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Using Contracting to Improve Building Project Delivery and Achieve Sustainability Goals

Several interrelated problems with traditional building project delivery inhibit building project teams from achieving aggressive sustainability goals. This document will describe how contracting can address these problems and help teams achieve goals.

Acknowledging Problems with Building Project Delivery

This section will describe several interrelated problems with traditional building project delivery. These and other problems contribute to several unimpressive facts about the buildings industry. Acknowledging these problems during planning of a building project delivery is a good first step to achieving sustainable design and other project goals.

For several decades, the buildings industry has been plagued by *concerns over liability and risk*. These concerns tend to increase design and construction expense due to the extra paperwork for architects, engineers, and builders. The concerns also make implementing radical efficiency extremely difficult by inhibiting out-of-the-box design thinking and potentially denying construction of a design innovation.

Another problem is *oversizing equipment*, which is common for minimizing liability and reducing design expense. Nearly all lawsuits brought against mechanical engineers are about not meeting the thermal load, so an oversized system ensures the thermal load is met. In addition, since designers' fees are not commensurate with energy efficiency, designers use rules-of-thumb and manufacturer's designs to limit design time and keep expenses low.

Even if equipment has been sized appropriately and specified for high efficiency, builders sometimes use a substitution process to provide ready-at-hand but less efficient equipment in order to ensure on-time delivery. Designers are often coerced into approving these *construction shortcuts* to keep work flowing and to stay on schedule. Even if the designer resists, owners are often reluctant to back them in order to avoid conflict with the contractor.

Another major problem is the prevalence of *design as a linear sequence*. The typical design process begins with the architect who generates the building aesthetic. Then, the design is passed to various specialists who, in turn, add their respective systems. This input-output, linear approach removes any possibility for design integration or innovation. A building is a set of interrelated systems and should be treated as such. For instance, windows and wall assembly impact thermal comfort in addition to HVAC. By deftly integrating design elements to achieve design objectives, designers can optimize the whole building for energy efficiency with little to no added capital cost, and sometimes net capital-cost savings.¹ A linear design sequence precludes any such design integration.²

Finally, and perhaps most detrimental to resource efficiency, participants in building project delivery typically have *no whole-systems design view*. With all the specialists designing the building's sub-parts, no one usually looks at the whole system to identify design synergies. For example, few practitioners will recognize that integrating the ductwork and structural system to minimize plenum height has cascading benefits: increased ceiling height allows daylight deeper into the space enabling a lighting energy reduction. The lighting reduction, in turn, reduces overall peak cooling load³, allowing the ductwork to be sized smaller and perhaps further reducing the required plenum height. This whole-systems design view is required to optimize the whole building by integrating—and seeking synergies between—solutions to multifarious design and construction concerns.

These and other problems with building project delivery are responsible for the fact that, over the last 40 years, the construction industry productivity index (\$ of contracts/work-hour) has decreased by 20 percent, while for all other economic sectors the productivity has doubled.⁴ In addition:

- 30 percent of projects do not make budget or schedule;⁵
- 37 percent of construction materials become waste;⁶
- 60 percent of fan systems are oversized by an average of 60 percent;⁷ and

¹ An example of such design integration is using super-insulating glazing to eliminate the need for perimeter heating. For cases-in-point, see Lovins, Amory. "The Super-Efficient Passive Building Frontier," *ASHRAE Journal* June 1995, available at <http://rmi.org/rmi/Library>.

² It is important to note that many designers do not consider their design sequence to be linear because, for instance, the mechanical engineers reviewed the early concept design. It should be obvious (but apparently is not) that "reviewing" does not constitute an integrative design process because it is not "designing."

³ Some daylighting designs can illuminate a space with less overall heat gain than even the most energy efficient lighting technology.

⁴ U.S. Department of Commerce, Bureau of Labor Statistics. Courtesy of Phillip G. Bernstein, Vice President, Industry Strategy and Relations, Autodesk, Inc. AEC Solutions Division.

⁵ Construction Management Association of America (CMAA) Industry Report 2007, in Edmondson, Amy C., and Faaiza Rashid. (2009) "Integrated Project Delivery at Autodesk, Inc." Harvard Business School Publishing, www.hbsp.harvard.edu/educators.

⁶ Movement for Innovation in Industry Reports and *Economist* magazine (2002) Courtesy of Phillip G. Bernstein.

- 48 percent of U.S. energy goes to building operation and construction⁸.

As we will see in the following section, these problems can be addressed through appropriate contracting.

Addressing Problems through Contracting

Several contract aspects can directly address the aforesaid problems, as shown in Table 1. These aspects can be part of a design-build or other project delivery approach; however, an integrative project delivery (IPD) is likely most amenable to such stipulations. Moreover, the AIA provides extensive guidance to plan for and implement these aspects as part of an IPD approach.⁹ This section will briefly describe how these aspects directly address the problems.

Problems with building project delivery:	Contract aspects that directly address problems: ¹⁰					
	Early Involvement of Key Project Stakeholders	Shared Risk	Multi-party Contract	Collaborative Decision-Making	Liability Waivers	Financial Reward for Achieving Jointly Developed Goals
Concern over liability and risk	√	√	√	√	√	√
Over-sizing equipment	√	√		√	√	√
Construction shortcuts	√	√		√		√
Design as linear sequence	√	√		√		√
No whole-systems design view	√	√		√		√

Table 1. Contract stipulations that address building project delivery problems.

Early involvement of key project stakeholders breaks from the more traditional linear design sequence. When specialized designers begin work earlier, it is easier for them to see the interrelationships of building systems because the systems have

⁷ ENERGY STAR® Buildings Upgrade Manual, U.S. EPA Office of Air and Radiation, 62021 EPA 430-B-97-024D, July 1997.

⁸ U.S. Energy Information Administration, at Architecture 2030's "Building Sector," <http://www.architecture2030.org/>.

⁹ American Institute of Architects. <http://www.aiacontractdocuments.org/ipd/>

¹⁰ To develop this table, we assumed the IPD project goals include some level of operational resource efficiency. IPD terms are slightly modified from Cohen, Jonathan. (2010) "Integrated Project Delivery: Case Studies," AIA California Council Integrated Project Delivery Steering Committee and AIA National Integrated Practice Discussion Group.

not yet been fully designed. The ability to adjust system components enables the integration of design solutions for greatest energy efficiency and other project goals. In addition, engineers neither have to worry about liability nor oversize equipment because they have established a trusting relationship with other team members and have easy access to specific design information. Finally, early involvement of builders increases the design's constructability and the builders better understand design intent (which reduces construction shortcuts).

Both shared risk of failure and a financial reward for achieving jointly developed goals align the interests of all project stakeholders. An IPD team is only as strong as the weakest link; so all members must work with each other to ensure goals are met. If a mistake is made, there is no finger pointing because responsibility is automatically shared. Shared risk and reward encourages everyone to become involved with problem solving and to watch for issues that affect other disciplines, engendering a whole-systems design view.

Case Study of Integrated Project Delivery: Autodesk AEC Solutions Division Headquarters

Autodesk, Inc. used IPD to successfully achieving its goals for its AEC (Architecture, Engineering & Construction) Solutions Division Headquarters project. The tenant fit-up project resulted in a "triple win": design and construction costs ended up below target (benefitting both the design-build team and owner); designer and contractor profits exceeded targets; and the building achieved LEED Platinum and all other goals. A complete case study of this project can be found in Cohen, Jonathan. (2010) "Integrated Project Delivery: Case Studies," AIA California Council Integrated Project Delivery Steering Committee and AIA National Integrated Practice Discussion Group.