Industrialized Construction & Lean Manufacturing

Where the ecosystem needs to be

Amy Marks Head of Industrialized Construction Strategy and Evangelism



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Amy Marks

Head of Industrialized Construction Strategy and Evangelism – Autodesk

#QueenofPrefab

- Formerly CEO of XSite Modular
- Industry thought leader on Industrialized Construction
- Alumna of Harvard Business School and a graduate of the UF
- Ambassador of Advancing Prefabrication Conference January
- Trainer Mechanical Contractors Association of America (MCAA)
- Singapore Govt. Panel of Experts on Construction and Productivity
- Worked on six of the seven continents consulting on large scale projects to optimize Industrialized Construction





Gorilla Factory Pods DfMA Rising Factory Factory Built Offsite Construction Racks Flying Factory Industrialized Construction Offsite Manufacturing Offsite Modular Prefab Skids Modules

Industrialized Construction: The application of manufacturing techniques in the built environment

INDUSTRIALIZED CONSTRUCTION

	Advanced Building Products	Single Trade Assemblies Prefabrica	Multi Trade Assemblies	Volumetric Modular		Robotics & Automation	Additive Manufacturing	I AL
	DfMA	BIM	Lean MFG		چېچ آ <u>ن</u> Cloud	Eig Data & Analytics	رزن اOT	
PROCESS ENABLERS				No Marco	TECHNOLOGY ENABLERS			



Advanced Building Products



Single Trade Assemblies

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Multi Trade Assemblies



Volumetric Modular

Prefabrication Continuum

Over next 15 years

- 45% of AEC value will shift away from traditional processes
- Prefabrication will increase to ~30% of construction revenue



Increasing Pressure to Adopt IC Across Ecosystem



Increasing Pressure to Adopt IC Across Ecosystem



DfM and DfA

Design for Manufacturing (DfM)

- Method of design for ease of manufacturing for a collection of parts that form the product/element
- Optimization of the manufacturing process through design choices



Design for Assembly (DfA)

- Method of design of the product/element for ease of assembly
- Design principles used by the design teams in the design of products/elements focusing on the number of parts to assemble, shipping, handling and ease of assembly (integration on site)

IKEA JOB INTERVIEW



Design for Manufacturing and Assembly (DfMA)

Design for Manufacturing (DfM)

- Reduce material, overhead and labor cost
- Shorten design cycle time
- Utilize standards to reduce cost

Design for Assembly (DfA)

Definition: A **design methodology** to enable and optimize prefabrication using a **set of design choices (principles)**

DfMA Enables Industrialized Construction



DfMA - Generic Principles

Design for ease of fabrication – Element specific	Design for ease of assembly and minimized handling/logistics	Modular (not volumetric box modular) design	
Maximize multi-trade elements when adjacencies exist	Design it once, use it many times	Design parts for multi-use	
Use of standard components	Use of advanced building products	Safety in design	

Balance ease of fabrication vs. ease of assembly

DfMA – Element Specific

Element specific DfMA is a particular set of instructions that apply to one type of element and include the proprietary rules of each manufacturer – because there are few standards





DfMA – Element Specific

- One proprietary precast panel system can have 45 DfM and 10 DfA principles
- Multiply by number of elements
- Multiply by proprietary systems







Target Value Design



Target value design – trade centric



Target value design – trade centric

TVD Element-Centric vs Trade Centric

 Focuses on performance-based specifications vs. prescriptive specifications

 Places focus on sharing costs as part of the design criteria

Requires target costs for element-based solutions vs. trade focus

Conventional Bathroom:



Required Trades: 9 Carpenter, Plumber, Mech, Elec, Drywaller, Door, Fire Protection, Tiler, Painter

Bathroom Pod:



Required Trades: 1 Bathroom Pod Manufacturer

Target value design – trade centric



Define Elements, identify products and supply chain partners, understand remaining scope

Constraint Log Creation & Resolution

 I CAN do "prefabricated element", IF this criterion is met

 Team focus is on removing constraints and collaborating on solutions





Prefab Pitfalls

- Late engagement
- The "apples to oranges" comparison
- Conventional procurement process
- Lack of Alignment Why are we doing this?
- Single Element Focus
- Project-Centricity



Project-Centric Mentality

Autodesk IC Strategy



Autodesk IC Strategy

MAKE DfMA AND PREFABRICATIONCONNECT AUTODESK PLATFORM WITH THE
EASIEREASIERIC ECOSYSTEM

CREATE A COLLABORATIVE IC COMMUNITY







Map Ideal Pathways

Map processes for 5 major prefabricated elements







Assess for each element

- Pains/gains
- Value mapping
- Tasks/tools/data
- People/personas
- Define idealized workflow





Deliver Connected Solution through Functional Data



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Product Mindset Enables IC Optimization

From project-centric to product-led



CMMI – Maturity Framework

'New Possible' Roles



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