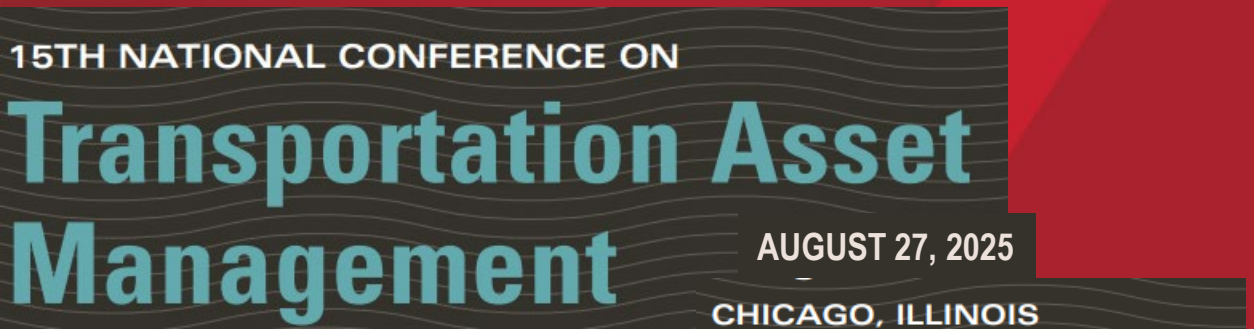
IOWA STATE UNIVERSITY
Institute for Transportation

The Enhanced Role of Risk Registers in Developing a Framework for Integrating Performance, Risk, and Process Management in Transportation Agencies



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Objective

- Explore how transportation agencies can leverage risk registers to create a unified framework that aligns performance management (PM), risk management (RM), and process improvement (PI).

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Agenda

- State of the practice
- The use of risk registers in risk-based TAM
- Enhancements
- Discussion

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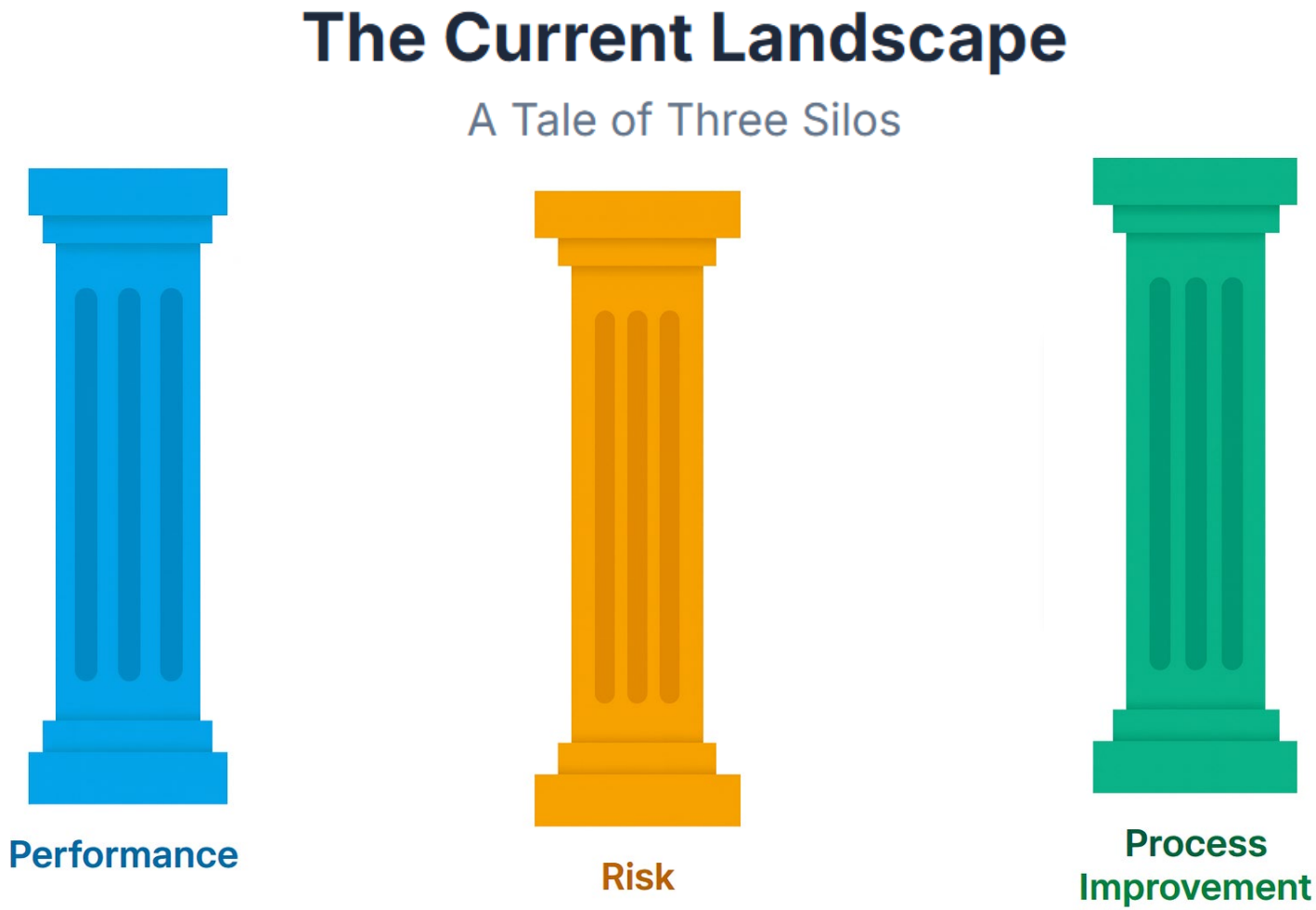
Introduction



State of the Practice

- **What happens today-**
  - **PM** sets targets and reports KPIs;
  - **RM** logs threats;
  - **PI** runs fixes inside units

  — with **minimal linkage** across them.

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State of the Practice

- Data lives in different places
- Decisions lack a risk–performance lens
- Local optimizations beat enterprise value
- Firefighting is common

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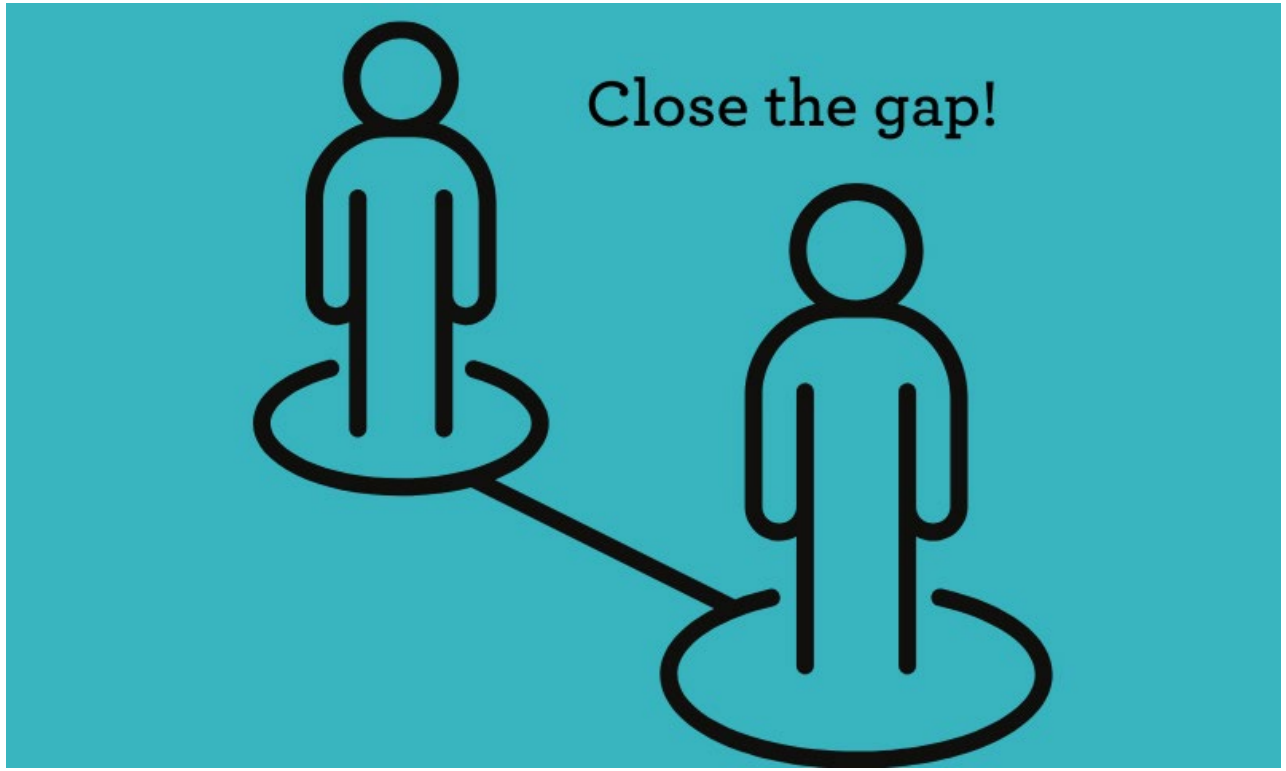
Cost of the status quo

- **Misaligned priorities**
- **Slower cycle times**
- **Lower ROI**
- **Accountability gaps**



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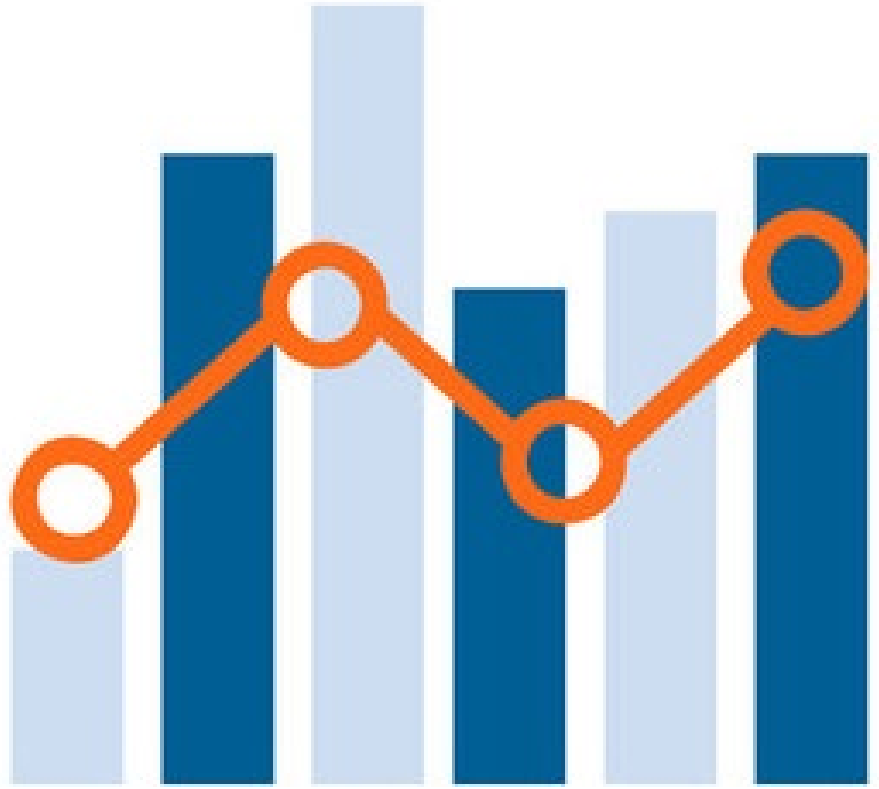
Core root causes

- No shared **single source of truth**
- **Fragmented governance**
- **Incompatible scoring/metrics**



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A Growing National Momentum

- The integration of these disciplines is evolving and gaining traction.
- FHWA Initiatives: Efforts like the "Roadmap to Risk Management for Transportation Planning"
- NCHRP Project 23-37: "Integrating Performance Management, Risk Management, and Process Improvement: A Guide"
- This presentation builds on this foundational work.

FHWA

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP

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Problem Statement

Maturity	What it looks like	Representative signals
Typical	PM, RM, PI operate on different cadences; risk logs lack KPI impact fields; PI projects not tied to register items.	Risk-based TAMP exists but mainly for pavements/bridges; planning uses PBPP; CI/Lean is local.
Leading	Risk register includes ΔKPI and owners; mitigation actions are PI projects with due dates; quarterly governance reviews RM⇄PM⇄PI.	UDOT ERM within TPM; INDOT program/strategy alignment; MnDOT ancillary-asset risk use.
Gap	No “single source of truth”; weak traceability from risks → KPI shifts → PI outcomes; manual crosswalks.	Ongoing NCHRP 23-37 aims to standardize integration patterns and artifacts.

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The Solution

- Risk register
  - Originally, risk registers were used to drive the RB-TAMP

. Typical Risk Register Example

Risk number	Risk description	Impact	Likelihood	Risk rating
PM2	Increased truck weights increase deterioration rates of existing infrastructure	Catastrophic	Almost certain	Critical
PM1	Lack of reliable traffic loading data decreases confidence and effectiveness of pavement design	Major	Likely	High
PM4	Public demand for low construction impacts increases costs and decreases quality	Moderate	Almost certain	High

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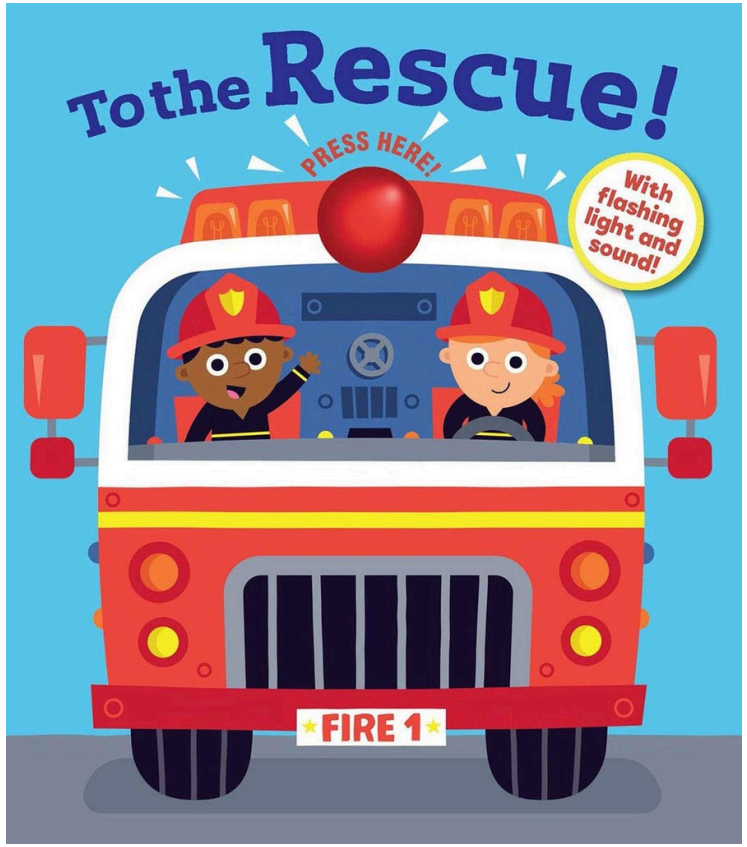
The Solution

- Risk register
  - Originally risk registers were used to drive the RB-TAMP
- **Strong points** 
  - Workshop was held of important stakeholders
- Limitations 
  - No info on tracking



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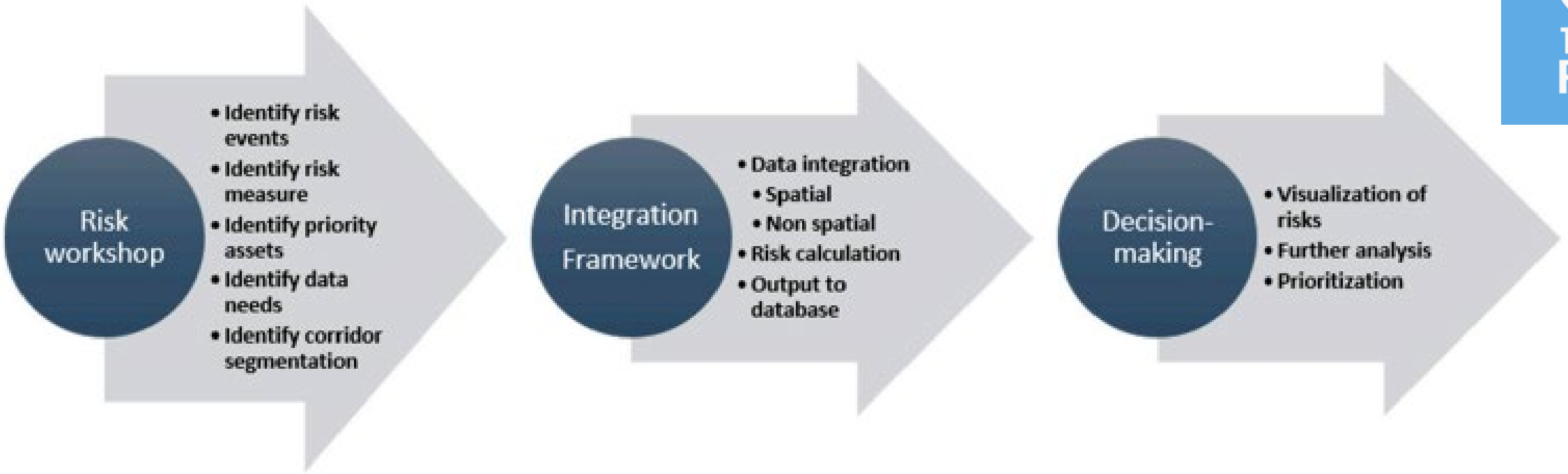
The Solution

- Modified Risk register workshop



Implementation framework for agency.

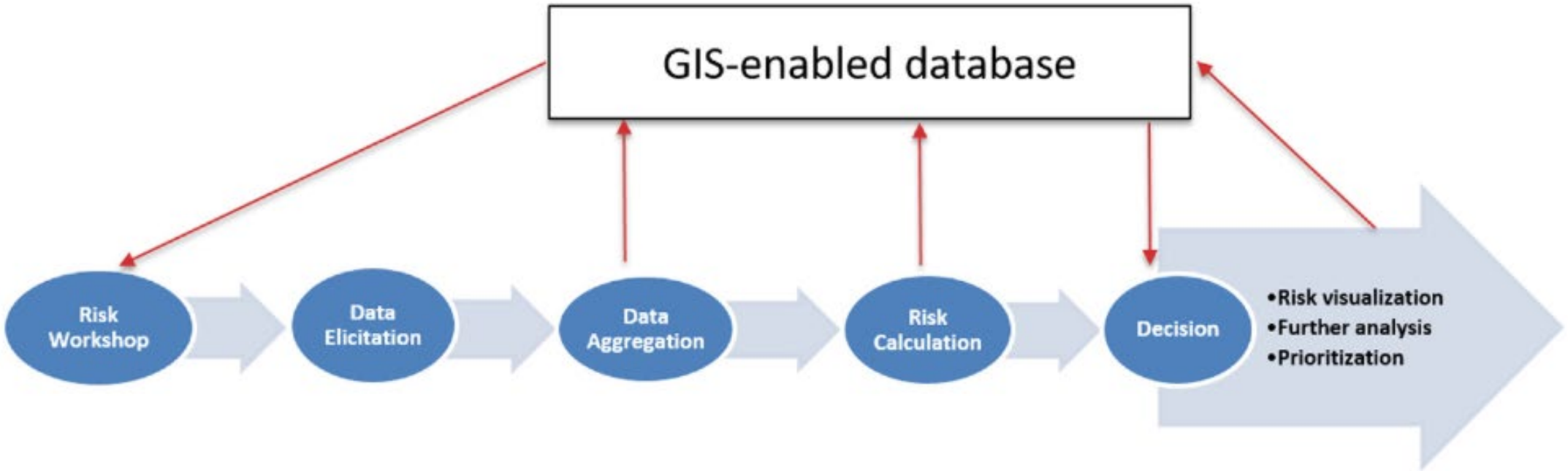
The Solution

- Modified Risk register

Risk number	Risk description	Impact	Likelihood	Risk rating	Risk measure	Data sources
PM2	Increased truck weights increase deterioration rates of existing infrastructure	Catastrophic	Almost certain	Critical		
PM1	Lack of reliable traffic loading data decreases confidence and effectiveness of pavement design	Major	Likely	High		
	Public demand for low		Almost			

The Solution

- Modified Risk register



Complete risk management database framework.

The Solution

- Enhanced Risk register workshop for integration
  - Add PM and PI stakeholders
  - Define KPIs
  - Define processes
  - Identify barriers
  - Resource mapping (tools, analyses, visualization, etc.)

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The Solution

- Enhanced Risk register for integration
  - A structured log of **asset- and program-level information**
    - that records each risk's cause, likelihood,
    - the **actions** (and owners) to treat it,
    - impact on **asset performance/condition**,
    - and continuous (iterative) improvement

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The Solution

- **ID, Objective/Asset**
- **Risk statement** (cause–event–effect)
- **Likelihood** (1–5 or %), **Impact** (ΔKPI, Δ$, schedule/cost variance) → **Risk score**
- **Category** (financial, condition, external, info/decision, delivery, safety, resilience)
- **Controls & Mitigation strategy** (preventive/detective/reactive)
- **Owner, Due date, Status**
- **Linked PI action** (Work order #)
- **Residual risk**, **Next review date**, **Trend**

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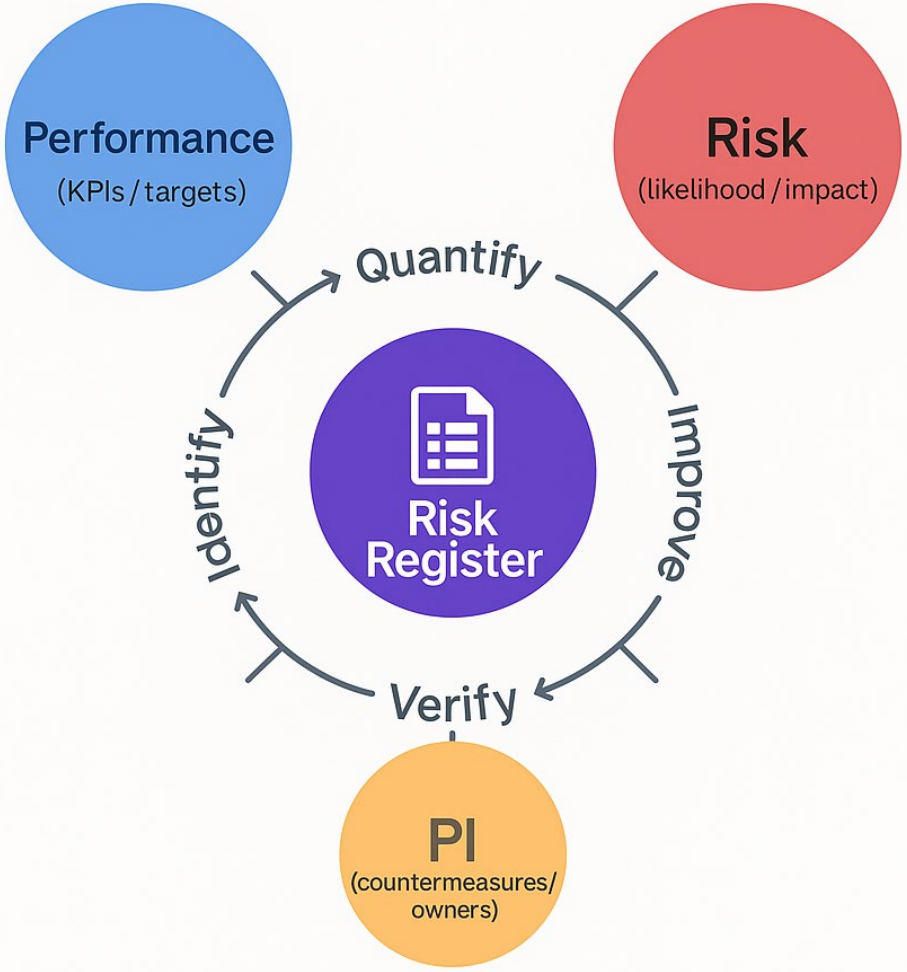
Swimlanes



- **PM (Performance):** define targets, supply variance triggers, validate ΔKPI.
- **RM (Risk):** maintain register quality, facilitate scoring/portfolio rank.
- **PI (Improvement):** implement countermeasures, report residual risk.
- **Finance/Programs:** allocate by risk-reduction-per-$; track spend vs. benefit.

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TAM Cycle

- **Policy & Strategy:** captures enterprise and climate/resilience risks to shape objectives and risk appetite.
- **Planning:** informs **lifecycle strategies** (treatment timing, standards) and **resilience measures**.
- **Programming:** prioritizes investments by expected **risk reduction per dollar**.
- **Project Delivery:** flags delivery risks (scope, schedule, cost) affecting asset outcomes.
- **Operations & Maintenance:** surfaces reliability, safety, and deterioration risks; triggers **preventive work**.
- **Monitoring & Reporting:** trends risk vs. KPI movement; updates targets and strategies.

AASHTO TAM Guide

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TAM Data/System

- **Upstream feeds:** inventory & condition (PMS/BMS), inspections, reliability, safety, incidents, finance, climate/GIS.
- **Downstream use:** TAMP, program prioritization tools, dashboards, maintenance management, portfolio reviews.
- **Mappings needed:** risk ↔ **KPI(s)**, risk ↔ **asset class/segment/corridor**, risk ↔ **project/PI action**.

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Benefits

- **Makes TAM (truly) risk-based**: connects risks to **targets and lifecycle strategies** (e.g., pavements ≥X% good).
- **Improves tradeoffs**: expresses impact in **KPI units and dollars**, enabling cross-asset prioritization.
- **Closes the loop**: links risks to **mitigations/PI actions** and tracks **residual risk** over time.
- **Strengthens accountability**: clear owners, due dates, and review cadence.

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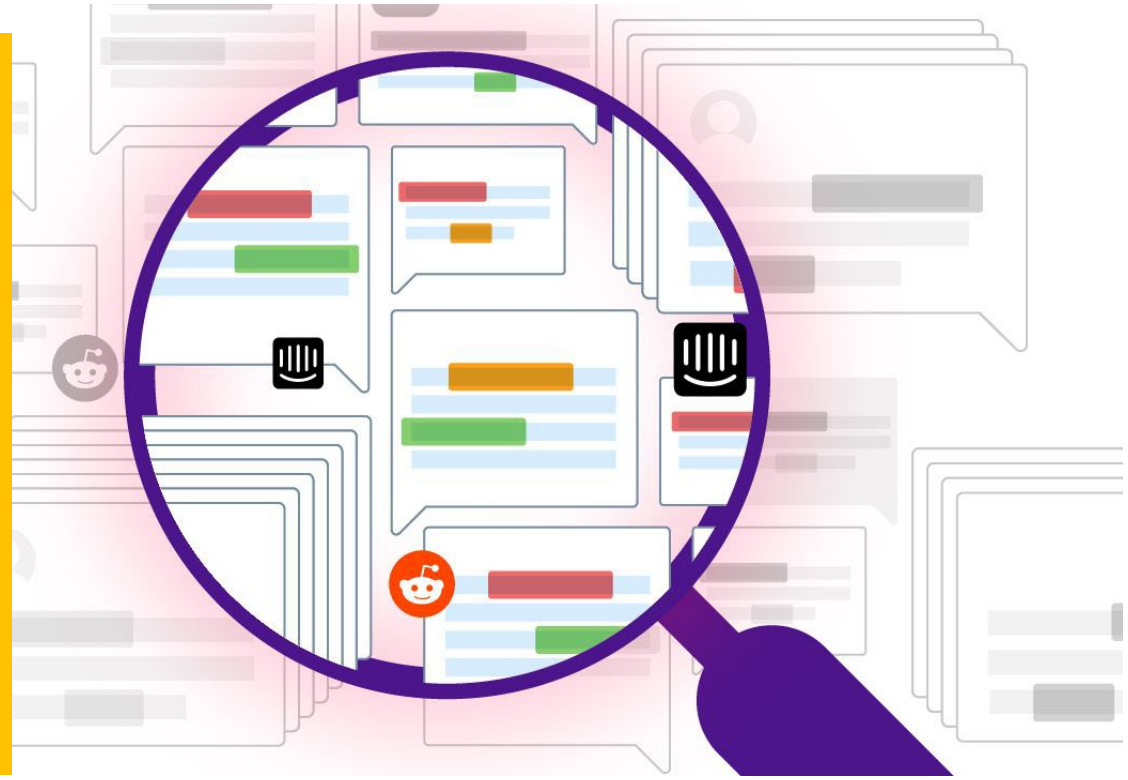
More Questions to ask

- **Top-X risk list** by ΔKPI or expected annualized $ impact.
- **Risk heat map** (likelihood × impact) with KPI overlays.
- **Risk-to-value curve**: cumulative risk reduction vs. investment.
- **Residual-risk trend** after mitigations (verify benefits).



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Maintenance

- **Frequent PI reviews:** update entries, confirm status/owners.
- **Portfolio reviews:** re-rank risks, approve programs based on **risk reduction per $**.
- **Annual refresh:** align with TAMP update, targets, and risk appetite.

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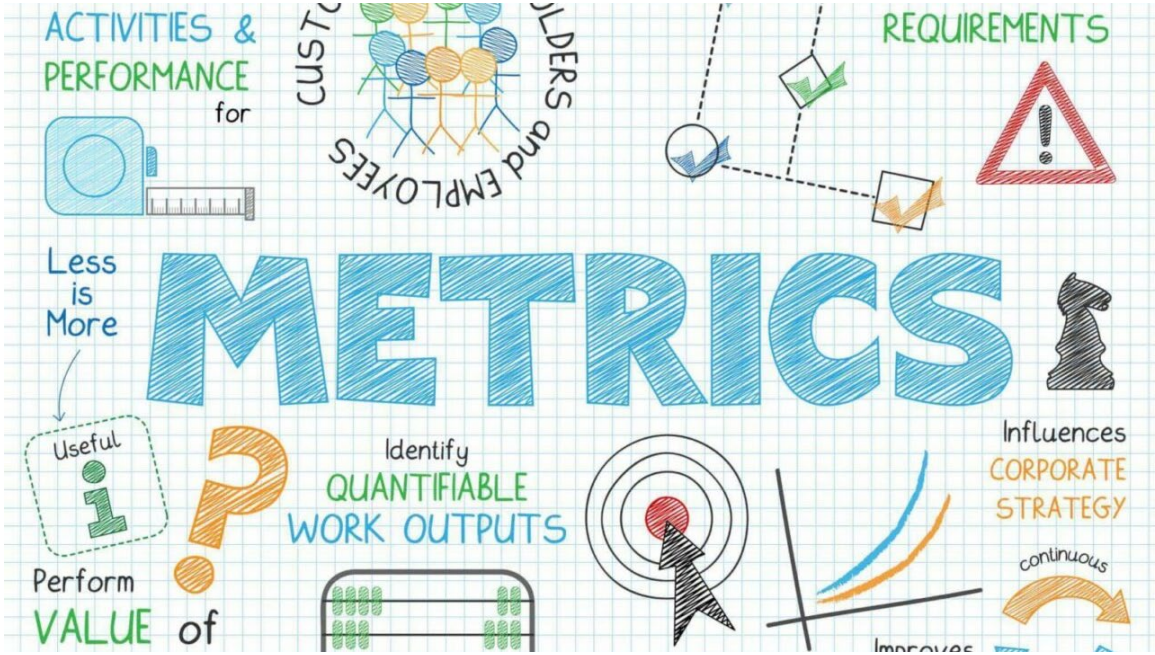
Success Metrics

- ≥90% of priority risks have **active mitigations** and current owners.
- **Residual risk↓** across top 10 items within 12 months.
- % of programs ranked using **quantified risk impact**.
- **Time-to-mitigation** from identification to action start.



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Discussion

- Communication strategies
- Proactive change management tactics
- Technology adaptability
- Taxonomy sync
- Workforce development

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Reference

- Nlenanya, Inya & Smadi, Omar. 2021. “Database Design and Integration Framework for Risk Management for State Highway Agencies.” *Transportation Research Record*, 2675(11), 812–827. DOI: 10.1177/0361198121102000 4.
- Nlenanya, Inya, and Omar Smadi. 2021. "A Risk Management Database Framework Implementation for Transportation Asset Management" *CivilEng* 2, no. 1: 193-213. https://doi.org/10.3390/civileng2010011

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Questions

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PROGRAMS

AMPP ASPHALT MATERIALS & PAVEMENTS PROGRAM

Aurora

CMAT

Iowa LTAP Local Technical Assistance Program

SUDAS Statewide Urban Design & Specifications

PROSPER

REACTOR Realtime Analytics of Transportation Data

SWZDI Smart Work Zone Deployment Initative