

# 2018 OPEN INTEGRATION SUMMIT

Transforming  
Project Collaboration through a  
Common Data Exchange



ConstructionProgressCoalition

Different Perspective. **Same Mission.**



# Letter from the Executive Director

In our second season, the Open Integration Summit has once again brought together influential AEC & Technology leaders to address the #SharedPains of poor data interoperability in construction. Last year, we focused specifically on the Request for Information (RFI), only to realize that there were many interpretations and definitions for classifying an RFI, depending on your perspective of the project. The discoveries captured in last year's report *Transcending the RFI*, have evolved into two of the four CDX challenges we expanded upon this year.

The following report is a graphical review of the discussions, debates, discoveries, conclusions, and next steps surrounding the four CDX challenge topics we tackled inside the Open Integration Hub this past June. I hope this report will inform and inspire those who have not attended an Open Integration Summit to join us May 22-23, 2019. We will return to the AEC Next | SPAR 3D Expo Hall to showcase our progress on current CDX Task Force Initiatives and host more CDX challenges on new AEC workflow pain points.

A special thanks is owed to our technology sponsors, industry subject matter experts, and the event host; AEC Next | SPAR 3D. This event (and report) would not be possible without everyone's support, specifically:

- **Sasha Reed**, CPC Co-Founder & Board of Directors
- **Brianna Halfhide**, CPC Events Committee Chair
- **Myles M. Martin**, CPC Best Practices Committee Chair
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- **Tom Stemm**, CPC President & Board Chairman
- **Becky Weir**, Graphic Design & Report Production
- **Grigs Crawford**, Copywriter & Report Editor

For more information on how to support CPC or get involved with a CDX Task Force Initiative, head to [www.constructionprogress.org/membership](http://www.constructionprogress.org/membership).

Ever Forward,

*Nathan C. Wood*

**Nathan C. Wood**

Executive Director, Construction Progress Coalition  
[nathan.wood@constructionprogress.org](mailto:nathan.wood@constructionprogress.org)



# 2018 OPEN INTEGRATION SUMMIT

Transforming Project Collaboration through  
a Common Data Exchange

Prepared By  
the Construction Progress Coalition

December 2018

## Abstract

The following report is a graphical review of the discussions, debates, discoveries, conclusions, and next steps surrounding the four CDX challenge topics that the Construction Progress Coalition tackled inside the Open Integration Hub at the AECNext Conference in June 2018. This is the second report generated in a response to influential AEC & Technology leaders addressing the #SharedPains of poor data interoperability in construction.

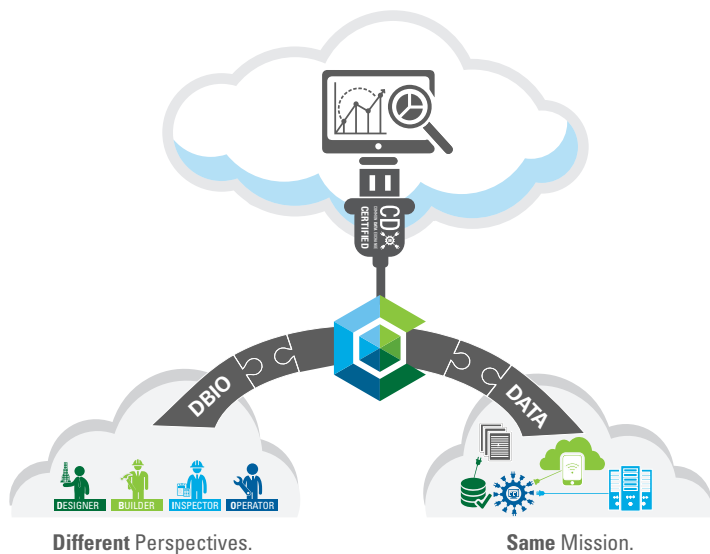
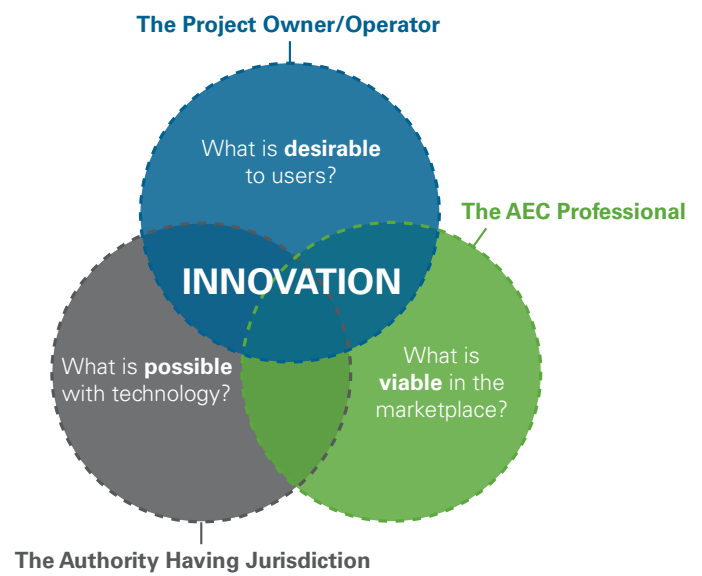
# CPC History, Mission & Vision

## CPC History

Five years ago, two organizations formed. They came from different perspectives, but faced the same #SharedPains as a result of poor adherence to industry data standards. One of the organizations, the Construction PDF Coalition, began by addressing the frustrations with poor PDF drawing output from design authoring applications. The other organization, the Construction Open Standards Alliance (COSA), brought together construction and financial software firms to advance the agcXML efforts and define integration standards for critical data exchanges such as RFIs, Submittals, Pay Applications, Timesheets, etc.

Today, the Construction Progress Coalition (CPC) is the byproduct of a merger between these two groundbreaking organizations — threading the needle of an industry on the brink of digital transformation by addressing the #SharedPains between the project stakeholders, seeking to answer the following questions: The Project Owner/

Operator: “What is desirable to the User,?; The AEC Professional: “What is viable in the Marketplace,?;” and the The Authority Having Jurisdiction: “What is Possible with Technology?”



## CPC Mission

The Construction Progress Coalition (CPC) unites Architecture / Engineering / Construction (AEC) professionals, Technology Solution Providers (TSPs), and their Governing Organizations (GOs) to promote a Common Data Exchange (CDX) to help project teams define interoperability standards.

## CPC Vision

To define a **new baseline for the measurement of project performance** across the design, build, inspect, and operate supply chain that focuses on **shared value, transparency, and streamlined collaboration**.



**“What gets measured,  
gets managed.”**

-Peter Drucker

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# Digest

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What are the challenges facing AEC professionals looking to streamline data flow across the project lifecycle?



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# What Shared Pains were discussed?

The 2018 Open Integration Hub honed in on four CDX workflow challenges. The two validation challenges are a byproduct of discoveries made during the [2017 Open Integration Summit: Transforming the RFI](#). Their focus was to identify specific contract exchanges (e.g. Trade Contractor to GC, GC to Owner) that precede and succeed the Request for Information (RFI) response from the designer of record which can be improved through a CDX integration standard.

Each of the two innovation challenges explored larger process transformation challenges that will require several different project stakeholders to comply with drastically new ways of working. Both the design submittal review process and as-built deliverable requirements are baked into the project specifications, leading us back to the common challenge of contract delivery type and the financial incentive to innovate. Industry report statistics are shared below that highlight the impact of these integration #SharedPains. *More detail on the background and outcomes from each of these challenges will be presented in the Decide section of this report.*

## CDX VALIDATION CHALLENGES

### FIELD DATA TO DASHBOARD REPORT

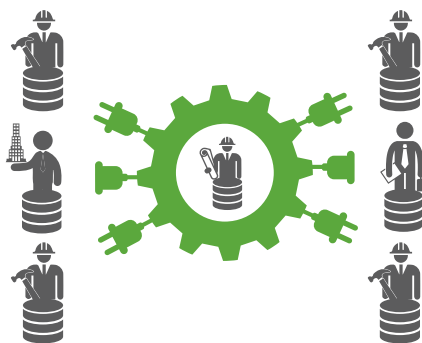


In the World Economic Forum report [“Shaping the Future of Construction”](#), one survey ranks the most important transformation areas for the industry. The top three are:

- People
- Adoption of new technologies, materials, and tools
- Industry collaboration

Ironically, the fourth priority is “Business models.” Traditional business models (based on hard bid, adversarial contracts) motivate stakeholders to hide field data. Integrated “shared risk and reward” contracts that incentivize data transparency, measurement, and continuous improvement are still few and far between.

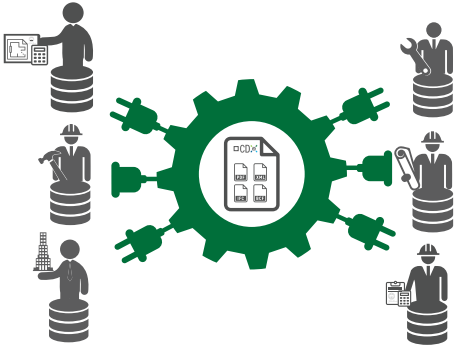
### DESIGN CHANGE TO IMPACT REPORT



According to global construction data collected by McKinsey & Co., there’s a 98% chance that your nearest \$1 billion “mega project” is going to be delivered at least 30% over budget. There’s a 3 in 4 chance the scheduled completion date will be delayed by 40% or more. Most of these mega projects are publicly funded projects.... so who foots the bill?

CDX INNOVATION CHALLENGES *(continued)*

**TRANSFORMING THE SUBMITTAL EXCHANGE**



Research data estimates that \$15.8 billion is wasted every year due to non-interoperability between owners, A/E firms, GCs, and Trade Contractors. The number one listed driver of that waste?

**“manually re-entering data from application to application.”**

Despite capabilities for cloud collaboration to streamline these critical data exchanges, the industry contract and culture must also adapt to the times.

**TRANSFORMING THE AS-BUILT EXCHANGE**



Globally, there are over 42 separate published data requirements related just to a project’s Level of Development (LOD), let alone the other possible data and documentation requirements that may or may not be integrated with the central Building Information Model (BIM).

Over the past decade, BIM has transformed from a utopian “single source of truth” to simply the 3D visual representation of a project’s Common Data Environment (CDE). But the old adage still remains — garbage in, garbage out.



**3 TOP FACTORS**  
Impacting ConTech Adoption

1. People
2. Adoption of Technology
3. Industry Collaboration

**42** Number of Unique Data Standards  
Globally related to BIM Level of Development (LOD)

**\$15.8 B** Wasted due to poor data interoperability between project delivery stakeholders

**MEGA PROJECT DILEMMA**

**98%**  
likelihood of project cost overrun

**77%**  
likelihood of schedule delay



# How Will a Common Data Exchange (CDX) Solve Our #SharedPains?

Simply put, CDX is a new framework and language for project teams to decide their workflow and exchange requirements collaboratively. The trick is to allow for a development process with flexible standards, while also ensuring each decision relates back to a common subset of industry-recognized standards.

One such organization that has successfully done this — with material safety and quality standards for over 120 years — is the [Underwriters Laboratory \(UL\)](#). By aligning the disparate needs of the specifying Engineer, the material fabricator/installer, and the Authority Having Jurisdiction (AHJ) responsible for certification, UL has established themselves as a “matchmaker” over the pain point of product testing and inspection. Similarly, a CDX registration and certification process will help AEC Professionals, Technology Solution Providers, and our Governing Organizations to ensure the consistency and reliability of project data exchanges, regardless of the open file type or software platform utilized. Just as UL looks to “Empower Trust” in the manufactured products we use every day, a CDX will empower trust through transparency between respective AEC project stakeholders.



## JUST ASK TRAVIS VOSS

Construction Technologist for Mechanical, Inc.

*Autodesk University Connect & Construct Summit Keynote Address*

“The flow of data is one limiting factor for us. As a specialty contractor, we’re often dictated to regarding what technology and software will be used on a project. That leaves us working in solutions that are not optimized for us, or with us doing **duplicate and triplicate entry of data**. We’ve joined Autodesk and other partners in the Construction Progress Coalition, who are working to **address this problem with the concept of a Common Data Exchange** and common data standards. This flow of data is a big problem for all of us in the industry, so to truly advance we **need to work together** to develop standards that will **release this data** and allow for new ways of working.”



# Debate

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What changes are necessary between people, processes, and technology to overcome our #SharedPains with project collaboration and interoperability?



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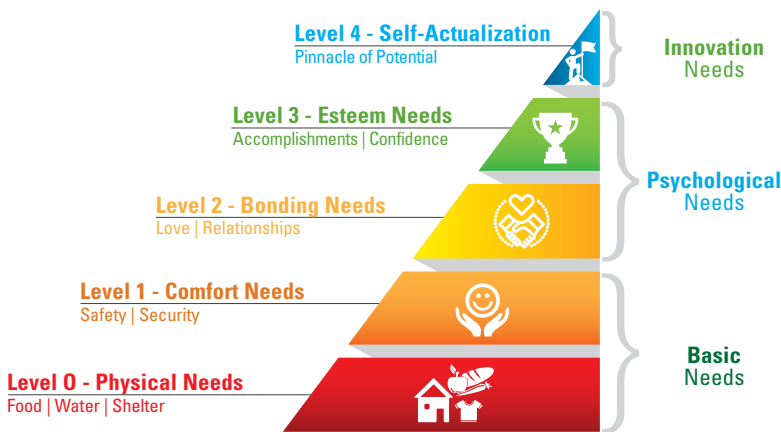
# In Search of a Common Purpose

CDX is not a panacea. It's a common framework for teams to have the necessary conversations at project kickoff to optimize data interoperability. Every project is unique, just as every person is unique; indeed, the only thing more complex than a construction project might be the human mind itself. Therefore, it's impossible to think that one standard could ever fit all project scenarios. CDX workflow definitions should provide each stakeholder across the Design, Build, Inspect, and Operate supply chain with a voice in the development of project standards to optimize collaboration and reduce manual data entry.

Dr. Abraham Maslow proposed five categories to define the individual's *'Hierarchy of Needs'* in his 1943 paper "A Theory of Human Motivation". This framework of needs is used to communicate the foundation of support that is required to achieve greatness in life. It can also be used to reflect the individual needs of a construction project.

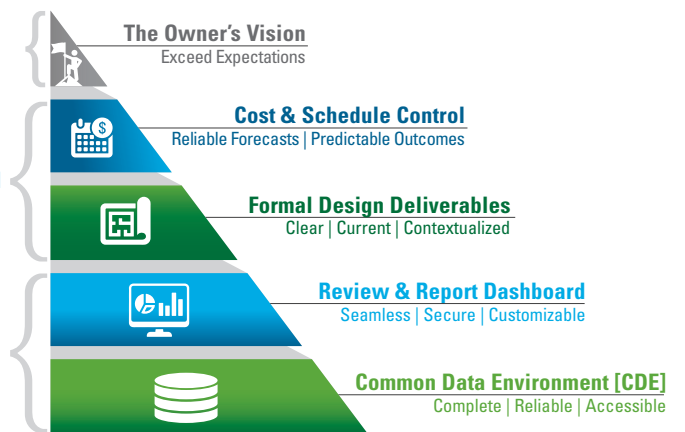
The unique needs of a construction project, though complex, can be categorized. Ultimately, every project stakeholder wants to exceed their owner's expectations, but not before these steps have been accomplished.

**Maslow's Hierarchy of Human Needs, 1943**



The concept of Maslow's pyramid is much like the food pyramid. We crave fats and sugars at the top, but can't truly enjoy them unless we've had enough of the veggies and whole grains at the bottom. Similarly, Maslow's theory says that you cannot find love, esteem, or self-actualization until your basic food, shelter, and safety needs are met.

**CPCs Hierarchy of Project Delivery Needs, 2018**



The physiological needs of a project begins with a clean, reliable, and accessible Common Data Environment (CDE) followed by a safe, secure, and efficient Collaboration Platform. The key to finding belonging and cooperation between project stakeholders starts with a Design Communication strategy that engages with non-designers earlier. This alignment leads to more predictable and reliable project outcomes.

# Addressing the Needs of the Marketplace

Digital transformation requires a disruption of certain legacy process standards to produce new standards that align all project stakeholders around a common goal. Before we begin the process of breaking down old standards to build new ones, we first need to clarify who our fellow project stakeholders are, and what's in it for them.

## Who are the Players?

There are many different project stakeholders across the informational supply chain of a project — from the project owners and investors, the project managers, and the design professionals, to the contractors and subcontractors, and eventually to facility management and operations. One project type or region may refer to the inspector as IOR (Inspector of Record) or AHJ (Authority Having Jurisdiction).

Regardless of the specific name given to each project stakeholder, it is important to recognize that each has a

separate company database (and standards) that need to translate between the other stakeholders' databases. The icons below represent the core players across the project delivery supply chain. When used in a CDX workflow definition, **green icons represent the data producers in the workflow.** The **blue icons represent the influencers over that piece of data, which are generally the process standard generator or the responsible review authority over that piece of data.**

### Data Producers In The Workflow



Architect



Engineer



General Contractor



Trade Specialist

### Influencers Over That Piece Of Data



Owner



Inspector



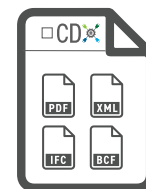
Facilities Manager

## What Data Matters and How is it Exchanged?

CDX workflow definitions can vary from the single transfer of a few data fields to an iterative review cycle with dozens of stakeholders and thousands of pieces of data to capture, manage, and report from. The following definitions are proposed as contract terminology for explaining the types of digital exchanges and collaborative workflows that are now possible in the digital age:

### A CDX Data Package

represents any open-source file exchange (PDF, IFC, XML, CSV, etc.)



### A CDX-Listed Exchange

represents any technology product that can export or import a CDX Data Package, or directly integrate between platforms using cloud integrations, like an API

### A CDX-Validated Exchange

integration, or cloud session signifies that there is some level of administrative data authorization (e.g., profile information, issue status, time stamps, etc.)



### A CDX-Verified Data Package or Database

has been reviewed and confirmed by a third-party data commissioner for correctness and adherence to project standard protocols

**A CDX Platform** represents the project rules and regulations regarding read and write access to the project's Common Data Environment (CDE)



### A CDX Session

is similar to a CDX platform or integration, but is focused on a single CDX data package over specified review periods and orders of operation for specific review and approval by stakeholders

## Addressing the Needs of the Technology

Before we embark on this journey to solve the data standards dilemma in construction, we first need to educate ourselves on the core components that define what data "is" and how it's exchanged.

To be clear, data standardization does not have to mean that all project stakeholders must change to adopt a single standard. The power of digital integration is the ability to translate from one data standard to another, as long as the team gets together during project kickoff to identify the necessary CDX-validated translations as shown in step two below.

But first....

### What is Metadata and Why Should I Care?!

To help explain the difference between a CDX-Listed, CDX-validated, and CDX-Verified data package, we must first break down the three core components that make up a piece of data, also known as Metadata. Each component below requires a separate type of standardization.

### Metadata Example

Structural	Descriptive
Title:	Field welding substitution request
Description:	At locations indicated on attached S-532 detail 5 and in location S-105 confirm if acceptable to replace full Pin weld with with CJP weld.
<b>Administrative</b>	
Project:	H2-53-2018
Name:	John.Smith@xyz.com
Author:	John Smith
RFI Number:	RFI-0062
Date:	10.28.2018

## Debate.

- The first component of data begins with the **Structural Element Taxonomy**. This is the specific naming convention of each individual form field. When looking to integrate an RFI request from a Trade Contractor's platform to the GC's, small changes in the naming convention (e.g., "RFI Number" vs. "RFI #") can quickly lead to integration failure, frustration, and finger pointing.
- Second, the **Administrative Response Fields** should generally be auto-populated by the system, and not need human interference except to change a status or edit a data error. This is where standard profile and project information can be standardized at project kickoff to eliminate duplicate entries between stakeholder databases.
- And the third component of data is **Descriptive Response Fields**. These are the trickiest ones to standardize because they almost exclusively rely upon human input – and succumb to human error. However, the combination of new technology like natural language processing (NLP), machine learning, and artificial intelligence (AI) can better process this unstructured data and form it into keywords, conversations, and context to better predict and resolve our #SharedPains before they ever occur.

## How does the CDX approach compliment existing efforts to standardize?

The CDX concept is unique because it does not act as a standard, per se. Instead, it is a language for project teams to define collaboration standards. By communicating real-world implementation best practices through a common framework, we will slowly but surely map the digital integration between the wealth of existing contract and reporting standards that exist in the marketplace today. A fully developed CDX definition looks at a single AEC workflow (e.g. RFIs, Submittals, etc.) and addresses **the three step process to standardize each component type that makes up a piece of data.**

STEP  
1

### Harmonize Industry Standards

A CDX enables disparate taxonomy standards to connect at their lowest common denominator.



STEP  
2

### Translate Company Standards

CDX acts as the thesaurus when translating common data values from one company standard to another.



STEP  
3

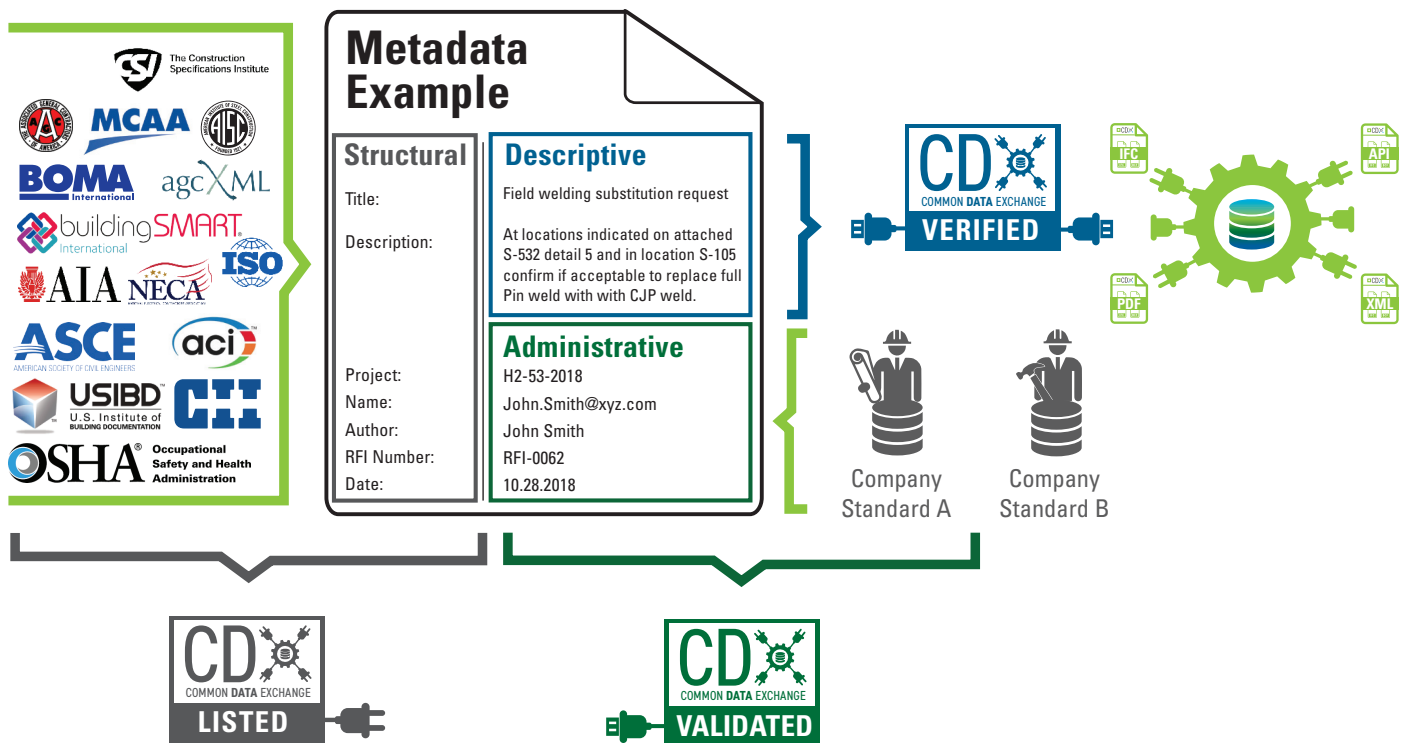
### Capture & Verify Descriptive Data Across Open Exchanges

CDX will enable third-party inspectors to validate data at the point of exchange rather than long after the project handover.



The following graphic breaks down the **three step process** to produce a complete CDX workflow:

- STEP 1** A **CDX-listed workflow** definition, referencing industry data and process standards.
- STEP 2** A **CDX-validated** integration between two or more stakeholders on a pioneer project.
- STEP 3** A **CDX-verified** integration to capture and tag project collaboration data for future Machine Learning (ML) and Artificial Intelligence (AI) opportunities.





# Decide

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How does a Common Data Exchange (CDX) framework help project teams define integration requirements that also align with company and industry standards?



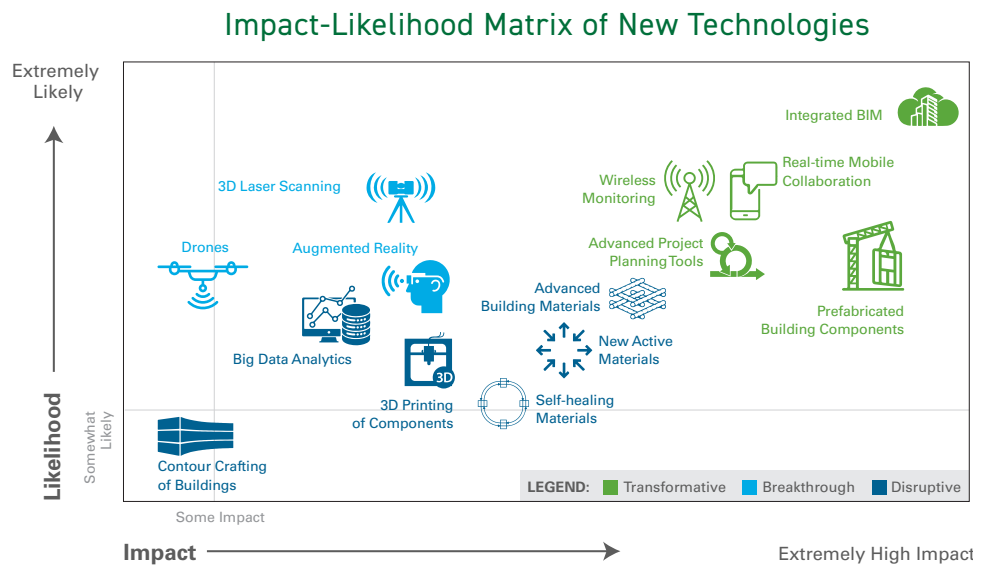


# The Need for Process Transformation

## The Machine that Changed the World

A resounding message from AEC and technology stakeholders during both of our last two summits centered around time — both the lack of time available, and the traditional timing and sequence of events between project stakeholders. Since the mid 1980s, Toyota has proven to GM and the rest of the global automotive industry that Lean Manufacturing and production control techniques produce higher quality cars more efficiently compared to the traditional waterfall approach of the Critical Path Method (CPM). Unfortunately, it was not until the 2008 recession and the auto industry bailout that U.S. car companies finally took the time to invest in new ways of thinking and doing their work.

As articulated in this [2015 episode of NPR's "This American Life" podcast](#), the recipe for Toyota's success was not any proprietary



process or technology. It began with a company culture and mindset held between all managers and line workers; they called it kaizen, or continuous improvement.

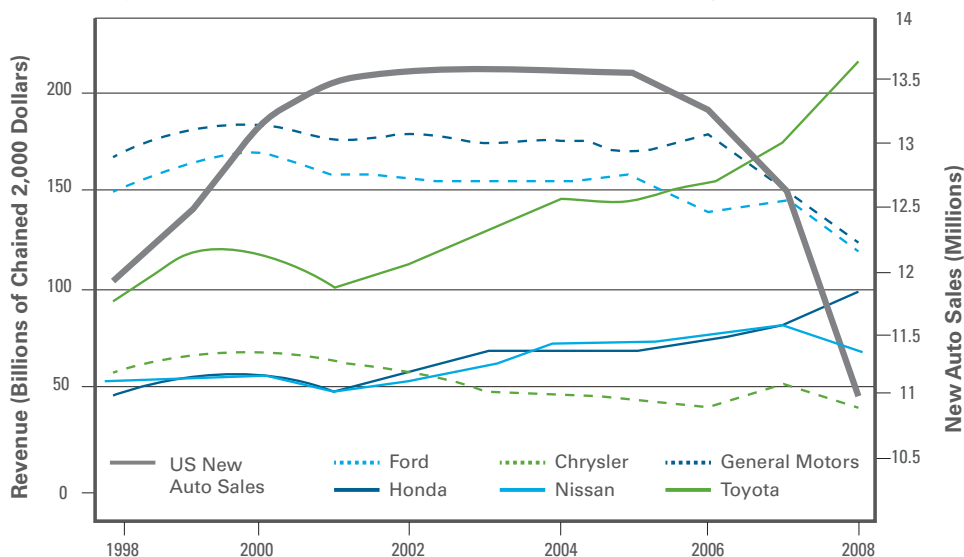
The concept of kaizen is simple, but the application is quite the opposite. If you see something that isn't right, you speak up and make sure that something is done about it. If you cannot fix it yourself, you are

empowered to "stop the line" and report the issue to a manager for support. It is their job to support the needs of the line workers who are in their care, not just to "manage" them. When project teams embrace kaizen, they accept that all stakeholders in the project delivery supply chain are both customers and suppliers, depending on the scenario.

Just as Toyota proved the error in traditional manufacturing practices, prefabricated building components are the second most likely technology to bring disruptive impacts to the AEC industry according to the World Economic Forum (the number one item listed is integrated BIM). As a result, prefabrication start-ups like Kattera and RAD Urban are beginning to see a growing market share.

***What is going to be AEC's interpretation of the Toyota Production System with a kit-of-parts approach to process standardization?***

## Toyota Marketshare vs. US Automotive Companies



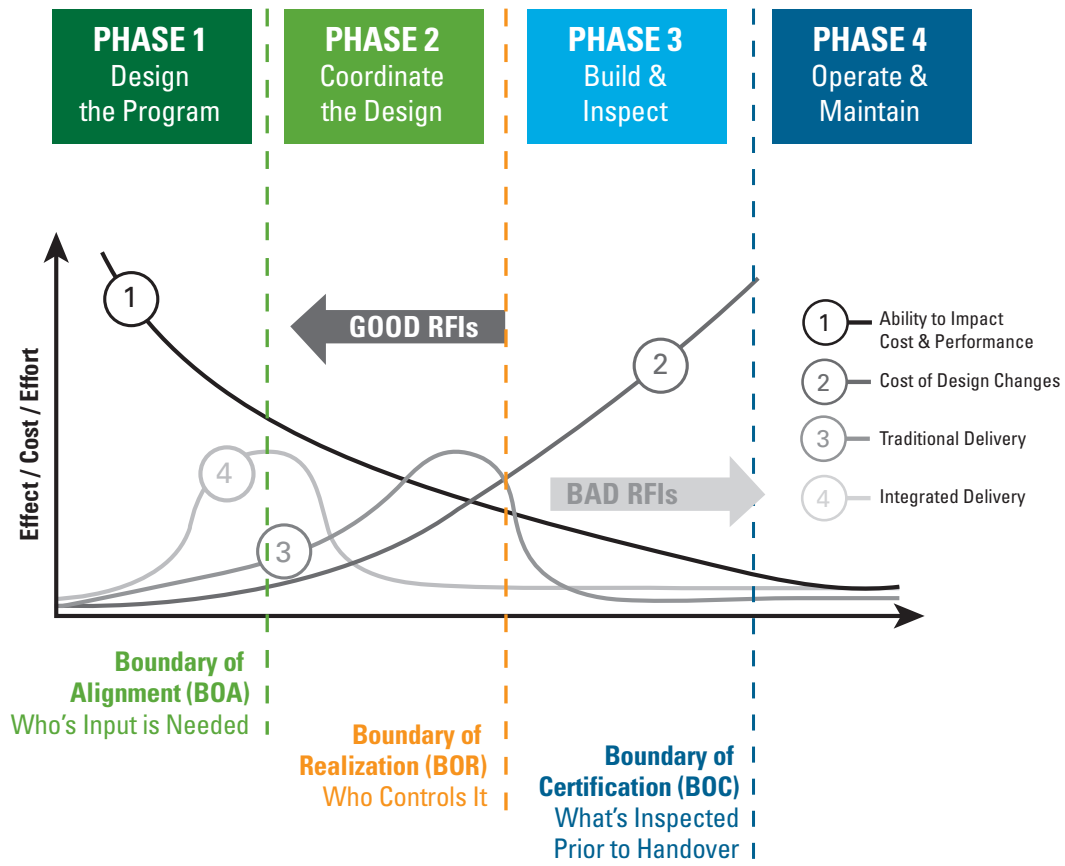
# Decide.

Both BIM and prefabrication fundamentally rely on a transparent and autonomous supply chain. A huge challenge for GM to overcome when adopting Lean Manufacturing was gaining influence over the centralized Detroit standard part manufacturers. It appears construction is not the only industry that struggles with “complaining up.”

## A New Framework for Project Collaboration

Regardless of contract delivery type, every physical component of a construction project will go through four distinct phases. The differences between each phase on a traditional hard-bid contract versus an integrated design-build are significant, but the language used to communicate those differences should be the same. The graphic below is an extrapolation of the original cost-influence curve introduced in [last year's report](#).

### CDX Phases and Boundaries Across the Project Delivery Lifecycle



A critical aspect that separates traditional from integrated project delivery is the ability for downstream project stakeholders to provide input earlier in the design process. The following table visually articulates the challenge that GCs and Trade Contractors face on traditional hard-bid projects when trying to influence design changes during Phases 1 & 2.

The intent of each phase definition is again not to create a standard definition. The primary objective is to build consensus around a common language to define who is responsible for generating the data, when it should be produced (phase), and what review and acceptance criteria is required for the package to be released across its respective boundary.

## HOW CONTRACT IMPACT COLLABORATION (BY PHASE)

	PHASE 1	PHASE 2	PHASE 3	PHASE 4
TRADITIONAL Contract Type				
INTEGRATED Contract Type				

Even more important than the phases themselves are the boundaries that lie between each phase. What does it mean for the formal design document to pass over the Boundary of Alignment (BOA)? How does that differ from the [Boundary of Realization \(BOR\)](#)? Each project team will have to collaboratively decide the contractual definition of each phase and boundary. However, the goal is to develop a common language to articulate the difference between projects using this simple sequence of phases separated by the following boundaries:

## THE ROLE OF PHASE BOUNDARIES (BY CONTRACT TYPE)

	HARD BID BUILD	CM AT RISK	DESIGN-BUILD	INTEGRATED PROJECT DELIVERY
BOUNDARY OF ALIGNMENT (BOA)	When the owner hires the Designer of Record (DOR)	When at-risk contractor signs GMP contract	When DB team signs preconstruction contract	When IPD team agrees to cost of Target Value Design (TVD)
BOUNDARY OF REALIZATION (BOR)	When contractor bids are collected and selected	When at-risk CM approves submittals for fabrication	When DB team signs GMP construction contract	When IPD team releases shop drawing submittals for fabrication
BOUNDARY OF CERTIFICATION (BOR)	After receipt of final occupancy permit from AHJ	When project is fully commissioned and operational	When first section of project receives a temporary occupancy permit	When each IPD team member has done QA/QC review of final area before handover

As a project owner, the best way to improve your asset data is to identify where these barriers exist across the project development lifecycle. Just as the Apple iOS app store has created checkpoints for app developers before releasing to their users, a CDX-validated or verified integration will capture and qualify the critical pieces of data that were identified during project kickoff.

These broad definitions should provide enough flexibility for project teams to adapt them to their real-world scenarios, while giving technology developers a common dictionary of terms to use when developing CDX playbook definitions using two or more integration platforms.

# Decide.

The long-term intention of aligning projects around a standard language of phases and barriers is to establish a common baseline for measurement for similar data exchange workflows across hundreds of live construction projects using different contract delivery methods. Unlearning generations

of bad habits developed from contracts full of adversarial incentives will not be easy. Despite the collaboration landmines that exist around each project stakeholder, we must find the opportunities for win-win innovation that focuses on **shared value, transparency, and streamlined collaboration.**

## The CDX Playbook

Project teams need a simple graphical framework to communicate a project's data collaboration standards. For a given project workflow (e.g., Submittals), a completed CDX playbook must effectively answer the following questions:

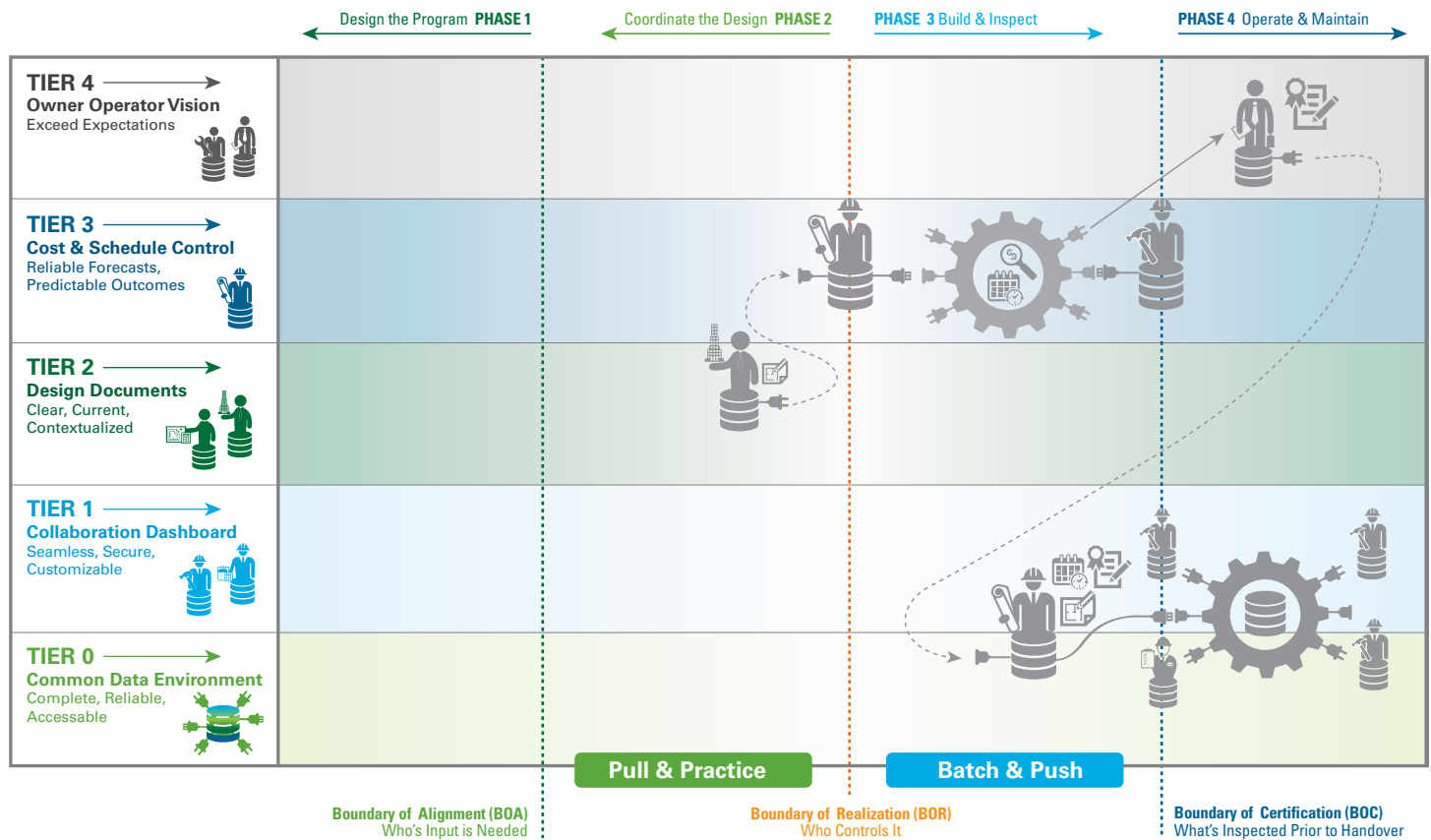
### What data fields are required for a given exchange, and what standard is referenced?

Project Name, Project Number, Submitter Name, Company, Email, etc.

**Where does the risk reside?** Trade Contractor submits shop drawings from Tier 1 (Report Dashboard) to Tier 2 for the design team to formally review and stamp, thus releasing it into the Tier 0 (Common Data Environment) for all project participants to access and rely upon.

**Who is involved in the workflow?** Trade Contractor, Engineer of Record, Architect of Record, General Contractor, etc.

**When does the exchange(s) occur?** At Boundary of Realization (BOR), prior to release for fabrication

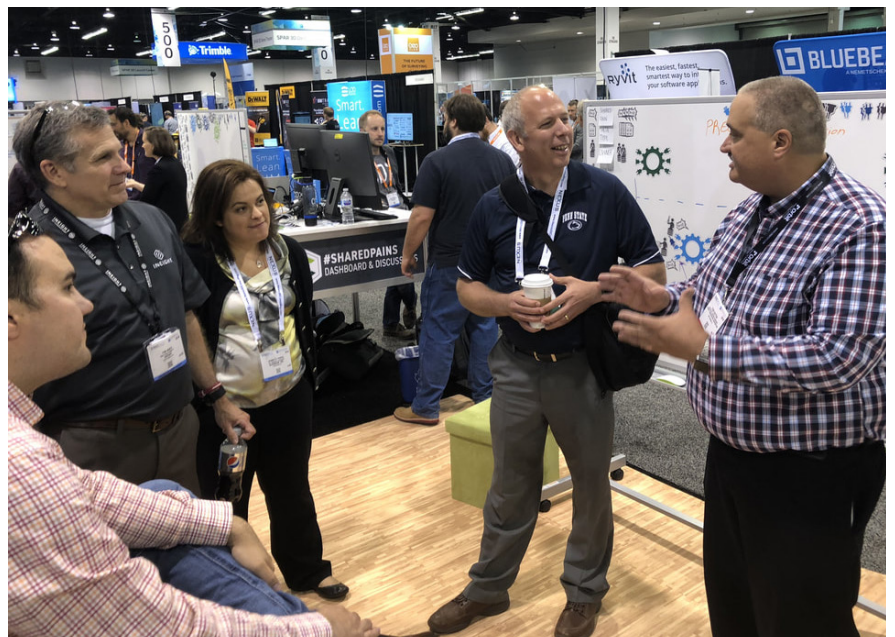


The CDX Playbook is intended to support the process of “complaining up” by creating a level playing field for project teams to communicate their contract collaboration standards, as silly as they may be. Armed with a new lexicon of project stakeholders, exchange types, and levels of CDX accreditation, teams can now effectively communicate their workflow requirements in a simple graphic.

When developing CDX workflows and integration checkpoints, be mindful that any increase in the requirement for data creation or auditing can come at an increased cost. As long as the intended benefit of having certified data outweighs the burden of checking it, the innovation maintains a positive return on investment (ROI) and should move forward. If a positive ROI cannot be calculated, the CDX approach should be revised or abandoned.

## Key Discussions and Discoveries From the Open Integration Hub

Each CDX Challenge brought together industry and technology perspectives to hash out the common language and integration standards needed for construction to thrive in the digital age. Read on for a brief summary of each group’s conclusions.



Decide.

# CDX Validation Challenge #1: The Field Data to Dashboard Exchange

PRESENTED BY



The ability to aggregate data from construction projects to analyze off-site safety, quality, or productivity trends is a hot topic for any trade contractor, GC, or insurance provider. **The challenge, however, arises at the point of data capture and qualification.** If the documentation requirement is too burdensome, the field won't do it. If it's too automated, the concern shifts to "big brother is watching."

HOW MIGHT WE CDX-Certify software integrations and file exports between jobsite personnel

IN WAYS THAT automate the transfer and aggregation of Tier 1 issue and report data

SO THAT teams can utilize an integrated dashboard to better predict and prevent the root causes of cost overruns and schedule delays.

## INDUSTRY EXPERT PARTICIPATION



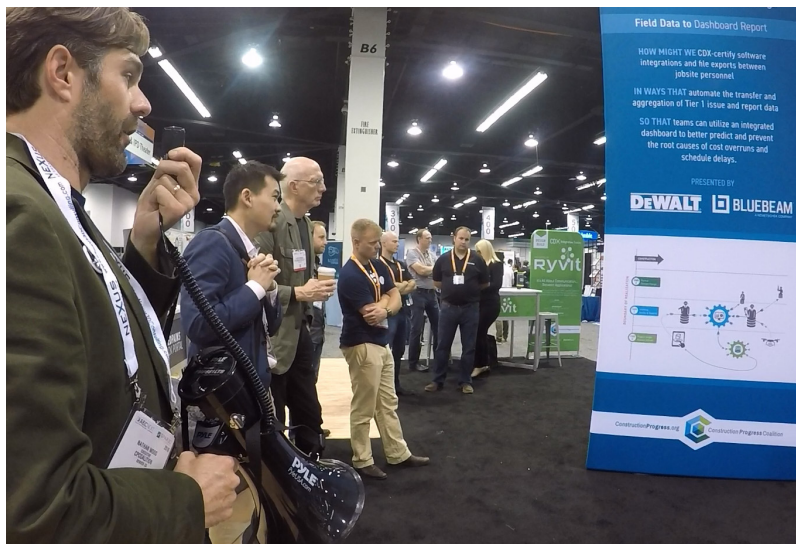
Jim  
Gentile  
Lendlease



Amrita  
Bajwa  
Jacobs



David  
Burns  
McCarthy



WHO	Trade Contractor, Authority Having Jurisdiction, General Contractor, Designer of Record, Owner
WHAT	Streamline capture and sharing of project data related to coordination [Phase 2] or construction [Phase 3], including progress reports and constraint logs.
WHERE	Tier 1 – The Informal Collaboration Platform
WHEN	Phase 2+3 "The Field" can be defined as the physical jobsite (after the BOR) or the virtually integrated BIM (prior to the BOR). The value of a Tier 1 collaboration zone depends on the trust, transparency, and integration between project delivery stakeholders.
WHY	Motivate project stakeholders to address project risks up front versus hide them for others to uncover later.

# CDX Validation Challenge #2:

## The Design Change to Impact Report Exchange

PRESENTED BY



Regardless of contract delivery type or quality of the design, it is inevitable that late design changes will lead to a cost or schedule impact — **an impact that then must be documented and approved as a Change Order by the owner.** Time is of the essence in these scenarios, and any redundant data entry requirements will compound the effect of those late design changes.

HOW MIGHT WE define a CDX collaboration between the General and Trade Contractors

IN WAYS THAT streamline the Tier 3 design change impact report and Tier 4 change order approval process

SO THAT builders can accurately and efficiently communicate the true cost and schedule impacts from late design changes

### INDUSTRY EXPERT PARTICIPATION

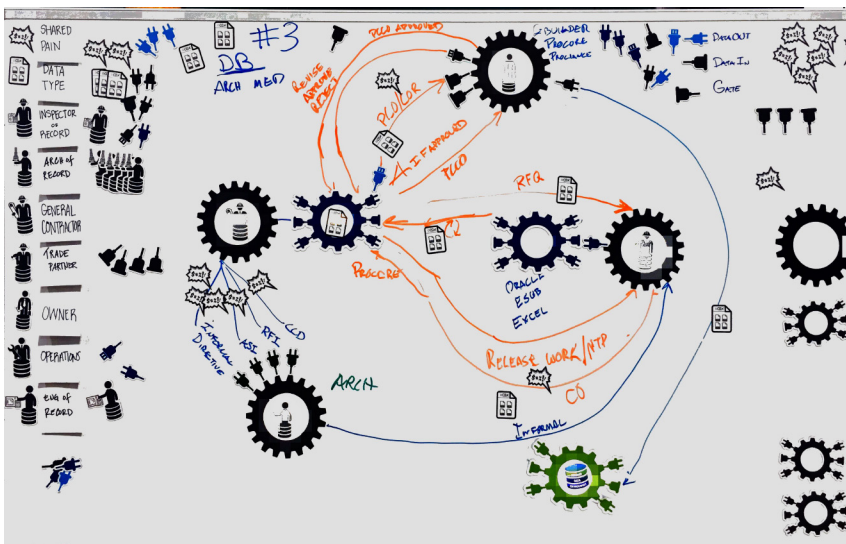


Kris Lengieza  
Stiles

Matt Lamb  
Rosendin

Travis Voss  
Mechanical, Inc.

DJ Phipps  
XL Cons.



- WHO** Designer of Record, Trade Contractor, General Contractor, Owner, Project Manager
- WHAT** Report the true material and manpower waste generated from late design changes
- WHERE** Tier 3 – Cost & Schedule Control
- WHEN** Phase 2 – manpower rework only | Phase 3 – manpower + material rework
- WHY** Educate project owners and design professionals of the true cost and schedule impact caused by late design changes.

Decide.

# CDX Innovation Challenge #1: Transforming the Submittal Exchange

PRESENTED BY



Prior to releasing for fabrication, the liable design professional is contractually required to review a submittal package from the Trade Contractor. The requirements of the submittal package are detailed in the project specifications, and generally include shop drawings, material samples, or product data sheets. The value of the submittal review process is increased quality, not necessarily efficiency. **How can project teams leverage collaborative technology to redefine submittal requirements for the digital age?**

**HOW MIGHT WE** disrupt the fabrication submittal review and approval process

**IN WAYS THAT** satisfy the legal requirements of the Engineer of Record & Authority Having Jurisdiction

**SO THAT** pre-fabrication design review quality and speed is improved

## INDUSTRY EXPERT PARTICIPATION



Luke Brown

Hoffman Cons.

Ian Brown

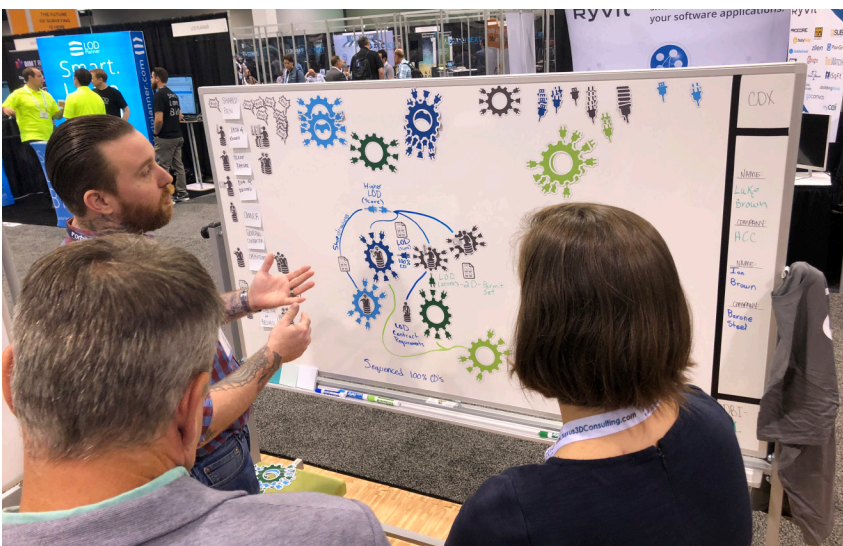
Baronne Steel

Brianna Halfhide

Clark Pacific

Tony Campos

Viatechnik



**WHO**

MEP Trades, MEP Engineers, Structural Engineer, GC, Architect

**WHAT**

A cloud CDX-Session to host the a simultaneous review between the submitting Trade Contractor and all responsible review parties.

**WHERE**

Tier 2

**WHEN**

Phase 2 @ BOR

**WHY**

Higher quality and more efficient review of contractually required submittal documents



# CDX Innovation Challenge #2: Transforming the As-Built Exchange

PRESENTED BY



The true “customer” of the project’s data is the Owner/Operator. Reliable and accessible asset data at project handover is nearly impossible if the client cannot communicate their data requirements effectively. **How might we support project delivery stakeholders so that they can produce current and reliable as-built documentation without negatively impacting the overall project cost?**

**HOW MIGHT WE** disrupt the digital asset handover and verification process

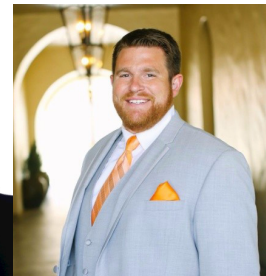
**IN WAYS THAT** require key stakeholders to certify as-built data fields prior to acceptance

**SO THAT** operations managers can trust and leverage the data received from previous project stakeholders

## INDUSTRY EXPERT PARTICIPATION



**Darren Roos**  
Bernards



**Mark Manstoff**  
Newport Mesa



**Todd Sutton**  
Zachry Cons.



**WHO** Owner, FM, Design PORs, TCs, GC

**WHAT** Exports, Integrations, Sessions

**WHERE** Tier 0

**WHEN** Phase 1 (defined), Phase 2 (generated), Phase 3 (inspected), Phase 4 (referenced)

**WHY** Improve reliability and efficiency of data hand-offs across DBIO supply chain

# Deliver

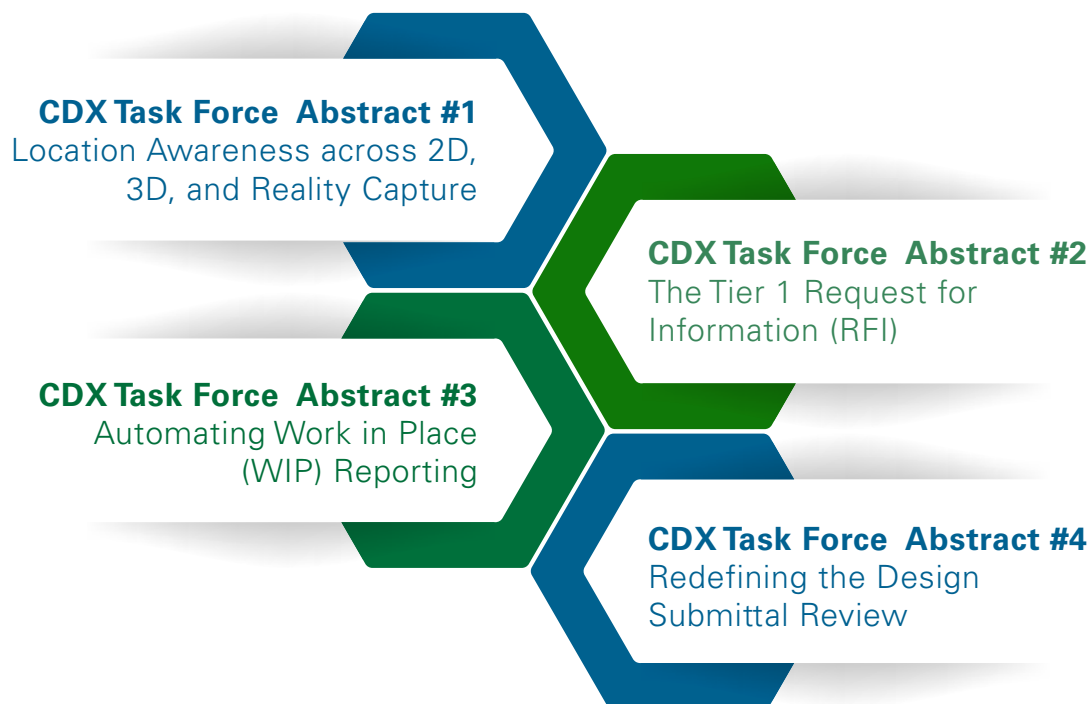
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What real-world opportunities exist for project teams to transform process and technology standards through a CDX Task Force?

# The CDX Task Force Initiatives

Several concrete opportunities to establish CDX initiatives came from our discussions at this year's summit. Some of the leading contenders for 2019 include:



## CDX Task Force Abstract #1: Location Awareness across 2D, 3D, and Reality Capture

**IN ORDER TO** improve jobsite safety and transparency, we need to identify a CDX “tag” that can be ascribed to an element, issue, or observation. CPC intends to collaborate with the U.S. Institute of Building Documentation (USIBD) and Construction Owners Building information exchange (COBie) to form a CDX task force committee. The committee will be focused on identifying the minimum standard Metadata fields needed for an element or issue to be “tagged” simultaneously between 3D virtual, 2D vector space (relative), and real world coordinates (x,y,z).

**WE WILL** measure this on a pioneer project by successfully integrating a location tag between 3D virtual, 2D vector, and real-world coordinates. At a minimum, there should be three pieces of data required as part of the CDX definition:

- Asset ID (or issue/observation ID)
- Room or Zone ID
- Real world x,y,z coordinate location

## CDX Task Force Abstract #2: The Tier 1 Request for Information (RFI)

**IN ORDER TO** measure the true cost impact this industry faces from late design changes, we need to ease the burden of capturing and reporting the true cost impact from field RFI to signed Change Order. CPC intends to collaborate with the Association of General Contractors (AGC) and the National Electrical Contractors Association (NECA) to form a CDX task force committee focused on integrating the standard form fields for a Trade Contractor to GC (Tier 1) RFI.

**WE WILL** measure this on a pioneer project by successfully integrating the basic RFI documentation fields required by multiple Trade Contractors and a GC, all using different internal Project Management (PM) software platforms. This initiative will take into account previous efforts to establish these protocol standards, and document best practices through real-world implementation. The proposed benefits of a CDX integration standard for Tier 1 RFIs includes, but is not limited to:

- Transparent cloud review, which reduces likelihood of scope gaps/overlaps.
- Reduction in overall change management cycle.
- Improvement in the accuracy and data reliability of PCO impact reports.

## CDX Task Force Abstract #3: Automating Work in Place (WIP) Reporting

**IN ORDER TO** improve construction productivity, we need to spend less time tracking the work that we did, so that we can spend more time doing. CPC intends to collaborate with the U.S. chapter of XBRL (Extensible Business Reporting Language), as well as the Construction Specification Institute (CSI) to form a CDX task force committee focused on aligning standard Metadata fields from bid pre-qualification forms to final payment applications.

**WE WILL** measure this on a pioneer project by capturing redundant form fields and integrating them with XBRL

and CSI taxonomy standards. The proposed benefits include a CDX-validated integration, which would allow for an automated check of XBRL and CSI administrative data, improving quality of financial and progress reporting data.

- The ideal candidate to sponsor this task force implementation would be a state-level department of transportation or other government entity that runs large, federally funded or municipally bonded projects.
- To learn more about the efforts of XBRL and their impact on financial reporting standards, read this recent article from [Forbes Magazine](#).

## CDX Task Force Abstract #4: Redefining the Design Submittal Review

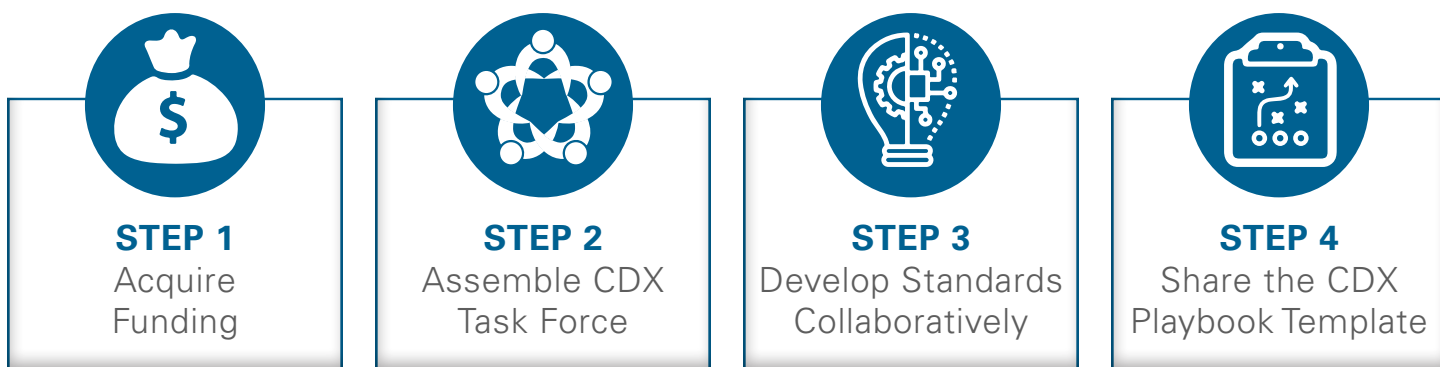
**IN ORDER TO** improve the quality and efficiency of design submittal reviews, we need to eliminate data loss from the Engineer of Record (EOR) to the fabricating Trade Contractor, and review latency between the GC and design reviewers. CPC intends to partner with the American Institute of Steel Construction (AISC) and the Structural Engineers Association (SEA) to form a CDX task force committee focused on identifying opportunities to improve how EOR data is passed back and forth to a detailer prior to release for fabrication.

**WE WILL** measure this on multiple pioneer projects with varying contract delivery methods to identify a common integration standard to baseline from. The proposed benefits of a CDX integration standard for Tier 2 submittal review include, but are not limited to:

- Removal of redundant design and detailing between EOR and fabricator.
- Higher quality submittals in less time when reviewed in cloud collaboration session.
- The path to prefabrication begins with higher quality and more efficient submittals.

# Ok, Great! But How?

The proposed 4-step process will bring industry, technology, and their governing organizations together around a common pathway to adopting open interoperability standards.



## Step 1: The Funding

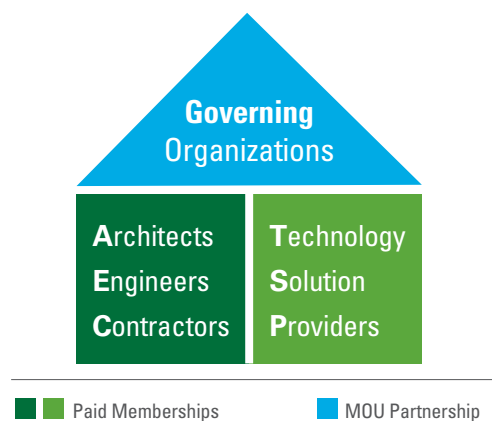
Software professionals are usually familiar with a challenge in the 2000s when there was no funding for the management and advancement of hyper-text markup language, or HTML (i.e., your Internet browser). After several years, it took crowdsourced funding from the Online developers to self-police and standardize it.

Underwriters Laboratories (UL) has played a significant role to ease both the registration and enforcement of a manufacturer’s product safety and quality based on a subset of fragmented code standards. As a non-profit organization, UL is funded by the fees it charges the same manufacturers that must submit to UL for certification. UL charges an initial evaluation fee, plus ongoing maintenance service fees.

In 2019, CPC will be adopting a similar business model. However, in our situation, we need joint participation and support from both the AEC professional users and the technology solution providers (TSP). Annual membership dues will fund general maintenance and promotional marketing. CDX task force initiatives will be funded separately, but in order to become a CDX delegate and join a committee, your company must first become a CPC member.

Between AEC & TSP professionals, we have a lot of governing organizations (GOs). Between data standards, contract standard, or safety and quality standards, there are too many GOs to keep track of. As a communication arm between these disparate organizations, CPC seeks a mutual partnership without the exchange of any regular dues or fees.

### Three Delegate Types





## Step 2: The CDX Task Force

A coalition of 5-9 CDX delegates will propose their intent to define a CDX workflow to the director of CDX development. The delegate committee must consist of all three delegate types (AEC, TSP, and GO), but there cannot be a majority of TSPs within a committee. This proposal should involve a brief scope of work, including the intended pioneer project and anticipated budget for any potential integration development and case study documentation. Funding to cover the CDX task force budget is generated from one or more of the CDX delegates.

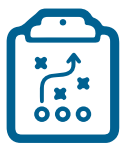
CDX delegates who were not able to participate in their first-choice task force will be able to review and vote on CDX definitions as they are developed on pioneer projects.



## Step 3: The Innovation Platform

It became clear from each of the CDX Challenge discussions that our #SharedPains were not centered around technology as much as communication, and mainly the lack of it. The majority of data interoperability standards that we need already exist today, but we fail to adopt them. Even when they are included in contract requirements, poor enforcement leads to poor data, and poor data leads to poor results.

How do we stop this vicious cycle of complacency with bad data and poor standards adherence? We can look back to UL for inspiration. They have released the [\*Collaborative Standards Development System \(CSDS\)\*](#) to improve transparency and efficiency of new standards development. This is a great tool to support the crowdsourcing and alignment of cross-industry code standards. Similarly, CPC Standards Review Chairman Connor Christian has researched several cloud innovation platforms like [\*IdeaScale\*](#) and [\*Spigit\*](#), and he will recommend a solution to the CDX development director for communicating development updates and gathering delegate votes on specific feedback items.



## Step 4: The Project Kickoff Playbook

Just as the cool features on your iPhone only work when the phone and app settings have been modified accordingly, a CDX-listed definition can only become a CDX-validated integration when a project team has set up the rules and settings for a given project. The CDX playbook is intended to be used as a standards communication template. Unlike traditional standards that are carbon copied from one project to the next, a CDX playbook is uniquely specific to a project. However, the back-end of the digital worksheet will allow project teams to “reverse engineer” how a previous project developed their tools and data requirements, while also providing a fully vetted standard for projects that may be starting from a clean slate.

# Definitions, Descriptions, and Concepts

The definitions, descriptions, and concepts contained in this report are intended to spur a debate amongst AEC Professionals and Technology Service Providers. We encourage and consider all comments, questions, and feedback, which you can do by visiting [ConstructionProgress.org/contact-us.html](http://ConstructionProgress.org/contact-us.html). The outcome of this debate will be a crowdsourced consensus on the terminology we will use to reshape construction standards for the digital age.

## References

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<sup>2</sup> **The Construction Productivity Imperative** [www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-construction-productivity-imperative](http://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-construction-productivity-imperative).

<sup>3</sup> **History of Underwriter's Laboratories (UL)** <https://www.ul.com/aboutul/history/>

<sup>4</sup> **Abraham Maslow and the Hierarchy of Happiness** [www.pursuit-of-happiness.org/history-of-happiness/abraham-maslow/](http://www.pursuit-of-happiness.org/history-of-happiness/abraham-maslow/)

<sup>5</sup> **This American Life: NUMMI 2015 (Podcast)** [www.thisamericanlife.org/561/nummi-2015](http://www.thisamericanlife.org/561/nummi-2015)

<sup>6</sup> **Japan vs. US Auto Industry Revenue Comparison** [www.ibrc.indiana.edu/ibr/2010/spring/article2.html](http://www.ibrc.indiana.edu/ibr/2010/spring/article2.html)

<sup>7</sup> **Transforming the Request for Information** [www.constructionprogress.org/oisummit17.html](http://www.constructionprogress.org/oisummit17.html)

<sup>8</sup> **Four Phase Project Delivery & the Boundary of Realization** <http://iglc.net/Papers/Details/1013>

<sup>9</sup> **XBRL Impact on Financial Reporting Standards** [www.forbes.com/sites/investor/2018/12/04/the-four-letters-transforming-the-municipal-bond-market-and-government-finance/#520963bf7994](http://www.forbes.com/sites/investor/2018/12/04/the-four-letters-transforming-the-municipal-bond-market-and-government-finance/#520963bf7994)

<sup>10</sup> **UL Collaborative Standards Development System (CSDS)** [https://csds.ul.com/Home/Request\\_Access.aspx](https://csds.ul.com/Home/Request_Access.aspx)

<sup>11</sup> **IdeaScale for Innovation Crowdsourcing** <https://ideascale.com/crowdsourcing-for-nonprofits/>

<sup>12</sup> **Planview Spigit Leverages Ideas for Top Construction Companies** <https://www.spigit.com/industry/construction-innovation/>

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