Design to Turnover: Integrated VDC Workflow for Lean Construction on a Mega Project

Piyush Pandey
VDC Manager
Our Mission

To be one of the most admired companies by 2030
About the Speaker

Piyush Pandey

Piyush Pandey is a VDC Project Manager at DPR Construction. With almost a decade of construction industry experience, Piyush has brought his passionate approach to applied construction technologies to over 30 projects. His core market expertise includes mission critical data centers, hospitals, and commercial office space. Piyush’s skillset includes VDC process integration, AR/VR implementation, reality capture and drone technologies, visual planning (4D/5D visualization), site logistics, and model-based production tracking and cost estimating. Additionally, Piyush enjoys giving back to the industry and has mentored hundreds of professionals in VDC processes for efficient construction methods.
Learning Objectives

COORDINATION
ONE TEAM APPROACH
How to track issues from design to closeout.

CONSTRUCTION
USE FIELD TECHNOLOGY
How to create a laser scan program centered around high-value assets.

AS-BUILT
INNOVATE AND DELIVER
How to create an effective as-built document.

DASHBOARD
DATA IS POWERFUL TOOL
How to use metrics and dashboards to track progress and tell a story that is worth telling.
How to use gamification in the process to help drive adoption and involvement while increasing accountability.
VDC - Design to Closeout

<table>
<thead>
<tr>
<th>Phases</th>
<th>Preconstruction</th>
<th>Virtual Coordination Phase</th>
<th>Building Construction</th>
<th>Reality Capture</th>
<th>Turnover Package</th>
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**Design / Precon**
- GC-Precon
- Owner
- Design Team
- Design coordination

**VDC**
- BIM 360
- BIM Team
- Field team
- Design team
- VDC teams
- Owner
- Design team
- Field team
- Pre Fabrication
- Skycatch
- GC-VDC
- GC Team
- Owner review
- RFS
- Design team
- Field team
- Pre Fabrication

**Construction**
- BIM 360
- BIM Manager
- Project Manager
- Field team
- VDC team
- Owner
- Design team
- Field team
- Pre Fabrication
- Skycatch
- BIM 360
- BIM 360 Field
- BIM 360 Docs
- Field fix
- Field Team
- AR

**As-built**
- QA/QC
- Shop Drawings
- Design team
- Superintendent
- Field Team
- GC VDC
- Trade VDC
- Overlay IFC
- Document controller

**Turnover**
- Laser Scanning
- Reop
- MetaData properties
- Trade VDC
- Field Team
- GC VDC
- 100% As-built model

**Sign off**
- Assembly System
- QV-QC
- Shop Drawings
- Design team
- AR

**Trade VDC**
- Capture
- Reop
- MetaData properties
- Trade VDC
- Field Team
- GC VDC
- 100% As-built model

**Sheet Revisions**

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**Project Formal Issuances**

- [PROJECT FORMAL ISSUANCES]
One-Team Approach
Divide and Concur

- **Traditional process**
  - GC VDC team responsible for Clash identification, prioritization, and chasing other for closure.
  - Trades respond to GCs process
  - One person may become bottleneck to entire process
  - One person becomes responsible and accountable for success of the project

- **Collaborative approach**
  - GC VDC team facilitates the process
  - Trades responsible for their clashes and reporting meaningful issues for resolution
  - Use issues management platform instead of just managing clash batches
  - Approach shift from reactive to proactive.
Executive Summary

Section 2: BIM Uses & Goals

Based on the aspirations and requirements of the project team, as well as their capabilities, the following are the strategic objectives for uses of BIM on the project:

1. Author an accurate and reliable model to document the design and coordinate the construction of the project.
2. Enhance design and construction processes through increased transparency, information access, and exchange among the design team and trade partners to ensure cost certainty, schedule certainty, and creative intent with an end goal to improve project delivery.
3. Improve BIM/VDC project delivery strategies by gathering metrics throughout the project and by developing lessons learned, as a basis to define BIM/VDC project delivery on future projects.

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<th>Schematic Design</th>
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<th>Construction Document</th>
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Legend:
- Blue: Definitely
- Light Blue: Likely
- White: Opportunity

**Virtual Design & Construction**

**BIM+**
### Coordination Tracker

**Schedule in Alignment with Master Project Schedule**

- **Smart visual tool to track progress**
- **Provides useful data to drive the coordination process.**
- **Tier system help better manage issues for resolution**

#### Coordination Tracker

<table>
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<tr>
<th>Coordination area / Tier</th>
<th>Actual Coordination Start</th>
<th>Trade Model Complete / Pre-Coordination Start</th>
<th>Planned Coordination Start</th>
<th>Coordination Time Remaining</th>
<th>Coordination Begins Activity (Tool)</th>
<th>Actual Sign-off Date</th>
<th>Planned Sign-off Date</th>
<th>Stop Drawing Development (Stop)</th>
<th>Stop Drawing Due to BPA</th>
<th>Stop Notice (Stop)</th>
<th>Approve Stop notice</th>
<th>Lead / Field Time (Days)</th>
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**Status Color**

- **Sign-off past due**: Red
- **Sign-off in 1 Weeks**: Yellow
- **Sign-off in 2 Weeks**: Green
- **Coordination Starts in 2 weeks**: Dark Green
- **Signed-off Tier/Area**: White

**Tier Color Scheme**

- **Tier 1**: Yellow
- **Tier 2**: Orange
- **Tier 3**: Green
- **Tier 4**: Blue
- **Tier 5**: Purple

**Coordination Phases**

- **Design / BIM Modeling Kick-off**
- **Construction**
- **Production**
- **Pre-Construction**

**Critical Construction Milestone / Master Schedule**

**03/10/2019**
### Tier and System Priority

- **Tier:** Divide the scope in Tiers
- **System Priority:** Set-up system priority within Tiers

#### DPR Coordination Progress Tracker

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<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
<th>Tier 4</th>
<th>Tier 5</th>
<th>Tier 6</th>
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<tbody>
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<td>Structural steel - Equipment, duct risers, cill steel openings, ISP Panels</td>
<td>Mech Duct system</td>
<td>Mopers</td>
<td>VR B &amp; S Review</td>
<td>Irrigation, landscape</td>
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<td>Telecom, Electrical, Temp Power</td>
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<td>MFP, Plumbing system</td>
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<td>All Tier Cable trays, BMS, voids system, Pw System Branch conduits</td>
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<td>Electrical Turn-ups, Equipment placement, equipment pods</td>
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<td>Framing - King and Corner studs, Door frames</td>
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<td>Equipment pods (Non OFC), slabs, ramps, EOS Foundation</td>
<td>Fire Alarm, Security, cameras</td>
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<td>OFC dependent coordination for UG</td>
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Project Coordinates
State plane (Real world) vs Project Plane

- Set up the relation between Civil and different project planes in one master file.
- This little effort will make everyone’s life easy and save time throughout.
One Team Approach – Workflow

BIM Model Development

- Release 100% Contract Drawings
- BIM modeling
  - RFIs for missing / supplementary information
  - Run Clash detection for Tier of coordination

Owner/Design Team

- RFIs
- Set up clash batches by Tier priorities

Coordination

- Confirming BIM RFIs
  - Issue Management Platform

Subcontractor

- Tier / Overall substantial Sign-off
  - Owner/Design team Review process

Fabrication and Construction

- Shop drawing approved
  - Generate Shop drawing for design approval
  - Release for Prefabrication

Construction

- Install per approved BIM models

OA/QC process – Later Section
Value for all Stakeholders

Issues Management System – Benefits

- One Source
- Eliminate Waste
- Record Keeping
- Shared Responsibility
- Accountability
- Increased communication
- Integration
- Time saver
Improve Productivity

Construction
Construction Phase VDC Implementation

- Prefabrication
- BIM for Field
- Reality Capture
- Drone Data
- Installation Tracking
Plan
It’s easier to get to where you’d like to go if you have a map!
Plan

It’s easier to get to where you’d like to go if you have a map!
The Scope
To Scan or Not to Scan…

Then – Simple List by Type Only

- Structures
- Crossings
- Penetrations
- Near-parallel
- Stub-ups

Now – Predefined Specific List of Each
Scan Log
Identification Data and Naming Convention

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### Scan Log

**Scan Review Data**

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Scans
Scan vs Model in Navisworks
Scans
UAV vs Scan vs Model in Navisworks
Scans
Identifying Incorrect Installs Early
Scans

Telecom Duct Bank Laser Scan vs BIM model
**Scans**

Equipment placement with correct stub-up

Overlaying laser scans with BIM Models to verify conduit stub ups
Scans
Capture as-built for in-wall smaller diameter conduits
Issue Tracking
Using BIM Track – Sample Issue

617. Sanitary Storm - ST16

To whom it may concern,

This structure was installed 3" off center, towards building south. Please review and advise accordingly.

Thank you for your time!

Status: Open
Type: Oil Inaccurate Installation
Priority: High (5 Days)
Tag: (No tag)
Zone: OS Installation
Assigned to: [Details]
Due date: 5/18/2019
Issue group: [Details]
Confidentiality: [Details]
Notify: [Details]
Tier: [Details]
RVA Internal Use Only
Issue Tracking
Using BIM Track – Inaccurate Installation
Scan Data
Using Scan Data for Floor Flatness

Floor Flatness/Levelness

Elevation Heat Map
Drone Data – Skycatch
Overlays with Shop Drawings
Drone Data – Skycatch

Billing and Progress Validation
Drone Data – Skycatch

Drone point cloud vs BIM model
Drone data – Skycatch

BIM Model Overlays with Drone Data – As-built verification
4D - Model Status Tracking

Use of model for progress update

Dashboard
Record Document Turnover
As-built overlay with design drawing in turnover package
Dashboards
It’s not just data, it keeps all aligned
If you aren’t keeping score, it’s just practice.
KPIs – Coordination
If you aren’t keeping score, it’s just practice.
KPIs – Reality Capture
Tracking where we’ve been to know where we are going
KPIs – Reality Capture

Tracking Performance Trends
KPIs – Reality Capture
Tracking Critical Issues
KPIs – Field Engineering
Solving problems when they are small before they grow
### Facts & Numbers

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<td>RVA3 BIM Issues</td>
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- Total # of scans performed: 2,717
- RVA1&2 Reality capture issues: 220
- RVA3 Reality capture issues: 57
- # of controls set on RVA job: 646
- # of Aerial photos taken: 253k
- # of Field Engineering Hours: 317

All the data is up-to-date to current stage of the project.
Executive Summary
We Exist to Build Great Things
Q & A

Thank You