A CTDOT Governance Approach For Managing Roadway, Project, Asset and Safety Data
Where We Are and Where We Would Like To Be

Our Primary Driver For Establishing Data Governance
History and Evolution of Data Governance at the Connecticut DOT

- What Is TED and Why Is It Important?
- Early Efforts And Drivers That Gave Birth to the Data Management Process
- Creation of a Data Governance Council
- Making Data Governance Achievable In Our Lifetime:
  - Changing the Data Culture
- Takeaways from our Data Governance Experience
What is the Transportation Enterprise Data Program?

- A single transportation enterprise database, fed and maintained by authoritative data sources, which supports the analysis of Agency-wide transportation data using multiple assessment tools and methods.
Why Is TED Important?

• The Perfect Antidote To Data Silos
  – TED represents a *change in philosophy and mind set* in how we manage transportation data
    • Data will be managed, maintained and supported as a *shared and integrated asset*
    • Reduces costly, *time intensive* efforts to find and transform data to meet core business needs

• Offers One Stop Shopping For All The Data You Need
  – TED provides a venue for authoritative business data assets to be *readily available and accessible*
    from a *common enterprise platform*

• Will Reduce Data Collection and Management Costs
  – TED offers opportunities to link and integrate different business datasets to *improve efficiency*
  – Minimize duplication of effort ((C
    – Collect once, use many times

• Will Improve Business Intelligence and Analytics
  – More *data driven decisions* on making investments in infrastructure, safety, and asset management
  – Easier ways to visualize and consume data

• Most importantly, TED is helping to create a new data culture of collaboration, cooperation, and communication
Early Efforts To Bring Order to the Data Management Process

- Need for a Geospatial LRS and a Capital Projects Tracking and Location System
- Proof of Concept: Internal Enterprise Data Platform Known As TED
- Other Drivers: Evolving Need For Better and More Timely Asset Data
- RDIP Assessment and the Need For Safety Data
- FHWA Technical Support Workshops-Data Governance
Need for a Geospatial LRS and a Capital Projects Tracking and Location System

TED was Born out of the Need for Collaboration...

Two Major Identified Business Needs Coming Together: 2012-2016

Planning
Need to develop a geo-spatially accurate linear referencing system for all public roadways (ARNOLD)

Engineering
Need to geo-locate and track capital projects

TED

TED’s Evolution Into A Major Enterprise Data Integration Effort: 2016-2017

• CTDOT leveraged FHWA resources to support safety analysis as a core TED business need
• TED adopted formal business planning model to drive data planning, integration, and management
• CTDOT is one of the few transportation agencies in the country using this planning model to build a broad based multipurpose enterprise data platform to meet a full range of core business needs
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Other Drivers For TED Improvement
RDIP Assessment 2016
FHWA Workshops in 2017
Data Integration, Data Governance and Local Community Involvement
TAMP Plan #1 2018
### Roadway and Asset Data

#### CTDOT RDIP Assessment Recommendations

- **Consolidate and Manage Enterprise Data Integration Efforts**
  - Create an *enterprise data management system* for all roadway, safety and asset data users within CTDOT;
    - Expand *mapping* within the linear reference system (LRS)
    - Establish procedures to *integrate mapping and reporting (via GIS)*
    - Eliminate *duplicate* data collection and maintenance activity
    - Improve *accessibility of roadway/asset data* for all internal users and external partners

- **Data Management and Governance**
  - Establish *formal data governance structure* that views Departmental needs across organizational lines
  - Create a *clear vision statement* that represents the collective views and needs of the Department for effective management of data as a resource

- **Local Coordination**
  - Coordinate with *regional and local agencies* to meet roadway safety data capture requirements for all public roads
  - Reduce duplication of effort with locals and expand reach of safety analyses

*December, 2016*
Vision Statement For CTDOT’s Transportation Enterprise Data Base

“Create a readily accessible transportation safety and asset data enterprise system where high quality data sets are maintained and managed by data stewards and formatted for consumption and analysis in a manner that allows internal users and external stakeholders to use tools with which they are most familiar and comfortable”
Result of Data Integration Workshop
April, 2017

TED DEVELOPMENT WORK GROUP CONCEPT
- Work groups meet as needed at least weekly
- Report to TED Development Group bi weekly

TED DEVELOPMENT BUSINESS PLAN
- Consolidation of Individual Work Group Plans
- Work Group Tasks, Milestones, and Deliverables

Pilot Work Plan

Work Group I: Field Data Collection Tool, Roadway Asset Development, MIRE Self-Assessment, and Gap Analysis

Work Group II: EXOR and Other Authoritative Data Base Development Roadway Data Migration and Asset Readiness Planning

Work Group III: System Architecture Work Flow, ETL, and TED Data Warehouse Build Out

Work Group IV: ATLAS Project Geospatial Management Capabilities

Work Group V: Development of Network Screening and Safety Analysis Tools (UCONN)

Other Technical Support Players
- Bentley
- VHB and Spy Pond
- Business Systems Integration Specialist
- CAD To GIS Developer
- Transcend (Field Data Collection Tool)
- CTDOT IT consultants

TED DEVELOPMENT GROUP
- Provides overall direction and sets priorities
- Guides work group plan implementation
- Resolves issues
- Sets requirements for Asset Wise Publishing Tools
- Data Governance within TED domain

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Work Group V: Development of Network Screening and Safety Analysis Tools (UCONN)
Creation of a Data Governance Council

- Mission and functional Statement (Endorsement by Senior Management)
- Early meetings
- Draft Data Governance Rules for Creating Enterprise Data
- Challenges and Problems with Enterprise Data Platform
  - Freezing of TED Assets-June, 2018
- Onset of business requirements documentation expertise
  - TED Architecture Analysis/Documenting Existing Business Requirements
  - Starting over from a Best Practice Perspective
What is Data Governance?

Data management is the decisions made related to data within and enterprise system, such as; data structure, collection methodology, storage systems, etc. Data governance is the execution and enforcement, with appropriate authority, of those decisions, as it relates to data assets and enables the Department to perform its functions. Data stewardship is the personnel responsible for data entry, quality assurance, and analysis.

Management
(top level decisions)

Governance
(implementation)

Stewardship
(the people)
Mission of CTDOT Data Governance

Agency Enterprise Data and Technology Oversight Executive Committee

“Provide guidance and help secure resources to support all strategic transportation data enterprise planning activities including regular review of data management practices and tools, and development of policies and procedures.”
Mission and Functions
Agency Enterprise Data and Technology Governance Council

- **Prioritize safety and asset data governance solutions**
  - to provide the foundational tools necessary to expand enterprise data participation across all disciplines within the agency
- **Identify data** being collected and maintained agency wide.
- **Document data standards and coordinate development** of new standards.
- **Develop guidance for data dictionaries, user manuals, and training programs.**
- **Establish quality control/quality assurance (QC/QA) processes.**
- **Facilitate the integration and interoperability of information**
  - between authoritative roadway inventory databases and the Department’s enterprise wide data system.
- **Identify and inform the Executive Committee**
  - of emerging data priorities and how they best might be addressed
- **Report to the Executive Committee** as needed to make recommendations regarding data governance challenges or technology opportunities.
Data Governance Guidance Memoranda Summary

Never Published - Asset Data Stewards Were Not Ready

- Memoranda #1 Definition of Data Assets and Assignment of Asset Data Owners and Asset Data Stewards
  - A “data asset” is defined as any database, data record, data system, application, output file, service, or Web page that has been developed to support core business functions within the Department
  - Each data asset must have an identified asset data owner and asset data steward to work on TED and ATLAS enterprise development issues

- Memoranda #2 Roles and Responsibilities of Asset Data Owners and Asset Data Stewards
  - Asset data owners are responsible for oversight of the collection, storage, maintenance, and implementation of business rules / managing its use including rules for how data will be exposed for general public consumption.
  - An asset data steward is a person responsible for the management of data assets on a day to day basis in terms of content, update and data extract processes, data migration to TED and for the development of metadata

- Memoranda #3 Metadata Requirements
  - Metadata must be supplied for every data asset residing in TED, ATLAS, and ESRI if labeled as a production data set before exposing the data to users
  - All metadata will be entered and maintained in the CTDOT supported ATLAS data base and must be completed before being released to internal users or published to public facing applications

- Memoranda #4 Asset Data Requirements for TED Enterprise Data Warehouse
  - Asset Data Readiness: The assigned Asset Data Steward (ADS) will work with the TED Development Team to accomplish the following: Complete metadata requirements in ATLAS, Define and include asset management terms in the Data Glossary, Complete asset business process work flow to identify gaps in asset data quality, Work to develop and monitor a “readiness assessment” for an assigned data asset

Drafted Early 2018
Challenges Facing New Data Governance Structure

• Executive Buy In and Support from Each Bureau
  – Core Business Needs Took Priority Over Enterprise Needs

• Recognition of DG within Department-wide IT Strategic Plan
  – Never quite rose to the level of importance

• Consideration of Additional Resources as needed
  – Any new rules or guidance would require business process changes, expertise and additional resources
  – Data Culture Not Ready To Fully Adopt A Data Governance Regime
Challenges With The Prototype TED Platform

- Complicated data flow framework connecting source data files
- No data quality checks – just extract and load processes
- Changes in source code would break ETL processes and shut down system
- Initially just a proof of concept that was productionized without due process
- Limited querying and mapping capabilities
- Absence of a definition of business needs
- Lack of technical documentation
- Resulting action: Froze any more data input to TED as of June, 2018
Took A Step Back
Brought on Board Business Analyst To Begin BR Documentation
TED High Level Functional Requirements Summary:

- TED will be the authoritative enterprise data warehouse and the data bridge between departments at the CTDOT.
- TED source and stewarded data will be housed in various data storage methods and not limited to EXOR, Atlas and ESRI (i.e. SQL databases, ACCESS, EXCEL etc.).
- TED data will be updated as specified by the data steward / owner.
- TED initial user count will be small but will grow into the hundreds within a year.
- TED data will be used to feed various reporting, analytics, graphing and mapping solutions.
- TED data will be consumed by internal CTDOT staff and external users (i.e. consultants, COG’s, web sites and local towns).
- TED data will ultimately be secured and only available to authenticated and authorized users.
TED Architecture Review Project (Early 2019)

• Review the current architecture of the TED platform. The goal was to expand, modify and validate the current solution architecture based on business requirements documented during the months of October and November 2018

• Recommendations In The Following Areas:
  – Data Quality and Storage
  – Temporal Data Base Structure
  – Security and Data Access
  – Create business intelligence
  – Define cloud based server solution
  – Simpler ETL design
  – Modify ATLAS (Capital Project) planning tool
  – Build new metadata solution
  – Address staffing and capability issues
Making Data Governance Achievable In Our Lifetime: Learning To Change the Data Culture First

- TED Lean Event, Peer Exchange with Ohio and Iowa, Guiding Principles
- New Levels of Transparency in Asset Data Development and Delivery
  - Routine Engagement of Asset Data Stewards In Reporting Progress
  - Regular TED Meetings-Change In Format
  - Documenting Work Flows and Data Tables for Migration To The New TED
- Building Support Services Through Our Roadway Team
  - Linking assets to the LRS
  - Use of FME software for bulk loading and DQ checks
  - Power BI for dashboard analysis
  - New GIS team to benchmark the landscape
- Reinventing TED Through the UCONN MOU:
  - Targeted Assets- ADA Compliant Curb Ramps and Sidewalks, Guiderail, and Signals
  - Business Requirements, GIS Solutions, Web Portal
  - Stand up new Web Portal and GIS Solutions by September, 2020
• The CTDOT has made impressive strides over the past several years in building its enterprise data management capabilities

• The CTDOT is currently at a crossroads with respect to future development of TED. The CTDOT has completed TED as a prototype but needs to step back and examine business requirements, data quality management and the stability of the current TED architecture.

• The future plan needs to consider people, process and technology elements.

• IADOT and ODOT offered numerous ideas and examples that the CTDOT can adopt or adapt. Maturity models can provide a useful tool for identifying areas for improvement and tracking progress.
Our Guiding Principles Going Forward

A collaborative, transparent, consensus driven approach will be implemented to achieve cooperation and support. Reaching out and adding value to organizational units’ business processes is imperative to optimize multiple benefits from integrated tools and systems.

Common sense reasonable standards will guide data stewardship, readiness, maintenance, and sharing without disruption to business processes.

Our data will be managed in a way that meets the needs of individual business owners as well as the collective needs of the Department and outside stakeholders.

The TED Enterprise draws on multiple consistently changing authoritative data sources to integrate, store, and display data. Transparency and communication will be key to how data is managed and shared.
TED Tasks and Milestones To Be Tracked

- **UCONN MOU-Detailed Project Plan (Through September 2020)**
  - TED architecture
  - New ATLAS data base and capital project management Web site
  - Documented business and technology requirements (for pilot assets): Roadway, ADA, Guiderail and Signals
  - GIS solution, tools and apps and publishing standards
  - TED Web Portal
  - Use Case Scenario of safety project decision making

- **Other TED Components**
  - Asset Data Management for legacy TED data sets, TAMP priorities, and emerging ESRI data
  - CMMS RFP and Grant Application
  - EXOR/LRS: Migration from RIS, MIRE development, MAVRIC
  - Data Integration-ATLAS Enhancement

- **IT Technical Support Tasks**
  - ESRI Licensing and Azure Cloud Support

- **TED Management**
  - Asset Data Stewards and GIS User Groups
Takeaways from our Data Governance Experience Thus Far

What Have We Learned

• Need to respect the priority of core business functions no matter how inefficient they may be.....every DOT has its own DNA and one has to read and adjust to it

• Grow Data Governance from the “bottom up” as well as from the “top down”. Need to win the trust and confidence of data stewards; develop needed tools, apps and services

• Begin with known “best practices” in developing an enterprise home for accessing authoritative data (i.e. find a Business Analyst to document business and functional requirements)

• Secure and grow staffing expertise to get things done and to sustain successes; create cross organizational team especially for GIS capabilities

• Make sure IT is totally on board and has the resources to support software purchases

• Make sure everyone is a player including field staff who touch assets every day

• Secure a university partner/vendor to do some of the early “heavy lifting”

• Continue to engage senior management with demonstrations of project gains
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Questions?