Digitally Manufactured Housing

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MIT

Effective computing
Machining that is computer controlled
Assembly Only construction sites

Customized home delivery for culturally sensitive design

- New Orleans – 109,000 House lost
- 7 years @ 75/day
- Mass Customize 75 designs
- Mass Produce
WALL [A]

\[144 \text{ tiles} \times a = \text{cost}\]

**Wall - j**

\[10'' \times 10'' \text{ tile}\]

WALL [B]

\[144 + (25 \text{ tiles} \times a (m & c)) = \text{cost}\]

**Wall - j**

\[\text{error [1]} \quad \text{error [2]}\]

They are working on the wall.
Cost of Error

House Construction = Labor + Materials

Labor \ [A] = - Assembly only

Labor \ [B] = Assembly + Measure + Cut

House Construction = (nLabor \times [A]) + (nLabor \times [B]) + Materials
Vision of Materialization

[1] CAD
Machine Measuring (MIT)

Machine Cut or Build

[3] assembly
Machine Assembled (ETH)
Analogue

I  starting shape

Ⅱ working shape (1-modeling)

Ⅲ working documents (2-drafting)

Ⅳ drawing translation to material (3-ruler/pencil)

Ⅴ cutting (4-saw)

Ⅵ assembly (5-drill)
I
starting shape

\[5''\]
\[5''\]
\[5''\]

II
computer base shape
interpretation & translation
(1-modeling)

III
computer controlled
切割
(2-cnc mill)

IV
self guided
assembly
Waste in Design & Construction

• Factory based construction
• Hand Operations
• High Energy
• Imprecise measuring
• Imprecise cutting
• Imprecise assembly
Instant House
Supports Non-Western Design & Construction

Marcel Botha
Nic Rader
Victoria Lee
Maggy Nelson
Diana Nee
Universal Technologies

Fab Lab MIT/India

Fab Lab MIT/India
Design System
Integral Assemblies
(Plywood)
Summer 2005

(a) Box Joinery

(b) Dado Joint

(c) Biscuit Joint
AutoCAD Design Model

AutoCAD Construction Model
Digitally Fabricated

- Outdoor or Indoor Digital Factory
  - Any Shape
  - Machines Scale
  - Complexity is in the cutting

- Advantages
  - Design models used for cutting
  - Controlled manufacturing
  - Low Energy (Flat packed)
  - Controlled waste
  - Precise

- Impact
  - Broad approach to housing
  - Luxury or low cost housing
  - Process works with many materials
What is digital fabrication

Computer model
“Precision measuring”

“Laser cutting”
Precise Cutting in Studio

“Prototype”
Error Detection & Correction

Scale Objects : 6
Inspiration
Computing a model

1. Precise measuring
2. Manufacturing Layered
3. Automated Assembly
Production: Design

(Design Grammar)

Step 1


Production: Product Modeling
(Construction Grammars)

Step 2

G0: Introduction of initial shape
G1: Section definition (materials)
S1: Analysis: applied forces and cartesian grid
S2: Analysis: rib definition
S3: Structural sections & difference

Figures by MIT OpenCourseWare.
Production: Manufacturing
(Computing for manufacturing)
Step 3
On-Site: Structure
(Assembly Only)
Step 4
On-Site: Ornamentation
(Multi-lateral Layering)
Step 5
Design and Machines