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Findings of Focus Group Meetings for the Pilot Study of Advisory On-Board Vehicle Warning Systems at Railroad Grade Crossings

By:

Rahim F. Benekohal

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The Pilot Study of Advisory On-Board Vehicle Warning Systems at Railroad Grade Crossings

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Department of Civil and Environmental Engineering

University of Illinois at Urbana-Champaign

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16. Abstract

This report contains the results from several meetings of three different focus groups. The meetings were conducted as a part of the evaluation for the Pilot Study of Advisory On-Board Vehicle Warning Systems at Railroad Grade Crossings. The focus groups were used to obtain in-depth information about driver-perception, driver-system-interaction, and other related issues. The three focus groups were drivers, operation managers, and members of the Project Management Committee (PMC)/Technical Oversight Committee (TOC). This Pilot Study used commercially available equipment that did not meet the system reliability standards promised by the contracting team and required for this particular application. False alerts ruined the trust of the drivers and the project team for the In-Vehicle Receiver (IVR) system. The driver's interest was reduced due to repeated false alerts, the long development period before deployment, and annoying noise when the IVR was activated (beeping). A lot of drivers did not report the false alerts because it involved additional paperwork. Drivers preferred the combination of audible and visual messages to the individual (visual only or audible only) message. The visual mode by itself was ineffective during the daytime since it was not clearly readable and usually did not increase the drivers' awareness of the approaching trains. However, during the nighttime this mode worked well. Drivers did not understand the necessity to have the IVR system at crossings with existing active warning devices, but they understood that at unprotected crossings, the system could be very valuable. Suggestions were also made to improve the effectiveness of the IVR system.

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INTRODUCTION

This report contains the results from several meetings of three different focus groups. The meetings were conducted as a part of the evaluation for the Pilot Study of Advisory On-Board Vehicle Warning Systems at Railroad Grade Crossings. There are five other reports related to the evaluation of the Pilot Study (1, 2, 3, 4, and 5). The evaluation plan emphasizes the reaction/perception of drivers to the information provided by the system. The focus group meetings were conducted to address the following three broad categories of issues:

1. Driver-Perception related issues
2. Driver-System-Interaction related issues
3. Non-Driver related issues

The three focus groups were drivers, operation managers, and members of the Project Management Committee (PMC)/Technical Oversight Committee (TOC). The results for each group are presented separately.

I. PMC/TOC FOCUS GROUP MEETING

I.1. Introduction

The PMC/TOC focus group meeting was conducted on January 24, 2001 at the IDOT ITS Office. Seven people participated in the focus group meeting representing five different federal and state agencies. Most of the focus group members had the IVR in their vehicles. Three categories of questions were asked:

1. Driver-Perception related concerns
2. Driver-System-Interaction related concerns
3. Non-Driver related concerns

Each category had several questions. The participants were given a copy of the questions and were instructed to provide responses to each question. The following sections summarize the responses to each question.

I.2. Driver-Perception Related Concerns

I.2.1. Reaction/perception of drivers to the in-vehicle receiver (IVR) information

The main points the focus group members made are given below:

- The participating drivers asked why should they trust a system that didn't give them an advance warning.
- Drivers felt that the IVR system was a burden because it was asking them to do extra things beyond their duties. This may have been one of the reasons most companies did not fill out the false alert reports.
- A focus group member recalled the transmitter was broken in a vehicle but IDOT was not contacted about it.

At the beginning, the drivers had some excitement about this study. However, the first IVR mode did not work well. The drivers did not like it and were not enthusiastic about the study when the deployment phase began. Drivers did not want the IVR to be in their vehicles. The main issues they raised are listed below:

- The drivers asked many times why the IVR system was tested at crossings equipped with gates/flashing lights.
- The drivers asked why the transmitter was placed at the crossing instead of putting it on the train. Some drivers thought the Pilot Study was a waste of money because the crossings were already protected.

Some other issues the focus group members mentioned are as follows:

- The drivers felt the audible warning was too loud. The drivers wanted to have an opportunity to turn the audible warning off and keep the visual warning on when a long train was passing.
- People with impaired hearing said that the IVR visual message could help them.
- Some drivers did not want another federal mandate that forced them to drive with such a device in their vehicles.
- Some drivers said any additional improvement on the IVR could be helpful.
- It was suggested that all the crossings could be in one town or in one region so the drivers would easily know which crossings were included in the study.

- Some drivers wanted to know what direction the train was going, its speed and how long it would occupy the crossing.

I.2.2. Clarity of the message given by IVR

- The focus group felt that the original visual message “Warning Train” was clear. There was only one message and it was relatively simple. However, when we put “Caution Train” and “Warning Train” messages, this might have confused some drivers. It was the activation of the device that got the drivers’ attention not the text of the message. The drivers did not look whether the message was “Warning Train “or “Caution Train”.
- One issue concerning the clarity of the message was that on sunny days it was hard to see the visual message.

I.2.3. Drivers’ acceptance and trust of the warning messages

- The IVR system was supposed to activate every time a train came. Whenever it activated without a train (false alert), system reliability suffered. The drivers had a lack of trust because of the numerous false alerts. False alerts not only ruined the trust of the drivers, but also the trust of the project team for the IVR system. This even damaged the credibility of the project because of the inability to follow through on project commitments made to the drivers.
- In addition, the modality was supposed to be changed at certain stages of the project. The sub-contractor stated that all units were changed but some drivers said they weren’t. The project required constant commitment from the contracting team, and the sub-contractor failed to follow through on some important responsibilities. IDOT discovered these performance failures through their own investigation. The performance failures damaged the credibility of the project. Also, some broken units were not replaced by the sub-contractor.
- The drivers shared their problems with the IVR system with each other and this negative attitude affected the credibility of the project. In some vehicles, drivers cut the wires and disconnected the system. Some of the IVRs were found disconnected in vehicle glove boxes.

I.2.4. Drivers' reactions to the warning messages

The focus group members said that the drivers had a positive view of the IVR system.

- The focus group participants said that the drivers were excited in the beginning of the project, but due to the long development period before deployment, and repeated false alerts after deployment, the interest was reduced.
- Drivers thought they would get an additional warning message to increase their safety.
- The drivers as well as the general public were impressed with the project concept and goals.

However, the focus group members echoed the drivers' sentiments.

- The gates and flashing lights at the crossings provide an adequate warning without the need for the IVR. Conscientious drivers would obey the warning devices anyway and pay attention to an approaching train.
- When the engine was started in the equipped vehicles, the IVR went through a start-up routine that annoyed the drivers.
- At the end of the project, some drivers were happy that the IVR was removed, but at least one driver said he missed having the IVR.

I.3. Driver-System-Interaction Related Concerns

I.3.1 Audible, visual, and combination warning messages

- The focus group participants said that more drivers found the audible warning more effective and important. The decibel level was higher than it needed to be. For school buses, the IVR-tested decibel level was needed. However, for other vehicles, it became a nuisance.
- If you were waiting behind the crossing gates, you didn't need the IVR to stay on during the entire train event. However, if another train was approaching from the opposite direction, the system should recognize the next event and give another train warning. At Shermer Road, there were times a second train was approaching. It would be better if an audible message stated that there was a second train. If the device went off for the first event and stopped and then reactivated again, this would have been synonymous with the second train event.

- The combination mode gave the drivers the benefits of having two modes of warning. An audible only warning message could be provided as a part of the vehicles' radio system, but for a visual message, a device is needed to display the message.
- If this was a successful product with proper activation and no false alerts, it could have been used on snowplows and maintenance trucks that are struck by other highway traffic.

I.3.2. Placement of IVR and Human Interface

- There was no problem with placement of the receivers in the vehicles. The sub-contractor in charge of human factors did a very thorough job analyzing the placement for each vehicle type.
- Some drivers got used to having the IVR in their cars. The initial start-up was too long, but was shortened in later versions. Overall, the IVR system was good and when it went off, you had to pay attention to driving.
- It was suggested to put the transmitters on the trains and then deploy an in-vehicle warning system at unprotected crossings.

I.4. Non-Driver Concerns

I.4.1. Improvements that can be made to the overall system

- The focus group members indicated that false alerts needed to be reduced to improve the credibility of the IVR system. The technology is available to eliminate most of the false alerts. The Pilot Study used commercially available equipment that did not work as promised for this particular application. The false alerts happened continuously at the same locations and reduced the project credibility.
- One major improvement would be to provide an advance warning before the gates are activated and avoid false alerts. If this is not provided, the product won't be used.
- In ITS railroad related work, if the system reliability is less than 100%, you are open to liability.
- To improve the overall performance of this system would be wasting time.

- Significant time was spent tweaking the transmitter to work properly. They need constant maintenance, monitoring and reorientation for drift, environmental effects, trees, etc.
- This system is not a deployable system and lets move on to the next project.

I.4.2. Capabilities that should be kept or modified and future of the system

- The original concept was very good. Somebody had to do this study to see if the technology worked.
- If there were easy ways of making railroad crossings safer, it would have been done years ago.
- Giving an in-vehicle warning in the combination mode was good.
- One little device is not going to make a big difference if the drivers are not educated and do not use the IVR wisely.
- If the transmitters were designed for this specific purpose and they worked properly, then there is a chance for a project like this.
- One member preferred the IVR system to warn him before he got to the crossing.
- The best transmitter placement is to put it on the train. It is then another item railroads have to maintain.
- There is a chance you can make this system better by using track circuitry.

I.4.3. Comments about the system, operation and management

- Lessons learned will be the most effective thing to come out of this study.
- One member did not see this concept going anywhere without having a designated radio frequency. ITS needs to work with USDOT and FCC to get dedicated radio frequencies for safety related work.

HAND OUT USED IN PMC/TOC FOCUS GROUP MEETING

Three categories of questions were asked:

1. Driver-Perception concerns
2. Driver-System-Interaction concerns
3. Non-Driver concerns

1. Driver-Perception Concerns:

1-1. What are your thoughts on reaction/perception of drivers to the IVR information?
1-2. What are your thoughts on the clarity of the message given by IVR?
1-3. What are your thoughts on the drivers' acceptance and trust of the warning messages?
1-4. What are your thoughts on the drivers' reactions to the warning messages?
1-5. What are your thoughts on the reliability and effectiveness of the system?

2. Driver-System-Interaction Concerns

2-1. What are your thoughts on the visual warning message?
2-2. What are your thoughts on the audible warning message?
2-3. What are your thoughts on combination of audible and visual warning messages?
2-4. What are your opinions regarding the IVR placement?
2-5. How successful was the IVR-human interface?
2-6. What are your inputs, thoughts on the false alerts?

3. Non-driver Concerns

3-1. What improvements can be made to the overall system?
3-2. What features or capabilities of the system do you liked the most?
3-3. What aspects of the system do you want to see changed in the future projects?
3-4. What are your opinions related to the performance of the system?
3-5. How do you think the system should evolve in the future?
3-6. Do you have any further comments/suggestions about the system?

II. OPERATION MANAGERS FOCUS GROUP MEETING

II. 1. Introduction

On January 23, 2001, a letter was sent to all operations managers thanking them for participation in the "Pilot Study of Advisory On-Board Vehicle Warning Systems at Railroad Grade Crossings" study and encouraging them to participate in a focus group meeting to provide feedback. The focus group meeting for the operation managers was scheduled for March 21, 2001 in Northbrook, IL. Five people participated in the face-to-face focus group meeting. A focus group teleconference was also held on March 30, 2001 for those who could not attend the face-to-face focus group meeting. Four operation managers participated in the teleconference.

Three categories of questions were asked:

1. Driver-Perception related issues
2. Driver-System-Interaction related issues
3. Non-Driver related issues

Each category had several questions. The participants were given a copy of the questions and were instructed to provide responses to each question. The following sections summarize the responses to each question.

II. 2. Driver-Perception Related Issues:

II.2.1. Drivers' perception/reaction to the In Vehicle Receiver (IVR) information?

- The operation managers indicated that drivers did not like the visual message without an audible sound because it was hard to notice the visual IVR message without the sound. The audible warning was needed to attract attention.
- The visual IVR message was hampered by the glaring condition of the sun.
- The combination of audible and visual message was preferred.

II.2.2. Clarity of the message given by IVR

The operation managers thought that there was only one visual message titled train is approaching and this message was clear.

II.2.3. Drivers' acceptance and trust of the messages given by IVR

The operation managers said that false alerts convoluted the situation. The drivers were not sure when they would get false alerts and when they would get a "real" alert. They did not have a lot of faith in the system. The drivers thought that bugs should have been worked out before deployment. They did not have much confidence with the IVR system. The IVR activated near stores or shopping centers with automatic door openers and such false alerts diminished driver trust of the IVR. False alerts started even before the system was in the deployment phase and this eroded the trust of the drivers.

II.2.4. Drivers' reactions to the messages given by IVR

The operation managers indicated that when the IVR was working, the reaction was positive. Sometimes after passing the railroad tracks, the IVR would go off when the drivers did not need it. This distracted the drivers.

II.2.5. Reliability and effectiveness of the system

- The operation managers said that existing gates and bells are very reliable in providing a warning that a train is approaching. People can notice the gates when they approach railroad crossings. If gates fail to work, the transmitter would fail too.
- It could be beneficial if the IVR worked independent of the crossing gates.
- The system was not in place long enough to judge its effectiveness in improving traffic safety.
- They indicated that a lot of people will be reluctant to buy a warning device for just railroad crossings. If it is integrated into the dashboard electronics, doesn't cost extra, and works properly at every railroad crossing, then it may be feasible.
- If it provides an advance notice of approaching emergency vehicles, this could be a valuable additional warning.

- The operation managers said that false alerts started even before the system was turned on and that caused the drivers to ignore them. A lot of drivers did not report the false alerts because it involved additional paperwork. If the IVR had a button to push to report a false alert, it would have been more effective than completing forms. People were overloaded with work and when you asked them to complete a form, they were unwilling to put in that much extra effort.
- It was annoying when the audible message continued as long as the train occupied the crossing. This was especially annoying in the case of long freight trains.
- The IVR was also a distraction in law enforcement vehicles because these vehicles contain many other communication devices.

II.3. Driver-System-Interaction Related Issues

II.3.1. The visual warning message

The operation managers said that the visual warning alone was not enough because drivers may have not been looking at the device.

II.3.2. The audible warning message

- It was suggested that a button be installed to silence the sound or periodically reset the system so that the IVR was not beeping for a long time. The IVR didn't need to sound every time the vehicle was started.
- The quality of the sound was not pleasant.
- In the law enforcement vehicles, the audible message was disliked because of the presence of other warning sounds in the vehicles.

II.3.3. The combination of audible and visual warning messages

- The operation managers said that the combination of audible and visual messages was better than the individual (visual only or audible only) message.
- The IVR, however, didn't need to beep continuously. The beeping should have stopped after a short period of time.

II.3.4. The IVR placement inside the vehicle

The operation managers said that in general the placement was OK. However, some short drivers in buses had a problem. The IVR should be incorporated into the dashboard.

II.3.5. The IVR-human interface

The sound is only needed for a few seconds. When the gates were down, the warning message continued even if there was no train at the crossing.

II.3.6. On the false alerts

Mostly, the alerts sounded when the driver was not near the railroad track.

II.4. Non-driver Related Issues

II.4.1. What improvements can be made to the overall system

These are suggested improvements:

- Install a silencing button or a volume adjustment button.
- Make the IVR a part of the dashboard.
- Use combined audible and visual mode.
- Build an automatic reset feature so the IVR does not beep for a long time.
- Make the system a standard feature in vehicles and let the emergency vehicles activate it.
- Reduce the false alerts and make the system perfect.
- Enhance the quality of audio and visual messages and use pictorial messages (train)

II.4.2. What features/capabilities of the system did you like the most

- One manager said he liked the early warning that he got before reaching the railroad crossing.
- One person felt that the IVR system started beeping before the gates came down.
- One person felt that the receiver picked up a signal one mile away.

- At unprotected crossings, the system could be very valuable

II.4.3. What aspects of the system would you suggest changing in future projects

These are the suggested ideas:

- Eliminate the irritating noise
- The system has to be part of the dashboard and it should be made repairable
- The IVR shouldn't look like a radar detector
- The system should be activated by emergency vehicles

II.4.4. What are your opinions related to the performance of the system

- The system was not working, and when it was working it was unreliable. Too many false alerts were given early on.
- The alert was on for a long time and that was annoying. The system has to attract the driver's attention and reduce false alerts.
- The reliability must be greatly improved.

II.4.5. How do you think the system should evolve in the future

- It should be activated by emergency vehicles and should tell the direction of the emergency vehicle. It would be useful in cases of an emergency vehicle coming from a direction that you couldn't see.
- The operation managers suggested integrating the system with GPS and making it more sophisticated.
- It must be a part of the dashboard and the car. It must be fool proof.

II.4.6. Do you have any further comments/suggestions about the system

- The operation managers said that the technology had some merits, however, railroad grade crossings equipped with gates and flashing lights seemed to provide an adequate warning.
- To be hit by a train is a rare accident.

- To improve railroad crossing safety, the following should be used: a) vehicle arresting barriers, b) longer gates to prevent going around the gates, c) driver education and higher fines, d) cameras to monitor railroad crossings, e) reduced gate down time, and f) information on how long the train will occupy the crossing and the direction of the train.
- The system was not useful and helpful in the current form because one could see the gates and lights, but the system could be good for unprotected crossings. For protected crossings, an early warning sign is needed.

III. DRIVERS FOCUS GROUP MEETING

III.1. Introduction

To identify drivers to participate in a focus group meeting, on January 23, 2001, a letter was sent to all operations managers asking them to identify one primary and one alternate driver. The alternate driver would be contacted if the primary driver was unable to participate in the focus group meeting. On March 6, 2001, a follow-up letter was sent to those companies that had not nominated drivers for the focus group meeting. A focus group meeting was scheduled for 3-7 PM on Tuesday April 17, 2001. The focus group meetings were held in the Northbrook Junior High School that was close to where participants worked. The operation managers were asked to inform the primary or the secondary driver about the focus group meeting and ask them to participate. The operation managers were told to send one of their other drivers to participate if the primary or secondary driver was not available. The focus group meeting was open-house style and approximately one hour long. As a token of our appreciation, $25 was given to each participant, authorized to accept gifts.

The participants were given a copy of the questions. A copy of the questions is included at the end of this section. The questions were in three broad categories and each category had several sub-categories. The following sections summarize the responses to each question:

III.2. Driver-Perception Issues

III.2.1. Drivers' perception/reaction to the IVR Information

- Drivers said that the IVR system increased their awareness of the existence of railroad crossings occupied by trains.
- Not knowing when the system/transmitter was operational (turned on), some drivers felt a little confused at the beginning as to how the system worked.
- Once the system was operational, drivers reported that the system operation was easy to understand.
- Drivers thought that the IVR system was redundant because of the existing warning devices in place at railroad crossings.

III.2.2. Clarity of the message given by IVR

- The drivers said that the system provided clear messages.
- All drivers felt that only one message was displayed on the visual system.
- The combined mode provided a clear warning message and attracted more drivers' attention than the audible or the visual modes separately.

III.2.3. Drivers' acceptance and trust of the messages given by IVR

- Drivers said that it took a while for them before accepting and trusting the warning message given by the system.
- Drivers were initially confused when the IVR activated near or at shopping malls or hospitals where there were automatic door openers. However, later they got used to these false alerts because they occurred regularly at certain places.
- In general, drivers accepted the warning message and trusted the system once it was operational.

III.2.4. Drivers' reactions to the messages given by IVR

- Most of the drivers said their reaction was to look for a train.
- Some drivers started looking for alternate routes to avoid the crossing that was occupied by trains.

- Sometimes drivers reduced their speeds. For bus drivers, it was not unusual to slow down since they are required to stop at railroad crossings.

III.2.5. Reliability and effectiveness of the system

- Drivers felt that most of the time the system was reliable and worked every time.
- Not knowing when the system (transmitter) was activated, in the beginning one driver felt that the system was not reliable.

III.2.6. Training

- Drivers reported that the training was well delivered, and that good communication existed between the trainees and instructors.
- The time gap between training and installation of the IVR system was too long and drivers were not well informed about the progress and changes in making the system operational. The information sent to operation managers sometimes did not filter down to the employees.

III.2.7. Survey

- One driver reported that the survey was a little long, but some said that the survey was just right as it took him 10 minutes to complete/answer all the questions.
- Some drivers felt that the survey should contain simpler questions.
- Some of the questions were redundant and some of them were good.
- One driver reported getting confused with "ranking" questions especially those that were related with the warning devices at railroad crossings.

III.3. Driver-System-Interaction Issues

III.3.1. Thoughts on the visual warning message

- The visual mode by itself was ineffective during daytime since it was not clearly readable and usually did not increase the drivers' awareness of the approaching trains, but during nighttime this mode worked well.

- The display needed to be brighter and manually adjustable.
- The lettering of the displayed warning message was too small.
- During bright sunny days and certain sun angles, the displayed warning message was hard to see.
- In the three months of the visual mode installation, drivers paid less attention to the displayed warning message.
- Only one driver (post office driver) preferred the visual mode system as opposed to the audible and combined modes.

III.3.2. Thoughts on the audible warning message

- Almost all drivers thought that the audible mode was better than the visual one.
- Most of drivers accepted and were satisfied with the beeping sounds, but one driver reported that the sound was annoying.
- The audible mode was acceptable for a fire truck driver as he could recognize the unique noise of the audible IVR system.
- The beeping pattern of the sound captured the attention of drivers.
- One driver discovered that this system could be easily deactivated (turning off the beeping) by simply putting the drivers' hand in front of the receiver.

III.3.3. Thoughts on the combination of audible and visual warning messages

- Drivers felt that the combination mode provided the best warning system.
- Activation of this mode resulted in the highest level of driver awareness for approaching trains.
- Only one driver reported that the combined mode was not preferable due to the annoying beeping sound from the audible system.

III.3.4.Thoughts on the IVR placement inside the vehicle

- A van driver reported that the IVR unit was mounted too low so its display was hardly seen, however, drivers of a GMC truck and post office vehicle reported that the placement of the IVR unit was just perfect, right at eye level.

- The IVR unit should be placed facing drivers so it would be easier for drivers to see the displayed message.
- The placement of the IVR unit should be manually adjusted according to the type of vehicle (truck or van) and drivers height.

III.3.5. Thoughts on the IVR-human interface

- Drivers felt that it would be more useful to have a button that could adjust the audible level and the brightness of the IVR unit. However, if the IVR was placed in a school bus, it should not have any volume adjustment.

III.3.6. Thoughts on the false alerts

- Repeated and regular false alerts at certain locations made the drivers confused, but later drivers expected them to occur when they passed these locations and eventually ignored the false alerts.
- In the beginning, drivers reported the frequency of false alerts but they stopped reporting as they ultimately ignored these repeated false alerts.
- A fire truck driver reported false alerts at hospitals only one time and stopped reporting afterward.
- One driver said that 3 to 5 percent of false alerts were reported.
- One driver did not remember whether or not false alerts occurred.
- Some drivers felt that false alerts were annoying because they (the beeping sounds) lasted for a while and could not be manually turned off.
- A post office driver got only 3 to 4 false alerts as his fixed routes were all in residential areas.
- Drivers felt that false alerts could also be caused by a loose connection of the IVR unit.

III.4. Non-driver Issues

III.4.1. Improvements of the overall system

- Activation of the IVR system needed to be independent from the activation of the crossing gates.

- Manual adjustment on the placement of the unit according to the drivers physical appearance (short or tall) as well as the brightness of the displayed IVR unit were highly recommended.

III.4.2. Features/capabilities of the system drivers like the most

- The beeping sound of the audible mode that could strongly attract drivers' attention.

III.4.3. Aspects of the system suggested to change in future projects

- For non-emergency vehicles, a smaller size of the IVR unit was preferred.
- Drivers preferred to have the unit integrated into the dashboard.
- The system should be equipped with the volume or display adjustment button, for example, a display warning with two different colors rather than one single color (yellow).
- The system should automatically deactivate when trains occupy railroad crossings.

III.4.4. Performance of the system

- Most of drivers reported that the system with the audible mode performed better than the visual mode.

III.4.5. System evolves in the future

- The transmitter should be installed on the locomotive rather than on the train track.
- The system should be equipped with a warning message when the second train approaches railroad crossings, and this message should be different from the message for the first train.
- The IVR system should be equipped with additional different messages or beeping sounds to incorporate different types of trains including freight, commuter, and express trains, as well as trains approaching from different directions.

III.4.6. Further comments

- Some drivers recommended equipping more crossings with IVR transmitters.
- Do not recommend changing the IVR system into an early warning system.

- Installing this IVR system on emergency vehicles is a good idea, but the usefulness of installing it in personal vehicles was questioned.
- Reduce the size of the unit. One bus driver felt that the IVR unit took up considerable space.
- Do not mandate installing the IVR system in every car but suggested installing it in school buses.
- Even though only one company provides the IVR unit, drivers felt that some IVR units were good and some were not.

DRIVERS FOCUS GROUP QUESTIONS

April 17, 2001

Pilot Study of Advisory On-Board Vehicle Warning Systems at Railroad Grade Crossings

Three focus areas for discussion:

1. Driver-Perception issues
2. Driver-System-Interaction issues
3. Non-Driver issues

1. Driver-Perception Issues:

What are your thoughts on:

1.1. Drivers' perception/reaction to the In Vehicle Receiver (IVR) information?
1.2. Clarity of the message given by IVR?
1.3. Drivers' acceptance and trust of the messages given by IVR?
1.4. Drivers' reactions to the messages given by IVR?
1.5. Reliability and effectiveness of the system?

2. Driver-System-Interaction Issues

What are your thoughts on:

2.1. The visual warning message?
2.2. The audible warning message?
2.3. The combination of audible and visual warning messages?
2.4. The IVR placement inside the vehicle?
2.5. The IVR-human interface?
2.6. On the false alerts?

3. Non-driver Issues

3.1. What improvements can be made to the overall system?
3.2. What features/capabilities of the system did you like the most?
3.3. What aspects of the system would you suggest changing in future projects?
3.4. What are your opinions related to the performance of the system?
3.5. How do you think the system should evolve in the future?
3.6. Do you have any further comments/suggestions about the system?

IV. CONCLUSIONS AND RECOMMENDATIONS

IV.1. Conclusion

Three different focus groups were used to obtain in-depth information about driver-perception, driver-system-interaction, and other related issues. The three focus groups were drivers, operation managers, and members of the Project Management Committee (PMC)/Technical Oversight Committee (TOC). This Pilot Study used commercially available equipment that did not work as promised for this particular application. The IVR system was supposed to activate for every train event at the five-equipped crossings. Whenever it activated without a train present (false alert), system credibility diminished. IVR system false alerts not only ruined the trust of the drivers, but also the trust of the project. In the beginning, the drivers were excited about the project, but the interest was reduced due to repeated false alerts, the long development period before deployment, and annoying noise when the IVR was activated (beeping). The drivers did not have much confidence with the IVR system. The IVR activated near stores or shopping centers with automatic door openers and such false alerts diminished the drivers' trust for the IVR. A lot of drivers did not report the false alerts because it involved additional paperwork. If the IVR had a button to push to report a false alert, it would have been more effective than filling out forms. Drivers were overloaded with work and they were unwilling to put in much extra effort to complete a form. Drivers preferred the combination of audible and visual messages to the individual (visual only or audible only) message. The combined mode provided a clear warning message and attracted more drivers' attention than the audible or the visual modes separately. The visual mode by itself was ineffective during the daytime since it was not clearly readable and usually did not increase the drivers' awareness of the approaching trains, but during the nighttime this mode worked well. Drivers did not understand the necessity to have the IVR system at crossings with existing active warning devices, but understood that at unprotected crossings, the system could be very valuable.

IV.2. Recommendation

These are some of the suggestions to make the system more effective:

- Make it easy for driver to report false alerts so they won't feel that the system is a burden.
- Provide the direction the train is going, its speed and how long it would occupy the crossing.

- Provide a visual message that is relatively simple because the activation of the device gets the drivers' attention not the text of the message.
- The IVR went through a start-up routine every time a vehicle started and this annoyed the drivers. Simplify or avoid this process.
- It was suggested to put the transmitters on the trains and then deploy an in-vehicle warning system at unprotected crossings.
- Provide an advance warning before the gates are activated.
- There is need for ITS providers to work with USDOT and FCC to get dedicated radio frequencies for safety related work such as this study.
- It could be beneficial if the IVR worked independent of the crossing gates.
- Integrate this system into the dashboard electronics because a lot of people will be reluctant to buy a warning device for just railroad crossings.
- If it provides an advance notice of approaching emergency vehicles, this could be a valuable additional warning.
- Change the system operation such that the IVR didn't need to beep continuously. The beeping should have stopped after a short period of time. This was especially annoying in the case of long freight trains.
- Install a silencing button or a volume adjustment button.
- Make the system a standard feature in vehicles and let emergency vehicles activate it.
- Enhance the quality of audio and visual messages and use pictorial messages (train).
- It would be more useful to have a button that could adjust the audible level and the brightness of the IVR unit.
- Activation of the IVR system needed to be independent from the activation of the crossing gates.
- The system should be equipped with a volume or display adjustment button.
- The system should automatically deactivate (stop beeping) when trains occupy railroad crossings.
- The transmitter should be installed on the locomotive rather than on the train track.
- The system should be equipped with a warning message when the second train approaches railroad crossings.
- The IVR system should be equipped to recognize different types of trains (freight, commuter, and express trains) and give a message accordingly.

V. REFERENCES

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