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2026 RPUG CONFERENCE ★ PITTSBURGH, PA ★ APRIL 28 - MAY 1

TOWARD A DATA VALUE CHAIN FOR CONTINUOUS TIRE-PAVEMENT FRICTION DATA

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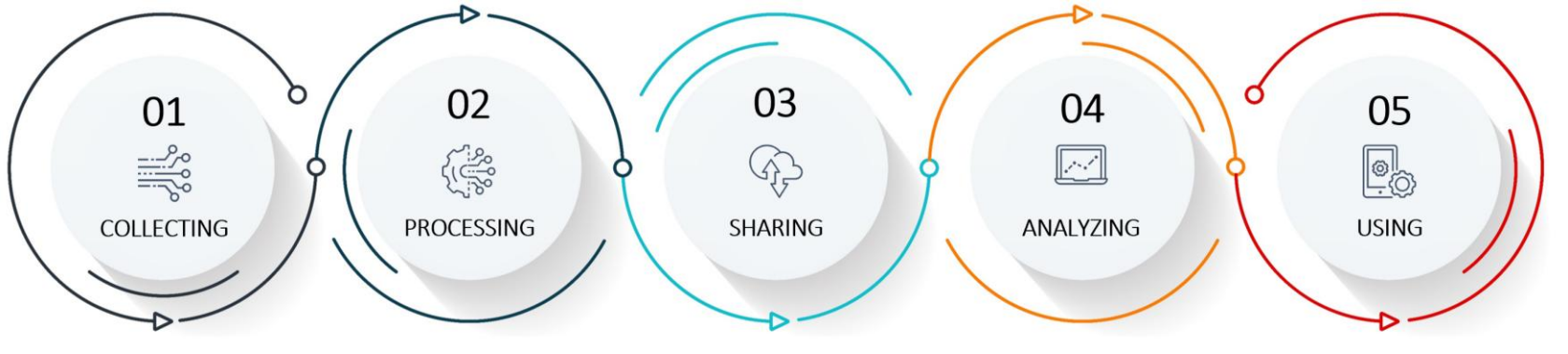
DATA VALUE CHAIN: DEFINED

1. THE DATA VALUE CHAIN (DVC) DESCRIBES THE PROCESS OF DATA CREATION AND USE FROM FIRST IDENTIFYING A NEED FOR DATA TO ITS FINAL USE
2. THE DVC IS AN END-TO-END MANAGEMENT TOOL TO MONITOR AND EVALUATE THE DATA PRODUCTION PROCESS AND ENSURE THE SUITABILITY OF DATA FOR FINAL USE – OR POTENTIAL RE-USE



Example data value chain sourced from Aperio.ai

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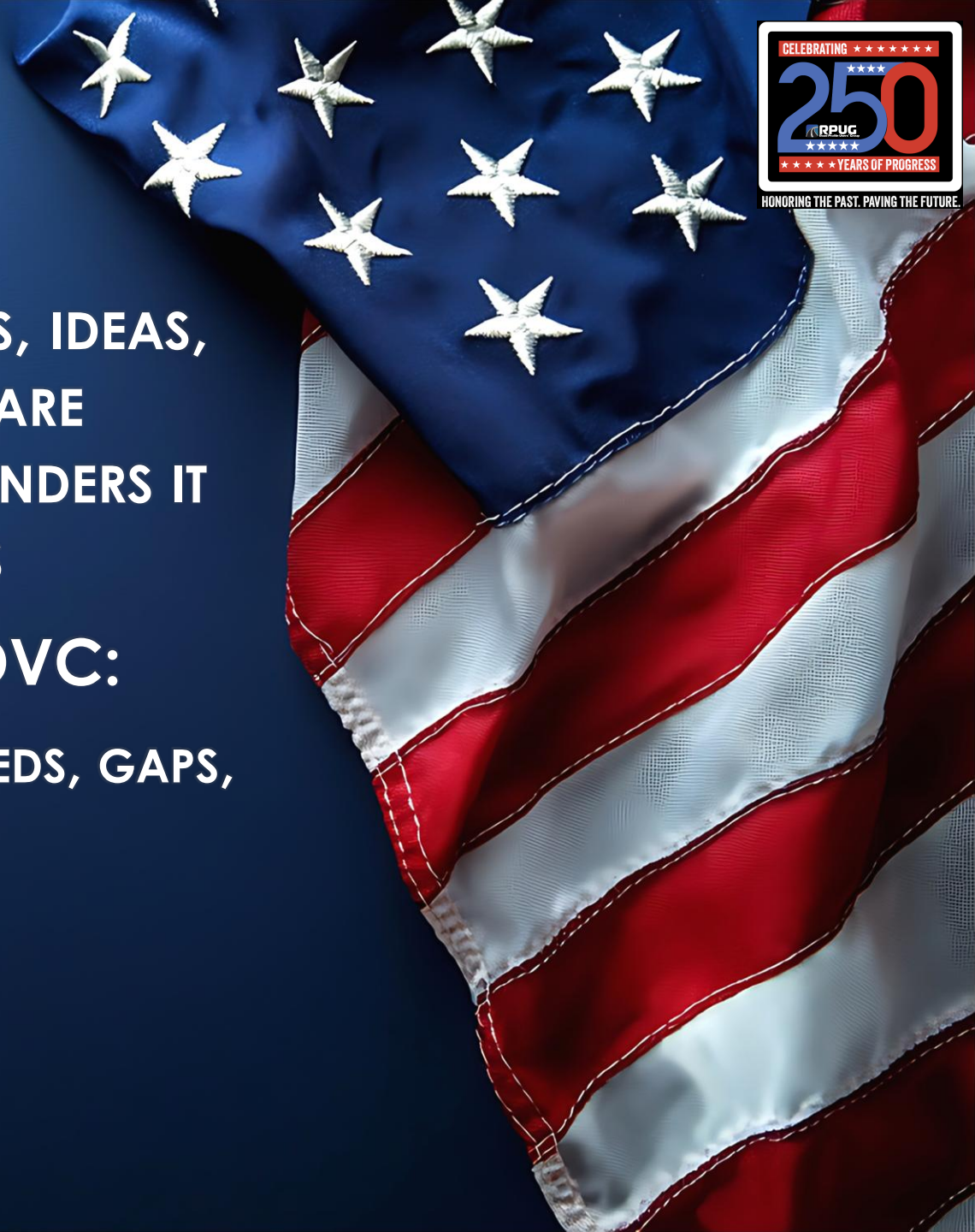
THE VALUE OF THE DVC APPROACH

- In settings with emerging technologies, ideas, and opportunities for new data, there are countless ways to handle data that renders it unfit for desired and/or evolving uses
- Documenting data governance in a DVC:
  - provides transparency, highlighting needs, gaps, and opportunities for improvement
  - improves decision-making
  - supports a positive return on investment



WHY ADOPT THE DVC FRAMEWORK?

- Continuous friction data is "new":
  - It isn't in many data systems
  - It isn't part of a standard decision-support system
- There are many known use cases for continuous friction data, but more will emerge

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PROPOSED CONTINUOUS FRICTION DVC

- Data Collection
- Validation
- Integration
- Analysis
- Use

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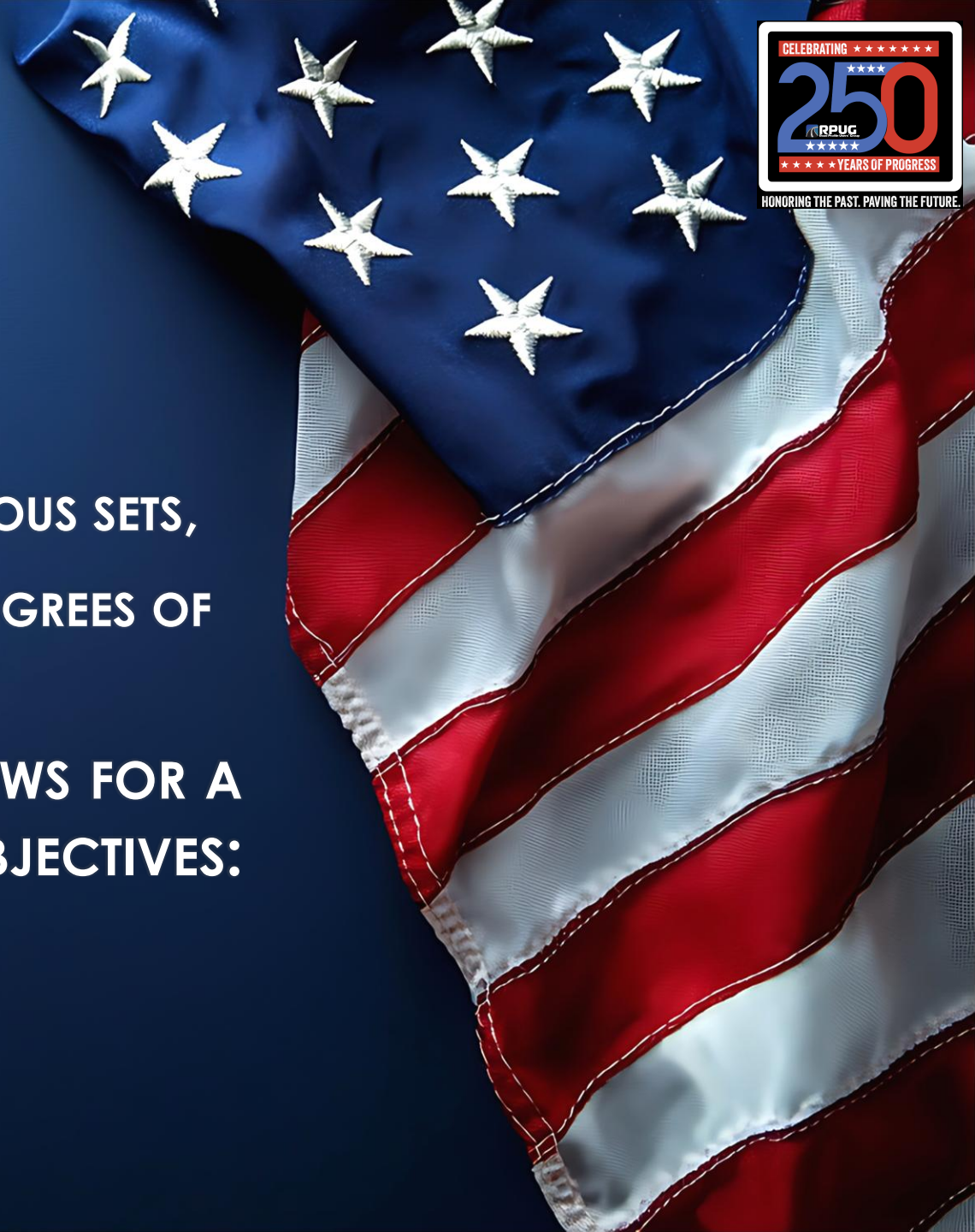
THE DVC IN PRACTICE

- Data may be…
  - collected regionally and validated chronologically,
  - analyzed in context specific, homogenous sets,
  - used for decision making at varying degrees of granularity
- Built-in attention to data quality allows for a focus on two seemingly competing objectives: flexibility and specificity



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HOW TO ENSURE FLEXIBILITY & SPECIFICITY

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Stakeholder Engagement is a foundational step to:

- Identify an initial range of anticipated use cases
- Specify the following elements of an overarching Data Governance Plan:
  - A Data Quality Management Plan (DQMP) that captures data collection plan, necessary resolution, methods/protocols, quality standards, acceptance criteria, etc.
  - A flexible Data Integration Plan that documents how data can be transformed to consider existing and future uses
  - A Specific Data Analysis Plan that details analytical methods and the application of the outputs in use

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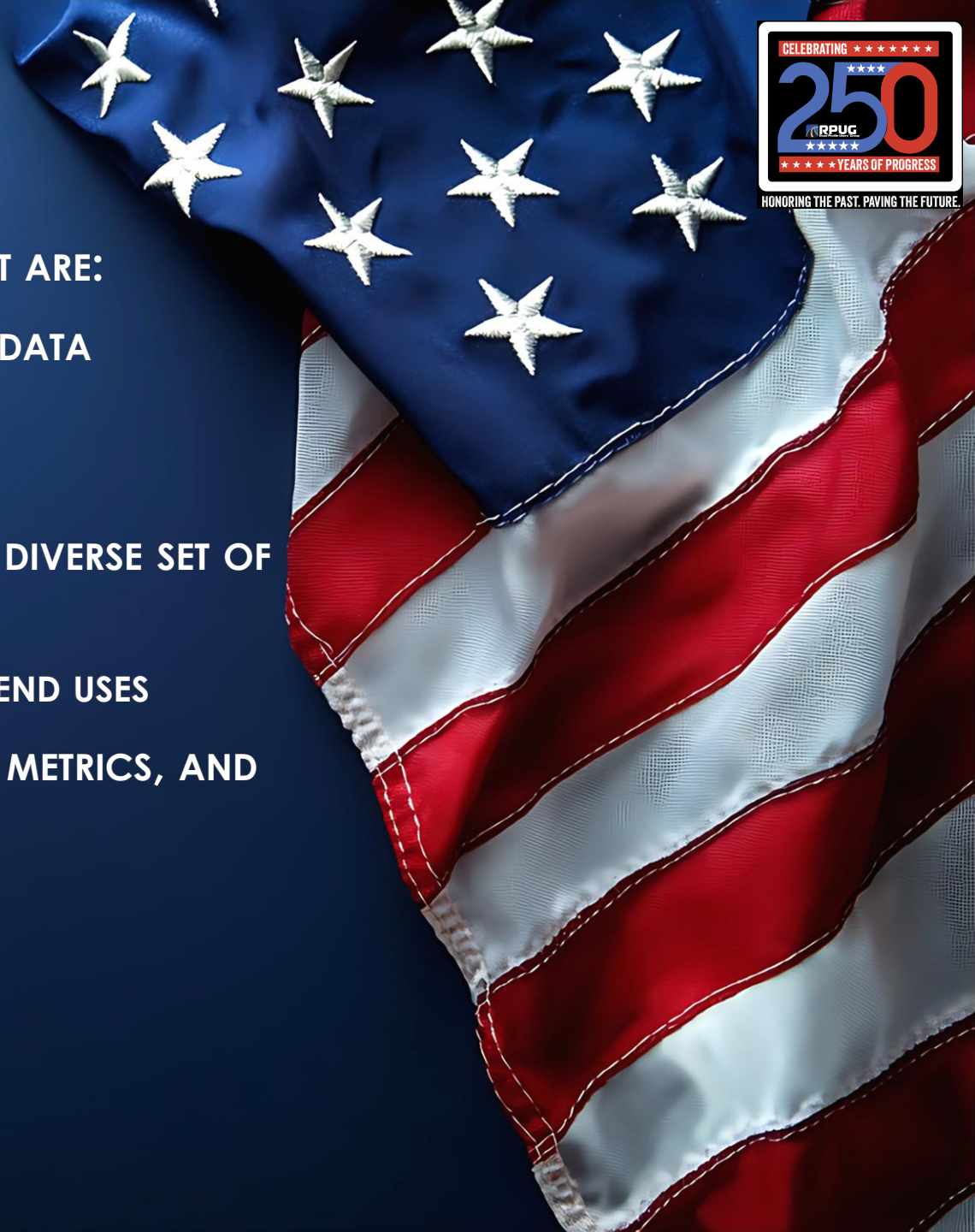
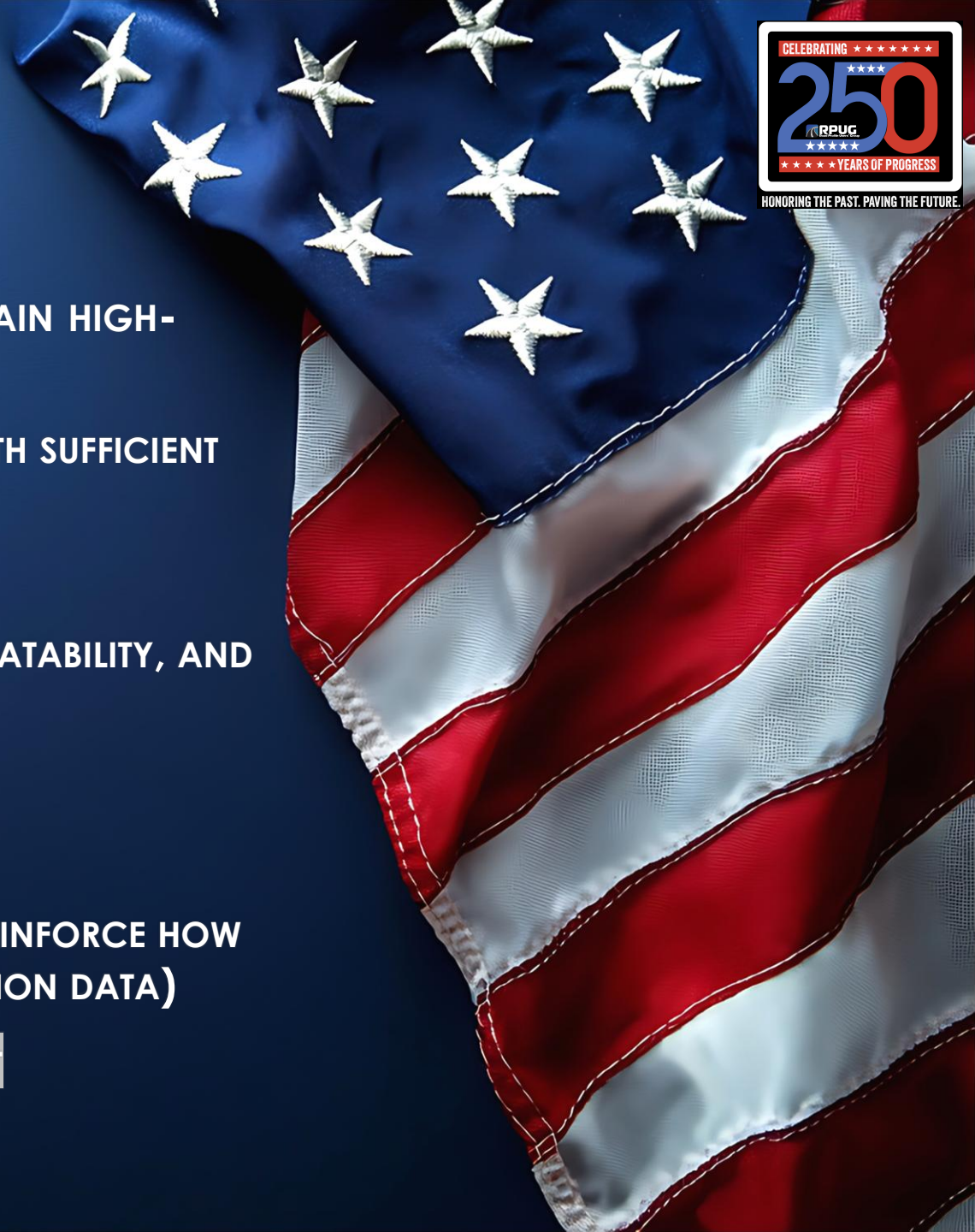
TOOLS WITHIN THE DVC



THE DATA GOVERNANCE PLAN SPANS THE ENTIRE DVC; WITHIN IT ARE:

- DQMP: ENSURES THAT DATA REMAINS HIGH QUALITY, FROM DATA COLLECTION THROUGH DATA VALIDATION
  - HIGH QUALITY DATA → FLEXIBLE DATA
- DATA INTEGRATION PLAN: ENABLES INTEGRATION ACROSS A DIVERSE SET OF DATA SYSTEMS
  - HIGHLY SPECIFIC AND FLEXIBLE → TIED TO BROAD SET OF END USES
- DATA ANALYSIS PLAN: DESCRIBE THE ANALYTICAL METHODS, METRICS, AND ASSUMPTIONS USED FOR THE PLANNED USE CASES
  - HIGHLY SPECIFIC → TIED TO SPECIFIC END USE

DATA QUALITY MANAGEMENT PLAN



The DQMP contains concrete steps to collect and maintain high-quality and flexible data.

- A summary of a comprehensive data collection plan with sufficient diversity of coverage
- Equipment calibration and validation process toolkit
- Definitions of quality metrics, including accuracy, repeatability, and allowable variance acceptability criteria
- Outlier thresholds and handling procedures
- Validation site strategy and testing schedule
- Alignment with national standards (e.g. AASHTO) to reinforce how high-quality data is achieved (similar to surface condition data)

Ex: Direction of data collection and downstream impact

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DATA INTEGRATION PLAN

THE DATA INTEGRATION PLAN MAPS THE DATA TRANSFORMATIONS, KEY VARIABLES, AND SHARING PROCEDURES, REQUIRED TO ENABLE FLEXIBLE DATA THAT CAN BE INTEGRATED INTO A DIVERSE SET OF DATA SYSTEMS

- CONTINUOUS FRICTION METADATA
- STRUCTURE OF TARGET DATA SYSTEMS
- DATA TRANSFORMATIONS REQUIRED FOR DATA STRUCTURE ALIGNMENT
- DATA INTEGRATION SCHEDULES
- FINAL FILE FORMATS FOR SHARED DATA

EX: PAVEMENT MAINTENANCE AND SAFETY INTERVENTIONS

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DATA ANALYSIS PLAN

The Data Analysis Plan outlines the specific analytical methods and how those analyses and resulting insights can be used

- Description of analytical choices and the reasoning behind them, including assumptions, metrics, and intended use
- Definitions of key-variables that form context-specific groups for analysis
- Interpretations of planned analysis output and results
- Description of how the analysis connects to the use, including any limitations of the planned analysis

Ex: Contextual Crash Modification Factor (CMF) use

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KEY TAKEAWAYS

1) The DVC is a connected, ongoing, and incremental, framework for ensuring network-level data maintains its quality, precision, accuracy, flexibility, scalability, and value for a range of existing and emerging continuous friction data use cases.

2) Utilizing a DVC approach requires:

   - ongoing engagement across data collection, quality management, systems integration, and analysis,
   - clear documentation and appropriate reporting, and
   - evidence-based standards for quality and acceptance.

3) DVC tools, including the continuous friction DQMP, ensure that data users can benefit from the flexibility and scalability continuous of the friction data to make confident, data-driven decisions.

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FUTURE NEEDS

1) Consensus on required infrastructure and methodology to accommodate continuous friction data at certification facilities
2) Guidelines for assessing continuous friction accuracy and repeatability
3) Ongoing research and collaboration to evaluate and share analytical methods and use cases for continuous friction data

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THANK YOU!

Questions or Discussion?

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