified specifics, which would be appropriate for consideration in subsequent generations of overall highway safety improvement relative to Heavy Vehicles;

Generation 1 - Shorter Horizon

- Electronically controlled Braking System (ECBS)
- Robust, commercial vehicle oriented map database.
- GIS environment, which accepts dynamic condition along routes.
- Expansion of "blind spot" obstacle detection with consideration of a variety of sensing technologies.
- Enhanced "signaling" of Heavy Vehicle/Operator intentions and maneuvers to other nearby vehicles.

Generation Two - Longer Range Planning

- Continuation and expansion of communications between trucks and nearby passenger vehicles.
- Heavy vehicle stability and control techniques based on earlier ECBS testing.

Recommendations for Ongoing Government - Industry Dialogue

- The stretch goals for Highway Safety improvements will demand continued effort in developing technology concepts, and deployment initiatives in the area of the IVI Heavy Vehicle Platform.
- Continued funding of current product deployment and future projects need to be part of new fiscal year planning. Lacking this, new development, future deployment and progress toward the stretch goals will not occur.
- The procurement process used to solicit plans from the Heavy Vehicle industry was felt by the group to be best served through the use of the more general Broad Agency Announcement, rather than through a specific Request for Proposal.
- In order to continue with a productive dialog among the participants, and stakeholders, the Group decided to meet on a more frequent basis.

IVI SPECIALTY VEHICLE PLATFORM RECOMMENDATIONS

October 13, 2000

Background

The Specialty Vehicle steering group last met in 1998. At the July 21, 2000 meeting the Specialty Vehicle steering group reviewed and updated the 1998 recommendations. The current Specialty Vehicle steering group was purposely developed as a small committee, consisting of relevant and specific public, private, and academic representatives. The group's size is conducive to identifying the goals of key stakeholders and developing consensus for recommendations. The Specialty Vehicle Steering Group had previously identified and should continue to address the fact that the Specialty Vehicle platform provides a good test bed for the technologies that are applicable to other platforms. The steering group will focus on the IVI technologies and not on the legal issues, human factors, etc. Current issues indicate that the Specialty Vehicle steering group should be expanded to include public safety organizations such as police, fire and EMS.

A number of issues were identified during a brainstorming session of the meeting. The following paragraphs summarize the topics, issues and future areas of concentration that were discussed during the brainstorming session

A number of representatives of the Specialty Vehicle Steering Group identified that public safety representative need to be brought in to the Specialty Vehicle Steering Group. It was suggested that a grass roots effort be initiated to bring representatives from police, fire, rescue, EMS and other public safety organizations into the IVI Specialty Vehicle platform. This should be completed by engaging these stakeholders at their respective meetings, providing articles to their trade publications and paying for their attendance at Specialty Vehicle meetings.

Additionally, it was identified that the Specialty Vehicle platform be subdivided into 2 groups, which meet separately to discuss the issues, concerns, development and activities. These groups would likely be formed as (1) maintenance and operations vehicles and (2) emergency responder/services vehicles. The two groups would also meet jointly to discuss overlapping activities and the needs for coordination within the Specialty Vehicle platform.

The Specialty Vehicle platform should spend significant time in future efforts in integrating the vehicle with the infrastructure. Additionally, the in-vehicle applications that are currently being investigated need to be researched further in terms of an integrated system. It was suggested that over the next 10 years, the IVI components of a vehicle would outweigh the mechanical components. The SV platform has had a component-based architecture. It was noted that SAE has developed an in-vehicle-networking standard that should be reviewed and tested in future IVI SV activities.

OEMs should be engaged and involved in deliberations on the future of the Specialty Vehicle platform. It was noted that the light vehicle platform had significantly more OEM representation and a lack of infrastructure representation, while the reverse is true for the SV platform.

While the light vehicle platform has a defined a goal of reducing the number of accidents over the next 10 years (i.e. reduce crash fatalities by 20% over the next 10 years), no statistical analysis has been conducted on the safety issues associated with the Specialty Vehicle. It was suggested that the group reviews what the safety problems/issues are with Specialty Vehicles and identify goals based on this analysis. It was also suggested that based on current knowledge, the number of fatalities (and accidents) associated with Specialty Vehicles is likely a much small number (and percentage) then other platform vehicles. As a result, the steering group should consider goals outside of the "incident reduction" goals defined in other platforms and perhaps focus on operational benefits and cost savings resulting from the deployment of IVI technologies in Specialty Vehicles.

The SV platform should examine IVI deployment planning with systems engineering process as the guide. The steering group should begin with identifying user services, then defining requirements and finally developing architecture.

It was suggested that not enough research has been completed on human factors. Future research for the SV platform should focus on identifying and defining what "driver overload" is. This issue was identified in light of the recent national coverage of driver distraction safety concerns.

Recommendations

Specialty Vehicle Goals:

- Reduce crashes involving Specialty Vehicles by 35 % by 2010.
- Reduce personal injuries and fatalities of Specialty Vehicle operators by 50% by 2010
- Improve operating efficiency in both operations and maintenance vehicles and emergency service vehicles. Specifically, the SV platform should improve emergency service efficiency by reducing the treatment time (identification, response, and treatment) for crash-related injuries by 25 % by 2010.
- 40% of SV's should be equipped with some IVI device by 2010

Future Activity

- USDOT should expand the list of IVI program goals to include those needs that are relevant to the Specialty Vehicle Platform. These would include operational efficiency goals.
- The USDOT should fund activities that research and assess business models and paths to IVI deployment.
- The IVI program should provide a forum (and separate platform group) for defining and assessing cross-cutting issues which examine:
- infrastructure requirements for vehicle to infrastructure communications across all platforms (systems integration of all IVI technologies)
- transfer of technology development to other platforms (noting that the SV platform provides an excellent test bed for testing technologies applicable to other platforms).
- Human-factors studies should be funded. Specifically, the different operational requirements of IVI Specialty Vehicle operators (emergency vehicles and O& M vehicles) should be analyzed.
- A broader group of participants (states) should be engaged in future IVI activities.
- Identify additional stakeholders (emergency service providers and other groups) to participate in future SV platform meetings.
- Reconvene after the USDOT has responded to the recommendations.
- ITS America should initiate efforts to engage representatives from the Advanced Vehicle Control Systems (AVCS), Public Safety and Advanced Construction and Maintenance (ACMS) committees (of ITS America). Separate meetings with these groups will be initiated to gather input and broaden the steering group.

The following identify future specific areas of research or IVI technologies that should be pursued by the SV platform:

- Railroad crossing (standards for railroad crossing is archaic).
- Driver condition monitoring (No-dose alerts; impaired driver monitoring, etc.)
- Road condition monitoring. (icy conditions, fog, smoke, etc.)
- GPS generated maps and geo-location databases. Route guidance/real-time information for public safety. Note that for public safety, it is a different set of requirements and needs for how maps are displayed and how routes are chosen. How do we develop maps that will get to decimeter mapping?
- Communications deployment infrastructure. Center-to-center comms/incident response (IEEe 1512A. Standards for incident command between TMCs.)
- Smaller component development and integration of devices. Specifications for in-vehicle components.
- Intersection collision avoidance

- Operator safety
- Operational efficiency [reduce resource requirements and enhance services]
- Systems integration [vehicle-infrastructure, vehicle-vehicle]
- Data/for decision support (for fleet and asset management, archive data, integrating with other data across applications)
- Mobile road visibility systems.
- Geo-stationary satellites that acquire images over the transportation network (see what's over the hill for transportation management.
- Emergency communication systems (interagency communications within public safety service providers - police, fire, EMS, etc.)
- Diagnostics for systems.
- Automatic collision notification (ACN).

IVI TRANSIT
PLATFORM RECOMMENDATION
October 13, 2000

Background

Safe operation affects transit ridership in many ways. Transit must not only be safe, but must be perceived as safe. IVI can help transit operations reduce crash rates and severity and mitigate the economic consequences of crashes. Accidents cost industry $400 million annually. IVI technology in the pipeline can help bus drivers avoid accidents. It can also assist Safety officials in objectively determining liability.

In recognition of these opportunities the Transit Steering Committee has held seven very productive meetings:

- December 1997 in Houston, TX, at which the IVI principals were introduced, issues identified and technical demonstrations identified.
- February 1998 in Salt Lake City, UT, at which the Committee discussed needs and IVI user services were identified and prioritized.
- May 1998 in Phoenix, AZ, at which the Committee refined and amended user services priority and adopted a series of recommendations.
- August 1998 in University Park, PA, at which the Committee discussed future directions and observed a demonstration of the IVI technology installed on a Port Authority of Allegheny County bus.
- October 1998 in New York, NY in conjunction with the APTA Annual Meeting for a briefing and gathering of industry input.
- September 1999 at ITS America's Headquarters in Washington, DC in which committee discussed program status, bus rapid transit applications, and information integration in driver workstation and pedestrian safety.
- June 2000 in Washington DC at which time the Committee reaffirmed the goals (listed below), adopted a set of recommendations consisted with DOT goals, and identified future needs and action.

The most frequent types of crashes are lane change accidents, rear end collisions, intersection collisions, parking accidents, and accidents that occur while backing up. IVI technologies such as rear impact mitigation warning systems, lane change/merge collision warning and avoidance systems, tight maneuvering and docking systems, pedestrian and object detection systems and automated controls all will serve to improve transit system safety.

Consequently the following priority user services have been identified:

Near Term:

- Lane change collision avoidance
- Rear-end/forward collision avoidance
- Rear impact mitigation and recording
- Precision docking and tight maneuvering

Mid Term

- Safety event recording
- Vehicle diagnostics
- Maintenance facility automation

Far Term

- Pedestrian detection and avoidance

A number of demonstration projects have been initiated over the last several years and preliminary findings are becoming available. A list of the locations of projects and preliminary results is attached.

Platform Goals and Principals

The Committee voted unanimously to reconfirm the goals and principals that were presented at the four-platform IVI meeting in Dearborn, Michigan in May 1998.

These goals and principals were:

- Transit is one element of a multi-platform program
- Safety is important as well as efficiency and mobility
- Program mission is to accelerate deployment of IVI systems
- Human factors considerations are critical
- Non-federal partners are essential

Recommendations

Transit Goal: Reduce transit crashes by 20 percent over the next 10 years.

Specific Goal: Ten percent of new transit bus sold by 2010 will be equipped with effective IVI technologies.

Future Activity

The group agreed on the following principals of future activity.

- Proceed with development of performance specifications.
- Use preliminary results of demonstrations to create an operational test that integrates two or three of the systems starting in 2001. In pursuing this strategy transit agencies will take
  the lead in partnership with manufacturers and suppliers. This strategy will maximize existing state and local entities and partnerships.
- Continue to emphasize human factors, pedestrian safety, and intersection safety in IVI research.
- Work to develop innovative procurement techniques in acquiring ITS technology.
- Better analyses is required in segregating transit safety statistics and comparing "apples to apples"
- Transit in urban environment vs. highway rural
- Accidents per vehicle-miles and per vehicle-passenger-miles
- Need better/more collaboration with truck and specialty vehicle platforms
- Human factors work on specialty vehicles
- Use of simulator technologies
- Program should properly balance and emphasize mobility goal without sacrificing safety goal
- Collect more data and better focus on passenger accidents/incidents inside buses
- Collect better data required on pedestrian related incidents. Can learn from the school bus industry in this area.
- Collect better economic/societal impact data
- FTA to focus on outreach to industry in regards to the IVI tests
- Address the use of pooled funds across the industry as way of attracting dollars to program.

It is also the recommendation of the Committee that there be more frequent meetings to assess the progress being made and provide any additional direction necessary.

ON-GOING DEMONSTRATIONS AND PRELIMINARY RESULTS

A. Frontal Collision Warning System

Location
- San Mateo County Transit
- CA PATH, Berkley
- Caltrans
- Gillig Corporation
- FTA/FHWA
- Advisory committee (9 Calif. Transportation Agencies)

Preliminary results
- Vehicle speed is modest/low causal factor
- Impact typically at front corners
- On-board passenger injuries occur when bus brakes
- Sensors on corners
- Forward looking radar
- First phase testing and validation on 2 buses

B. Lane Change/Merge Collision Warning

Location
- Port Authority of Allegheny County (PAT)
- Carnegie Mellon University
- PennDOT
- FTA

Preliminary results
- Technology assessment complete
- Need 360-degree coverage
- Need to distinguish pedestrians from objects
- Need to determine velocity
- Cost less than $5,000 and be easy to install and maintain
- Need multi-sensor warning devices
- Ultimate application 100 buses

C. Rear Impact Collision Warning System

Location

- PAT, PennDOT, Carnegie Mellon prototype demonstration, September 1998*
- Ann Arbor, Veridian/ERIM International, California 2000**
- FTA

Preliminary results
- Need rear sensor and alert
- Gap closure too fast
- Both operators need to be alerted
- Video recording of accident

* Systems utilized a variable message sign, air horns, and flashing lights
** Performance specification project