



Transportation Cost Estimation Best Practices, Tips and Techniques

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Raise your hand if you are a Cost Estimator?



Raise your hand if you are a PMP?



Project Management Tools, Techniques, and Best Practices

*Successful projects don't
just happen...*

they're managed!



TxDOT
PMD INSTITUTE

Project Manager Development Institute



October 2, 2024

Framework



Apply to the Transportation Field



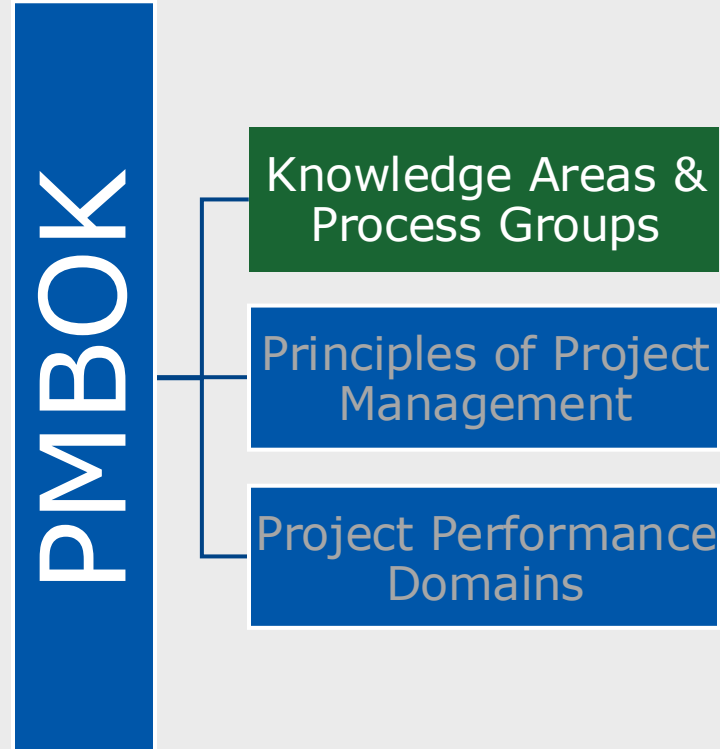
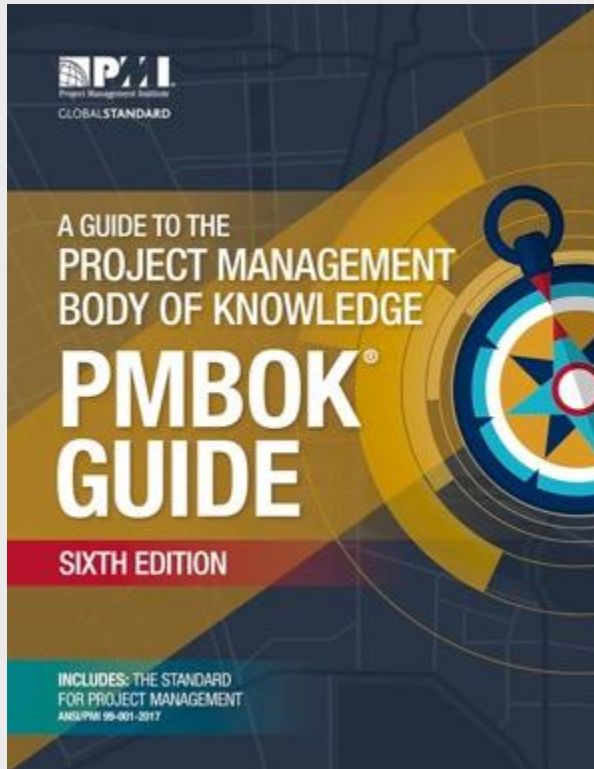
TxDOT Policies, Procedures, and Preferences

Tools, Tips, and Best Practices

to meet project requirements



Project Management - Body of Knowledge



10 Knowledge Areas – What Project Managers need to KNOW

Scope

Schedule

Cost

Risk

Quality

Communication

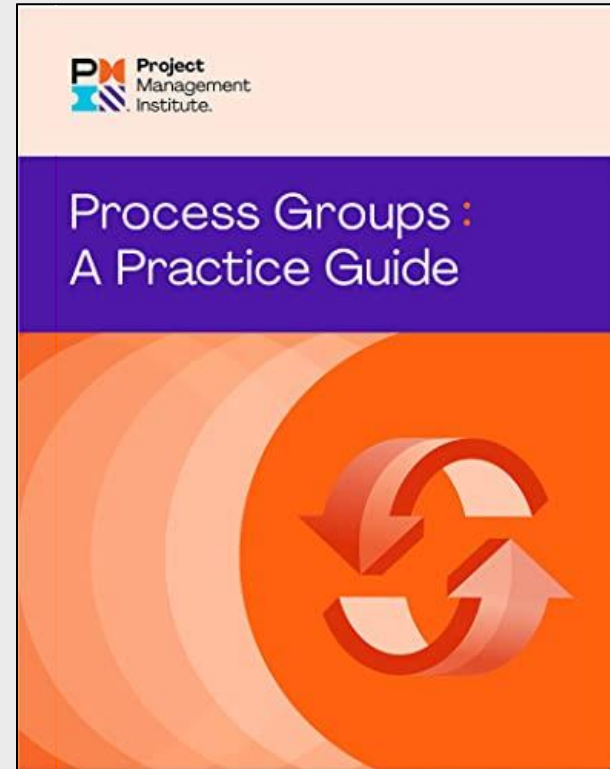
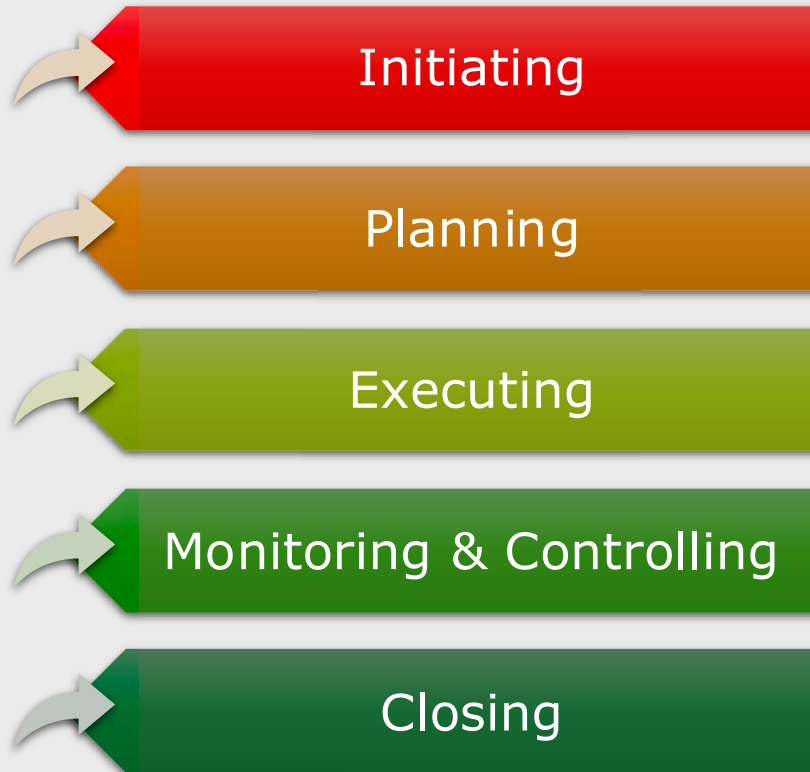
Stakeholder

Resource

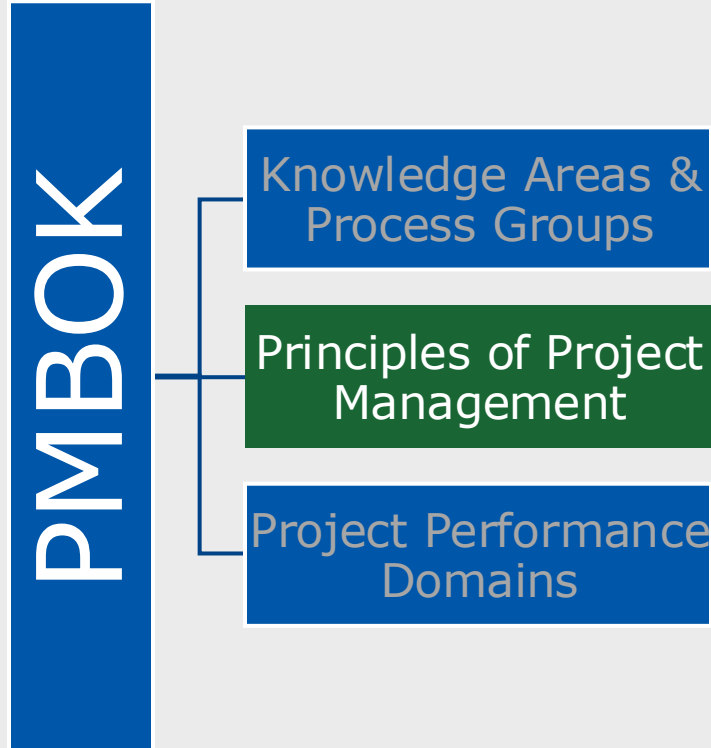
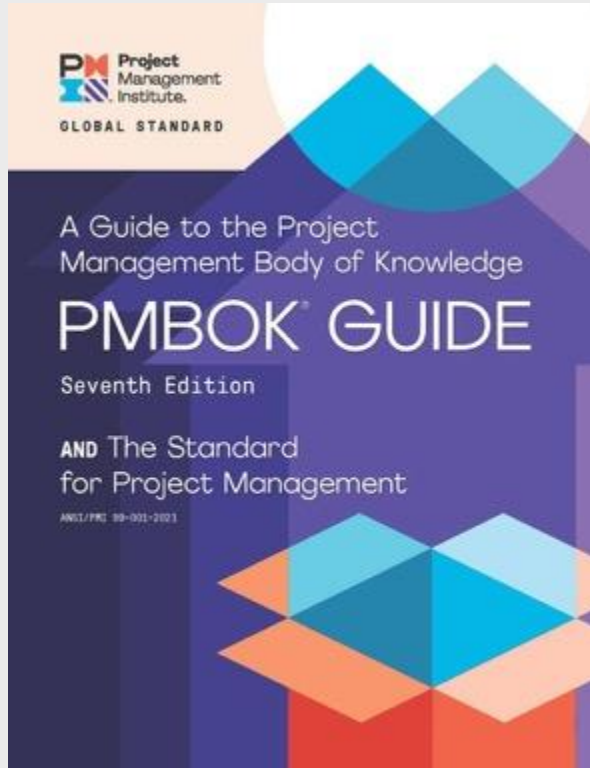
Procurement

Integration

Process Groups – What Project Managers DO



Project Management - Body of Knowledge



Principles of Project Management

- Stewardship
- Team
- Stakeholders
- Value
- Systems Thinking
- Leadership
- Tailoring
- Quality
- Complexity
- Risk
- Adaptability & Resiliency
- Change



Be a Diligent, Respectful, and Caring Steward

STEWARDSHIP

Stewards act responsibly to carry out activities with integrity, care, and trustworthiness while maintaining compliance with internal and external guidelines. They demonstrate a broad commitment to financial, social, and environmental impacts of the projects they support.

- ▶ Stewardship encompasses responsibilities within and external to the organization.
- ▶ Stewardship includes:
 - Integrity,
 - Care,
 - Trustworthiness, and
 - Compliance.
- ▶ A holistic view of stewardship considers financial, social, technical, and sustainable environmental awareness.

Focus on Value

VALUE

Continually evaluate and adjust project alignment to business objectives and intended benefits and value.

- ▶ Value is the ultimate indicator of project success.
- ▶ Value can be realized throughout the project, at the end of the project, or after the project is complete.
- ▶ Value, and the benefits that contribute to value, can be defined in quantitative and/or qualitative terms.
- ▶ A focus on outcomes allows project teams to support the intended benefits that lead to value creation.
- ▶ Project teams evaluate progress and adapt to maximize the expected value.

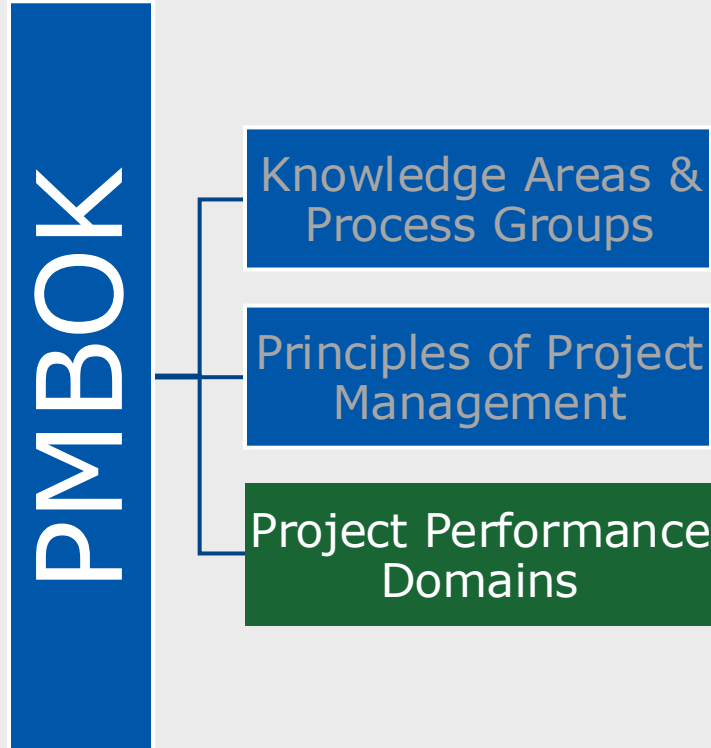
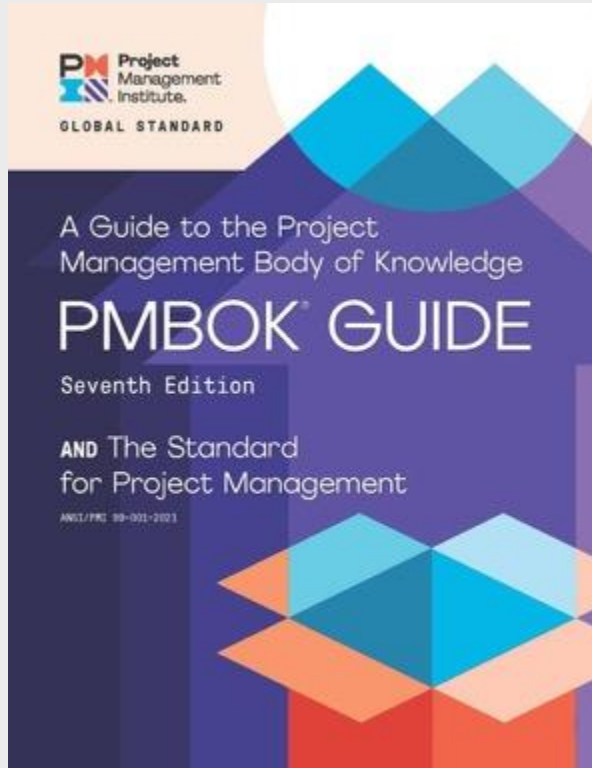
Optimize Risk Responses

RISK

Continually evaluate exposure to risk, both opportunities and threats, to maximize positive impacts and minimize negative impacts to the project and its outcomes.

- ▶ Individual and overall risks can impact projects.
- ▶ Risks can be positive (opportunities) or negative (threats).
- ▶ Risks are addressed continually throughout the project.
- ▶ An organization's risk attitude, appetite, and threshold influence how risk is addressed.
- ▶ Risk responses should be:
 - Appropriate for the significance of the risk,
 - Cost effective,
 - Realistic within the project context,
 - Agreed to by relevant stakeholders, and
 - Owned by a responsible person.

Project Management - Body of Knowledge





Project Performance Domains

- **Stakeholder** Performance Domain
- **Team** Performance Domain
- **Measurement** Performance Domain
- **Uncertainty** Performance Domain
- **Development Approach and Life Cycle**
- **Planning** Performance Domain
- **Project Work** Performance Domain
- **Delivery** Performance Domain

MEASUREMENT PERFORMANCE DOMAIN

The Measurement Performance Domain addresses activities and functions associated with assessing project performance and taking appropriate actions to maintain acceptable performance.

Effective execution of this performance domain results in the following desired outcomes:

- ▶ A reliable understanding of the status of the project.
- ▶ Actionable data to facilitate decision making.
- ▶ Timely and appropriate actions to keep project performance on track.
- ▶ Achieving targets and generating business value by making informed and timely decisions based on reliable forecasts and evaluations.

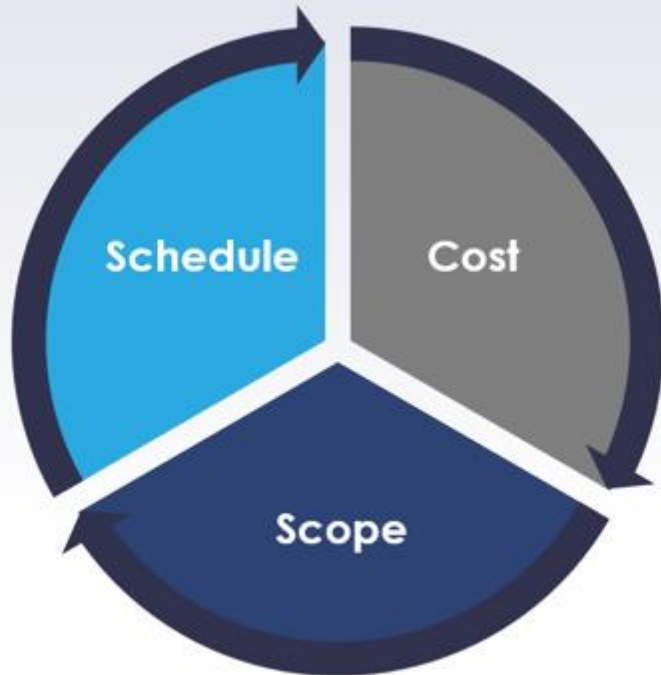
PLANNING PERFORMANCE DOMAIN

The Planning Performance Domain addresses activities and functions associated with the initial, ongoing, and evolving organization and coordination necessary for delivering project deliverables and outcomes.

Effective execution of this performance domain results in the following desired outcomes:

- ▶ The project progresses in an organized, coordinated, and deliberate manner.
- ▶ There is a holistic approach to delivering the project outcomes.
- ▶ Evolving information is elaborated to produce the deliverables and outcomes for which the project was undertaken.
- ▶ Time spent planning is appropriate for the situation.
- ▶ Planning information is sufficient to manage stakeholder expectations.
- ▶ There is a process for the adaptation of plans throughout the project based on emerging and changing needs or conditions.

Scope Management



Triple Constraint

Can't manage the schedule and budget if the **SCOPE** is out of control



SCOPE IS KING!

Scope Creep in Transportation Projects



Scope Creep in Transportation Projects

Safety Items



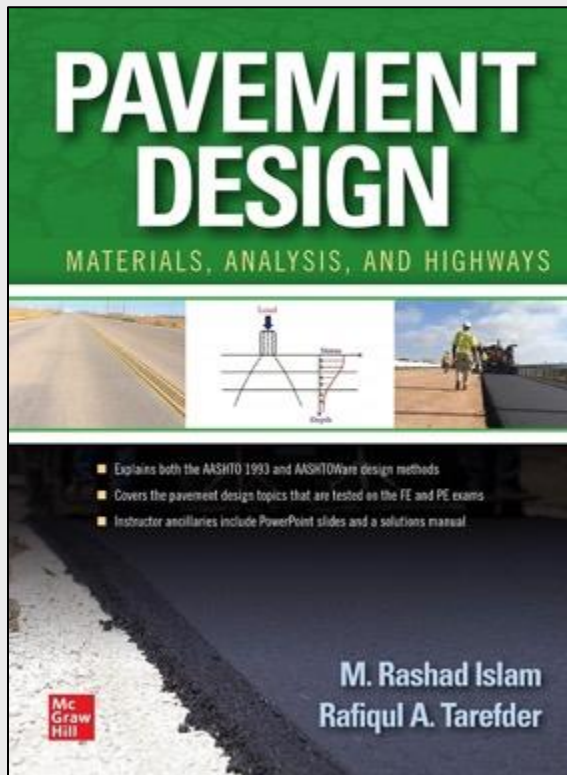
Scope Creep in Transportation Projects

Operation
Improvements



Scope Creep in Transportation Projects

Pavement Design



Scope Creep in Transportation Projects

Bridge
Improvements



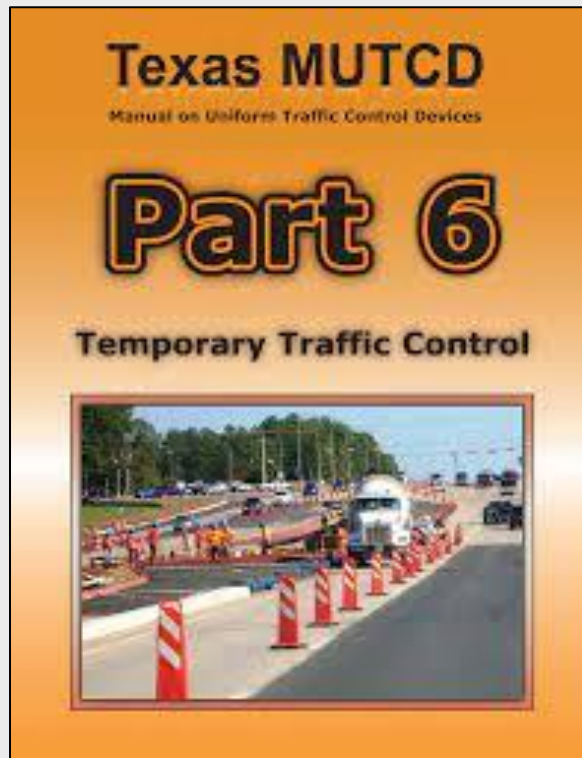
Scope Creep in Transportation Projects

Traffic Demands



Scope Creep in Transportation Projects

Standards Updates



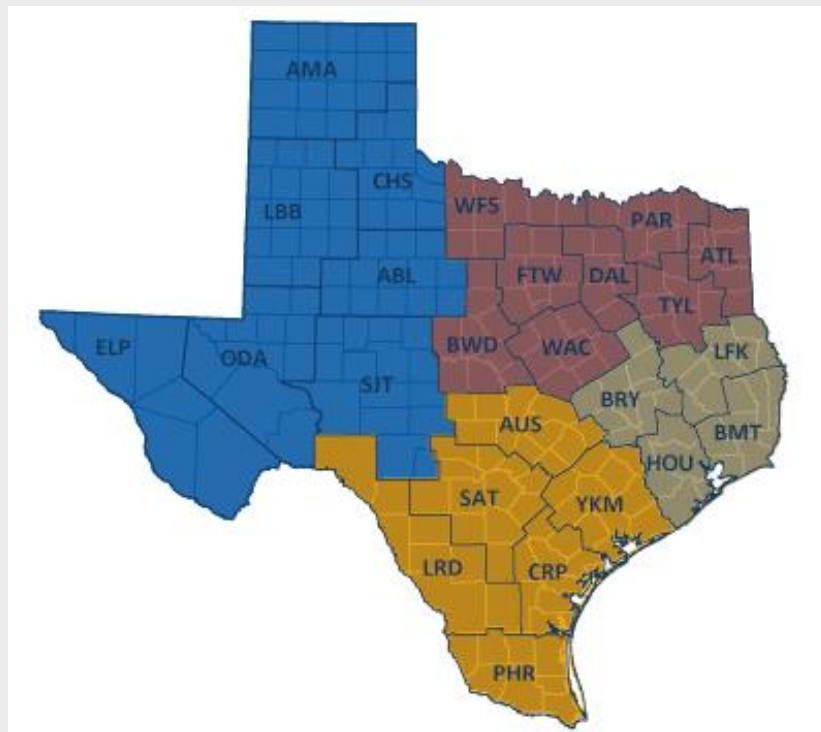
Scope Creep in Transportation Projects

Bicycle and Pedestrian Improvements



Scope Creep in Transportation Projects

District Preferences



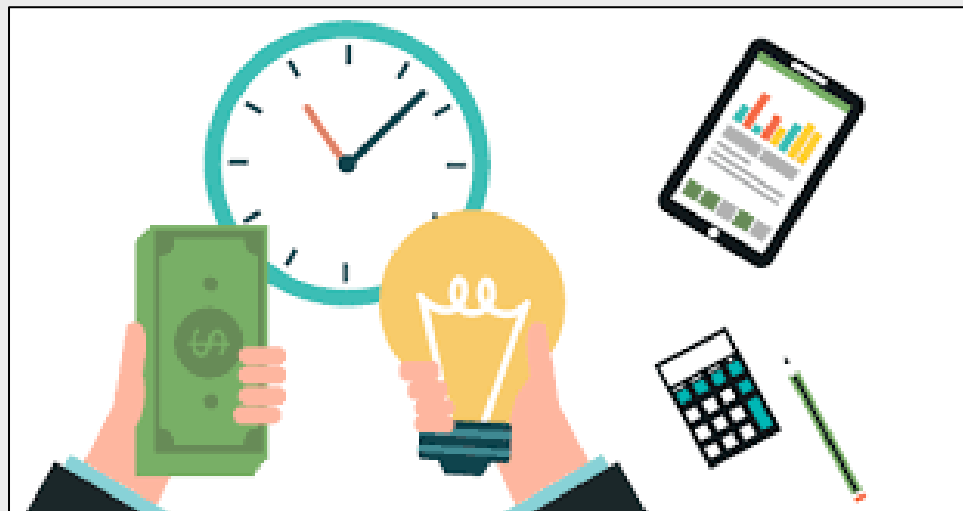
Scope Creep in Transportation Projects

Intelligent
Transportation
Systems

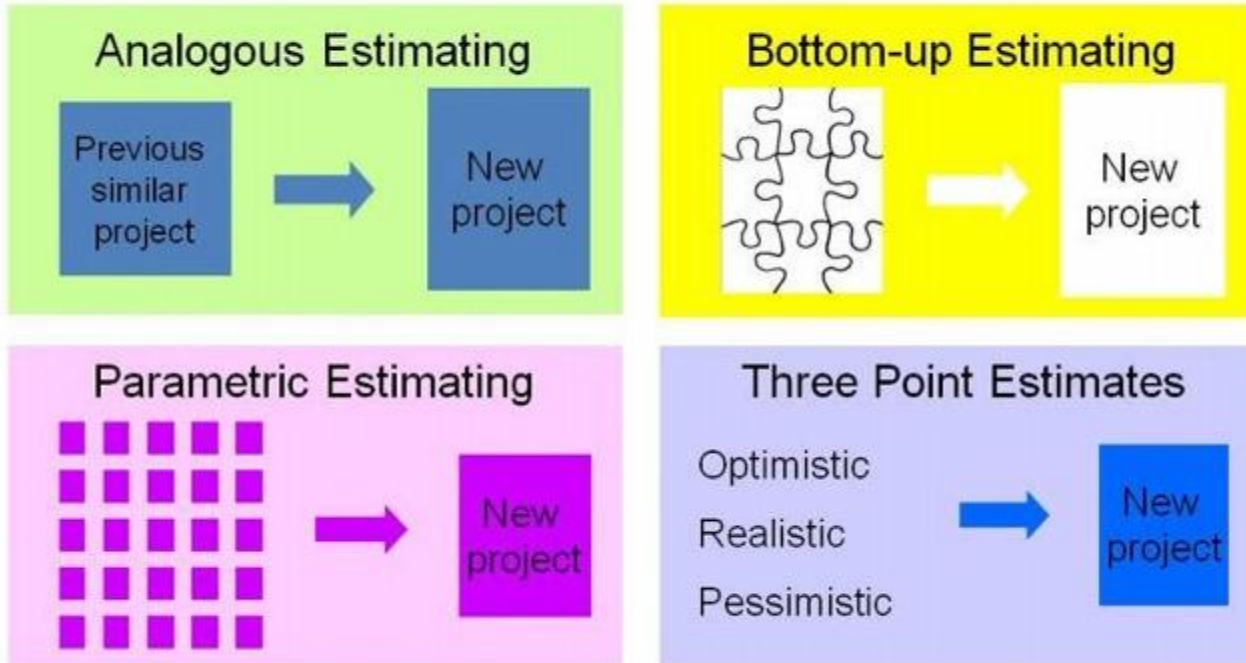


Planning Performance Domain

- Modules (Estimating)
 - Estimating Methods and Definitions
- Tools
 - Three Point Estimating Tool
- Activities
 - Travel Costs to Conference Estimating Exercise



Estimating - Methods



Three-Point Estimating

- PERT Beta Distribution Estimation Equation:
$$E = \frac{(O+4M+P)}{6}$$
- Most Likely (M): Most realistic expectations of activity durations/quantities/costs
- Optimistic (O): Best-case scenario of activity durations/quantities/costs
- Pessimistic (P): Worst-case scenario of activity durations/quantities/costs

Utilization of three estimates to define an approximate range for an activity's durations, quantities, and costs to improve upon the accuracy of a single-point estimate by considering uncertainty and risk. Concept originated from the Program Evaluation and Review Technique (PERT).

Three Point Estimating Tool



3 Point Estimating

| | |
|-------------------|--|
| Project Name | |
| District/Division | |
| Estimator's Name | |
| Date of estimate | |

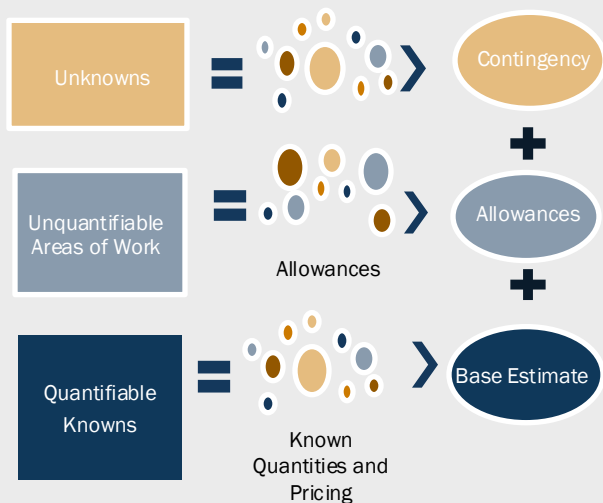
| Item to be estimated | Units | Optimistic (Best Case) | Most likely amount (Base Estimate) | Pessimistic (Worst Case) | Expected Value | Standard Deviation (SD) | Variance | P10 Confidence Level | P10 Z score | P50 Confidence Level | P50 Z score | P70 Confidence Level | P70 Z score | P90 Confidence Level | P90 Z score | Notes |
|----------------------|-------|------------------------|------------------------------------|--------------------------|----------------|-------------------------|----------|----------------------|-------------|----------------------|-------------|----------------------|-------------|----------------------|-------------|-------|
| Pavement Design | HRS | 16 | 40 | 80 | 43 | 11 | 121 | 29 | 1.27 | 43 | 0.00 | 49 | 0.55 | 57 | 1.27 | |
| Dallas to Houston | MIN | 200 | 240 | 360 | 253 | 27 | 729 | 218 | 1.30 | 253 | 0.00 | 267 | 0.52 | 288 | 1.30 | |
| | | | | | | | | | | | | | | | | |

Planning Performance Domain

- Modules (Cost Management)
 - Construction Estimate Life Cycle
 - Risk Based Contingency
 - Average Bid Prices
 - Reviewing Estimates
- Tools
 - Construction Cost Estimating Guide
 - Construction Cost Estimate Resources



Components of a Cost Estimate:

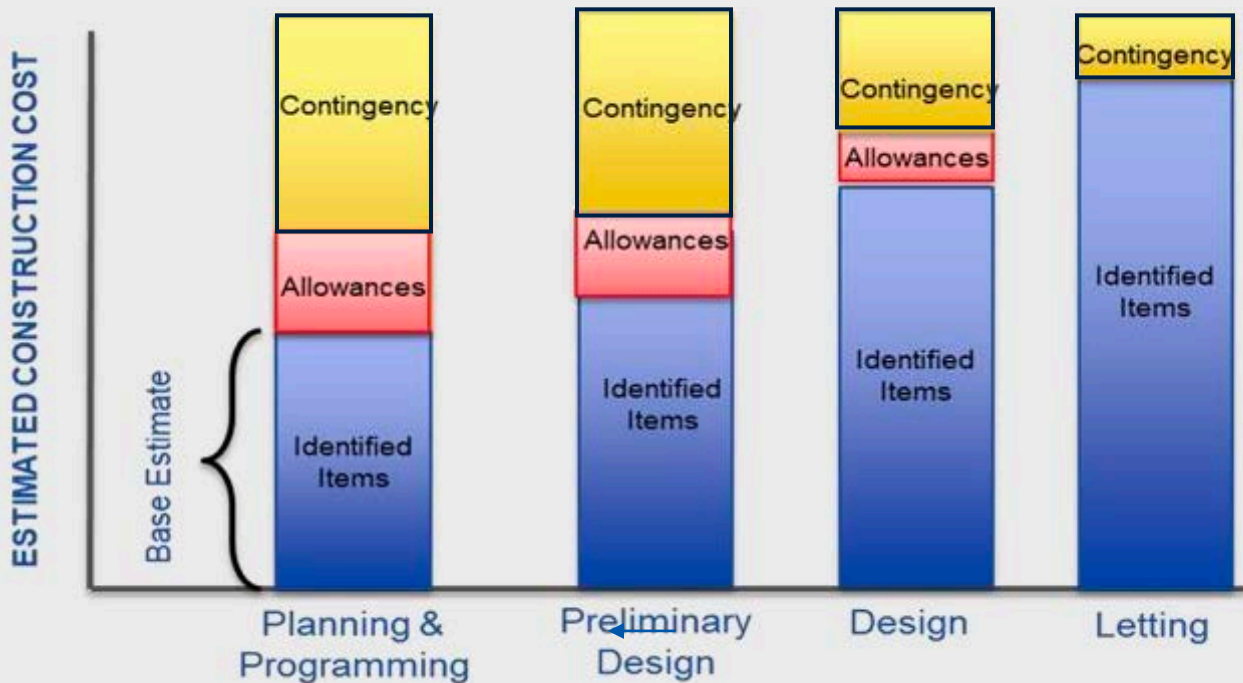


Contingencies: Costs for unknowns and uncertainties should be documented and included in the engineer's estimate.

Allowances: Items known to be required on the project but at a particular project development stage are not yet known or quantifiable.

Base Estimate: Items known to be required on the project and quantifiable.

Construction Estimate Life Cycle



Risk Based Contingency for Estimate

Impact X Probability =
Risk Based Contingency



| Example: Unknown bridge rating | | |
|--------------------------------|-------------|------------------------|
| Impact | Probability | Risk Based Contingency |
| \$5.75M | 10% | \$575,000 |

Average Bid Prices

- Start BIG and Drill Down
- Statewide to District-Wide
- 12 months to 3 months
- Quantity Ranges
- All Bidders to Low Bidders



Reviews Using the 80/20 Rule

- You can review 80% of your Estimate by reviewing 20% of your Items
- For example:
 - Estimate has 100 Items
 - Totals \$15 Million in Construction Costs
- GOALS:
 - Review 20% of the Items (100 items X 20%) = 20 items
 - Impact 80% of the Costs (\$15M X 80%) = \$12M



UNCERTAINTY PERFORMANCE DOMAIN

The Uncertainty Performance Domain addresses activities and functions associated with risk and uncertainty.

Effective execution of this performance domain results in the following desired outcomes:

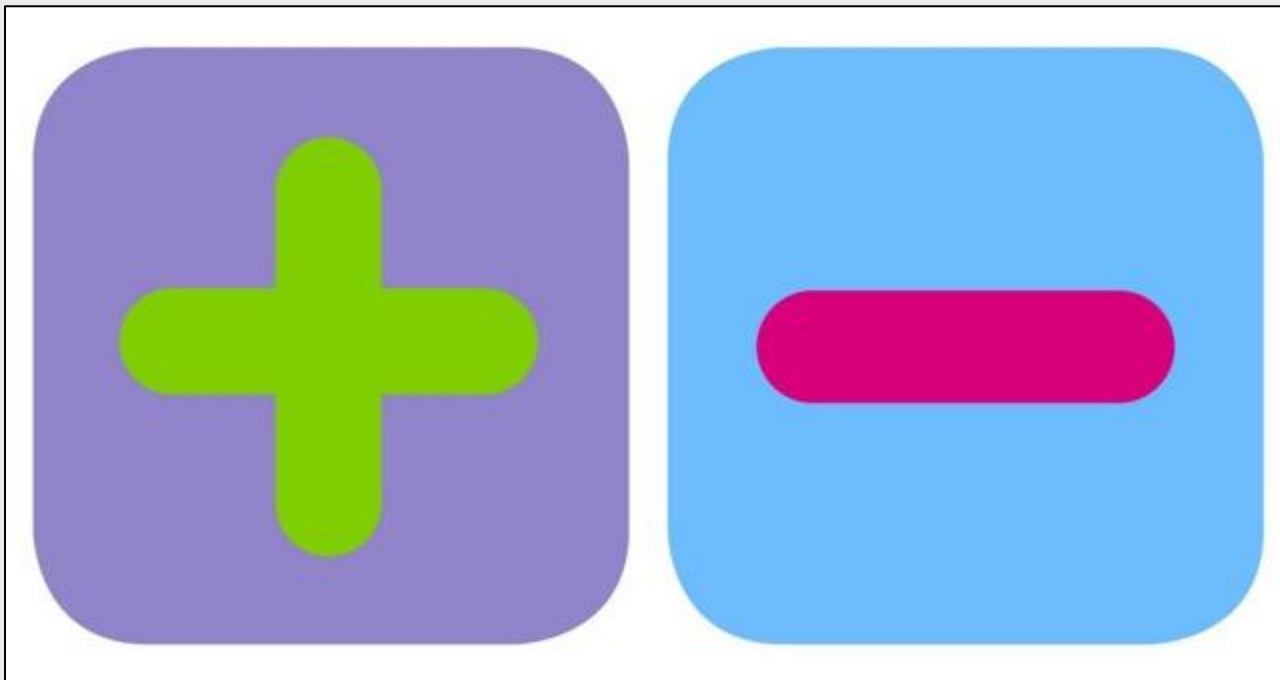
- ▶ An awareness of the environment in which projects occur, including, but not limited to, the technical, social, political, market, and economic environments.
- ▶ Proactively exploring and responding to uncertainty.
- ▶ An awareness of the interdependence of multiple variables on the project.
- ▶ The capacity to anticipate threats and opportunities and understand the consequences of issues.
- ▶ Project delivery with little or no negative impact from unforeseen events or conditions.
- ▶ Opportunities are realized to improve project performance and outcomes.
- ▶ Cost and schedule reserves are utilized effectively to maintain alignment with project objectives.

Uncertainty Performance Domain

- Modules
 - Risk Identification
 - Risk Analysis
 - Risk Responses
 - Risk Monitoring
- Tools
 - Risk Breakdown Structure
 - Risk Workshop Workbook



POSITIVE versus Negative





Opportunities



Threats

Risk Attitudes



Risk Averse

- Does not like uncertainty
- Overestimates threats and underestimates opportunities
- Glass-half-empty personality



Risk Tolerant

- Has a laissez-faire approach to risk
- May not take proactive action
- Most dangerous risk attitude



Risk Neutral

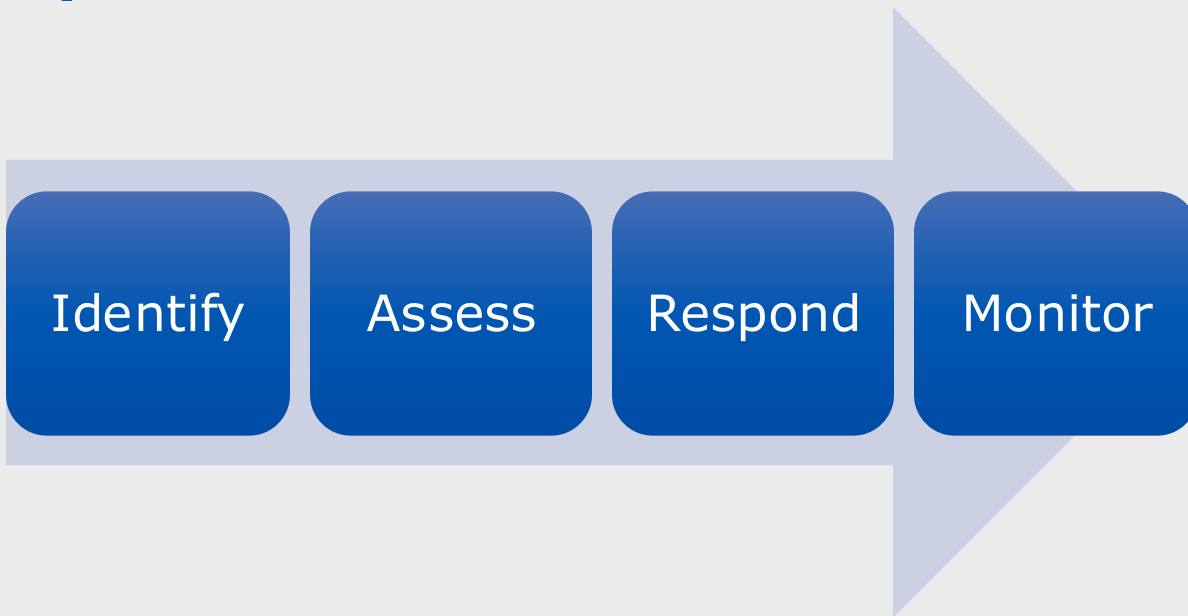
- Views risk management from a long-term perspective, weighing the risks with the rewards
- Healthiest attitude



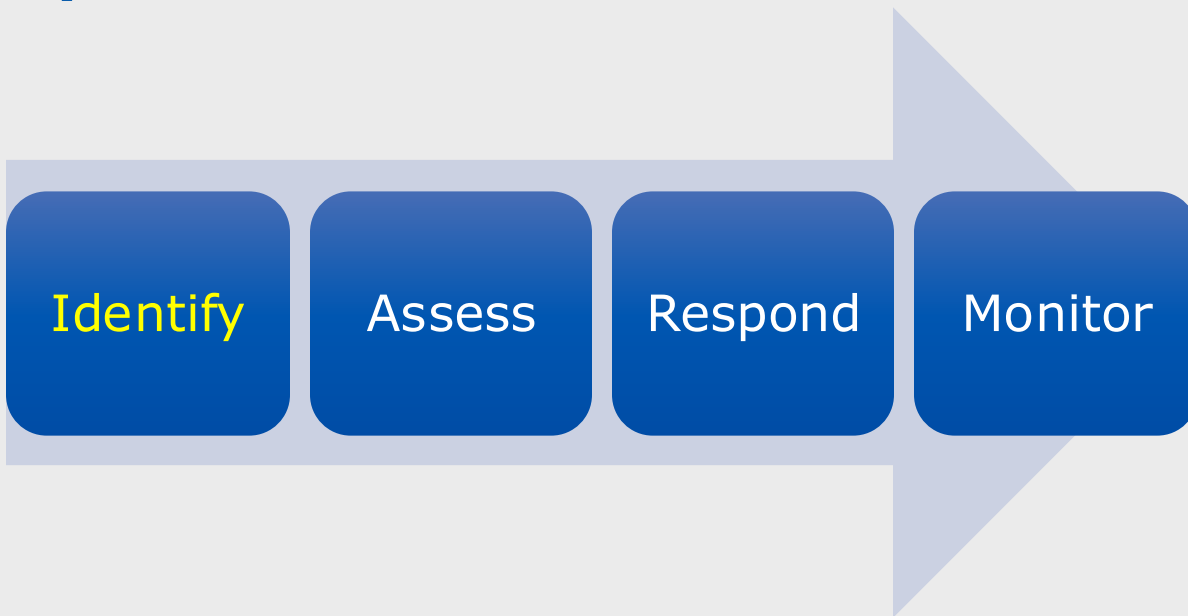
Risk Seeking

- Ready to jump into anything
- Underestimates threats and overestimates opportunities
- Glass-half-full personality

Uncertainty Performance Domain



Uncertainty Performance Domain



Identify Risks

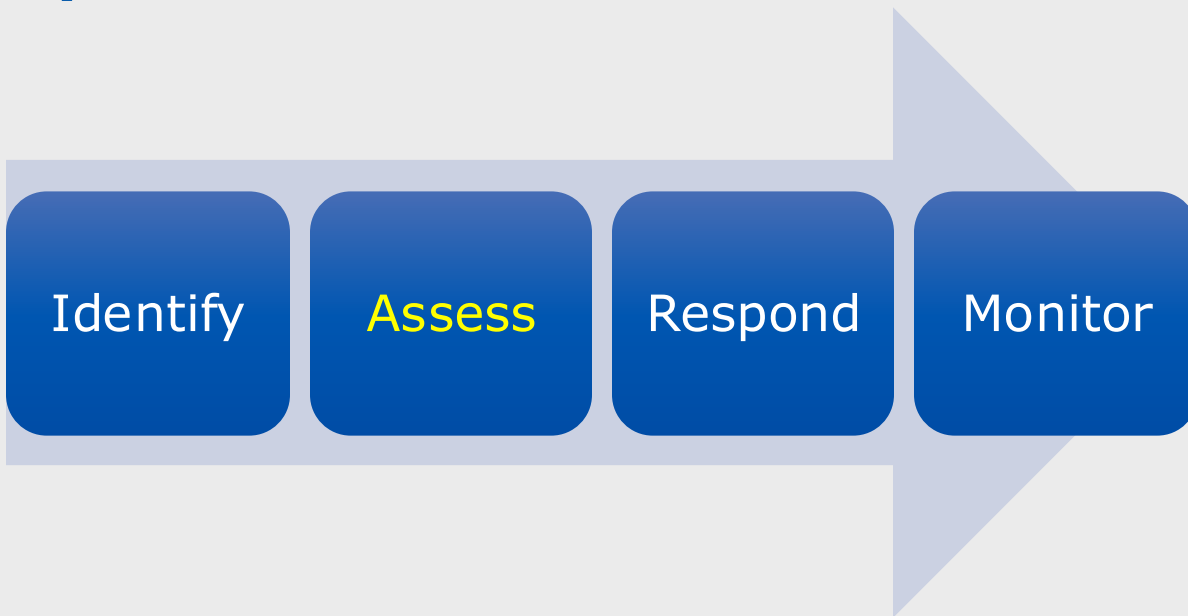


Brainstorm



Risk Breakdown
Structure

Uncertainty Performance Domain



Assess Risks



Probability



Impact

Assess Risks

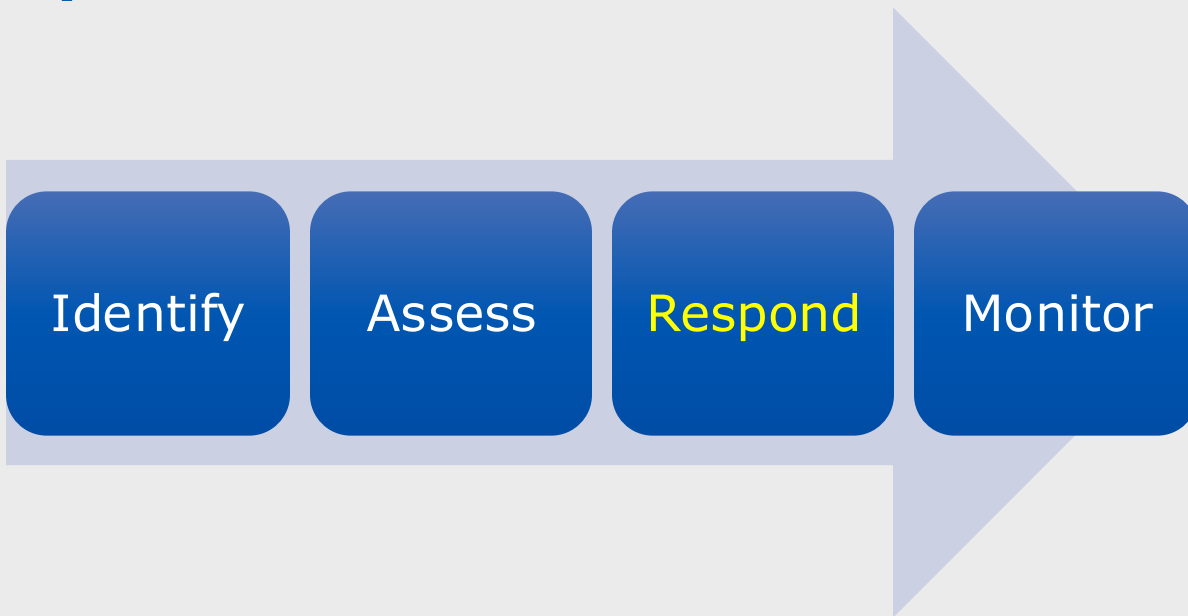


Qualitative



Quantitative

Uncertainty Performance Domain



Risk Responses for Threats



Accept



Mitigate



Transfer



Avoid

Risk Responses for Opportunities



Accept



Enhance

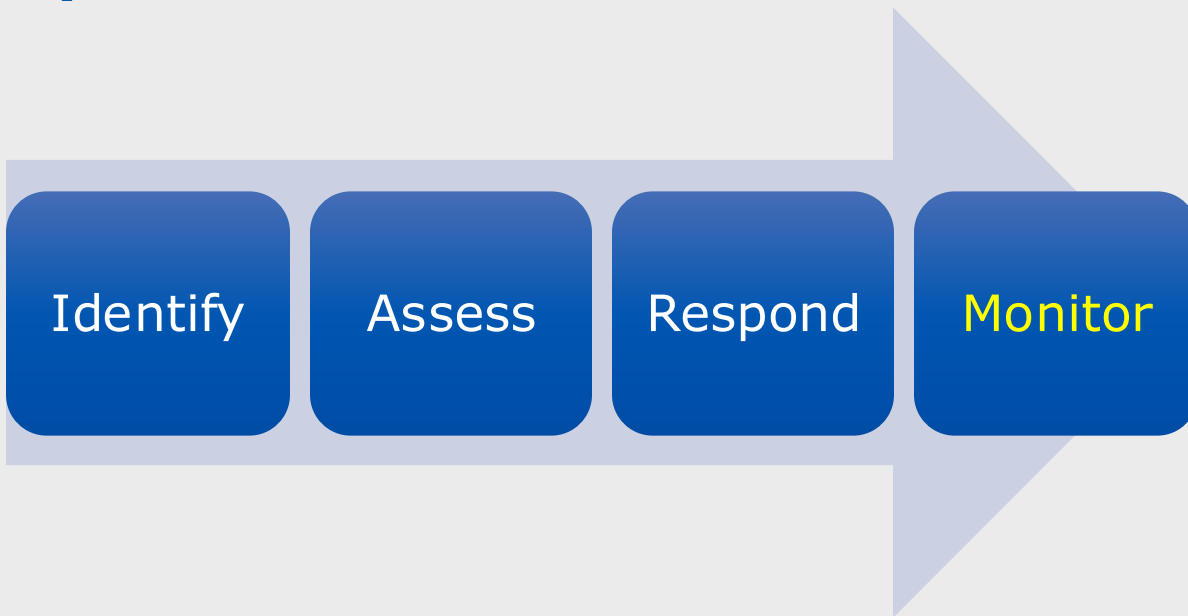


Share



Exploit

Uncertainty Performance Domain



Monitor Risks



Probability



Impact

Subject Matter Experts



Monitor Risks



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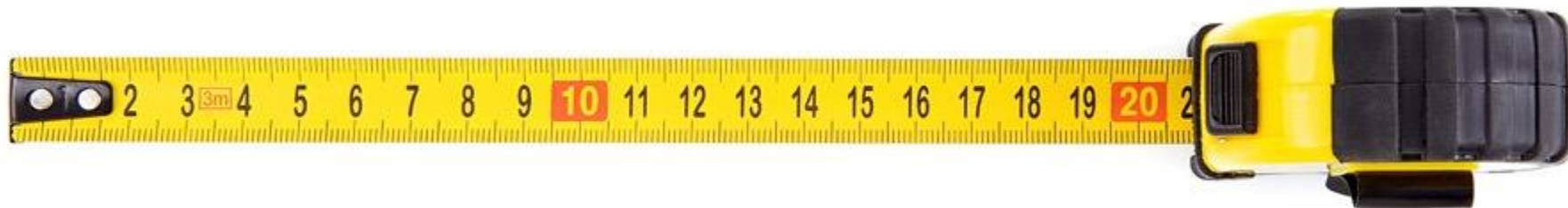
Risk Breakdown Structure

- Agreements
- Environmental
- Right-of-Way
- Utilities
- Design
- Resources
- Construction



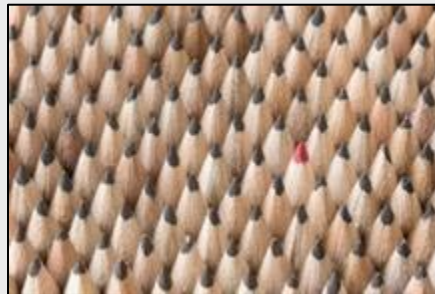
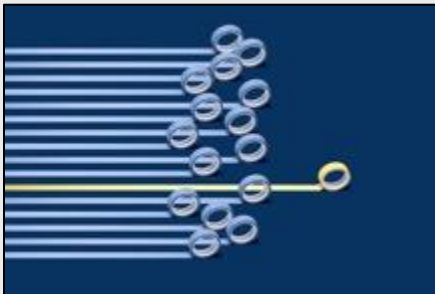
Measurement Performance Domain

- Modules
 - Metrics and Key Performance Indicators
 - Monitoring and Controlling
- Tools
 - Dashboards



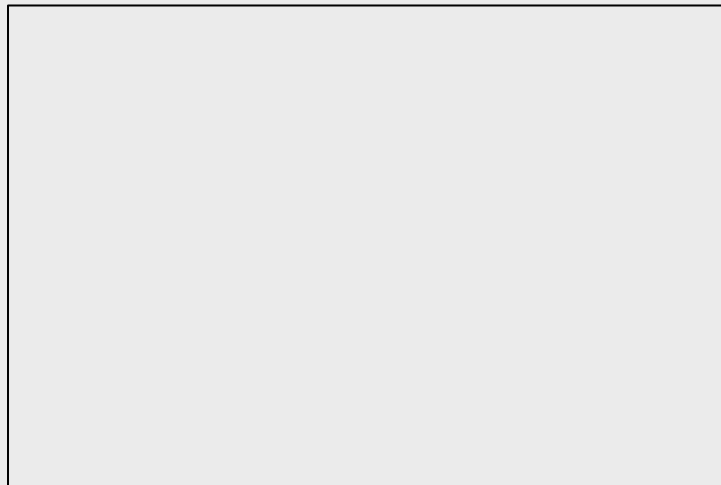
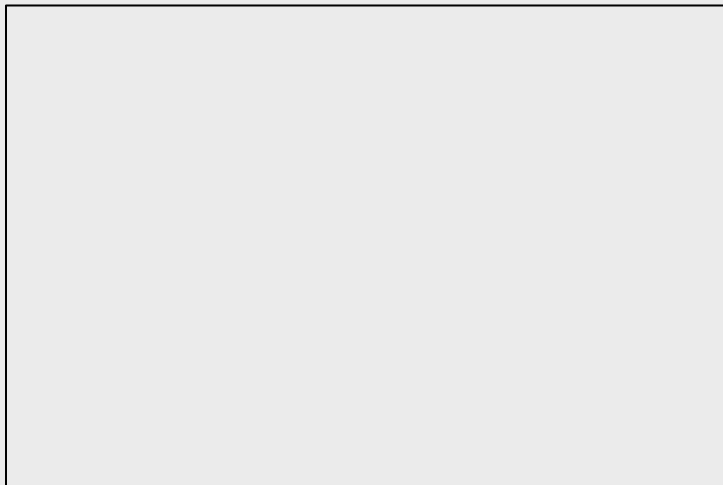
Metrics and Key Performance Indicators

- Metric- Description of project or product attribute and how to measure it
- Baseline- Approved version of work product used as basis for comparison to actual results
- Key-Performance Indicators-
 - Leading indicators- predict changes or trends
 - Lagging indicators- measure project deliverables or events



Monitoring and Controlling

- Monitor Risks, Stakeholder Engagements, Communication
- Control Scope, Schedule, Cost, Quality, Procurements



Dashboards

Set of charts and graphs showing progress or performance against important measures of the project

- Tableau
- Power BI
- Smartsheet
- Salesforce
- Google Charts

