

"INTEGRATED TECHNOLOGIES FOR  
MANAGING HEAVY VEHICLES ON  
HIGHWAYS"

by

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## Introduction

As the demand for moving goods on our highway system continues to increase so does the pressure for changes in truck weights and dimensions. Similarly, the evolution of technologies has surfaced opportunities which may be considered as elements of a "smart highway" or "integrated vehicle highway system" (IVHS). A challenge confronting both government and industry is in the management of these heavy vehicles in order to meet goals and objectives within these sectors in our economy. A program has been designed to bring to bear emerging technologies in an integrated system to facilitate heavy vehicle management (HVM). One major initiative is the Heavy Vehicle Electronic License Plate (HELP) program including the CRESCENT Demonstration Project component. The research and demonstration project is intended to design and test the integrated technologies including automatic vehicle identification (AVI), automatic vehicle classification (AVC), and weigh-in-motion (WIM) technology using low-cost technology, satellite data links, and data communication networks including on-board computers.

This research initiative involves fourteen states, Canadian interests, one port authority and trucking industry representatives in a forum to examine what lies ahead for improvements in heavy vehicle management technology and to what extent a cooperative effort between public and private sectors can be effective in fostering this initiative.

A variety of integrated system scenarios have been developed including some which might be able to facilitate trucking systems using simple coded messages sent by two way communications with enhanced AVI, on-board computers, or satellite systems. Using roadside AVI/WIM facilities, messages could be sent or received by trucks when they pass an AVI/WIM site. Satellite messages would be more immediate yet more costly. In either case users would need to install special equipment on their trucks. The system might provide the motor carrier industry with information that they need as well as facilitate government information for planning and management in addition to monitoring routes for specific movements of hazardous materials.

The goals and objectives of the program are to define the feasibility of the HELP program and the CRESCENT Demonstration as determined by progress in achieving the following four goals:

1. Assess the Viability of the Technology in the Highway Environment (eg. reliability, accuracy, etc.)
2. Improve Institutional Arrangements (eg. one stop shopping, pre-clear at weigh stations and ports of entry, border transparency)
3. Measure Efficiency and Productivity (eg. improve safety, enforcement, reduced administration, data collection, etc.)
4. Identify Additional Applications of the Technology (eg. public/private sector applications)

The CRESCENT Demonstration Project element of the program is scheduled to begin in 1990. The demonstration project should last for one year followed by an evaluation. The demonstration will test as many applications of the HELP technologies as possible within the budget constraints and should provide useful information and data on the utility of the technologies involved as well as opportunities for systems integration. The challenges of working within state institutions as well as multi-state arrangements build upon initiatives underway such as within the National Governors Association, the IRP, IFTA, and other such initiatives to provide regulatory uniformity thereby enhancing productivity and efficiency.

## The HELP Program

This program, initiated in 1983 by representatives of Arizona and Oregon Departments of Transportation began with the development of concept papers. The FHWA provided grants to Arizona DOT to undertake a concept feasibility study and to Oregon DOT to perform a proof of concept demonstration. These efforts considered merging of new technologies into an automated vehicle monitoring system. The results were encouraging regarding the technical feasibility and the potential benefits to states and truckers alike.

In early 1985, a core group of western states joined with a number of other interested states to form a joint-funded, multi-state development and testing program. The project was originally called the CRESCENT Study because of the shape of the proposed demonstration route along the west coast and east to Texas. With the inclusion of many participating states outside of the Crescent, the name of the overall study was changed to HELP (Heavy Vehicle Electronic License Plate), although the demonstration phase maintains the CRESCENT name. The program has evolved today to include participants from across the U.S. and Canada. (Figure 1).

## Program Description

As previously stated, the HELP project is a north American multi-state, cooperative study and demonstration project involving both government and industry participation to investigate current technologies that have the potential to provide an integrated heavy vehicle management system with applications to both highway and vehicle management.

The study elements of the HELP program focus on five technologies that can be integrated into a management system:

1. Automatic-Vehicle-Identification (AVI)
2. Weigh-In-Motion (WIM), using low-cost technology
3. Automatic-Vehicle-Classification (AVC)
4. Satellite Data Links
5. Data Communications Networks including on-board computers

The entire HELP program can be divided into three phases.

Phase I involved the early work by Oregon and Arizona to assess the feasibility of the concept. This effort was performed during 1983 to 1985.

Phase II has consisted of a number of technical studies involving each of the individual technologies. These studies have investigated each technology through research, field and laboratory testing and development of equipment performance specifications, where appropriate. This phase began in 1985 and was essentially completed in 1988 with continuing studies regarding on-board computers and refinement of some of the other technologies.

Phase III is the CRESCENT Demonstration, which will test the integration of the technologies and institutional aspects in a real world environment.

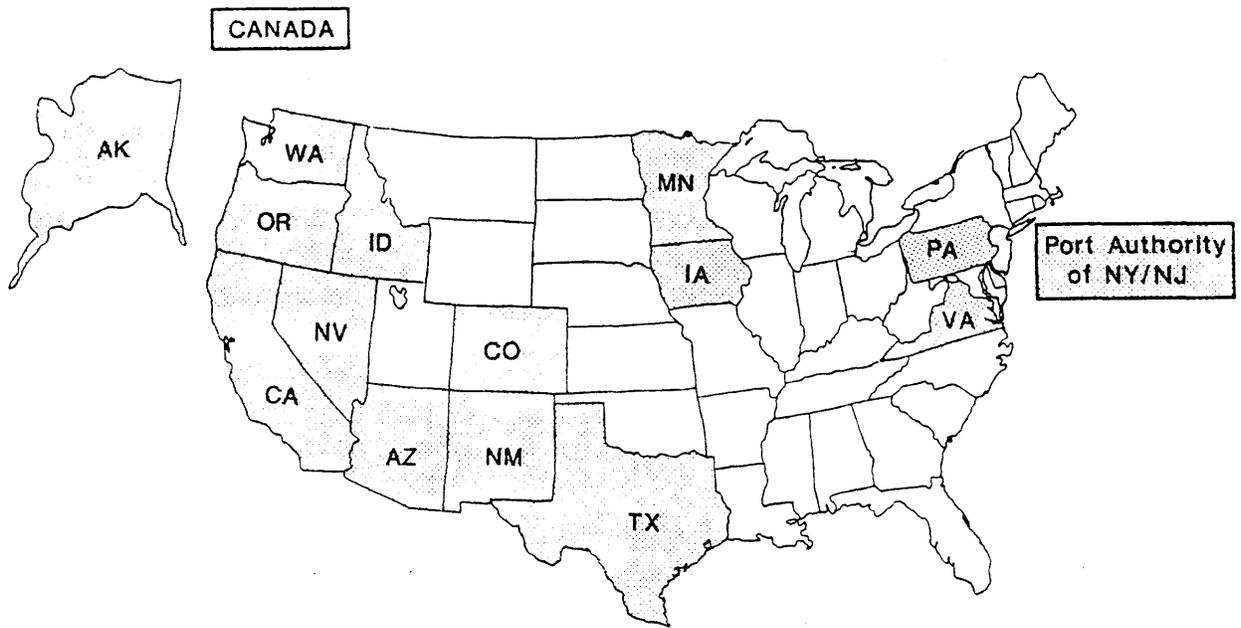


Figure 1. HELP PROGRAM PARTICIPANTS

## The CRESCENT Demonstration

The demonstration project will attempt to provide a sufficient number of vehicle monitoring locations, as well as participating vehicles, to test an integrated system concept in a real world environment. Detailed planning for the demonstration is being handled by the CRESCENT Implementation Group comprised of the affected state government agencies and participating trucking interests. A map of the demonstration states, routes and site locations are shown in Figure 2. The following is a brief overview and status:

- The planned demonstration corridor is I-5 and I-10 from Washington to Texas with I-10 and I-20 links in Texas.
- Approximately twenty eight equipped sites are anticipated to be included in the demonstration. A minimum of 5,000 trucks are expected to be equipped with transponders. Not all applications will be tested at each site.
- The current schedule calls for all equipment and systems to be in place in early 1990. The actual CRESCENT Demonstration would then run for one year. An evaluation will be undertaken throughout the demonstration, and a report is expected to be completed within six months upon completion of the demonstration phase.
- The project is intending to test as many applications of the HELP technologies as is possible given the budget limitations. The final report will document the results of the demonstration, the extent to which each of the four HELP goals was achieved, and possible national and international implications of the project.

## Applications

Equally important as the functioning of the technology in an operating environment is the testing of institutional arrangements within and between states which will allow trucks operational and administrative opportunities beyond what is currently possible. Indeed many participants in the HELP program view the institutional issues to be far more challenging and, potentially, more rewarding than advances in the use of these technologies. However, it is obvious that the operational efficiency and reliability of the hardware is a complement to the institutional issues. The success or failure of one could alter the significant potential of the entire concept. Therefore, a series of applications has been identified as illustrative of the institutional issues to be confronted. These applications are summarized as data collection, weight enforcement, and automatic clearance. Figure 3 provides a matrix view of the applications and the individual site locations within each of the participating states.

## Evaluation

The goals and objective previously cited were carefully defined so as to facilitate the evaluation of the HELP program as reflected in the CRESCENT Demonstration Project. Internal committees were formed and comprised of state agency and industry representatives. A committee was assigned to each program goals and corresponding objectives and charged with devising a methodological framework for evaluating the degree to which the demonstration project satisfied their assigned goal and objectives. In some cases this may involve a "before and after" approach, others a detailed performance critique based on measurements of accuracy and reliability, for example, while in other cases it may be an assessment of how well various agencies worked together in accepting an alternative means of achieving their particular mission (i.e. transparent borders).



Figure 2. CRESCENT DEMONSTRATION PROJECT PARTICIPANTS AND ROUTE

APPLICATIONS	WASHINGTON		OREGON							CALIFORNIA										ARIZONA					NEW MEX										
	BOWHILL	EVERETT	SEA-TAC	CHEHALIS	KELSO	VANCOUVER	1-205	WDBRN POE	WDBRN	JEFF NB	JEFF SB	ASH NB	ASH POE	ASH SB	MT SHASTA	REDDING	LODI	SNT NELLA	BKRSFLD	WILK RDGE	NEWHALL	BANNING	INDIO	EIRBG POE	EIRBG WB	TONOPAI	S. PHOENIX	MARANA	BENSON	SN SMN POE	SN SMN EB	LRDSBRG	BERINO		
DATE COLLECTION																																			
STATE DATE COLLECTION																																			
WEIGHT ENFORCEMENT																																			
WT. ENF. USING SWIM																																			
FIXED SITE WT. SCREENING																																			
AUTO CLEARANCE																																			
REGISTRATION																																			
WEIGHT/LENGTH																																			
MILEAGE																																			
SAFETY																																			
PERMITS																																			

 Recommended  
 Audit Purposes

Figure 3. CRESCENT DEMONSTRATION PROJECT APPLICATION/SITE MATRIX

An overall evaluation framework will be created which will encompass the results of each committee assignment and provide for integration into a final determination as to the viability of individual technologies, institutional issues and the like.

### Conclusion

The HELP Program and CRESCENT Demonstration represents a regional application of an integrated vehicle highway system (IVHS) employing emerging technologies to enhance efficiency and economy in both public and private sectors. This initiative is unique in many respects and on the leading wave of technological and institutional innovation in the enhancement of our highway system. Many spinoffs have surfaced during the life of this project including greater appreciation and mutual understanding of the needs and concerns of industry groups and government agencies represented. These attributes are only a beginning of what may, in the long run, be more significant in overall productive gains than one may have envisioned originally.



# **WORKSHOP 1 – VEHICLE AND INFRASTRUCTURE COMPATIBILITY**

Chairman: J.T. Christison, Alberta Research Council

## **Presentations**

1. **Relevance of HDM3 Road User Cost Model to Canadian Heavy Vehicles**  
P. Bein, J. Cox, M. Clark, N.D. Lea International
2. **Some Evidence of the Trade-Off Between Truck Operating Costs and Pavement Damage Costs**  
B. Hutchinson, University of Waterloo

## **OPEN DISCUSSION**

