



# TECHNOLOGY TRENDS IN CONSTRUCTION

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# ENGAGE WITH THE EXPERTS

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## HOST:

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## SPEAKERS:

**Joe Mascari**, Childs Mascari Warner Architects  
Topic: Lean Construction and BIM

**Simon Warner**, Childs Mascari Warner Architects  
Topic: Lean Construction and BIM

**Paul McParlane**, McParlane & Associates  
Topic: BIM and LEED/Green Building

**Ed Wenz**, Reno Contracting  
Topic: Preconstruction and Estimating Applications

# LEAN:

*What is it?*

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- Based on the Toyota Production System (TPS)
    - Application of Toyota’s methodology to the construction project delivery process
  - “Giving the Client exactly what they want, when they need it and without defect”
  - LEAN is a mindset and culture of continuous improvement resulting in increased value to the Client
  - Original paradigm – Cost, time, and quality – not all **THREE** - LEAN – Why not all three?

# LEAN:

*How does LEAN aid the design and construction process?*

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- Brings the whole Team together from the beginning
- Discards the silo system and implements the Integrated Team
- Owner, A/E Team, Contractor/Sub-contractors – all equal partners to ensure the success for the project

# LEAN:

*How does LEAN aid the design and construction process?*

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- Improved the Work Plan
  - Get input from all participants
  - What works well?
  - What can we improve?
- How do we reduce Waste – MUDA?

# LEAN:

*How does LEAN aid the design and construction process?*

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## **Seven Types of Waste – MUDA**

1. Overproduction
2. Waiting
3. Unnecessary transport or conveyance
4. Over processing or incorrect processing
5. Excess inventory
6. Unnecessary Movement
7. Defects

# LEAN:

*How does LEAN aid the design and construction process?*

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- Integrated Form of Agreement – IFOA. Relational contract versus today's transactional contracts
- Trust – A network of commitments and the reliability of promises made
- Involves continuous learning to improve the process
- Incentive – Each share in the achieved (predetermined) savings

# LEAN:

*How does LEAN aid the design and construction process?*

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- **Design**

- Brings Client and Contractor on-board from DAY 1 to ensure design and construction costs are in line and that they are both in line with Client values
- All decisions are based on increased value

- **Construction**

Last Planner (Pull System)

- Avoids overproduction and deliver just-in-time (no waiting around, no excess inventory, no need for storage space)
- The whole team communicates and commits to resources, product delivery and schedule
- Looks for continuous improvement.

# LEAN:

*How does LEAN benefit the client?*

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- No project surprises
- Zero change orders
- Increase in project value
- Project completion on schedule or early

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## Building Information Modeling:

- 25 years ago – the industry was changing from “pin-bars” to computer aided design
- Today we are changing to BIM
- An integration of people, process and technology

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- BIM uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. The process produces the **Building Information Model**
  - BIM creates a virtual model of every component of the building:
    - Building geometry
    - Spatial relationships
    - Geographic information
    - Quantities and properties of building components

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- BIM is currently employed by professionals on all building types from the simplest warehouse to many of the most complex new buildings. BIM is currently young in its development
  - BIM enables virtual information model to be handed from Design Team to Contractor and Subcontractors and then to the Owner, each adding their own additional discipline-specific knowledge and tracking of changes to the single model

# BIM:

*How does BIM aid the design and construction process?*

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- BIM aids the A/E design coordination effort
- A/E program – Autodesk “Revit”
- Clash detection program - Navisworks
- BIM greatly decreases errors through A/E coordination and conflict detection where the computer actually informs team members about parts of the building in conflict or clashing, and through detailed computer visualization of each part in relation to the total building
- This error reduction results in reduction of costly change orders and time consuming RFI’s during construction

# BIM:

*How does BIM aid the design and construction process?*

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## **The BIM Model can currently accommodate:**

- Quantity take-offs
- Cost estimating
- Construction sequence simulation
- Replacement of shop drawing for fabrication
- Systems coordination (clash detection)
- Hyper linking data
- Energy Analysis
- Life Cycle cost analysis

# BIM:

*How does BIM aid the design and construction process?*

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**From a design fee perspective we see the design cost to shift to be more frontloaded:**

SD	from 15%	to 40%
DD	from 20%	to 30%
CD	from 35%	to 15%
Agency	from 5%	to 5%
CA	from 25%	to 10%

The overall design fee should ultimately not increase

# BIM:

*How does BIM benefit the client?*

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- Better coordinated design documents – clash detection
- Better control of construction schedule
- Better control of cost during construction (fewer COs and RFI's)
- Less surprises
- Use for facility management once building is occupied

# LEED:

*Why Should a developer/stake holder  
pursue LEED?*

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## **LEED = Leadership in Energy & Environmental Design:**

Inception: 1998

- Projects a positive environmental image
- Increases marketability of facility
- Increases the value of a building
- Energy + cost savings for the life of the structure
- Healthier work environment that translates into a happier and more productive occupants
- Return on investment typically within less than a 2-year payback
- Use of key resources more efficiently
- Lowers the buildings carbon footprint

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## The Rating System Addresses Six Major Areas:

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|---------------------------------------|-----------|
| 1. Sustainable Sites (SS)             | 14 points |
| 2. Water Efficiency (WE)              | 5 points  |
| 3. Energy & Atmosphere (EA)           | 17 points |
| 4. Material & Resources (MR)          | 13 points |
| 5. Indoor Environmental Quality (IEQ) | 15 points |
| 6. Innovation and Design Process (ID) | 5 points  |

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## LEED V2.2 Scoring System:

Certified	26-32 points
Silver	33-38 points
Gold	39-51 points
Platinum	52-69 points

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## Currently, There are 6 LEED Categories:

- New Construction (NC)
- Existing Building (EB)
- Commercial Interiors (CI)
- Core & Shell (C&S)
- Schools
- Homes

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## Additional Items to Discuss:

1. A 2008 survey determined 83% of Developer/Builders said they would be “very” likely to seek LEED Certification for buildings that they are planning to build within the next 3 years
2. Healthier buildings with better indoor air quality and good day lighting strategies increases a company’s profitability because of increased employee productivity. Typically, employees’ salaries are about 10 times higher than the combined cost of rent, utilities, and maintenance

# Estimating & Preconstruction Technology:

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## Estimating Systems:

*Primary levels of a building design from an estimating perspective*

- Schematic - Site plan with building foundation outline, one building elevation and general s.f. information for both, warm shell, etc.
- Design Intent - Site soft & hardscape, building exterior glazing and finishes and the building core elements including elevators, stairs, restrooms, lobbies, etc.
- Detailed - Complete design and specifications
- With advanced systems such as Timberline Estimating, all design levels should generally reflect the same costs

# Estimating & Preconstruction Technology:

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## How Estimating Uses BIM Files:

### Model Viewers for 3D Perspective

- BIM model viewers will provide estimators with an enhanced perspective of the project in 3D even when traditional quantity takeoffs are performed
- Viewers allow analysis by rotating, sectioning and virtually walking through models

### Extracting Quantities from BIM Models

- An emerging technology of extracting the true designed quantities directly from the BIM model eliminating today's standard methods of quantity takeoffs

# Estimating & Preconstruction Technology:

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## Specification Codes:

### Managing CSI 1995, 2004 and UniFormat Codes

- The current standard is still CSI 1995 with 16 Divisions
- CSI 2004 is currently being implemented representing 48 Divisions
- UniFormat is ideal for early preconstruction allowing effective cost evaluation of 24 groups of major components or systems
- Managing a smooth migration from CSI 95 to 04 will require the ability to view project costs from either format - See Reporting
- Effective cross referencing of specification codes will require estimating systems to retain multiple specifications references



# Estimating & Preconstruction Technology:

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## Advanced Reporting Systems for Estimates and Quantity Takeoffs:

### Quantity Extraction from BIM files or On-Screen Takeoffs

- Accuracy - Fewer items are missed or improperly quantified with the visual analysis
- Takeoff Auditing and validation is possible when working with visual quantities

### Communication

- Communication - Effectively provides visual colored takeoff images and quantities to assist with schematic and design intent level documents



# Estimating & Preconstruction Technology:

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## **Cost History:**

- Timberline Estimating systems can support historic costs of completed similar projects that can generate quick budgets in current and projected future costs

# Estimating & Preconstruction Technology:

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**Estimate Reports must effectively transfer the estimator's basis of cost to the client in an understandable and definable format.**

- **Sorting Data** - A variety of views or sort options can be defined to provide estimates the way the client needs or prefers to view them Regardless of how the estimate was developed
- **Interactive Estimate Proposals** - To further promote the “Lean Culture”, interactive digital proposals will supplement if not replace the traditional 3 ring binders
- **Interactive indexes** launch all proposal information that would mimic the traditional hard copy
- **Estimates** would be fully interactive by allowing the client/user to view an estimate by CSI 95, 2004, UniFormat, Trade etc. while at the same time provide various levels of detail from rolled up 16 division costs or drill down to the most granular item level analysis
- **File transfer** would take place via email, FTP sites or CD's