

# ITS Archived Data User Service (ADUS) Safety Applications

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UT-BATTELLE

The Federal Highway Administration (FHWA) is currently sponsoring projects aimed at determining how data collected by the deployed Intelligent Transportation Systems (ITS) infrastructure can be used to improve safety on the nation's roadways. These research and development efforts include assessing the potential usage of ITS technologies to support innovative real-time ITS safety measures, developing "Safety Level" analysis methodologies that can quantify the roadway/facility hazardous conditions in real-time, and developing Archived Data User Service (ADUS) elements for safety oriented applications. The main objective of this project, which is part of the last group, was to provide to FHWA an overall evaluation of the progress being made on the development of the ITS ADUS standards, as well as to report on ITS data archiving-related projects and their impacts on safety applications.

## Methodology

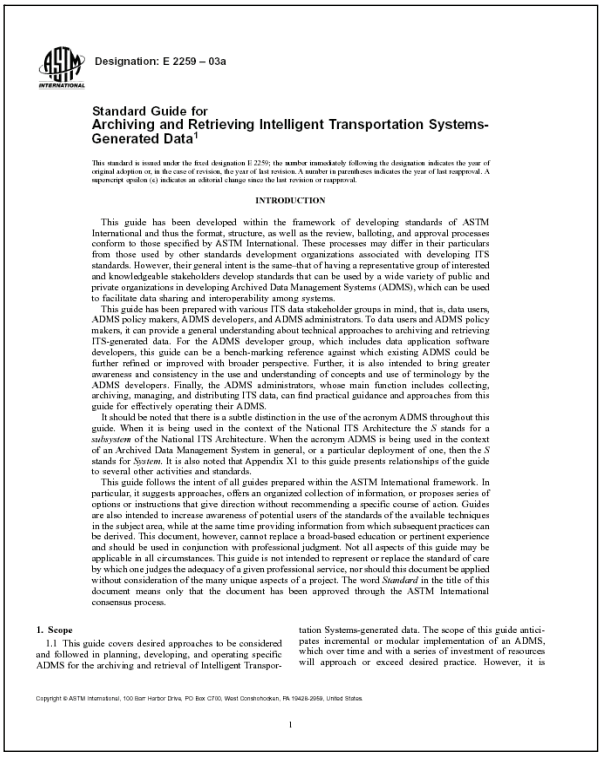
In an attempt to understand how evolving standards and guidelines may potentially affect current and future safety applications, this research reviewed the current state-of-the-art safety methodologies, focusing on the type of data required to develop such applications.

In general, these studies have as an objective, the real-time assessment of the likelihood of a crash occurring on a given segment of a freeway. Their methodologies take as input, real-time traffic information collected through roadside sensors, as well as other types of information. They produce traffic-related hazardous condition assessments, and attempt to reduce their impact by, for example, changing the speed limit on that segment of roadway. However, the development and testing of these applications rely on archived data, particularly traffic condition information, crash data, weather information, and roadway geometric characteristics. Therefore, the applications reviewed in the course of this research provide guidelines on what type of data, and at which spatial and temporal resolution, is needed to develop real-time safety models and applications. In the most demanding case, that data needs to be archived with a resolution of at least 20 seconds, for at least 30 minutes previous to a crash occurrence, not only for the day in which the crash occurs, but also for the same day of the week when no incident occurs, and for sensors upstream and downstream of the crash site.

## Standards Development

The National ITS Architecture provides general guidelines regarding Archived

Data and other user services. The implementation of these services, however, requires normative procedures and specific guiding principles to assure compatibility and interoperability, which are usually achieved through the use of standards. In the case of ADUS, the development of the standards was assigned to the ASTM ADUS Subcommittee (ASTM E17.54) under the ASTM Committee on Vehicle - Pavement Systems (ASTM E17). As of July 2005, the ADUS Subcommittee has published one guideline –*the Standard Guide for Archiving and Retrieving Intelligent Transportation System-Generated Data* (ASTM E2259-03a)– and is working on two other standards –the *Standard Practice for Metadata to Support Archived Data Management Systems* and the *Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data*.



Designation: E 2259 – 03a

**Standard Guide for Archiving and Retrieving Intelligent Transportation Systems-Generated Data**[1]

This standard is issued under the fixed designation E 2259; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

**INTRODUCTION**

This guide has been developed within the framework of developing standards of ASTM International and thus the format, structure, as well as the review, balloting, and approval processes conform to those specified by ASTM International. These processes may differ in their particulars from those used by other standards development organizations associated with developing ITS standards. However, their general intent is the same–that of having a representative group of interested and knowledgeable stakeholders develop standards that can be used by a wide variety of public and private organizations in developing Archived Data Management Systems (ADMS), which can be used to facilitate data sharing and interoperability among systems.

This guide has been prepared with various ITS data stakeholder groups in mind, that is, data users, ADMS policy makers, ADMS developers, and ADMS administrators. To data users and ADMS policy makers, it can provide a general understanding about technical approaches to archiving and retrieving ITS-generated data. For the ADMS developer group, which includes data application software developers, this guide can be a bench-marking reference against which existing ADMS could be further refined or improved with broader perspective. Further, it is also intended to bring greater awareness and consistency in the use and understanding of concepts and use of terminology by the ADMS developers. Finally, the ADMS administrators, whose main function includes collecting, archiving, managing, and distributing ITS data, can find practical guidance and approaches from this guide for effectively operating their ADMS.

It should be noted that there is a subtle distinction in the use of the acronym ADMS throughout this guide. When it is being used in the context of the National ITS Architecture the *S* stands for a *subsystem* of the National ITS Architecture. When the acronym ADMS is being used in the context of an Archived Data Management System in general, or a particular deployment of one, then the *S* stands for *System*. It is also noted that Appendix X1 to this guide presents relationships of the guide to several other activities and standards.

This guide follows the intent of all guides prepared within the ASTM International framework. In particular, it suggests approaches, offers an organized collection of information, or proposes series of options or instructions that give direction without recommending a specific course of action. Guides are also intended to increase awareness of potential users of the standards of the available techniques in the subject area, while at the same time providing information from which subsequent practices can be derived. This document, however, cannot replace a broad-based education or pertinent experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This guide is not intended to represent or replace the standard of care by which one judges the adequacy of a given professional service, nor should this document be applied without consideration of the many unique aspects of a project. The word *Standard* in the title of this document means only that the document has been approved through the ASTM International consensus process.

**1. Scope**

1.1 This guide covers desired approaches to be considered and followed in planning, developing, and operating specific ADMS for the archiving and retrieval of Intelligent Transportation Systems-generated data. The scope of this guide anticipates incremental or modular implementation of an ADMS, which over time and with a series of investment of resources will approach or exceed desired practice. However, it is

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## Recommendations

Based of the lessons learned from the review of state-of-the art safety applications, and taking into account the current status of the ADUS standards, particularly the traffic monitoring standard, ORNL made several recommendations aimed at making this standard compatible with the development of future safety methodologies and applications. Those recommendations include:

- *Archive data at the finest possible resolution.* Traffic monitoring data should to be archived at the finest granularity provided by the sensors to make possible the calculation of the variability, and averages, of traffic parameters used as crash precursors during time intervals centered on the time of the crash. This fine resolution also permits in some cases (e.g., freeways) to determine the time of crash through the use of traffic flow theory methodologies.
- *Archive raw sensor data for at least a minimum period of time.* The raw sensor data should be archived for a minimal time allowing the collection of statistically significant safety data information. The development of safety applications requires the knowledge of traffic conditions at the location of a crash not only around the time of its occurrence, but also on the same day of the week, and at the same time of day when there were no accidents at that location. This requires a minimum archiving time that could extend for at least several months.
- *Archive spatial distribution of traffic information.* As in the case of temporal distribution of the traffic information, its spatial distribution also plays a key role in the development of safety applications, especially those geared towards real-time hazardous condition identification. Spatial distribution of the traffic information along the direction of travel allows the determination of this space-related variability of traffic parameters (e.g., speed differentials between consecutive detector stations) which are used by many safety applications as crash predictors.
- *Add previsions to archive new traffic parameters.* The standards should be able to archive new traffic parameters, such as travel time generated from pseudo probe-vehicles. The latest development of real-time safety applications was only possible due to the recent availability of high resolution (temporally and spatially) traffic parameters such as speed, volume, and density. New technologies (e.g., license-plate readers, new generation of inductive detectors, and the US DOT Vehicle-Infrastructure Integration initiative, VII) are being, or will be, deployed that supply other types of traffic information (e.g., travel time). In the past, these data were either not available or not very accurate. This type of information, once it becomes readily available, would play a very important role in the development of new safety applications.

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