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2017 OPEN INTEGRATION SUMMIT

POST-SUMMIT SUMMARY REPORT

TRANSFORMING THE RFI

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TRANSFORMING THE RFI

“We’re all on the same team.
The real enemies are chaos and ignorance”

Benjamin Crosby, Director of BIM & VDC
W.G. Yates & Sons Construction

2017 Open Integration Summit Report
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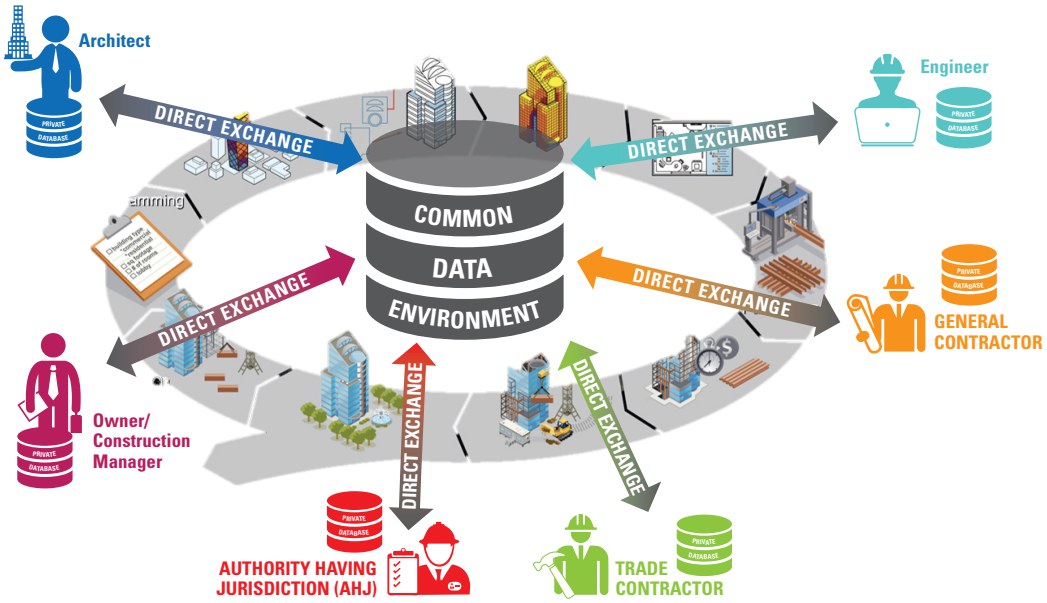
Open Integration Summit: Solving the RFI Dilemma

EXECUTIVE SUMMARY

On August 2, 2017 a select group of 30 subject-matter experts (SMEs) representing industry, technology, and government perspectives came together to tackle a shared pain: the efficient and effective exchange of request for information (RFI) data through open-source integrations. The following report summarizes the discussion, findings, and recommendations from the first CPCoalition Open Integration (OI) Summit in partnership with the Construction Open Software Alliance (COSA).

The agenda began with a digest of the RFI dilemma from both an industry and a technology perspective. Thought leaders from Autodesk, Procore, and Stiles Construction spurred a debate relative to their expertise in balancing the needs of people, process, and technology. During the afternoon breakouts, transparent dialogue around the current adoption barriers and roadblocks led to an agreed direction towards a baseline data standard with the flexibility to navigate the contract and government requirements that are unique on every project.

The Digital Collaboration Utopia



Even when project stakeholders are incentivized to freely share in the same "digital collaboration utopia," the challenge presented by digital collaboration is establishing data standards which can meet the needs of both the internal customer (i.e. corporate integration) and the external customer (i.e. project exchange). Despite the existence of standards for a project Common Data Environment (CDE), its adoption is built upon the (flawed) theory that

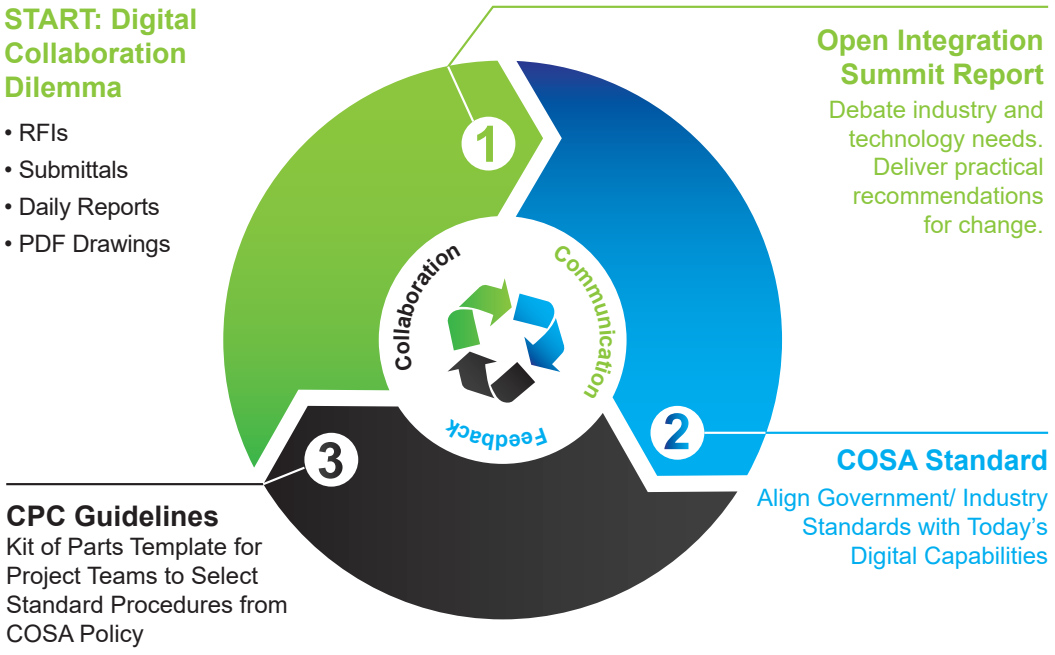
a central Building Information Modeling (BIM) would become a single source of truth for all project participants to access freely.

Each perspective left with a better understanding of how contract incentives impact the opportunities for efficient digital collaboration.

To the surprise of many industry professionals in the room, we learned about the shared pains from the technology perspective. Software developers looking for end user feedback have been scratching their heads trying to understand why two projects from the same customer would provide conflicting feature requests. By the end of the day, people viewing from each perspective left with a better understanding of how contract incentives impact the opportunities for efficient digital collaboration.

This report is just the first of a three-step framework to transform collaboration standards between design, build, inspect, and operate (DBIO) professionals. RFIs are just one aspect of the wicked problem this industry is currently facing. Architects, engineers, contractors, owners, government, and technology must all work collaboratively to attack the different variables impacting our collaboration dilemma. Positively affecting construction's productivity imperative through integrated technology will require more than just data standards. We need foundational changes to our most basic collaboration tools, starting with the RFI.

Transforming Construction Standards Adoption



This report is just the first of a three-step framework to transform collaboration standards between design, build, inspect, and operate (DBIO) professionals.

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SpectrumAEC

Open Integration Summit: Participants

No.	Name	Title/Company	No.	Name	Title/Company
1	**Benjamin Crosby**	Director of BIM/VDC - **WG Yates & Sons Construction**	18	**Niran Shrestha**	CEO - **onTarget**
2	**Benny Baltrotsky**	Chief Strategy Officer - **eSUB**	19	**Omar Sheikh**	Enterprise Platform Manager - **Bluebeam, Inc.**
3	**Brad Schuck**	Associate/Project Architect - **Gensler**	20	**Peter Lasensky**	Founder & CEO - **NoteVault, Inc.**
4	**Brent Cranmer**	VP, Technology & Engineering - **ISEC**	21	**Reuben Stone**	Delivery Manager - **T.Y. Lin International**
5	**Charles Julius**	Product Manager Strategic Integrations - **Procore**	22	**Scot Clark**	Application Architect - **Isec, Inc**
6	**Connor Christian**	Director of Digital Implementation Services - **HDR**	23	**Steven Velozo**	Chief Technology Officer - **Pavia Systems**
7	**Cody Nowak**	AEC Disruptor - **@DisruptAEC**	24	**Todd Sutton**	Sr. Project Controls Manager - **Zachry Construction**
8	**David de Yarza**	CEO - **Builderbox.io**	25	**Tom Jodeit**	Project Manager - **Square One Consultants**
9	**Jason Barber**	Operations Manager - **Dynalectric Colorado**	26	**Tom Stemm**	CEO - **Ryvit**
10	**Jeff Sample**	IT Director - **The Gallegos Corporation**	27	**Tony Nicolaidis**	VP of Marketing, Connected Systems - **DEWALT**
11	**Matt Edwards**	CEO / Founder - **APE Mobile**	28	**Walt Davis**	Estimating Market Manager - **Sage**
12	**Josh Mariea**	Vice President, Strategic Accounts - **Faction**	29	**Zach Scheel**	CEO and Co-Founder - **Rhumbix**
13	**Kris Lengieza**	Director of VDC - **Stiles Construction**	30	**Boal Chris**	Sr. Integrated Construction Manager - **Mortenson**
14	**Lekshmy Sankar**	Engineering Applications Support Manager - **Colorado Dept of Transportation**	31	**Josh Newland**	Sr. Manager, Industry Marketing - **Procore**
15	**Laurie Spitler**	Industry Manager, Construction - **Autodesk**	32	**James Gentile**	Quality Operations Manager - **Lendlease**
16	**Nathan Wood**	Chief Enabling Officer - **SpectrumAEC**	33	**Fara Francis**	Chief Information Officer - **AGC of America**
17	**Nichole Carter**	Special Operations - **Catamount Constructors, Inc.**	34	**Sasha Reed**	Co-Founder - **CPCoalition, VP of Strategic Development, Bluebeam**

PART 1: Digest

What is an RFI and why should we care?

The RFI is at it's core a communication tool between a General Contractor (GC) and the Architect of Record (AOR). AIA contract document A201-2017 states that "The Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require" before the Architect will respond to the RFI. In other words, the RFI is a formal record of questions to the design team — questions that have the potential to impact the cost, schedule, or permitted design of the project depending on how and when they're responded to.

AVERAGE TOTAL COST PER RFI REVIEW & RESPONSE: $1,080

$328 Admin Time + $752 Technical Review Time = $1080 Per RFI Response

RFIs have become a significant burden to process for designers, builders, and inspectors. Legal consulting firm Navigant produced a report in 2014 on the impact of RFIs in construction. Case study research found the average cost of time spent on **review and response only (not including downstream impact) for a single RFI averaged $1,080. On a typical project with 900 RFIs, that's over $100,000 spent processing RFIs!**

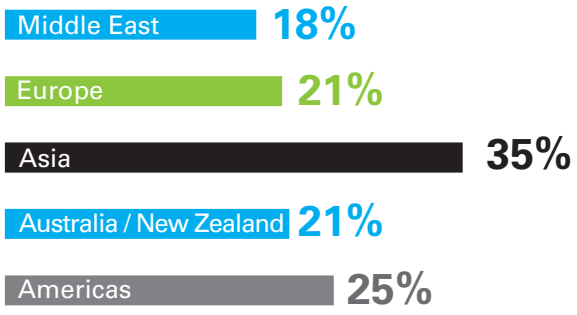
The RFI Dilemma

9.7 MEDIAN DAYS FOR RFI RESPONSE

$1,080 AVG TOTAL COST PER RFI REVIEW & RESPONSE

SOURCE: Impact & Control of RFI's on Construction Projects, Navigant Construction

PERCENT OF RFI'S WITH NO RESPONSE BY REGION



"The RFI process provides a methodology for the contractor to document a deficiency in the contract documents and at the same time establishes a basis for an increase in the contract amount and/or time." 11

RFIs have also gotten a bad reputation due to their history of malicious use. GCs have been known to pile on unnecessary RFIs in hopes of creating a delay that can be pinned on the designer, owner, or governing authority having jurisdiction (AHJ). It's no wonder Navigant found that 25 percent of RFIs in the United States never even get a response.

Project Owners previously burned by deceptive RFI tactics in the past have inserted contract language that eliminates RFIs altogether. Without realizing it, these owners are enforcing the same contract silos they intended to eliminate. The abuse of this critical communication tool from many stakeholders is, in part, why the RFI has gotten this stigma.

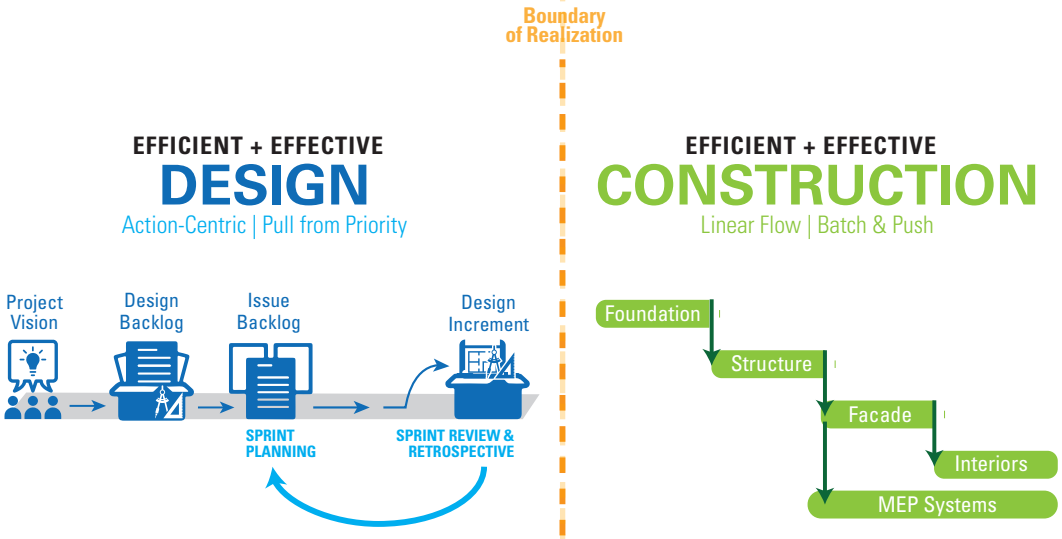
The overuse and abuse of RFIs has unfairly led to this bad reputation as well. Eliminating RFIs will not eliminate the issues that generate them. **To address the current stigma and revive this valuable collaboration tool, we must establish flexible data standards.** Then those standards must adapt to project-specific demands like contract type, company standards, and local government policy — all while keeping pace with technology changes.

DILEMMA #1: The Potential of BIM & VDC

The National Institute for Building Sciences (NIBS) defines BIM as "a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle". Benjamin Crosby, BIM & VDC Director at Yates Construction, shared his experience managing the coordination of a "single source of truth" using both integrated and traditional project delivery models. The integrated approach of investing more construction stakeholders into design is not as simple as it looks.

Efficient construction process follows a linear "push" model of thinking; receive complete design, apply market cost estimates to the design, and sequence the work to best manage the variables of physics and weather. Gravity and material science are the two biggest factors driving the use of a rational model. For example, the rebar has to be in the concrete before it hardens, and the Air Handling units sit on top of the roof structure. When no changes occur to the design or existing site conditions, the rational model works flawlessly.

The Boundary of Realization



Conversely, architectural design (like software design) works most effectively using action-centric thinking. When leveraging BIM & VDC collaboration prior to the "boundary of realization" between completed design and fabrication, the rebar could be redesigned because the concrete had only been poured virtually in the BIM design. The intended outcome of this approach is to generate more RFIs. New production management tools like value stream mapping (VSM), scrum, or the Last Planner System ® all derive from action-centric thinking.

Integrated delivery requires significantly more investment from the construction perspectives during the agile design coordination phase. This has the potential to eliminate RFIs prior to the boundary of realization. Traditional, hard-bid contracts like design-bid-build (DBB) do not leverage the benefits of BIM & VDC nearly as much as integrated approaches like Design-Build or Integrated Project Delivery (IPD).The mere requirement of BIM & VDC is hardly a guarantee of success.

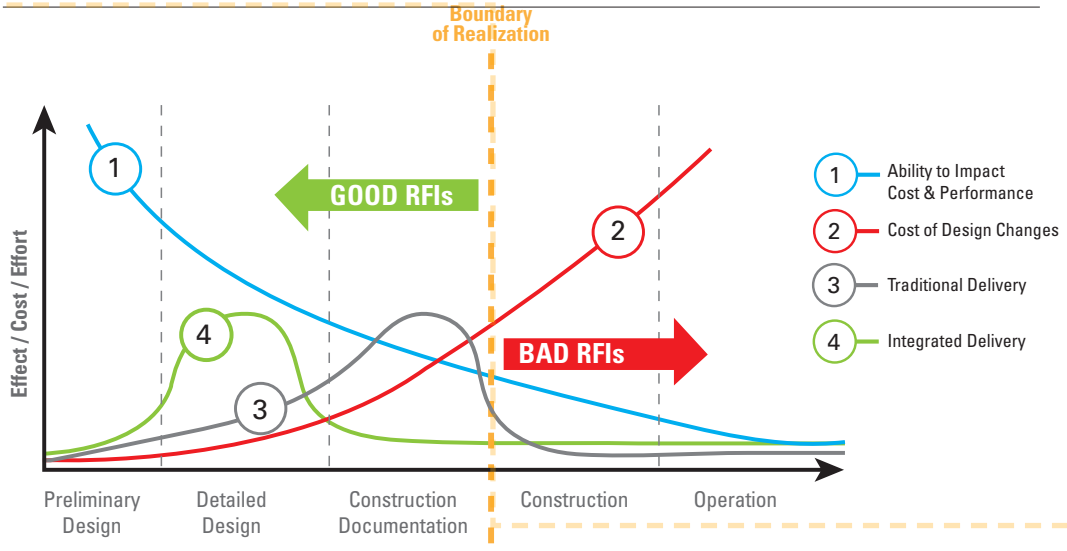
DILEMMA #2: Traditional Contract Incentives

This separation between action-centric design and linear construction is a main reason why traditional Design-Bid-Build (DBB) contracts remain so appealing to owners. Contractually, it creates a very clear line (cost) between the function of design and construction. However, the challenge with this approach is a familiar problem — it incentivizes project stakeholders to create more data silos between those who need to collaborate most effectively. The relationship map below depicts how contracts control the flow of communication at the project level. Importantly, one can see how the most efficient communication methods are often not allowed by traditional contracts.

Importantly, one can see how the most efficient communication methods are often not allowed by traditional contracts.

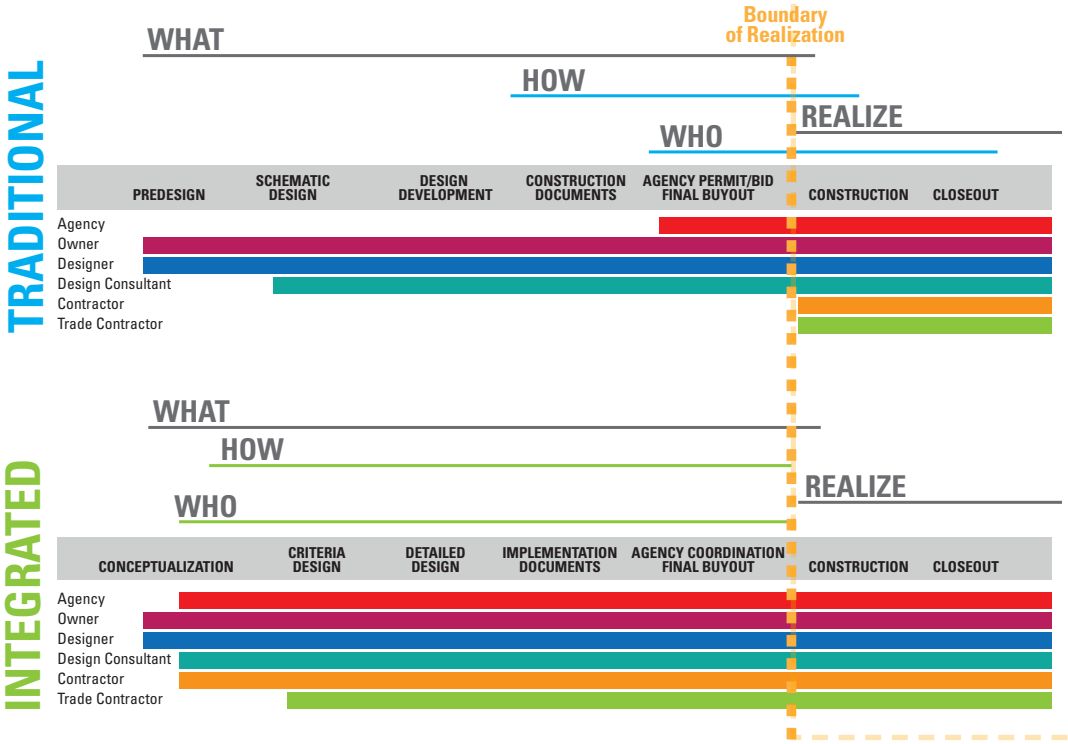
Since the inception of the integrated Design-Build contract delivery in the early 1980s, the AEC industry was told that moving more design effort earlier in the project timeline would lead to fewer delays and errors in construction (as shown in the MacLeamy Curve). The reality is much more complicated; when design and construction activities become integrated, the boundary between action-centric design thinking and linear construction thinking, which was once clear, now becomes blurred.

The MacLeamy Curve



"We're all on the same team. The real enemies are chaos and ignorance" - Benjamin Crosby

Federal Government Integration Standards



Project owners have a responsibility to align the contract incentives between design and construction stakeholders to support healthy RFI collaboration. Granular data capture and insights have the potential to predict and avoid costly issues. However, no issues can be predicted if there is no historical data to reference.

"Tell me how you measure me, and I will tell you how I will behave." - Eli Goldratt

Solving the contract dilemma will take more than just changes to contract language. There needs to be a fundamental paradigm shift in how designers and builders collaborate and exchange data at the project level. Regardless of contract delivery type, project coordination success should be measured by the team's ability to answer informal "issues" before they are elevated either to a formal RFI's, or worse up to a public change order. These crucial conversations should key performance indicators (KPIs).

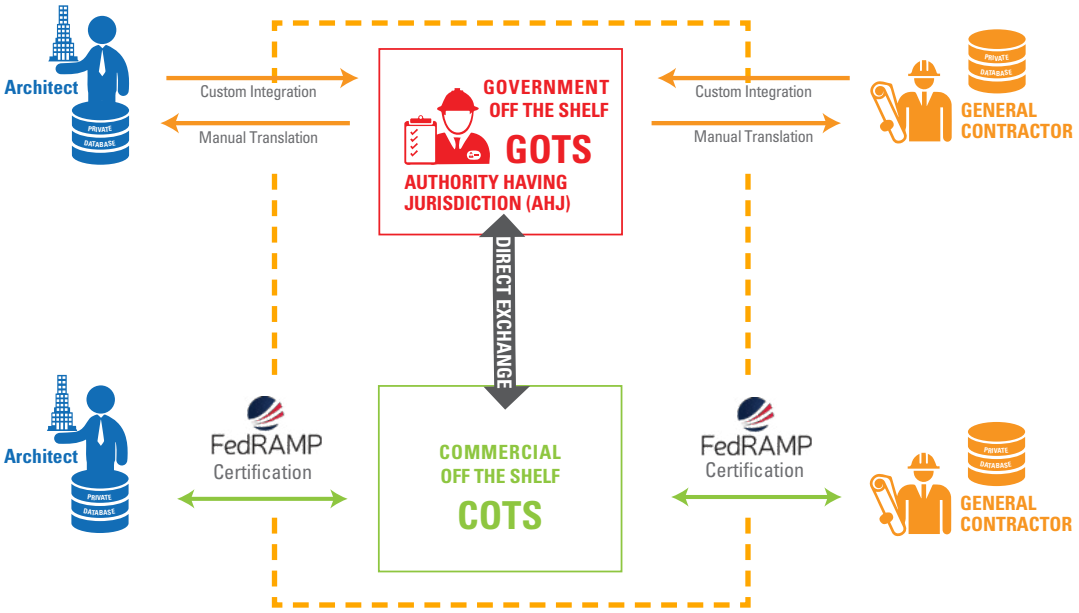
DILEMMA #3: GOVERNMENT OVERSIGHT

The conversation quickly moved from business incentives to government incentives as Connor Christian, Digital Integrations Manager at HDR, Inc. shared his perspective on the adoption of federal technology standards. Too often, Christian explained, designers and builders forget that the purpose of government is to maintain our safety and security. The filter of government standards is a necessary "waste" to ensure the quality we depend upon as a society. Because of this function government serves, AHJ inspectors and policy makers are not typically motivated to take innovation risk as much as industry or technology.

The dilemma of oversight occurs when the government generates unnecessary roadblocks based upon outdated policies and procedures. Conservative AHJs rely on closed, proprietary data systems behind government firewalls. This makes it extremely challenging for outside software developers to develop any direct exchange or integration with these closed data systems.

Proprietary systems are created for the government because they have strict security requirements that no other softwares are capable of meeting. Private software firms must invest significantly just for the opportunity to be considered for certification within programs like FEDRAMP so that government entities have the option to use **commercial off the shelf products (COTS).**

Federal Government Integration Standards



Many RFIs are generated when an inspector identifies, for example, a building code deficiency during construction. With close to 93,000 different building codes referenced across the United States, it can be difficult — if not impossible — for every designer or general contractor to follow every code.

Government off the shelf products (GOTS) meanwhile, can't keep up with marketplace demands, and have little incentive to include standard data exchanges. These closed systems,

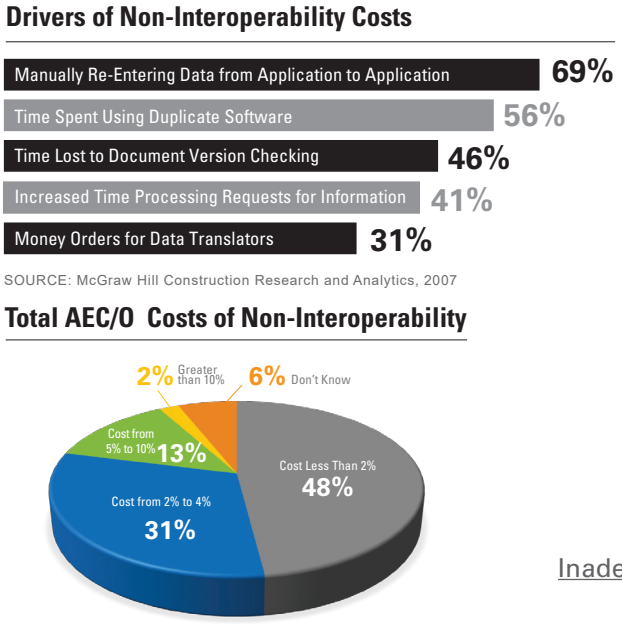
by design, don't provide open integration — due mainly to the perceived security risk. To standardize RFI data at an industry level, both the government and private sector have to play a role in defining the exchange process. The public sector accounts for 20-30% of total construction spending in America and Europe. . In these cases, governments are not only setting the rules, they are also the customers of the data. The first thing the private sector can do to facilitate this exchange is provide government with a kit-of-parts standard built on a harmonized set of building codes. Organizations like the GSA have already begun to standardize infrastructure data in BIM using the ISO IFC format. This level of foundational restructuring is a necessary first step towards streamlining the transition from a traditional to digitally integrated delivery.

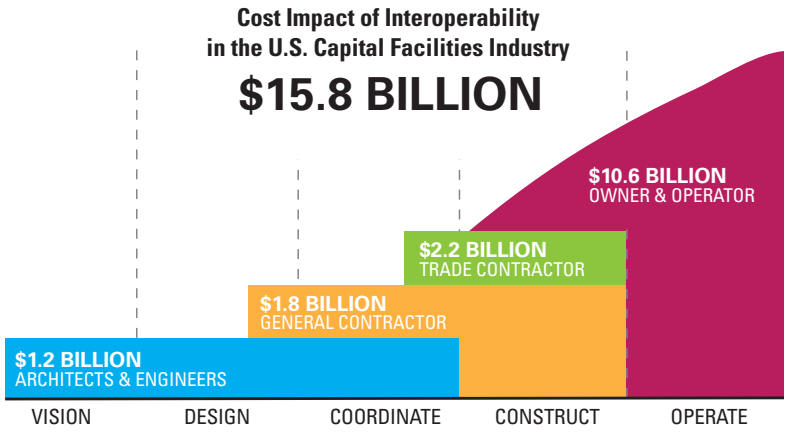
DILEMMA #4: DATA STANDARDS & INTEROPERABILITY

The top two cost drivers of non-interoperability were "manually re-entering data from application to application" and "time spent using duplicate software".

The cost impact of poor data interoperability across the AEC industry is substantial. According to a 2007 McGraw-Hill study, the top two cost drivers of non-interoperability were "manually re-entering data from application to application" and "time spent using duplicate software". It was clear from the industry professionals in the room that these metrics have likely not improved at all in the past 10 years. Owners and facility operators face the largest direct impact, followed by specialty contractors/suppliers, then general contractors, and finally architects and engineers.

The AGCXML does have a viable RFI schema developed, but the more important question raised during discussions was if the standard data exchange could also be represented in newer formats like JSON. Hopefully, Fiatech's prior work with the data Harmonization of PUMP Schemas using AEX cfiXML Schemas with the ISO 15926 Reference Data Library will assist with the efforts to harmonize RFI data across these existing standards.



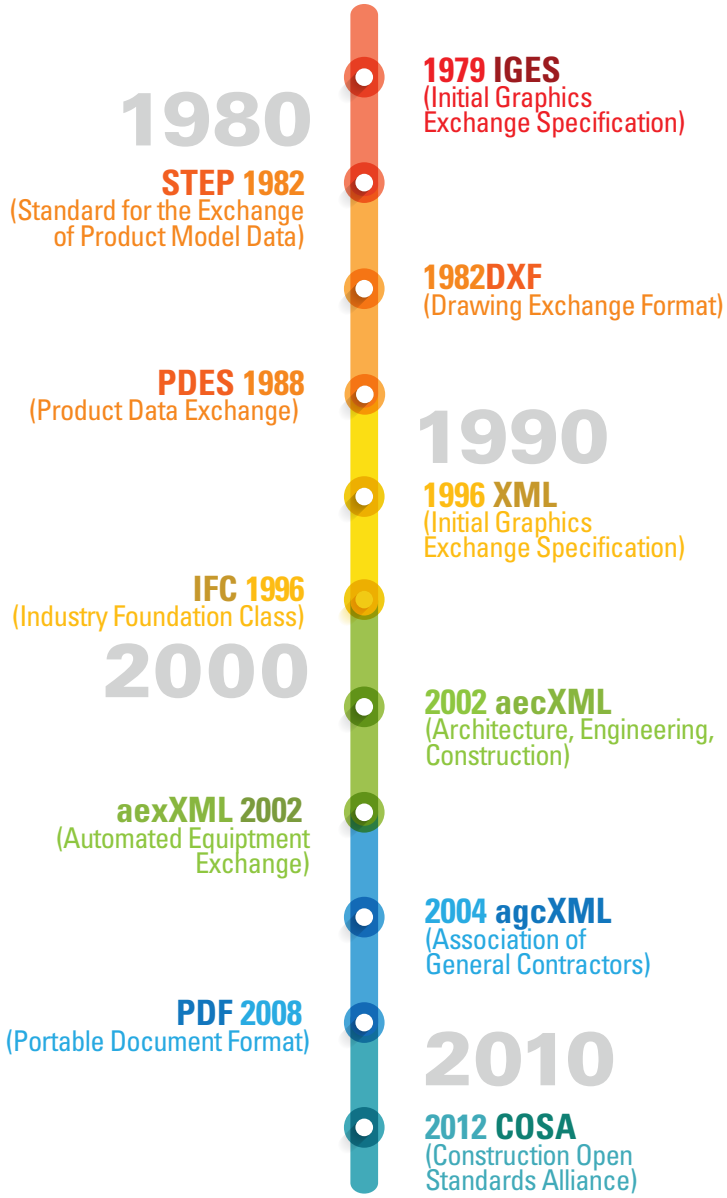


The total annual waste, according to the NIST Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry Report **is $15.8 Billion annually in the capital facilities industry.**

Todd Sutton, Sr. Project Controls Manager for Zachry Construction shared his experience with establishing and implementing open data standards. In addition to harmonizing building code standards, there is also a need to harmonize open-data exchange standards like XML, IFC, and PDF. Todd shared the history of open data standards in construction over the past 35 years.

Past initiatives to integrate data standards stalled mainly because they were based on the false premise that every project stakeholder would share the same central database. Now, however, with secure cloud exchanges like blockchain, it is possible to develop smart contracts to exchange tiered levels of data across the project for the supply chain.

30+ YEARS of Open Data Standards



The dilemma with RFI data standards is not that they don't exist; it's that they don't align.

PART 2: Debate

DEBATING PROCESS: FORMAL VS. INFORMAL COMMUNICATION

Laurie Spitler, Construction Industry Manager at Autodesk, brought her knowledge of construction contracts, lean process, and software integration strategy to help bridge the communication gap between industry and technology, and to find a common language. Laurie presented a new distinction to consider when addressing the line between formal contract communication and informal collaboration between design and construction professionals.

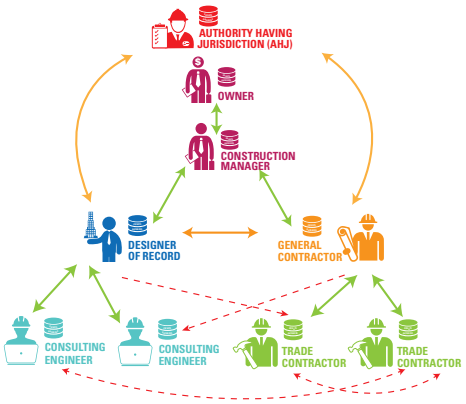
Formal communication can be defined as the contractually driven exchange of information between a liable designer and a liable builder. Informal collaboration is the traditionally undocumented exchange of information between designers and builders necessary to advance the job or solve complex coordination challenges. This concept can be connected to the four phase delivery model and boundary of realization. Formal communication shouldn't be needed before the boundary of realization, as the team is working in design space. If all issues are resolved prior to passing through the boundary of realization, no RFIs would be written on the project.

How Contracts Impact Formal vs Informal

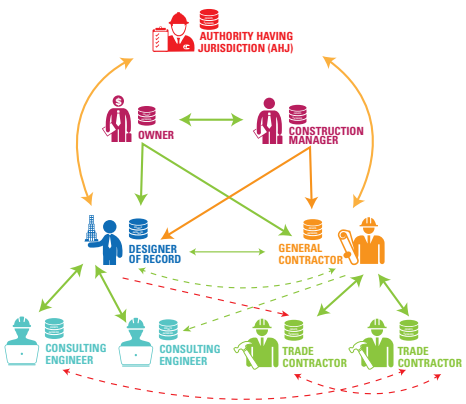
FORMAL COMMUNICATION (Solid Line)
Indicates formal lines of communication defined by contract (direct relationship (green) or indirect relationship (orange)

INFORMAL COMMUNICATION (Dashed Line)
Indicates informal lines of communication at the workforce level that are contractually incentivized relationship (green) or pose contract risk (red)

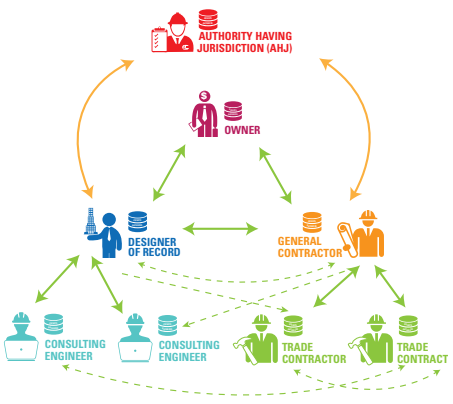
Design - Bid - Build (DBB)



Design - Build (DB)



Integrated Project Delivery (IPD)



Though Autodesk is committed to open exchange, such as the openBIM(R) exchange standards, it should be recognized that it is very difficult, if not impossible, to address every design issue before the boundary of realization. As Benjamin Crosby shared earlier, design and construction are procedurally different, which is why we still need the formal RFI.

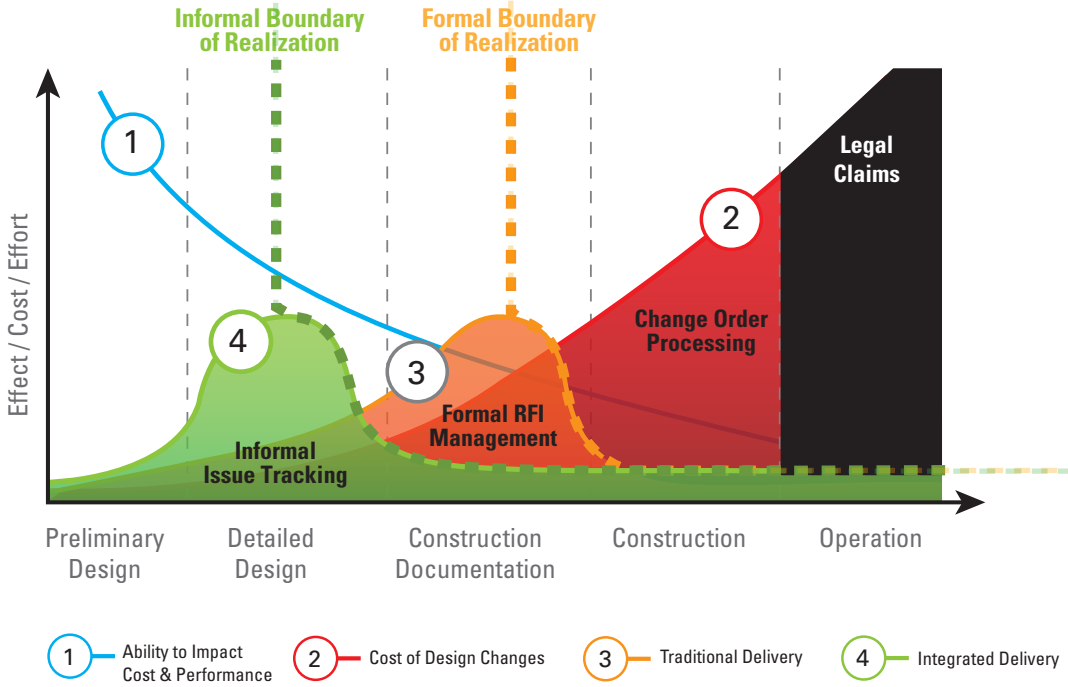
The formal RFI is an inefficient and expensive process, and it's led project teams to develop informal communication to improve the efficiency of the RFI process. Every young engineer

is told over and over again that they should pick up a phone, or that every RFI should be a confirming RFI. The logic behind this wisdom is that conflicts should be resolved in a direct and informal manner, and that documentation should follow through the contractually sanctioned RFI.

But what if we could shape contract language to allow for informal, efficient collaboration to occur prior to this theoretical boundary?

With the rise of cloud computing, we have the ability to store and manage infinite amounts of information. If the RFI was developed as a formal method of documentation, is it even relevant in the current era of the cloud? Even on a traditional DBB contract delivery, the bidding collaboration process could be evolved through more informal transactions between bidding trades and their design counterparts prior to final contract award. Due to existing challenges with contract incentives and liabilities, it is important to define a common language when we speak about different types of integrations.

Informal vs. Formal Boundaries



DEBATING TECHNOLOGY: INTERNAL INTEGRATION VS. EXTERNAL EXCHANGE

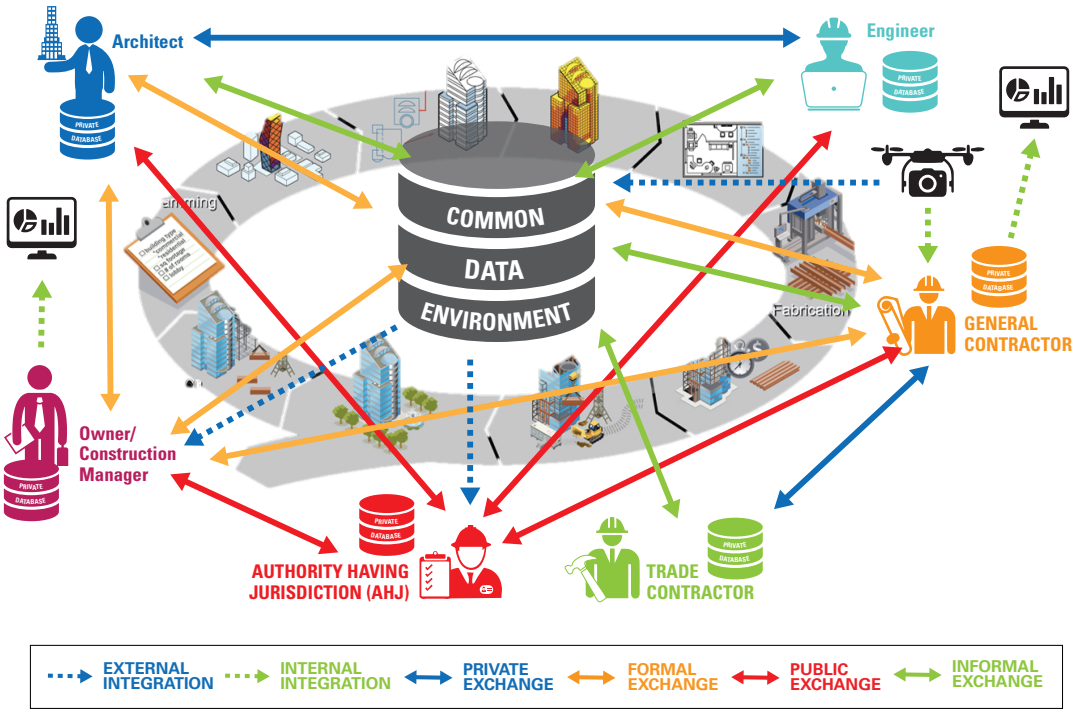
GCs are not looking to cut costs at the field operations level. Instead, they are looking at the opportunity to see project data metrics across the entire company through a seamless integration between corporate ERP, accounting systems, and point solutions used for issue management, daily reporting, or digital drawing access.

Charles Julius, Technical Partnership Manager at Procore, shared his experiences developing integration partnerships with more than 100 AEC software providers through their App Marketplace. Procore leverages RESTful web services to enable open exchange of data from one cloud database to another (as long as the other system has also published its API).

The demand from Procore customers is primarily for internal integrations over external exchanges. GCs are not looking to cut costs at the field operations level. Instead, they are looking at the opportunity to see project data metrics across the entire company through a seamless integration between corporate ERP, accounting systems, and point solutions used for issue management, daily reporting, or digital drawing access.

Admittedly, there is less demand for external API exchanges between the Architect or Trade Contractor's project management system and the GCs. At the same time, this lack of external integration can create a lot of frustration when project teams have to choose whose system to use, or do double entry in each other's systems.

The Digital Collaboration Reality



Just as project stakeholders lack the incentive to exchange RFI data across certain contract boundaries, software developers hesitate to invest efforts into API development with potential competitors in their marketplace. The industry demands software vendors do something about it, and many are answering the call. As a result, software vendors that close their doors to API integrations with new and dynamic vendors who could complement their existing system may soon be shutting their doors for good.

The challenge of implementing internal integrations depends on the company's ability to adhere to corporate standards. The challenge of implementing external exchange standards is that every project data standard will be different. And the challenge of developing technology integration standards is that the formal data handoff policies and procedures can differ significantly between customer internal preferences and the projects they work on.

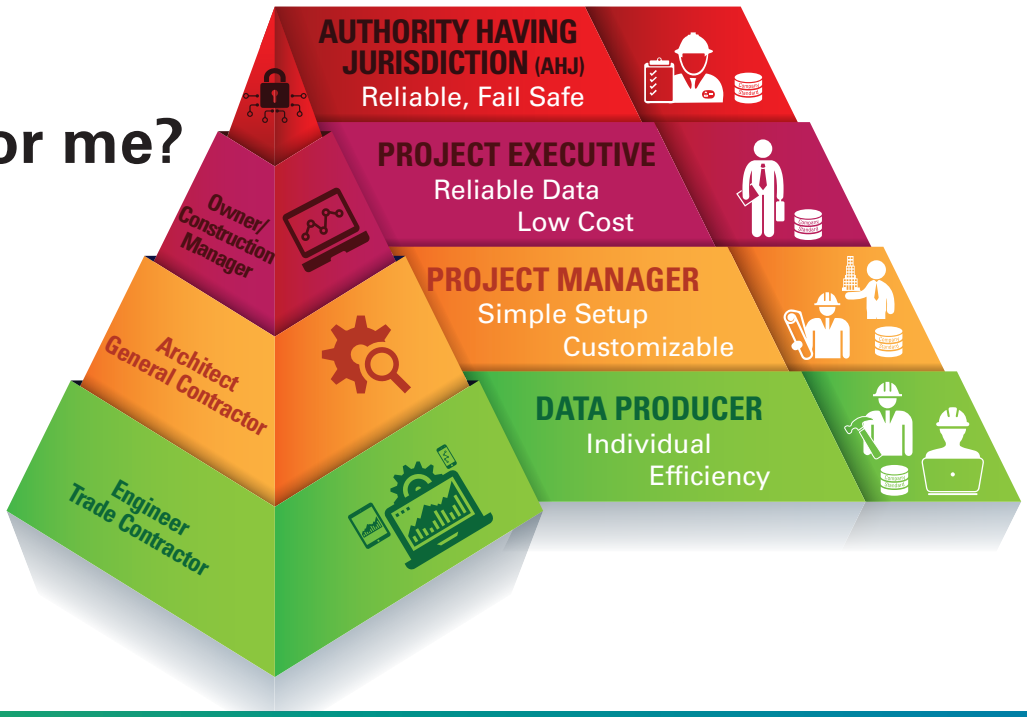
To overcome these challenges, there needs to be a harmonization of current open data exchange standards. Currently, data types (e.g., string, integer, etc.) are inconsistent across like concepts (e.g., project, status, etc.) in other systems. Generally, this can be alleviated through a mapping exercise with each respective independent software vendor's (ISV) engineers, but it also slows things and creates friction. Mechanisms like microservices can fix this sort of issue, but they generally create additional complexities and problems (i.e., it's difficult to verify that information was sent and received properly). The ability to leverage technology outside of the construction ISV ecosystem is made possible by the adoption of a RESTful JSON API.

DEBATING PEOPLE: "WHAT'S IN IT FOR ME?"

Kris Lengieza, VP of Operational Success, shared his experience developing a data-driven culture inside Stiles Construction. Kris explained how every perspective, both inside and outside of the organization, must have an intrinsic motivation to input the data that another internal or external customer desires.

For example, consider company executives who want to implement RFI standards so that an online dashboard could report RFI status and metrics across all projects. Those looking only to outside software or technology consultants to provide low cost and reliable data input are likely to be disappointed in the results. The key to company-wide data standardization depends on the incentive for project or division leaders, and the data producers below them, to change their modus operandi.

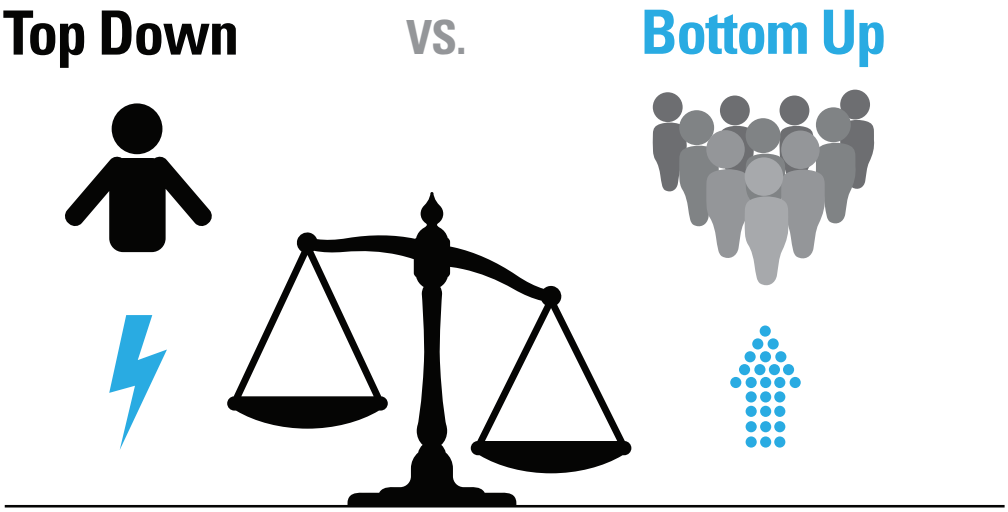
What's in it for me?



Project Managers are relationship builders who tend to cater to the preferences of their external customers. This is why they need a flexible standard that can be customized to the needs of the owner and other project stakeholders. Project Managers also tend not to be the most savvy with technology setup, and would like that to be as easy, if not easier than, past experiences.

Project Engineers, Superintendents, Estimators, and other data producers, on the other hand, often care more about getting things done than the quality of the data reported from it. They like checking the box and moving onto the next task. Their motivation is all about personal efficiency. If it doesn't make them better at their job or make it easier, they likely won't use it.

When standards adoption is not being adhered to, an executive or project owner can respond in two ways. The first option is to increase enforcement of the standards from the top down, which is expensive and likely to create more waste than it saves. The second option is to take time to communicate with the different end-user perspectives and empower them to redefine the standard in a way that aligns the objectives of the top and the bottom.



- **Inflexible**
- **Goals are Determined Early on**
- **Lack of Employee Participation**
- **Process Imposed by Management**
- **Lack of Motivation**
- **Employees Feel Input Not Valued**

- **Flexible**
- **Teamwork**
- **Project is Team-Driven**
- **Lack of Long-Term Vision**
- **High Level of Team Motivation**
- **Employees Feel Valued**

PART 2: Debate

STANDARD & PROCESS RECOMMENDATIONS

To overcome the compounding dilemmas facing the future RFI standards and process, we broke into four groups with the following focus areas:

1. Contract Standards
2. Data Standards
3. The Design Driven RFI Process
4. The Field Driven RFI Process

It was clear that no one standard could address all challenges in all situations. The construction industry needs to adopt a 'kit of parts' approach to RFI contract and data standards to allow project teams the flexibility to **optimize workflow standards that meet the needs of** corporate integration standards, project level exchange standards, and government reporting standards.

BREAKOUT #1: SOLVING THE CONTRACT DILEMMA [PRESENTED BY BLUEBEAM]

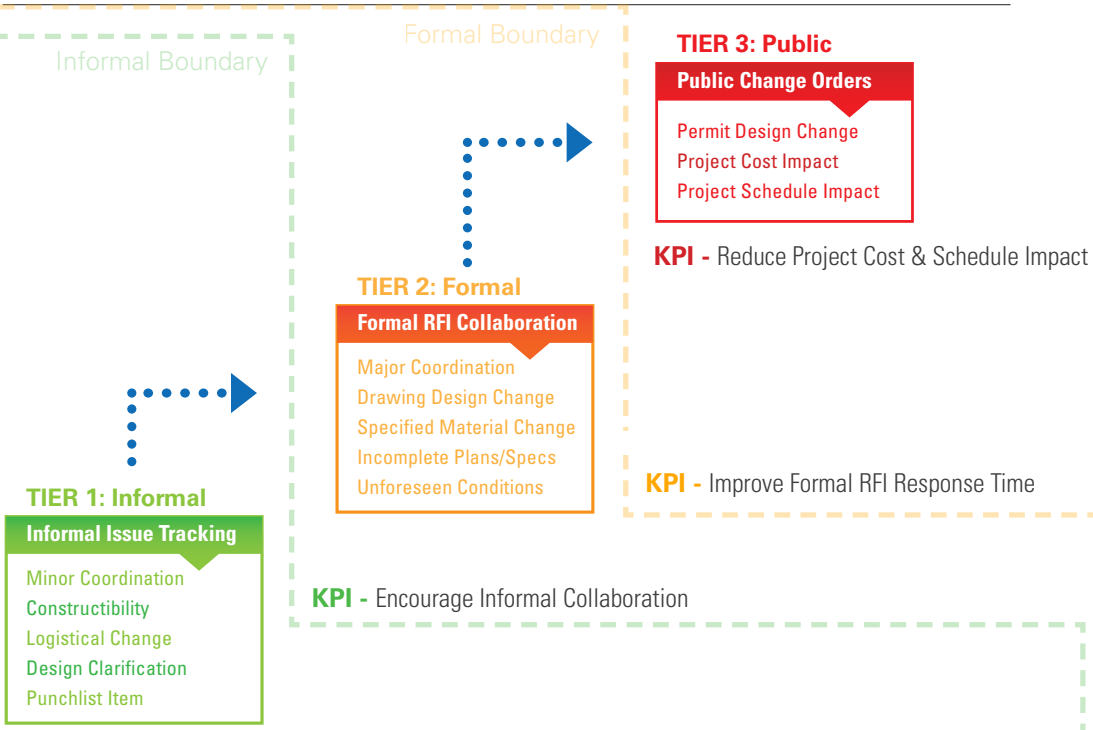
The focus of discussion in this group centered around the contractual definition of formal versus informal communication, and the important data to track in each scenario. Rather than looking at issues, RFIs, and change orders as separate, they should be viewed as a tiered exchange. An informal issue should contain a minimum set of data fields to describe the question, location, initiator contact, responder contact, response, timestamp, etc. If this question requires a formal response from the designer of record, then it is elevated to a formal RFI, which has additional data fields required but references any data captured from the informal issue.

If the response to that formal RFI will affect cost, schedule, or permitted design, then it rises to the top tier of public change order reporting. This is especially critical when discussing federal or bonded projects that have quarterly financial reporting standards.

It's not likely that contract delivery standards will ever truly align between informal, formal, and public data exchanges. For this reason, project teams need the ability to customize what data is shared, who it is shared with, and how it should be communicated between the informal and formal boundaries of realization.

Integrated and design-build projects will encourage more informal collaboration, while traditional projects may only define informal data standards between the GC and subcontractor level. By establishing a common language for defining the exchange tiers between informal and formal communication, we can drive new industry metrics to benchmark project collaboration effectiveness across any contract type.

Tiered Exchanges Across Formal and Informal Boundaries



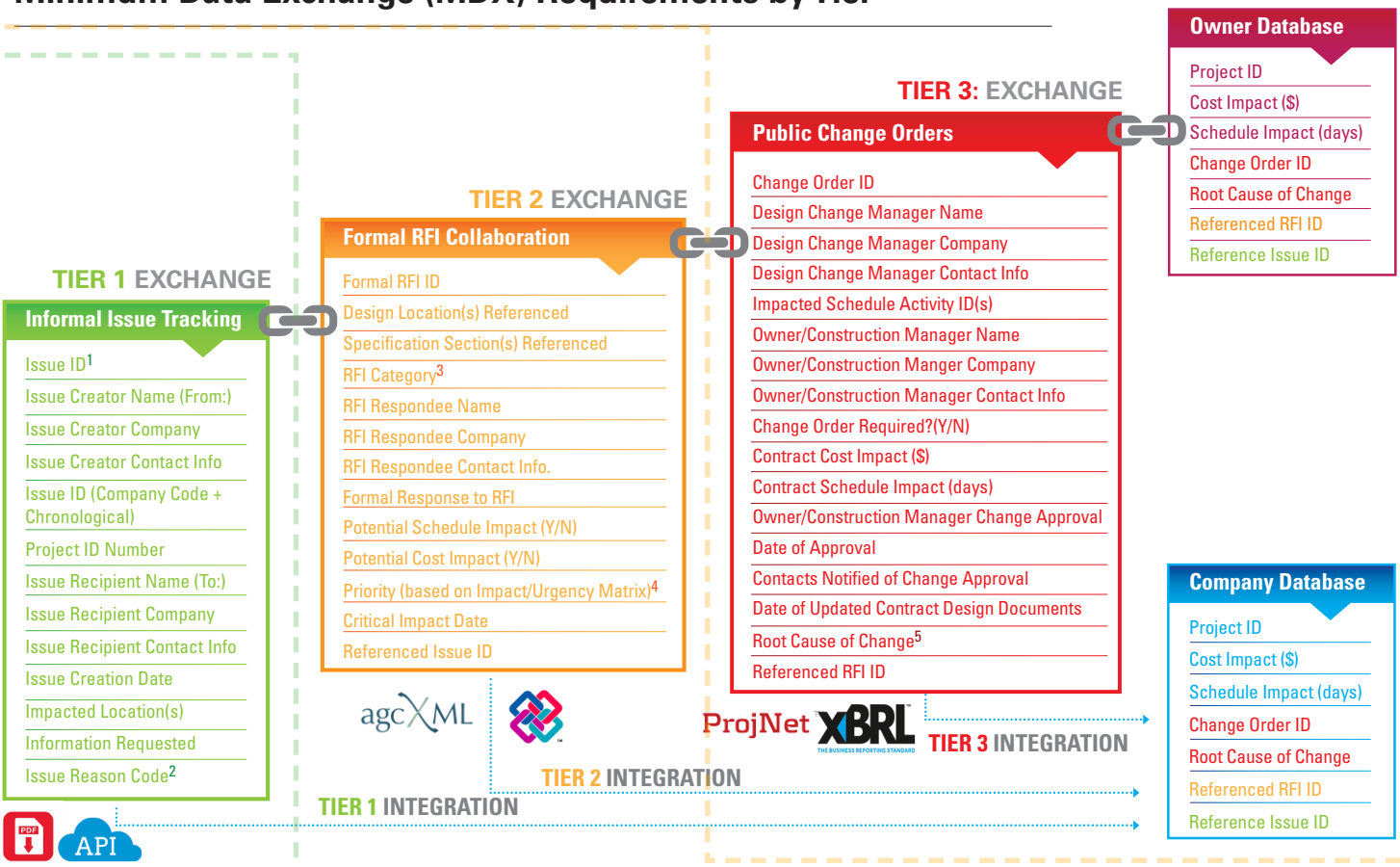
Technology integrators can also adopt this same language of formal versus informal collaboration by harmonizing all open data sources around a common minimum data exchange (MDX). For example, a punchlist item created as a PDF markup has profile, location, and question data already attached. The informal markup metadata could be exported to a formal RFI system and then exchanged back with the updated response data in the appropriate markup data field. **This simple integration of auto-generated issue data referenced into formal RFI systems could save hundreds of hours per worker every year.**

BREAKOUT #2: SOLVING THE DATA STANDARDS DILEMMA [PRESENTED BY BUILDERBOX]

The goal of this breakout was to analyze the critical data required for the minimum data exchange (MDX) standard at tier one (issue to RFI) tier two (RFI to change order) or tier three (change order update to project and company ledger). Whether the goal is internal integration or external exchange, the MDX schema below should be maintained across all open software integrations and open file exchanges.

The group began with standard RFI form fields recommended from the Navigant RFI report, and several critical points came up during the discussion: First, Issue IDs[1] should be categorized by the initiating company, followed by a sequential number. This creates an easy way to track how many issues each company is generating. If an issue is elevated to a formal RFI, it is assigned a new, chronological RFI ID number. Despite the confusion of having an issue number referenced inside an RFI number, the separation of issue tracking by company and RFI tracking by project allows project managers to encourage issue generation while still discouraging unnecessary RFI generation.

Minimum Data Exchange (MDX) Requirements by Tier



The Issue Reason Code[2] (dictated by initiator) and RFI Category[3] (dictated by responder) should be a standard set of choices across all projects. This level of issue and RFI tagging produces granular data for predictive analytics.

The Critical Impact Date[4] and Priority Matrix[5] is a new way to measure the quality of RFI response times on a project. Rather than 10 working days for response, this sets a last responsible moment (LRM) that a designer must respond to in order to not affect the critical path. That date could be one day or one month, but it must be set in real-world constraints.

The priority matrix assesses both the impact (cost/schedule) and the urgency (LRM date). RFI dashboards will show the percentage of RFIs responded to before or after the LRM date, rather than the total number of RFIs and average response time.
This type of transactional integration of sensitive contract data is not likely to be done through open-API integrations alone. Through the use of smart contracts, blockchain, and digital signatures, the AEC industry could make standard data exchanges at the project and government levels possible. Establishing a standard data schema for each of these tiered exchanges and integrations will be a top priority for COSA to address in the coming months.

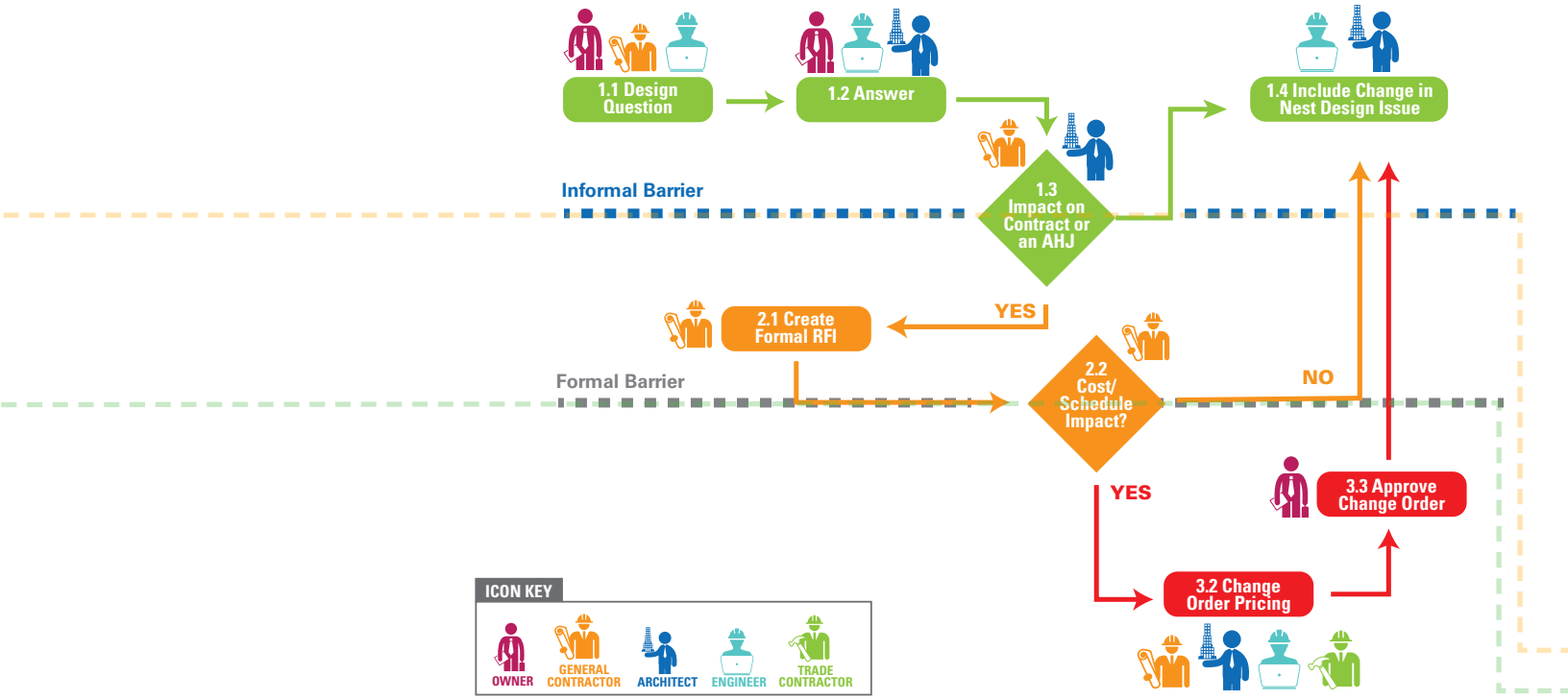
BREAKOUT #3: MAPPING THE DESIGN COLLABORATION WORKFLOW [PRESENTED BY AUTODESK]

To improve digital efficiency during the design collaboration phase, it is important to keep everyone aware of changes that occur; this is the best way to determine whether their scope of work has been affected. In the analog days, this was a labor intensive process of printing full size drawing sets and shipping them to prospective bidders or reviewers. Today, it is expected that new drawing sets will update digitally every two weeks with incorporated answers to the rolling list of design questions.

Regardless of contract delivery type, every project has a window of informal review that occurs prior to the formal boundary of realization. The review window could be days to weeks on a traditional bid, or months to years on an integrated project delivery. During the design collaboration phase, project teams should follow this same tiered approach to elevating design questions.

Informal questions asked by the GC or trade contractors should be discussed collaboratively with the responsible design professional with the aim of arriving at a proposed solution.

Design Driven Issue Resolution Map



At this stage, the designer of record decides whether that answer impacts any permitted or contracted designs; if not, the change is incorporated in the next drawing issuance and the team is notified of the change.

If there's a formal change to the design, an RFI must still be created. Ideally, in an integrated delivery this would only happen if an issue were identified beyond the informal boundary of realization (i.e., design permit). If the formal RFI response results in a cost or schedule impact to the project, it would pass the formal boundary of realization into a change order.

BREAKOUT #4: MAPPING THE FIELD COLLABORATION WORKFLOW
[PRESENTED BY ONTARGET]

RFIs identified in design phase are always encouraged, but the reality is that something always falls through the cracks. Thankfully, the AEC industry now has amazing mobile data capture devices to help identify and solve problems, and communicate more effectively on site. Cody Nowak demonstrated a proof of concept (POC) workflow using Microsoft Hololens to create, share, navigate, and respond to a field RFI. This example proves how powerful technology has become to address the different office-to-field barriers between people, process, and technology.

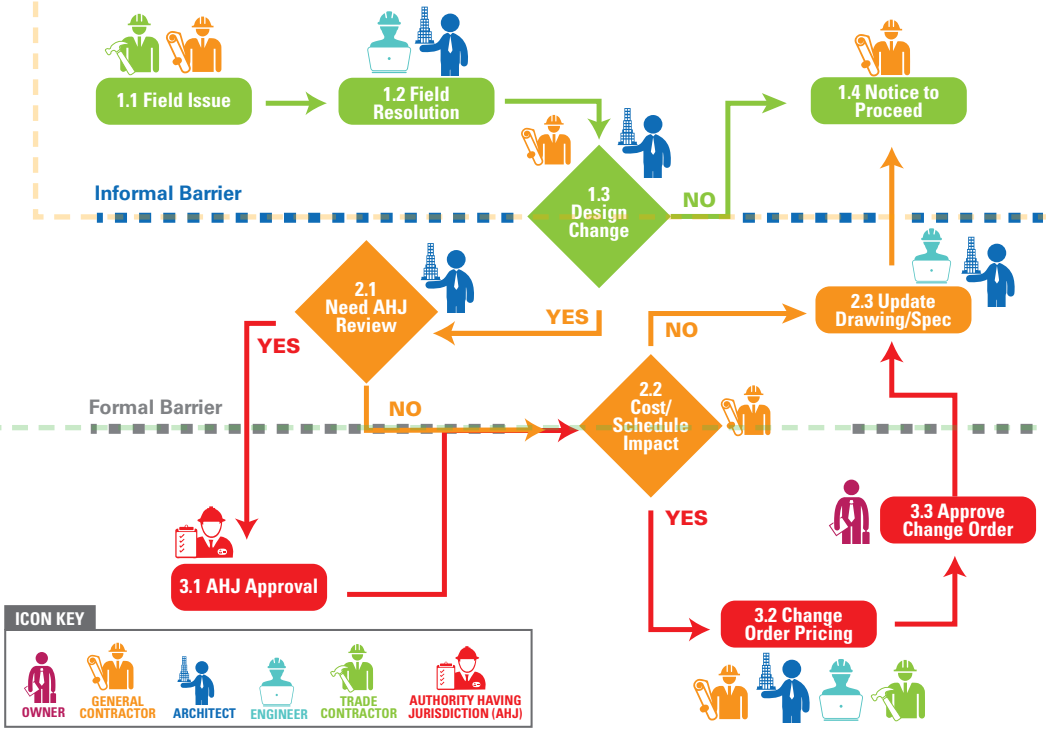
> The last step in adoption falls on AEC professionals and project owners to align contract and data standards around this new framework of informal vs. formal collaboration boundaries.

The field workflow diagram (pictured on the following page) adds more complexity due to the separation of design change order approval and cost or schedule impact approval. Field issues are generally identified long after the boundary of realization, so it's important to allow for creative flexibility without losing sight of design intent.

The tiered framework, beginning with informal issues, is critical for enabling a designer and builder to discuss options openly and arrive at the best solution. The proposed solution must then be vetted to determine whether a Formal RFI approval is required. If the designer thinks there is a formal design change, then they will elevate the issue to an RFI (and tag the category). If the change creates a potential cost or schedule impact, then the GC will elevate the issue.

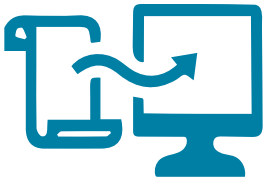
When formal permit design review is required, the tier 3 data exchange standard would be dictated by the local AHJ requirements. AHJs are encouraged to visit openpermit.org to learn more about digital collaboration between designers and AHJs. When change order pricing is approved, the total cost and schedule impact to a project should be reported using the XBRL financial reporting standard.

Field Driven Issue Resolution Map



PART 4: Deliver

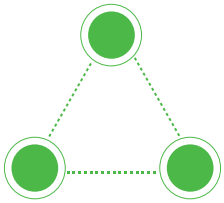
SUMMIT FINDINGS & RECOMMENDATIONS



Step 1. Digitize

The digitization of construction is inevitable. Just the ubiquity of smartphones on the job site alone creates tons of possibilities for data. However, that data is rarely captured and leveraged for discovery or analytics because of the aforementioned contract incentives.

To harness the potential of digitization, project teams must find a way to contractually make it "safe" to collaborate freely. One breakout group discussed the idea of a "Slack for Construction," which would allow for free-form communication with hands-off oversight. By separating informal from formal data collection, project teams can begin to unlock the synergistic power of IOT, drones, 360 cameras, augmented reality, and many more devices to come.



Step 2. Standardize

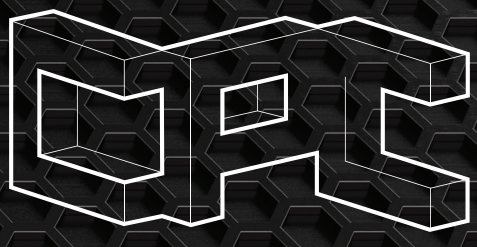
There's a big difference between leveraging digital tools and digital collaboration. D**igital collaboration requires a harmonized set of standards between the needs of the company, the project, and the individual.** The intent of standardization, meanwhile, is to translate between the needs of each perspective, rather than force people into a one-size-fits-all approach. Furthermore, separating internal data integration standards from external project exchange standards is a critical step toward improving this industry's poor track record with digital standards adoption.

This RFI report can act as a guide for project teams to better define the difference between company level, project level, and government level standards. However, this report only scratches the surface of what needs to be done from the data standards perspective. The next step toward recycling these traditional collaboration standards is to develop a new COSA RFI standard for software partners to leverage when developing RFI data integrations.

Step 3. Optimize

To optimize digital collaboration at the project level, standards must evolve into a kit-of-parts selection guideline similar to the Construction PDF Guidelines. Flexible company and project standards built on industry standard data exchange protocols is the key to unlocking disruptive innovations like machine learning, predictive analytics, and artificial intelligence.

The digital optimization of construction cannot happen until the industry paradigm changes. **The methods for measuring performance and success in construction are broken, but new KPIs, such as the priority index, will help to motivate the right behaviors and encourage more data capture.** The unstructured data collection can support the use of natural language processing (NLP) to enhance the discovery and resolution of most typical RFIs.



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