From Handshake to Hardware:
Questions & Pathways to Provide North American Offsite Construction with Uniform Law & Commerce

Detailing the roadmap for improved *standard forms of agreement* and eventually *statutory review*.

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Abstract

For over a century, the architecture, engineering, and construction (AEC) industry in the United States has operated under a legal structure defined by Common Law service agreements. These contracts, standardized by industry groups like the American Institute of Architects (AIA) and ConsensusDoc, assume that buildings are delivered through a series of services: drawing sets, site labor, field inspections, and negotiated scopes. **While this system was suited to the age of bespoke buildings and artisanal trades, it has become a structural obstacle to innovation in an era of modular assemblies, offsite fabrication, and industrialized building processes.**

This paper argues that, with the growth of offsite construction methodologies, a legal realignment from *projects* and towards *products* is overdue. Further, today's calcified AEC legal ecosystem is blocking solutions to address nationwide affordable housing issues. Appendix B grounds this argument in current ETO practice by reframing a contemporary GC counsels' modular risk guidance as an Engineer-to-Order (ETO) risk-control checklist. This side-by-side makes the ETO/offsite mismatch legible even to readers who have never used the ETO/CTO language.

The paper makes the case that the AEC industry's continued reliance on Common Law service contracts is preventing the emergence of a national **Configure-to-Order** (CTO)[1] marketplace for building component deliveries, which are the minimum production method in nearly every other manufacturing industry. In place of these legacy agreements, we propose a shift to a suite of contracts shaped by the Uniform Commercial Code (UCC), the legal framework that governs the sale of goods across the United States.

This paper invites consideration of how such standard contracts can be sped to use, and ultimately how the Uniform Commercial Code (UCC) might evolve to reflect a built environment increasingly produced through offsite manufacturing. As building components move through fabrication, assembly, transport, and installation, they traverse multiple legal regimes — first governed as goods under UCC Article 2, then as fixtures, and finally as real property. Each transition alters who owns the product, who bears its risk, and which remedies apply when something goes wrong.

The Center for Offsite Construction (CfOC) presents this paper not as a proposal for reform but as a structured set of questions for study. Its purpose is to help statutory reviewers identify where commercial and property law now overlap, conflict, or leave critical gaps. Drawing on ANSI-accredited consensus methods, the CfOC is positioned to gather balanced industry data, document recurring disputes, and supply the evidence base that future uniform-law work will require. This document therefore frames inquiry into how fairness, clarity, and efficiency can travel with a product from handshake to hardware.

[1] See "From ETO to CTO" on the CfOC's "Future of Design and Delivery" site. Also note This paper proposes new roles, tools, and project delivery methods. See the "Key Terms" section for clarification.

1. Legacy Foundations: Common Law in the AEC Industry

Construction law in the United States emerged as an extension of English Common Law traditions that emphasized services, real property, and fiduciary duties rather than the sale of goods. As a result, nearly every contract in the AEC industry today is written as a service agreement. These agreements are jurisdictionally bound (by state), adversarial in structure (GCs and designers are not teamed), and deeply embedded in professional education and industry norms.

Standard-form contracts developed by trade organizations such as the American Institute of Architects (AIA), Associated General Contractors (AGC), define relationships among owners, architects, engineers, and contractors as a *sequence* of professional services. These documents translate the principles of offer, acceptance, consideration, and performance into the project environment — allocating risk through drawings and specifications, then procurement and building, and finally field inspection and approvals. Standard of care and due diligence define negligent acts in context. Project course corrections are negotiated though change orders. Courts interpret disputes through precedent and expert testimony, leaning on the industry's "custom and practice" to fill gaps. The result is a resilient, precedent-driven system well suited to an artisanal economy.

These contract templates provide a vast ecosystem: series of owner–contractor agreements[2], others for owner–architect relationships[3], and a collection of supplementary forms addressing change orders, schedules of values, and payment applications. Taken together, they represent a complete *social technology*[4] for managing the design and construction of site-built projects.

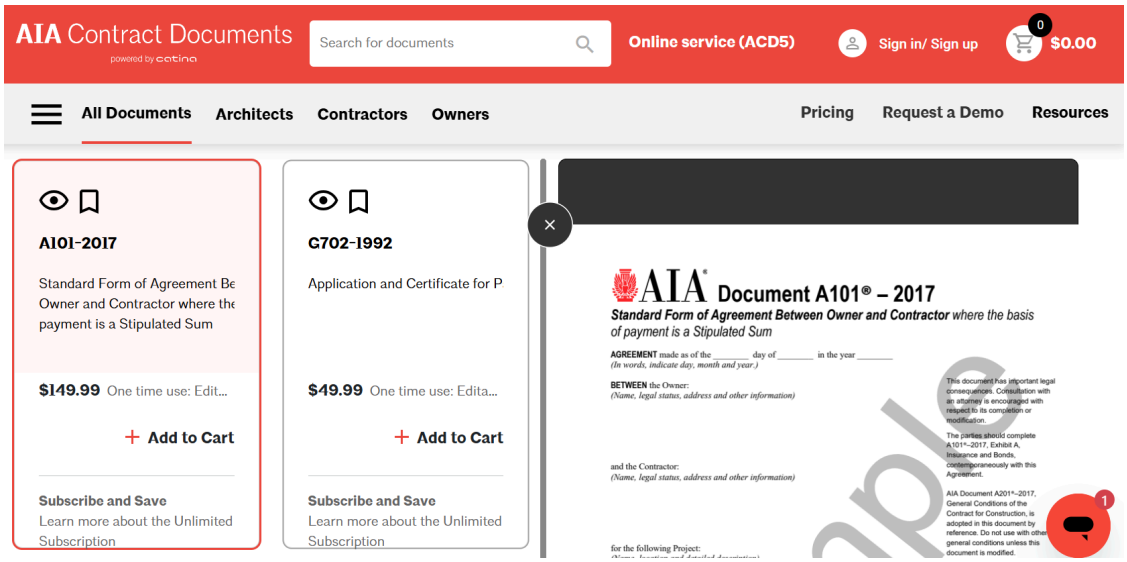

Figure 1: *A sample of the suite of the inter-dependent contract documents available for purchase from the AIA.*

That infrastructure rests on five assumptions—each sensible in a bespoke economy, but increasingly strained in an industrialized one:

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[2] https://learn.aiacontracts.com/articles/6150803-list-of-all-current-aia-contract-documents/#a_series
[3] https://learn.aiacontracts.com/articles/6150803-list-of-all-current-aia-contract-documents/#b_series
[4] Social technologies, in this context, are the ways people organize and coordinate their actions. They are essentially systems of organization, rules, and practices that enable individuals and groups to interact and work together effectively. See Techrachet's summary of "The Origin of Wealth." by Eric D Beinhocker.

- That the project documents and team will be bespoke, and unquestionably necessary.
- That the scope will be negotiated, not selected.
- That production will occur predominantly on the jobsite, not in a factory.
- That risk will be distributed through interpersonal relationships, not guarantees.
- That progress will be measured in services delivered, not goods shipped.

This framework evolved for a time when nearly every building was **Engineer-to-Order** (ETO): one-off, site-specific, and crafted largely by hand.

That ETO structure now constrains modernization. As the construction industry adopts industrialized methods (like factory-built assemblies, prefabricated pods, and digitally-coordinated production) the boundaries of Common Law contracting show strain. A single contemporary project can combine thousands of field services with hundreds of manufactured products, each carrying its own warranties, certification data, and serial tracking. Yet the prevailing contract forms treat them all as service outputs, governed by inspection and approval rather than sale and delivery.

From a legal standpoint, this is more than semantic. When a prefabricated unit crosses state lines, its status under the law also changes: before installation it behaves like a good, after installation it becomes real property. Common Law service contracts are ill-suited for built-in mechanisms to track that transition. Their reliance on professional sign-off (rather than defined transfer of title) creates uncertainty about who owns, insures, or bears risk for each product at each stage.

Historically, that uncertainty was manageable because most construction was local, bespoke, and sequential. Today's offsite supply chains are national, pre-coordinated, and concurrent. Increasingly larger products reflect the contributions of multiple trades (electrical, plumbing, etc.). They are also fabricated in one jurisdiction, warehoused in another, and installed in a third… they traverse multiple legal regimes without a homogenous legal framework to connect them.

Beneath these contracts lies an entire administrative stack that evolved to keep the ETO world coherent. The AIA's standard forms, the CSI MasterFormat, and long-standing union jurisdictions interlock to organize labor, risk, and payment before construction even begins. This ecosystem translates design intent into billable scope and enforceable duty; it functions as the invisible infrastructure of the Common-Law model. Its very completeness is what now makes adaptation so difficult — each part depends on the others, and innovation anywhere threatens stability everywhere.

Statutory review may therefore wish to consider how far this Common Law inheritance (rooted in the service model) can continue to govern an industry that is rapidly becoming product-based. The challenge is not to discard the principles of diligence and professional care that define the AEC professions, but to integrate them with commercial law's complementary emphasis on standardization, predictability, and transferable warranty. Understanding this legacy is the first step toward identifying where modern commerce in building components has outgrown the legal architecture that once supported it.

2. The Administrative Stack Behind ETO Construction

The Common Law, service-based model of construction is not held up by contracts alone. It is supported by a mature administrative stack that reaches from law into practice: standard agreements, specification systems, drawing conventions, payment mechanisms, and labor jurisdictions all tuned to an **Engineer-to-Order** (ETO) world. Long before a specific project exists, this infrastructure shapes how scope is divided, how risk is allocated, and how work is performed.

At its center sit the Standard Forms of Agreement (AIA Contract Docs, ConsensusDocs, and their peers). Documents such as the AIA's A101 (Owner–Contractor), A201 (General Conditions), and B101 (Owner–Architect) define how parties relate, who designs, who builds, how changes are priced, how disputes are resolved, and how payment flows. They presume that value is created as professional services and labor are performed over time, in the future. The Schedule of Values G703 operationalizes this logic: it allocates the contract sum across site-based activities, and progress payments are certified against "work in place," not goods in inventory. Risk, cash flow, and performance are all indexed to *service categories*.

Those contracts are anchored in an architect's project manual: the construction drawings and specifications, bidding instructions, etc.[5] that the AIA framework treats as the architect's "Instruments of Service." Geometry, details, and specifications become the legally enforceable description of services, called "the Work."[6] When a contractor applies for payment, or an owner asserts a defect, the question is whether the Work conform to these documents and their categories. The system assumes that what matters legally is conformance to bespoke design intent, not conformance to a catalogued product.

The CSI MasterFormat ties this legal and financial structure into shared technical categories.[7] Specifications are organized into divisions and sections;[8] the AIA Schedule of Values[9] commonly mirrors those divisions; bids and subcontracts are sliced along the same lines.[10] This alignment allows every dollar, drawing, and dispute to be traced back to a numbered category of "the Work." MasterFormat is not just a filing system — it is the categorical spine along which ETO risk, scope, and responsibility are pre-sorted before construction begins.

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[5] For more on the bespoke nature of the architect's Project Manual, see the AIA's *The Architecture Student's Handbook of Professional Practice*, 15th Edition (2017) page 390.

[6] AIA A201-2017 § 1.1.3 The Work : The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

[7] From CSI's CEO: "The textbook definition of specifications would say it's a document that outlines the materials, methods, and practices that are used in a construction project, but that leaves out a lot of critical nuance provided by the specifiers themselves." from CSI's blog article *CSI CEO Mark Dorsey … Shares How CSI's Rich Past Will Lead to Future Opportunities* (April 26, 2023)

[8] See CRM Service's guide to divisions.

[9] See more at *What is a Schedule of Values and Why is it Required on Construction Projects?* by Sara M. (Bour) Betancourth, March 2, 2018.

[10] See more at *Understanding the Schedule Of Values (SOV) and Payment Applications: An entry-level perspective.* by Gisel Marisol Hernandez, March 22, 2022.

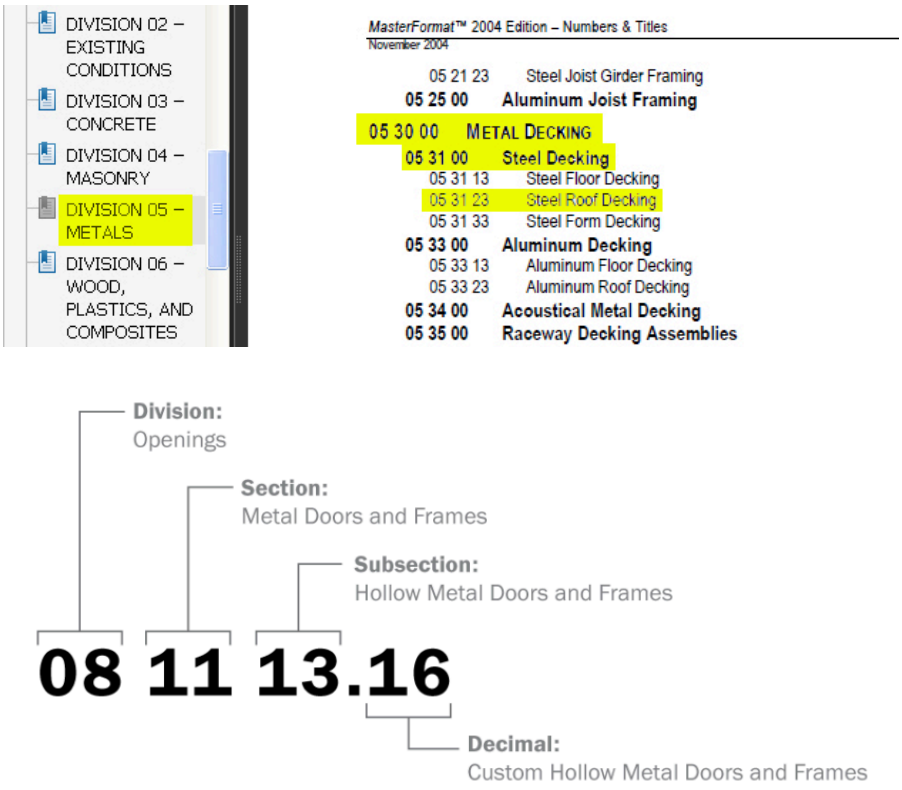


Figure 2a: *A guide to understanding MasterFormat's three-part number (sometimes four-parts) for classifying construction products into categories, composed by ArchToolbox.*

Organized in parallel, is the layer of union and trade jurisdiction, which organizes who may perform which scopes of work. While MasterFormat classifies by *system*, unions classify by corresponding *trade*. General contractors and construction managers reconcile these two maps using the AIA-CSI contract hierarchy and dispute mechanisms. In practice, this combination of contracts, specifications, and labor rules functions as a *self-reinforcing operating system*: it pre-distributes work, pre-defines boundaries, and pre-negotiates many of the conflicts that might otherwise arise on every job.

Within this ETO structure, the boundaries of "the Work" are not neutral; they are contested terrain. Each CSI division, specification section, and pay-application line item represents both economic opportunity and jurisdictional claim. When new technologies or assemblies appear (such as prefabricated bathroom pods) they threaten to redraw those lines. *Should the pod be classified under Division 22 (Plumbing), Division 09 (Finishes), or treated as a specialty under Division 13 (Special Construction) or Division 11 (Equipment)?* Each choice determines which trade or union gains authority, man-hours, and dues. Competing locals may argue that their members should install the pod because it contains their traditional work — carpenters for framing, plumbers for piping, electricians for wiring, tile setters for finishes. In an ETO system, where labor jurisdiction and payment are linked to divisions of "the Work," expanding one's scope to capture these new assemblies becomes a defensive act of economic survival. The system rewards territorial control, not integration, making innovation appear as encroachment rather than progress.

In the same way, offsite products are inspected not as standardized goods but as bespoke assemblies; they are evaluated case-by-case by each jurisdiction having authority (JHA). Identical bathroom pods can therefore face entirely different inspection criteria, documentation requirements, and approval pathways depending on where they land, reinforcing the same territorial fragmentation that slows adoption and prevents true productization.

These recurring categorical and jurisdictional contests are evidence of a highly tuned, self-reinforcing system that keeps the ETO ecosystem coherent, even as it resists change.

Taken together, these elements form a coherent ETO administrative ecosystem. **The ecosystem runs ahead of individual projects**, standardizing expectations, workflows, and relationships, so that bespoke buildings can still be delivered through familiar patterns of documents and roles. Crucially, it is all **quasi-optimized for a world in which scope is defined as services performed *on site*** — not as products manufactured in advance.

What offsite construction currently lacks is an equivalent ecosystem for a **Configure-to-Order** (CTO) world: a parallel stack of contracts, classifications, interfaces, and roles designed for repeatable products, interstate movement, and UCC-style treatment of goods. The project-by-project workarounds now used for modular deliveries are not yet that system. The work described in this paper (hybrid contracts, legal matelines, standardized roles, and data-driven documentation) is aimed at seeding that missing stack so that statutory review, when it comes, can see a complete and testable alternative, not just isolated experiments.

3. From Engineer-to-Order to Configure-to-Order: The Structural Shift Underway

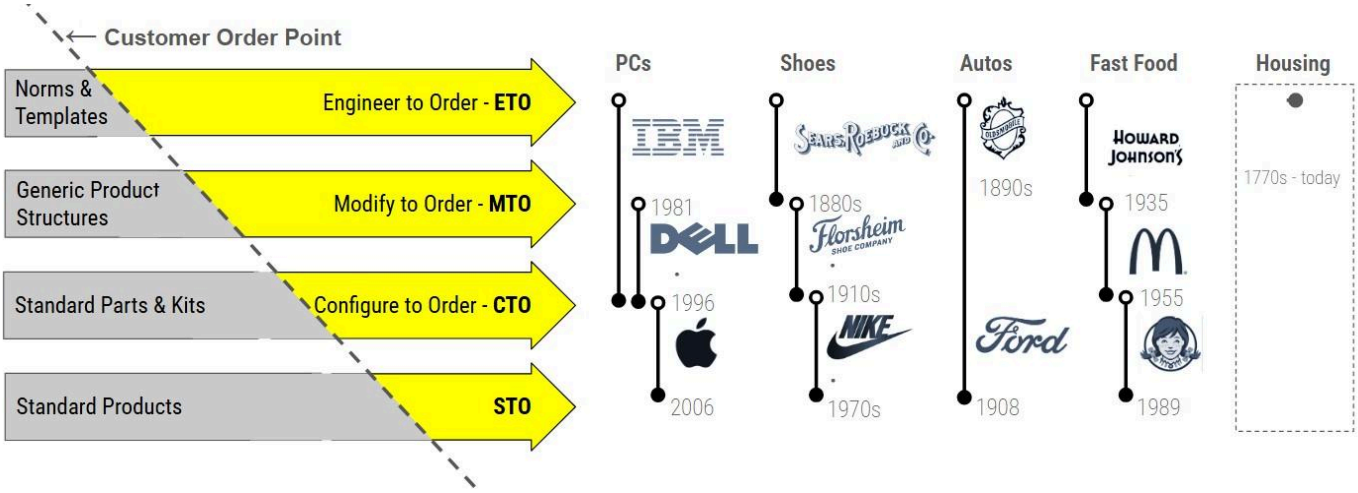


Figure 3a. From Engineer-to-Order (ETO) to Configure-to-Order (CTO). *This diagram illustrates the structural transformation at the core of the CfOC's Vision: moving from bespoke, one-off project delivery to a platform-based ecosystem of standardized, interoperable components. In ETO, clients are maximally at financial risk, because each building is engineered from scratch, requiring sequential workflows and ad-hoc supply chains. In CTO, such risk is dramatically reduced, since compositions are made within a pre-engineered product platform, enabling parallel production, and predictable performance. Image adjusted from Jensen, Patrik.* Configuration of Platform Architectures in Construction*. Doctoral Thesis (2014).*

A mature **Configure-to-Order (CTO)** marketplace operates on a fundamentally different logic than today's **Engineer-to-Order (ETO)** environment: it is built around pre-designed, pre-certified products that can be specified from catalogs and installed without professional oversight. Hallmarks of CTO include.

- Manufacturers placing complete, code-compliant sub-products into larger compositions with defined scopes, tolerances, and warranty terms, *instead of relying on bespoke drawings authored by licensed design professionals for every assembly,*
- Individual products sold with credentials already attached, *instead of depending on code inspectors to perform quality-control review services.*
- Individual products designed to connect instantly through shared dimensional interfaces so that components from different firms interoperate, *instead of requiring a collection of project-specific designers to administer all scales of coordination with planning and negotiation.*
- Customers (key: not clients) configuring their larger project solutions from catalogs, *instead of beginning with a unique design, and inventing a bespoke project delivery plan from scratch*.

The CTO shift turns construction from a one-off engineering-and-logistics exercise into a repeatable act of configuration, whose interoperable products are the precondition for scale, reliability, and market liquidity.

Every other mature industrial sector has already solved these interoperability problems through external certifications and standardized interfaces, demonstrating the path construction must follow:

- Electronic components circulate globally because products carry UL listings, ETL marks, CE conformity declarations, or CSA certifications, which guarantee safety and performance without requiring each project team to re-engineer or re-inspect them.

- Digital devices interoperate because of universal interfaces such as USB-C, HDMI, Bluetooth, and Wi-Fi, all of which allow components from competing manufacturers to plug into shared ecosystems instantly.
- Defense and transportation sectors depend on standard interfaces (NATO STANAG mountings, ISO shipping container geometries, SAE automotive connectors) that allow equipment, containers, and vehicles to intermix seamlessly.

These precedents show that once a market agrees on certifications and interfaces, innovation accelerates: firms invest in better products rather than reinventing basic compatibility on every project. Offsite construction remains an outlier only because these shared rules do not yet exist.

Here are examples of CTO-enabled workflows applied to distinctive offsite construction-like circumstances:

- A homeowner installing her unique IKEA™ kitchen, after ordering from an online configurator of pre-designed elements, and assembling the cabinets from flat-packed boxes.
- A child assembling his unique LEGO™ playscape, after ordering several pre-designed sets, and assembling a larger diorama of individually-sold box sets on a stud-scape plate.

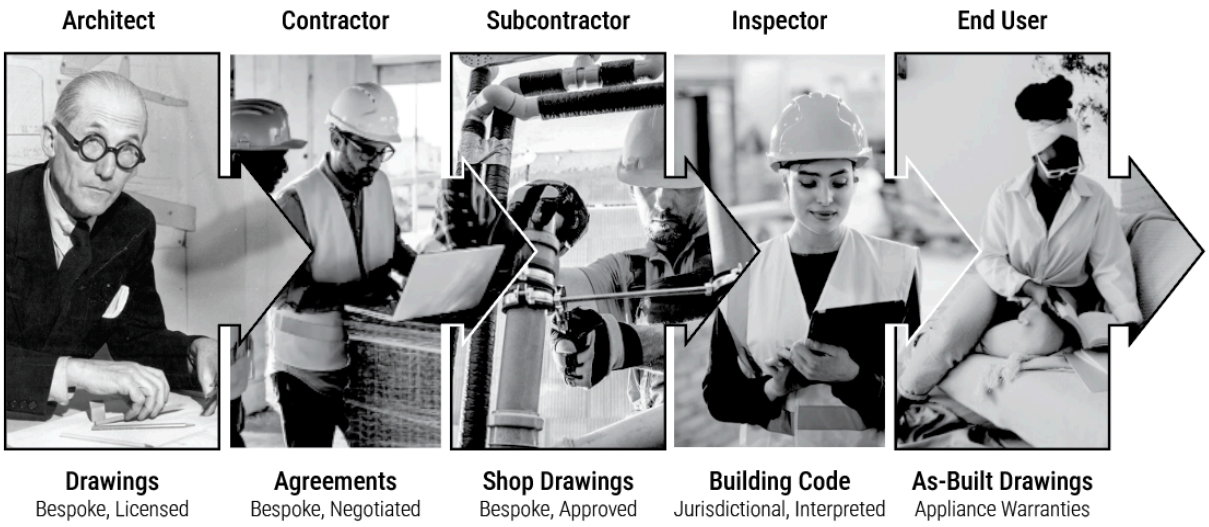
Figure 3b: Installing IKEA kitchen cabinets on a wall-mounted steel cleat.
Screen-shot from IKEA METOD Kitchen Installation 3/7 - Installing the cabinets.

Figure 3c: Child installing LEGO sets on a large LEGO-stud slab.
Screen-shot from blog "Life with My Little," post titled "How to Save and Protect Your LEGO Building Instructions".

The legal and economic implications of this shift are profound.

- Under an ETO regime, the central legal question is, *"How well is the service performed?"* — whether the design met the standard of care, or the workmanship met specifications.
- Under a CTO regime, the central legal question becomes, *"How well does the product perform?"* — whether it conforms to the agreed description, warranty, or certification.

ETO Roles for the AEC industry



CTO Roles for the AEC industry

Figure 3d: The roles in a CTO workflow are reduced, less complex, and easy to adopt.
Reliance on pre-engineered products that work interoperably with industry-standard interfaces allow for simplicity and speed.

The US offsite construction space is already undergoing a disorganized shift to CTO tools and methods.

- Private firms are making proprietary interfaces, like the Z-Block connector (Z-modular) and the Cloud Connect (Cloud Apartments).
- The Center for Offsite Construction is working to organize open-source industry-standard interfaces[11] as the only ANSI Accredited Standards Developer dedicated to the North American offsite industry[12].
- The International Code Council (ICC) has developed *Appendix N* to provide individual jurisdictions with a means of incorporating guidelines for replicable buildings into their building code adoption process. Individual state adoption has been uneven and slow.[13]
- The ICC and Modular Building Institute (MBI) have formed the ICC/MBI-1200 to provide standard requirements for planning, designing, fabrication, transportation, and assembly of off-site construction, and ICC/MBI-1205 to provide requirements for inspection, approval, and compliance practices of off-site construction. Both require individual state adoption, which has been uneven.[14]

[11] See "Modular interface Standards" here and here.
[12] See "Vision for Offsite Construction Standardization" in the CfOC's .edu site.
[13] See this adoption table, compiled by MiTek.
[14] ibid.

Moving from the ETO to CTO requires more than these individual steps, as a fundamental reorganization of how vast portions of the Architecture, Engineering, and Construction (AEC) industry conceives, designs, contracts, and delivers the built environment.[15]

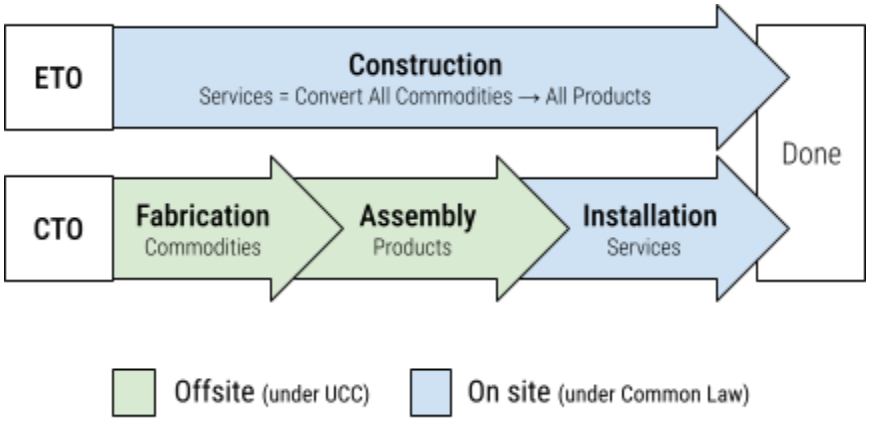


Diagram 3a: Promotion of commodities into housing Products, with the on site and offsite labor scope of ETO vs CTO.
Note that all Services are trade-based in Construction, delivered on-site at a maximum expense.
In contrast, Products convert Services into an MSRP, offsite.

In commercial terms, this move marks a legal shift from contract-for-service (Common Law) to contract-for-goods (UCC).

In other industries, CTO frameworks have been supported by uniform commercial law and digital interoperability standards. In automotive, aerospace, and electronics manufacturing, for example, buyers configure products within predefined technical limits, and sellers guarantee conformity through certification, not interpretation. Contract law in those fields evolved accordingly, supported by data standards that enable transparency and verification.

[15] For a complete map, visit the Future of Design & Delivery's *Modes of Delivery* section.

Why the ETO-to-CTO shift is Urgent: Housing, Sustainability, and Labor

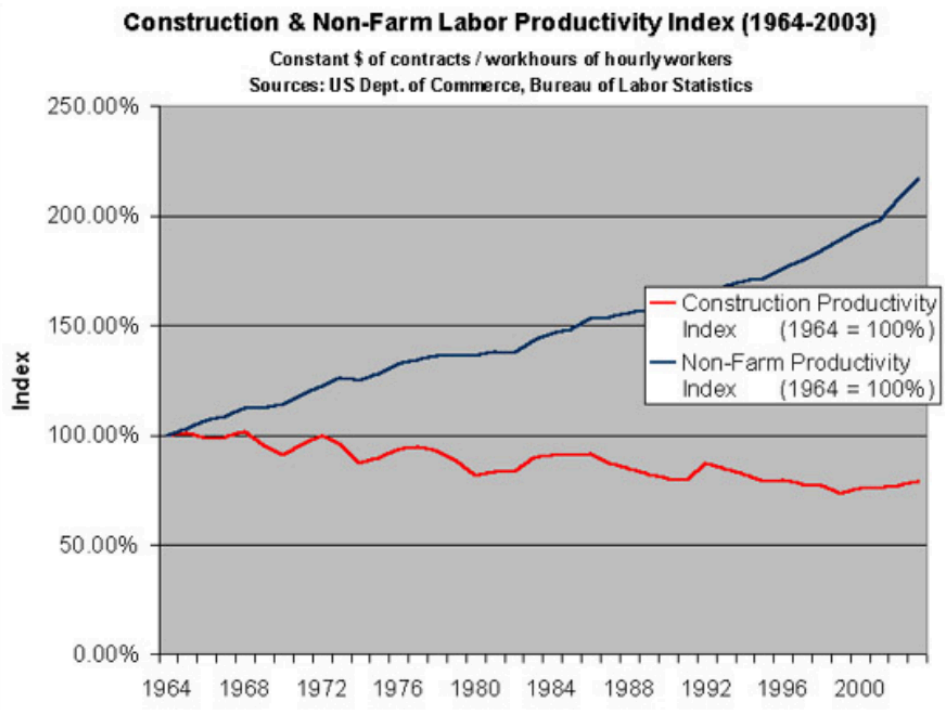


Figure 3e: Teicholz Construction Productivity Index Graph*. (Paul Teicholz 2013)*
Indexes of labor productivity from construction and non-farm industries, 1964-2004, indicates no productivity gain in the construction industry.

The economic consequence of remaining in an ETO regime is visible in national productivity data. The Teicholz Productivity Index (above)[16] shows that while productivity in most non-farm industries has more than doubled since the 1960s, construction productivity has remained flat for half a century — a signature symptom of the ETO model's limits. In contrast, industries that adopted CTO production (on a pathway of further advancement), converted design-and-delivery repetition into exponential efficiency gains.

These are gains that construction has yet to realize, and that stand at the heart of today's nationwide affordable housing challenges.[17] It is why manufactured homes are still found to be much lower-cost, averaging $72 per ft^2, or just over half the site-built home average of $144 per ft^2.[18]

Below is an expanded list of benefits attainable, when converting design repetition into exponential product-based efficiency gains — precisely the kind of repeatable reliability that legal standardization is meant to protect.

1. **Productivity Gains (Economic Competitiveness)** The U.S. construction sector has lagged behind other industries in productivity growth for decades. CTO aligns construction with the manufacturing

[16] Teicholz, P. M., Goodrum, P., & Haas, C. (2001). *U.S. Construction Labor Productivity Trends, 1970-1998*. Journal of Construction Engineering and Management, 127(5), 427-429. DOI: 10.1061/(ASCE)0733-9364(2001)127:5(427)
[17] For more, see Alexandrov, A., & Goodman, L. (2024, January). *Place the Blame Where It Belongs: Lack of Housing Supply Is Largely Responsible for High Home Prices and Rents*. Washington, DC: Urban Institute, Housing Finance Policy Center. https://www.urban.org
[18] *Comparison of the Costs of Manufactured and Site-Built Housing*, Joint Center for Housing Studies Harvard University (2023), pages 4-5.

playbook that drove productivity gains in automotive, aerospace, and electronics: repeatable processes, precision tooling, and supply chain integration.

2. **Environmental Performance (Sustainability)** Industrialized production allows for tighter material control, less waste, and more efficient energy usage. Standardized products can be optimized for lifecycle performance (from embodied carbon to operational efficiency) in ways that bespoke ETO projects rarely achieve.

3. **Risk Reduction (Reliability and Warranty Clarity)** Standardization reduces the number of unique failure modes. Components are tested in controlled environments, defects are caught before deployment, and maintenance regimes can be standardized across a fleet of buildings.

4. **Scalability (Housing Supply Impact)** CTO enables the parallelization of design and production. While site work proceeds, modules and assemblies are fabricated offsite, collapsing overall delivery schedules. This parallel workflow is almost impossible in an ETO environment.

Having traced the operational and economic rationale for CTO production, the next question is legal: can the Uniform Commercial Code — long the foundation for industrial commerce — also provide a coherent framework for this new mode of building delivery?

4. A Better Fit: The Uniform Commercial Code (UCC)

The **Uniform Commercial Code (UCC)** provides the legal architecture for commerce in goods across the United States[19]. Adopted in every state, it standardizes how products are bought, sold, warranted, and delivered.[20] The UCC was written to standardize[21] an industrial economy — one in which goods are mass-produced, transactions are repeatable, and fairness depends on predictability rather than professional discretion. In that sense, it already reflects many of the economic conditions now emerging within offsite construction.

Where Common Law treats each construction contract as unique, the UCC presumes repetition. Its purpose is to ensure that commercial relationships can continue across transactions, jurisdictions, and product types without renegotiating basic terms.[22] For industries that rely on distributed manufacturing, this uniformity has been transformative: it allows suppliers, distributors, and customers to operate under a shared vocabulary of rights and remedies. If construction is now evolving toward **Configure-to-Order** (CTO) production (where standardized components are fabricated, shipped, and integrated nationwide) then its legal framework must eventually speak that same language of commerce.

Article 2 of the UCC governs the *sale of goods*. It supplies "gap-fillers" for price, delivery, and risk of loss when contracts are silent, and it implies warranties of merchantability and fitness for purpose unless disclaimed. It codifies a buyer's *Right to Reject*, a seller's *Right to Cure*, and standardized *remedies* when performance fails. It also defines when *title and risk transfer*,[23] how acceptance occurs, and how written notice must be given. These provisions were designed to make trade efficient in complex supply chains, and they align intuitively with how offsite manufacturers already operate.

The ETO/CTO and Common Law/UCC difference matters most where products cross legal thresholds. Today, bathroom pods are designed and delivered as a service (see Figure 5a)... but… that bathroom pod, for example, may soon begin its life as a good, become a fixture once attached, and ultimately merge into real property. Each stage invokes a different body of law: UCC for goods, Common Law for services, and real-property law for improvements. The UCC itself does not yet specify how to manage that transition, but its principles of clarity, documentation, and uniform definitions could provide a starting point for statutory review.

Statutory partners might eventually ask: can the UCC's existing structure be extended (or interpreted) to recognize the hybrid nature of offsite construction? Could contract language or model forms be developed that allow a product to "carry" its warranties, certifications, and risk allocation from factory to site, without

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[19] See Uniform Law Commission.
[20] The UCC is a model code, not federal law. Each state chooses how to adopt it. Legislatures may modify, delay, or reject revisions to fit local statutes, and courts in different states interpret provisions differently. As a result, the UCC is broadly uniform but not *identical* across all 50 states.
[21] Although each state adopts and may amend the UCC independently, most provisions remain substantially consistent nationwide, preserving the code's function as a broadly uniform framework.
[22] See Berkley Law "The Common Law And Civil Law Traditions"
[23] For example, title transfer in contemporary offsite methods before delivery. This raises insurance/bonding concerns, as well as a lender's need to securitize its collateral prior to releasing funds.

legal ambiguity?[24] These are not questions of advocacy but of fit. The UCC was designed to govern modern trade; offsite construction is, finally, modern trade by another name.

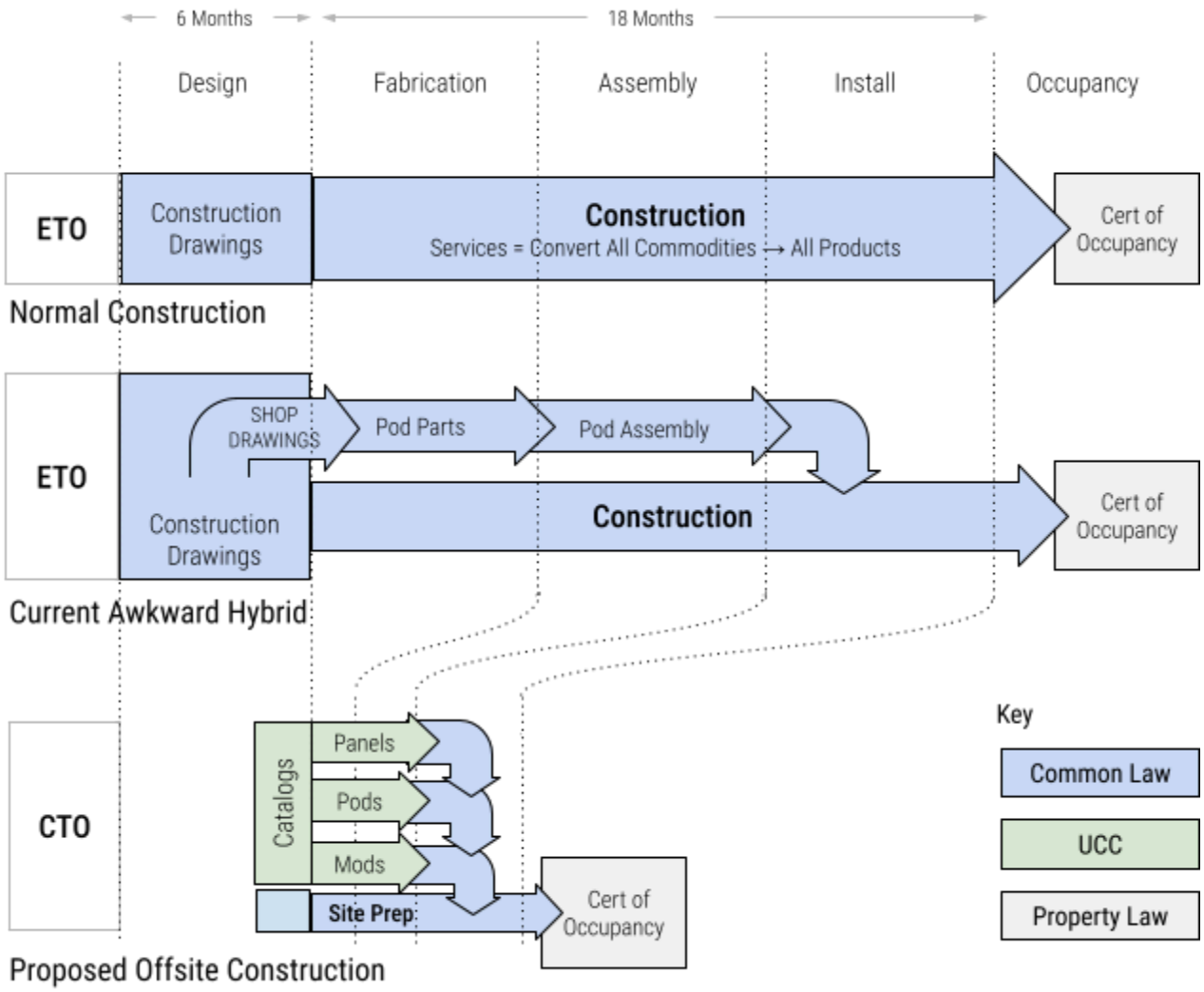

Figure 4a: Proposed Legal Scope of ETO vs CTO.
Services are bespoke, delivered on-site, at a maximum expense. In contrast, CTP Products convert Services into an MSRP, offsite.

Precedent: Loblolly House and the Early Architectural Critique of CSI MasterFormat

The structural mismatch between Common Law contracting and offsite production was identified long before offsite construction reached today's scale. In *Loblolly House*, Stephen Kieran and James Timberlake made a pointed architectural critique of the CSI's MasterFormat system, arguing that its fifty-plus divisions trap the building industry in an era of craft-based, part-by-part assembly. Their project proposed reorganizing buildings not as thousands of specification-driven elements but as a small number of interoperable, productized assemblies: its an approach they described as the "elements of a new

[24] Reference the title transfer question above, this transfer is of particular interest in contemporary offsite contract negotiation. Contemporary lenders continue to show hesitancy in financing module projects given the challenge in when best to take securitized title of the bespoke product (across various suppliers/subcontractors) vs. traditionally when it is installed on site and becomes real property. Case law is still limited and inconsistent on the goods vs. services debate (and when it is deemed part of the real property - delivered to site, stacked, mateline connection, sign-offs, commissioning - such ambiguity leads to lender uncertainty and adds to the risk profile.

architecture."[25] Loblolly's "scaffold–cartridge–block–floor/ceiling–wall" framework (Figure 4b) collapses the roughly 40,000 parts of the typical American house into five coordinated assemblies designed for offsite fabrication, digital coordination, and rapid on-site integration.[26]

Kieran and Timberlake's critique illustrates the legal argument of this chapter. Their attempt to replace CSI divisions with integrated building "cartridges" confronted the same structural constraints that shape today's offsite sector: contracts, specifications, and inspection regimes built to administer services, not goods. The Loblolly system prefigured many features of a CTO environment (parametric modeling, prefabricated assemblies, distributed production, and upstream quality assurance) but lacked the commercial and contractual infrastructure that the UCC provides in every other product-based industry.

Similar critiques have appeared in construction economics literature, which identifies specification-division fragmentation as a root cause of productivity stagnation and a key barrier to integrated, manufacturing-style delivery.[27]

The Loblolly House thus stands as early evidence that technological progress alone cannot overcome the legal and administrative machinery of the Common Law ETO system. Only with a supporting legal and commercial framework can such product-based approaches scale.

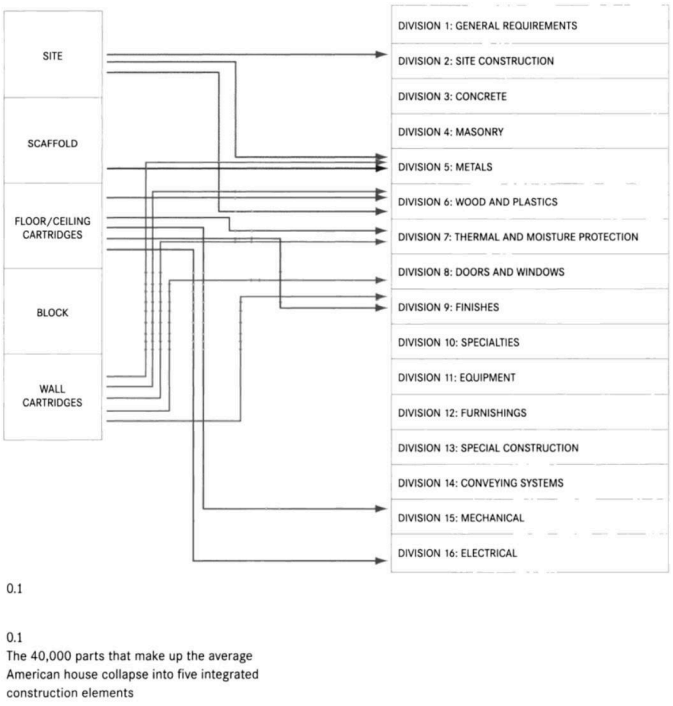

Figure 4b: Loblolly House component hierarchy.
Kieran and Timberlake's reorganization of the American house into five integrated assemblies collapses CSI MasterFormat's divisions into a coordinated, offsite-ready system.

[25] Stephen Kieran & James Timberlake, *Loblolly House: Elements of a New Architecture* (New York: Princeton Architectural Press, 2008), 18–24.
[26] Ibid., 20–21.
[27] See Jones, K., Mosca, L., Whyte, J., Davies, A., & Glass, J. (2021). *Addressing specialization and fragmentation: product platform development in construction consultancy firms*. Construction Management and Economics, 40(11–12), 918–933.

Example Conflicts, and Their Remedies, in ETO vs CTO (with UCC)

Situation 01 - Leaky Window Sills (Envelope)

A new school opens, and students begin attending class. During the first rainstorm, water starts leaking in under the leeward window sills (involving >75 individual window installations).

Under ETO

The district's insurance policy is engaged. The insurance company investigates to determine if one of three conditions:

- The architect's wall assembly is correctly detailed according to the window manufacturer's specification.
- The general contractor built the wall assembly as designed by the architect.
- The window manufacturer delivered faulty windows.

Both the architect's professional liability insurance, and the GC's bond are engaged. All three firms' insurance companies spring to action. Several suits and counter-suits are filed. After years of investigation, depositions, and litigation, fault is determined and replacement costs are levied.

Under CTO (with UCC)

The district's insurance policy is engaged. The insurance company contacts the wall panel manufacturer. The panel manufacturer visits, determines no fault from installation, and hires handymen to re-seal the windows on site.

Situation 02 - Floor Tile Cracking in Corridors (Finishes)

A new office building opens. Hairline cracks spread through common corridors within months.

Under ETO

The owner's insurance policy is engaged. Experts debate substrate prep, adhesive selection, and curing conditions. After months of investigation, depositions, and arbitration, fault is determined and replacement costs are levied.

Under CTO (with UCC)

The owner contacts the prefabricated flooring panel manufacturer. Since the panels arrive pre-bonded and warranted for flexural performance, responsibility is isolated to a single supplier. The panel manufacturer hires a local flooring contractor to remedy the problem.

Situation 03 - HVAC System Noise and Vibration (Mechanical)

A new apartment building opens. The first tenants move in, and complain of loud humming from rooftop air-handling units.

Under ETO

The owner's insurance policy is engaged. The insurance company investigates to determine if one of four conditions:

- The architect's dunnage assembly is correctly detailed according to the air-handling unit manufacturer's specification.
- The MEP engineer has sized the correct air-handling unit for this application.
- The general contractor has mounted and installed the air-handling unit according to designer drawings and manufacturer's instructions.
- The air-handing unit's manufacturer delivered faulty machinery.

All four of the firms' liability insurance are engaged. A constellation of insurance companies spring to action. Suits and counter-suits are filed. After years of investigation, depositions, and litigation, fault is determined and replacement costs are levied.

Under CTO (with UCC)

Vibration-isolated mechanical pods carry certified performance data; the manufacturer's defects are addressed via replacement (or adjustment) under warranty.

Situation 04 - Electrical Outages in a New Home (Systems Integration)

A family moves into their newly-constructed house. Most lights flicker after extended use. Intermittent power loss traced to miswired junction boxes.

Under ETO

The homeowner's insurance policy is engaged. Building contracts trigger blame between electrician, GC, and design team. After weeks of investigation, accusations, and finally the threat of a lawsuit, the GC re-wires all the light fixtures in fear of extended legal fees and possible litigation.

Under CTO (with UCC)

The modular builder's electrical raceways were installed as certified assemblies. The modular supplier replaces defective segments by swapping them under product warranty.

Situation 05 - Fire-Rating Compliance Challenge (Code / Certification)

With federal funds, a daycare facility is attached to an existing elementary school. During late inspections, authorities question whether corridor wall assemblies meet required 2-hour rating.

Under ETO

Construction was forced to advance to honor funding requirements. Documentation gaps force a scramble for after-the-fact testing and affidavits. The resulting litigation fees force the General Contractor to declare bankruptcy before a resolution is determined. The daycare facility is forced to fund the application of redundant wallboards at their own cost.

Under CTO (with UCC)

UL-listed wall modules already carry their certification, and any non-conformance is treated as a product return, not a design dispute.

Legal Consequence of the CTO Shift

The difference lies in the nature of proof. Under Common Law, the question is "*Who erred?*" Under the UCC, it is "*Does the product conform?*" In the former, conflict resolution is interpretive, mediated through professional opinion and precedent. In the latter, it is procedural, governed by predefined warranties and objective standards. Responsibility attaches to a product's specification, not to a person's judgment. The process transforms disputes from an adversarial reconstruction into a commercial transaction.

Broader Implication

This shift does not eliminate conflict, it industrializes it. In a UCC-based CTO marketplace, defects trigger logistics, not lawsuits. The same principles that govern warranty claims in other manufactured sectors apply to modular products, pods, wall panels, and integrated building components. The result is a legal framework that privileges repair over blame, continuity over paralysis, and commerce over case law; a necessary foundation for construction to function as a scalable, product-driven industry.

5. The Legal Mismatch Blocking Offsite Construction Innovation

Despite the increasingly clear fit between offsite manufacturing and the Uniform Commercial Code (UCC), most building projects remain dominated by Common Law service agreements that predate industrialized production. The result is a persistent legal mismatch: products are fabricated and inspected like goods, yet contracted, insured, and litigated like services (without warranties that protect consumers). The clearest proof is not academic, but practical. Elite offsite project teams now rely on repeatable 'compensating controls' to make offsite scopes behave inside legacy service-based agreements.

This structural confusion discourages investment, complicates warranty enforcement, and prevents the emergence of a transparent **Configure-to-Order** (CTO) marketplace for building components.

At the root of this mismatch is the *contract form itself***.** Standard AIA Contracts (or ConsensusDocs) agreements treat every participant as a service provider, not a merchant. They allocate risk through inspection and approval rather than shipment and acceptance. Title passes implicitly — through progress payments and substantial-completion certificates — rather than explicitly through delivery terms. When disputes arise, courts reconstruct intent from correspondence and drawings, not from bills of sale or conformity records. In this world, a pod or panel may carry a manufacturer's label, but legally it is still a "service rendered," not a "good delivered."

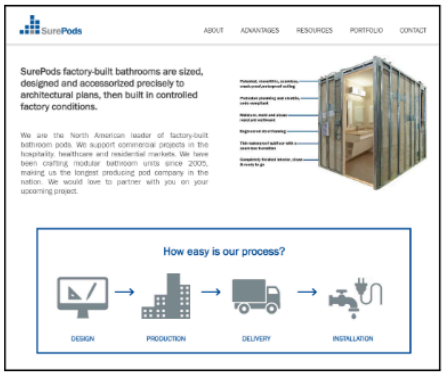

FIG 01: Screenshot of **SurePods** (Orlando, FL) website landing page. (www.surepods.com)

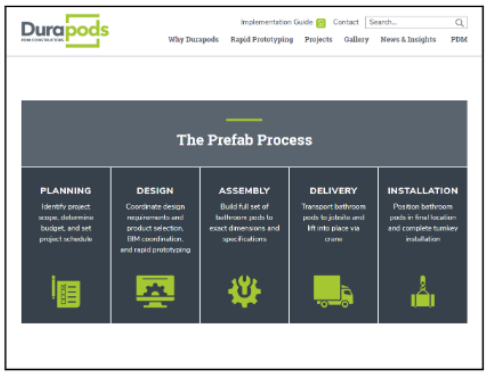

FIG 02: Screenshot of **DuraPods** (North Wales, PA) website landing page. (wwwdurapods.com)

FIG 03: **BLOX** (Bessemer, AL) website landing page. (www.bloxbuilt.com)

FIG 04: **B&T** (Rapid City, SD) website landing page. (www.bandtmfg.com)

Figure 5a: Screen-captures of the 4 major US bath pod manufacturers' websites… usually their "Our Process" (-style) page. from the CfOC whitepaper "US Offsite Connectivity Standards". Note that each manufacturer starts a new relationship with a Service step – called "Design" on their site. This signals an ETO paradigm, designing a new product per production agreement.

Practitioner Evidence: The ETO Compensating Controls Required to Deliver Offsite Work

In a recent American College of Construction Lawyer's webinar,[28] a construction executive from a top-tier national contractor presented a practical checklist for managing risk on modular-enabled projects under today's standard construction agreements.[29] The checklist is excellent. Its central lesson is not that offsite methods are inherently fragile, but that the ETO legal stack forces teams to invent special controls to keep product-like scopes from behaving like bespoke services.

These controls function like braces on an already-stressed system. They are required precisely because most offsite scopes are still contracted as professional performance under Common Law, even when they are fabricated, transported, staged, installed, and warrantied like goods.

The pattern is consistent across legal and production practitioners: ETO must manage modular risk through custom contractual discipline; CTO marketplaces prevent much of the same risk through product definition, constrained configuration, repeatable interfaces, and installation manuals that define acceptance and transfer of value.

The practitioner checklist below is therefore best understood as a set of ETO compensating controls. It functions as a list of "pain points" that appear whenever offsite methods are executed inside an Engineer-to-Order legal environment.

Appendix E reinforces this diagnosis from a different vantage point. In the Advancing PreFab Day 2 plenary panel, practitioners from across the offsite value chain (developer/manufacturer, general contractor, and supplier) offered thoughtful, experience-earned guidance on scope definition, coordination discipline, and design freeze timing. The tone is aspirational, with teams clearly wanting to carry learning forward and reduce friction on the next job. But the content is also revealing: the advice remains largely "project-by-project" and procedural,[30] because the market still lacks the product definitions, shared interfaces, and administrative conventions that would make those practices repeatable without re-negotiation.

Read alongside the ACCL checklist, the panel discussion becomes a second, independent example of the same phenomenon: ETO must manage modular risk through custom coordination and bespoke controls, while a CTO marketplace prevents much of that same risk through catalog-defined scope, constrained configuration, pre-resolved interfaces, and installation logic that makes acceptance and transfer of value objective. In this sense, the panel is equal parts encouraging and cautionary: it shows an industry trying to behave like a product ecosystem, while still being forced—by the legacy contract stack—to operate as if

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[28] "Building Differently, Contracting Differently: Managing the Risk of Modular Construction" - Presented January 28, 2026 by Kristin E. Protas (Deputy General Counsel, Gilbane Building Company) and Carl J. Circo (Ben J. Altheimer Professor of Legal Advocacy, University of Arkansas School of Law)

[29] Links to video and transcript provided in Appendix B.

[30] This is a classic project-by-project quote from an ETO practitioner (Appendix D) [14:45] Mika Reckers: I mean, lessons learned. Who really wants to talk about the mistakes that they made, right? And so we have to get real with ourselves… so that if we want to improve a lot of these prefab systems are new. They're newer. We don't want to say, *"Oh, let's go back to the old way because that was easier and we won't make those mistakes."* Well, the old way had mistakes too.
We have always had lessons learned as an industry, so we need to be a little bit more vulnerable with each other and share what happened on some of these projects. That we can continue to improve our processes. And roll those into future projects, future designs processes. To understand what trade sequencing is required to make something successful and not be afraid to tell an owner, *"Hey, this is what happened on the last job and this is why, but we're gonna do everything we can to ensure that that's not gonna happen again."*

every integration is a one-off. That gap is precisely what the compensating-controls list below is documenting.

ETO Compensating Controls, as taught by practitioners

1. **Underwrite the manufacturer early** (factory visits, backlog, financial health) because the project becomes dependent on the supplier's continuity.

2. **Treat manufacturer default as catastrophic** because partial work-in-process is difficult to transfer or complete with a replacement firm.

3. **Force a design freeze date** because fabrication cannot proceed under continual design evolution.

4. **Replace conventional security assumptions** (retainage, bondability, SDI eligibility) with milestone-based payments and alternative instruments.

5. **Map risk of loss through transport and storage** (factory → transit → yard → set) because the normal "work in place" logic of construction contracts does not apply cleanly to mobile goods.

6. **Control shipping by site readiness** because staging and just-in-time delivery become critical constraints, not conveniences.

7. **Consolidate installation responsibility ("one source of truth")** because splitting manufacture/transport/installation across parties creates ambiguous handoffs for acceptance, warranty activation, and remedies.

The significance of this list is that each item corresponds to a structural seam in today's ETO contract stack—seams that a CTO marketplace would treat as native features of product commerce.

ETO compensating control	→	CTO / UCC-native structure
Design freeze date	→	Catalog-defined options + configuration constraints + pre-resolved interfaces (preventing drift before it becomes dispute)
Underwriting the manufacturer	→	Repeatable qualification regimes + standardized product documentation (so continuity is less hostage to a single firm)
Catastrophic default risk	→	Platform-based interoperability + clearer substitution pathways (where possible) + commercial remedies that preserve continuity
Milestone prepayment + weak retainage leverage	→	Product-oriented payment triggers tied to identified goods, documentation, and acceptance states

Risk of loss across transit/storage	→	Explicit title/risk transfer points that track the product from factory to installation, rather than relying on "work in place" logic
Shipping governed by readiness	→	Installation manual prerequisites (staging, handling, access, hoisting, sequencing) treated as contractual conditions
"Single source of truth" for installation	→	Installation manuals that define the terminal integration step, objective acceptance criteria, warranty activation, and remedy pathways

Figure 5b: Table Mapping ETO Compensating Controls to CTO / UCC-Native Structures

Collected Offsite Misunderstandings: The 'Phantom CTO Marketplace' Problem.

Many offsite projects now behave as if a mature Configure-to-Order (CTO) marketplace already exists: teams assume they can specify and assemble pre-engineered components inside a predictable framework, as if the interfaces, responsibilities, and tolerances were already adopted by all other parties. In reality, those shared understandings are not yet established. The result is friction, rework, and scope disputes that undermine both productivity and trust.

A useful way to understand the Phantom CTO condition is this: the industry has begun to purchase and fabricate "systems," but it still administers those systems using an Engineer-to-Order (ETO) legal stack. In Amy Marks' language, "the interfaces really become the work," and the trouble signal is when success depends on "heroes."[31] (Appendix C.)[32] When a project's critical integrations only succeed through Herculean coordination, it is signaling that the administrative environment is forcing system-integration work to happen late, informally, and expensively.[33]

[31] "You're in trouble when (system) success depends on heroes. … We gotta kill you heroes out there. We gotta make sure if you win the lottery … what happens? You retire. OK. Well, what happens to the rest of your company? … (In the AEC industry) We don't want it to be in trouble. We don't want the industry to be in trouble. We certainly don't want our companies to be in trouble. And that is a problem if you feel like you're making a Herculean effort every single day.

[32] Appendix C captures a valuable systems-level diagnosis: the industry is trying to scale offsite methods, but keeps running into cross-system dependency failures that can't be solved by better project management alone. Where we diverge is at Amy Mark's " Level 6." In FoD&D terms, the "Market Ecosystem" change Amy describes is not just a general maturation of prefab supply chains—it is the transition from an Engineer-to-Order (ETO) marketplace to a Configure-to-Order (CTO) marketplace, the market form that actually commercializes repeatable offsite products at scale (pods, panels, volumetric modules, and hybrid assemblies). CTO is the missing name for Amy's destination state. Without it, Level 6 remains too ambiguous to operationalize: practitioners can feel that change is coming, but lack the organizing model that tells them what to build and how to coordinate with others as innovation accelerates. The CTO hallmark is interoperability through shared, industry-standard interfaces: once products can reliably "plug in" to one another (legally, digitally, and physically) teams stop reinventing scope boundaries on each project and the market begins to compound learning rather than reset it.

[33] The CfOC values Amy' Marks' 'Level 1–6' framing. The CfOC contribution is to name Level 6 explicitly as Configure-to-Order (CTO), so Advancing PreFab practitioner's goal market shift becomes legible and actionable.

Chris Crosby describes the same structural reality from the owner side: today's construction "system is designed to not allow… a manufacturing technical approach."[34] (Appendix D) That observation from datacenter delivery[35] reframes the root cause: the bottleneck is not primarily fabrication capability; it is the mismatch between offsite's product/system logic and the legal/administrative machinery that governs construction.

The Phantom CTO mechanism: matelines are assumed, not defined

Phantom CTO behavior shows up when projects begin without early, explicit agreement on the matelines—the boundary conditions that define where factory scope ends and site scope begins. In practice, offsite work is often administered through evolving 2D drawings that do not clearly define 3D boundaries early enough, leaving design responsibility, fabrication roles, and warranty coverage ambiguous.[36] Each party defaults to its own ETO mental model of scope boundaries, which creates gaps, overlaps, or both. This is precisely why sophisticated owners repeatedly emphasize early integration planning. In an recent PreFab industry panel,a panelizer describes bringing the superintendent in early to define "the flow of installation so that we fabricate, we ship it, and we install it," and to avoid repeated handling and sloppy handoffs across teams.

That is a plain-language description of what CTO requires: a defined integration flow, upstream, that ties design, fabrication, logistics, and installation into one operational sequence.

Why this is jurisdictional: ETO law presumes services, but offsite behaves like goods

These barriers are not just technical; they are jurisdictional. The current legal system largely presumes that every building is ETO and that every contract describes a professional service, not a transferable good. The ETO world benefits from a century-old administrative stack, shared templates and conventions that coordinate bespoke work through standardized documents layered with project-specific exceptions. Offsite manufacturing lacks the equivalent connective tissue. No broadly agreed cataloging system exists, no common payment structure, and no consistent handoff between factory records and site documentation.

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[34] "You have in this model when you systematize it, you just, you have to consistently remove those tendencies because it's set up for this litigious environment. That was probably one of the biggest epiphanies I had is how the system is designed to not allow – or the historical nature of design and construction – does not allow a manufacturing technical approach."

[35] Appendix D offers a second kind of practitioner evidence from the datacenter sector. Chris Crosby's remarks illustrate what becomes possible when offsite methods are paired with an owner environment that is saturated with capital and intolerant of schedule slip. Datacenter delivery is currently fueled by the AI marketplace, where every day of operation has quantifiable value, and where owners can afford to behave like industrial customers: placing long-lead orders early, standardizing multi-trade assemblies, and sequencing work as a logistics problem rather than a craft problem. In that context, Crosby's recommendations read as a practical introduction to pre-CTO behavior: he describes procurement actions (pre-ordering equipment and racks before the design is fully complete) that only make sense when the project is implicitly converging on product-like interfaces and predictable integration. We share the optimism in his manufacturing-informed stance—especially the application of just-in-time logic to reduce idle time and integration chaos—but we also see a risk for housing-sector listeners. The datacenter world can "buy its way" through some interoperability gaps with extraordinary funding and owner leverage; housing cannot. Without naming the destination state as CTO, and without intentionally building the interface standards that make early procurement safe and repeatable, listeners may mistake datacenter tactics as universally transferable project-management hacks rather than as signals of a deeper market transition. The lesson FoD&D draws is sharper: what looks like schedule discipline in datacenters is, in fact, a preview of CTO market structure, and housing will need more of that structure (especially open, shared interfaces) to achieve similar reliability in the absence of datacenter-level capital.

[36] "It's tough when we look at the overall cost. "*Hey, the project is not set up that way to bring the cost up front for the design coordination.*" or (sometimes) we are missing (things). Or pushing, bringing a trade on board later and having the coordination later, so the feedback value is diminished." Gayatri Umashankar of Digital Building Components, Appendix E

This explains why “design-assist” is increasingly used as a bridge: it’s a symptom of an immature marketplace where teams must custom-engineer how elements connect, rather than pulling pre-approved components from a catalog.

The key cost of legal ambiguity: interoperability collapses

The most consequential cost of this ambiguity is the loss of interoperability. CTO requires the ability of different systems, components, and organizations to connect and perform together. Without interoperable interfaces (physical and legal), each project becomes an isolated administrative ecosystem that cannot exchange parts, data, or responsibility seamlessly.

This operates on three coupled levels:

- **Legal interoperability**: contracts and inspection regimes vary so widely that products approved in one jurisdiction may be legally invisible in another; agreements that should connect factory, carrier, and contractor instead act as barriers.
- **Product interoperability**: without common dimensional standards or digital schemas, components can’t connect physically or digitally across manufacturers.
- **Organizational interoperability:** because no shared framework defines engagement, partnerships restart from zero—roles, trust, and liability renegotiated each time.

Only when law, product design, and organizational behavior share a coherent interface can a true CTO marketplace emerge.

Practitioner “symptoms” are compensating controls

The fastest way to recognize Phantom CTO conditions is to watch what experienced teams do to compensate. The practitioner checklist already introduced above (Underwrite early; treat default as catastrophic; force design freeze…) is exactly that: ETO compensating controls. They are pain points that recur when CTO-looking offsite methods are executed inside an ETO legal environment.

With this Phantom CTO lens established, the “Generalized Patterns” below can be read as the predictable downstream consequences of trying to run product/system delivery inside a services-centric ETO administrative stack.

Generalized Patterns in the Mismatch between ETO workflows and Offsite Products

The contemporary (and highly manual) ETO contract adjustment-and-interpretation of offsite products creates cascading consequences. Aggravating mismatch appears in every corner of an offsite construction enabled ETO project delivery process:

1. Confusion at the Point of Inspection

Every state (and often every large city) enforces modular inspections differently. Authorities Having Jurisdiction (AHJs)[37], state departments, and third-party inspectors have overlapping and

[37] See Cornell Law definition of AHJ.

sometimes contradictory authority. Otherwise capable builders are forced to engage third-party inspectors to route around these constraints. That process is onerous[38], requiring AHJ to authorize bespoke inspection plans, hiring inspectors close to the point of manufacture, and oversight that all parties follow AHJ-approved quality assurance plans. Confusingly, some states require extensive documentation and offsite inspections; others offer no framework at all.

2. Legal Bottlenecks in Productization

Because modular products cannot be sold without first entering a bespoke service agreement, true catalogs do not exist. There is no marketplace of repeatable, UL-listed, financeable modules. Instead, larger third-party inspectors are setting up UL-approved labs to list individual project products[39]. Currently, a constellation of bespoke ETO offsite producers rely on a variety of inspection vendor services to simulate manufacturing workflows. This is costly friction. Demand cannot be aggregated; products are not being reused between projects; production cannot be scaled.

3. Financial Exposure and Incomplete Contracts

Service contracts fail to provide adequate collateral or payment triggers for modular manufacturing. A pod that is 80% finished may still be only 10% billable. This is because under AIA or ConsensusDocs contracts, as progress payments are primarily based on the value of the work put in place.[40] This creates an unsustainable cash flow gap[41] for suppliers and makes lender participation unlikely.

4. Design Freeze as a Contractual Stop Sign

ETO agreements are designed to accommodate ongoing design evolution through revisions and change orders. Offsite production cannot. Fabrication depends on stable design inputs, long-lead procurement, and repeatable tolerances, which forces project teams to impose an explicit “design freeze” date as a special contractual control. Under service-based forms, late design changes become cost and schedule multipliers, eroding the very efficiencies that offsite methods are meant to deliver.

5. Risk of Loss Between Factory, Transit, Staging, and Installation

Service contracts are not built to track high-value goods as they move through multiple pre-installation states: finished in a remote factory, shipped across jurisdictions, staged in a storage yard, hoisted, set, and only then connected and commissioned. This creates recurring ambiguity about when title transfers, which policy responds to damage, and who bears the risk of loss at each

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[38] See ICC Off-Site Solutions.

[39] i.e. Evergreen Innovation Group.

[40] Both types of contracts generally have provisions that also allow for payment for materials suitably stored on-site. The standard AIA documents (like the A201 General Conditions) require the contractor to submit a Schedule of Values, and applications for payment are based on the percentage of work completed and, in many cases, materials delivered and stored on site. The architect reviews these applications and certifies the amounts due based on on-site observations of the progress of the work. Similarly, ConsensusDocs forms (such as the 291, 292 or 293 payment applications) are designed to document and calculate progress payments based on the actual value of work performed and materials stored on site. The use of notarized certifications in ConsensusDocs emphasizes the verification of the value of performance to date.

[41] Recently, this has led lenders to insist on outsized reserve funds and (often) for the developer to increase their equity contribution (sometimes above 50%), before the lender starts reimbursing funds. The result is a shift of risk back to the developer.

stage. In practice, teams are forced to negotiate bespoke handoffs for insurance, acceptance, and responsibility — precisely the kind of standardized clarity that UCC-style commerce normally supplies. (See Appendix A for practitioner guidance and timestamped quotations.)

6. Litigation as a Default Outcome

With ambiguous scopes, conflicting jurisdictions, and no default warranties, modular construction under Common Law defaults to litigation. This deters innovation, slows adoption, and pushes manufacturers into defensively conservative postures.

The problem extends beyond transactions.

- In a Common Law project, accountability is tied to *people* — architects, contractors, inspectors — whose professional duties are enforced through licensure and tort.
- In a UCC transaction, accountability is tied to *products* — items identified by model number, serial code, and warranty.

As construction shifts from *drawings and performance* to *deliverables and interfaces*, the law's focus on professional conduct becomes increasingly mismatched with the realities of serialized production. A defect may stem from a product, not a person, yet the current contract system struggles to recognize that distinction.

This mismatch does not call for wholesale replacement of the Common Law framework. Site-built work will always require professional judgment and fiduciary care. But as the share of prefabricated assemblies grows, statutory review may wish to explore how these two regimes should be reconciled along a clearer boundary. That seam, or "legal mateline," might one day allow risk, title, and warranty to migrate smoothly from manufacturer to builder to owner, preserving both professional accountability and commercial predictability.

For now, the central insight is simple: the industry's technical modernization has outpaced its legal modernization, and the result is a market restrained not by capacity, but by contract.

The next section proposes a practical next step: instead of forcing product-like scopes to behave like services (and then managing the fallout with "compensating controls"), we can make the boundary between goods and services explicit, so that title, risk, warranty, and remedies have a clear place to attach.

6. A Proposed Realignment: Hybrid Contracts Preparing Statutory Review

The Center for Offsite Construction (CfOC) is not calling for the wholesale abandonment of Common Law contracts. The AEC industry will — and should — continue to rely on service-based agreements for much of its site-built, coordination-heavy work that supports Configure to Order (CTO) delivery.

What is called for is the careful interrogation of the boundary between Common Law- and UCC-dominated contract language, for the eventual improvement of both agreements and statute.

That inquiry must also reckon with the administrative machinery that surrounds those contracts. The existing Engineer-to-Order (ETO) framework already operates as a fully realized ecosystem—an AIA–CSI–union triad that standardizes how bespoke projects are documented, bid, and paid. A hybrid system will need an equivalent scaffolding for offsite work: digital classifications, procurement protocols, and payment structures that make productized scopes as administratively legible as site labor is today.

The Mateline Concept

The CfOC proposes testing the joint of Common Law- and UCC-dominated contract language in new offsite-oriented standard forms of agreement. These agreements would pilot a **deliberately hybridized contractual framework**, using an explicit **'legal mateline'** (see Key Terms, last page) between two fundamentally different scopes:

- **Manufactured, productized scopes** — modules, pods, façades, MEP assemblies, and other repeatable goods — governed by UCC principles.
- **Site-built, hosting scopes** — foundations, primary structure, utility connections, and other bespoke field work — governed by Common Law service principles.

In both construction and manufacturing, a *mateline* marks the seam where two assemblies connect. Each side must be complete, certified, and testable before the joint is closed. A legal mateline serves the same purpose: it identifies when a module ceases to be a product and becomes part of a building.

A skeptic may view the proposed "legal mateline" as an unnecessary disruption to the long-settled relationship between the UCC and Common Law. In their view:

- Article 2 already governs the sale of goods until delivery, while Common Law properly takes over once construction services begin; *the boundary, though sometimes blurry, has proven workable for decades.*
- Offsite construction does not justify a new hybridized framework: *courts routinely decide fixture status, risk transfer, and mixed-goods contracts without the need for a statutory seam.*

For these critics, the existing legal tools (fixture doctrine, predominant-purpose tests, and contract drafting) already supply a flexible framework that does not require a new conceptual joint.

But it is precisely this reliance on ad hoc doctrines that underscores the need for an explicit mateline in offsite construction. The existing boundary between the UCC and Common Law was developed for bespoke projects assembled almost entirely onsite, not for buildings composed of pre-certified, repeatable products whose commercial identities persist long after shipment. The mateline resolves ambiguity. By clarifying

when a module, pod, or panel remains a “good” (thus benefits from uniform commercial protections) and when it becomes part of a site-built improvement, the mateline replaces inconsistent fixture determinations, vague predominant-purpose analyses, and state-by-state interpretations with a predictable, contractually designated transition point.

In offsite construction, the mateline functions as the missing connective tissue between two legal regimes that were never designed to meet in a factory-built future.

The Commissioning Concept

Notably, the UCC does not contemplate a commissioning stage during the commercial lifecycle of goods.

Article 2 presumes that inspection (§2-513) and conformity assessment occur while goods are still movable and before acceptance (§2-606). In offsite construction, however, many performance attributes (uniform plumbing pressure across interfaces, electrical load balance, HVAC commissioning) cannot be validated until the product is installed. This creates a legally ambiguous interval that sits outside the UCC’s framework. Recognizing commissioning as a distinct, uniform stage would help align UCC concepts with the realities of factory-built construction without rewriting the remedies themselves.

Commissioning occupies a legal space not contemplated in the UCC: it sits after ‘tender’ and before ‘acceptance,’ enabling verification of performance that cannot be tested while the good is still a good.[42] This limbo underscores that commissioning effectively creates a third state for a good: not-yet-accepted, not-rejectable as goods, not-assessable as fixtures. This ambiguity causes real-world uncertainty in warranty activation, risk of loss, payment timing, bonding, insurance coverage, and liability in case of defect.

Commissioning reveals that inspection, in this context, is no longer a pre-delivery act. In offsite construction, key performance characteristics may emerge only after installation, forcing inspection to migrate into real-property space.

A critic might argue that elevating commissioning to a defined legal stage overreaches the scope and purpose of the UCC. Article 2 already provides buyers with a right to inspect goods before acceptance (§2-513), they would note, and commissioning is simply a sophisticated form of inspection—not a new doctrinal category. To such critics, commissioning belongs in construction contracts, not commercial statutes: it is a performance obligation embedded in project delivery, not a phase in the sale of goods. They would further warn that recognizing commissioning in statutory language risks blurring the longstanding boundary between personal property (CTO, and the UCC’s domain) and real property (ETO, and the domain of state construction and building codes). Worse, it could invite litigation by creating an ambiguous “middle state” between delivery and acceptance, with parties disputing when commissioning begins, ends, or triggers risk transfer. For these critics, the UCC’s strength lies in its simplicity, and adding industry-specific stages could undermine the uniformity the UCC was designed to protect.

Yet these critiques ultimately reaffirm the need to acknowledge commissioning as a distinct legal moment in offsite construction. The UCC’s inspection framework (§2-513) presumes that conformity can be

[42] The tree closest-but-insufficient analogues are: [a] §2-513 (Buyer’s Right to Inspection) – but assumes goods are still movable. [b] §2-606 (Acceptance of Goods) – but commissioning occurs before acceptance. [c] §2-508 (Seller’s Cure) – but cure typically ends upon acceptance, while commissioning often reveals issues requiring immediate correction.

evaluated before goods are integrated into a larger system. In offsite construction, this assumption no longer holds: electrical system balance, uniform plumbing pressure, life-safety circuitry, air-seal performance, and whole-system interoperability are not verifiable while the product remains movable. Commissioning is not an engineering embellishment but a structural feature of industrialized building. It is an unavoidable transitional phase between the sale of a manufactured good and the creation of real property. Far from diluting the UCC's simplicity, a uniform definition prevents fifty different interpretations of this increasingly common stage, reducing disputes over risk transfer, warranty activation, and acceptance.

Recognizing commissioning clarifies where the UCC's commercial logic properly ends and where real-property obligations legitimately begin. In this way, a clear definition strengthens, rather than unsettles, the boundary that critics seek to protect.

Hybrid Standard Forms of Agreement: Matelines, Commissioning, & New Industry Roles

At the moment, the applicable body of law (read: "the chain of accountability") in standard forms of agreement are blind to offsite methods. Clarifying that shift with sensitive forms of agreement would allow warranties, risk, and certification data to travel with offsite-specific industry products, until the instant they become real property, ensuring no lapse in coverage or clarity.

Recent practitioner guidance reinforces why this hybrid "mateline" mechanism is needed. In projects delivered inside an Engineer-to-Order environment, experienced teams routinely impose a set of compensating controls — design freeze dates, bespoke risk-of-loss handoffs across transport and storage, improvised payment security, shipping governance tied to site readiness, and pressure to consolidate installation responsibility into a "single source of truth."[43] Read diagnostically, these are not critiques of offsite methods; they are evidence that today's service-oriented contract stack is straining to govern product-like work.

Hybrid forms offer a cleaner path: they can make these controls structural rather than improvised by tying them to a shared body of product documentation — especially installation manuals that define prerequisites, handling, staging, hoisting, connection steps, commissioning checks, and objective acceptance criteria. In a CTO marketplace, the installation manual is not just a field guide; it is the operational instrument that carries warranties, certifications, risk allocation, and remedies across the legal mateline — clarifying when a product stops being a movable good and becomes installed property.

The CfOC proposes the following steps to operationalize this hybrid model:

1. **Develop Standardized Agreements for Modular Products**

   To develop a family of agreements mated to UCC principles, treating manufactured assemblies as goods:

   - **Sales agreements** with clear title transfer points tied to production milestones.
   - **Scopes** described by boundaries between product interfaces (not by specification).
   - **Warranties** for merchantability, conformance to specifications, and fitness for purpose.
   - **Remedies frameworks** for repair, replacement, or cure, clearly separated from site-work obligations.

[43] For timestamped practitioner quotations and the full checklist, see Appendix B.

- **Payment schedules** linked to fabrication progress rather than installation[44].

These templates should be developed collaboratively by MBI, ICC, CfOC, and other standards bodies, and published as public infrastructure for manufacturers, developers, and their legal counsel.

2. Formal Recognition of New Industry Roles

These hybrid contracts should explicitly acknowledge emerging functions unique to modular and offsite delivery (see Key Terms, below):

- **IC Specifier** — determines products of industrialized construction selections, confirms product certifications, confirms inter-product interface compatibility, and navigates options during design development.
- **Mateline Integrator** — manages the physical and digital fit between productized and site-built systems.
- **Installer** — manages the product requirements initiated at the end of delivery. Installation starts at staging. It acts through hoisting, rigging, and positioning. It concludes with product installation instructions and product commissioning (see above).
- **Platform Provider** — maintains the catalog, configurator, and digital twin environment that define the products used.

By naming these roles, CTO contracts can assign clear duties, liabilities, and collaboration protocols.

3. Digital Procurement Integration

To fully exploit the speed of CTO delivery, hybrid-contract production scopes should be:

- **Machine-readable** for direct integration with building configurators (and gradually, AI agent-based project delivery methods).
- **Version-controlled** to track specification changes through procurement.
- **E-commerce enabled** to support direct, repeatable ordering of assemblies.

Embedding these terms in procurement platforms bridges the gap between legal agreements and the digital tools driving design and supply.

This CTO hybrid-contracts approach provides clarity in three critical ways:

1. **Avoids interpretive limbo** — courts no longer have to guess whether a mixed-scope project should be treated wholly as services or wholly as goods.
2. **Protects both parties** — manufacturers get the predictability of UCC product law; builders retain the flexibility of Common Law where it's appropriate.
3. **Supports gradual industry transition** — teams can adopt product-based contracting without dismantling established project delivery methods overnight.

Such instruments already exist in other industries. In shipbuilding, for example, hull sections are sold, transported, and welded under multiple legal regimes but joined under a single contract that tracks

[44] Understanding the risk that factory milestone payments may not align with a lender's draw schedule is key. A hybrid solution must be carefully coordinated with the lender and create a clearer cash flow schedule than currently available.

ownership and risk continuously. In software development, *end-user license agreements* delineate where code ceases to be a good and becomes a service. Construction lacks an equivalent mechanism.

The hybrid-contract approach deliberately creates a contractual seam — a legal mateline — that reflects the physical and organizational reality of contemporary offsite construction projects. By making that seam explicit, we equip the industry to adopt productized delivery methods without losing the contractual tools that work best for traditional scopes. This alignment of legal precedent to scope type is essential for scaling Configure-to-Order delivery across the AEC sector.

The Role of the CfOC in Testing Hybrid Contract Forms

Creating these hybrid forms will require broad participation from manufacturers, contractors, insurers, and public agencies. The Center for Offsite Construction (CfOC) intends to supply that forum. Its ANSI-accredited procedures ensure openness, balance, and consensus — principles essential for developing model agreements that are both fair and evidentiary.

Through a similar process to ANSI's procedures, prototype hybrid contracts could be drafted, tested in pilot projects, and refined through documented case experience. ***The resulting data (showing where obligations align or conflict) would offer statutory reviewers the evidence needed to evaluate whether existing uniform law can accommodate these transitions or requires adjustment.***

Working Toward Statutory Review

The aim is not to legislate a new code, but to make visible where two existing bodies of law can more properly intersect. Once hybrid contracts begin to generate consistent documentation (i.e. recording when title passes, when risk transfers, and how warranties are enforced) ***statutory review can proceed from fact rather than speculation.*** The CfOC's role is to organize that evidence, not to prescribe outcomes.

Hybrid contracts built around a legal mateline therefore serve as both metaphor and mechanism: a line of connection rather than division, designed to let two proven systems (commercial and professional) operate together without ambiguity. The long-term benefit is *efficiency through clarity*: a building process in which every stakeholder knows precisely when a product stops being a promise and starts being property… and suffers few legal fees.

7. Path to Adoption

The transition from **Engineer-to-Order** (ETO) to **Configure-to-Order** (CTO) delivery must be constructed step by step, through evidence, agreement, and trust.

The goal is to build a fair legal system for offsite construction with *interoperability* protected between its stakeholders. That path begins with consensus, proceeds through pilot testing, and culminates in statutory review.

A Five-Phase Pathway to Interoperability

1. **Publication and Study**
   This paper establishes the conceptual groundwork by identifying where Common Law and UCC regimes currently conflict in offsite-enabled delivery. It also supplies two concrete tools for study: Appendix A, a structured set of questions for contract drafters and statutory reviewers, and Appendix B, a practitioner-derived ETO risk-control checklist (evidence of recurring contract seams). Together, these tools invite professional and statutory review grounded in both practice signals and answerable legal questions.

2. **Formation of a Consensus Committee**
   Matching its ANSI procedures, the CfOC will convene a balanced group of manufacturers, contractors, insurers, regulators, and public-interest representatives to draft fair, offsite-oriented standard forms of agreement. These forms will be developed through open comment, revision, and documented consensus.

3. **Pilot Testing and Data Collection**
   The draft agreements will be deployed in selected modular and panelized projects in collaboration with industry partners. Each project will record how title, risk, and warranty migrate from factory to site, and where ambiguity persists. The resulting dataset will reveal which clauses promote clarity and which generate conflict.

4. **Evidence Compilation for Statutory Review**
   Using this evidence, the CfOC will prepare structured reports summarizing precedent conflicts, arbitration outcomes, and insurance interpretations. These materials will help statutory reviewers assess whether existing uniform law already accommodates hybrid transactions or requires adjustment.

5. **Dissemination and Education**
   The final phase will distribute the results through academic, professional, and policy channels. Law schools, design programs, and continuing-education platforms will be invited to integrate these findings, ensuring that the next generation of practitioners understands both the technical and legal dimensions of industrialized construction.

The cumulative effect of these phases is the gradual definition of a new administrative stack for CTO delivery. This alternative administrative stack will organize offsite commerce through hybrid contracts, product certifications, and standardized data exchanges. Its legal layer will define matelines and warranties; its digital layer will manage product identity and traceability; and its organizational layer will align roles,

payments, and inspections. Building this stack (open, interoperable, and fair) is the CfOC's core deliverable: a replacement operating system for how risk, responsibility, and reward move through an industrialized building economy.

A Measured Transition

This pathway avoids disruption by preserving what already works. Site-built construction and professional services will continue to operate under Common Law.

The proposed hybrid contracts simply provide an alternative legal lane for productized work, allowing manufacturers and builders to engage through standardized terms while the rest of the industry observes and learns.

The transition will be gradual, evidence-driven, and transparent — precisely the qualities that have long defined the evolution of uniform law in the United States.

Speed, with the Right Partners

The CfOC is uniquely positioned to lead this process.

- As an ANSI-accredited standards developer, the CfOC operates under a governance model that requires openness, balance, and consensus—ensuring that manufacturers, contractors, insurers, regulators, and public advocates all hold equal seats in the room.
- Its network of Senior Research Fellows, drawn from across the offsite sector, extends this inclusivity into continuous applied research and peer review.
- Each CfOC publication—from the *Future of Design & Delivery* research roadmap to its accompanying white papers—has attracted dozens of formal commenters, demonstrating both the center's convening power and its commitment to transparency.

The CfOC views this next phase as a natural progression of its CTO-serving mission: transforming evidence and dialogue into the shared legal infrastructure an industrialized building economy will require.

8. Conclusion: A Legal Foundation for North American Offsite Construction

The modernization of building delivery will not be achieved through technology alone. It requires a legal framework capable of recognizing how buildings are increasingly made: through standardized products, shared data, and interconnected supply chains. The Uniform Commercial Code (UCC) already provides much of that logic for other industries, but construction remains divided between the bespoke discipline of Common Law and the uniform principles of commercial trade. The path forward lies in clarifying the boundary between them, not in choosing one over the other.

This paper has outlined a methodical path toward building that new administrative stack. Hybrid contracts, digital classification systems, and clearly defined matelines are not ends in themselves: they are the components of a coordinated operating framework for **Configure-to-Order** (CTO) delivery. Each pilot project, consensus process, and data record will help construct the connective infrastructure that the **Engineer-to-Order** (ETO) world already enjoys through AIA forms, CSI divisions, and trade jurisdictions. When complete, this new stack will allow offsite manufacturing, site work, financing, and oversight to interoperate with the same administrative coherence that once made bespoke construction viable. The work is about re-engineering the ecosystem through which law, technology, and practice meet.

The long-term value of this work extends far beyond the contracts themselves. Statutory clarity will enable a genuine CTO marketplace for building components, accelerate housing production, and lower systemic risk across design and construction. It will also realign education and practice, preparing future professionals to operate confidently across both service-based and product-based delivery models. The CfOC's continuing research roadmap, Senior Research Fellow program, and open-comment publication model are designed to sustain this transition, and ensure that modernization proceeds with transparency, balance, and consensus.

The CfOC offers this paper as both a framework and an invitation: to study where goods become property, where contracts become commerce, and where the next generation of law can recognize how modern buildings are truly made.

Key Terms

Engineer-to-Order (ETO) A project delivery model in which each building is designed and engineered as a one-off prototype. Scope is negotiated from scratch, workflows are sequential, and knowledge is rarely reused across projects.

Acceptance (Offsite Context) When an installed offsite product is deemed to have satisfied all commissioning, performance, and inspection criteria and is legally incorporated into the building. Acceptance triggers warranty activation, payment release, and the end of UCC-governed obligations.

Commissioning The verification stage that occurs after an offsite product has been installed but before it is legally accepted. In offsite construction, commissioning closes the gap between the factory-certified design and its in-place operation.

Common Law A body of law derived from judicial decisions and legal precedent rather than from statutes. In U.S. construction, Common Law underpins most service-based contracts, such as the AIA Standard Forms of Agreement, which govern bespoke, project-specific scopes. It varies by state, emphasizes case-by-case interpretation, and is traditionally suited to Engineer-to-Order (ETO) delivery models.

Configure-to-Order (CTO) A manufacturing-informed delivery model in which buildings are assembled from a platform of pre-engineered, interoperable components. Designs are configured within a controlled range of options, enabling repeatability, scalability, and parallel production.

IC Specifier A design professional (or consultant) responsible for selecting industrialized construction (IC) products early design phases. The IC Specifier matches project requirements with available offsite products (pod, panel, module, etc.), ensures selections conform to applicable codes and standards, and coordinates with manufacturers to maintain compatibility with the chosen product platform.

Mateline The physical or contractual boundary where the responsibilities, warranties, and performance obligations of one scope end and another begin. In hybrid offsite projects, the “legal mateline” separates productized scopes governed by UCC principles from site-built scopes governed by Common Law.

Mateline Integrator A role dedicated to managing the physical and digital fit between productized and site-built systems across the legal mateline. The Mateline Integrator ensures that tolerances, connection details, and interface specifications are coordinated across all trades, and that both Common Law and UCC-governed scopes align in fabrication, delivery, and installation.

Offsite Construction Product (a.k.a. **Industrialized Construction (IC) Product** A pre-engineered, repeatable good (such as a pod, panel, module, façade cassette, or MEP assembly) designed for offsite fabrication and onsite integration. These products should be governed by commercial rules (UCC) until their fixture transition.

Platform Provider An entity that maintains the catalog, digital configurator, and technical standards for a family of modular products. The platform provider ensures interoperability between components, manages updates, and supports integration with design and procurement tools.

Phantom CTO Marketplace A term used here to describe the current state of many offsite projects, in which teams behave as if a mature, standardized CTO marketplace exists — when in fact there are no widely agreed interfaces, matelines, or procurement conventions. The result is recurring scope disputes, rework, and inefficiency.

Product Platform (Offsite) A coordinated family of interoperable components, connection details, and certified assemblies governed by a shared rulebook. Platform providers ensure that each product in the platform has known tolerances, allowable configurations, and predictable installation behaviors.

Uniform Commercial Code (UCC) A harmonized set of U.S. laws governing the sale of goods across state lines. The UCC provides default warranties, clear title transfer rules, and standardized definitions that enable large-scale, repeatable commerce — but has yet to be widely applied to modular construction.

Appendix A - Key Questions for Contracts & Statute

Overview

This series of questions invites the contract writers and statutory reviewers to examine how the Uniform Commercial Code (UCC) might evolve for a built environment increasingly produced offsite.

- The sequence begins with threshold questions about *ontology*: when goods fabricated in factories become real property (**Q1a**) and whether a buyer's Right to Return can exist in such a transition (**Q1b**).
- It then explores how uniform "gap-fillers" (**Q2a**) and data-based *course of dealing* (**Q2b**) could replace the bespoke, project-by-project contracting of construction law.
- Mid-sequence questions test the mechanics of trust: how warranties (**Q3a**), risk and title (**Q3b**), notice (Q3c), and the Right to Cure (**Q3d**) might function across multiple jurisdictions and inspection gates.
- The final set turns to continuity and modernization—how remedies could preserve relationships rather than terminate them (**Q4a**), how digital automation challenges the meaning of consent (Q4b), and how standardized remedies (**Q4c**) could restore fairness when all else fails.

Together with uniform definitions (**Q5**), these questions outline a single inquiry: how uniform law can follow a product's entire journey without losing fairness, clarity, or trust – completely from fabrication to installation, from human agreement to machine execution.

Q1a - How does the graduation from “goods” through “fixtures” into “real property” require study?

Summary

Article 2 of the UCC was designed for goods that remain movable through the course of sale, but modern offsite manufacturing introduces a sequence of transformations that cross legal thresholds the UCC was never built to sense. A modular bathroom or kitchen begins its life as a good, passes briefly through the status of a fixture, and ultimately becomes part of real property. Each transition raises questions: who owns it, who insures it, who carries the warranty, and when does liability change hands? Today, no coherent legal framework follows a product across these stages. ETO disputes over title, warranty, and risk multiply precisely because the governing law switches mid-journey. Clarifying that boundary, or designing a portable legal framework that travels with the product, may be one of the most consequential uniform-law questions facing the built environment today.

Detailed Explanation

Under Common Law
Work that becomes part of a building is governed by property and construction law. Ownership passes to the landowner upon installation, and materials “annexed” to the real estate cease to be personal property. The contractor’s obligations are defined by the project contract, and disputes are handled through damages, liens, or tort, not by return or replacement. The law presumes permanence: once installed, the improvement belongs to the land.

Under the UCC
Article 2 governs the sale of goods: movable, identifiable items at the time of sale. It offers clarity on title, warranties, and risk of loss for objects that stay mobile. Prefabricated modules, pods, and panels easily meet this definition prior to installation, but as soon as they are affixed, Article 2 gives way to real-property regimes. The UCC provides only limited guidance through §2-107[45] and §9-334[46] (fixtures and security interests), leaving courts to apply the “predominant purpose” test, deciding case by case whether a contract concerns goods or construction services.

In Offsite Construction

This divide is not theoretical; it is operational. Offsite products move through four legally distinct stages the scale of which is alien to the ETO definitions of construction:

- **Fabrication & Assembly:** Goods status, governed by UCC Article 2 (sales and warranties).
- **Transport:** Goods status continues; risk allocated under shipping terms (§2-509–510).[47]

[45] § 2-107. Goods to Be Severed From Realty: Recording. “…(3) The provisions of this section are subject to any third party rights provided by the law relating to realty records, and the contract for sale may be executed and recorded as a document transferring an interest in land and shall then constitute notice to third parties of the buyer's rights under the contract for sale…”
[46] § 9-334. Priority Of Security Interests In Fixtures And Crops. “...A security interest under this article may be created in goods that are fixtures or may continue in goods that become fixtures….”
[47] § 2-509. Risk of Loss in the Absence of Breach and § 2-510. Effect of Breach on Risk of Loss.

- **Installation:** Transitional stage; product becomes a fixture, sometimes invoking Article 9 (secured interests in fixtures).
- **Post-Installation:** Real property law governs ownership, insurance, and dispute resolution.

Across these thresholds, title, liability, and warranty coverage may transfer multiple times, often without the ETO parties realizing that the governing law has changed underneath them.

Stage	Legal Classification	Governing Law	Key UCC Article
Design & Manufacture (factory stage)	**Goods**	UCC Article 2 (Sales)	§2-105[48]
Transit to Site	**Goods**	UCC Article 2 (Risk of Loss, Warranties)	§2-509[49]–2-318[50]
Installation (before attachment)	**Goods → Fixtures**	UCC Article 9 (Security Interests)	§9-334[51]
After Affixation	**Real Property**	State Real Property Law	—

Analysis

The boundary between goods and real property defines a key problem space of offsite construction law. It determines which set of rules (commercial or property?) controls the transaction at each step of the product's life. Today that boundary is porous and inconsistently applied. Courts must improvise, and parties shoulder redundant insurance, unclear warranties, and overlapping liabilities. For statutory review, this is the foundational question: "Should the UCC's framework for movable goods be expanded, or should a bridge framework be built to follow offsite products through fabrication, assembly, transport, and installation?" Clarifying this "graduation" would not only prevent conflict but also unlock the possibility of a national marketplace for standardized offsite components… precisely the kind of uniformity the UCC was created to achieve.

[48] § 2-105. Definitions: Transferability; "Goods"; "Future" Goods; "Lot"; "Commercial Unit"....
[49] § 2-509. Risk of Loss in the Absence of Breach.
[50] § 2-318. Third Party Beneficiaries of Warranties Express or Implied.
[51] § 9-334. Priority Of Security Interests In Fixtures And Crops.

Q1b – Could a buyer's right to return ever apply to offsite products that begin as goods but end as real property?

Summary

In consumer and wholesale commerce, the right to return ensures fairness where inspection alone cannot confirm suitability. But in offsite construction, that inspection window must close the moment a product is installed. A bathroom pod or wall panel cannot be "returned" once it becomes part of a building. Yet these products may be warehoused, staged, or even re-sold before installation: precisely the kind of pre-deployment phase the UCC envisions. The question for statutory review is whether uniform law might recognize a *conditional* revocation of acceptance within this pre-installation window, giving buyers recourse for latent defects without collapsing the economics of permanent installation.

Detailed Explanation

Under Common Law	**Under the UCC**
Installed work is non-returnable; disputes are resolved through warranty or damages, not reversal. The legal assumption is physical permanence: concrete, steel, and wiring are part of the land the moment they are affixed.	The right to return is a form of transactional flexibility. Buyers can reject or return goods if they fail to conform, preserving liquidity in markets where value depends on immediate usability. For offsite construction, these regimes meet awkwardly. A pod or module could, in theory, be returned while still warehoused or staged, but once installed, removal may be impractical or destructive.

A uniform act could clarify how "returnability" transitions to "warranty" as a product moves through staging, rigging, hoisting, and installation. It might define an *inspection and acceptance threshold,* for instance, the buyer's right to return expiring once the product is hoisted or connected to permanent systems. Alternatively, it could permit limited return rights for serialized subcomponents or leased modular assets.

The deeper inquiry for statutory review is whether the spirit of the right to return (**buyer protection through reversibility**) can be preserved in a field built on permanence. Doing so might not only modernize remedies for offsite trade but also illuminate how uniform law can bridge the final conceptual gap between goods and buildings.

Analysis

The **right to return** is imperfectly *implied* in ETO, under the architect's Schedule of Value. In contrast, it is one of the UCC's most distinct buyer protections, and one that feels almost *alien* inside construction law. It exposes, in miniature, the philosophical divide between the two systems: one assumes products can be returned; the other assumes improvements are permanent.

In the offsite context of CTO, that assumption finally becomes negotiable. Because offsite products (pods, panels, modules) *begin as movable goods* before installation, the right to return could conceptually apply — yet once installed, those same goods become fixtures, and the right evaporates.

That ambiguity invites a very powerful statutory question. It exposes an important thought experiment about **reversibility** and **consumer protection** in a newly hybrid domain.

Q2a – Can a uniform set of default terms make *offsite agreements* more reliable across jurisdictions?

Summary

One of the UCC's strengths is its ability to keep commerce moving even when parties fail to define every term. When a price, delivery window, or warranty condition is omitted, the Code automatically supplies a "commercially reasonable" default, allowing trade to continue. Construction contracts take the opposite view: silence is dangerous, and lawyers are expected to fill every gap manually. As a result, even standardized offsite transactions require lengthy, bespoke agreements that vary by jurisdiction and project. The result is friction and inconsistency for manufacturers selling identical products in multiple states. A uniform act or companion standard could explore how the UCC's pragmatic gap-filling principles might extend to offsite construction—balancing predictability with the flexibility needed to accommodate diverse state codes.

Under Common Law

Construction contracting is designed for uniqueness. Every term (from delivery schedule to risk allocation) must be explicitly negotiated. Any silence or ambiguity invites disputes, often resolved through costly litigation or change orders. Because projects are one-of-a-kind, contracts are drafted to anticipate every eventuality, even at the cost of speed and clarity. The legal system reinforces this culture: courts interpret ambiguities against the drafter, not through standardized defaults.

Under the UCC

Article 2 was written for recurring commerce between merchants. It assumes that transactions can proceed even when some terms are missing, supplying defaults for price (§2-305)[52], delivery (§2-308)[53], payment (§2-310)[54], and warranties (§2-314[55]–315). These "gap-fillers" promote continuity of trade and reduce drafting overhead. In disputes, courts rely on these provisions to preserve contracts rather than void them, reflecting the UCC's pro-commerce philosophy.

In Offsite Construction

The offsite sector lies between these worlds. Increasingly, products like kitchen pods or façade panels are sold repeatedly across jurisdictions, yet still bound by construction-style contracts that treat each sale as bespoke. This mismatch burdens manufacturers with legal overhead inconsistent with the scale and speed of modern supply chains.

If a uniform framework allowed certain defaults: delivery at the staging yard, payment upon inspection, warranty tied to factory certification. It could thereby standardize expectations without erasing the parties' ability to negotiate unique terms.

Importantly, as CTO matures, these defaults would need to coexist with current ETO state modular programs and building codes, ensuring that gap-filling operates only within commercial, not regulatory, boundaries.

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[52] § 2-305. Open Price Term.
[53] § 2-308. Absence of Specified Place for Delivery.
[54] § 2-310. Open Time for Payment or Running of Credit; Authority to Ship Under Reservation.
[55] § 2-314. Implied Warranty: Merchantability; Usage of Trade, and, § 2-315. Implied Warranty: Fitness for Particular Purpose.

Analysis

The tension between exhaustive drafting and adaptive defaults goes to the heart of offsite commerce. Common Law insists on perfect foresight; the UCC relies on commercial reasonableness. For offsite manufacturing to scale nationally, contracts must operate more like product orders and less like bespoke construction agreements.

The question for statutory review is whether a new uniform act could safely introduce UCC-style defaulting into hybrid transactions (offering standard fallback positions for timing, payment, and warranty) without displacing the states' authority over building codes and licensing.

A well-crafted set of defaults could dramatically reduce friction while retaining fairness, transforming offsite contracts from one-off negotiations into reliable instruments of interstate trade.

Q2b – How does the legal transition to "Course of Dealing" from "Industry Custom" require adjustment?

How should contract law evolve when industry practice gives way to repeat commercial relationships?

Summary

Traditional construction contracts assume every project is unique; disputes are resolved by appealing to "industry custom" or expert testimony about prevailing practices. The UCC replaces that backward-looking lens with a forward-looking one: the *course of dealing* between specific parties establishes the commercial norm. In a Configure-to-Order environment, where a manufacturer and a contractor may complete dozens of nearly identical module purchases, that relational history could offer clearer evidence of fairness and intent than vague appeals to industry custom. Yet real-property law has no mechanism to record or recognize those accumulating precedents. Statutory review might ask whether a future uniform act could codify how repeat, cross-state transactions build a reliable evidentiary record — one that lowers litigation risk while still protecting new entrants. In effect, this is the question of whether offsite construction commerce should be governed by *tradition* or by *data*.

Detailed Explanation

Under Common Law	**Under the UCC**
Construction disputes rely heavily on "usage of trade" or "industry custom," established through expert testimony about what competent professionals *typically* do. This method is interpretive, subjective, and expensive. It assumes that each project is unique, so patterns across jobs hold little legal weight. The result is that every dispute re-litigates the standard of reasonableness, often through dueling experts.	Article 2 minimizes reliance on experts by substituting **course of dealing** and **course of performance** as primary interpretive tools (§1-303)[56]. Courts examine the parties' actual history (their prior orders, deliveries, payments, and communications) to infer intent and fill ambiguity. This approach rewards documentation and transparency, not reputation or testimony. In markets where the same manufacturers and buyers interact repeatedly, it creates predictability and reduces litigation costs.

In Offsite Construction

Offsite commerce naturally generates the kind of structured data the UCC values: digital orders, inspection reports, serial numbers, timestamps, and payment records. Each transaction leaves a traceable digital footprint that could establish *course of dealing* automatically.

Yet the law (in ETO) currently ignores this evidentiary richness, defaulting to the looser standards of industry custom. If a future framework were to recognize verified data exchanges (such as QA logs or certified product histories) as legitimate evidence of course of dealing, commercial expectations could be

[56] § 1-303. Course of Performance, Course of Dealing, and Usage of Trade.

proven without relying on expert reconstruction. This would allow new entrants to build trust quickly, while holding established actors accountable for consistent performance.

Analysis

This question invites statutory review to confront how *evidence* itself is evolving. Under Common Law, fairness is argued; under the UCC, it is recorded. Offsite commerce replaces oral custom with digital traceability, suggesting that trust can now be measured rather than asserted.

For uniform law, the challenge is to define how such records (automated, authenticated, and auditable) might function as a *course of dealing* within hybrid property transactions. The answer will determine whether the law continues to rely on tradition or evolves toward a data-driven conception of commercial reasonableness. In short, this is where the rule of precedent begins to meet the rule of pattern.

Q3a – How should implied warranties evolve when offsite products carry their own quality assurance through testing, listing, and certification?

Summary

Under the UCC, every sale of goods carries automatic implied warranties unless disclaimed. These provisions protect buyers in opaque markets but can misalign with modern offsite manufacturing, where performance is validated through certification and inspection before delivery. A bathroom pod carrying an UL listing, (for example, already documents compliance with plumbing, fire, and accessibility codes) contains information far more specific than the generic warranty of merchantability. Yet the law still layers implied obligations on top, creating overlapping or conflicting standards of performance. Future statutes could allow certification, digital traceability, or testing data to serve as partial satisfaction of implied warranties — transforming them from implicit promises into explicit, verifiable quality metrics. Such a recalibration could harmonize UCC principles with building code enforcement and reduce redundant liability for compliant manufacturers.

Detailed Explanation

Under Common Law

Construction practice, quality assurance is defined by *inspection and approval*: an architect or authority verifies that workmanship conforms to drawings, specifications, and codes. Warranty obligations are often fragmented across subcontractors, each bound by bespoke terms negotiated in advance. The process is visual, local, and human — relying on observation and certification at the jobsite.

Under the UCC

In Article 2, warranties are systemic rather than observational. The law *implies* two fundamental promises in every sale of goods: that the product is merchantable (fit for ordinary use) and fit for a particular purpose if the seller knows the buyer's intended use. These implied warranties arise automatically, without negotiation, ensuring baseline consumer protection in opaque markets where goods are mass-produced and buyers lack direct visibility into manufacturing quality.

In Offsite Construction

Offsite manufacturing shifts quality control upstream (regardless of ETO or CTO context). Pods, panels, and modular units are inspected and certified before shipment, currently by third party inspectors mandated by state modular programs. Each inspection produces detailed evidence of code compliance (structural integrity, fire resistance, energy efficiency) verified through testing and recorded digitally. In such cases, quality is neither hidden nor assumed; it is certified. Yet the UCC still overlays implied warranties as though no data exists. The result is double coverage: a manufacturer may carry liability for both the verified performance of a certified product and the open-ended expectations implied by statute.

A modernized framework could graduate from third-party certification per jurisdiction, and into UL listing.

It can also leverage serial traceability, and digital QA records to fulfill or limit implied warranties, shifting from assumption-based promises to data-based guarantees. This would maintain buyer protection while aligning liability with measurable evidence of performance.

It could also reduce redundant insurance and clarify which party (manufacturer, certifier, or installer) bears responsibility for the verified attributes of the product.

Analysis

The tension between implied trust and documented proof captures a central paradox in modern commerce. The UCC's implied warranties assume informational asymmetry; productization with offsite manufacturing eliminates it. When a product's conformity is validated through certification, applying implied warranties in their traditional form may not increase fairness, it may only multiply uncertainty.

For statutory review, the question is whether warranty law should continue to rely on presumption, or evolve toward recognition of certification as an evidentiary substitute for merchantability and fitness. Doing so would not weaken buyer protection; it would translate the UCC's core promise — trustworthiness — into the language of data and verification.

Q3b – How should risk of loss and title passage operate when offsite products change ownership before installation?

Summary

In traditional construction, ownership and risk follow physical possession: once materials are incorporated into the building, they become the owner's property, and insurance coverage flows accordingly. Under the UCC, by contrast, risk of loss and title passage are defined by contract terms such as "Free on Board" (i.e. "FOB origin" or "FOB destination,")[57] reflecting the logistics of goods in commerce. For offsite products that move through several jurisdictions and stages of assembly, these two systems collide. A module can be sold, insured, and financed while still in the factory, yet until it is installed, its code compliance and safety are unresolved. The absence of a uniform rule leaves contractors, lenders, and insurers uncertain about when liability attaches and when it ends. Statute might consider whether the UCC's transactional clarity could be adapted to define a continuous chain of custody that survives the transition from *movable good* to *fixed improvement*.

Detailed Explanation

Under Common Law	**Under the UCC**
Risk and ownership in construction are tied to physical progress. When a contractor installs materials in a structure, ownership passes to the owner by accession, and those materials become part of the real property. Payment, insurance, and bonding align with construction milestones—work in place equals value earned. The framework assumes a single site, a single jurisdiction, and a linear build sequence. If damage occurs before completion, responsibility is resolved through project-specific contracts or tort law.	Article 2 governs the sale of goods and defines both title passage and risk of loss by transaction type and shipping term. If delivery is *FOB origin*, risk transfers when the seller ships the goods; if *FOB destination*, when the buyer receives them. Title typically passes upon identification to the contract (§2-401[58]), while risk allocation is addressed in §2-509–510.[59] This system works cleanly for movable goods but falters once the goods are destined to become part of real property. The Code assumes mobility, not installation.

At what moment do offsite products cease to be a "good" and become an "improvement"? Who bears the risk if the product is damaged after delivery but before installation?

Prefabricated products cross several legal thresholds before installation:

- **Fabrication & Assembly:** The product exists as a good; title and risk rest with the manufacturer.
- **Transport:** Risk may transfer under the shipping contract, insurable as personal property.
- **Installation:** Title and risk shift upon acceptance inspection or connection to permanent systems.
- **Post-Installation:** The product becomes part of the real property, governed by state property law.

[57] § 2-319. F.O.B. and F.A.S. Terms.
[58] § 2-401. Passing of Title; Reservation for Security; Limited Application of This Section.
[59] § 2-509. Risk of Loss in the Absence of Breach, and § 2-510. Effect of Breach on Risk of Loss.

Because these phases often occur in different jurisdictions, each governed by a separate body of law, conflicts arise: insurers dispute which policy applies, lenders question when collateral becomes real estate, and contractors are uncertain when their liability ends.

A future uniform act (tested through model agreements or data registries) could establish a multi-stage title and risk timeline for offsite construction. It would allow the same product to pass through multiple legal identities — good, fixture, improvement — without losing the continuity of contract. Such a model could also clarify how digital confirmation of delivery or inspection data serves as evidence of title transfer, replacing manual certificates with verifiable records.

Analysis

When does a product stop being a good and start being a building? Common Law assumes a single, local transition; the UCC assumes mobility. Offsite construction does both, creating moments when neither framework fully applies. For statutory review, the policy challenge is whether risk and title should continue to transfer in one legal instant or be recognized as a sequence of legal transitions that reflect real manufacturing and delivery practices. Clarifying these handoffs would prevent double insurance, untangle liens, and modernize the concept of “ownership” for a marketplace that now trades in building components, not just materials. The continuity of ownership is not a commercial convenience; it’s the legal infrastructure that will determine whether offsite construction can scale nationally.

Q3c – When does the "Right to Cure" expire in an offsite supply chain that extends beyond the factories, showrooms, and completion?

Summary

The UCC's Right to Cure presumes that defects can be remedied quickly, before a good is fully deployed or consumed. In a CTO environment, however, a bathroom pod or mechanical module might be discovered as defective only after it is installed and enclosed within a finished building. At that point, physical correction may be economically or technically impossible.

> The first question is whether the buyer's right of rejection should end once the product is installed—or whether a tailored acceptance procedure should require inspection and sign-off before installation, shifting risk thereafter.
>
> The second question concerns scope: if multiple layers of QA/QC—factory testing, third-party certification, and pre-delivery inspection—have already verified conformity, should those checkpoints gradually limit the manufacturer's continuing duty to cure?

Together these issues suggest that "right to cure" may need to evolve from a single event in time to a tiered sequence of acceptance gates that allocate risk as the product moves from factory floor to building shell.

Detailed Explanation

Under Common Law

The contractor has the option to acknowledge and address defects by performing corrective work directly on site. The remedy is local and physical: defects are corrected through punch-list work, warranty calls, or negotiated allowances while the builder still controls the premises. Responsibility follows possession; if something is discovered during construction, the contractor fixes it under supervision of the architect or owner's representative. This approach assumes defects are *visible* and *accessible* — and that those responsible for the work remain on-site and licensed to repair it.

Under the UCC

The same role is addressed through the *right to cure*: the seller may substitute, repair, or re-tender conforming goods within the contract time. It is an elegant device for commerce in movable goods but becomes strained when applied to offsite products that travel through fabrication, assembly, interstate transport, and installation. Once a pod or panel is enclosed within a finished building, physical cure may be economically or technically impossible.

> **First Issue – Temporal Feasibility:** When a non-conformity emerges only after installation, the literal right to cure may be meaningless. Removing and reinstalling a pod could damage the surrounding structure or violate local licensing rules. A uniform act could explore whether acceptance should occur earlier—perhaps at factory release or upon third-party certification—so that rejection or cure occurs *before* irreversible installation. Alternatively, contracts might define which defects remain curable in situ (e.g., finish replacements) and which shift risk to the buyer after installation.

Second Issue – Diminishing Obligation: Modern offsite workflows include layered inspections: internal QA, independent listing agencies, and customer witnessing. Each checkpoint narrows the universe of possible latent defects. The law might recognize this diminishing exposure, limiting the seller's cure obligation proportionally to the completed inspections. In effect, the right to cure would taper as documented assurance accumulates, aligning legal responsibility with measurable control over the product.

For statute, the deeper question is whether cure should remain a binary right or evolve into a graduated mechanism that tracks both the product's physical journey and its evidentiary trail of quality assurance. Clarifying that continuum could preserve fairness for both buyer and seller while preventing the costly absurdity of trying to "cure" a defect entombed behind drywall.

Analysis

The Right to cure sits at the intersection of time, control, and fairness. Under current law, the UCC assumes that defects can be discovered and remedied before the goods are permanently deployed. In offsite construction, however, that assumption collapses once a pod or panel is installed, inspected, and enclosed within a finished building. At that point, cure is no longer a remedy—it is a disruption. This makes timing and documentation critical: the law must decide when acceptance occurs and how each stage of quality assurance narrows the scope of curable defects.

A modern right to cure might therefore operate as a graduated continuum rather than a single event, tapering in scope as the product moves from fabrication to installation. Early stages might allow full replacement; later stages might limit cure to in-place repair or price adjustment. Codifying that progression would bring the doctrine in line with the staged acceptance framework that already defines offsite production. For statutory review, the deeper policy question is whether "cure" should continue to mean restoring conformity in principle, or whether it must evolve to mean restoring functionality in context, preserving fairness while acknowledging that some cures simply cannot travel backward through the wall.

Q3d – How should the UCC's notice requirements adapt to tiered acceptance milestones in offsite construction?

Summary

Under current law, "prompt notice" presumes a single moment of discovery and a direct line of communication between buyer and seller. Offsite construction complicates that logic: quality data now flows through manufacturers, inspectors, shippers, contractors, and installers, each with partial custody of the same product. A defect discovered during transport or staging may be recorded digitally long before the contracting buyer learns of it. The result is uncertainty about whether the notice clock starts at detection, transmission, or acknowledgment. Future uniform language could define how notice operates across tiered acceptance milestones—ensuring that the opportunity to cure is preserved without overextending liability for every party in the chain.

Detailed Explanation

Under Common Law	**Under the UCC**
Notice typically follows hierarchical communication channels. A subcontractor notifies the general contractor, who notifies the architect or owner, often within a specified number of days. The process is formal but localized, and failures of notice are litigated after the fact.	The obligation is more direct: once a buyer discovers non-conformity, they must notify the seller "within a reasonable time," or forfeit remedies. The law presumes linearity: one seller, one buyer, one delivery. But in offsite construction, that linearity collapses into a chain of custody that crosses firms and states. A product may clear a factory QA inspection (triggering one notice event), then fail a third-party certification, sustain damage during transport, or be discovered defective after installation. Each stage presents both an opportunity and an obligation to notify, yet the UCC provides no rule for how these sequential events interact.

A future uniform act could formalize tiered notice, aligning it with the staged acceptance framework envisioned in Q5a and Q6. For instance:

- **Factory release:** manufacturer-to-buyer notice of readiness; begins buyer's inspection period.
- **Third-party certification:** inspection agency-to-all-parties notice of conformity or deficiency.
- **Transport handoff:** carrier-to-buyer notice of condition upon delivery.
- **Installation:** installer-to-owner notice of visible or functional non-conformities.

Codifying such a structure would convert today's fragmented paper trail into a predictable series of notice obligations, each linked to documented acceptance gates. For statutory review, the underlying question is whether "notice" should continue to mean a single, reactive communication, or evolve into a system of traceable acknowledgments distributed across the entire offsite supply chain.

Analysis

Points in **Q3b** (Risk of Loss & Title Passage) and **Q3c** (Right to Cure) already build a *temporal ladder* of checkpoints: factory release, third-party certification, shipping, installation, and final acceptance. The Notice Requirements question shouldn't sit *outside* that ladder — it should *thread through it*.

The true problem isn't just *what counts as notice*, but when notice belongs in a supply chain where multiple acceptance thresholds already exist. Right now, the UCC assumes one linear relationship: one buyer, one seller, one discovery moment. Offsite construction involves tiered discovery and tiered responsibility, meaning that notice becomes a relay, not an event.

If we reframe the question that way, statutory review should engage the need for legislative clarity, and how notice timing interacts with the staged acceptance framework established in this document.

Q4a – Can commercial remedies evolve to preserve relationships rather than terminate them?

Summary

Traditional construction contracts treat disputes as endings. When a breach occurs, performance halts, lawyers are engaged, and the relationship collapses. The UCC takes the opposite approach: it structures remedies (i.e. cure, cover, and damages) to restore commercial balance and resume trade. In an offsite marketplace where manufacturers and contractors work together repeatedly, continuity itself is a form of value. Severing a relationship can disrupt supply chains, increase costs, and stall entire projects. A future uniform act could explore whether remedies in offsite commerce should prioritize the restoration of trust and performance over termination, using verifiable data to measure fairness and compliance. The question for JEBURPA is whether continuity should become a protected commercial interest in its own right.

Detailed Explanation

Under Common Law	**Under the UCC**
Breach of a construction contract often leads to a declaration of default, termination, and adversarial claims for delay or damages. The process is punitive and isolating—each dispute resets trust to zero. Dispute-resolution boards and mediation attempt to soften this, but the underlying logic remains fault-based.	Remedies are structured to preserve commerce. The buyer may "cover" by purchasing substitutes; the seller may re-tender conforming goods; damages are compensatory, not punitive. The UCC's philosophy is that relationships are more valuable than retribution.

Offsite construction sits between these regimes. Manufacturers and contractors often share recurring, data-rich relationships governed by serial purchase orders rather than one-off design-build contracts. In this environment, the fastest path to recovery is usually operational, not legal: re-dispatch a replacement unit, share performance data, or modify digital specifications for future orders. A uniform law could recognize these continuity-based remedies—for example, allowing a seller to issue digital credits, share verified defect data, or trigger pre-authorized adjustments through the same automated systems described in Q3d.

Such an approach would align legal remedies with the iterative, data-driven nature of modern offsite trade. It would also harmonize with ANSI's consensus ethos: resolving conflict through structured collaboration rather than escalation.

For statutory review, the closing question is whether the next generation of uniform law can protect not only transactions but also the relationships that make a CTO marketplace resilient.

Analysis

Continuity may be the most under-recognized form of commercial value in the built environment. Productization through offsite manufacturing brings the UCC's repetition into the building sector: the same firms buy, sell, and integrate standardized products across projects and jurisdictions.

If future uniform law were to acknowledge continuity as a protected commercial interest, it could transform how remedies are framed, from punitive correction to operational recovery. Instead of defining success as restitution after failure, statutes could define it as the restoration of collaboration. This reframing would not only reduce litigation but also strengthen data integrity, since digital credits, verified repair logs, and transparent defect records depend on ongoing relationships to retain meaning.

For statutory review, the question is whether legal continuity (the expectation that parties will repair rather than sever ties) should be formalized as a principle of modern commerce. Embedding that ethos into offsite agreements would extend the UCC's deepest logic: that fairness is best measured not by who prevails in a dispute, but by how quickly and equitably trade can resume.

Q4b – How should commercial law evolve when offsite contracts, certifications, and acceptances are executed automatically through digital systems?

Summary

Digital contracting has progressed from scanned PDFs to self-executing data transactions. In offsite construction, contracts are increasingly embedded in configure-to-order digital workflows, where product configurators (rather than BIM authoring) generate bills of materials, materials are procured with automations, and inspection data from factory QA systems may trigger payment or warranty activation. While Article 2 recognizes electronic records, it does not yet define how an automated act—such as a timestamped model update or a sensor-verified shipment—constitutes legal acceptance or delivery. The absence of clear rules leaves both buyers and sellers uncertain about when digital confirmation equals contractual performance. Future statutes might consider whether the next generation of uniform law should provide explicit definitions for automated offers, acceptances, and performance events, giving digital transactions the same reliability that paper contracts once guaranteed.

Detailed Explanation

Under Common Law	Under the UCC
Project contracting and approval are human, sequential, and specification-based. An architect issues a spec; A project manager submits product descriptions; an architect reviews a submittal; A project manager issues a purchase order; an inspector signs a certificate of occupancy. Each act is deliberate and witnessed.	These functionally identical relationships can be captured electronically (email exchanges, purchase confirmations, or digital signatures all suffice to form a binding contract) but the law still assumes a human initiator and recipient.

In Offsite Construction

Offsite construction is now testing those limits. A manufacturer's enterprise system may auto-generate a purchase acknowledgment when a product is configured and ordered through a machine-readable digital interface. Factory QA data might automatically post to a shared ledger, triggering shipment release and insurance coverage. A blockchain record could simultaneously update title, certification, and warranty status. These are not hypothetical; they are emerging standard practices designed to compress procurement cycles and eliminate administrative latency. Yet the law has not caught up: if a payment is triggered by a sensor reading, who is the "merchant" giving acceptance? If a digital inspection log fails, is the contract breached or merely delayed?

A future uniform act could establish principles for machine-interpretable contracting, treating verified data events as valid evidence of offer, acceptance, and performance—provided they meet defined standards of authentication and auditability. Such clarification would extend the UCC's pragmatic spirit into the digital age, ensuring that automation enhances fairness rather than creating new ambiguities. For statutory review, the deeper question is how far uniform commercial law can evolve to recognize agreements executed by non-human systems—such as AI-enabled configurators interpreting product-defined constraints—while maintaining the accountability that underpins trust in commerce.

Analysis

The next frontier for contractual assent is intent expressed through data itself: transactions that confirm, ship, or certify automatically, without human intervention. The question is not whether such acts will occur (they already do) but whether the law will recognize them as carrying the same force as traditional acceptance.

For uniform law, this shift is less about technology than about traceability and accountability. Machine-readable contracting relocates human agency: embedding judgment in the configuration rules that define permissible actions. The legal task is to ensure those rules are transparent, auditable, and contestable, so that automation strengthens, rather than obscures, the chain of responsibility.

A future uniform act could articulate standards for authenticated data events, defining when an automated acceptance is binding, and how liability attaches when an AI agent acts within or beyond its authorized limits.

For statutory review, this is both a challenge and an opportunity. The UCC was created to standardize commerce in the industrial era; its modernization could standardize commerce in the agent-based era, where agreements are not just written, but executed by systems. The deeper policy question is whether the law can evolve to treat data as a medium of trust, capable of carrying the same legal weight as the paper and signatures it replaces.

Q4c – How should buyer's and seller's remedies be adapted when offsite products become inseparable from the buildings they form?

Summary

UCC remedies are designed to restore commercial balance quickly when a transaction fails. But in offsite construction, a failed transaction may involve goods already installed within a larger module, or a completed building. A buyer cannot simply "return" a wall panel or "cover" by purchasing a substitute once a structure is closed. The seller, likewise, cannot easily reclaim non-paid goods without disturbing the real property. These realities call for new interpretations of familiar terms: could "cover" mean sourcing a functionally equivalent system, rather than a physical replacement? Could "rejection" become a price adjustment or credit rather than removal? Statutory review might examine how UCC remedies could be adapted to preserve the Code's spirit (speed, fairness, and continuity) without relying on physical reversibility.

Detailed Explanation

Under Common Law	Under the UCC
Disputes are resolved through damages, setoffs, or arbitration; physical reversal is rarely possible. A defective installation might yield a change order, not a return. The remedies are bespoke and project-specific, negotiated long after performance.	Remedies are standardized, immediate, and symmetrical: the buyer may reject or revoke acceptance, demand "cover" (purchase of replacement goods), or seek damages for non-delivery; the seller may resell the goods or recover the contract price. These mechanisms presume mobility and interchangeability—attributes poorly suited to fixtures or assembled systems.

In Offsite Construction

Offsite construction blurs the UCC's assumptions of remedy. Once a module or panel is integrated into a building, the concept of "return" or "rejection" collapses. Yet the UCC's underlying goal (swift restoration of fairness) remains sound.

A future uniform act could reinterpret UCC remedies to operate in *functional*, *digital*, and *data-verified* terms, maintaining the Code's emphasis on fairness and efficiency while aligning its concepts with the practical realities of factory-built construction.

- **"Cover"** could mean obtaining a functionally equivalent replacement component, deploying a certified subcontractor to complete a corrective installation, or substituting a conforming digital design file when physical replacement is impractical (explicitly defined in § 2-712).[60]
- **"Rejection"** could translate into a price offset, service credit, or partial refund recorded in a digital ledger, creating a verified transactional adjustment rather than physical removal (see § 2-601).[61]

[60] § 2-712. "Cover"; Buyer's Procurement of Substitute Goods.
[61] § 2-601. Buyer's Rights on Improper Delivery.

- **"Revocation of acceptance"** could allow a buyer to suspend payment or warranty activation upon discovery of latent defects detected through post-installation data, pending verification (see § 2-608).[62]
- **"Specific performance"** could authorize manufacturer-led in-place repairs, verified by third-party inspection or digital QA logs, restoring conformity without dismantling the structure (see §2-508).[63]
- **"Replevin"** (buyer's right to reclaim identified goods) could become a right to recover undelivered or uncertified components still in staging, before they are installed or legally transformed into real property (see § 2-716).[64]
- **"Liquidated damages"** could evolve into time-stamped (digital) credits triggered automatically when lead-time or performance thresholds are missed, minimizing disputes over delay quantification.
- **"Incidental and consequential damages"** could be measured using verifiable logistics and sensor data rather than affidavits, turning what were once contested estimates into data-supported reimbursements.

Such adaptations would preserve the UCC's efficiency while grounding its concepts in the physical reality of construction.

For statutory review, the core question is whether *functional equivalence* can stand in for *physical substitution,* and whether that evolution could harmonize commercial remedies for a built world increasingly assembled from prefabricated parts.

Analysis

This question about buyer's and seller's remedies complete the progression built above. Already covered are:

- *How* defects are detected (notice - **Q3d**),
- *When* they can be cured (right to cure - **Q3c**),
- *Who* bears risk (title & loss **Q3b**), and
- *Whether* relationships can survive (continuity remedies - **Q1a**).

This remedies question ties all of these threads together by asking "What happens when those mechanisms *fail* — when cure isn't possible, risk has already shifted, and the relationship still breaks down?"

This question is also a hallmark of the UCC that exposes just how *ill-fitting* Common Law's bespoke remedies are in modular or offsite trade. Unlike construction's slow, fault-based adjudication, UCC remedies are fast, transactional, and aimed at restoring equilibrium, but they assume goods can be replaced or re-tendered, not disassembled from a building.

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[62] § 2-608. Revocation of Acceptance in Whole or in Part.
[63] § 2-508. Cure by Seller of Improper Tender or Delivery; Replacement.
[64] § 2-716. Buyer's Right to Specific Performance or Replevin.

Q5 – How might uniform definitions across states enable a more consistent legal treatment of offsite construction?

Summary

The UCC's uniform vocabulary created a shared commercial language that allowed interstate trade to flourish.[65] Builders, banks, and insurers all operate more efficiently because "title," "delivery," and "risk of loss" mean the same thing across jurisdictions. Offsite construction, however, lacks this linguistic infrastructure. Each state's modular program and licensing statute defines the same processes differently, some regulating factory work as manufacturing, others as construction, and still others as product assembly. These definitional gaps create practical confusion about insurance, bonding, taxation, and permitting. The question for statutory reform is whether a consistent set of definitions (codified alongside existing UCC terminology) could provide a uniform legal chassis for the physical systems already moving interstate.

Detailed Explanation

Under Common Law

Definitions evolve through case law and administrative practice. Terms like *contractor*, *improvement*, and *fixture* carry local interpretations rooted in historical precedent and licensing law. This diversity reflects state sovereignty but produces a patchwork of meanings that frustrates manufacturers operating across borders. A component approved as a "factory-built housing unit" in California may require new certification as a "modular building" in Florida—even when identical in design and performance. Financing, insurance, and warranty instruments must then be rewritten to conform to each jurisdiction's vocabulary.

Under the UCC

Uniform definitions form the backbone of commercial reliability. "Goods" are tangible, movable items;[66] "merchants" are professionals in their trade; "security interest" defines a creditor's claim — all consistent across fifty states. This terminological discipline allows contracts, insurance policies, and lending documents to operate nationally without renegotiation.

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[65] §1-201 is the UCC's master glossary. It contains the foundational definitions that create uniform commercial language across states. See:

(b)(35) "Security interest" — central to financing across jurisdictions
(b)(15) "Good faith" — baseline commercial standard
(b)(29) "Purchase" — the act that shifts title
(b)(36) "Rights" — foundations for enforcement

This question's argument, that offsite construction lacks a shared commercial vocabulary, maps directly to this section. It is the clearest demonstration of what definitional uniformity makes possible.

[66] § 2-105. Definitions: Transferability; "Goods"; "Future" Goods; "Lot"; "Commercial Unit".

In Offsite Construction

A future statutory infrastructure could extend the UCC's clarity into the built environment by codifying a concise vocabulary that captures the lifecycle of an offsite product as it transitions from *personal property* to *real property*. Such definitions would not create new regulation but provide a shared language for contracts, insurance, financing, and code enforcement across jurisdictions. (Related: § 2-501)[67] Illustratively:

- **Fabrication** – The controlled factory process in which component parts are manufactured or assembled into an offsite product in compliance with a listed design or certification. Title and risk remain with the manufacturer until transfer under agreed shipping terms.

- **Assembly** – The joining, integration, or completion of subcomponents within the manufacturing environment to produce a deliverable offsite product. *In many cases, assembly includes incorporating "tier-2" manufactured goods — such as dishwashers, water heaters, or ventilation units — that arrive with their own product warranties. These warranties must be preserved through the assembly process and transferred intact to the eventual building owner.* Assembly may occur within the factory or at an affiliated staging location under manufacturer supervision.

- **Transport** – The movement of an offsite product from the place of manufacture to a contractor-directed storage or staging area. This period includes any transfer of title, custody, or risk under the contract of sale, and is governed by applicable shipping or insurance provisions (see § 2-509-510[68]).

- **Installation** – The act of staging, hoisting, rigging, positioning, securing, and connecting an offsite product to building systems, foundations, or utilities. Installation converts the product from personal property to a fixture within real property and may trigger local licensing and inspection requirements (see §9-102(a)(44)[69])

- **Commissioning** – The process by which installed offsite products are verified for functionality, integration with building systems, and conformity to design intent before final acceptance. *Commissioning closes the loop between manufactured performance and in-place operation, yet, the act occupies a legal space not contemplated in the UCC: it sits after 'tender' and before 'acceptance,' enabling verification of performance that cannot be tested while the good is still a good.*

- **Acceptance** – The legal and administrative acknowledgment that an offsite product has met all contractually defined performance and inspection criteria, marking the transition of ownership, warranty activation, and the end of the manufacturer's risk of loss (see §2-401[70]).

- **Traceability** – The permanent documentation linking an offsite product's unique identifier, manufacturing data, certifications, transport history, installation record, and commissioning results. Traceability provides the evidentiary bridge connecting the product's commercial life under the UCC to its service life under real-property law.

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[67] § 2-501. Insurable Interest in Goods; Manner of Identification of Goods.
[68] § 2-509. Risk of Loss in the Absence of Breach, and § 2-510. Effect of Breach on Risk of Loss.
[69] §9-102(a)(44) " …" Goods " means all things that are movable when a security interest attaches. The term includes (i) fixtures… and (v) manufactured homes."
[70] § 2-401. Passing of Title; Reservation for Security; Limited Application of This Section.

Together, these definitions outline a shared taxonomy for offsite construction, one that could unify terminology across state programs while giving courts and contracting parties a stable framework for assigning risk (§2-509[71] and §2-510[72]), title (§2-401[73]), and accountability as products move from factory to foundation.

Such standardized language would not displace state modular programs but link them under a shared conceptual umbrella.

For statutory review, the deeper inquiry is whether definitional consistency (long the hallmark of the UCC)[74] could now serve as the connective tissue between commercial law and property law, allowing both to recognize and regulate the same artifact with the same words.

[71] § 2-509. Risk of Loss in the Absence of Breach.
[72] § 2-510. Effect of Breach on Risk of Loss.
[73] § 2-401. Passing of Title; Reservation for Security; Limited Application of This Section.
[74] Note especially § 1-103. Construction of Uniform Commercial Code to Promote its Purposes and Policies: Applicability of Supplemental Principles of Law. (emphasis added by authors)

(a) The Uniform Commercial Code must be **liberally construed and applied** to promote its underlying purposes and policies, which are: (1) **to simplify, clarify, and modernize the law governing commercial transactions**; (2) to permit the **continued expansion of commercial practices through custom, usage, and agreement** of the parties; and (3) to **make uniform the law** among the various jurisdictions.

Appendix B - Kristen Protis (Gilbane Construction) ETO Risk-Control Checklist for Offsite Methods

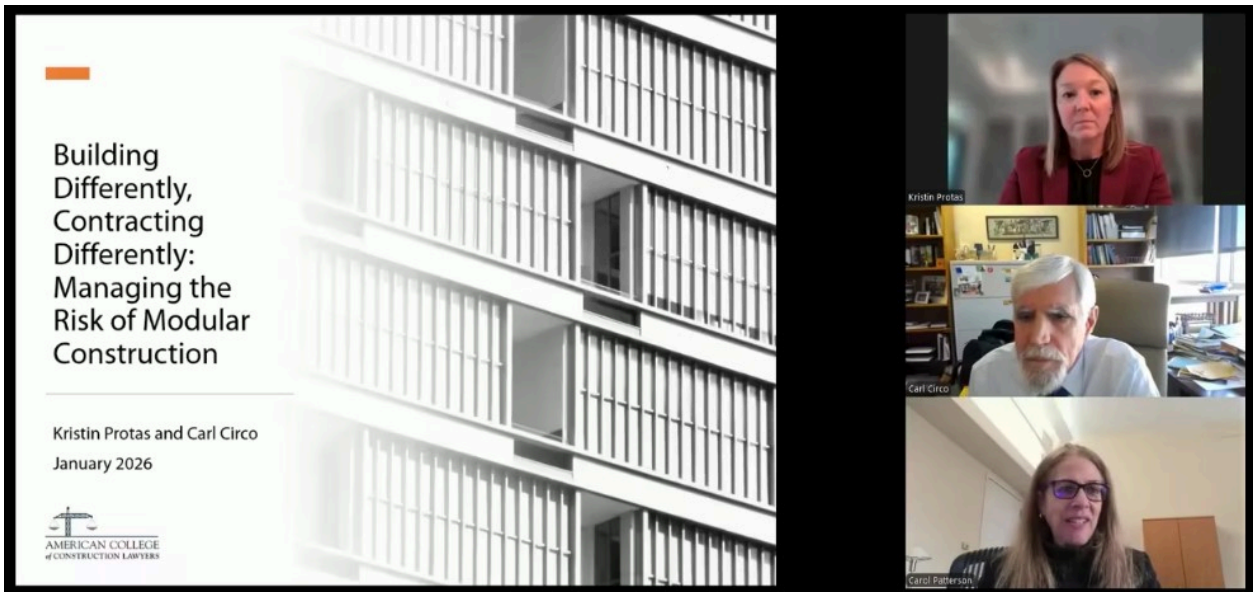

Image: *Screenshot of the ""Building Differently, Contracting Differently…" online ACCL webinar held on January 28, 2026.*

Overview

On January 28, 2026 the American College of Construction Lawyer's Education Committee provided a free webinar titled "Building Differently, Contracting Differently: Managing the Risk of Modular Construction." [video link] [transcript] The following description was provided by the producers:

> *Join Kristin E. Protas (Deputy General Counsel, Gilbane Building Company) and Carl J. Circo (Ben J. Altheimer Professor of Legal Advocacy, University of Arkansas School of Law) for a dynamic webinar exploring the evolving legal landscape of modular construction. Discover how volumetric modular approaches are reshaping project delivery, contracts, and risk management in construction law.*

Kristen's list functions as a practitioner's inventory of compensating controls required when offsite methods are governed by an ETO legal stack. Transcribed below is a list of those recommended controls.

- Each checklist item is evidence of a specific contract seam (risk of loss, acceptance, security, substitution, installation accountability) required in ETO.
- Each list time is a naturally structured in CTO + UCC-style workflows – via catalogs, constraints, and installation manuals.

In other words, this list is a general contractor's clear call for:

1. the development of CTO marketplaces to leverage offsite methods (generally), and
2. A call to develop the offsite-specific standard forms of agreement advocated for in this paper.

B1) Prequalify early, and treat the manufacturer like a mission-critical counterparty

What was advised:

- “the prequalification process needs to be done as early as possible.” (00:15:21)
- “I recommend you go … and you visit their factories.” (00:15:10)
- “You look at the quality of materials that they are using.” (00:15:17)
- “you’re checking the modular subcontractors backlog.” (00:15:25)
- “You’re looking at their financial capabilities.” (00:15:29)

How this suggests an ETO/offsite misalignment

ETO procurement assumes late substitutions and on-site recoverability. Kristen’s underwriting-style diligence is an implicit admission that, once fabrication starts, offsite scopes behave less like a trade and more like a product supply chain + counterparty risk problem.

B2) Verify bonding capacity up front (and treat its absence as a primary risk)

What was advised:

- “Do they have bonding capacity?” (00:15:32)
- “What is their bonding capacity?” (00:15:34)

How this suggests an ETO/offsite misalignment

ETO forms rely on familiar performance security instruments to keep projects financeable. Offsite firms often don’t fit those instruments cleanly, forcing project teams into bespoke risk scaffolding.

B3) Treat manufacturer default during fabrication as catastrophic, not “replaceable trade” risk

What was advised:

- “if you have a default… your project is gonna be dead in the water.” (00:15:52)
- “these are not widgets.” (00:15:54)
- “once you select your modular contractor, you’re pretty much hitched to them.” (00:16:21)

How this suggests an ETO/offsite misalignment

ETO assumes continuity via substitution; offsite manufacturing introduces non-substitutability (partially completed, proprietary work-in-process). That forces ETO contracts into defensive measures that CTO marketplaces largely avoid through standardized product interfaces and repeatable vendor qualification.

B4) Use a detailed responsibility matrix “from cradle to grave,” not a loose scope narrative

What was advised:

- “a sample design responsibility matrix…” (00:16:32)
- “you really wanna go through and be as detailed as possible…” (00:16:48)
- “identifying who is responsible… from cradle to grave.” (00:17:00)
- “design… erection… quality control… testing, inspections.” (00:17:03)

How this suggests an ETO/offsite misalignment

ETO scope narratives are tolerable when interfaces are resolved by field coordination. Offsite shifts interface resolution upstream; the matrix becomes a compensating control for a system that lacks product-grade definitions of responsibilities, acceptance criteria, and remedies.

B5) Finalize modular design early enough to price GMP credibly

What was advised:

- “in order for you to identify your GMP, that design has to be… finalized…” (00:19:06)
- “the modules are the biggest component of the project.” (00:19:20)

How this suggests an ETO/offsite misalignment

ETO’s traditional sequencing tolerates later design refinement. Manufacturing economics do not. Kristen’s point is that modular value only emerges when the legal/admin stack forces earlier decisiveness than ETO teams are structurally built to deliver.

B6) Establish and enforce a “design freeze date” (and treat post-freeze changes as risk-shifting events)

What was advised:

- “the… documents [call] the design freeze date.” (00:19:33)
- “the… freeze date is critical… so that manufacturing can begin.” (00:19:56)
- “if the owner… approves changes… after this… the owner is taking that financial risk.” (00:20:09)

How this suggests an ETO/offsite misalignment

ETO must *invent* a hard stop because it’s still managing a one-off artifact. CTO catalogs enforce “freeze” structurally through configuration constraints and pre-resolved interfaces—preventing late change from becoming a contract fight.

B7) Map “risk of loss” through transport: mode, policy, and whose insurance responds

What was advised:

- “risk… with how these modules are transported…” (00:22:20)
- “who owns the insurance if something were to happen during transport?” (00:22:28)
- “you need to understand who owns that risk of loss.” (00:22:51)
- “And whose policy is going to respond?” (00:23:04)

How this suggests an ETO/offsite misalignment

ETO contracting presumes most value sits on the jobsite and becomes “real property” continuously. Offsite methods create extended product states (factory → transit), forcing bespoke determinations of title/risk transfer that UCC-style product workflows handle more natively.

B8) Do the same “risk of loss” analysis for storage yards and staged modules

What was advised:

- “modular project storage yard.” (00:23:15)
- “what… if there was… a… windstorm… or… accident… who owns the modules at this point?” (00:23:26)
- “Who has the insurance associated with… accountability…?” (00:23:38)

How this suggests an ETO/offsite misalignment

The ETO legal stack has weak vocabulary for “high-value goods waiting to become building.” Storage and staging are normal in product supply chains; in ETO they become bespoke risk zones that require custom contract patching.

B9) Push insurance and risk-of-loss responsibility to the modular subcontractor until acceptance, then scrutinize limits/exclusions

What was advised:

- “places the risk of loss… fully on the modular subcontractor until… the construction manager accepts the units.” (00:24:34)
- “they are responsible for all of the insurance up until the point of acceptance.” (00:24:47)
- “you need to understand… limits… [and] exclusions…” (00:24:56)

How this suggests an ETO/offsite misalignment

Kristen is describing a hand-built acceptance regime to decide when value (and risk) transfers. In CTO workflows, acceptance states are ideally bound to product documentation and installation/commissioning criteria (not negotiated ad hoc per project).

B10) Control shipping: the manufacturer can't ship "when they're ready" if the site isn't

What was advised:

- "the modular subcontractor can't just start shipping the modules… without agreement…" (00:25:20)
- "projects… don't have large footprints… don't have storage." (00:25:29)
- "the subcontractor has to make sure… the project is ready… before they start transporting them." (00:25:48)

How this suggests an ETO/offsite misalignment

ETO treats deliveries as a site logistics problem; offsite deliveries are closer to Just-in-Time (JIT) product delivery with high consequence for readiness failures. The need for explicit shipping governance is another signal that the workflow has become *product*-like while the legal structure remains *project*-like.

B11) Consolidate installation/erection responsibility: one "source of truth" is safer for liability sorting

What was advised:

- "who is gonna actually install the units?" (00:25:59)
- "Who owns that risk of the installation?" (00:26:29)
- "I would like the modular subcontractor to hold that risk." (00:26:36)
- "it's much easier if it's one source of truth…" (00:26:54)

How this suggests an ETO/offsite misalignment

ETO liability sorting breaks down when manufacture/transport/installation are split across parties without a clean product boundary. Kristen's "one source of truth" is essentially a push toward product warranty structures, where the product provider controls the last mile of integration.

B12) Retainage won't protect you; many modular firms aren't bondable or eligible for SDI; LOC is partial leverage only

What was advised:

- "retainage… not gonna be sufficient to protect you." (00:36:46)
- "a lot… of these modular companies are not bondable." (00:37:00)
- "not eligible… [for] contractor default insurance…" (00:37:05)
- "we obtained a letter of credit…" (00:37:40)
- "not going to help you… if you have a catastrophic default…" (00:37:47)

How this suggests an ETO/offsite misalignment

ETO security instruments assume site-observable progress and a mature subcontractor ecosystem. Offsite manufacturing concentrates value earlier and offsite, pushing teams toward alternative instruments (LOCs, bespoke milestones, custom acceptance triggers) that look far more like product commerce than construction services.

Appendix C - Fostering a Culture of Innovation to Push the Boundaries of Prefabrication

Image: *Screenshot of the "Advancing PreFab 2026 Conference Agenda" The transcription captures portions of the conference's welcoming event, held on the main stage, with no other events scheduled against it.*

Location: Advancing PreFab 2026 (Industry convention held this year at the Marriott Allen, in Dallas, TX).

Time: 9:30A CT. Tuesday, February 3, 2026. Day 1 of the convention.

Session Description from Organizers (Hansen Wade)

> *• Exploring how teams are embedding innovation into their prefab culture, from leadership mindset to grassroots experimentation to drive continuous improvement and breakthroughs*
>
> *• Examining the structures, incentives and collaboration models that empower teams to challenge norms, share ideas and scale successful innovations across projects*
>
> *• Highlighting real examples where a culture of innovation has led to tangible advances in design flexibility, productization, automation and speed-to-market*

This appendix is assembled from two audience recordings (~23m total). Timestamps are approximate and are indexed to each recording (R1 and R2) using a linear word-to-time mapping (word count scaled to recording duration). For exact quoting, verify against the audio.

Recording 1: "Amy Marks - Advancing prefab, 2026, opening remarks.m4a" (duration ~08:40). Starts ~5 minutes into the live talk (per recorder).

Recording 2: "Amy Marks … more..m4a" (duration ~14:45). Starts later in the live talk.

Recording 1 - Opening remarks (starts ~5 minutes into the talk)

Transition: from field improvisation to an integration mindset

[R1 00:00] …we have to make sure that we're not out in the field figuring out how to put these things together. How many of you are still stuck out there thinking, well, how are we doing this? What are the means and methods for this?

[R1 00:13] And we're a little frustrated out in the field. We just make do so. We're past that. We don't wanna do that anymore.

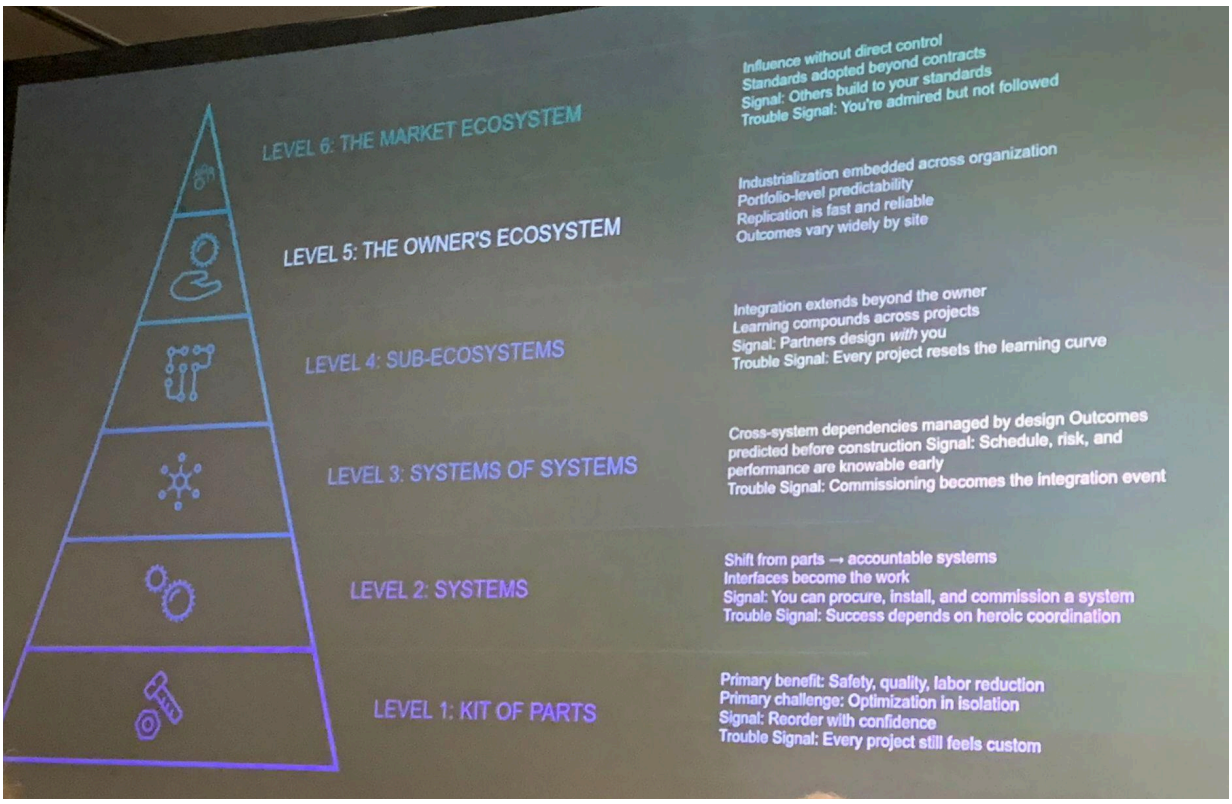

Image: *The pictured slide functions as the presenter's system overview.*
Note that this slide was projected at the conclusion of this event, and not at this point of the transcription.

[R1 00:19] I would propose to you a new framework today. This is the first time I'm showing this framework. And I would love feedback on it. I'm always open to continuous improvement, and different kinds of success.

[R1 00:32] So please, if you watch this today and you wanna challenge me or have questions at the end, I'm always open to questions and challenges.This is a new way of thinking about the system stack.

[R1 00:42] We have to get away from just those kits of parts, and we wanna go all the way up through market ecosystems, and I'm gonna go through each of these for you, a systems view.

Level 1 - Kit of parts

[R1 00:53] We know what a kit of parts, is. (This slide is) for my beginners that are out there.

[R1 00:58] These are things like electrical skids or power sensors or, multi-trade racks - any component part that we've prioritized over time and we know that we're doing that so we can move labor off site. (A kit of parts will) reduce the hours, of course it's safer, of course we know it's better quality when it's under a controlled environment, of course all of those things.

[R1 01:16] The challenge is optimizing that in isolation. How many of you sit there and you work on your products by yourself? A lot of you? How many of you are actually working with other people, competitors, owners, other architects across the industry to really think about that kind of art?

[R1 01:31] How do we know it's going well? The signal that it's going well is that people can keep reordering it from you with confidence. They know what the product is. They know they can order it. How do you're in trouble? Every project seems like we're starting from scratch.

[R1 01:45] Every time we go there, we have to redesign the component part. Every time we're there, it's not the 80/20 rule where we make some customizations, right, where our product is fungible and we can fix a few things and set it up. It's a brand new product.

[R1 02:00] That's how (you know) you're in trouble. That's the signal, the trouble signal. You should pay attention to that you haven't quite productized. We used to say back in the day that “a generator is a product.”

[R1 02:10] If you can think about your product, like a generator, “we know the inputs, we know the outputs, we know the performance of that.”

[R1 02:17] If you can't think about your product, like we think about generators, you probably haven't taken it far enough. We all know what that is. But, now let's think

Level 2 - Systems

[R1 02:26] One level up. Let's think about the component part as part of the system. Think about things like end-to-end electrical systems. These days in the data center world we're talking about liquid cooling loops. That's a system, right? Within that there are multiple component parts.

[R1 02:41] It may be a rack. It may be a water treatment skid. It might be, different types of overhead branching and racks for, hot out containment with multi-drain. That's a real entirety, with all those controls and it's BMS. That's a system. And so it's a shift.

[R1 02:55] You may not make all of those pieces and parts in that system. In fact, most of the time you're not. You're just making one of those pieces and parts.

[R1 03:04] How many of you have a part that works within a system that you actually feel like you're integrated into the rest of the people in the system? Raise your hand if you feel like you've fully been integrated in conversations and design.

[R1 03:17] I see a couple of people raising their hands. This is good, this is aspirational. This is where we have to get to. The interfaces really become the work. The signal that you're doing it right is you can procure and install and commission a system with ease.

[R1 03:31] You're in trouble when (system) success depends on heroes. How many of you feel like you're a hero at your job every day? Heroes, we gotta kill you. We gotta kill you heroes out there. We gotta make sure if you win the lottery, we used to say “If you, get hit by a bus,” but now we, we're not allowed to say that anymore. We say “If you win the lottery, what happens?” You retire. OK. Well, what happens to the rest of your company? What's the legacy your company leaves if you win the lottery?

[R1 04:00] We don't want it to be in (systems) trouble. We don't want the industry to be in trouble. We certainly don't want our companies to be in trouble. And that is a problem if you feel like you're making a Herculean effort every single day.

[R1 04:14] The metric of that is about system installation and first past success of everything working together with the integration. You don't have to go out there.When I was a little girl, my dad would take me to job sites.

[R1 04:28] He'd see a lot of MEP contractors pointing and looking in the ceiling. My dad would say “We're either making a lot of money right now or we're losing a lot of money right now.I don't know which, but everybody's pointing at something that has not been integrated well.”

[R1 04:43] There's lack of information. Misinformation. You're doing well when the metric is about “How long does it take for that system to actually get up and running to be ready to be commissioned?”

Level 3 - Systems of systems

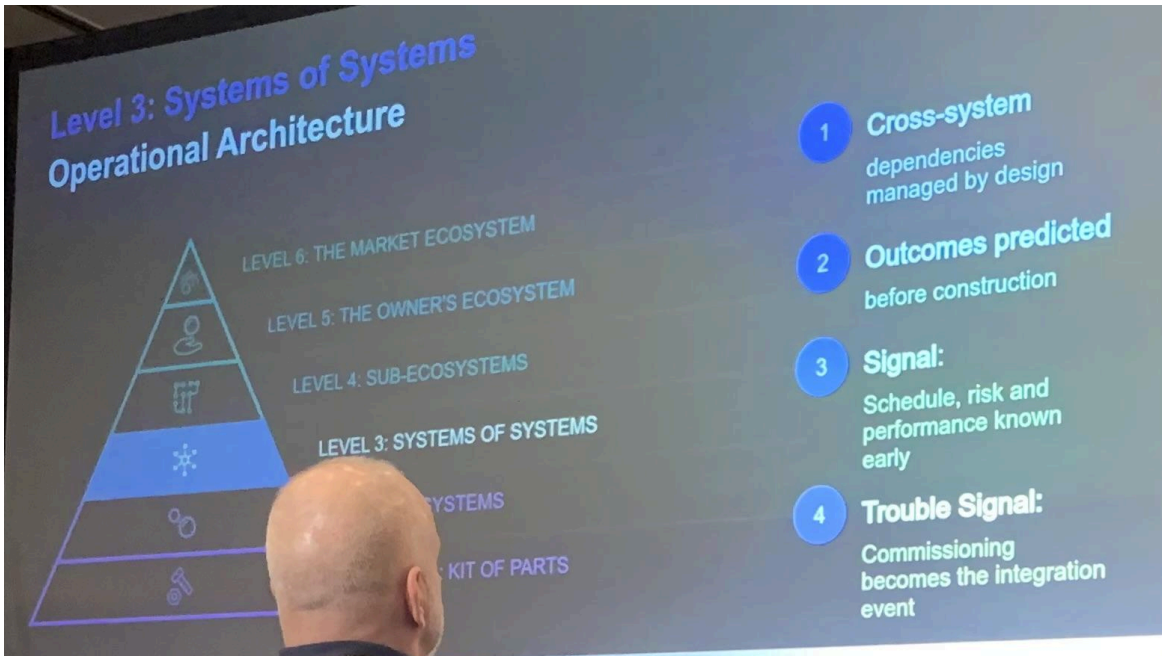

Image: *Presenter's slide for 'Level 3.".*

[R1 04:53] One level up from that, after we think about things within a system, right? We start thinking about, whatever the building is, whether it's a hospital or a data center or multi-story housing, that there are layers of systems that have to work together.

[R1 05:07] We know that things like power and cooling and controls along with commissioning logic. If you're looking at something like a data center like us. And what's the metric?

[R1 05:16] “What is the length of time it takes for commissioning from the baseline, every time?” from the target to the actual duration from multiple systems to get.. whether it's your TCO or occupancy, whatever that is to get your end users in the building.

[R1 05:30] We have to think about cross-systems dependencies. How many of you have the structural system in place and then all of a sudden “Let's talk about prefabricated MEP.” It's too late by then.

[R1 05:40] We used to make a joke in housing when we did multi-story housing, like, “You shouldn't put the bathtub over the main line, right?” That's a joke.

[R1 05:50] It's like all of a sudden you have the roof structure put together and now we're talking about where we're gonna put mechanical prefabricated mechanical systems, and it's like, “Hold on a minute, now we have maybe the wrong structural system.” Is that right?

[R1 06:03] Is it the optimized structural system for what we're doing with the very expensive components in the MEP system? We have to start thinking systems on systems on systems. And how we're really thinking across the building in totality, we know we're looking for outcomes that are predictable.

[R1 06:17] That's what you're really striving for, that you have durations that are attainable. I've always said from day one, right, Melissa, it's not about savings. Where' is <inaudible name>? He said it first on stage. It's not about savings. It's about certainty, right?

[R1 06:30] I don't care how much he works in big hospitals around <inaudible name>, and he said, I don't care how much you tell me we're gonna save. I need certainty. It's about certainty. It's about. The ready for service date. It's about when your beds are gonna open in the hospital.

[R1 06:44] It's more important to have certainty over your commissioning time, your installation times, your, ready for service, whatever that is, it's gonna be about certainty, and the only way you're gonna be able to start predicting these types of certainties is with systems integration with other systems up front where we think about this upfront where we hopefully standardize some of these systems up front so.

[R1 07:04] Every time we layer them on, we understand how to optimize not just the system but which component parts and systems work best with others, which structural system is the right structural system for us, we use precast (concrete panels) at Compass, and it's a fantastic system for us with the other systems that we've prototyped and put in standards and want to layer on those systems.

[R1 07:23] We know what systems work well with other systems. We've thought about that in advance so we can get more predictable, so we understand the component schedule. In time, not just a P6 schedule with 8000 line items. That's really important for us.

[R1 07:36] And after that, this is where it gets a little bit interesting to me, I think the first three things of this, and I was talking with, our CEO Chris Crosby. I said, “What do you think about the new framework?” And he said, “I think it's a little academic.”

[R1 07:51] And I said, “It is a little academic, and we do have to think about where we wanna get to aspirationally.” How many of you feel like you're already at the system of systems conversations in your work right now? Raise your hands.

[R1 08:03] Some of you? How many of you are still stuck at just optimizing the entirety of one system? If you're a mechanical contractor, we're just looking at one system across the board. Anybody? How many people are still at the component part level? A lot. Are you like me?

[R1 08:18] Raise your thanks, <inaudible name> raising your hand over there for being honest. So after we think about the physicality of the component parts, we talked about components being part of an optimized system, right? Being part of multiple systems that make up a building.

Level 4 - Sub-ecosystems (setup)

[R1 08:31] Then you wanna start thinking about sub-ecosystems, and this is a new conversation. It's not about the physical piece parts. This is about, do you have a group of subcontractors.

Recording 2 - Continued (starts later in the talk)

Level 4 - Sub-ecosystems (continued)

[R2 00:00] You reuse those designs, right, and they're fungible, they're customizable, but you're doing them across multiple organizations and they're helping one another.

[R2 00:07] It's interesting when we think about systems and systems, we get the sub ecosystem partners together and if I told you right now in, I don't know, any kind of system, an electrical loop or a liquid cooling loop.

[R2 00:19] You might have a great part, but once you get together in the sub-ecosystem together that works together, eventually what ends up happening is people start talking to one another and they say, I don't think you should do that part of the loop. I, we should do that. We're better at that part.

[R2 00:34] Do you wanna give us that part of the scope, and we'll take on this part of the scope. We're just better at it and we're more in our organization, better to do that.

[R2 00:44] And then you'll see little bits of the integration start swapping between the sub-ecosystem partners because they feel confident and secure that those are their jobs. And they can work collaboratively with one another and so you'll start to see groups of people, groups of companies working more and more together for different applications and we have that actually.

[R2 01:01] We're showing, at Compass, that it is possible, because we're working with the same sub-ecosystem of closely coupled partners on every single job. It's one of the reasons why we can move faster, and I – I love to make the joke – how many of us love the movie Stepbrothers?

[R2 01:16] Like a little bit of humor here. “We already made bunk beds!” We made bunk beds when we signed those enterprise contracts. We have lots of room for activities. We have a lot of time.

[R2 01:26] Time on our hands we don't have to worry about transactions anymore because we can sit and talk about how we evolve this product, how do we get you with the rest of our partners to optimize this entirety of this system?

[R2 01:38] How do we think about the sub ecosystem with the incentives for contracts that make the most sense for you? I feel like where I went to work, I hear this phrase more often than not. How do we make this easier for you, partner? What is the normal way you would wanna do this, right?

[R2 01:55] I'm looking at my partner in front. How many times have you heard that? What's the easiest way for RK to do this? or what's the easiest way for <inaudible name> to do this? How do we make this easier for Schneider? How do we make this easier for <inaudible name>?

[R2 02:09] And it's not about just fitting, it's about what is the right combination in the sub-ecosystem that makes us the most productive, and a lot of that has to do with our culture, right, our business cultures. I can't imagine at Compass if we inserted somebody into our sub-ecosystem that didn't have our culture.

[R2 02:24] We would turn to them and say, how do we make this easier for you and for your next partner and I, I just, I never hear that in conventional construction like how do we make it easier for you? Do we need to pay you, this instead of that? Is this a better schedule for you?

[R2 02:41] Can we come to your factory? Can we look and see how you're set up for production? Can we help? Does it help you if we order this instead of that first, or can we store things for you? I think that is where we're moving towards.

[R2 02:54] And so when I say meet five great people, I'm gonna look at you, Mark. You've met. Some of those people at this conference, right, in your sub-ecosystem, your preferred sub-ecosystem, 100%, Jamie, you've met people here in 10 years that Billy Bullock, where are you?

[R2 03:08] Yeah, you've met people here that have become part of your Star Electric and things like that that I know you've met at this conference that have become part of your sub-ecosystem. This is really important. This is about people, about companies, and about culture, and you have learned across multiple projects, right?

[R2 03:23] You can talk about projects because you're on multiple projects with each other. you're doing this well if. Your sub ecosystem partners designed with you. They're there and it's like this was product 1.0. This is now 2.0. You have a say in that. You feel like you're part of a team.

[R2 03:37] It's like, again, all those things we hoped for that you would be treated like one team. it's working when you see that. If you see this, the trouble signal is that every project resets the learning curve. Where were you, Michael? I know you're on that sometimes because you raised your hand. That's a problem.

[R2 03:53] you're not in a sub-ecosystem if that happens, right? On those projects, Michael, you're not with people you've worked with before or the same people, correct? Yeah, you're with different people. We don't realize that our procurement and our risk management does us a disservice because of that, right?

[R2 04:07] Think of all the wasted time you have in trying to reteach people stuff that they should have already known or that you have partners that do know already. So if your projects look like that, start asking yourself, am I part of a sub-ecosystem with other people that are like-minded?

[R2 04:22] Am I working for customers that believe in the sub-ecosystem, that believe in the certified installer, that have. Inventory across multiple projects that are programmatizing things and not thinking just about products.

Level 5 - Owner's ecosystem

[R2 04:31] Let's talk about the owner ecosystem. I've moved over to the owner's side. It's fantastic.

[R2 04:36] I feel like I've had a 360 view of the industry from almost every angle, and what's so great about it is you start thinking if you're with the right owner and you're with the right group of people with the right culture, you start thinking portfolio-wide, right? You start thinking programmatically.

[R2 04:50] You start thinking about what is the standard design that we wanna use every time. How do we think about it? Everything we do in productization, not the component part itself, but everything, not just the physical features of the building, but the maturity of the company in totality, right? What is the standard data?

[R2 05:06] What's the right logic? What's the right culture? And how many of you have heard of the industrialized construction maturity assessment here with ICG? Raise your hand.

[R2 05:14] I see my ICG guys up in front. I see some guys that have actually taken it that are sitting up in front. So if you haven't taken the ICG industrialized construction maturity assessment, you are really assessing your owner ecosystem in that assessment. We are very proud that we've just received the first platinum.

[R2 05:30] Thank you to ICG and thank you to Compass. Really, I feel like that was the whole team effort of years and years. Prior to me even getting there that really allowed us to receive a platinum award.

[R2 05:41] But if you haven't thought about that, it's so much less about the component parts than it is about your risk management set up properly to procure to do this right. Do you have the right thought process in your procurement? Do you have HR that likes hires for the right culture?

[R2 05:56] Are you thinking about strategy in the right way? Is it you see? Suite that's thinking about it the right way, it permeates into everything that happens. I was just telling this story to Chris actually last night that somebody called me and they were like, Hey, we wanna do more prefab at our business.

[R2 06:12] Can you, basically, give us some advice? And as I heard them talking and they said, Well, you guys, you do so much to accomplish, you're doing so much prefab. And I said to Chris, I was like, it dawned on me that I don't think the person who was talking to me.

[R2 06:27] Actually realized that I have nothing to do with why we do great prefab, literally nothing. I mean, I could leave your point about being here. I could leave tomorrow and the prefab will be as great, if not better, than it was yesterday because of the maturity of the organization.

[R2 06:42] And as the person was describing to me what they wanna do, they were like, Yeah, we've got engineers. They just wanna do projects and they're buying it like this, and all they wanna do is bid it out. I thought the whole time he was talking to me, I'm like, you're going to fail.

[R2 06:57] It's hard not to think that. And again, it has nothing to do with a single individual person. It has nothing to do with if you have done prefab in the past on projects. It has nothing to do with the beautiful case studies you've seen from this company in marketing.

[R2 07:12] It has everything to do with the fact that the owner's ecosystem was not ready for that kind of success. They're not set up for that through their culture, through their program, through their innovations, through, the fact that we're looking at things like Kaizen, everything that we've done in the past, we wanna continuously improve.

[R2 07:28] We read that, drink that, sleep that when you get there, it's like a reprogramming. Of your mind at Compass and it's a great reprogramming that I would love for every organization to go through and assess if you're ready for this because you cannot move up on these levels unless you mature as an organization in totality.

[R2 07:45] So the metric there is time to replicate. How long does it take us to do one data center and replicate that consecutively even concurrently at the same time at another campus? And for those of you who don't know what we do, we're hyper scalar, data center owners and developers, so we're doing giant campuses.

[R2 08:01] 10 buildings at a time and we're talking about the same building over and over and over and over again with the same partners over and over and over again. But every time (we are) evolving to the next level of detail.

[R2 08:12] To the next better standard, collaborating with our partners, collaborating with the design team, collaborating internally, making sure that everybody has a voice in innovation and incremental innovation, incremental little steps forward all the time, not giant home runs, small incremental steps to get more predictable over the entirety of the portfolio.

[R2 08:27] How do you walk on a job site and immediately know that it's on time or not on time? You can almost tell by the way the big assemblies are being installed when you walk out. I don't need my dad to see people pointing anymore.

[R2 08:40] I can, we can walk out and be like, I know those are 5 a day and this is 10 a day, and it looks like that's on time and you don't even need to read a P6 schedule. You would know. Those things are on time in the portfolio, right?

[R2 08:55] And so the signal that you're doing it right is that you can replicate things really fast. It's very reliable, right? You don't (need) a Herculean effort. It doesn't feel like we're starting a campus in the beginning and it's totally different. The trouble signal is when outcomes vary widely, right?

[R2 09:10] Like when all of a sudden you're like, wait, this campus is supposed to be like this campus and that one was X amount of weeks and this one is X amount of weeks, and we don't really have that. That's when you have an issue and, and you should be aware of that.

Level 6 - Market ecosystem

[R2 09:26] And then we've talked about this a little bit before and for those of you, I'm a Clayton Christensen fan about the innovator's dilemma. We've talked about that in the past here at this conference if you haven't read his book. It's fantastic. It talks about how you can chip away at an industry from the bottom up.

[R2 09:42] And he talks about that with the steel mills and the mini mini mills and over time I have to be honest, after reading those books, it feels like an innovator's deception to me. It's like you told us we could change an industry like one little part at a time and it's like.

[R2 09:58] I don't really think that's how an ecosystem works. Yeah, you could change the steel industry, but how do you change the built environment ecosystem one little thing at a time from the bottom, and I don't think that that is how it's happening. I think it's actually happening top down, not bottom up.

[R2 10:13] For those of you who know what's going on in the data center world these days or the semiconductorship, how many of you are building in those spaces right now? Oh, so many of you. You're seeing innovations happen because there's a need, right? You see there's a need for fastest to ready.

[R2 10:28] You see there's a lot of money put into those industries. We're learning things. We're meeting other partners. We're getting together because it's necessary right now, and there's that, that need is overcoming a lot of obstacles that have been there with us in the past, right? That same thing happened in pharma a little bit as well.

[R2 10:45] That's why pharma picked up a lot of. Prefabricated systems and and owners adopted that because we had a need, right? COVID made a need for that in a lot of ways to go from 7 years changing over a production line there to 7 months, right?

[R2 10:58] And some of us that witnessed that saw the need is what drove that differential top down. The biggest companies with the biggest money and the biggest need actually creates scale for us so that what we do in data centers, I know Chris always says we hope other data.

[R2 11:12] Centers companies copy us and we hope they learn something and they that they benefit from the sub-ecosystems that we've set up at Compass and we wanna see more data centers being built and then if more data centers can learn how to do some of these things, then more hospitals will borrow those things and we'll see more hospitals being built and more hospitals are built like that.

[R2 11:32] We have more manufacturing that can happen and big manufacturing facilities and ultimately, where's my friend from Long Island, it trickles down the house. It doesn't start with housing in my opinion. It can't move upward. It's coming down.

[R2 11:43] Everything that you learn on these very complicated jobs where people have the money to spend and they're learning all these great things and the scale is created, they have time to do the smaller jobs.

[R2 11:53] They have time in some of our partners to have an extra production line making the same thing for a hospital that we would make for a data center. I know because I've talked to our partners about it.

[R2 12:04] They're not quite selling it like that yet, but they could, and eventually it gets down to housing where we can have better housing for all if we build better data centers today. We build better hospitals today. I truly, truly believe that that is the deception, unfortunately that Clayton Christensen gave us. We have to think top down.

[R2 12:21] And so you have influence. that this is happening. When I go to a different show and people at hospitals are like, we're watching what's happening at Compass. We want to replicate that for our hospital chain. I know in the beginning HDA was in this space. People would come to HCA Hospital Corporation of America.

[R2 12:37] You had billions of dollars of work and you were starting with prefab when nobody else was doing prefab, right? And people came to you just to learn. And you have influence at that point. you've affected the market. And when you have that kind of influence like Compass has right now, I feel like standards are adopted.

[R2 12:54] The signal is that you built your own standards and people start using your standards elsewhere, and the trouble signal is people think you're cool, but they don't actually follow you. They're like, wow, that, I mean those guys are great, but I don't wanna do what they're doing. So where do we fail right now at this framework?

[R2 13:11] We stopped at level 1 or 2. A lot of us are stuck there, and we push integration to the field and we say, figure it out, make do. We don't let that learning come back into the office. We don't have that learning come back to us. We treat partners as very transactional.

[R2 13:26] you are making a mistake when you're transactional, and we're depending on individual heroes and not systems, and

Conclusion: where the industry stalls, and what to do next

[R2 13:31] I'll leave you with this. It's not a technology gap. It's not a component gap. It's not, it's really an integration and an ownership gap, it's not any of those things that you see when it's about the part itself.

[R2 13:42] We have to reframe this and really start thinking about "In order to have components scale efficiently and systems really scale with certainty." A culture is gonna determine whether either one of those things becomes a reality, and that is true. Without a good culture, without a good environment, you can't, you cannot move forward.

[R2 13:58] And so think about this, this is your homework. Think about where you actually operate. Where are you, at on this framework, right now? Where are you seeing value leaking from your organization? Where could you do better? Where do you wanna invest next?

[R2 14:11] You can't, you shouldn't start investing at the top of the food chain if you're still down at level one. Start thinking about what you need to invest in. Take one first concrete step of action from this conference. Just do one thing and you'll be better off and align your people processes and partners.

[R2 14:26] Be intentional, so that you can move beyond prefab as the baseline and start optimizing your sub-ecosystem and really focus on proper integration. I'm going leave this up here for learning. This is the framework in its entirety and I'm open to any kind of feedback to hear about it.

[R2 14:41] I think we have a couple of minutes for questions – and challenges.

Appendix D - How a Vision for Speed, Modularity & Sustainability Transformed Data Center Delivery

Image: *Screenshot of the 15 Years of Compass presentation from the "Advancing PreFab 2026 Conference Agenda" The transcription captures portions of the conference's first presentation, held on the main stage, with no other events scheduled against it.*

Location: Advancing PreFab 2026 (Industry convention held this year at the Marriott Allen, in Dallas, TX).

Time: 10:00AM CT. Tuesday, February 3, 2026. Day 1 of the convention.

Session Description from Organizers (Hansen Wade)

> *•Exploring the founding vision for Compass Datacenters to understand how speed, quality and sustainability became the company's defining principles*
>
> *• Unpacking the role of modularity and prefabrication to see how these methods enabled Compass to consistently deliver faster and more cost-effective projects*
>
> *• Examining Compass's sustainability journey to learn how early commitments have evolved into industry-leading practices that continue to push the sector forward*

This appendix is assembled from an audience recording (~23m total). Timestamps are approximate and are indexed to each recording (R1 and R2) using a linear word-to-time mapping (word count scaled to recording duration). For exact quoting, verify against the audio.

Source materials: Audio recording of Chris Crosby (CC) from the audience (.m4a) + AWS-generated transcript (.txt).

Coverage note: Recording begins approximately ~2 minutes into the live talk. Timestamps below are approximate and are relative to the start of this recording (not the event). Timestamp format: [CC mm:ss]

[CC 00:00] Construction, by its very nature, by the entire way that it's set up, necessitates heroes.It's a necessity. It resets learning every time, and we have to break that.

We call it breaking the brain at Compass, with all of our contracting partners, when we go into new markets. We spend all of our time on the left side of the schedule trying to make them understand "We are not like anything else." "Please don't make any assumptions." "We'll work through it; this is differently."

[CC 00:30] What (William Edwards) Deming came up with was “How we manage at a system level, not the people.” In the industrialization era, the GM cars of the world, Ford cars of the world, going back to the 1980s, that was a very industrialized model.

[CC 00:45] It sounds a lot like how construction is done. Oh, I've got high volume, so I buy these parts and pieces. I have a few different sets of things. I've got some kits of parts, but for the most part, it's based upon volumes. And labor follows in a very sequential process.

[CC 01:10] And what happened in the Toyota way? It threw it on its head. It built a system that empowers workers to make things more efficient on a consistent basis.

[CC 01:15] (The Toyota way) highly values self-discovery, self-evident behavior over learner-trained behavior. So, think of a three-pronged outlet. You hand it to an 80 year old with dementia, or a 3-year-old that's never seen it before, they (both) can look at the wall outlet, look at the plug, and self-discover what to do with built-in quality control.[75]

[CC 01:30] (Think about) IKEA furniture versus baby furniture. Legos versus Erector sets. One is easy and one is hard. But the beauty in that is in the simplicity, the profoundly simple.

[CC 01:45] In this world, you value simplicity much, much higher than anything that's complex. <Motioning to the slide> Japanese words here, kaizen, jidoka… continuous improvement how we automate with a human touch.

[CC 02:00] Where we take things from, um, the standpoint of, “We're gonna do things but we are not going to do things in a dumb manner.” “We are going to always check it.” “We're going to look at it.” “Our workers have value.” and “We are always going to follow the order when we go to automation.”

[CC 02:15] In other words, the people first have to understand how, how it's supposed to work. Everybody understands what all the interfaces are. Then when you create a process, that process then gets repeated multiple times. You call out the things that don't make any sense. Finally, after you've repeated that on an efficient basis, then you get a system in place. You're never a slave to that system.

[CC 02:45] So how do you let people be involved with everything? The human element – that Amy talked about in her last chat – is everything. Everything in our world, when you do this type of manufacturing approach, empowers problem-solving, and it takes a fundamental concept that instead of having to walk around through the world where you think everybody's trying to screw you all the time – which is the result of Sarbanes-Oxley and 3 bid models – and all of those things got created post the Enron blow up.

[CC 03:15] I remember as a public officer I'd get questioned by the audit committee about, “Wait, wait a second, you, you didn't bid that model? That's not best practices.” Yup, absolutely right, it's not best practice. Thanks for your input. Yeah. Who screws their best customer. The person that goes to business once. Nobody does that. It's the most idiotic concept. What are you protecting against?

[CC 03:45] Deming proposed – and we prove it out day in and day out – that we can be the lowest total cost of ownership on our side. And the highest margin customer on the other side. We prove that out every day.

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[75] CTO markets converge on interface standards that make components interoperable across vendors and project contexts. Examples include USB, standardized couplings, or as Chris Crosby signals, the three-prong electrical outlet. In this plenary discussion, Chris Crosby invoked the three-prong outlet as a mental model: once the interface is standardized, the ecosystem can scale without renegotiating how everything connects each time.

We have hard evidence for that, whether it's in cost, whether that's the speed, uh, whether that's in the quality that we're able to do.

[CC 04:16] But now, when you take and you make it a manufacturing floor … by the way, any of you guys, who does high rises here? All right, you guys have it further along and this industry needs to steal from the high-rise industry. Because for whatever reason, a GC can absolutely understand the concept that he put a different trade on every floor in a high rise.

[CC 04:30] But as soon as I flatten that building, it's right back to linear thinking. That makes no sense whatsoever. A perfect job has every zone active. That's how I would know… because it looked like a factory.

[CC 04:45] I wouldn't have people waiting for, "Oh no, we can't do that! That would be a double mobilization." Who cares? You're looking at the whole problem wrong. How come we can't do it? (Just) like, we already do some other things? We see those continuous improvement elements happen (on our projects). So you got be step-built, linear thinking, and scheduling. We have to "re-sequence…" boy… talk about a word I really hate.

[CC 05:15] What is sequence? What does that even mean? That already implies that we're linear in our thinking as opposed to parallel networks. How can you possibly get faster, more efficient if you, if you frame every discussion from a linear perspective? The other big thing that happens is you don't take defects and just pass it downstream.

[CC 05:45] (Instead) You empower teams to stop. Safety is one of the easiest examples. I don't know if that's at every job site. Anyone can stop the site at any point in time. It doesn't matter your level, whatever. It could be a janitor. A janitor call an all stop from a safety perspective, if we think there's a risk at site. So that's from a safety perspective. How do you do that for the workers?

[CC 06:05] How do you empower them? Well, you have to allow failure on job sites because failure is where you learn. You have to be encouraged to be able to get back the feedback of what's not working. What can we do better? How could we – Amy brought it up earlier – how can we help you? What's hard? What are we making hard by what we're asking you to do versus what could be easy? If you're not empowering the workers, empowering the teams to do that, then you don't get the real data.

[CC 06:35] And that was the beauty in (contrast to) the GM model of the factory line, where you wait for union management to tell you what to do. You can't, can't make a suggestion. If you're doing step A, B, C, and D, and even though B and C are really stupid, you still have to do them in that order, otherwise management's going to yell at you.

[CC 07:50] What are you gonna do? You're probably gonna skip B and C when they're not looking. That may create a risk. A new person comes in, they don't understand it. I'm not doing that. Next thing you know, you get some defect at some later point in time.

[CC 07:05] If you empower the worker, the worker can raise their hand and say, "Hey, A, B, C, D is dumb. We don't need to do that. If I just did A, I could skip to E or I do A, E, and then we end up at D." That's much more efficient, and he'll say "I'm going to like my job."

[CC 07:20] You have to be able to do that. What happens when you do that is you're no longer just passing the line of defects over and over and over again. (Instead,) You're getting accountability from the worker to "Tell me what's stupid. Tell me what doesn't make any sense," without any pride associated with that. I mean, finding errors, catch it before it's covered… That's everybody's dream. Nothing better than that.

[CC 07:50] The further left they catch it, the less of an issue it is, the better off we are. We actually started all the way at the bid process. If we take our drawings out.. and we give it to a contractor… we get a shitty bid.

[CC 08:00] If we do not sit there and spend time educating, going through it, showing projects, bringing them to our site, we fly people to our sites to go see how other people are doing it. We facilitate phone calls between our partners. “This is how this is done. Please don't make your bid yet. Please learn more.” Because all they're gonna do is price in. They've heard 90 million times that, “Yeah, we do a lot of prefab.And all prefab does is cost you more and take longer.” Unless you are system thinking. It doesn't do anything else. It's just the same thing that you can do at a job site, off-site.

[CC 08:50] ..If you're not system thinking, about how they all fit together, and “Why you want to do that, holistically…” (Well,) You would know from an economics perspective. (Economics was) one of Deming's fields. (He spoke) of a concept called LRAC, the long range average cost.

[CC 09:00] And what happens with every system is when it starts, you think it's gonna be here <hold his hand shoulder height>, but it actually costs you about this <hand at head height>. It gets to this peak of cost and then all of a sudden you start doing little kaizens. Them the short range average cost reductions (build). and that curve starts to go down <hand steps toward belt level>.

[CC 09:20] We like to peg all of that curve about halfway down that slope and give our partners the rest of the margin. Because our curve at that point is so good we're so far below we can't even share what we're getting on pricing with folks. And we don't need all of it. Because we want them to sit there and innovate with us.

[CC 10:00] We want them to design new products with us like we've done many times. We want them to stand up new factories, like one of our partners has just done for us.

[CC 09:45] It's through partnership that you can get to that point. So Kaizen, two real forms of innovation. One is, you know, the big idea, and we've definitely had a lot of that at Compass over the years on, on the big idea innovation.

[CC 10:30] But the other is Kaizen. Everybody can Kaizen. All these are little things, little improvements. How do you take everything and just make it a smidge better? **“**If I don't have to move that from there to there but one time instead of two times, can I eliminate the movement waste.” Can I eliminate that extra material that we put on everything?

<Drywall sub story.>

[CC 10:50] … The material waste, hourly waste, movement waste – all these different forms– all you need to do is open up the opportunity bucket. And have a system that helps you prioritize how you get it done. Because the other thing that the construction industry hates is a concept called “change management.”

[CC 11:10] You cannot do everything all the time and expect to build a system. Would you ever buy a car if there was no consistent model? No. Because every time they find something wrong they fixed it?

[CC 11:25] Nobody would do that. It wouldn't work. There's no way to make any money. Any at all. You're just on a road marching constantly, “Oh my gosh, yeah, look at that, this little flapper thing on the air conditioner! OK, next car better have that fixed!” Right, you're going stop the line, change, retool? Nobody's doing that.

Why do you do it in construction? It's massively more capital. You already know what the fix is for that piece. Don't do a new design release. Just fix that thing on that job. What's that construction level fix. We have people at job sites that make sure that those changes come out on a more systemic basis. On a release basis.

[CC 12:15] The other big thing which is antithetical to the (construction) industry is "You lead the system, you don't command the work." Our job at a job site – when we're there – is just to remove obstacles. We've got video conferencing set up. We've got a trailer that's just for the design team and our design manager. They sit there for any question that comes in. They'll get this to me on a call. They'll bring in the third-party engineer, architect, and just ask the question, "Hey, this is weird on the drawing" or "Here's the field condition that I am dealing with." We change. Why isn't everything have to be an alarm? That doesn't make any sense.

[CC 12:56] No other industry works with these levels of inefficiency. Now I know why. The secret – the reason why this world is so litigious – is because there's only three ways to make money in real estate. Way One is, "You sell it to a client for more, because that's what they really want." Way Two is, "You build it for less because you're better at building stuff than others." Way three is, "You finance it a lot better than the others do."

[CC 13:30] What do you think the odds are that 100% of the market does those things? Pretty small. Pareto says that 20%. What's your way out, if you're an owner-developer? Well, I can't sue the banks, so the finance guys are out. I can't go after them. I can't sue the tenants. Yeah, because that's who pays my rent. It's obviously these design-build idiots that did it wrong. And that's why we have such a litigious industry.

[CC 14:00] You have in this model when you systematize it, you just, you have to consistently remove those tendencies because it's set up for this litigious environment. That was probably one of the biggest epiphanies I had is how the system is designed to not allow – or the historical nature of design and construction – does not allow a manufacturing technical approach.

If you are using a contract to motivate human behavior, you're history. You're dealing with human beings. Everybody hates lawyers. If you have to use a contract to to know that you've got alignment with somebody, you have already effed it up.

[CC 14:35] Why not align around common interests? Align around positives, not around negatives. It's a big difference, and it's how the greatest companies have manufactured products.

[CC 15:00] Do you think Apple, with the iPhone, three-bids it every time, with Foxconn? No, they don't. That would be dumb. You can't be the most profitable company in the world, you do that. And yet we do it all the time in this business.

[CC 15:05] So you must manage it from a system level, not try to drive behavior at the work level. It just doesn't work. You can do kits of parts or a component level and things like that, sure. But to really make it work, you gotta command. You have to lead the system. How they all work together from bid, to build, to OSCI, to commissioning, to feedback loop, to operations. What happens is, you get a lot fewer surprises.

[CC 15:35] You'll build a lot faster ramps. Our cost per megawatt (improvements go) well into double digits. Not fully dozens, but pretty damn close. In terms of cost versus the other best top of the market and you're talking about a time frame that's half time frame, with single shifts.

[CC 16:00] That's because it's a system. We don't reinvent the wheel every time. Once the underground dirt is done, the black art is over. And we're not doing magic anymore, we're just doing science. We don't have lead times. We buy 50 megawatts a month. That's how much capacity we get. We allocate it. “Wait, you can't do that because an air conditioner is different in Phoenix than in Montreal!”

[CC 16:30] Yeah, it performs differently, but it's the same damn air conditioner. Worked pretty well for Kelleher and Southwest Airlines for a long time, didn't it? If you can think of these system type levels and manufacturing types of concepts, you are gonna get way less variable risk. It's variance risk that is the risk in the (construction) industry. Amy talked about it earlier, “I want the ability to have a tighter range on things.”

[CC 17:00] That's worth a lot more. Our vision at Compass is to be the best risk-adjusted return using manufacturing approach from everything from design through operations while delivering hyperscale campuses. That's our vision. That's what it's been.

[CC 17:15] It wasn't hyperscale (originally), but client campuses. We've been a campus company since day one. That vision has stayed the same (through hyper-scale). Risk-adjusted return means a lot. There's a big difference if I'm gonna give you a 10% return. And then I say “Well, it's 10% plus or minus 3%.” Then it's “10% plus or minus 0.05%.” One you can count on, the other you can't. That variance that exists in our industry is wider than 300 basis points.

[CC 17:50] It's way bigger. And that's the volatility that people see. Because you don't plan enough at that system level to actually have… <thinking>... you don't have the discipline that it takes. I think discipline is the hardest word.

[CC 18:00] To be great at something means you have to willfully suck at other things. <Compass> cannot <do other things> in our industry. “Oh, let's go do multi-story.” or, “Hey, instead of optimizing for our prototype, let's just shoehorn it in and get maximum FAR on the site!”

[CC 18:20] That's a loss. We are gonna lose. If we try to cram every square foot or every megawatt of everything, no, we've got to stay disciplined or building blocks, and as long as we do that, do we leave some money on the table? In theory? Sure, in some perfect storm scenario. Perfect storms don't exist. We're going to make a hell of a lot more by taking our variance risk and shrinking it to almost nothing.

[CC 18:45] And that all boils down to the essence of everything being worth humility. “It's not thinking less of yourself. It is thinking of yourself less.” That's a quote from CS Lewis on humility. It's my favorite. This is the core of our culture.

[CC 19:00] Everything teaches us, and if we can be OK with our failures; be OK with what we see and hear from others; not always have to be right… then we learn. We grow. “The more a man has learned, the less he knows,” right?

[CC 19:20] It is a great truth. The more of a lifelong learner you are, well, on your deathbed, you'll sit there and think you know less on your deathbed than you did at any other point beforehand. That desire to learn how this stuff is done, look at it holistically like a dummy… (that’s the) whole brain.

[CC 19:40] You must be a composer and a writer in addition to being an engineer.

[CC 19:45] It takes the whole thing in order for it to work. Anytime you're working on what the great products and the great companies have been, it is through that humility, that lifelong learning, and that, that sheer thought of at every waking moment, “Maybe we're not right.”

[CC 20:00] What else could we do to learn today? And that's success. That is where I will close.

Appendix E - Defining the Future of PreFabrication

Image: *Screenshot of the "Advancing PreFab 2026 Conference Agenda" The transcribed event was held on the conference's main stage, with no other events scheduled against it.*

Location: Advancing PreFab 2026 (Industry convention held this year at the Marriott Allen, in Dallas, TX).

Time: Wednesday, February 4, 2026. Day 2 of the convention.

Panelists: Devin Snyder (host, SurePods), Mika Reckers (GC, DPR Construction), Justin Franklin (owner, Hammes Healthcare), Gayatri Umashankar (prefab solution, Digital Building Components).

Session Description from Organizers (Hansen Wade)

> ***Title - Panel Discussion: Aligning Preconstruction Priorities, Scopes & Schedules for Maximum Prefab Value***
>
> *• Identifying your project's true priorities in preconstruction to create fit-for-purpose, achievable plans*
>
> *• Preventing duplication of tasks and unnecessary costs through clear scope definition, precise contract language and aligned project partner expectations*
>
> *• Sharing how we tracked project scopes and intention to ensure the plan was executed effectively*

This transcript recording begins ~2 minutes into the live session. Timestamps are approximate and are relative to the start of the recording. Speaker attributions are best-effort, based on role-cues in the transcript and the panel structure.

[-00:10] Mika Reckers: In the industry for a little over 30 years, primarily in preconstruction for commercial projects, and one of my main goals is to make prefab absolutely seamless and normal as part of our everyday construction process.

[00:00] Justin Franklin: I'm Justin Franklin, Vice President of Hammes Healthcare, in our West Region.

I've been in the industry for 20+ years. I always say plus because I don't know when to start. Like is it out of school? It was my first job. I was doing construction at 16…

Hammes is a healthcare, real estate development, consultancy, and a project management firm. I run … a project management role in the west region.

One of the things I'm very passionate about is *improving how we deliver projects specifically around collaboration and building teams.* That's the perspective you're gonna get from me as an owner, that's my perspective. It's a lot of the questions we are going to answer today.

[01:00] Gayatri Umashankar: A very good morning everyone. I'm Gayatri Umashankar. I'm a region-based manager for Digital Building Components: we are a prefab exterior wall system.

My background is in architecture, construction management, and prefab (right now). So (I am) looking at the scope like that would be interesting for our session.

[01:30] Devin Snyder: As you guys can probably see we really structured this discussion to have. All opinions from the whole project team: we have our own representation, our general, and then also from a prefab solution perspective. So hopefully we come forward with a holistic viewpoint of how we do pre-con better for prefabrication.

[01:50] Devin Snyder: We're gonna get started on identifying the true priorities of preconstruction when we have prefab in mind. So kind of to get us started, when you start with preconstruction for prefabrication, what are the top priorities that you focus on? And how do you ensure they're realistic? And I think we're gonna start with Justin. (Justin:) How do you define success for the owner and communicate that to the team? What are you looking at?

[02:15] Justin Franklin: So as an owner, I don't know that I always necessarily have a preference on what is prefab and what is not, right? Each project, each owner has a different strategic objective.

So it depends … if you're doing a renovation, an expansion of a healthcare system or a hospital, that strategic objective may be different than if you're doing an N +1, so a new hospital going into a new market where speed the market may be more of a priority because you have competition also trying to fill that space.

And so to me it's about

- “What are the right strategic objectives and how do those strategic objectives align with?”
- “How are we planning to deliver that project?”
- “Whether it's a prefabrication or not, you know, are those priorities schedule-driven?”
- “Are they, are they cost-driven?”
- “Are we in a market where there's not as much labor and so prefabrication is a solution to kind of overcome those challenges?”

[03:15] Mika Reckers: Yeah, and, and what I like about that is that you're looking at prefab from the perspective of solving an issue. In order to implement prefab on a project we also look at “Did the owner call us in time? “Are we aligned and being engaged at the right time?” “If we engage in a design build project? What sort of project delivery are we looking at?”

I think everyone across the room is engaged in a different type of prefab. Sometimes it might be something that affects the primary structure of the building or the exterior envelope, and in order to implement those

types of prefabricated solutions, we have to look at "Are we engaged early enough in design that we can affect change, and not cause a redesign of some things?"

[04:10] Gayatri Umashankar: And so from a prefab perspective, of course, from yesterday like we were talking about right time, right scope and schedule, but like Mika saying like as a solution, so "*Is it solving any issue for the site whether it's a tight site or a logistic issue or even like a remote location or accelerating any critical scope in your schedule?*" (or "*Is it) bringing any savings for the overall project and the owner*?"

If prefab acted as a solution and if we think it as a lens as a value proposition, I think it would be better to prioritize in the precon(struction) for that.

[04:50] Devin Snyder: (To) add a real-world … we have a project that we're working on that's a large expansion. (It involves) an (Operating Room (OR) fit out. We're having a conversation about preb elements for an OR. Some of the challenges they're specifically facing is:

- This is an operating facility, so not having as many trades and as much mess in the facility.
- One of the comments that the owner made was. "*If I can get this done faster…* (we're trying to bring it, we're trying to get it scheduled forward 11 months on this specific scope in the hospital) … (They can make and if it costs another $150,000 per OR because they're using a prefab solution) … *I can make that up in 30, 45 days of operation.*"

I'd much rather use the prefab solution if it gets me in the building that much faster because my ROI is way way bigger than that.

[05:45] Devin Snyder: Can you follow ups to these comments?

[05:50] Mika Reckers: Well, as far as you're touching on cost and schedule, and I think that's really important to acknowledge: … costs and schedule are always related.

When we look at saving time on a project or we look at opening a facility early and bringing in revenue, time and budget are always related. When we look at closing the building early (like what Gayatri's) product does,) that allows us to work in the space earlier and get our finishes done earlier.

As general contractors look at the critical path (editor note: Critical Path Method), "*What, what is making the workspace better for those follow-on trades?*"

I appreciate that your organization is looking for comments, like *"If we can get an OR operating sooner and we're bringing in revenue,"* that means a lot for that organization.

Some healthcare organizations even look at, *"How can we fund future projects with that?"* It's a really great perspective.

[06:50] Gayatri Umashankar: One other thing is, Mika and myself, we work on like the *first cost* versus *the total cost.* There are different owners looking for different things. So, *"Is it actually saving anything?*" is one of our studies which we actually do. (In it) You're bringing like prefab versus, you know, like overall project value, so.

[07:15] Devin Snyder: The infamous cost study.

[07:20] Mika Reckers: Yeah, I'm trying to change the terminology in the, in the, industry. If you all leave here saying *"I wanna value study."* versus *"…a cost study."* then, that's what we all wanted to, to get the industry talking about.

[07:35] Gayatri Umashankar: It's not just the first cost, it's the overall value that prefab is bringing to the project.

[07:30] Devin Snyder: Moving into our second segment, (let's talk) through preventing duplication and scope misalignment.

This is really important: how we actually execute and have a successful project. We've already done the early part of identifying the priorities, what are we trying to solve for the project, the goals for the customer, and what prefab will help achieve those goals. Now we're moving into how we create the scope clarity in order to ultimately execute successfully.

So, scope of clarity, very critical. "*What strategies prevent overlap and unnecessary costs?*"

And I think from here maybe Mika if you can talk through some of the structure of the contracts that you utilize or how you talk, how you kind of keep that clarity in roles and responsibilities.

[08:30] Mika Reckers: Sure. A lot of what many of us experience when we're trying to roll prefab into a job is kind of this chicken and egg thing.

(Say, that) I want to write a scope of work. I wanna put a bid package together, but, I don't really have the plan baked completely yet. We're still exploring different opportunities.

I hear a lot of comments of, well, like "*How do I get this apples to apples?*" and, "*How do I compare prefab Product A to prefab Product B?*"

We really have to look at it from an overall education perspective. (Getting that) Understanding (of) "*What does Product A provide?*" versus "*What does Product B provide*?" and "*How do I fill in those scope gaps?*"

Even after we acknowledge… say… I work with SurePods or I work with Digital Building Components, and we've identified what those scope items are… how do I tell the rest of the trades what's happening? (This is important,) because we're all working together and it affects every trade on the job.

So, having that complete plan documented – not necessarily just "*Here's each scope of work.*" (is important). And (saying) "*Here's how it affects your trade*." (Go further,) create a manual that tells the entire team how we're executing this particular job.

Have that plan known, if we can get it baked into the design documents. Even better, we want that rolled into, a complete manual – a scope of work that everyone can follow, so that we all know what the next person is doing.

[10:00] Devin Snyder: This is probably a good follow up for Gaya. I would assume that you (at Digital Building Components) lean on your prefab partners to support you in creating those like scope responsibility matrixes.

[10:15] Gayatri Umashankar: Yes. … From a prefab perspective, it's different systems, right? (Every) different project has different scope of work. … To avoid the scope misalignment, we work with the GC. (We say) *"If*

this is said in the drawing it doesn't mean that we are doing it." We are showing the way how the times are happening… (to create) a clear boundary of … *what's our scope of work* versus *what (on) the GC*. And buy up, right?

Like, *"Hey, I have always seen this in your drawing. I thought that you are providing this flashing or like this MDP tie-in which is happening."* That is because we provide that for understanding.

We also have a scope consolidation document which is basically the manual or the tool. We show our scope versus another scope, in another color, so that the designer and GC would understand that (separation).

(We) Plan a process like (a) page turn(ing session), just do those (conversations) with everybody and do the page turn(ing session). … From prefab, we always say *"Oh, I want to coordinate with this trade."* or "*Do we have the MEP on board?*" or even like, the signage. The signage is very good.

It's tough when we look at the overall cost. "*Hey, the project is not set up that way to bring the cost up front for the design coordination.*" or (Sometimes) we are missing (things). Or pushing, bringing a trade on board later and having the coordination later, so the feedback value is diminished.

So I think Mika, on the other hand, has handled this (for) the owner, Justin. How do you feel about that, Justin? Like, when we ask "*Oh I want this trade, this day, this day.*" We have this whole release trade that, that, yeah, then.

[12:15] Justin Franklin: (Sure!) Who in the audience thinks that if they're brought on earlier in the project, they can provide value? Yeah, exactly right. So, again, I'm an owner that I believe in collaboration. So, I see the value in bringing contractors and trade partners on board early.

I can't bring … everyone on board early, but I do think there is a tremendous value to that because you're bringing the best ideas, from both the schedule and a cost perspective, but also from a constructability standpoint.

We talked about this previously, right? So we're on a project where it was developed under an IPD-light model, right? So it's not true IPD, but you're trying to incentivize the behaviors of collaboration and, and all that. And so we had not just the contracting partner and the design department, but we had several trades from MEP, to structural steel, to glazing, and we were struggling with a budget problem.

We brought the architect (who was focused on the skin), the structural steel contractor, and the curtain wall contractor together. Without changing the overall scope and (exterior aesthetics), they came up with a solution from a constructability standpoint that ended up saving almost seven figures just because of the efficiencies that they had and how they're gonna install it.

That was a 660,000 square foot hospital, so it wasn't a small facility.

We got those economies of scale. That's just one example of where I, as an owner, find value in bringing the right trades on at the right time, in order, in order to come up with those types of solutions that an architect or even a GC on their own wouldn't necessarily be able to do.

[10:00] Devin Snyder: We also talked in some of our prep about some common mistakes that we see in this part of the planning process for preconstruction, and we talked a lot about lessons learned.

I feel like, you know, we're always growing. Prefabrication is a growing thing within our industry. We capture a lot of lessons learned on projects, especially in this segment: the planning.

(It's about) how we actually push those forward and learn from them, so we can learn from our mistakes. I know Justin, you felt like that's something we could probably do better as an industry. I just wanted to throw that out there.

[14:45] Mika Reckers: I mean, lessons learned. Who really wants to talk about the mistakes that they made, right? And so we have to get real with ourselves… so that if we want to improve a lot of these prefab systems are new. They're newer. We don't want to say, "*Oh, let's go back to the old way because that was easier and we won't make those mistakes.*" Well, the old way had mistakes too.

We have always had lessons learned as an industry, so we need to be a little bit more vulnerable with each other and share what happened on some of these projects. That we can continue to improve our processes. And roll those into future projects, future designs processes. To understand what trade sequencing is required to make something successful and not be afraid to tell an owner, "*Hey, this is what happened on the last job and this is why, but we're gonna do everything we can to ensure that that's not gonna happen again*."

[15:45] Devin Snyder: Yeah. Moving into our last segment… tracking scopes and executing successfully. Hopefully taking in those lessons learned to do better, but once the plan is set, we're moving forward. How are we ensuring that we're measuring success and that we are executing as we intended to on the project?

Any thoughts?

[16:00] Mika Reckers: Well I know we've talked about dashboards. Some of the best ways of tracking on a job with the most visibility is a dashboard. But we have to set those expectations early on.

One of the things that everyone in prefab likes to see is how many hours we are rebuilding off-site versus on site. If we don't share that with the team early on, and we can't gather that information, then it's really tough to get people to do that after the fact because we just don't remember.

So, as far as tracking success along the way, let's establish what those milestones are that we want to know. And, let's put a dashboard that everyone can see.

I don't know if DBC has had some success in that and, and tracking those milestones along the way, and yeah, that's a pretty interesting one because from a project to project in different locations, so, you know, like we made promises at the beginning, right?

[16:55] Gayatri Umashankar: Yeah, that's a pretty interesting one because from project-to-project in different locations, so, you know, … we made promises at the beginning.

Like during precon(struction) *"Hey, we'll need this many installation (days) and this time and our schedule is 20 days or something like that for a total."*

So let's say that, and then, when we measure that from day to day, that might be like a climate issue. Maybe we could enter the job site. We couldn't do that or even like the trucks not showing up because there was a holiday.. during December. Or it's in Colorado where there is a weather condition like snow we couldn't even enter the site.

So even though we plan all those things, you know, we like to use the word “sandbag.” Like, “OK, maybe we need to have like that 5 days in or something like that,” but with the transparency with the GC. (To build) understanding, “*Hey, it's an actual issue and like, OK, we can track that 20 days plus, like these are like the bad weather days, or like slow days*“ or something like that. From a project-to-project when we take the lesson learned, we get better at it.

We don't plan on, “*OK, holiday seasons where there's no like truck drivers or, you know, like we don't get permits, permit delays or the like Colorado there is like weather conditions which we always have to like to keep in mind,”* when we plan. So before even the execution happens, we determine what is the flow of the (work).

So, bringing the super on very early to determine the flow of installation so that we fabricate like that. So that's not a monthly handling of “*These are like finished products, so we wanted to be as careful as possible*.” We don't want to (be) offloading somewhere and then offloading in another location and (on-)going.

We would like to always coordinate with the GC. Identifying the flow of installation so that we fabricate, we ship it, and we install it. I think that's where the promises are meeting reality. We make sure that we are doing a good job of following up and even with the handoffs from pre-con the fabrication to construction because there are like different teams doing different things. So those handoffs are also proper.

[19:30] Justin Franklin: I love the idea of dashboards. I think when you can track and measure things, I think performances overall are better and people hold each other accountable. So I'm a huge fan of dashboards from everything from obviously cost and schedule, but to commitments that are made, risks on the project, you know, status of things.

So I'm a huge fan of that.

[19:50] Mika Reckers: If someone says, “*I'm gonna put 10 panels a day.”* You're able to see, are we keeping score with. What was that?

[19:50] Justin Franklin: Yeah, keeping score, competition, it's just fun, right? It helps. You mentioned a lot about Colorado weather. It's definitely horrible if you're not from Colorado. It's miserable. It's definitely not 55 and sunny right now. Yeah, stay away from Colorado right now.

I think from a success standpoint as an owner, how I measure it is *“First, are we accomplishing what we set out to accomplish?”* Are we meeting the KPIs that we wanna do, whether it's, you know, costing schedule, whether it's panels installed, like down to that level, whether it's, safety, cleaning job sites, or even, you know, things that I, I like to track, especially on larger projects is team health. At the end of the day, is this a team that I would want to work with again? I would say “To go to battle with,” when you're on a construction project, like it's not easy. It's not the least-stress job out there. It's stressful. And you have owners that are demanding. And so, again, I think it's just simple a lot of times it's simple things. But what makes it simple is the tracking of metrics. The problem solving as a team, you know, keeping people. Holding people accountable. Coming together to solve challenges on a project. Whether that is sequencing, or whether it's what kind of prefab we use.

And then the other thing is understanding “*How many unintended consequences?*” I think so often we make a decision based on limited factors and then downstream there's unintended consequences, whether it impacts the contractor for the owner and their future operations. So understanding how, how much of those do we actually incur. And then tracking those lessons learned so that we don't do it again on the next project.

We don’t do a great job of that, because a lot of times we're offering the next one. I was with another owner last night and it was he's he's in operations or was in operations and now is in the development side and they're trying to figure out like how to do things better where you're not always just looking at you know from a from the construction perspective but from the holistic like the operational outcome for that.

I also think that construction usually gets a bad rap sometimes. We talk about how far behind we are on things when it comes to prefab and modulization. But I think we've come a really long way. What I mean by that is there's a lot of really cool things out there like SurePods and Clean Cube and, you know, other prefab doors and … the big things. But if I walk on a job site – and I had a GC background for about half my career – and you look at what mechanical electrical contractors .. what they're doing … they're just incorporating prefab into their everyday lives on projects. In the simplest of ways that make improvements, we're like not everyone recognizes that. So I just think we've we've we've come a long way, and I think when you keep pushing the envelope.

[23:15] Gayatri Umashankar: From, from a prefab perspective, Instead of like the cost study, like the value study. When we compare with other products or even like stick-built, right? Taking like the overall scope and like taking the value like for comparison. Just don't go from bit to bit or just take the stick number and like the prefab number. “*OK, like prefab is like, you know, like 2 to 5% higher than stick, so I'm just gonna go for the stick.*”

So, comparing from a big tally to a big tally on like the pre-con and this was, I believe, and I, I would love to change and get feedback also from, you know, like the GCs of, “*Hey, like I did like apple to apple comparison and this is how you are high.”* Because there could be so many other factors even if you miss something like a scaffold or a crane or install or even a Level 5 finish on a drywall... Looking from like an apple to apple comparison: that would be helpful

Then, the second thing is always the timing. Because like we don't want to get into, I think we touched on it in our yesterday's panel, like, hey, we are going in in at like a 50% CDs, that's not the right time to bring a prefab and the value is already gone even though you bring a prefab and that's not the value will not be recognized at all.

So finding the right time and having it in a different approach like (at) SD level would be helpful. Those are the two things I would like.

[24:50] Devin Snyder: And I would say too, from our (SurePods) perspective on the prefab solution side we're always supporting the (Cost Benefit Analysis) CBA's and you know bringing you know the evaluation of traditional versus prefab and seems to be just like an expectation now on every project that we're brought in for.

I think as an industry on the prefab side we need to do better at capturing the true data points. To bring data to those CBAs. Versus just saying “*Oh, you know, we save time on the schedule.*”

I know there's a lot of factors that play into that, but on every project type if we could just start working on capturing some of that data that we can use to fuel our CBA conversations. And move faster, so. OK. We have a lot of questions. Let's start with the first one that has the most upvotes…

<Moving to Audience Q&A>