



How Do I Get What I Need?

***Work Zone ITS
and 23 CFR 940***

What Do Motorists Want?

- *“Road Construction! I really don’t want to detour or find another route”*

Translation: They are not going to make it easy for us as we plan our construction and lay out our work zone

- *“Looks like they expect me to slow down and shift lanes!”*

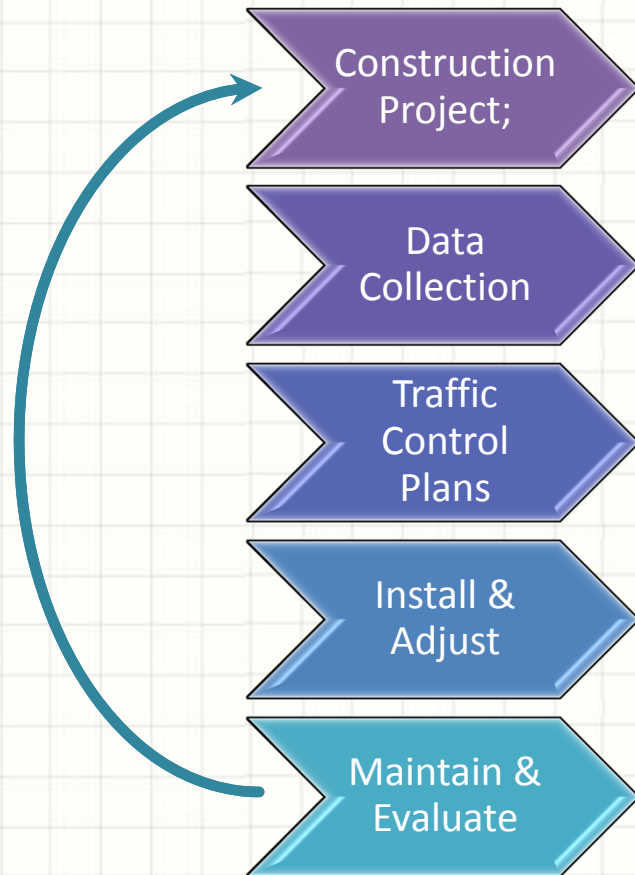
Translation: We expect them to follow our instructions and drive more alertly through the work zone

Variability is Normal - And the Problem

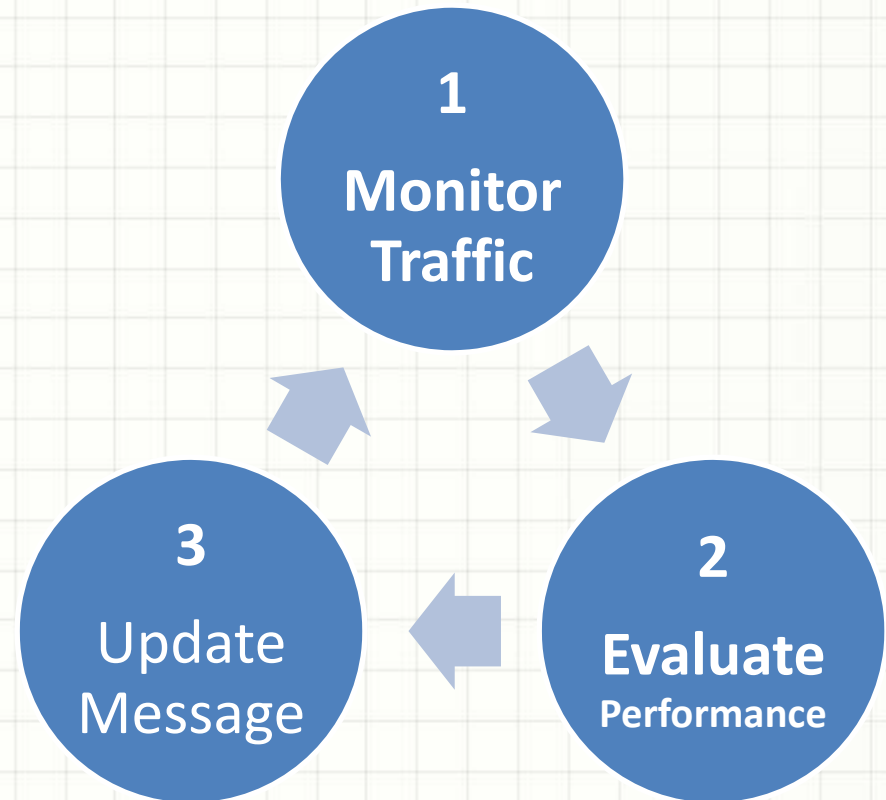
- Morning/Afternoon Rush Hour
- Get out of town – it's Friday
- Ball Games and Concerts
- Snow, Sleet, Heavy Rain
- Nighttime
- Young Drivers – Old Drivers
- Heavy Traffic

Work Zone ITS Technology

Traditional



Dynamic



Work Zone ITS Technology

- Better
 - Benefits to Road Users & Agencies
 - Ongoing performance measurement
- Smarter
 - Solves problems that are difficult to address with standard work zones
 - Addresses different levels of demand
- Faster
 - Moves traffic through a work zone dynamically

Readily Available Work Zone ITS

Name Your System or Vendor Here:

NCHRP SYNTHESIS 20-05/Topic 45-06(new) Active and Passive Methods for Slowing Traffic in Work Zone Technology and Procedure

Getting It Right is Important

New focus on technology means

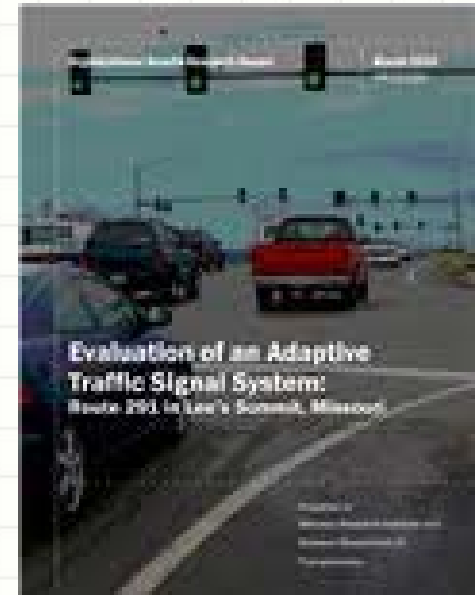
- New opportunities for success
- New consequences of failures
- Greater interest from industry
- More visibility and scrutiny

- Federal regulations governing ITS projects
- Federal regulations governing procurements

What is Intelligent Transportation Systems?

- According to 23 CFR 940, “ITS means electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.”
- Smart Work Zone deployments meet this definition

What is ITS?



23 CFR 940.11 Requirements

- **All** ITS projects must be developed using a *Systems Engineering (SE) analysis*
- The analysis shall be on a scale commensurate with the project scope
- SE analysis shall address (7) requirements
- The purpose is to ensure that agencies get what they (and their stakeholders) need

Seven Requirements of SE Analysis

1. Identify portions of the regional ITS architecture being implemented
2. Identification of participating agencies roles and responsibilities
3. Requirements definitions
4. Analysis of technology options to meet requirements
5. Procurement options
6. Identification of applicable ITS standards and testing procedures
7. Procedures and resources necessary for operations and management of the system

How Do We Deploy SWZ?

- “Consumer Reports”
 - Evaluate Available Technology
 - Consult with vendors / distributors
 - Deploy small scale system
 - Evaluate
 - Abandon or Expand

- Systems Engineering
 - Objectives
 - Needs / Constraints
 - Requirements
 - Design
 - Implement
 - Verification
 - Validation
 - Abandon or Expand

Focus on the **process**, not the technology!

SWZ – The Systems Engineering *Process*

Concept of Operations

- What are my current situation, needs, goals, and objectives?
- What can I do to optimize my current system without smart work zones?
- What scenarios will fit my current and future work zone situations?
- Envisioned concept for smart work zones.

Requirements

- What will I need to prepare for smart work zones?
- Which type of smart work zone is best for me?

Design

- Evaluate existing smart work zone systems.

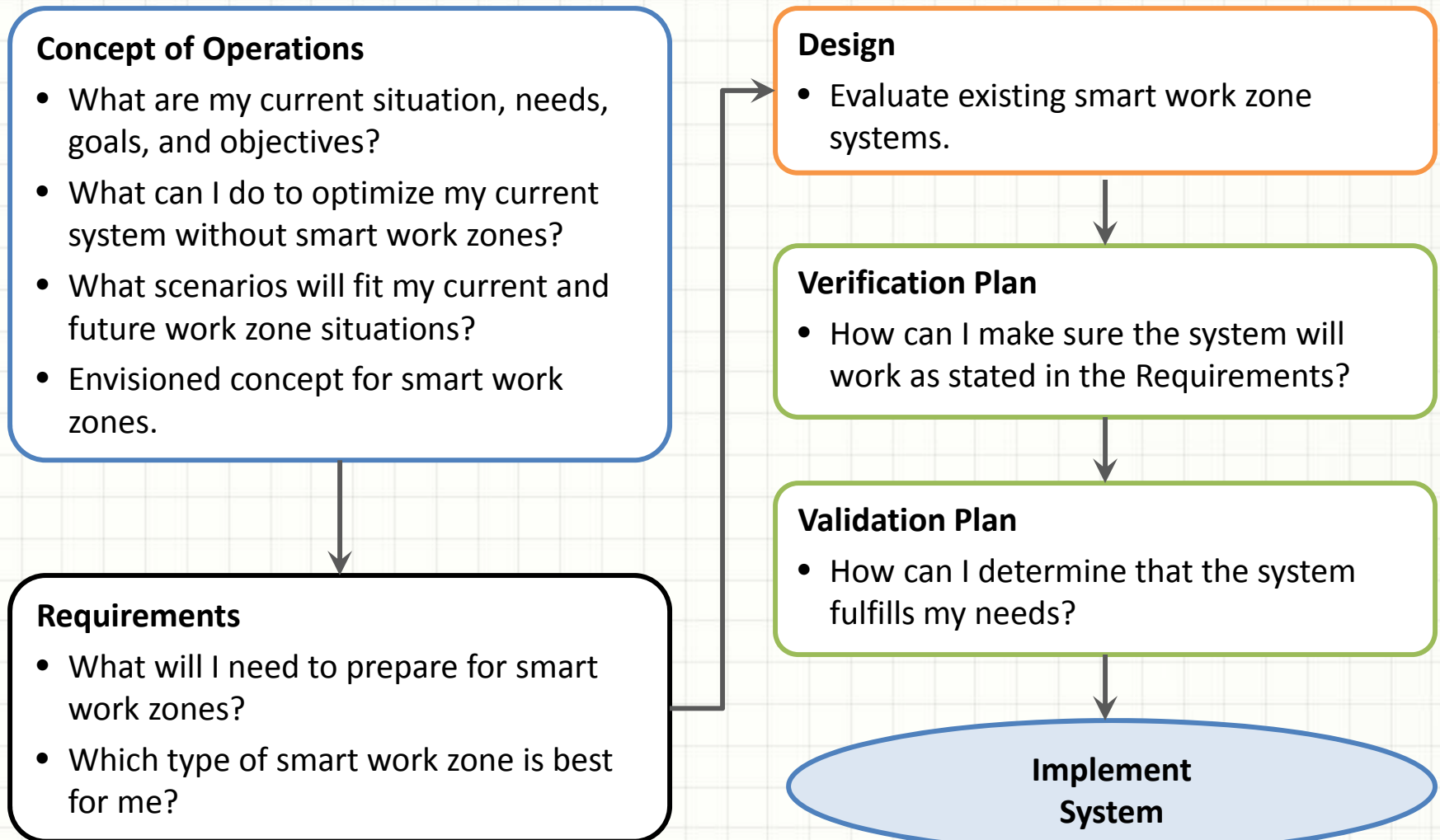
Verification Plan

- How can I make sure the system will work as stated in the Requirements?

Validation Plan

- How can I determine that the system fulfills my needs?

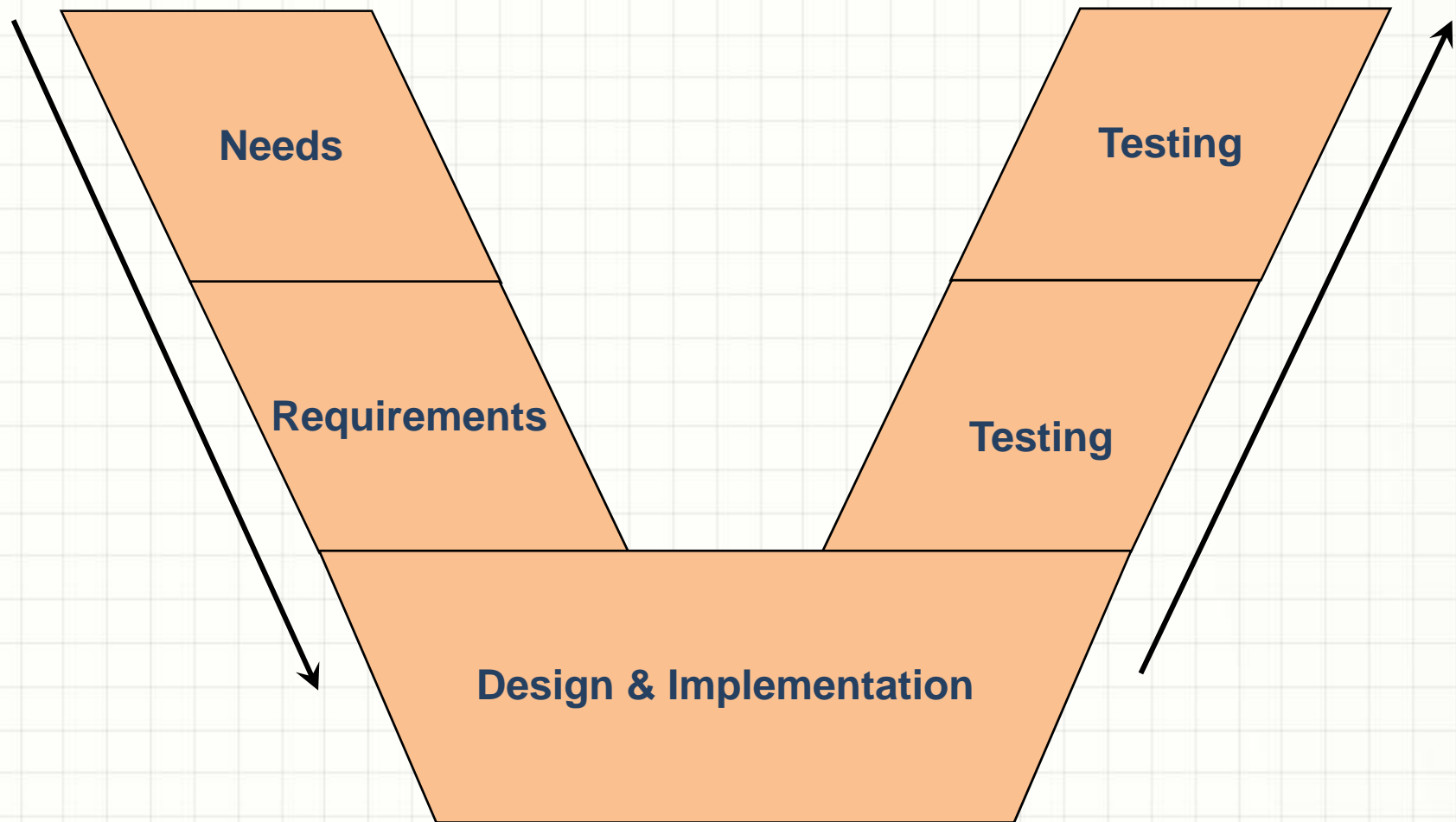
**Implement
System**



Basic Systems Engineering Deliverables

- Concept of Operations
- Requirements
- High Level Design
- Verification Plan
- Validation Plan

Systems Engineering V Diagram



Work Zone ITS – What are the risks?

- Technology is new to most and still evolving.
- Most systems have very limited track record.
- Increased complexity, very dependent upon other stuff (communications, detection, staff).
- Often pitched as “one size fits all” silver bullet.
- What is the failure rate?

A Work Zone ITS system may not be the answer to your problem.

The Role of Systems Engineering

1. Understand the problem
2. Minimize the risk.

Where to start:

The Guide to Contracting ITS Projects and its companion web-based tool, available at

<http://www.citeconsortium.org/Model/index.htm>

Purpose of SE Model Documents

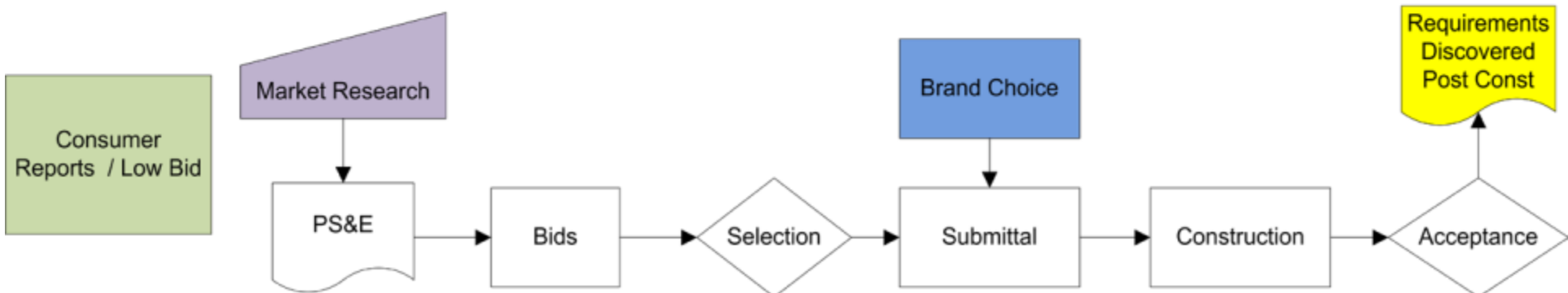
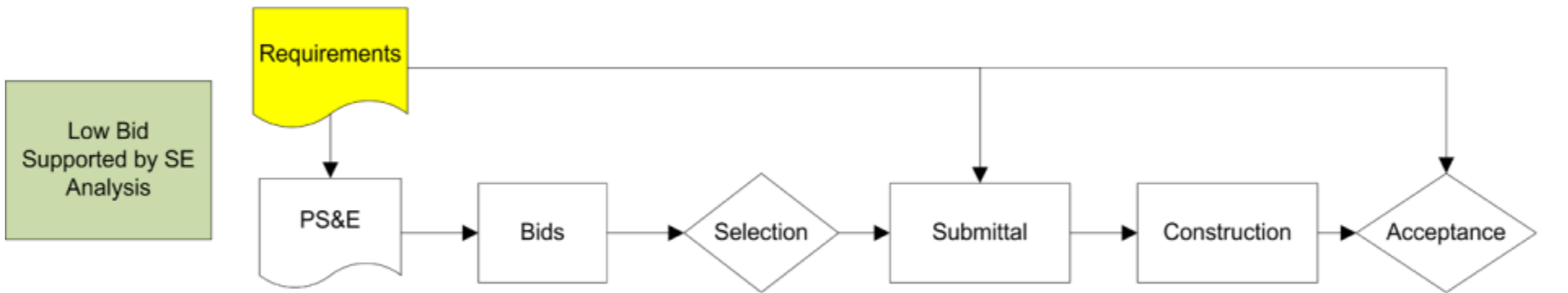
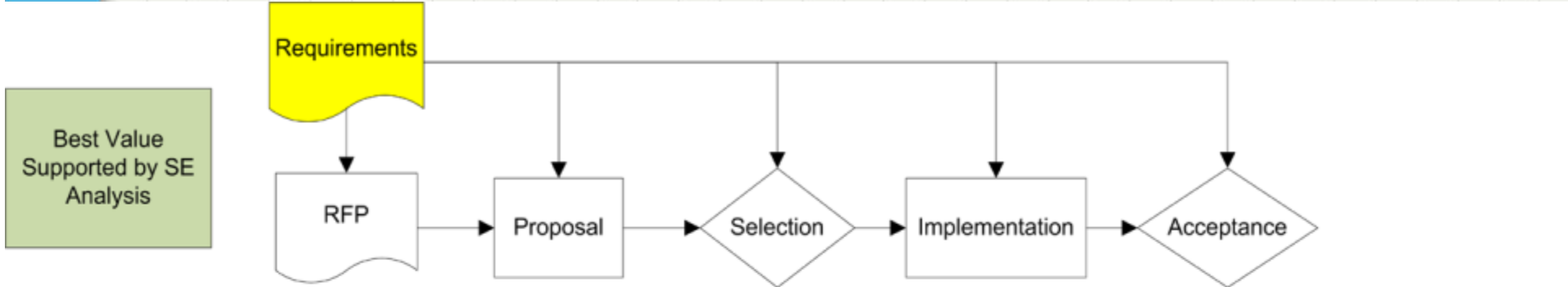
- Evaluate need for Work Zone ITS
- Help agencies identify verifiable, needs-driven requirements for evaluating design and implementation choices
- Model documents greatly reduce systems engineering effort by providing wording and documentation...
- ...but agencies still must identify their needs

Procurement Regulations

- Proprietary Materials (23 CFR 635.411)
 - **Certification** of no available competitive product
 - Uniquely fulfills the *requirements* imposed on the product
 - Achieves *synchronization* with existing systems
 - **Public Interest Finding** for proprietary purchase despite *alternative* available competitive products
 - Limited **experimental** application
- Systems Engineering provides justification

What is Commercial-Off-the-Shelf?

FAR definition of COTS: a non-developmental item of supply that is both commercial and sold in substantial quantities in the commercial marketplace, and that can be procured or utilized under government contract in the same precise form as available to the general public.



Outcome of the Process

- Informed Technology Selection
 - Agency Needs and Objectives
 - Agencies Policies
 - Operations and Maintenance Capability
 - Resources
 - Expansion
 - Equipment Life Cycle
 - Procurement Options
- Meet Federal Rule 940 and Rule 635 requirements for Federal Funding

Tailor the SE Process Based on Risk

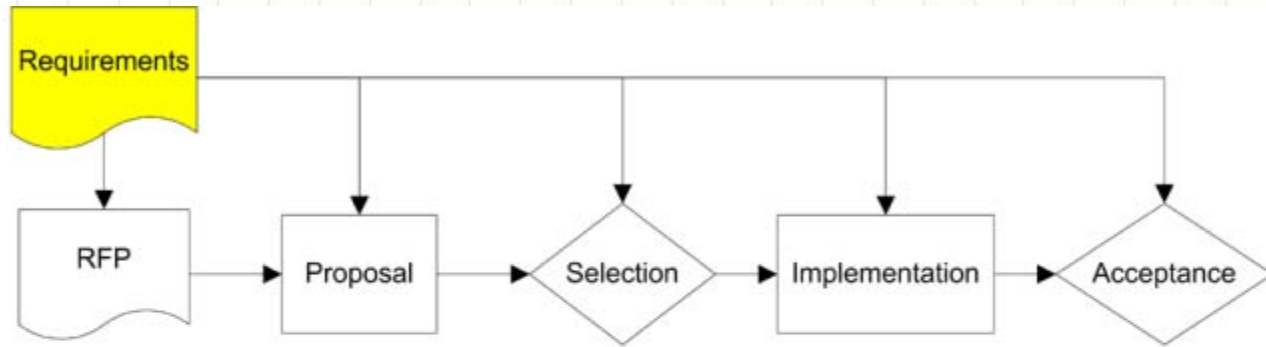
Risk Factor

- Project Type
- Project Complexity
 - No. of Stakeholders
 - No. of Interfaces
 - Technology
 - Custom Development
 - Criticality
- Project Understanding
- Staff Experience

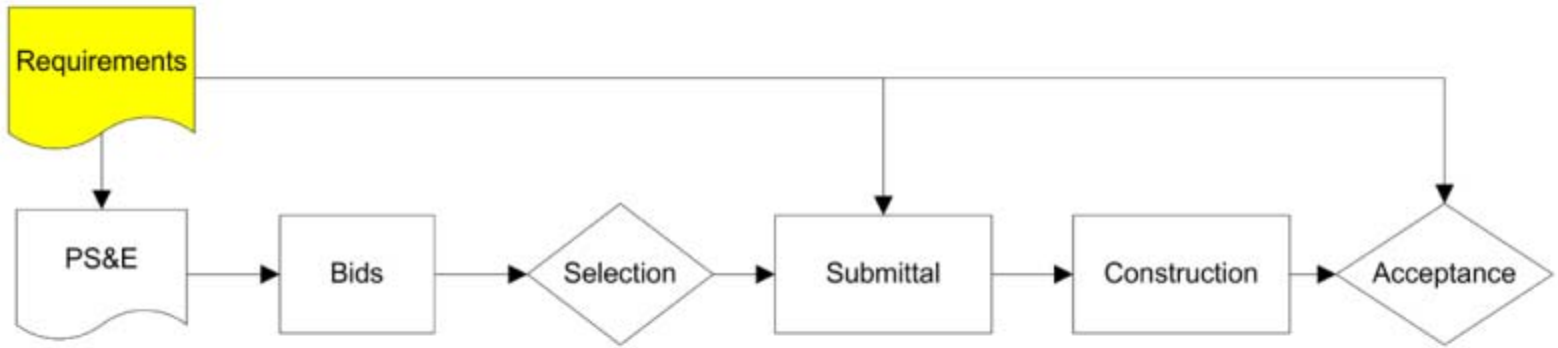
Low Risk vs High Risk



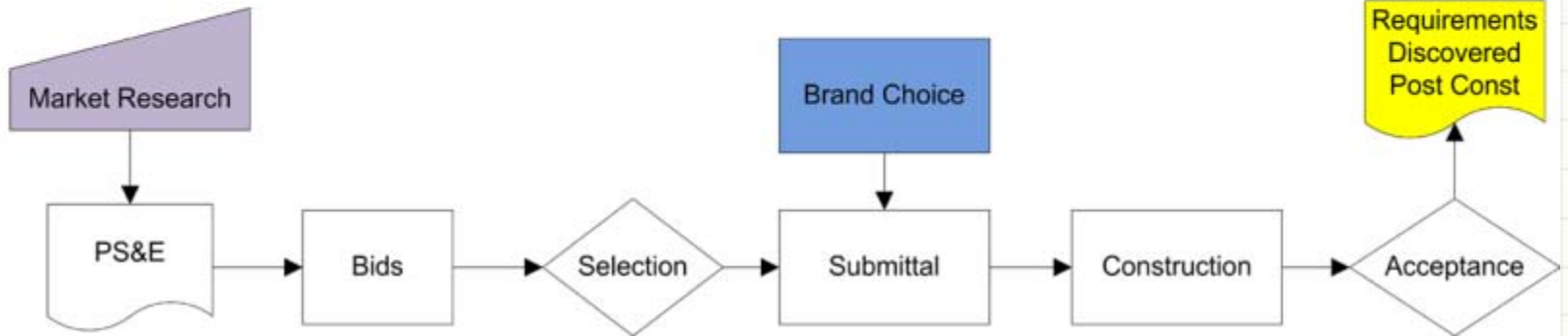
Best Value
Supported by SE
Analysis



Low Bid
Supported by SE
Analysis



Consumer
Reports / Low Bid





**Credits: Richard Jury, OK Div-FHWA
Eddie Curtis, Rick Denney, Paul Olson, Ed
Fok - FHWA Resource Center
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Systems Engineering Process

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