Designers Taking Back Control of BIM Design Coordination

Doug Williams + Justin Hughes
DOUG WILLIAMS  LEED AP BD+C, CDT
ASSOCIATE + DIGITAL PRACTICE MGR

- Perkins+Will – 6yrs
- BS Architecture - 1993
- BIM/CAD/IT Mgr for 18yrs
- Speaker (RTC, AU, BIMForum)
- Fmr. Leader Orlando Revit User Group
- Revit Architecture Certified Professional
- Ret. US Army Sr. NCO Inst. (+20yrs Svc.)

JUSTIN HUGHES  VD+C SPECIALIST

- Perkins+Will > 1yr
- 3yrs BIM Manager
- +8yrs Navisworks Exp.
- +15yrs Electrical Trade Experience
- 3yrs GIS + Robotic Total Station

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HOW DO YOU ACCOMPLISH DIGITAL 3D COORDINATION IN THE BIM WORLD TODAY?

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The design side often has this perception when we go to “Issue For Construction” with our BIM’s.

BEYOND THIS POINT
YOU WILL RECEIVE
A BEAT DOWN...
VD+C Defined is the process of validating the constructability of the design models.
Think of it as BASE jumping but with a parachute of built in “continuous feedback”

Vs. jumping on a wish and a prayer hoping to survive CCA
SO WHY DID PERKINS+WILL DECIDE TO HIRE A VD+C SPECIALIST IN HOUSE?
Is this what we are doing with BIM’s?
Contractor VD+C informed us that @ 100% CD’s ~80% of the mechanical ductwork was modeled below the designed ceilings

- Contract Documents were 2D-centric

Sept 2014 → 2 days before short-list interview for 2nd project on campus (potential ~$60-80M Proj)

- Contractor Submitted Delay Claim
  - Influenced the tempo of the interview
  - Cumulative CO ~$5M

- We did not effectively analyze 3D space with the tools we already have access too during design...
We have to stop this with our 2D deliverables!

1. Compromises Design Intent
2. Delays construction schedule
3. Cost increases on virtually every team
   - Re-design effort
   - Material cost of Construction
   - Litigation potential
4. Compounds + extends other CA tasks
5. And worse yet → increases potential for future loss of work (credibility)
MacLeamey – Coordination Workflow

<table>
<thead>
<tr>
<th>Con./S.D.</th>
<th>Design Dev.</th>
<th>Construction Documents</th>
<th>Construction (CA)</th>
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<tbody>
<tr>
<td>Time</td>
<td>Labor Cost</td>
<td>Effort / Effect / Effect</td>
<td>Cost of Design Ch</td>
</tr>
</tbody>
</table>

Effort Multiplier

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Foundation of VD+C @ Perkins+Will

1. MITIGATE RISK → Reduce Contract Administration cost exposure

2. REDUCE WASTE → Reduce overall Project coordination cost exposure + improve efficiency

3. DESIGN CONFIDENCE → Improve design team confidence & morale + (litigation mitigation)

4. DESIGN + VD+C → Proactive constructability reviews as the design evolves + before IFC
So How Are We Doing This?

Model Development

Concept/S.D.

Design Development

Construction Documents

LOD 100

LOD 200

LOD 300

~50% DD

~50% CD

VD+C Check Points

Weekly Team BIM Mtgs

Issue For Construction Deadline

Time

~50% DD

~50% CD

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Illustrates the workflow to Teams
- Timetables
- Milestones

Sets Project expectations
- What do we need from Consultants?
- Roadmap + deliverable formats

Model Guidelines
- Identifies View Setup Requirements
- Names + Templates
External Partner Collaboration

• We are engaging Structural and MEP’s to expand their content contribution

• We will also be engaging other contractors and sub-contractors to identify streamlining opportunities

• Successful implementation of this process will make us a competitive differentiator
### LOD Milestone Matrix

**PULL Plan for Component LOD / Phase**

- **ID’s component needs by phase priority**
- **Green** indicates initial constructability review check points

<table>
<thead>
<tr>
<th>Component</th>
<th>50% SD</th>
<th>100% SD</th>
<th>50% DD</th>
<th>100% DD</th>
<th>50% CD</th>
<th>100% CD</th>
<th>LOD Progress Dependencies</th>
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<tr>
<td>Duct - Main Trunks +Insulation</td>
<td>100</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>Need sound criteria requirements.</td>
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<td>Sound Attenuators</td>
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<td>100</td>
<td>200</td>
<td>300</td>
<td>Need supply air equipment type and size.</td>
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<tr>
<td>Main Air Dist. - Vertical</td>
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<td>300</td>
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<tr>
<td>Duct - Branches +Insulation</td>
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<td>200</td>
<td>200</td>
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<tr>
<td>Grills / Diffusers</td>
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<tr>
<td>VAV, FCU, FPR</td>
<td>100</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>Need Owner Furnished Equipment requirements and loads @100%DD to finalize equipment sizes.</td>
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<tr>
<td>Air Handler &amp; ORWH Units</td>
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<tr>
<td>Equipment Access, Filter Pull, &amp; Clearance Zones</td>
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<tr>
<td>Pumps / Motors / Cooling Towers / Mod EUP</td>
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**Structural**

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<th>100% DD</th>
<th>50% CD</th>
<th>100% CD</th>
<th>LOD Progress Dependencies + Constructability Review</th>
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<td>Shear Walls / X-bracing</td>
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<td>Beams(LAF to expand)</td>
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<td>Supplementary Steel (LAF to expand)</td>
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<td>200</td>
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<td>300</td>
<td>300</td>
<td>300 in specific areas only, as identified by team.</td>
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<tr>
<td>Equipment Supports (Light Booms, etc)</td>
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<td>Piers</td>
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<tr>
<td>Carbon Forms / Formwork Keep Out Zones / Clearances</td>
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<td>Slab Depressions / Pits / Vaults</td>
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<td>Roof Structure</td>
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<td>Roof Top Equipment Supports / Structure</td>
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<td>Fire Proofing / Sound Insulation</td>
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<td>Architect to provide requirements.</td>
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<td>Embeds</td>
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<td>Bar Joint Bridging</td>
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</tbody>
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RFP Language Updates

- Including new boilerplate VD+C participation language for consultants during design phases

Standard VD+C RFP Language

1.1. Virtual Design + Coordination (VD+C) Requirements

a. All consultants will participate in the constructability review process during the design and documentation phases. The schedule for this process including milestones and meetings will be coordinated with the scheduled deliverables.

b. Throughout the constructability review process conflicts between model geometry and constructability review action items will be identified. All consultants are required to either resolve the clash, take the action indicated in the constructability review, or coordinate with the appropriate team members to otherwise resolve the issue.

c. In order to streamline the resolution of issues identified, design team members will be responsible for resolving or leading the resolution coordination of issues as defined by the Roles & Responsibilities Matrix included in the BIM Execution Plan.

d. Intermediate constructability review meetings and check points, between contracted deliverables, may be required based on project needs. These intermediate check points are an important part of successfully completing the coordination so as to avoid unnecessary design modifications during construction.

e. All consultants will participate and assist in the development of the Model Level of Development Milestone Schedule to define when model elements will be added to the model and the level of detail represented by their respective models at each phase in the design process.

f. Architect requires Consultants to provide Autodesk Navisworks Cache (.NYWC) file exports as part of the BIM file transfers so that they can be incorporated as part of digital constructability review sessions to be led by the Architect. The (.NYWC) file exports should be created from Revit Model Views of the specific view structure and naming conventions will be defined in the BIM Execution Plan.

g. All throughout the VD+C process various model clashes and constructability review action items will be identified.
Discipline Responsibility Matrix

- **Streamline** issue resolution process
  - Issue assignments by discipline
- Gives extended team guidance on the responsibility to **engage the other disciplines** to resolve conflicts
- **Empowers disciplines** to work together and does not exclusively rely on Architect
Level 1
- Generally **Sloppy Modeling**
- Single elements or small group set

Level 2
- Possibility of generating **RFI**
- Covers a large group set or area

Level 3
- Possibility of generating **Change Order**
- Not constructible
Discovery Phase Multiplier

Phase 1
• Schematic Design

Phase 2
• Design Development

Phase 3
• Construction Documentation

Phase 4
• Contract Administration
Discovered a Structural Issue
• Possible RFI (2 Sev. Index)
• Discovered in Design Dev. (2 Ph)
• 2x2 = 4 point risk exposure

Discovered a Foundation Issue
• Possible Change Order (3 Sev. Index)
• Discovered in CCA (4 Phase)
• 3x4 = 12 point risk exposure
Workflow + Automation

- Export Navisworks (XML) + Images
- Script in Excel template (import XML)
- Import to Newforma Action Items
Workflow + Automation

- Newform - Action Items (Feeds Mobile Apps)
VD+C Workflow: From Design to Analyze

Design Tool

Auto Export Viewpoints

Clash Detection

Export Report

Project Info Mgmt

Analysis

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