Session 1-A: Leveraging Project & Firm Networks to Deliver Facilities

Room 202

Track: Resilience
Facilitator: Yumna Kurdi
Chair: Somayeh Asadi

Questions:

- What is integrative design?
- What makes some teams more successful at integrative design?
- What are the success factors?
- How can we better facilitate the owner's values/expectations to the potential project teams?
- How would team selection impact the design of a project?
- How can the owner's' values be implemented in the design and construction of a project?
- How can we base the design and construction decisions on the total cost of ownership instead of first cost of project?
- What are the challenges to implementing integrative design?
- How can the owner move the design process to be more integrative?
- What role can integrative design play in creating sustainable buildings?
- What is the impact of integrative design on cost, quality, schedule?

Notes:

- The current design process is a shared process rather than integrated. Pieces are simply gathered and put together; Usually tasks don't get revisited as resources are limited, linear process, limited budget,
- To evolve the process within the limited resources teams should allocate resources at the right level.
- Teams should connect early with end users and trade-partners to eliminate waste in time and redesign
- Assure accountability when engaging end-users early in the design process
- Be careful with distraction and overwhelming when engaging end-users at the beginning
- If design team engages contractor too early it may result in wasteful time
- Engagement of key stakeholders may need to start as early as planning the program of the building
• are teams chosen or developed?
• construction starts but design is not finished yet, causes frustration.
• analyze carefully execute decisively
• challenges when working/engaging with customers in the design process: 1- they don't understand the process 2- their requests can be overwhelming to the design team
• cost: chose design teams who are qualified not cheap
• not just about choosing the good firm, but who from the firm are going to work on this specific project
• you may chose a highly qualified firm but end up with not so much qualified team members (may have less experience or they are hard to work with)
• projects with lots of variables (complex projects) requires more collaboration therefor may requires a unique delivery method such as integrated project delivery method or Design Build method
• choosing the best delivery method does not guarantee the behaviors and the culture of the design teams
• the role of owner on the success of a project,
• flexible owner vs difficult owner
• flexible owner can drive the teams to success. can control the demands of the end users, give trust to teams, guide them but does not control them
• owner responsibility is not just to choose the right teams but also to enable them
• Selection method : Interview over lunch vs across table /Committee interview
• interview over lunch: observe manners of team members, builds relationship, flexible interaction
• across table /Committee interview : teams prepared themselves to impress the committee. can show the best proposal but the teams are not flexible in the way they interact with others, this type of interview may not help show their behavior/cultural side
• Selection meetings/ interviews should enable the teams to interact with end user in a workshop session, committee should observe how the team is able to engage and gather information from the audience
• the expected behaviors/cultures of teams should be clearly defined in the contract language
Session 1-B: Toward Lean Methods

Room 203

Track: Integration
Facilitator: Sagata Bhawani
Chair: Robert Leicht

Questions:

- What is your understanding of lean in construction?
- How do you implement lean on your projects?
- What lean methods do you use?
- What are the challenges in implementing lean?
- What types of resources are available to you to support in your lean implementations?
- What type of resources would help advance implementation of lean on more projects?
- What do owners ask for regarding lean?
- How should owners ask for lean processes or methods?
- How can we better engage project teams in planning and deploying lean?

Notes:

- When thinking of lean, the terms that come to forefront are: efficiency, scheduling, simplicity, value, culture, pull planning, empowerment of downstream workforce, communication.
- On how organizations and project teams implement lean (strategies):
  - Pull everyone (example: foreman) into validation
  - Use partners vs. subcontractors
  - Start by picking one project to implement lean
  - Pick a lean champion
  - Pick a few methods in the beginning
  - Align with inherent culture and practices
  - Engage in routines that empower the entire workforce and project team
  - Educate project team and/or organizational members
  - Targeted training focused on implementation to develop lean champion
  - Not force but use supportive strategies: such as a selection process for lean partners, consistent onboarding, lead by example and model lean behavior when engaging trade partners
- Methods use: Last Planner System, Target Value, Value stream mapping, Gemba, Ohno circles, Daily huddles, Takt/ SIPS, A3, Kanban, Dashboard, Prefab/modular
- Resource needs:
  - Awareness/knowledge,
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- Expertise/experience,
- Support & education,
- Trade and other lean partner buy-in
- PM efficiency
- Owner buy in to avoid resistance (early involvement) - one off versus repeat
- Upfront resources needed:
  - Less work for designers if they understand TVD, etc.
  - Function of timing - late adoption - "rework"

- Reminiscent of BIM adoption
  - Figure out planning
  - Define process
  - Owner requirement

- Drivers:
  - Speed of projects goes up
  - Resources available goes down

- Contractual CPM vs. Last Planner
  - Duplication of work
  - Potential conflicts

- Waste in contractual requirements
  - Meeting minutes
  - CPM reporting

- What teams need
  - information: trickle down
  - buy-in to culture versus going through the motions
  - committing the resources (time)

- How are we measuring success?
  - KPIs
  - Conditions of satisfaction

- Student topics/questions:
  - standardization for tools/methods
  - managing LPS versus Gantt/CPM schedule win contract?
  - ‘proof’ of time/money savings
  - employee satisfaction on lean project
  - market sector, value (healthcare sector versus office building
  - lean methods by project delivery (example: colocation, big room, last planner, etc.

*missing some designer perspective due to lack of representation....but there is value in developing some structure around using lean in design such that they do not feel it is extra work.
Session 1-C: Exploring Automation in Construction
Room 204

Track: Technology
Facilitator: Zhouqian (Jason) Jiang
Chair: John Messner

Questions:
- What is state-of-the-art for implementing automation in the Construction Industry?
- What is needed to increase the use of automation in construction?
- What are the challenges that impede automation implementation?
- In what areas / trades do you think automated machinery may replace or supplement field workers?
- How do you envision our work practices changing based upon automation in design, construction, and maintenance over the next five years? Or the next 20 years?
- How has your company started to explore or implement automation on projects?
- How should construction firms establish their efforts to implement automation?

Notes:
- Automation throughout Design:
  - A model is the prerequisite for automation. The model not only need to reach the level of development, but also the level of implement.
  - Potential use cases: 3D coordination, parametric design, prefab, 3D printing, etc.
  - Prefab is critical. Automation can be used in factory to preassemble. E.g. steel, and mechanical systems.
  - From material perspective: new material could lend themselves to automated assembly.
- Autonomous machinery can be classified into different levels (like different levels of autonomous driving)
  - From fully autonomous to semi or teleoperated, like teleoperated cranes.
- Influence of automation in construction from social perspective:
  - The activities / roles of field workers will change. Will they be taken over or supplemented by robots / automated machinery? (Employment challenges).
  - How do you capture “craft knowledge” from experts in field, and integrate into robots?
  - Challenge with robots trying to replicate human postures and activities. But it is not always the best approach (People tend to think robots are similar to humans, but it does not have to be).
  - Challenge with workforce retraining and education, to leverage technology, or to potentially collaborate with robots/automated machinery on jobsite.
Challenge with unions, workforce health, and safety.

How will the automation gain traction in construction industry:
- Small evolution, stepwise change. Gradually implement new automations on construction sites.
- Industry consortium: new regulations, change delivery methods.
- External forces: A technology giant company jump in and totally change the rules of the industry.

Possible research topics regarding this area:
- Case studies of automation implementation in projects: factory prefabs, construction robotics, autonomous machinery, etc.
- Framework development for classifying different types of automation in construction.
- The ways to fund the research and development (R&D) of automation in construction.
Session 2-A: Big Data in the Built Environment
Room 202
Track: Resilience
Facilitator: Junqi Zhao
Chair: Somayeh Asadi

Questions:

- What does ‘Big Data’ mean to you?
- What are the state-of-the-art applications of “Big Data” in the building construction environment?
- What data can be captured in construction?
- How are we currently collecting these data?
- How can we improve the collection and use of such data?
- What are the opportunities for using “Big Data”?
- What are the areas with the greatest potential for “Big Data” in building construction in the future (10 to 20 years)?
- What are the enablers or opportunities to spur adoption of “Big Data” and related analytics in building construction?
- What are the potential challenges and barriers for “Big Data” in our industry?

Notes:

- Big Data may not be clearly defined in the area of Building Construction. While the practitioners have already realized the benefits of leveraging the numerous information generated in building construction and operation stage to support decision making.
- The promising application of such techniques in building construction includes: 1) forecasting the price of construction materials and pre-order the materials with anticipated price rising; 2) monitoring the usage ratio of elevators in the buildings for “smart” control of building equipment and energy saving; 3) tracking the site injury records to identify the time and trades with the highest risk of injuries.
- Facilitating information share is a potential approach for propelling Big Data application in construction. Currently, information is isolated within each company, through sharing useful information between companies, it is possible to contribute to the common knowledge of the construction industry.
- Concerns about Big Data in Building Construction. Ownership of the data and information is a key concern, as the information can be used for profit and the ownership of such information would decide who would enjoy such benefit. Another concern is about ethical of Artificial Intelligence (AI). Once we have a decision making based on the AI system...
driven by the Big Data, who should be responsible for adverse consequences from the decision making. This is a particularly important issue exposed in self-driving cars and might be a future concern in a construction area with more AI-based decisions.

- **Further opportunity:** AE department has started to work with IST. The Building Construction area is a good testing bed to deploy the advanced data analytics techniques for improving the building operation performance. This area not only stands as a frontier of building construction research, but also a pressing need from industrial practitioners.
Session 2-C: Smart and Connected Jobsite

Room 204

Track: Technology
Facilitator and Chair: John Messner

Questions:

- How would you define a smart and connected jobsite?
- What technologies are being implemented in the field to improve safety, productivity, time, cost, quality and information management?
- How will the jobsite changes over the next 5 years?
- How will the jobsite changes over the next 20 years?
- What is impeding an increased use of technology in the field?
- Where are you gaining value from the implementation of technology on the jobsite?
- How are you tracking and measuring the value?
- What new skills will the workforce need to be effective in a more technology enhanced jobsite?
- What skills should we be teaching in the University to prepare our students to be leaders in jobsite technology?

Notes:

The session focused on technologies that are, or could be, implemented on a jobsite to improve the delivery of a project.

Several technologies identified include:

- QR codes for linking areas to the current documents for the location that can be automatically retrieved from a mobile device
- QR codes for identifying punchlist items
- QR codes for daily report entry — set up to connect directly with a reporting app on a phone
- 360 photos for documenting progress and quality control
  - Example of the development of a custom rig to take the images
  - Quality control examples included fire caulking, window, and in wall items.
  - Images can be used to update the schedule
- AI photo software - example of SMARTVID.IO which will auto tag photos, along with identify safety violation (e.g., tag with lack of PPE)
- Unmanned Aerial Vehicle (UAV) Images for progress monitoring and photogrammetry
- Collaborative Project Management Systems
Some items that people would like to see:

- Improved methods to track materials
  - Some examples given were to shift from Excel spreadsheets to more intelligent spreadsheets (using Smartsheet) or database approaches
  - Include schedule tie with materials
  - Could include QR code or RFID
- Automatic schedule update, leveraging images or photogrammetry
- Improved labor tracking onsite - some devices / apps will track location of people on site (live location tracking)
- Automating mundane tasks, e.g., auto generating a submittal log from the text of the specification (already available) - concerns with accuracy. Also begs the question of ‘why isn’t the specification in a format to enable an automatic submittal log’.
- Sensor data to capture existing conditions, with example of a sensor that tracks water, humidity and temperature, and alarms if it is out of range for an area.

Some suggestions related to adoption:

- Aim to win over the biggest skeptic(s). They will be the best people to convince others.
- Set a goal to go paperless. Example of making a requirement that no paper is allowed.

Implementation Challenges Identified:

- Identifying accurate locations.
- Challenge with permissions for flying a UAV is certain location
- Challenge with getting buyin

Discussed the educational opportunities and needs for our AE students related to smart and connected jobsites:

- Important to not just teach tool, but instead, learn how to lean to use a tool
- General agreement that a construction modeling course could be valuable
  - Idea for an assignment to investigate how to find a tool to solve a problem, and then a student could present the tool / solution to the class
- Engage with vendors and project teams to show sites.