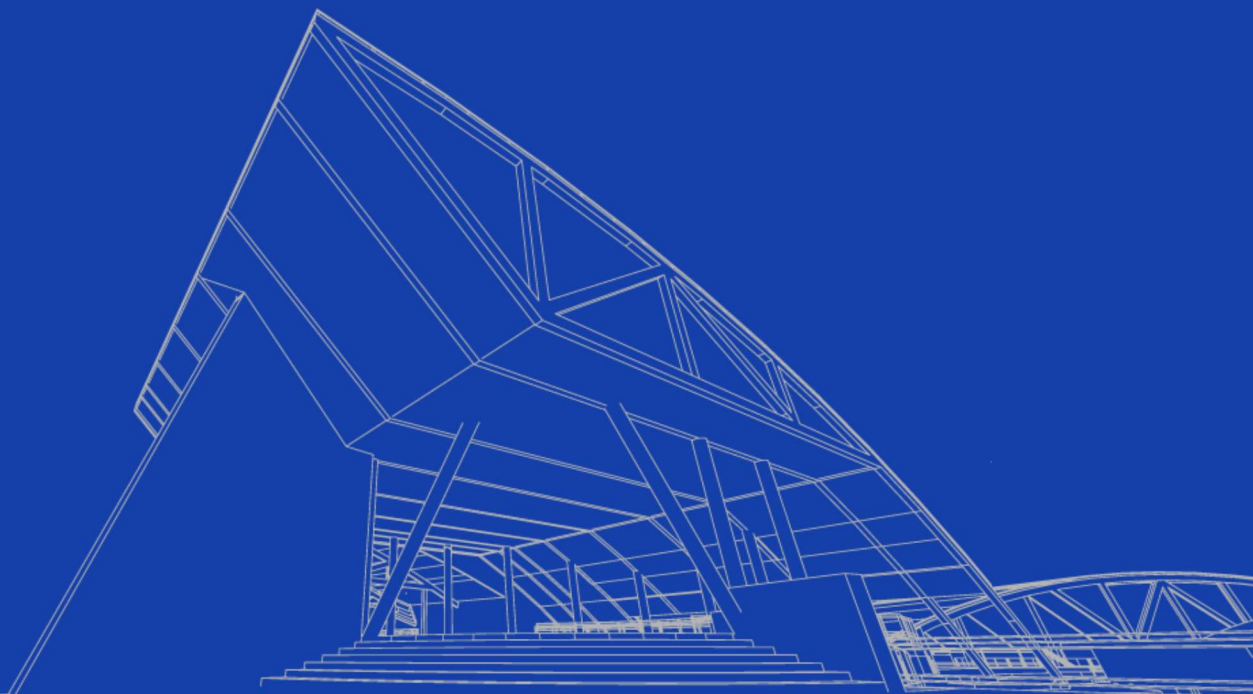


BUILDING A SUCCESSFUL DIGITAL PRACTICE

October 2022





“Data is the new language of building”



There is a revolution underway in the design and construction industry with digital fabrication, modular construction, 3D printing of building components (and even buildings), and robotics playing a larger role in every aspect of the construction process. The instructions for these buildings are evolving from paper-based documentation to digital information that is both human and machine-readable.

In July 2022, the team at AIA Contract Documents released a new suite of Digital Practice Documents, designed to transition the contractual reliance for construction from 2D, paper-based, documentation to fully integrated digital communication systems. For the first time in the history of design and construction, this suite of contract exhibits laid out an explicit path for digital information – data assets – to become the instructions for building.

Concert was created anticipating this evolution, and we believe digital delivery of design information is fundamental to future gains in construction productivity, quality control, and cost management. We've invested our time and energy to better understand digital integration and where architects might obtain additional value in the design and construction process. While our discussion here includes references to the AIA Contract Documents 2022 Digital Practice Documents suite, our review of these documents is not exhaustive, we recommend each firm conduct its exploration to align with your client's needs.

Welcome to the future!

The Concert Team

Executive Summary

In 2016, World Economic Forum Founder and Executive Chairman, Klaus Schwab, published The Fourth Industrial Revolution¹, a seminal book predicting the hallmarks of the next wave of economic activity. In this sweeping vision, we move beyond mere industrial automation to systems that are transparent to one another, self-healing, and responsive. This anticipates a forthcoming “golden age of creators” as the distance between creation and output will be shortened with machines taking on increasing roles and capabilities.

While the impact on the AECOO industry is just beginning to unfold, there is no question that there will be a significant change in the way buildings get built. Here, we identify the core ideas critical to understanding how to deliver services in this new digital realm. They are:

The New Fundamentals – Digital Delivery requires a clear understanding of a different set of business fundamentals.

Risk & Data Sharing – There are many misconceptions about the risk of sharing data assets. It’s better to understand and manage them appropriately.

Data is Driving the Engine of Emerging Technologies – More than any other communication method, data will inform the building process.

Leading a Digital Practice – There is a new literacy required of firm practice leaders in the digital world – understanding the value and application of data is essential.

Data will be Decentralized and Must Be Managed – The volume and breadth of data sharing require a decentralized approach. The critical factor will be establishing a method of verification for data that will be used for fabrication, construction, and other purposes.

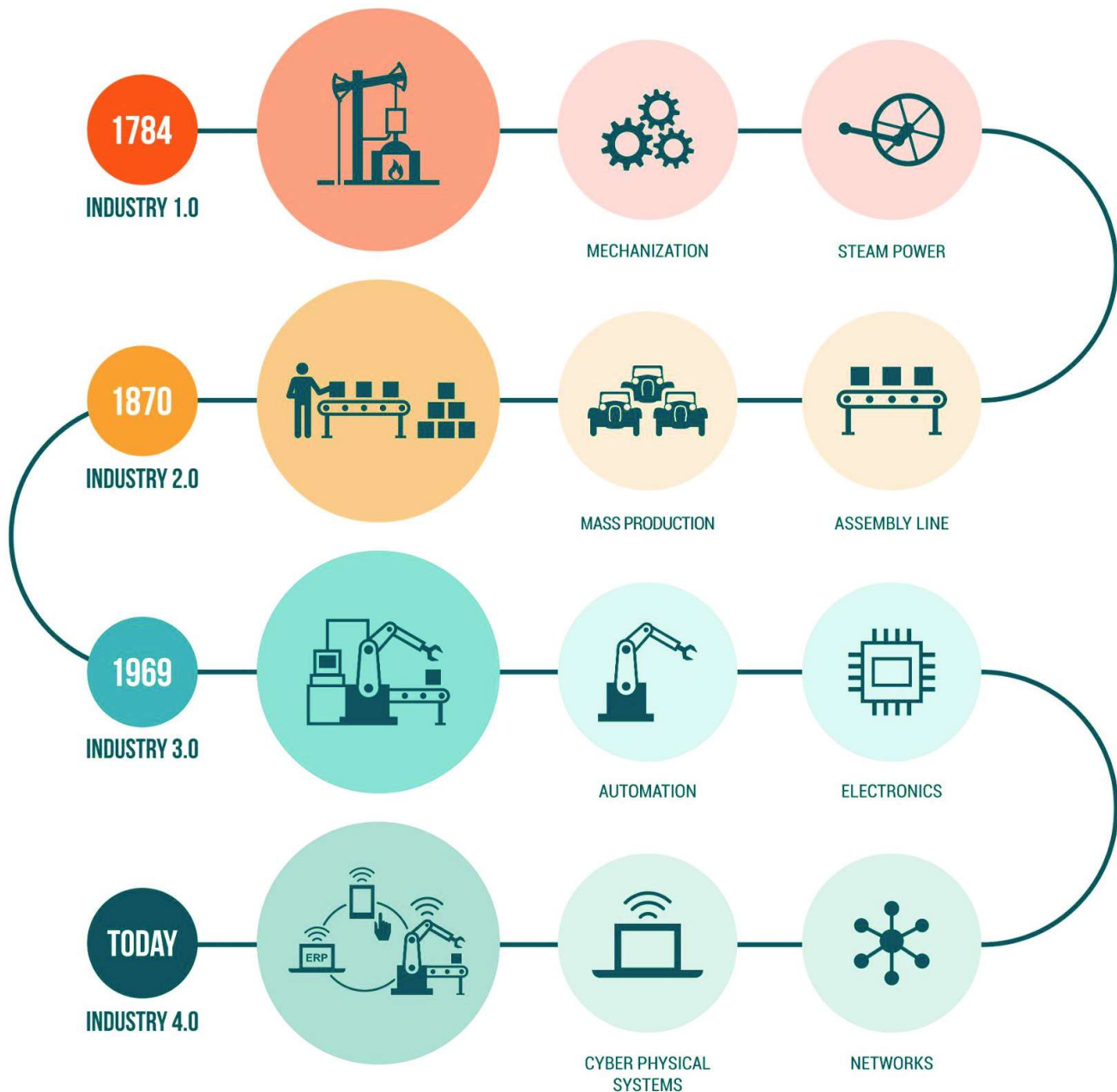
The early stages of this are already present and the forthcoming adoption of machine learning and artificial intelligence programs and processes will rapidly accelerate the transition. Data is fast becoming the most important product the industry will produce. In short, data is becoming an asset.

As we explore each of these topics in more detail, it is important to understand how your practice will adapt to this new environment. We believe that practices that choose not to adopt will be at risk of obsolescence.

“Design and construction leaders must understand that the impact of the Fourth Industrial Revolution will be significant and will reshape everything in the AECOO industry.”

INDUSTRIAL REVOLUTION

TRANSFORMING INDUSTRIES AND INNOVATION



The New Fundamentals

Today's Context

For centuries, paper-based drawings have held primacy in design and construction. We still refer to drawings as “blueprints”, even though it has been more than 60 years since an actual blueprint was created. We are familiar with the iconic image of the architect holding a roll of drawings, symbolic of the design and construction process. Yet, for most “average” commercial projects today, you would find it impossible to hold the full set of drawings in your hand. Modern construction documents often consist of hundreds, sometimes thousands, sheets of drawings.

Today, design concepts are created using sophisticated design authoring software, resulting in built outcomes that would have been impossible just 20 years ago. Computational and generative design software is shaping early design processes. Algorithms optimize design iterations, ultimately leading to higher performance in the built product. Architects control and lead these processes and yet, ironically, before the project goes into construction, architects

“Architects must lead the digital transformation; leadership will create new opportunities for greater fees”

and engineers deprecate all that valuable information into 2D drawings and specifications. There is then an expectation that somehow, the construction team will correctly re-interpret the 2D information back into a three-dimensional building.

The tide is turning as innovations in construction begin to drive a more integrated process. This is the Fourth Industrial Revolution manifesting itself in design and construction.

Only about a decade ago, it was relatively unheard of for an

architect to share their data assets with the construction team. Concerns about risk, blame and IP theft limited sharing to files that present the framework of the model to be used for convenience only.

By the start of the pandemic, more information was beginning to be shared to drive emerging construction and fabrication technologies, but leadership in this space remains missing. It is now the time for the Architect to become the leader of this transformation driving the revolution.

Basic Concepts

Fundamental #1 – Data is an Asset

Quit treating the data you create as an expense and start leveraging the value that it represents. Establish systems in your office to recognize this. Your data will be used for fabrication, take advantage of that!

Fundamental #2 – The Architect is the Genesis of the Data

You and your practice are the origin point of all data that will be used to build the building. As the original author of the data understand that your data will save time and money downstream, so treat it as important as drawings used to be.

Fundamental #3 – Design Intent and Means and Methods are no longer relevant

Digital delivery means data created during design will be the basis for fabrication and installation. This is a good thing! This saves time and money for the client and reduces the opportunity for errors in interpretation, and it means the architect will be involved in how the building will be built.

Fundamental #4 – Develop strong contract habits and adopt well-defined documentation on digital deliverables

2022 marks a milestone in digital delivery and the *2022 AIA Digital Practice Document Suite²* (E201-2022 and G203-2022) creates a solid foundation for the project team to discuss, define, and document how digital information will be used. Use them!

Does this Raise the Bar?

Architects are responsible for meeting the professional “Standard of Care³”. Will this change result in the burden of delivering a perfect BIM and related data assets? Read on as we discuss this and other related issues in the pages ahead.





The Myths about Risk & Sharing Data Assets

“The greatest risk architects face is missing out because they believed in the myths of digital project delivery.”

Unpacking the Myths

Let’s take a moment to unpack and bust the key myths around digital delivery:

Myth #1-BIM replaces the drawings and specifications outright.

Digital delivery systems do not automatically replace the traditional Instruments of Service⁴ with BIM. Instead, they allow you to specify when and how model portions or model-derived data assets will be used to describe specific building elements such as structural framing, tapered roof slopes, complex rainscreen geometries, or even custom-manufactured furniture and fixtures.

Myth #2 - BIM is the deliverable.

AIA E-series and G-series documents are exhibits⁵ to the core Owner/Architect/Contractor agreements and give you the discretion to define what digital information will be delivered. The project participants must contractually define the specified use and parameters of all data assets Any use outside those parameters would be outside the contractual approvals.

Myth #3 - This is going to cost architects more and reduce fees.

Data is an asset – charge for its use! Fees for service are a negotiation between the two contracting parties. You are saving the client time and money downstream, which is valuable for them.

Myth #4 - Your intellectual property (IP) is protected by copyright laws and your software licenses.

This could not be further from the truth. Your IP is at risk, protect it by creating an unassailable third-party record of your digital data assets with authorship and ownership rights encoded. This is exactly why we designed Concert specifically for architects and designers.

Note: Digital Practice Documents don’t replace traditional contract deliverables or mandate new deliverables; rather, they supplement them. It is important to understand that they are established through a discussion among project participants and that they are memorialized in the core agreements.

Data is Driving Emerging Technologies and Value

Expanding Agency

This is what the 4th Industrial Revolution will look like—unprecedented access to opportunities for innovation and expansion of the agency of the architect in the form of new services and new relationships with society at-large.

Data-Driven Analytics and Optimization

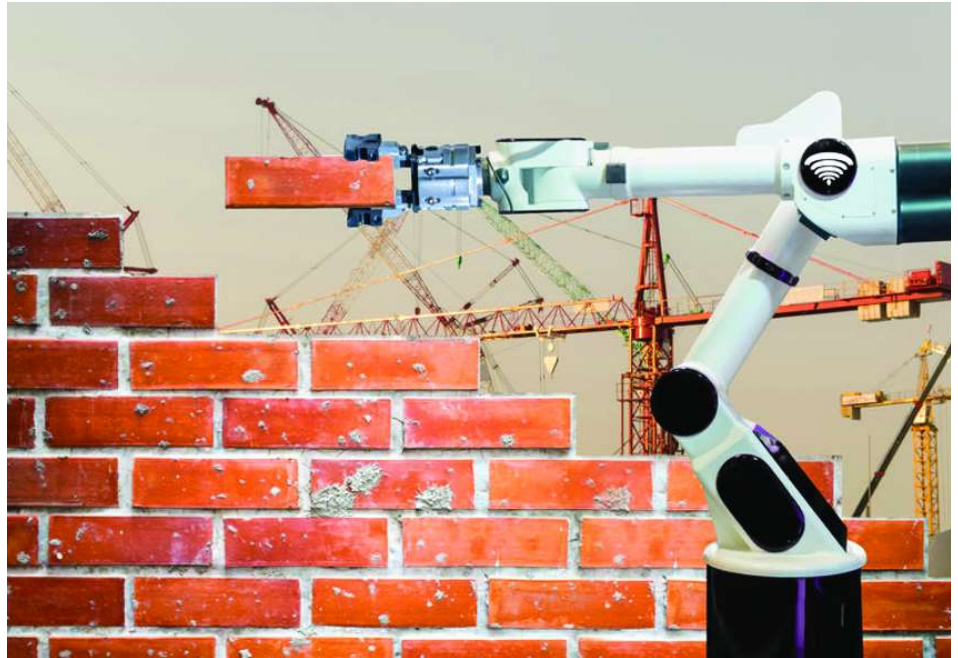
Analytics is an important tool. When combined with an integrated data model, analytic processes can be performed on a regular and recurring basis. As more definition is added to the design, the model will offer opportunities for real-time assessments of performance outcomes. In a world of challenging economic conditions and increased speed to market pressures, effective data-driven decision processes add value.

Data-Driven Fabrication and Automation

Robotics are now engaged in many on-site activities including excavation (Trimble), wall layout (Dusty Robotics), drywall finishing (Canvas), and painting (Okibo)⁶. Technology startups like Doxel, and OpenSpace use computer vision to measure daily construction progress. 3D printing at all scales is an emerging trillion-dollar market shifting significant portions of construction traditional processes to in-situ fabrication. All these technologies rely on 3D information generated from the architect's design documents.

Data that Looks Forward

Digitally delivered buildings create a platform where technology coalesces with traditional systems of operational management. These data-rich interactions promise to boost productivity (of the space), improve occupants' health, and increase energy performance well beyond the capabilities of our current generation buildings. This advancement in core capabilities is needed to achieve real reductions in Green House Gasses (GHGs)



and reduce the impact of the built environment on global warming⁷.

Architects at the Origin Point

Data as a building tool requires trust between all parties involved. Trust requires clear and specific authorization for use, must be authenticated by the originator, and have a mechanism to be verified by recipients. By the nature of their professional license, the architect is uniquely qualified to facilitate this.



© Dusty Robotics

Under the requirements of their license (regardless of jurisdiction), the architect embodies trust and authority by the following:

- The work of the architect must be the original work of the architect, completed under their direct supervision, and reflect the professional credentials and experience of that individual.
- The work is the contractual deliverable between the owner and the architect and is bound by the conditions of the contract.

These are unique attributes that reflect how digital delivery is a value that architects will deliver, a value built on trust and representative of the skill and



Leading a Digital Practice

Live, Learn, and Grow

Within the next three years, data will become the primary method of design communication and construction delivery. Digital delivery will require a lot of growth and learning as a leader and the sooner you start, the faster you'll grow – and your leadership will be rewarded.

Digital Literacy Sets You Apart

Digital Practice leaders understand digital tools and the opportunities they create. Firms that exemplify this understanding are already leading the industry and are garnering the best projects and awards⁸. Leadership doesn't mean you must be proficient or even capable of using the tools – it requires an understanding of how to extract value, functionality, limitations, and utility from them. The more time leaders take to learn and understand, the better they will be at assessing the opportunities to expand the value of their practice.

“The average architectural practice will take at least three years to transition to digital delivery.”

Data is Your Value and Your Differentiator

A digital practice requires individuals who have a deeper understanding of the applications of the technology and tools. There are four general areas of digital practice expertise:

- Those who know how to exchange data assets directly with fabricators or modular manufacturers
- Those who understand the information required to inform field-driven applications like robotic bricklaying, floor stenciling robots, or automated quality control systems
- Those who will understand how to coordinate and create a digital twin
- Those who use computational design software to 3D model new design geometries and performance frameworks to inform the design process.

Contract Negotiation is a Skill, Hone It

Part of the value and strength of the AIA 2022 *Digital Practice Documents* are the tools they provide to establish and negotiate how data assets will be used in the project. It remains the responsibility of firm Principals to negotiate with their client and the contractor several important processes before the design starts including:

- Identify the data lifecycle phases and purposes for all data throughout the project
- The exact process for sharing data assets
- Limitations on the uses and utility of the data assets
- The record-keeping processes
- The mechanism to create a clear chain of custody

This is where digital practice leaders will succeed, provided they have the knowledge and understanding of how the digital tools work, what they produce, and how that information can be used.





“Architecture and design firms that actively engaged in integrated digital delivery earn more revenue and are realizing higher profits and success.”

The Economic Promise of Digital Project Delivery

Abandon the Standard Fee Model

An architect’s data assets have real value throughout the entire lifecycle of the building. Delivery of 3D model data is increasingly becoming a required deliverable under most contracts. It is time for architects to reconsider their approach to valuing their data assets.

Digital delivery is an asset-based economic opportunity – data is an exchangeable asset and is used to transfer value to the appropriate party when needed. Shift the economic model to reflect an asset-based approach. Properly defined and memorialized digital delivery mechanisms can be a basis for transforming the standard model from fee for service to one based on the value of data.

Focus on the Data

A data-focused fee model abandons time-based value (hourly billing rates) in favor of targeted value tied to the data required.

Examples include:

- Early in the project definition process, performance modeling can be used to assess the capacity of the property to meet the goals of a financial proforma. This is increasingly being done with generative design systems like TestFit[®] which significantly reduce the time for the assessment.
- During the early design phases, performance modeling can be used to project and optimize the design’s energy performance, functional efficiency, operational efficiency, and/or system integrations.
- Active cost modeling can be an ongoing and interactive process that reduces the delta between budget and projected cost at all stages.
- The 3D model can be used to model 4D data to analyze construction sequencing and schedules .
- Integration of major building infrastructural systems from manufacturer’s data can optimize both design and constructability issues virtually before they are problems in the field.
- Data assets can be conceived, designed and prototyped for direct digital-to-fabrication (aka model-to-machine) manufacturing.
- Lidar data scanned from the real-world can optimize building siting and provide high fidelity information to inform big design decisions and opportunities.
- Development of a digital-twin can foster an ongoing post-construction relationship with building owners.

This is not an exhaustive list, but it serves as a starting point for discussions with your clients. Each identified use of the data asset represents a value point where compensation can be discussed. Each can be defined as a deliverable; each can be measured against success metrics.

Managing Project Data in a Decentralized World

Files Everywhere, All At Once

Data sharing is core to digital delivery, but data silos are preventing the right data assets to be shared when they are needed. We are experiencing a new normal where files are increasing in volume and distributed with greater frequency to more and more project participants and their silos.

The response from technology companies serving the AECOO market has centered around one idea, the Common Data Environment (CDE). The CDE focuses on creating a single repository for all data on the project. Properly applied and managed, a CDE is a valid idea. Reality, however, makes it difficult to achieve.

The desire of every business, and individual, is to have a record of the information they believe represents the “truth”¹⁰. Thus, the vision of a single repository for ALL data assets presents an almost insurmountable problem – how do you prevent individuals and organizations from creating copies of the data assets and changing or corrupting the original information? How do you get everyone to play along and by the rules?

CDEs are available today through big software vendors, with products like Autodesk’s Construction Cloud (ACC, also BIM360) and Oracle’s Aconex, as examples.

CDEs are not perfect systems and data frequently moves independently in and out of these giant platforms, going untracked and without context or accountability.

Issues with Common Data Environments

The CDE concept also comes with the following challenges:

- The service requires an expensive annual subscription in perpetuity to function
- The value proposition requires ALL data assets to be consistently stored in a single repository
- They require all project participants to be included and follow exacting data protocols
- They are controlled by a singular host who determines access to the CDE platform at their whim
- Access to the data assets and records will be shuttered by the host eventually and the value is lost forever to an inaccessible archive



“Data tends to live where it is created - the ‘Common Data Environment’ will never be a perfect solution for digital project delivery”

The Next Normal = Data in Concert

Digital Project Delivery

Meeting the combined goals of a CDE and the requirements of digital contract deliverables requires an innovative approach to data management. Concert was developed for digital project delivery and to address all the needs, systems, structures, and requirements noted without the drawbacks of a CDE.

With Concert, exchanged data assets are recorded to a blockchain-based smart contract that records the original state of the data, right-of-reliance statements, assignment of ownership, recipients, and much more, permanently. Data exchanged with Concert is trusted data, and when coupled with the power of properly negotiated contract terms, it opens opportunities and possibilities for design firms globally. Concert is the tool to equip your firm with the processes you need to succeed in this new environment.

Concert Works With You Everywhere

We invite you to learn more about Concert and how we can not only meet your project data management needs but also open new opportunities to realize the value of your data assets.



Core Attributes

- **Secure** – Concert is built using public Blockchain services – we chose this medium because of the permanence, decentralization, and openness of its processes
- **Permanent** – Concert creates a record – a digital fingerprint of the data assets– that can never be removed, altered, or corrupted insuring that the true record is indisputable
- **Decentralized** – Data assets can be authenticated no matter where they are stored, focusing on authorization so users better understand ownership, versioning, permitted uses, and more

“CONCERT is the only solution that solves the data management problems of digital project delivery.”

- **Accessible** – Concert records are perpetually and immutably available to all project participants. No single entity can restrict access or make modifications. All data remains tied to the project for its full lifecycle
- **Economical** – Concert does not require annual maintenance or user fees. Records are established with a one-time fee per transaction
- **Transferable** – At the end of construction, the full record can be transferred to the building owner for their use and reference – say goodbye to as-builts and maintenance manuals

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Annotations

1. The Fourth Industrial Revolution, © 2016, Crown Business | ISBN 978-1524758868
2. In 2020, AIA spun off AIA Contract Documents (ACD) into a separate company to enable them to advance their software independent of AIA. The agreements themselves continue to undergo the same rigorous evaluation before being publicly released. We will refer both to the documents and the company interchangeably.
3. <https://www.aia.org/articles/146491-the-standard-of-care-should-i-care>
4. Instruments of Service are defined in the AIA A201-2007 – General Conditions of the Contract for Construction, article 1.1.7, and generally identify all mechanisms that will be used to communicate the design intent under the architects' Professional Services Agreement.
5. As exhibits to the master agreements (regardless of the form of the top-level agreement), the documents carry the full legal authority of the core agreement.
6. The companies referenced here represent only a small portion of the research and new technologies that are emerging in construction. Their inclusion here is not an endorsement.
7. The built environment is responsible for 40% of all GHGs in the US. This estimate is based on the emissions generated during the manufacturing of all the building materials, the transport of those materials to the construction site, the construction processes and techniques, and the lifetime operation of the building to support its inhabitants. Sources include fossil fuels, electricity generated by fossil fuels, embodied carbon emitted during manufacturing, and the destruction of natural carbon-capturing environments. Core to reducing this impact will be systems that track, monitor, and replace these current practices.
8. As examples, the work of Studio Gang, ZHA (Zaha Hadid Architects), BIG (Bjarke Ingalls Group), and MAD all derive more value from the ability of the architect to manipulate the digital tools in innovative ways, but also by extending the use of that data beyond the design phase.
9. Programs like TestFit work well with repetitive structures like multi-family housing, hotels, hospitals, parking structures, or speculative office buildings.
10. Truth is a heavily weighted word in today's communication climate. In this context, truth represents the digital artifacts or data that would stand in a court of law as official and authorized for the use intended. Therefore, creating certainty of a digital artifact's validity, authenticity, and ownership would be the primary determinants of its truth.



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