BRIEF CONSTRUCTION HISTORY
Special Construction Projects

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1. INTRODUCTION

A. What is building technology?

Tools
- material
- knowledge

Idea, Design

Materialization (building)

Technology = the method
1. INTRODUCTION

B Repetitive technological solutions – Civilizations, regions

similary techncal solution for the same practical problem

Sakkarah Chichen Itza

Babilon
1. INTRODUCTION

B Repetitive technological solutions – Civilizations, regions

America

Europe

Africa

Asia

- Wooden posts
- Wooden column
- Stone column
- Stone wall
- Wall section
- Stone pillar
INTRODUCTION

Repetitive technological solutions – Civilizations, regions

BEGINNINGS OF CONSTRUCTION (Neolithicum)

Material, tools, techniques

Period: up to 1500 B.C.

Material:
- stone
- wood
- earth (foundation + clay, mud)

Techniques:
- Tenon and mortise joints
- wedging
- restraining to earth
- wattling
- plastering with mud (daub)

Tools:
- stone, bone, wood and metal tools – depending on culture

- relative high technical knowledge in other fields as well (e.g. dentistry)
- skeleton construction!!!! The next appearance in the monumental architecture is the time of the gothic.
### BEGININGS OF CONSTRUCTION (Neoiticum)

#### A. Material, tools, techniques

Neolithic house reconstruction (5000-4600 B.C.)

#### B. Construction trades, organization of the construction

(sacral and) defensive construction, organized by the community:

- physical and supernatural defense
- communal = defensive spaces
- family huts

**NO specified building trades**
- ploughmen (peasants) build their buildings for their own usage

mining (e.g. mining of ochre) and metalworking are the first seceding trades
BEGININGS OF CONSTRUCTION (Neolithic)

C. Temporary structures and construction equipment

Pile scaffolding, roller, sledge

D. Examples

Durrington Walls Woodhenge

2500 B.C. 2200 B.C. 2000 B.C.
ANCIENT CULTURES – MIDDLE-EAST

A  Material, tools, techniques

**Egypt** | **Fertile Crescent** | **Coasts of the Mediterranean sea**

**Material:**
- stone
- wood
- mud-brick → clay brick
- mud – disappear at monumental works
- metal: decoration, supplementary structures

**Tools**
- specialized trades
- copper and stone tools

**Techniques**
- masonry
- carving (stone/wood)
- production of brick and decorative ceramic elements
- mud plasters, and thin gypsum plasters (Egypt)

Another technological direction! – Wall based construction.

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B  Construction trades, organization of the construction

**Organization on level of the society**

**Construction management:** sacral leaders (priests)

**Specialized trades:**
- carpentry,
- stonemasonry,
- smithy
- etc.

regulation on construction
ANCIENT CULTURES – MIDDLE-EAST

Temporary structures and construction equipment

Scaffolding, rollers, sledge

Examples

Babilon
Jerusalem
Luxor
## ANCIENT CULTURES – GREECE, ROME

### Material, tools, techniques

<table>
<thead>
<tr>
<th>Material:</th>
<th>Techniques:</th>
<th>Tools:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• all material of the ancient times</td>
<td>• masonry, vault</td>
<td>- forebears of our present handtools</td>
</tr>
<tr>
<td>• metals in the load bearing structures</td>
<td>• wood carving</td>
<td></td>
</tr>
<tr>
<td>• bronze, copper, iron, concrete!</td>
<td>• stone carving, stone inlay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• brick</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• mixed masonry walls (Greek, Roman)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• wall painting (Pompei)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• cement → concrete</td>
<td></td>
</tr>
</tbody>
</table>

### Construction trades, organization of the construction

Organization on the level of the society, specialized trades: carpenter, mason, etc.

Regulations, construction law etc.

The first known standards and technical specifications (Greece)

Rome: the separation of the theoretical and practical knowledge

Novelty: engineering! – military engineering

Technical establishment, infrastructure:

Road network, aqueduct, tunnels (Greece)
ANCIENT CULTURES – GREECE, ROME

C. Temporary structures and construction equipment

New equipment systems

• pulley (Archimedes)
• ancient crane

D. Examples
5. ANCIENT CULTURES – FAR EAST

A

Material, tools, techniques

<table>
<thead>
<tr>
<th>China</th>
<th>India</th>
<th>Japan</th>
<th>Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Metal casting (bronze, cast-iron)</td>
<td>• Stone carving</td>
<td>• Timber construction system</td>
<td></td>
</tr>
<tr>
<td>relative early</td>
<td>• Early high quality steel production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Stone masonry, stone carving, ceramic tiling</td>
<td>• Wood carving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Light construction technique with tying (bamboo)</td>
<td></td>
<td>• Joinery-like carpentry</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality steel (weapons)</td>
<td></td>
</tr>
</tbody>
</table>

5. FAR EAST

B

Construction trades, organization of the construction

<table>
<thead>
<tr>
<th>China</th>
<th>India</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>builder trades - in the bottom of the caste system</td>
<td>e.g. smith (swordsmith) high social status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sanskrit tales about the maintenance and preservation</td>
</tr>
</tbody>
</table>
ANCIENT CULTURES – FAR EAST

C  Temporary structures and construction equipment

**transport elevation**

wheel-barrow (Chinese)

bamboo scaffolding

D  Examples

- “sacred jewel” (sōju)
- “dragon wheel” (tyūsha)
- “water flame” (suisen)
- “sacred rings” (shōrin)
- “flower bowl” (sakubana)
- “reversed bowl” (shokubachō)
- “deer basin” (tetsuhi)
6. ANCIENT CULTURES – AMERICA

A Material, tools, techniques

<table>
<thead>
<tr>
<th>Aztec</th>
<th>Maya</th>
<th>Inca</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150–900 B.C.</td>
<td>early preclassical period (olmec towns – near to San Lorenzo)</td>
<td>up to the 12th century B.C. small states of different tribes at the lake Titicaca</td>
</tr>
<tr>
<td>• earth walls, stone statues</td>
<td>• up to the 1200 A.D. toltec and zapotec indian cultures city-states, trade, stonemasonry, etc.</td>
<td>from the 11–13th century B.C. to the spanish conquest progressive development of the inca empire</td>
</tr>
<tr>
<td>900 B.C. – 250 A.D.</td>
<td>preclassical period (progressive development of the maya city-states – La Vera, El Mirador, Tikal)</td>
<td>• high technical and mathematical knowledge</td>
</tr>
<tr>
<td>• mud walls, earth pyramids</td>
<td>• stone masonry is developed to the end of the period, stone sculptures, wall paintings, picture-writing, stuck-like decoration</td>
<td>• road network, bridge building, fortified towns</td>
</tr>
<tr>
<td>250 – 900 A.D.</td>
<td>classical period (Tikal, Teotihuacan, Palenque)</td>
<td>900 – 1519 A.D.</td>
</tr>
<tr>
<td>• monumental stone architecture, maya sculptures and statues</td>
<td>postclassical period (Tula, Chichen Itza, Mayapan – up to the spanish conquest)</td>
<td>• decadent society, high technical knowledge – big multicultural cities</td>
</tr>
<tr>
<td>• Aztec invasion – conquest of the local cultures - Teonochtitlán is the capital of the aztec empire – up to the spanish conquest</td>
<td></td>
<td></td>
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</tbody>
</table>

B Construction trades, organization of the construction

- • clay and mud technologies
- • wall painting, stucco
- • stone tiles or thatch (corn roofing)
- • stone carving, giant consoles
- • stone masonry technique with chiselled joints

- • in the early periods - non-differential societies
- • after the classical periods - hierarchical social systems
ANCIENT CULTURES – AMERICA

Temporary structures and construction equipment

scaffolding

transport

wheel, roller were unknown!

Examples

Palenque

Chichen Itza

Tikal

Teotihuacan

Machu Picchu
Material, tools, techniques

Early middle age: 3-4th century A.D. (from preroman period) – 11th century A.D.

- match-board, each trade
- glass maker
- smith

Late middle age: 11th century A.D. – 13(-15)th century A.D.

- lead (roofs, pins)
- wrought iron (iron structures, stone cramps)
- reed, thatch
- natural paints

Minor works: sawmill, hammer mill, finery, glassmaker furnaces etc.

Construction trades, organization of the construction

Organization of construction on the level of the community:

- familiar
- larger community (settlement)
- clerical (monastery, cloister)
- royal, partisan

regulations

→ e.g. fire protection, street width

Standards (local, regional) for measuring units

Representation by guild system (for each trade)

Trades:

- carpenter
- thatcher
- mason, stonemason
- joiner
- glass maker
- smith → locksmith
MIDDLE AGE – EUROPE, MIDDLE-EAST

Temporary structures and construction equipment

Examples

- wolf
- wheel-barrow, wagon
- restrained console scaffolding
- treadwheel crane
- Evolution of transport and elevation!

- stonemason
- smith
- carpenter
- glaser
- joiner
- wall painter
8. **15-18\textsuperscript{th} CENTURY**

A. **Material, tools, techniques**

New and traditional material and techniques:
- stone, brick, mud
- metal flashings with copper (molding, roofs, steeples)
- wood – new types from colonies for furniture
- wrought iron
- cast iron (novelty)
- rendered surfaces come to the front (Baroque)
- ornaments and decorative paints (fresco bouno), artificial marble, sgraffito
- artificial paints (metal oxides and metal-salts)

\textbullet\ carving tools - knives
\textbullet\ development of plastering
\textbullet\ special tools for ornaments and sgraffito

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B. **Construction trades, organization of the construction**

The construction based on:
- medieval traditions of the construction
- military knowledge
- development of the nature sciences and the mathematics
- colonisation

organization on the level of the society and smaller communities, private constructions

Specialized trades:
- carpenter
- mason
- joiner
- plasterier
- upholsterer
- thatcher, roof tiler
- smith, locksmith
- glazier
- stonemason

more and more strict construction regulations for property insurance, fire protection, quality insurance

Large-scale technical facilities:
- large bridges (stone, wrought iron, cast iron)
- dams (Holland)
- dome and tower structures
- mine structures
8 15-18TH CENTURY
C Temporary structures and construction equipment

Scaffoldings, transportation, elevation

8 15-18TH CENTURY
D Examples

1677
19th Century

A. Material, tools, techniques

**IMPORTANT DUALITY**

- Evolutional highlight of the handicrafts
- Industrialization of the technologies
- New material (cements, steel, reinforced concrete)
- Prefabrication (ornaments, loadbearing structures)
- Appearance and the structure behind separated
- (Pre)modern philosophy

Antecedents of the 20th century tools and equipments

Works, blast-furnaces, foundries, factories, industrialised mines

19th Century

B. Construction trades, organization of the construction

- Strong specialized trades (e.g. 8-10 kind of smithy / ironwork)
- Organisation of construction on every level of the society

New trades at the end of the century: e.g. formwork carpenter, concrete reinforcement worker, insulation worker, ironworker

Re-organisation of the representative organisations of the professions
- End of the guilds
- Special technical school system for the vocations and professions

Detailed acts for construction and for special fields (e.g. monument preservation)
19th CENTURY

Temporary structures and construction equipment

- wooden scaffolding
- transport: animal power, railway, ship
- elevation: steam, animal power
- scaling up

Examples
10. **20th Century**

### A Material, tools, techniques

**General evolution**  
Armaments industry  
Space research  
Building industry  
New tectonical ("non tectonical") systems  
E.g. assembled, drywall systems  
Numerous innovations and innovation attempt in technology  
New material e.g.:  
- Reinforced concrete  
- Different steel alloys (Cr, Ni)  
- AAC (Autoclave Aerated Concrete Block)  
- New ceramics (masonry blocks, floor and wall tiles)  
- Plastics (paints, cladding, doors, windows)  
- Aluminum (cladding, doors, windows, load-bearing structures)  
- Specialized composites (e.g. gypsum plasterboards, OSB boards)  
- Different metal alloys (plates, screws etc.)  

At the end of the century: energy-efficient construction

### B Construction trades, organization of the construction

Construction trades are determined by construction law  
International standards ISO, CE  
Quality management TQM  
Safety regulations  
Continuous development of new trades:  
- Insulation works  
- Dry wall system works  
- Electrical works  
- Building installation works  

Construction management – on different levels

The phase out (transformation) of vernacular architecture
20th Century

Temporary structures and construction equipment

general automation → scaling of the building vertically

scaling in time, and volume

modern (aluminum, steel) scaffoldings and formworks
electric, hydraulic elevators

at the end of the century - giant machinery

Examples
11 SOURCES


• Császár L.: Építőmesterség a magyar múltban. ÉTK, Budapest, 1986, p.166


