

22nd Century Design and Construction, LLC

One team, One Model, a lifetime of data TM

OUR VISION AND VALUE PROPOSITION

Transform the culture of the AEC Industry (Architecture, Engineering, Construction, Operations and Maintenance) making it into a cohesive, cutting edge, fiscally efficient industry.

The problem we have to solve

The average time U.S. construction professionals spend on rework, conflict resolution and looking for project data — issues that can be avoided with improved communication and data management — is costing the industry more than \$177 billion annually.ⁱ

The design-build industry is working with an antiquated and broken economic model, whose problems are well known to everyone in the industry. Relationships among participants are largely defined by linear processes, with inefficient communication, strung together by a disjointed spider web of contractual and insurance relationships that treat the allocation of risk among the parties like a game of hot potato. The resulting inefficiencies increase costs and result in delays in project completion. Pre-completion cost overruns and delays are just the tip of the iceberg. The resulting problems negatively affect the utility and performance of the construct, whether vertical (building), or horizontal (infrastructure), over its useful life.

It begins with the industry's approach to design. The root cause of low productivity in the industry, is the culture that continues to support INCOMPLETE DESIGN. The design documents prepared by the architect generate a set of drawings (or a BIM model) that are the architect's "design intent" for achieving the owner's program and construction dollars are committed as the project moves forward without significant understanding by any party of the project. No one can have a grasp of the whole project because the details of structure, process, and function have not been worked out. (Not even design details are worked through at this point.) The errors and omissions in contract documents the parties use to build the project is the primary cause of construction disputes.ⁱⁱ

The problem is exacerbated by poor communication. Information necessary to complete a project is generated late and the generally poorly orchestrated communication between the many parties to the process results in waste of materials, resources, and time and results in delays and increased costs.ⁱⁱⁱ Construction is an inherently risky business made more difficult by the poor communications that are memorialized in the industry's form contracts. The siloing of the professions and risk aversion entrenched in the standard form contracts employed by the industry continues to prevent effective collaboration.

Given what is known about the waste, costs and causes of construction disputes, the collective failure of the industry to do better seems inexcusable. The industry up to this point in time has

been mostly impervious to new ideas and fundamental change, stymied in the economy of the past!

Why Current Solutions are Inadequate

Recent implementation of solutions based on more collaborative project delivery methods like design-build, integrated project delivery (IPD), or Lean project delivery, and on integrative information technologies like Building Information Modeling (BIM) have provided measurable, but incomplete, relief. Even with these strategies, we can no longer afford the lowest bid as a way to procure projects.

Any new solution needs to be based on value. The concept-design-build-maintain process is a complex process of information transfer that typically fails at multiple points, raising the cost of the product, reducing the quality and utility, and creating conflict. No solution can be effective unless it addresses the fundamental problem that our current approaches begin with incomplete information poorly transferred among participants. Reality is a lot of information already exists but gets locked inside silos of proprietary software agreements. It can't be shared without translating the data into some other format. This is not agile and results in static data. Our intent is transparent data with live interactive encounters between all participants - all the time.

Let's rethink the business model. Change how participants in a construction project approach the generation and transfer of information from start to finish. Make the Project the focus of the relationship thereby give owners the tools they need to control the process, to get what they want. This will add value.

22nd Century Design and Construction Offers a Solution

The adoption of 22nd Century Design and Construction (22 CDC) methodology advocates a business model that will eventually change the culture of the industry. Our process, when combined with emerging technologies, promotes seamless information transfer. 22 CDC puts the Owner firmly and completely in control of a project from Day 1. The Owner creates ONE team, not a collection of consultants that are poorly coordinated by someone else. ONE MODEL is produced by all the participants and contributors. The ONE MODEL contains all relevant data that lives as long as the project exists. The Owner owns the ONE MODEL. An Owner can contractually state that the intent is transparent data and something that all parties all the time can view and manipulate and can be sure that this happens.

How is it that the Owner is in Control? How does the Owner Benefit from the Process? 22 CDC process allows the Owner to be the ONE POINT OF CONTROL of the project from Day 1. 22 CDC puts together the High Performance Team for the Owner, which includes the Architects, all Engineers, the General Contractor, Subcontractors, the Facility Managers, Suppliers, Accountants, Insurers, and Marketers. All this is done concurrently, not linearly as is normally done, and before the Architect ever draws a line on paper.

The Owner contracts individually with each consultant (not through the Architect). Through the data flow process advocated by 22 CDC, the Owner is constantly informed about the total cost of

the project as it is being designed, so the risk for the Project becomes nominal. This level of certainty can only happen when the Owner's High Performance Team completes the design to the highest level of detail. Consultants will be motivated to do this when the risk of being sued is greatly reduced.

What is the ONE MODEL? What do we mean when we say "a Complete Design"? ONE MODEL is the integration of all data by all participants into one interactive, interoperable database, forming a Big Data model. Each consultant's data is uploaded to the ONE MODEL, with 22 CDC technology. Shop drawings are produced from the ONE MODEL. Final permit drawings are created from the ONE MODEL. The ONE MODEL, created from inception with "living", real time adjustments, is the culmination of a team collaboration, and completed before construction starts, and should be as close to an as-built as possible. Results: the entire team knows what to expect next through the entire life cycle of the project. Nearly all RFI's and Change Orders are eliminated. Quantities are part of the data from the beginning and the ONE Team, including the contractor and all subcontractors, can go to the World Wide market to find the best value, so that then the best materials in the most economical context can be incorporated as part of the design. The budget is developed just like the plans and an estimate is constantly evolving coincident with the plans. It isn't something left until after design is finished only to be something the contractor has to justify and can come back and haggle with the Owner and the designers over. Everyone, from inception, participates in the development of all aspects of the project and all are at risk for the project's outcome. The project data is transparent to all.

What is the Collaboration and Communication Process? 22 CDC is hired by the Owner. 22 CDC orchestrates the day-to-day operation of the ONE MODEL, vets and hires all the members of the High Performance team, and collaborates with the Owner to choose the team members based on an unbiased evaluation of their capability and suitability to perform as a team.

This reordering of the interaction of consultants happens in a risk-controlled environment. This single change in process will affect the existing culture of the AEC Industry by allowing participants to communicate, cooperate and coordinate in real time, in an environment which rewards good work instead of laying off blame. In the present day world this is not possible. The benefits and efficiencies of designing with 22 CDC methodology quickly become obvious.

The 22 CDC process naturally results in checks and balances through collaboration and communication, as the project is designed and then built and managed. Participants do not have to wait on each other to complete their portion of the ONE MODEL; everything is happening simultaneously. Construction which is normally sequential can have several elements being fabricated simultaneously. The Supply Chain is designed, not allowed to be happenstance, and begins Day One. Procurement of all materials to be used in the project is coincident with design and is founded on best economic models projecting the schedule of construction and ability to obtain the right materials and equipment in the most economical manner. The ONE MODEL is dynamic, and even though dimensions are finalized, the model continues to evolve and produce more data as analytics of how the project functions over its life cycle.

What is the result of the 22 CDC Process? Projects become agile and responsive. With the ONE MODEL, all means, methods and sequencing become obvious because the Model can be assembled or disassembled to determine the best means and methods in real time. Key

byproducts of the ONE MODEL are: drastic reduction in wasted materials, labor cost savings through knowing means, methods and sequencing for every facet of the project before construction starts, reduction of schedule and decrease in design/build time. There are major cost savings over the life cycle of the project as well, savings based on the seamless handoff that occurs from construction to facilities management. The continued use of the ONE MODEL well into the life span of a project will significantly reduce ongoing operation cost for the life of the building through the use of the Internet of Things (IOT) based on the data base in the One Model.

Realistically, we can show how 22 CDC can save 30% on construction cost, reduce schedule and reduce facilities management cost by 30%. In summary, 22nd Century Design and Construction is the new business model for the AEC Industry.

Team and Experience:

The Members of 22nd Century Design and Construction LLC bring proven skills and over 135 years of experience in each of the fields that will be critical to the success of the mission.

Gregory P. Luth

Gregory P. Luth, Principal of Gregory P. Luth and Associates in Santa Clara, California, is a world-class structural engineer, pioneer and industry leader in the development and application of 22nd Century Design and Construction (22 CDC). Greg is the first-ever PhD in structural engineering at the Center for Integrated Facilities Engineering at Stanford University. As the innovator of 22 CDC, he is often asked to consult with the owners of major projects around the world: large construction companies such as Turner Construction, and national architectural firms such as HOK. Using 22 CDC, Greg recently played the central role in the development of Tesla's first three Gigafactories, and is now completing the 4th and 5th buildings. Over the past 35 years, Greg has also built some of the most challenging projects in the United States and China, ranging in size from \$20 million to \$300 million, and is often called in to troubleshoot mega-projects around the world.

Cliff Bourland

Cliff Bourland, an architect by training, is the Principal at Cliff Consulting in Dallas, Texas. With more than 30 years' experience in American and international project management and leadership, Cliff has been a part of design, construction and recently, facility management objectives for educational institutions, corporation, industrial and manufacturing projects. Cliff is a nationally recognized expert at translating design intent into the new world of information management for building maintenance and operations. He is now involved with IOT and Big Data solutions for projects. His central goal has always focused on the use of open, real time collaboration to improve the AEC Industry. Between 2006 and 2013, Cliff led the team at University of Southern California, planning and implementing a 3-phase, \$571 million project, one of the most successful fully integrated projects in the United States for the School of Cinematic Arts, the first in the US to be built with 22 CDC. Cliff also led the committee at the National Institute of Building Sciences creating National Building Information Modeling / Management Standards. Cliff and Greg have collaborated on several projects using 22 CDC. Cliff holds a BS in Geology from Texas Tech University, an MS in Geology and Geochemistry from Virginia Tech and an MS in Architecture from University of Texas at Arlington.

Nancy Greenwald

Nancy Greenwald currently serves as Executive Director of the Construction Institute at the University of Hartford in Connecticut. The Institute's members include all aspects of the industry – owners and facility managers, architects and engineers, contractors and subcontractors, project managers, consultants, manufacturers and distributors, governmental agencies, lawyers, accountants, and other industries that support them, and includes national and international companies. Nancy Greenwald has more than 35 years of experience in the construction industry, including as in-house counsel and CFO of a design-build company. She has worked with contracts and disputes involving construction projects from residential remodeling to nuclear power plants, ranging in value from \$25,000 to \$7 billion. As a former design-build company executive, she has practical experience with all aspects of the construction business, including licensing and

regulation, design and estimating, bidding and contract drafting, scheduling, financing, and insurance as well as related areas, including corporate law and employment law. As an attorney, she has experience representing the interests of all players, including contractors, owners, architects, engineers, employees, subcontractors, suppliers, insurers and financing institutions. Ms. Greenwald speaks and writes frequently on best practices in the industry as well as on conflict resolution and dispute systems design. She is active in many of the major construction industry groups, including the ABA Forum on Construction. She received her J.D. from Harvard Law School (cum laude) 1981.

Mark Goldberg

Mark Goldberg has worked as a Real Estate Advisor and real estate developer in the Greater Seattle area for over 30 years, and brings the perspective of an Owner to 22 CDC. Mark is well-versed in the entire development process, from site acquisition through hiring and directing all consultants through the design, permitting and construction process. He has a wealth of experience in the complex world of business arrangements underpinning the intersection of land, permits, financing, building design, construction and managing buildings that are a principal target of AEC Industry innovations. He has been involved in real estate transactions with a diverse group of individuals and companies, including development companies, REITs, major insurance companies and Wall Street investment firms. Mark holds a BS in Geography from Valparaiso University, and an MA in Kinesiology from Ball State University.

ⁱ Kathleen Brown, *Industry could be overspending \$177B per year, study finds.* (2018). Construction Dive. Retrieved 3 September 2018, from

https://www.constructiondive.com/news/industry-could-be-overspending-177b-per-year-study-finds/529450/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202018-08-07%20Construction%20Dive%20Newsletter%20%5Bissue:16527%5D&utm_term=Construction%20Dive

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Arcadis 2018 Global Construction disputes Report. Available at https://images.arcadis.com/media/0/2/3/%7B023244E0-F18B-43BC-A949-14CAF401B9E8%7DGCDCR%202018-Global%20Construction%20Disputes_FINAL.pdf

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The same Arcadis report show the top five causes of construction disputes are the result of poor communication.