Design to Fabrication

Exploring the Chain of Design Through Residential Case Studies

George Minardos
.build / Minardos Group
@dotbuild_gtld / @minardosgroup
About me:

- Builder for 25 years
- Entrepreneur
- Founder of several tech companies
- Passionate about Technology & Intersection with People
- Speaker on IoT, Construction Tech and Internet

George Minardos
CEO .Build & Minardos Group
george@bmail.build
My Building Story Begins Here
• **Specialty Builder:** 25 years located in Santa Monica California
• **Markets:** Los Angeles, Santa Barbara and Napa
• **Project Types:** Fine Residences, Creative Commercial, Museums, Restaurants and Spiritual and Community Centers
• **Awards and Certifications:** Numerous AIA awards, LEED platinum projects
BIM = Plato’s Ideal Forms

The Residential Sector has been slower to adopt BIM
Continuous Flow of Information throughout the project lifecycle

Currently there is a data drop at each stage of the process.
With BIM Information aggregates with the process applies to all scales

The data flows from the design process to the building team to operations
Our Goals with our BIM experiments

- Use of Model in the field
  - Intuitive interface and rapid deployment

- Choose Areas to Model
  - Improve efficiency
  - Accuracy
  - Addressing issues earlier
  - Better scheduling & phasing

- Utilize the LEAN Startup Method
  - MVP, Evaluate, Pivot

- Evaluate Progress
  - Standardize
  - Teach and Communicate
  - Constantly improve process and service
Step 1: Integration

- Provide the Model directly to field team with a simple interface
- IPad Pro: Tech Convergence of screen size and power of processor
- Use of BIMx and A360 as viewing tool
- .OBJ files on Websites (Web3D)
Step 2: The Method

Test building model output
• (increased LOD) for production

Determine specific scopes of work
• Field benefit: define need
• Subcontractor Involvement

Discover and define Input / Output / Benefit
Step 2: Analysis

**Input**
- Model / LOD 100 - 400
- Dimensions
- Elevations
- Shop Drawings
- D2M-Design to Machine

**Output**

**Benefit**
- Clash Detection
- Design Issues
- Early production
- Quality Control
- Visualization

optimize
Case 1: Civil Excavation, Grading, Drainage
Case 1: Civil Excavation, Grading, Drainage
Case 1: Civil Excavation, Grading, Drainage
Case 1: Civil Excavation, Grading, Drainage
Case 1: Civil Excavation, Grading, Drainage
Case 1: Civil Excavation, Grading, Drainage
Case 1: Civil Excavation, Grading, Drainage

Input

- Model / LOD 200

Output

- Foundation overlay
- Elevations & Contours
- Pipe Utilities
- Topcon equipment
- As-built Conditions

Benefit

- Accuracy
- Multiple Trade Coordination
- Quality Control
- Visualization

Case 1 - Earthwork
Case 2: Concrete Foundations & Slabs
Case 2: Concrete Foundations & Slabs
Case 2: Concrete Foundations & Slabs

Input
- Model / LOD 300
- Accurate Dimensions & Volumes
- Elevations of Foundations
- Slab Plan with curbs & Depressions
- Pad plan for Columns

Output
- Clash Detection MEP
- Improved coordination with Excavation & Structural Steel
- Sequencing
- Quality Control
- Visualization

Benefit

Case 2 - Concrete Foundations, Walls & Slabs
Case 3: Structural Steel

#BIMForumED  @dotbuild_gtltd
Case 3: Structural Steel

Output = Shop Drawing
Case 3: Structural Steel

**Input**
- Model / LOD 400
- Elevations
- Shop Drawings & Connection Details

**Output**
- Dimensions
- Clash Detection & Design deficiencies
- Early production adjacent trades
- Quality Control
- Visualization

**Benefit**
- Case 3 - Structural Steel
Case 4: Specialty Architectural Block

#BIMForumED  @dotbuild_gtld
Case 4: Specialty Architectural Block

**Input**
- Model / LOD 400

**Output**
- 3D Printed Model
- Shop Drawings
- D2M-Design to Machine

**Benefit**
- Production Viability
- Systems Integration & Production Approval

Case 4 - Custom Block Wall
Case 5: Millwork
Case 5: Cabinetry

Input

- Model / LOD 400

Output

- Detailed dimensions
- Shop Drawings
- D2M-Design to Machine
- Production to CNC fabrication

Benefit

- Early production
- Quality Control
- Visualization & Client Approval

Case 5 - Millwork
What we learned about BIM Ecosystem

Preliminary Design
- Revit
- Sketch-up
- Archicad

Fabrication
- Autocad Civil 3D
- Revit (concrete)
- 3D printer output .STL
- Graitec Structural Steel

Collaboration
- A360
- BIMx
- Web3D / HTML protocol
What we learned about adoption

Challenges

• Difficulty establishing standards
• Knowledge of BIM from zero to advanced
• Authors and users may be fragmented
• Lack of Interoperability among programs
What we learned about adoption

Benefits

• Coordination of adjacent trades
• Early and accurate fabrication
• Archive
• Field Access
• Get ahead of issues
• Client approval / Submittals
What we learned about adoption

Real world lessons

- Authoring and Use may not be connected
- LOD dependent on output needs
- More fabrication is going direct to machine
- Can’t necessarily use initial model and improve LOD
- Field measure is changing to Model measure
- Field ease of use is key
What’s Next?

• Continue to explore additional trades (MEP’s)
• Create Internal Pre-construction / Building Standards
• Estimating from BIM
• Find the interoperability gaps and explore solutions
• Drone mapping
• Augmented Reality
Thank you

To do more and more with less and less until eventually you can do everything with nothing.

— R. Buckminster Fuller —