Innovation Through Practice

The Messy Work of Making Technology Useful for Architecture, Engineering and Construction Firms and Teams

By Dr. Laura Osburn and Dr. Carrie Sturts Dossick
CERC: Multiple Labs - single purpose
To Inspire discovery in the Construction Industry

CTOP: Communication, Technology, and Organizational Practices
ESC: Energy & Sustainability in Construction
LCR: Lean Construction Research
SHARE: Safety & Health Advancement through Research & Education

Project Delivery: Design-Build & Public Private Partnerships

CENTER FOR EDUCATION AND RESEARCH IN CONSTRUCTION
Department of Construction Management, College of Built Environment
CERC where Theory meets Practice
Communication Technology and Organizational Practices Lab

Information Technology

Collaboration

Better Projects
What we’ve learned from a decade of CTOP Research

BIM & Energy Modeling
2007 – 2016

Globally Distributed Teams
2010-2017

Information Exchange
2008 - 2017

Organization needs to mirror technology

Need for multiple types of media

Human work to make technology work
Organization needs to mirror Tech

Information exchange does not replace dialog

Information tech require teams to work more closely together
Technology and Collaboration Studies

**BIM**
- Ethnographic Observations
- 5 AECO Teams
- 3 Projects
- 125 Interviews
- 33 AIA COTE Cases

**Energy Modeling**
- Ethnographic Observations
- 3 Energy Modelers
- 18 Project
- 20 Interviews
- 7 High-performing Hospital Cases

4 years (2007 – 2011)

3 years (2013-2016)

CENTER FOR EDUCATION AND RESEARCH IN CONSTRUCTION
Department of Construction Management, College of Built Environment
The Context of Project Teams

Conflicting Obligations

- **MEP Coordination**
  - **Who**
  - **Level**
  - **Mission**
  - **Approach to Collaboration**

<table>
<thead>
<tr>
<th>Scope</th>
<th>Project</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailers</td>
<td>General Contractor</td>
<td>Management</td>
</tr>
<tr>
<td>Individual</td>
<td>Temporary Team</td>
<td>Firm</td>
</tr>
<tr>
<td>Produce Documents</td>
<td>Produce Building</td>
<td>Balance Projects</td>
</tr>
<tr>
<td>Exchange Information</td>
<td>Solve Problems</td>
<td>Avoid Exposure</td>
</tr>
</tbody>
</table>
MEP 3D Coordination Team Example

- Architect
- HVAC Subcontractor
- Plumbing Subcontractor
- Engineer
- Fire Safety Subcontractor
- Electrical Subcontractor
- General Contractor
- Architect
Isolated MEP Teams

- HVAC Subcontractor
- Plumbing Subcontractor
- Fire Safety Subcontractor
- Electrical Subcontractor
- General Contractor
- Project Engineer
Integrated MEP Teams

- HVAC Subcontractor
- Plumbing Subcontractor
- Fire Safety Subcontractor
- Electrical Subcontractor
- Engineer
- Architect
- General Contractor Superintendent
## Energy Modeling Team Requirements

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>Owner Operator</td>
<td>Lighting Designer</td>
<td>HVAC Engineer</td>
<td>HVAC Engineer</td>
<td>Owner Operator</td>
</tr>
</tbody>
</table>

### Building Enclosure Strategies
- South Exposure W Exterior Shading
- Dynamic Exterior Shading
- Improved Roof Insulation
- Improved Exterior Wall Insulation
- Increased Air Tightness of Building Skins
- Daylight Harvesting
- Green Roof

### Lighting Systems
- LED Lighting for Patient Rooms
- Public Space LEDS

### User Driven Strategies
- Reduced Ventilation
- Energy Star Equipment
- Automatic Glare Coverage

### Comfort Delivery Systems
- Patient FM Mixed Mode W Natural Ventilation
- VAV with Reheat
- Recirculating Air Handling Unit W HEPA
- HEPA Recirc System in Patient Rooms
- 100% Outside Air With Heat Recovery

### Central Plant Systems
- Distributed Heat Generation
- Heat Recovery Chillers
- Ground Source Heat Pumps
- Condensing Boilers
- Water Cooled Chillers W High Eff Compressor
- Plant Generation Systems
- Photovoltaic Panels
- Wind Turbines
- Community Based Bio-Energy

### Control Systems
- HVAC
- Plug Strip Controls for Office
- Energy Efficient Elevators
- CO2 Sensors in High Occupancy Areas
Leadership

Owner: key leader & active role

> Goal setting & alignment

> Organizational champion
  – Get the right people together with the right information
  – Navigate across boundaries when meetings are not feasible
MULTIPLE MEDIA FOR MESSY TALK

DISCOVERY

Passive – Formal - Inflexible

DIALOG

Active– Informal - Flexible
INTERPRETIVE FLEXIBILITY
SKETCHING – 2D – 3D – SIMULATION
The work needed to make BIM work

How to get organization to mirror tech

> Avoid information bottlenecks
> Owners with AEC expertise as team members and champions
> Use multiple media for messy talk
> Use visualizations with interpretive flexibility for innovative problem-solving
Questions, Comments

> Contact: Laura Osburn, lbusch@uw.edu