



The following presentation is supplemental to *NCHRP Research Report 1076: A Guide to Incorporating Maintenance Costs into a Transportation Asset Management Plan*. (NCHRP Project 23-08 of the same title). The full report can be found by searching on *NCHRP Research Report 1076* on the National Academies Press website (nap.nationalacademies.org).

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Guide for Incorporating Maintenance Costs into a TAMP





Topics

*Background

- Challenges to Incorporating Maintenance Costs into a TAMP
- Benefits of The Guide
- Intended User Groups

*Defining Maintenance

*Framework for Incorporating Maintenance into a TAMP

- Data Needed
- Life-cycle Planning
- Risk Management
- Financial Planning
- Investment Strategies

*Implementation and Continual Improvement



Background

- * 23 CFR 515 Requires State DOTs to develop TAMPs that indicate planned investments in five different work types
- * As of 2019, only 11 State DOTs included detailed information on maintenance costs in their TAMPs

TAMP WORK TYPES (23 CFR 515.5)

- * Initial Construction
- * Maintenance
- * Preservation
- * Rehabilitation
- * Reconstruction



NCHRP 23-08

Literature Search

Current TAMPs

NCHRP Research

AASHTO Guides

FHWA Publications

Peer Exchanges

State and County DOTs

Four virtual sessions held in 2020

Case Studies

Alabama DOT

Florida DOT

Maryland SHA

New York State DOT

Nevada DOT

Texas DOT

Maricopa County DOT

Challenges to Incorporating Maintenance Costs into a TAMP

OBSTACLES

- * Lack of a common definition for maintenance
- * Lack of quality data
- * Limited understanding of the maintenance and asset life-cycle relationship
- * Immature risk management practices
- * Separation of maintenance and capital budgets
- * Maintenance and asset management have different budget or planning periods
- * Unlike other work types, maintenance is applicable at all life-cycle stages





Benefits of the Guide



- * Better incorporate maintenance costs into TAMPs.
- * Establish clear connections between maintenance investments and asset condition.
- * Understand how maintenance activities support asset management strategies



Intended Users

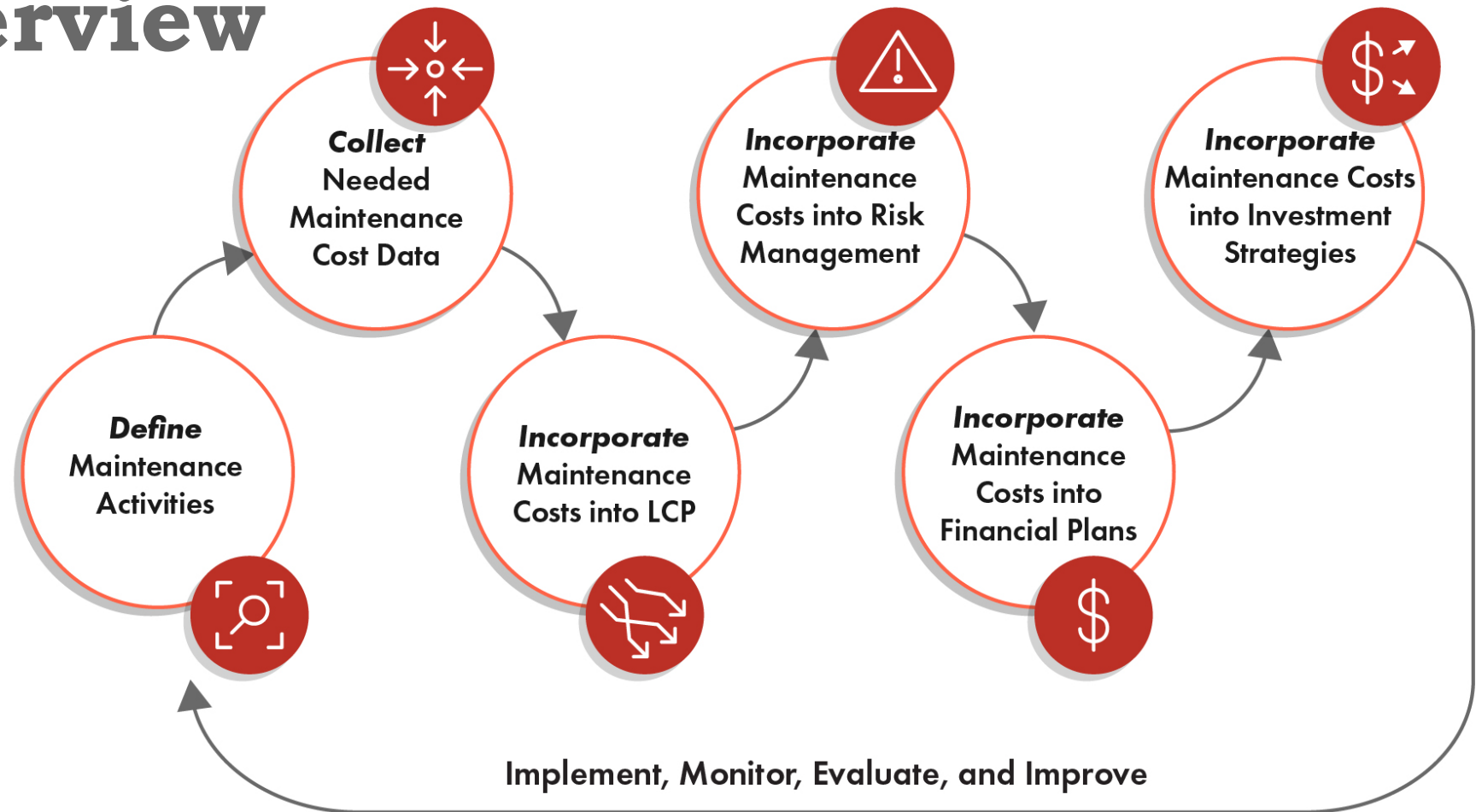
*Asset Managers' Concerns

- Long-term planning
- 10-year investment strategies
- Asset condition ratings
- All funding
- Enterprise and programmatic risks

*Maintenance Managers' Concerns

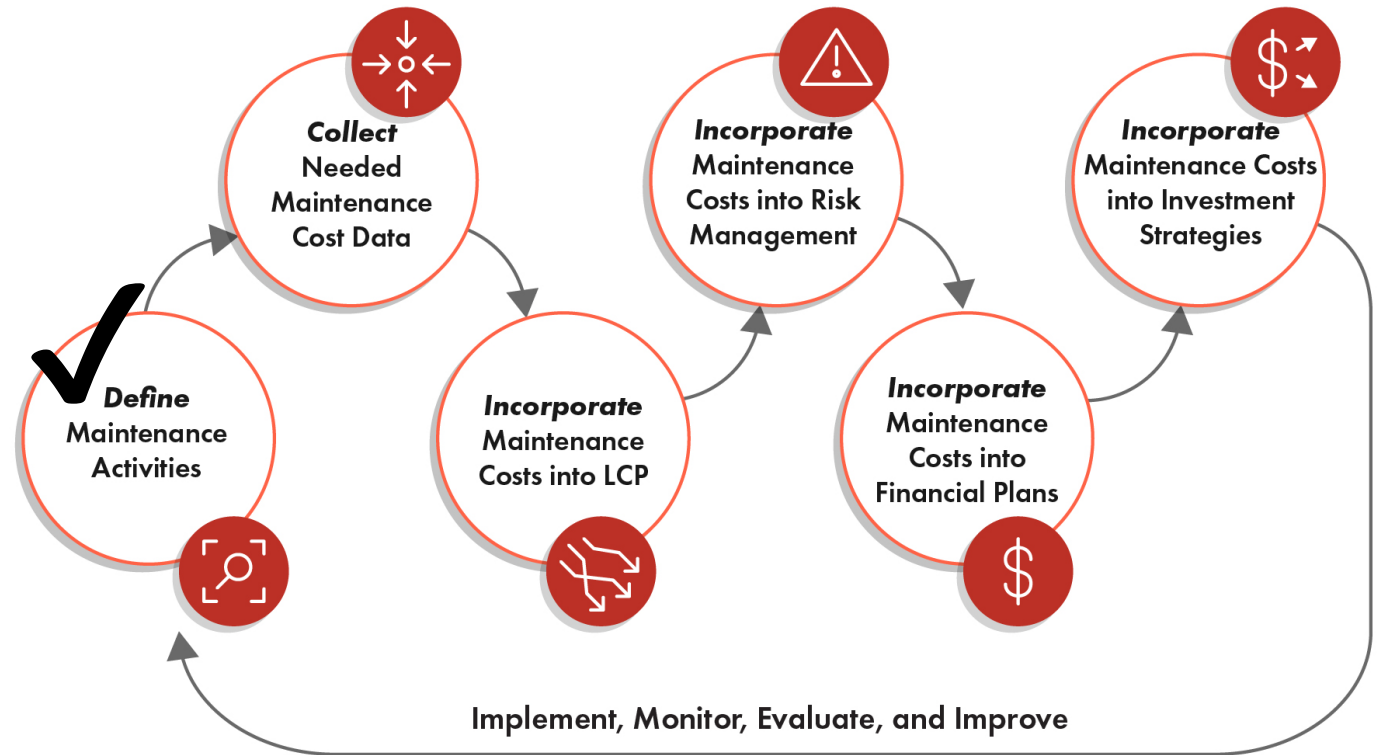
- Short-term operations
- Annual budgets
- Maintenance quality assessments
- Maintenance budget
- Implementation of risk mitigation efforts

Framework Overview



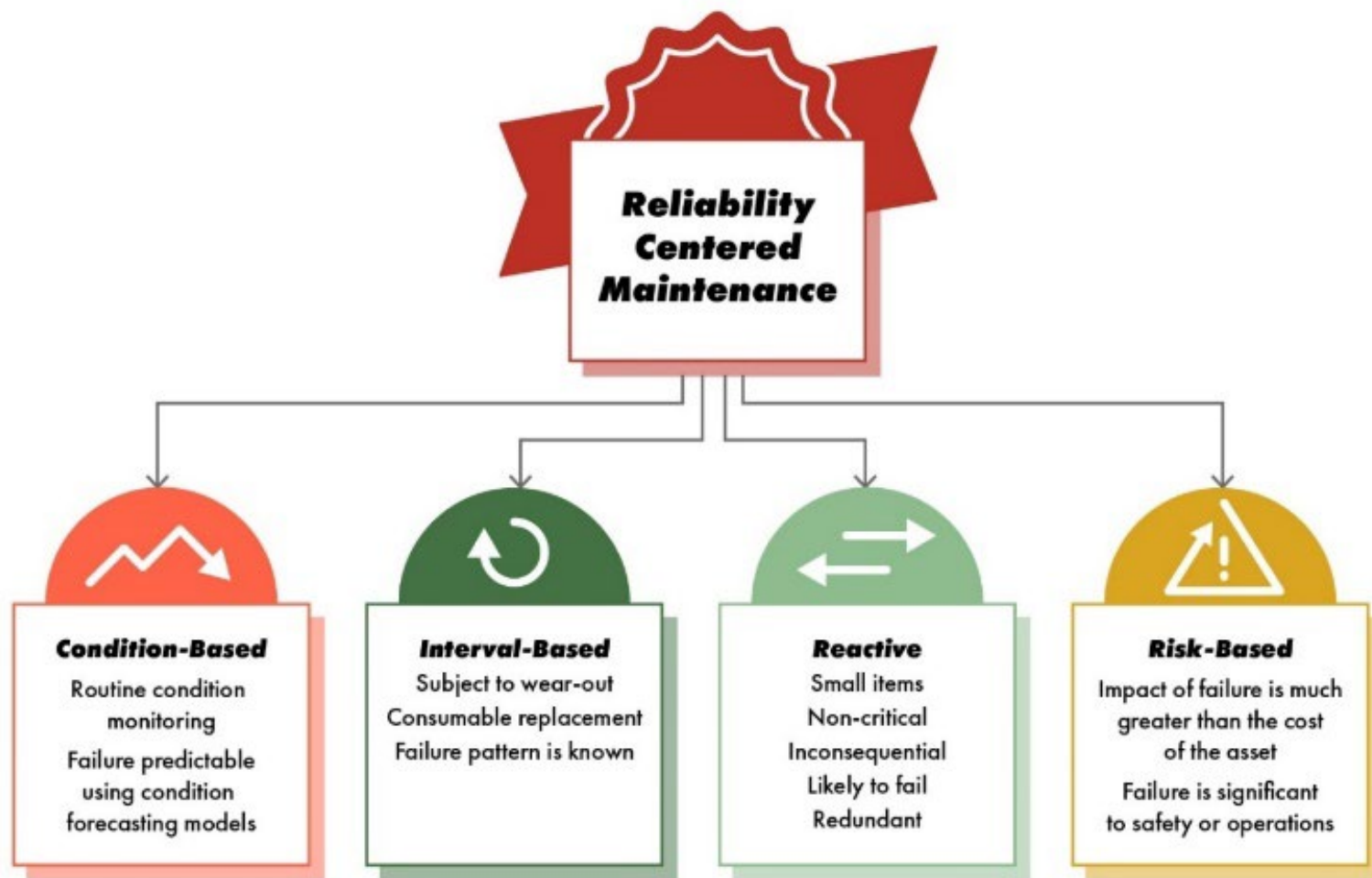


Defining and Categorizing Maintenance Activities





Reliability Centered Maintenance



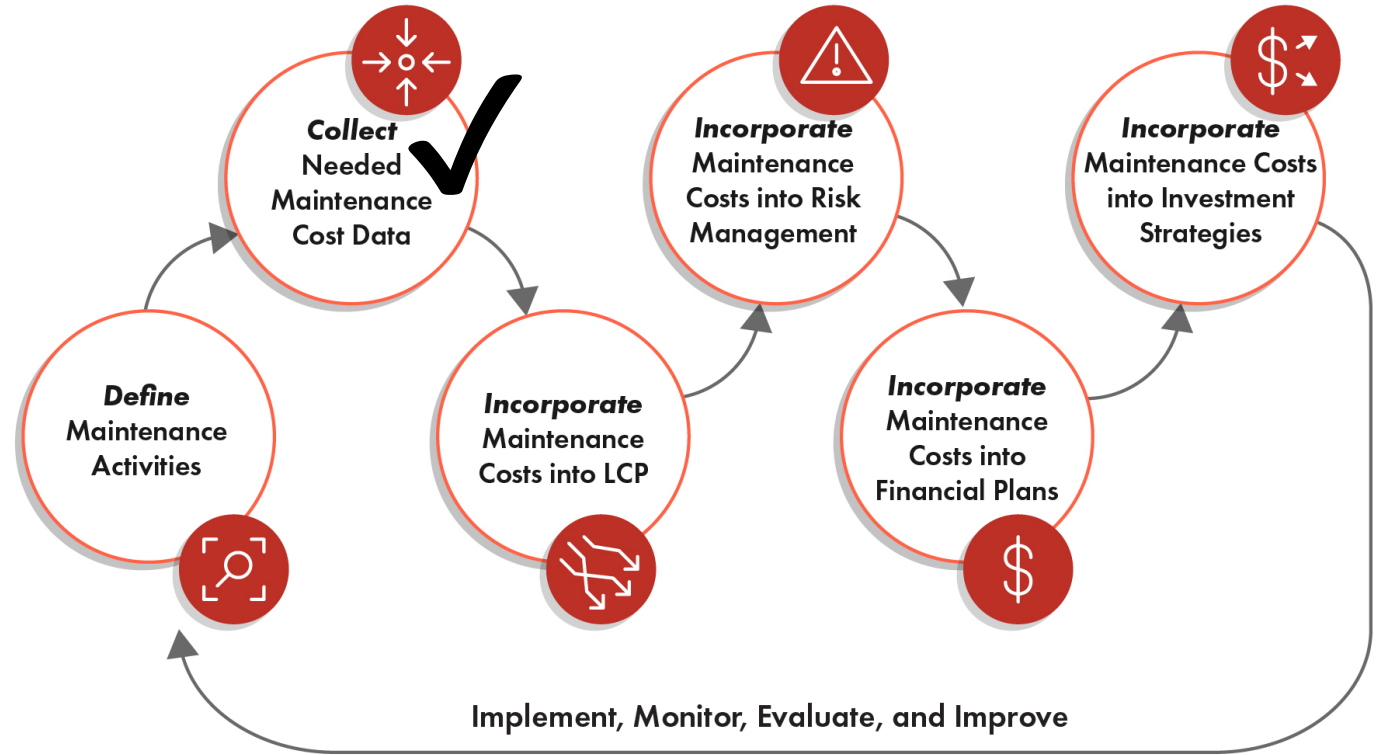


Categorizing Maintenance Activities

Category	Activity Examples
Operations and routine maintenance	Road patrol, mowing, snow and ice control.
Preventive maintenance	Crack seal, chip seal, sweeping, drain cleaning, bridge washing.
Repair	Mill and inlay, deck repair, replacement of parts.
Unit or major component replacement	Sign panel replacement, striping, traffic signal component replacement.
Organizational strengthening	Training, safety briefings, management system use, planning supervision.



Collecting Needed Data



Maintenance Data Collection Attributes

Required

- **Asset ID:** a shared, unique identifier for the asset
- **Location:** spatial, linear referencing
- **Asset Categories:** a specific grouping of the asset
- **Key Condition/ Performance Attributes:** as appropriate

Recommended

- **Supporting Condition/ Performance Attributes:** such as drainage or bleeding issues on a pavement
- **Component Inventory:** such as controller models for traffic signal or guardrail blockout material types
- **Field Priority:** field identified priorities for investment

Optional

- **Detailed Inventory or Assessment Notes:** captures unique circumstances, context, and one-off conditions
- **Detailed Component Information:** installation dates of individual components
- **Attachments:** providing detailed supporting documents

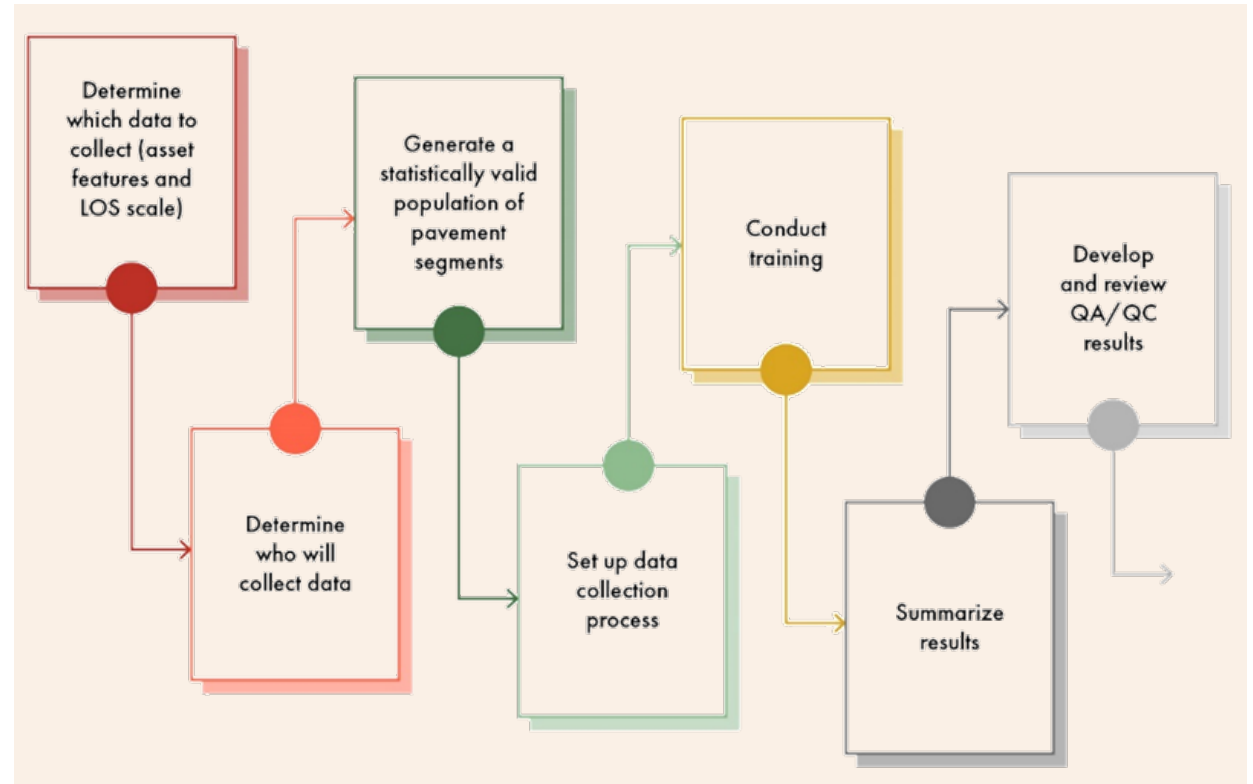
Defining Performance for Different Maintenance Strategies

Approaches	Condition Data	Age / Last Treatment	Risk Data
Condition	✓	✓	Optional
Interval	Optional	✓	Optional
Reactive	Optional	Optional	Optional
Risk Based	Optional	Optional	✓

Maintenance Quality Assurance Program

ALABAMA DOT EXAMPLE

MQA program enables ALDOT to compare asset condition over time and across organizational units in a consistent manner.



Data source: Alabama DOT



Maintenance Quality Assurance Program

ALABAMA DOT EXAMPLE

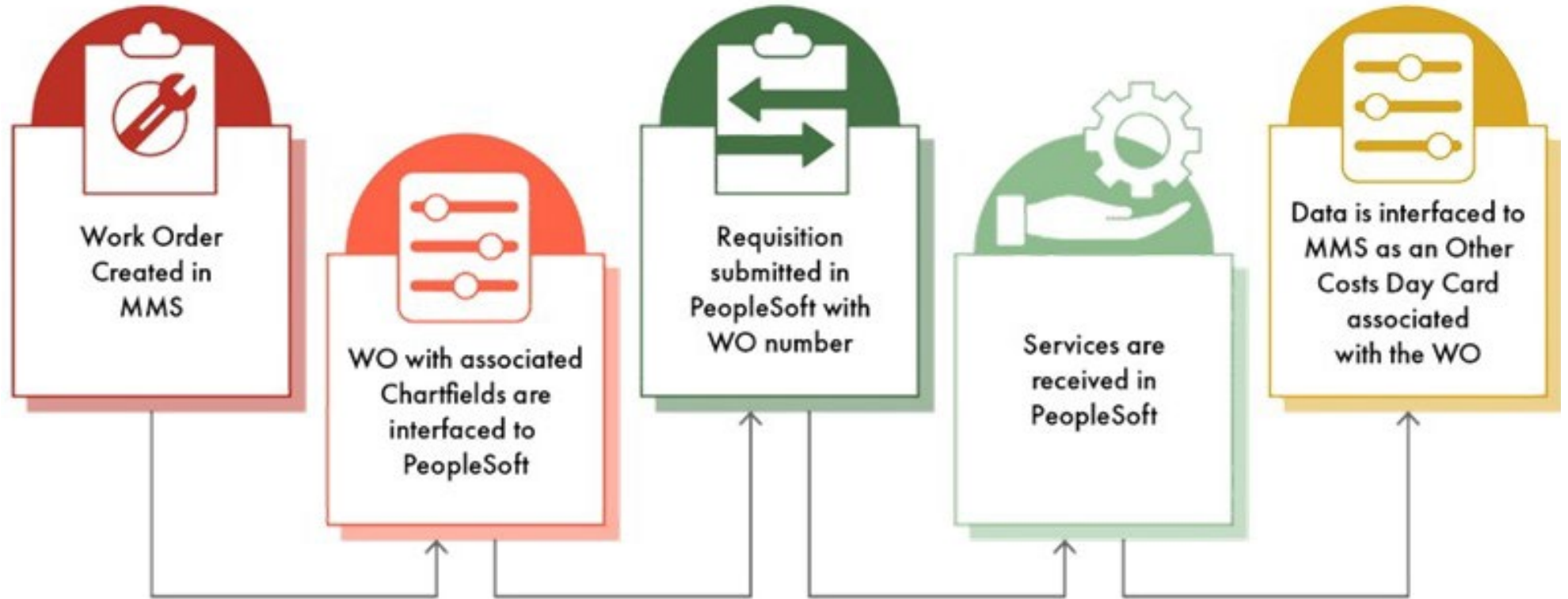
MQA program enables ALDOT to compare asset condition over time and across organizational units in a consistent manner.

Group	Feature	2016	2017	2018	2019	2020
Asphalt Pavement	Asphalt—Potholes	A	A-	B+	A+	A+
	Raveling	B-	B-	B+	B+	B+
	Shoving	C	F	D-	F	D-



Tracking Maintenance by Contract Costs

TEXAS DOT EXAMPLE

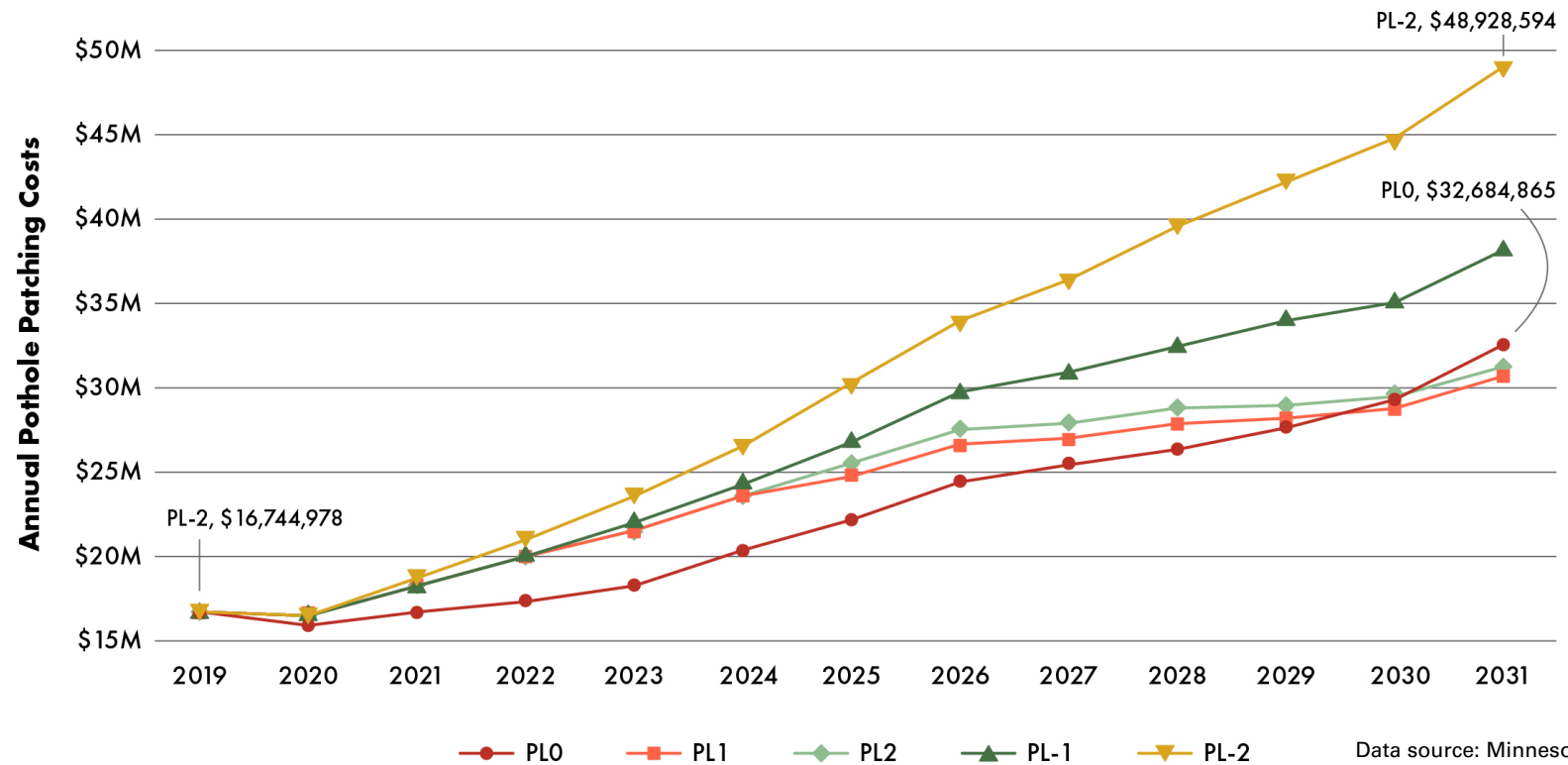


Data source: Texas DOT

Relating Pavement Condition to Maintenance Costs

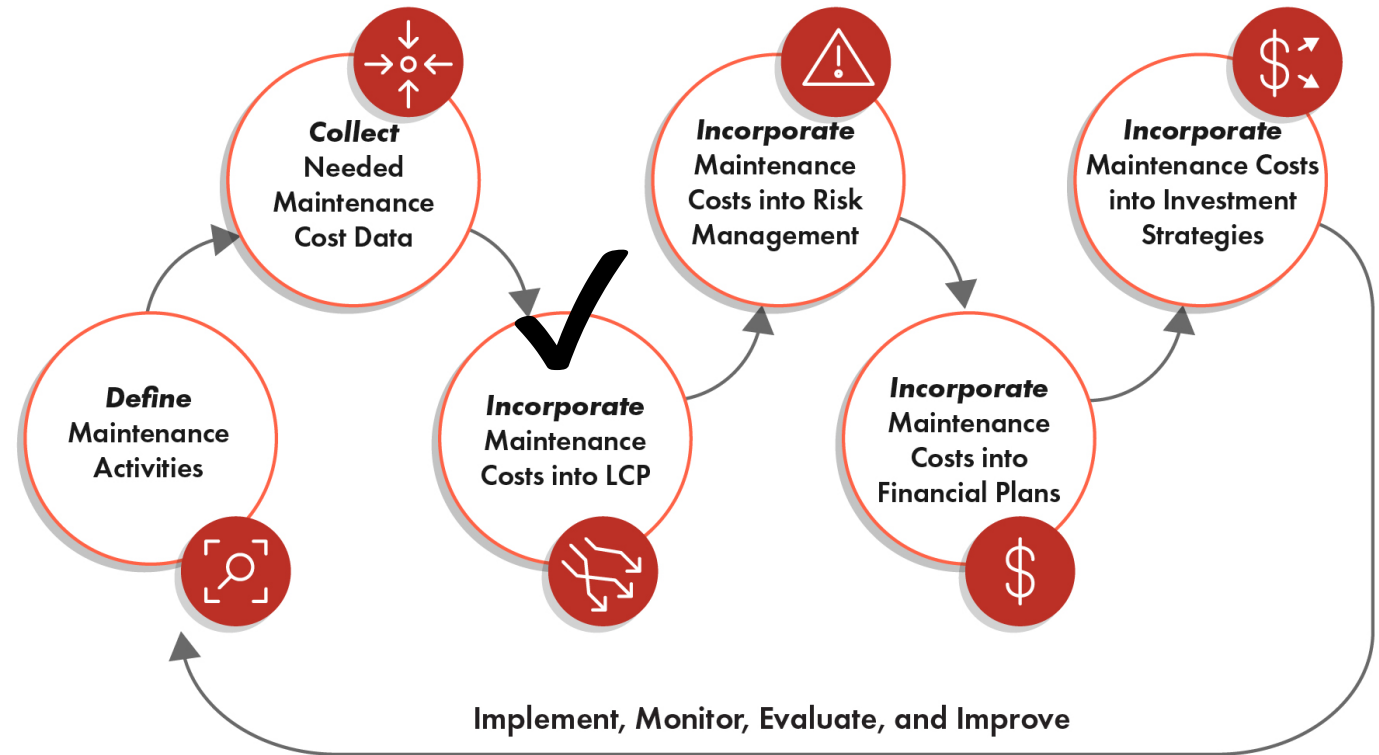
MINNESOTA DOT EXAMPLE

10-Year Patching Predicted Costs—by Revenue Scenario Pavement Condition



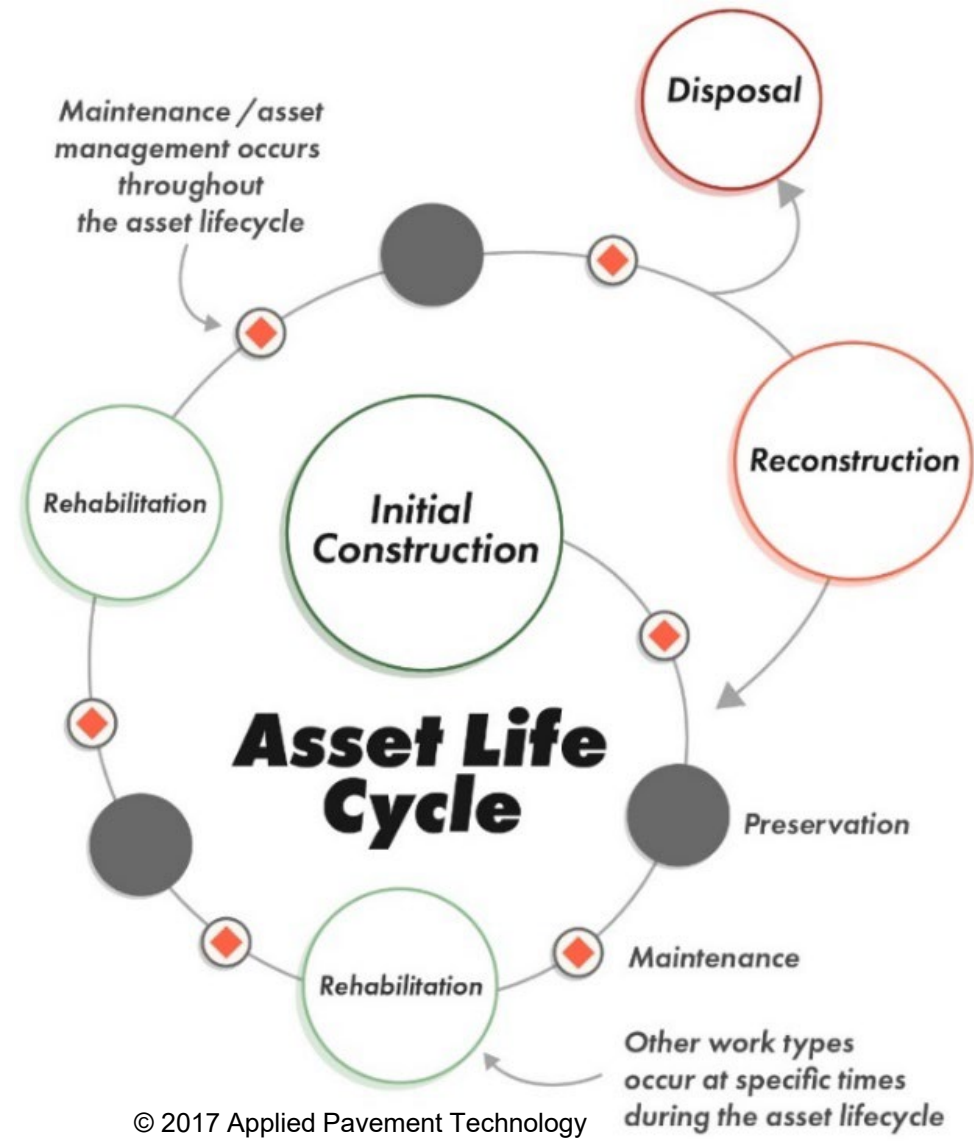


Supporting Life-Cycle Planning (LCP)





Approaches for Considering Maintenance Costs in LCP



Case Examples – Maintenance Costs in LCP



Unit or Component Replacement

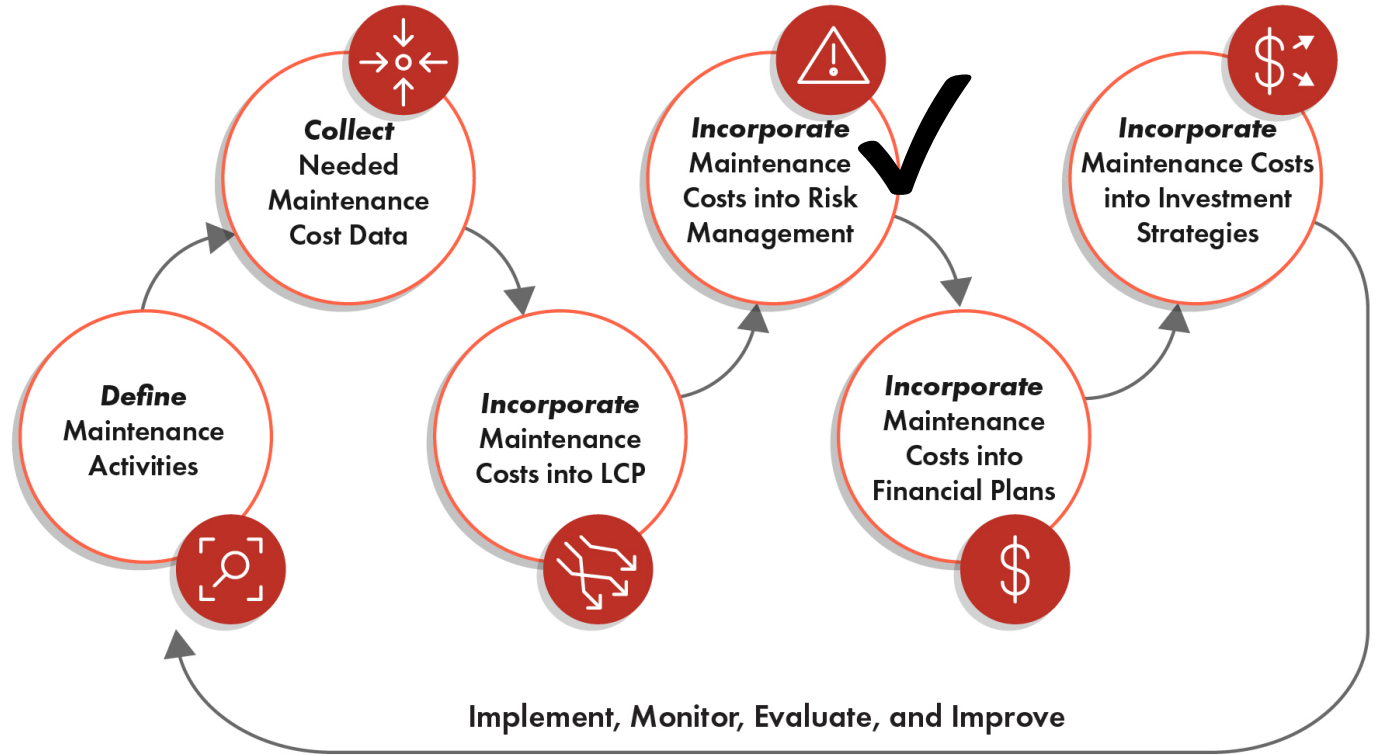


Repair and Preserve

- *New York State DOT – Use of structural repairs to defer the need for bridge replacements.
- *Nevada DOT – Prioritizing preservation over replacement treatments maximizes cost-effectiveness (i.e., level of condition improvement) of ITS assets.



Addressing Risk





Incorporating Maintenance Costs into Risk Management

TRENDS

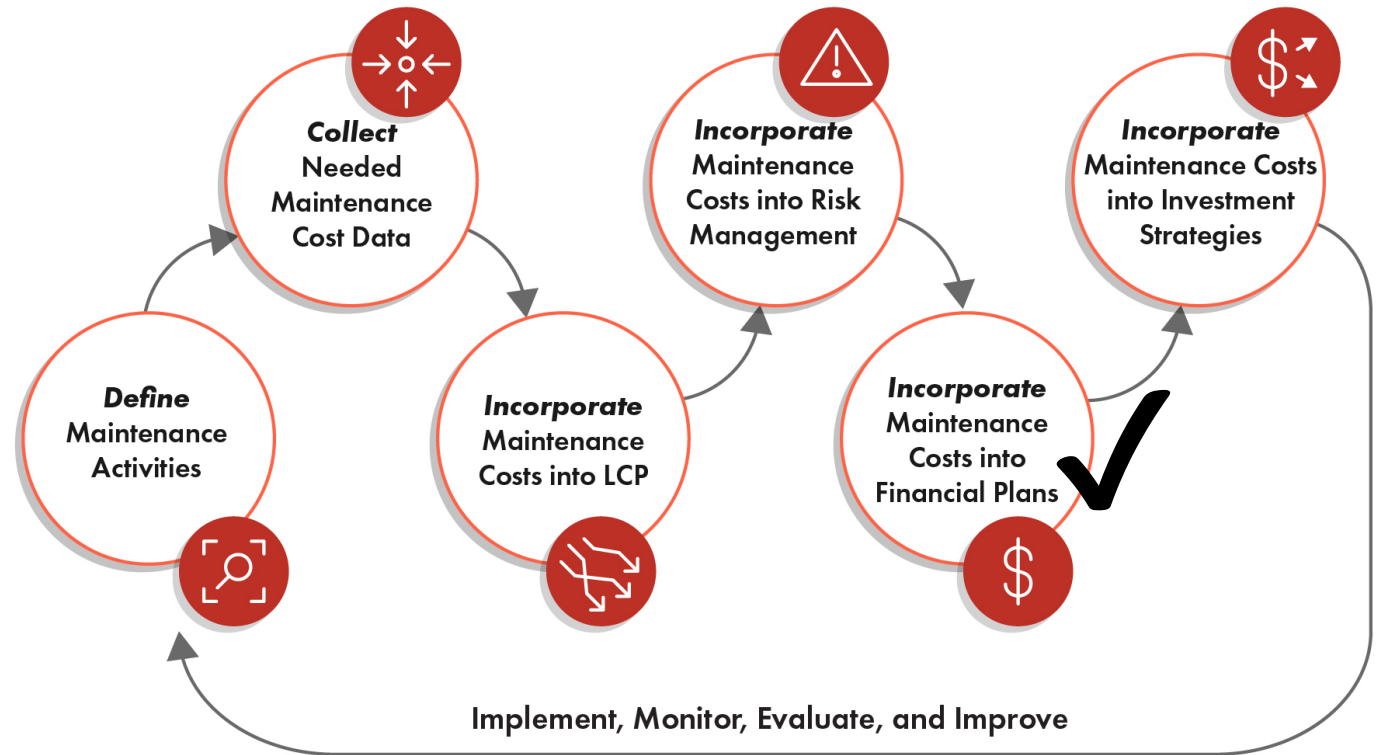
- *Funding fluctuation
- *Aging infrastructure
- *Staffing
- *New infrastructure
- *Environmental changes

EVENTS

- *Extreme weather (emergency events and 23 CFR 667)
- *Economic disruption
- *Regulations or requirements

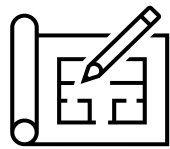


Financial Planning

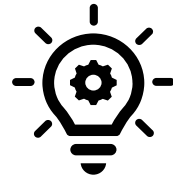


Financial Plan Development Process

The 7-step process helps agencies to list maintenance sources and uses to forecast maintenance costs for TAMP financial plan.



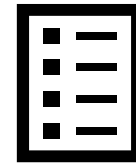
1. Determine TAM scope



2. Identify funding sources



3. Establish fund uses



4. List fund sources and uses



5. Validate list



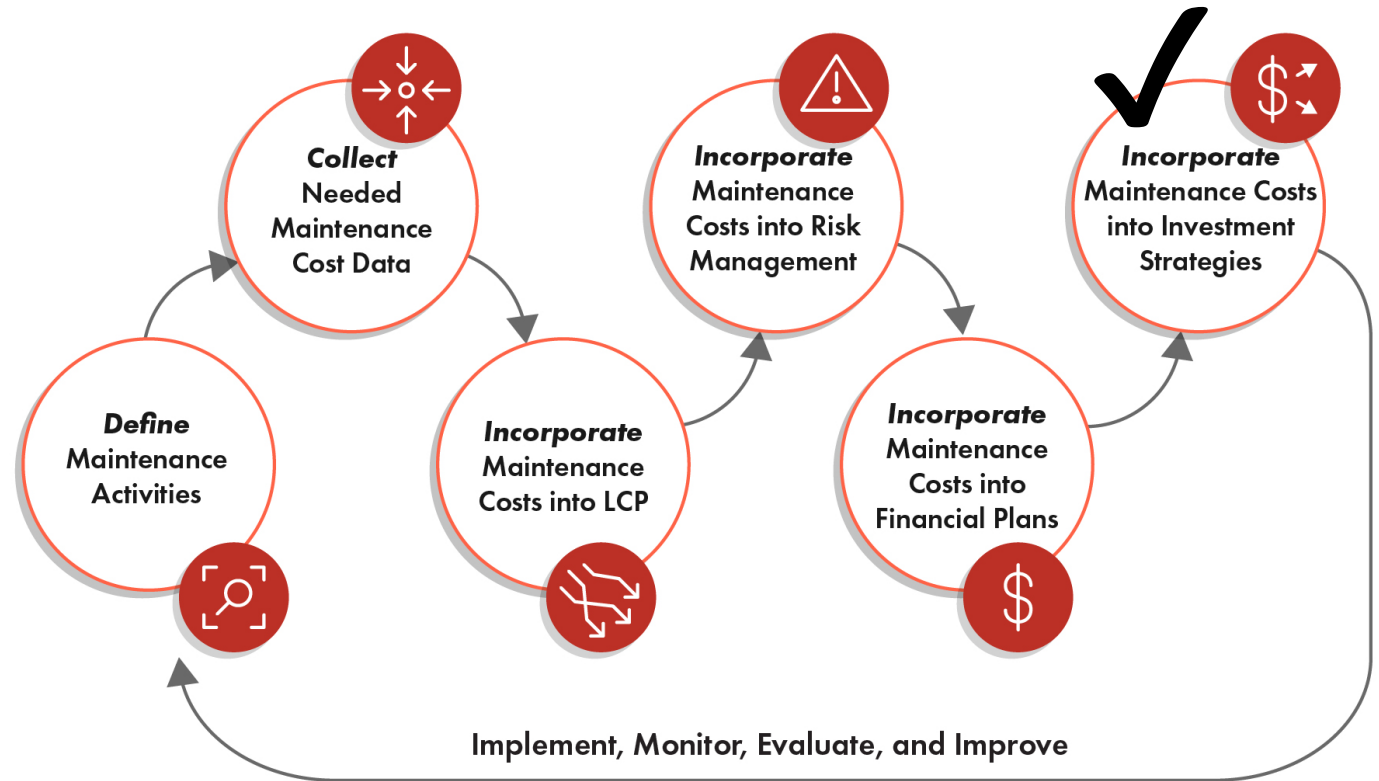
6. Document constraints



7. Document fixed cost

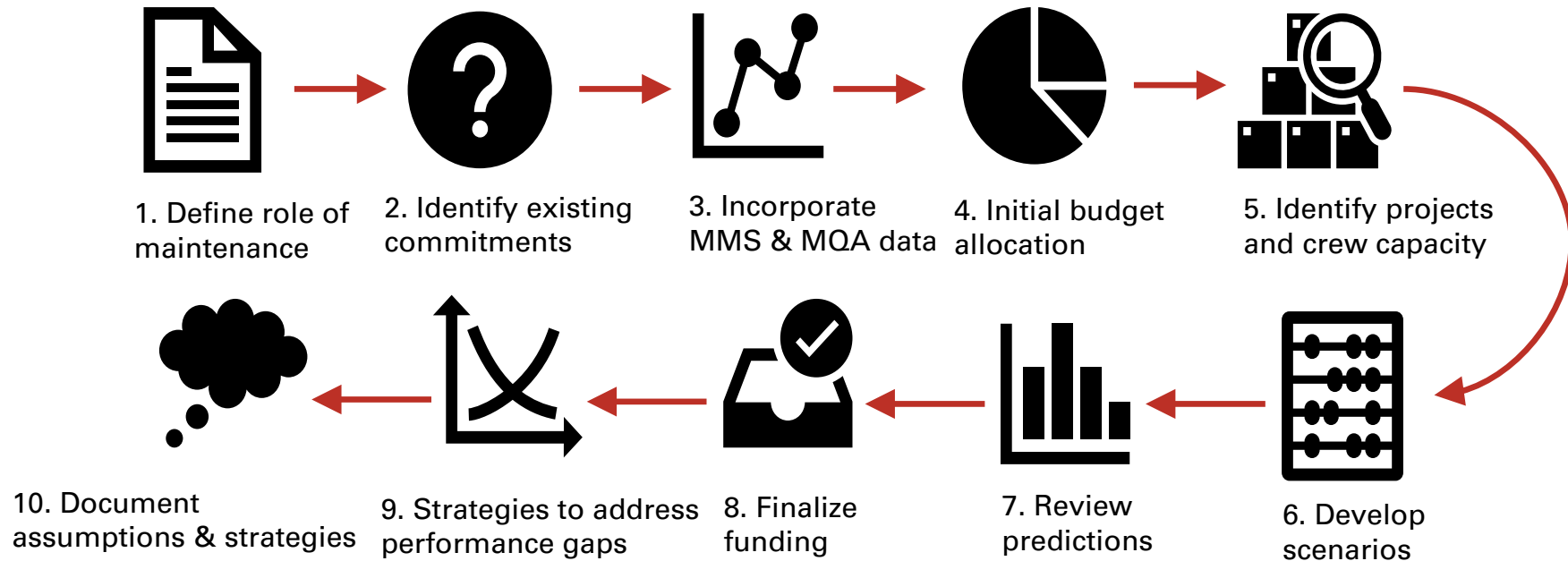


Financial Planning



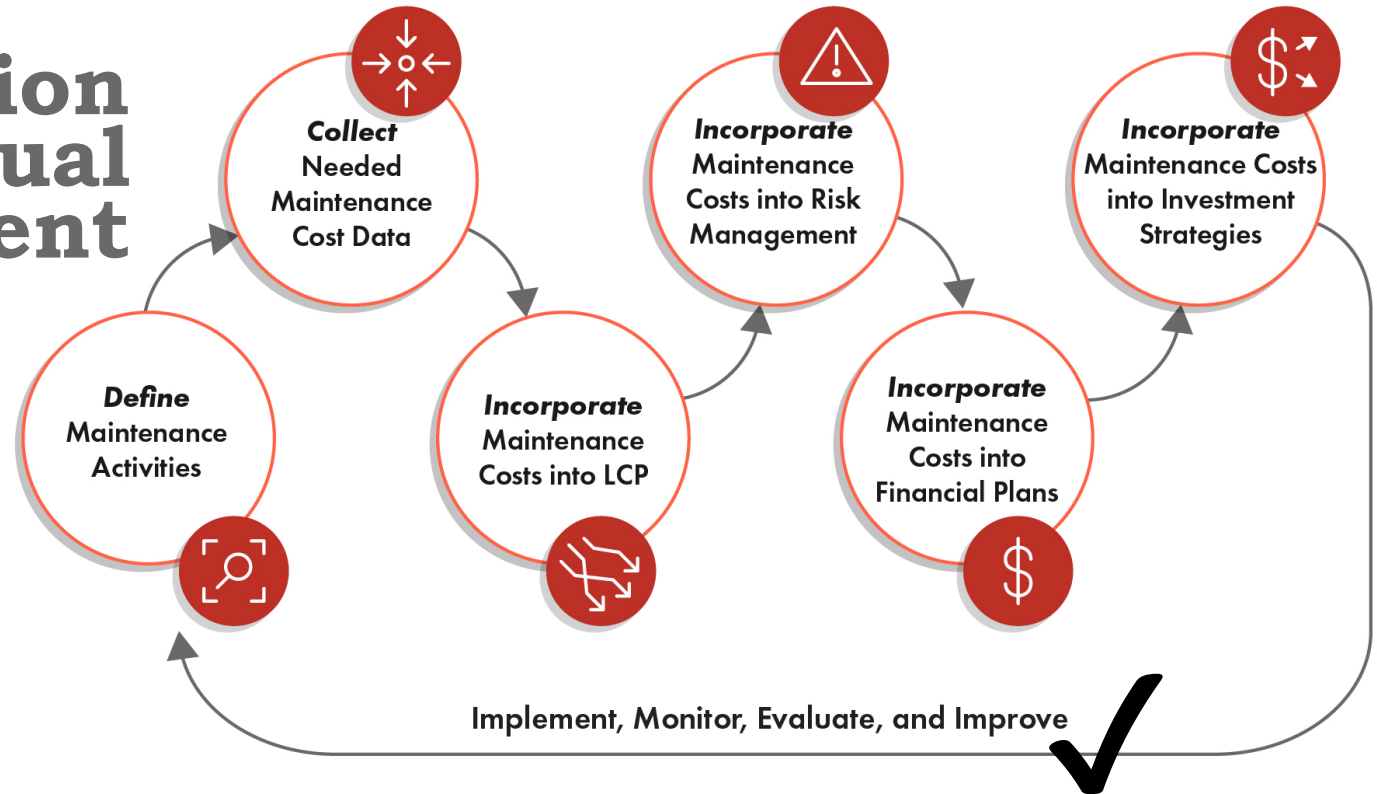
Investment Strategy Development Process

This guidance adjusted the 10-step process established in NCHRP 898 and FHWA guidance for maintenance activities that are not delivered through construction project.





Implementation and Continual Improvement





Keys to Success

- * Coordination with capital program
 - ALDOT's maintenance contracting
 - NYSDOT's innovative maintenance contracting
- * Coordinate timing of maintenance delivery
 - TDOT's coordination among maintenance, safety, and operations
- * Training, equipping, and supplying
 - NYSDOT's investment in organizational development





NCHRP 23-08 Products

- * A Guide for Incorporating Maintenance Costs into a TAMP
- * Executive Summary
- * Tech Memo
- * Presentation
- * Workshop (To be held at the 2023 TRB Annual Meeting)