

Automated Vehicle Occupancy Monitoring Systems for HOV / HOT Facilities

EXECUTIVE SUMMARY



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Police and High Occupancy Vehicle (HOV) facility operators have long called for an effective system of counting vehicle occupants on the road, to allow more cost-efficient, targeted and reliable HOV lane management. This research study builds on previous work to lay out a new way of addressing this problem.

Research to date has focused on the use of photographic-based systems to record vehicle occupancy from outside the moving vehicle. Such systems have shown some promise, but suffer from inherent flaws in dealing with tinted windows, different vehicle types and passenger seating arrangements, varying weather and light conditions, and high-volume high-speed operation, and as a consequence appear unlikely to be able to be relied upon as a fully automated HOV monitoring system.

This study focuses on recent advances that indicate the potential for the development of an *in-vehicle* system for automatically counting the number of vehicle occupants and making that information available to an external recording system. This could form the basis of an automated, comprehensive HOV facility monitoring program.

A variety of in-vehicle systems to count and record vehicle occupancy are available “off the shelf” and a technically feasible pilot project could be implemented in the near term. Front passenger seat occupancy is currently being monitored for air bag safety reasons (such systems are mandatory in 100% of new vehicles sold in the U.S. from the 2006 model year onwards) and “smart” windshield-mounted transponders with roadside readers are also in use for electronic toll highways.

An effective Occupancy Monitoring System (OMS) would allow the tracking and citation of 100% of HOV facility violators (including freeway *and* arterial HOV lanes, plus carpool lots and other HOV facilities). It would be invaluable in identifying HOVs in a High Occupancy Toll (HOT) lane, and would allow HOT lane operation in a non-barrier-separated environment.

Wideranging consultation with HOV practitioners and proponents revealed some enthusiasm for the prospect of a reliable automated HOV monitoring system, but highlighted some areas of major concern, particularly:

- Public / political perceptions regarding personal privacy
- The difficulties associated with making the necessary legal / legislative changes
- Practical issues of auto industry rollout
- Cost and economics

The Business Case for an automated OMS compares the cost of rolling out the system (in-vehicle components, roadside equipment, and back office / administrative costs) against the benefits (reduced policing cost, more effective facility monitoring capabilities, and substantially increased fine revenues). Definitive figures cannot be attached to the costs and benefits at this stage. Indications are that the capital cost of a full-scale rollout on all North American HOV facilities would be substantially greater than the annual investment currently made in police work and lane monitoring, although the potential for a quantum increase in fine revenue from HOV lane violators may even the equation somewhat.

As violations (and fine revenues) decrease over time with an effective OMS, the value of the system would accrue mainly from being able to maintain the operational integrity of the lane and engender public support for HOV network expansion. This may be particularly valuable to the arterial HOV area, which suffers today from lack of public support due primarily to apparent inability to manage and control usage.

Over and above the HOV and HOT lane applications, an automated OMS offers the potential to contribute “added value” in numerous areas of urban transportation:

- Managed Lanes, Value Pricing, and Congestion Pricing
- Interoperability with “Standard” tolling
- Safety / Seat Belt Use
- General HOV Monitoring (off HOV lanes)
- Data Collection
- Vehicle emissions
- Vehicle Identification
- Vehicle / Operating Diagnostics
- Vehicle Safety Systems
- Emergency Systems
- Passenger security systems
- Transit Service
- Preferential Parking
- Carpool Incentives
- Insurance
- Marketing
- Use of HOV Facilities by Non-HOVs

To progress the OMS opportunity, further work needs to be done in the Technical, Social-Political, and Commercial spheres. It is important to tackle the problems in the latter two areas, since the technical aspects of the problem are well advanced but further work in that area will be fruitless unless the critical issues of roll-out, public perception, political / legal support, cost, and auto industry commercial requirements are resolved. It is imperative that further work involves both government and the auto industry. Broadly speaking, actions are required in all three areas:

Technical Action Plan

- develop a real, practical, working prototype of an in-vehicle OMS
- apply a pilot project in a HOT lane environment as well as in a non-separated HOV lane

Social-Political Action Plan

- carry out market research to understand public / user perspectives
- develop appropriate legislation to support the use of an automated OMS
- expand on the Business Case and address financing issues

Commercial Action Plan

- consult with the auto industry to develop an implementation strategy