Off-Site Construction

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Building with Confidence - Best Practices to Integrate Manufactured Building Components

Kent Hodson
President, PIVOTEK

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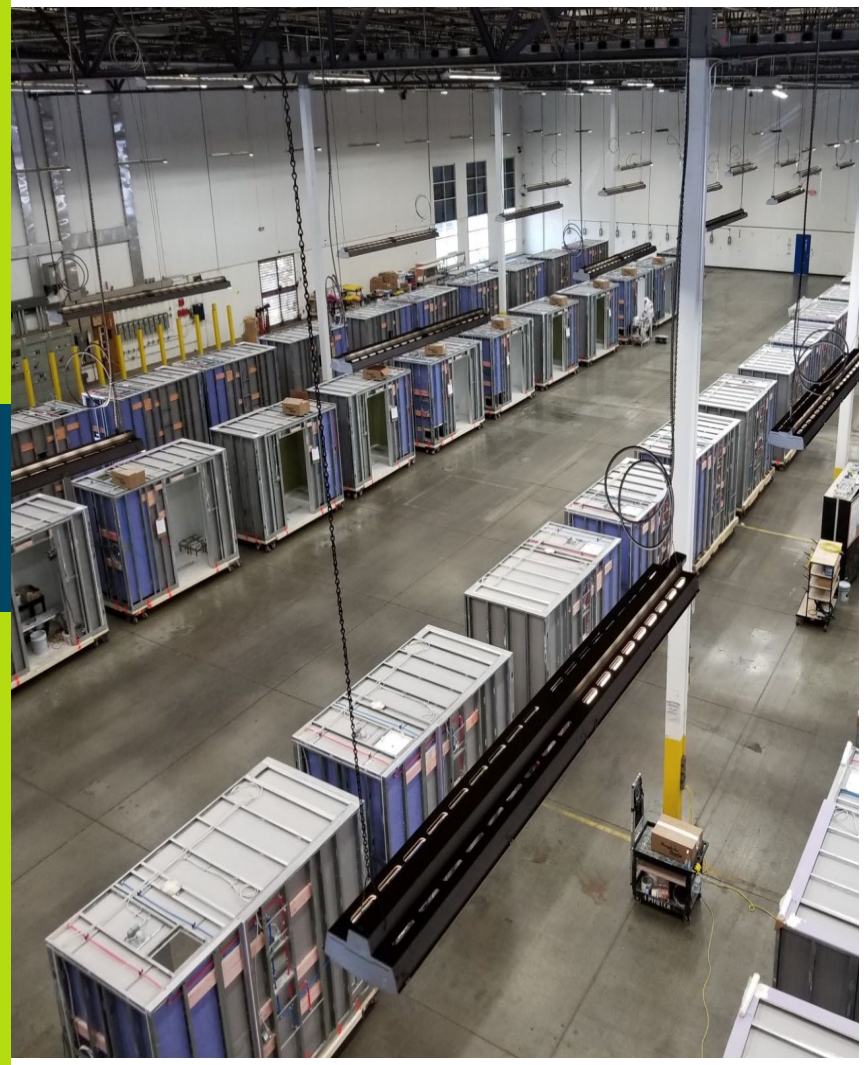
BEST PRACTICES



TOP 5

Reasons Construction Needs Manufacturing Solutions?

1. Shorter Construction Timeline
2. Increased Revenue due to early occupation
3. Quality Control Processes
4. Less Material & Labor Waste Onsite and Offsite
5. Lower Overall Construction Costs

BEST PRACTICES






Design:

- Engage manufacturing partner very early.
- Build efficiency by collaborating early with design team, MEP coordination, & constructability.
- Interior finish selections & final decisions completed early in design.
- Create standards. Limit the amount of designs.
- 50+ units per design type suitable for manufacturing.

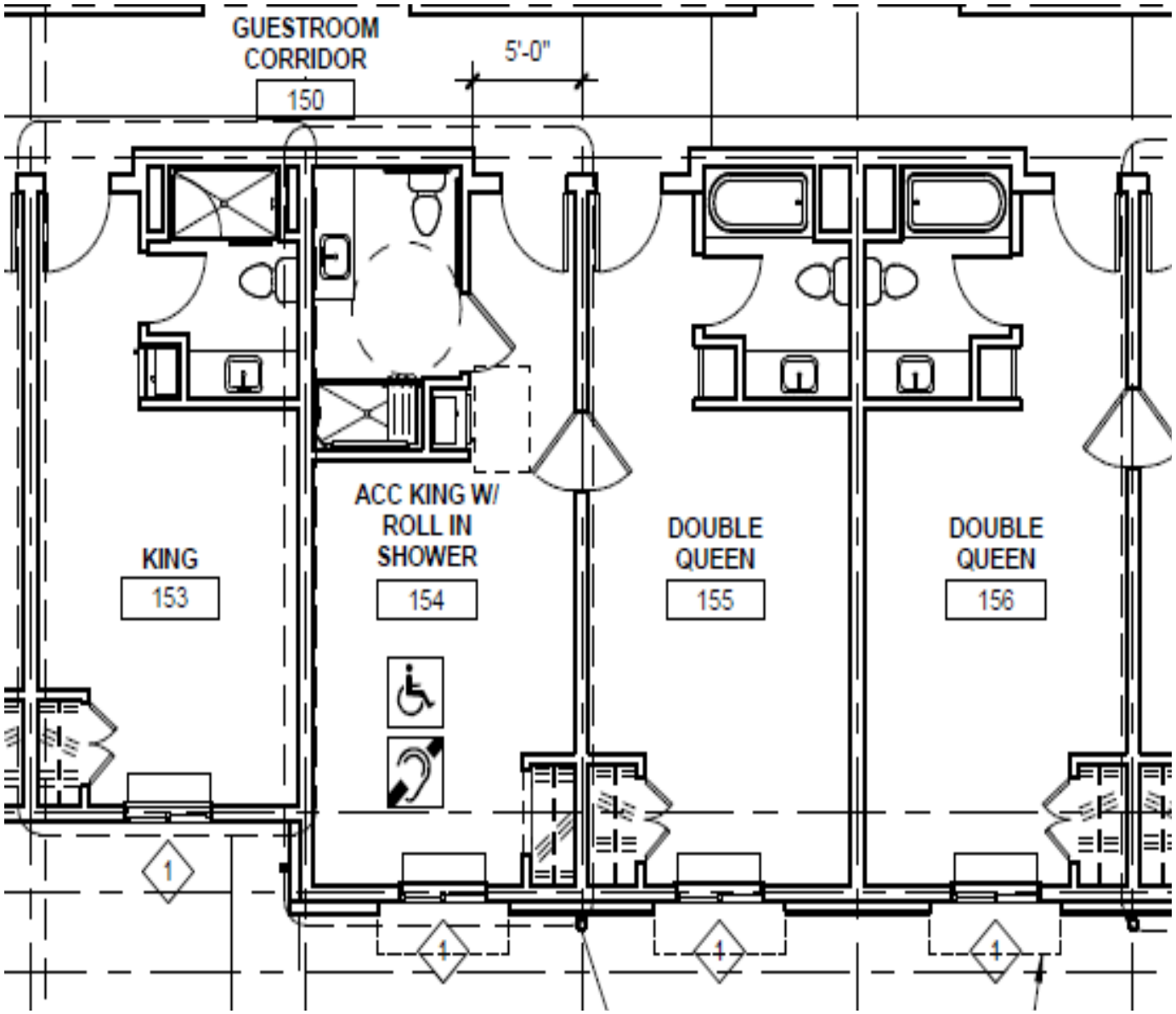
BEST PRACTICES

Estimate/Budget:

- Lead with manufacturing scope of work to ensure accuracy in comparison with traditional construction process.
- Soft cost savings includes decreased construction management time, labor & material waste, schedule savings, & reduced rework/punch out.
- Cost Assurance & Schedule Guarantees

DESIGN/FEASIBILITY

- Design
- Constructability
- Exterior Skin
- Pathway
- Floor to Floor Height
- Early Budget Estimate



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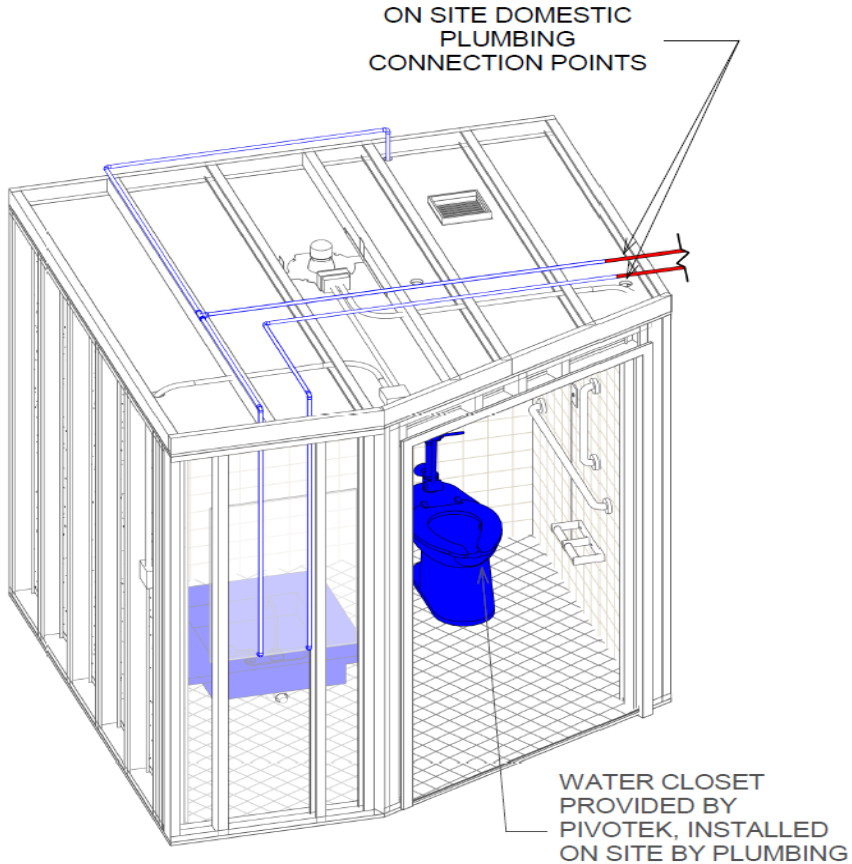
ENGAGEMENT

- Specification Development
- DD Drawings
- Scope Clarification
- Proposal Development
- Sub-Contractor Engagement

DOMESTIC PLUMBING - SCOPE

RED BY OTHERS

- ONSITE HOT & COLD DOMESTIC WATER LINES
- WATER CLOSET WITH FLUSH VALVE, TOILET FLANGE,WAX RING, & JOHNNIE BOLTS PROVIDED BY PIVOTEK FOR ON SITE INSTALLATION.



BLUE BY PIVOTEK

- HOT & COLD DOMESTIC WATER LINES
- TO ALL FIXTURES WITHIN THE POD.
- WATER CLOSET PROVIDED BY PIVOTEK

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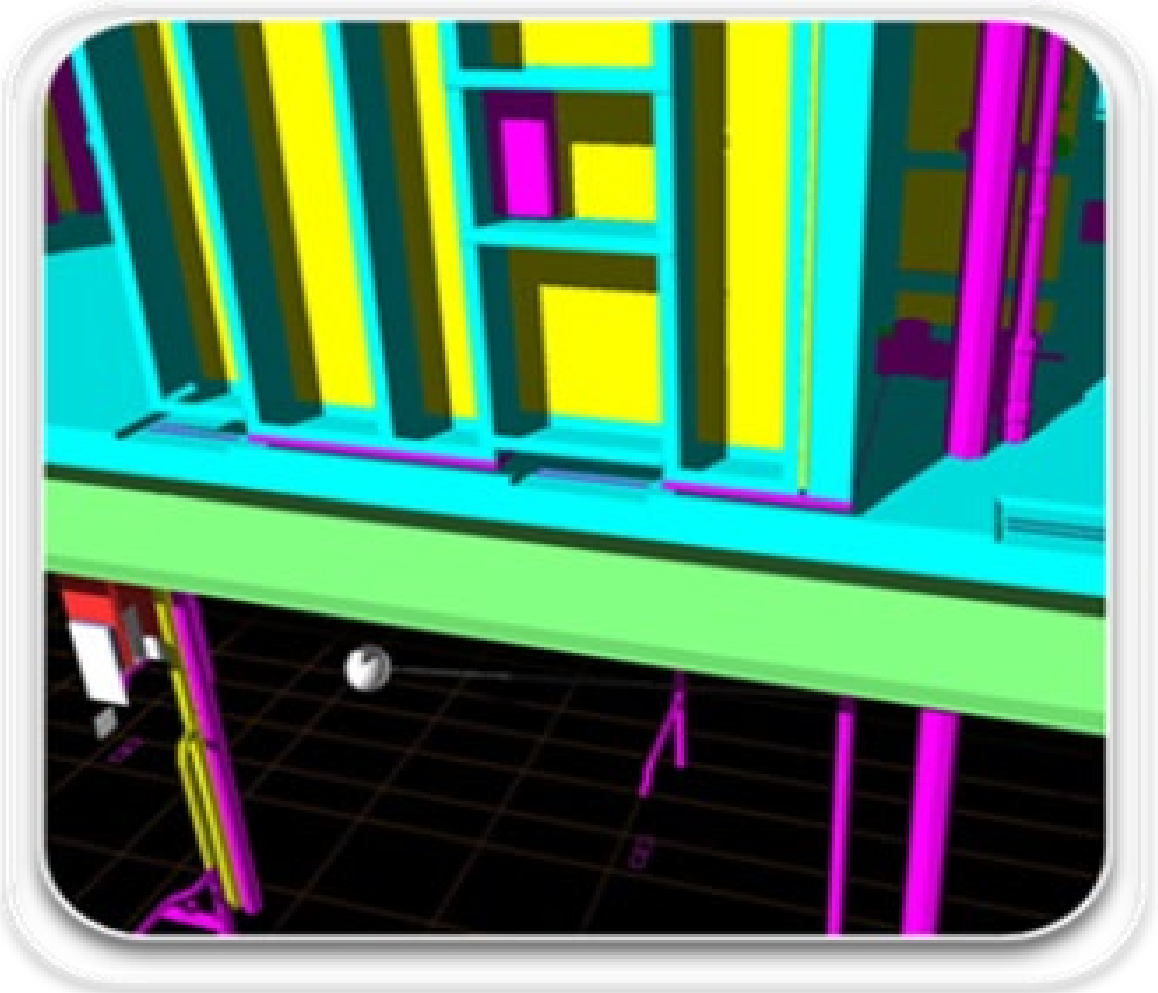
ENGINEERING

- Shop Drawing Submittal
- Coordination Drawings
- Clash Detection
- Mock Up
  - Design
  - Procurement
  - Review



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MANUFACTURING

- Schedule Driven
- Inspections
- Punch List Complete
- LEAN/Process
  - Quality Control
  - Repeatability
  - Reduced Risk
  - Project Assurances

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INSTALLATION

- Logistics & Schedule
- Coordination
- Project Planning
- On Site Support
  - Template
  - Platform & Halo
  - Installation Guide

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2018 Case Study

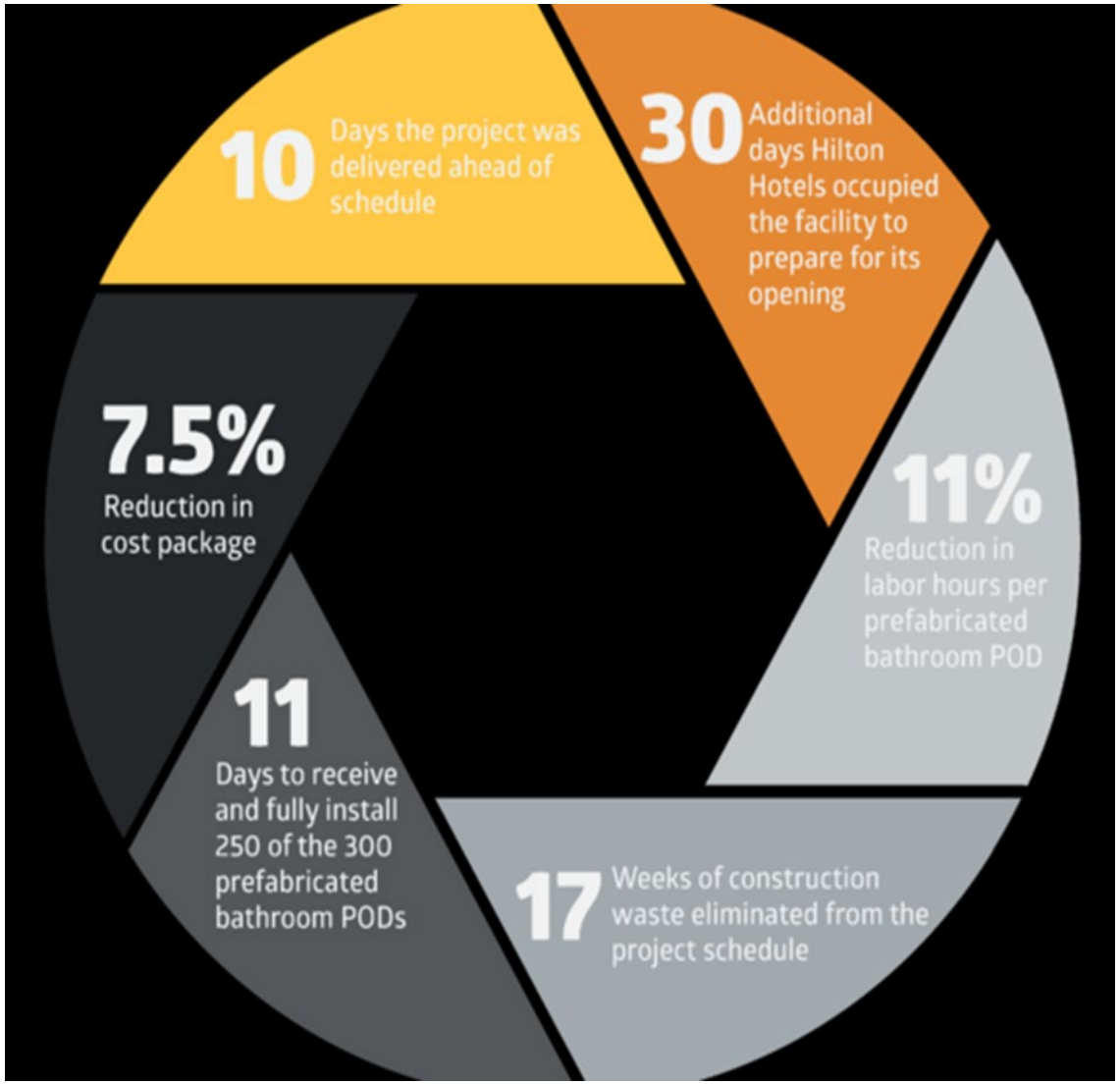
Project: 330 Room- 4 Star Hotel

- 300 Bathrooms-Manufactured & Installed.
- 30 Bathrooms Constructed Traditionally.

Data:

- “Eliminated 9.25 hours -material distribution per bathroom”
- 250 finished bathrooms set in 11 days”.
- “Hilton was able to occupy the building 30 days early”.

https://www.weitz.com/publication-download/download-id/3288/



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Technology Automation

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21st Century Masonry

Tom Elliott & Brian Trimble

Directors of Industry Development

International Masonry Institute

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21st Century Masonry

Tom Elliott & Brian Trimble

Directors of Industry Development,

International Masonry Institute

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Modern Masonry Practices and Today's Masons

- Change in masonry wall assemblies over the years
- Implementing new technologies into one of the earliest trades
- Today's masons and how they are trained

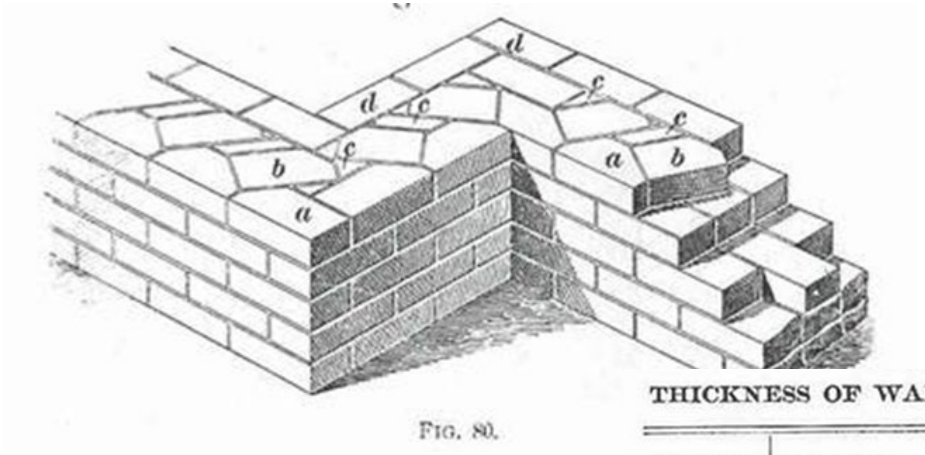
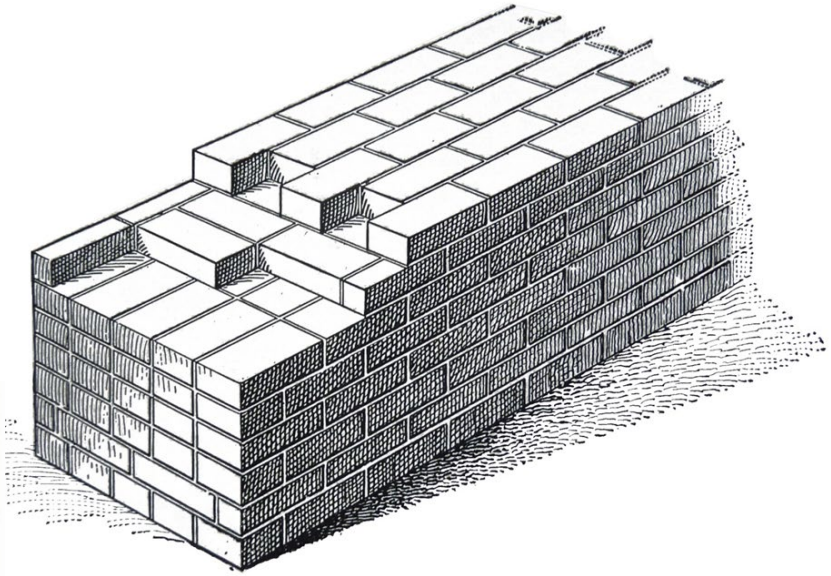


Fig. 80.



THICKNESS OF WALLS IN INCHES FOR WAREHOUSES, ETC.

Height of Building.	City.	Stories.									
		1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.
Eight Stories,	Boston,	28	24	20	20	20	20	20	16		
	New York,	32	28	24	24	20	20	16	16		
	Chicago,	24	24	20	20	20	16	16	16		
	Minneapolis,	24	20	20	20	16	16	16	12		
	Memphis,	45	40½	36	31½	27	22½	18	13		
	Denver,	30	26	21	21	21	17	17	17		
Nine Stories,	Boston,	28	24	24	20	20	20	20	20	16	
	New York,	32	32	28	24	24	20	20	16	16	
	Chicago,	24	24	24	20	20	20	16	16	16	
	Minneapolis,	24	24	20	20	20	16	16	16	12	
	Memphis,	49½	45	40½	36	31½	27	22½	18	13	
	Denver,	30	26	26	21	21	21	17	17	17	

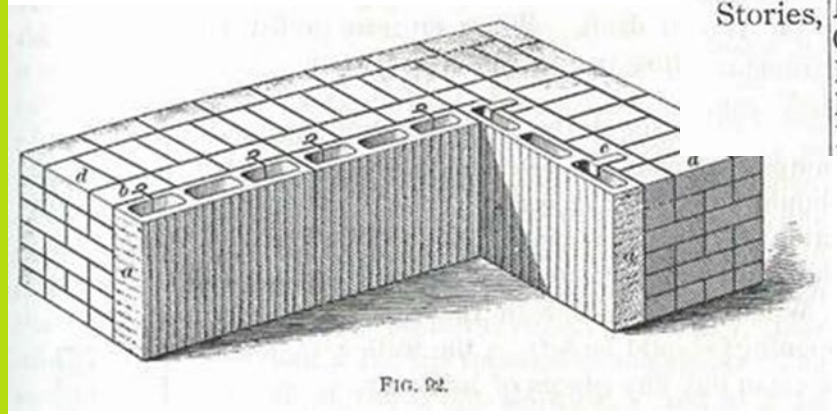
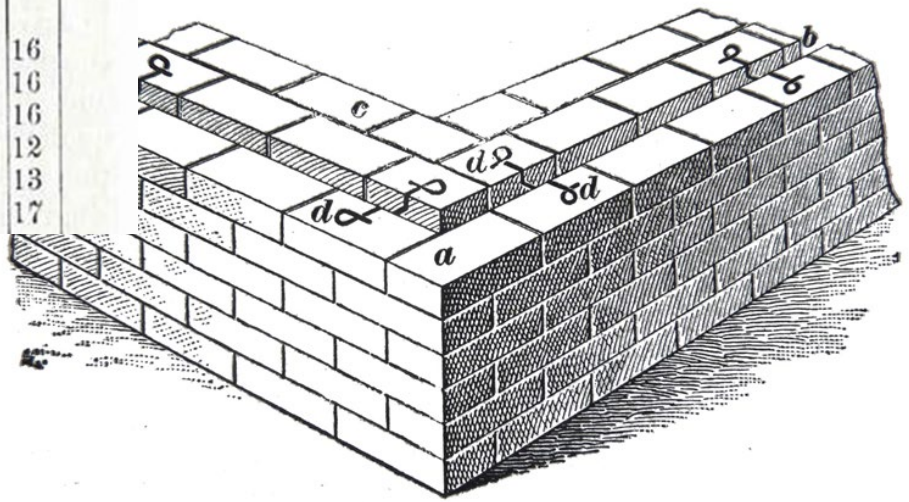


Fig. 92.



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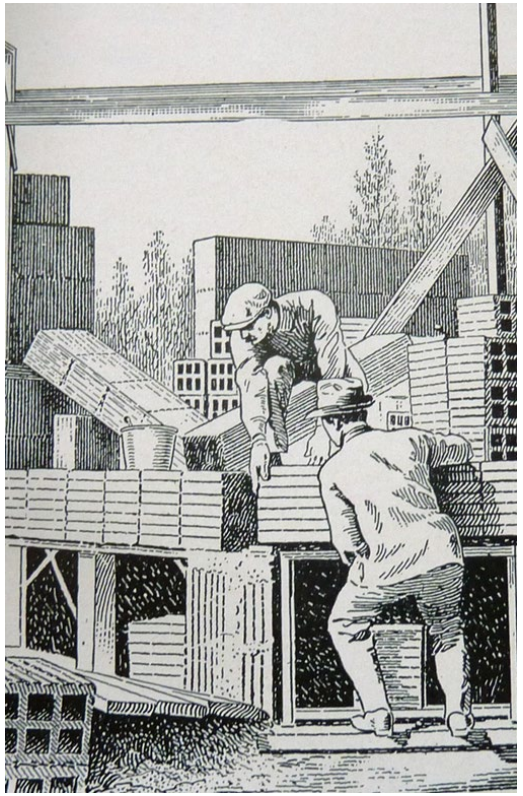
Early Masonry Materials

- Mass masonry walls comprised mainly of brick
- Terra Cotta/clay tile
- Stone



- Barrier walls
- No cavity

Today's Materials

Stand the test of time!

- Still brick, stone & terra cotta
- Cement-based materials instead of stone
- Thinner veneer systems
- Cavity walls => Rainscreen wall systems

Pre-Fabrication (Off-site Constr.) & Masonry

- CMU walls
- Stair towers
- Lintels
- Arches
- Sound barriers

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Modern Masons

- Traditional craft training
  - Flashing certification
  - Grout certification
  - Air barriers
  - Rainscreens
- Modern technology tools (iPad, Plan Grid)
- Robotics

The Mule

- Assists the craftworker
- Helps prevent injuries
- Increases production
- Saves time and money

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S.A.M. (semi-automated mason)

- Assists the Craftworker (not replaces)
  - Keeps the craftworker from dirty, dangerous or dull work

Contact

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btrimble@imiweb.org

Green Construction & Resiliency

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How to expect the unexpected.

E. Mitchell Swann, PE
Principal Consultant
MDC Systems

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Sometimes…

projects encounter problems

in the ‘thinking’

in the ‘doing’

or

in the ‘being’

(‘after the fact’)

To foresee and predict

aka “planning”

What about the foreseeable yet unpredictable?
(Is that even ‘a thing’?)

‘Qualitative’ expectation of happening.
Without a quantitative prediction of frequency or intensity.

Asymmetric risks (“black swans”)

Seeing around corners

What do we assume?
Why?

What should we ‘anticipate’?
How? How much?

What should we assume?
How do we bridge that gap?

Pre-mortem*'Pre-topsy'*

Unpredictable Foreseeables

Resilience and Climate Adaptation

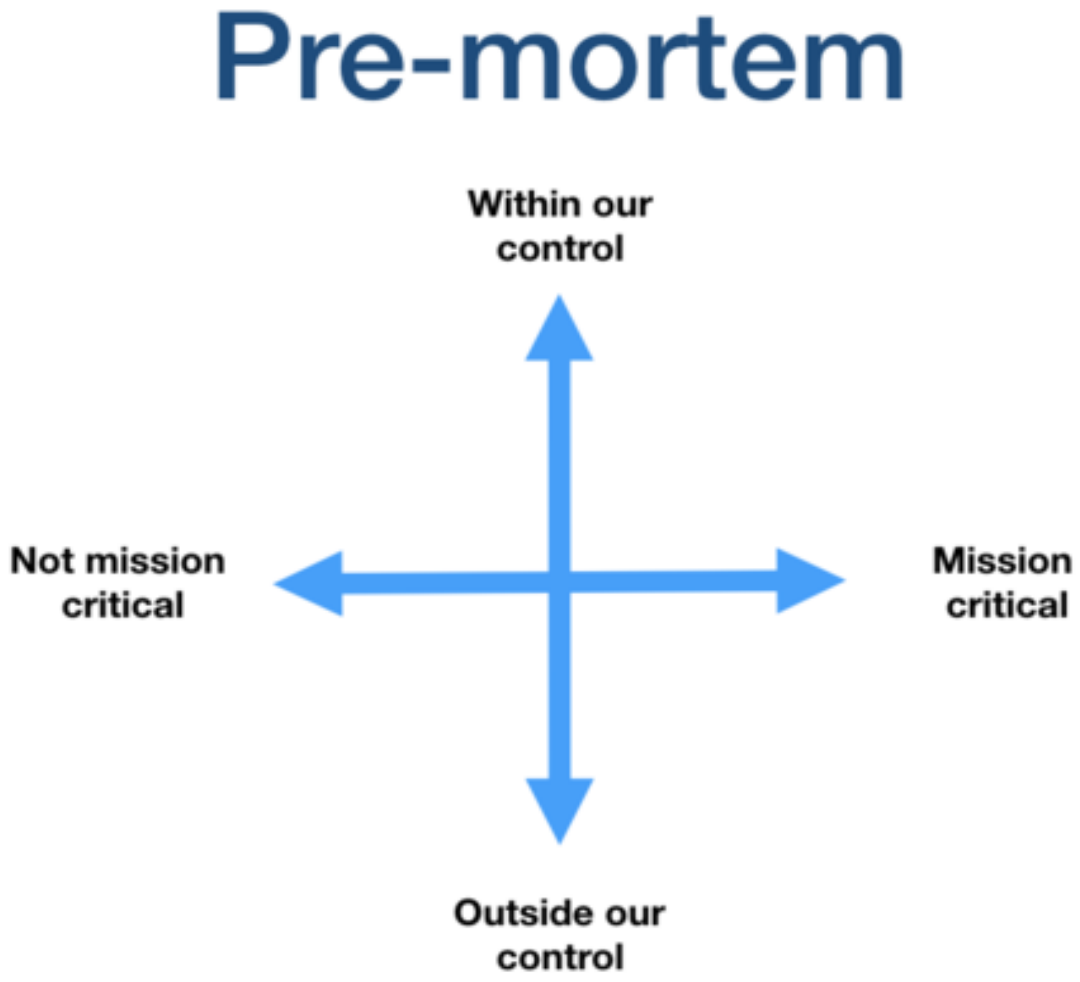
- Hotter summers?
- Bigger Storms?
- The Polar Vortex?

What is reasonable and prudent?

What are the implications?

- First cost?
- Operating cost?
- Replacement cost?

Pre-mortem*'Pre-topsy'*



Embrace Controversy

Why ask why?

"Every team needs a deviant, someone who can help the team by challenging the tendency to want too much homogeneity, which can stifle creativity and learning."

J. *Richard Hackman* - *Hackman, J. Richard, and Diane Coutu. 2009. "Why Teams Don't Work" Harvard Business Review 87(5): May 2009.*

Because it is important; that's why.

To Counterbalance…

- **overconfidence bias**
- **confirmation bias**
- **Group think can be fatal. (Find the "10th man")**

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What do you look for?

E. Mitchell Swann, PE
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BREAK

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Visualization and On-Site Tools

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Virtual Reality Mockups to Save Time and Effort

Hal Jones, Director of Innovation and Virtual Design and Construction
Skanska

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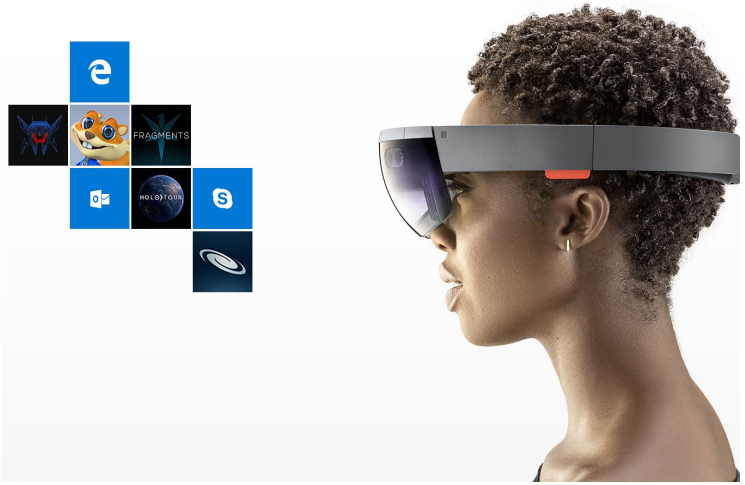
What is Digital Reality?

MR

Merging the digital and physical environments



AR

Enhancing your environment with digital content

VR

Replacing your environment with digital content

VR Mockups for Planning and Operations

VR Mockup – *Computer generated Immersive environment for the purpose of enhancing or replacing a traditional physical mockup.*

Uses

- Functional review
- Equipment layout
- Design alternatives
- Maintenance review

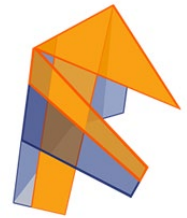
Benefits

- Earlier engagement
- Varying Level of Detail
- Multiple iterations
- Distributed collaboration

VR Mockups for Planning and Operations

VR Production Platforms

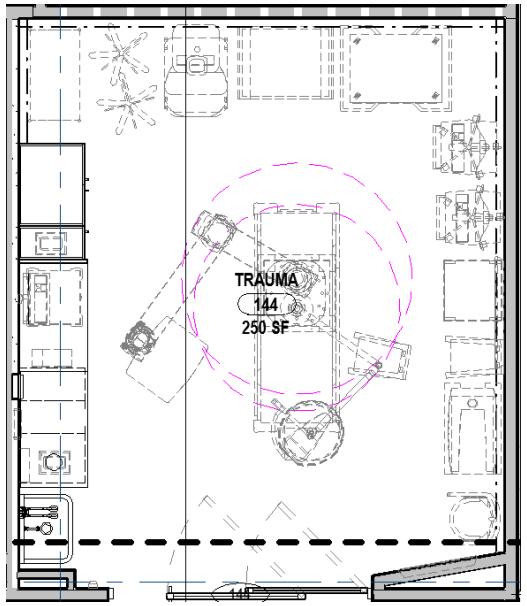
Revit Plugins
- Revit Live
- Enscape
- Fuzor

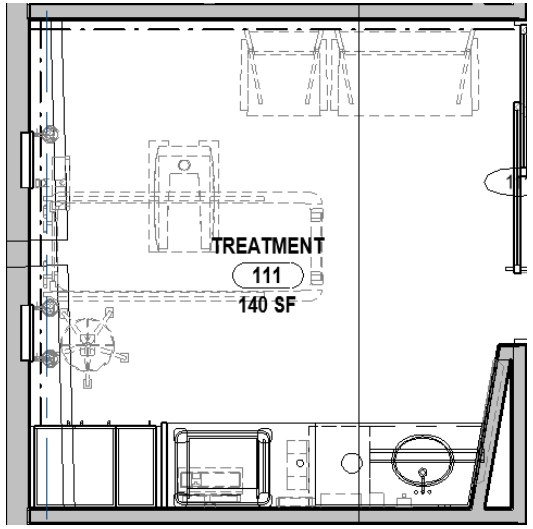


- Easy to Use
- Scalable
- Collaborative

Game Engines
- Stingray
- Unreal
- Unity

- Interactive
- Flexible
- High Fidelity





Emergency Department Virtual Mockup

Client requested clinician groups evaluate equipment layout and review value engineering (VE) decisions before finalizing construction documents

Not enough time to build physical mockup <u>and</u> get feedback before construction documents

Produce virtual mockups of two high value / importance rooms


Moveable Boom
UNREAL
ENGINE
Highly Accurate And Detailed
Equipment Layout


UNREAL
ENGINE
Adjustable and Accurate Lighting

VR Mockups for Planning and Operations

Metrics / Bottom line

VR Mockup for ED Rooms
$14,000
Including headset

Physical Mockups Hospital Bed tower
OR - $120,000
ICU - $80,000

VR Mockup for Apartment Rooms
Completed 3 months early

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Virtual Meetings, Virtual Reality, Virtually Awesome

Aaron Domini
OHM Advisors

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Virtual Reality: A Design Imperative

Charlie Jahnigen
Vice President, Architecture
SHP

Greg Lewis
Design Leader
SHP

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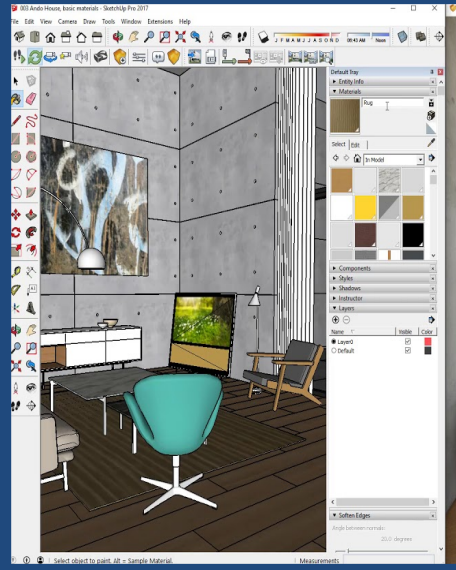
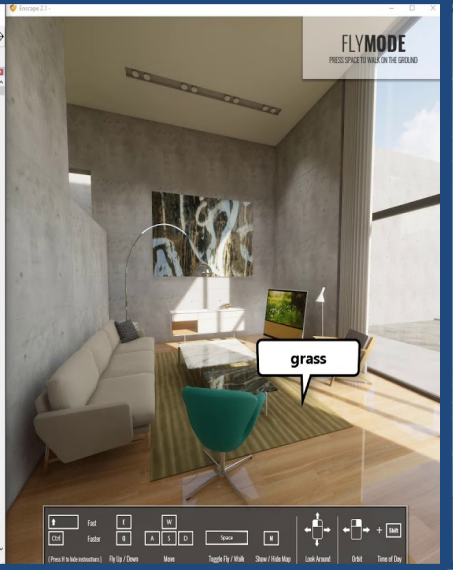
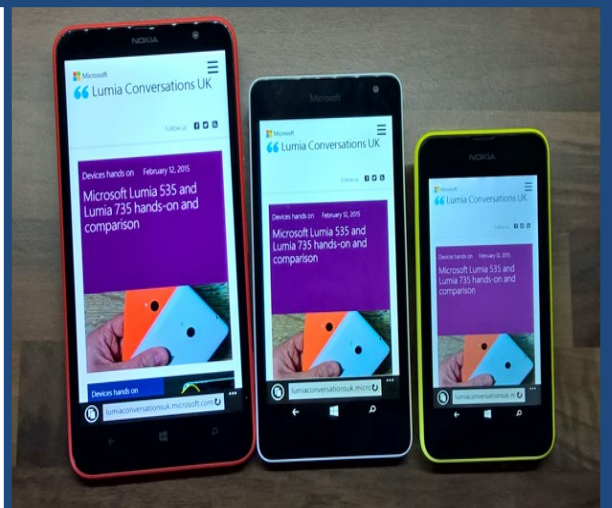
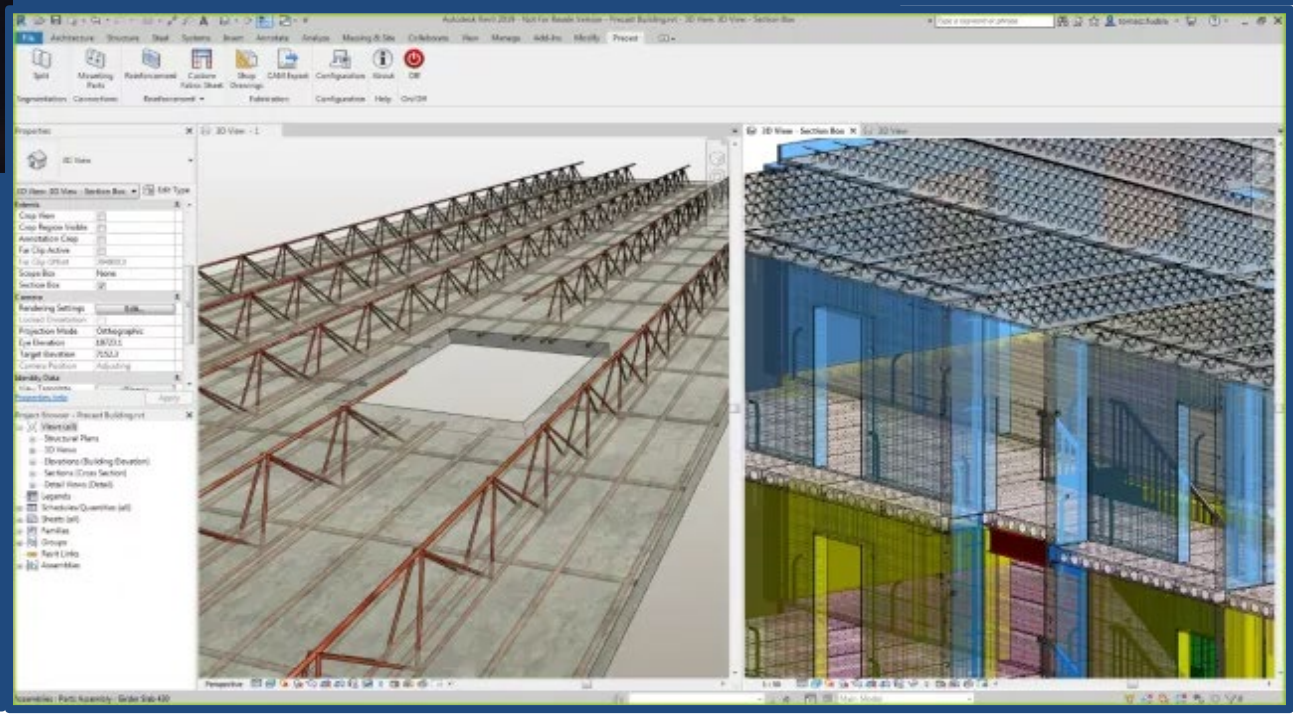
Two scenarios

Tools of the trade









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Why virtual reality

- Enhance the design process
- Make the design real
- Communicate design intent

Virtual reality in early study models

Barriers to adoption

- Technological
- Physical
- Emotional

The next frontier

- Augmented reality, gaming experience
- A direct relationship between the physical and the virtual
- Interdisciplinary teams
- An even more intuitive experience

Contact

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Grab Your Gadgets! Drones and GIS Applications Lead to Smarter Spending and Better Data

Harvey Schwager - Director of Architecture, OHM Advisors

Michael Cousins - Practice Leader - GIS, OHM Advisors

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Topics and Content

Use of Technology to streamline inspections, gather data and provide interactive database.

- Case Study – Ohio Courts Building Exterior Assessment.
  - Unmanned Aerial Drone Façade Examination.
  - Swing stage versus drone.
  - Benefits.
- Case Study - Wayne County Airport (Detroit) ADA Assessment
  - GIS Technology tied to Smart Data Points.
  - Interactive Live Database Versus Written Document.

Façade Assessment

Ohio Courts Building

- Built 1932
- Renovated 1998
- Became SCOO 2004
- Exterior Renovation 2019

Façade Assessment

- Exterior Condition Assessment
  - Swing Stage Access
    - Weather Dependent
    - Safety Issues
    - Staging and Contractor Assistance
  - UAD Access
    - Armchair Assessments Done From Office
    - Minimal Safety Concern
    - High Resolution Images

Ohio Courts Building

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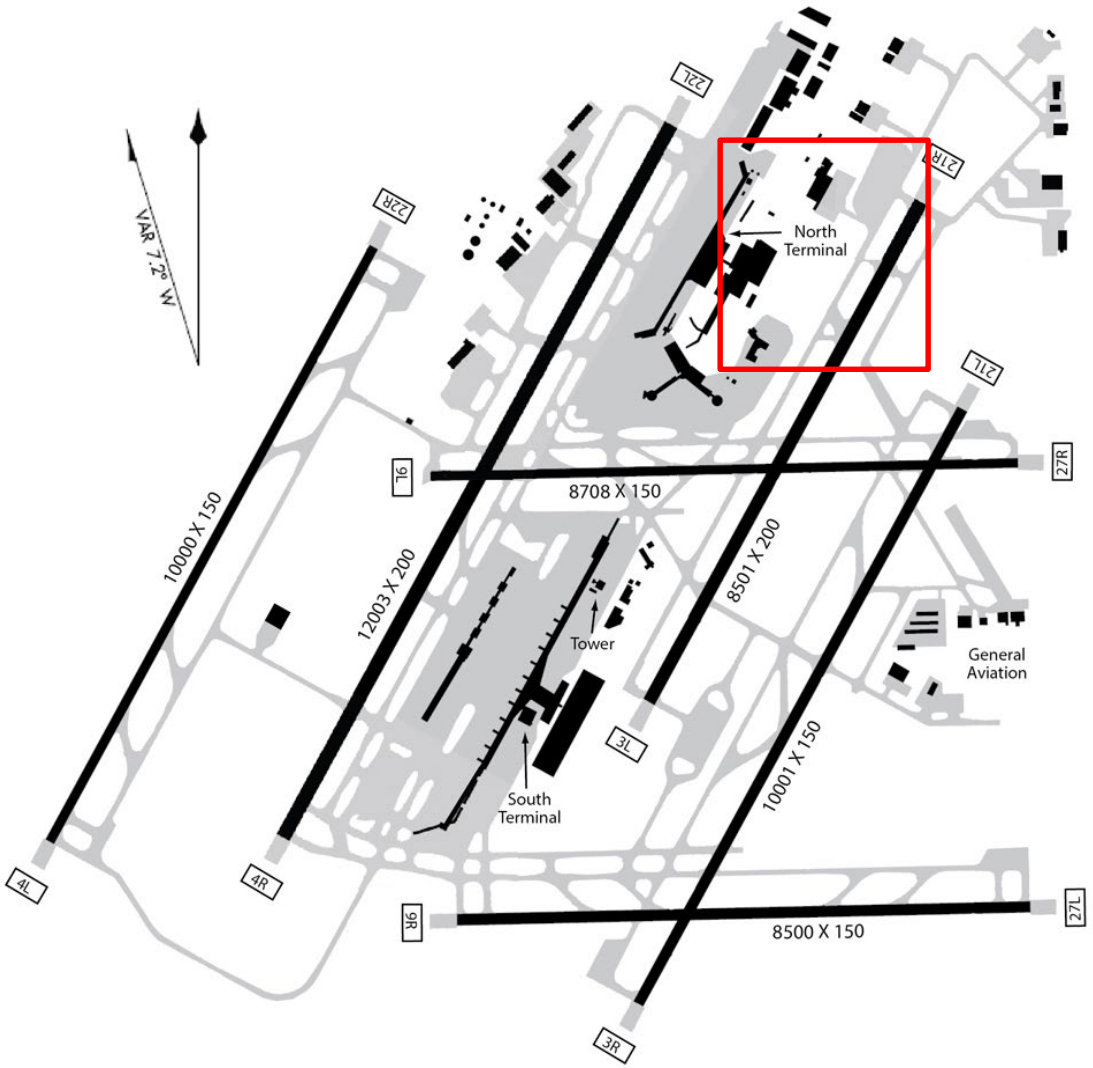
Façade Assessment

Ohio Courts Building

- Allowed narrower scope for up close inspection.
- Allowed more accurate quantities for estimates.
- Saved time in the field.
- Allowed office staff to revisit data multiple times.
- Allowed more accurate drawings.
- Entire Building captured in two days.
- Allowed views not accessible from the swing stage.

ADA Assessment



Wayne County Airport

- Assessment of North Terminal and Big Blue Parking Deck.
- ADA and ICC A117.1.
- 3 year update
- FAA monitors compliance
- Traditional method included using paper and a camera
- Past deliverable was a thick hard-copy binder report

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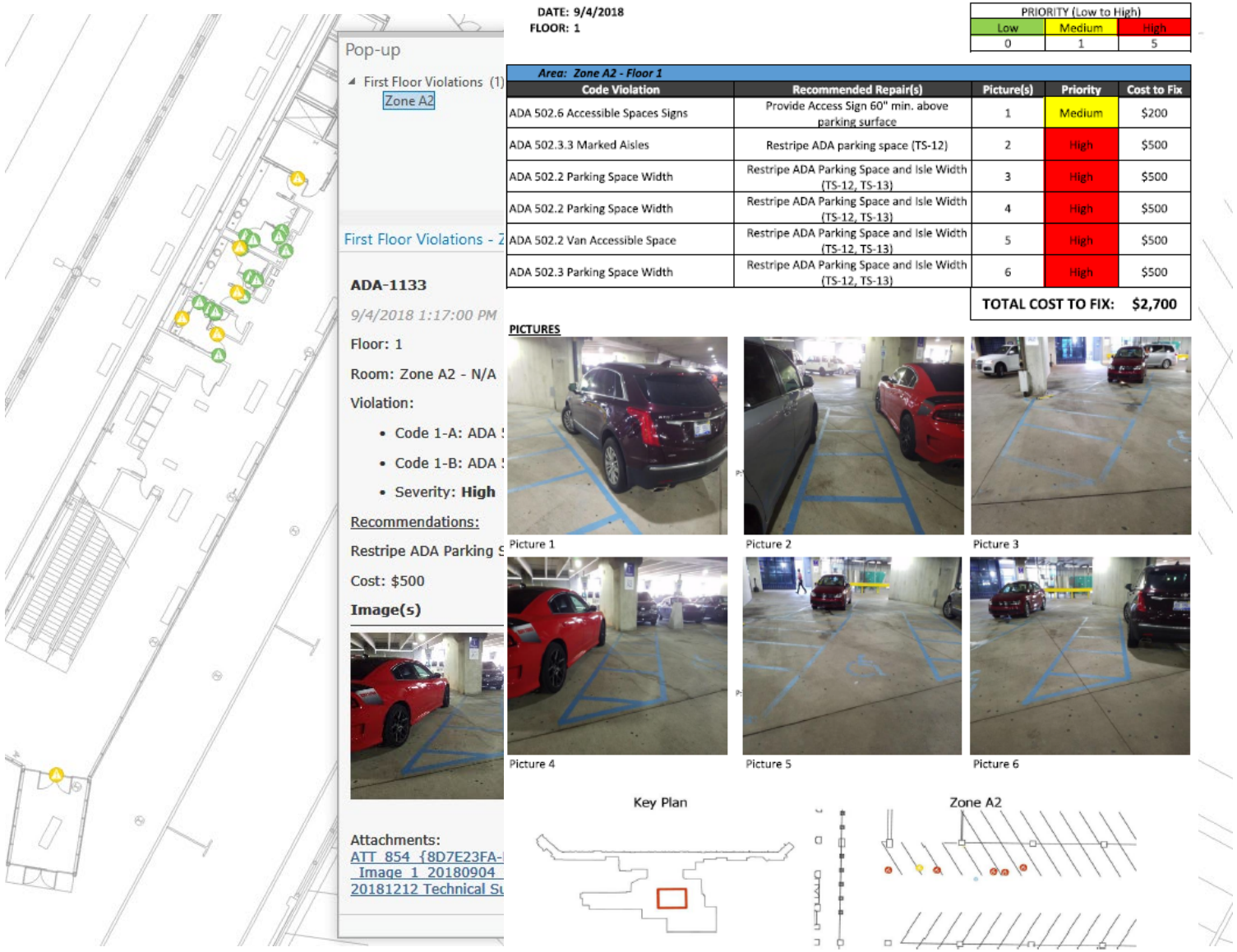
ADA Assessment

Wayne County Airport

- What we had and what we used

ADA Assessment

Wayne County Airport



DATE: 9/4/2018
FLOOR: 1

PRIORITY (Low to High)		
Low	Medium	High
0	1	5

Area: Zone A2 - Floor 1

Code Violation	Recommended Repair(s)	Picture(s)	Priority	Cost to Fix
ADA 502.6 Accessible Spaces Signs	Provide Access Sign 60" min. above parking surface	1	Medium	$200
ADA 502.3.3 Marked Aisles	Restripe ADA parking space (TS-12)	2	High	$500
ADA 502.2 Parking Space Width	Restripe ADA Parking Space and Isle Width (TS-12, TS-13)	3	High	$500
ADA 502.2 Parking Space Width	Restripe ADA Parking Space and Isle Width (TS-12, TS-13)	4	High	$500
ADA 502.2 Van Accessible Space	Restripe ADA Parking Space and Isle Width (TS-12, TS-13)	5	High	$500
ADA 502.3 Parking Space Width	Restripe ADA Parking Space and Isle Width (TS-12, TS-13)	6	High	$500
		TOTAL COST TO FIX:		**$2,700**

PICTURES

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 6

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Conference Wrap Up

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CEU Reminders –

Separate Registration tables for:

- LPDC
- Certificate of Participation
  - Registered architects, landscape architects, all other attendees
- AIA Architects – MUST sign out at a Registration Kiosk to receive credit.

This concludes the American Institute of Architects Continuing Education Systems Course

This concludes the American Institute of Architects Continuing Education Systems Course

Provider Name: Ohio Facilities Construction Commission
Provider #: G442
CEU Contact: sue.meyer@ofcc.ohio.gov

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