BRIEF CONSTRUCTION HISTORY

Special Construction Projects

By: István Vidovszky PhD – BUTE Department of Construction Management and Technology, 2009

1. INTRODUCTION

A. What is building technology?

- Tools
  - material
  - knowledge

- Idea, Design

- Materialization (building)

Technology = the method
<table>
<thead>
<tr>
<th>1. INTRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetitive technological solutions – Civilizations, regions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>theory of Atlantis</th>
</tr>
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<tbody>
<tr>
<td>OR</td>
</tr>
<tr>
<td>similary solution for the same problem</td>
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<table>
<thead>
<tr>
<th>Sakkarah</th>
<th>Chichen Itza</th>
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<table>
<thead>
<tr>
<th>Babilon</th>
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</thead>
</table>

1. INTRODUCTION
B Repetitive technological solutions – Civilizations, regions

America

Europe

Africa

Asia

wooden posts ➔ wooden column ➔ stone column

stone wall ➔ wall section ➔ stone pillar
1. INTRODUCTION

B Repetitive technological solutions – Civilizations, regions

2. BEGININGS OF CONSTRUCTION (Neoticum)

A Material, tools, techniques

**Period: up to 1500 B.C.**

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

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

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

- 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.
2. BEGININGS OF CONSTRUCTION (Neolithicum)

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

C Temporary structures and construction equipment

Pile scaffolding, roller, sledge
### BEGININGS OF CONSTRUCTION (Neolithic)

#### Examples

- **Durrington Walls**: Woodhenge
- **Stonehenge**

<table>
<thead>
<tr>
<th>Year</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500 B.C.</td>
<td>Durrington Walls</td>
</tr>
<tr>
<td>2200 B.C.</td>
<td>Woodhenge</td>
</tr>
<tr>
<td>2000 B.C.</td>
<td>Stonehenge</td>
</tr>
</tbody>
</table>

### ANCIENT CULTURES – MIDDLE-EAST

#### Material, tools, techniques

**Egypt**

- **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.
3. ANCIENT CULTURES – MIDDLE-EAST

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

C. Temporary structures and construction equipment

Scaffolding, rollers, sledge
3. ANCIENT CULTURES – MIDDLE-EAST

D Examples

Babilon

Jerusalem

Luxor

4. ANCIENT CULTURES – GREECE, ROME

A Material, tools, techniques

Material:
- all material of the ancient times
- metals in the load bearing structures
- bronze, copper, iron, concrete!

Techniques:
- masonry, vault
- wood carving
- stone carving
- brick
- mixed masonry walls (Greek, Roman)
- wall painting (Pompeii)
- cement → concrete

Tools:
- forebears of our present handtools
4. ANCIENT CULTURES – GREECE, ROME

B 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)

<table>
<thead>
<tr>
<th>New equipment systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>• pulley (Archimedes)</td>
</tr>
<tr>
<td>• ancient crane</td>
</tr>
</tbody>
</table>
4. ANCIENT CULTURES – GREECE, ROME

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) relative early</td>
<td>• Stone carving</td>
<td>• Timber construction system</td>
<td></td>
</tr>
<tr>
<td>• Stone masonry, stone carving, ceramic tiling</td>
<td>• Early high quality steel production</td>
<td>• Joinery-like carpentry</td>
<td></td>
</tr>
<tr>
<td>• Light construction technique with tying (bamboo)</td>
<td></td>
<td>• High quality steel (weapons)</td>
<td></td>
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</tbody>
</table>
5. FAR EAST

B. Construction trades, organization of the construction

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

5. ANCIENT CULTURES – FAR EAST

C. Temporary structures and construction equipment

- transport elevation
- wheel-barrow (Chinese)
- bamboo scaffolding
5. ANCIENT CULTURES – FAR EAST

D Examples

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.</td>
</tr>
<tr>
<td>-earth walls, stone statues</td>
<td>-small states of different tribes at the lake Titicaca</td>
<td></td>
</tr>
<tr>
<td>up to 1200 A.D. - toltec and</td>
<td>-progressive development of the</td>
<td>from the 11-13th century B.C. to</td>
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<tr>
<td>zapotec indian cultures</td>
<td>maya city-states – La Venta, El</td>
<td>the spanish conquest</td>
</tr>
<tr>
<td>city-states, trade, stonemasonry,</td>
<td>Mirador, Tikal)</td>
<td>progressive development of the</td>
</tr>
<tr>
<td>etc.</td>
<td></td>
<td>inca empire</td>
</tr>
<tr>
<td>900 B.C. – 250 A.D.</td>
<td>-mud walls, earth pyramids</td>
<td>-high technical knowledge</td>
</tr>
<tr>
<td>preclassical period</td>
<td>-stone masonry is developed to</td>
<td>-road network, bridge building,</td>
</tr>
<tr>
<td>(progressive development of the</td>
<td>the end of the period, stone</td>
<td>fortified towns</td>
</tr>
<tr>
<td>maya city-states – La Venta, El</td>
<td>sculptures, wall paintings, picture-</td>
<td></td>
</tr>
<tr>
<td>Mirador, Tikal)</td>
<td>wrighting, stuck-like decoration</td>
<td></td>
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<tr>
<td>250 -900 A.D.</td>
<td>-monumental stone architecture,</td>
<td></td>
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<tr>
<td>classical period</td>
<td>maya sculptures and statues</td>
<td></td>
</tr>
<tr>
<td>(Tikal, Teotihuacan, Palenque)</td>
<td>-high technical and mathematical</td>
<td></td>
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<tr>
<td>-maya sculpture, etc.</td>
<td>knowledge</td>
<td></td>
</tr>
<tr>
<td>1200 A.D.</td>
<td>-aztec invasion – conquest of the</td>
<td></td>
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<td>local cultures - Teonochtltlan is the</td>
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<td>capital of the aztec empire – up to</td>
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<td>the spanish conquest</td>
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<tr>
<td>the spanish conquest</td>
<td>-decadent society, high technical</td>
<td></td>
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<tr>
<td></td>
<td>knowledge – big multicultural</td>
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<tr>
<td></td>
<td>cities</td>
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ANCIENT CULTURES – AMERICA

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!
6. ANCIENT CULTURES – AMERICA

Examples

- Palenque
- Chichen Itza
- Teotihuacan
- Tikal
- Machu Pichu

7. MIDDLE AGE – EUROPE, MIDDLE-EAST

Material, tools, techniques

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

- Industrial revolution: water wheel → new machines, tools, material

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

- Match-board, minor door hinges, forged iron ornaments

Material:
- Wood, stone
- Wrought iron (iron structures, stone cramps)
- Lead (roofs, pins)
- Reed, thatch
- Natural paints

Minor works: sawmill, hammer mill, finery, glassmaker furnaces etc.
### B. Construction trades, organization of the construction

**Organization of construction on the level of the community:**
- familiar
- larger community (settlement)
- clerical (monastery, closter)
- royal, partician

**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

### C. Temporary structures and construction equipment

- restrained console scaffolding
- treadwheel crane
- wheel-barrow, wagon
- wolf

**Evolution of transport and elevation!**
7. MIDDLE AGE – EUROPE, MIDDLE-EAST

D Examples

- stonemason
- smith
- carpenter
- glaser
- joiner
- wall painter

8. 15-18TH 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)

- carving tools - knives
- development of plastering
- special tools for ornaments and sgraffito
### 15-18th Century

#### 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

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

**Large-scale technical facilities:**
- large bridges (stone, wrought iron, cast iron)
- dams (Holland)
- dome and tower structures
- mine structures

**Organization on the level of the society and smaller communities, private construction**

#### Temporary structures and construction equipment

**Scaffolding, transportation, elevation**

- Scaffoldings, transportation, elevation

1677
8 15-18TH CENTURY

Examples

9 19TH CENTURY

Material, tools, techniques

IMPORTANT DUALITY

- evolitional 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

C Temporary structures and construction equipment

- wooden scaffolding
- transport: animal power, railway, ship
- elevation: steam, animal power
- scaling up
19TH CENTURY

Examples

20TH CENTURY

Material, tools, techniques

General evolution

<table>
<thead>
<tr>
<th>armaments industry</th>
<th>space research</th>
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<tbody>
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<td>new tectonical (&quot;non tectonical&quot;) systems</td>
<td></td>
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<tr>
<td>e.g. assembled, drywall systems</td>
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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
20TH CENTURY

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) scaffolding and formworks
- electric, hydraulic elevators

- at the end of the century - giant machinery
10. **20th Century**

**Examples**

- Császár L.: *Építőmesterség a magyar múltban*, ÉTK, Budapest, 1986, p.166
- Cs. Dobrovits D.: *Építkezés a XVIII. századi Magyarországon (Az uradalmak építészete)*. Akadémiai Kiadó, Budapest, 1983, p.150

11. **Sources**

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