



# Product vs. Project:

Addressing Localization in Industrialized Construction

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**Forest Flager**

Director of Software and Design Automation

Katerra

CitA TECHLIVE 2020

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# 8,000+ Global Team

Manufacturing | Design | Construction  
Engineering | Supply Chain | Software

Google



SanDisk



FLEXTRONICS®



MOTOROLA

Schlumberger



NOKIA





End-to-End Integration

# Katerra delivers end-to-end building products and services.

Architecture

Interior Design

Engineering

Manufacturing

Building Materials

Supply Chain Services

General Contracting

Skilled Labor

Renovations

Software

Intelligent Buildings





Market Experience

We have **market experience**  
across industries and continents.

Multifamily

Senior Living

Student Housing

Masterplan Development

Commercial

Hospitality

Education

Industrial

Retail

Hospitals

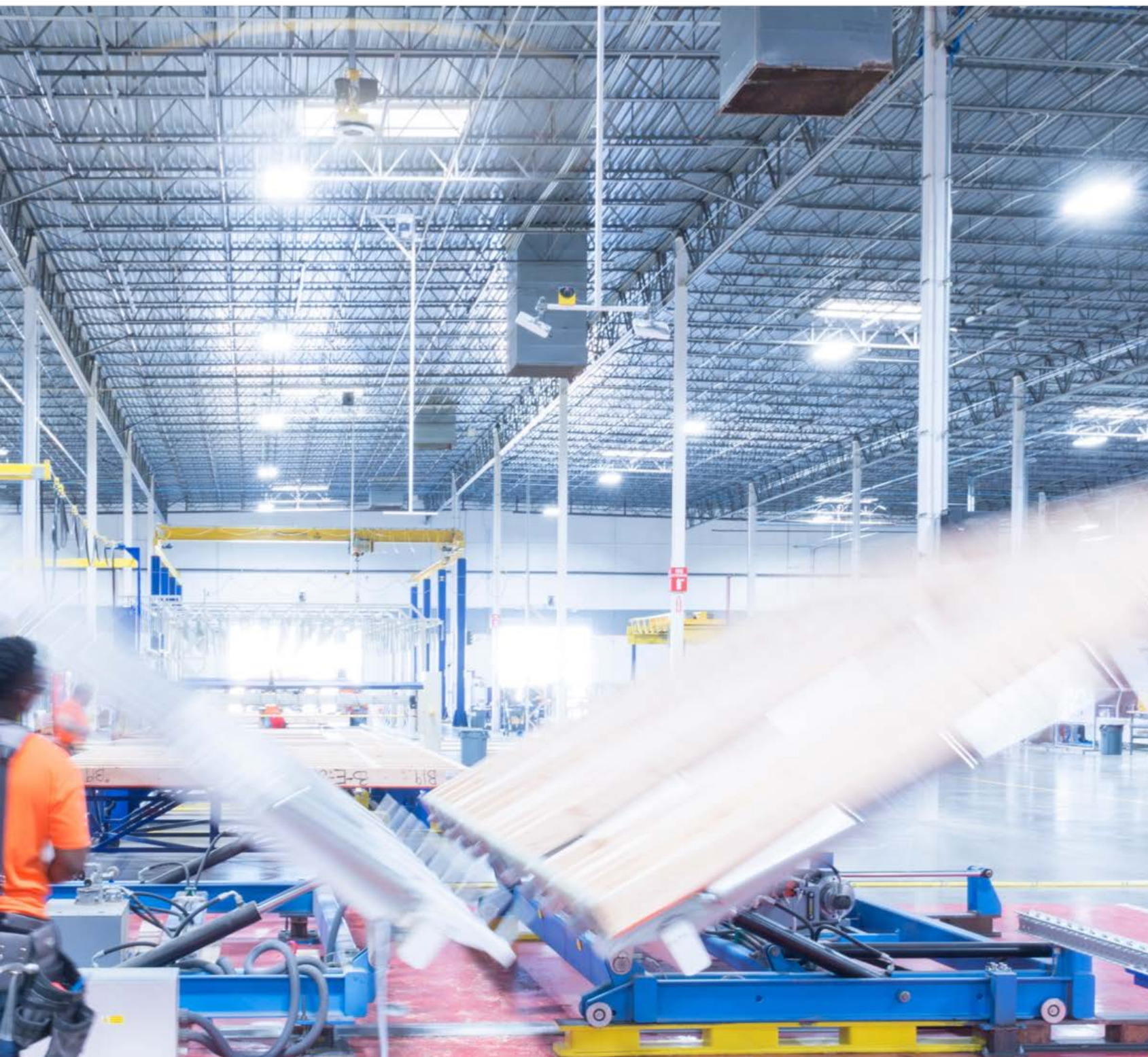
Schools

Malls





We move as much construction completion as possible to the **factory environment**.



Components & Finishes



Mass Timber



Precast Concrete





# Target Pattern

## Right and Wrong



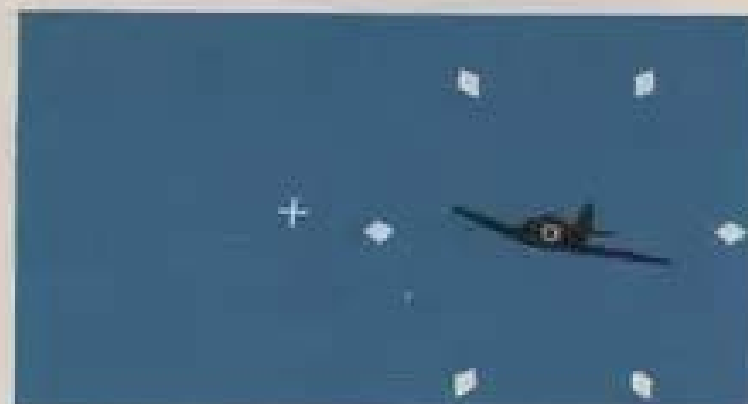
Correct—You have exact range now. Fire!



Incorrect—Dot is not on target.



Correct—Circle of diamonds corresponds to target's wing span.



Incorrect—Circle of diamonds is too large, making range and lead angle wrong.



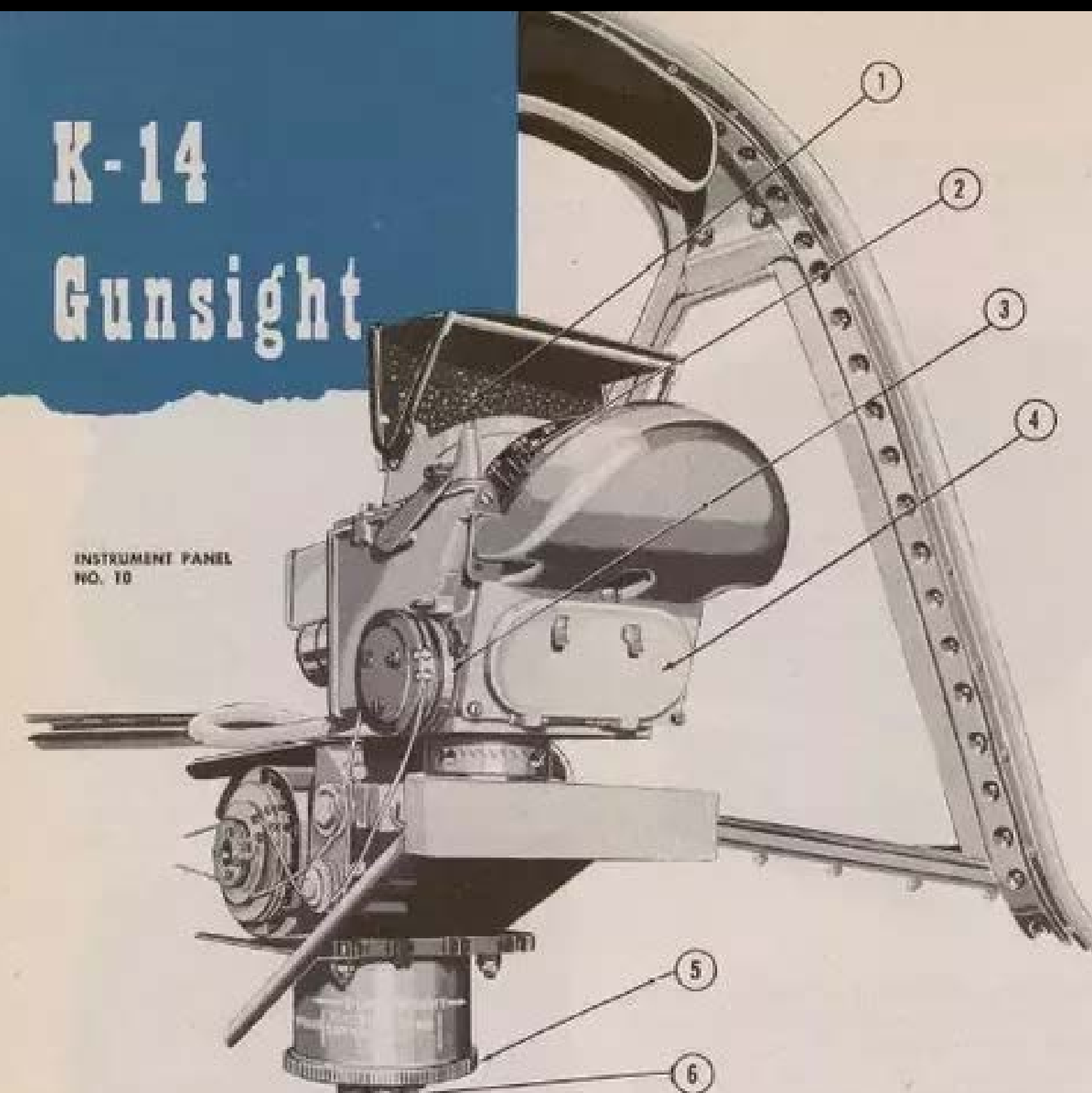
Correct—On broadside attacks the circle should be a trifle larger than length of fuselage, as wing span is greater than length.



Incorrect—Imaginary circle formed by inner tips of diamonds should correspond to target's wing span.

# K-14 Gunsight

INSTRUMENT PANEL  
NO. 10



1. Reflector Plate
2. Span Dial
3. Range Dial
4. Lamp Cover
5. Light Rheostat
6. Selector Switch

As you adjust the K-14 gyroscope gunsight, it automatically gives you the correct lead and shows you the range of the target. In other words, it's the answer to a poor deflection shooter's prayer.

Though exceedingly complicated internally, the sight is easy to operate with a little practice.

Actually, the K-14 contains 2 sights: The compensating sight, and an ordinary fixed electrical sight. In the fixed sight, a cross has been substituted for the pipper.

The fixed sight may be used alone, but ordinarily the cross is employed (with the ring extinguished) to show the amount of lead the gyro sight is allowing.

The gyro sight consists of a dot surrounded by six small diamonds. Your problem is to

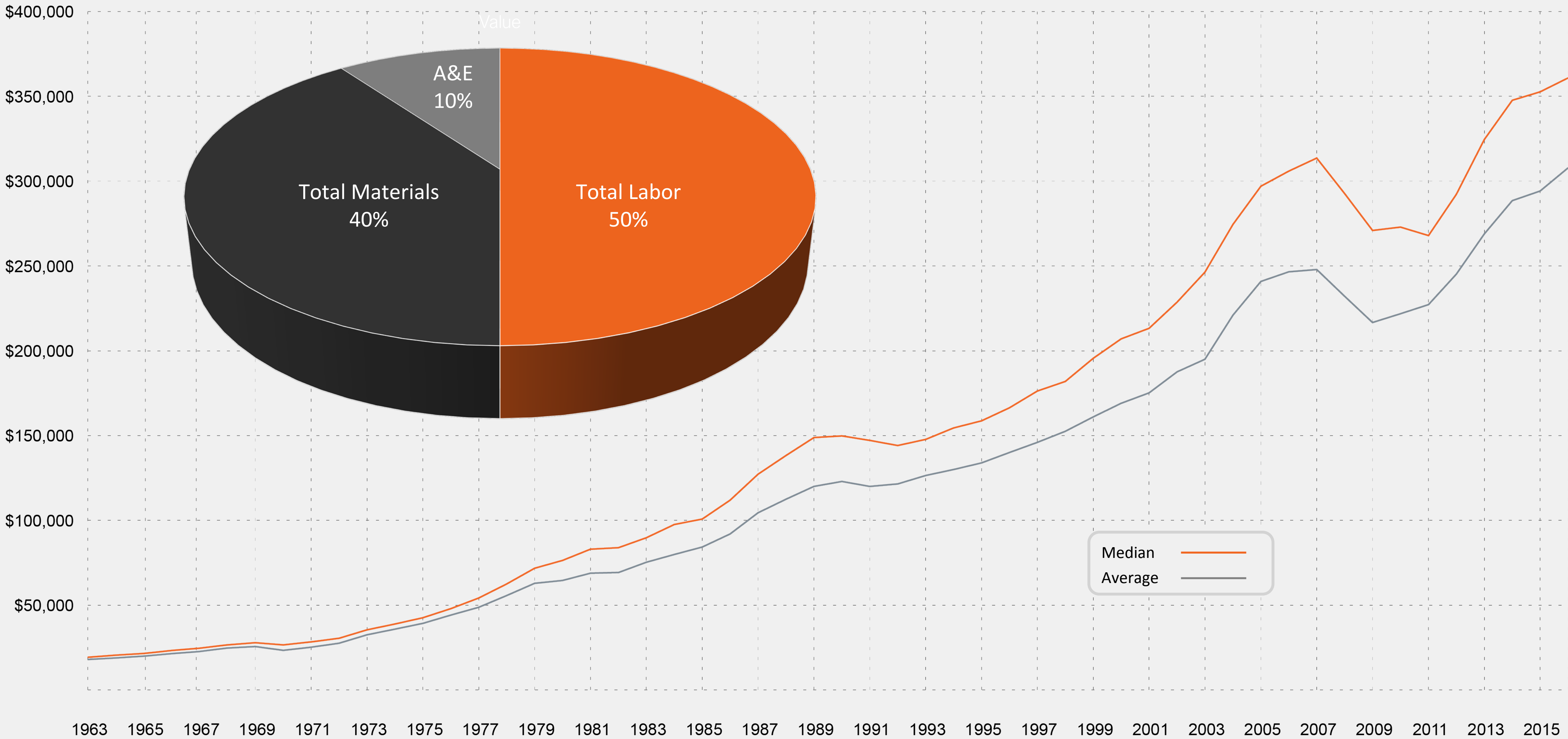


Inevitabilities

# 1. Industrialized construction

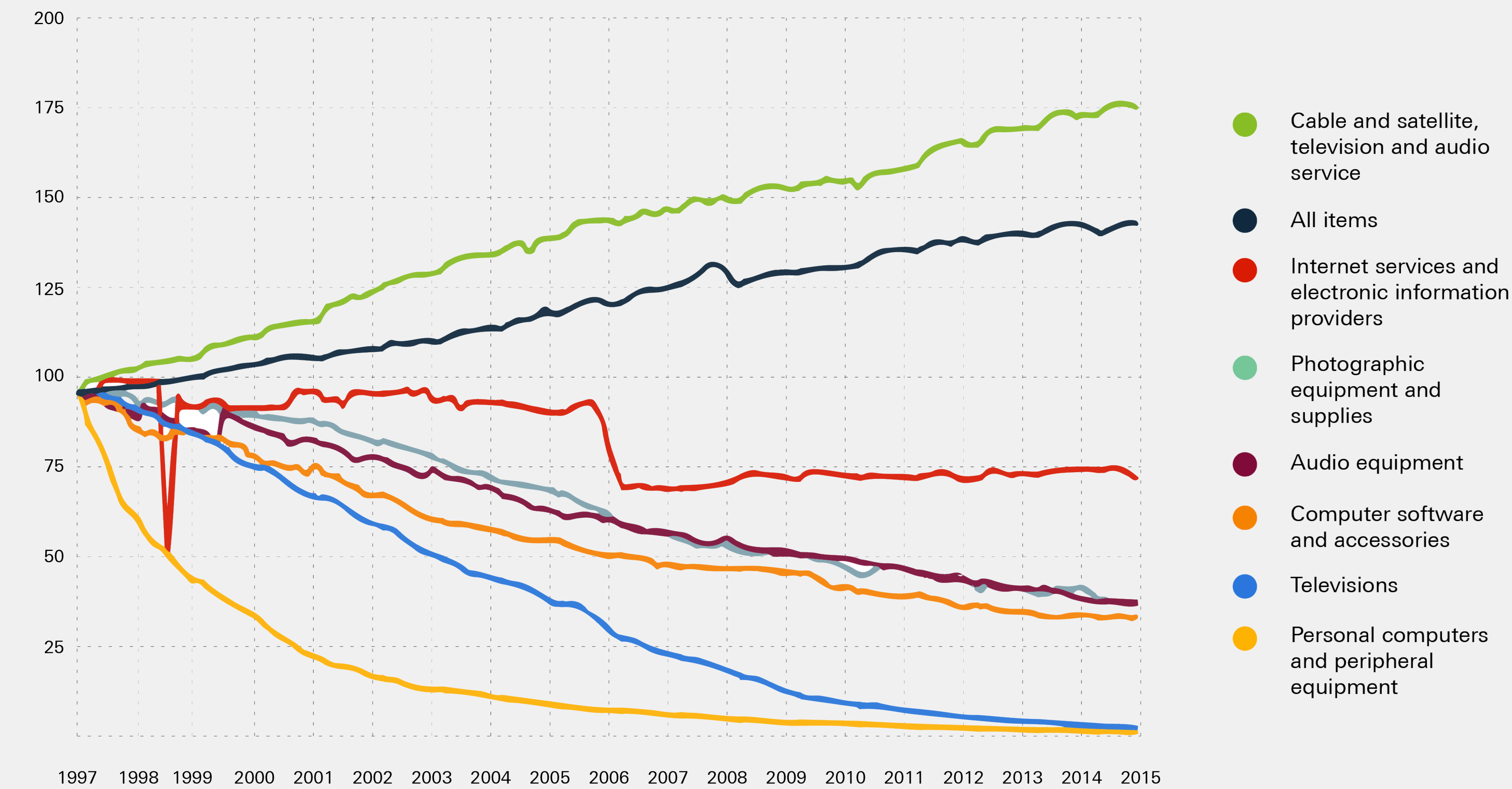


# US Historical Housing Prices





# Consumer Price Indexes for Electronic Goods & Services





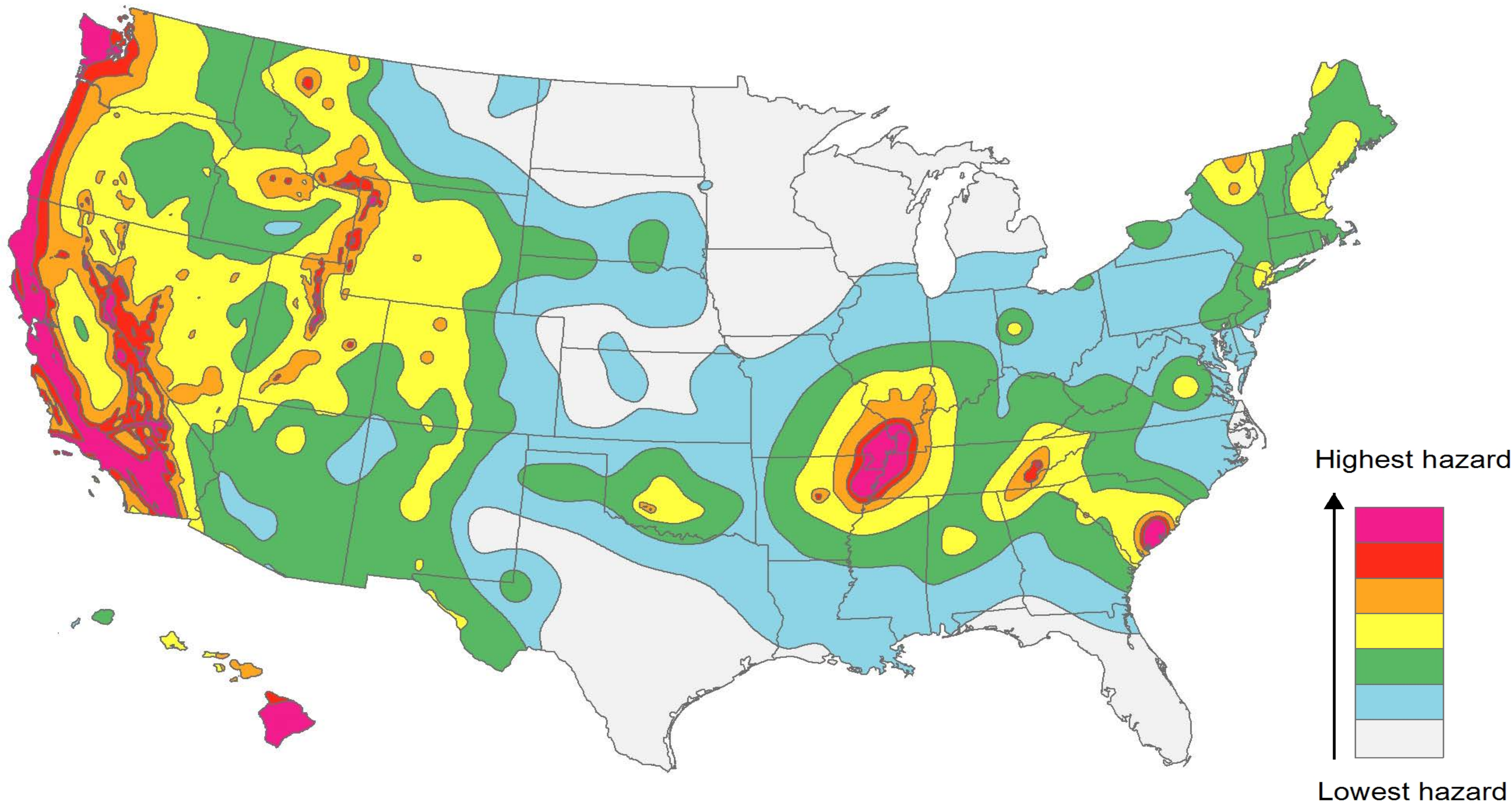
Inevitabilities

1. Industrialized construction

2. Mass customization

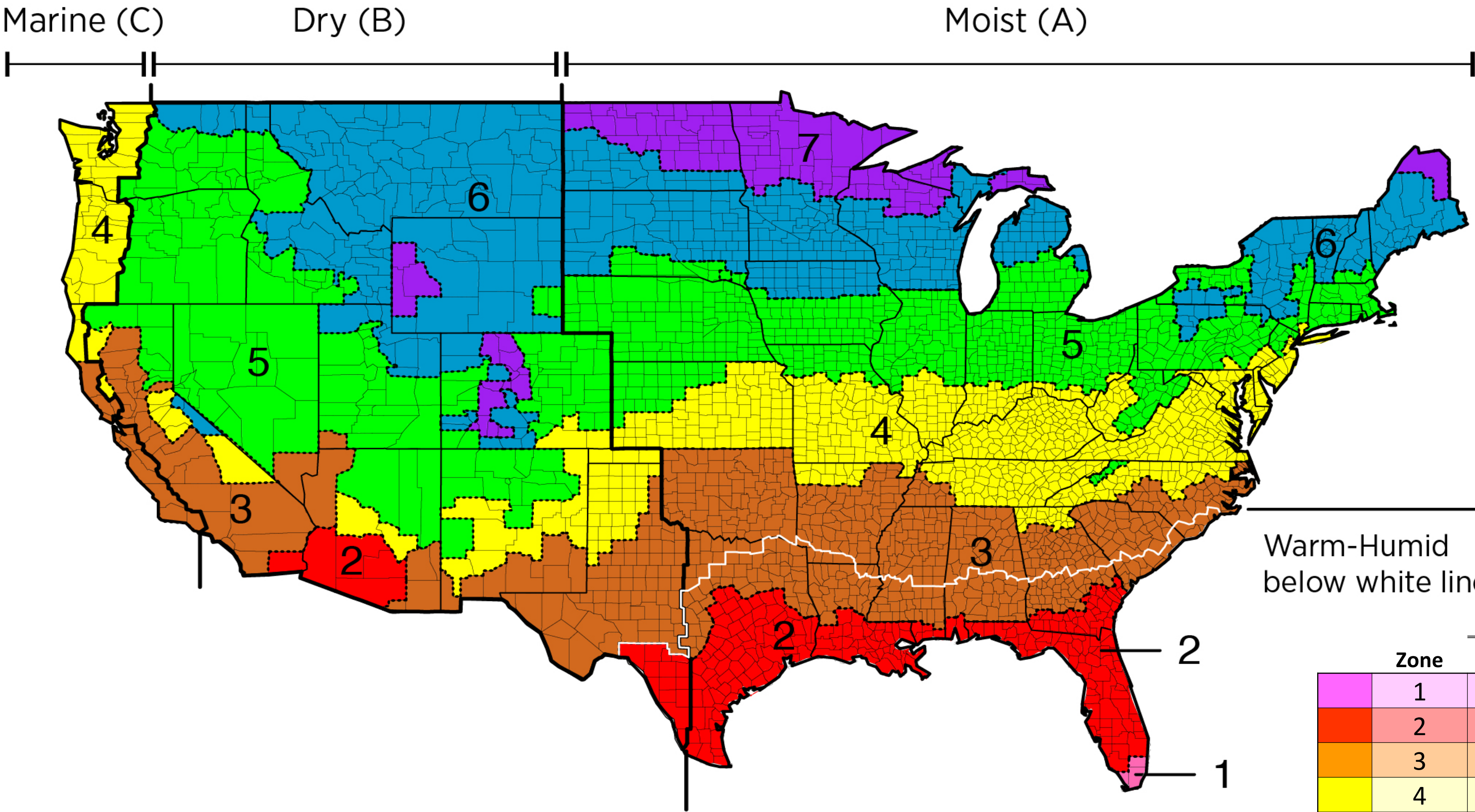


Seismic Hazard Map of the United States





# Climate Zones of the United States



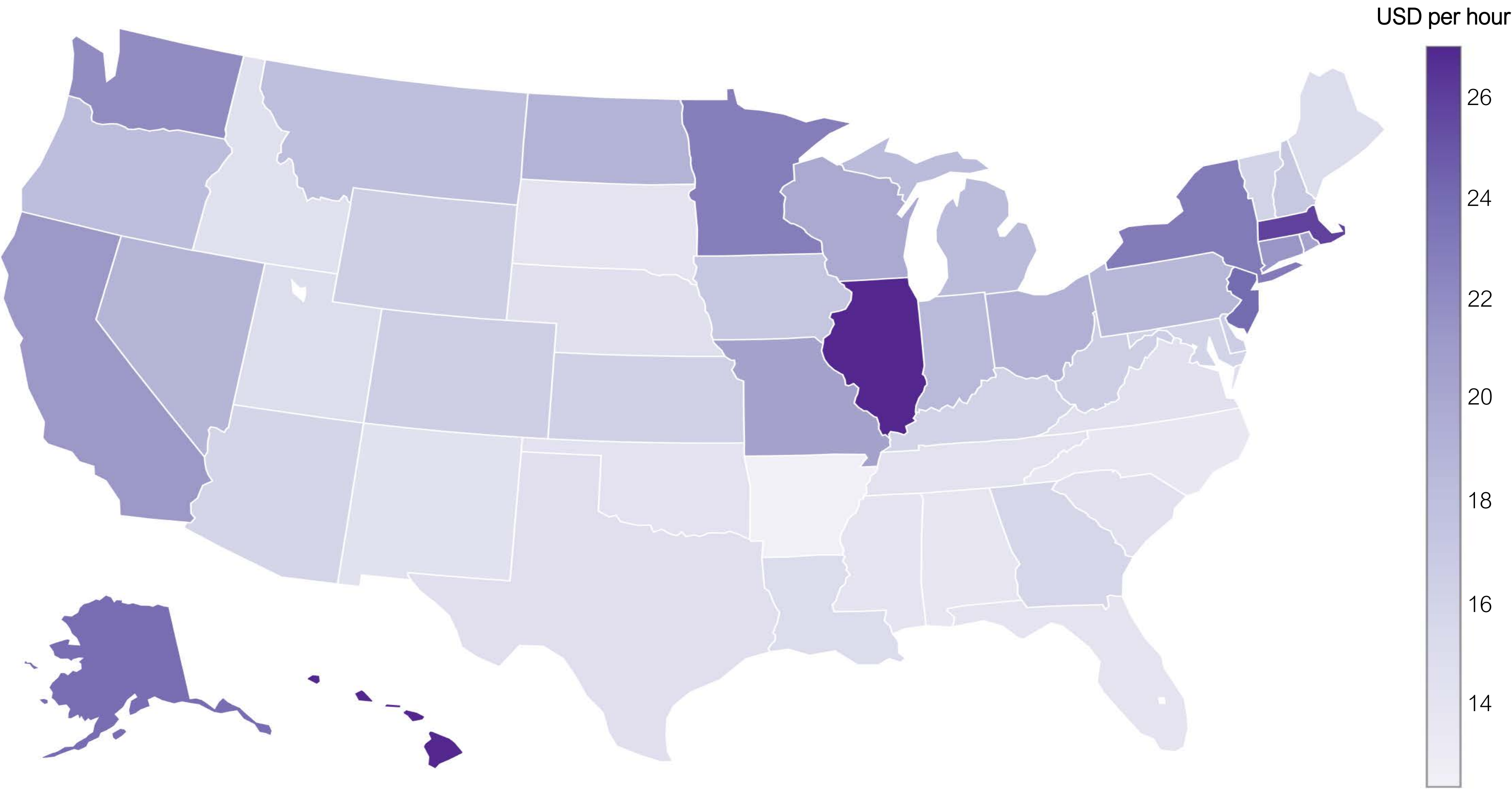
Thermal Criteria			
Zone		CDD 50*	HDD 65**
	1	> 9000	-
	2	6,300 - 9,000	-
	3	4,500 - 6,300	-
	4	< 4,500	< 5,400
	5	-	5,400 - 7,200
	6	-	7,200 - 9,000
	7	-	9,000 - 12,600
	8	-	> 12,600

\* Cooling Degree Days over 50°F

\*\* Heating Degree Days under 65°F



# Construction Labor Rates





Inevitabilities

1. Industrialized construction

2. Mass customization

3. Automated design



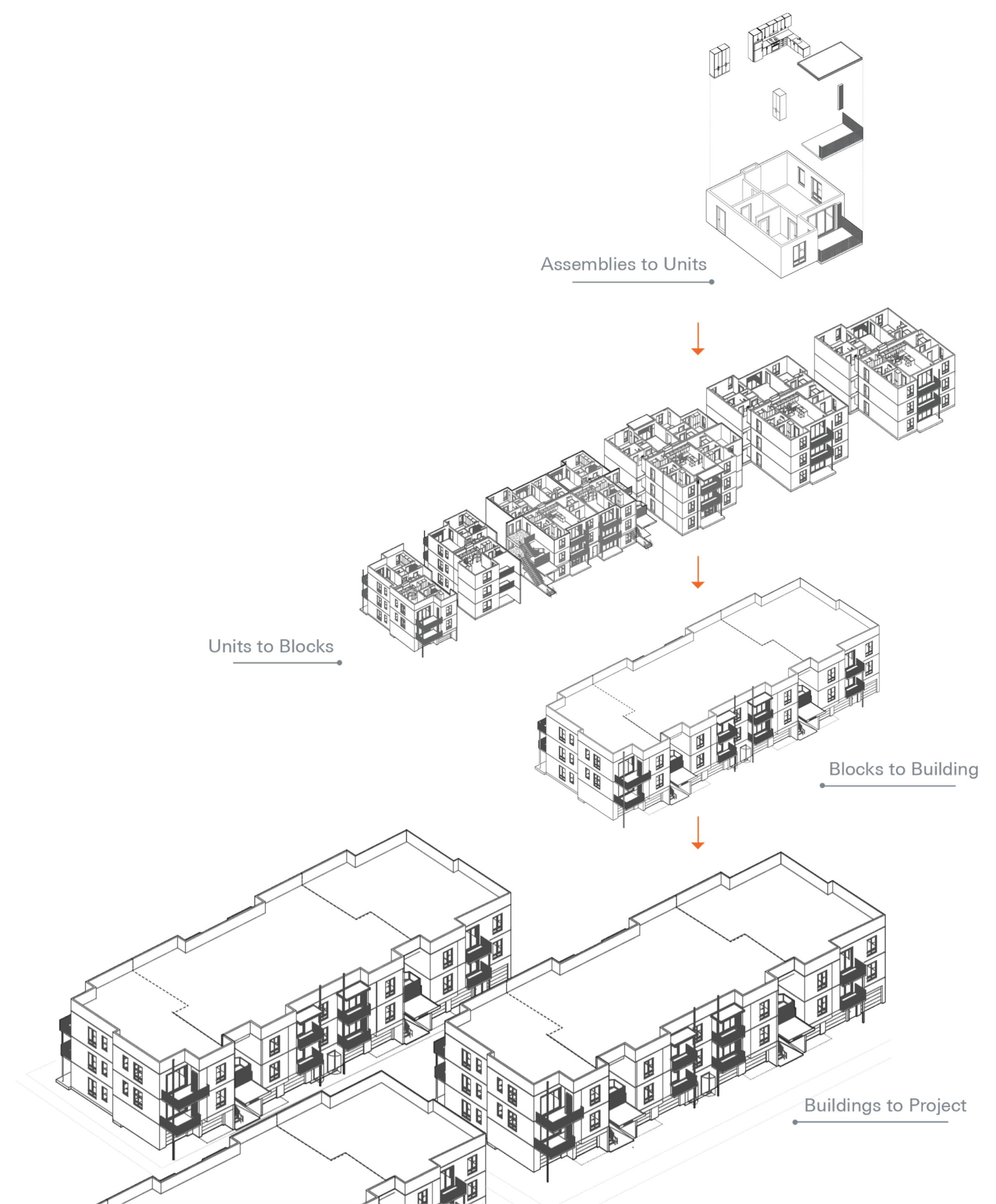
Katerra Building Platforms take the guesswork out of construction by applying the principles of repeatable manufacturing to entire buildings.

Katerra buildings are made from manufactured assemblies and components; including wall and floor panels, casework, bathroom and kitchen kits, and more.

48 State Compliance

Complete Bill of Materials

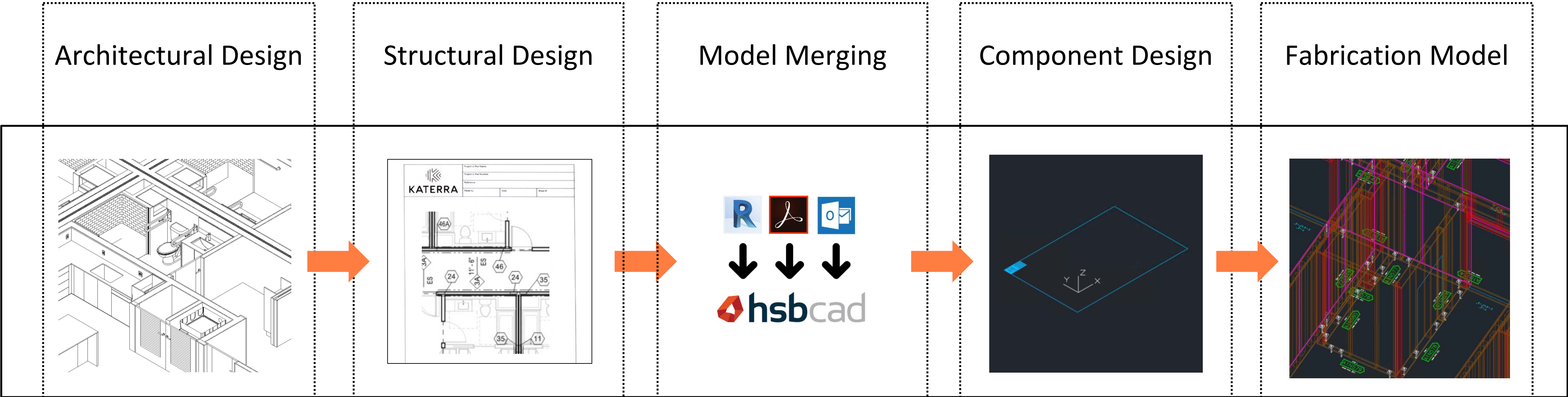
1000's of Unique Design Configurations



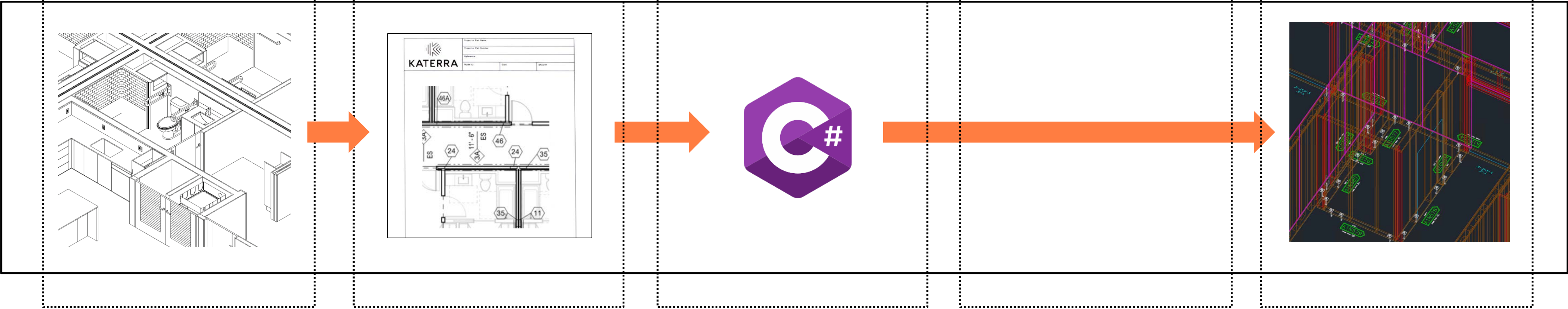


Wall Design Process

Manual

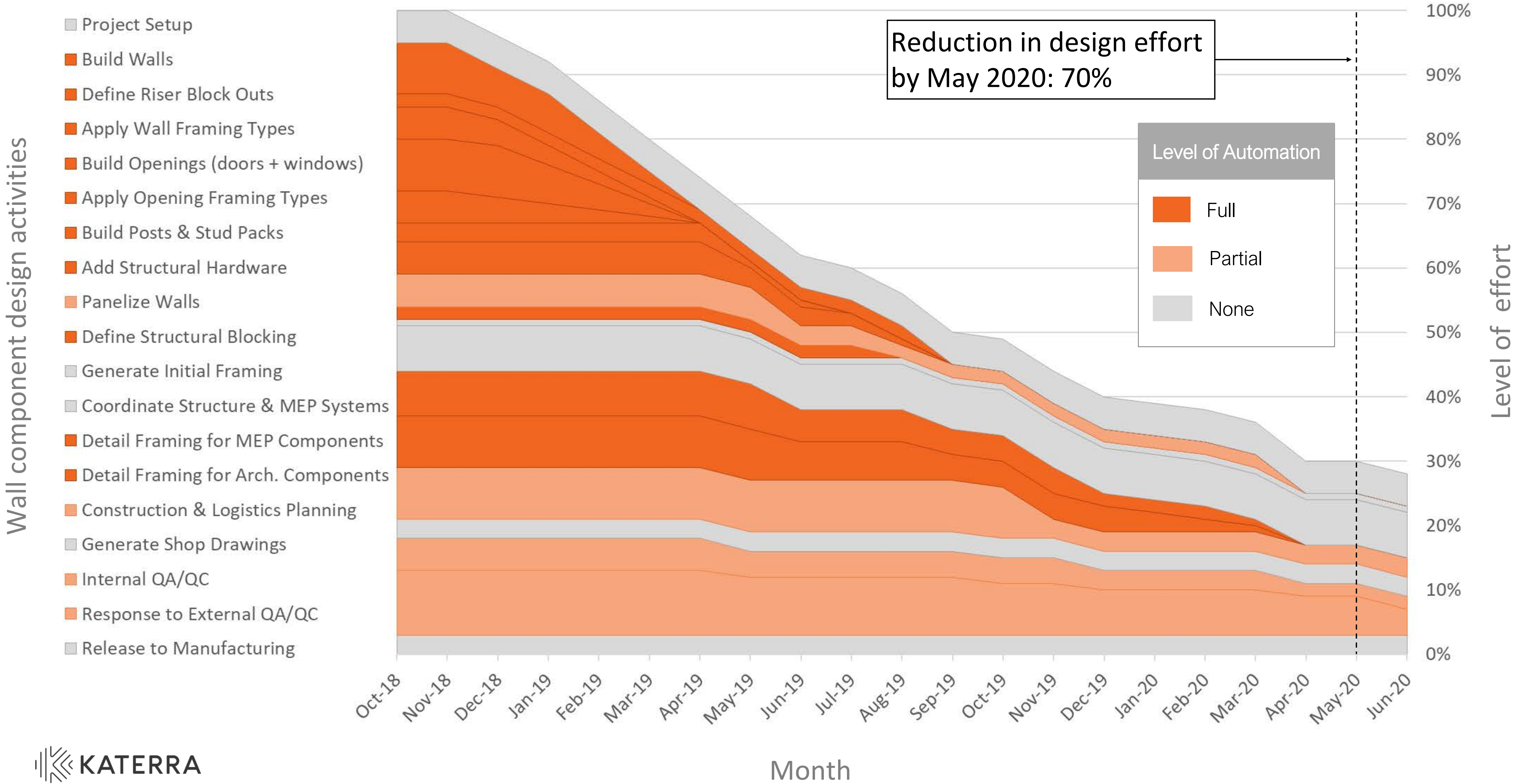


Automated



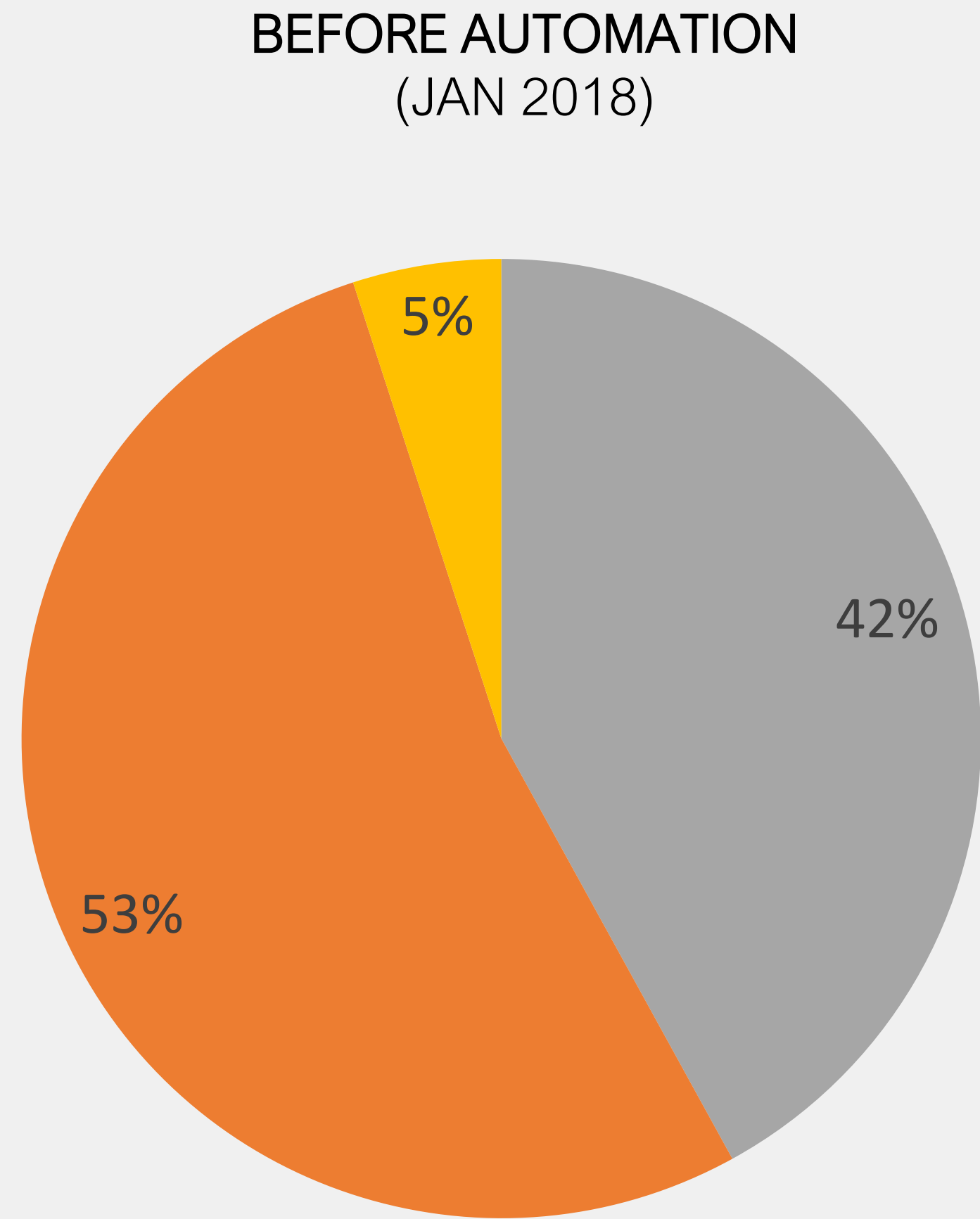


Component Design Automation Roadmap

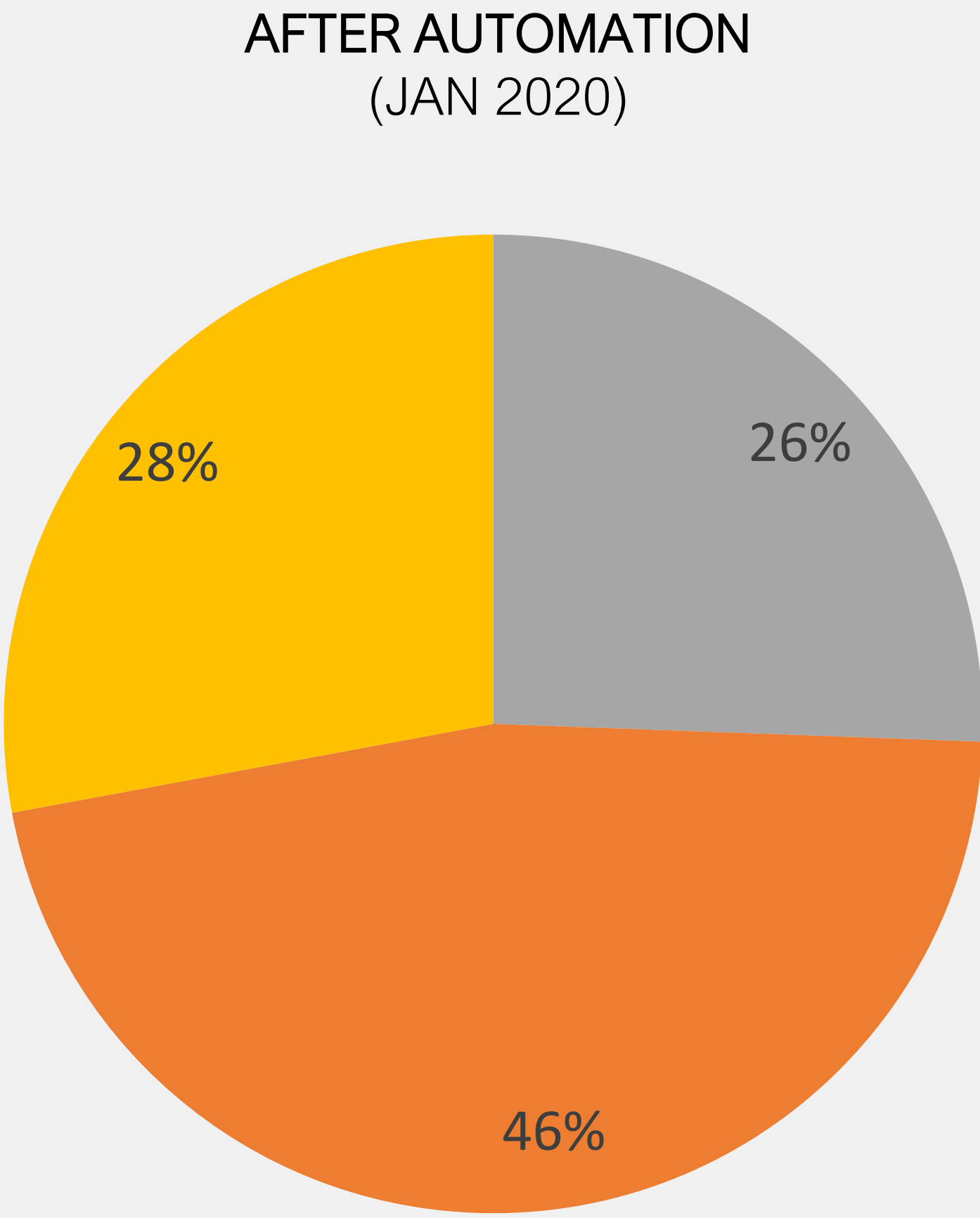




Impact on Design Skills and Experience?



- Novice
- Journeyman
- Expert





## Inevitabilities

1. Industrialized construction

2. Mass customization

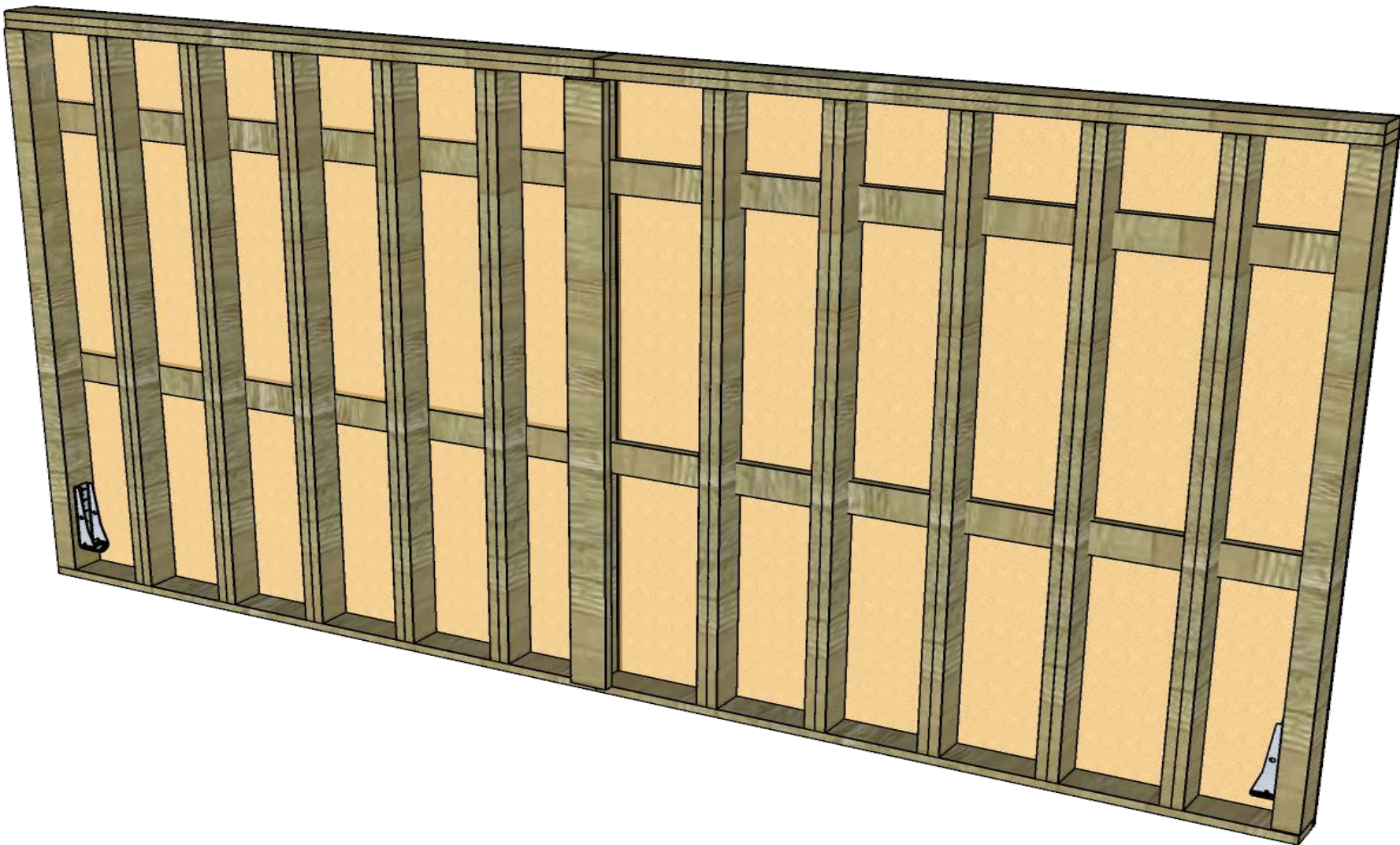
3. Automated design



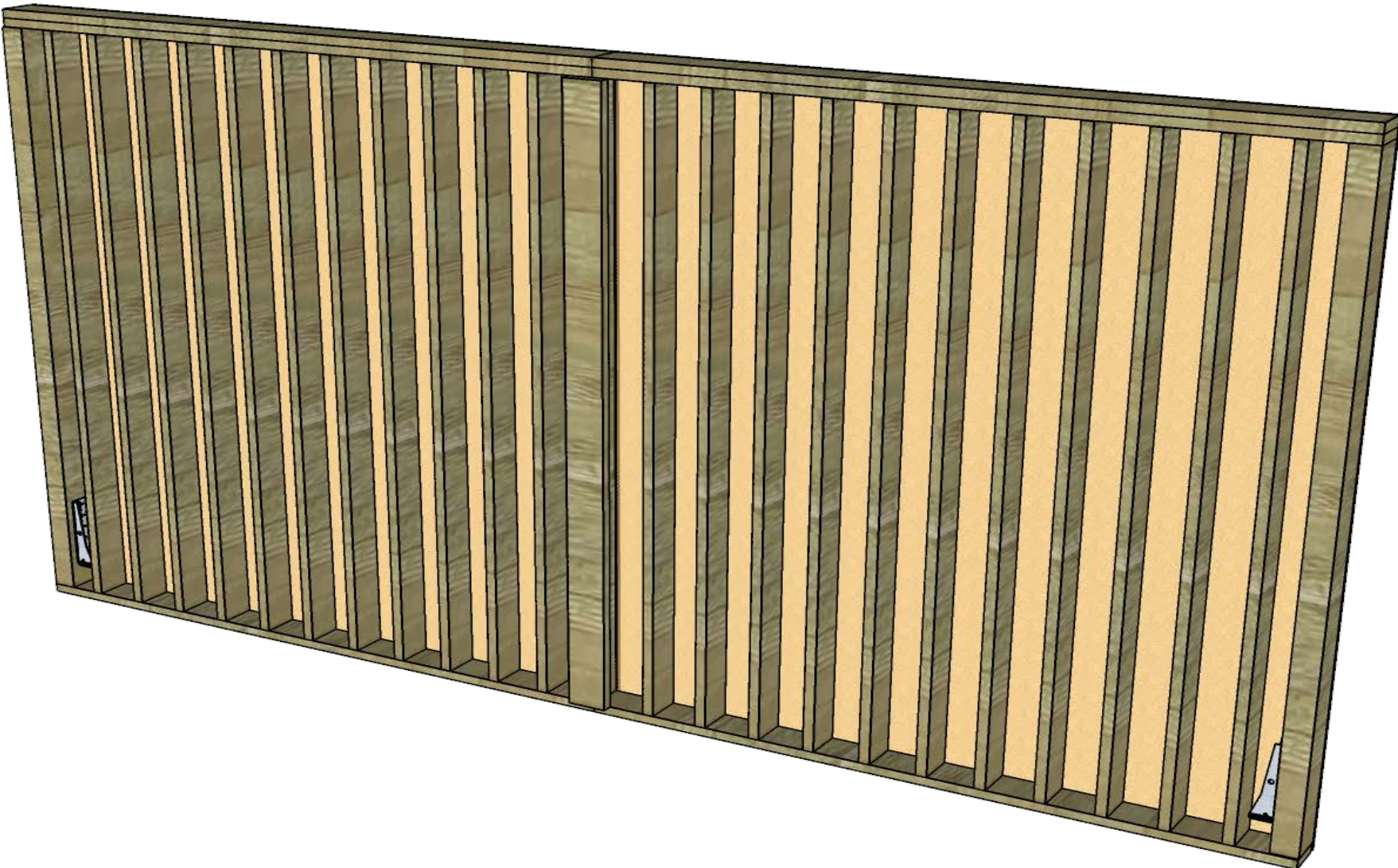


Which Wall Type?

Type A



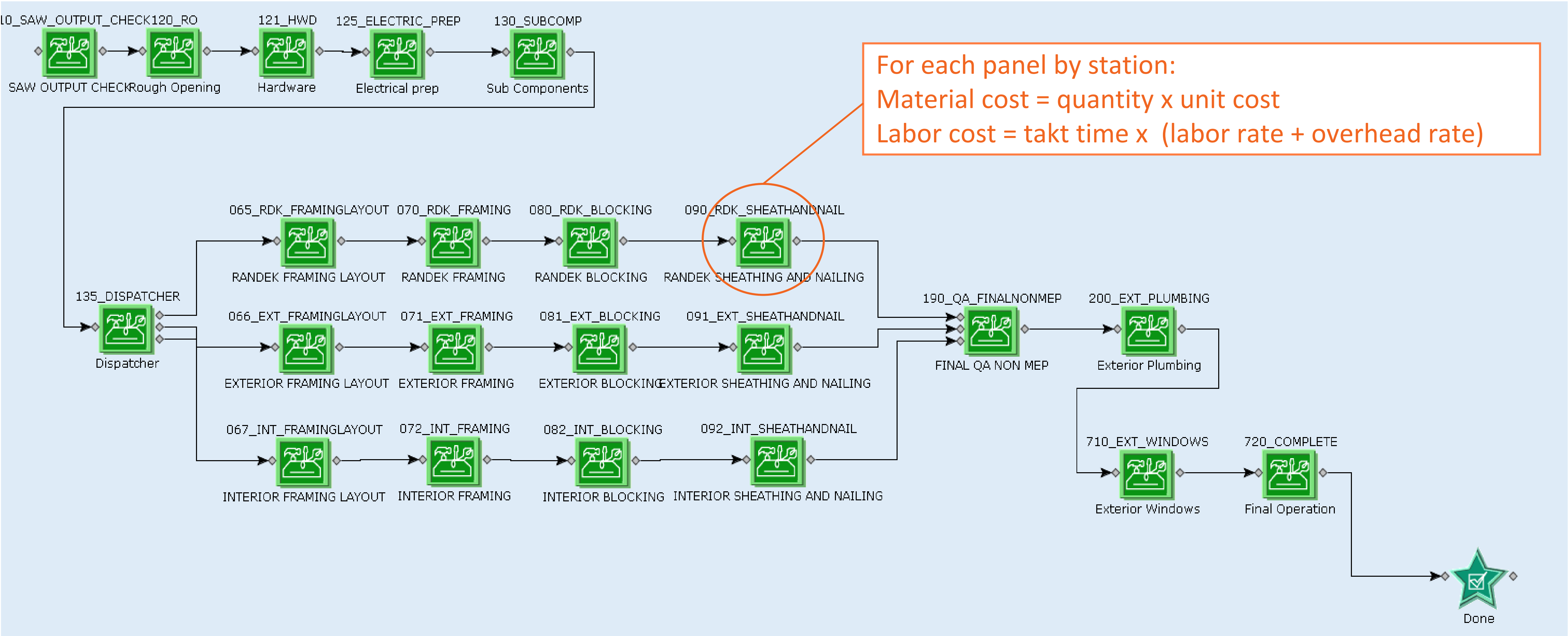
Type B



Stud Type	Double	Single
Stud Spacing	16"	8"
Sheathing Type	Ply	OSB
Sheathing Thickness	3/8	3/8
Nail Spacing	3"	2"
Field Spacing	12"	6"
Sheathing Orientation	Horizontal	Vertical
Shear Capacity	1000 lb/ LF	1020 lb/ LF
Bearing Capacity	2775 lb/ LF	2775 lb/ LF
Cost	\$582 / LF	\$453 / LF



# Wall Costing Methodology





# Wall Optimizer Tool

Wall Design Optimizer

Engineering Performance Criteria

Bearing Capacity

23942

88060

Shear Capacity

1714

3480

Design Variables

Stud Species & Grade

☒ DF#1

☐ DF#2

☐ HF#2

☒ SPF#2

☒ DF1800

☒ DF2400

☒ SPF1650

☒ SPF2400

Stud Spacing

☒ 8

☒ 12

☒ 16

☒ 24

Stud Size

☐ 2x4

☐ 3x4

☒ 3x6

☐ 3x8

☒ 2x6

☐ 2x8

Stud Type

☐ Single

☐ Double

☒ Triple

Double Sheathed?

☒ False

☒ True

Sheathing Thickness

☒ 15/32

☒ 19/32

☒ 3/8

☒ 7/16

Sheathing Type

☒ OSB

☒ OSBStruct1

☐ Ply

Sheathing Orientation

☒ Vertical

☐ Horizontal

Nail Type

☒ 10d

☒ 6d

☒ 8d

Nail Spacing

☒ 2

☒ 3

☒ 4

☒ 6

Field Spacing

☒ 6

☐ 12

SELECT / UNSELECT ALL

SUBMIT

Design Options ordered by Cost


Parameters	Option 1	Option 2	Option 3	Option 4
Cost (\$/LF)	53.37	54.29	57.86	58.3
Axial Capacity	27620.0	27620.0	27620.0	27620.0
Shear Capacity	1740.0	1740.0	1740.0	1720.0
StudSize	2x6	2x6	2x6	2x6
Spacing	16	16	16	16
Stud Type	Triple	Triple	Triple	Triple
Grade	DF2400	DF2400	SPF2400	DF2400
Double Sheathed?	False	False	False	True
Sheathing Thickness	15/32	19/32	15/32	15/32
Sheathing Type	OSBStruct1	OSB	OSBStruct1	OSBStruct1
Sheathing Orientation	Vertical	Vertical	Vertical	Vertical
Nail Type	10d	10d	10d	8d
Nail Spacing	2	2	2	4
Field Spacing	6	6	6	6

(1) Enter the required engineering performance parameters

(2) Constrain design variables as required

(3) Submit the request

(4) Review feasible wall constructions ordered by cost

 KATERRA



# Building Platform Case Study

	Traditional Process	Design Automation
Structural Engineering Design Effort (Δ baseline)	71 hours	39 hours (-45%)
# Options Considered (Δ baseline)	< 20	3.03E6 (>150,000x)
Hard Cost of Walls (Δ baseline)	\$318,000	\$287,000 (-10%)

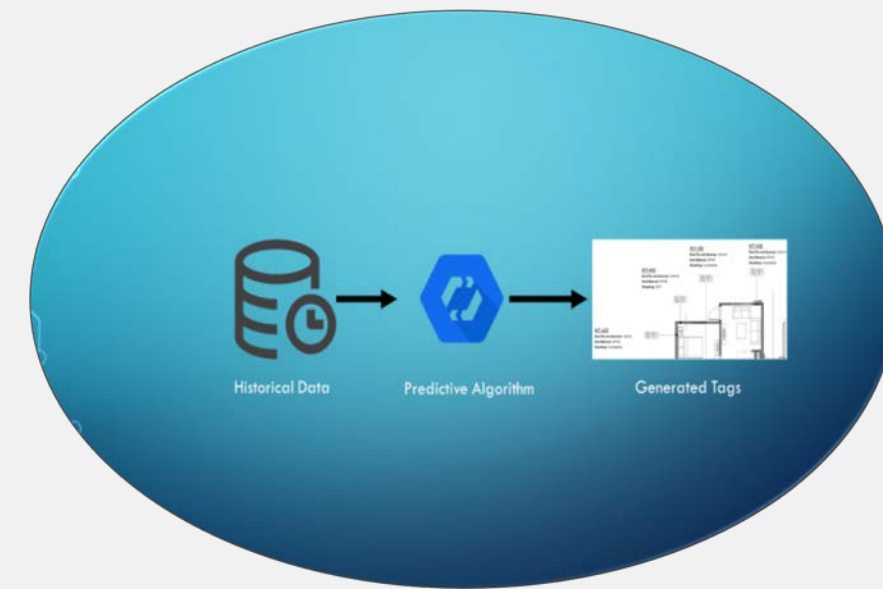
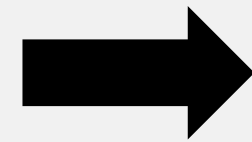




# Process and Impact



Revit Model  
Extraction



Fill Data  
Gaps



BOM Transformation



Dashboard

**90%** Reduction in  
QTO effort

- > 65,000 Revit elements extracted automatically

**40%** Reduction in early  
forecast error<sup>1</sup>

- AI predicts material quantities for in progress designs

**Faster** BoM  
Generation

- Automation creation of Design, Costing and Production BOM

**5-10%** Cost savings  
by category

- Visualization of aggregated quantity information by need date



<sup>1</sup> Applies to projects that are 6 months or more from material need date.



Thank you.



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