Using the Systems Engineering Checklist for ITS Projects

ITS architectures, including the AKIA, provide valuable input in at least four contexts: planning, program development, project development, and project design. Additional detail is available in the AKIA Use and Maintenance Guide. All of these contexts are necessary for successfully implementing ITS project.

The ITS architecture also provides information to aid in the completion of the Systems Engineering Checklist. The Systems Engineering Checklist is both required for ITS projects that use Federal funds and is an AKDOT & PF institutional requirement.

Copies of the checklist and its instructions are included below. Both documents are also available online at http://www.dot.state.ak.us/iways/sys-eng.shtml.

Statewide Alaska Iways Architecture (AKIA) and **Anchorage Regional ITS Architecture (ARIA)** **Systems Engineering Checklist**	**1a. Date**	
	1b. Project Title	
The AKIA, ARIA, and this systems engineering checklist adhere to the Federal Highway Administration (FHWA) National ITS conformity rule (23 CRF Part 940) and the FTA National ITS Architecture Policy on Transit Projects. Rule 940 states that system engineering, including an ITS architecture, is required for ITS projects that are considered significant for the region and eligible for Federal funding.	**1c. ADOT & PF STIP Need ID**	
	1d. IRIS # *(if available)*	
	1e. Name	
• For more information on Systems Engineering, see: http://www.dot.state.ak.us/iways/sys-eng.shtml	**1f. Title**	
• For more information on the Iways Architecture, see: http://iways.alaska.gov/	**1g. Phone Number**	
• For more information on MOA Architecture, see: http://www.muni.org/Departments/OCPD/Planning/AMATS/Pages/1_ITS.aspx	**1h. E-Mail**	
The instructions for this form contain additional information, including guidance on when a project is subject to these requirements. *The instructions are available through the Systems Engineering link above.*	**1i. Project Contact** *(if not listed above)*	

2. Brief Project Description including purpose of the project and major ITS elements (*see table on page 2 for complete list of service areas and ITS elements*). Additional items may be included as well, such as the nature of work and relationships to any other projects and phases.

3. Project Controls

3a. Does this project qualify as a **Major or Minor ITS project**? (see instructions for criteria)   Major ☐   Minor ☐

3b. Check to indicate if this is a **New Federal Project** (a new request for Federal funds) ☐ or a **Modification** of an existing Project ☐

3c. If the project amount is $25,000 or more, has the **DOA IT Spend Review Form** been reviewed and approved? Yes ☐ No ☐ N/A ☐

3d. Has the **ISSD Collaboration Form** been reviewed and approved?   Yes ☐   No ☐

3e. If communications rely on radio spectrum outside the public unlicensed bands, and does not use a commercial licensed provider, e.g. cellular provider, has the PM coordinated with Greg Patz, ADOT&PF ALMR Coordinator?   Yes ☐ No ☐ N/A ☐

4. Documentation of Federal Systems Engineering Requirements

• For the six Systems Engineering Elements listed in the table below, indicate how it is met or fulfilled. Additional documents can be referred to or attached as needed. See instructions for additional guidance.

- The seventh systems engineering element - Portions of the Regional ITS or Statewide Iways Architecture Being Implemented – is covered by the Service Areas and ITS Elements tables that follow the Systems Engineering Element table.

Systems Engineering Elements	Existing from Previous Project or Document?	How Element is Met/Fulfilled
4a. Identify Participating Agencies Roles & Responsibilities (could be in Concept of Operations). Also list agreements needed.	☐	
4b. Define Systems Requirements.	☐	
4c. Analyze alternative system configurations and technology options to meet requirements.	☐	
4d. Identify procurement/ contracting options.	☐	
4e. Identify applicable ITS standards; developed testing procedures (could include a System Acceptance Plan and Verification Plan).	☐	
4f. Outline procedures and resources necessary for operations and management.	☐	

5. Architecture Service Areas and ITS Elements – The following two tables contain the service areas for the statewide Alaska Iways Architecture (AKIA) and for the Municipality of Anchorage's Anchorage Regional ITS Architecture (ARIA). Please check all included service areas affected by this project and list all included ITS elements or attach copies of the service area diagrams with the project components highlighted. See the instructions to this form for more detailed references to the service area descriptions and ITS elements in the AKIA and ARIA.

AKIA Service Areas	Included in Project?	ITS Elements Included in Project
Traffic Management	☐	
Winter Maintenance	☐	
CVO & Freight	☐	
Public Transportation	☐	
Incident & Emergency Management	☐	
Traveler Information	☐	

AKIA Service Areas	Included in Project?	ITS Elements Included in Project
Data Archive	☐	

ARIA Service Areas	Included in Project?	ITS Elements Included in Project
Archive Data Services	☐	
Arterial Management	☐	
Roadway Maintenance and Construction	☐	
Transit Operations	☐	
Traveler Information	☐	

Reviewed for Completeness

_____   _____
Signature   Date

Print Name: _____

Title: _____

DO NOT COMPLETE THIS SECTION – For Internal Use Only

Are any changes recommended to either the AKIA or ARIA due to this project?   Yes ☐   No ☐

    If yes, provide detail:

Is a Systems Engineering Analysis required?   Yes ☐   No ☐

To be Completed by the ITS Coordinator

Statewide Alaska Iways Architecture (AKIA) and
Anchorage Regional ITS Architecture (ARIA)
Systems Engineering Checklist & Instructions

Background

On January 8, 2001, the Final Rule on Intelligent Transportation Systems (ITS) Architecture and Standards Conformity (Final Rule) and the Final Policy on Architecture and Standards Conformity (Final Policy) were enacted by the FHWA and FTA respectively. The Final Rule/Final Policy ensures that ITS projects or ITS elements within a project carried out using funds from the Highway Trust Fund including the Mass Transit Account conform to the National ITS Architecture and applicable ITS standards.

The Final Rule requires that all ITS projects or ITS elements within a project that use Federal Funds be developed using a systems engineering analysis. Section 23 CFR 940.11 specifies seven activities that are to be performed to accomplish a systems engineering analysis. These seven activities are identified on the Systems Engineering (SE) Checklist in items 4 and 5.

Determining Which Projects Require a Systems Engineering Checklist

Project managers are required to complete a systems engineering analysis (SEA) for "...any project in whole or in part that funds the acquisition of technologies or systems of technologies, that provide or significantly contribute to the provision of one or more ITS user services, as defined in the National ITS Architecture. In other words, an ITS project is any project that may provide an opportunity for integration at any point during its life." This applies to all projects or portions of projects. Systems that stand alone, that are not and will not integrate with another system is not subject to a systems engineering analysis.

A project is a Non-Systems Engineering Project (NSE), and does not require the Systems Engineering Checklist to be filled out if the project:

- Does not include any ITS devices
- Only includes signal system equipment upgrades, signal re-timing / coordination
- Only includes stand-alone ITS devices that do not / will never communicate
- Only include fiber or conduit

General Instructions for Completing the Systems Engineering (SE) Checklist

Project managers are required to use the SE Checklist to demonstrate that their ITS project(s) or ITS element within a project were developed using a systems engineering approach. For Alaska DOT&PF projects, this checklist is a required Appendix to Design Study Report (DSR) for projects with ITS elements that require a DSR. See section 480.4 of the Preconstruction Manual.

The SE checklist can be found at http://iways.alaska.gov or http://web.dot.state.ak.us.

For larger projects, there may be separate documents that cover one or more of the systems engineering requirements. In those cases, a summary of the relevant information should be included in the SE Checklist and the document should be referenced. References should include: the full name of the plan or document; date and year the document was prepared; and the heading/heading number of the section within the document where the information is provided

If documents or plans do not exist for the necessary information, all the relevant information must be entered in the SE Checklist. For minor or straightforward projects, the required information may only be one or two paragraphs for each of the seven required systems engineering elements. For complex projects, documentation for some of the elements will likely be much longer and a separate document that can be attached to the checklist may be in order.

More detailed instructions for documenting each of the required systems engineering elements is provided in this package, on the pages following the checklist.

Questions?

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Detailed Instructions for Completing the Systems Engineering Checklist

The instructions below are numbered to correspond to the fields in the checklist form.

1. **Basic Information:** The date of the form (1a) and project identification information (1b – 1i).

2. **Brief Project Description:** Information to convey the key project aspects.

3. **Project Controls:** This series of questions covers items of particular importance for ITS projects.

   3a. Major or Minor ITS Project – All ITS projects require systems engineering analyses**.** If all items in this Systems Engineering Checklist can be identified at 30% design, the project is considered a "minor" ITS project. Otherwise, the project is considered a "major" ITS project and a formal System Engineering Analysis must be undertaken and a SE Checklist submitted to FHWA for approval. Note: the SE Checklist must be filled out and testing and verification will need to occur during construction for both Major and Minor ITS projects.

4. **Documentation of Federal Systems Engineering Requirements**

   - If documentation exists from previous projects and would apply to the current project without modification (for typical deployments, i.e. DMS signs), attach to the checklist or list where it is available.
   - Note that some projects have multiple ITS elements, only some of which will have the required documentation. Please check all that apply to the project.
   - Responses can reference sections of the project's DSR.

4a. Identify participating agencies roles and responsibilities

Summarize and reference the document(s) that define agency roles and responsibilities as they pertain to ITS system design, purchase, installation, operation, maintenance, and modification. Chapters 4 and 5 of the latest version of the AKIA and of the ARIA (Operational Concept and Interfaces and Information Exchanges respectively) may provide an initial starting point for satisfying this requirement. Also, check to see if there is a project level or system concept of operations that might include discussion of participating roles and responsibilities.

If there are no existing documents that define agency roles and responsibilities as they pertain to ITS system design, purchase, installation, operation, maintenance, and modification, then this section of the Systems Engineering Checklist should provide this description.

Also list agreements that are either in place or are needed.

4b. Define Systems Requirements

Summarize and reference the documents(s) that define "what" the subject ITS project or element is required to do. This includes all items necessary to complete a fully operational system including hardware, software, installation, training, etc.   For many projects, there may be a formal requirements document that is developed. For example, you might have a requirements list included with an RFP. If there is no existing requirements document, this section should identify high-level requirements for the project. The ITS architecture provides high level requirements for each of the ITS elements included. If no other document provides more project specific requirements, those included in the ITS architecture provide a good starting point (see Appendix B in the architecture document for either the AKIA or ARIA). Please note that requirements are "what" statements. They are later further developed into "how" statements (or specifications) during the design process. Refer to the U.S. Department of Transportation report titled [Developing Functional Requirements for ITS Projects](#) for specific guidance on developing functional requirements.

4c. Analyze Alternative System Configurations and Technology Options to Meet Requirements

Summarize and reference the document(s) that list the alternatives that were considered during the development of the ITS project or element. Such a document should list strengths and weaknesses, technical feasibility, institutional compatibility, and life cycle costs of each alternative, and the preferred alternative. If there is a project level or system concept of operations that covers this project, it should include an alternatives analysis that could be referenced here.

If there are no existing documents that list the alternatives that were considered, then this section of the Systems Engineering Checklist should provide this listing.

4d. Identify Procurement/ Contacting Options

Summarize and reference the document(s) that identify procurement options for the ITS project or element, or list the procurement method used on the Systems Engineering Checklist.

If there are no existing documents that identify procurement options, then this section of the Systems Engineering Checklist should describe the procurement options.

4e. Identify Applicable ITS Standards that are being Implemented and Testing Procedures that will be used upon Project Implementation

Summarize and reference the document(s) that identify the ITS standards that apply to new ITS projects or elements. A list of standards applicable to projects identified in the AKIA and ARIA can be found in Appendix E (ITS Standards) of the respective architecture documents. Depending on the elements of the new ITS project, additional ITS standards may have been approved since the initial development of the AKIA and ARIA. Also, check to see if there is a project level or system concept of operations that might include a discussion of standards.

If there are no existing documents that identify the ITS standards that apply, then this section of the Systems Engineering Checklist should identify the applicable standards.

4f. Outline Procedures and Resources Necessary for Operations and Management of the System

Summarize and reference the document(s) that identify the internal policies or procedures necessary to recognize and incorporate the new system into current operations and decision processes. Resources that support continued operations, including staffing and training should also be referenced.

If there are no existing documents that identify the procedures and resources necessary to operate and manage the ITS elements of the project, then this section of the Systems Engineering Analysis form should identify the needed O&M procedures and resources.

5. Identify Portions of the Regional ITS or Statewide Iways Architecture being Implemented – Architecture Service Areas and ITS Elements

Use the ARIA and/or AKIA service area tables depending on the project scope.

Summarize and reference the document(s) that describe the new ITS project or elements and how they meet the functional needs of one or more of the ITS Service Areas identified in the ITS Architecture. ITS elements are the basic building blocks of an architecture represented by a box in the architecture. Some examples are specific field systems, centrally located systems, users of the system, or operators of the system. ITS elements and information flows are grouped into Service Areas.

In both the AKIA and ARIA, Chapter 4 (Operational Concept) may provide an initial starting point for meeting this requirement. The list of Elements can include a reference to attached copies of relevant Service Areas marked with the ITS elements and flows included in the project. The following table lists the service areas and their corresponding sections in their ITS Architectures:

Architecture	Service Area	Reference
AKIA	Traffic Management	AKIA Section 4.4
	Winter Maintenance	AKIA Section 4.5
	CVO & Freight	AKIA Section 4.6
	Public Transportation	AKIA Section 4.7
	Incident & Emergency Management	AKIA Section 4.8
	Traveler Information	AKIA Section 4.9
	Data Archive	AKIA Section 4.10
ARIA	Archive Data Services	ARIA Section 4.4
	Arterial Management	ARIA Section 4.5
	Roadway Maintenance and Construction	ARIA Section 4.6
	Transit Operations	ARIA Section 4.7
	Traveler Information	ARIA Section 4.8

Also, check to see if there is a project level or system concept of operations that might include a discussion of the portions of the architecture being implemented.

If there are no existing documents that describe new ITS project or elements and how they meet the functional needs of one or more of the ITS Service Areas identified in the ITS Architecture, then this section of the Systems Engineering Checklist should provide this description.

Reviewed for Completeness

This section is for use by the DOT&PF or MOA depending upon the project jurisdiction.

ITS Administrator Section

To be completed by the ITS Administrator for both DOT&PF and MOA projects.