ConstructionProgressCoalition

CDX COMMON DATA EXCHANGE

BLUEBEAM A NEMETSCHEK COMPANY

2020 RESEARCH SCHOLARSHIP

2020 CDX Research Report

Quality Management Workflow

TxDOT Design-Build Projects

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If at any point throughout the document you need to know the definition for an acronym or CDX term, click the info icon at the bottom of the page to go directly to the appendix.

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1. Background

The Construction Progress Coalition Pillars of Innovation

At the Construction Progress Coalition (CPC), we seek to collaborate with diverse perspectives to resolve the most pressing challenges facing the Architecture/Engineering / Construction (A/E/C) industry. Every initiative that CPC supports must align with one of the following pillars:

- **Thought Leadership** Bringing together diverse perspectives to improve our understanding of the #SharedPains facing project delivery stakeholders in their attempts to streamline data interoperability while improving project data insights.
- **Interoperability** Bringing together a diverse set perspectives on a common topic, we debate the root causes of our #SharedPains to identify where #SharedGains can lead to real change. The Common Data Exchange (CDX) framework brings together construction supply-chain stakeholders to design machine-readable project data interoperability standards.
- **Insights** A rising tide lifts all ships. CPC seeks to partner with other industry member organizations, research universities, project owners, the importance of data quality and project exchange standards.

As part of the Interoperability Initiative, CPC recognized the need for real-world research and testing. In 2020, CPC partnered with Bluebeam to engage young construction technologists to tackle data interoperability.

Bluebeam CDX Scholarship Fund

In the summer of 2020, Bluebeam Inc generously donated $20,000 to sponsor three undergraduate interns and one graduate research student to learn the CDX framework and investigate a CDX workflow of their choice. Workflows investigated by the summer researchers included the Request for Information (RFI), Document Control, Quality Management, and Production Tracking. Each researcher worked with an industry mentor, and received feedback throughout their research from the CDX Advisory Panel of AEC technology experts.

Kellie Ward
Bluebeam, Sr. Community Development Manager

> Congratulations to each of the winners of the Bluebeam CDX Scholarship! We have been so honored to be a part of these students' journeys as they dedicated their time to solving real industry problems. Thanks to the CPC for partnering with us to provide a platform that recognizes these students as true industry heroes!

Bluebeam CDX Scholarship Fund CDX Advisory Panel of AEC Technology Experts

Marge Hart
Newforma

Joe Williams
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Jeremiah McNicholas
Sage

Tom Jodeit
Procore

Researcher's Acknowledgments

Abdullah Alsuhaibani

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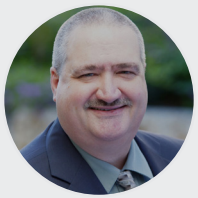
Thanks to CPC, the CDX Advisory Committee, and CPC Executive Director Nathan Wood who organized this research and provided me and all the researchers with continuous support and guidance throughout this research project.

I would like to thank my mentor, Todd Sutton, who is the Construction Technology Manager at Zachry Construction. I appreciate the support provided to me by Mark Brown, the Corporate Quality Manager at Zachry Construction, and Brian Bullen, the Construction Quality Manager at Zachry Construction.

I am also grateful to my University of Texas at Austin graduate advisor at the Dr. Fernanda Leite, who encouraged me to participate in this research project and has provided continuous support throughout the research.

Finally, I would like to thank the people who I interviewed throughout this research project. They shared with me some of their valuable experience, their shared pains, and their innovative thoughts.

Construction Progress Coalition Research Mentors



Todd Sutton
Zachry Construction

Dr. Fernanda Lelite
University of Texas at Austin

Dan Smoilio
Walsh Construction

Common Data Exchange

Common Data Exchange (CDX) is a discussion framework for A/E/C project delivery stakeholders to produce interoperability solutions that align the capabilities of technology with the requirements of contract, code, or standard.

To be clear – CDX is not a data standard. It's a visual aid for AEC stakeholders to define people, process, and technology requirements that align with existing industry standards. When they tell you "data is the new oil," remember that data requires its own refinement process called standardization. The drivers of data standardization include project contract, building code, and industry standard.

Data standardization does not require that all projects agree on one standard. Rather, it requires that all stakeholders on a project agree to the standards that they will adhere to. Regardless of what standards must be referenced or translated between software applications, the CDX framework provides industry and technology with a human language for translating contract to code.

CDX-Listed profiles provide a clear picture of software integration capabilities and stakeholder data requirements enabling customers to match specific-use cases with purpose-built solutions. Whether it's file-based "containers" like the Portable Document Format (PDF) or web-enabled platforms with open Application Programming Interfaces (APIs), every exchange of mission-critical data across the lifecycle of the data asset can (and should) be documented using CDX.

The barrier to digital adoption in AEC is not a lack of technology, it's a lack of motivation. Even the most proven solutions can lead to failed results when the needs of people and processes are neglected. CDX puts the decision-making power back into the hands of the individuals who create, manage, and share data. When utilized early in project execution planning, the CDX Playbook actively nudges AEC stakeholders to refine their process and data requirements in lieu of untamed digital chaos.

CDX provides a visual language for project teams to define their collaboration standards. Using CDX-Listed solution profiles born from CDX-Validated case studies, teams have more flexibility than ever to transform information exchange standards based on project specific requirement.

CDX
COMMON **DATA** EXCHANGE

1. Background

The CDX Playbook, whether in analog or digital format, facilitates a common understanding between project delivery stakeholders. CDX provides a visual language for project teams to define their collaboration standards. Using CDX-Listed solution profiles born from CDX-Validated case studies, teams have more flexibility than ever to transform information exchange standards based on project specific requirement. As stakeholders coalesce around industry-specific data reporting standards (i.e. XBRL, IFC), competing platforms will provide the ability to opt-in CDX-Verified project data for industry-wide benchmarking and performance analysis.

CDX workshops provide teams with the impetus to have the detailed – but necessary – conversations required to optimize project data interoperability. Sharing the responsibility of setting workflow and measurement parameters for mission-critical transactions (i.e. RFI) is crucial. It fosters a culture of team cooperation and accountability instead of blame and distrust. Even on traditional hard-bid projects, CDX kickoff meetings held during stakeholder onboarding can at least provide a common understanding of the roles and responsibilities regardless of their influence over the decision.

CDX brings software capability and industry requirement together to solve the shared pains facing project data standardization. Without input and buy-in from all impacted stakeholders, standardization could be the "weakest link" in the supply chain that takes down the whole team. Just like any technology tool, CDX is only as good as the people and processes surrounding it.

CDX is used to accelerate understanding and alignment between project delivery stakeholders as they define their data interoperability requirements. Bringing together iconography with Lean work structuring, CDX is a tool to visually define:

- **WHAT** data is required?
- **WHO** needs it?
- **WHERE** must it be stored?
- **HOW** will it be maintained?

The answers to these questions come together to produce CDX-Validated case studies documenting various ways to ensure that all project stakeholders are working from a reliable and accessible Common Data Environment (CDE).

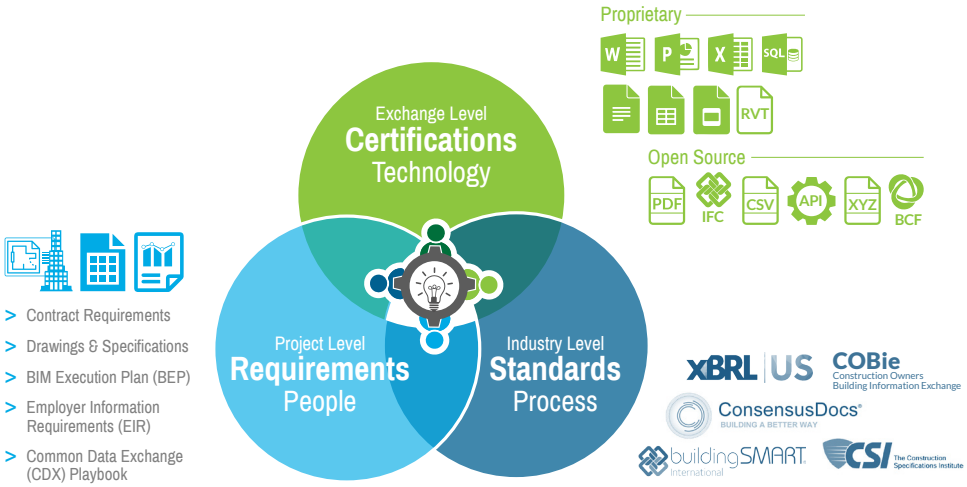


FIGURE 1 Visual depiction of transformation strategy between People, Process & Technology

Efforts today from CPC Members and Partners to produce CDX-Listed capabilities and CDX-Validated case studies align with CPC's mission to improve project outcomes by aligning project insight demand with interoperability need. The not-so-distant future of CDX-Verified data aligns with CPC's vision to transform the measurements of project performance.

FIGURE 2 CDX Classifications

> Tell me how you will **measure** me, and I will tell you how I will **behave**.
>
> Eli Goldratt

2. Research Findings

When working with construction projects, agreeing on a Common Data Exchange (CDX) and implementing an effective workflow can lead to a myriad of benefits. Some benefits include: reduced working hours, prioritizing critical tasks, minimizing data loss, and better utilization of historical data for predictive analysis and future needs. Although the benefits of adopting IT solutions and improving interoperability between stakeholders seem to be obvious, there are still some construction and engineering firms relying on data-less or "analog" exchanges of quality information in the form papers, phone calls, text messages, etc. According to The National Institute for Standards and Technology (NIST), the lack of interoperability between the stakeholders generates $15.8 Billion of waste from US capital facilities annually. The report showed that manual reentry of data is the main driver of the cost of interoperability.[1]

The research investigation began by studying the quality management process on Design-Build (DB) Highway projects for the Texas Department of Transportation (TxDOT). Current interoperability "pain" points and potential innovation opportunities were identified through subject matter expert interviews and analysis of publicly available documents.

The following report includes illustrations of the current state of DB Quality Control strategy using macro and micro CDX workflows to describe the interoperability pain points (or "shared pains") for each document exchange. After that, the shared pains found in this research will be investigated. The last section of the report proposes a prototype workflow and data management strategy to address the current challenges and barriers that hinder the industry from achieving this ideal state.

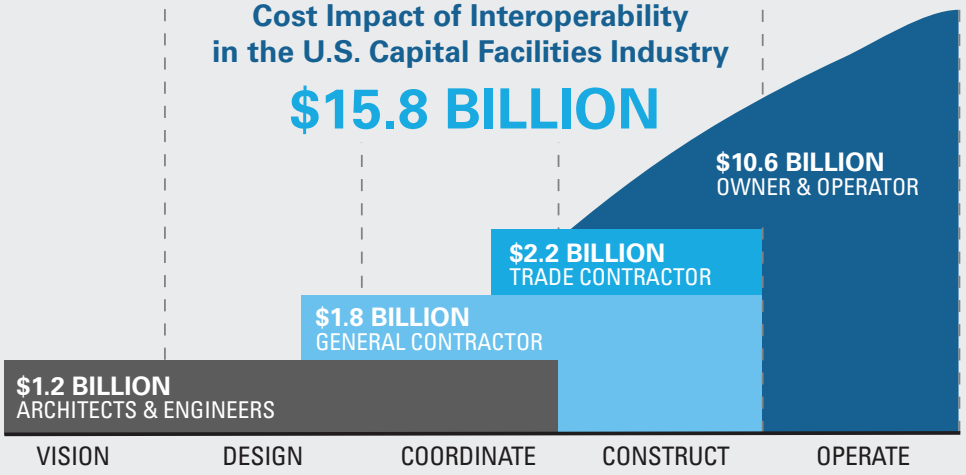
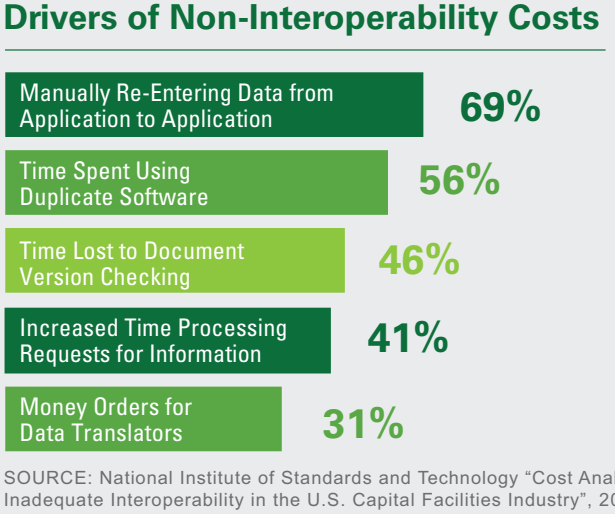


FIGURE 3 Illustration of the Cost Impact of Interoperability



Discovery and Definitions

This section introduces the extent of stakeholders, personas, systems, documents, and exchanges discovered through the CDX research process within the scope of TxDOT's Quality Assurance Program (QAP) for Design-Build (DB) construction projects.

Stakeholders & Personas

The stakeholder entities identified through this research include the Project Owner (TxDOT), the Design Build Contractor (DBC), the Independent Quality Firm (IQF), and the Owner's Verification Firm (OVF) and are identified in Figure 4.

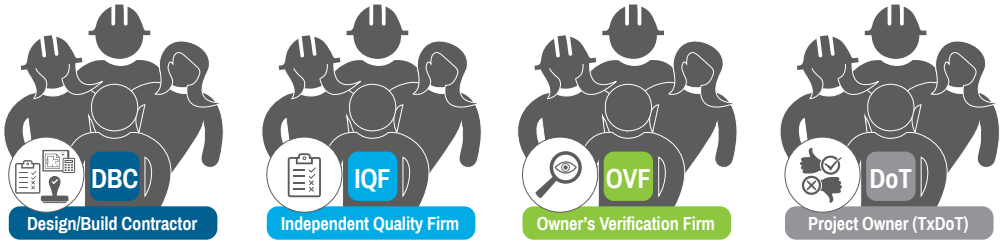


FIGURE 4 Stakeholders

Personas representing different stakeholders were interviewed including two TxDOT experts, quality control managers from the DBC, and an IQF manager. However, not all persona perspectives were available during the course of this research. Those personas who were interviewed are identified as such in Figure 5.

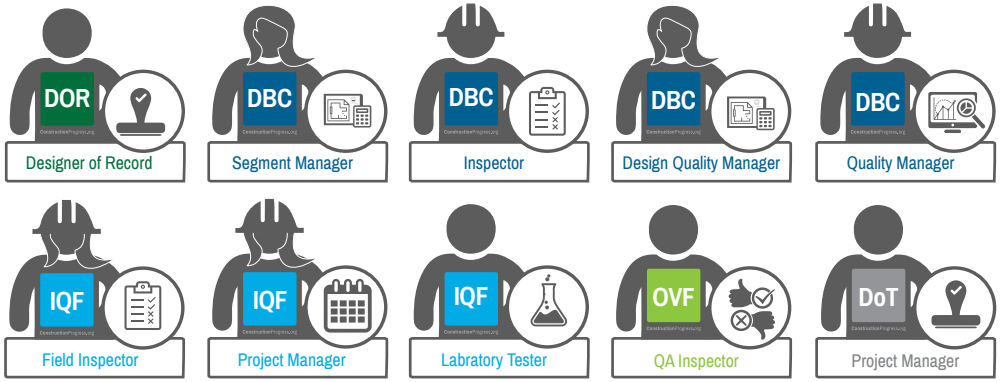
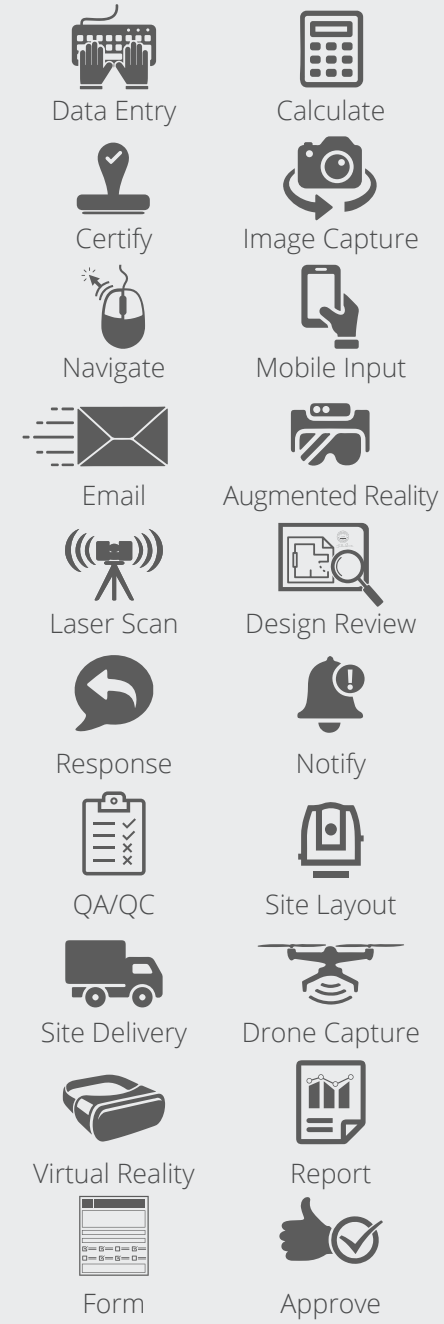


FIGURE 5 Personas

Potential Activities



Interviews were conducted through teleconference calls. Notably, an IQF perspective could not be obtained for interviewed. Despite their similarity to the OVF perspective, it is important to understand where shared pain points may exist between respective quality stakeholders.

Stakeholder Systems of Record

The systems of record used by TxDOT for DB projects are consistent and presented in Figure 6. They include SiteManager for submittals, SharePoint for internal communications, and the Inspection and Materials Management System (I2MS) for tests and inspection results submission. I2MS is where the IQF and OVF to submit their test results. Regarding the systems of records for the DBC, IQF, and OVF, they can vary from one organization to another. These systems and document applications can be updated by those individual stakeholders. For example, Zachry Construction utilizes ELO software as their digital document management system, while other DBCs may use more traditional storage systems such as local hard drives, paper, or personalized spreadsheets.

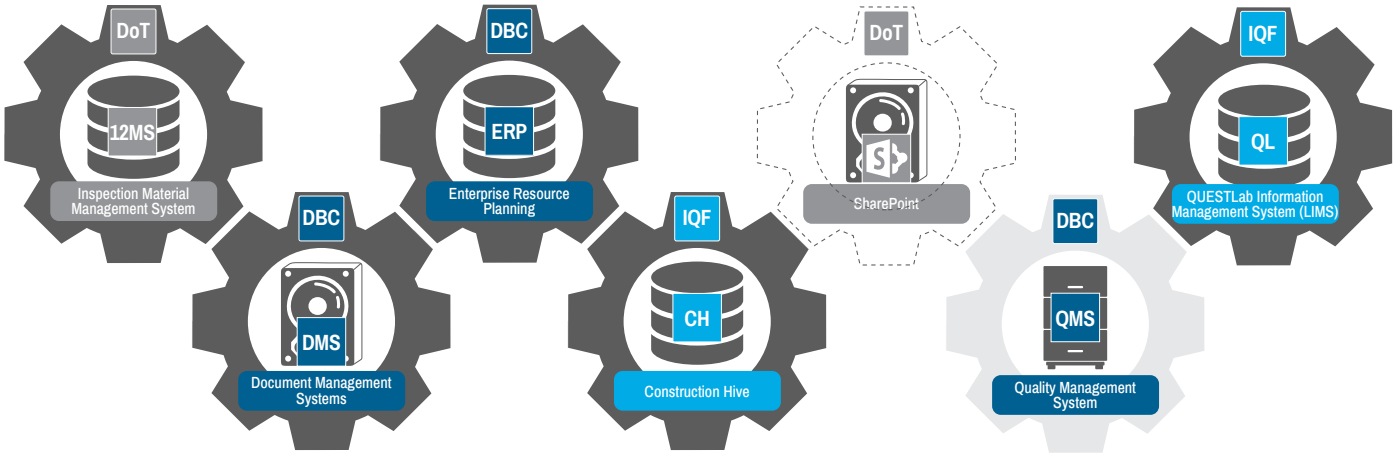


FIGURE 6 Stakeholder Systems of Record (SoRs)

Systems of Record

Database

Paper Filing Cabinet

Local File Sharing

Mobile Device

Laptop Computer

Cloud File Sharing

Project Documents of Record

The formal documents identified through the course of this discovery are presented in Figure 7. Each document is assigned a responsible stakeholder and a number to represent the impact tier. Tier 1 (blue fill) represents quality conformance documents like test or inspection results. Tier 1 documents are to be completed on a regular schedule. If the Tier 1 conformance document does not produce any issues or questions, it remains in Tier 1. Failed test results or other issues will produce the need for a Tier 2 non-conformance report (NCR) or request for information (RFI) - each requiring their own response or acceptance protocol. The formal response to a Tier 2 NCR or RFI by the responsible stakeholder persona is categorized as a Tier 3 response. If that Tier 3 response were to result in a cost or schedule impact that requires additional Tier 3 Impact report, it would be approved as a Tier 4 Change Order.

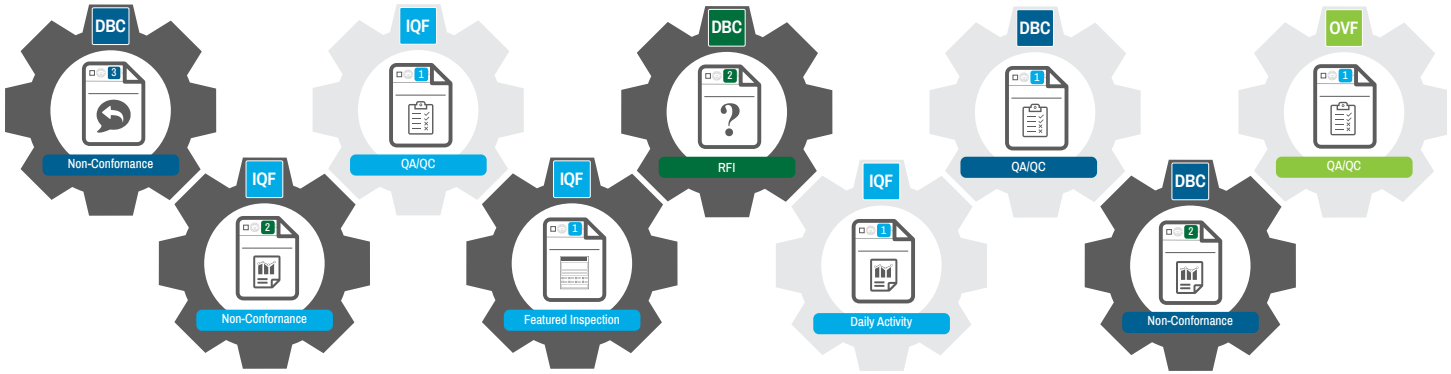
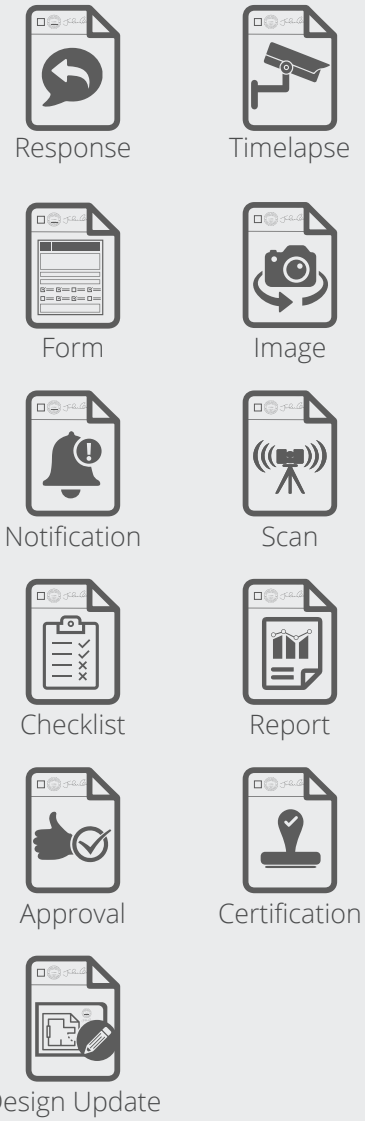


FIGURE 7 Documents of Record (DoRs)

Documents of Record



Current State

TxDOT has developed a Quality Assurance Program (QAP) specifically for DB highway projects. Figure 8 depicts these inspection stakeholders and their contractional relationship to one another. Note the dependency of the QAP on both the IQF and OVF.[2] The QAP requires the DBC to hire an Independent Quality Firm (IQF) to report inspection and test results directly to TxDOT. In addition, the Federal Highway Administration (FHWA) requires TxDOT to hire a separate independent Owner Verification Firm (OVF) to verify the reliability of the IQF testing. Typically, the OVF audits 10% of the IQF testing.

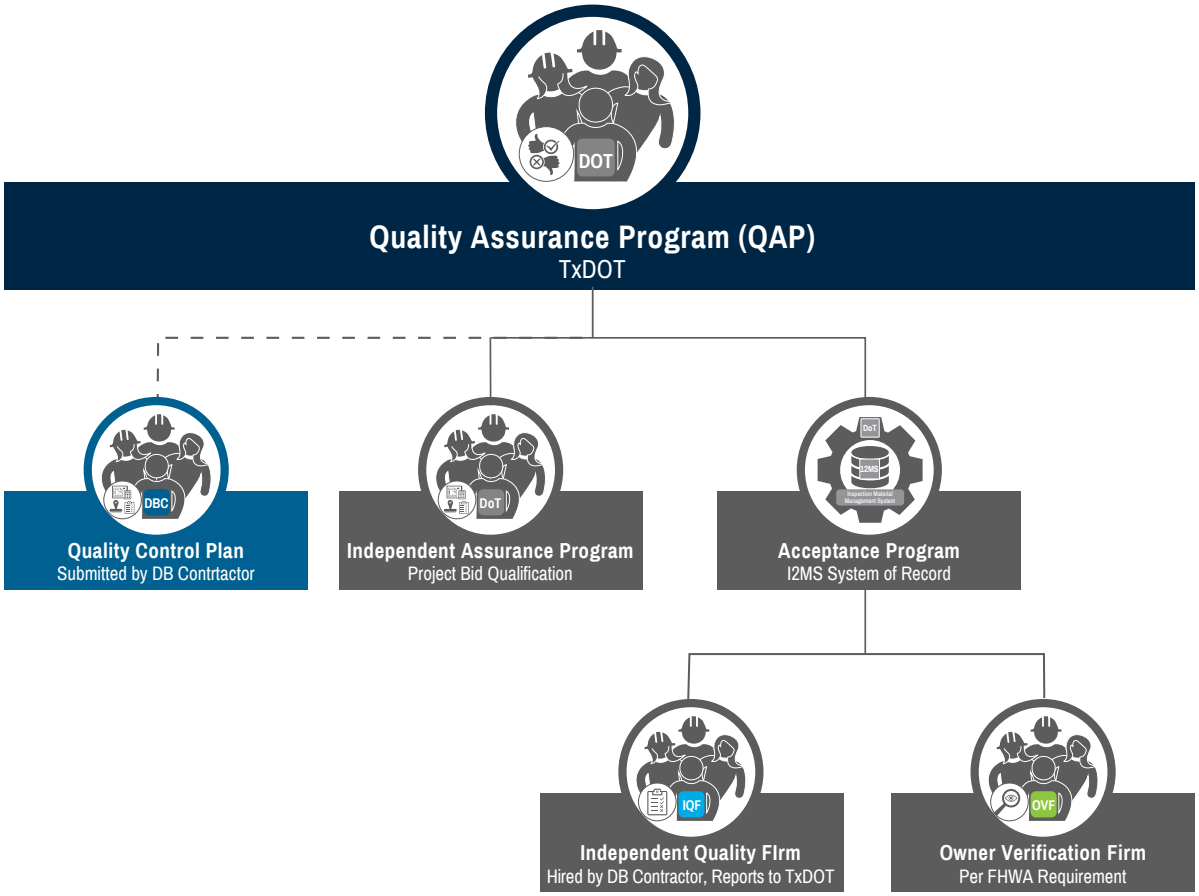
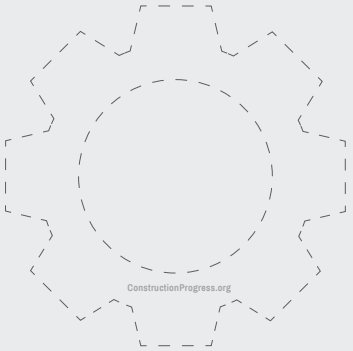


FIGURE 8 QAP stakeholder relationship map on TxDOT DB Projects.

System & Document Environments

Analog Environment



Digital Environment

Cloud Environment

Tier 1 Quality Inspection (CDX MACRO)

Tier 1 document exchanges such as the Featured Inspection Reports (FIRs) and the QA/QC Checklists are documented at a macro level using the CDX Playbook. The numbers inside the parentheses in this section are a reference to points of exchange in Figures 9 and 10.

The inspectors working for the DBC report issues to the QC manager using either emails, phone calls, or verbally **(1).** The IQF inspectors will have to complete at least two Tier 1 documents daily that include the Featured Inspection Reports (FIRs) to the DBC and the daily activity reports to the IQF manager **(2).** Although the laboratory has an interoperable system with TxDOT's I2MS, test results are reported to the IQF through email for their approval before submitting them **(3).** TxDOT project team compares the results from the DBC-hired IQF with the OVF which TxDOT hires to assure the reliability of the IQF. Although most of this process is done automatically through I2MS, the reports will still have to be manually downloaded and submitted to TxDOT and the FHWA through SharePoint **(4).**

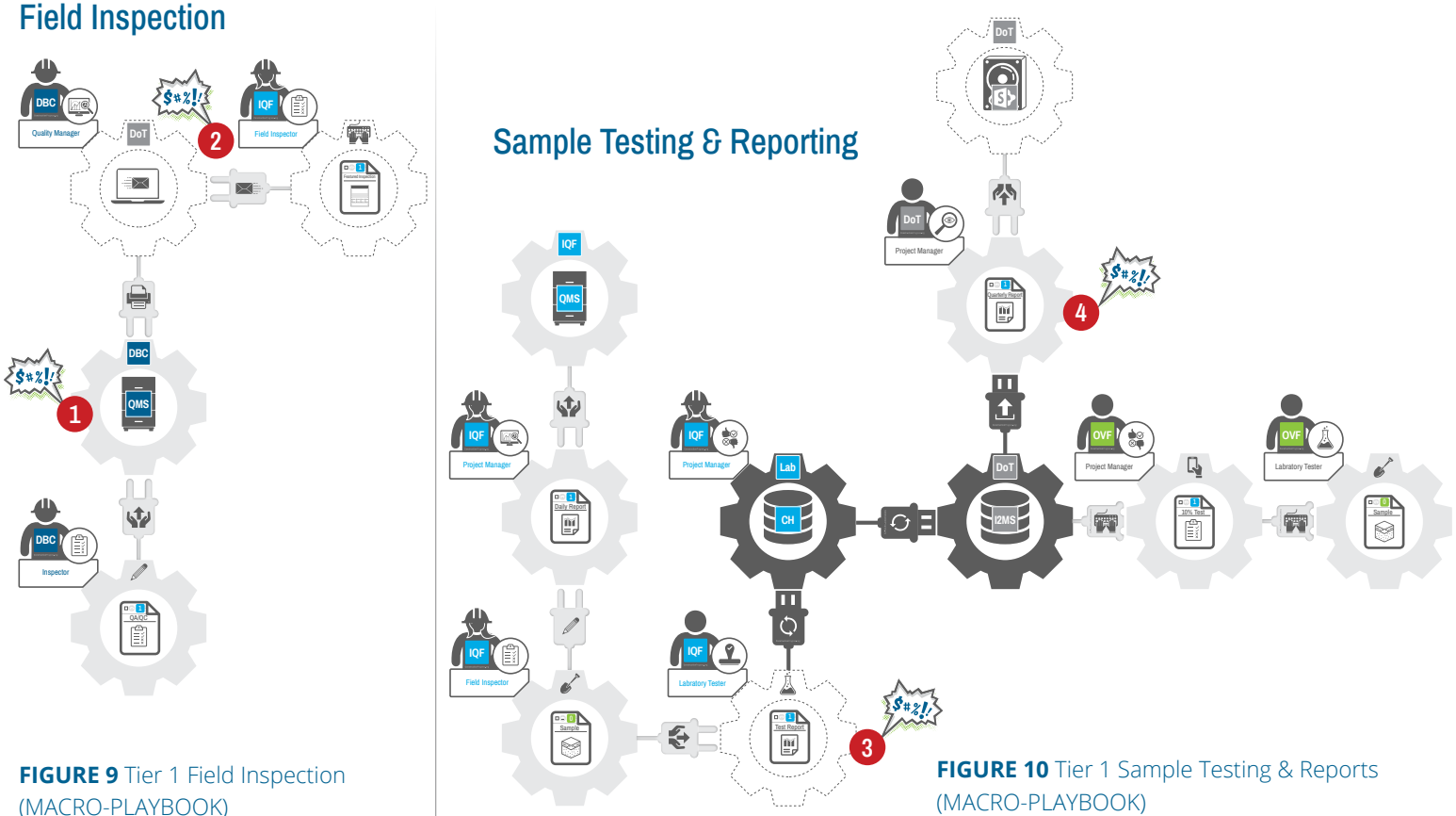


FIGURE 9 Tier 1 Field Inspection (MACRO-PLAYBOOK)

FIGURE 10 Tier 1 Sample Testing & Reports (MACRO-PLAYBOOK)

Pain Points

1. **Duplicate Entry** Not using a quality management system for internal communication and reporting. For example, the DBC quality control requires the manual entry of form data because their document management system does not support digital exporting of quality reports.
2. **Duplicate Entry** The IQF inspectors report two types of documents – the Featured Inspection Reports (FIRs) to the DBC and the daily activity reports (an aggregation of the FIRs) to their manager.
3. **Ineffective process** Laboratory test results are not auto-reported to I2MS. Instead, they are sent manually by email for approval.
4. **Duplicate Entry/Manipulation Potential** TxDOT manually downloads the OVF reports. The reports are used to verify the results of the IQF, uploaded to the TxDOT for review, and then reported to the FHWA after approval.

Tier 2 Non-Conformance Report (CDX MICRO)

Tier 2 document exchanges, such as the non-conformance report (NCR), are explained using the micro level CDX Scenario. The numbers inside the parentheses in this section are a reference to points of exchange in Figure 11.

Non-conformance Report (NCR) is initiated by any of the stakeholders, and it is triggered by failing test results or any other deviation from the specifications. Figure 11 shows the micro representation of an NCR initiated by the DBC quality inspector **(1).** The NCR is reported to the QC managers for review **(2).** The NCR requirements are then either denied or submitted to the project-specific document management system (PSDMS).

The workflow of the NCR in the PSDMS starts with the segment manager **(3).** If a design change is required, it goes to the design quality manager for review and subsequent submission to the design team. The design team then prepares the design and specifications of the proposed solution **(4).** After that, the NCR returns to the design quality manager for review before submission to the Owner **(5)**.

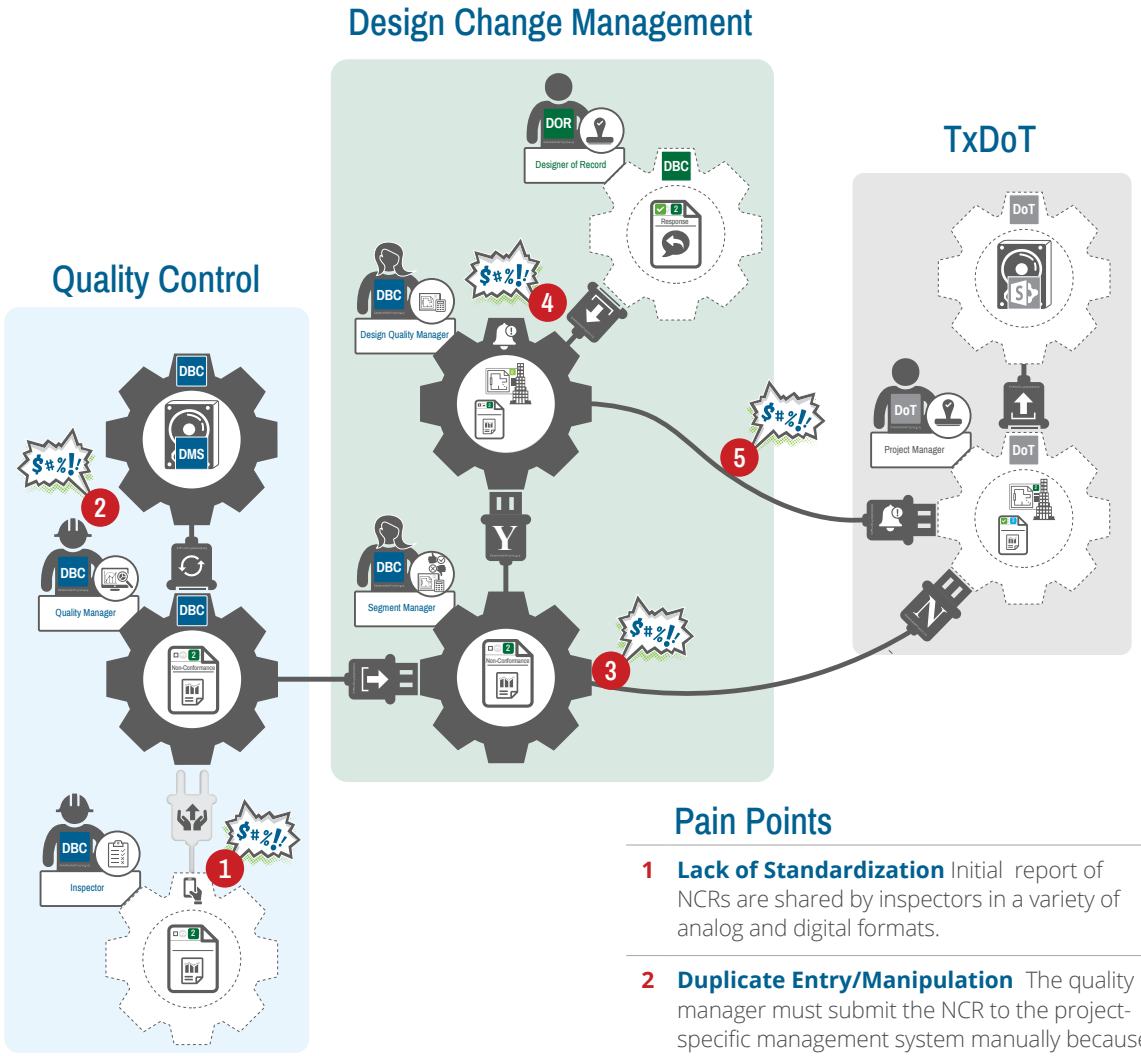


FIGURE 11 Tier Non-Conformance report (NCR) (MIRCO PLAYBOOK)

Pain Points

1 **Lack of Standardization** Initial report of NCRs are shared by inspectors in a variety of analog and digital formats.

2 **Duplicate Entry/Manipulation** The quality manager must submit the NCR to the project-specific management system manually because the DMS used by the DBC is not interoperable with the one used specifically for the project.

3 **Late Notification of Owner** The Owner is only notified about the NCR at a very late stage of the workflow.

4 **Ineffective Processes** The DOR notification of NCR and request for formal response adds additional steps to the approval process.

5 **Late Notification of Owner** The Owner is only notified about the NCR at a very late stage of the workflow.

3. Shared Pains

This section summarizes the common interoperability pain points (i.e. Shared Pains) identified through the discovery research including a brief root cause analysis when applicable.

1. Manual Data Re-Entry

Without access to smart devices or tablets, IQF and OVF inspectors must utilize paper forms to report inspection results. Then, the paper form is manually entered into a computer by the technician or their supervisor. If the inspection report is also submitted to TxDOT, the same report must be filled out a third time in I2MS.

This quality assurance strategy differs from traditional Design-Bid-Build (DBB) projects that rely solely on TXDoT or a third party quality firm hired by TxDOT. Although the OVF is hired by TXDoT to improve project quality by avoiding conflicts of interest, redundancy of quality inspections by other stakeholders (DBC and IQF) is necessary.

Redundant inspections will continue to prove beneficial from a quality control perspective. However, redundant reporting of the same inspection creates digital waste and opportunities for error. Because the size and cost of DB projects are generally greater than DBB projects, small changes to the QAP reporting process on DB projects can produce significant improvements in reporting efficiency and overall data quality.

2. Lack of Data Standards

When quality information is submitted in analog or unstructured data formats, supervisors are challenged by time consuming reviews to assure the data is correct. This inefficiency prevents senior staff from focusing their time on inspection data

A **'Shared Pain'** occurs when two or more project delivery stakeholders experience a communication or collaboration breakdown that negatively impacts all parties.

analysis. Instead, time is unnecessarily spent analyzing report data for accuracy and accessibility.

Maintaining quality report data using spreadsheets can facilitate some analysis, but with many limitations. If an OVF or TXDoT official wants to review the rejection or non-conformance percentage by project across a specific date range, there must be a standardized approach to collect, aggregate, and analyze inspection report data across all projects.

3. Data Loss or Manipulation

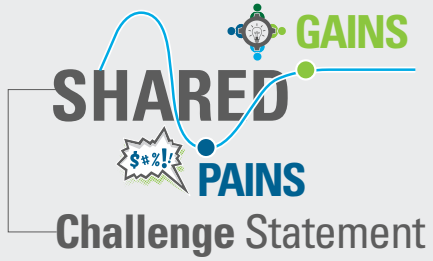
Even when process and data standards are in place, there are still opportunities for data loss or manipulation by the personas involved. Process standards should account for the reality that individuals may accidentally or intentionally deviate from the standard.

Often times, the deviation from standard is motivated by expediency. For instance, an inspector may wish to reject an inspection verbally on-site with the project manager present. Quality assurance standards should be in place to ensure that the rejection notification is properly documented in the appropriate QMS.

4. Ineffective Process Standards

Current QAP workflows are designed in a way that notifies TXDoT at a very late stage. While this relieves the burden of owner involvement early in decision making, it also leads to late decision changes, schedule delays, and cost overruns.

The challenge with making time-sensitive decisions between project delivery stakeholders is recognizing who needs to be informed, and when. There should be an option within the process standard that allows for expedited owner notification in order to produce consensus-based decisions.



HOW MIGHT WE...
improve the exchange and access to quality data between TxDOT Design-Build Project Delivery Teams

IN WAYS THAT...
reduce risk and waste through increased transparency

SO THAT...
together we can focus on predicting quality problems before they happen.

4. Shared Gains

This section proposes some basic strategies to address the shared pains identified in the previous section. Some of the shared gains that can be achieved if a CQMS is adopted are listed below:

1. Minimizing Data Re-Entry

Having interoperable systems will minimize the requirement of data reentry both within the organization and by other stakeholders.

2. Single Source of Truth for Documents

Allowing all stakeholders to access the documents in the CQMS will minimize data silos and redundancy which can cause conflicts or errors.

3. Increased Transparency & Collaboration

Having a centric system that is accessible by all stakeholders increases the transparency in the workflow, and as a result, increases collaboration.

Adopting the CQMS in TxDOT's DB projects will undoubtedly provide value to all stakeholders involved. However, it is unknown if the value provided will outweigh the significant stakeholder investment and individual commitment from personas required to reach the adoption benefit threshold.

A **'Shared Gain'** occurs when two or more project delivery stakeholders resolve a Shared Pain by transforming people and process using digital technologies.

5. Future State Prototype Proposal

The proposed solution, shown in Figure 12, is a central quality management system (CQMS). The CQMS is an open standard, cloud-based platform that would integrate with each stakeholders internal QMS. This prototype CQMS would generate seamless interoperability between I2MS, Construction Hive,and the DB Contractors QMS. More stakeholder systems would also be able to connect to the CQMS, depending on the project requirements.

The existence of a project CQMS is only half of the solution. This integration platform only works when the stakeholders and personas involved with it come together during project kickoff to provision the workflow and data standards.

To address the data loss and duplicate entry pain points identified in the current state, the CQMS allows teams to customize their notification and approval workflows depending on project demand. For example, if an NCR submitted by an IQF inspector is subsequently approved by the DB QC quality manager, the system should automatically notify and allow access to all impacted personas.

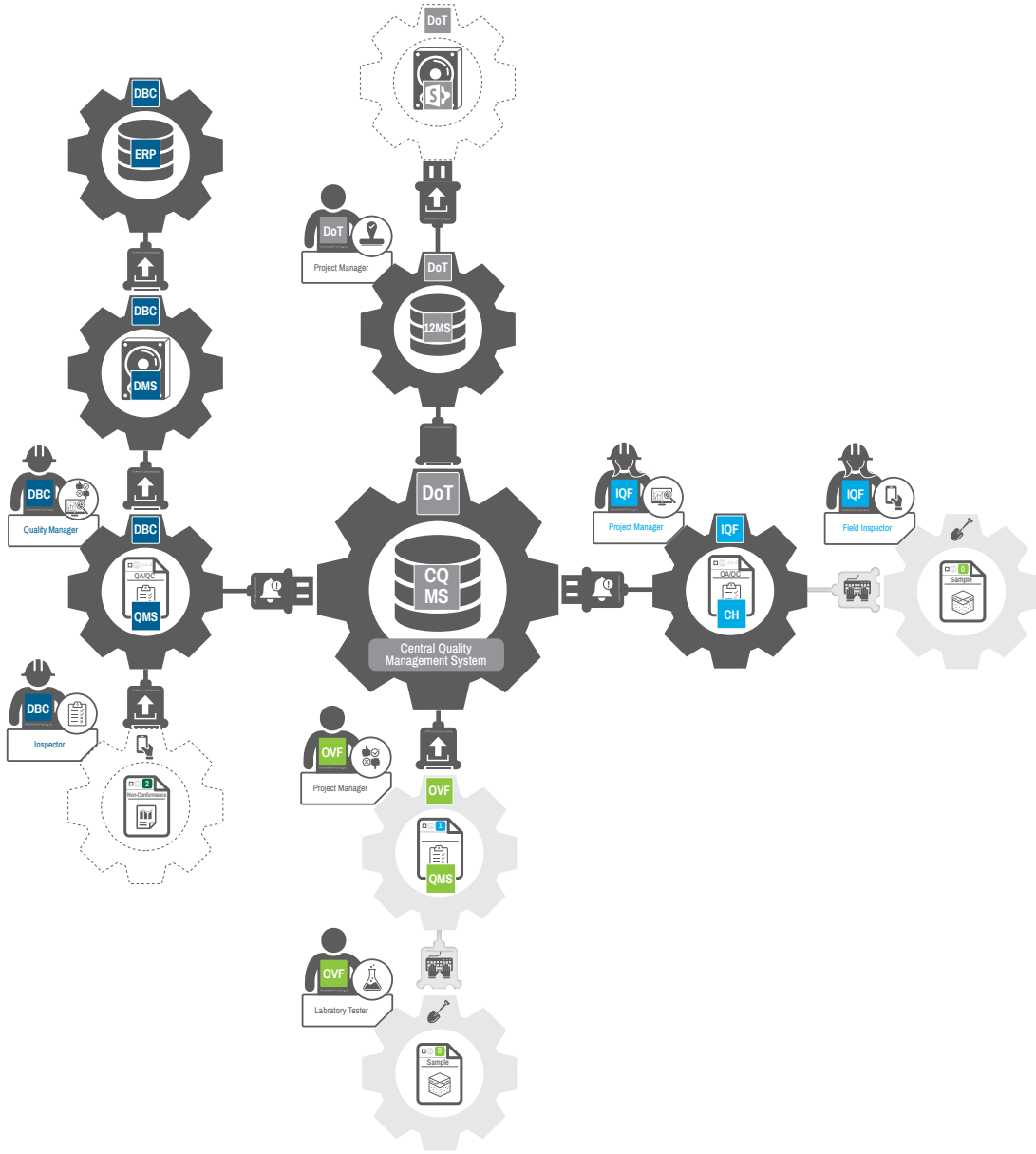


FIGURE 12 Prototype CDX Scenario Depicting a Central Quality Management Systems (CQMS)

Central Quality Management System
Points of Success and Measurable Impact

Interoperable platforms, cloud storage, and agreement on CDX requirements between the different stakeholders involved in the project and within the company can result in numerous benefits to each stakeholder. The benefits of an interoperable CQMS are listed in Table 1 and categorized as either direct or indirect.

Direct Savings	Indirect Savings
> Eliminating double entry and non-added value steps in the workflow process	> Ability to visualize the data in BI Dashboards
> Accessibility to quality report data for current activities	> Ability to use the data for predictive analysis

TABLE 1 Benefits of an Interoperable CMQS

For example, the Construction Hive QMS platform provides a direct savings to the OVF by eliminating duplicate entry between QuestLab and I2MS. It also provides an indirect value to TXDoT when the report data from Construction Hive is received in I2MS for visualization and analysis.

Cultural and Contractual Barriers to Adopting a Digital CQMS Platform

This section discusses cultural and contractual barriers to adopting a digital CQMS platform between all project delivery stakeholders and personas.

Barrier	Root Cause	Countermeasures
Nature of the Industry	> Most of the construction projects are one-offs > Variabilities in delivery methods, the stakeholders, and regulations > Quality requirements and acceptance criteria change for each project	> Agreement at an early stage of the project development on the data exchange and reporting requirement > Tailoring the system according to each project's specific needs
Lack of motivation to leverage quality data	> Stakeholders do not recognize the importance of measurement to predict risk and maintain a competitive advantage > The concept of exploiting the quality historical data for future use and predictive analysis is not yet a common practice in highway projects	> Awareness and education
Motivating quality managers by implementing KPI on quality jobs - Show the analysis in business intelligence boards - Scalability vs. Efficiency	> The use of text boxes in reports and forms will improve the scalability; however, text boxes reduce the ability to quickly sort and filter large data sets	> When applicable, standardize form fields by opting for drop down selections and check boxes rather than open-ended responses
No one software system solution for all workflows	> Most companies use different systems for HR, Finance, Project Controls, Quality Management	> Providing integration requirements and documentation for the CQMS to all stakeholders at an early stage of the project development phase > Stakeholders should also improve interoperability within their systems to avoid waste within the company
Lack of contractual requirements for data exchange	> Exchange requirements between stakeholders are not adequately addressed in the contracts	> The Owner should be explicit on what and how quality data is submitted to their system by all the stakeholders involved in quality management

TABLE 2 Cultural & contractual barriers to adopting a CQMS platform

6. Recommendations

Transformation Strategy

In order to adopt this solution, collaborative efforts from all the stakeholders should be done in the early project development phase. This subsection will explain the role of TxDOT and the other stakeholders to achieve the maximum benefits from the proposed solution.

TxDOT Role

As the owner, TxDOT is ultimately responsible for the success of their DB projects. Therefore, the CQMS platform should be initiated and owned by TxDOT and made accessible to all stakeholders involved in quality management. In addition, the CQMS should be built on open standards and interoperable with internal systems (i.e. I2MS and SharePoint) as well as external stakeholder systems (i.e. Construction Hive, EOS).

In addition, the use of CQMS for documentation and reporting should be explicit in the contract documents. This includes participation in the CDX kickoff that will define project specific CQMS requirements. Similar to what is done for I2MS, data standard and programming protocols should be provided by TxDOT to allow stakeholders to connect their internal QMS with the TXDoT CQMS.

Project Delivery Stakeholder Role

While TxDOT should own and initiate the CQMS platform, the other project stakeholders should still own and maintain a separate digital QMS. While this may seem redundant, having separate QMS platforms for each stakeholder allow for easier integration between the external CQMS and other internal platforms like Enterprise Resource Planning (ERP) and Document Management Systems (DMS).

Moreover, the QMS used by the DBC and quality firms should have a mobile version equipped with all required QAP forms (such as the FIRS – Featured Inspection Reports) so the data gathered from the field will not have to be entered twice.

7. Appendix

References

1. National Institute of Standards and Technology - Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry (https://nvlpubs.nist.gov/nistpubs/gcr/2004/NIST.GCR.04-867.pdf)

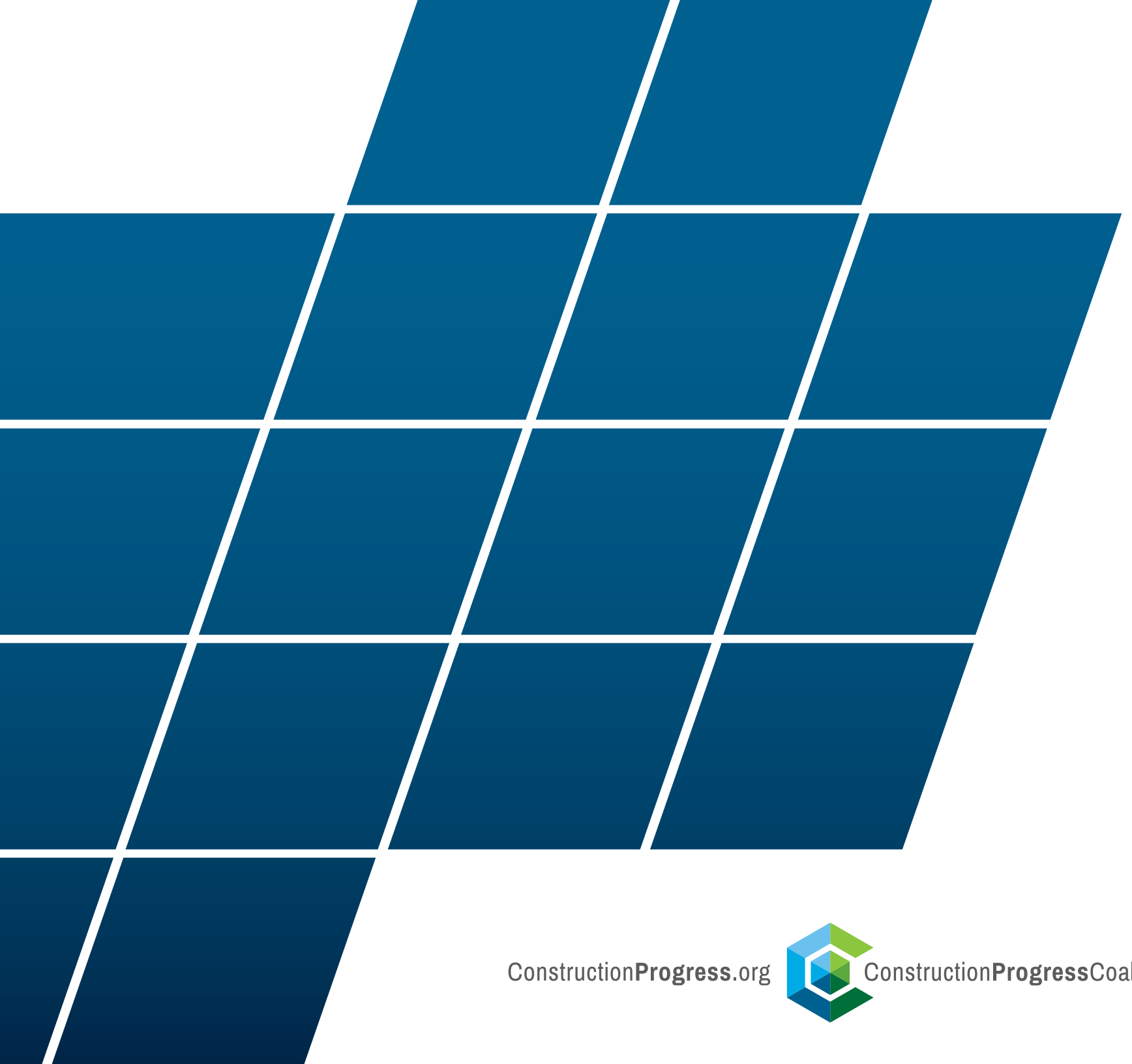
2. Texas Department of Transportation - Quality Assurance Program for CDA / Design-Build Projects with a Capital Maintenance Agreement with Three Optional 5-Year Terms (https://ftp.txdot.gov/pub/txdot-info/cst/qap_db.pdf)

CDX Terminology

- **Stakeholder** A business or government entity that is legally bound to cooperate in the delivery of a capital project.
- **Persona** the individual role(s) that perform an activity on a Document of Record (DoR) or System of Record (SoR).
- **System of Record (SoR)** A repository for legally discoverable information across the project lifecycle. Ex – Enterprise Resource Planning (ERP), Project Management, Document management, Scheduling, Estimating, etc.
- **Document of Record (DoR)** A container of information that passes through multiple statuses (eg. – draft, open, submitted, responded, reviewed, approved)
- **Point of Exchange (PoE)** The point at which a DoR containing of project information is transmitted from one stakeholder SoR to another.
- **Tier 0** Project reference information that should be accessible to all stakeholders and personas
- **Tier 1** Project status and report information that does not alter the project design or execution plan
- **Tier 2** Formal design communications that may or may not alter the project execution plan
- **Tier 3** Formal report of cost or schedule impact caused by an update or change to the design
- **Tier 4** Owner's communication of (and approval of any changes to) the project design, cost, or schedule requirements.

Acronym Definitions

- **CDX:** Common Data Exchange
- **CPC:** Construction Progress Coalition
- **DB:** Design-Build
- **DBB:** Design-Bid-Build
- **DMS:** Document Management System
- **ERP:** Enterprise Resource Planning
- **FHWA:** The Federal Highway Administration
- **I2MS:** Inspection and Material Management System
- **IQF:** Independent Quality Firm
- **QAP:** Quality Assurance Program
- **OVF:** Owner Verification Firm
- **QMS:** Quality Management System
- **SP:** SharePoint
- **TxDOT:** Texas Department of Transportations



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