

## Interim Guidance on Conformity with the National ITS Architecture and Standards

### **INFORMATION: Interim Guidance on Conformity with the National ITS Architecture and Standards**

**October 2, 1998**

Federal Highway Administrator  
Federal Transit Administrator

HVH-1

FHWA Division Administrators  
FTA Regional Administrators  
FHWA\OMC State Directors

Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21) requires that Intelligent Transportation Systems (ITS) projects using funds from the Highway Trust Fund (including the Mass Transit Account) conform to the National ITS Architecture and standards. To begin the process of implementing this legislative requirement, the U.S. Department of Transportation (DOT) has developed the attached Interim Guidance (which includes sections on definitions, questions and answers, and statutory language).

The Interim Guidance reflects input received from Federal, State, local, and private sector transportation stakeholders in conjunction with national transportation association forums and

10 outreach sessions held across the Nation this spring. The intent of the Interim Guidance is to:

- o foster integration,
- o encourage the incorporation of ITS into the transportation planning process, and
- o focus on near-term ITS projects with the greatest potential for affecting regional integration.

The Interim Guidance is effective immediately, and is expected to be in effect for approximately 1 year. During this period, it is anticipated that a final policy will be developed through formal rulemaking. Therefore, Interim Guidance is the first step of a phased approach for implementing the TEA-21 conformity provision.

To support U.S. DOT field staff with implementation of the Interim Guidance, a Resource Guide has been prepared that includes the Interim Guidance, background material on the National ITS Architecture and Standards, benefits of using the National ITS Architecture, ITS and Commercial Vehicle Operations, and additional supplemental information. The Resource Guide will be distributed to members of your staff. In addition, the Department's ITS website serves as a helpful source of current/recently published information: [www.its.dot.gov](http://www.its.dot.gov).

### **Interim Guidance**

Consistent with the integration goals supported by the National ITS Architecture, as you begin the process of implementing the Interim Guidance, careful consideration of potential Y2K

(Year 2000) computer problems should be a crucial part of your efforts. As you know, intelligent, integrated transportation systems, like most computer-based systems, are susceptible to Y2K computer problems. Additional information on Y2K issues specific to ITS can be found at the following website: [www.fhwa.dot.gov/y2k](http://www.fhwa.dot.gov/y2k).

Implementation of the Interim Guidance is an important step toward regional ITS integration. Your comments and experiences in applying the Interim Guidance will help to shape the final policy. Your efforts in support of implementing this Interim Guidance are appreciated.

Signed by: Gordon J. Linton

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### **I. Introduction**

The Transportation Equity Act for the 21st Century (TEA-21) contains a provision requiring Intelligent Transportation System (ITS) projects implemented with funds from the Highway Trust Fund (including the Mass Transit Account) to conform to the national architecture [National ITS Architecture], applicable or provisional standards, and protocols. This document provides Interim Guidance for meeting this section of the law (Section 5206(e)-Conformity with National Architecture). Included with the Interim Guidance is a recommended approach to assist in meeting the legislative intent.

## II. Background and Goals

Section 5206 of the legislation aims to accelerate the integrated deployment of ITS in metropolitan and rural areas and in commercial vehicle operations through the use of the National ITS Architecture or locally developed regional architectures. The legislation also aims to facilitate interoperability through the use of standards and protocols. The National ITS Architecture is a tool to help agencies identify and plan for the many functions and information sharing opportunities which may be desired.

The greatest benefit from ITS accrues when ITS projects are planned and designed within a broad regional context that supports the operation and management of the transportation system. Additionally, the development and use of a regional ITS architecture to guide the integration of ITS projects and programs and enable information sharing among stakeholders within an area is good, sound practice. Due to the variety of ITS services and stakeholders, a "region" can be defined as metropolitan, statewide, multi-state, and, for some applications, national.

Implementation of this legislative provision will foster sound ITS systems planning and design practices to achieve the following goals:

- involve and unite a wide range of stakeholders in planning for ITS
- support flexibility in tailoring ITS deployment and operations to local requirements
- achieve integration of ITS systems and components
- enable information sharing among stakeholders
- facilitate future ITS expansion in a cost-effective way
- provide for future interoperability of key ITS services at a national level.

The achievement of these goals will ultimately be manifested in five ways:

1. The consideration of transportation system operations and management will be integrated into the transportation planning process and reflected in regional transportation goals and objectives.
2. ITS strategies that effectively address regional goals and objectives will be considered and prioritized within regional planning efforts to promote efficient system management and operation. The development of a regional ITS architecture will complement this framework.
3. ITS projects will provide for all applicable information sharing opportunities.
4. ITS projects will use open standards and protocols in support of interoperability.
5. The National ITS Architecture will be used as a tool in regional architecture development and project design, as appropriate.

## III. Applicability and Exceptions

The processes and practices being promoted in this document are sound practices for any project; however, listed below are the factors that affect whether or not this Interim Guidance applies:

### Type of Project

For the purposes of the Interim Guidance, projects are classified into four categories:

- (1) projects without ITS,
- (2) ITS projects that affect regional integration,
- (3) ITS/Commercial Vehicle Operations (CVO) projects, and
- (4) other ITS projects

Categories (2), (3), and (4) are all considered to be ITS projects. ITS projects include both stand-alone ITS projects and projects that contain ITS elements. (See Appendix A for definitions). The Interim Guidance applies to all ITS projects, with particular attention to those ITS projects that affect regional integration. In the case of category (3), ITS/CVO projects, the Interim Guidance references other procedures that have been developed to support Commercial Vehicle Information Systems and Networks (CVISN) deployment. The Interim Guidance does not apply to category (1), projects without ITS.

### Funding Source

All ITS projects receiving funding in whole or in part from the Highway Trust Fund are subject to the Interim Guidance.

## Stage of Development

As of the date of issuance of the Interim Guidance, all ITS projects that are under construction or projects for which final design is complete are exempt from this Interim Guidance.

## Legislative Exceptions

TEA-21 allows the Secretary to authorize exceptions to the conformity requirement for projects designed to achieve specific research objectives [as defined in Section 5206 (e) (2) (A)] and for projects to upgrade or expand an ITS in existence as of the date TEA-21 was enacted. Only those projects meeting three specific criteria are eligible for exception as an upgrade or expansion. These criteria [as defined in Section 5206 (e) (2) (B)] are that the project:

- (i) (would) not adversely affect the goals or purposes of this subtitle [The ITS Act of 1998];
- (ii) is carried out before the end of the useful life of such system; and
- (iii) is cost-effective as compared to alternatives that would meet the conformity requirement.

TEA-21 also includes a general exception on funds used for the operation or maintenance of an ITS in existence on the date TEA-21 was enacted. A copy of the TEA-21 ITS Act goals, purposes, and exception language is provided in Appendix C.

Meeting the intent of the TEA-21 conformity language (and this Interim Guidance) does not in any way require replacements or retrofitting of existing systems. Logically planned enhancements take existing (or legacy) systems into account. Because one of the purposes of the ITS Act is to improve regional cooperation and operations planning, ITS projects that affect regional integration would generally not satisfy exception criteria (i) above. If an exception is granted, documentation of the determination and rationale should be kept in the project files.

## IV. Interim Guidance

**For the period of this Interim Guidance, to ensure conformity with the National ITS Architecture and applicable standards, the following applies:**

### A. ITS Projects

1. Recipients of funds from the Highway Trust Fund for ITS projects that affect regional integration shall evaluate those projects for institutional and technical integration with transportation systems and services within the region, and consistency with the applicable regional ITS architecture or the National ITS Architecture. Based upon this evaluation of the project(s), Highway Trust Fund recipients shall take the appropriate actions to ensure that development of the project(s): (a) engages a wide range of stakeholders, (b) enables the appropriate electronic information sharing between shareholders, (c) facilitates future ITS expansion, and (d) considers the use of applicable ITS standards.
2. Recipients of funds from the Highway Trust Fund for ITS/CVO projects should follow the ITS/CVO Conformance Assurance Process Description to guide development of the project(s). These procedures are provided in the National ITS Architecture and Standards Resource Guide. Projects having a CVO technology component, but not meeting the definition of an ITS/CVO Project, should be treated as either ITS projects that affect regional integration or other ITS projects for the purposes of this Interim Guidance, and are subject to (IV.A.1) above or (IV.A.3) below.
3. Recipients of funds from the Highway Trust Fund for other ITS projects (not deemed to affect regional integration and not defined as ITS/CVO projects) should consider the same evaluation and actions described in (IV.A.1) above.

### B. ITS Considerations in Transportation Planning

Statewide and metropolitan planning activities should include consideration of the efficient management and operation of the transportation system. This should include the regional implementation and integration of ITS services and development of a regional ITS architecture(s), as appropriate. Regional consideration of ITS should address (a) the integration of ITS systems and components, (b) inclusion of a wide range of stakeholders, (c) flexibility in tailoring ITS deployment and operations to local needs, (d) electronic information sharing between stakeholders, and (e) future ITS expansion.

The Interim Guidance is anticipated to be in effect for approximately one year. The Interim Guidance is the first step in a phased approach for implementing the TEA-21 conformity provision. The final implementing policy may contain additional requirements.

## V. Recommended Approach

An approach for meeting the Interim Guidance (given in section IV) is suggested below.

## A. Immediate Actions

1. Agencies should cooperatively work with FHWA Division (Federal Aid and Office of Motor Carriers) and/or FTA Region staff and other local agencies, including the applicable Metropolitan Planning Organization (MPO) or planning agency, to categorize projects receiving funding through the Highway Trust Fund into four categories: (1) projects without ITS, (2) ITS projects that affect regional integration, (3) ITS/CVO projects, and (4) other ITS projects. These categories will help to determine the projects for which the Interim Guidance applies. As a minimum, this action applies to all projects included in transportation plans, Statewide Transportation Improvement Programs (STIPs), Transportation Improvement Programs (TIPs), Commercial Vehicle Safety Plans (CVSPs), projects in design, and other projects that are under consideration. If an overall categorization is not carried out, then determination should be made on a case by case basis by recipient agencies and federal field staff.
2. In consultation with FHWA Division and/or FTA Region field staff and the applicable MPO or planning agency, agencies should determine if a regional ITS architecture exists within which individual ITS projects and programs should fit (at a metropolitan, statewide, corridor, or multi-state level). The regional ITS architecture should be defined at the subsystem and information (architecture) flow level, showing the type of information exchanges planned between specific agencies.

## B. ITS Projects

The suggested approach for meeting the Interim Guidance on ITS Projects is provided below for the different categories of ITS projects. It is suggested that these steps be accomplished early in the planning and/or design process, as there will be greater ease in making modifications in the scoping and early design stages.

### For ITS Projects that Affect Regional Integration and Other ITS Projects :

**The suggested approach provided below (or an alternative approach that meets the intent of the Interim Guidance) should be applied to ITS projects that affect regional integration. The same approach is also recommended for other ITS projects, to a degree that is appropriate to the local situation, integration needs, and the type of project being implemented. The approach is tailored to accommodate areas both with and without a regional ITS architecture.**

#### **1A. For areas with a regional ITS architecture:**

**Scope the project to be consistent with the regional ITS architecture. If the project is under design, determine if that project fits within (is addressed by) the regional ITS architecture. If the project does not fit within the regional ITS architecture, consider whether the regional ITS architecture needs revision or whether the project scope/design needs modification.**

#### **1B. For areas without a regional ITS architecture:**

**Determine the applicable portions of the National ITS Architecture within which the project generally fits. As closely as possible, define the project using the subsystems and information (architecture) flows from the National ITS Architecture.**

### **2. Early in project design (and periodically throughout the design process), the following considerations should be addressed:**

**a. Include all relevant agencies/stakeholders (including agencies responsible for transportation operations and appropriate planning agencies) in the project design process and ensure their continuing participation.**

**b. Ensure that all applicable subsystems and information (architecture) flows from the regional ITS architecture [or from the National ITS Architecture, for areas without a regional ITS architecture] have been considered in the project design. If not, consider modifications. It may be helpful to include, in the design documentation, listings or illustrations of the subsystems and information flows that are being provided by the project, and any relevant supporting discussion that indicates why information flows suggested by the regional ITS architecture [or from step 1B, for areas without a regional ITS architecture] may not have been included.**

**c. Consider incorporating additional information flows, as appropriate to the situation, in anticipation of future needs.**

**d. Ensure that relevant technology and operating agreements are reached between the affected parties.**

**e. Ensure that future expansion and information sharing opportunities are kept open through the project design strategy.**

3. Identify any applicable standards and protocols that are appropriate for the project. Consider incorporating them into the project design and specifications. Wherever feasible, open systems should be considered in lieu of systems with proprietary interfaces. It may be helpful to clearly identify, in the design documentation and specifications, the standards which are being used in the project.

Even if a regional ITS architecture exists, the National ITS Architecture can be used as a valuable resource for many of the above steps (e.g., for consideration of additional information flows, item 2c).

#### For ITS/CVO Projects:

1. Review the ITS/CVO Architecture Utilization Policy and, at a minimum, the following two related documents: the ITS/CVO Conformance Assurance Process Description and the Interoperability Testing Strategy. All three documents are included in the National ITS Architecture and Standards Resource Guide.
2. Follow the recommendations in the ITS/CVO Conformance Assurance Process Description:
  - a. Assess commitment to the architecture and operational concepts,
  - b. Assess project and work plans, reviews, and top-level design,
  - c. Assess detailed design, and
  - d. Assess implemented systems through interoperability testing.

The Conformance Assurance Process Description defines evaluation criteria for ITS/CVO architectural conformity, and establishes a mechanism for fostering conformance in a deployment or implementation. Each ITS/CVO project should have a plan which includes an incremental checkpoint system for assessing architecture conformance. At each checkpoint, documents should be reviewed against architecture criteria and issues and potential interoperability problems identified. If problems are discovered, remedial actions should be developed and implemented to resolve the problems. Progress toward resolution should be tracked, and action assignments/resolutions should be documented to serve as a monitoring and lessons learned tool for future CVO deployments.

3. Use the standards recommended for ITS/CVO to facilitate interoperability.

#### C. ITS Considerations in Transportation Planning

The activities within the suggested approach given below are intended to encourage sound consideration of the operations and management of the transportation system, including the development of a regional ITS architecture and related efforts to advance ITS in a region.

It should be noted that what constitutes a region is locally determined based on the needs for sharing information and coordinating operational strategies. For a metropolitan region, it is recommended that the size of a region not be smaller than a metropolitan planning area boundary. For ITS/CVO projects, it is recommended that the size of the region not be smaller than a state, with consideration for multi-state, national, and international applications. The size of the region should promote integration of transportation systems by fostering the exchange of information on operating conditions across a number of agencies and jurisdictions. Likewise, the determination of the leadership or "champion" role in carrying out these planning activities is a local decision.

##### Engage a broad range of stakeholders

An open and inclusive process for engaging a broad range of transportation stakeholders in developing ITS activities is key to achieving integration and information sharing. As appropriate, stakeholders should include but are not limited to the following: state transportation agencies, transit providers, metropolitan planning organizations, local (city/county) transportation agencies, police departments, fire departments, emergency medical services, toll authorities, traveler information providers, the media, telecommunications providers, other private transportation providers, port authorities, airport authorities, commercial trucking associations, freight railroad associations, motor carrier regulatory or enforcement agencies, non-governmental organizations, and the general public.

##### Identify needs that can be addressed by ITS

The transportation problems and needs that can potentially be addressed through operations and management strategies should be identified. These needs should be developed in the context of the needs, goals, and objectives already developed as part of the applicable transportation planning process. Participants should discuss opportunities for using ITS applications as part of the overall mix of strategies to meet identified needs and goals.

##### Describe existing and planned ITS enhancements

A sound understanding of current and committed ITS projects, operational agreements, and information

sharing arrangements is needed before future plans for ITS development are discussed. Participants should (1) identify existing ITS components and integration and (2) then develop a list of planned ITS enhancements that will address identified needs and improve the operations and management of the transportation system. The existing situation and planned ITS enhancements should be described in terms of the physical system description and the extent of information sharing. Metropolitan ITS and CVISN Deployment Tracking Surveys and indicators provide a useful starting point and approach for describing existing and planned ITS enhancements.

#### Define a regional ITS architecture

Given the existing and planned ITS enhancements, identified needs, and using the National ITS Architecture as a tool, a regional ITS architecture can be developed to serve as a high-level template for ITS project development and design. The regional ITS architecture should include subsystems and information flows relevant to the area. The regional ITS architecture should be periodically revisited and updated to reflect ongoing discussions and improvements. An existing regional ITS architecture should be assessed to ensure that it provides an appropriate level of detail.

#### Define operating requirements

Implementation of the planned ITS enhancements and information sharing arrangements requires further definition of the operational agreements between the various agencies and jurisdictions. An operating concept should be established that identifies the general roles and responsibilities of the stakeholders in the development and day-to-day operation of the system. This includes establishing requirements or agreements on information sharing and traffic device control responsibilities and authority (e.g., deciding if back-up control capability is desired given a loss of power or failure condition). These decisions will be factored into the regional ITS architecture and will also flow-down through ITS projects as they are phased in. Because many ITS services and strategies involve communication and coordination, this step should not be overlooked.

#### Coordinate with planned improvements

As agencies begin to determine ITS projects that can be implemented in the near to mid-term time frame, potential opportunities should be explored for leveraging activities with planned capital projects such as facility reconstruction, capacity expansion, or new bus purchases. These projects are likely already contained in Transportation Improvement Programs (TIPs), Statewide Transportation Improvement Programs (STIPs), Commercial Vehicle Safety Plans (CVSPs), applicable transportation plans, or specific agency plans. An example of this coordination would be adding the ITS communications and surveillance infrastructure (or other components) at the same time as a reconstruction project, resulting in overall cost savings and minimized traffic disruption compared to adding the ITS infrastructure after the reconstruction project was completed.

#### Develop phasing schedule

The phasing of ITS projects and strategies into the regional transportation system and planning process will need to be considered. Phasing considerations include anticipated time frame for implementation, geographic context (both within and between jurisdictions), functional capabilities, and funding considerations. Geographic considerations involve decisions such as the initial and future system coverage area, which jurisdictions in the region will be upgraded first, which transit agencies in the region will participate in the electronic fare media project, etc. Functional considerations include deciding which basic functions of a system should be implemented first and which should be deferred. The phasing considerations and decisions made in the initial stages may be conceptual, with flexibility for changes and further definition during future project development and design.

#### Develop regional technology agreements

As potential ITS actions are advanced, it may become necessary for stakeholders to reach agreement on some technologies, standards, or deployment choices that have regional significance. This particularly applies to the near-term projects that have been identified. For example, regional choices on technologies or standards may be required for the telecommunications infrastructure, electronic toll tags, signal controllers and interfaces, electronic fare media, and specialized mobile radio systems. For ITS/CVO projects, public and private stakeholders need to reach agreement on hardware, software, operational, and programmatic requirements for interoperability to exist in multi-state and national systems. Standards should be identified to foster interoperability of systems and interchangeability of components. When identifying standards, agencies should consider the current status of ITS standards development activities and determine how and when these can best be incorporated into the designs of projects within the region.

#### Identify ITS projects for incorporation into transportation planning products

ITS projects utilizing funds from the Highway Trust Fund will be incorporated, as appropriate, into transportation planning and programming products (such as the transportation plan, the STIP, TIP, and the CVSP) and adopted by the metropolitan planning organization or other applicable planning agency. Ultimately, this can be best achieved when the consideration of ITS is consistent with the goals and objectives adopted

by regional transportation planning bodies and carried out in the context of the transportation planning process.

## **VI. Appendices**

**Appendices include:**

- A. Definitions**
- B. Questions and Answers**
- C. Applicable Legislation**

### **A. Definitions**

*For the purpose of explaining terms used in this Interim Guidance, the following definitions are provided:*

**Intelligent Transportation Systems (ITS) - As defined in TEA-21, the term "intelligent transportation system" means electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.**

**ITS Project - Any project that (in whole or in part) involves the application of ITS.**

**ITS Project that Affects Regional Integration - An ITS project that can serve as a catalyst in achieving regional ITS integration. Generally, those ITS projects with the potential to support electronic data sharing between transportation stakeholders, projects with substantial software design, projects involving major upgrades of central transportation management functions, and projects involving significant communications would be considered ITS projects that affect regional integration.**

**ITS/CVO Projects - A subset of ITS projects which: (1) complete any component/service incorporated in the Commercial Vehicle Information Systems and Networks (CVISN) Level 1 deployment, and/or (2) install the International Border Clearance Safety System (IBCSS).**

**Other ITS Projects - The remaining ITS projects that are not characterized as affecting regional integration or being an ITS/CVO project, as explained above.**

**CVISN - Commercial Vehicle Information Systems and Networks. A concept that includes the information systems and communications networks that support Commercial Vehicle Operations (CVO). CVISN includes information systems owned and operated by governments, carriers, and other stakeholders.**

**CVISN Architecture - The ITS/CVO information systems and networks portion of the National ITS Architecture. The CVISN Architecture documentation begins with the National ITS Architecture and adds more detail in some areas (e.g., the operational scenarios and Electronic Data Interchange (EDI) message requirements) to facilitate further development. Documentation is available on the World-Wide Web at <http://jhuapl.edu/program/transport/trans.htm> or contact the FHWA ITS/CVO Division Office at phone: 202-366-0950, fax: 202-366-7908.**

**CVISN Level 1 Deployment - The development and implementation of basic ITS/CVO information system elements in three capability areas (safety information exchange, credentials administration, and electronic screening) in conformance with the CVISN Architecture and Standards.**

**International Border Clearance Safety System (IBCSS) - An information system to identify impending border movements, access relevant safety and credentials information, and conduct clearance assessments on motor carriers, commercial motor vehicles, and drivers. The IBCSS is a portion of the International Border Clearance System, which provide the communications path between the commercial motor vehicle (CMV) and the border crossing in support of all border stakeholders, and an electronic border clearance assessment process for motor carriers, commercial motor vehicles, and drivers at North American land borders.**

**National ITS Architecture (also "national architecture") - As defined in TEA-21, the National ITS Architecture is the common framework for ITS interoperability that defines**

- (A) the functions associated with intelligent transportation system user services;**
- (B) the physical entities or subsystems within which the functions reside;**
- (C) the data interfaces and information flows between physical subsystems; and**
- (D) the communications requirements associated with the information flows.**

**Documentation is available from the U.S. DOT on the World-Wide Web at**

<http://www.its.dot.gov> or <http://www.odetics.com/itsarch/> or contact the ITS Joint Program Office at phone: 202-366-9536, fax: 202-366-3302. As of September 20, 1998, Version 2.0 is the official version of the National ITS Architecture.

**Regional ITS Architecture** - A regional framework for ITS project development and design, which could be specified at a metropolitan, statewide, multi-state, or interurban corridor level. A regional ITS architecture is tailored to address specific local needs and, for the purposes of this Interim Guidance, includes the subsystems, agencies, and information flows relevant to the area. The National ITS Architecture may serve as a tool in the development of a regional ITS architecture.

**ITS User Service** - A categorization of ITS that represents what the system will do from the perspective of the user. User services formed the basis for the National ITS Architecture development. As of July 1998, the National ITS Architecture consists of 30 user services. Additional user services are planned for incorporation during the next year or two.

**Standard** - As defined in TEA-21, the term "standard" means a document that is published by an accredited Standards Development Organization, and

(A) contains technical specifications or other precise criteria for intelligent transportation systems that are to be used consistently as rules, guidelines, or definitions of characteristics so as to ensure that materials, products, processes, and services are fit for their purposes; and

(B) may support the national architecture and promote

(i) the widespread use and adoption of intelligent transportation system technology as a component of the surface transportation systems of the United States; and

(ii) interoperability among intelligent transportation system technologies implemented throughout the States.

**Provisional Standard** - As defined in TEA-21, Section 5206 (c), a provisional standard is a standard that the Secretary may establish if the Secretary finds that the development or balloting of an ITS standard jeopardizes the timely achievement of the objectives identified in Section 5206 (a), after consultation with affected parties, and using, to the extent practicable, the work product of appropriate standards development organizations.

**Subsystem** - A physical entity within the National ITS Architecture or a regional ITS architecture within which the ITS functions reside. Subsystems are typically associated with one or more transportation agencies or stakeholders. Examples of subsystems from the National ITS Architecture include traffic management, transit management, fleet and freight management, toll administration, emergency management, information service provider, roadway, remote traveler support, and vehicle.

**Information (Architecture) Flow** - A representation of data that originates at one subsystem (or external system) and ends at another within the National ITS Architecture or a regional ITS architecture, depicting the information exchanges planned between specific agencies. The National ITS Architecture documentation refers to these information flows as physical architecture flows.

## **B. Questions and Answers**

### **Applicability and Scope**

#### **1. Q: Which federally funded projects does this Interim Guidance apply to?**

**A: Any ITS project receiving whole or partial funding from the Highway Trust Fund (including the Mass Transit Account) is subject to this Interim Guidance. The Highway Trust Fund includes a broad range of transportation projects and programs, including Federal Aid Highway Programs, Federal Transit Administration programs, and safety programs. Examples of subject programs include (but are not limited to):**

- o **National Highway System Program**
- o **Congestion Mitigation and Air Quality Improvement Program**
- o **Surface Transportation Program**
- o **Urbanized and Non-Urbanized Areas Formula Grants Programs**
- o **Transit Capital Investment Grants and Loans (Section 5309 funding)**
- o **Motor Carrier Safety Assistance Program Grants**
- o **Demonstration projects identified in TEA-21 (including High Priority Projects, and other earmarks under the ITS subtitle)**
- o **Federal Lands Highways Program**



- o Interstate Maintenance Program
- o Highway Bridge Program
- o Job Access and Reverse Commute Program
- o Rural Transportation Accessibility Programs
- o Elderly and Persons with Disabilities Program
- o Federal Aid Highway Safety Programs

**2. Q: Are any ITS projects excepted from the conformity requirement?**

**A: Yes. Section 5206(e) of TEA-21 excepts the following projects:**

- 1. Authorized projects designed to achieve specific research objectives outlined in the National ITS Program Plan or the Surface Transportation Research and Development Strategic Plan;**
- 2. The upgrade or expansion of an existing ITS, if the expansion won't adversely affect the goals of conformity, is carried out before the end of the system's useful life, and is cost-effective as compared to alternatives that would be consistent; and**
- 3. Projects to operate or maintain an existing ITS.**

**In addition, the Interim Guidance excepts projects already in construction and those that have completed the design phase. Note, however, that ITS projects that affect regional integration likely will not be excepted by Number 2 above, because to do so would adversely affect the goals of conformity.**

**3. Q: Does the Interim Guidance apply to ITS projects that do not receive funding from the Highway Trust Fund?**

**A: No. The Interim Guidance only applies to ITS projects that receive whole or partial funding from the Highway Trust Fund. However, the Interim Guidance and recommended approach to ITS projects and planning are considered sound practices for regional integration of ITS. Therefore, it is recommended that ITS projects not funded by the Highway Trust Fund also adhere to the Interim Guidance. Examples of projects which would not need to follow the Interim Guidance include projects funded entirely by state or local transportation agencies; projects funded by police, fire, or emergency medical services; and projects which are privately funded.**

**4. Q: Does the Interim Guidance apply to demonstration projects and other earmarks?**

**A: The Interim Guidance applies to all ITS projects with funding from the Highway Trust Fund, including demonstration projects (also referred to as "High Priority Projects"). The Interim Guidance also applies to CVO projects as indicated in the ITS/CVO Architecture Conformance Assurance Process. In addition, for ITS projects funded under section 5001(a) of TEA-21, refer to the Guidance for Congressionally-Designated ITS Projects (commonly referred to as "earmarked projects").**

**5. Q: How does the Interim Guidance differ from the Guidance for Congressionally-Designated ITS Projects?**

**A: The applicability differs in that Interim Guidance applies to all ITS projects funded in part or in whole by the Highway Trust Fund, whereas the guidance for congressionally-designated ITS projects (often known as "earmark" projects) applies only to projects being funded with ITS program category funds found under Section 5001(a) of TEA-21. The principles and intent of the Interim Guidance and the ITS earmark guidance are the same. However, since congressionally-designated projects are intended to serve as examples for meeting the conformity requirement, the ITS earmark guidance has slightly more detailed and specific documentation requirements. As an example, for one category of earmarked projects (regional deployments), states are being asked to commit to the development of a regional ITS architecture (and other regional ITS systems planning activities) as part of the partnership agreement. In addition, under the ITS earmark guidance, project designs must include specific documentation of architecture conformity, which will be reviewed by FHWA Division and/or FTA Region offices, as appropriate. This is in contrast to the Interim Guidance, which does not require specific documentation, but encourages agencies to incorporate conformity documentation into normal project and planning documentation.**

**6. Q: Which transit projects does the Interim Guidance apply to?**

**A: Any ITS project receiving whole or partial funding from the Highway Trust Fund, including the Mass Transit Account, is subject to the Interim Guidance. This is true for both transit and highway projects.**

**7. Q: Does the Interim Guidance apply to ITS applications that are part of a larger construction project?**

**A: Yes. The Interim Guidance applies to all ITS projects that receive Highway Trust Funds, even when the ITS application is part of a larger project. However, having an ITS component in a larger project does not subject the non-ITS portions of your project to the Interim Guidance; but, you can consider the Interim Guidance as a framework to look for sensible ways to enhance connectivity in your region. Looking at it another way, larger projects may provide an opportunity to include ITS elements that may not have originally been scoped, such as laying telecommunication cable during construction.**

**8. Q: Does the Interim Guidance apply to ITS projects outside metropolitan areas or in rural areas?**

**A: Yes, the Interim Guidance applies outside metropolitan areas and in rural areas. As stated in the Interim Guidance, ITS projects that affect regional integration must be assessed for integration opportunities. Furthermore, development of a statewide architecture which addresses rural and small urban ITS applications is encouraged. Regardless of whether your area is rural or metropolitan, the National ITS Architecture can be useful in the development of the regional architecture.**

**9. Q: The National ITS Architecture is quite extensive in scope and lays out a multitude of information sharing possibilities. Do I have to plan for all of these interfaces and information exchanges in order to meet the intent of the Interim Guidance?**

**A: No. It is unlikely that any one region would implement everything envisioned by the National ITS Architecture. Planning and project development should continue to focus on meeting local and/or regional needs. Some of the functionality and information exchanges in the National ITS Architecture will not apply to your situation (e.g., your region might not have any toll roads and thus the Toll Administration and Toll Collection Subsystems of the National ITS Architecture would not apply). Using the National ITS Architecture may help you identify opportunities you might not have otherwise considered in developing your regional ITS architecture and ITS projects. In all circumstances, however, the regional ITS architecture and individual ITS projects should be tailored to local needs and problems.**

**10. Q: Will National ITS Architecture conformity dictate the characteristics of the design of my ITS system?**

**A: No. The National ITS Architecture and ITS standards do not specify design; rather, they focus on ensuring interface compatibility and structured information exchange. The National ITS Architecture supports a variety of detailed designs and is flexible enough to support both distributed and centralized systems. The National ITS Architecture does not make technology decisions for you. For example, collection of traffic data can be performed with a variety of technologies, including loop detectors, video imaging, and vehicle probes. Nor are you required to implement interfaces identified in the National ITS Architecture. The Interim Guidance on National ITS Architecture conformity does, however, imply that information sharing opportunities between transportation stakeholders are explored to the extent possible and appropriate for your area.**

**11. Q: Does conformity with the National ITS Architecture ensure interoperability?**

**A: No. The vision of ITS integration is a seamless, interoperable transportation network. Because the National ITS Architecture does not specify the interfaces or the technologies to be used in transportation systems and services, conformity does not ensure interoperability. Only through interjurisdictional agreements and cooperation can interoperability be assured. The National ITS Architecture does provide a framework for determining the needs or desirability of interoperability, and for making the institutional and technological decisions that are the foundation of an interoperable network. Interoperability is furthered through the adoption and widespread use of ITS standards.**

**12. Q: Will U.S. DOT require interoperability?**

**A: Where federal funding supports technologies and interfaces considered critical for national interoperability, U.S. DOT expects to require interoperability, but only after the standards have matured to ensure their operational capability. As called for in TEA-21, U.S. DOT is currently developing a list of critical standards appropriate for ensuring interoperability.**

**13. Q: What is the distinction between the use of the terms "conformity" and "consistency?"**

**A: The TEA-21 language (Section 5206[e]) addressed by the Interim Guidance calls for ";conformity"; with the National ITS Architecture and Standards. U.S. DOT's incremental, phased approach to implementing this provision is better reflected by the use of the term "consistency" with the National ITS Architecture. For the purposes of the Interim Guidance, these terms are deemed synonymous.**

## **ITS Projects**

**14. Q: What are some examples of "ITS projects that affect regional integration" as defined in this Interim Guidance?**

**A: Generally, ITS projects that affect regional integration are those that can serve as catalysts in achieving ITS integration for a region. Examples of ITS projects that affect regional integration include the construction or functional expansion of a transportation management center, installation or expansion of the functional capability of a communications system, and the purchase of an AVL-equipped bus fleet. Another example is a multi-agency project which aims to integrate transportation systems (e.g., freeway-arterial system integration, traffic-transit integration).**

**15. Q: What do I do for ITS projects that do not affect regional integration?**

**A: The Interim Guidance is designed to focus attention on ITS projects that do affect regional integration, but all ITS projects (receiving Highway Trust Funds) should consider the intent and approach in the Interim Guidance as a way to ensure conformity with the National ITS Architecture and permit cost-effective future expansion should the need arise. Examples of ITS projects that do not affect regional integration are the installation of an isolated traffic signal system in a small, rural town; or the purchase of a limited set of replacement buses.**

**16. Q: How does the Interim Guidance apply to projects in the final stage of design?**

**A: Adherence to the Interim Guidance is not required for projects in the final stage of design as of the date of Interim Guidance issuance. However, it is good practice to review projects for anything that can be done at a reasonable cost to facilitate future integration. Projects in the final stage of design are not specifically excepted by the legislation, so the project's lead agency should work with the FHWA Division or FTA Region office to determine the appropriate course of action. Projects for which design has been completed or that are in construction as of the date this Guidance is issued do not need to revisit the design stage.**

**17. Q: How will existing (legacy) equipment with proprietary interfaces be addressed?**

**A: The Interim Guidance does not require replacement of legacy systems or equipment having proprietary interfaces. Rather, it is recommended that you plan with existing systems in mind and encourage future investments that would facilitate electronic data-sharing and the use of open interfaces, while minimizing the use of proprietary interfaces. Existing systems such as traffic signals, overhead messages, computer-aided dispatch for ambulances, or automatic vehicle location for buses are an important consideration in developing an ITS project and your regional ITS architecture. As new features and system upgrades are planned, the new designs should provide for open, non-proprietary interfaces identified in the National ITS Architecture and approved ITS standards as appropriate for your area and consistent with your regional ITS architecture.**

### **ITS Considerations within Transportation Planning**

**18. Q: Are ITS projects excepted from the metropolitan or statewide planning processes?**

**A: No. ITS projects should be developed using the same planning processes as other transportation projects, in accordance with metropolitan and statewide planning procedures specified in TEA-21 (sections 1203, 1204, 3004, and 3005). In addition, ITS may be considered as one strategy for addressing the new systems management and operation planning factor requirement in TEA-21.**

**19. Q: What are the benefits of integrating ITS into the planning process?**

**A: Statewide and metropolitan planning activities should consider a broad range of actions and investments aimed at improving the management and operation of the transportation system. ITS is a powerful tool for meeting the system operation and management needs of a region. Like any tool, it is most effective when it has broad support and is applied in the proper circumstances. Regional efforts aimed at identifying appropriate ITS strategies and investments should be advanced in the context of the goals and objectives adopted by the planning process. This will ensure that specific ITS deployment options will address regional transportation goals and objectives in the most effective possible manner. In addition, there is considerable overlap between the planning process and ITS systems planning. The integration of ITS and planning will ensure that these processes are carried out together in a consistent and efficient manner.**

**20. Q: Who should be the lead in developing a regional ITS architecture?**

**A: Identifying a lead agency is a local decision; development of a regional architecture can take place in whatever forum suits the area. You are encouraged to develop ITS activities within your existing**

planning processes. Making use of existing agency agreements and structures may help you to determine who should be involved and who may be best suited to take the lead role.

**21. Q: Who should be involved as ITS is considered within the planning process?**

**A: The range of stakeholder involvement is most appropriately addressed at the local level. A fundamental goal is to involve and unite a wide range of stakeholders to ensure consideration of the broadest range of integration opportunities. It is expected that the number of stakeholders included in any area will grow over time as ITS is incorporated into the regional transportation planning process and the range of ITS activities expands. As a starting point, agencies or other groups within a region that are typically involved in transportation planning or ITS development should be involved. The National ITS Architecture may help you identify stakeholders that are not normally included in the transportation planning process but who may be important to ITS systems planning (e.g., private sector information service providers; police, fire, and other emergency services; and private sector transportation service providers).**

**22. Q: What if certain stakeholders do not want to participate?**

**A: The intent of gathering a broad range of stakeholders is to ensure that the consideration and development of potential ITS actions and investments stems from a collaborative, inclusive effort. Good faith efforts should be made to include all stakeholders. Notwithstanding this, the process should begin with those agencies/parties willing to participate.**

**23. Q: What is a "region" as it relates to the development of a regional ITS architecture?**

**A: What constitutes a region is a local determination that should be based on the needs for sharing information and coordinating operational strategies in order to address transportation problems. In this context, a region is not constrained by political boundaries, and could be specified at a metropolitan, statewide, multi-state, or inter-urban corridor level. For a metropolitan region, it is recommended that the size of a region not be smaller than a metropolitan planning area boundary. For ITS/CVO projects, it is recommended that the size of the region not be smaller than a state, with consideration for multi-state, national, and international applications. The size of the region should promote integration of transportation systems by fostering the exchange of information on operating conditions across a number of agencies and jurisdictions.**

**24. Q: What is the relationship between the nine core components of the metropolitan ITS infrastructure and the National ITS Architecture?**

**A: The nine core components of the metropolitan ITS infrastructure (Freeway Management, Incident Management, Traffic Signal Control, Electronic Toll Collection, Transit Management, Electronic Fare Payment, Highway Rail Intersections, Emergency Management, and Regional Multimodal Traveler Information) represent an initial way of thinking about the potential types of ITS technologies that could be usefully linked in a metropolitan region. The National ITS Architecture provides the framework necessary for more detailed planning about how to structure the communications and information flows between and among the different subsystems that characterize a fully integrated regional ITS system.**

**25. Q: How does the Interim Guidance relate to the deployment and integration tracking of CVISN and metropolitan ITS infrastructure that have been ongoing in recent months in some regions?**

**A: The definitions of metropolitan ITS infrastructure and the framework used in the deployment tracking questionnaire provide excellent starting points for developing and collecting the information necessary for beginning work on a regional ITS architecture in your area. If a deployment tracking survey has already been filled out, it should be very helpful in documenting the existing level of ITS deployment (including information sharing arrangements), which is fundamental to future planning efforts. Further explanation of the metropolitan and CVISN deployment tracking is included in the Resource Guide.**

**26. Q: Can a regional ITS architecture, developed from an Early Deployment Plan, be used to demonstrate conformity with the National ITS Architecture?**

**A: Architectures developed under previous early deployment efforts may be considered for potential applicability to the Interim Guidance. Some early deployment studies that do not include architectures, or were not inclusive of a wide range of stakeholders, do not meet the intent and approach of the Interim Guidance. In such cases, additional steps may be necessary, such as identifying/determining information flows between regional architecture subsystems. Conversely, Early Deployment Plans that engaged a broad range of stakeholders and included a regional ITS architecture would likely meet the intent of the Interim Guidance.**

## Federal Role

**27. Q: What is the federal oversight role, specific to integrating ITS into the planning process?**

**A: The Interim Guidance does not change federal oversight of the transportation planning process. Within existing federal oversight roles and activities, FHWA and FTA staff are encouraged to explore opportunities with their constituents for integrating ITS into the transportation planning process. Such opportunities may become obvious during the development of plan updates to Unified Planning Work Programs, the STIP or TIP, or triennial certifications. These reviews should also consider whether a regional ITS architecture exists, defined at the subsystem and information (architecture) flow level. For commercial vehicle operations, ITS opportunities should be considered during updates of the Commercial Vehicle Safety Plan.**

**28. Q: How will the Interim Guidance affect the STIP/TIP development cycle?**

**A: The Interim Guidance is not intended to delay the development cycle (preparation, review, or approval) of a STIP or TIP. However, applying the Interim Guidance to the transportation planning process at the earliest practical convenience will aid in identifying and capitalizing on potential cost-saving and system-enhancing opportunities.**

**29. Q: What constitutes the federal oversight role at the project stage?**

**A: The Interim Guidance does not change the federal oversight role at the project stage. For those ITS projects with federal oversight, the appropriate federal office will ensure that the Interim Guidance is followed as part of the regular review process. For those projects with no federal oversight requirement, recipients are responsible for ensuring that the Interim Guidance is followed. Compliance with the Interim Guidance may be a discussion topic in process or triennial reviews.**

**30. Q: Are all ITS projects subject to federal oversight?**

**A: No. Refer to the appropriate oversight procedure for the project in question. If the state DOT is willing, it is suggested that FHWA and FTA be involved in all ITS projects on the National Highway System during the initial implementation period for the Interim Guidance.**

**31. Q: What kind of help and support can be expected from U.S. DOT?**

**A: Various support mechanisms are under way or being planned at the present time. A training course on the National ITS Architecture is available now with more offerings planned in the fall of 1998. Technical assistance documents on the use of the National ITS Architecture to facilitate project development and planning for specific application areas will be available shortly. Technical assistance is also available through the U.S. DOT peer-to-peer program. Checklists also will be made available to serve as helpful guidance and reminders. For more information, contact your local FHWA or FTA office, and visit the ITS website: [www.its.dot.gov](http://www.its.dot.gov).**

## ITS Standards

**32. Q: What is an ITS standard and which standards have been adopted?**

**A: Standards define how system components inter-connect and interact within an overall framework called an architecture. The National ITS Architecture identified the need for many ITS standards to support interface compatibility. U.S. DOT has yet to adopt ITS standards, and anticipates proceeding cautiously in order to allow emerging standards to reach a point of acceptability by implementing agencies. Initial standards are just now beginning to be completed and approved by Standards Development Organizations. Once approved by the Standards Development Organizations, it will take some time for standards to be validated to the satisfaction of implementing agencies.**

**33. Q: Should an ITS standard be used if it has not yet been approved, or adopted by U.S. DOT?**

**A If an agency deems that an ITS standard is not yet sufficiently mature for routine use, it should deploy ITS mindful of the new standard and in anticipation of an eventual transition. Your design process may incorporate draft standards, but recognize that these may change before being finalized. Therefore, work with your vendors to be sure that they commit to bringing their products into compliance with the final standard when it is approved.**

## Documentation

**34. Q: What documentation is required for implementation of the Interim Guidance?**

**A: No new documentation is required, but additional information within existing documentation needs to demonstrate that the intent of the Interim Guidance has been met.**

### **C. Applicable Legislation**

#### **SECTION 5203. GOALS AND PURPOSES [of the Intelligent Transportation Systems Act of 1998].**

**(a) Goals.--The goals of the intelligent transportation system program include** □

**(1) enhancement of surface transportation efficiency and facilitation of intermodalism and international trade to enable existing facilities to meet a significant portion of future transportation needs, including public access to employment, goods, and services, and to reduce regulatory, financial, and other transaction costs to public agencies and system users;**

**(2) achievement of national transportation safety goals, including the enhancement of safe operation of motor vehicles and nonmotorized vehicles, with particular emphasis on decreasing the number and severity of collisions;**

**(3) protection and enhancement of the natural environment and communities affected by surface transportation, with particular emphasis on assisting State and local governments to achieve national environmental goals;**

**(4) accommodation of the needs of all users of surface transportation systems, including operators of commercial vehicles, passenger vehicles, and motorcycles, and including individuals with disabilities; and**

**(5) improvement of the Nation's ability to respond to emergencies and natural disasters and enhancement of national defense mobility.**

**(b) Purposes.--The Secretary shall implement activities under the intelligent system transportation program to, at a minimum** □

**(1) expedite, in both metropolitan and rural areas, deployment and integration of intelligent transportation systems for consumers of passenger and freight transportation;**

**(2) ensure that Federal, State, and local transportation officials have adequate knowledge of intelligent transportation systems for full consideration in the transportation planning process;**

**(3) improve regional cooperation and operations planning for effective intelligent transportation system deployment;**

**(4) promote the innovative use of private resources;**

**(5) develop a workforce capable of developing, operating, and maintaining intelligent transportation systems; and**

**(6) complete deployment of Commercial Vehicle Information Systems and Networks in a majority of States by September 30, 2003.**

#### **SECTION 5206. NATIONAL ARCHITECTURE AND STANDARDS.**

**(a) IN GENERAL-**

**(1) DEVELOPMENT, IMPLEMENTATION, AND MAINTENANCE-**

**Consistent with section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note; 110 Stat. 783), the Secretary shall develop, implement, and maintain a national architecture and supporting standards and protocols to promote the widespread use and evaluation of intelligent transportation system technology as a component of the surface transportation systems of the United States.**

**(2) INTEROPERABILITY AND EFFICIENCY- To the maximum extent practicable, the national architecture shall promote interoperability among, and efficiency of, intelligent transportation system technologies implemented throughout the United States.**

**(3) USE OF STANDARDS DEVELOPMENT ORGANIZATIONS-** In carrying out this section, the Secretary may use the services of such standards development organizations as the Secretary determines to be appropriate.

**(b) REPORT ON CRITICAL STANDARDS-** Not later than June 1, 1999, the Secretary shall submit a report to the Committee on Environment and Public Works of the Senate and the Committee on Transportation and Infrastructure and the Committee on Science of the House of Representatives identifying which standards are critical to ensuring national interoperability or critical to the development of other standards and specifying the status of the development of each standard identified.

**(c) PROVISIONAL STANDARDS-**

**(1) IN GENERAL-** If the Secretary finds that the development or balloting of an intelligent transportation system standard jeopardizes the timely achievement of the objectives identified in subsection (a), the Secretary may establish a provisional standard after consultation with affected parties, and using, to the extent practicable, the work product of appropriate standards development organizations.

**(2) CRITICAL STANDARDS-** If a standard identified as critical in the report under subsection (b) is not adopted and published by the appropriate standards development organization by January 1, 2001, the Secretary shall establish a provisional standard after consultation with affected parties, and using, to the extent practicable, the work product of appropriate standards development organizations.

**(3) PERIOD OF EFFECTIVENESS-** A provisional standard established under paragraph (1) or (2) shall be published in the Federal Register and remain in effect until the appropriate standards development organization adopts and publishes a standard.

**(d) WAIVER OF REQUIREMENT TO ESTABLISH PROVISIONAL STANDARD-**

**(1) IN GENERAL-** The Secretary may waive the requirement under subsection (c)(2) to establish a provisional standard if the Secretary determines that additional time would be productive or that establishment of a provisional standard would be counterproductive to achieving the timely achievement of the objectives identified in subsection (a).

**(2) NOTICE-** The Secretary shall publish in the Federal Register a notice describing each standard for which a waiver of the provisional standard requirement has been granted, the reasons for and effects of granting the waiver, and an estimate as to when the standard is expected to be adopted through a process consistent with section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note; 110 Stat. 783).

**(3) WITHDRAWAL OF WAIVER-** At any time the Secretary may withdraw a waiver granted under paragraph (1). Upon such withdrawal, the Secretary shall publish in the Federal Register a notice describing each standard for which a waiver has been withdrawn and the reasons for withdrawing the waiver.

**(e) CONFORMITY WITH NATIONAL ARCHITECTURE-**

**(1) IN GENERAL-** Except as provided in paragraphs (2) and (3), the Secretary shall ensure that intelligent transportation system projects carried out using funds made available from the Highway Trust Fund, including funds made available under this subtitle to deploy intelligent transportation system technologies, conform to the national architecture, applicable standards or provisional standards, and protocols developed under subsection (a).

**(2) SECRETARY'S DISCRETION-** The Secretary may authorize exceptions to paragraph (1) for--

**(A) projects designed to achieve specific research objectives outlined in the National ITS Program Plan under section 5205 or the Surface Transportation Research and Development Strategic Plan developed under section 508 of title 23, United States Code; or**

**(B) the upgrade or expansion of an intelligent transportation system in existence on the date of enactment of this subtitle, if the Secretary determines that the upgrade or expansion--**

- (i) would not adversely affect the goals or purposes of this subtitle;**
- (ii) is carried out before the end of the useful life of such system; and**
- (iii) is cost-effective as compared to alternatives that would meet the conformity requirement of paragraph (1).**

**(3) EXCEPTIONS- Paragraph (1) shall not apply to funds used for operation or maintenance of an intelligent transportation system in existence on the date of enactment of this subtitle.**

**(f) SPECTRUM- The Federal Communications Commission shall consider, in consultation with the Secretary, spectrum needs for the operation of intelligent transportation systems, including spectrum for the dedicated short-range vehicle-to-wayside wireless standard. Not later than January 1, 2000, the Federal Communications Commission shall have completed a rulemaking considering the allocation of spectrum for intelligent transportation systems.**