

# **NCHRP 8-92: Implementing Transportation Data Program Self- Assessment**

NATMEC

Working Together for Improved Travel Monitoring

June 30, 2014

# Agenda

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1. Project Overview
2. Progress to Date
  - Review of Methodology with Stakeholders
  - Proposed Assessment Steps and Criteria
  - Case Studies
3. Feedback

# NCHRP 8-92 Background and Objectives

## Background

- NCHRP 8-36/Task 100: Transportation Data Self-Assessment Guide – developed an initial framework for transportation agencies to assess their data programs

## Project 8-92 Research Objectives

- Test the feasibility of the data program self-assessment process
- Operationalize the framework & produce a guide for transportation agencies to implement a data self assessment

## Challenge


- Create a generic methodology applicable to all of a DOTs data programs

# NCHRP 8-92 Background and Objectives

## Key Questions

- Are we collecting the right data?
  - What data do we need and why?
- Is our current data good enough?
  - What level of accuracy, timeliness, completeness, etc. is needed?
- Are we making best use of our data collection and management resources?
  - Are we being efficient about how we collect and manage the data?
- Are we getting full value from the data that we have?
  - Are users able to access, integrate and analyze it?

# Schedule Overview



| PHASE | RESEARCH TASK                        | 2013 |   |   |   |   |   |   | 2014 |   |   |   |   |   |   |   |   |   |   |   | 2015 |   |   |   |   |   |   |   |
|-------|--------------------------------------|------|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|
|       |                                      | J    | J | A | S | O | N | D | J    | F | M | A | M | J | J | A | S | O | N | D | J    | F | M | A | M | J | J | A |
| I     | 1. Literature Review                 | █    | █ |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 2. Interview Guide                   |      | █ | █ |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 3. Review Methodology w Stakeholders |      |   |   | █ | █ | █ |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 4. Revise Methodology                |      |   |   |   |   | █ | █ | █    |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 5. Update Phase 2 Work Plan          |      |   |   |   |   |   |   |      | █ |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 6. Phase 1 Interim Report            |      |   |   |   |   |   |   |      | █ | █ |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
| II    | 7. Finalize Case Study Selection     |      |   |   |   |   |   |   |      |   | █ | █ |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 8. Conduct Case Studies              |      |   |   |   |   |   |   |      |   |   | █ | █ | █ | █ | █ |   |   |   |   |      |   |   |   |   |   |   |   |
|       | 9. Phase 2 Interim Report            |      |   |   |   |   |   |   |      |   |   |   |   |   | █ | █ |   |   |   |   |      |   |   |   |   |   |   |   |
| III   | 10. Draft Guidebook                  |      |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   | █    | █ |   |   |   |   |   |   |
|       | 11. Draft Final Report               |      |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      | █ | █ |   |   |   |   |   |
|       | 12. Final Report                     |      |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   | █ |   |   |   |   |

# Implementing Transportation Data Program Self-Assessment

NCHRP 08-92

## PERSPECTIVES

Do we have the data we need to meet federal mandates and effectively manage our core business functions?



Executives

How can our agency make it quicker and easier to access and analyze data so that we can do our jobs more efficiently and effectively?



Data Users

Is our data good enough for what it is being used for, or do we need to improve its level of accuracy, precision or timeliness?



Data Owners

Are we managing our data to maximize its use and ensure its integrity?



Enterprise Data Managers

### Prepare

#### ESTABLISH ASSESSMENT GOALS

Assemble a broad-based team and set a clear direction for what is to be accomplished.

#### INVENTORY DATA PROGRAMS

Take stock of existing data programs to provide a foundation for the assessment.

#### PRIORITIZE ASSESSMENT NEEDS

Select data programs and assessment elements to include and establish a scope and schedule for the effort.

### Assess

#### ASSESS CURRENT STATUS

Apply the applicable maturity scale and associated tools/guidance to assess the current status of data programs.

#### SET MATURITY TARGETS

Identify where you want to be based on the value your agency would obtain from improvements.

#### DETERMINE MATURITY GAPS

Identify gaps between current state and desired state.

### Improve

#### ANALYZE MATURITY RESULTS

Analyze the results and determine priority gaps to be addressed.

#### DEVELOP MANAGEMENT PLAN

Develop a plan of specific actions to address the priority gaps.

#### IMPLEMENT PLAN

Assign responsibilities, allocate resources and track implementation.

## GAP ANALYSIS

### STRATEGIC ALIGNMENT

Maturity Level  
1 2 3 4

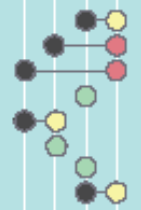
Alignment with strategic goals  
Clear and appropriate roles  
Alignment with user needs  
Identification of data sources, uses, and users  
Data utilization and visualization



### DATA QUALITY

Maturity Level  
1 2 3 4

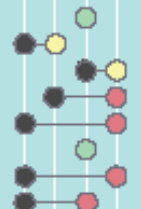
Accuracy  
Consistency  
Reliability  
Timeliness  
Completeness  
Currency  
Integrity  
Confidentiality



### DATA ADMINISTRATION

Maturity Level  
1 2 3 4

Clear definitions  
Ability to segregate, aggregate, and analyze  
Time and resources for analysis and visualization  
Regular audits and validation procedures  
Consideration for trade-offs, costs and life-cycles  
Mechanisms for security, privacy, and ethics  
Data collaboration  
Management continuity



# Stakeholder Focus Groups & Interviews

**Objective:** Identify any needed changes to the conceptual design of Task 100 report, and input into revised assessment tools and guidance

## Conducted

- 5 state DOT focus groups: CO, MD, KY, MN, OR
- 12 interviews with MPO and DOT executives
  - Focus group states + NY, MI, UT, VA, AZ
  - Metro Council – St. Paul, PSRC, WashCOG

# Executive Interview Highlights

## Top Data Program Concerns

- Need for better translation of data for use in policy making, resource allocation, operational decisions
- Efficiency of data programs, i.e. extent to which data is being fully leveraged and not duplicated across agency

## Assessment Process Feedback

- Should be organized around policy or program areas, not data types



# Executive Interview Highlights

## Other Data Concerns

- Capturing full value from data programs
- Integration for analysis
- Adapting data systems to new policy questions
- Getting agreement on sustainable level of data collection that meets needs of multiple users
- Data discovery by casual users
- Technology infrastructure
- Data quality tradeoffs: coverage, timeliness, accuracy

# Focus Group Data Programs

| Data Programs                    | CO | MD | KY | MN | OR |
|----------------------------------|----|----|----|----|----|
| GIS                              | ✓  | ✓  | ✓  |    | ✓  |
| Roadway Inventory/HPMS           |    | ✓  |    | ✓  | ✓  |
| Traffic Monitoring               | ✓  | ✓  |    | ✓  | ✓  |
| Traffic Operations/ITS           | ✓  | ✓  | ✓  | ✓  | ✓  |
| Safety/Crash Data                | ✓  | ✓  | ✓  |    | ✓  |
| Performance/Asset Management     | ✓  |    | ✓  | ✓  |    |
| Bridge                           | ✓  |    |    | ✓  |    |
| Pavement                         | ✓  |    | ✓  |    |    |
| Maintenance                      |    |    | ✓  | ✓  |    |
| Planning/Travel Modeling/Freight | ✓  | ✓  | ✓  | ✓  | ✓  |
| Bike/Pedestrian                  |    |    |    | ✓  |    |
| Financial                        |    |    |    | ✓  | ✓  |
| Capital Program Management       |    | ✓  |    |    |    |
| District Project Development     |    |    | ✓  |    |    |
| Motor Carrier (IFTA/IRP)         |    |    | ✓  |    |    |
| Data Services/Data Management    | ✓  | ✓  | ✓  | ✓  | ✓  |

# Focus Group Results

- Strategic Alignment
  - Distinguish why data programs aren't in alignment with needs:
    - Don't have right data
    - Don't have resources to collect more
    - Don't have tools to store, manage, analyze, distribute
    - Not integrating to meet decision needs
    - Not providing required level of granularity or aggregation or trend data
  - Ask about relationship between data provider and users
  - Explore willingness & ability to re-purpose data for multiple units

# Focus Group Results

- Quality
  - Users understanding of quality is anecdotal – don't have global perspective on confidence levels or QA procedures applied
  - Area of relatively low maturity – processes and standards not formalized, payoff from investing in data quality not well understood
  - Key concerns: setting and managing expectations, setting up feedback loops, informing data collectors about how data will be used

# Focus Group Results

- Data Program Administration
  - Maturity progression themes:
    - siloed to enterprise
    - ad-hoc to formalized and automated
    - special request to self-serve
    - short-lived to institutionalized and sustained
  - Agencies struggle with operationalizing data governance
  - Technology a major factor – connectivity, bandwidth, data warehousing, analysis tools, data integration processes, etc.

# Focus Group Results

## Feedback on Assessment Process

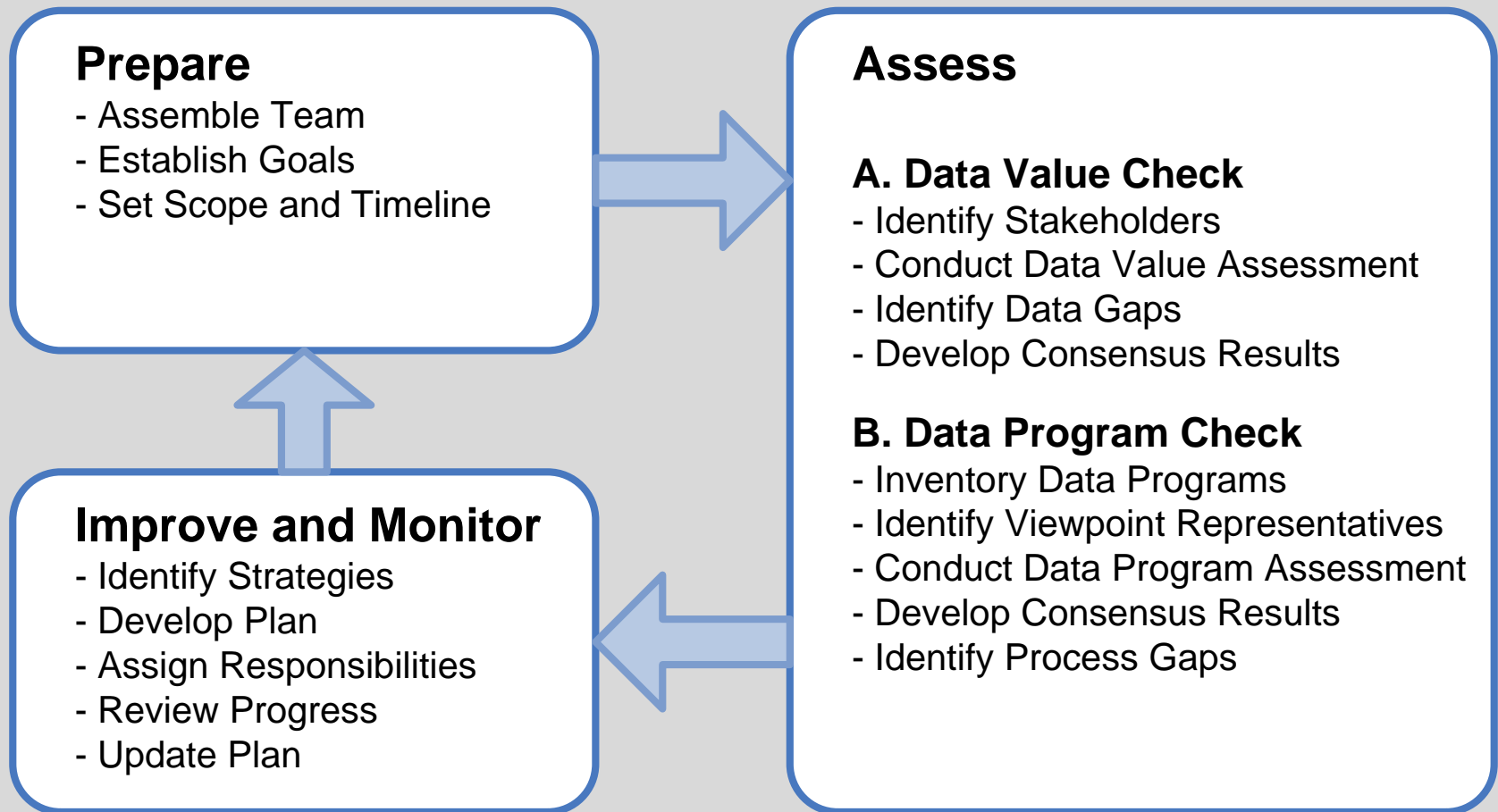
- Keep it manageable and limit the timeframe (3-9 months)
- Ensure executive sponsorship and involvement
- Ensure wide stakeholder representation
- Include screening process to focus on biggest issues
- Recognize value of detailed data mapping to inform the process – but also the effort required to do this
- Leave target setting process flexible
- Provide diagnostics and guidance for actions to be taken
- Allow for integration with existing business planning efforts

# Revise Methodology

## Summary Observations

- Task 100 report provided solid foundation for assessment
- Based on Task 3, several issues identified:
  - **Confusion about assessment categories** – need to separate assessment for user perspective (availability and usability) and manager perspective (administration, quality assurance, integration)
  - **Data program versus enterprise assessments** – allow selected application of assessment within a program but build in consideration of cross-unit considerations
  - **Maturity levels** – use different scales for process/practices assessment versus data availability/usability assessment

# Revised Assessment Methodology





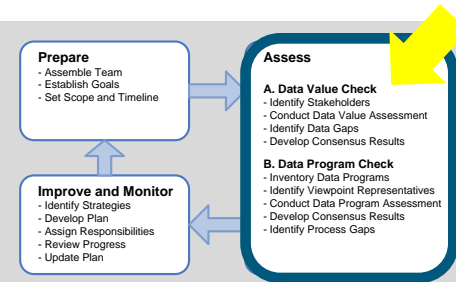
# Mapping to SCOP Data Principles

| SCOP Data Principle   | Proposed NCHRP 8-92 Self-Assessment Elements  |
|---|---|
| 1. VALUABLE: Data is an asset   | Value – Data Availability<br>Management – Data Governance<br>Management – Data Quality Management |
| 2. AVAILABLE: Data is open, accessible, transparent and shared            | Value – Data Availability<br>Management – Data Architecture & Integration                         |
| 3. RELIABLE: Data quality and extent is fit for a variety of applications | Value – Data Quality  |
| 4. AUTHORIZED: Data is secure and compliant with regulations              | Management – Data Governance  |
| 5. CLEAR: There is a common vocabulary and data definition                | Management – Data Governance<br>Management – Data Architecture & Integration                      |
| 6. EFFICIENT: Data is not duplicated                                      | Management – Data Governance<br>Management – Data Architecture & Integration                      |
| 7. ACCOUNTABLE: Decisions maximize the benefit of the data                | Value – Data Quality<br>Value – Usability   |

# Assess Step – Data Value Check

## Data Value Check: Provide “birds-eye view” of how data is working to support decision making

1. Identify Stakeholders
  - Individuals to complete assessment for each policy area
2. Conduct Data Value Assessment
  - Establish assessment areas, use maturity scale, assessment summary Ratings for Availability, Quality and Usability for decision support
3. Develop Final Consensus Ratings and Gaps
  - Small group meeting convened to discuss divergence, arrive at consensus and identify specific gaps



# Assess Step – Data Value Check

## Assessment Elements: Information Needs

- **A-Understanding Performance:** tracking, analyzing and communicating transportation system performance
- **B- Tracking Accomplishments, Costs and Resource Utilization:** tracking and analyzing delivery, spending, resource utilization.
- **C-Anticipating Future Needs:** monitoring and analyzing trends and building predictive capabilities to respond to future needs
- **D-Performance Diagnostics:** understanding impacts and effectiveness of actions taken
- **E- Identifying Improvement Actions:** solutions, priorities, tradeoffs, real-time response to needs

# Assess Step – Data Value Dimensions

- **Data availability** – are data available at the right level of detail, with sufficient coverage?
- **Data quality** – are data sufficiently accurate, credible and current to support decision making?
- **Usability** – can data be integrated, analyzed and presented as needed to support decision making – or is too much manual effort is required to package and deliver meaningful information?

# Assess Step - Data Value Assessment Maturity Levels

| Maturity Level Name | Definition   |
|---------------------|--|
| 1 - Initial         | Data are generally not available at all                                |
| 2 - Limited         | Limited data are available, but many important gaps remain             |
| 3 - Basic           | Data are available, but not routinely processed, integrated, presented |
| 4 - Sufficient      | Data are available in a useful form to support decision-making         |
| 5 - Advanced        | Data are available in the right form to support decision-making        |

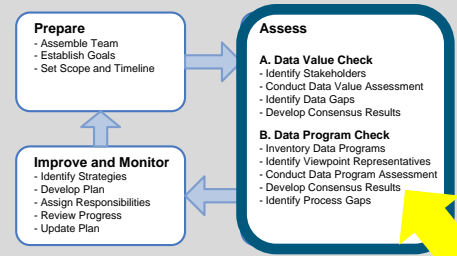
# Assess Step - Data Value Assessment Sample

|  | Assessment Elements: Information Needs |  |                              |                            |                                    |
|--|--|--|------------------------------|----------------------------|------------------------------------|
| Assessment Areas: Agency Functions             | A. Understanding Performance           | B. Tracking, Accomplishments, Costs & Resource Utilization | C. Anticipating Future Needs | D. Performance Diagnostics | E. Identifying Improvement Actions |
| Mobility – Long Range and Corridor Planning    | 4-Sufficient                           | Not Assessed   | 2-Limited                    | Not Assessed               | 3-Basic                            |
| Asset Management (Pavement and Bridge)         | 5-Advanced                             | 3-Basic  | 3-Basic                      | 2-Limited                  | 4-Sufficient                       |
| Asset Management (Traffic and Safety Hardware) | 2-Limited                              | 4-Sufficient   | 1-Initial                    | 3-Basic                    | 4-Sufficient                       |
| Safety Planning                                | 5-Advanced                             | 4-Sufficient   | 3-Basic                      | 4-Sufficient               | 4-Sufficient                       |
| Traffic Operations                             | 5-Advanced                             | 4-Sufficient   | 2-Limited                    | 3-Basic                    | 4-Sufficient                       |
| Project and Program Management                 | 3-Basic                                | Not Assessed   | Not Assessed                 | 2-Limited                  | 3-Basic                            |
| Project Delivery                               | 5-Advanced                             | Not Assessed   | Not Assessed                 | 3-Basic                    | 2-Limited                          |

# Assess Step – Data Program Check

## Data Program Check: Review data management process maturity level

1. Inventory Data Programs
  - Establish map of where data is gathered, analyzed, etc.
2. Identify Viewpoint Representatives
  - Data owner, steward, custodians, etc. for each program
3. Conduct Data Program Assessment
  - (see following slides)
4. Develop Final Consensus Ratings
  - Use small group meetings
5. Identify Process Gaps



# Assess Step – Data Program Check

| Data Category                       | Sample Typical Data Programs   |
|-------------------------------------|--|
| General                             | IT Applications Development, Transportation Data Office, GIS, Performance Management |
| Travel Data                         | Traffic Monitoring, Planning/Travel Monitoring, Planning/Freight                     |
| System Inventory and Condition Data | Road Inventory, HPMS, Pavement Management  |
| Facilities Data                     | Property Management, Fleet Management, Maintenance Management                        |
| Financial/Program Management Data   | Capital Program/STIP, Financial Management, Human Resources                          |
| Project Development Data            | Design and Materials, Right of Way, Environmental                                    |
| System Operations Data              | Incident Management, Traffic Management, Maintenance Management                      |
| Safety Data                         | Crash Records/FARS Reporting, Safety Planning  |
| Customer Relations                  | Public Affairs   |



# Assess Step – Data Program Check - Viewpoints

| Representatives            | Viewpoints/Roles  |
|----------------------------|---|
| Data Owners                | Decision making authority for data program, determine what data are collected                 |
| Data Stewards              | Accountable for quality, value, use of data   |
| Data Custodians            | Responsibility for data loading, validation, extraction, transformation and integration tasks |
| Enterprise Data Architects | Responsibility for agency-wide data standardization and governance practices                  |
| Data Analysts              | Responsibility for reviewing, reporting & visualizing data                                    |
| Data Users                 | Receive information that draws on data provided by the program                                |

# Assess Step – Data Program Check Elements

| Data Program Assessment Elements | Includes  |
|----------------------------------|---|
| Data Governance                  | <ul style="list-style-type: none"><li>• Roles &amp; Responsibilities</li><li>• Business Alignment</li><li>• Data Customer Relationship Management</li><li>• Findability and Documentation</li><li>• Data Preservation and Security</li></ul>  |
| Data Architecture & Integration  | <ul style="list-style-type: none"><li>• Linkages &amp; Standards</li><li>• Coordination and Cooperation</li><li>• Data Access</li><li>• Change Management</li></ul>   |
| Data Quality Management          | <ul style="list-style-type: none"><li>• Quality Assurance Processes</li><li>• Accuracy Measurement &amp; Improvement</li><li>• Consistency Measurement &amp; Improvement</li><li>• Completeness Measurement &amp; Improvement</li><li>• Timeliness and Currency Measurement &amp; Improvement</li></ul> |

# Assess Step – Data Program Check

| Data Governance Categories            | Sample Questions   |
|---------------------------------------|--|
| Roles and Responsibilities            | Does each data set have a clearly identified owner and steward?                                |
| Data Customer Relationship Management | Are the intended users and uses of each data set clearly understood by the data program owner? |
| Findability & Documentation           | Are staff adequately trained to access and use the available data?                             |
| Data Archiving                        | Are there designated archive locations for data sets?  |
| Data Security & Integrity             | Is a disaster recovery plan in place for the data program(s)?                                  |

# Assess Step – Data Program Check

| Data Architecture & Integration Categories | Sample Questions   |
|--|--|
| Linkages & Standards                       | Does the agency manage common “master data” elements so that they are consistent and synchronized across applications?                             |
| Coordination & Cooperation                 | Are data being collected in the most efficient way?  |
| Access & Presentation                      | Can field staff access and collect information about assets, projects, or work orders on field devices?  |
| Change Management                          | Is there a change management process in place for data systems – including assessing impacts of changes to data structures or master data content? |

# Assess Step – Data Program Check

| Data Quality Categories     | Sample Questions   |
|-----------------------------|--|
| Business Rules              | Are data validation rules developed and documented?  |
| Quality Assurance Processes | Are data validation and reconciliation processes carried out on a regular basis?   |
| Application Design          | Are data collection systems designed to maximize validity of data at the source through use of pick lists and application of business rules? |
| Quality Assessment          | Have quality metrics been defined? Is quality measured and reported? Have acceptable thresholds been agreed upon?                            |
| User Feedback               | Are processes in place for data users to report and/or correct errors?   |

# Assess Step - Data Program Check Maturity Levels

| Maturity Level Name | Definition   |
|---------------------|--|
| 1 – Initial         | Processes, strategies and tools are generally ad-hoc rather than proactive or enterprise-wide; successes are due to individual efforts |
| 2 - Aware           | Widespread awareness of more mature data management practices; recognition of the need to improve processes, strategies and tools      |
| 3 - Defined         | Processes, strategies and tools have been developed, agreed-upon and documented  |
| 4 – Proficient      | Processes, strategies and tools are generally being implemented as defined   |
| 5 – Optimizing      | Strategies, processes and tools are routinely evaluated and improved   |

# Assess Step – Data Program Check Sample

|                                 | Assessment Elements |                    |                            |
|---------------------------------|---------------------|--------------------|----------------------------|
| Assessment Areas: Data Programs | Data Governance     | Quality Management | Architecture & Integration |
| Agency-wide                     | 2-Aware             | Not Assessed       | 2-Aware                    |
| Traffic Monitoring              | 4-Proficient        | 3-Defined          | 3-Defined                  |
| Safety – Crash Data             | 5-Optimizing        | 4-Proficient       | 4-Proficient               |
| Pavement Inspection             | 1-Initial           | 5-Optimizing       | 2-Aware                    |
| Bridge Inspection               | 4-Proficient        | 4-Proficient       | 3-Defined                  |
| STIP/ Capital Projects          | 3-Defined           | 3-Defined          | 4-Proficient               |
| Budgets and Expenditures        | 1-Initial           | 3-Defined          | 3-Defined                  |
| Road Inventory/ HPMS            | 4-Proficient        | 5-Optimizing       | 3-Defined                  |
| Real-Time Traffic               | 2-Aware             | 3-Defined          | 3-Defined                  |

# Improve and Monitor Step

## Improve and Monitor: Improvements planned, initiated, tracked

### 1. Identify Strategies

- Should cover all phases of data life cycle



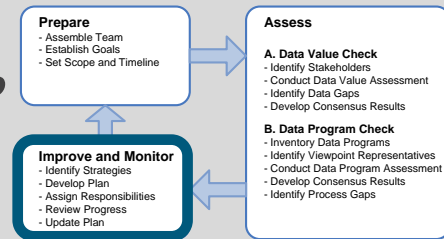
### 2. Develop High Level Plan and Assign Responsibilities

### 3. Identify and Implement Tactical Plans

- Define “who, where, when, what and how”

### 4. Review Progress and Plan Update

- Monthly or quarterly meetings to review implementation progress





# Case Studies

**Purpose:** Provide a “pretest” of assessment tools & develop concrete examples for the Guide

## **Selected States & Data Programs:**

- Michigan DOT
  - Data Value: Traffic Monitoring & Facilities
  - Data Management: Aviation and Real-Estate
- Utah DOT
  - Data Value: Project Scoping/Design & Maintenance
  - Data Management: Asset Management Data & Construction As-Builts

# Draft Outline for Guide

- Introduction
- Methodology Overview
- Preparing for the Assessment
- Managing the Assessment
- Assessment Tools
- Benchmarking and Gap Identification
- Implementing Data Improvements
- Appendix A: Case Studies
- Appendix B: Data Management Strategies Catalog

**FEEDBACK**