

# WHAT TYPE OF PRODUCTION IS CONSTRUCTION

Todd Zabelle, PPI



# Owners are frustrated





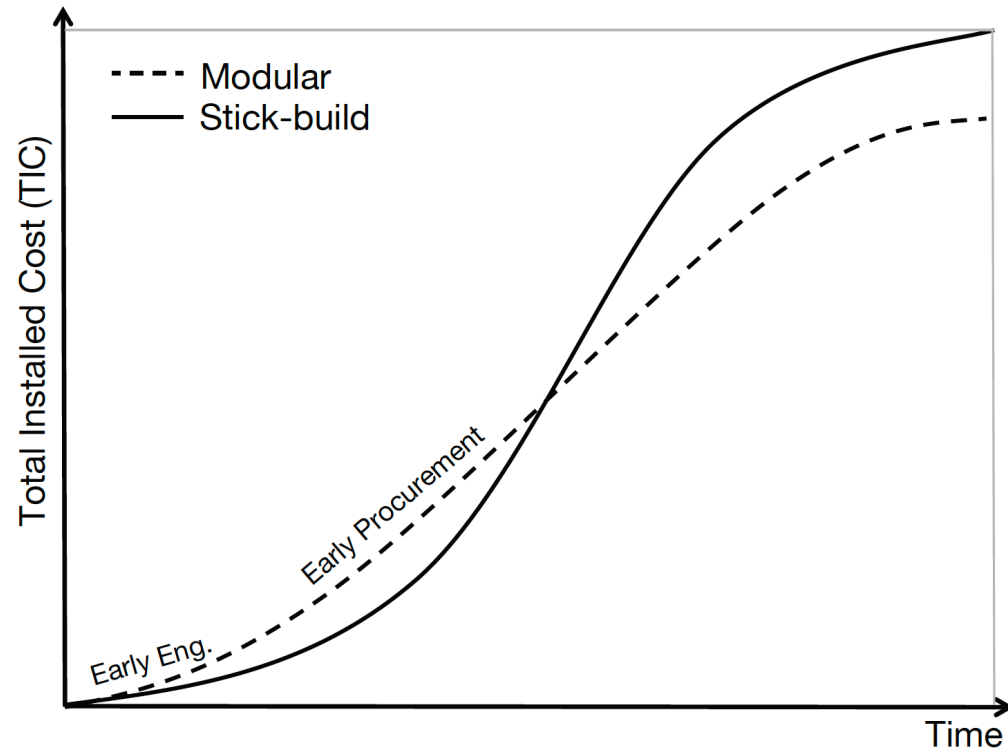
# “Factory Models” and Build Offsite



aka Modularization



# Construction Industry Institute (CII) RT - 283



**Figure 7.** Conceptual Comparison of TIC over Time for Modular and Stick-build Projects of Equal Duration

Risk	Stick Build	Modular
Engineering Design		Earlier start/earlier design freeze
Procurement		Selective purchase (engineering and materials) to support module fabrication yard needs
Fabrication	Onsite local conditions/ local workforce	Temperate climate/ experienced labor force
Shipping	Common carrier concerns and delays/risk of damage	Requirements for very large specific vessels
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# Contractors see opportunity





# Manufacturing / Production Engineers



What is a factory model and does moving work offsite solve the problem?



For most people, factory model means  
standard products or assets

# *Versus* adoption of advanced production thinking



# Automotive pushing personalization through configuration

# What type of production?



High Cost

One Off, Custom Products

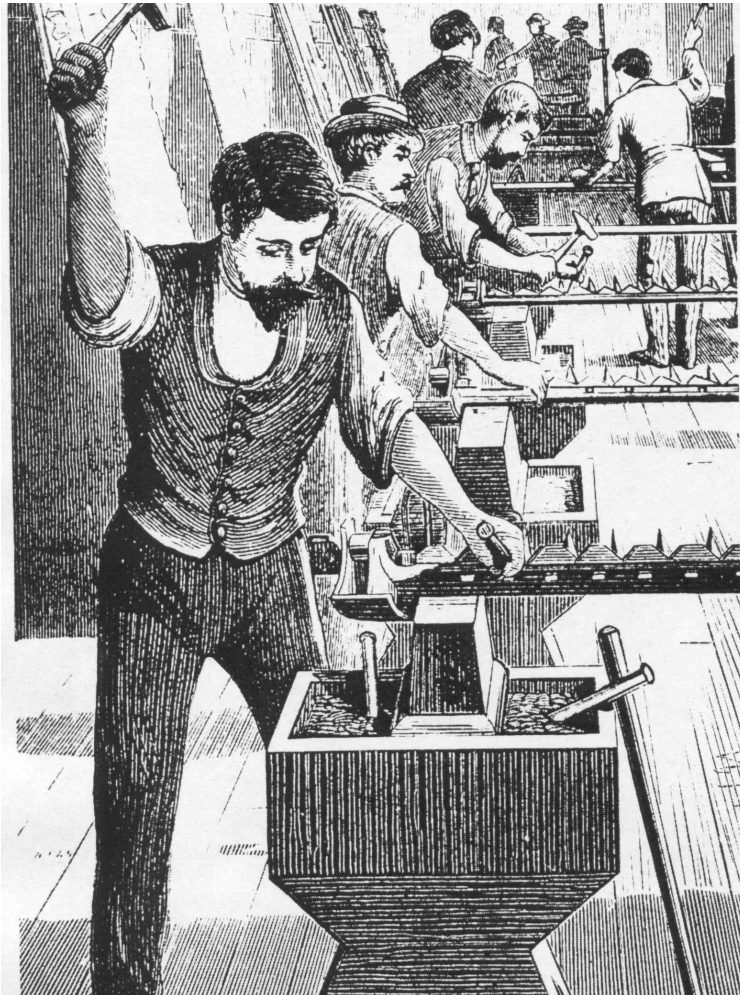
Built to Order

Highly Skilled Workforce

Flexible, Simple Tools

Tinkering and Rework

Field Measure then Make



# Craft Production



# Organized and operates as such



Fragmentation	Disciplines and Trades Lots of Contractors
Business Model	Service Based (vs product based) $\text{Cost} + \text{Profit} = \text{Price}$ (vs $\text{Price} - \text{Cost} = \text{Profit}$ ) Customer threats from GC/CM to Subcontractors
Performance Measurements	Productivity Factor Earned Hours
Liability & Risk	Avoid means and methods
Administration	Focus on contracting and risk
Processes & Tools	Project Controls (CPM)
Mental Models	Cost / Time Tradeoff & Iron Triangle Confusion about fundamental production concepts

## Project Management

# What, Who and When



Project Management

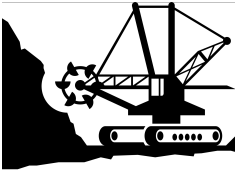
What, Who, When, How and Where

Project Production Management





# How to do What, Where?



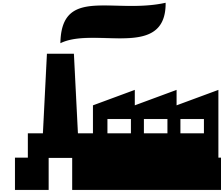
Mine / Recycle



Process



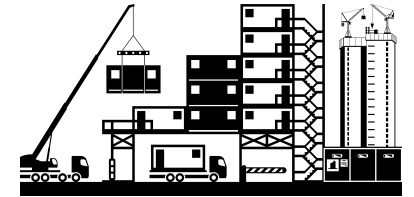
Transport



Fabricate / Manufacture



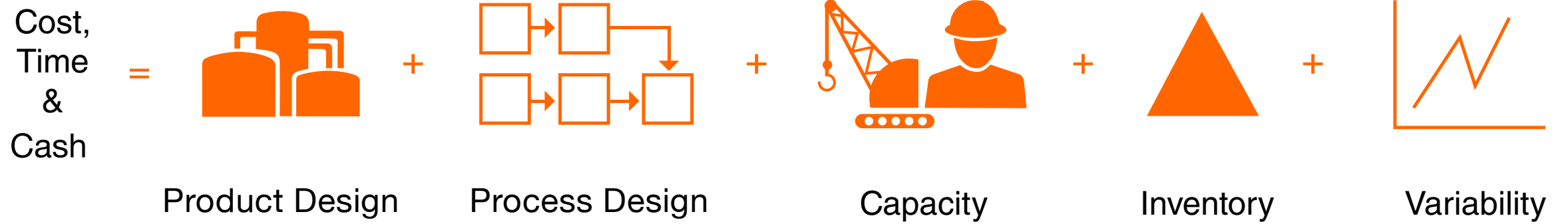
Deliver

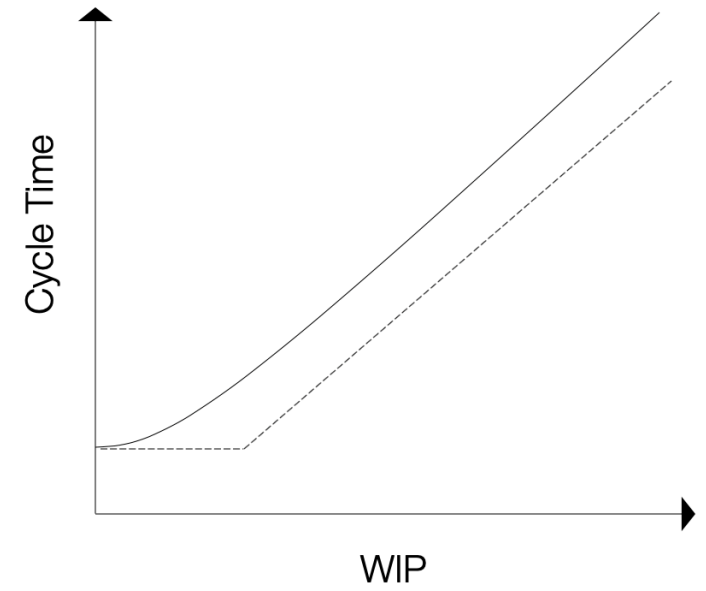
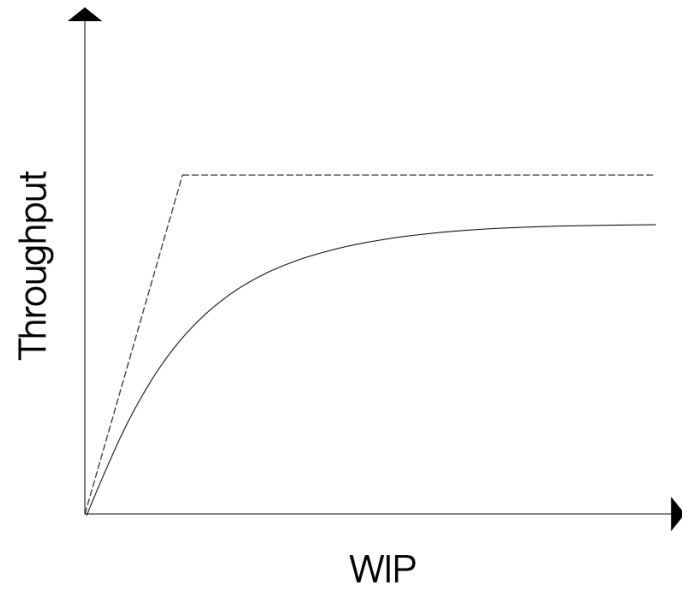
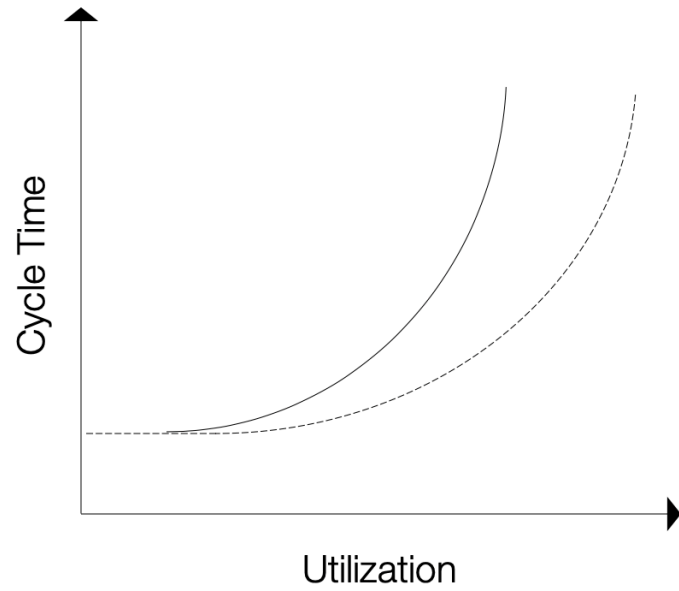


Install

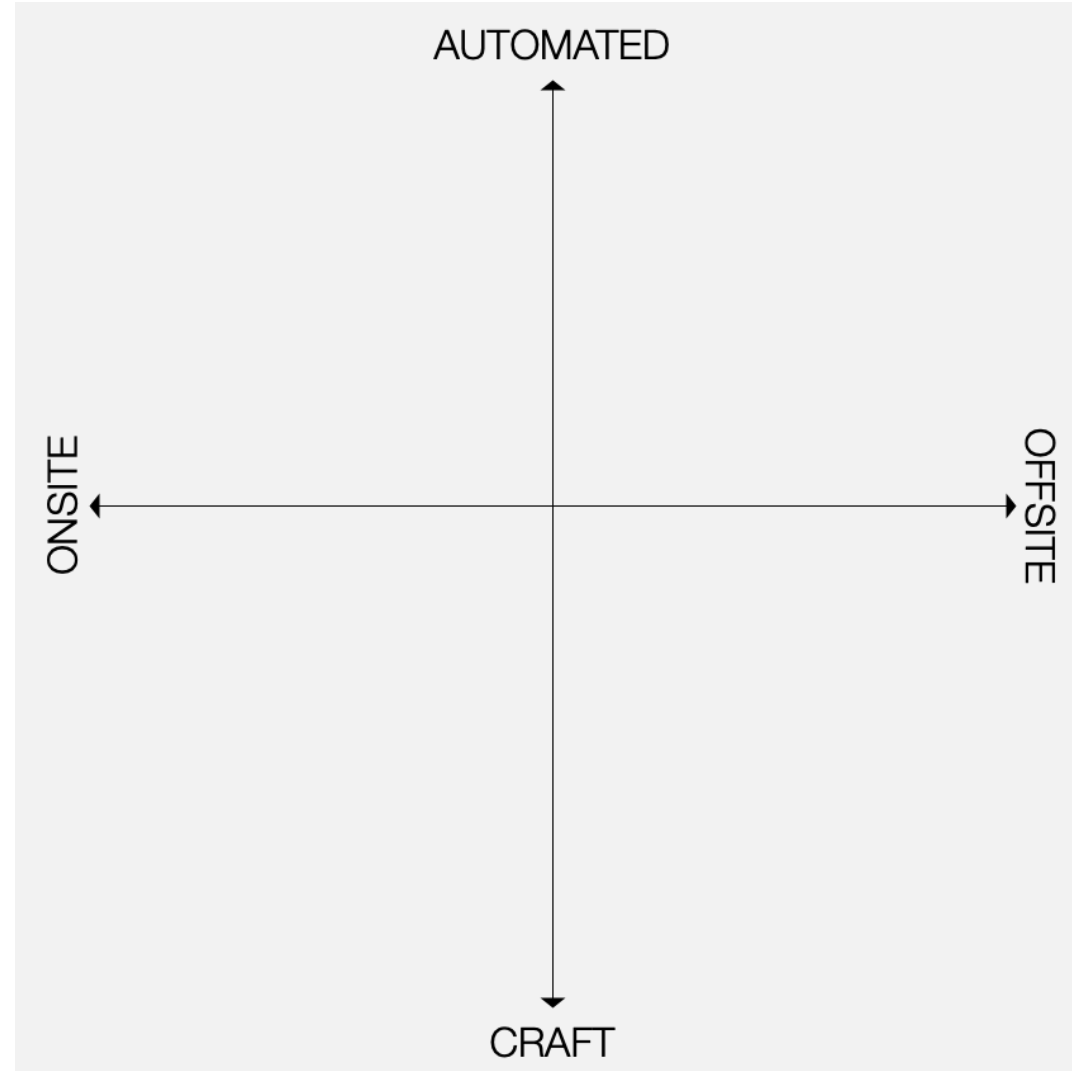


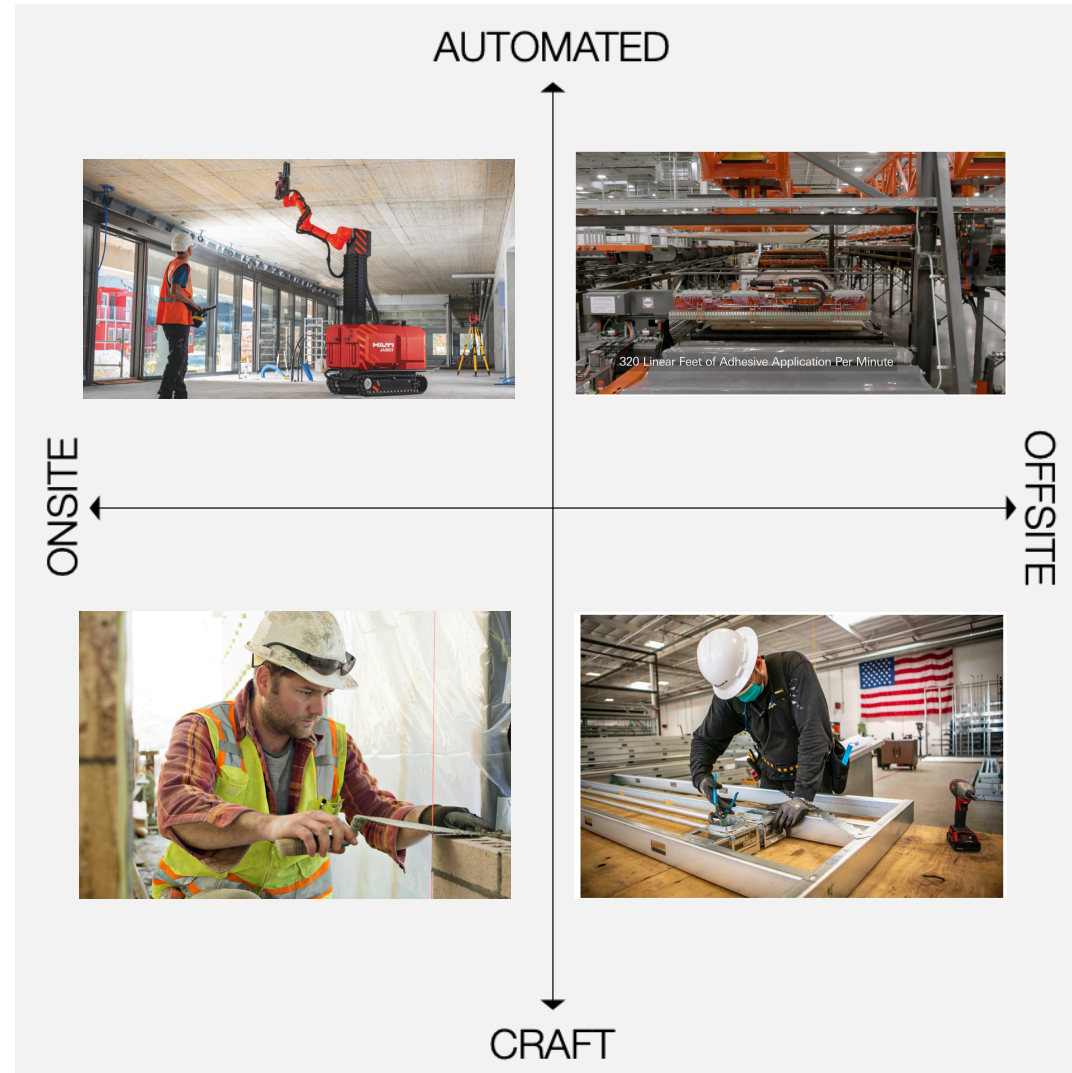
Onsite, Offsite, Craft, Automate?

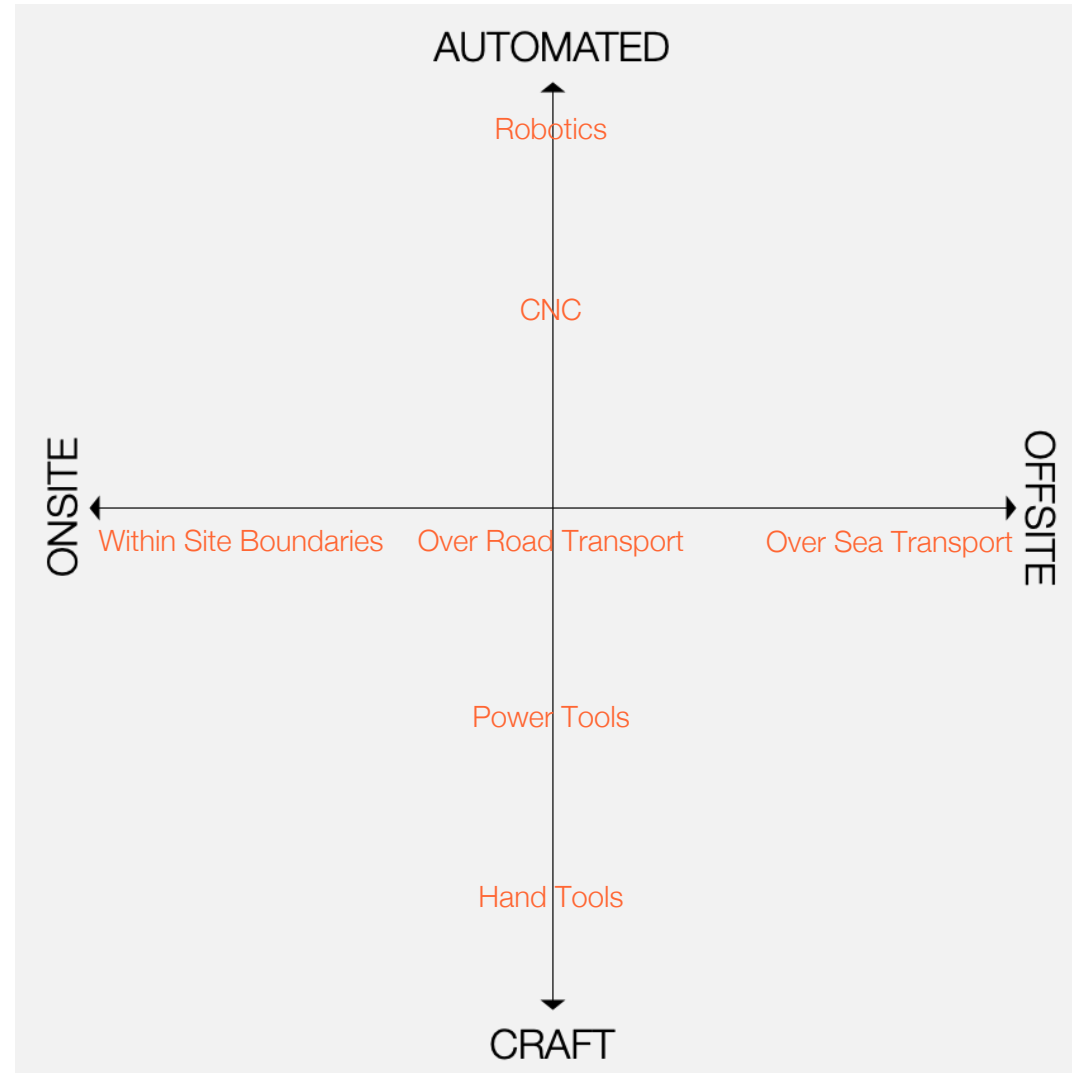


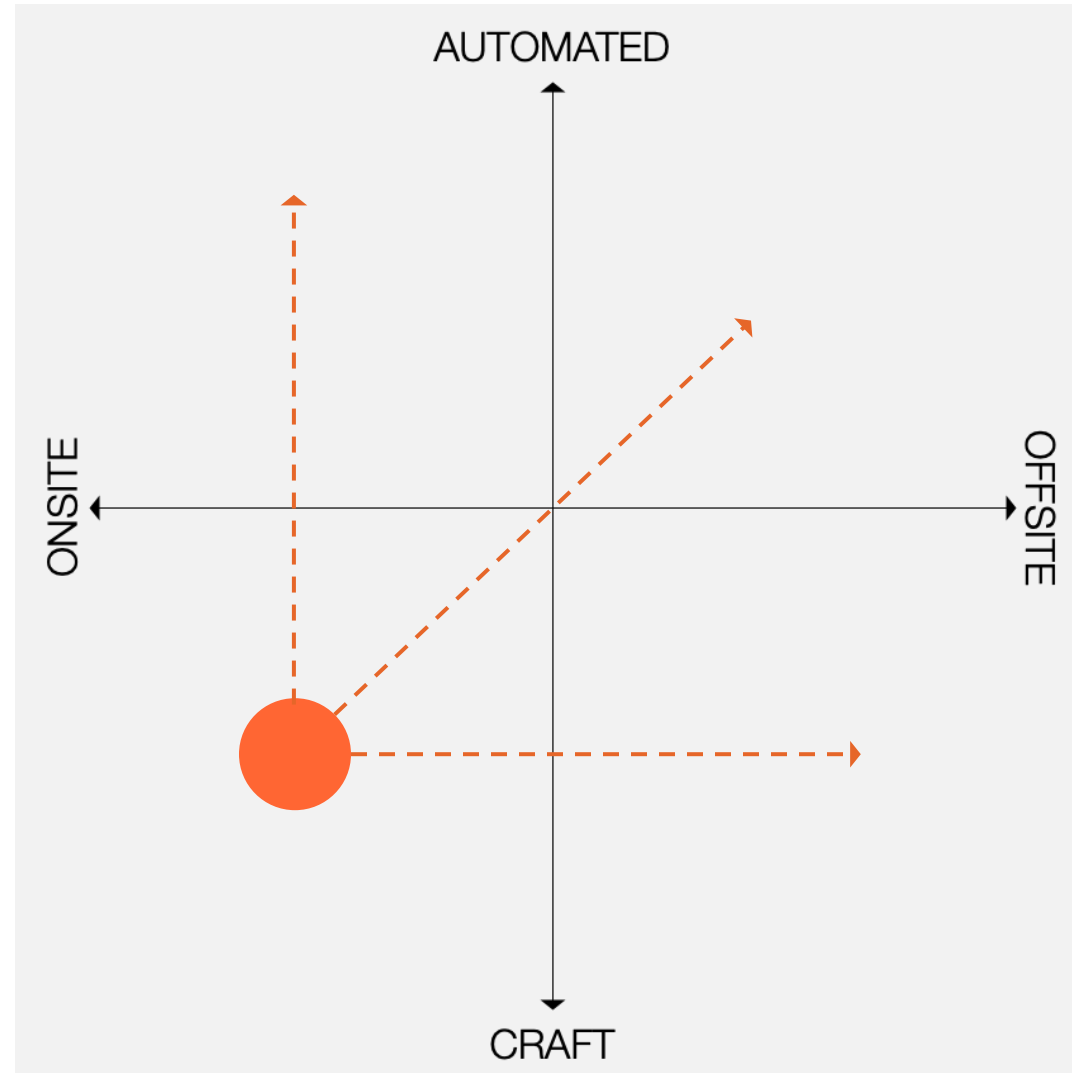


Process Pattern					Challenges for Management
	One of a kind or few	Low volumes; many products	High volumes; several major products	Very high volumes; standard product (commodity)	
Very jumbled flow: process segments loosely linked	<p>Project</p> <p>Job Shop</p> <p>Batch Flow</p> <p>Line Flow</p> <p>Continuous Flow</p> <p>out-of-pocket costs</p> <p>opportunity costs</p>				Scheduling; materials handling; shifting bottlenecks
Jumbled flow, but a dominant flow exists					
Line flow					Worker motivation; balance; maintaining enough flexibility
Worker paced					
Machine paced					
Continuous, automated, and rigid flow; process segments tightly linked					Candid expenses for big chunk capacity; technological change; materials management; vertical integration
Challenges for Management	Bidding; delivery; product design flexibility Quality (product differentiation); flexibility in output volumes Price				





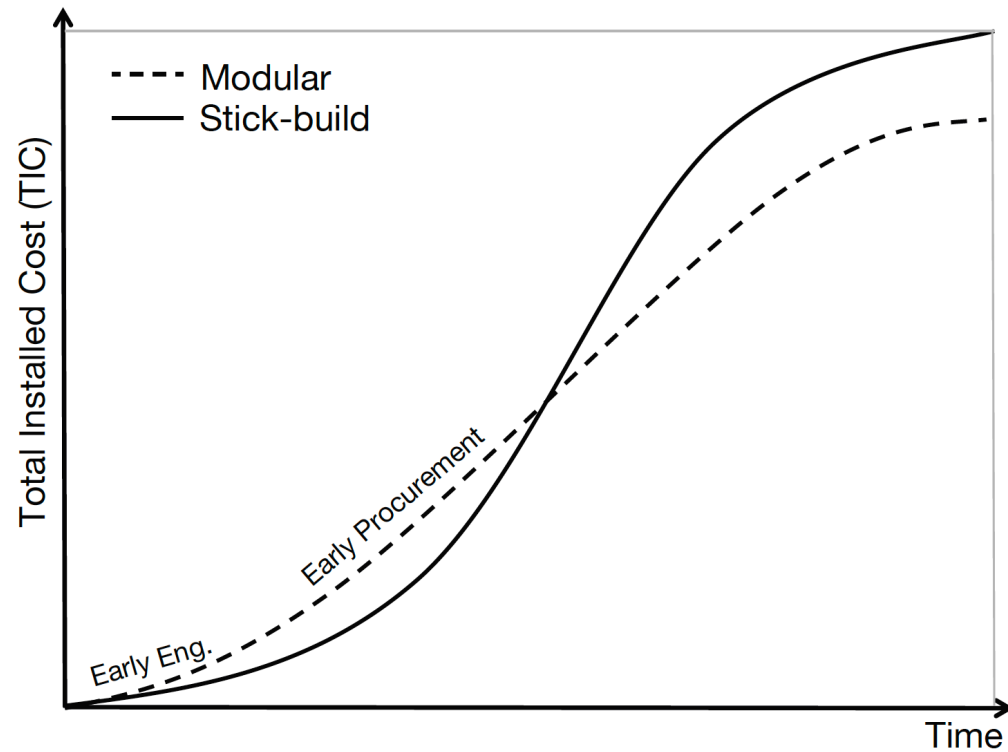








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# Concurrency of work (site preparation and offsite assembly)



# Additional Costs Related to Offsite - Inventory

Amass

Damage

Handle

Theft

Hold

Obsolescence

Preserve

# Additional Costs Related to Offsite - Process

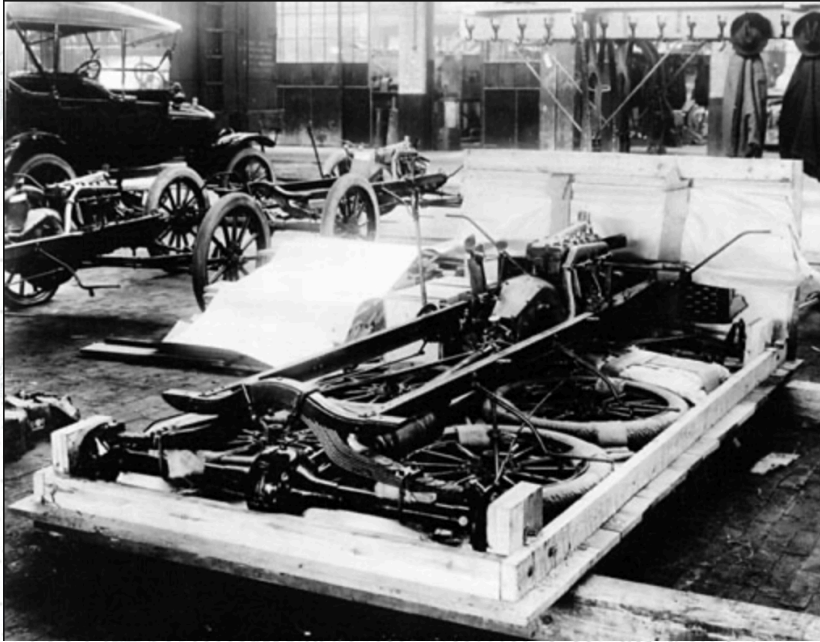
Disassemble / Reassemble

Structural Support

Protection

Poor use of Transport Capacity

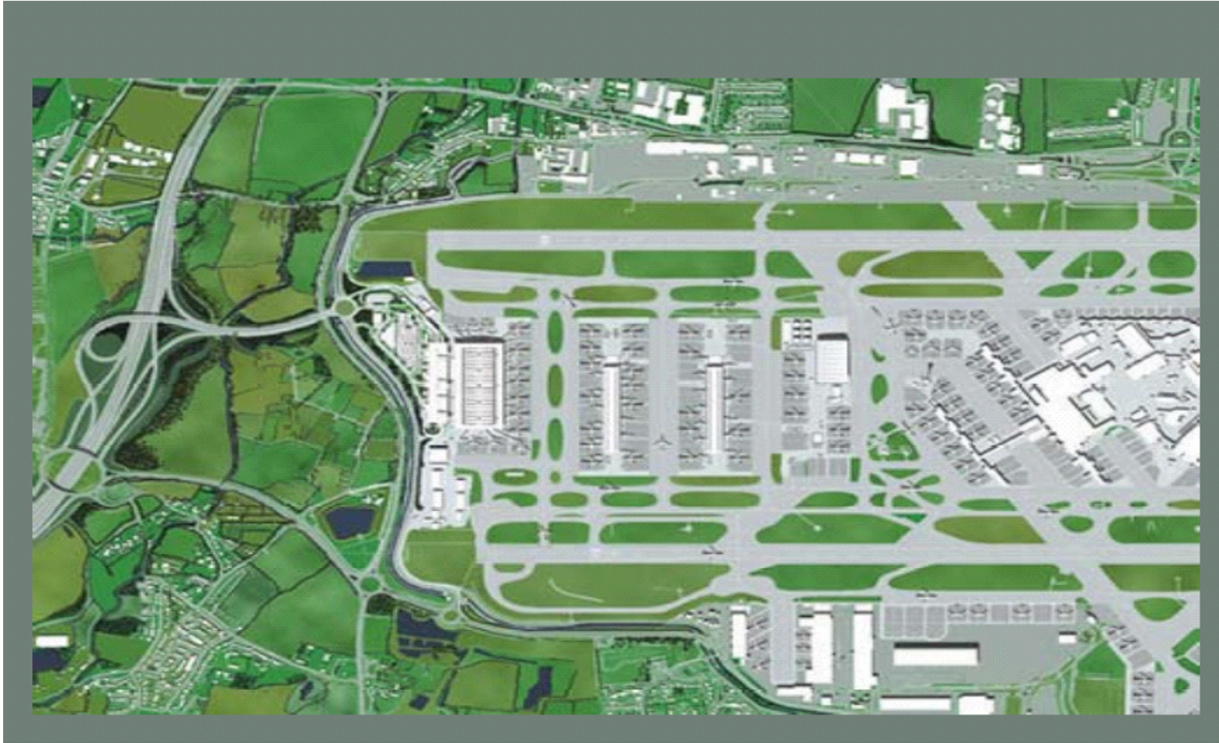












Delivery to site every 30 seconds

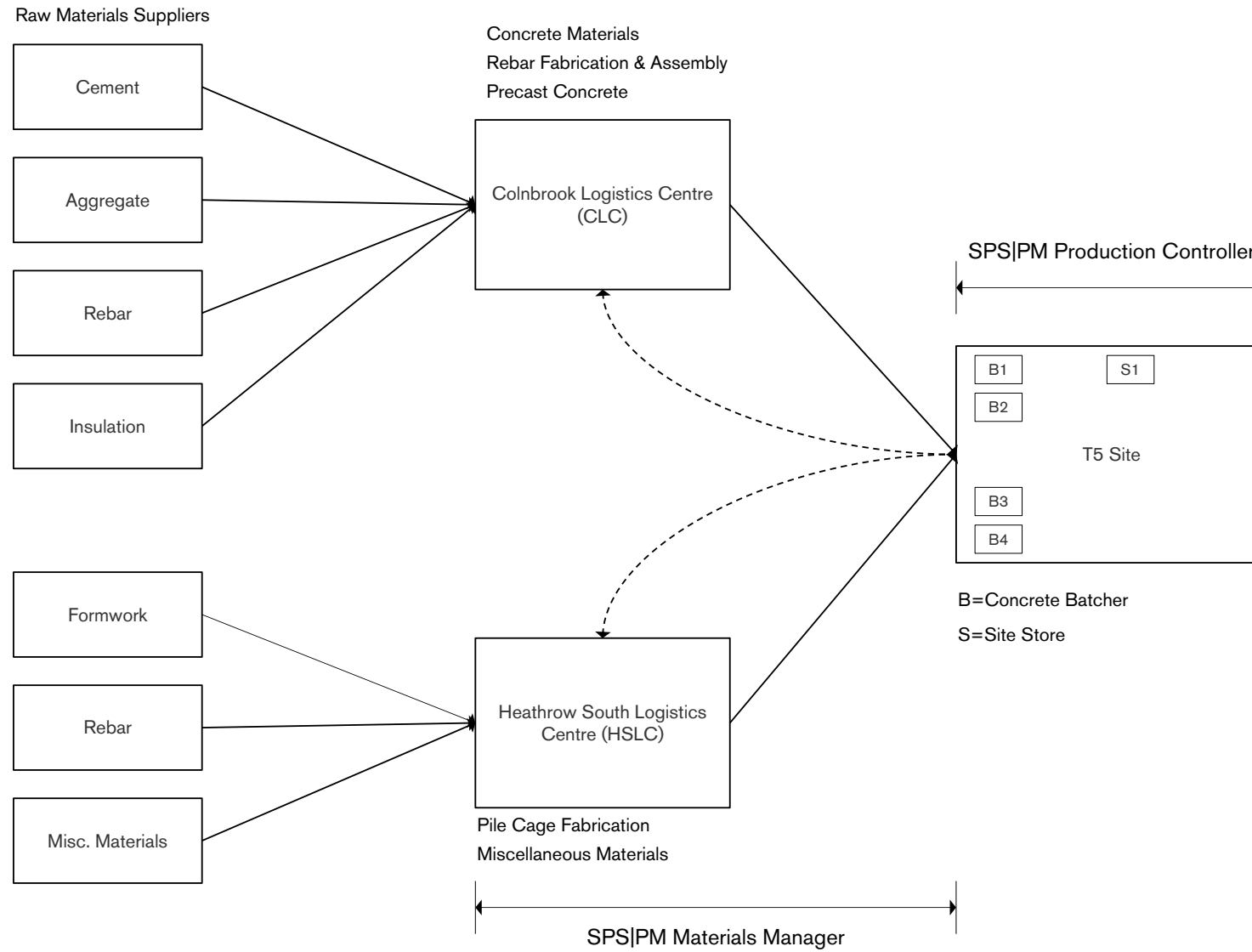
No deliveries between 7-9am and 4-6 pm

Access to site was single road with one point of entrance / egress

Storage on site equaled one day or less

Majority of the work occurred after 9-11  
(intense security measures)



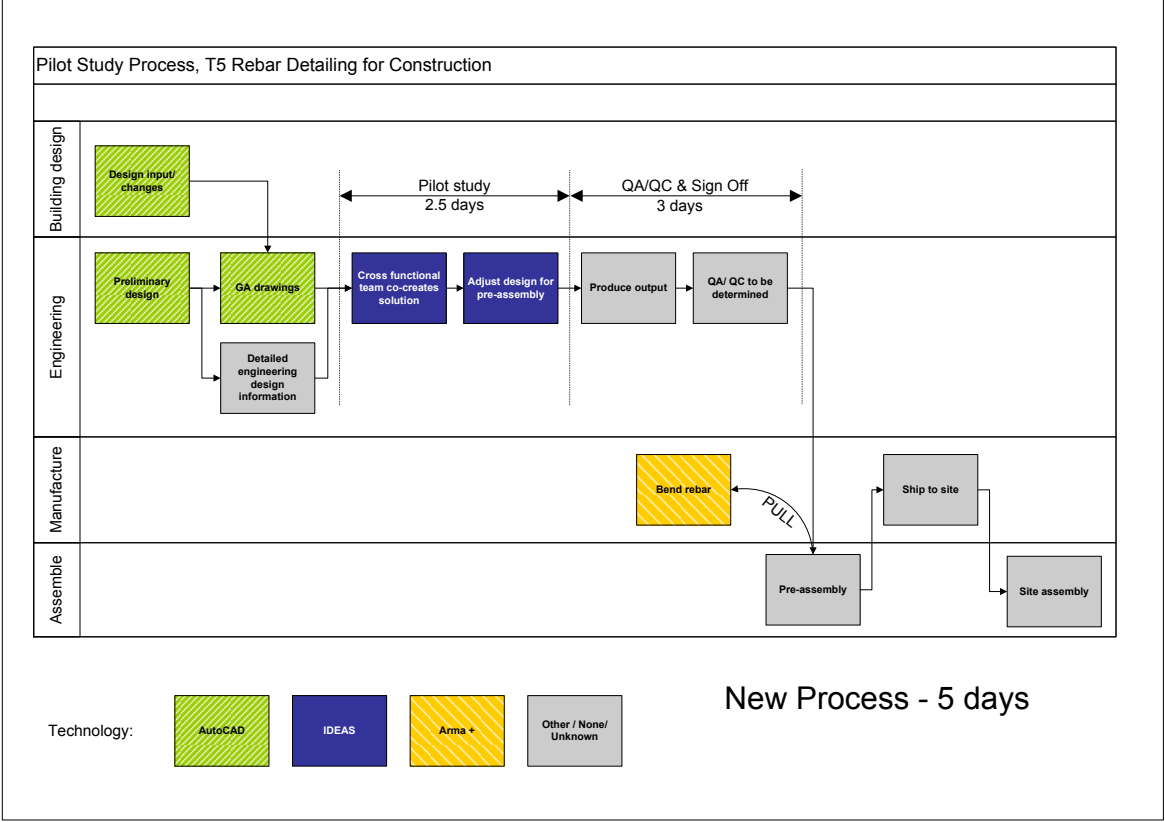
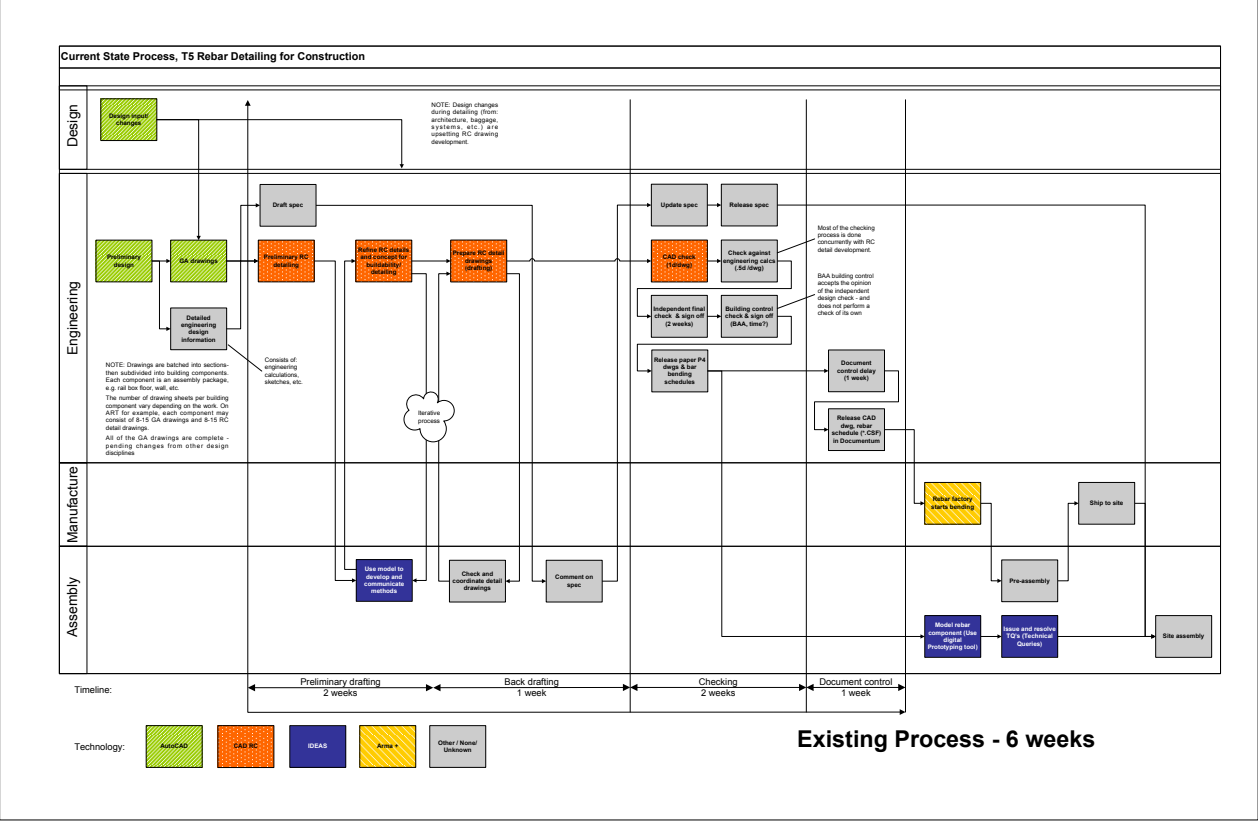


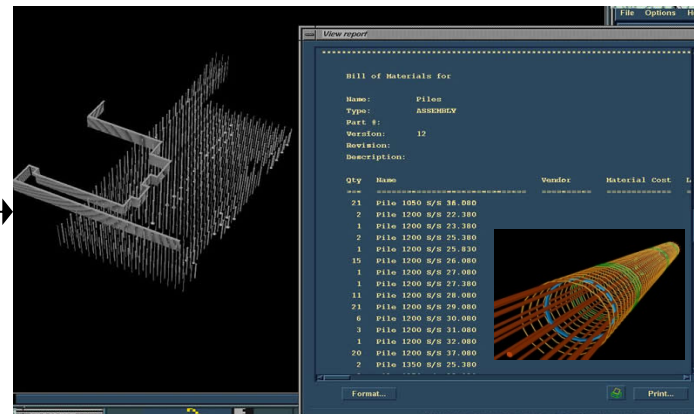
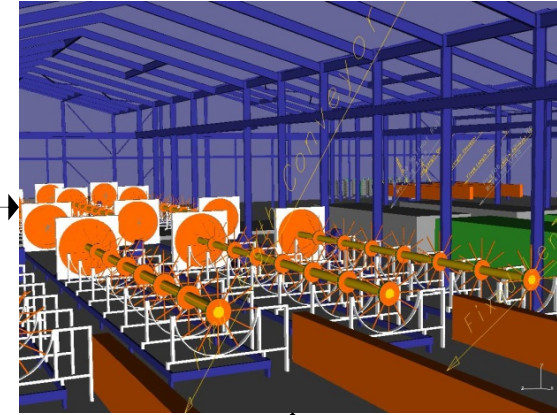
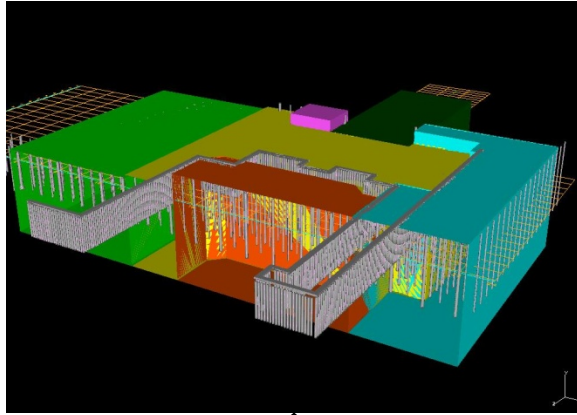
# Inventory Strategy

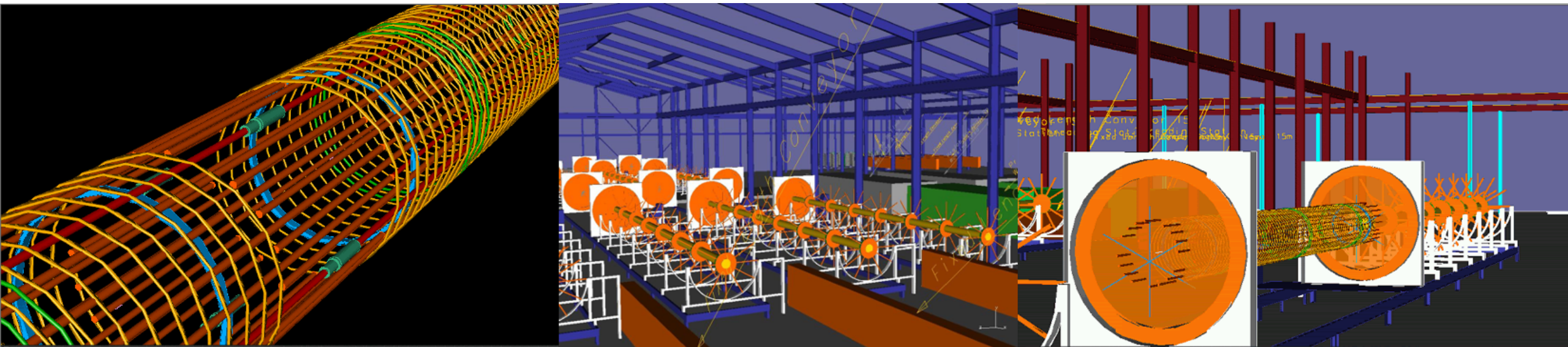
Today	Tomorrow	Day After	Beyond
Project Site			Supplier
Point of Installation		Logistics Center	

# Rebar Production System Cycle Time



















Lots of interest and activity around automation and  
offsite – “Factory Models”

Challenges current practice do lack of understanding  
how and where to do work

PPM and its foundation of Operations Science  
provides the needed framework