

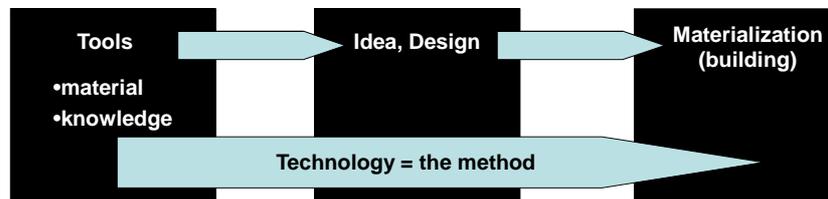
# BRIEF CONSTRUCTION HISTORY

Special Construction Projects

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

## 1. INTRODUCTION

A What is building technology?



1. INTRODUCTION

B Repetitive technological solutions – Civilizations, regions

similary techncal solution for the same practical problem

1. INTRODUCTION

B Repetitive technological solutions – Civilizations, regions



Sakkarah



Chichen Itza



Babilon

1. INTRODUCTION

B Repetitive technological solutions – Civilizations, regions



America



Africa



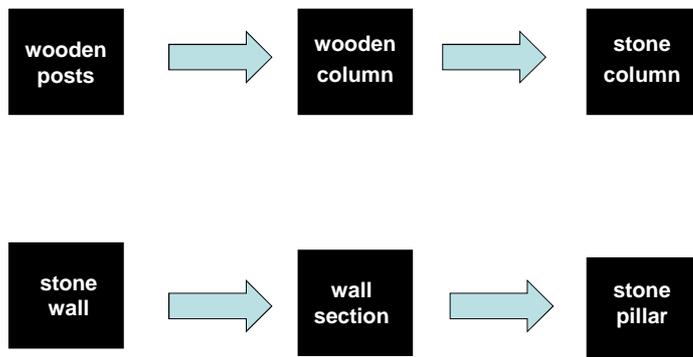
Europe



Asia

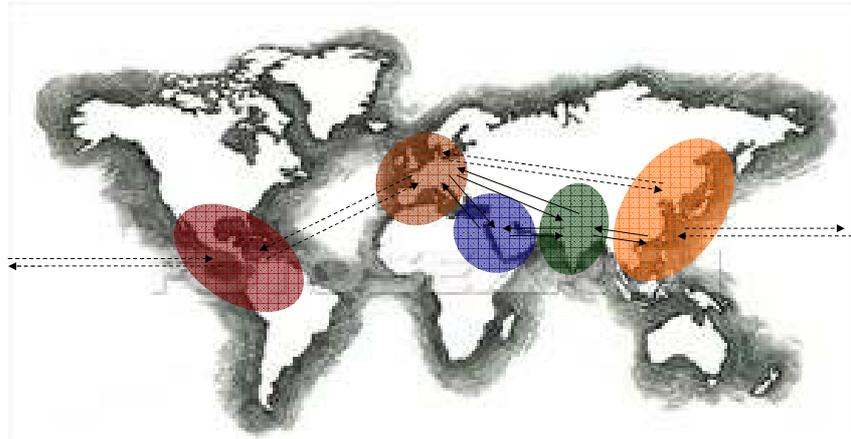
1. INTRODUCTION

C Repetitive technological solutions – Civilizations, regions



## 1. INTRODUCTION

### B Repetitive technological solutions – Civilizations, regions



## 2. BEGININGS OF CONSTRUCTION (Neolithic)

### 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 (Neolithic)

A Material, tools, techniques



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

2. BEGININGS OF CONSTRUCTION (Neolithic)

B Construction trades, organization of the construction

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

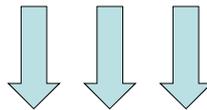
**physical and supernatural defense**

•communal=defensive spaces

•family huts

**NO specified building trades**

– ploughmen (peasants) build their buildings for their own usage

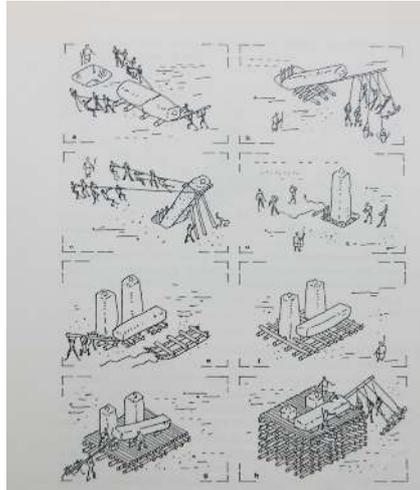


**mining (e.g. mining of ochre) and metalworking are the first seceding trades**

2. BEGININGS OF CONSTRUCTION (Neolithic)

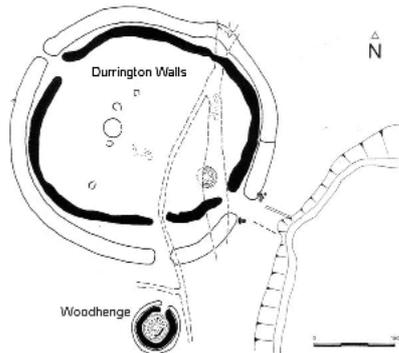
C Temporary structures and construction equipment

Pile scaffolding, roller, sledge



2. BEGININGS OF CONSTRUCTION (Neolithic)

D Examples



Durrington Walls

Woodhenge

Stonehenge

2500 B.C.

2200 B.C.

2000 B.C.



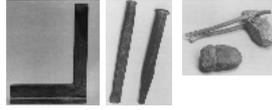
3. ANCIENT CULTURES – MIDDLE-EAST

A Material, tools, techniques

Egypt Fertile Crescent Coasts of the Mediterranean sea

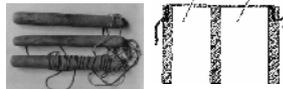
Material:

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



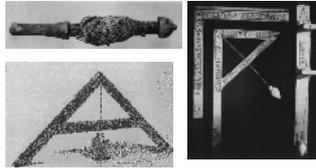
Tools

- 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.

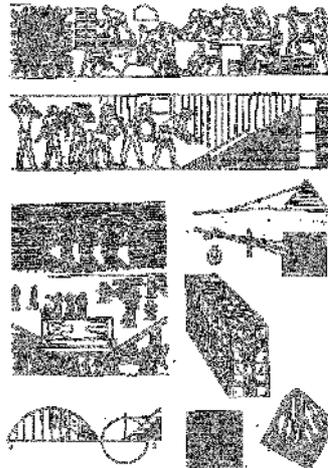
3. ANCIENT CULTURES – MIDDLE-EAST

B Construction trades, organization of the construction

Organization on level of the society  
Construction management: sacral leaders (priests)

Specialized trades:

- carpentry,
- stonemasonry,
- smithy
- etc.



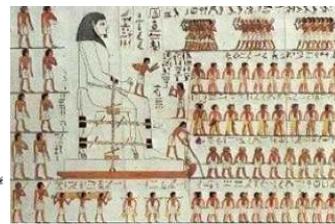
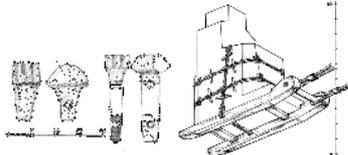
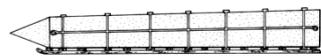
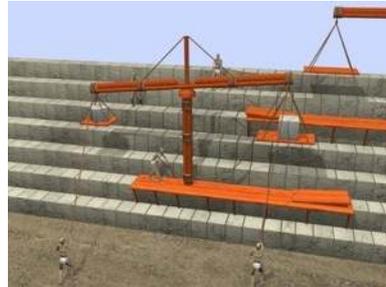
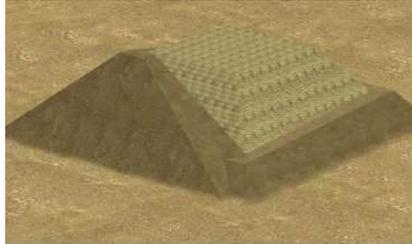
regulation on construction



3. ANCIENT CULTURES – MIDDLE-EAST

C Temporary structures and construction equipment

Scaffolding, rollers, sledge



3. ANCIENT CULTURES – MIDDLE-EAST

D Examples



Babilon



Jerusalem



Luxor

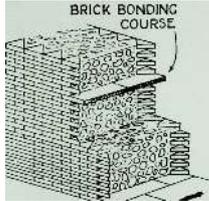


#### 4. ANCIENT CULTURES – GREECE, ROME

##### 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, stone inlay
- brick
- mixed masonry walls (Greek, Roman)
- wall painting (Pompei)
- 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, aquaduct, tunnels (Greece)

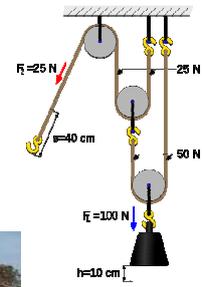


4. ANCIENT CULTURES – GREECE, ROME

C Temporary structures and construction equipment

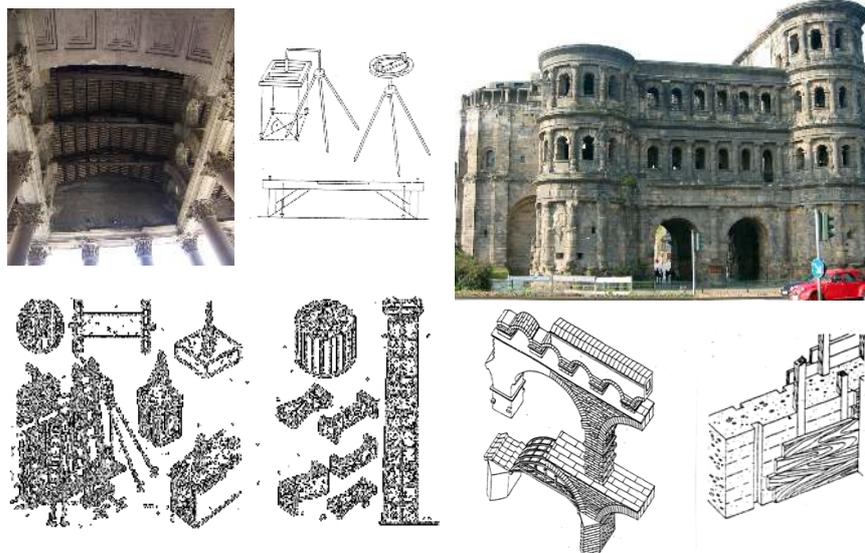
New equipment systems

- pulley (Archimedes)
- ancient crane



4. ANCIENT CULTURES – GREECE, ROME

D Examples



5. ANCIENT CULTURES – FAR EAST

A. Material, tools, techniques

China	India	Japan	Korea
<ul style="list-style-type: none"> <li>•Metal casting (bronze, cast-iron) relative early</li> <li>•stone masonry, stone carving, ceramic tiling</li> <li>•light construction technique with tying (bamboo)</li> </ul>	<ul style="list-style-type: none"> <li>•stone carving</li> <li>•wood carving</li> <li>•early high quality steel production</li> </ul>	<ul style="list-style-type: none"> <li>•timber construction</li> <li>•joinery-like carpentry</li> <li>•high quality steel (weapons)</li> </ul>	<ul style="list-style-type: none"> <li>•timber construction system</li> </ul>

5. FAR EAST

B. Construction trades, organization of the construction

China	India	Japan
	<p>builder trades - in the bottom of the caste system</p> <p>sanscrite tales about the maintenance and preservation</p>	<p>e.g. smith (swordsmith) high social status</p>

5. ANCIENT CULTURES – FAR EAST

C Temporary structures and construction equipment

transport elevation



wheel-barrow (Chinese)

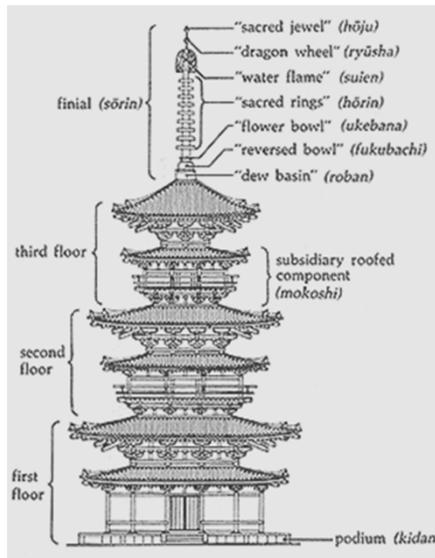
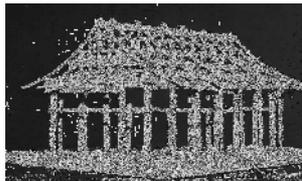


bamboo scaffolding



5. ANCIENT CULTURES – FAR EAST

D Examples



6. ANCIENT CULTURES – AMERICA

A Material, tools, techniques

**Aztec**

1150 -900 B.C.  
early preclassical period (olmec towns – near to San Lorenzo)  
•earth walls, stone statues

up to 1200 A.D. - toltec and zapotec indian cultures  
city-states, trade, stonemasonry, etc.



1200 A.D.  
aztec invasion – conquest of the local cultures - Teonochtitlán is the capital of the aztec empire – up to the spanish conquest

**Maya**

900 B.C. – 250 A.D.  
preclassical period (prgressive development of the maya city-states – La Venta, El Mirador, Tikal)  
•mud walls, earth pyramids  
•stone masonry is developed to the end of the period, stone sculptures, wall paintings, picture-wrighthing, stuck-like decoration

250 -900 A.D.  
classical period (Tikal, Teotihuacan, Palenque)  
•monumental stone architecture, maya sculptures and statues

900 -1519 A.D.  
postclassical period (Tula, Chichen Itza, Mayapan – up to the spanish conquest)  
•decadent society, high technical knowledge – big multicultural cities

**Inca**

up to the 12th century B.C.  
small states of different tribes at the lake Titicaca



from the 11-13th century B.C. to the spanish conquest  
progressive development of the inca empire  
•high technical and mathematical knowledge  
•road network, bridge building, fortified towns

6. ANCIENT CULTURES – AMERICA

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

6. ANCIENT CULTURES – AMERICA

C Temporary structures and construction equipment

scaffolding



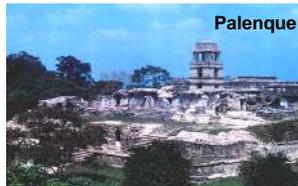
transport



wheel, roller were unknown!

6. ANCIENT CULTURES – AMERICA

D Examples



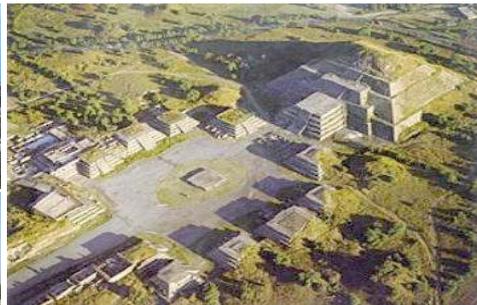
Palenque



Chichen Itza



Tikal



Teotihuacan



Machu Pichu

7. MIDDLE AGE – EUROPE, MIDDLE-EAST

A. Material, tools, techniques

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



industrial revolution-  
water wheel →  
new mashines,  
tools, material



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



minor works: sawmill, hammer mill, finery, glassmaker furnances etc.



match-board,  
minor door hinges, forged  
iron ornaments



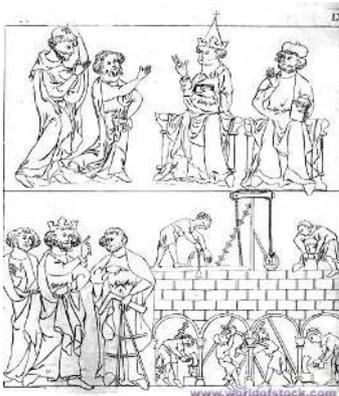
- Material:**
- wood, stone
  - wrought iron (iron structures, stone cramps)
  - lead (roofs, pins)
  - reed, thatch
  - natural paints

7. MIDDLE AGE – EUROPE, MIDDLE-EAST

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

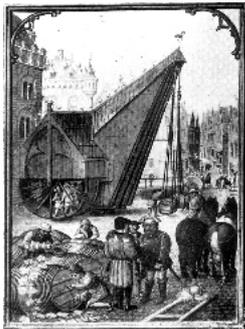


7. MIDDLE AGE – EUROPE, MIDDLE-EAST

C Temporary structures and construction equipment



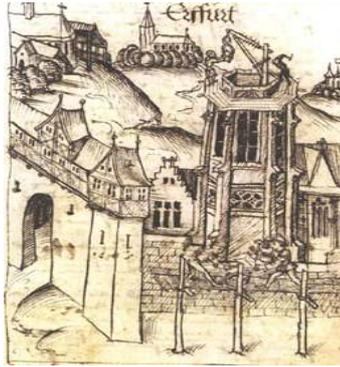
wolf



treadwheel crane



wheel-barrow, wagon



Evolution of transport and elevation!



restrained console scaffolding



7. MIDDLE AGE – EUROPE, MIDDLE-EAST

D Examples



stonemason



smith



carpenter



glaser



joiner



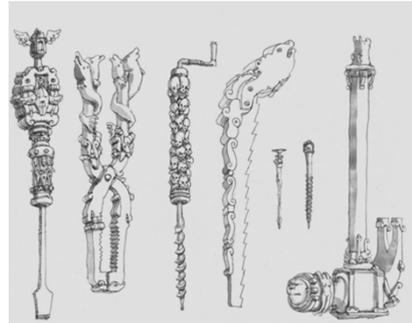
wall painter

8. 15-18<sup>TH</sup> 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

8. 15-18<sup>TH</sup> CENTURY

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:

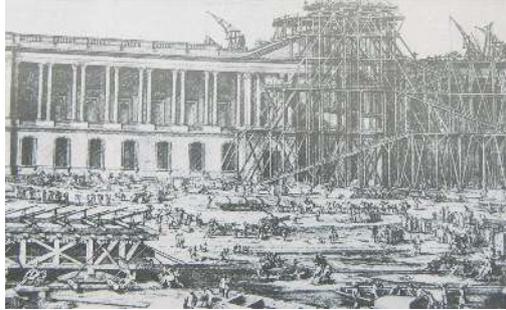
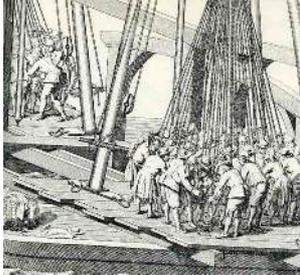
- large bridges (stone, wrought iron, cast iron)
- dams (Holland)
- dome and tower structures
- mine structures



8. 15-18<sup>TH</sup> CENTURY

C Temporary structures and construction equipment

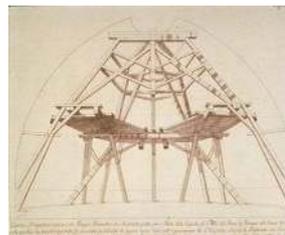
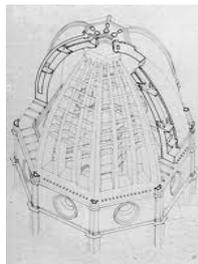
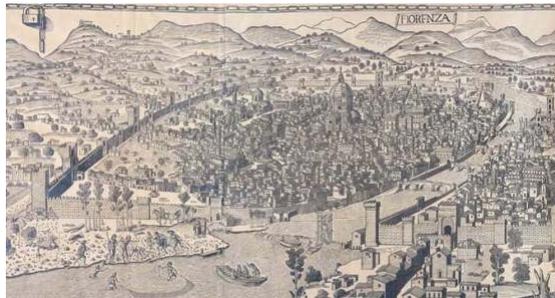
Scaffoldings, transportation, elevation



1677

8. 15-18<sup>TH</sup> CENTURY

D Examples



9. 19<sup>TH</sup> 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-furnances, foundries, factories, industrialised mines

9. 19<sup>TH</sup> 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)

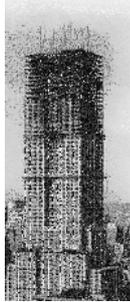
9. 19<sup>TH</sup> CENTURY

C Temporary structures and construction equipment

wooden scaffolding



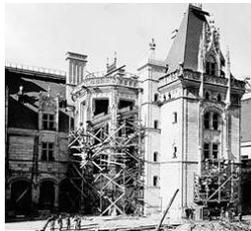
elevation: steam,  
animal power



transport: animal power, railway, ship

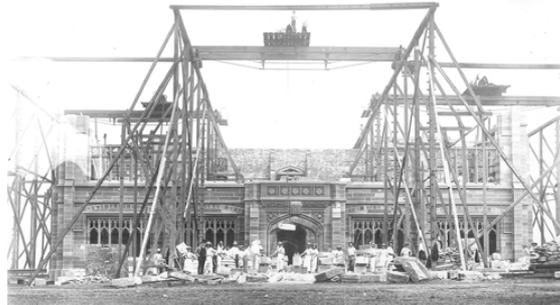


scaling up



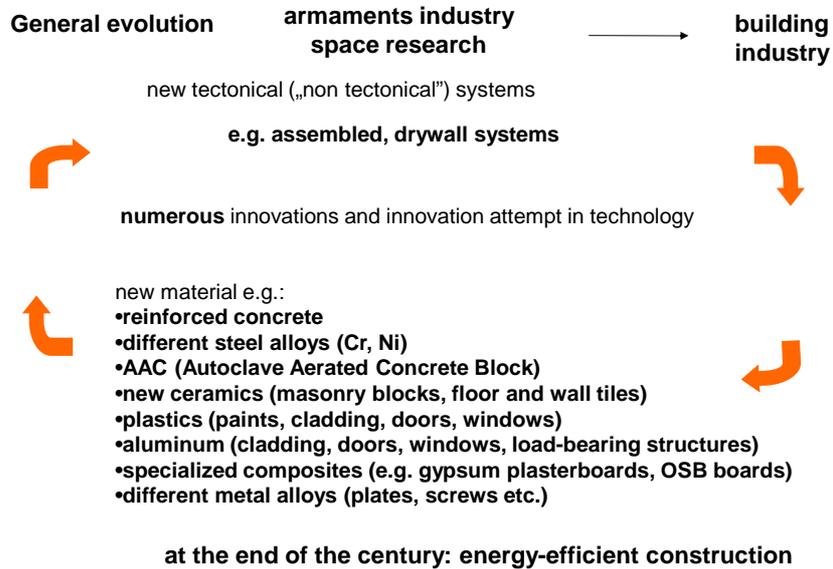
9. 19<sup>TH</sup> CENTURY

D Examples



10. 20<sup>TH</sup> CENTURY

A Material, tools, techniques



10. 20<sup>TH</sup> CENTURY

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

10. 20<sup>TH</sup> CENTURY

C Temporary structures and construction equipment

general automation → scaling of the building vertically



scaling in time, and volumen



modern (aluminum, steel) scaffoldings and formworks

electric, hydraulic elevators

at the end of the century - giant mashinery



10. 20<sup>TH</sup> CENTURY

D Examples



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