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Interoperability Issues on Managed Lanes Facilities

Bringing a managed lanes facility to completion is a complex process of planning, design, and daily operations. Typical on-going operations include management, enforcement, incident detection, revenue collection, and more. Often, a managed lanes facility is cross-cutting, not only from the multiple types of ongoing operations, but also because it can involve multiple agencies and vehicle user groups.

These types of interactions all point to a level of interoperability heretofore unseen for most roadways. As a definition, interoperability can best be expressed as “the ability of a system to use the parts, information or equipment of another system.” This new level of interoperability raises several questions, such as:

- What are the major areas of interoperability within a managed lane facility?
- What is the scope of each area?
- What are the critical issues associated with each area?

What We Did . . .

There were three steps in the research approach to this task. The first step was the conduct of the literature review. The objective of the literature review was to identify the major areas of concern with regard to interoperability. In addition, the literature formed the basis for developing detailed questions for step two of the task.

Step two of the research developed a survey, based on the knowledge obtained from the literature. The goal of the survey was to use the knowledge of the profession to identify not only the scope of each area of concern but also its relative importance. The survey was developed for ease-of-use, using an online format to enable researchers to capture input from a large body of potential respondents.

Step three was the culmination of the project, where the results from both the literature and the survey were used to develop the final

recommendations for addressing interoperability concerns within the managed lanes manual. In addition, the goal of this step of the task was to produce draft text for each of those sections.

What We Found . . .

While there were a number of pieces of useful information that resulted from the in-depth review of literature, there was one key concept that quickly became apparent – the notion of multiple levels of interoperability. The concept of multiple levels was somewhat opposite the initial thinking that interoperability was a global concept that existed across entire systems. Instead, the literature gave credibility to three levels of interoperability, namely:

- agency,
- facility, and
- equipment.

These three levels, illustrated in Figure 1, can essentially be used to provide more

structure and definition to the identified interactions.

By defining the levels of interoperability, the focus of the interactions at that level becomes more clear. As an example, agency level interactions are typically going to consist of long-term planning or design coordination, as well as broad-scale agreements for creating similar policies and procedures for operating managed lane facilities. In sharp contrast to that high-level planning and interaction, coordination at the equipment level is meant to ensure that data elements from one system can be transmitted, received, and understood by another system, irregardless of their eventual use in both systems.

In the middle of the two endpoints are the facility level interactions, which typically would occur in areas such as geometric design, traffic control devices, enforcement, and more.

The results of the literature review provided a solid basis for understanding the broad range of interoperability concerns as well as providing researchers with enough information to construct an initial matrix of areas of interoperability concerns. However, researchers felt that more in-depth knowledge could be obtained from a survey of the profession, where the depth of these interactions could be explored to a greater degree than was present in the literature.

A 24-question survey was constructed and put online at the managed lanes website. Notification of the survey was sent out via newsletters, and email listservs to an estimated audience of more than 5,300 professionals in the transportation industry. It should however be recognized that only a small percentage of the target audience has experience with

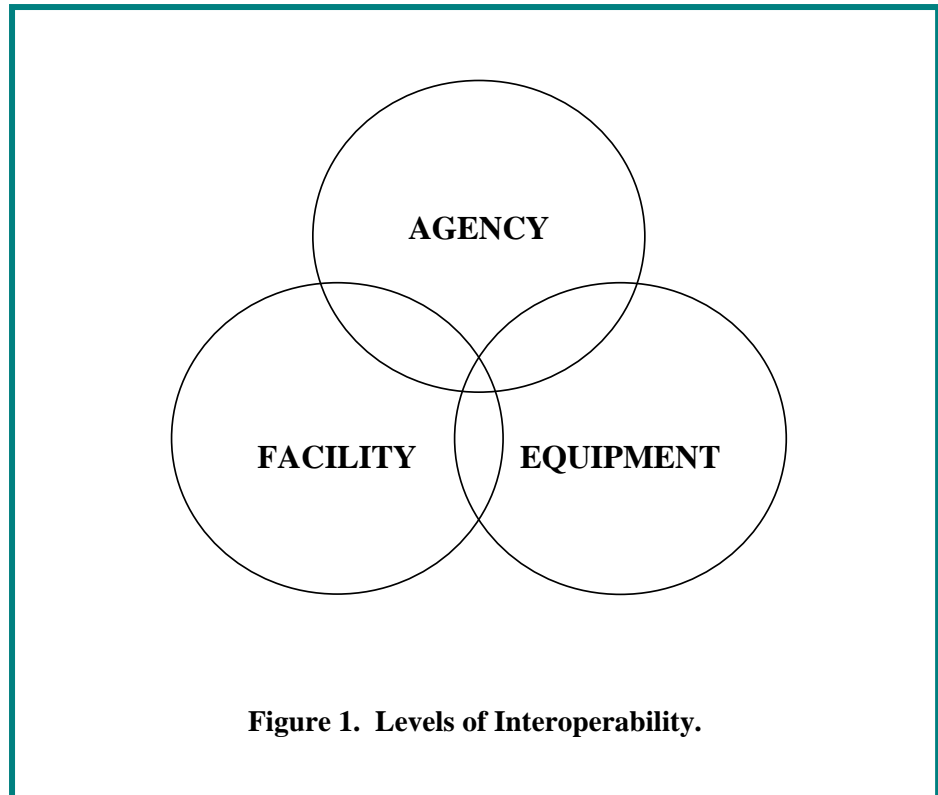


Figure 1. Levels of Interoperability.

managed lanes facilities and that a significant response rate was not anticipated. Survey results have been recorded from approximately 0.5% of the target audience.

The most significant question of the on-line survey explored the participants' thoughts on the relative importance of each area of interaction, from "Most Important" to "Least Important". In essence, this was a modification of the literature review matrix by allowing five levels of criticality to be assigned to each area. A weighted average technique was used to determine the critical levels associated with each area. The results are shown in Table 1.

In Table 1, the checkmark (✓) represents the most important or critical interactions. An obvious example to check as a sounding board for validity in the results is geometric design. The results of the survey indicate that participants related that geometric design was most important to coordinate at a facility level. This makes sense, since managed lanes have to

interact with adjacent facilities, through the use of ramps, access lanes, and other geometric features that can only be designed and merged on a per-facility basis. Since all geometric design is developed from national standards, there is no critical need to coordinate across agency levels.

The plus sign (+) in Table 1 represents an important area of interoperability. Feedback from the survey indicates that while these areas are important to consider, the failure to do so will not result in a breakdown of the facilities in question, although there may be inefficiencies in operation.

Finally, the asterisk sign (*) represents those interactions which should be considered in the future. While they are not critically important to the overall design, construction, and operation of the managed lanes, their eventual coordination can lead to increased effectiveness and a better transportation system for the motorists.

	Agency	Facility	Equipment
Geometric Design		✓	
Operations		✓	+
Enforcement	*	*	*
Communications	✓		*
Traffic Control Devices		✓	*
Planning	✓		
Incident Management	+	+	*
Legislation	✓		
Evaluation	+	+	
Surveillance & Monitoring		+	✓
Traveler Information Systems	*	+	*
Maintenance			
Agency Staffing & Training	+		

Table 1. Refined Matrix of Interoperability Concerns From On-Line Survey.

The Researchers Recommend . . .

The researchers recommend that interoperability issues be addressed within the managed lanes handbook. In particular, text pertaining to interoperability issues should be part of the following sections:

- planning,
- geometric design,
- traffic control devices,
- operations,
- incident management,
- surveillance and monitoring, and
- communications.

In the above listing, although it did not ‘make the cut’ as an important issue, communications has been added. Communications is a critical component of both surveillance and monitoring and traffic control devices at the equipment level and any discussion of interoperability in the handbook would be remiss in neglecting this important facet.

For More Details . . .

Related Report:

Report 4160-18, *Interoperability Issues on Managed Lanes Facilities*.

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