



VDC

**VIRTUAL DESIGN
+ CONSTRUCTION**



Barton Malow
BUILDERS

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12

TEAM
MEMBERS



150

TOTAL YEARS OF EXPERIENCE

84

VDC

22

PROJECT
DELIVERY

16

ENGINEERING

14

ARCHITECTURAL
DESIGN

9

PRECONSTRUCTION

3

TRADE

2

OWNER

WHAT IS VDC?

Virtual Design and Construction is the application of 3D models and innovative technology throughout the project's lifecycle to improve performance from initial pursuit, to project closeout.

The VDC Solutions team uses their years of expertise to provide interactive technology solutions to Barton Malow's projects. With a shared goal of developing a fully technology-enabled workforce, the team documents Barton Malow's VDC standard processes, best practices, and training opportunities to support individuals across the organization.

COST SAVINGS



PRODUCTIVITY GAINS



SCHEDULE OPTIMIZATION



ENHANCED COMMUNICATION

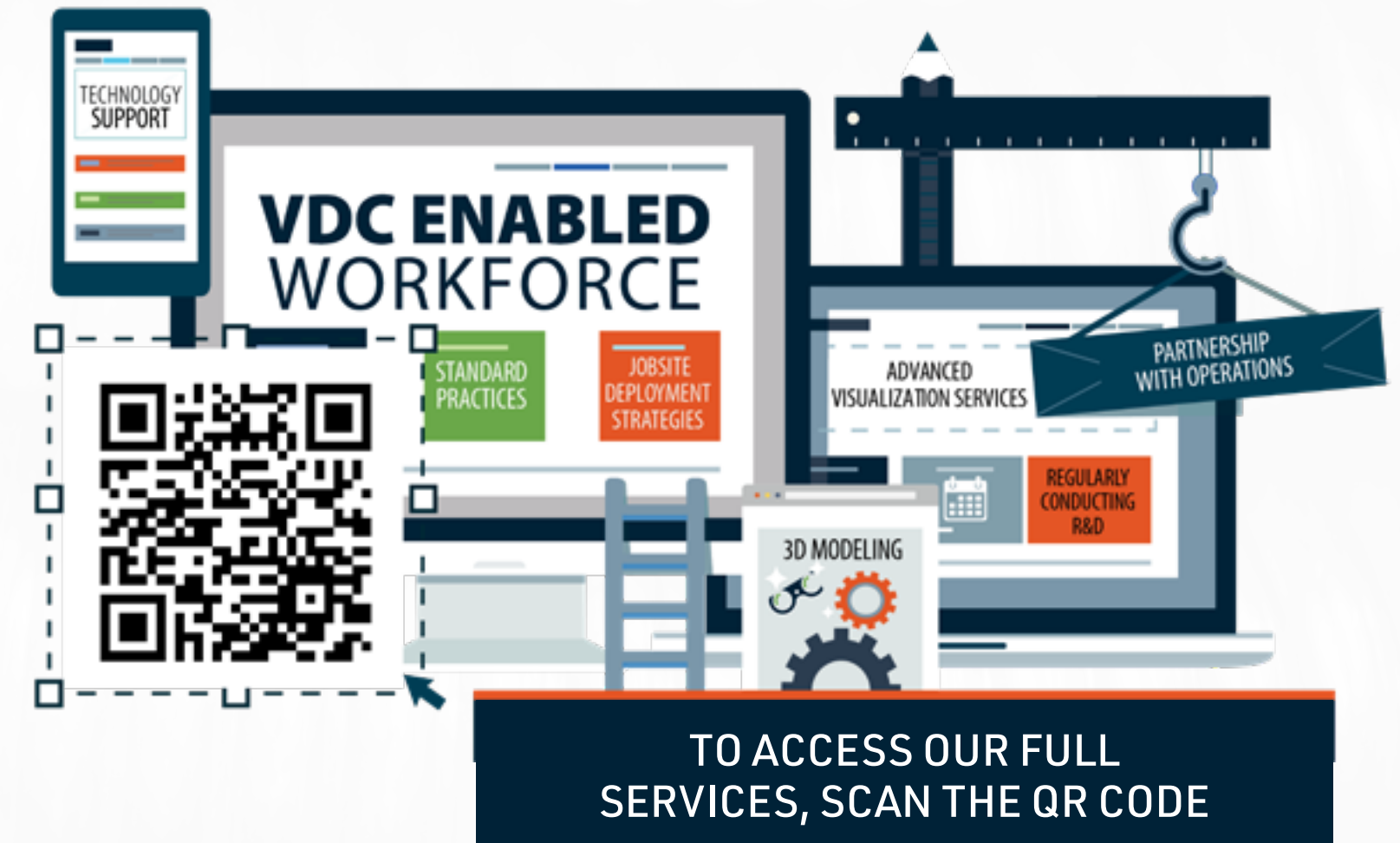


QUALITY ASSURANCE



VDC ENABLED WORKFORCE

Barton Malow has provided the intelligence, tools, and resources to empower a VDC-enabled workforce comprised of dedicated project professionals who partner with our in-house VDC experts to implement strategic technology-based initiatives.



VDC CAPABILITIES MATRIX

		DELIVER/ PERFORM	TRAIN/ ENABLE	Safety	VALUE		
					Cost	Quality	Schedule
REALITY CAPTURE + INTEGRATION	360 Photo/Video Capture	✓	✓	✓		✓	
	Drone Data Capture	✓	✓	✓	✓	✓	✓
	Laser Scanning	✓			✓	✓	✓
	Point-Based Layout (BMC)	✓				✓	✓
BUILDING INFORMATION MODELING (BIM)	BIM Execution Planning	✓				✓	
	Self-Perform Concrete, Steel, Civil Models (BMC)	✓			✓	✓	
	Prefabrication		✓	✓	✓	✓	✓
	3D Coordination		✓	✓	✓	✓	✓
	Design Docs + Model Constructability Reviews	✓	✓		✓	✓	✓
	4D Scheduling	✓			✓		✓
	5D Cost Integration + Quantity Take-Off		✓		✓	✓	
VISUALIZATION + DOCUMENT CONTROLS	7D FM Asset Management + As-Built BIM	✓		✓	✓	✓	
	Logistics + Safety Planning	✓	✓	✓	✓		✓
	3D Visualization/VR	✓			✓	✓	
	Autodesk Build		✓	✓		✓	✓
	Mobile Technology		✓			✓	

REALITY CAPTURE + INTEGRATION

360 PHOTO/VIDEO CAPTURE	8
DRONE DATA CAPTURE	9
LASER SCANNING	10

OUR IN HOUSE VDC CAPABILITIES BRING VALUE TO EACH STEP OF OUR PROCESS, FROM PLANNING TO EXECUTION.

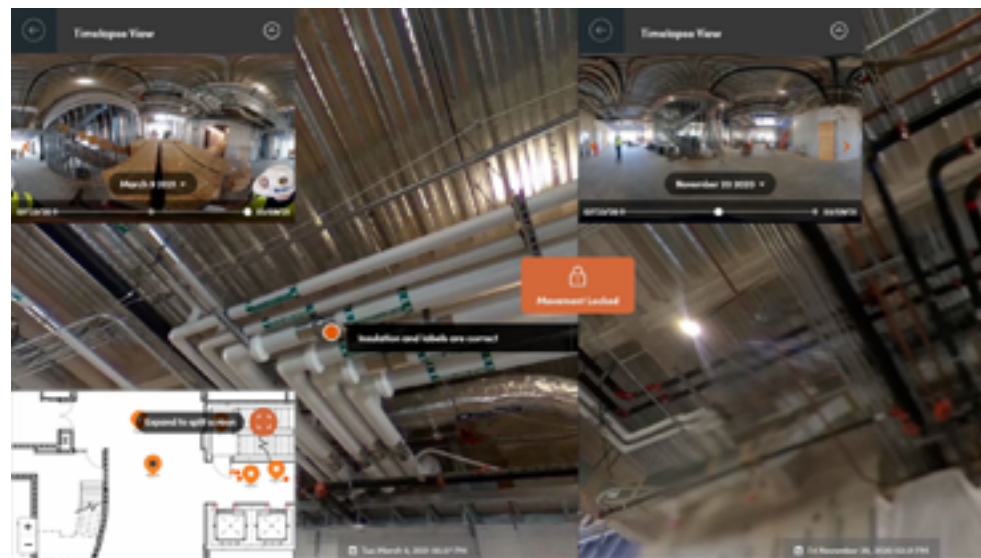
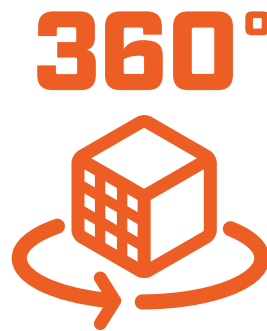
360 PHOTO/VIDEO CAPTURE

WHAT IT IS

A 360° camera can capture all the scenery and space that surrounds it. The camera is equipped with two wide-angle lenses that capture 180 degrees and then stitch the images together automatically to generate complete 360° photos and videos.

WHY WE DO IT

- Interactive progress documentation
- Inspection reporting/approvals
- Punch list verifications
- Document in-wall conditions
- Virtual as-built verification
- Interactive floorplan walkthroughs
- Timeline validation
- Visual conditions review



DEPICTION

- Model vs Install
- As-built Aid
- Quality Control
- Inspection Aid

DRONE DATA CAPTURE

WHAT THEY ARE

Unmanned Aerial Vehicles (UAVs) or Drones are fitted with high-resolution cameras that have the capability of capturing still images and video.

WHY WE DO IT

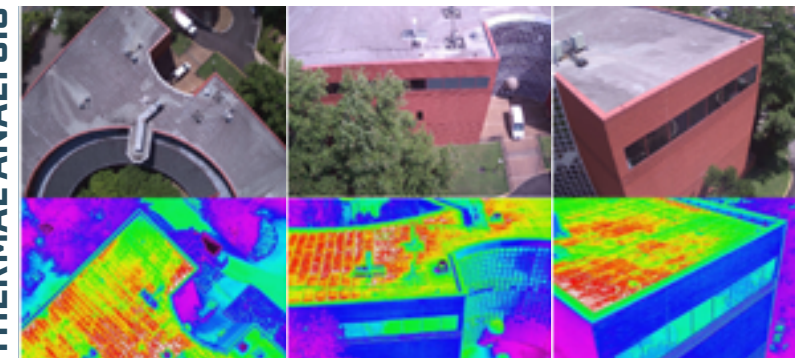
- Existing conditions analysis
- Inspections- quality/safety/thermal
- Progress imagery + interactive dashboards
- Cut/fill + material volume analysis
- Measurements
- Installation validation
- 3D model capture
- Logistics planning

BARTON MALOW HAS IN-HOUSE FAA LICENSED DRONE PILOTS.

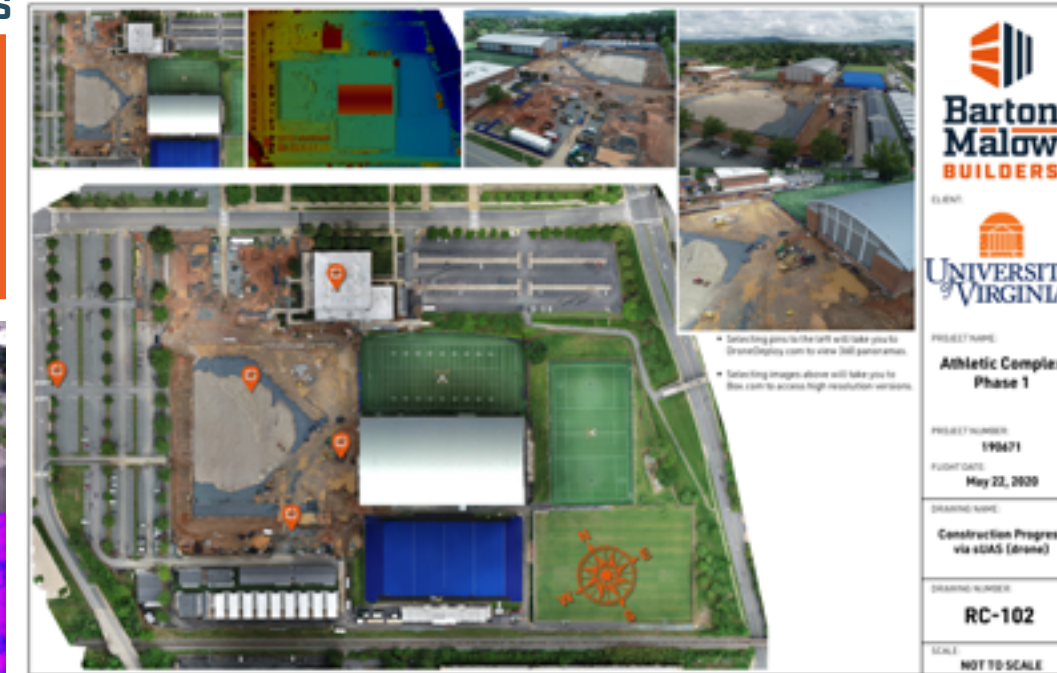
CIVIL ANALYSIS



DATA ANALYSIS



PROGRESS DASHBOARD



LASER SCANNING

WHAT IT IS

Laser Scanners are non-contact devices that capture millions of discrete data points to measure an object or space using laser infrared technology. The images comprise millions of 3D data points, known as a point cloud.

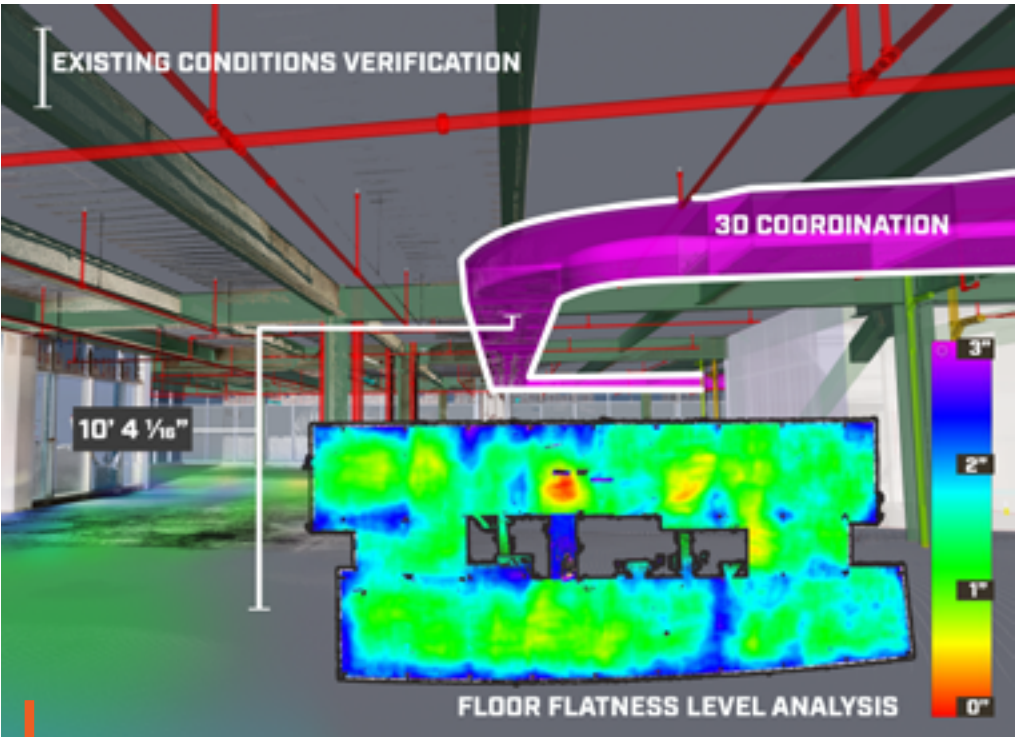
WHY WE DO IT

- Existing conditions capture
- Offsite fabrication measurement aid
- Model aid for 3D coordination
- Floor flatness analysis
- 3D as-built documentation

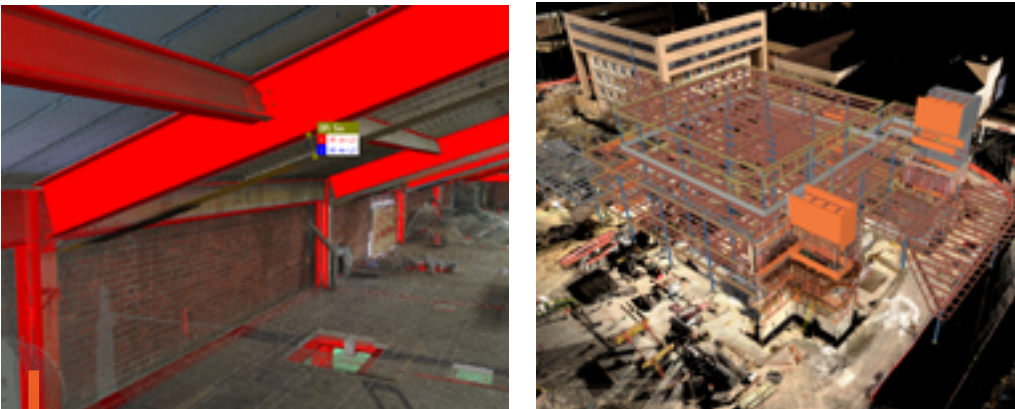


EQUIPMENT + SOFTWARE

- FARO
- Revit
- Recap



Laser Scan of Existing Conditions



Structural Analysis Reporting

BUILDING INFORMATION MODELING

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BIM EXECUTION PLAN

WHAT IT IS

The BIM Execution Plan (BIMxP) provides a standardized document template, with which Barton Malow and all partners can outline the information, procedures, and responsibilities relevant to a Building Information Model (BIM) development effort. Each project's BIMxP will be a living document started during early design – revised and updated as necessary by the project team to reflect changes in BIM development that occur during project execution.

WHY WE DO IT

- Stakeholder alignment
- Consistency between projects
- Enhanced collaboration
- Quality, schedule, + cost improvements
- Outline BIM roles + responsibilities



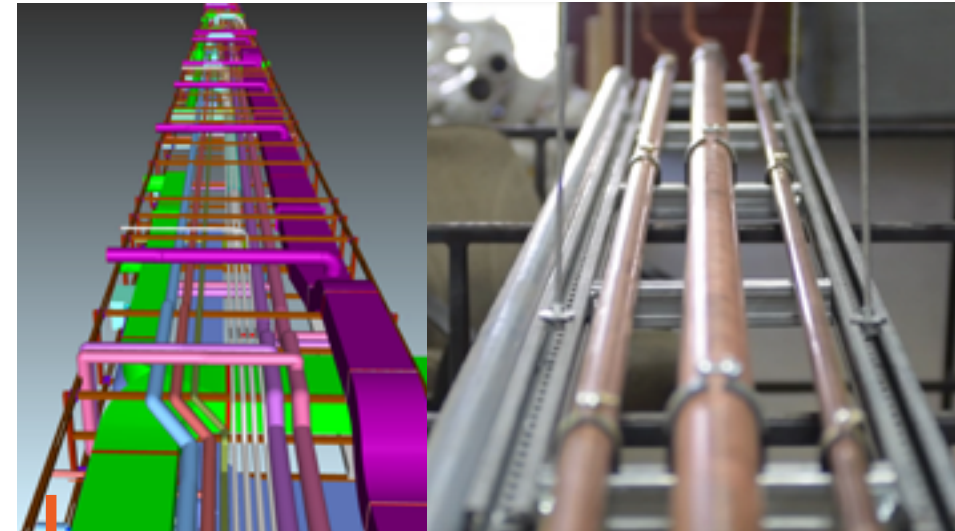
PLAN



GOAL



ACTION



Prefabricated Overhead Piping



Gang Water Closets

PREFABRICATION

WHAT IT IS

Prefabrication is manufacturing multi-component assemblies ahead of time in a controlled environment and installing as a complete system on site. This supplements and/or replaces traditional construction methods, in which pieces or parts of a system are installed individually in the field.

WHY WE DO IT

- Productivity + schedule gains
- Cheaper installation
- Enhanced safety + less labor fatigue
- Enhanced quality control
- Reduces labor requirements



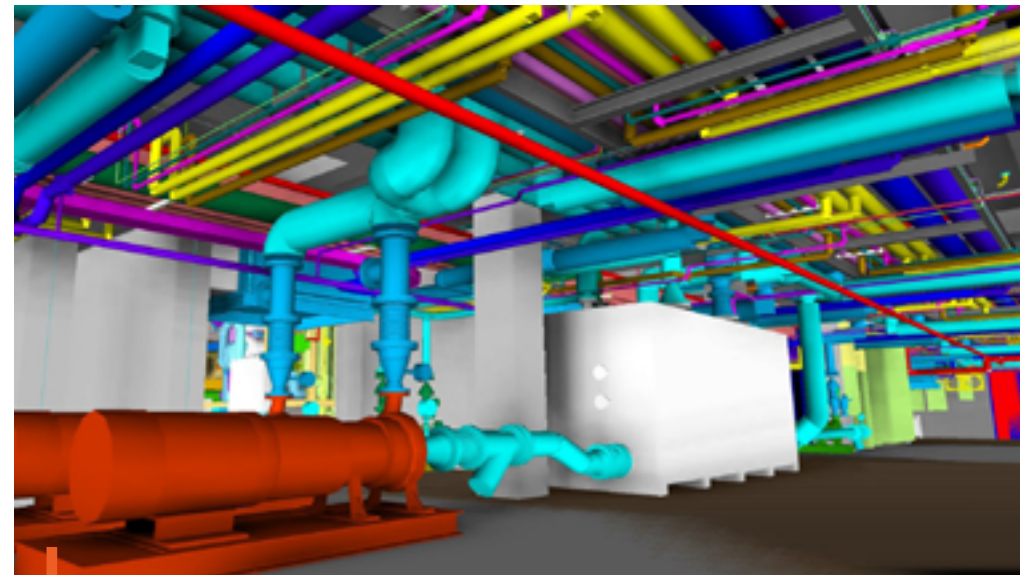
3D COORDINATION

WHAT IT IS

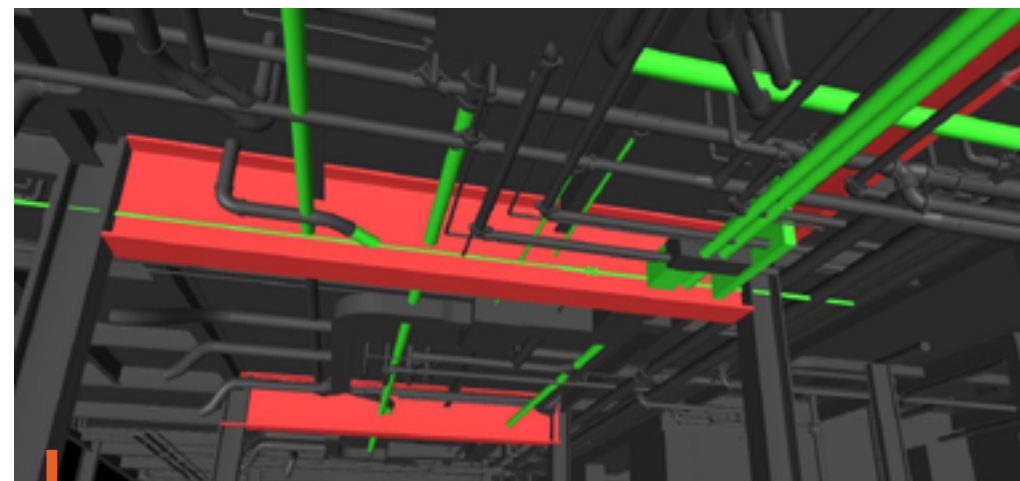
3D Coordination is the process of combining all the design intent and trade fabrication models into one environment to coordinate all systems for shop drawing production and fabrication.

WHY WE DO IT

- Stakeholder alignment
- Consistency between projects
- Enhanced collaboration
- Quality, schedule, + cost improvements
- Outline BIM roles + responsibilities



Coordination Issue Example

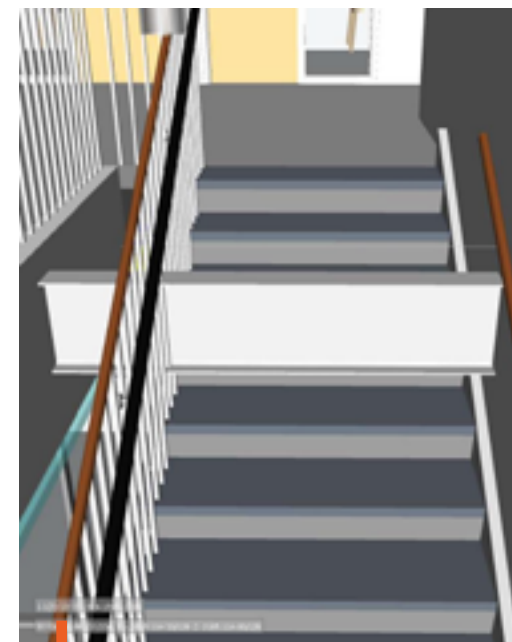


Piping Clash with Existing Concrete Structure

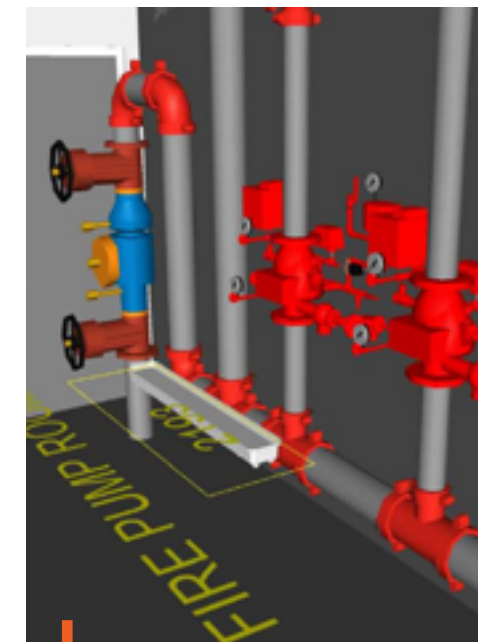
DOCUMENT + MODEL CONSTRUCTABILITY REVIEW

RESULTS

- Reduced costs
- Reduced changes
- No impact delays
- Smooth 3D trade coordination
- Early team coordination
- Better design



Design Issue



Clearance Issue

WHAT IT IS

Constructability Reviews are a preconstruction design deliverable review of 2D drawings, 3D models, and specifications that help identify various issues that could impact construction. Barton Malow leverages Autodesk Build for these reviews.

WHY WE DO IT

- Reduces design-related coordination issues + RFIs during construction
- Vet design to ensure the project can be constructed
- Assists the design effort for quality construction
- Autodesk Build ensures issues are tracked from design into construction
- Eliminates design issues

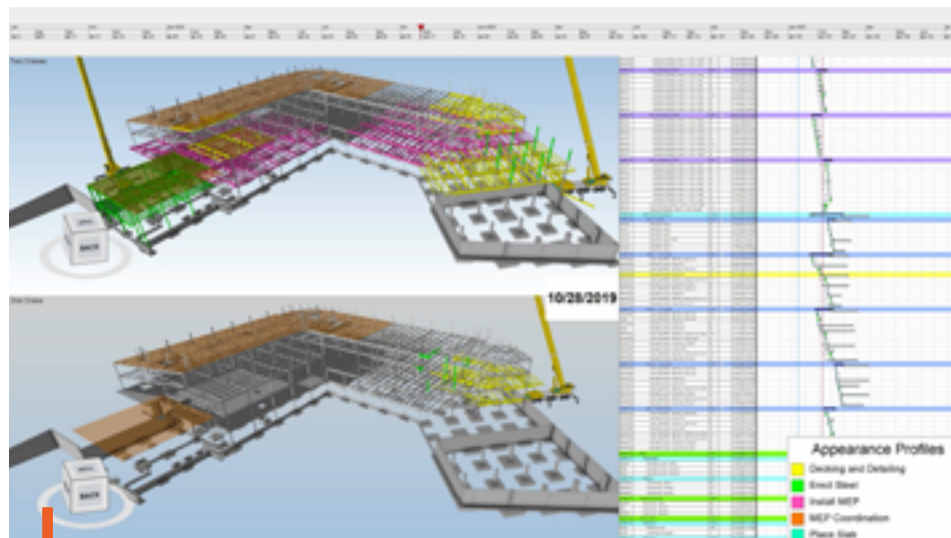
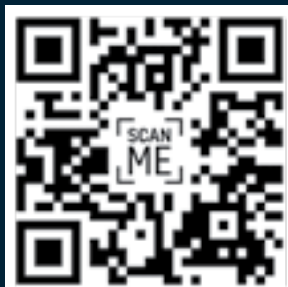
4D SCHEDULING

WHAT IT IS

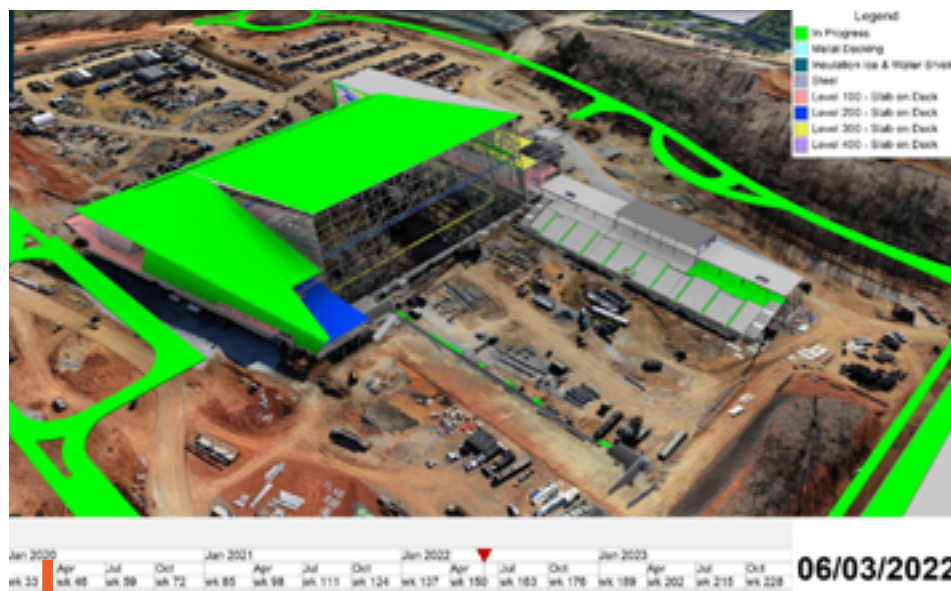
4D scheduling is the process of adding schedule information to the elements of the model and simulating where the project should be at any given time. Continuous progress 4D scheduling is a premium service that we offer our clients.

WHY WE DO IT

- Enables early safety + logistics analysis
- Validates schedule logic
- Milestone tracking + communication
- Visualization tool for project stakeholders
- Community + fundraiser engagements
- Options examination



Crane Analysis



Construction Sequence Analysis

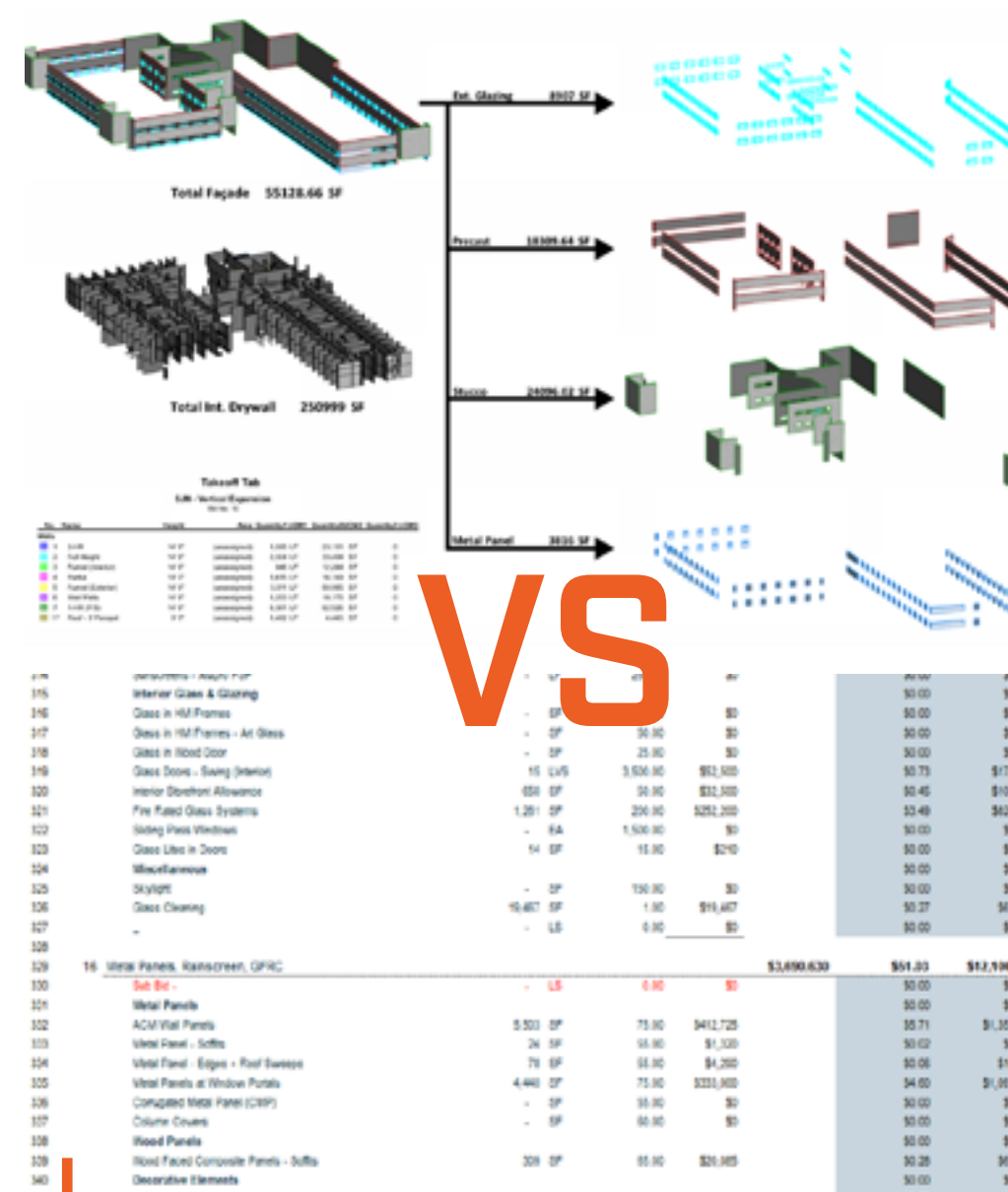
5D COST INTEGRATION

WHAT IT IS

5D cost integration is utilizing 3D models to quantify materials utilized for construction. It enables accurate cost estimation through additional real-time layers of quantity take off information derived from in-house created models or models received from design.

WHY WE DO IT

- Enables early decision making and improves cost certainty
- Quick cost and quantity estimates
- Enhanced analysis of project
- 3D representation of estimate



Assembly Overview vs Traditional Dashboard

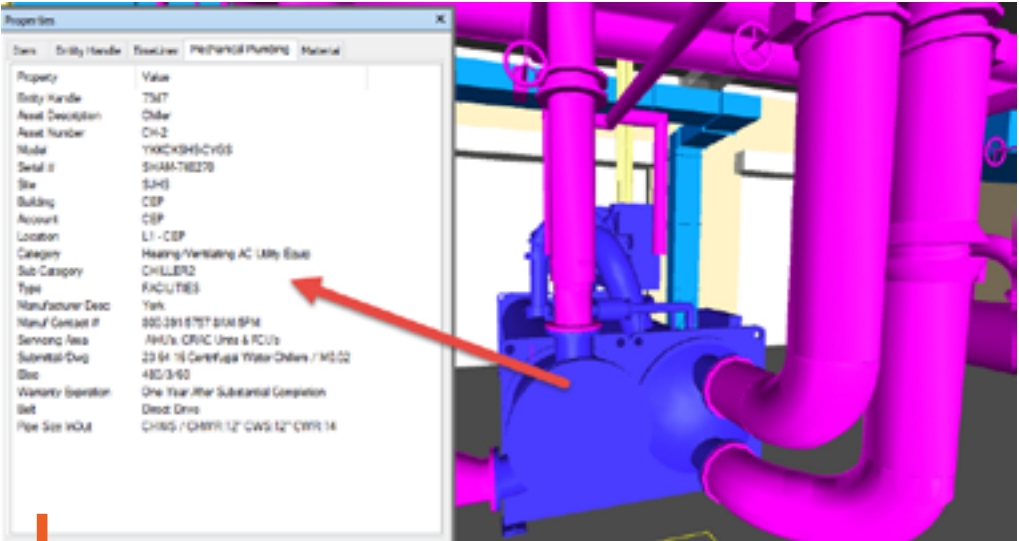
7D FACILITY AS-BUILT MODELING

WHAT IT IS

The 7D Facility as-built Model, or Digital Twin, is an as-built BIM deliverable embedded with equipment information that helps facilitate building maintenance and upkeep.

WHY WE DO IT

- 3D visualization of facility asset management
- Provides comprehensive spatial data and reporting functionality
- Streamlines closeout documentation navigation
- Organizes relevant information for facility management
- Provides organized model information for future renovations + additions



Digital Twin Model

VISUALIZATION + DOCUMENT CONTROLS

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LOGISTICS + SAFETY PLANNING

WHAT IT IS

A logistics and safety plan is a proactive production created by project stakeholders with the intent to create a robust plan at the start of a project. It consists of graphical details that clearly communicate logistics and safety instructions.

WHY WE DO IT

- Creates an efficient jobsite that considers schedule, workflow, + material movement
- Reduce safety risks through proactive planning
- 2D+3D visualization for enhanced communication
- Use alongside 4D scheduling to identify safety issues with movement of equipment, people, materials, etc.



On Site

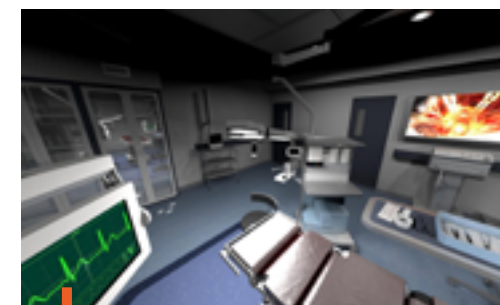


Pursuit Focused

3D VISUALIZATION/VR

SOFTWARE

IRIS VR 3D Studio Max	Lumion Sketchup	Enscape Revit
VIRTUAL REALITY A 3D representation of a physical outcome/product	AUGMENTED REALITY An overlay of 3D model geometry over real-world conditions	VIRTUAL MOCKUPS Mockups focused on a specific area to help facilitate decisions about a physical outcome



3D Mockups

WHAT IT IS

3D visualization consists of virtual reality, augmented reality, and virtual mockups. Utilizing mobile devices, VR headsets, and/or more traditional displays, data can quickly be analyzed for streamlined decision making on items such as spatial layouts, equipment locations, and maintenance access points. This is typically a premium service.

WHY WE DO IT

- Facilitate early stakeholder decisions
- Supplements physical mock-ups
- Community + fundraiser engagements



MOBILE TECHNOLOGY

WHAT IT IS

Mobile Technology at Barton Malow is the utilization of software and devices such as iPads, iPhones, laptops, and/or Mobile Kiosks to quickly communicate action on our project sites. Making sure our teams have access to tools like Autodesk Build for document management/review, StructionSite for 360° Photo reference, 3D coordination models for planning and conflict resolution, and connection to our intranet for reference of our Standard Practices for quick action and response to field conditions greatly increases efficiency.

WHY WE DO IT

- Enhanced communication
- More efficient teams
- Reduction in wasted time onsite
- Real time information



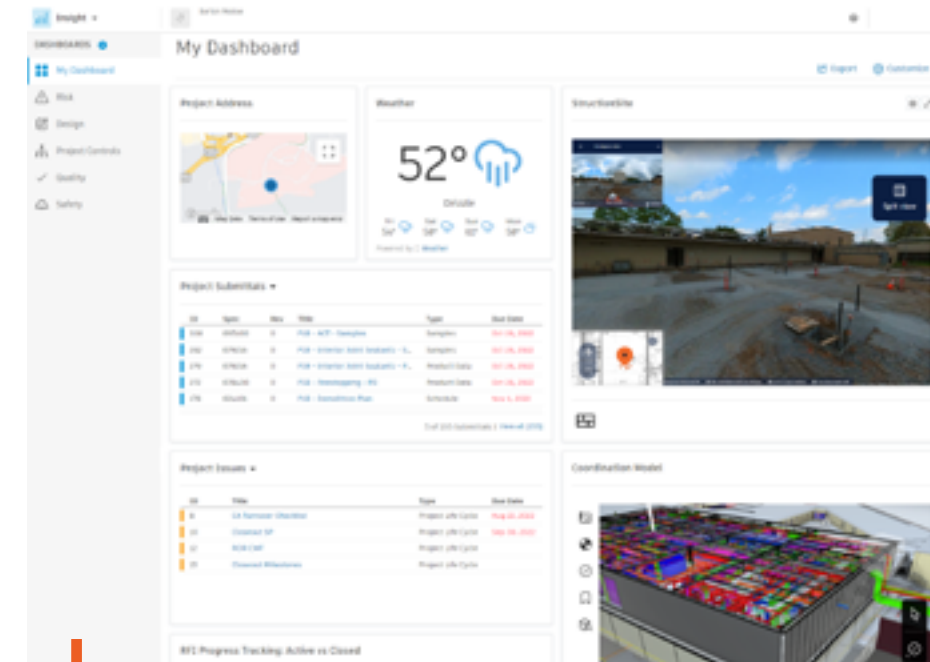
AUTODESK BUILD

WHAT IT IS

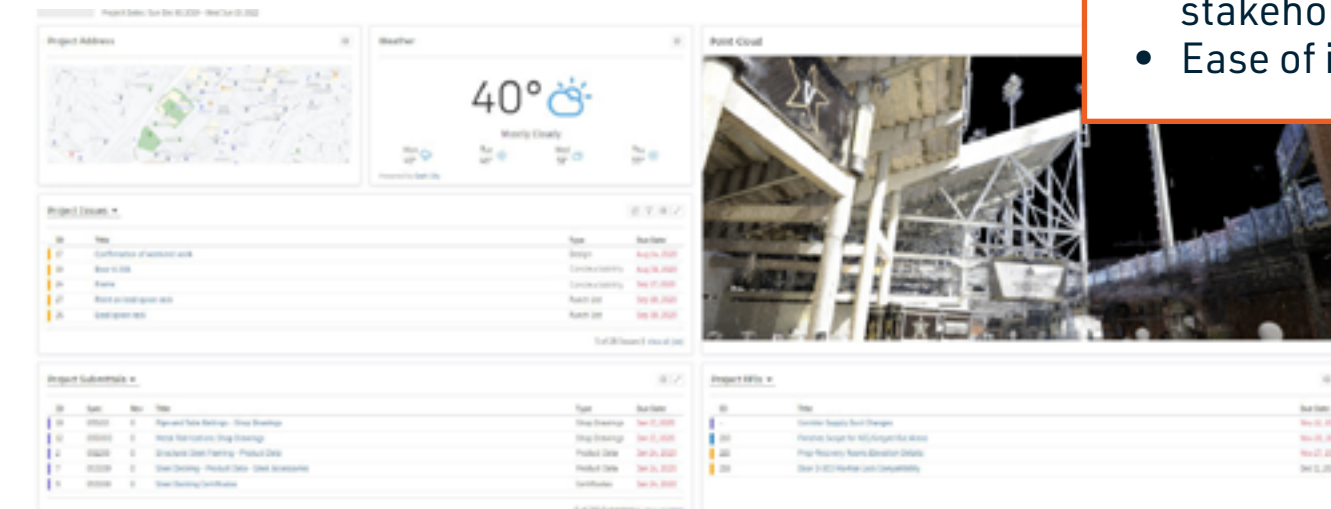
Autodesk Build is an easy-to-navigate cloud-based comprehensive Project Management solution that is utilized for file storage, drawing management, meeting minutes, quality control, issue tracking, model review, schedule review, live work sessions, etc.

WHY WE DO IT

- Enhanced communication on a single platform
- Consistent project experience for all stakeholders
- Ease of information sharing



Project Dashboard



ROBOTICS

WHAT IT IS

Robotics in construction is the use of partially to fully automated machines that more efficiently perform tasks that humans have traditionally manually performed working with various less sophisticated tools.

WHY WE DO IT

- Productivity + schedule gains
- Cheaper installation
- Enhanced safety + less labor fatigue
- Enhanced quality control
- Reduce labor requirements



MULE



Autonomous Layout Printer



SAM (Semi Automated Mason)

SAM

SEMI-AUTOMATED MASON

WHAT IT IS

Semi-Automated Mason (SAM100) is a bricklaying robot for onsite and prefabricated masonry construction.

WHY WE DO IT

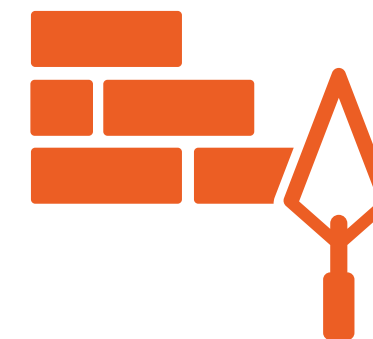
- Productivity – 3x speed
- Reduced labor fatigue/injury
- Complex + unique brick design
- Quality + consistency



SAM (Semi Automated Mason)

CAPABILITIES

- Brick sizes up to 12" long
- Half bricks/cut bricks
- Measures each brick + adjusts spacing
- Rejects bricks out of tolerance
- Multiple load locations for pattern flexibility
- Laser mimics string-line



MULE

MATERIAL UNIT LIFT ENHANCER

WHAT IT IS

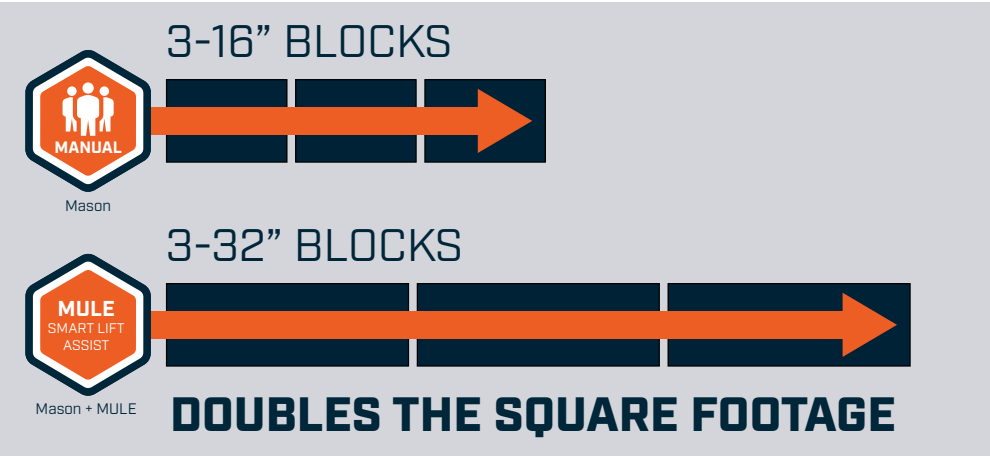
Material Unit Lift Enhancer (MULE) is an ergonomic material handling hoist designed for the construction industry.

WHY WE USE IT

- Productivity: 2-3x speed
- Reduced labor fatigue/injury
- Customizable applications
- Quality + consistency

CAPABILITIES

The MULE handles the weight of the block while allowing you to put your hands on the product, enabling fast + accurate placement of heavy objects while optimizing high dexterity with required capacity.



ROBOT-READY DRAWINGS

Create 2D CAD with all printable information in designated layers

3D BUILDING MODEL

Begin with an existing 3D design and/or trade model

CONTROL PRINTS

Establish control points

FIELD OPERATION

Operator directs printer to print CAD model on deck

QUALITY ASSURANCE

Create as-built report



DUSTY

DUSTY ROBOTICS FIELD PRINTER

WHAT IT IS

Dusty Robot Field Printer is a robot that takes layout data and prints a full-scale model into the construction surface.

WHY WE DO IT

- 10x1 layout speed
- Reduced labor fatigue/injury
- Multi-trade layout
- Usable during curing
- Quality + consistency
- Layout team buy-in

THE FUTURE OF VDC



Barton Malow strategically and continuously evaluates industry transforming innovations. Some of these technologies for example include AI, Power BI, and Robotics. As technology changes, Barton Malow continues to adapt leveraging innovations to enhance quality, safety, and value for our clients.

BUILDING WITH THE
AMERICAN SPIRIT
**PEOPLE
PROJECTS
COMMUNITIES**

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