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Technical Summary

ITS Architecture Requirements and Features Needed to Provide for Safety-Related ITS User Services

DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

TECHNICAL SUMMARY

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Task Objective

The Intelligent Transportation System (ITS) Architecture is based on DOT requirements to provide user services in areas such as mass transit, commercial vehicle operations, traffic management, and personal vehicles, among others. The objective of this task was to assess the extent to which the ITS Architecture supports or is compatible with safety-related ITS user services of interest to the National Highway Traffic Safety Administration (NHTSA), particularly those having significant in-vehicle control and warning functionality. The task was structured to permit feedback of NHTSA needs and concerns to the architecture development teams during the process of ITS Architecture development.

Background

The ITS Architecture defines the various functions, the physical entities which execute these functions, and the interfaces and information flows between them necessary to implement a set of 29 user services defined by DOT. The architecture is intended to support national and regional interoperability including the interoperability of products performing the various ITS services. Of the 29 user services, nine were identified by NHTSA/OCAR as having important in-vehicle safety-related functions to be addressed in this assessment. These were: driver advisory, emergency notification and personal security, emergency vehicle management, longitudinal collision avoidance, lateral collision avoidance, intersection collision avoidance, vision enhancement for collision avoidance, safety readiness, and pre-crash restraint deployment.

Task **Approach**

The overall approach to performing this analysis was to use the available ITS Architecture documentation as inputs to a system design process. Using the various logical and physical elements extracted from the architecture, efforts were made to define systems to correspond to each of the nine targeted user services. The resulting systems were then assessed for factors such as: Completeness in satisfying the relevant ITS functional requirements; Consistency in nomenclature and data flows; Compatibility and integrability with in-vehicle warning and control systems; Technical errors such as duplicated or omitted elements, ambiguous or erroneous definitions and specifications; Capability to support an evolutionary deployment strategy; and adequacy of the interfaces between in-vehicle systems and other ITS Architecture elements.

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Key Study Results

This study found no major issues in the ITS Architecture that would Iimit or adversely impact the efforts of NHTSA to facilitate the deployment of future in-vehicle safety-related systems. To a large extent, this can be attributed to the fact that the ITS Architecture does not address in-vehicle safety systems in detail-actual deployment and design issues were considered beyond the scope of the architecture. It also assumes that these systems fall into the category of higher risk/later deployment, with most of the cost being borne by the private sector.

The study did, however, identify several technical concerns and issues that were brought to the attention of NHTSA and the ITS Architecture Team during the course of the effort. While several areas of concern were addressed by the Architecture Team during the course of the study, other issues (documented in the final report) remain open.

Potential Application of Study Results

The most significant of the concerns identified within the study meriting attention by NHTSA and associated recommendations are summarized below.

- Lack of Detail in Definition of In-Vehicle Control Services. The ITS Architecture focuses on user services that involve interfaces external to the vehicle. While this concentration is appropriate given the desire to concentrate on communications and performance standards involving interfaces exterior to vehicles, there are significant concerns relevant to in-vehicle real-time control systems that merit NHTSA attention. While potentially out-of-scope for the ITS Architecture, a more detailed NHTSA examination of performance issues relevant to these in-vehicle control functions, in the context of the ITS Architecture, appears warranted.
- Lack of Consideration for Human Interface Requirements. The ITS Architecture does not appear to address or to describe the needs of the (human) driver interface. The design of actual interfaces is beyond the scope of the architecture, but its features will shape possible implementations. Further examination concerning the impact of the architecture on human interfaces appears warranted.
- Inaccessibility of the Architecture Documentation. While not a major issue affecting safety-related services, the difficulty in using the documentation may inhibit the development of ITS Architecture compatible safety-related systems. If NHTSA desires to promote the evolution of the safety-related user services of the architecture, then NHTSA should consider approaches to obtaining more accessible architecture documentation for use by developers-either within the context of the ITS Architecture or as a separate activity.
- Vulnerability of Wireless Interfaces. Due to the openness of wireless communications, there exists a risk in performance from interference from other systems or deliberate sabotage. Both vehicle to vehicle and vehicle to roadside communications may be degraded or "spoofed" causing potentially dangerous situations. As with many other issues, good design practices not specified by the architecture can alleviate this risk, but the architecture does not address or note this issue as an important consideration. Additional examination by NHTSA appears warranted but may effectively translate to monitoring of the ITS implementation and standardization process.